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European Assessment Document for

# Joint sealing profile made of ethylene propylene diene monomer for the sealing of joints in tubbing constructions

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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) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

# Contents

# 1 SCOPE OF THE EAD

## 1.1 Description of the construction product

The joint sealing profile made of ethylene propylene diene monomer (EPDM) for the sealing of joints in tubbing constructions (in the following referred to as sealing gasket(s)) is a gasket for sealing the joints between tubbing constructions used in shield tunneling.

The sealing gaskets are made of elastomer, namely ethylene propylene diene monomer, without any hydrophilic/swelling part. The sealing gaskets are provided with longitudinal hollow channels and grooves that enhance their compression capability (see Figures A.1, A.2, A.3 and A.4).

There are two types of the sealing gaskets:

- Glued sealing gaskets (Figures A.1 and A.2): The sections of sealing gaskets are assembled to the frames of hardened concrete segments (tubbings) with glue. The function of the glue is the temporary fixation of the sealing gaskets (during construction works). It does not influence the performance of the sealing gaskets. Thus, it is not part of the product and, thus, not subject to assessment based on this EAD.
- Anchored sealing gaskets (Figures A.3 and A.4): The sealing gaskets are provided with anchoring feet. The sealing gaskets are assembled to the frames of the concrete segments (tubbings) during the production of the segments (pre-installed in the shuttering before concreting). They are also provided with a hollow groove bottom plate which prevents filling in the hollow grooves during concreting.

Based on the assessment methods included in the EAD (especially, the ones using elevated temperature, namely Clauses 2.2.5, 2.2.6 and 2.2.9) which are concepted on products with a specific resistance against heat und due to the lack of experience in applicability of these assessment methods for products with higher sensitivity to heat, the scope of this EAD is limited to products with a performance of durability against thermal aging (in accordance with Clause 2.2.9) within the following ranges:
Changes of hardness IRHD: -5% to +10%.
Changes of tensile strength: -20% to +10%.
Changes of the elongation at break: -30 to +10%.

The product is not covered by a harmonised technical specification.

Concerning product packaging, transport, storage, 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 or (in absence of such 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)

The sealing gaskets are used to seal joints between the tunnel segments to withstand the maximum water pressure acting against the tunnel tube.

The sealing gaskets are used only in segmental linings. The geometry of the frames is chosen for the specific case of application in accordance with the implementation planning (e.g., diameter of the tunnel, number of segments in a segmental ring).

The sealing gaskets are concepted - based on their shape and dimensions - to be used with a corresponding minimum groove bottoms distance of the joint between the tunnel segments, see Figure A.5. The product-specific minimum groove bottoms distance (mGBD) that shall be considered in the assessment of the product, where relevant, shall be given in the ETA based on manufacturer's specifications.

### 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 sealing gaskets for the intended use of 100 years when installed in the works provided that the sealing gaskets are subject to appropriate installation/project (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 works[1].

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 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 Specific terms used in this EAD

### 1.3.1 Symbols/Terms

| | |
|---|---|
| GBD | Groove bottoms distance (see Figures A.1 and A.3)<br>For glued sealing gaskets:<br>GBD = distance between the opposing concrete groove bottoms<br>For anchored sealing gaskets:<br>GBD = distance between the opposing concrete groove bottoms – 2 x $t_{bp}$<br>In case of zero compression: GBD = 2 x $H_{eff}$ |
| H | Total heights of uncompressed/relaxed sealing gaskets (see Figures A.2 and A.4) |
| $H_{eff}$ | Effective height of uncompressed/relaxed gaskets<br>For glued sealing gaskets: $H_{eff.} = H$ (see Figure A.2)<br>For anchored sealing gaskets: $H_{eff.} = H - t_{bp}$ (see Figure A.4) |
| $L_g$ | Length of the double sections of sealing gasket for the tests in accordance with Clauses 2.2.6, 2.2.7 and 2.2.8 |
| mGBD | Minimum groove bottoms distance (see Clause 1.2.1 and Figure A.5)<br>mGBD corresponds to the situation when the inside (in the direction of tunnel inside) edges of the joint between two segments are closed as well as to the maximum compression of the sealing gasket in the "real installation situation" |
| T | Groove depths of steel form for the tests in accordance with Clauses 2.2.6, 2.2.7 and 2.2.8 (see Figures 2.2.6.1 and 2.2.8.1)<br>For glued sealing gaskets: T = 0,5 x mGBD<br>For glued sealing gaskets: T = 0,5 x mGBD + $t_{bp}$ |
| $t_{bp}$ | Thickness of the hollow groove bottom plate (see Figure A.4) |

