



EUROPEAN ASSESSMENT DOCUMENT

EAD 180018-00-0704

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**FLEXIBLE COUPLINGS FOR
GRAVITY AND PRESSURE
SEWERAGE AND DRAINAGE
PIPES**

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1	Scope of the EAD	4
1.1	Description of the construction product	4
1.2	Information on the intended use(s) of the construction product	5
1.2.1	Intended use(s).....	5
1.2.2	Working life/Durability.....	5
1.3	Specific terms used in this EAD	6
1.3.1	Adaptors	6
1.3.2	Type 1 coupling (without shear band)	6
1.3.3	Type 2 coupling (with shear band)	7
1.3.4	Bushes.....	7
1.3.5	Nominal size	7
2	Essential characteristics and relevant assessment methods and criteria	8
2.1	Essential characteristics of the product	8
2.2	Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product	8
2.2.1	Mechanical resistance and stability.....	9
2.2.2	Reaction to fire	11
2.2.3	Safety and accessibility in use	12
3	Assessment and verification of constancy of performance	14
3.1	System(s) of assessment and verification of constancy of performance to be applied	14
3.2	Tasks of the manufacturer	14
3.3	Tasks of the notified body	15
4	Reference documents	16

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD refers to flexible couplings consisting of:

- One elastomeric sleeve made by moulding or extruded strip joined by vulcanization.
- One bush made by moulding or extruded strip joined by vulcanization.
- Two stainless steel tension bands.
- Possibly one stainless steel shear band.

The EAD applies for elastomeric elements supplied in line with EN 681-1 and for steel grades 1.4307, 1.4301, 1.4404, 1.4401 or 1.4571 according to EN 10088-2.

It specifies the requirements for flexible couplings of nominal size according to EN 476 with a maximum value of 600.

The tension bands enable the elastomeric sleeve to form a seal with the pipes to be joined.

The shear band gives resistance against shear forces and imposed loads whilst allowing some flexibility to cater for ground settlement.

Connections may be made between pipes of different sizes and materials.

Where the difference between the outside diameters of the pipes is too significant (see table below), the connection may be made by using the appropriate bush together with the coupling. Bushes are used only with Type 2B couplings (see §1.3.3 for definitions).

Table 1: Choice of use of a bush depending on the external diameters of the pipes and their difference

	Using a Type 2B coupling, bush is necessary if the difference of external pipe diameters exceeds:
OD ≤ 120 mm	10 mm
300 ≥ OD > 120 mm	12 mm
600 > OD ≥ 300 mm	15 mm

The product is not fully covered by the harmonised technical specification hEN 295-4:2013-04 which covers only flexible couplings for vitrified clay pipe systems, whereas the product described in the present EAD can be used to connect any type of sewerage and drainage pipes, inside and outside the building.

Concerning product packaging, transport, storage, installation, maintenance, replacement and repair, it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions and safety information (provided by the manufacturer as foreseen in CPR, Article 11(6)) or, in absence of specific installation instructions, according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

Flexible couplings are intended for use for connecting drains or sewer systems for the conveyance of sewage or surface water (including rain water) under gravity or a low head of pressure lower than 0,10 MPa (1,0 bars).

Different types of flexible couplings depending on the conditions of use are as follows:

Table 2: Types of flexible couplings and their characteristics

Types of flexible couplings*	Maximal pressure (bars)	External diameters and materials of pipes	Shear resistance* (N)
Adaptor couplings	Gravity	Different	Low
Drain coupling (type 1)	Gravity	Same	Low
Standard couplings and extra wide couplings (type 2 B)	1	Different***	25 N/mm of nominal pipe size (25 DN) **
Low pressure couplings (type 2 A)	Gravity	Same	25 N/mm of nominal pipe size (25 DN) **
* According to EN 295-4 ** Nominal pipe size to take into account is based on the maximum value of diameter that can be connected with the flexible coupling (in mm) *** A bush can be necessary, see Table 1			

Type 1: coupling without shear band

Type 2: coupling with shear band

They can be used to connect pipes outside and inside the building.

They can operate at temperatures within a range of +5°C to +95°C.

Flexible couplings are used for:

- Repair of damaged pipeline components,
- Post connection of branches to existing sewers or drains,
- Connecting pipes of different materials and/or diameters where there is no standard product,
- Joining short cut lengths of pipe.

