BS EN 16397-1:2014

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Flexible couplings

Part 1: Performance requirements

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/505, Wastewater engineering.

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

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Foreword

This document (EN 16397-1:2014) has been prepared by Technical Committee CEN/TC 165 “Waste water engineering”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by May 2015 and conflicting national standards shall be withdrawn at the latest by August 2016.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.

EN 16397 “*Flexible couplings*” contains the following parts:

— Part 1: Performance requirements;

— Part 2: Characteristics and testing for metal banded flexible couplings, adaptors and bushes.

This European Standard takes into account the requirements of EN 476.

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.

1 Scope

This European Standard specifies the performance requirements for flexible couplings and adaptors and bushes for use with pipes and fittings in drain and sewer systems, usually operated under gravity and periodic hydraulic surcharge, both above and below ground inside or outside buildings and intended to connect pipes for:

— repair of damaged pipelines;

— connecting pipes of different materials and/or diameters;

— jointing short/cut lengths of pipe;

— jointing specific pipe systems;

— jointing post-inserted preformed junctions.

Typically a coupling consists of a moulded or extruded flexible sleeve with two clamping bands with or without a shear band. The clamping bands enable the sleeve to form a seal with the pipes to be jointed. The shear band gives resistance to shear forces. Connections may be made between pipes which cannot be satisfactorily jointed by a coupling alone, of dissimilar sizes or material, by using an appropriate bush or bushes with the coupling or by using an appropriate adaptor.

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 476:2011, *General requirements for components used in drains and sewers*

EN 1055:1996, *Plastics piping systems - Thermoplastics piping systems for soil and waste discharge inside buildings - Test method for resistance to elevated temperature cycling*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

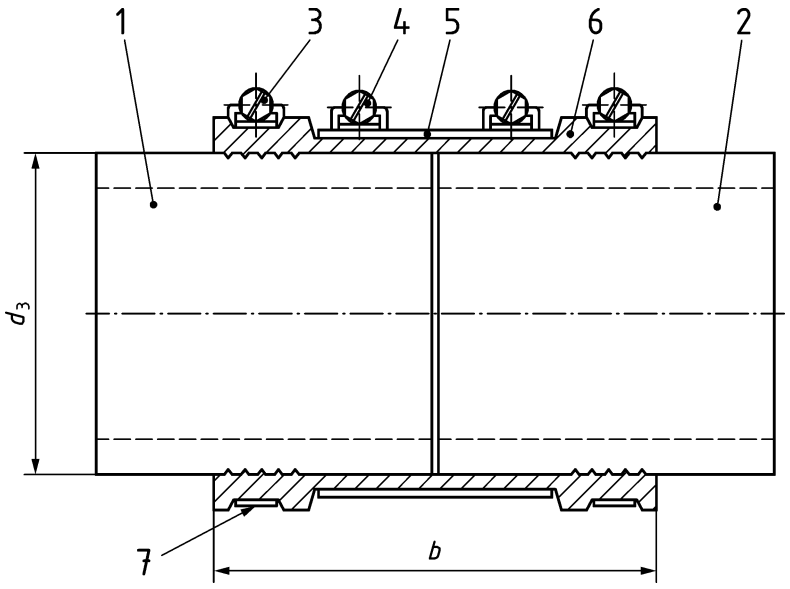
EN 16397-2, *Flexible couplings – Part 2: Characteristics and testing for metal banded flexible couplings, adaptors and bushes*

3 Terms and definitions

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

3.1
flexible coupling
moulded or extruded and joined flexible sleeve, with or without bushes or shear band, with adjustable clamping bands by which it is secured to the ends of pipes with outside diameters within the tolerance range covered by the coupling

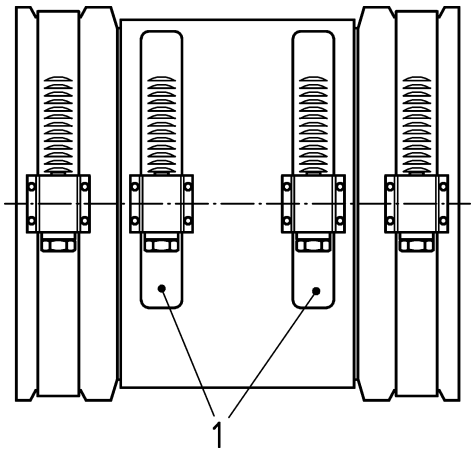
Note 1 to entry: Examples are shown in Figures 1 to 3.



