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APPENDIX

**1 - PURPOSE**

The present technical specification governs the supply of steel rings for buffer springs.

All requirements governing the execution of the contract, especially those concerned with the application of paragraphs 2-3-1, 2-3-2, 2-3-3, 2-4, 2-5 and 4-2-2 of the present specification, must be stated on the purchase order or its appended documents.

**1.1 - Classification**

The rings are of 4 types (see Appendix) :

- closed exterior rings
- closed interior rings,
- open interior rings,
- interior half-rings.

**1.1.1 - Condition of metal on delivery**

The rings shall be delivered in hardened and tempered condition.

**1.2 - List of reference documents**

The following document is referred to in the present specifications :

- ISO Recommendation R 80

**2 - CHARACTERISTICS**

**2.1 - Chemical characteristics**

Two grades of steel may be used, the limit values for the various elements and impurities being indicated below in percentage form.

**58 Cr V4 steel**

**62 Si Cr 5 steel**

$0.57 \leq C \leq 0.62$   
 $0.15 \leq Si \leq 0.40$   
 $0.70 \leq Mn \leq 1.10$   
 $0.90 \leq Cr \leq 1.20$   
 $0.10 \leq V \leq 0.20$   
 $S \leq 0.035$   
 $P \leq 0.035$

$0.55 \leq C \leq 0.65$   
 $1.00 \leq Si \leq 1.30$   
 $0.90 \leq Mn \leq 1.10$   
 $0.40 \leq Cr \leq 0.60$   
 $S \leq 0.035$   
 $P \leq 0.035$

**2.2 - Physical characteristics**

**2.2.1 - Appearance**

The rings must be sound in all parts, on the surface as well as the interior and shall have no cracks, flaws, burrs, lack of metal, rolling laps or any other defects liable to impair their use.

Surfaces must be smoothed and carefully cleaned of rust.

**2.3 - Mechanical characteristics**

**2.3.1 - Hardness of rings**

The hardness of the rings must be within the tolerances specified in the drawing.

**2.3.2 - Flexibility of assembled springs :**

After tests have been carried out in accordance with the provisions of paragraph 4.2.5.3, the rings should show no breaks, defects, signs of cracking or abrasions.

The height  $H_1$  must be within tolerances specified in the drawing.

During the initial cycle of operations, the loads in proportion to the deflection must comply with the specifications of the graph shown in the drawing, allowing for the tolerances provided.

After 20 compression and release cycles, the new loads recorded, in proportion to the deflection, must remain within the same tolerances.

**2.3.3 - Endurance test**

After the tests have been carried out in accordance with the provisions of paragraph 4.2.5.4, the rings must show no breaks, defects, signs of cracking or abrasions.

The flexibility test, repeated on the assembled spring after the endurance test, must give results which comply with the specifications given in the drawing.

During and after the endurance test, energy absorption must remain within the limits laid down in the drawing.

**2.4 - Geometrical characteristics**

The rings must be manufactured in accordance with the specifications given in the order or the appended documents.

Unless otherwise specified in the documents, the tolerances given below must be complied with.

Height of rings	$\pm 0.5$ mm
External diameter of interior rings	$\pm 0.2$ mm
Internal diameter of external rings	$\pm 0.2$ mm
Thickness of rings	$\pm 0.3$ mm
Ovalisation of rings after quenching	$\leq 1$ mm
Eccentricity	$\leq 0.2$ mm
Width of opening for open rings	+ 0.1 mm - 0.5 mm
Angle of highest point of contact surfaces	$\pm 30$ minutes

**2.5 - Manufacturer's marks**

Rings must be marked as specified in the order or the appended documents.

In the absence of specifications in the documents, the rings shall show :

- the manufacturer's mark
- the date of manufacture (month and last two figures of the year of manufacture).

Markings shall be stamped on one of the flat surfaces, using blunt-edged punches preferably when hot ; sharp-edged punches are prohibited. However, when rings are manufactured by rolling, these marks may be replaced by a circular line or groove marked during the rolling process on a curved surface, the shape and position of which will indicate the above information in a conventional code.

### 3 - MANUFACTURE

Steel rings for buffers may only be manufactured by suppliers approved by the Railway for this type of manufacture.

#### 3.1 - Manufacture of rings

##### 3.1.1 - Shaping

Rings shall be shaped by forging, by rolling or by forging followed by rolling.

