

No. 24—PART 1—1921.

British Engineering Standards Association.

(Incorporated 1918.)

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE

BY

THE INSTITUTION OF CIVIL ENGINEERS.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE IRON AND STEEL INSTITUTE.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

CANCELLED

SEE REVISED SPECIFICATION.

BRITISH
STANDARD SPECIFICATIONS

FOR

RAILWAY ROLLING STOCK MATERIAL.

PART 1

LOCOMOTIVE, CARRIAGE AND WAGON AXLES

(REVISED 1921.)

LONDON:

PUBLISHED FOR THE ASSOCIATION BY GOSBY LOCKWOOD & SON
7, STATIONERS' HALL COURT, LUDGATE HILL, LONDON, E.C. 4;
AND TO BE PURCHASED FROM ANY BOOKSELLER, OR DIRECT FROM THE OFFICES OF THE
BRITISH ENGINEERING STANDARDS ASSOCIATION,
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March, 1921.

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This Report was adopted by the Sectional Committees on Locomotives and Railway Rolling Stock Underframes at their Joint Meeting on December 3rd, 1920, and approved on behalf of the Main Committee on March 10th, 1921.

Published March, 1921.

NOTE.

In order to keep abreast of progress in the Industries concerned, the British Standard Specifications are subjected to periodical review.

Suggestions for improvements, addressed to the Secretary, British Engineering Standards Association, 28, Victoria Street, London, S.W. 1, will be welcomed at all times. They will be recorded, and in due course brought to the notice of the Committees charged with the revision of the Specifications to which they refer.

BRITISH
STANDARD SPECIFICATIONS

FOR

RAILWAY ROLLING STOCK MATERIAL.

PART I.

LOCOMOTIVE, CARRIAGE AND WAGON AXLES.

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PART 4—1921.	Steel Forgings, Blooms and Castings.
PART 5—1925.	Copper Plates, Rods, Tubes and Pipes, and Brass Tubes.
PART 6—1921.	Steel Plates, Angles, etc., and Rivets for Locomotives, Carriages and Wagons.

Note.—The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to, but does not purport to include all the necessary provisions of a Contract.

BRITISH
STANDARD SPECIFICATION
FOR
LOCOMOTIVE CRANK AXLES.
(WITH ANALYSIS.)
(REVISED 1921.)

Quality of Material.

1. The Crank Axles shall be manufactured from the highest quality of Steel made from the best selected material by the Acid Open Hearth process, and must not show on analysis more than 0.04 per cent. of Sulphur or of Phosphorus.

The Manufacturer shall supply an analysis when required to do so.

Freedom from Defects.

2. The Crank Axles must be free from defects of any kind and accurately finished to the prescribed dimensions.

Branding.

3. The Crank Axles shall be distinctly stamped, when hot, on the web nearest the top of the ingot with such brands as the Engineer (or the Purchaser) may require.

Test Pieces.

4. *Crank Axles having Flat or Oval Webs*:—Test pieces shall be machined cold from between each pair of webs of each Crank Axle and taken in the direction indicated in the sketch. The Cranks shall be slotted or sawn.

Crank Axles having Round Webs:—Test pieces shall be taken from pieces forged on each end of each Crank Axle, and having the same diameter as the Wheel Seat.

In either case the test pieces shall not be detached from the Axles until stamped by the representative of the Engineer (or of the Purchaser).

Mechanical Tests.

5. Test pieces machined from the Axles as above must withstand the following tests without further re-heating or any other manipulation whatever.



(4)

Tensile Tests

6. A Standard Test Piece **C** or **D** (see Appendix, page 25) must show a tensile breaking strength of not less than 32 tons per square inch, with an elongation of not less than 22 per cent. The yield point* in either case must be not less than 50 per cent. of the ultimate tensile strength. 5

Number of Tensile Tests.

7. *Crank Axles having Flat or Oval Webs* :—One tensile test shall be taken from between each pair of Webs of each Crank Axle.

Crank Axles having Round Webs :—One tensile test shall be taken from each end of each Crank Axle. 10

Cold Bend Test.

