BS EN 488:2015

BSI Standards Publication

District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 488:2015. It supersedes BS EN 488:2011 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/9, Insulated underground pipelines.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2015

ISBN 978 0 580 85226 8

ICS 23.060.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2015.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 488

November 2015

ICS 23.060.01

Supersedes EN 488:2011+A1:2014

English Version

District heating pipes - Preinsulated bonded pipe systems for directly buried hot water networks - Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

Tuyaux de chauffage urbain - Systèmes bloqués de tuyaux préisolés pour les réseaux d'eau chaude enterrés directement - Robinets préisolés pour tubes de service en acier, isolation thermique en polyuréthane et tube de protection en polyéthylène

Fernwärmerohre - Werkmäßig gedämmte Verbundmantelrohrsysteme für direkt erdverlegte Fernwärmenetze - Vorgedämmte Absperrarmaturen für Stahlmediumrohre mit Polyurethan-Wärmedämmung und Außenmantel aus Polyethylen

This European Standard was approved by CEN on 5 September 2015.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 488:2015 E

Contents

Page

European foreword

This document (EN 488:2015) has been prepared by Technical Committee CEN/TC 107 “Prefabricated district heating and district cooling pipe systems”, the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 488:2011+A1:2014.

In comparison with the previous edition, the main changes in EN 488:2015 are:

— improvement and simplification of the type test of the steel valve. The cycle test has been integrated in the test sequence;

— the formulae in Annex C for the calculation of bending forces have been improved. C.1.3 of EN 488:2011+A1:2014 concerning alternative test application for diameters DN ≤ 200 mm, has been deleted.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

EN 488 has also been aligned with EN 448 and other relevant European Standards.

Other standards from CEN/TC 107 are:

— EN 253, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene*;

— EN 448, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene*;

— EN 489, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene*;

— EN 13941, *Design and installation of preinsulated bonded pipe systems for district heating;*

— EN 14419, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Surveillance systems*;

— EN 15632 (all parts), *District heating pipes — Pre-insulated flexible pipe systems*;

— EN 15698-1, *District heating pipes — Preinsulated bonded twin pipe systems for directly buried hot water networks — Part 1: Twin pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene*;

— EN 15698-2, *District heating pipes — Preinsulated bonded twin pipe systems for directly buried hot water networks — Part 2: Fitting and valve assembly of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.*

1 Scope

This European Standard specifies requirements and test methods for valves of prefabricated thermally insulated valve assemblies comprising a steel valve, rigid polyurethane foam insulation and an outer casing of polyethylene for use in directly buried hot water networks with pre-insulated pipe assemblies in accordance with EN 253.

This European Standard applies only to factory made prefabricated insulated valve assemblies for continuous operation with hot water at various temperatures in accordance with EN 253:2009+A2:2015, Clause 1 and the valve assemblies with a maximum operation pressure of 25 bar. For higher pressures, additional demands apply.

NOTE For this application, the following valve types are commonly used: ball valves, gate valves, and butterfly valves.

This European Standard does not include calculation rules for loads and stresses. These depend on the configuration of the system as it is installed. The design and installation rules are given in EN 13941.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 19, *Industrial valves — Marking of metallic valves*

EN 253:2009+A2:2015, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene*

EN 448:2015, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene*

EN 736-1, *Valves - Terminology — Part 1: Definition of types of valves*

EN 10088-1:2014, *Stainless steels — Part 1: List of stainless steels*

EN 10204, *Metallic products — Types of inspection documents*

EN 12266-1, *Industrial valves — Testing of metallic valves — Part 1: Pressure tests, test procedures and acceptance criteria — Mandatory requirements*

EN 12502-4, *Protection of metallic materials against corrosion — Guidance on the assessment of corrosion likelihood in water distribution and storage systems — Part 4: Influencing factors for stainless steels*

EN 13941:2009+A1:2010, *Design and installation of preinsulated bonded pipe systems for district heating*

EN 14419, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Surveillance systems*

EN ISO 12944-2, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments (ISO 12944-2)*

EN ISO 12944-5, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems (ISO 12944-5)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 253:2009+A2:2015 and EN 448 and the following apply. For types of valves, the terms and definitions given in EN 736-1 apply.

3.1
nominal pressure (PN) class
alphanumeric designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipe work system

Note 1 to entry: It comprises the letters PN followed by a dimensionless number.

Note 2 to entry: The number following the letters PN does not represent a measurable value and should not be used for calculation purposes except where specified in the relevant standard.

Note 3 to entry: The designation PN is not meaningful unless it is related to the relevant component standard number.

Note 4 to entry: The maximum allowable pressure of a pipework component depends on the PN number, the material and design of the component, its maximum allowable temperature, etc. The relevant European Component standards include tables of specified pressure/temperature ratings or, in minimum, include rules how to determine pressure/temperature ratings.

Note 5 to entry: It is intended that all components with the same PN and DN designations have the same mating dimensions for compatible flange types.

[SOURCE: EN 1333:2006, 2.1, modified – added Note 1 to entry.]

3.2
maximum operation pressure
maximum internal pressure acting against the pipe wall at any point or in any section of the pipeline at a given operating temperature

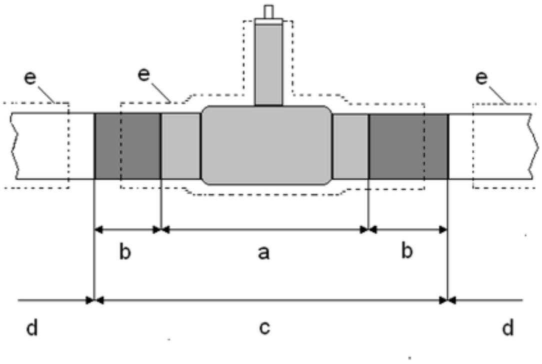
[SOURCE: EN 13941:2009+A1:2010, 3.1.19, modified]

3.3
nominal size
DN
alphanumeric designation of size, common to components in piping systems which are used for reference purposes

[SOURCE: EN ISO 6708:1995, 2.1, modified]

3.4
valve assembly
assembly of valve, valve extension pipe, PE-casing and PUR-foam

Note 1 to entry: Figure 1 gives an example of a valve assembly and its components.