Key

1	pipe 1	6	sleeve
2	pipe 2	7	clamping band
3	drive unit	b	width of sleeve
4	adjustor unit	d_3	outside diameter
5	shear band		

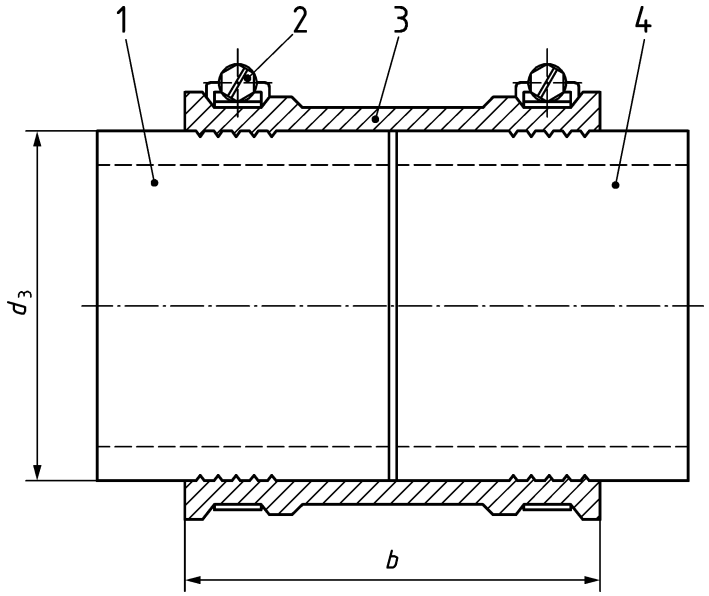
Figure 1 — Example of a flexible coupling with shear band



Key

1 shear band adjustors

Figure 2 — Example of elevation showing shear band adjustors



Key

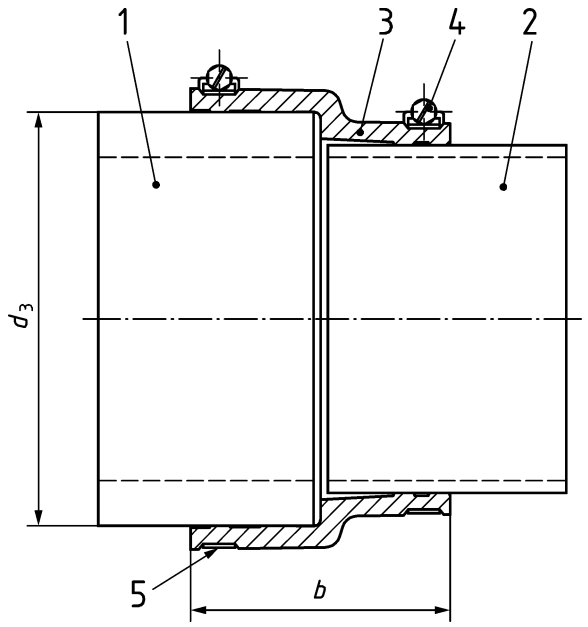
1	pipe 1	b	width of sleeve
2	clamping band with drive unit	d_3	outside diameter
3	sleeve		
4	pipe 2		

NOTE More than one drive unit could be used where required.

Figure 3 — Example of flexible coupling without shear band

3.2
flexible adaptor
moulded or extruded stepped flexible sleeve with adjustable clamping bands by which it is secured to pipes of different outside diameters beyond the tolerance range for a flexible coupling which may incorporate an abrupt change of section

Note 1 to entry: An example of a metal banded adaptor is shown in Figure 4.



Key

1	pipe 1	5	clamping band
2	pipe 2	b	width of sleeve
3	moulded rubber	d_3	outside diameter
4	drive unit		

NOTE More than one drive unit could be used where required.

Figure 4 — Example of metal banded adaptor

3.3
bush
moulded or extruded and joined elastomeric section only used with couplings having shear bands to compensate for variations between the outside diameters of pipes which cannot be satisfactorily joined by a coupling alone

3.4
nominal size of a flexible coupling and an adaptor
maximum outside diameter of the pipes with which a flexible coupling or adaptor can be used

3.5
shear band
component for bearing of shear loads after installation

3.6
clamping band
means of clamping the flexible coupling to a pipe using a specified force

3.7
adjustor strip
shear band fixing
means of clamping the shear band to the flexible coupling using a specified force

Note 1 to entry: See Figure 2.