Where the couplings are to be used in ground such as industrial fill or where the ground contains chloride, the coupling manufacturer should be consulted.

Nota:

The choice of the flexible coupling solution depends on two considerations:

- Existing or no standardized solutions,
- Global performances of installation.

The durability of the connection depends on the characteristics of the flexible coupling and pipe material to connect.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the flexible couplings for the intended use of 50 years when installed in the works (provided that the flexible coupling is subject to appropriate installation (see 1.1)). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works¹.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD

1.3.1 Adaptors



Figure 1: Example of adaptor coupling

Moulded or extruded stepped vulcanized rubber sleeves with adjustable stainless steel tension bands by which they are secured to the pipe ends. Adaptors may induce an abrupt change of section.

1.3.2 Type 1 coupling (without shear band)



Figure 2: Example of Type 1 coupling

Moulded or extruded vulcanized rubber sleeves with adjustable stainless steel tension bands by which they are secured to the pipe ends without shear bands.

¹ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

1.3.3 Type 2 coupling (with shear band)



Figure 3: Example of Type 2 coupling

Moulded or extruded vulcanized rubber sleeves with adjustable stainless steel tension bands by which they are secured to the pipe ends. They shall have shear bands to give resistance to shear loads.

Type 2A couplings are used where the ends of the jointed pipes comply with EN 295-1:2013, 5.4, with a maximum separation of 10 mm. For larger separations and tolerances on squareness of ends and other applications, Type 2B couplings are required.

1.3.4 **Bushes**



Figure 4: Example of bush

Bushes are used with couplings to compensate variations between the outside diameters of pipes which cannot be satisfactorily joined by a coupling alone or by an adaptor and shall comprise moulded or extruded and joined rubber sections.

1.3.5 Nominal size

Nominal size of a coupling or adaptor is the maximum outside diameter of the pipe with which it can be used.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 3 shows how the performance of flexible couplings is assessed in relation to the essential characteristics.

Table 3: Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance (level, class, description)
Basic Works Requirement 1: Mechanical resistance and stability			
1	Dimensions - Sleeves - Shear and tension bands	2.2.1.1 2.2.1.1.1 2.2.1.1.2	Level Classes of tolerances
2	Strength of tension band assembly	2.2.1.2	Level
3	Tensile strength of welds or clinch	2.2.1.3	Level
4	Heat resistance (for use inside the building)	2.2.1.4	Description
5	Assembly torque	2.2.1.5	Level Description
Basic Works Requirement 2: Safety in case of fire			
6	Reaction to fire (for use inside the building)	2.2.2	Class
Basic Works Requirement 4: Safety and accessibility in use			
7	Coupling performance: - Shear test and vacuum - Vacuum and deflection - Pressure and shear - Pressure and deflection - Vacuum and diametral distortion - Pressure and diametral distortion	2.2.3.3	Description or Level
8	Long term shear resistance	2.2.3.4	Description

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

The groups of nominal size which are referred to in this part are as follows:

Nominal size:

- Up to 200,
- 201 to 300,
- 301 to 600.

2.2.1 **Mechanical resistance and stability**

2.2.1.1 Dimensions

2.2.1.1.1 Sleeves

Dimensions and tolerances of the sleeves and bushes:

- Internal diameter,
- Minimum width,
- Minimum thickness under tension band for the sleeves,

shall be tested according to ISO 3302-1.

Internal elastomeric sleeve diameter shall be checked with the clamps removed by measuring the external circumference around the tension band position. The diameter is calculated by:

$$\text{Dint} = \text{Ext circumference}/\pi - (2 \times \text{sleeve thickness})$$

The internal diameter of the adaptation bush shall be checked in three equi-spaced positions around the bush.

Three samples in each group of nominal size shall be tested.

The values of internal diameter, minimum width of the sleeves and bushes, and minimum thickness under the tension band for the sleeves shall be given in the ETA per nominal coupling size.

In compliance with EN 295-4, the tolerances on the manufactured dimensions of moulded components shall comply with class M3 fixed by ISO 3302-1, and the tolerances on the manufactured dimensions of extruded vulcanized rubber components shall comply with class E3 fixed by ISO 3302-1. classes of tolerances shall be given in the ETA.

2.2.1.1.2 Shear and tension bands

Dimensions of the shear and tension bands:

- Minimum width,
- Minimum thickness,

shall be tested by using a calliper with a precision of 0,01 mm.