Key

a valve

b valve extension pipe

c valve assembly

d service pipe

e insulation

Figure 1 — Example valve assembly components

3.5
valve
part of the valve assembly supplied by the valve manufacturer (with or without valve extension pipe)

3.6
valve extension pipe
pipe part of the valve assembly welded to the valve

Note 1 to entry: The valve extension may be required before the insulation process. This can be done by the valve manufacturer or the insulation manufacturer. The valve can be extended with valve extension pipes before insulation or delivered by the valve manufacturer with extensions.

3.7
steel service pipe
service pipe according to EN 253:2009+A2:2015

4 Requirements

4.1 Pressure ratings for valves

4.1.1 General

The valves shall be designed for use in pipe systems with a maximum operating pressure of 16 bar or 25 bar.

The valves shall be able to withstand a strength test pressure of the district heating system of 1,3 times the maximum operating pressure at ambient temperature in open and closed position.

4.1.2 Valves without indicated flow direction

Valves without an indicated flow direction shall support the pressure load in both directions.

4.2 Service temperatures for valves

The valves shall be able to withstand continuous operation with hot water at various temperatures in accordance with EN 253:2009+A2:2015 and at a minimum water temperature of 4 °C.

4.3 Steel parts

4.3.1 General

All valves, steel pipes and steel components used for manufacturing of valve assemblies under the scope of this European Standard shall as a minimum be delivered to the manufacturer with an inspection certificate 3.1 according to EN 10204. The manufacturer shall keep documentation of the inspection certificates.

In case a material related inspection certificate 3.1 according to EN 10204 is required by the client who orders the preinsulated valve assemblies, this information shall be given while placing the order with the manufacturer of the preinsulated valve assemblies.

NOTE Any later request for provision of such documentation can be too late and can possibly not be met by the manufacturer, since the manufacturer has to organize the assignment of 3.1 certificates to valves and valve assemblies before starting the production.

4.3.2 Valve

The valve shall be fully welded. Detachable joints, such as flanged or screwed connections, except sealing system at the stem, shall not be used in the pressurized area.

4.3.3 Valve extension pipe

The quality of the valve body shall match with the quality of the valve extension pipe.

4.3.4 Welding ends

The welding ends of the valve assembly shall match with the service pipe in accordance with EN 253:2009+A2:2015, 4.2.2.

Pipe ends shall be prepared in accordance with EN 448:2015, 4.1.10.3.

4.3.5 Welding of steel parts

Fusion welding between valves and valve extension pipe, shall be carried out in accordance with EN 448:2015, 4.1.10.

The quality of the steel at the welding ends of the valve or valve assembly shall match with steel of the service pipes.

Welding of pressurized parts of the valve assembly shall comply with EN 448:2015, 4.1.10.2 and 4.1.10.5.

4.4 Casing

4.4.1 General

The casing shall be in accordance with EN 448:2015 and EN 253:2009+A2:2015.

4.4.2 Requirements for polyethylene welding

The general requirements for polyethylene welding shall be in accordance with EN 448:2015, 4.4.3.

4.4.3 Diameter and wall thickness of the casing

The outside diameter and the minimum wall thickness of the PE casing shall be in accordance with EN 448:2015, 4.4.5.

4.5 Polyurethane rigid foam insulation (PUR)

4.5.1 General

The requirements for PUR shall be the same as in EN 448:2015, 4.3 when tested in accordance with 5.5 of this European Standard.

4.5.2 Minimum insulation thickness

The minimum insulation thickness shall be in accordance with EN 448:2015, 4.4.6.

4.6 Valve assembly

4.6.1 Ends of valve assembly

4.6.1.1 General

The ends of the valve extension pipe of the valve assembly shall be prepared for welding according to 4.3.3 and shall be free from insulation for a minimum length of 150 mm. The tolerance in the declared value shall be ± 10 mm.

4.6.1.2 Centre line deviation

The distance between the centre lines of the valve extension pipe and the casing at the ends of the valve assembly shall not exceed the limits given in EN 253:2009+A2:2015, Table 7.

The centre line deviation shall be measured between the centre lines with the largest deviation.

4.6.1.3 Angular deviation

The angular deviation between the centre lines of the not insulated ends of the valve extension pipe at the length of 100 mm from the ends shall not exceed 2°.

The angular deviation shall be measured between the centre lines with the largest deviation.

4.6.2 End of stem construction

To ensure a long service life of the end stem passing through the casing, it shall withstand the aggressive underground condition such as heat, cold, moisture, ground and salty water. Where the stem construction passes the casing there shall be an arrangement to protect against water ingress to the insulation.

The stem construction outside the insulation shall be:

— made from stainless steel as defined in EN 10088-1:2014, 3.1, however minimum specified Cr-content is 16 %. Factors influencing the corrosion probability of the stainless steel construction can be assessed according to EN 12502-4.

  Specifically used steel type is documented by appropriate quality management system;

NOTE Under specific installation and operation conditions a chrome content of 16 % alone might not be sufficient, so that other alloy elements are then recommended.

— or made from carbon steel and protected by a paint system securing durability range “high” according to EN ISO 12944-5. Underground installed valves shall be suitable for corrosivity categories of Im1, Im2 and Im3 according to EN ISO 12944-2 and for atmospheric-corrosivity categories C5-M and C5-I according to EN ISO 12944-2.

Specifically used paint system shall be according to EN ISO 12944-5 and documented by appropriate quality management system.

