

Steel pipes and tubes for pressure purposes: ferritic alloy steel with specified elevated temperature properties —

**Part 2: Specification for longitudinally
arc welded tubes**

Confirmed December 2011

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.
- British Compressed Air Society
- British Forging Industry Association
- British Gas plc
- British Steel Industry
- Electricity Supply Industry in United Kingdom
- Engineering Equipment and Materials Users' Association
- Lloyd's Register of Shipping
- Power Generation Contractors' Association (BEAMA Ltd.)
- Process Plant Association
- The 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 Welded Steel Tube Association
- Confederation of British Industry
- Energy Industries Council
- Stainless Steel Fabricators Association of Great Britain

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Foreword

This Part of BS 3604 has been prepared under the direction of the Iron and Steel Standards Policy Committee. It complements BS 3604-1 which specifies seamless and electric resistance welded alloy tubes, and BS 3602-2 which specifies carbon and carbon manganese steel longitudinally arc welded tubes.

This Part of BS 3604 is one of a series specifying requirements for steel pipes and tubes for pressure purposes. Other standards in the 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: Longitudinally arc welded tubes.*

BS 3603, *Specification for carbon and alloy steel pipes and tubes with specified low temperature properties for pressure purposes.*

BS 3604, *Steel pipes and tubes for pressure purposes: ferritic alloy steel with specified elevated temperature properties — Part 1: Specification for seamless and electric resistance welded tubes.*

BS 3605:1973, *Specification for seamless and welded austenitic stainless steel pipes and tubes for pressure purposes.*

BS 3605, *Austenitic stainless steel pipes and tubes for pressure purposes — Part 1: Specification for seamless tubes.*

This Part of BS 3604 takes account of current production procedures for longitudinally arc welded tubes. It contains three chromium, molybdenum types of steel.

The steels covered by this Part of BS 3604 are generally regarded as being weldable. However, care should be taken and welding should be carried out in accordance with the appropriate British Standards for welding.

The corresponding steels in BS 1501-2 meet the requirements of the steels in this Part of BS 3604. Tubes complying with this Part of BS 3604 are subject to non-destructive testing of the weld seam.

The designation of steel tubes in this Part of BS 3604 and their nearest equivalent designations in ISO 2604-VI are given in Appendix A for information purposes.

This Part of BS 3604 is aligned as far as possible with corresponding material requirements and test procedures now agreed for incorporation in documents by the International Organization for Standardization (ISO).

For class 40 tubes, the specified elevated temperature yield or proof stress values are those derived from national data by the procedure described in BS 3920. Additionally, provision is made for the application of the related procedure for verifying that a product consistently meets specified levels of elevated temperature values.

It is recommended that the results of elevated temperature tests, together with information on the product thickness, the room temperature tensile properties and the chemical composition of the material, should be sent to the Secretary of ISM/73/-/1, British Standards Institution, 3 York Street, Manchester M2 2AT, UK, so that, for future revisions of this Part of this Standard, minimum elevated temperature proof stress values can be derived from a continuously updated data bank.

Impact test values are not specified in this Part of BS 3604 but if the purchaser requires an impact test to be carried out then it is recommended that the Charpy impact test should be carried out in accordance with BS EN 10045-1.

The appropriate British Standards for the design and construction of boilers, pressure vessels, pipework, etc. should be consulted for requirements relating to the application and permissible design stress for products made in accordance with this Part of this Standard.

Assessed capability. Users of this British Standard are advised to consider the desirability of assessment and registration of a supplier's quality systems against the appropriate Part of BS 5750 by a third party certification body.

It is outside the scope of this Part of BS 3604 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 Part of BS 3604, no difference is intended in the meaning between "pipe" and "tube" though idiomatic use prefers sometimes the one and sometimes the other.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 3604 specifies requirements for plain end, longitudinally arc welded ferritic alloy steel tubes suitable for pressure purposes.

Tubes manufactured in accordance with this Part of BS 3604 have specified room temperature properties and specified proof stress values at elevated temperatures.

In addition to the definitive requirements this Part of BS 3604 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 Part of BS 3604 both the definitive requirements and the documented items have to be satisfied.

NOTE 1 The range of diameters and thicknesses appropriate to this Part of BS 3604 is given in Appendix B for guidance.

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, i.e. the number and Part of this British Standard, the type of steel, and the final supply condition, (see clause 3), e.g. BS 3604-2:622: class 20;
- b) the tube outside diameter and thickness;
- c) the tube length if exact (see 10.9);
- d) the quantity in metres or numbers of lengths.

