

BS 8561:2021



BSI Standards Publication

**Specification for mechanical fittings
for use in the repair, connection and
renovation of pressurized water
supply pipelines — Requirements and
test methods**

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 November 2021. It was prepared by Technical Committee B/504, *Water supply*. A list of organizations represented on this committee can be obtained on request to the committee manager.

Supersession

This British Standard supersedes [BS 8561:2013](#), which is withdrawn.

Information about this document

This British Standard consists of the following sections under the main title "Mechanical fittings for polyethylene barrier pipe and mechanical fittings for use in the repair, connection and renovation of pressurized water supply pipelines – Requirements and test methods".

[Section 1](#): General requirements

[Section 2](#): Mechanical fittings for polyethylene barrier pipe

[Section 3](#): Mechanical fittings for use in the repair, connection and renovation of pressurized water supply pipelines

Fittings for repair and renovation of an existing water supply pipe include (but are not necessarily limited to) repair clamps and joint encapsulation units. Fittings for joining of new pipe to existing pipe include (but are not necessarily limited to) steel bodied couplings, wide tolerance couplings, flange adaptors and under pressure tees. This standard does not cover fittings for connection of new polyethylene pipes or new ductile iron pipes for which European or International Standards exist.

Where appropriate, ISO test methods have been used. The test loads for resistance to pull-out test have been aligned with IGN 4-01-02:2017 [N3].

The hydrostatic tests included in [Section 2](#) of this standard are consistent with tests on polyethylene barrier pipe to [BS 8588](#), polyethylene pipe to BS EN 12201-2 and polyethylene fittings to BS EN 12201-3.

This is a full revision of the standard, and introduces the following principal changes:

- The recognition of European Standards for connection of new polyethylene pipes and new ductile iron pipes.
- The standard has been restructured to provide clear requirements and test methods for connection of new polyethylene barrier pipe ([Section 2](#)) and repair, connection and renovation of existing water supply pipes ([Section 3](#)).
- Alignment of test methods and requirements with European and International standards where possible.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

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

In particular, attention is drawn to the following specific regulations in respect of water quality:

- Water Supply (Water Quality) (England) Regulations 2016 [1];
- Water Supply (Water Quality) (Northern Ireland) Regulations 2017 [2];
- Water Quality (Scotland) Regulations 2010 [3]; and
- Water Supply (Water Quality) (Wales) Regulations 2018 [4].

Section 1: General

1 Scope

This British Standard specifies the requirements and associated test methods for mechanical fittings intended to:

- a) join polyethylene pressure pipes with an aluminium barrier layer for the supply of cold potable water for installation in contaminated land;
- b) join new water supply pipes to existing water supply pipes for the purposes of repair, branch connections or pipeline renovation; and
- c) repair existing water supply pipes.

It also specifies requirements for materials and dimensions and mechanical properties for mechanical fittings.

It applies to fittings:

- 1) in the diameter range of DN 50 to DN 1 200 made for use on grey iron; ductile iron; steel; or polyvinyl chloride (PVC-U, PVC-O);
- 2) in the diameter range of DN 63 to DN 1 000 made for use on polyethylene pipe; and
- 3) in the diameter range DN 63 to DN 630 made for use on polyethylene barrier pipe.

NOTE Fittings are not made or tested for use on fibre cement and glass-reinforced polyester (GRP) pipes. Where there is a requirement for connection to existing pipework from these materials, advice may be sought from a fitting manufacturer.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

[BS 4190](#), *Isometric black hexagon bolts, screws and nuts – Specification*

[BS 8588](#), *Polyethylene pressure pipe with an aluminium barrier layer and associated fittings for potable water supply in contaminated land – Size 20 mm to 630 mm*

BS EN 681-1, *Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Vulcanized rubber*

BS EN 1092-1, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges*

BS EN 1092-2, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Cast iron flanges*

BS EN 1563, *Founding – Spheroidal graphite cast irons*

BS EN 10025-2, *Hot rolled products of structural steels – Technical delivery conditions for non-alloy structural steels*

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

BS EN 14525:2004, *Ductile iron wide tolerance couplings and flange adaptors for use with pipes of different materials: ductile iron, grey iron, steel, PVC-U, PE, fibre-cement*

[BS EN 14901-1](#), *Ductile iron pipes, fittings and accessories – Requirements and test methods for organic coatings of ductile iron fittings and accessories – Epoxy coating (heavy duty)*

BS EN ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids – Determination of the resistance to internal pressure – General method*

BS EN ISO 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids – Determination of the resistance to internal pressure – Preparation of assemblies*

BS EN ISO 3459, *Plastic piping systems – Mechanical joints between fittings and pressure pipes – Test method*

BS EN ISO 3501, *Plastic piping systems – Mechanical joints between fittings and pressure pipes – Test method for resistance to pull-out under constant longitudinal force*

BS EN ISO 3506-1, *Fasteners – Mechanical properties of corrosion-resistant stainless steel fasteners – Bolts, screws and studs with specified grades and property classes*

Other publications

[N1] ENGINEERING AND OPERATIONS COMMITTEE. *Specification for anti-corrosion coatings on threaded fasteners*. WIS 4-52-03. Bucks: WRc Plc, 1994.

[N2] SEWERS AND WATER MAINS COMMITTEE. *Specification for polymeric anti-corrosion (barrier) coatings*. WIS 4-52-01. Bucks: WRc Plc, 1992.

[N3] WATER UK. *The determination of end-loads for the performance testing of fittings for polyethylene pipe – Information and Guidance Note*. IGN 4-01-02. London: Water UK, 2017.

