

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1005/VII

RAILWAY ROLLING STOCK MATERIAL

WHEEL SETS FOR TRAILER STOCK

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BRIEF HISTORY

The ISO Recommendation R 1005/VII, *Railway rolling stock material – Wheel sets for trailer stock*, was drawn up by Technical Committee ISO/TC 17, *Steel*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of a Draft ISO Recommendation based on a corresponding UIC* code.

In January 1968, this Draft ISO Recommendation (No. 1381) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Austria	Hungary	Romania
Belgium	India	South Africa, Rep. of
Canada	Israel	Spain
Colombia	Italy	Sweden
Czechoslovakia	Korea, Rep. of	Switzerland
Denmark	Netherlands	Turkey
Finland	New Zealand	U.A.R.
France	Norway	United Kingdom
Germany	Poland	Yugoslavia

Two Member Bodies opposed the approval of the Draft :

Brazil
Japan

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in May 1969, to accept it as an ISO RECOMMENDATION.

* Union Internationale des Chemins de Fer (International Union of Railways).

RAILWAY ROLLING STOCK MATERIAL

WHEEL SETS FOR TRAILER STOCK

1. SCOPE

This ISO Recommendation applies to the supply of wheel sets* for trailer stock (with the exception of railcar-type trailer stock).

It states the conditions for the construction of wheel sets, each component of which is covered by a separate document in this ISO/R 1005 series of Recommendations.

In addition, it states the conditions for acceptance and guarantee.

2. CLASSIFICATION

This ISO Recommendation covers two categories of wheel sets :

- axles whose journals are fitted with plain bearings;
- axles whose journals are fitted with roller bearings.

These two categories differ essentially in the shape of the axle ends. The conditions for acceptance being the same, there is no special designation for distinguishing each class, other than those which may be shown in the contracts prepared by each purchaser.

3. MECHANICAL PROPERTIES

Back pressure. The back pressure should reach, in the case of each wheel, at least

- 1.2 times the actual application pressure, if the operation has been carried out when cold,
a value, expressed in kilogrammes-force, equal to 600 times the diameter of the seating surface,
expressed in millimetres, if the operation has been carried out when hot,

without causing any displacement of the wheel on the axle.

* The term "wheel set" designates the complete unit constituted by the assembly of an axle and two wheels, which unit supports the underframe of a vehicle and permits the movement of the vehicle on the track.

The wheels may be either

- solid wheels in rolled or forged steel, or
- tyred wheels : in this case they should consist of a wheel centre of rolled, forged or cast steel, fitted with a tyre.

4. PHYSICAL PROPERTIES

4.1 Soundness of tyre (in the case of tyred wheels)

The wheel assembly should give a clear ring when struck with a hammer.

4.2 Balance

The purchaser should specify one of the following two characteristics :

4.2.1 *Static balance.* The out-of-balance should be less than 0.250 m.kgf.*

4.2.2 *Dynamic balance.* The maximum out-of-balance, and the method to be adopted for its measurement, depending on the use for which the axles are intended, should be stated on the order.

4.3 Electrical resistance

The electrical resistance of the wheel set should not exceed 0.01 Ω .

4.4 Surface condition of the journals

When specified on the order, the cylindrical surfaces of the journals should be roller burnished.

5. DIMENSIONAL CHARACTERISTICS

The wheel set should comply with the information shown on the standards or drawings for the dimensions and the dimensional tolerances, the running tread thickness being kept as great as possible.

When the dimensional tolerances are not stated in the standards or drawings, the tolerances given in the Annex to this ISO Recommendation should apply.

In addition, the running surface should reveal only slight traces of machining.

6. IDENTIFYING MARKS

The component parts of the wheel sets should bear the identifying marks shown on the particular drawings of each purchaser. In addition, the wheel set should be stamped with the marks necessary, in order to identify

- its type,
- its number,
- the purchaser,
- the date of construction or of entry into service (number of the month and last two figures of the year).

Example : U2R – 4561 – S.N.C.F. – 9.69

These identifying marks should be stamped on the ends of the axle, in characters of similar dimensions to those of the brands on the axle itself.

When, in very exceptional cases, there is insufficient room on the ends of the axles (in the case of roller-bearing axles), the brands should be stamped on a steel sheet collar placed around the body of the axle, and the ends of the collar should be riveted or welded together.

In the case of tyred wheels, the following marks should also be stamped near the identifying marks on the tyres :

- date of tyreing;
- the brand of the particular workshop or factory having carried out the tyreing operation.

* In the case of certain special stock, the order may specify a maximum out-of-balance value less than that given above.

7. PREPARATION OF THE COMPONENTS

The axles, solid wheels, wheel centres, tyres and retaining rings for the tyres should satisfy the requirements of the technical specifications, and the standards or drawings specially prepared for each component.

The components should also comply with the conditions described in clauses 7.1 to 7.5.

7.1 Axle

The centre holes or "centres", in accordance with the drawings, should be retained in the two ends.

