UIC CODE 518-2

1st edition, June 2004

Translation

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Supplement to UIC Leaflet 518: application to wagons with axleloads more than 22,5 t and up to 25 t

Complément à la fiche UIC 518 : application aux wagons de charge à l'essieu supérieure à 22,5 t et jusqu'à 25 t
Ergänzung zu UIC-Merkblatt 518: Anwendung auf Güterwagen mit einer Radsatzlast größer als 22,5 t und bis 25 t

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

Leaflet to be classified in Volumes:

V - Rolling Stock

VII - Way and Works

Application:

With effect from 1 June 2004
All members of the International Union of Railways

Record of updates

1st edition, June 2004	First issue

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

Contents

Summary

UIC Leaflet 518-2 is a supplement to *UIC Leaflet 518* regarding acceptance of wagons with axleloads more than 22,5 t and up to 25 t.

Wagons are accepted on the basis of a standard described in *UIC Leaflet 518* taking into account:

- specific conditions of tests concerning speed and cant deficiency,
- specific limit values of track fatigue assessment quantities,
- specific application conditions for the partial acceptance procedure and the simplified method.

1 - Scope of the leaflet

UIC Leaflet 518, entitled "Testing and approval of railway vehicles from the point of view of their dynamic behaviour, safety - track fatigue - ride quality", sets out a standard to be applied when accepting a vehicle for introduction into international traffic.

Wagons with axleloads more than 22,5 t and up to 25 t[1], not taken into account in the *UIC Leaflet 518*, are addressed by the present supplement.

All the requirements of *UIC Leaflet 518* are applicable with some adaptations concerning:

- the conditions of line tests,
- limit values for some assessment quantities.

1. for practical reasons, the ratio between kN and tonne is assumed as 10.

2 - Test conditions

They are the same as in *UIC Leaflet 518* taking into account speed and cant deficiency given in Appendix A - page 6 (supplement to *UIC Leaflet 518, Appendix C*).

3 - Limiting values for assessment quantities

3.1 - Acceptance of a new vehicle

3.1.1 - Normal method

All the requirements of *UIC Leaflet 518, point 10.1.1* are applicable except for the following assessment quantities:

Track fatigue

- Vertical force Q_{lim}

  - Area of application:
    Maximum static load per wheel: 125 kN.

  - Limit:
    For $V_{lim} \leq 100$ km/h, $Q_{lim} \leq 210$ kN.

- Quasi-static vertical force in curves $(Q_{qst})_{lim}$

  $(Q_{qst})_{lim}$ = 155 kN.

3.1.2 - Simplified method

Not applicable.

3.2 - Extension of acceptance

If the wagon's operating conditions or construction are changed, an extension of acceptance is necessary.

The latter is possible only if the wagon has already been accepted according to the normal measurement method. Otherwise a new acceptance is necessary.

The extension procedure referred to here is applicable only if $I_{adm} \leq I_{adm\ acceptance}$.

If $I_{adm} > I_{adm\ acceptance}$, the full procedure and the normal measurement method shall be applied.

3.2.1 - Conditions for application

- Let λ be the minimum value of the "limit value / estimated maximum value" ratios of the safety parameters: ΣY, Y/Q, and

- λ' the minimum value of the "limit value according to this leaflet / estimated maximum value" ratios of the track fatigue parameters: Q_{qst}, Q,

the tables of Appendix B - page 7 may be applied if $\lambda \geq 1{,}1$ and $\lambda' \geq 1$ for each test zone.

If $\lambda < 1{,}1$ or $\lambda' < 1$, the full procedure and the normal measurement method shall be applied.

A new parameter χ represents a theoretical estimation of Q_{qst} depending on the height of centre of gravity and the permissible cant deficiency. This parameter has to be calculated for both the reference and the new wagons (and/or operating conditions) according to the following formula:

$$\chi = Q_0 \left[1+2{,}3\, h_g \frac{I_{adm}}{e^2} \right]$$

with:	Q_0	static wheel load (kN);
	h_g	height of centre of gravity relative to the top of rail (mm);
	I_{adm}	cant deficiency (mm);
	e	lateral distance between the contact points of wheels (mm) (approximately 1 500 mm for standard gauge).

3.2.2 - Definitions of procedure and testing conditions

The requirements of *UIC Leaflet 518, point 10.2.2* must be applied.