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 mechanical fitting

fitting which includes one or more compression zones to provide a leaktight seal on a pipe, between pipes, and a fitting

3.2 joint

mechanism within a mechanical fitting that provides a leaktight connection between a fitting and a pipe or between fittings

3.3 flexible joint

joint that permits significant angular deflection between the pipe and the fitting both during and after installation

3.4 end load resistant joint

joint capable of resisting the end load transmitted via a connecting pipe and generated by internal pressure, pipeline external interference, and thermally induced stress, in any combination

3.5 dedicated coupling

mechanical fitting providing connection between two pipe spigot ends of the same outside diameter

NOTE A dedicated coupling would typically connect pipes of the same material together.

3.6 dedicated stepped coupling

mechanical fitting providing connection between two pipe spigot ends of different outside diameter

NOTE A dedicated stepped coupling would typically connect two different pipe materials together. Also known as a dedicated reducing coupling.

3.7 wide tolerance coupling

mechanical fitting capable of connecting a range of pipe materials and/or pipe dimensions providing connection between two pipe spigot ends

3.8 wide tolerance step coupling

mechanical fitting capable of connecting a range of pipe materials and/or pipe dimensions providing connection between two pipe spigot ends of different outside diameter

3.9 dedicated flange adaptor

mechanical fitting providing connection between a spigot and a flange

NOTE For repair of existing water supply pipes, flange adapters are designed such that they can slide over the pipe spigot or have a setting gap to facilitate assembly.

3.10 wide tolerance flange adaptor

mechanical fitting capable of connecting a range of pipe materials and/or pipe dimensions providing connection between a spigot and a flange

NOTE For repair of existing water supply pipes, flange adapters are designed such that they can slide over the pipe spigot or have a setting gap to facilitate assembly.

3.11 repair clamp

mechanical fitting installed around a leaking pipe barrel to affect a seal on both local and circumferential pipe defects

3.12 joint encapsulation unit

mechanical fitting installed around a leaking pipe joint that seals to both sections of pipe barrel either side of the joint forming a pressure-tight container to contain the leakage

3.13 under pressure tee

mechanical fitting installed on/around a pipe to create a branch connection usually terminating in a flange outlet

NOTE 1 The fitting, along with other equipment and fittings, facilitates a live connection to the pipe without interruption to the supply flowing through it.

NOTE 2 Under pressure tees may have full pipe surface contact sealing to accommodate the branch connection and also any circumferential cracking which might occur.

3.14 barrier pipe

multi-layer pipe consisting of two polyethylene layers with an intervening aluminium barrier layer that together provide the necessary strength and resistance to permeation

3.15 nominal pressure (PN)

numerical designation which is a convenient rounded number for reference purposes

NOTE For plastic piping systems conveying water, it corresponds to the maximum continuous operating pressure, expressed in bar, which can be sustained with water at 20 °C, based on the minimum design coefficient.

3.16 pipe nominal size (DN)

nominal size, related to the outside diameter

3.17 standard dimension ratio (SDR)

numerical designation of a pipe series, which is a convenient round number, approximately equal to the dimension ratio of the nominal outside diameter, DN, and the nominal wall thickness, EN

3.18 end load resistance

resistance to end load transmitted via the connecting pipe and generated by internal pressure, pipeline external interference and thermally induced pipe stresses in any combination

3.19 fastener

device that serves to secure one part to another

NOTE These include but are not limited to nuts, bolts and washers.

3.20 depth of engagement

when jointed, the distance between the end of the spigot and the face of the socket on a couplings, stepped/reducing couplings and flange adaptors

3.21 joint angular deflection

angle between the axis of two connected pipeline components which a flexible joint can accommodate

3.22 setting gap

when jointed, the distance between the ends of the spigots in a coupling or the end of the spigot and the flange face for a flange adaptor

3.23 allowable operating pressure PFA

maximum hydrostatic pressure that a fitting is capable of withstanding continuously in service

3.24 spigot

male end of a pipe or fitting

4 Material characteristics**4.1 Effect on water quality**

All fittings for potable water applications shall ensure the constructional materials, coatings, seals or gaskets in contact with potable water present no risk to human health with regard to affecting the quality, appearance, smell or taste.

The effect on water quality of fittings for PE barrier pipe shall meet the requirements of [BS 8588:2017](#), 7.7.

4.2 Materials

All fittings shall be made from thermoplastics or materials which conform to the relevant standard listed in [Table 1](#).

Table 1 — *Materials for fitting body or components*

Material	Relevant Standard
Ductile iron	BS EN 1563
Mild steel	BS EN 10025-2
Copper	BS EN 12449 or BS EN 1057

NOTE Materials other than those listed in [Table 1](#) may be used for the fitting body or components where it can be demonstrated that the resulting fitting meets all requirements of this standard.

Where other materials are used, they shall conform to a specification and fitness for purpose shall be demonstrated through compliance to the requirements of this standard.

Fasteners shall be either stainless steel to BS EN ISO 3506-1 or mild steel to [BS 4190](#) with corrosion protection.

4.3 Elastomers

Any elastomeric sealing ring or gasket used in the construction of the fitting shall conform to BS EN 681-1, Type WA.

4.4 Corrosion protection measures

All fasteners shall be protected in accordance with [BS EN 14901-1](#) or WIS 4-52-03 [N1] as applicable. Where the fitting body and components are metal, they shall be protected in accordance with [BS EN 14901-1](#) or WIS 4-52-01 [N2] as applicable.

NOTE Other corrosion protection measures may be used.

5 General requirements

When viewed without magnification, the internal and external surfaces of fittings shall be smooth, clean and shall have no scoring, cavities and other surface defects that would prevent conformity to the requirements of this standard.

Section 2: Mechanical fittings for polyethylene barrier pipe

6 Dimensional requirements

6.1 Dimensions of couplings

Couplings shall be manufactured with such dimensions and within such tolerance as will permit their use with pipes conforming to [BS 8588](#).

The size of coupling shall be designated by the nominal metric outside diameter of the pipe with which the coupling is to be used.

Where inserts or any internal support are part of the fitting design, these shall provide adequate support over the entire compression area of the gasket and restraining mechanism.