3.8
stopper
mechanical means of sealing the open end of a pipe, typically used in a pressure test

4 Symbols and abbreviations

Symbol	Description	Unit
F_E	nominal self-weight of stopper (for tightness testing)	kN
F_R	nominal self-weight of pipe (which may be obtained by calculation - volume and density)	kN
F_S	shear load	kN
F_W	the weight of water in pipe	kN
F_Z	the applied load	kN
C_1	distance between seal and load application line for F_Z	m
C_2	distance between right hand support and load line for F_E	m
S_s	distance between seal and support of loaded pipe	m

5 Product characteristics

5.1 General

Flexible couplings and adaptors and bushes shall meet the product characteristics of this European Standard.

When fitted according to the manufacturer's instructions, flexible couplings and adaptors and bushes shall not damage or distort the pipes to which they are connected.

Flexible couplings and adaptors and bushes shall be free from such defects as would impair their function when in service.

5.2 Materials

All materials used in flexible couplings and adaptors and bushes shall comply with the specific material characteristics in accordance with EN 16397-2.

5.3 Dimensional tolerances

NOTE The requirements on tolerances and dimensions are specified in EN 16397-2.

5.4 Tightness of joint assemblies

5.4.1 General

Joint assemblies using flexible couplings and adaptors and bushes shall meet the requirements of 5.4.2, 5.4.3, 5.4.4 and 5.4.5.

Couplings and adaptors shall be tested in assemblies comprising both rigid pipes, both flexible pipes and a combination of rigid pipes with flexible pipes.

When bushes are supplied as part of the product range a minimum of one test per test configuration shall include at least one bush/coupling combination.

In addition when subjected to the test specified in the material specific part of this European Standard (EN 16397-2), the maximum sized coupling assembled with the thickest bush supplied and the appropriate pipes from each designated size group and test mode shall be tested at the recommended assembly torque.

5.4.2 Test pressures

Joint assemblies using couplings incorporating a shear band shall meet the requirements of 5.4.3 and 5.4.4, when tested at an internal pressure of 100 kPa (1,0 bar) in accordance with 6.1.2.

Joint assemblies using couplings or adaptors without a shear band shall meet the requirements of 5.4.3 and 5.4.4, when tested at an internal pressure of 50 kPa (0,5 bar) in accordance with 6.1.2.

If products covered by this standard are required to withstand continuous working under low pressure (i.e. continuous surcharge flow is expected, e.g. for water transfer pipelines), the test pressure shall be higher than specified above for either type of coupling or adaptor.

The higher test pressure should be agreed between manufacturer and specifier.

Joint assemblies using couplings incorporating a shear band shall meet the requirements of 5.4.3 and 5.4.4 when tested with a vacuum pressure of -0,25 bar (0,75 bar absolute) when tested in accordance with 6.1.3.

A component of a joint assembly shall not be used in more than one test.

5.4.3 Angular deflection

One pipe in a joint assembly shall be deflected by the method described in 6.1.4 by the amount specified in Table 1 for its relevant nominal size and when so deflected shall withstand the test pressures specified in 5.4.2 for 5 min without visible leakage or more than 10 % change in pressure after the pressure has stabilised.

Table 1 — Deflection

Nominal coupling size mm	**Deflection**[a] mm/m	**Deflection** degrees
Up to 200	80	4,6
201 to 500	30	1,7
501 to 800	20	1,1
> 800	10	0,6
[a] Per metre of deflected pipe length (see Figure 5).		

Where a joint assembly is made up with pipes of two different sizes the deflection appropriate to the larger pipe shall be applied.

5.4.4 Shear resistance and deformation

5.4.4.1 General

A joint assembly shall withstand short term and long term shear load when tested according to 6.1.5. This should be either 6.1.5.1, 6.1.5.3 and 6.1.5.4 or 6.1.5.2, 6.1.5.3 and 6.1.5.4.

5.4.4.2 Joint assemblies connecting rigid pipes

For joint assemblies connecting pipelines of materials which do not undergo significant diametral deformation under shear test load (e. g. vitrified clay, concrete, cast-iron, ductile iron, steel and fibre-cement) an external load F_Z (see Formula 1) shall be applied to one pipe to produce a minimum shear load at the joint assembly of 25 N per millimetre of nominal size. The joint assembly shall withstand the test pressures specified in 5.4.2 for 15 min without visible leakage or more than 10 % change in pressure after the pressure has stabilised.