# 2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

All undated references to standards or to EADs in this EAD are to be understood as references to the dated versions listed in chapter 4.

## 2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the sealing gaskets is assessed in relation to the essential characteristics.

**Table 2.1.1 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 |
|---|---|---|---|
| Basic Works Requirement 2: Safety in case of fire | | | |
| 1 | Reaction to fire | 2.2.1 | class |
| Basic Works Requirement 3: Hygiene, health and the environment | | | |
| 2 | Dimensions and tolerances of sealing gaskets | *2.2.2* | description/level |
| 3 | Hardness IRHD | *2.2.3* | level |
| 4 | Tensile strength and elongation at break | 2.2.4 | level |
| 5 | Residual pressure deformation (compression set) | 2.2.5 | level |
| 6 | Stress relaxation | 2.2.6 | level |
| 7 | Restorative capacity at 20°C | 2.2.7 | level |
| 8 | Load displacement behavior of the sealing gasket | 2.2.8 | level |
| Aspects of durability | | | |
| 9 | Durability against thermal ageing | 2.2.9 | description/level |

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

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

### 2.2.1 Reaction to fire

The sealing gasket shall be tested, using the test method(s) relevant for the corresponding reaction to fire class according to EN 13501-1. The product shall be classified according to Commission Delegated Regulation (EU) No 2016/364 in connection with EN 13501-1.

For the execution of tests according to EN 13823 (SBI) and EN ISO 11925-2 the provisions of EAD 350141-00-1106, Annex A, shall apply regarding the mounting and fixing conditions of the test specimens, but with the following additions.

- The specimens of tests according to EN 13823 consist of sealing gaskets placed side by side in front of a representative standard substrate (use of a calcium-silicate board according to EN 13238 is recommend). For that the gaskets shall be slightly cut at their non-fire-exposed backside (as less as necessary) to obtain an even surface for fixing on the substrate.
- The anchoring feet of the gaskets shall be removed within the preparation of test specimens.
- The possible misalignment between two adjacent gaskets in the same gap (see figure A.5) shall not be considered in the tests.
- All specimens shall be prepared and tested without any compression of the gaskets (at least for SBI tests according to EN 13823).

The test according to EN ISO 11925-2 shall be carried out with surface exposure and edge exposure.

The following parameters shall be considered within the tests:

- type of the rubber material (as defined by a certain combination of raw materials and produced in a certain type of production process)[2],
- vulcanisation conditions/procedure,
- thickness of the elastomer shell,
- density of the rubber material,
- depth of the built-in gasket,
- width of the gap to be sealed (at least for tests according to EN ISO 11925-2),
- compression.

The results of tests are valid for products:

- made of the same type of the rubber material,
- made using the same vulcanisation conditions/procedure,
- with the same thickness of the elastomer shell as tested or higher,
- with the same rubber density (if only one was tested) or the range between highest and lowest density evaluated in the tests,
- with the same depth of the gasket (if only one was tested) or the range between the highest and lowest depth tested,
- with the same or lower width of the gap to be sealed than tested according to EN ISO 11925-2 and
- with the same or higher compression grade of the gaskets than tested.

Reaction to fire class shall be stated in the ETA together with the conditions (see listed parameters above) for which the classification is valid.