6.2 Dimensions of flanged joints

Flanged joints shall be designed such that they can be attached to flanges whose dimensions and tolerances are in accordance with BS EN 1092-1 or BS EN 1092-2.

7 Performance requirements

7.1 General

Mechanical fittings used as part of a polyethylene barrier pipe system shall conform with the requirements specified in [BS 8588](#).

Performance tests shall be carried out in accordance with [7.2](#) to [7.5](#) for at least one size in each of the following groups:

- DN 63 to DN 315;
- DN 355 to DN 500; and
- DN 560 to DN 630.

NOTE 1 Where joint design is identical for couplings and flange adaptors, flange adaptors may be used as test specimens to determine joint performance.

NOTE 2 Where the design of the product is different across a group, each design is tested.

A fitting shall be assembled and tested with pipe conforming to [BS 8588](#). Where inserts are part of the fitting design these shall be used in the test assembly. Where inserts are not part of the fitting design these shall not be used in the test assembly.

7.2 Test conditions

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned for not less than 24 h at $(20 \pm 2) ^\circ\text{C}$.

7.3 Hydrostatic pressure test for leak tightness under positive internal pressure

7.3.1 Long term test at elevated temperature

When assembled in accordance with BS EN ISO 1167-4, the test assembly shall be subjected to the internal water pressure test method described in BS EN ISO 1167-1. The assembly shall withstand a pipe circumferential stress for the period and temperature given in [Table 2](#) without leakage at any time during the test.

Table 2 — *Parameters for long term test at elevated temperature*

	Pipe circumferential stress	Test period	Test temperature
	MPa	h	°C ^{A)}
For PE80 pipe	4.0	1000	80
For PE100 pipe	5.0	1000	80

^{A)} The test may be carried out at a lower test temperature (typically 50 °C or 60 °C). The minimum test period is calculated using Equation B.2 (PE80) or B.3 (PE100) of BS EN ISO 15494+A1:2020.

7.3.2 Short term test at elevated temperature

When assembled in accordance with BS EN ISO 1167-4, the test assembly shall be subjected to the internal water pressure test method described in BS EN ISO 1167-1. The assembly shall withstand a pipe circumferential stress for the period and temperature given in [Table 3](#) without leakage at any time during the test.

Table 3 — *Parameters for short term test at elevated temperature*

	Pipe circumferential stress	Test period	Test temperature
	MPa	h	°C ^{A)}
For PE80 pipe	4.5	165	80
For PE100 pipe	5.4	165	80

^{A)} The test may be carried out at a lower test temperature (typically 50 °C or 60 °C). The minimum test period is calculated using Equation B.2 (PE80) or B.3 (PE100) of BS EN ISO 15494+A1:2020.

7.3.3 Short term test at 20 °C

When assembled in accordance with BS EN ISO 1167-4, the test assembly shall be subjected to the internal water pressure test method described in BS EN ISO 1167-1. The assembly shall withstand a pipe circumferential stress for the period and temperature given in [Table 4](#) without leakage at any time during the test.

Table 4 — *Parameters for short term test at 20 °C*

	Pipe circumferential stress	Test period	Test temperature
	MPa	h	°C
For PE80 pipe	10.0	100	20
For PE100 pipe	12.0	100	20

7.4 Leak tightness of joints under negative internal pressure

When tested in accordance with the method given in BS EN ISO 3459, a test assembly shall withstand an external pressure of 0.1 bar below atmospheric pressure for 1 hour followed by a pressure of 0.8 bar below atmospheric pressure for a further 1 hour without leakage at any time during the 2 hours test duration.

7.5 Pull out performance

When tested in accordance with the method given in BS EN ISO 3501, a test assembly shall be subjected to the appropriate minimum axial load in IGN 4-01-02:2017 [N3], Type 1 or Type 2. The pipe shall not pull out from the fitting nor shall it fracture within the jointed assembly. While initial movement of the pipe within the joint is allowed, no further movement shall be allowed after the test load has been reached.

8 Marking for mechanical fittings for polyethylene barrier pipe

8.1 Marking

The fitting shall be legibly and durably marked and shall bear at least the following information:

- a) the manufacturer's name or mark;
- b) the number and publication date of this BS;²⁾
- c) the section of this BS that the fitting is relevant to, i.e. BS 8561 (S1);
- d) nominal diameter (in mm);
- e) nominal pressure (PN);
- f) product information³⁾; and
- g) nominal size (DN) and PN rating of flange.

8.2 Additional information

The following information shall be supplied on or with each product, where applicable:

- a) the pull-out performance (i.e. Type 1 or Type 2 as defined by IGN 4-01-02:2017 [N3]);
- b) need for pipe inserts;
- c) manufacturer's recommended bolt torque (Nm); and
- d) jointing instructions.

²⁾ Marking BS 8561:2021 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

³⁾ To provide traceability to production period with year and month and the production site if the manufacturers are producing at different sites.

Section 3: Mechanical fittings for use in the repair, connection, and renovation of pressurized water supply pipelines

9 Dimensional requirements

9.1 Dimensions of fittings

The pipe material(s) for which the fitting is intended for use shall be declared by the manufacturer.

The maximum and minimum pipe outside diameters for which the fitting is to be used shall be declared by the manufacturer.

Fittings shall be manufactured with such dimensions and within such tolerance as will enable the fitting to meet all requirements of this standard at the maximum and minimum pipe outside diameters declared.

The size of joint shall be designated by the nominal size of the pipe with which the fitting is to be used.

Where inserts or any internal support are part of the fitting design, these shall provide adequate support over the entire compression area of the gasket and restraining mechanism.

9.2 Dimensions of flanged joints

Flanged joints shall be designed such that they can be attached to flanges whose dimensions and tolerances are in accordance with BS EN 1092-1 or BS EN 1092-2.

