

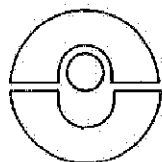
UIC Code

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1st edition, 1.7.1990

**Technical specification  
for the supply of tyred wheels  
for tractive and trailing stock.  
Tyre fitting and tolerances**

**NUMERISATION DANS  
L'ETAT DU DOCUMENT**



International Union of Railways

**8 1 2 - 4**

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**Leaflet to be classified in Volumes :**

V - Transport Stock  
VIII - Technical Specifications

**Amendments**


This leaflet is :

- *obligatory* in respect of the regulations for tyre fitting and the tolerances given in the technical documents established within UIC and ORE,
- *recommendatory* in respect of the tolerances given in the technical documents of the Member Railways of the Union.

**Contents**

- 1 - Purpose and field of application
- 2 - References
- 3 - Information to be provided by the purchaser
- 4 - Production finish on delivery
- 5 - Production of tyred wheels
  - 5.1 - Wheel tyres
  - 5.2 - Wheel centres
  - 5.3 - Retention spring ring
  - 5.4 - Tyre fitting
  - 5.5 - Balancing
- 6 - Requirements
  - 6.1 - Tolerances
  - 6.2 - Surface roughness
  - 6.3 - Residual out-of-balance
  - 6.4 - Oil pressure relief groove
  - 6.5 - Appearance
  - 6.6 - Absence of faults
  - 6.7 - Marking
- 7 - Inspections
  - 7.1 - Wheel tyres
  - 7.2 - Wheel centres
  - 7.3 - Tyred wheels
    - 7.3.1 - Responsibility for inspections, types and dates
    - 7.3.2 - Production control
    - 7.3.3 - Checking the characteristics of the tyred wheels
    - 7.3.4 - Presentation for quality control by the purchasing railway
    - 7.3.5 - Test certificate

- 7.3.6 - Number of inspections and tests
- 7.3.7 - Type of inspections and tests
  - 7.3.7.1 - Fit between tyre and wheel centre
  - 7.3.7.2 - Balancing
  - 7.3.7.3 - Checking of appearance
  - 7.3.7.4 - Checking of dimensional properties
  - 7.3.7.5 - Checking of surface roughness
- 7.3.8 - Conclusions from the inspections
- 7.3.9 - Repetition of tests and supplementary tests
- 8 - Delivery
  - 8.1 - Corrosion protection
  - 8.2 - Protection against mechanical damage during transport
- 9 - Guarantee

## 1 - Purpose and field of application

1.1 - These technical specifications govern the conditions of fitting as well as the tolerances and surface roughness of tyred wheels.

1.2 - The specifications concerning the quality of wheel tyres and wheel centres are set out in Leaflets 810-1 and 812-1 respectively.

1.3 - The specifications relating to tolerances and surface roughness of the wheel centres are set out in Leaflet 812-5.

## 2 - References

- |                   |  |
|-------------------|--|
| UIC Leaflet 810-1 | Technical specification for the supply of rough rolled non-alloy steel tyres for tractive and trailing stock.                                      |
| UIC Leaflet 810-2 | Technical specification for the supply of rough tyres for tractive and trailing stock — Tolerances.  |
| UIC Leaflet 810-3 | Technical specification for the supply of non-alloy flat and profile steel for retention spring rings.   |
| UIC Leaflet 812-1 | Technical specification for the supply of rolled or forged steel wheel centres for tractive and trailing stock — Quality requirements.             |
| UIC Leaflet 812-5 | Technical specification for the supply of rolled or forged steel wheel centres for tractive and trailing stock — Tolerances and surface roughness. |
| UIC Leaflet 813   | Technical specification for the supply of wheelsets for tractive and trailing stock — Tolerances and assembly.                                     |

ISO 1101/1

Form and fitting tolerances — Part 1 : General, symbols, information on drawings.