The clamping bands, shear bands, their adjustors and any means of attaching adjustors shall not exhibit any obvious signs of physical distress or degradation.

5.4.4.3 Joint assemblies connecting flexible and rigid to flexible pipes

For joint assemblies connecting pipelines of materials which undergo significant diametral deformation under shear test load (typical examples include PVC-U, PE, PP and low stiffness GRP) the applied load shall be that required to produce a diametral deformation of (10 ± 1,0) % on the external diameter where both pipes in an assembly are flexible and (5 ± 0,5) % on the external diameter where one pipe in an assembly is rigid. When testing flexible pipes, there should be no gap between the supporting block and the pipe above.

The clamping bands, shear bands, their adjustors and any means of attaching adjustors shall not exhibit any obvious signs of physical distress or degradation.

The joint assembly shall withstand a test pressure in accordance with 5.4.2 for 15 min without visible leakage or more than 10 % change in pressure after the pressure has stabilised.

5.4.5 Thermal cycling

5.4.5.1 General

Joint assemblies shall also be tested under shear load and deflection conditions after being subjected to a thermal cycling test. This shall be limited to joints for pipes up to 200 mm internal diameter, beyond which high effluent temperatures would not be expected to occur for extended periods (see EN 476:2011, 6.5).

5.4.5.2 Below ground application

When tested in accordance with 6.1.6.1 there shall be no visible leakage from the joint assembly at the manufacturers recommended torque rating.

5.4.5.3 Above ground and inside buildings

When tested in accordance with 6.1.6.2 there shall be no visible leakage from the joint assembly at the manufacturers recommended torque rating.

5.5 Strength of clamping and shear bands

5.5.1 Clamping band assemblies

Unless features are in place to prevent accidental over tightening, the clamping band assembly for flexible couplings shall be tested so as to demonstrate adequate strength whilst maintaining the joint seal performance.

NOTE The test requirement and test method are specified in the material specific part of this European Standard.

5.5.2 Testing of means of fixing clamping and shear band adjustor strips

The means of fixing adjustor strips to clamping or shear bands shall be stronger than the parent material as demonstrated by the failure of the parent material rather than the means of fixing.

NOTE The test requirement and test method are specified in the material specific part of this European Standard.

5.6 Reaction to fire

5.6.1 Use below ground

Where use of flexible couplings and adaptors and bushes is subject to national regulatory requirements on reaction to fire, their reaction to fire performance shall be declared as that of the main constituent pipe

material. For materials such as vitrified clay and concrete this shall be declared as Class A1 according to EN 13501-1, without the need for testing in accordance with the relevant Commission decision[1)] .

NOTE The class of reaction to fire performance of flexible couplings is regarded as the class for the constituent pipe material as only a negligible area of joint material would be exposed to fire inside the pipe and the outside of the pipeline will usually be buried.

Pipes such as vitrified clay and concrete which do not consist of any organic material and consequently do not contribute to any fire may be considered as Class A1 materials.

Conversely, where the use of this product is not subject to national regulatory requirements on reaction to fire, either Class A1 (see above) or NPD (No Performance Determined) may be declared.

5.6.2 Use above ground

When subject to national regulatory requirement the class of reaction to fire performance of flexible couplings and adaptors and bushes used in above ground drainage systems shall be determined and declared according to EN 13501-1 based on testing of a sample of the material according to the standards referred to in EN 13501-1, when the material does not meet the requirements for CWT (classified without need for testing).

5.7 Durability

5.7.1 General

Flexible couplings and adaptors and bushes are products of known and stable performance for defined end use applications with respect to their established durability for which experience has been accumulated over a long period of time. Durability is ensured by meeting the requirements of this European Standard, which represents the state of the art.

5.7.2 Durability of watertightness

Joint assemblies shall be tested by the methods described in 6.1, using all the test solutions specified and using pipes which are inert in relation to the test solutions (e. g. clay, PVC, PE, PP). A separate joint assembly shall be used for each test solution. Each joint assembly which has been exposed to one of the test solutions shall withstand the internal pressure specified in 5.4.2 for 5 min without visible leakage after the pressure has stabilised.

5.8 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets. In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: http://ec.europa.eu/enterprise/construction/cpd-ds/".

