

SPECIFICATION FOR
STEEL PIPES AND TUBES
FOR PRESSURE PURPOSES
Carbon Steel : Ordinary Duties

B.S. 3601 : 1962

Price 10/- net

BRITISH STANDARDS INSTITUTION

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THIS BRITISH STANDARD, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 29th November, 1962.

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.

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.

A complete list of British Standards, numbering over 4000, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook, price 15s.

This standard makes reference to the following British Standards:

- B.S. 18 Tensile testing of metals.
- B.S. 21 Pipe threads.
- B.S. 534 Steel spigot and socket pipes and specials for water, gas and sewage.
- B.S. 778 Steel pipes and flanged joints for hydraulic purposes.
- B.S. 806 Ferrous pipes and piping installations for and in connection with land boilers.
- B.S. 879 Steel tubes for water-well casing.
- B.S. 1387 Steel tubes and tubulars for screwing to B.S. 21 pipe threads.
- B.S. 1507 Steel pipes for pressure vessels for use in the chemical and allied industries.
- B.S. 3059 Steel boiler and superheater tubes.
- B.S. 3351 Piping systems for the petroleum industry.
- B.S. 3602 Steel pipes and tubes for pressure purposes: carbon steel, high duties.

- B.S. 3603* Steel pipes and tubes for pressure purposes: carbon steel, low temperature duties.
- B.S. 3604* Steel pipes and tubes for pressure purposes: low and medium alloy steel.
- B.S. 3605* Steel pipes and tubes for pressure purposes: austenitic stainless steel.

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The following B.S.I. references relate to the work on this standard:
Committee references MEE/146, MEE/146/1
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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
- Air Ministry
- *Associated Offices' Technical Committee
- Association of Consulting Engineers (Incorporated)
- Association of Mining Electrical and Mechanical Engineers
- *British Chemical Plant Manufacturers' Association
- *British Compressed Air Society
- British Electrical and Allied Manufacturers' Association
- British Engineers' Association
- British Gear Manufacturers' Association
- British Internal Combustion Engine Manufacturers' Association
- *British Iron and Steel Federation
- *British Railways, The British Transport Commission
- *Crown Agents for Oversea Governments and Administrations
- D.S.I.R.—National Engineering Laboratory
- *Electricity Council, The Generating Board and the Area Boards in England and Wales
- *Engineering Equipment Users' Association
- *Gas Council
- High Commission of India
- 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 and Allied Manufacturers' Association of Great Britain
- Machine Tool Trades Association
- Ministry of Labour (Factory Inspectorate)
- Ministry of Power
- Ministry of Public Building and Works
- *Ministry of Transport
- *National Coal Board
- National Physical Laboratory (D.S.I.R.)
- Radio Industry Council
- War Office

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

- Association of Heating, Ventilating and Domestic Engineering Employers
- British Waterworks Association
- Council of British Manufacturers of Petroleum Equipment
- Institute of Welding
- Institution of Water Engineers
- Lloyds' Register of Shipping
- London Transport Executive, The British Transport Commission
- Oil Companies Materials Association
- Tank and Industrial Plant Association
- Manufacturers of boilers and pressure vessels
- Manufacturers of pipes and tubes
- Steelmakers

BRITISH STANDARD SPECIFICATION FOR

STEEL PIPES AND TUBES

FOR PRESSURE PURPOSES

Carbon Steel : Ordinary Duties

FOREWORD

At the request of large user organizations, a conference was held to consider the co-ordination of existing British Standards for steel pipes and tubes with the object of unifying them and avoiding minor discrepancies. As a result of that conference, a Committee was set up under the direction of the Mechanical Engineering Industry Standards Committee to carry out this work and a series of specifications for steel pipes for pressure purposes has been prepared. This standard, which has been approved by all Industry Standards Committees concerned, is one of the series.

Other standards in the series are:

- B.S. 3602 Steel pipes and tubes for pressure purposes: carbon steel, high duties.
- B.S. 3603 Steel pipes and tubes for pressure purposes: carbon steel, low temperature duties (in the course of preparation).
- B.S. 3604 Steel pipes and tubes for pressure purposes: low and medium alloy steel (in the course of preparation).
- B.S. 3605 Steel pipes and tubes for pressure purposes: austenitic stainless steel (in the course of preparation).

NOTE. For the purpose of this standard, no difference is intended in the meaning between 'pipe' and 'tube' though idiomatic use prefers sometimes the one and sometimes the other.

