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BSI Group
389 Chiswick High Road
London, W4 4AL
United Kingdom

T: +44 20 845 086 9001
F: +44 20 8996 7400
cservices@bsigroup.com
bsigroup.com

British Standards Limited
Registered in England no: 07864997
Registered address: 389 Chiswick High Road
London, W4 4AL, United Kingdom

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SPECIFICATION FOR

PIPING SYSTEMS

FOR PETROLEUM REFINERIES AND PETROCHEMICAL PLANTS

BRITISH STANDARDS INSTITUTION

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BS 3351 : 1971

BRITISH STANDARDS INSTITUTION
Incorporated by Royal Charter
2 PARK STREET, LONDON, W1A 2BS
Telex: 266933 Telephone: 01-629 9000

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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.

This standard makes reference to the following British Standards, in addition to those contained in Table 1:

BS 131. Methods for notched bar tests. Part 2. The Charpy-V notch impact test.
BS 639. Covered electrodes for the manual metal-arc welding of mild steel and medium-tensile steel.
BS 1500. Fusion welded pressure vessels for general purposes.
BS 1515. Fusion welded pressure vessels for use in the chemical, petroleum and allied industries.
BS 1723. Brazing.
BS 1821. Class I oxy-acetylene welding of steel pipelines and pipe assemblies for carrying fluids.
BS 2633. Class I arc welding of ferritic steel pipework for carrying fluids.
BS 4165. Electrode wires and fluxes for the submerged arc welding of mild steel and medium-tensile steel.
BS 4300/8. NS 51 Plate, sheet and strip.
BS 4677. Class I arc welding of austenitic stainless steel pipework for carrying fluids.

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

CO-OPERATING ORGANIZATIONS

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

British Mechanical Engineering Confederation
British Rubber Manufacturers Association
*British Steel Industry
*Council of British Manufacturers of Petroleum Equipment
Gas Council
Ministry of Technology
*Oil Companies Materials Association

The 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:

Aluminium Federation
British Chemical Engineering Contractors Association
British Non-Ferrous Metals Association
British Valve Manufacturers Association
Chemical Industries Association Ltd.
Engineering Equipment Users Association
Imperial Chemical Industries Ltd.
Lloyd's Register of Shipping

The following BSI references relate to the work on this standard:
Committee reference PEE/14 Draft for comment 68/26917

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BRITISH STANDARD SPECIFICATION FOR

PIPING SYSTEMS

FOR PETROLEUM REFINERIES AND PETROCHEMICAL PLANTS

FOREWORD

This British Standard is one of a series published under the authority of the Petroleum Equipment Industry Standards Committee.

In the original edition, 1961, the provisions represented standards of design and construction basically similar to those laid down in the American standard code for petroleum refinery piping, ANSI B31.3. Since that time a number of significant differences from that code have been introduced in the light of experience and the technical developments. These differences appear, for example, in the provisions for the application of materials for low temperature service, the requirements for quality control and inspection of fusion welding, and the modifications to design stresses in accordance with currently accepted design stress criteria. Determination of these design stresses has been assisted by the publication of a series of British Standards for pipe, BS 3601–5, wherein are listed proof stress values at temperature and creep and stress to rupture properties.

In some respects, in particular the provisions for the treatment of piping flexibility, identity with the ANSI B31.3 code has been maintained, and acknowledgment is made to the American National Standards Institute for data used in the preparation of this standard.

The continuous development of materials and design makes it necessary for the provisions of this standard to be reviewed periodically, and in consequence it is desirable that experience in its application be conveyed to the Committee by users.

SPECIFICATION

1. GENERAL

1.1 SCOPE

This British Standard specifies minimum requirements and recommended practice for the selection and application of materials and components of piping systems in petroleum refineries and petrochemical plants and the design, fabrication, installation and testing of these systems.

Piping systems are interpreted as assemblies of pipe, valves, pipe fittings, flanges, bolting, gaskets and pipe supports.

This British Standard applies to piping systems within the plot limits of petroleum refineries, petrochemical plants, gas processing plants, refinery tank farms and marine discharge and loading points, and interconnecting lines between such facilities.

The standard is divided into seven sections, and full details of the scope of each section are given in the first clause of the section.

It does not apply to:

(1) piping systems within the boundaries of steam and power plants, for the design and construction of which British Standards or other accepted national codes are available;

(2) heater tubes, tube fittings and headers, including connections for piping;

(3) pressure vessels, heat exchangers, pumps, and other such equipment, including internal piping and connections for piping;

(4) piping located on refinery property which has been set aside for cross-country piping transmitting oil or gas through, to, or from the refinery;

(5) pilot plants and research equipment generally, except insofar as this standard may be considered as a guide.

1.2 DEFINITIONS

For the purposes of this British Standard the following definitions apply.

1.2.1 Process piping. All piping in a unit used in the processing of hydrocarbon and chemicals.

The term is taken to apply also to process lines directly interconnecting units, and to piping and fittings used to connect instruments to process piping and equipment.

1.2.2 Plot (battery) limits. The boundaries of an area occupied by a processing unit.

It is taken not only to apply to 'processing units' in the strict sense but also to other locations where it is felt that the restrictions and limitations specified in this standard for certain materials in connection with 'processing units' should be adhered to.

1.2.3 Non-hazardous service. A service in which failure would not, under normal circumstances, create a hazard to personnel and considered generally to be limited to neutral aqueous solutions and to the low pressure services of water, air, steam and inert gases.