2.2 Options to be documented

A number of options are permitted by this Part of BS 3604 as listed below and the purchaser shall identify the options required. Both the definitive requirements specified throughout this Part of BS 3604 and the following documented items stated by the purchaser shall be satisfied by the manufacturer before a claim of compliance with this Part of BS 3604 can be made and verified by the manufacturer. 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 k)];
- b) whether welding procedure details and evidence of welding procedure approval are required (see 5.2);

c) whether evidence of welder or welding machine operator approval is required (see 5.2);

d) whether additional procedure approval is required (see 5.2);

e) whether a product analysis is required [see 6.2 and 15 l)];

f) whether the content of selected chemical elements additional to those specified are to be reported [see 6.3 and 15 m)];

g) whether the upper limit above which the dressing of surface imperfections is required will be 1.5 mm (see 9.8);

h) whether end sizing is required (see 10.8);

i) whether lengths other than random are required (see 10.9);

j) whether the hydraulic test is to be carried out at a pressure in excess of 140 bar¹⁾ and the pressure required (see 13.3);

k) the method of non-destructive testing to be used (see 13.4);

l) whether additional non-destructive testing of the weld is required (see 13.5.1);

m) the quality grade to which the plate is to be tested (see 13.5.2);

n) whether verification of elevated temperature proof stress values is required for class 40 tubes (see 13.6.1);

o) whether verification of elevated temperature proof stress values by testing is required (see 13.6.2) and the temperature selected from Table 5 at which this is to be carried out;

p) whether the tubes are to be supplied uncoated or with the manufacturer's normal mill coating (see clause 16);

q) whether marking requirements to BS 5383 are required (see 17.1 and 17.4).

3 Designation

The tubes shall be designated by the number and Part of this British Standard, i.e. BS 3604-2, by a number which indicates the type of steel (see Table 1) and the class number which indicates the final supply condition (see clause 7).

For example, BS 3604-2:622:class 20, designates longitudinally arc welded tube made from steel type 622, in the stress relieved condition.

NOTE The designations for tubes in this Part of BS 3604 and their nearest equivalent designations in ISO 2604-VI are listed in Appendix A for information.

¹⁾ 1 bar = 10⁵ N/m² = 10⁵ Pa.

Table 1 — Chemical composition and mechanical properties at room temperature

Steel type	Type number	Chemical composition (ladle analysis) (see notes 1 and 2)														Mechanical properties at room temperature (see note 7)					
		C		Si		Mn		P	S	Cr		Mo		Cu	Ni	Others	R_m		R_e	A	
		min	max	min	max	min	max	max	max	min	max	min	max	max	max	(see note 6)	min	max	min	min	
1 % chromium 0.5 % molybdenum	620 (see note 3)	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	N mm ²	N mm ²	N mm ²	%	
		0.09	0.18	0.15	0.40	0.40	0.65	0.025	0.015	0.80	1.15	0.45	0.60	0.30	0.30	Al_{met} 0.02 max.	480	600	340	18	
1.25 % chromium 0.5 % molybdenum	621 (see note 4)	0.09	0.17	0.50	0.80	0.40	0.65	0.025	0.015	1.00	1.50	0.45	0.60	0.30	0.30	Al_{met} 0.02 max.	515	690	340	18	
2.25 % chromium 1 % molybdenum	622 (see note 5)	0.09	0.15	—	0.50	0.30	0.60	0.025	0.015	2.00	2.50	0.90	1.10	0.30	0.30	Al_{met} 0.02 max.	515	690	310	16	
NOTE 1 Elements not quoted in Table 1 shall not be intentionally added without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition of such elements from scrap or other materials used in the manufacture. Elements added for the purpose of finishing the heat shall be reported.																					
NOTE 2 For permitted deviations on product analysis, see Table 2.																					
NOTE 3 Steel complying with BS 1501-2:620 meets the requirements of steel type 620.																					
NOTE 4 Steel complying with BS 1501-2:621 meets the requirements of steel type 621.																					
NOTE 5 Steel complying with BS 1501-2:622/515 meets the requirements of steel type 622.																					
NOTE 6 Where a maximum Al_{met} of 0.02 % is specified, determination of the total aluminium content, provided it does not exceed the specified value, shall be deemed to meet this requirement. In cases of dispute, the metallic aluminium content shall be determined.																					
NOTE 7 R_e is the yield strength. For acceptance purposes either the upper yield strength R_{eH} or the 0.5 % proof strength (total elongation) $R_{t0.5}$ may be used (see 13.1.2). R_m is the tensile strength; A is the percentage elongation after fracture on a gauge length of $L_0 = 5.65 \sqrt{S_0}$ (where S_0 is the original cross-sectional area of the gauge length).																					