The width and the thickness of the tension and shear bands shall be checked at two points diametrically opposite to each other.

Three samples in each group of nominal size shall be tested.

The values of minimum width and thickness of the shear band and tension band shall be given in the ETA per nominal coupling size.

2.2.1.2 Strength of tension band assembly

The tension band assembly is tested in accordance with EN 295-4/A.3.4.2

Test tools include a cylindrical former which will not distort under the applied load from the bands and a calibrated torque wrench in accordance with ISO 6789 (accuracy of 1%).

Three samples in each group of nominal size shall be tested.

The minimum torque that is withstood by the tension band assembly shall be given in the ETA.

2.2.1.3 Tensile strength of welds or clinch

Precision on tensile testing machine that complies with the accuracy requirement for grade 1.0 testing machine is given in EN ISO 6892-1.

The sample shall be prepared with a minimum of 100 mm length of unperforated tension band strip to a section of shear band strip cut with a minimum 100 mm length.

The sample shall be prepared as shown in figure 5. Equipment and conditions of welding (or “clinch”) used to prepare the sample shall be representative of the production process.

Extend the sample at a cross-head separation rate of 3 mm/min until failure and record the maximum tensile force.

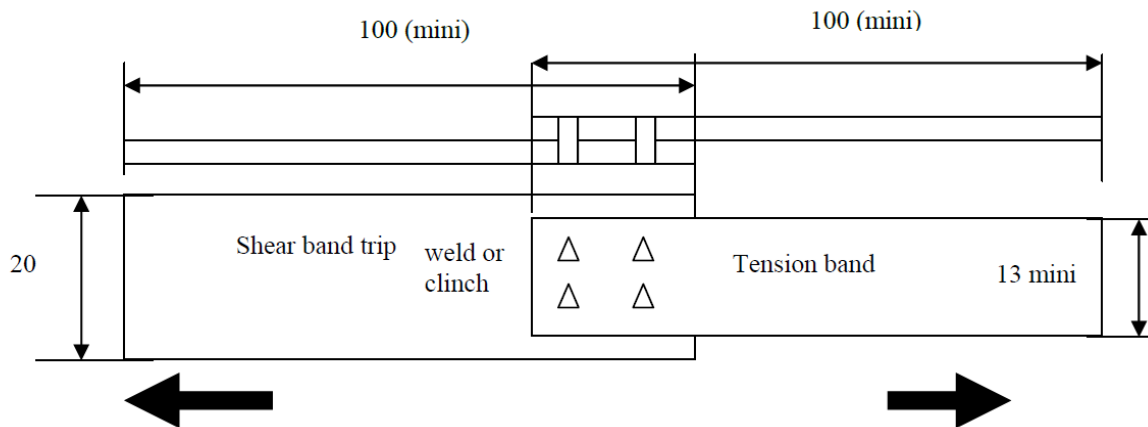


Figure 5: Test samples for tensile strengths of welds or clinched points (dimensions are in mm)

One sample for each shear band thickness shall be tested.

The value of maximum tensile force of welds or clinch shall be given in the ETA.

2.2.1.4 Heat resistance

The method of verification is based on EN 1055.

The test is realized on test device according to §6 of EN 1055 with pipes which are intended to be used inside building (application area code “B”) with a maximum internal diameter of 160 mm.

Three flexible couplings are installed and shall be tested.

The flexible couplings shall be tested according EN 1055 §7.

The reaction (in terms of water tightness) of the flexible couplings to this test shall be given in the ETA.

