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BRITISH STANDARD 487 : 1949

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FUSION WELDED STEEL AIR RECEIVERS

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THIS BRITISH STANDARD having been approved by the Mechanical Engineering Industry Standards Committee was published under the authority of the General Council on 24th May, 1949.

First published May, 1933.
First revision February, 1937.
Second revision May, 1939.
Third revision April, 1949.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

A list with abstracts of other British Standards for air receivers will be found on page 30 of this standard.

A complete list of British Standards, numbering over one thousand, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

This standard requires reference to the following :—

B.S. 21. Pipe threads, Part I : Basic sizes and tolerances.
B.S. 639. Covered electrodes for metal arc welding wrought iron and steel.
B.S. 1295. Tests for use in the training of welders.
B.S. 1387. Steel tubes and tubulars.

British Standards are revised, when necessary, either by the issue of amendment slips or revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or edition.

Users wishing to be kept informed of any alteration to this standard should notify Sales Department of the institution, giving the number and title of the standard.

MEE/21/3

CO-OPERATING ORGANIZATIONS

The Mechanical Engineering Industry Standards Committee under whose supervision this British Standard was prepared consists of representatives from the following Government departments and scientific and industrial organizations :—

*Admiralty
*Associated Offices Technical Committee (Engineering Insurance Companies)
Association of Consulting Engineers (Incorporated)
*British Chemical Plant Manufacturers' Association
*British Compressed Air Society
*British Electrical and Allied Manufacturers' Association
British Engineers Association
British Internal Combustion Engine Manufacturers' Association
*British Iron and Steel Federation
British Railways
Crown Agents for the Colonies
Department of Scientific and Industrial Research
*Institute of Marine Engineers
Institute of Petroleum
Institution of Civil Engineers
Institution of Gas Engineers
Institution of Heating and Ventilating Engineers
*Institution of Mechanical Engineers
Institution of Mechanical Engineers (Automobile Division)
Institution of Production Engineers
Locomotive Manufacturers' Association
Machine Tool Trades Association
*Ministry of Labour and National Service (Factory Department)
*Ministry of Supply
*Ministry of Transport
Ministry of Works
*Office of the High Commissioner for India
War Office

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this standard :—

Agricultural Engineers Association
Air Ministry
British Acetylene Association
British Corporation Register of Shipping and Aircraft
British Welding Research Association
Bureau Veritas
Diesel Engine Users Association
Imperial Chemical Industries Ltd.
Institute of Welding
Institution of Engineers and Shipbuilders in Scotland
Institution of Mining Engineers
Institution of Naval Architects
Lloyds Register of Shipping
Manufacturers of Air Receivers
Ministry of Fuel and Power
National Physical Laboratory
North-East Coast Institution of Engineers and Shipbuilders
Society of Motor Manufacturers and Traders

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FOREWORD

This British Standard forms one of a series (see page 30) for steel air receivers, the preparation of which was authorized by the Mechanical Engineering Industry Standards Committee.

First published in 1933 this standard was revised in 1937 and 1939. The 1939 revision was mainly due to the requirements as to access in the Factories Act, 1937.

The present 1949 revision has been necessitated by representations from several quarters relating to discrepancies in permissible working pressure as between the requirements of the 1939 edition and those of other authorities in the United Kingdom.

To meet these representations (and as a result of experience) this 1949 edition has been extensively revised. Clauses 20, 21 and 22 are new. Clauses 3, 12, 13, 14 and 15 differ substantially from similar clauses in the 1939 edition. Clauses 16, 17, 23 and 24 have also been modified and amended. Due to the incorporation of new matter the clause numbers differ from those in the 1939 edition.

It has been found expedient to segregate the Figures from the text, and place these at the end of the standard. The numbers of the Figures differ from those in the 1939 edition. Extracts from B.S. 18 and B.S. 709 are included as appendices for convenience and ready reference.

For the purposes of this standard the calculations made to determine the scantlings shall be based on the design pressure, which shall be not less than the highest pressure at which any safety or relief valve is to be set to lift.

NOTE. It is desirable that there should be a margin between the actual pressure at which the vessel receives and delivers air and the lowest pressure at which any safety or relief valve is set to lift.

BRITISH STANDARD FOR

FUSION WELDED STEEL AIR RECEIVERS

DEFINITIONS

AIR RECEIVER

1. The term 'air receiver' shall, for the purposes of this standard, mean any vessel intended to contain air or inert gas above atmospheric pressure.

FUSION WELDED

2. The term 'fusion welded' shall, for the purposes of this standard, apply to all air receivers made by the metal-arc process with covered electrodes (see Clause 19), or by other electric arc process in which protection against atmospheric contamination is provided during welding.