### 2.2.2 Dimensions and tolerances of sealing gaskets

The dimensions shall be measured on at least 1 m section of the sealing gasket with a minimum precision of ±0,05 mm using the methods of ISO 23529, clause 9, in connection with ISO 3302-1, clause 3. The appropriate method shall be chosen depending on the specific size and shape of the product as given in clause 9 of ISO 23529.

A standard laboratory temperature of (23 ± 2) °C (ISO 23529, clause 5.1) shall be used for the conditioning of test specimen (ISO 23529, clause 8.1) and during performing the measurements of dimensions.

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2 To permit the TAB to apply extended application rules for the test results, it is recommended that the manufacturer should provide (but is not obliged to do so) sufficient information (e. g., on the basis of the composition of the product in question), allowing the TAB to determine – with regard to the various product parameters - which products or product variants shall be submitted to testing and to reduce the number of tests required.

In deviation from ISO 23529[3], at least 10 measurements shall be made of each dimension and the mean value and the standard deviation shall be determined. Each of the aforementioned 10 measurements shall be made at different measuring point. The measuring points shall be evenly distributed over the test specimen (1m section of the sealing gasket).

The values [mm] of width, height, thickness and respective tolerances and a sketch of geometry of the sealing gasket shall be stated in the ETA.

In addition to the above, the test results can be processed and categorised according to ISO 3302-1, provided that the assessed mean values and range of measured values fit to ranges of dimensions and to relevant tolerance fields given in ISO 3302-1, table 3. In this case, the relevant category of gasket precision in accordance with ISO 3302-1, table 3, can additionally be given in the ETA.

### 2.2.3 Hardness IRHD

The hardness IRHD shall be assessed in accordance with ISO 48-2 considering the following test conditions/parameters and specifications:

- Only one specimen shall be tested.
- The test specimen shall be in accordance with ISO 48-2, clause 6.2.2.3, of a standard thickness (2 mm ± 0,5 mm). The test specimen shall be cut out of the elastomer part of the sealing gasket without any voids (i.e., the hollow channels and grooves shall be avoided) or, if not possible (e.g., because of its shape/small dimensions), the test specimen shall be cut out of a press-vulcanised plate which is produced by the manufacturer - just for the purpose of the test - from the same elastomer mix that is used for producing the sealing gasket as well as under applying the same vulcanisation conditions/procedure.
- The method M (micro test) shall be used.
- The number of readings (measurements) shall be 5[4] at different points distributed over the test piece and separated from each other by a minimum of 6 mm and the hardness IRHD is the median of the results when these are arranged in increasing order (ISO 48-2, clause 11).
- A standard laboratory temperature of (23 ± 2) °C shall be used for the conditioning of the test specimen (ISO 48-2, clause 8.1) and during the test (ISO 48-2, clause 9).

The hardness IRHD shall be stated in the ETA.

### 2.2.4 Tensile strength and elongation at break

The tensile strength and elongation at break shall be assessed in accordance with ISO 37 considering the following test conditions/parameters and specifications:

- The number of test specimens is 5.
- The test specimens shall be of type 2 in accordance with ISO 37, clause 6.2.
- The test specimens shall be cut out of the elastomer part of the sealing gasket without any voids (i.e., the hollow channels and grooves shall be avoided) or, if not possible (e.g., because of its shape/small dimensions), the test specimens shall be cut out of a press-vulcanised plate which is produced by the manufacturer - just for the purpose of the test - from the same elastomer mix that is used for producing the sealing gasket as well as under applying the same vulcanisation conditions/procedure.
- A standard laboratory temperature of (23 ± 2) °C shall be used for the conditioning of the test specimens (ISO 37, clause 10.4, in connection with ISO 23529, clause 8.1) and during the test (ISO 37, clause 14).

The tensile strength [N/mm2] and elongation at break [%] and specimen type shall be stated in the ETA.

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3 Due to the specific nature/shape of the product (extruded, elongated profiles) at least 10 measurements of each dimension on a section with a length of at least 1 m shall be made and not only three measurements as given in ISO 23529, clause 9. In addition, the mean value of the 10 measurement and not the median of 3 measurements shall be determined.