The protection by corrosion resistant material or corrosion protecting paint shall be added at the length of at least 100 mm from the top of the 'stem house' (see Figure 2).

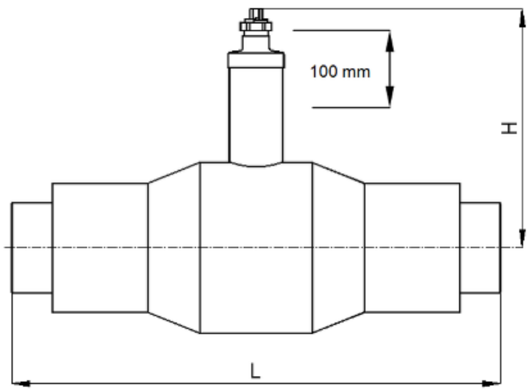


Figure 2 — Anti corrosion protection of the stem construction

4.6.3 Main dimensions of the valve assembly

The main dimensions of the valve assembly H and L are shown in Figure 3.

The values of the main dimensions "L" and "H" are to be declared by the manufacturer.

The tolerances of the valve assembly dimensions shown in Figure 3 shall be in accordance with Table 1.

Table 1 — Tolerances on the main valve dimensions

DN	**H** mm	**L** mm
≤ 300	±5	±20
> 300	±10	±50

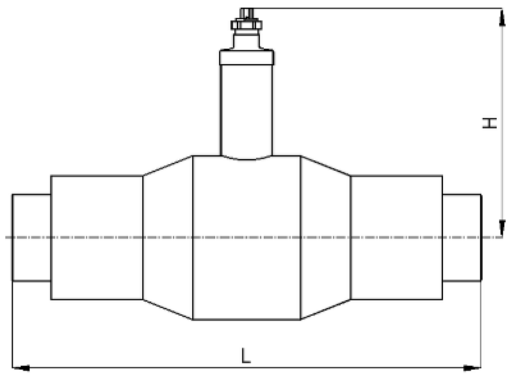


Figure 3 — Main dimensions

4.6.4 Installation of measuring elements

Measuring elements for surveillance systems shall be in accordance with EN 14419.

4.7 Requirements for effective operation and maintenance

The design of the valve shall make it possible to operate the valve outside the insulation.

The valve shall close when turned clockwise and open when turned anti-clockwise.

The stem construction shall make it possible to manoeuvre the valve by means of a T key from ground level.

NOTE 1 Commonly used keyways are 19 mm, 27 mm, 36 mm, 50 mm and 60 mm or conical quadrangle 27 mm/ 32 mm.

Butterfly valves with nominal diameter DN 100 and larger, ball valves and gate valves with nominal diameter DN 200 and larger shall be provided with a gear or a connection for an actuator to ensure controlled manoeuvring of the valve.

NOTE 2 Commonly used keyways for connections for actuators are 60 mm, 70 mm and 90 mm, or conical quadrangle 27 mm/32 mm.

Valves shall be provided with a stop device that can be replaced without removing the insulation. Alternatively, an internal stop device can be used. The internal stop device shall be designed to resist a maximum strength torque of at least twice the maximum operating torque specified by the manufacturer with a minimum of 150 Nm in the fully open and fully closed position of the valve. Using an internal stop device, the valve stem shall be designed to resist a maximum strength torque of at least 1,5 times the designed strength torque of the stop device.

The sealing around the stem shall be capable of being maintained without removing the insulation.

4.8 Resistance to axial forces and bending moments

The resistance of the valves to axial forces and bending moments shall comply with Table B.1.

5 Testing, test methods and test requirements

5.1 General

This clause specifies test methods, test sequence, test conditions and required test results for type and production testing.

Where test requirements specified in this European Standard differ from those in other standards referred to, the requirements described in this European Standard shall apply.

NOTE Informative Annex A of this European Standard gives guidelines for inspection and testing.

5.2 Test specimens

5.2.1 General

Test specimens shall be representative for the production.

5.2.2 Test specimens for type testing steel parts of valve

The tests for axial forces, bending moments and torque are type tests for a range of valves with the same construction principle, design and materials.

To qualify a whole product range with the same construction principle, design and materials, two valve sizes within this product range shall be tested. The qualification shall be valid from half the size of the smaller valve (but limited by smallest valve size of the product range under consideration) and twice the size of the bigger valve (but limited by the largest valve size of the product range under consideration) which were tested.

If the construction principle, design and materials are not the same for the whole product range, the product range shall be split in separate ranges (where the construction principle, design and materials are the same) and the above mentioned rule shall be applied to each split range. The manufacturer is responsible to ensure that the complete test sequence as specified in this European Standard is carried out and all test results are documented.

5.2.3 Test specimens from casings and polyurethane foam

The test specimens from casing and polyurethane foam shall be taken in accordance with EN 448:2015, 5.2.

5.3 Steel parts

5.3.1 General

This clause describes the type test and production test of the steel parts.

5.3.2 Type test of the steel parts

5.3.2.1 General

The type test shall be done on the same valve.

The type test shall be carried out on the same valve for the whole test sequence and executed in the order given in Table 2. The mandatory clauses shall be carried out as a minimum in the test program.

Table 2 — Overview and sequence of the type test program

Test sequence		Name of the test
Mandatory clauses	**Optional clauses**	
	5.3.2.2	Leak-tightness of shell and stem casing of the unloaded valve
	5.3.2.3	Leak-tightness of the seat of the unloaded valve
5.3.2.4		Torque load measurement of the unloaded valve
	5.3.2.3	Leak-tightness of the seat of the unloaded valve
	5.3.2.4	Torque load measurement of the unloaded valve
5.3.2.5		Axial compressive force test
	5.3.2.3	Leak-tightness of the seat of the unloaded valve
	5.3.2.4	Torque load measurement of the unloaded valve
5.3.2.6		Axial tensile force test
	5.3.2.3	Leak-tightness of the seat of the unloaded valve
	5.3.2.4	Torque load measurement of the unloaded valve
5.3.2.7		Bending test
5.3.2.2		Leak-tightness of shell and stem casing of the unloaded valve
5.3.2.3		Leak-tightness of the seat of the unloaded valve
5.3.2.4		Torque load measurement of the unloaded valve

5.3.2.2 Leak-tightness of shell and stem casing of the unloaded valve

Test condition:

— according to EN 12266-1, P10 and P11, type test.