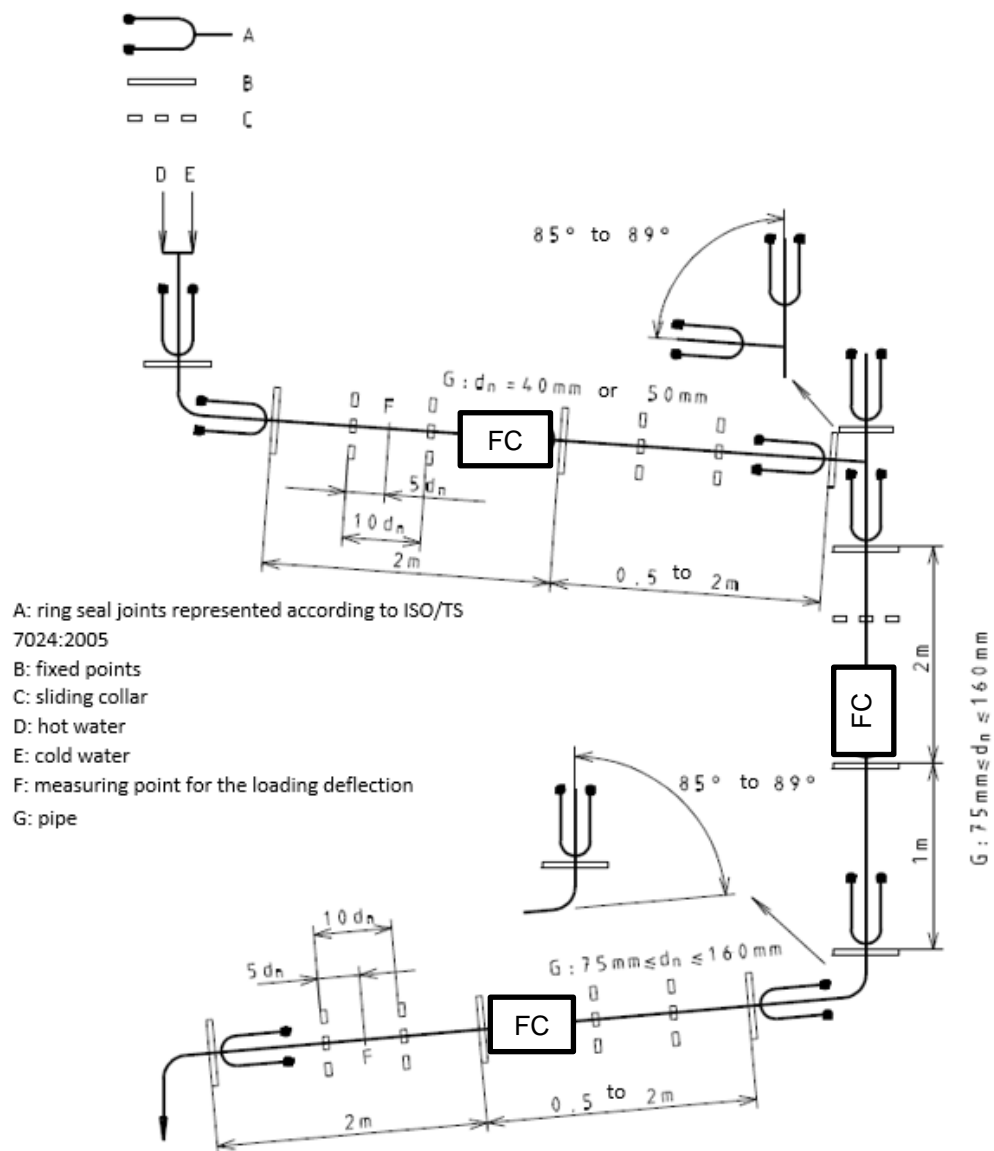


Figure 6: Determination of joint water tightness and heat resistance (FC: flexible coupling)

2.2.1.5 Assembly torque

From each group of nominal size of coupling, the maximum sized coupling assembled with the thickest bush supplied and the appropriate pipes shall be tested at the maximum torque until being blocked when tested in accordance with §2.2.3.1.1.4 (with two rigid pipes, or rigid and flexible).

The reaction (in terms of water tightness) of the flexible couplings to this test shall be given in the ETA. The maximum torque used shall be given.

2.2.2 Reaction to fire

The flexible coupling shall be tested in accordance with EN ISO 11925-2, using the test methods referred to in EN 13501-1 and relevant for the corresponding reaction to fire class. The product shall be classified according to Commission Delegated Regulation (EU) No 2016/364.

The class shall be given in the ETA.

The stainless steel tension bands and shear band are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire, in accordance with the provisions of EC decision 96/603/EC (as amended) without the need for testing on the basis of listing in that decision.

2.2.3 Safety and accessibility in use

2.2.3.1 Coupling performance

2.2.3.1.1 Definition of test procedures

2.2.3.1.1.1 Shear load

Shear load is only applied for Type 2A and 2B couplings.

