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About This Standard

This specification is based on the TRS 0136

TRS 0136 was formerly Specification F136 CME titled “Axles for Locomotives and Rolling Stock”

Version History

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1 Scope

This Specification provides for the manufacture and supply of forged axles for locomotives and rolling stock.

Drawings are referred to without amendment suffixes. This Specification therefore, shall be read in conjunction with all applicable drawing issues current at the time of the inquiry. Variations will not be permitted from any of the conditions contained in this Specification or the order without authority in writing from the Principal Engineer Rolling Stock & Mechanical Assurance.

It should be noted that where the term "The Engineer" is used within this Specification, it is deemed to mean the Principal Engineer Rolling Stock & Mechanical Assurance or his appointed representative.

All new axles shall be non destructive tested in accordance with RSS 0033.

2 Manufacture

The steel shall be made by either the basic oxygen process or by electric furnace melting.

Axles shall be made from ingots or concast blooms.

Ingots shall be kept in a vertical position until ready to be rolled or until the metal in the interior has had time to solidify. No bled ingots shall be used.

Sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

Concast blooms shall be substantially free from centre porosity and any present must be such that it will not persist after forging or rolling. Electromagnetic stirring shall be incorporated in the process to prevent undue segregation.

Locomotive axles shall be produced by forging. Rolling stock axles may be produced by forging, rolling or rolling then forging.

In processing from ingot to axle bloom, the minimum cross section reduction shall be:-

for forging 3 times reduction

for rolling 5 times reduction

for rolling then forging 4 times reduction

The blooms shall be free from injurious defects and finished in a workmanlike manner, with the ends cut square. They may be chipped to remove surface defects provided that the depth of chipping does not exceed 1.5mm per 25mm of dimensions concerned up to a maximum depth of 20mm and provided also that the width of the chipping is at least four times its greatest depth. Where two chipping grooves run approximately parallel and near together, the narrow tongue between them may be removed at the discretion of the Engineer.

The blooms shall be true to the prescribed dimensions within the limits of tolerance as specified by the Engineer.

The cast number shall be legibly stamped on the end of each bloom.

2.1 Margins Of Manufacture

Axles shall be manufactured to the dimensions, tolerances and type of machining specified on the appropriate detail drawings.

All journal, gear and wheel seats shall be machined truly cylindrical and when spun between centres the total dial gauge variation shall not exceed 0.075mm.

Ovality shall not exceed 0.025mm at any point on the journal, gear and wheel seats.

Gear and wheel seat taper shall not exceed 0.025% and shall provide increasing interference in the direction of assembly.

Finished traction motor suspension bearing journals shall conform to RIC Rolling Stock Standard RSS 0098.

2.2 Chemical Composition

The steel shall conform to the requirements for chemical composition as shown in Table 1.

| Product Analysis (%) | |
|-----------------------------|---------------|
| Carbon | 0.45 to 0.59 |
| Manganese | 0.60 to 0.90 |
| Phosphorus | 0.045 maximum |
| Silicon | 0.15 minimum |
| Sulphur | 0.050 maximum |

Table 1

The manufacturer shall supply the analysis of each heat for the above elements.

3 Heat Treatment

Axles shall be heat treated by either of the methods specified in Clause 3.1 or Clause 3.2. The method chosen is at the option of the manufacturer unless specified by the Engineer at the time of enquiry.

3.1 Normalised and Tempered:

Axles shall be heated uniformly in a furnace to above the upper critical temperature (but not exceeding 900°C) and allowed to cool uniformly in air. They shall be reheated gradually to, and held at, a suitable temperature below the critical range and then allowed to cool under suitable conditions.

3.2 Quenched and Tempered:

Axles shall be heated uniformly to a suitable temperature and then quenched in a suitable medium under uniform conditions. They shall be reheated gradually to, and held at, a suitable temperature for a predetermined time and then allowed to cool under suitable conditions.

3.3 Reheat Treatment:

If the results of the mechanical tests (Section 4) for any batch of axles do not conform to the requirements specified, the axles may be reheat treated, but not more than two additional times, and retested in accordance with this Specification.

3.4 Notification of Reheat Treatment:

The Engineer shall be notified should any batch of axles be reheat treated for any reason(s). The notification shall be in writing and include the reason(s) for reheat treatment.

4 Tensile Test

Tensile test specimens shall be taken from the test prolongation or an axle.

For the purposes, prolongations shall be attached to at least 5% of the axles of each heat, in each heat treating batch.

If axles with prolongations have been expended then axles may be used for test procurement.

The rate of testing shall be one tensile test per heat treatment batch per heat of axles, provided always that each test represents no more than 70 axles.