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1) See Decision of the Commission 96/603/EC of 1996-10-04 (see OJEU L 267 of 1996-10-19), as twice amended by 2000/605/EC of 2000-09-26 (see OJEU L 258 of 2000-10-12) and by 2003/424/EC of 2003-06-06 (see OJEU L 144 of 2003-06-12).

6 Test methods

6.1 Tightness test methods for joint assemblies

6.1.1 General

The apparatus shall accommodate two pipes, jointed with a flexible coupling or adaptor and supported in such a way that they can move in relation to each other to the limits required by the tests.

If it is not practicable to apply precisely the deflection pressure, load or separation required, a joint assembly shall be deemed to satisfy the test requirements provided that the levels applied are greater than those specified.

6.1.2 Internal pressure

With the pipes closed by watertight seals, fill the pipes with water at a temperature not exceeding 30 °C; expel all air before the test pressure is applied until that pressure is considered to be stable.

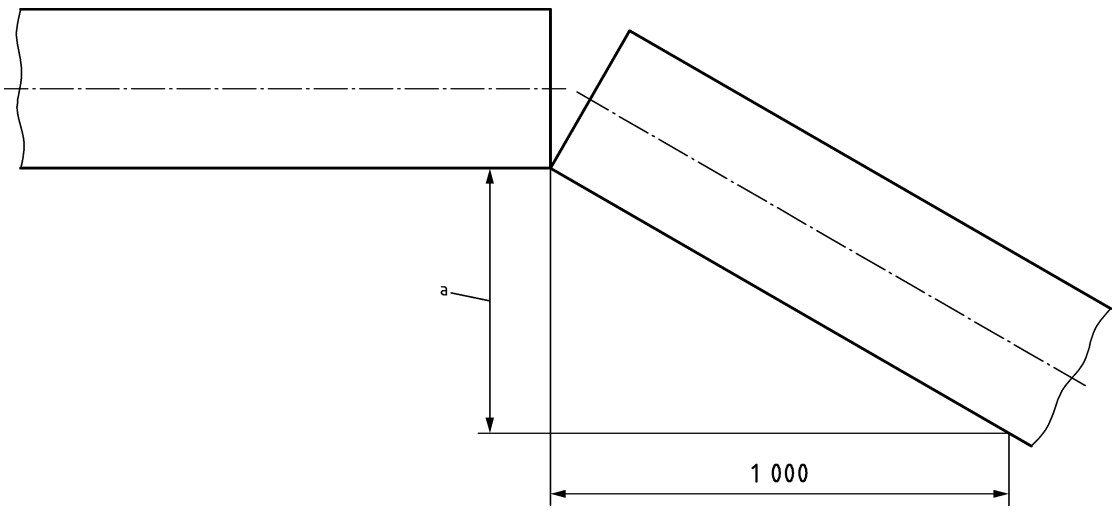
6.1.3 Vacuum

With the pipe closed by air tight seals, evacuate to the test pressure, isolate the test assembly from the vacuum source and measure the pressure within the test assembly.

6.1.4 Deflection test

Deflection is defined, in millimetres per metre, as the distance from the extended longitudinal axis of one pipe to the longitudinal axis of the other pipe at a measured length (see Figure 5).

Dimensions in millimetres



key

a joint deflection value in mm

Figure 5 — Geometry of joint deflection

Fully engage the pipes in the joint, axially align them and then separate them on the longitudinal axis with their ends restrained to prevent further longitudinal movement. The separation shall be 5 mm for couplings of less than 300 mm nominal size. For nominal sizes of 300 mm and larger, the separation shall be the minimum to permit the deflection according to Table 1.

Deflect to the test requirement one pipe angularly with respect to the other with the fulcrum on the longitudinal axes of the pipes and within the joint (see Figure 6).