8. A test piece 9 inches long, $1\frac{1}{4}$ inches square, with $\frac{1}{8}$ inch radius at the edges, machined from the Crank Axles as in Clause 4, must withstand being bent cold by direct pressure from a tool 2 inches wide, the end having a radius of 1 inch, until the sides of the test piece are parallel (see Diagram, Plate 1). The ends of the test piece are then to be brought together, without fracture, by direct pressure. 15

Number of Cold Bend Tests.

9. *Crank Axles having Flat or Oval Webs* :—One cold bend test shall be taken from between each pair of Webs of each Crank Axle. 20

Crank Axles having Round Webs :—One cold bend test shall be taken from each end of each Crank Axle. 25

Alternative Test.

10. As an alternative to the cold bend test, the test piece referred to in Clause 8 may be placed upon bearings having a clear span of 6 inches, resting on a solid foundation, and must withstand, without fracture, 20 blows from a weight of 1,120 lbs., having a rounded end of $1\frac{1}{4}$ inch radius, falling 6 inches. The test piece shall be reversed after the first and every alternate blow. The fall shall then be increased to 12 inches, and the test continued until fracture occurs. 30

* The yield point shall, for the purpose of this Specification, be the load per square inch at which a distinctly visible increase occurs in the distance between gauge points on the test piece, observed by using dividers; or at which, when the load is increased at a moderately fast rate, there is a distinct drop of the testing machine lever, or, in hydraulic machines, of the gauge finger. 35

(5)

*** Normalising or Oil-treating.**

11. All Crank Axles shall be either normalised or oil-treated as desired by the purchaser. If ordered to be heat-treated, the cranks should be rough machined before treatment, the slabs from between each pair of webs of crank axles having flat or oval webs being bound together and treated similarly in all respects and at the same time as the crank axle, the test pieces being afterwards machined therefrom in the usual manner. 5

Inspection.

12. The representative of the Engineer (or of the Purchaser) 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 this Specification. 10

Testing Facilities.

13. 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. 15 20

* In this Specification the word "normalising" means heating a steel (however previously treated) to a temperature exceeding its upper critical range and not exceeding 900° C. and allowing it to cool freely in the air. 25

Reference to be quoted.

Report No. 24
Specification No. 2-1921

(6)

Note.—The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to, but does not purport to include all the necessary provisions of a Contract.

BRITISH
STANDARD SPECIFICATION
FOR
LOCOMOTIVE STRAIGHT AXLES.
(WITH ANALYSIS.)
(REVISED 1921.)

Quality of Material.

1. The Axles shall be manufactured from the highest quality of Steel made from the best selected material by the Acid Open Hearth process, and must not show on analysis more than 0.05 per cent. of Sulphur or of Phosphorus.

The Manufacturer shall supply an analysis when required to do so.

Freedom from Defects.

2. The Axles must be free from defects of any kind and accurately finished to the prescribed dimensions.

Branding.

3. The Axles shall be distinctly stamped when hot, as far from the centre as practicable, with such brands as the Engineer (or the Purchaser) may require, and in such a manner that these marks shall be legible when the Axles are worn out. When Axles are machined the brands shall be re-stamped cold on one end.

Mechanical Tests.

4. Extra Axles for testing in the manner described in Clauses 5, 6 or 7 shall be provided by the Manufacturer, at his own expense, at the rate of two per cent. of the Axles ordered under the contract, but, except as provided below, one extra Axle shall be provided from each cast, and the representative of the Engineer (or of the Purchaser) shall select and test such of the Axles as he may think proper to the extent of such percentage or extra number. The Axles tested shall be handed over to the Engineer (or to the Purchaser) free of charge if required, and shall be held to represent correctly the average quality of the lot from which they were selected. In the case of a less number than 15 Axles being asked for under the contract, or less than 15 being made from each cast, the Manufacturer may either (1) provide an extra Axle for testing, or (2) leave a piece on each Axle of the same diameter as the forged end of the Axle, to

Reference to be quoted.