10 Performance requirements

10.1 General

Unless otherwise specified, performance tests shall be carried out on Test Assembly 1 (see [10.2.1](#)) in accordance with [10.2](#) to [10.4](#) for at least one size in each of the following groupings as applicable to the product size range.

For joints to iron, steel, or PVC (PVC-U, PVC-O) pipe:

- DN 50 to DN 300;
- > DN 300 to DN 700; and
- > DN 700 to DN 1 200.

Unless otherwise specified, performance tests shall be carried out on Test Assembly 2 (see [10.2.1](#)) in accordance with [10.2](#) to [10.4](#) for at least one size in the group > DN300 to DN 700. Where the product size range does not extend into this group, an alternative size shall be selected.

Unless otherwise specified, performance tests shall be carried out on Test Assembly 3 in accordance with [7.2](#) to [7.5](#) for at least one size in each of the following groupings as applicable to the product size range.

For joints to PE or PE barrier pipe:

- DN 63 to DN 315;
- > DN 315 to DN 500; and

- > DN 500 to DN 1 000.

NOTE 1 Where joint design is identical for couplings and flange adaptors, flange adaptors may be used as test specimens to determine joint performance.

NOTE 2 Where the design of the product is different across a group, each design is tested.

NOTE 3 Annex B provides a summary of the test methods to be undertaken on each test assembly.

NOTE 4 Mechanical repair clamps, joint encapsulation units and mechanical under pressure tees are not recommended for use on PE pipe or PE barrier pipe.

10.2 Test assembly

10.2.1 Test pipes

A fitting shall be assembled and tested with pipe in accordance with Table 5. Where inserts are part of the fitting design these shall be used in the test assembly. Where inserts are not part of the fitting design these shall not be used in the test assembly.

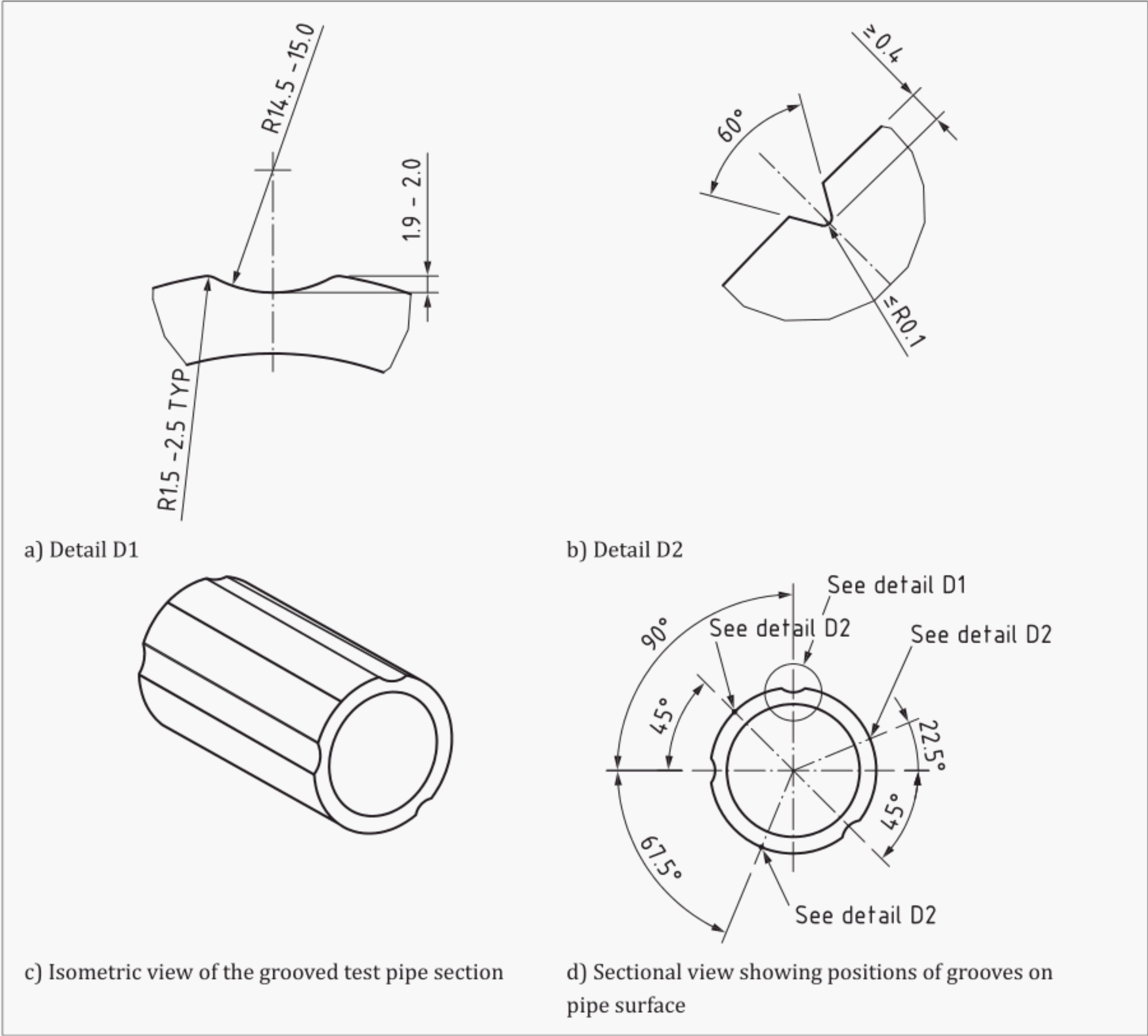
Table 5 — Test assemblies

Fitting	Test assembly 1	Test assembly 2 ^{A)}	Test assembly 3
Wide tolerance coupling	a) Two steel pipes machined to minimum pipe outside diameter declared by the manufacturer b) Two steel pipes machined to maximum pipe outside diameter for fitting as declared by the manufacturer	Two steel pipes machined with an external grooved profile	Two PE or PE barrier pipes
Wide tolerance stepped coupling	a) Two steel pipes machined to minimum pipe outside diameter declared by the manufacturer b) Two steel pipes machined to maximum pipe outside diameter for fitting as declared by the manufacturer	Two steel pipes machined with an external grooved profile	Two PE or PE barrier pipes
Wide tolerance flange adaptor	a) One steel pipe machined to minimum pipe outside diameter declared by the manufacturer and one flange b) One steel pipe machined to maximum pipe outside diameter declared by the manufacturer and one flange	Steel pipe machined with an external grooved profile	Two PE or PE barrier pipes