4 According to ISO 48-2, clause 11: "…measurement at each of a minimum of three different points…". For the purposes of this EAD 5 readings (measurements) shall be made.

### 2.2.5 Residual pressure deformation (compression set)

The residual pressure deformation (compression set) shall be assessed in accordance with ISO 815-1 considering the following test conditions/parameters and specifications as well as deviations:

- The number of test specimens is 3.
- The test specimens shall be of type B in accordance with ISO 815-1, clause 7.1. The test specimens shall be cut out of the elastomer part of the sealing gasket without any voids (i.e., the hollow channels and grooves shall be avoided) in a way that the measurements/compression of the test specimens corresponds to the actual compression direction of the sealing gasket. This type of specimen is the reference type, which shall be used wherever possible.
- If it is not possible to obtain test specimens which comply with the dimensions of type 4 (e.g., because of its shape/small dimensions), alternative test specimens shall be prepared by cutting full-size cross-section specimens of thickness 12.5 mm ± 0.5 mm that shall be cut perpendicular to the longitudinal axis of the sealing gasket. The measurements/compression of full-size cross-section specimens shall then be performed against the actual compression direction of the sealing gasket (perpendicular to the longitudinal axis of sealing gasket).
- Due to the different shape/dimensions of the full-size cross-section specimens (alternative test specimens) in comparison with specimens of type B (reference test specimen) and due the presence of voids in the full-size cross-section specimens (originally, hollow channels and grooves of the sealing gasket), these two types do not necessarily give the same values for compression set, and thus, the type of specimens used shall be given in the ETA (see below).
- A standard laboratory temperature of (23 ± 2) °C shall be used for the conditioning of the test specimens before testing (ISO 815-1, clause 7.5).
- Test shall be performed at elevated temperature of 70°C ± 1 °C (ISO 815-1, clause 8.2).
- The duration of test shall be $\left(24\ ^{0}_{-2}\right)$ hours (ISO 815-1, clause 8.1).
- The test shall be terminated in accordance with ISO 815-1, clause 9.5.2, method A.

The residual pressure deformation (compression set) [%] and the specimen type shall be stated in the ETA.

### 2.2.6 Stress relaxation

Stress relaxation shall be assessed over a 3-month period at 70° C based on ISO 3384-1 but with a test specimen which consists of double gasket sections of a length ($L_g$) equal to 100 mm (- 0.5 / + 0 mm) in 100 mm long steel groove forms with end closures, so that the test object cannot move in a longitudinal direction (see figure 2.2.6.1). The geometrical groove of the steel form shall comply with the embedment concrete groove in the segment, see Figures A.1 and A.3. No lubricant shall be used at the end closures (to avoid sliding up at the specimen ends).

For testing of anchored gasket profiles (see Figures A.3 and A.4) the anchoring feet shall be cut off. The hollow groove bottom plate shall be kept but its thickness shall not be considered in the calculation of width of test gap (see below and definition of $H_{eff}$ in Clause 1.3.1).

The number of test specimens is 3.

After mechanical and thermal conditioning of test specimens in accordance with ISO 3384-1, clause 7.5, the test shall be performed in accordance with test method B of ISO 3384-1 applying the following test conditions/parameters:

Width of the test gap (compressed situation during the test) = 0.3 x (2 x $H_{eff}$ – mGBD) ± 0.01 mm (for symbols see Clause 1.3.1).