Appendix A - Application conditions and cant deficiency to be taken into account

supplement to *UIC Leaflet 518, Appendix C*

Train category	Speed (km/h)	I_{adm} (mm)
I_d - Freight trains (wagons with axleload more than 22,5 t and up to 25 t)	V ≤ 100	100

Appendix B - Application conditions for the partial acceptance procedure and the simplified method

B.1 - Bogie wagons with axleloads more than 22,5 t and up to 25 t

Modified parameters		Conditions for waiving the test and applying a simplified method, when $\lambda \geq 1{,}1$ (1) and $\lambda' \geq 1$ (1)			Procedure to be applied (full, partial)				
		Variation range compared to already approved wagon (2)			Loading conditions		Test sections (3)		
		For dispensation from tests	For simplified method				Straight track	Curves	
			Measurement $\ddot{y}^+$, $\ddot{y}^*$ and $\ddot{z}'$	Measurement H, $\ddot{y}^*$ and $\ddot{z}^*$	Empty	Loaded		Large radius curves	Small radius curves
Vehicle		**Vehicle**			**Vehicle**				
Wagon wheel-base	2a* ≥ 9 m	- 15%, + ∞(4)	- 30%, - 15%		YES	NO	YES	NO	NO
	2a* < 9 m	- 5%, + ∞(4)	- 10%, - 5%		YES	NO	YES	NO	NO
Height of centre of gravity	empty wagon h_g	- 100%, + 20%	+ 20%, + ∞(4)		YES	NO	YES	YES	NO
	loaded wagon χ (5)	- 100%, + 0,8 (λ'- 1) x 100%			NO	YES	YES	YES	YES
Torsional stiffness $C^*_t(10^{10}kN.mm^2/rad)$	C*t ≤ 3	- 66%, + 200%			YES	YES	YES	YES	YES
	C*t > 3	- 50%, + ∞(4)			YES	YES	YES	YES	YES
Tare	≥ 16 t	- 15%, + ∞(4)	- 30%, - 15%		YES	NO	YES	NO	NO
Increase in maximum axle-load ($2Q_{0max} \leq 250$ kN/axle)		0, + 5%		+ 5%, + 10%	NO	YES	NO	YES	YES
Increase in operating speed			0, + 10 km/h	+ 10 km/h + 20 km/h	YES	YES	YES	YES	NO
Bogie		**Bogie**			**Bogie**				
Wheel-base of bogie		0, + 10%		+ 10 %, + 20 %	YES	YES	NO	NO	YES
			- 10%, 0		YES	NO	YES	YES	NO
Nominal wheel diameter		- 10%, + 15%			YES	YES	YES	YES	YES
Vertical suspension (6) primary or secondary	Increased stiffness(es)	0, + 25%			YES	YES	YES	YES	YES
	Lower transitional load	- 5%, 0			YES	YES	YES	YES	YES
Axle-guiding (stiffnesses, damping, clearances, ...)					YES	YES	YES	YES	YES
Rotational torque		± 20%			YES	YES	YES	YES	YES
Moment of inertia of the bogie relative to the vertical central axis		- 100%, + 10%	+ 10%, + 20%		YES	NO	YES	NO	NO
Secondary lateral suspension (stiffnesses, damping, clearances, ...)					YES	YES	YES	YES	YES

Explanation of notes

(1) By definition,

$$\lambda = \min\left(\frac{\text{limit value}}{\text{maximum estimated value}}\right)$$

taking into consideration the following safety parameters: ΣY, Y/Q.

$$\lambda' = \min\left(\frac{\text{limit value according to this leaflet}}{\text{maximum estimated value}}\right)$$

taking into consideration the following track fatigue parameters: Q_{qst} and Q.

(2) Beyond the variation ranges or when the latter are not mentioned, the full procedure should be applied, solely for the test cases shown in the right-hand part of the table.

(3) The test should be carried out with one rail-inclination only.

(4) ∞ : maximum limiting value authorised.

(5)

$$\chi = Q_0\left[1 + 2{,}3\, h_g \frac{l_{adm}}{e^2}\right]$$

hg : height of centre of gravity relative to the top of rail (mm).
e : lateral distance between the contact points of the wheels (mm) (approximately 1 500 mm for standard gauge).

(6) Checking the non-bottoming of springs is part of design and shall be set out in a forthcoming document.