Test requirement:

— shell and stem casing shall be leak-tight.

5.3.2.3 Leak-tightness of the seat of the unloaded valve

Test condition:

— according to EN 12266-1, P12, type test.

Test requirement:

— the maximum seat leakage of the seat during the test shall be in accordance to EN 12266-1, test number P12 rate A for valves up to DN 400 or rate B for valves higher than DN 400;

— for the last mandatory leak tightness test after completion of the whole test sequence (axial compressive force, axial tensile force and bending test) the maximum seat leakage rate B is acceptable for all valve sizes.

5.3.2.4 Torque load measurement of unloaded valve

Test conditions:

— valve filled with water at temperature (25 ± 10) °C.

Test requirements:

— the torque value in any test shall not be higher than 100 % of the maximum value in the technical specification of the manufacturer;

— the torque shall be measured and recorded when opening and closing the valve;

— all test torque measurements shall be recorded and stated in test reports for evaluation.

5.3.2.5 Axial compressive force test

Test conditions:

— valve shall be in an open position;

— valve loaded with an axial compressive force in accordance with Table B.1;

— internal water pressure for the valve accordance with the nominal pressure class PN of the valve;

— valve filled with water at temperature (90 ± 5) °C. Forming of steam shall be prevented at all times;

— test duration shall be 48 h;

— compressive force, water pressure, water temperature shall be measured and recorded continuously;

— torque, when opening and closing of the valve, shall be measured and recorded at least 24 times during the test period of 48 h with a minimum of 30 min between the measurements;

— before the valve is opened to measure the torque, the pressure at one side of the valve shall be relieved to zero pressure;

— the last measurement of the torque will be done at the end of the 48-h test period.

Test requirements:

— the valve shall be able to withstand the axial compressive force, according to Table B.1, without leaking or damaging;

— the maximum torque value shall not be higher than 100 % of the maximum value in the technical specification of the manufacturer.

5.3.2.6 Axial tensile force test

Test conditions:

— valve shall be in an open position;

— valve loaded with an axial tensile force in accordance with Table B.1;

— internal water pressure in accordance with the nominal pressure class PN of the valve;

— valve filled with water at temperature (25 ± 10) °C;

— test duration shall be 48 h;

— tensile force, water pressure, water temperature shall be measured and recorded continuously;

— torque, when opening and closing of the valve, shall be measured and recorded at least 16 times (open and close) during the test period of 48 h with a minimum of 30 min between the measurements;

— after the valve is closed while measuring the torque, the pressure at one side of the valve shall be relieved to zero pressure, before opening the valve while measuring the torque (again);

— the last measurement of the torque will be done at the end of the 48-h test period.

Test requirements:

— the valve shall be able to withstand the axial tensile force, according to Table B.1, without leaking or damaging;

— the maximum torque value shall not be higher than 100 % of the maximum value in the technical specification of the manufacturer.

5.3.2.7 Bending test

The bending test shall be performed in accordance with Annex B and Annex C.

Test conditions:

— valve shall be in an open position;

— valve loaded with a bending moment in accordance with Table B.1;

— internal water pressure in accordance with the nominal pressure class PN of the valve;

— the bending test shall be carried out at temperature of (25 ± 10) °C;

— test medium is water;

— test duration shall be 8 h (two times);

— the test can be executed for all diameters according to the four points bending test, described in Annex C;

— when opening and closing of the valve, shall be measured and recorded at least 8 times (open and close) during the test period of 8 h with a minimum of 30 min between the measurements.

— after the valve is closed while measuring the torque, the pressure at one side of the valve shall be relieved to zero pressure, before opening the valve while measuring the torque (again);

— the last measurement of the torque will be done at the end of the 8-h test period;

— the test shall be executed two times (in two planes), one plane defined by the axis of the stem and the pipe axis, the second plane defined by an axis perpendicular to the axis of the stem and the pipe axis.

Test requirements:

— the valve body shall be able to withstand the bending moment, according to Table B.1, without leaking or damaging;

— after loading, the applied torque in open and closed direction shall be measured. The maximum torque value shall not be higher than 100 % of the maximum value in the technical specification of the manufacturer.

5.3.3 Production testing of valves

5.3.3.1 General

Production tests on valves shall be carried out as in Table 3.

Table 3 — Overview of the production tests

Order	Test	Clause
1	Leak-tightness of shell and stem casing of the unloaded valve	5.3.3.2
2	Leak-tightness of the seat of the unloaded valve	5.3.3.3
3	Testing of steel welds	5.3.3.4
4	Torque load measurement of unloaded valve	5.3.3.5

5.3.3.2 The leak-tightness test of the shell and stem casing

Test condition:

— the leak-tightness test of the shell and stem casing shall be carried out in accordance with EN 12266-1, shell tightness (test reference, P11), production test.

Test requirement:

— the shell and stem casing shall be leak-tight.

5.3.3.3 The leak-tightness test of the seat

Test condition:

— the leak-tightness test of the seat shall be carried out in accordance with EN 12266-1, seat tightness (test reference, P12), production test.

Test requirement:

— the maximum seat leakage of the seat during the test shall be conform to EN 12266-1, test number P12 rate A for valves up to DN 400 or rate B for valves higher than DN 400.