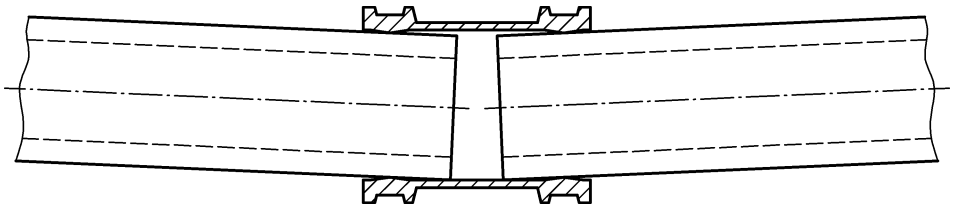


Figure 6 — Deflection test

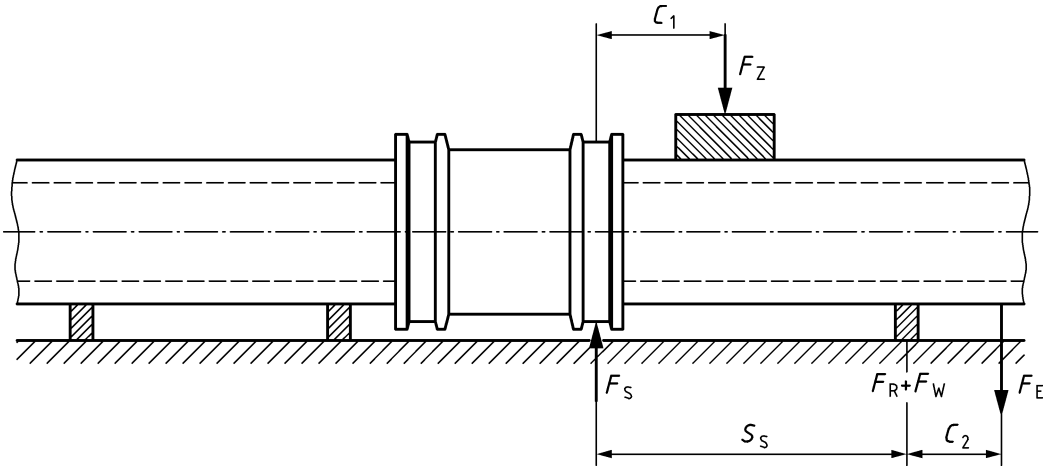
6.1.5 Shear test

6.1.5.1 Shear resistance test for couplings with shear bands

The pipes shall be fully engaged in the joint, axially aligned and then separated by 5 mm on the longitudinal axis with their ends restrained to prevent further longitudinal movement (see Figure 7).

One pipe shall be firmly supported and restrained from movement. The second pipe shall be supported at a suitable distance S_S from the joint under test.

The shear load on the joint seal is produced by the externally applied loading as well as by the self-weight of the inserted pipe and the associated water content and shall be applied for 15 min.



Key
See Formula (1)

Figure 7 — Shear resistance test for couplings joining rigid pipes

The level of external loading to be applied is determined amongst other things by the distance of the load application point from the pipe joint and by the length of the free, inserted pipe between pipe joint and support.

The additional external load to be applied, F_Z, is calculated using Formula (1):

$$F_Z = \frac{1}{S_S - C_1}\left[F_S \cdot S_S + F_E \cdot C_2 - \frac{F_R + F_W}{2}(S_S - C_2)\right] \quad (1)$$

where

F_E is the nominal self-weight of stopper, in kN;

F_R is the nominal self-weight of pipe (which may be obtained by calculation - volume and density), in kN;

F_S is the shear load, in kN;

F_W is the weight of water in pipe, in kN;

F_Z is the applied load, in kN;

S_S is the distance between seal and right hand support, in m;

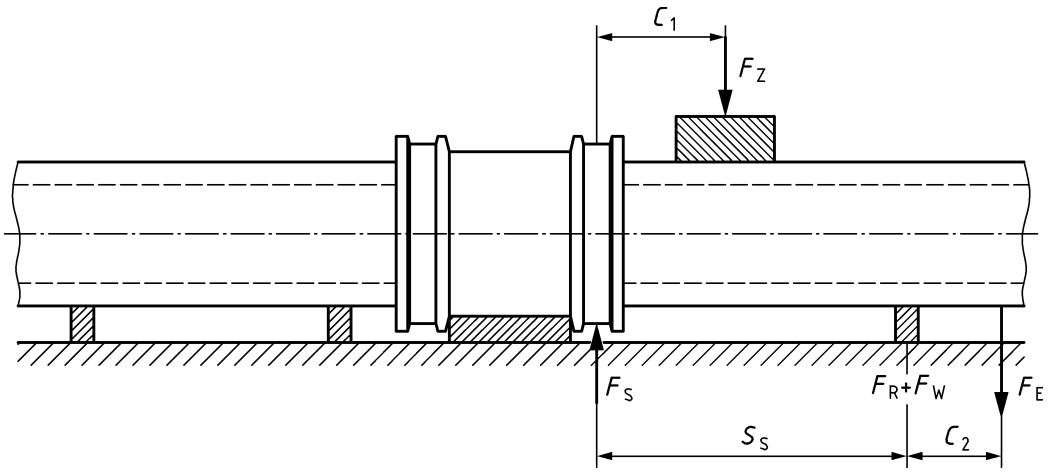
C_1 is the distance between seal and load application line for F_Z, in m;

C_2 is the distance between right hand support and load line for F_E, in m.