1.2.4 Pipe making processes. The various methods of making pipe or tube, as follows.

1.2.4.1 ***Seamless process.*** A wrought steel tubular product made without a welded seam. It is manufactured by hot working steel and, if necessary, by subsequently cold finishing the hot-worked tubular product.

1.2.4.2 ***Electric fusion welding process (EFW).*** Steel plate formed into tubular shape and the abutting edges joined by manual or automatic electric arc welding with or without the use of filler metal.

1.2.4.3 ***Spiral seam fusion welding process (SFW).*** Steel strip, sheet or plate rolled into tubular shape so as to form a helical seam around the circumference of the pipe. The helical seam is electric fusion welded by an automatic metal arc welding process (SFW), or by electric resistance welding process.

1.2.4.4 ***Electric resistance welding process (ERW).*** A length of steel strip formed into tubular shape and longitudinally resistance welded continuously by the passage of an electric current across the abutting edges without the addition of filler metal.

1.2.4.5 ***Electric induction welding process.*** A length of steel strip or plate formed into tubular shape and longitudinally induction welded continuously by the passage of an electric current across the abutting edges without the addition of filler metal.

1.2.4.6 ***Electric flash welding process.*** A length of steel strip or plate formed into tubular shape and longitudinally flash welded over the full length simultaneously by the passage of an electric current across the abutting edges without the addition of filler metal.

1.2.4.7 ***Butt-welding process (BW).*** A continuous steel strip passed through a tunnel furnace from which it emerges at forge welding temperature to enter a series of rolls which form it into a tube and forge weld the abutting edges together.

1.2.5 Design pressure. The value of pressure to be used in calculations of pipe thickness (see Section 5).

1.2.6 Design temperature. The temperature to be used to establish the appropriate value of design stress.

1.2.7 ***t*** **for weld sizes.** Where in the various figures at the end of this standard the sizes of welds are related to t, then t shall be taken to be the actual metal thickness of the section under consideration.

2. COMPONENTS

2.1 SCOPE OF SECTION 2

This section lists the standards with which the components should comply and gives an outline of requirements in the construction of piping systems.

2.2 GENERAL

2.2.1 The components used shall be in accordance with the relevant standards given in Table 1, except that this shall not preclude the use of other materials, designs or methods of manufacture which can be shown to meet the intent of this standard. In any such cases this shall be explicitly stated as a qualification of any claims that the piping system complies with the requirements of this standard.

2.2.2 Components shall be marked in accordance with the requirements of the relevant standards in Table 1. The marking shall permit the component to be properly identified.

TABLE 1. LIST OF STANDARDS

NOTE. Standards marked 'D' include dimensional requirements. For the purposes of this standard, the standards listed below are intended to apply only to the components listed in the second column.

Material	Component	Standard		Title
		FERROU		
Steel		BS 449	—	The use of structural steel in building.
		BS 1501–6: 1958	—	Steels for use in the chemical, petroleum and allied industries.
		BS 1510 : 19	—	Steels for use in the chemical, petroleum and allied industries. (Low temperature supplementary requirements to BS 1501–1506).
	Plates	BS 1 1 : Part 1 : 19	—	Steels for fired and unfired pressure vessels. Plates. Part 1. Carbon and carbon manganese steels. Imperial units.
		BS 1501 : Part 2 : 1970	—	Steels for fired and unfired pressure vessels. Plates. Part 2. Alloy steels. Imperial units.
	Forgings	BS 1503: 1969	—	Steel for fired and unfired pressure vessels. Forgings.
	Castings	BS 1504	—	Carbon and alloy steel castings (not yet published; included in BS 1501–6: 1958).
	Bar	BS 1506	—	Carbon and alloy steel bars for bolting material (not yet published; included in BS 1501–6: 1958).
	ipe	BS 1600	D	Dimensions of steel pipe for the petroleum industry. Part 1. Imperial units. Part 2. Metric units.
		BS 3601*	—	Steel pipes and tubes for pressure purposes. Carbon steel: ordinary duties.
		BS 3602*	—	Steel pipes and tubes for pressure purposes. Carbon steel: high duties.
		BS 3603*	—	Steel pipes and tubes for pressure purposes. Carbon and alloy steel: low-temperature duties.
		BS 3604*	—	Steel pipes and tubes for pressure purposes. Low and medium alloy steel.
		BS 3605*	—	Steel pipes and tubes for pressure purposes. Austenitic stainless steel.
		API STD. 5L	D	Line pipe.
		API STD. 5LS	D	Spiral-weld line pipe.
	Valves	BS 1414	D	Flanged and butt-welding end steel outside-screw-and-yoke wedge gate valves for the petroleum industry.
		BS 1570	D	Flanged and butt-welding end steel plug valves for the petroleum industry (excluding well-head and flow-line valves).
		BS 1655	D	Flanged automatic control valves for the petroleum industry (face-to-face dimensions).
		BS 1868	D	Flanged steel check valves for the petroleum industry.
		BS 1873	D	Flanged steel globe valves for the petroleum industry.
		BS 2080	D	Summary of face-to-face dimensions of flanged ferrous valves for the petroleum industry.
		BS 2995	D	Cast and forged steel wedge gate, globe, check and plug valves, screwed and socket-welding, sizes 2 in and smaller, for the petroleum industry.
		BS 3808	D	Cast and forged steel flanged, screwed and socket-welding wedge gate valves (compact design), sizes 2 in and smaller, for the petroleum industry.
		BS 4460	D	Steel ball valves for the petroleum industry.
		API STD. 6D	D	Steel gate, plug, ball and check valves for pipe line service.

* See 2.3.1.