Each wheel seat should be machined so as to obtain a cylindrical assembly. This machining should be carried out so that no scoring or accidental trace of machining remains. The surface condition (micro-geometry) of the wheel seats should comply with all the additional requirements specified by the purchaser.

If required by the purchaser, each wheel seat can be improved by burnishing, in accordance with the conditions defined on the order.

When the drawing gives no numerical information, a slight conical lead-in not exceeding 1 mm at the smallest diameter may be permitted on the wheel seats over a maximum length of 10 mm (3/8 in).

If requested by the purchaser on the order, the cylindrical bearing surface of the journals should be burnished before being placed beneath the vehicle, this operation being carried out either before or after assembly of the wheel centres on the axle.

After machining, the identifying marks stamped on the wheel seats of the axle should be re-stamped in the prescribed position on the ends of the wheel seats.

7.2 Solid wheels and wheel centres

The bore of the boss of the wheels and wheel centres and the cylindrical surface of the wheel centres intended to receive the tyres should be machined with a slow feed and should not show any groove or abnormal trace of machining.

The condition of these surfaces (microgeometry) should comply with all the additional requirements specified in the order by the purchaser.

Each solid wheel or wheel centre should have been balanced in accordance with the requirements of the technical specifications, standards or drawings relating to it.

When holes for stops are provided, these should be drilled after the balancing of the wheels and wheel centres, in such a way that their centres lie on the diameter passing through the position of the out-of-balance.

The edges of these holes should not be sharp.

7.3 Tyres

The bore of the tyres should be machined with a slow feed and should not show any groove or abnormal trace of machining.

The surface condition (microgeometry) should satisfy all the additional requirements specified in the order by the purchaser; the value of the diameter of the bore is given in mm by the following formula :

$$D = D_1 - \frac{(1.5 \pm 0.2) D_1}{1000}$$

where

D is the diameter of the bore of the tyre, expressed in millimetres;

D_1 is the mean outside diameter of the rim of the wheel centre, expressed in millimetres.

The mean diameter of the rim is that resulting from the average of the measurements from at least two perpendicular diameters.

7.4 Retaining rings

The cross-section of the rings may be of two types, in accordance with the drawing of the purchaser :

- special profile,
- rectangular profile.

The ring should be used rough-rolled. Bending should be carried out with care so as to avoid all twist. Its length should be such that, after fitting, the distance between the two ends is not greater than 5 mm.

7.5 All components

All portions machined to the finished size of components which are not required to be assembled immediately after machining, should be protected against corrosion by the application of a coating of some protective material agreed upon by the purchaser.

8. ASSEMBLY OF THE COMPONENTS

The axles, solid wheels, wheel centres, tyres and retaining rings having been manufactured in accordance with the conditions specified in section 7, and checked by suitable gauges, assembly should be carried out in compliance with the following requirements.

The shrinkage necessary to obtain the fixing under the pressure indicated hereafter can be determined by the purchaser, who lays down the corresponding dimensional tolerances.

Shrinkage onto the axles should be carried out either

- by machining the axle to a diameter greater than the diameter of the bore of the wheel centre, when the latter diameter is laid down in the assembly drawing, or
- by boring the wheel centre to a diameter less than the diameter of the axle when the latter diameter is specified in the assembly drawing.

In the case of hot-fixing, the shrinkage allowance should be between 0.9 and 1.25 ‰.

Example : for a wheel seat of 180 mm diameter, the shrinkage should be between

$$\frac{180 \times 0.9}{1000} = 0.16 \text{ mm}$$

and

$$\frac{180 \times 1.25}{1000} = 0.23 \text{ mm}$$

8.1 Fixing of solid wheels or wheel centres onto axles

One or other of the methods described in clauses 8.1.1 and 8.1.2 may be adopted, at the choice of the purchaser.

8.1.1 *Cold-fixing* should be carried out by means of a hydraulic press, and so that the out-of-balance in each wheel is placed in the same diametrical plane and on the same side of the axle. The contacting parts of the axles, wheels or wheel centres should be greased, preferably with pure white tallow or with a vegetable oil (linseed or colza oil). All precautions should be taken to avoid distortion of the wheels and the axle, and deterioration of the machined surfaces, in particular of the journals.

The press used for this operation should possess a correctly calibrated recording pressure gauge. The operation should be carried out, in principle, in the presence of the accepting inspector. The pressure gauge needle should begin to move before a 20 mm penetration is reached; the needle movement should then be regular.

The value attained by the fixing force P should be within the limits given by the following formula :

$$P = D \times K$$

where

- P is the force, expressed in kilogrammes-force;
 D is the diameter, expressed in millimetres,
 K is the value of the coefficient given by the following table :

Component	Method of manufacture	K	
		Grease lubricated	Oil lubricated
Non-tyred wheel centre	cast steel	200 to 300	300 to 450
	forged or rolled steel	300 to 450	350 to 500
Tyred wheel centre or solid wheel	all classes of steel	350 to 500	400 to 600

Example : for a wheel seat of 180 mm diameter being fitted with a solid wheel, with grease lubrication, the force P should be between

$$350 \times 180 = 63\,000 \text{ kgf}$$

and

$$500 \times 180 = 90\,000 \text{ kgf}$$

The force record should be placed at the disposal of the purchaser during the entire guarantee period.