## 3 - Information to be provided by the purchaser

The purchasing Railway shall supply the following information, when inviting tenders and placing orders :

- 1 - the number of this technical specification
- 2 - a dimensioned drawing of the product
- 3 - the production finish (see 4)
- 4 - whether machining of the running surface is required (see 5.1)
- 5 - the method of fitting the tyred wheel on to the axle (see 5.4)
- 6 - tolerances and surface roughness, if they are different from this technical specification (see 6.2)
- 7 - whether balancing is required and, if so, the limiting value of the residual out-of-balance (see 6.3)
- 8 - whether the location and magnitude of the residual balance is to be marked (see 6.7)
- 9 - whether optional inspections will be required.

### Production finish on delivery

On delivery, the production finish of the various sections of the tyred wheel can conform with one of the following conditions :

- a) rough (as forged or as rolled), when the sections do not require machining, except for machining carried out by the manufacturer to bring the tyred wheel to conformance with this technical specification ;
- b) rough-machined, when such machining is required ;
- c) finish-machined, when such finish is specified (not to be applied to the hub bore) ;
- d) ready for assembly, condition of hub bore, after final surface processing and before fitting the tyred wheel on to the axle, or before fitting the tyre.

## 5 - Production of the tyred wheels

### 5.1 - Wheel tyres

The wheel tyre must be produced in accordance with the information given on the drawing of the purchasing railway and must conform with UIC Leaflet 810-2.

Unless other values are given in the purchasing order, the following values must be observed :

$$C_{\text{wheel tyre bore}} = C_{\text{wheel centre}} - \frac{X \cdot C_{\text{wheel centre}}}{1000}$$

$C_{\text{wheel centre}}$  = the value measured on the outer diameter of the wheel centre rim in mm

X = a factor within the range from 1.3 to 1.8 to make allowance for influences, such as wheel centre design and stiffness. (1)

(1) The "X" factor may be brought down to 1.1 for large diameter wheels.

### 5.2 - Wheel centre

The wheel centre must be produced in accordance with the information given on the drawing of the purchasing railway and in conformance with UIC Leaflet 812-5.

### 5.3 - Retention spring rings

The retention spring rings must conform with UIC Leaflet 810-3 (1).

### 5.4 - Tyre fitting

The wheel tyre is fitted before or after press-fitting or shrink-fitting of the wheel centre (see section 5.3 of UIC Leaflet 813).

The wheel tyre must be heated, preferably, to between 200 °C to 250 °C, but not above 300 °C, using an approved method. Before fitting, the bore of the wheel tyre and the surface of the rim must be carefully cleaned by means of a brush to remove any foreign particles, which may interfere with the contact between the two parts.

While fitting, the seat of the tyre lip at the end surface of the wheel centre must be checked.

The retention spring ring must be inserted as quickly as possible so as to ensure a good fit in the groove provided for this purpose ; the ends must be immediately locked into position by hammer blows applied against the edges.

Immediately after fitting the tyre the wheel centre or wheelset must be allowed to cool in still air and protected against water spray.

The operation of rolling a spring ring with special profile into position is carried out between 200 °C and 80 °C in order to prevent the formation of cracks or fissures in the tyre retention band due to cold working.

(1) In preparation.

In accordance with the instructions by the purchasing railway rolling in can be applied over the whole length of the spring ring.

The distance between the ends of the spring ring, after fitting, must not exceed 5 mm.

After rolling in spring rings with special profiles, the use of patch pieces is not permitted.

Spring rings with a rectangular cross-section shall not be rolled in. Their ends must be connected by welding using an intermediate piece.

Before delivery, markings must be applied to the rim and the tyre so as to be able to detect any relative movement between the two parts.

#### 5.5 - Balancing

Unless otherwise specified in the purchase order or its appended documents, out-of-balance is eliminated by off-centre turning of the tyre in the bore on the outer surface (see Fig. 1). The thickness of the metal removed must not exceed 4 mm and the re-machined surface should show a smooth transition to the adjoining surfaces.

It is not permitted :

- to affix additional weights,
- to bore balancing holes,
- to machine the wheel centre with cutting tools, provided that the wheel centre itself has been properly balanced.

## 6 - Requirements

### 6.1 - Tolerances

The tolerances are set out in Table 1.