Table 5 — Test assemblies (continued)

Fitting	Test assembly 1	Test assembly 2 ^{A)}	Test assembly 3
Repair clamp	a) Two steel pipes machined to minimum pipe outside diameter declared by the manufacturer b) Two steel pipes machined to maximum pipe outside diameter for fitting as declared by the manufacturer	Two steel pipes machined with an external grooved profile	–
Joint encapsulation unit	a) Two steel pipes machined to minimum pipe outside diameter declared by the manufacturer b) Two steel pipes machined to maximum pipe outside diameter for fitting as declared by the manufacturer	Two steel pipes machined with an external grooved profile	–
Under pressure tee with full pipe surface contact sealing	a) Two steel pipes machined to minimum pipe outside diameter declared by the manufacturer b) Two steel pipes machined to maximum pipe outside diameter for fitting as declared by the manufacturer	Two steel pipes machined with an external grooved profile	–
Under pressure tee with local sealing	Steel pipe machined to minimum pipe outside diameter declared by the manufacturer and drilled	Steel pipe machined with an external grooved profile and drilled	–
A) Details of surface preparation are provided in Figure 1 . Testing on Test Assembly 2 is carried out on a single size of pipe selected from the middle group (i.e. > DN 300 to DN 700). If the manufacturer's product range does not extend into this size group, the largest pipe in the range is selected.			

Figure 1 — External profile of grooved steel/ductile pipe: surface defects



The length of the grooved area of the test pipe section shall be such that it extends beyond the fittings (s) it is intended for use with by a minimum of half the depth of engagement for each joint. Where drilled pipe is required, it shall be a hollow test section with the external profile as per [Figure 1](#); the drilled hole shall coincide with one of the grooves in a).

10.2.2 Test configuration

Unless otherwise specified, the test shall be carried out on an assembled joint comprising a fitting and two pipe sections (see [Figure 2](#)) or a flange adaptor comprising one pipe section (see [Figure 3](#)). The pipes shall be supported by means of V shaped blocks with an angle of 120°, located at a distance a, of $0.2 \times OD$ in mm, from the coupling face, and up to a maximum of 50 mm. The length of each pipe section, b, shall be at least $2 \times OD$ in mm, and with a minimum of 1 m.