Heating of billets or blooms shall be carried out in such a way as to avoid any overheating and limit the depth of superficial decarbonisation.

##### 3.1.2 - Heat treatment

The rings shall be subjected to hardening and tempering ; the method, including heating temperature before quenching, type and temperature of quenching fluid, tempering temperature, shall be left to the choice of the supplier but must be suited to the chemical composition of the steel.

Heating shall be conducted in such a way as to avoid overheating and to limit the depth of superficial decarbonisation of the metal. The length of time in the furnaces must be sufficient to allow each ring to be heated through to the required temperature.

The temperature of furnaces and quenching liquids specified beforehand by the supplier according to the chemical composition shall be checked by means of calibrated recording pyrometers, and the charts shall be made available to the Railway representative.

The volume of the quenching tanks and supply of quenching liquid shall be such that the temperature around the rings is maintained within the specified limits.

After heat treatment, the rings should be free of all traces of scale.

#### 3.1.3 - Repairs

##### 3.1.3.1 - Authorised repairs

Superficial defects on surfaces not coming into contact with those of other rings may be eliminated with the agreement of the Railway's representative by removing the metal with a tool or by gentle grinding, provided that the metal is not heated, that no cracks are produced and that dimensional tolerances are complied with.

##### 3.1.3.2 - Prohibited repairs

Any surfacing by overlay deposit welding, by metallizing, by electrolytic or chemical deposition, and any finishing designed to cover up a defect are prohibited and shall result in rejection of the whole delivery.

### 4 - INSPECTION

Inspection shall include inspection of the manufacturing process and inspection of ring characteristics.

#### 4.1 - Inspection of the manufacturing process

The Railway's representative must be able to carry out all necessary checks to ensure that the conditions laid down in the order or its appended documents for the manufacture of rings have been complied with. He must be informed of the manufacturing schedule and of any difficulties that may occur. The charts produced by the recording pyrometers must be made available to him so that he can check heat treatment conditions, especially the temperature of furnaces and the length of time the rings are left in them.

4.2 - Inspection of ring characteristics

4.2.1 - Submission for acceptance

4.2.1.1 - Condition of items on submission

The semi-finished products used for manufacturing the rings shall be presented in annealed condition.

Rings shall be submitted in «as delivered» condition.

4.2.1.2 - Classification in batches

The semi-finished products shall be submitted in batches according to the cast of steel.

The rings shall be submitted in batches of 20 000 items at the most, each batch consisting of rings of the same type, the same dimensions and made of steel from the same cast.

The complete springs shall be presented in batches of not more than 1 000 items, all of the same type.

4.2.1.3 - Notification of submission

The Railway's representative shall be informed that the material ordered is to be submitted for inspection in a letter signed by the Works Manager or his authorised representative. The letter shall state the number of items submitted and the order references.

When the material is submitted for inspection, the Railway's representative shall be supplied with a certificate stating the chemical characteristics of the steel used, and certifying that the required manufacturing conditions have been complied with, that the appearance and dimensions have been inspected and that the results comply with the characteristics specified.

4.2.2 - Nature of inspections and proportion of items to be inspected

Each batch when submitted shall be subjected to inspections and tests of the type and number indicated in the table below :

Nature of inspections and tests	Number of inspections and tests				
	Number of tests per batch of rings				
Hardness test on rings (1) Chemical composition	up to 1000	from 1001 to 3000	from 3001 to 6000	from 6001 to 10000	from 10001 to 20000
	10	20	30	40	50
	1 per cast				
Flexibility Endurance (2) Appearance and dimensions	Number of tests per batch of springs				
	up to 50	from 51 to 150	from 151 to 300	from 301 to 500	from 501 to 1000
	1	2	3	4	5
To be fixed by the Railway At the discretion of the Railway's Inspector					
<p>(1) The Railway may order a number of tests, other than that indicated in the table to be carried out.</p> <p>(2) These tests are only carried out if specifically stated in the contract or appended documents.</p>					

4.2.3 - Selection and preparation of samples and test pieces.

4.2.3.1 - Inspection of materials used in manufacture

After the batch has been identified, the Railway's representative shall ensure that the chemical composition is correct by consulting the analysis report.

**4.2.3.2 - Inspection of rings**

After identification, the Railway's representative shall select a number of rings at random out of each batch submitted in delivery condition, for test purposes.

The identification marks and the stamp of the Railway's representative must remain on the rings and must not be transferred to another position unless the Railway's representative is present.