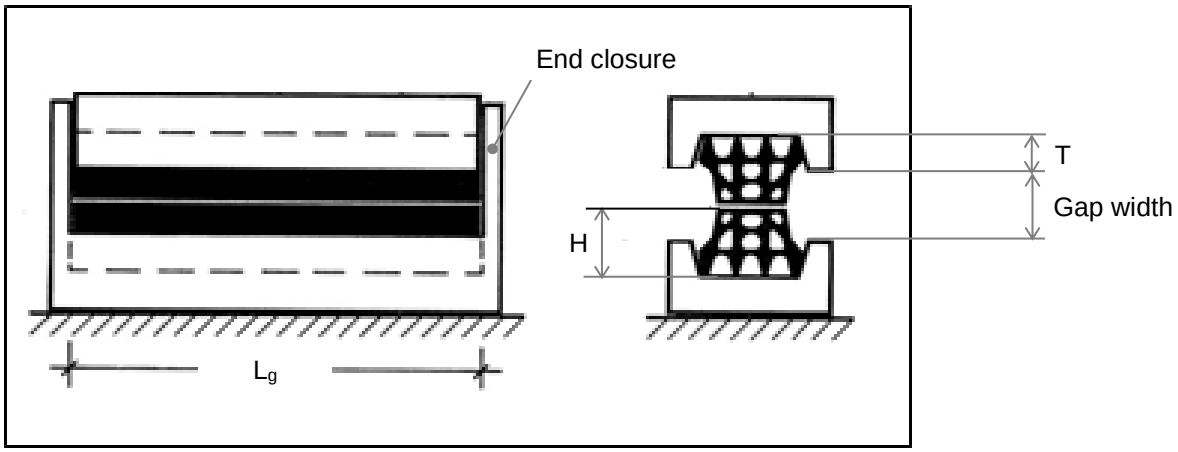


**Figure 2.2.6.1:** Example of test specimen (Ilustration of uncompressed situation before the test, fixing device is not shown)

The test shall be undertaken without misalignment (see Figure A.3).

The value of the counterforce at standard laboratory temperature of (23 ± 2) °C after 60 min shall be taken as starting value. Furthermore, measurements of counterforce shall be taken after 3 h, 1 day, 3 days and 7 days as well as after 30 days and 90 days of heat exposure at 70° C ± 3 °C. After the test specimens are removed from the oven, they shall be stored for 2 h at a standard laboratory temperature of (23 ± 2) °C before measurement of counterforce. After that the test specimen shall be returned into the oven to complete the prescribed exposure period for the next measurement.

The gasket sections shall be kept in the steel groove forms and the width of the test gap (compressed situation) shall be fixed during the whole test (except when measuring the counterforces, where a slight additional deformation is applied as given below).

Measurement of counterforces: The forces required to additionally[5] compress the test specimen by 0.5 ± 0.01 mm shall be measured[6].

The reduction of the stress after 90 days [%] shall be determined by means of a regression line in a graph with logarithmic time scale.

The performance of the product shall be stated in the ETA. Additionally, the regression line can be given.

### 2.2.7 Restoring capacity at 20°C

The restoring capacity shall be assessed with a test specimen which consists of double sealing gasket sections of a length ($L_g$) equals 200 mm (- 1 / + 0 mm) in 200 mm long steel groove forms with end closures, so that the test object cannot move in the longitudinal direction (see Figure 2.2.6.1). The geometrical steel groove form in the test shall comply with the embedment groove in the concrete segment, see Figures A.1 and A.3. No lubricant shall be used at the end closures (to avoid sliding up at the specimen ends).

For testing of anchored gasket profiles (see Figures A.3 and A.4) the anchoring feet shall be cut off. The hollow groove bottom plate shall be kept but its thickness shall not be considered in the calculation of the initial gasket height as well as the height after restoration, see below and definition of $H_{eff}$ in Clause 1.3.1).

The number of test specimens is 3.

5 Additional to the constant compression which leads to a fixed test gap width of 0.3 x (2 x $H_{eff}$ – mGBD).

6 Based on the intended use and size of the test specimen (two full sections of gasket), the specified additional deformation for measurement of counterforces (0.5 mm) is ten times higher than the maximum additional deformation of ISO 3384-1 (0.05 mm), which consider testing of a smaller test pieces (with a thickness of 2- 6,3 mm).

The initial gasket height = $H_{eff}$ before restoration as well as before inserting the sealing gasket in the steel groove forms.