Figure 2 — Test assembly for all fittings excluding flange adaptors

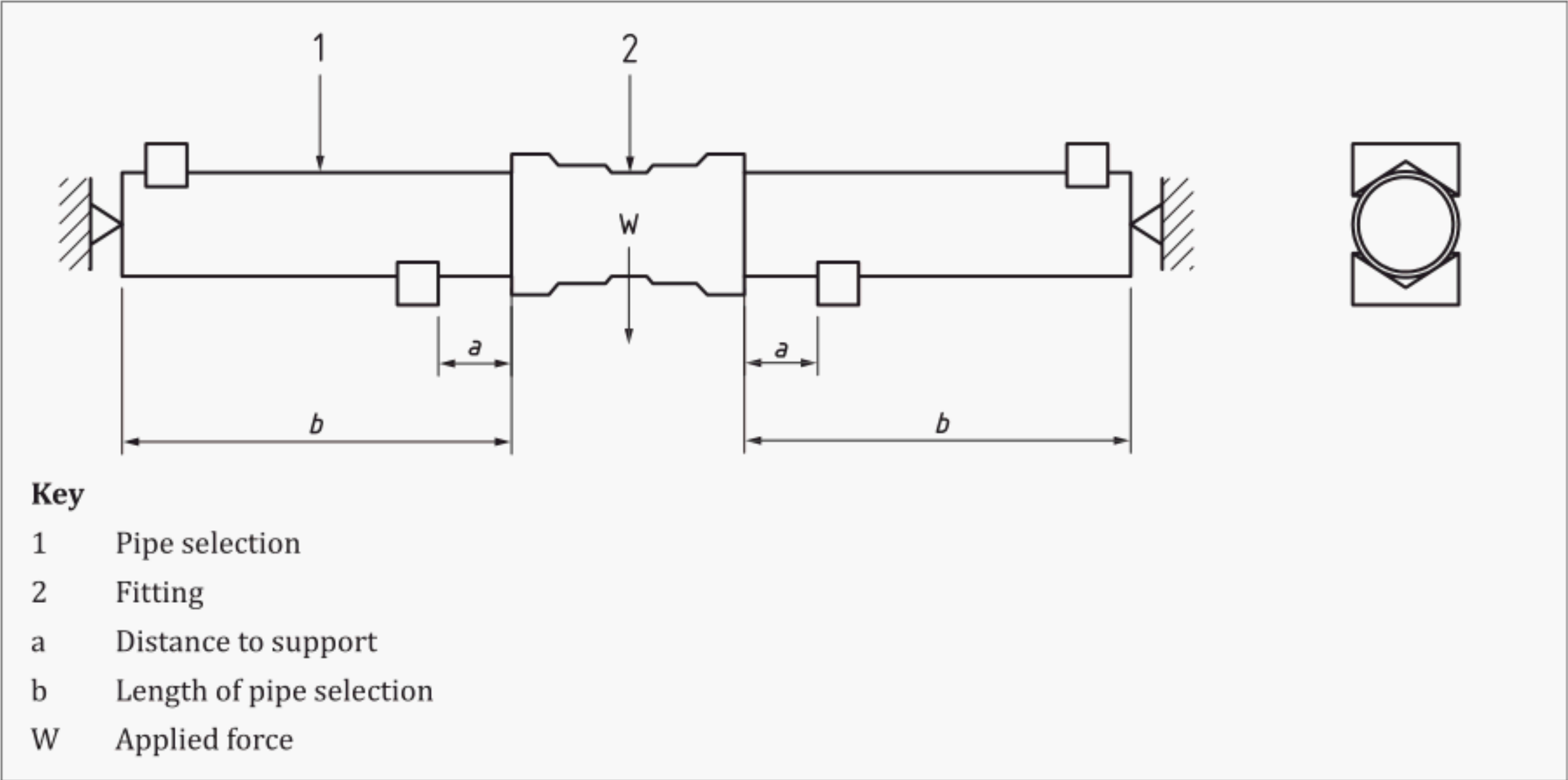
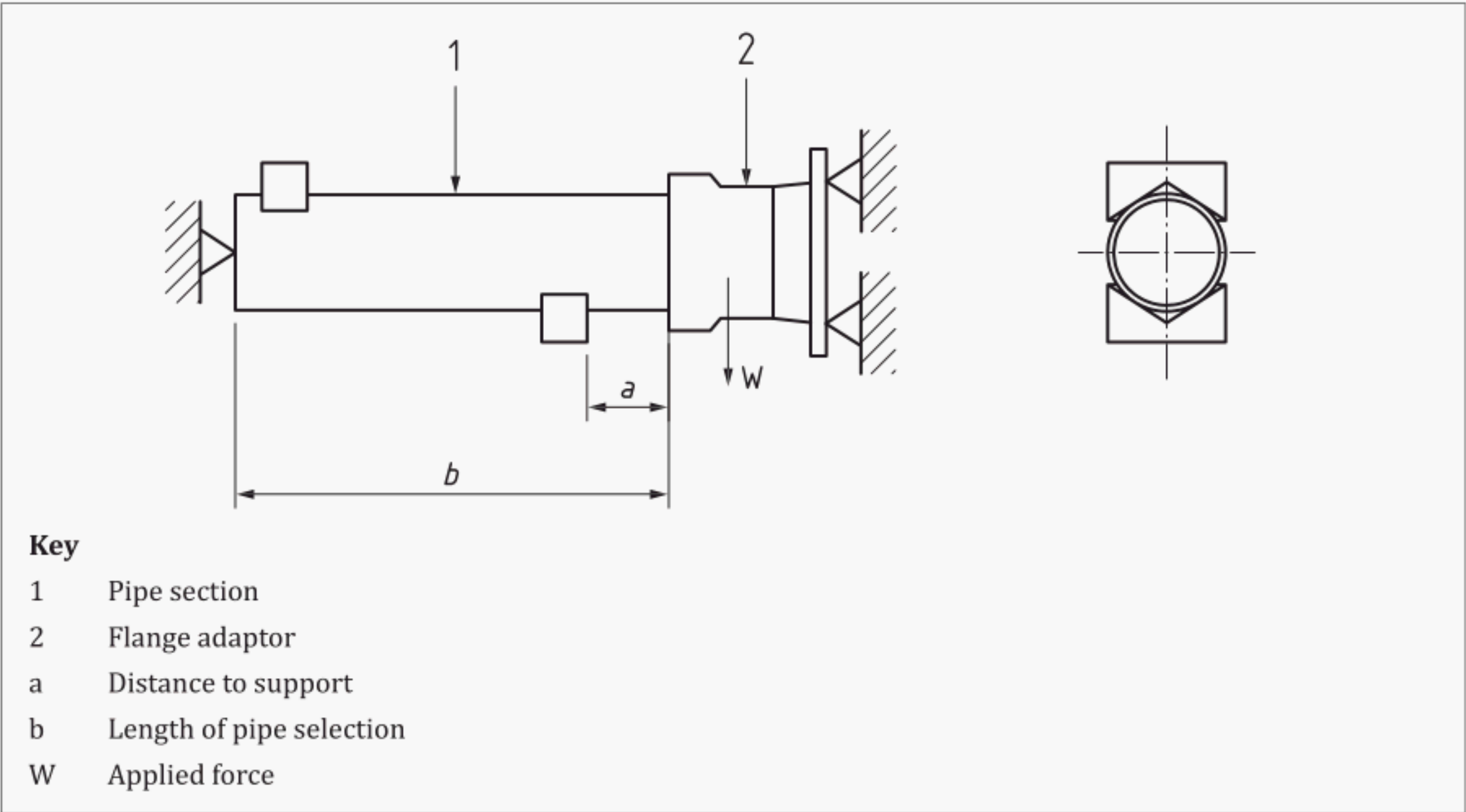


Figure 3 — Test assembly for flange adaptors



The test apparatus shall be capable of providing suitable end and lateral restraints whether the joint is in the aligned position, deflected or subjected to a shear load. It shall be equipped with a pressure gauge with an error limit of $\pm 3\%$.

The maximum shear load which a joint is designed to accommodate shall be no less than $10 \times DN$. When specified, a vertical force W taking into account the number of joints and the weight force M of the fitting shall be applied as follows.

Fittings excluding flange adaptors:

$$W = 2F - M$$

Flange adaptor:

$W = F - M$

where:

- W is the vertical force, in newtons;
- F is the shear force, in newtons;
- M is the weight force, in newtons.

The maximum setting gap at which the fitting is designed to be used shall be declared by the manufacturer. When applicable, the two pipe sections shall be set at this gap.

The maximum angular deflection at which a joint is designed to be used shall be declared by the manufacturer. When applicable, the two pipe sections shall be set at this deflection.

For wide tolerance couplings, stepped couplings, flange adaptors (spigot connection), the minimum angular deflection of a flexible joint shall be no less than the values specified in [Table 6](#).