**4.2.4 - Number, position and preparation of test pieces.**

**4.2.4.1 - Hardness test**

The hardness test shall be carried out on hardened and tempered rings in «as delivered» condition. The impressions must be made at the two extremities of two perpendicular diameters.

**4.2.4.2 - Flexibility test on assembled springs**

The test shall be carried out on a spring made up of a number of rings equal to that specified in the drawing.

If the Railway has only ordered one type of ring, the supplier must obtain rings of the other types in order to make up the test spring.

**4.2.4.3 - Endurance test**

The test shall be carried out on a spring identical with the one described in paragraph 4.2.5.3.

**4.2.5 - Inspection and test procedures**

**4.2.5.1 - Chemical analysis**

The chemical analysis shall be carried out in accordance with the methods defined in the relevant ISO Standards or recommendations, or otherwise, by any other procedure acceptable to the Railway. Except in the event of a dispute, spectrographic analysis may be used.

**4.2.5.2 - Hardness test**

The hardness test must be carried out in accordance with the terms of ISO Recommendation R 80.

**4.2.5.3 - Flexibility test on the assembled spring**

The flexibility test shall be carried out as follows : the slightly greased rings are stacked in such a way as to form a spring as used in service.

The stack thus formed is tested as indicated below on a test bench equipped with a chart recording device. The test bench must be checked at least once a year by an independent body :

- 1- The spring is compressed 3 times up to the maximum stroke as shown on the drawing and the load maintained, each time, for one minute up to this stroke.
- 2- The semi-static diagram is recorded. It must comply with the specifications of the drawing, with allowance for the tolerances.
- 3- The spring is compressed 20 times to the maximum stroke indicated in the drawing and the load maintained, each time, for 30 seconds, up to this stroke.
- 4- The semi-static diagram is recorded. It must comply with the specifications of the drawing, with allowance for the tolerances.

**4.2.5.4 - Endurance test**

A normally lubricated spring, which has been tested in accordance with the provisions of paragraph 4.2.5.3 is mounted in a buffer case or similar device, as stipulated.

The test machine is an automatically operated Charpy impact machine. The load frequency must be chosen in such a way that the temperature of the rings does not exceed 60 °C.

The test must be carried out according to the following load cycles :

- 200 loadings at 85% of nominal maximum capacity,
- 1200 loadings at 50% of nominal maximum capacity,
- 3000 loadings at 25% of nominal maximum capacity.

When the load cycles have been applied 3 times in all, the absorption value shall not exceed the specified limits.

To ensure that the quality meets the required standards, the test must be carried out with 5000 loadings at 85% of the nominal absorption load. When this test has been completed, the value for the absorption load must not exceed the specified limits.

#### 4.3 - Results of inspection

Any chemical or mechanical characteristic that does not comply with the required conditions, detected on anyone test specimen, shall result in rejection of the whole batch.

Any defect in appearance or dimensions shall result in rejection of that ring.

New tests may only be carried out at the written request of the supplier with the prior written agreement of the Railway.

### 5 - DELIVERY

#### 5.1 - Protection against rust and impact

After acceptance and before storage or dispatch, the rings shall be coated with a substance approved by the Railway to protect them against rust.

They must be suitably packed to prevent any damage or deterioration due to impact during transport and handling.

The rings dispatched in complete springs shall be protected by a layer of grease covered by a protective wrapping. The type of grease and wrapping must have the prior approval of the Railway.

### 6 - GUARANTEE

The rings shall be guaranteed by the supplier for two years against any manufacturing defect not detected during inspection at the factory.

If the rings are to be used on new rolling stock the delivery date of the vehicles on which they are mounted shall be considered as the beginning of the guarantee period.

Rings which, during the guarantee period reveal defects which make them unsuitable for use, or are liable to shorten their service life shall be rejected.

However, before final rejection, the defective rings may be subjected to a joint inspection by the Railway and the supplier if the latter so requests.