The pair of gaskets shall be pressed together without misalignment to form a 2 mm ± 0.01 mm gap width (see Figure 2.2.6.1) and shall be fixed using a fixing device. The test object shall then be stored for 72 h at room temperature of 20° C ± 5 °C, then released from the steel groove forms and stored in a relaxed state for 1 h at 20° C ± 5 °C. The gasket height after restoration ($H_{eff}$ after restoration) shall subsequently be measured. Measurements of heights before and after restoration shall be made in accordance with Clause 2.2.2.

The restoring capacity shall be calculated as follows:

$$Restoring\ capacity\ [\%] = \frac{gasket\ height\ after\ restoration}{initial\ gasket\ height} \times 100 \qquad \text{(Equation 2.2.7.1)}$$

The mean value of the restoring capacity [%] shall be stated in the ETA.

### 2.2.8 Load displacement behaviour of the sealing gasket

The compression of the sealing gasket shall be simulated by a displacement-controlled compression test in a test machine at a constant speed until the gap (see Figure 2.2.8.1) is completely closed (minimum groove bottoms distance (mGBD) , see Figure A.5, and at room temperature of 20° C ± 5 °C.

The test specimen consists of double sealing gasket sections of a length ($L_g$) equal to 200 mm (- 1 / + 0 mm) in 200 mm long steel groove forms with end closures, so that the test object cannot move in the longitudinal direction (see Figure 2.2.8.1). The geometrical steel groove form in the test shall comply with the embedment groove in the concrete segment, see Figures A.1 and A.3. No lubricant shall be used at the end closures (to avoid sliding up at the specimen ends).

For testing of anchored gasket profiles (see Figures A.3 and A.4) the anchoring feet shall be cut off. The hollow groove bottom plate shall be kept.

The number of test specimens is 3.

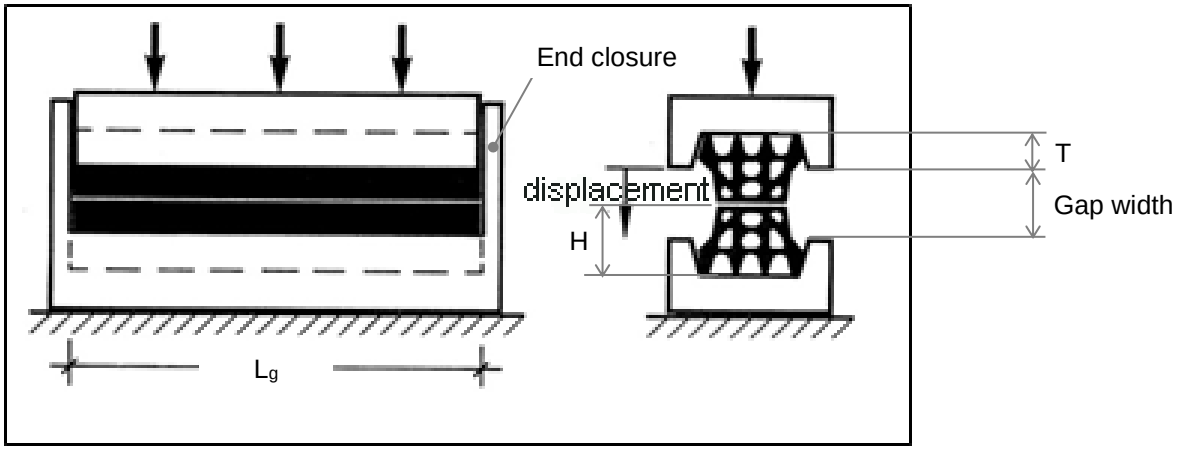


**Figure 2.2.8.1:** Test device "load-displacement behaviour of the sealing gasket"

The test shall be undertaken without misalignment (see Figure A.3).