8.1.2 *Hot-fixing* should be carried out, after heating the solid wheels or wheel centres, so that the out-of-balance in each wheel is placed in the same diametrical plane and on the same side of the axle.

The heating temperature should be limited to that strictly necessary for fitting, and should not exceed 250 °C.

Every care should be taken to ensure the cleanliness of the press-fit surfaces and to avoid damage to the machined surfaces, particularly the journals.

8.2 Tying

Tying should be carried out hot, before or after fitting the wheel centres, in accordance with the requirements of the purchaser. The tyre should be heated to the temperature just sufficient to obtain the expansion enabling the tyre to be placed in position, and this temperature should not exceed 300 °C.

Before placing into position, the bore of the tyre and the surface of the rim should be cleaned of all foreign matter which would hinder contact between the two components.

During tying, the extent to which the ring is inserted in the dovetail should be checked.

The retaining ring should be inserted as rapidly as possible and so that it is set well into the bottom of the groove; the ends should be fixed into position immediately by several blows with a sledgehammer applied to the retaining ring.

The wheels or wheel set, after tying, should be left to cool sheltered from draughts and water splashes.

The operation of fixing the special-profile retaining ring should be effected between 200 and 80 °C, in such a manner that the resultant cold-working does not cause the formation of cracks or fissures in the retaining ring.

According to the instructions of the purchaser, the fixing may be effected over the complete circumference of the ring or solely on four portions of 400 to 150 mm (4 to 6 in) in length, regularly spaced over the circumference of the tyre. Moreover, the two ends of the ring may be welded to one another, on condition that the welding does not touch either the tyres or the wheel rim.

Rectangular profile rings should not be fixed and their extremities should be welded to one another.

Immediately after fixing, punch marks should be stamped on the rim and the tyre, near the identifying marks, in order to make it possible to ascertain any loosening of the tyre.

9. REMOVAL OF SURFACE DEFECTS

Surface defects observed after assembly and finishing can be eliminated by removing metal in the cold state. The dimensional and balance tolerances should be maintained after these operations.

Any treatment which is carried out with the object of hiding a defect should be strictly forbidden and should result in the rejection of the complete order.

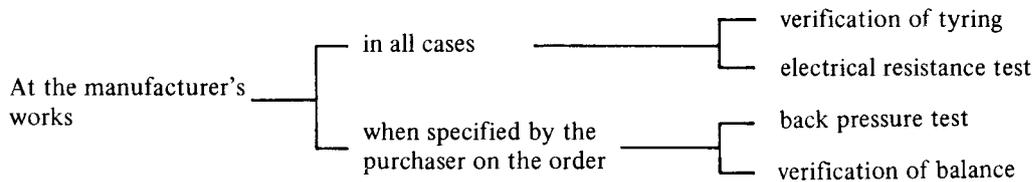
10. CONDITIONS OF ACCEPTANCE

Submission for acceptance, selection of samples and preparation of the test pieces as defined in the specifications peculiar to each of the components of the wheel set, and also the acceptance tests, should be carried out for each type of component before assembly of the wheel set.

The accepting inspector should then ensure that the assembly of the components is carried out in accordance with the conditions set out in section 8.

11. NUMBERS AND TYPES OF TESTS

Wheel sets should be subjected to the following tests and verifications :



These tests and verifications should be carried out on each axle, with the exception of the back pressure tests, the number of which should be specified by the purchaser.

12. INTERPRETATION OF THE TESTS – ADDITIONAL TESTS

Any characteristic which does not comply with the specified requirements can result in the rejection of the wheel set.

Defective components can be replaced by mutual agreement between the purchaser and the supplier with a view to obtaining the required characteristics.

If the purchaser agrees to additional tests, the number of wheel sets to be submitted to these tests should be defined by special agreement between the supplier and the purchaser.

13. TESTING

13.1 Verification of the tyreing of the wheels

13.1.1 *Test method.* The wheel set should rest freely on a section of track. It should be struck with a hammer at several points on the tyre.

13.1.2 *Results to be obtained :* see clause 4.1.

13.2 Balance test (static or dynamic at the purchaser's option)

13.2.1 *Test method.* Whichever method is used, the wheel set should rest by its journals on the flat and polished surfaces of two exactly level supports, or on the supporting bearings of a balance machine.

13.2.2 *Results to be obtained :* see clause 4.2.

13.3 Electrical resistance test

13.3.1 *Test method.* The wheel set should be placed on the supports of an apparatus for the measurement of electrical resistance, and carefully insulated from undesirable contacts.

13.3.2 *Results to be obtained :* see clause 4.3.

13.4 Back pressure test

13.4.1 *Test method.* A wheel set, on which the wheel fixing operation was carried out not less than 48 hours previously, should be placed in the press used for the removal of a wheel. Pressure should be exerted very gradually and evenly.

13.4.2 *Results to be obtained :* see section 3.