Table 6 — Minimum angular deflection of a flexible joint

Size range	Minimum angular deflection
DN 50 to DN 450	3.0°
> DN 450 to DN 600	2.5°
> DN 600 to DN 750	2.0°
> DN 750 to DN 1 200	1.5°

For repair clamps, joint encapsulation units and under-pressure tees with full pipe surface contact sealing the minimum angular deflection shall be 0.25° up to and including DN 200.

NOTE There is no requirement for angular deflection above this diameter or for under-pressure tees with local sealing.

Where a fitting is provided with a means to prevent separation of the assembled joint (restrained joint), no additional end restraints shall be provided in the test assembly.

10.3 Test conditions

Unless otherwise specified by the applicable test method, any thermoplastic components in the test assembly shall be conditioned for not less than 24 h at (20 ± 2) °C.

10.4 Performance requirements

10.4.1 Leaktightness under positive internal pressure

When tested in accordance with BS EN 14525:2004, [7.1](#) and under the test conditions in [10.1](#) to [10.3](#), the fitting shall remain leaktight under positive internal pressure of (1.5 x PFA) + 5 bar for a period of 2 h.

This test shall be carried out using the following test configurations:

- a) joint aligned and maximum setting gap with shear load; and
- b) joint deflected and with no shear load.

NOTE 1 For tests on Test Assembly 3, no shear load is applied.

NOTE 2 These test configurations do not apply when testing an Under Pressure Tee with local sealing, where the test assembly comprises only one pipe (see [Table 5](#)).

NOTE 3 Where the fitting can be demonstrated to meet the requirements of BS EN 14525, testing on Test Assembly 1 or Test Assembly 3 given in [Table 5](#) is not carried out.

NOTE 4 Where the fitting can be demonstrated to meet the requirements of this standard (BS 8561 – [Section 2](#)) testing on Test Assembly 3 given in [Table 5](#) is not carried out.

10.4.2 Leaktightness under negative internal pressure

When tested in accordance with BS EN 14525:2004, **7.2** and under the test conditions in [10.1](#) to [10.3](#), the fitting shall remain leaktight under negative internal pressure of 0.8 bar for a period of 2 h.

This test shall be carried out using the following test configurations:

- a) joint aligned and maximum setting gap with shear load; and

NOTE 1 For tests on Test Assembly 3, no shear load is applied.

NOTE 2 This test configuration does not apply when testing an Under Pressure Tee with local sealing, where the test assembly comprises only one pipe (see [Table 5](#)).

- b) joint deflected and with no shear load.

NOTE 3 These test configurations do not apply when testing an Under Pressure Tee with local sealing, where the test assembly comprises only one pipe (see [Table 5](#)).

NOTE 4 Where the fitting can be demonstrated to meet the requirements of BS EN 14525, testing on Test Assembly 1 or Test Assembly 3 given in [Table 5](#) is not carried out.

NOTE 5 Where the fitting can be demonstrated to meet the requirements of this standard (BS 8561 – [Section 2](#)) testing on Test Assembly 3 given in [Table 5](#) is not carried out.

10.4.3 Leaktightness under dynamic internal pressure

When tested in accordance with BS EN 14525:2004, **7.3** and under the test conditions in [10.1](#) to [10.3](#), the fitting shall remain leaktight for a minimum of 24 000 pressure cycles between (0.5 x PFA) and PFA.

This test shall be carried out using the following test configuration:

- joint aligned and maximum setting gap with shear load.

NOTE 1 For tests on Test Assembly 3, no shear load is applied.

NOTE 2 This test configuration does not apply when testing an Under Pressure Tee with local sealing, where the test assembly comprises only one pipe (see [Table 5](#)).

NOTE 3 Where the fitting can be demonstrated to meet the requirements of BS EN 14525:2004, testing on Test Assembly 1 or Test Assembly 3 given in [Table 5](#) is not carried out.

NOTE 4 This test is undertaken on Test Assembly 1 and Test Assembly 3 only.

10.4.4 Strength and resistance to distortion (bolted fittings only)

When tested in accordance with [Annex A](#) and under the test conditions in [10.1](#) to [10.3](#), the fitting shall remain leaktight under a positive internal pressure of PFA for a period of 2 h.

This test shall be carried out using the following test configuration:

- joint aligned and maximum setting gap with shear load.

NOTE 1 This test configuration does not apply when testing an Under Pressure Tee with local sealing, where the test assembly comprises only one pipe (see [Table 5](#)).

NOTE 2 This test is undertaken on Test Assembly 2 only.

11 Marking and additional information for mechanical fittings connecting, repairing and renovating water supply pipes

11.1 Marking

The fitting shall be legibly and durably marked and shall bear at least the following information:

- a) the manufacturer's name or mark;
- b) the number and publication date of this BS⁴⁾;
- c) the section of this BS that the fitting is relevant to;
- d) pipe nominal size (DN);
- e) nominal pressure (PN)/PFA of the fitting;
- f) product information⁵⁾;
- g) identification of the minimum and maximum outside pipe diameters for which the fitting is designed; and
- h) nominal size (DN) and PN rating of flange.

Where the fittings are cast, items a), d), g), and h), where applicable, shall be cast on where practicable.

NOTE 1 Items b), c), e) may be applied by any method, e.g. painting on the casting or attached to the packaging.

NOTE 2 A durable label fixed to the fitting may be used where it is impracticable to cast on, or for non-cast products.

11.2 Additional information

The following information shall be supplied on or with each product, where applicable:

- a) minimum depth of engagement and/or maximum setting gap (mm);
- b) maximum allowable angular deflection (°);
- c) for under pressure tees, the minimum internal diameter of the branch (mm);
- d) for repair clamps, the longitudinal length of repair which can be sealed by the clamp (effective repair length) (mm);
- e) pipe materials for which the fitting is intended;
- f) for fittings intended for use with PE or PE barrier pipe, the pull-out performance (i.e. Type 1 or Type 2 as defined by IGN 4-01-02:2017 [N3]);
- g) for fittings intended for use with iron, steel or PVC pipe, whether provided with a means to prevent separation of the assembled joint (i.e. restrained joint or non-restrained joint);
- h) need for pipe inserts;
- i) manufacturer's recommended bolt torque (Nm); and
- j) jointing instructions.