This series of standards supersedes the material specifications for plain end pipes in existing application standards. These application standards have still to be consulted for the other requirements appropriate to those standards. The existing application standard are:

- B.S. 534 Steel spigot and socket pipes and specials for water, gas and sewage.
- B.S. 778 Steel pipes and flanged joints for hydraulic purposes.
- B.S. 806 Ferrous pipes and piping installations for and in connection with land boilers.

- B.S. 879 Steel tubes for water well casing.
 B.S. 1507 Steel pipes for pressure vessels for use in the chemical and allied industries.
 B.S. 3351 Piping systems for the petroleum industry.

Standard sizes of carbon steel pipes are given in Appendix A. Information on obtaining the percentage elongation on various gauge lengths is given in Appendix B.

NOTE 1. In place of the customary, but incorrect, use of the pound as a unit of force, the unit called a pound-force (abbreviation lbf) has been used in this standard. It is that force which, when acting on a body of mass one pound, gives it an acceleration equal to that of standard gravity. The unit ton-force is used similarly.

NOTE 2. When metric equivalents of pipe dimensions in this standard are required, reference should be made to the corresponding values in the following ISO Recommendations:

ISO.R 64 Steel tubes, outside diameters.

ISO.R 65 Steel tubes suitable for screwing in accordance with ISO.R 7.

ISO.R 221 Steel tubes, thicknesses.

For this particular British Standard ISO.R 65 applies only to butt welded pipes. When it is required to convert other figures in this standard from British units into metric units it is recommended that the conversion factors and the tables of conversion contained in B.S. 350, 'Conversion factors and tables', be used.

SPECIFICATION

SECTION ONE: GENERAL

SCOPE

1. This British Standard provides for carbon steel pipes made by various processes for the conveyance of gaseous and liquid fluids. Pipes manufactured in accordance with this standard are intended for use in pipelines or similar services at ambient temperatures or, where heated conditions prevail, at pressures not exceeding 300 lbf/in² at temperatures not exceeding 500°F. Where carbon steel pipes are required for other duties or for close bending, corrugating or other special applications, reference should be made to B.S. 3602* or B.S. 3603†.

This standard covers plain end pipes. Joints, together with specials, are covered in standards such as B.S. 534 and B.S. 806.

Tubes required for boilers or similar plant are covered in B.S. 3059‡. Tubes required screwed and socketed or plain end for screwing to B.S. 21§ are covered in B.S. 1387||.

It should be noted that the requirements for butt welded pipes in this standard are identical with those for plain end tubes in B.S. 1387.

* B.S. 3602, 'Steel pipes and tubes for pressure purposes: carbon steel, high duties'.

† B.S. 3603, 'Steel pipes and tubes for pressure purposes: carbon steel, low temperature duties'. (In course of preparation.)

‡ B.S. 3059, 'Steel boiler and superheater tubes'.

§ B.S. 21, 'Pipe threads'.

|| B.S. 1387, 'Steel tubes and tubulars suitable for screwing to B.S. 21 pipe threads'.

The following pipes are covered by this standard:

Type of pipe	Reference	Grade of steel
Butt welded	BW	22
Hot finished seamless	HFS	22, 27 and 35
Cold drawn seamless	CDS	22, 27 and 35
Electric resistance welded	ERW	22 and 27
Hydraulic lap welded	HLW	26
Electric fusion welded	EFW	26

NOTE. The steels are designated by numbers corresponding to their minimum tensile strengths in tonf/in², viz. 22, 26, 27 and 35.

When the steel reference number is added to the pipe reference letters, the process of manufacture of the pipes and the tensile strength are indicated thus:

'HFS.22' indicates hot finished seamless steel pipes having a minimum tensile strength of 22 tonf/in².

For each type of pipe, the materials, the values for the appropriate tests, the heat treatment where applicable, and the dimensional tolerances are given in Section Two, but all types of pipes are subject to the general clauses in Section One.

INFORMATION TO BE SUPPLIED BY THE PURCHASER

2. The purchaser should state in his enquiry and order:
 - a. The type of pipe expressed by the appropriate reference and grade of steel where necessary as given in Clause 1.
 - b. The outside diameters and thicknesses (see Appendix A) and the lengths of the pipes required.
 - c. The design pressures and temperatures appropriate to the pipes if these are relevant.
 - d. Whether he desires to receive test certificates, or whether he wishes to have tests made specifically related to his order and, if the latter, whether or not he wishes himself or his representative to witness them.
 - e. Whether or not protective coating is to be provided (see Clause 5).
 - f. Whether end protection of pipes for transit is required.