5.3.3.4 Testing of steel welds

Steel welds in accordance with 4.3.5 shall be tested in accordance with EN 448:2015, 5.3.

5.3.3.5 Torque load measurement of unloaded valve

Test condition:

— valve filled with water at temperature (25 ± 10) °C;

Test requirements:

— the torque value in any test shall not be higher than 100 % of the maximum value in the technical specification of the manufacturer;

— the torque shall be measured and recorded when opening and closing the valve;

— all test torque measurements shall be recorded and stated in test reports for evaluation.

5.4 Casing

5.4.1 General

Casings in accordance with 4.4 shall be tested in accordance with EN 253:2009+A2:2015, 5.2.

5.4.2 Leak-tightness of the welded casing

The leak-tightness of the welding in the casing after foaming shall be examined in accordance with EN 448:2015, 4.4.4.

5.5 Polyurethane rigid foam insulation

The polyurethane foam insulation shall be tested in accordance with EN 448:2015, 5.5. Test specimens shall be taken and cut in accordance with EN 448:2015, 5.2.

5.6 Valve assembly

Valve assemblies in accordance with 4.6 shall be tested in accordance with EN 448:2015, 5.6.

5.7 Surveillance system

When measuring elements for a surveillance system are installed in the valve assembly, test for controlling the function of the installed measuring elements shall be performed. The test shall be performed according to EN 14419, section for manufacturing of pipe elements with measuring elements.

6 Marking

6.1 General

The valve assembly shall be marked by any suitable method which does not affect the functional properties of the casing, and which is able to withstand conditions of handling, storage and use.

All marking shall be legible on the valve assembly.

6.2 Steel valve

The steel valve shall be marked according to EN 19:

a) valves shall be marked with the allowable service pressure and temperature;

b) ball valves, butterfly valves and gate valves shall be marked permanently with closed and open positions.

6.3 Casing

The manufacturer of the casing shall mark thereon:

a) raw material of the PE, by trade name or code;

b) MFR – table value as declared by the raw material supplier;

c) nominal diameter and nominal wall thickness of the casing;

d) year and week of manufacture;

e) manufacturer's identification.

6.4 Valve assembly

The manufacturer of the valve assemblies shall mark on the casing:

a) pressure rating of the valve in accordance with 4.1.1;

b) nominal diameter and nominal wall thickness of the valve ends;

c) steel specification and grade of the valve end;

d) manufacturer's identification;

e) steel valve manufacturer's identification (possibly by a code);

f) number of this European Standard;

g) year and week of foaming;

h) type of physical blowing agent, if any;

i) information about the diffusion barrier, if any;

j) production year and month of the valve.

7 Installation and maintenance

The valve manufacturer shall provide clear and unambiguous installation and maintenance instructions.

Maintenance shall be possible without damaging the insulation and without influencing the operation of the pipeline.

Annex A
(informative)

Guidelines for inspection and testing

A.1 General

The following inspection frequencies are recommended to ensure that manufactured pre-insulated valves comply with the requirements specified in this European Standard.

A quality system certified to be in accordance with EN ISO 9001 with reference to EN 488 and the obtained statistics of consistency of test results can be used to adjust inspection frequencies to the actual needs.

The recommended inspection includes the following:

A.2 Manufacturer’s type test

A type test is used to obtain an initial validation of materials and production methods. A new test should be performed where these materials or methods are essentially changed.

A.3 Manufacturer’s quality control

The manufacturer’s quality control is applied to ensure that the intended quality level of the products is maintained. The manufacturer is responsible for ensuring that the tests specified in this European Standard are carried out and the results recorded.

A.4 External inspection

This inspection is primarily intended as an evaluation of the extent and the proper functioning of the manufacturer’s quality control. This inspection also includes sampling of products to ensure that the requirements specified in this European Standard are fulfilled.

A.5 Extent of inspection

The suggested extent of the inspection carried out by the steel valve manufacturer is given in Table A.1.

The suggested extent of the inspection carried out by the manufacturer of the valve assembly is given in Table A.2.

External inspection should normally be made at least once a year.

A.6 Manufacturer’s responsibility

Where a manufacturer makes their own raw material or produces parts for which there is a requirement for “manufacturer’s certificates”, the manufacturer of the valve assembly should take over the responsibilities of the supplier.

Table A.1 — Steel valve inspection

Clause	Item	Test frequency		
		Steel valve manufacturer's type test	**Steel valve manufacturer's quality control**	**External inspection**
5.3.2	**Type test of the steel parts**			
5.3.2.1	Type test sequence and program	Mandatory tests of Table 2 on the same valve. Two valves in a range see 5.2.2	Check design and material qualifications against type test	Verify design and material qualifications against type test
5.3.3	**Production testing of valves**			
4.3.4	Welding ends of valves		- Inspection of delivery - Statistic quality control of the dimensions of the welding ends when produced by a the steel valve manufacturer	- Inspection of procedures and internal reports - check of dimensions on one valve per size
5.3.3.2	Leak-tightness of shell and stem casing of the unloaded valve		100 %	Inspection of procedures and internal reports
5.3.3.3	Leak-tightness of the seat of the unloaded valve		100 %	Inspection of procedures and internal reports
5.3.3.4	Testing of steel welds		In accordance with EN 448:2015, Table A.1 when welded by steel valve manufacturer	Inspection of procedures and internal reports
5.3.3.5	Torque load measurement of unloaded valve		Statistic quality control	Inspection of procedures and internal reports

Table A.2 — Valve assembly inspection

Clause	Item	Test frequency		
		Valve assembly manufacturer's type test	**Valve assembly manufacturer's quality control**	**External inspection**
4.3	Steel parts	See EN 448:2015, Table A.1	See EN 448:2015, Table A.1	See EN 448:2015, Table A.1
4.4	Polyethylene casing	See EN 448:2015, Table A.2	See EN 448:2015, Table A.2	See EN 448:2015, Table A.2
4.5	Polyurethane	See EN 448:2015, Table A.2	See EN 448:2015, Table A.2	See EN 448:2015, Table A.2
4.6	Valve assembly	See EN 448:2015, Table A.2	See EN 448:2015, Table A.2	See EN 448:2015, Table A.2

Annex B
(normative)

Resistance to axial force and bending moment

B.1 Axial strength test

In the axial strength test, executed according to 5.3.2.5 and 5.3.2.6 of this European Standard, the valves shall be able to withstand conditions with a maximum axial tensile stress of 163 N/mm^2 and an axial compressive stress of 300 N/mm^2 at ambient temperature respectively 265 N/mm^2 (at 140 °C) due to the temperature changes. The corresponding axial tensile and compressive forces are shown in Table B.1.

