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Translation

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Technical specification for the supply of parallel leaf springs for vehicles

*Spécification technique pour la fourniture de ressorts à lames parallèles pour véhicules
Technische Lieferbedingungen für Fahrzeug-Blattfedern*



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Retyped in FrameMaker and up-date of references to ISO standards following changes made between 1985 and 2003:

- ISO 82:1974: Steel. Tensile testing (standard withdrawn on 1.7.1984) is mentioned in the 5th edition of UIC Leaflet 821 dated 1.7.1985. CTR SC03 suggests ISO Standard 6892:1998 as a replacement standard.

- ISO 85:1959: Bend test for steel (standard withdrawn on 1.7.1985) is mentioned in the 5th edition of UIC Leaflet 821 dated 1.7.1985. The ISO has officially replaced this standard by ISO Standard 7438:1985.

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

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Summary

This technical specification governs the supply of parallel leaf springs with constant thickness or with a parabolic profile, intended for use in the suspension gear for tractive or hauled stock.

It also applies to all springs which are comparable to the above types in terms of their functional or dimensional characteristics.

1 - Purpose

1.1 - Scope

This technical specification governs the supply of parallel leaf springs with constant thickness or with a parabolic profile, intended for use in the suspension gear for tractive or hauled stock.

It also applies to all springs which are comparable to the above types in terms of their functional or dimensional characteristics.

1.2 - Definitions

The term "parallel leaf spring" describes the complete unit formed by the following components:

- leaves, including the leaf fitted with devices connecting the spring to the underframe or another spring (eyes, small grippers, drill holes) and termed "the main leaf",
- buckle,
- insert(s) and buckle key(s) if required,

either hot or cold-assembled using a buckle.

Progressive flexibility springs consist of leaves at two different stages: the stage comprising the main leaf is termed "primary stage", the other "secondary stage". These stages may consist individually of one or several leaves.

Springs incorporating leaves with thicknesses varying according to a parabolic profile are termed "parabolic springs".

Springs incorporating constant-thickness leaves are termed "trapezoidal springs".

1.3 - Classification

Springs shall be classified into two categories (Category 1 and Category 2) with decreasing characteristics. Categories shall be determined by the engineering and design departments and indicated on drawings.

Parabolic springs shall be classified in Category 1.

All particulars relevant to contract implementation, and more especially those concerning observance of the following points in this specification:

2.1.1 - page 4, 2.1.3, 2.1.4 - page 5, 2.2.1 - page 6, 2.2.2, 2.2.3 - page 7, 2.2.4 - page 8,
3.2.2 - page 10, 3.2.3.2 - page 11,
4.3.2 - page 13, 4.3.4 - page 19,

shall be specified in the order or its appended documents.

The drawings of springs or component parts shall stipulate:

- the steel grade and the reference of the document governing supply of the material,
- the category,
- the characteristics,
- the method of assembly (hot or cold),
- the reference to this specification.

1.4 - List of reference documents

Reference is made in this technical specification to documents other than UIC leaflets, as follows:

ISO standards: *ISO 83 - ISO 630 - ISO 683/14 - ISO 6506-1, ISO 6892, ISO 7438* (see Bibliography - page 33).

2 - Characteristics

2.1 - Component parts

2.1.1 - Component materials

2.1.1.1 - Leaves

Leaves shall be manufactured from steel bars supplied under the terms specified in *UIC Leaflet 820* (see Bibliography - page 33).

The steel grade used for leaves shall be that specified in the order or its appended documents.

2.1.1.2 - Buckles

Buckles shall be manufactured from the steel grade specified in the drawing. Unless otherwise stipulated, use shall be made of Fe 360-C or Fe 510-C steel defined in *ISO Standard 630*.

2.1.1.3 - Other parts

The characteristics of other component parts such as inserts, wedges and buckle keys must be consistent with the indications given in the order or its appended documents.

2.1.2 - Physical characteristics

2.1.2.1 - Leaves

Leaves must be free of any flaw likely to prevent the springs from performing efficiently under service conditions.

Leaves must not be entirely decarburized, and the depth of partial decarburization must be less than the values indicated in Table 1 overleaf:

Table 1 :

Leaf thickness in mm	Decarburization depth in mm
< 7	0,20
$\geq 7 < 15$	0,30
$\geq 15 < 25$	0,40
$\geq 25 < 35$	0,55
$\geq 35 \leq 80$	0,80

If stipulated in the order or its appended documents, main leaves of Category 1 trapezoidal springs and all the leaves of parabolic springs shall undergo a magnetic crack detection test in accordance with the procedure and conditions set out in Appendix B - page 31. They must show no untoward effect either on the surface under stress under normal operating conditions or at the edges.

Leaves with random spectra measuring less than 5 mm in length on the surface under compression in normal operating conditions shall be accepted, provided:

- these are over 150 mm apart,
- the corresponding defect is eliminated by slight longitudinal grinding, without heating:
 - to a depth of 0,2 mm at the maximum,
 - with gradual levelling of the surface.

After removal of defect, leaves shall undergo a further magnetic crack detection test in accordance with the conditions in Appendix B - page 31.

2.1.2.2 - Other parts

The other component parts must not show any flaws likely to impair their use.

2.1.3 - Geometrical characteristics

2.1.3.1 - Leaves

The shape and dimensions of leaves shall be those stipulated in the order or its appended documents. Main leaf eyes shall be cylindrical and the ends shall not come into contact with the leaf.

2.1.3.2 - Other component parts

The geometrical characteristics of the other component parts must be consistent with the indications given in the standards or in the drawings.