CONDITION OF PIPES

3. All pipes shall be reasonably straight, free from harmful defects, of good commercial finish and as free as practicable from loose scale and rust. The ends shall be cut square with the axis of the pipe.

The repair by welding of minor defects on carbon steel pipes shall be permitted but when pipes are being manufactured under inspection at the manufacturer's works, such repair shall be done only after the sanction of the purchaser or his representative has first been obtained. Such pipes shall be hydraulically tested after the repairs by welding have been made.

LENGTH

4. Where length is specified 'exact' or 'cut length' this shall be within $\pm \frac{1}{4}$ - 0 in.

SURFACE PROTECTION

5. Unless otherwise specified, the pipes shall be despatched from the mill uncoated or with the manufacturer's standard mill protective coating.

MARKING

6. Each length of pipe shall be legibly marked with the purchaser's order number.

In the case of small pipes which are bundled, the purchaser's order number shall be legibly marked on each bundle or alternatively, stamped on one or more metal tags which shall be securely attached to each bundle.

Any additional markings shall be the subject of agreement between the purchaser and the manufacturer.

TEST FACILITIES

7. The manufacturer shall furnish and prepare the necessary test pieces and make the tests specified in this standard. If the testing is to be done at his own works, the manufacturer shall supply the necessary labour and appliances. Failing facilities at his own works for making the tests, the manufacturer shall arrange for the tests to be made elsewhere.

NUMBER OF SAMPLES FOR TEST

8. *a. Where the purchaser does not require tests specifically related to his order.* The manufacturer shall undertake the tests specified in the appropriate section of this standard from a sufficient number of pipes to ensure that the pipes comply with the requirements of that section.

b. Where the purchaser requires tests specifically related to his order. The number of pipes on which mechanical tests shall be performed shall be as follows, subject to a minimum of two pipes.

Up to and including $4\frac{1}{2}$ in outside diameter.	1 pipe in each 400 pipes as made.
Over $4\frac{1}{2}$ in outside diameter up to and including $12\frac{3}{4}$ in outside diameter.	1 pipe in each 200 pipes as made.
Over $12\frac{3}{4}$ in outside diameter.	1 pipe in each 100 pipes as made.

The samples shall be taken at random from batches as presented for inspection, each batch containing not more than 400 pipes for sizes up to and including $4\frac{1}{2}$ in outside diameter or not more than 200 pipes for sizes over

$4\frac{1}{2}$ in outside diameter. If the number of samples specified in this clause when applied to a particular order necessitates a number of pipes which includes a fraction, the fraction shall be treated as unity.

A batch is a convenient quantity of pipes, of the same size and thickness, such that a suitable number of sample pipes taken at random from the batch for purposes of test will adequately represent the whole batch.

TENSILE TEST

9. The tensile test shall be carried out in accordance with B.S. 18*. Round test pieces may be taken longitudinally or transversely.

In the tensile tests, both the tensile strength in tonf/in² and the percentage elongation shall be measured. The percentage elongation is specified in this standard and shall be reported with reference to a $4\sqrt{S_0}$ gauge length. For any other gauge lengths used, the corresponding elongation on $4\sqrt{S_0}$ can be obtained by calculation, as shown in Appendix B. It is suggested, however, that for general convenience a gauge length of 2 in should be used when the corresponding elongation referred to $4\sqrt{S_0}$ can be obtained from Appendix B.

The minimum percentage elongation required on $4\sqrt{S_0}$ is given as 700 divided by the tensile strength in tonf/in². The tensile strength to be used shall be the actual value obtained from the test piece.

FLATTENING TEST

10. A ring, not less than $1\frac{1}{2}$ in long, cut from one end of each selected pipe shall, when cold, be flattened between two parallel flat surfaces without showing either crack or flaw, until, when the pressure is released, the interior surfaces of the test piece remain at the middle a distance apart not greater than the value given in the appropriate clause in Section Two. The weld in a test piece from a butt-welded pipe shall be placed at 45° to the direction of flattening and from an electric resistance welded pipe at the point of maximum bending.

As a test of the weld itself for butt-welded pipes, the weld shall be placed at the position of maximum bending and no opening of the weld shall take place until the distance between the plates is less than the value given in the appropriate clause of Section Two.

BEND TEST: STRIP

11. A strip not less than $1\frac{1}{2}$ in wide, cut circumferentially from one end of each selected pipe or transversely from one end of each selected plate shall, when cold, be doubled over a round bar of the diameter specified in the appropriate clause in Section Two, without showing either crack or flaw but slight premature failures at the edges of a specimen shall not be considered a cause for rejection.

* B.S. 18, 'Method for tensile testing of metals'.