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Full document details: BS 931:1940

No. 931—1940

British Standards Institution

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Formed in 1901 as the Engineering Standards Committee.
Incorporated in 1918 as the British Engineering Standards Association.

BRITISH STANDARD SPECIFICATION

FOR

LOCO-TYPE MULTITUBULAR BOILERS.

LONDON:
Published by the British Standards Institution,
Publications Department,
28, Victoria Street, London, S.W.1.
Telegrams: Standards, Sowest, London. Telephone: Abbey 8888.

November, 1940.

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No. 931—1940.

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FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE.

INCORPORATED IN 1918 AS THE BRITISH ENGINEERING STANDARDS ASSOCIATION.

BRITISH STANDARD SPECIFICATION

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This Specification, having been approved by the Mechanical Industry Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council as a British Standard on 18th November, 1940.

LONDON:
PUBLISHED BY THE BRITISH STANDARDS INSTITUTION,
PUBLICATIONS DEPARTMENT,
28, VICTORIA STREET, LONDON, S.W.1.

Telegrams: Standards, Sowest, London. *Telephone:* Abbey 8888.

November, 1940.

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CO-OPERATING ORGANISATIONS.

The Mechanical Industry Committee under whose supervision this British Standard was prepared consists of representatives from the following Government Departments and Scientific and Industrial Organisations :—

*Admiralty.
Crown Agents for the Colonies.
Department of Scientific and Industrial Research.
*High Commissioner for India.
*H.M. Office of Works.
*Home Office.
Ministry of Transport.
War Office.
Agricultural and Road Machinery Manufacturers' Association.
*Association of Consulting Engineers (Incorporated).
*British Chemical Plant Manufacturers' Association.
*British Electrical and Allied Manufacturers' Association.
*British Engineers' Association.
*British Iron and Steel Federation.
British Marine Oil Engine Manufacturers' Association.
Engineering Insurance Companies.
*Institute of Marine Engineers.
Institute of Petroleum.
Institution of Automobile Engineers.
*Institution of Civil Engineers.
*Institution of Gas Engineers.
*Institution of Heating and Ventilating Engineers.
*Institution of Mechanical Engineers.
Institution of Production Engineers.
*Locomotive Manufacturers' Association.
Machine Tool Trades Association.
*Railway Companies of Great Britain.

The Government Departments and Scientific and Industrial Organisations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this British Standard :—

Board of Trade.
British Coal Utilisation Research Association.
Combustion Appliance Makers' Association.
Incorporated Municipal Electrical Association.
Institution of Electrical Engineers.

FOREWORD.

The formulæ in Section 4 of this Specification give in all cases the minimum scantlings, and apply to boilers constructed throughout under independent supervision and working under average normal conditions of draught, good feed water and adequate maintenance supervision.

Where working conditions are adverse, *e.g.*, abnormal evaporation, corrosive or bad feed water, exposure to the elements, or where of necessity maintenance supervision will be inadequate, it is recommended that the minimum scantlings found by calculation from the formulæ given should be increased.

The simplest method of compensation for adverse conditions of the kind is to design for an increased working pressure, having regard to the probable reduction of life in service due to the adverse causes.

This Specification forms one of a series of Specifications for Boilers, the preparation of which was authorised by the Mechanical Industry Committee.

Other Specifications in this series are :—

Lancashire and Cornish Boilers, B.S. 537.
Multitubular Horizontal Boilers (Dryback and Waste Heat), B.S. 609.
Vertical Cross Tube Boilers, B.S. 665.
Vertical Multitubular Boilers, B.S. 761.
*Water Tube Boilers.
*Miniature Boilers.
Cast Iron Boilers for Central Heating and Hot Water Supply, B.S. 779.
Riveted Steel Boilers for Central Heating and Hot Water Supply, B.S. 780.
Welded Steel Boilers for Central Heating and Hot Water Supply, B.S. 855.
Welded Steel Boilers for Steam Central Heating, B.S. 854.
Calorifiers, B.S. 853.

The terms "maximum permissible working pressure" and "safety valve blow-off pressure" are used in the series of British Standard Specifications for boilers and boiler fittings. These terms, for the purposes of this Specification, shall be defined as follows :—

The maximum permissible working pressure is the maximum pressure at which a boiler may be operated.

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The safety valve blow-off pressure is that at which the safety valves shall be set to prevent the boiler being worked at a pressure greater than the maximum permissible working pressure.

The Factories Act, 1937, requires that the steam pressure gauge fitted to a boiler shall have marked upon it in a distinctive colour, the maximum permissible working pressure. (See Clause 46, B.S. 759, Valves, Gauges and Similar Fittings for Land Boiler Installations.)