The manufacturer must ensure that the tolerances are observed so that, after the tyred wheels have been fitted on to the axle (see UIC Leaflet 813, section 5.2), the wheelset tolerances laid down in UIC Leaflet 813, Table 1, are attained without further machining being needed. (For wheel centres refer to UIC Leaflet 812-5).

### 6.2 - Surface roughness

In the absence of other specifications the average surface roughness  $R_a$  for machined surfaces should correspond to the conditions of the table below.

Surface roughness of tyred wheels		
Part	Degree of finish	Average surface roughness $R_a$ $\mu\text{m}$
Bore	Rough-machined	$\leq 12.5$
	Ready for fitting on to the axle	0.8 to 3.2
All other parts	Finish-machined	$\leq 12.5$

For unmachined surfaces the surface roughness shall be specified by the purchasing railway in the purchasing order or its accompanying documents.

**6.3 - Residual out-of-balance**

Unless otherwise specified in the purchasing order or its accompanying documents, the residual out-of-balance of the tyred wheel must not exceed the limiting values given in the table below :

Static out-of-balance for tyred wheels	
Maximum running speed (km/h)	Maximum permissible residual out-of-balance (gm)
$V \leq 120$	125
$120 < V \leq 160$ (1)	75
(1) For the maximum speed for tyred wheels refer to UIC Leaflet 510-2.	

**6.4 - Oil pressure relief groove**

If the purchasing railway requires the provision of an oil pressure relief groove, it must be machined in accordance with its instructions.

**6.5 - Appearance**

Parts not being machined must be cleanly trimmed and provided with a smooth transition to the machined sections.

The surfaces of the tyred wheels must not bear any marks in places other than specified in the purchasing order or its accompanying documents.

**6.6 - Absence of faults**

The tyred wheels must be sound in all parts and show no faults, which may impede their use.

**6.7 - Marking**

Unless otherwise specified, the location of the out-of-round must be shown by a paint mark consisting of a radial line approximately 15 mm wide.

The magnitude of the out-of-round shall be indicated as follows under the end of the line :

- E 2 if the residual out-of-balance is  $\leq 75$  gm,
- E 3 if the residual out-of-balance is  $\leq 125$  gm.

If required in the purchasing order or its accompanying documents, the date (month and year) of fitting and the mark of the manufacturer of the tyred wheel must be indicated on the tyre in addition to the manufacturing marks specified in UIC Leaflet 810-1.

Stamping tools with sharp ridges must not be used.

**7 - Inspections****7.1 - Tyres**

The inspections are governed by UIC Leaflets 810-1 and 810-2.

**7.2 - Wheel centres**

The inspections are governed by UIC Leaflets 812-1 and 812-5.

**7.3 - Tyred wheels****7.3.1 - Responsibility for inspections, types and dates**

The purchasing order or its accompanying documents must specify whether the inspection shall be carried out :

- by delegating the inspection to the appropriate service of the manufacturer,
- or in the presence of a representative of the purchasing railway.

Unless otherwise specified in the purchasing order or its accompanying documents, the provisions made in Table 2, column 4, shall apply.

Delegation of the inspection by the purchasing railway to the competent services of the manufacturer does not preclude the right of the purchasing railway to check the effectiveness of the manufacturer's production control methods and operations with its own test facilities, if desired.

In this connection the purchasing railway shall be permitted to attend all inspections made by the manufacturer and to check the results recorded.

#### 7.3.2 - Production control

The supplier shall submit the production processes used to fill the purchasing orders for the approval of the purchasing railway and ask for its agreement to any changes.

The representative of the purchasing railway shall be permitted to check that the various production operations conform with the provisions of this specification and the purchasing order and its accompanying documents.

For this purpose, he shall be supplied, in particular, with properly calibrated temperature measuring instruments and temperature chart recorders.

#### 7.3.3 - Checking the characteristics of the tyred wheels

When presented, each batch of tyred wheels shall be submitted to the obligatory or optional tests and inspections indicated in Table 2.

#### 7.3.4 - Presentation for quality control by the purchasing railway

The representative of the purchasing railway shall be informed of the presentation date in writing. This note shall indicate the number of each type of tyred wheels to be included in each batch together with the relevant purchasing order number.