Apply a downward vertical force of 25 N per mm of nominal size of pipe over a longitudinal distance of 150 mm from the face of the coupling of the unrestrained pipe.

As an alternative the force may be applied in an upward vertical direction provided the load is increased by the weight of the pipe.

2.2.3.1.1.2 Vacuum

Evacuate the pipes to a pressure of -0,3 bar (0,7 bar absolute).

Isolate the test assembly from the vacuum source and measure the pressure within the test assembly after 15 minutes.

2.2.3.1.1.3 Deflection

Deflect one pipe angularly with respect to the other by the amount shown in table 7 with the fulcrum on the longitudinal axis of the pipe and within the coupling.

2.2.3.1.1.4 Pressure

Apply the following hydrostatic pressure in function of the coupling type.

Types of flexible couplings	Test pressure (bars)
Adaptor couplings	0,6
Drain couplings (type 1)	0,6
Standard couplings and extra wide coupling (type 2B)	1,5
Low pressure couplings (type 2A)	0,6

For a period of 15 minutes and examine the assembly for leakage.

2.2.3.1.1.5 Diameter distortion

Apply vertical force to the top and bottom of the flexible pipe barrel over a longitudinal distance of 150 mm from the face of the coupling so as to cause a deformation of 5% of the pipe outside diameter. These vertical loads shall remain in place through the test.

2.2.3.1.1.6 Shear test and vacuum

Apply procedures described in §2.2.3.3.1.1 and §2.2.3.3.1.2.

2.2.3.1.1.7 Vacuum and deflection

Apply procedures described in §2.2.3.3.1.3 and §2.2.3.3.1.2.

2.2.3.1.1.8 Pressure and shear

Align the pipes and fill with water at a temperature not exceeding 25°C, taking care to remove all air from the pipes before application of pressure.

Apply the procedures described in §2.2.3.3.1.1 and §2.2.3.3.1.4.

2.2.3.1.1.9 Pressure and deflection

Apply the procedures described in §2.2.3.3.1.3 and §2.2.3.3.1.4.

2.2.3.1.1.10 Vacuum and diameter distortion

Apply the procedures described in §2.2.3.3.1.5 and §2.2.3.3.1.2.

2.2.3.1.1.11 Pressure and diameter distortion

Apply the procedures described in §2.2.3.3.1.5 and §2.2.3.3.1.4.

2.2.3.1.2 Coupling performance testing

The combination of pipe materials in table 6 shall be joined and tested using at least one coupling selected from within the designated size ranges (table 7).

Where bushes are supplied as part of the range, a minimum of one test per type shall include at least one bush/coupling combination.

For shear, deflection, diameter distortion test, requirements and test modes are given in tables 6 and 7.

Pipes made of vitrified clay, iron, steel or concrete are considered as rigid pipes.

Pipes made of PVC-U or PP or PE are considered as flexible pipes.

For pressure tests, the declared reaction (in terms of water tightness) of the flexible coupling to this test, for each kind of assembly and each test mode, shall be given in the ETA.

For vacuum tests, the declared pressure at the end of the test, for each kind of assembly and each test mode, shall be given in the ETA.

Table 6: Coupling performances test requirements

Test mode	Restrained pipe	Unrestrained pipe	Test mode
A	Rigid	Rigid	Pressure and shear Pressure and deflection
B	Rigid	Flexible	Pressure and diameter distortion Pressure and deflection
C	Flexible	Flexible	Vacuum and diameter distortion Vacuum and deflection

Note: for vacuum test, only use PVC-U, PP or PE pipes. Pipes used in tests shall be normalized, according to their corresponding European standards.

Table 7: Designated size ranges, deflection and test modes

Nominal coupling size (max. pipe DN/OD)	Minimum deflection (mm)*	Test mode
Up to 200	80	A, B and C
201-500	30	
501-600	20	
* Per meter of deflected pipe length.		

2.2.3.2 Long term shear resistance

Long term shear resistance is only applied for type 2A and 2B couplings.

Two rigid 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.

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

Apply a downward vertical force of 25 x DN (N) over a longitudinal distance of 150 mm from the face of the coupling of the unrestrained pipe. The shear load shall be applied for 3 months.

At the end of this period a pressure test (§2.2.3.1.1.4) shall be carried out for 15 min.