NOTE.—*It is desirable that there should be a margin between the actual pressure at which the boiler is to be operated and the set blow-off pressure to prevent the unnecessary blowing off of the safety valves.*

This Specification requires reference to the following British Standards :—

No. 21. Pipe Threads, Part I, Basic Sizes and Tolerances.

No. 51. Wrought Iron for General Engineering Purposes (Grade A).

No. 84. Screw Threads, British Standard Fine, and their Tolerances.

No. 425. Boiler Rivets, Forms and Dimensions of.

No. 494. Cold Drawn Weldless Steel Boiler and Superheater Tubes for Designed Steam Temperatures not exceeding 850°F.

No. 512. Hot Finished Weldless Steel Boiler and Superheater Tubes for Designed Steam Temperatures not exceeding 850°F.

No. 527. Lap Welded Wrought Iron Boiler Tubes for External Pressure.

No. 528. Lap Welded Steel Boiler Tubes for External Pressure.

In order to keep abreast of progress in the Industries concerned, the British Standards are subject to periodical review.

Suggestions for improvements, addressed to the British Standards Institution, 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 Publications to which they refer.

NOTE.—*The Institution 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 LOCO-TYPE MULTITUBULAR BOILERS.

1. GENERAL.

Scope.

1. This Specification applies to loco-type multitubular boilers for stationary, semi-portable or portable purposes and to loco-type boilers for road rollers and traction engines.

This Specification does not apply to railway locomotive boilers.

Brickwork setting, insulation, mountings, chimney, damper and furnace fittings do not come within the scope of this Specification, although the boiler(s) shall be complete with mountings, chimney, damper and furnace fittings unless the same are specifically excluded in the enquiry or order. The type of mountings, furnace fittings and length of chimney and damper to be supplied shall be agreed between the Purchaser and the Manufacturer. In default of specific instructions to the contrary (in the enquiry or order), the furnace fittings shall be for hand firing and natural draught, and the mountings shall be suitable for the boiler working as an independent unit.

NOTE.—Gas or Oil Burning Equipment, Forced or Induced Draught Equipment, or other accessories which may be required by the Purchaser, are extraneous to this Specification and are matters for mutual arrangement between the Purchaser and the Manufacturer. Where such accessories are required or contemplated it is recommended that all particulars which would affect the boiler(s) should be disclosed by the Purchaser to the Manufacturer at the time of the enquiry.

This Specification does not apply to boilers having barrels less than 24 inches in diameter.

Information to be supplied with the Enquiry or Order.

2. The information required by Appendix A (p. 37) should be supplied with the enquiry.

Information to be supplied by the Manufacturer.

3. (*a*) The Manufacturer shall, if required by the Purchaser, supply with the tender the information required by Appendix B (p. 39).

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(*b*) The Manufacturer shall supply the Inspecting Authority with a fully dimensioned sectional drawing showing in full detail the construction of the boiler(s) for approval before putting the work in hand.

Conformity with Law or Regulation.

4. The Purchaser shall disclose to the Manufacturer at the time of the enquiry any special statutory or other regulations with which the boiler(s) and mountings are required to comply. The Manufacturer in his tender shall undertake that the boiler(s) and mountings offered will comply in all respects with such statutory or other regulations.

2. MATERIALS.

A. STEEL PLATES, RIVETS AND BARS.

Process of Manufacture.

5. Steel for steel plates, rivets and bars shall be of Boiler quality made by the Open Hearth Process, Acid or Basic, as may be agreed upon between Purchaser and Manufacturer.

Chemical Analysis.

6. The steel shall contain not more than 0·05 per cent of sulphur or of phosphorus.

A sulphur print test shall be taken from the material of each charge used for rivet bars for the purpose of ensuring that sulphur segregates are not concentrated in the core. The stage in manufacture at which this test is made shall be at the option of the Steel Maker.

Freedom from Defects, etc.

7. The finished material shall be sound and free from cracks, surface flaws and laminations. Hammer-dressing, patching or welding is prohibited, but this does not prevent the removal of slight scale or shell by the use of chisel, file or buff, providing the material is not reduced to under the specified thickness.

Rolling Margin.

8. No plate or rolled section shall be under the specified thickness at any part, nor more than 5 per cent over the calculated weight.

Testing and Inspection.

9. The following tests and inspections shall be made at the place of manufacture prior to dispatch, but should any material prove unsatisfactory while being worked into boilers, such material shall be rejected notwithstanding any previous certification of satisfactory examination or testing.

TABLE 1.