The tensile test shall be carried out in accordance with AS 1391 (cold machined longitudinally from the prolongation so that the axis is 25mm from the surface of the full sized prolongation).

Such test pieces shall conform to the following requirements:

- Tensile strength to be not less than 590 MPa
- Yield strength to be not less than 330 MPa
- Elongation to be not less than 20%
- Reduction of area to be not less than 37%

4.1 Retests

If the results of the tensile tests representing any batch does not conform to the requirements specified because a flaw developed in the test specimen during testing, the Engineer at his discretion and at the expense of the manufacturer may allow two or more tests from that batch, if the defect is not caused by rupture, cracks or flakes in the steel.

If the results of the tensile test representing any batch does not conform to the requirements specified then the whole batch can be reheat treated in accordance with Clause 3.3.

5 Non Destructive Testing

All axles shall be non destructive tested by both magnetic particle inspection (MPI) and ultrasonic inspection in accordance with RSS 0033

6 Prior To Delivery

6.1 Branding

After the machining of ends, the axles shall be distinctly branded cold on each end with the markings as required by the Principal Engineer Rolling Stock & Mechanical Assurance.

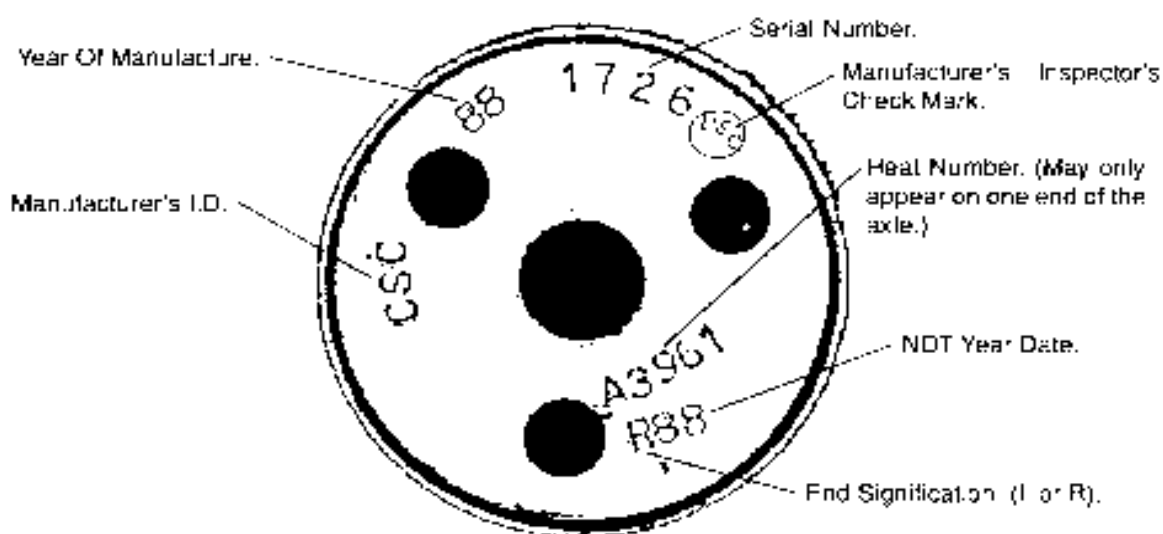


Figure 1: Typical stamping for axle ends

6.1.1 Protection Of Axles

Prior to delivery protective measures approved by the purchaser shall be taken to prevent damage to wheel seats and journals while the axles are in transit or storage. All holes are to be kept clean and free from swarf and dirt. Any anti-corrosion treatment shall be readily removed by washing with suitable non-toxic solvents, and wiping clean with cloth. Refer to RSS 0039.

6.2 Inspection

The Engineer shall have free access to the Works of the Manufacturer at all reasonable times; he shall be at liberty to inspect the manufacture at any stage, and to reject any material that does not conform to the terms of specification.

6.3 Testing Facilities

The Manufacturer shall supply the material required for testing free of charge and shall, at his own cost, furnish and prepare the necessary test pieces, and supply labour and appliances for such testing as may be carried out on his premises in accordance with this Specification. Failing facilities at his own works for making the prescribed tests, the Manufacturer shall bear the cost of carrying out the tests elsewhere within the State in which his works are situated, provided always that suitable NATA approved testing facilities exist in that State.

7 Referenced Documents

7.1 RIC Standards

| | |
|----------|---|
| RSS 0033 | Non Destructive Testing of Axles |
| RSS 0039 | Handling, Storage and Transportation of Axles |
| RSS 0098 | Specification for Suspension Bearing Surface Finish |