

Specification for

Carbon and alloy steel pipes and tubes with specified low temperature properties for pressure purposes

Tubes et tuyaux pour utilisations sous pression
en acier au carbone et en acier allié à
propriétés spécifiées à basse température —
Spécifications

Druckrohre aus legiertem oder unlegiertem
Stahl für den Einsatz bei niedrigen
Temperaturen

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Iron and Steel Standards Policy Committee (ISM/-) to Technical Committee ISM/73, upon which the following bodies were represented:

- Associated Offices Technical Committee
- BEAMA Ltd. (Power Generation Association)
- British Compressed Air Society
- British Gas plc
- British Shipbuilders
- British Steel Industry
- Electricity Supply Industry in England and Wales
- Engineering Equipment and Materials Users' Association
- High Pressure Pipework Consultative Committee
- Lloyd's Register of Shipping
- Process Plant Association
- Seamless Steel Tube Association
- Water-tube Boilermakers' Association
- Welding Institute
- Coopted members

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- British Fluid Power Association
- British Forging Industry Association
- British Industrial Truck Association
- British Welded Steel Tube Association
- Confederation of British Industry
- Energy Industries Council
- Coopted member

This British Standard, having been prepared under the direction of the Iron and Steel Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 28 February 1991

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Foreword

This British Standard has been prepared under the direction of the Iron and Steel Standards Policy Committee. It supersedes BS 3603 : 1977, which is withdrawn.

The standard takes account of current production procedures for seamless and electric resistance welded tubes for pressure purposes.

The steels covered by this standard are generally regarded as being weldable. However, care should be taken and welding should be in accordance with the appropriate British Standards for welding.

The main technical differences between this edition and the previous edition are that, for steel grade 410, values for minimum specified yield strength and tensile strength have been increased, and changes in chemical composition to take into account current steelmaking practice have been made. This steel has been re-designated grade 430. In addition, tolerances have been added for tubes supplied to inside diameter and thickness parameters. Furthermore, impact testing has now become a requirement of the standard.

This standard is one of a series specifying requirements for steel pipes and tubes for pressure purposes. Other standards in this series are as follows.

- BS 3601 Specification for carbon steel pipes and tubes with specified room temperature properties for pressure purposes
- BS 3602 Specification for steel pipes and tubes for pressure purposes: carbon and carbon manganese steel with specified elevated temperature properties
 - Part 1 Specification for seamless and electric resistance welded including induction welded tubes
 - Part 2 Submerged arc welded tubes
- BS 3604 Steel pipes and tubes for pressure purposes: ferritic alloy steel with specified elevated temperature properties
- BS 3605 Specification for seamless and welded austenitic stainless steel pipes and tubes for pressure purposes

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

It is outside the scope of this standard to specify formal qualifications for personnel engaged in testing but it is emphasized that the operation of all equipment should be supervised by competent, trained personnel.

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Specification

1 Scope

This British Standard specifies plain end, seamless and electric resistance welded, including induction welded, carbon and alloy steel tubes suitable for pressure purposes.

Tubes manufactured in accordance with this standard have specified low temperature impact properties.

In addition to the definitive requirements, this standard requires the items detailed in 2.1 to be documented. It also requires options selected by the purchaser from those detailed in 2.2 to be documented. For compliance with this standard both the definitive requirements and the documented items have to be satisfied.

This standard provides for two categories of room temperature test procedure, designated category 1 and category 2 (see clause 11).

NOTE 1. The range of diameters and thicknesses appropriate to this standard is given in appendix A. However, it may be convenient to select from the discrete sizes given in the following standards:

- (a) table 1 of BS 3600 : 1976;
- (b) BS 1600 : Part 2 (completely interchangeable with ANSI B36.10M¹⁾ and ANSI B36.19M¹⁾).

Tubes to diameters and thicknesses not covered by the above standards are also available, including those supplied by hot or cold finished seamless, and cold finished electric resistance weld processes.

NOTE 2. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Information to be supplied by the purchaser and options to be documented

2.1 Information to be supplied by the purchaser

The following information shall be supplied by the purchaser and shall be fully documented:

- (a) the designation of the tubes as specified in clause 3, i.e. the number of this British Standard, the method of manufacture of the tube, the type of steel and the category of test, e.g. BS 3603 : HFS 430 LT Cat. 1;
- (b) the tube outside diameter and thickness for electric resistance welded tubes or the outside or inside diameter and thickness for seamless tubes and cold finished electric resistance welded tubes (see 10.2);
- (c) the tube length, if exact (see 2.2(f) and 10.3);
- (d) the quantity in metres or number of lengths.