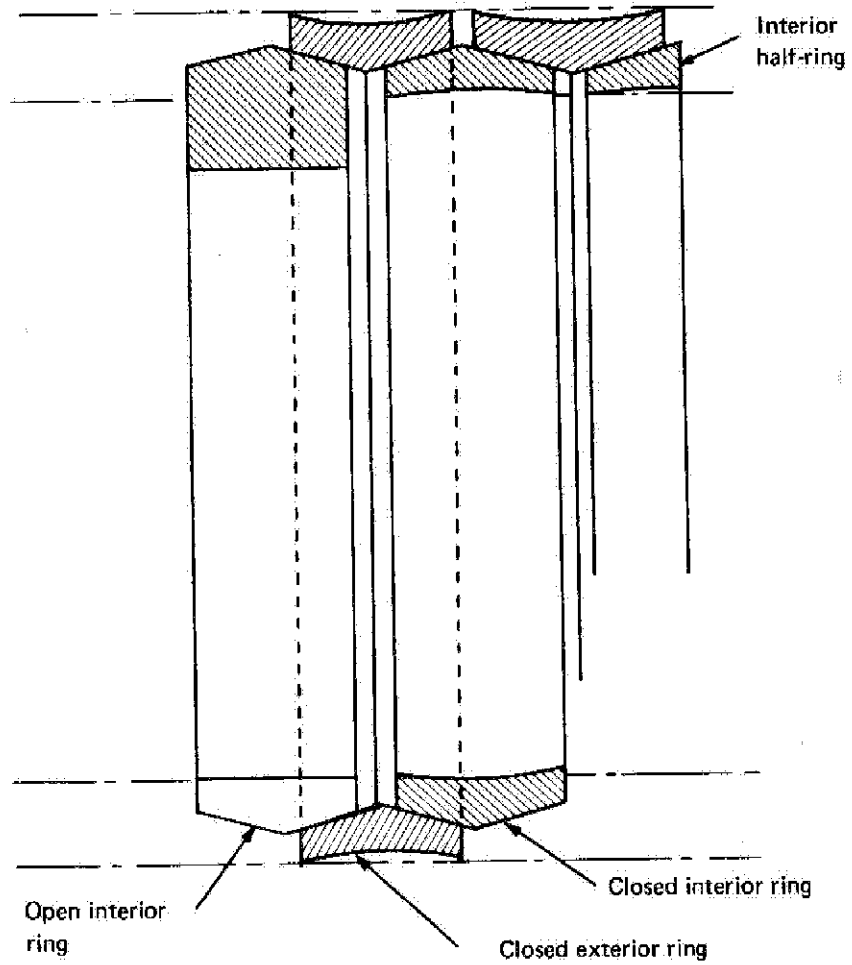
When the joint inspection proves that the defects are indeed due either to faulty manufacture or to the fact that the protective measures, provided for in Paragraph 5.1, were not properly applied, the defective rings shall be definitely rejected.

Should the results of the joint inspection not enable an agreement to be reached between the Railway and the supplier, approved outside experts shall be called in to arbitrate. Arbitration costs shall be borne by the party held responsible for the defects.

The rejected rings shall be held at the disposal of the supplier, who shall replace them or refund their value in new condition at the time of withdrawal.



STEEL RINGS FOR BUFFER SPRINGS



APPLICATION

With effect from 1 January 1981.

All Railways in the Union.

RECORD REFERENCES

*Headings under which the question has been dealt with :*

- Preparation of standard specifications for :

- a) steel plates for fire boxes,
- b) brake shoes,
- c) copper alloys,
- d) insulating materials for steam pipes,
- e) reinforced rubber springs.  
Special conditions relative to resistance to hydrocarbons and to cold.
- f) buffers,
- g) ring springs (Ringfedern),
- h) joints for heating hose couplings,
- i) copper steel for wagons.  
(5th Committee -R.S.- : Paris, June 1957).

- Completion of existing specifications to include new data : leaflets Nos :  
812-1, 812-2, 812-3, 827-2.  
(5th Committee -J.S.- : Paris, May 1961).

- Completion of existing specifications to include new data :  
- Leaflet 827-2 «Technical specification for the supply of steel rings for buffer  
springs».  
- Leaflet 831.....  
- Leaflet 893.....  
(5th Committee -J.Q.- : Paris, May 1963).

- Amendment of existing specifications to include new data :  
- Leaflet 827-2 «Technical Specification for the supply of steel rings for buffer  
springs».  
(5th Committee -J.Q.- : Florence, May 1968).

- Amendment of existing Specifications

- a) .....
- b) Harmonisation of guarantee clauses.  
(Sub-Committee for Specifications : Paris, January 1975).

- *Question 5/SA/FIC* : Revision and amendment of Leaflets managed by  
the Sub-Committee for Specifications.  
(Traction and Rolling Stock Committee : Oslo, June 1980).