SPECIFICATION

SCOPE

3. This standard applies to fusion welded steel air receivers for design pressures not exceeding 500 lb/sq. in. The product of the pressure in lb/sq. in. and the internal diameter in inches shall not exceed 21,000. This standard does not apply to air or vacuum vessels used on railways or to containers used for the independent conveyance of compressed air or 'permanent' or 'liquefiable' gases for which provision is made in B.S. 399, B.S. 400, B.S. 401 and B.S. 1045.

GENERAL

4. British Standard fusion welded steel air receivers shall conform in all respects to the requirements for the quality of material, construction and tests herein laid down.

MATERIAL

QUALITY OF MATERIAL

5. The material used in the construction of a receiver shall be mild steel made by the acid or basic open hearth or an electric process. The cast from which the plates are rolled shall contain not more than 0·05 per cent of sulphur or of phosphorus.

FREEDOM FROM DEFECTS

6. The finished material shall be free from cracks, surface flaws, and laminations. It shall have a workmanlike finish and shall not have been hammer-dressed, but slight scale or shell may be removed by the use of chisel, file, buff, or sand or shot blast.

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NUMBER OF TENSILE AND COLD BEND TESTS

7. One tensile and one cold bend test shall be taken from each plate as rolled. For plates exceeding 2½ tons in weight one tensile and one cold bend test shall be taken from each end.

ULTIMATE TENSILE STRESS AND ELONGATION

8. The ultimate tensile stress and elongation shall be determined on British Standard test piece A on a gauge length of 8 inches (see Appendix A) taken lengthwise or crosswise from the plates. The ultimate tensile stress shall be not less than 24 and not more than 32 tons per square inch, but there shall not be a range of more than 4 tons per square inch in the ultimate tensile stress of the plates used in the cylindrical shell of any one receiver. Similarly, the ultimate tensile stress of the end plates shall also fall within a 4-ton range but not necessarily the same range as for the material of the cylindrical shell.

Minimum elongations shall be as follows :—

Thickness inches	Tensile stress tons/sq. in.	Elongation 8 inch gauge length per cent
Up to but not including ⅜ thick	24/30 28/32	20 17
⅜ thick and over	24/30 28/32	23 20

BEND TEST

9. Bend test pieces shall be taken lengthwise or crosswise from plates and shall be not less than 1½ inch wide. Rough edges may be removed by filing or grinding and test pieces 1 inch in thickness and above may have the edges machined but shall receive no other preparation. 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.

HEAT TREATMENT OF TEST PIECES

10. The tensile and bend test pieces shall not be heat treated unless the material from which they are cut is heat treated, in which case the test pieces of the material shall be similarly and simultaneously treated before test.

CONSTRUCTION

NUMBER OF JOINTS

11. Wherever it is reasonably practicable and the dimensions are within the usual limits of rolling mill practice the shell of the receiver shall be made from a single plate.

Where the dimensions are such that the shell cannot be made from a single plate it shall be made with the minimum number of joints, and the longitudinal seams in adjacent sections shall not be in the same line.

TYPE OF WELDED JOINTS

12. The type of welded joints used in the construction of the receiver shall be as follows :—

a. Longitudinal seams. Longitudinal seams shall be made with butt welded joints of the V or U type as described in Clause 13 *b.* (see Figs. 1 to 4).

b. Circumferential seams. Circumferential seams either in the shell or the end of a receiver shall be made with any of the types of joint shown in Figs. 8 to 15. Where, however, the thickness of the cylindrical shell plate exceeds ½ in., the types shown in Figs. 13 and 15 shall not be used.

c. Flange joints. Flange joints either in the shell or the end of a receiver shall be made with any of the types of joint shown in Figs. 16 to 19.

METHOD OF MAKING WELDED JOINTS

13. The surfaces of all plates to be welded shall be clean and, during deposition of the metal, slag shall be removed after making each run. There shall be no appreciable undercutting of the plate.

a. Fillet welds. In a lap joint the length of each leg of a fillet weld shall be not less than the full thickness '*t*' of the edge welded. No part of the exposed face of the weld shall lie within a line joining the edge of the plate with the toe of the fillet weld as thus defined (see Fig. 7) ; the contour of fillet welds shall be free from marked irregularities.

b. Butt welds. Plate edges shall be prepared for welding by machining or flame cut by machine. Joints shall be welded from both sides, except that, where a joint is not reasonably accessible on the inside and the receiver is under 18 in. internal diameter, welding may be carried out from the outside only. Before the second side of a butt joint is welded the bottom of the first run shall be gouged out to provide a clean metallic surface (see Figs. 1 to 4). Backing strips (Figs. 5 and 6) may be used for single side butt welds in circumferential seams.

It is recommended that for V bevel grooves the included angle between the bevel edges shall be not less than 60 degrees. It is recommended that the minimum width of a U groove at the surface of the plates should be not less than ½ 'T' plus 3/16 in., where 'T' = thickness of the plate in inches.

The weld metal shall be built up to a thickness 10 per cent more than the thickness of the plate and the excess metal may subsequently

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