⁴⁾ Marking BS 8561:2021 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

⁵⁾ To provide traceability to production period with year and month and the production site if the manufacturers are producing at different sites.

Annex A (normative)

Strength and resistance to distortion test

A.1 Principle

This test determines the resistance of the fitting to damage when fasteners are overtightened.

A.2 Test equipment

- A.2.1** *Pressurizing equipment*, in accordance with BS EN ISO 1167-1, capable of delivering the required test pressure.
- A.2.2** *Pressure measuring device*, in accordance with BS EN ISO 1167-1, with a pressure gauge with an error limit of $\pm 3\%$.
- A.2.3** *Torque wrench*, capable of tightening to a value of $1.5 \times$ the manufacturer's recommended maximum bolt torque.
- A.2.4** *Blank flange*, drilled in accordance with BS EN 1092-1 or BS EN 1092-2 depending on selected material (for use when testing flange adaptors or flange connections).
- A.2.5** *Flange gasket*, in accordance with the fitting manufacturer's recommended material/grade or where not specified to BS EN 681-1, 1996 Type WA and with hardness value in the range of 75 international rubber hardness degrees (IRHD) to 85 IRHD.

A.3 Test assembly

NOTE See [Table 5](#) and [10.2.2](#).

A.4 Set up the test assembly

- A.4.1** Join the fitting to the test pipe/flange in accordance with the manufacturer's installation instructions.
- A.4.2** Tighten each fastener to $1.5 \times$ the manufacturer's recommended maximum bolt torque or 1.25 times the running torque (see Note 1) or the bolt torque given in [Table A.1](#) (see Note 2).

NOTE 1 Where no recommended maximum bolt torque is given, e.g. bolts are tightened to physical stops, the running torque of the fasteners is measured at the point immediately preceding contact with the stops.

NOTE 2 Where no recommended maximum bolt torque is given for a flange adaptor or flange connection, the values in [Table A.1](#) are used for the test.

Table A.1 — *Flange bolt torque in Nm [1.5 × nominal torque to seal at the respective flange (PN and DN)]*

Flange nominal size	PN 10	PN 16	PN 25
DN	unit	unit	unit
80	105	105	130
100	115	120	190
150	175	180	280
200	195	175	270
250	180	250	375
300	195	270	355
350	190	265	495
400	255	330	655
450	250	325	615
500	255	405	730
600	340	550	1 050
700	345	700	195
800	450	945	1 725
900	450	970	1 780
1 000	585	1 255	2 430
1 100	595	1 275	2 485
1 200	745	1 710	2 910
1 400	885	1 950	3 595
1 600	1 150	2 535	4 120

NOTE If flanges are tested outside the diameter or pressure ranges given in this table, manufacturer's recommended values for the fitting application should be used.

- A.4.3 Apply the hydrostatic test pressure PFA and maintain within ±0.5 bar for at least 2 h.
- A.4.4 Check for any leaks and/or structural failure of the fitting.

A.5 Expression of results

- Record the following:
- a) test pressure (bar);
- b) torque applied to the bolts (Nm);
- c) any visual leakage from the fitting; and
- d) any visual structural failure of the fitting.

A.6 Test report

The test report shall include the results of the test and any additional factors that might have affected the results of the test.

Annex B (informative)

Test matrix for mechanical fittings for use in the repair, connection, and renovation of pressurized water supply pipelines

Table B.1, Table B.2 and Table B.3 provide a summary of the test methods specified in Clause 10, to be undertaken on each test assembly as defined in Table 5.

Table B.1 — Test matrix for wide tolerance coupling, wide tolerance stepped coupling, wide tolerance flange

Test Assembly	Test pipes arrangement	Tests (BS 8561 clauses)							
		10.4.1	10.4.2	10.4.3	10.4.4 (bolted only)	7.2	7.3	7.4	7.5
TA1	a) Joint aligned and maximum setting gap with shear load	Y	Y	Y	Y	N/A	N/A	N/A	N/A
TA1	b) Joint deflected and with no shear load	Y	Y	N	N	N/A	N/A	N/A	N/A
TA2	a) Joint aligned and maximum setting gap with shear load	Y	Y	N	Y	N/A	N/A	N/A	N/A
TA2	b) Joint deflected and with no shear load	Y	Y	N	N	N/A	N/A	N/A	N/A
TA3		N/A	N/A	N/A	N/A	Y	Y	Y	Y

Table B.2 — Test matrix for repair clamp, joint encapsulation, UPT with full pipe surface contact sealing

Test Assembly	Test pipes arrangement	Tests (BS 8561 clauses)			
		10.4.1	10.4.2	10.4.3	10.4.4 (bolted only)
TA1	a) Joint aligned and maximum setting gap with shear load	Y	Y	Y	Y
TA1	b) Joint deflected and with no shear load	Y	Y	N	N
TA2	a) Joint aligned and maximum setting gap with shear load	Y	Y	N	Y
TA2	b) Joint deflected and with no shear load	Y	Y	N	N

Table B.3 — *Test matrix for UPT with local sealing*

Test Assembly	Test pipes arrangement	Tests (BS 8561 clauses)			
		10.4.1	10.4.2	10.4.3	10.4.4 (bolted only)
TA1		Y	Y	Y	N
TA2		Y	Y	N	Y

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- [1] ENGLAND. The Water Supply (Water Quality) (England) Regulations 2016. London: The Stationery Office.
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Further reading

BS EN 545, *Ductile iron pipes, accessories and their joints for water pipelines – Requirements and test methods*

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