NOTE The maximum possible tensile stress is the estimated actual yield stress for steel grades, referred to in EN 253:2009+A2:2015.

B.2 Bending test

In the bending test, executed according to 5.3.2.7 of this European Standard, the valves shall be able to withstand conditions with a maximum bending moment. The test force is calculated assuming (in the connecting service pipe) either a full plastic bending moment (up to DN 250) or an elastic bending moment caused by thermal expansion and/or by a subsidence difference, from trenching activities, of 100 mm over 15 m. The corresponding bending moments and service pipe geometry are shown in Table B.1.

NOTE For a circular cross section, the full plastic bending moment equals 1,3 times the maximum elastic bending moment. The maximum elastic bending moment is calculated with a maximum elastic bending stress, equal to the estimated average actual yield stress (300 N/mm^2 at ambient temperature) for steel grades, referred to in EN 253:2009+A2:2015.

Table B.1 — Service pipe dimensions, axial test forces and test bending moments

Nominal diameter	**Outside diameter of service pipe**	**Wall thickness of the service pipe** (NOTE 4)	**Tensile force** (NOTE 2)	**Compressive force** (NOTES 1 and 3)	**Test bending moment** (NOTES 5, 6 and 7)
DN	Do mm	t mm	kN	kN	Nm
15	21,3	2,0	20	32	209
20	26,9	2,0	26	41	350
25	33,7	2,3	37	60	650
32	42,4	2,6	53	86	1 200
40	48,3	2,6	61	99	1 600
50	60,3	2,9	85	139	2 800
65	76,1	2,9	109	177	4 600
80	88,9	3,2	140	228	6 950
100	114,3	3,6	204	332	13 100
125	139,7	3,6	251	408	19 900
150	168,3	4,0	337	547	32 300
200	219,1	4,5	495	804	62 200
250	273,0	5,0	686	1 116	108 100
300	323,9	5,6	913	1 484	120 200
350	355,6	5,6	1 004	1 632	132 200
400	406,4	6,3	1 291	2 098	144 300
450	457,0	6,3	1 454	2 364	156 400
500	508,0	6,3	1 619	2 423	168 500
600	610,0	7,1	2 192	3 087	192 600
700	711,0	8,0	2 880	3 926	314 600
800	813,0	8,8	3 624	4 761	476 400
900	914,0	10,0	4 629	6 144	702 400
1 000	1 016,0	11,0	5 661	7 439	878 800
1 200	1 220,0	12,5	7 729	9 636	1 385 900

NOTE 1 Compressive stress (actual hot value) up to: 265,0 [N/mm²].

NOTE 2 Tensile stress (Cold value = 0,67 Re, 20) up to: 163,0 [N/mm²].

NOTE 3 Compressive stress: according to EN 13941:2009+A1:2010, 6.4.2 (Limit state C1.4; Local buckling).

NOTE 4 Above forces and stresses relate to pipes with dimensions and steel grades according to EN 253:2009+A2:2015, 4.2.

NOTE 5 (DN 15 to DN 250) Calculated as full plastic bending moment for circular cross section.

NOTE 6 (DN 600 to DN 1200) Calculated from subsidence difference (trenching activities).

NOTE 7 (DN 300 to DN 500) Transition zone between NOTE 5 and NOTE 6.

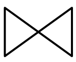
Annex C
(normative)

Resistance to bending forces

C.1 General

In order to test the resistance of valves against bending moments, some theoretical considerations have been made and related formulae are given. The basis for these considerations is a symmetric and statically determined beam with different loads.

Table C.1 — Keys for the formulae in C.2 and Figures C.1 to C.3

Symbol	**Unit**	**Definition**
g	$\frac{m}{s^2}$	*acceleration due to gravity*
ρ_{pipe}	$\frac{kg}{m^3}$	*density of the pipe*
ρ_{medium}	$\frac{kg}{m^3}$	*density of the medium flowing through the pipe*
m_{Valve}	kg	*mass of the valve*
M_F	Nm	*bending moment from test load*
M_Q	Nm	*bending moment from uniform load*
M_V	Nm	*bending moment from valve weight*
M_{total}	Nm	*overall bending moment*
a	m	*distance between mid of valve and the working point of test force F*
b	m	*length of the valve*
d_a	m	*outer diameter of the pipe*
d_i	m	*inner diameter of the pipe*
l	m	*overall length of the beam*
L	m	*length of the pipes between bearing and valve*
x	m	*position on the beam*
F	N	*test force*
F_V	N	*weight force of the valve*
P	N	*weight force of the pipes*
q	$\frac{N}{m}$	*uniform load of the pipes and medium*
R_A, R_B	N	*reaction forces at the bearings*
	--	*valve symbol*

C.2 Standard test assembly (four point bending test)