B.2 - Non bogie wagons with axleloads more than 22,5 t and up to 25 t

Modified parameters		Conditions for waiving the test and applying a simplified method, when $\lambda \geq 1{,}1$ (1) and $\lambda' \geq 1$ (1)			Procedure to be applied (full, partial)				
		Variation range compared to already approved wagon (2)			Loading conditions		Test sections (3)		
		For dispensation from tests	For simplified method				Straight track	Curves	
			Measurement $\ddot{y}^+$, $\ddot{y}^*$ and $\ddot{z}'$	Measurement H, $\ddot{y}^*$ and $\ddot{z}^*$	Empty	Loaded		Large radius curves	Small radius curves
Vehicle		**Vehicle**			**Vehicle**				
Wagon wheel-base	2a* ≥ 8 m	- 15%, + ∞(4)	- 30%, - 15%		YES	NO	YES	NO	NO
	2a* < 8 m	- 5%, + ∞(4)	- 10%, - 5%		YES	NO	YES	NO	NO
Nominal wheel-diameter		- 10 %, + 15%			YES	YES	YES	YES	YES
Height of centre of gravity	empty wagon h_g	- 100%, + 20%	+ 20%, + ∞(4)		YES	NO	YES	YES	NO
	loaded wagon χ (5)	- 100%, + 0,8 (λ'- 1) x 100%			NO	YES	YES	YES	YES
Torsional stiffness $C^*_t(10^{10}kN.mm^2/rad)$	C*t ≤ 3	- 66%, + 200%			YES	YES	YES	YES	YES
	C*t > 3	- 50%, + ∞(4)			YES	YES	YES	YES	YES
Moment of inertia of body relative to the vertical central axis		- 100%, + 10%			YES	NO	YES	NO	NO
Tare	≥ 12 t	- 15%, + ∞(4)	- 30%, - 15%		YES	NO	YES	NO	NO
Increase in maximum axle-load ($2Q_{0max} \leq 250$ kN/axle)		0, + 5%		+ 5%, + 10%	NO	YES	NO	YES	YES
Increase in operating speed			0, + 10 km/h	+ 10 km/h + 20 km/h	YES	YES	YES	YES	NO
Vertical suspension (6) primary or secondary	Increased stiffness(es)	0, + 25%			YES	YES	YES	YES	YES
	Lower transitional load	- 5%, 0			YES	YES	YES	YES	YES
Axle-guiding (k_x, k_y, damping, clearances, ...)					YES	YES	YES	YES	YES

Explanation of notes

(1) By definition,

$$\lambda = \min\left(\frac{\text{limit value}}{\text{maximum estimated value}}\right)$$

taking into consideration the following safety parameters: $\sum Y$, Y/Q.

$$\lambda' = \min\left(\frac{\text{limit value according to this leaflet}}{\text{maximum estimated value}}\right)$$

taking into consideration the following track fatigue parameters: Q_{qst} and Q.

(2) Beyond the variation ranges or when the latter are not mentioned, the full procedure should be applied, solely for the test cases shown in the right-hand part of the table.

(3) The test should be carried out with one rail-inclination only.

(4) ∞ : maximum limiting value authorised.

(5)
$$\chi = Q_0\left[1 + 2{,}3\, h_g \frac{l_{adm}}{e^2}\right]$$

hg : height of centre of gravity relative to the top of rail (mm).
e : lateral distance between the contact points of the wheels (mm) (approximately 1 500 mm for standard gauge).

(6) Checking the non-bottoming of springs is part of design and shall be set out in a forthcoming document.

Bibliography

1. UIC leaflets

International Union of Railways (UIC)
UIC Leaflet 432: Wagons - Running speeds - Technical conditions to be observed, 9th edition, January 2002

UIC Leaflet 515-0: Passenger rolling stock - Trailer bogies - Running gear, 2nd edition, April 2001

UIC Leaflet 515-3: Rolling stock - Bogies - Running gear - Axle design calculation method, 1st edition, 1.7.94

UIC Leaflet 515-4: Passenger rolling stock - Trailer bogies - Running gear - Bogie frame structure strength tests, 1st edition, 1.1.93

UIC Leaflet 515-5: Powered and trailing stock - Bogies - Running gear - Tests for axle-boxes, 1st edition, 1.7.94

UIC Leaflet 518: Testing and approval of railway vehicles from the point of view of their dynamic behaviour - Safety - Track fatigue - Ride quality, 2nd edition, April 2003

UIC Leaflet 615-0: Tractive units - Bogies and running gear - General provisions, 2nd edition, February 2003

UIC Leaflet 615-1: Tractive units - Bogies and running gear - General conditions applicable to component parts, 2nd edition, February 2003

UIC Leaflet 615-4: Motive power units - Bogies and running gear - Bogie frame structure strength tests, 2nd edition, February 2003

UIC Leaflet 705: Infrastructure for tilting trains, 1st edition, August 2003

2. ERRI reports

European Rail Research Institute (previously ORE)
ORE B 55 / RP 8: Prevention of derailment of goods wagons on distorted tracks - Final report: Conditions for negotiating track twists - Recommended values for the track twists and cant - Calculation and measurement of the relevant vehicle parameters - Vehicle testing, April 1983

ORE C 116 / RP 3: Interaction between vehicles and track - Geometry of the contact between wheelset and track - Part 1: Methods of measurement and analysis, October 1973

ORE C 138 / RP 1: Permissible limit values for the Y and Q forces and derailment criteria - Effect of the spacing of consecutive axles on the maximum permissible value of $\Sigma Y = S$, from the standpoint of track displacement - Part 1: Results of tests with a two-axled wagon, October 1977

ORE C 138 / RP 9: Permissible limit values for the Y and Q forces and derailment criteria - Final report: Verification of limit values - Tests under operating conditions - Comparison of limit values with the actual position, September 1986

ORE C 138 / DT 66: Permissible limit values for the Y and Q forces and derailment criteria - Valeurs limites admissibles pour les efforts transversaux appliqués par les essieux des véhicules du point de vue du risque de déripage de la voie - Point des résultats acquis par les réseaux, par le GT No 3 du CE ORE C 138, (exists only in French) June 1977

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