#### 7.3.5 - Test certificate

7.3.5.1 - Regardless whether the responsibility for inspections rests with the manufacturer or the representative of the purchasing railway, the manufacturer shall supply a certificate stating that the production conditions of this technical specification were observed. The final test certificate shall also contain the results of the following tests :

- check of appearance and dimensions,
- balancing, if required.

7.3.5.2 - The manufacturer shall issue the relevant certificates for the tests and inspections for which he is responsible :

- a) at the time of delivery, if responsibility for all tests had been delegated,
- b) at the time of first presentation for inspection, if delegation of responsibility covered only some inspections.

#### 7.3.6 - Number of inspections and tests

The number of tyred wheels to be submitted to inspections per test unit and the number of tests per tyred wheel are indicated in Table 2.

#### 7.3.7 - Type of inspections and tests

##### 7.3.7.1 - Fit between tyre and wheel centre

After fitting, the tyred wheel shall be checked, using a method approved by the purchasing railway, to ensure that the fit between tyre and wheel centre, and that of the retention spring ring, is proper and sound.

##### 7.3.7.2 - Balancing

if specified in the purchasing order or the accompanying documents, the residual out-of-balance of the tyred wheel shall be measured with an instrument approved by the purchasing railway.

##### 7.3.7.3 - Checking of appearance

Checking of appearance is carried out by visual inspection before delivery.

**7.3.7.4 - Checking of dimensional properties**

When the letter "m" is shown in the "inspection" column of Table 2, checking of the dimensional properties is obligatory. Due to the practical difficulties of checking certain dimensions in industrial production conditions the dimensions marked by the letter "o" in the "inspection" column of Table 2 need be checked only, if this was stipulated by the purchasing railway in the purchasing order.

The definitions of the different geometrical tolerances are given in the international ISO standard 1101.

**7.3.7.5 - Checking of surface roughness**

If the conformance with surface roughness specifications is to be checked, the number of wheels to be inspected and any other details required shall be indicated by the purchasing railway in the purchasing order or the accompanying documents.

**7.3.8 - Conclusions from the inspections**

Any faults in the fit of the tyre and retention spring ring, the appearance, dimensions and residual out-of-balance cause the rejection of the corresponding tyred wheel.

Any other result not conforming with the required characteristics cause the rejection of the corresponding batch.

Before despatch, all tyred wheels accepted shall be stamped; the method used for this operation shall be agreed between purchasing railway and manufacturer.

**7.3.9 - Repetition of tests and supplementary tests**

If in the case of test results not conforming with the required characteristics the purchasing railway agrees to tests being repeated, the methods to be used and any supplementary tests must be agreed between the purchasing railway and the supplier.

**8 - Delivery****8.1 - Corrosion protection**

After having been inspected, and before storage or despatch, the wheels accepted shall be provided with corrosion protection approved by the purchasing railway.

The preparation of the surfaces shall conform with the provisions of UIC Leaflet 842-3 and it is recommended that corrosion protection is applied in accordance with the provisions of UIC Leaflet 842-3, Appendix 2, para. 2.2.

On tyred wheels intended for trailing stock, protection shall be applied to :

- all finish-machined parts,
- all rough-machined and non-machined parts, if specified in the purchasing order or its accompanying documents.

No corrosion protection shall be applied to the surface of the tyre.

**8.2 - Protection against mechanical damage during transport**

Effective protection of the finish-machined parts and, especially, the wheel bores against impact shall be provided before despatch.

**9 - Guarantee**

The guarantee terms shall be agreed between the purchasing railway and the manufacturer, when the order is placed. Unless otherwise specified in the purchasing order, the wheels shall be guaranteed by the supplier for five years against any defect attributable to production and not detected during the works inspection.

This period shall come into effect from the end of the month given on the marked fitting date on the tyre.



OR

In the case of wheels installed in new vehicles the guarantee term starts with the delivery date of the vehicles, in which they have been installed.

Wheels showing defects during the guarantee period, which make them unfit for service or reduce their service life, are rejected.