Report No. 24
Specification No. 2-1921

(7)

enable the representative of the Engineer (or of the Purchaser) to stamp one such piece from which test pieces may be cut for the tensile test and cold bend test specified in Clauses 6 and 7. After selection of Axles for testing each test Axle must comply with the following tests, without further re-heating or any other manipulation whatever, either of the Axle selected for testing, or of any portion cut therefrom to furnish the test pieces.

Falling Weight Test.

5. The Axle shall be placed upon bearings resting on a block of metal of not less than 5 tons weight supported on a rigid concrete or other solid foundation, and must withstand, without fracture, five blows from a falling weight of 2,240 lbs., as specified below.

The Axle shall be turned after the first and third blow, and shall be broken after testing, both in the centre and at the journals.

Diameter of Axle at Centre.	Number of Blows.	Height of Fall, in feet.	Distance between Points of Support.*
Under 4 inches	5	16	Ft. Ins. 3 0
4 ins. and under 4¼ ins.	5	18	3 6
4¼ ins. and under 4½ ins.	5	20	3 6
4½ ins. and under 4¾ ins.	5	22	3 6
4¾ ins. and under 5 ins.	5	24	3 6
5 ins. and under 5¼ ins.	5	24	4 0
5¼ ins. and under 5½ ins.	5	28	4 0
5½ ins. and under 5¾ ins.	5	28	4 6
5¾ ins. and under 6 ins.	5	32	4 6
6 ins. and over	5	35	5 0

Tensile Test.

6. A Standard Test Piece C or D (see Appendix, page 25), machined cold from one end of each Axle tested as above, must show a tensile breaking strength of 35 to 40 tons per square inch, with an elongation of not less than 25 per cent. with 35 tons and 20 per cent. with 40 tons; the sums of the intermediate tensile breaking strengths and corresponding elongations being not less

* In cases where the length of the Axle does not permit of these distances being adhered to, the distance between the points of support shall be as great as possible.

(8)

than 60. The yield point* must be not less than 50 per cent. of the ultimate tensile strength.

Cold Bend Test.

7. A test-piece 9 inches long and $1\frac{1}{4}$ inches square, with $\frac{1}{16}$ inch radius at the edges, must withstand being bent cold by direct pressure from a tool 2 inches wide, the end having a radius of 1 inch, until the sides of the test piece are parallel (see Diagram, Plate 1). The ends of the test piece are then to be brought together, without fracture, by direct pressure.

N.B.—This test will be taken only when a less number than 15 Axles are ordered and the falling weight test (Clause 5) has not been carried out.

Additional Tests before Rejection.

8. In the event of the Axle selected for testing not satisfying the requirements of the tensile or bend tests, and the fractured test piece indicating that the result does not fairly represent the bulk of the Axles, the representative of the Engineer (or of the Purchaser) may at his discretion, and at the expense of the Manufacturer, take two more test pieces from the same Axle for repeating the test under which failure occurred. The Axles will be accepted if the results of the repeat tests are satisfactory.

Should the Axle fail in the falling weight test, the lot which the Axle represents shall be rejected.

Independent Tests.

9. If the Engineer (or the Purchaser) desires to make independent tensile or other tests of the material, the broken pieces of any of the Axles tested shall be placed at his disposal for the purpose, free of charge.

† Normalising or Oil-Treating.

10. All Axles shall be either normalised or oil-treated as desired by the Purchaser.

Inspection.

11. The representative of the Engineer (or of the Purchaser) 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 this Specification.

* The yield point shall for the purpose of this Specification be the load per square inch at which a distinctly visible increase occurs in the distance between gauge points on the test piece, observed by using dividers; or at which when the load is increased at a moderately fast rate there is a distinct drop of the testing machine lever, or, in hydraulic machines, of the gauge finger.

† In this Specification the word "normalising" means heating a steel (however previously treated) to a temperature exceeding its upper critical range and not exceeding 900° C. and allowing it to cool freely in the air.

(9)

Testing Facilities.

12. 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.