C.2.1 Bending moment due to test load *F*

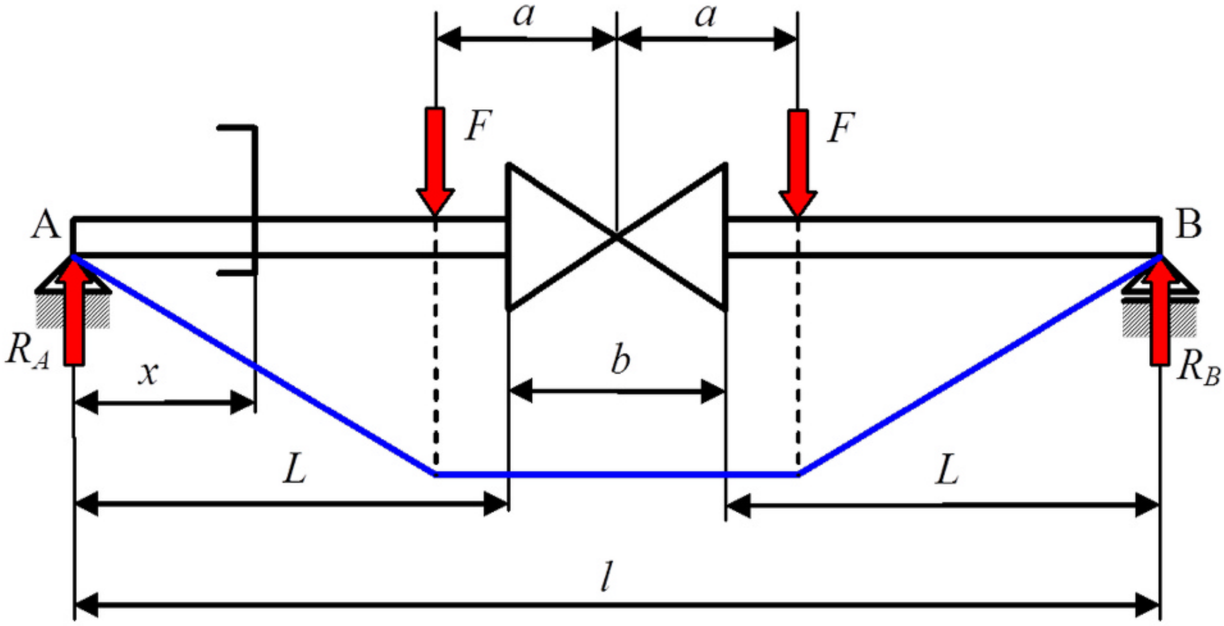


Figure C.1 — Bending moment due to test load *F*

Assuming a symmetric and statically determined beam AB and a symmetric load *F* (see Figure C.1), the general formula for the bending moment $M_{F(x)}$ at point x of the beam AB due to two test forces *F* is:

$$M_F(x) = \begin{cases} F \times x & \text{if} \quad 0 \leq x \leq L + \frac{b}{2} - a \\ F \times \left(L + \frac{b}{2} - a \right) & \text{if} \quad L + \frac{b}{2} - a \leq x \leq L + \frac{b}{2} + a \end{cases} \tag{C.1}$$

The moment $M_{F(x)}$ due to test forces F is a maximum and constant in section $L + \frac{b}{2} - a \leq x \leq L + \frac{b}{2} + a$ of the beam.

C.2.2 Bending Moment due to uniform load q (pipe weight and if applicable the medium weight)

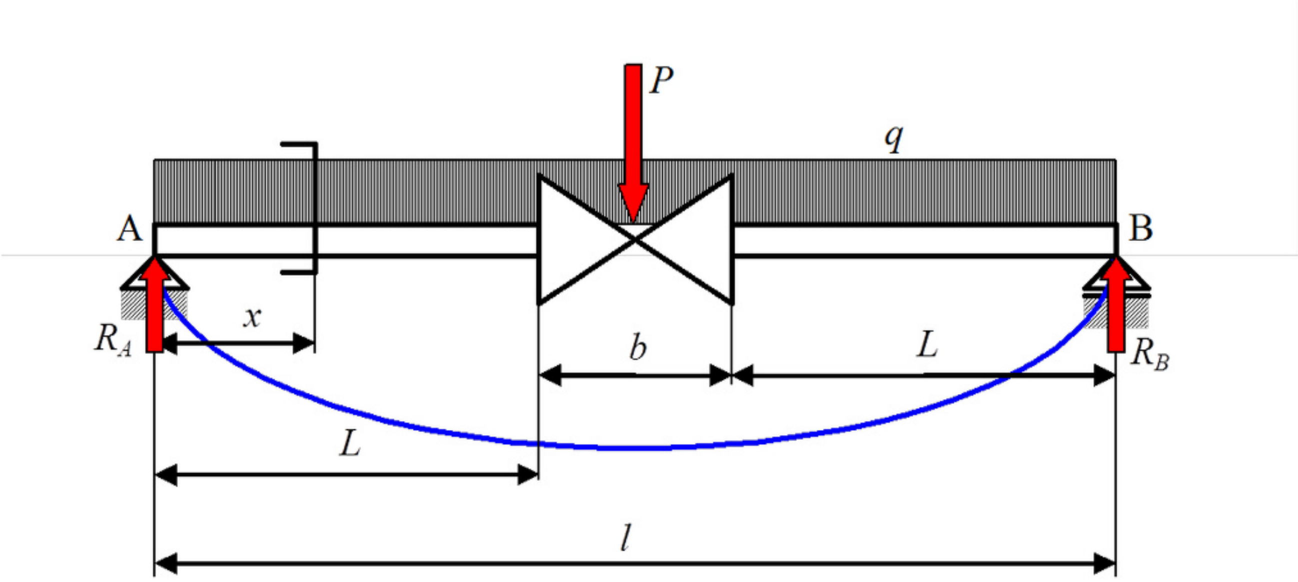


Figure C.2 — Bending Moment due to uniform load q (pipe weight and applicable the medium weight)