The declared reaction (in terms of water tightness) of the flexible coupling to this test shall be given in the ETA.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Commission Delegated Decision (EU) 2015/1959 of 1 July 2015 of the European Commission.

The system is: 4

In addition, with regard to reaction to fire for products covered by this EAD the applicable European legal act is: Commission Delegated Decision (EU) 2015/1959 of 1 July 2015 of the European Commission.

The systems are:

- 1 for products/materials for which a clearly identifiable stage in the production process results in any improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material),
- 3 in regular case, and
- 4 for products/materials that do not require to be tested for reaction to fire

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 8.

Table 8: Control plan for the manufacturer - cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples in accordance with a prescribed test plan]					
1	Aspect: surfaces of the sleeve, tension and shear bands	Visual	No failure or crack	1 sample	Each coupling
2	Dimensions - <i>Sleeves</i> - <i>Shear and tension bands</i>	2.2.1.1 2.2.1.1.1 2.2.1.1.2	-	1 sample	At each manufacturing batch
3	Strength of tension band assembly	2.2.1.2	-	2 tension bands with each type of tension band selected from within each of the group of nominal size	At each order reception of clamps
4	Weld or clinch	2.2.1.3	No failure or crack	1 for each shear band thickness	At each manufacturing batch
5	Tensile strength of welds or assembling by clinching process	2.2.1.3	-	1 sample	Monthly
6	Weld testing on rubber (aspect)	Visual	No failure or crack	1 for each profile (rubber quality and thickness)	At each manufacturing batch

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
7	Resistance of splice strength	2.2.3.2	No failure or crack	1 sample	Monthly
8	Assembly torque	2.2.1.5	No visible leakage	1 sample	Annually
9	Coupling performances: - vacuum and shear - pressure and deflection - pressure and shear	2.2.3.3	No visible leakage	1 sample	Annually
10	Steel grade	2.2.3.1	-	Certificate 3.1 (EN 10204)	Each delivery
11	Characteristics of elastomeric elements	2.2.3.2	-	Certificate 3.1 (EN 10204)	Each delivery
12	Reaction to fire (for use inside the building)	2.2.2	Classified according to EN 13501-1	1 sample	Every 5 years

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance are laid down in Table 10.

Table 9: Control plan for the notified body - cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control <i>(for system 1 only)</i>					
1	Reaction to fire	2.2.2	Classified according to EN 13501-1	1 per rubber / supplier	Annually
Continuous surveillance, assessment and evaluation of factory production control <i>(for system 1 only)</i>					
2	Reaction to fire	2.2.2	Classified according to EN 13501-1	1 per rubber / supplier	Annually

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment, is of relevance.

EN 295-1: Vitrified clay pipe systems for drains and sewers — Part 1: Requirements for pipes, fittings and joints.

EN 295-4: Vitrified clay pipe systems for drains and sewers — Part 4: Requirements for adaptors, connectors and flexible couplings.

EN 10088-2: Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.

EN 476: General requirements for components used in drains and sewers.

EN 681-1 and A1: Elastomeric seals. Material requirement for pipe joint seals used in water and drainage applications. Vulcanized rubber.

EN ISO 6892-1: Metallic materials — Tensile testing — Part 1: Method of test at room temperature.

EN 1055: Plastics piping systems – Thermoplastics piping system for soil and waste discharge inside building – test method for resistance to elevated temperature cycling.

EN 10204: Metallic products – types of inspection documents.

EN 13501-1 and A1: Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests.

EN 13823 and A1: Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item.

EN ISO 11925-2: Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – part 2: Single flame source test.

EN ISO 6789: Assembly tools for screws and nuts. Hand torque tools. Requirements and test methods for design conformance testing, quality conformance testing and recalibration procedure.

ISO 37: Rubber, vulcanized or thermoplastic – Determination of tensile stress- strain properties.

ISO 48: Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD).

ISO 188: Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests.

ISO 815-1 and -2: Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures / Part 2: At low temperatures.

ISO 1817: Rubber, vulcanized or thermoplastic – determination of the effect of liquids.

ISO 3302-1: Rubber – tolerances for products – Part 1: Dimensional tolerances.

ISO 3384-1 and A1: Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression — Part 1: Testing at constant temperature — Amendment 1: Revised calibration schedule.

Specification for flexible couplings for gravity sewerage and drainage pipe N°4-41-01-Water Industry Specification. Fondation for Water Research -WRc.