6.1.5.2 Shear resistance test for adaptors and couplings without shear bands

For joint assemblies without shear resistance the load shall be applied for a period of 15 min with the pipes set up as specified in 6.1.5.1 but with the underside of the joint assembly supported on a firm flat surface and restrained from movement (see Figure 8).

NOTE As the coupling is not designed to have shear resistance, it is fully supported so that only the integrity of the seal is tested.



Key
See Formula (1)

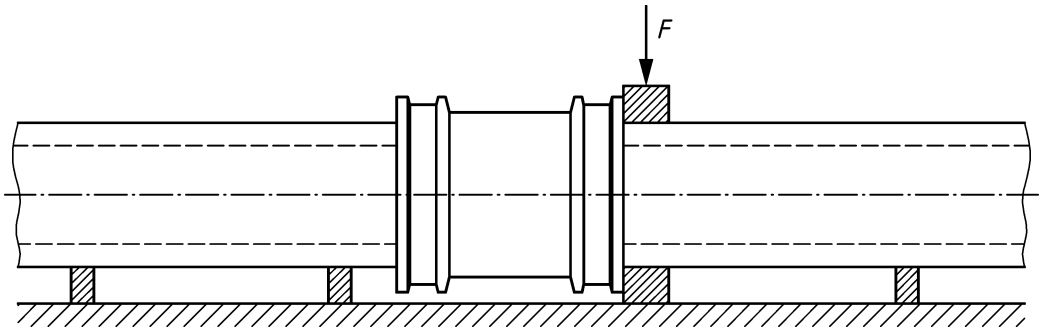
Figure 8 — Shear test arrangement with coupling laid on a support

6.1.5.3 Long term shear resistance test

Testing for long term shear resistance of joint assemblies shall be conducted in accordance with the procedures given in 6.1.5.1 with the load being applied for a period of 3 months (see Figure 7). At the end of this period the pressure test shall be carried out for 15 min.

For joint assemblies without shear resistance an additional long term test shall be carried out where the load shall be applied for a period of 3 months with the pipes set up as before but with the underside of the joint assembly supported on a firm flat surface and restrained from movement (see Figure 8).

6.1.5.4 Deformation test for flexible to rigid pipes



Key

F load

Figure 9 — Deformation test for couplings joining flexible pipes

The load on a flexible pipe shall be increased until the deformation specified in 5.4.4.3 is reached and applied for 15 min (see Figure 9).

6.1.6 Thermal cycling test

6.1.6.1 Below ground application

Using the assemblies in Figures 7, 8 and 9, pass hot water at not less than 45 °C for up to and including 200 mm internal diameter for the following thermal cycle (in air):

— Beginning at ambient temperature, cycle 4 times:

— 8 h at (-10 ± 2) °C

— 16 h at (+70 ± 2) °C

— 8 h at (-10 ± 2) °C

— Ambient temperature for 2 h.

— Then carry out the tests for angular deflection, shear resistance and deformation as specified in 5.4.3 and 5.4.4.

6.1.6.2 Above ground and inside buildings

Using the apparatus, test assembly and procedure for programme A, specified in EN 1055:1996, monitor the test assembly for any signs of leaks or changes of appearance. Subject the test assembly to 1 500 cycles as follows:

— (30 ± 0,5) l of water at (93 ± 2) °C, measured at the point of entry, over a period of (60 ± 2) s

— Rest and drain period of (60 ± 2) s

— (30 ± 0,5) l of water at (15 ± 5) °C, measured at the point of entry, over a period of (60 ± 2) s

— Rest and drain period of (60 ± 2) s

— Repeat cycle

On completion of the 1 500 cycles, fill the test assembly with water, as at temperature not exceeding 20 °C to a head of 0,5 m above the highest point of the centre line of the upper lateral pipe. Leave for a minimum period of 15 min and then visually check for and record any leakage. The test shall be carried out with standardised products intended for use inside buildings. The nature of the materials used for this test shall be representative of standardised materials.

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