2.2 Options to be documented

A number of options are permitted by this standard as listed in this clause and the purchaser shall identify the options required. Both the definitive requirements specified throughout this standard and the following documented items stated by the purchaser shall be satisfied by the manufacturer before a claim of compliance with this standard can be made and verified. In the event that the purchaser does not indicate his requirements at the time of enquiry or order the manufacturer shall select the options where appropriate:

- (a) the steelmaking process (see 4.1 and 15.2(a));
- (b) whether a product analysis is required (see 6.2 and 15.2(b));
- (c) whether selected chemical elements additional to those specified are to be reported (see 6.3 and 15.2(c));
- (d) the final supply condition of the tubes (see clause 7 and 15.2(d));
- (e) whether the upper limit above which the dressing of surface imperfections will be required will be 1.5 mm (see 9.8);
- (f) whether lengths other than random lengths are required (see 10.3);
- (g) whether the method of leak tightness test to be carried out on test category 2 tubes up to and including 180 mm outside diameter is the hydraulic test or the eddy current test (see 12.4 and 15.2(e));
- (h) the temperature at which the tubes shall be impact tested if other than at the lowest given (see 13.3);
- (i) whether the hydraulic test, if specified, is to be carried out at a pressure in excess of 140 bar²⁾ and the pressure required (see 13.4 and 15.2(e));
- (j) whether additional non-destructive testing is required (see 13.7 and 15.2(f));
- (k) whether the tubes are to be supplied uncoated or with the manufacturer's normal mill coating (see clause 16);
- (l) whether marking requirements in accordance with BS 5383 are required (see 17.1 and 17.4).

¹⁾ Published by the American National Standards Institute (ANSI) and available from BSI Sales Department, Linford Wood, Milton Keynes, MK14 6LE.

²⁾ 1 bar = 10⁵ N/m² = 10⁵ Pa.

3 Designation

The tubes shall be designated by the number of this British Standard, i.e. BS 3603 and, from table 1, by one of the references which indicates the method of manufacture (see clause 5) and, from table 2, by a number which indicates the type of steel, and the test category (see clause 11).

Example. BS 3603 : CFS 430 LT Cat. 1 designates cold finished seamless tube made from steel type 430 tested to category 1.

NOTE. The designations for tubes in this standard and their nearest equivalent designations in BS 3603 : 1977 and ISO 2604 : Parts II and III are listed in appendix B for information.

4 Manufacture of the steel

4.1 Steelmaking process

The steel shall be produced by an electric process or by one of the basic oxygen processes, at the option of the manufacturer unless otherwise specified by the purchaser (see 2.2(a)).

4.2 Deoxidation

Steels shall be fully killed and fine grain.

5 Manufacture of the product

The tubes shall be manufactured by one of the following processes.

(a) *Seamless.* The tubes shall be manufactured by a seamless process and shall be hot finished or cold finished (see notes 1 and 3).

(b) *Electric resistance welded* (see notes 2 and 3). The tubes shall be manufactured from hot or cold flat-rolled strip, longitudinally welded continuously by the passage of an electric current across the abutting edges or along the edges prior to closure under welding pressure without the addition of filler metal. They shall be as-welded, hot finished or cold finished (see note 1). The finished tubes shall not include welds used for joining lengths of the hot or cold flat-rolled strip, prior to tube forming (see note 1).

Table 1. Method of manufacture of tubes and reference

Method of manufacture	Reference
Hot finished seamless	HFS
Cold finished seamless	CFS
Electric resistance welded	ERW ¹⁾
Cold finished electric resistance welded	CEW
¹⁾ The reference ERW includes as-welded or hot finished tubes (see (b) of clause 5).	

Table 2. Steel type and type number

Steel type	Type number
Carbon steel	430 LT
3½ % nickel steel ¹⁾	503 LT
9 % nickel steel ¹⁾	509 LT
¹⁾ Welded tubes to this standard are not available in these steels.	

For tubes of both test categories, ultrasonic or other suitable non-destructive testing method shall be used for continuous examination of the weld area (see note 4).

NOTE 1. The terms 'as-welded', 'hot finished' and 'cold finished' apply to the condition of the tube before heat treatment, if required, in accordance with clause 7.

NOTE 2. Electric resistance welded tubes cover those produced by both high frequency and low frequency techniques using either direct contact or induction.

NOTE 3. The range of dimensions and tolerances in which tubes are available is dependent upon the method of manufacture. The thicknesses available are also dependent upon the diameter. The dimensional limits generally applicable to this standard are shown in appendix A and the tolerances are specified in clause 10.

NOTE 4. Non-destructive testing of the weld area is made for the purpose of quality control during the process of manufacture by a method and at a place chosen by the manufacturer.