Assuming a symmetric and statically determined beam AB and a load q, the general formula for the bending moment $M_{Q(x)}$ at point x of the beam AB due to the load q is (see Figure C.2):

Uniform load q is calculated as:

$$q = \left(d_a^2 - d_i^2\right) \times \frac{\pi}{4} \times \rho_{pipe} \times g + d_i^2 \frac{\pi}{4} \rho_{medium} \times g \quad \text{(C.2)}$$

$$= \frac{g\pi}{4} \times \left[\left(d_a^2 - d_i^2\right) \times \rho_{pipe} + d_i^2 \rho_{medium}\right] \quad \text{(C.3)}$$

Pipe weight P is calculated as:

$$l = 2L + b \quad \text{(C.4)}$$

$$P = q \times l \quad \text{(C.5)}$$

Bending moment $M_{Q(x)}$ is calculated as:

$$M_Q\left(x\right) = \frac{P}{2} \times \left(x - \frac{x^2}{l}\right) \quad if\ 0 \leq x \leq L + \frac{b}{2} \quad \text{(C.6)}$$

C.2.3 Bending moment due to valve weight F_v

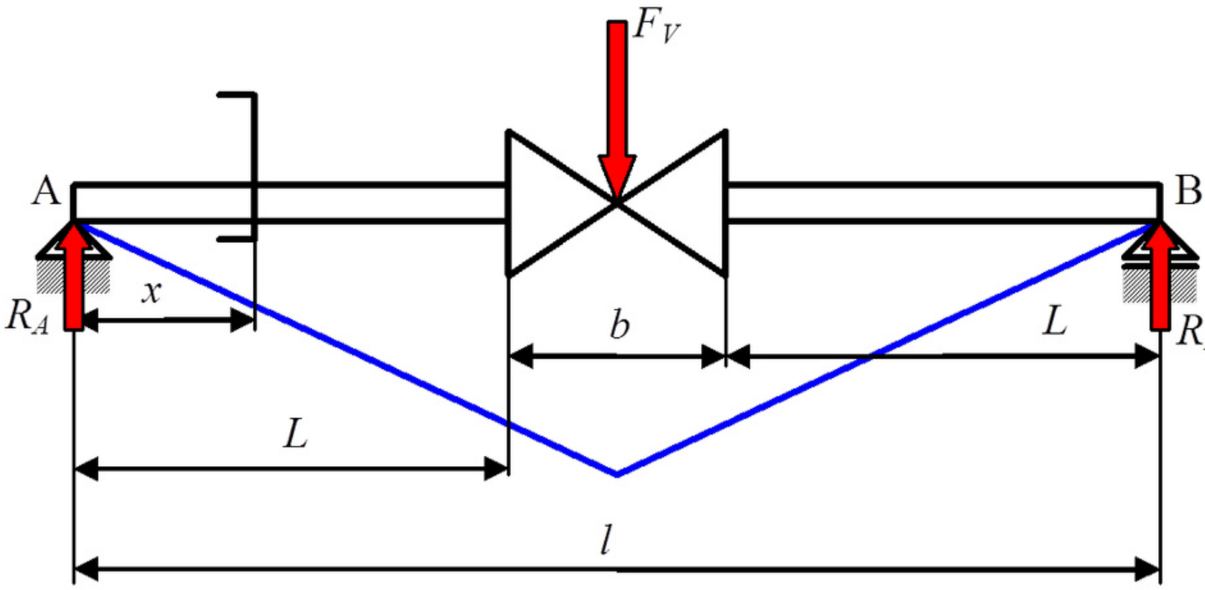


Figure C.3 — Bending moment due to valve weight F_v

The valve weight F_v can be calculated as:

$$F_V = m_{valve} \times g + b\left(d_i^2 \frac{g\pi}{4} \times \rho_{medium} - q\right) \tag{C.7}$$

F_v respects the mass of the valve, the medium inside the valve and is reduced by the uniform load q.

Assuming a symmetric and statically determined beam AB and a load F_v, the general formula for bending moment $M_{V(x)}$ at point x of the beam AB due to the force F_v is (see Figure C.3):

$$M_V(x) = \frac{F_V}{2}x \quad if \quad 0 \le x \le L + \frac{b}{2} \tag{C.8}$$

C.2.4 Total Bending Moment M_{total} due to F, P and F_V

The total bending moment is the sum of Formula (C.1), Formula (C.6) and Formula (C.8) and is calculated as:

$$M_{total}(x) = M_F(x) + M_Q(x) + M_V(x) \tag{C.9}$$

and at point $x = L$:

$$M_{total}(L) = F \times (L + \frac{b}{2} - a) + \frac{P}{2} \times \left(L - \frac{L^2}{l}\right) + \frac{F_V}{2}L \tag{C.10}$$

using Formula (C.4) leads to

$$M_{total}(L) = F \times (L + \frac{b}{2} - a) + \frac{P}{2} \times \frac{L(L+b)}{2L+b} + \frac{F_V}{2}L \tag{C.11}$$

NOTE The influence of the shear force is not taken into account in the formulae.

C.2.5 Calculation of test force F

Solving Formula (C.11) for *F* leads to

$$F = \left[M_{total}\left(L\right) - \frac{P}{2} \times \frac{L(L+b)}{2L+b} - \frac{F_V}{2} L \right] \times \frac{1}{L + \frac{b}{2} - a} \qquad \text{(C.12)}$$

M_{total} is greater than or equal to the test bending moment in Table B.1.

NOTE The size of *F* depends on the different dimensions of the test application.

Bibliography

[1] EN 1333:2006, *Flanges and their joints — Pipework components — Definition and selection of PN*

[2] EN ISO 6708:1995, *Pipework components — Definition and selection of DN (nominal size) (ISO 6708)*

[3] EN ISO 9001, *Quality management systems — Requirements (ISO 9001)*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.

...making excellence a habit.™