Description.	Ultimate tensile stress. tons/sq. in.	Minimum elongation per cent.		
		Test Piece A.	Test Piece B.	Test Piece B1.
Plates for Barrels, Butt Straps and Gusset Stays	26 – 32	23 for 26–30 tons/sq. in. 20 for 28–32 tons/sq. in.	—	—
Plates for Flanging and for Fireboxes	24 – 30	23	—	—
Angles, Tees and Round Bars	26 – 32	23 for 26–30 tons/sq. in. 20 for 28–32 tons/sq. in.	23 for 26–30 tons/sq. in. 20 for 28–32 tons/sq. in.	28 for 26–30 tons/sq. in. 24 for 28–32 tons/sq. in.
Rivet Bars	24 – 30	—	25 for 24–28 tons/sq. in. 23 for 26–30 tons/sq. in.	30 for 24–28 tons/sq. in. 28 for 26–30 tons/sq. in.

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Mechanical Tests.

10. Plates and bars for boilers shall comply with the mechanical tests herein specified (see Table 1, p. 9).

(*a*) *Selection of test pieces.*—All test pieces shall be selected by the Inspector (or by the Steel Maker's representative where testing and inspection are not carried out by the Purchaser) and shall be tested in his presence, and he shall satisfy himself that the conditions herein described are fulfilled.

(*b*) *Tensile Test Pieces.*—The tensile stress and elongation shall be determined from British Standard test pieces which, in the case of plates, shall be cut crosswise from the rolled material. When material is annealed or otherwise treated before dispatch, the test pieces shall be similarly and simultaneously treated with the material before testing.

(i) *Plates, Angles and Tees.*—Wherever practicable, the rolled surface shall be retained on two opposite sides of the test piece. The tensile stress and elongation shall be determined on standard test piece A (see Appendix C, p. 42).

(ii) *Round Bars.*—Round bars may be tested full size as rolled, or they may be turned down to a convenient size.

If tested 1 inch diameter or under, test piece B (see Appendix C, p. 42) shall be used. The sectional area of the test piece shall not be less than ¼ square inch.

Where the test piece is over 1 inch diameter, test piece B1 (see Appendix C, p. 42) may be used if preferred by the Manufacturer.

Rivet bars shall also be subjected to a dump test. See Clauses 10 (*f*) and 11 (*b*).

Any straightening of the test pieces which may be required shall be done cold.

(*c*) *Tensile Tests.*—The ultimate tensile stress and elongation of the various classes of materials shall be between the limits shown in Table 1, p. 9, but a range of not more than 4 tons in each class of material shall apply, such range to be specified for each boiler.

Should a tensile test piece break outside the middle half of the test gauge length (see Fig. 1) the test may, at the Maker's option, be discarded and another test be made of the same plate or bar.

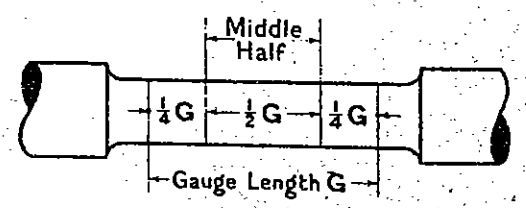

Fig. 1.—Diagram explaining the term "Middle-half" of the gauge length.

(*d*) *Bend Test Pieces.*—Test pieces shall be cut or sheared crosswise from plates and lengthwise from bars, and shall be not less than 1½ inches wide, but for small bars the whole section may be used.

The rough edge or arris caused by shearing may be removed by filing, grinding or machining, but the test pieces shall receive no other preparation. The test pieces shall not be annealed unless the material from which they are cut is to be annealed, in which case the test pieces shall be similarly and simultaneously treated with the material before testing.

(*e*) *Bend Tests.*—The test piece shall, when cold, withstand without fracture being doubled over until the internal radius is equal to one-and-a-half times the thickness of the test piece and the limbs are parallel.

Bend tests may be made either by pressure or by blows.

(*f*) *Dump Tests.*—Short lengths equal to twice their diameter cut from rivet bars shall, when cold, withstand without fracture being compressed to half their length.

Number of Test Pieces.

11. (*a*) *Plates.*—For shell plates, butt strap plates and gusset plates, one tensile test strip and one strip for a bending test shall be taken from each end of every plate as rolled.

For other plates, such as end plates, furnace and flanging plates, one tensile test strip and one strip for a bending test shall be cut from one end of every plate as rolled.

(*b*) *Angle, Tee, Round and Rivet Bars.*—One tensile test shall be made from each 15, or part of 15, bars rolled of each section or diameter from the same cast, but not less than two tensile tests shall be made unless the total number of bars rolled from the same cast is 8, or less than 8, and the bars are of the same section or diameter, when one test will suffice. For round bars 1¾ inches in diameter and under, the numbers 50 and 20 shall be substituted for 15 and 8, respectively, for determining the number of tests required.

A cold bend test shall be made for each tensile test in the case of angles, tees and round bars.

One dump test shall be made for each tensile test in the case of rivet bars.

Bend tests are not required for rivet bars.

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