Before final rejection of the wheels they can be submitted to another inspection by agreement between the purchasing railway and the supplier, if the latter requests it.

If this inspection confirms that the defects are attributable to the production process or non-observance of the protection measures provided for in 8.1 and 8.2, the defective wheels shall be definitely rejected.

If the results of the inspection carried out in the presence of both parties do not lead to an agreement between the purchasing railway and the supplier, experts recognised by both parties shall be consulted to resolve the dispute. The costs shall be borne by the party judged to be responsible.

Should two wheel tyres or centres from the same cast break in service (i.e. become unfit for service by material separation) or should more than 5 % of tyres or wheel centres from the same cast be found to be defective the purchasing railway shall be entitled to reject all components from this cast.

The rejected wheels shall be made available to the supplier for replacement or reimbursement at their as-new value at the time of withdrawal.

OR

Table 1 : Tolerances

Dimensional characteristics after tyre fitting	Symbol in Fig. 1 indicating Dimensional Tolerances	Geometric (1)	Values	Inspection (2)
Outer diameter	a		$\begin{matrix} +4 \\ 0 \end{matrix}$ (3)	m
Width	d		$\begin{matrix} +1 \\ -1 \end{matrix}$ (3)	m
Inner diameter (at the lip side)	b		$\begin{matrix} +2 \\ -2 \end{matrix}$	m
Inner diameter (spring ring side)	c		(8)	m
Width of collar	w		$\begin{matrix} +1 \\ -1 \end{matrix}$	m
Running surface profile		v	according to drawing	m
Running surface out-of-round		s	0.2	o
Off-centre		t	0.5	o
Cylindricity of bore		Y	0.15	m

T  
y  
r  
e

Projection of hub relative to tyre	r	+3 0	(3)	m
Hub length	h	+3 0	(3)	m
Inner diameter (bore)	g <sub>1</sub>	0	(7)	m
	g <sub>2</sub>	-2	(8)	m
Cylindricity of bore	x <sub>1</sub>	0.5	(4)	o
	x <sub>2</sub>	0.2	(5)	o
Out-of-round of bore rough-machined	q <sub>1</sub>	0.02	(6)	m
	q <sub>2</sub>	1.0	(4)	m
Out-of-round of bore ready for assembly	q <sub>1</sub>	0.2	(5)	m
	q <sub>2</sub>	0.3		o

W h e e l c e n t r e

- (1) See ISO 1101.  
 (2) m = obligatory, o = recommended.  
 (3) For tractive stock, other values may be required.  
 (4) Applies if balancing is not required or if the running surface serves as balancing reference.  
 (5) Applies if the bore of the hub serves as balancing reference.  
 (6) If there is a slight taper not exceeding the permitted tolerances, the largest diameter shall be on the insertion side of the axle, when the tyre wheel is fitted to it.  
 (7) The machining tolerance on the bore of the rough-machined wheel shall be 3 mm (i.e. g<sub>2</sub> - g<sub>1</sub> = 6 mm).  
 (8) The tolerances on the diameter and the interference-fit shall comply with the values of the technical specification or drawing to ensure a good fit.