2.1.4 - Mechanical characteristics

2.1.4.1 - Category 1 spring leaves

Unless otherwise stipulated in the order or its appended documents, category 1 spring leaves shall be manufactured from steel grade 13 or 14, as defined in *ISO Standard 683-14*.

Leaves must be shot-peened in such a way that the deflection in the Almen A2 test piece used under the conditions defined in Appendix A - page 28 is 0,5 mm for the surface under stress.

The shot-peened area shall represent at least 95% of the surface. This value shall be assumed to have been reached as soon as the impressions are seen during visual examination when magnified to the power of 10 to cover the whole surface.

After heat treatment, the test pieces taken under the conditions stipulated in point 4.3.3 - page 17 shall have the following characteristics:

Tensile strength:

$$1\,450\,\text{N/mm}^2 \leq R_m \leq 1\,600\,\text{N/mm}^2$$

$$R_p\,0,2 \geq 1\,320\,\text{N/mm}^2$$

$$A\% > 8$$

KU resilience at 20°C ≥ 13 J (mean value of results obtained on 3 test pieces; no individual result may have a value $< 75\%$ of the minimum mean value).

Hardness should be between 420 and 465 HBW

Differences in hardness on the same leaf or on the leaves of the same batch must not exceed 30 HBW.

2.1.4.2 - Category 2 spring leaves

These spring leaves shall be manufactured from steel grades 4 or 7 defined in *ISO Standard 683-14*, or from any other grade approved by the purchasing Railway.

The HBW hardness must lie between 380 and 430 for grades 4 or 7.

2.1.4.3 - Buckles

Buckles shall have the characteristics of the steel grade stipulated in the order or its appended documents.

Buckles must show no crack or fracture after the expanding test carried out under the conditions stipulated in point [4.3.4.11 - page 21](#).

Test pieces taken from one of the lateral surfaces of the buckle, and bent until the gap between the two ends is half the thickness of the test piece, must show no crack or fracture.

The buckle's HBS hardness must be between 100 and 130, or within the limits stipulated by the purchasing Railway.

2.1.4.4 - Other parts

The characteristics of other parts must be consistent with the stipulations contained in the order or its appended documents.

2.2 - Springs

2.2.1 - Geometrical characteristics

The shapes and dimensions of the springs when finished must correspond to those stipulated in the order or its appended documents.

The axial plane of the buckle, its surfaces and the centres of the assembly holes must either be parallel or perpendicular to one another as applicable, and correspond to the conditions or tolerances specified in these documents.

The centre planes (lateral and longitudinal) of the spring shall form its planes of symmetry.

On the assembled spring, the lateral surfaces formed by the edges of leaves must be such that no edge deviates from the plane tangent to the other edges by more than 1,5 mm.

When the spring is not under load, the ends of the leaves may be separated by a slight gap, but under Load F1 (see points [4.3.4.12 - page 21](#) and [4.3.4.13 - page 22](#)), this gap must disappear for constant-flexibility springs or the primary stage of progressive-flexibility springs.

2.2.2 - Mechanical characteristics

2.2.2.1 - Deflection test

It must be possible for the springs to withstand two successive test loads applied under the conditions laid down in point [4.3.4.12 - page 21](#).

After the deflection test, the height differences must be within the tolerances indicated on the drawing.

2.2.2.2 - Flexibility

The flexibility as measured under the conditions laid down in points [4.3.4.13](#) or [4.3.4.14 - page 23](#), according to whether the spring is of constant or progressive flexibility, must be consistent with the values indicated on the drawing.

Unless otherwise stipulated, the flexibility tolerance shall be $\pm 8\%$ for trapezoidal springs and $\pm 7\%$ for parabolic springs.

2.2.2.3 - Resistance of leaves to slippage

When spring leaves at least 90 mm wide are clamped in a buckle and the leaves are fastened together by interlocking centre nibs and keying with an insert, the strength of the assembly shall be such that no displacement of the component parts occurs when a load is exerted either on a central leaf of the spring, or on the insert, in accordance with the test conditions stipulated in point [4.3.4.15 - page 24](#).

The value of the load must be 75 kN for buckles made of Fe 360 C steel.

2.2.3 - Marking

Each spring must bear the following marks, either hot or cold stamped on the buckle:

- the manufacturer's mark,
- the owner's mark,
- the "interchangeable part" mark,
- the deflection under test load of 20 kN measured on each spring, and if so stipulated in the order or in its appended documents,
- the last two figures of the year of manufacture,
- the maximum axle load of the vehicle on which this spring is to be fitted, if this load is in excess of 200 kN,
- the category.

If the spring type has to be indicated, relevant particulars may be painted on leaves.

No hot or cold stamped mark should be made on the surface under stresses in normal conditions of use or on edges.

2.2.4 - Protection against rust

Unless otherwise stipulated in the order or its appended documents:

1. Category 1 springs shall be protected against rust by a coat of paint approved by the purchasing Railway;
2. Category 2 springs shall be protected against rust as follows:
 - on non-machined parts: a coating of grease or a similar product the composition of which has been approved by the purchasing Railway,
 - on machined parts: an anti-rust coating approved by the purchasing Railway;
3. separately-ordered buckles for cold assembly shall at least be given the same primary protective coat of paint as that stipulated for buckles of assembled springs;
4. each parabolic spring leaf shall be given a coat of paint with a high zinc content , approved by the purchasing Railway, before assembly of the spring.

The thickness of the coat of paint, when dry, shall be between 30 μm and 50 μm .

After assembly, the spring shall be given a coat of paint approved by the purchasing Railway. The minimum thickness of the coat of paint, when dry, must be 20 μm .