Symbols for the characteristic dimensions

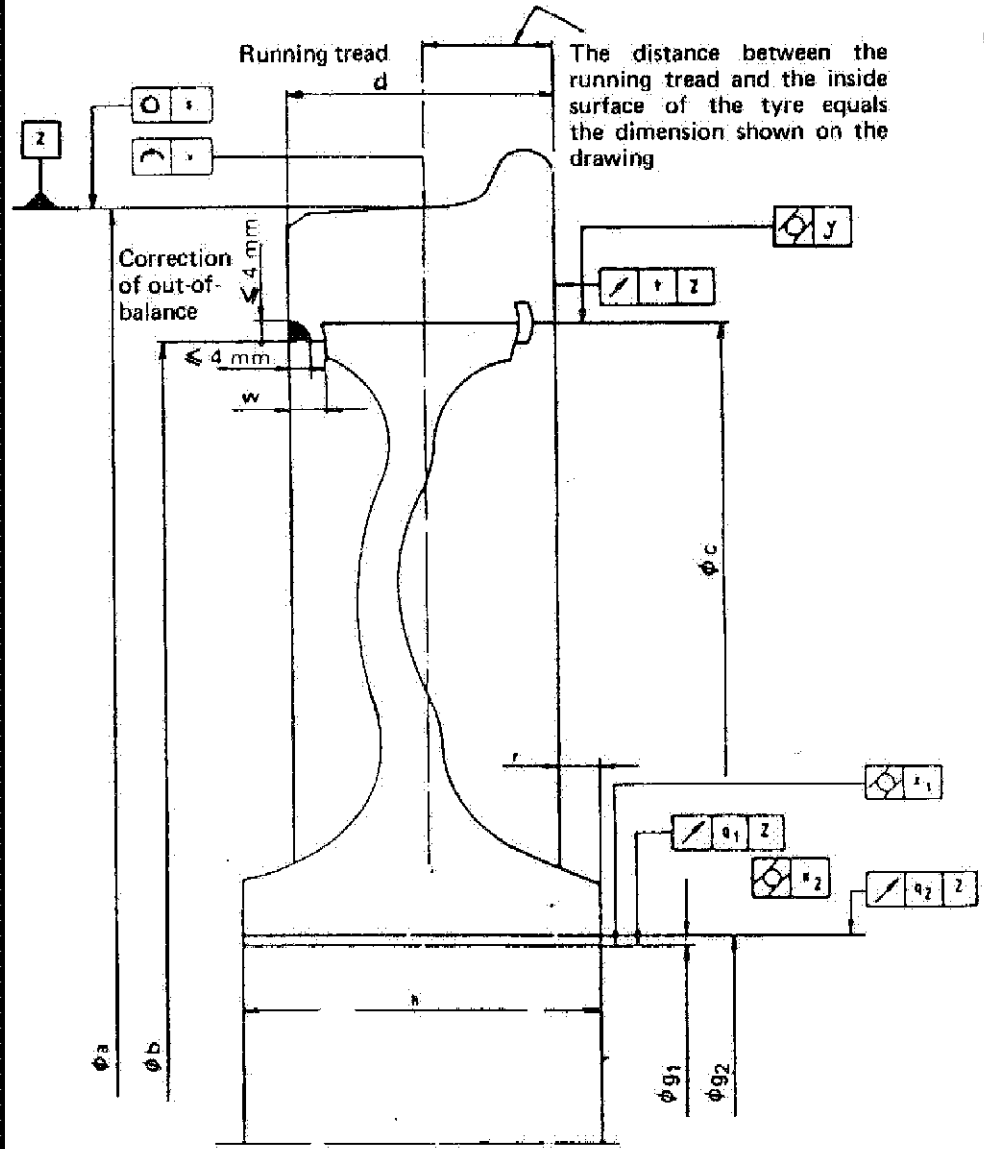


Figure 1

**Table 2 : Type and number of inspections on tyred wheels**

1	2	3	4	5
Inspections		Remarks (1)	(2)	Number of wheels per batch
1	Appearance	m	a	100 %
2	Surface roughness	o	a	to be agreed
3	Dimensional and geometric tolerances	(3)	a	100 %
4	Out-of-balance	o	a	100 %

(1) m = obligatory

o = the inspection is made only if required in the purchasing order or its accompanying documents.

(2) a = the inspection is made by the competent service of the manufacturer's works.

(3) See Table 1, column "Inspection".

**Application**

With effect from 1 July 1990.

All UIC railways.

**Record references**

*Headings under which this question has been examined:*

— *Question 5 SA FIC - Preparation of Leaflet 812-4 "Technical specification for the supply of tyred wheels for tractive and trailing stock — Tyre fitting and tolerances.*

(Sub-Committee "Specifications" : Paris, January 1989).

— *Question 5 SA FIC - Revision of Leaflet 812-4 "Technical specification for the supply of tyred wheels for tractive and trailing stock — Tyre fitting and tolerances.*

(Sub-Committee "Specifications" : Paris, January 1990; Working Party "Running gear" : Levallois, February 1990).