A preload of 100 N / 200 mm of length shall be applied. Then the test shall be executed subsequently at a constant speed of 50 mm/min until the gap is completely closed (minimum groove bottoms distance (mGBD) = steel surface contact of the groove forms). The gap shall be kept closed constantly and the relaxation occurring within 5 minutes shall be recorded. The force after 5 minutes shall be determined as the restoring force for the test specimen.

[Results on 200 mm] × 5 = Results for 1 m, this shall be represented in load-displacement diagram.

The mean value of the restoring force [kN/m] shall be stated in the ETA. Additionally, the load-displacement diagram can be given in the ETA.

### 2.2.9 Durability against thermal aging

Two test specimens shall be prepared as specified in Clause 2.2.3. The first specimen shall be tested before aging in accordance with 2.2.3 and the results shall be recorded as the state of delivery regarding the hardness.

Another two sets of 5 test specimens shall be prepared as specified in Clause 2.2.4. The first set shall be tested before aging in accordance with 2.2.4 and the results shall be recorded as the state of delivery regarding the tensile strength and the elongation.

Then the other test specimens (1 for hardness + 5 for tensile strength and elongation shall be aged for 168 h, at 70° C in a turbulent air flow cabinet according to ISO 188:

After aging the hardness according to ISO 48-2 and the tensile strength and elongation at break according to ISO 37 shall be determined.

The measured values after ageing shall be compared with those at the state of delivery (see above). If the deviation of results is within the ranges specified in the scope of EAD (clause 1.1), the changes of hardness, tensile strength and elongation at break after thermal aging in comparison with state of delivery [%] shall be stated in the ETA. Otherwise, the durability cannot be assessed on the basis of this EAD [no performance assessed].

# 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 Decision 2003/656/EC.

The applicable system is 2+ for any use except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire the applicable AVCP systems are 1, 3 or 4 depending on the conditions defined in the said Decision.

## 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 3.2.1.

**Table 3.2.1 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 taken at the factory in accordance with a prescribed test plan]** | | | | | |
| 1 | Reaction to fire | Dimensions – see line 2 | See control plan | See line 2 | See line 2 |
| | | Density / weight per meter according to EN ISO 1183-1 | | 3 | Once a day |
| | | Clause 2.2.1 | | 3 for EN ISO 11925-2 tests (for classes B to E) | Once a year |
| | | | | 1 for EN 13823 tests (for classes A2 to D) | Once per 3 years |
| | | | | 1 for EN ISO 1182 (for classes A1 and A2) | Once a year |
| | | | | 3 for EN ISO 1716 (for classes A1 and A2) | Once a year |
| 2 | Dimensions | According to delivery documents | See control plan | 2.2.2 | Every 30 minute |
| 3 | Hardness | ISO 48-2 | See control plan | 5 | Once a day |
| 4 | Tensile strength | ISO 37 | See control plan | 5 | Once a day |
| 5 | Elongation at break | ISO 37 | See control plan | 5 | Once a day |
| 6 | Residual pressure deformation DVR 22 h,70°C | ISO 815-1 | See control plan | 3 | Once a week |
| 7 | Thermal ageing 168 h, 70 °C | ISO 188 | See control plan | 5 | Once a year |
| 7.1 | Change in hardness | ISO 48-2 | See control plan | 5 | Once a year |
| 7.2 | Change in tensile strength | ISO 37 | See control plan | 5 | Once a year |
| 7.3 | Change in elongation | ISO 37 | See control plan | 5 | Once a year |
| 8 | Stress relaxation 3 months at 70° C | ISO 3384-1 | See control plan | 1 | Once a year |
| 9 | Restorative capacity at 20° C | 2.2.8 | See control plan | 1 | Once a year |

## 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 for the sealing gaskets are laid down in Table 3.3.1.

**Table 3.3.1 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** | | | | | |
| 1 | The Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the sealing gaskets.<br>In addition, where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 are fulfilled for reaction to fire, the notified body will consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire retardants or a limiting of organic material). | Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer | According to Control plan | According to Control plan | When starting the production or a new line |
| **Continuous surveillance, assessment and evaluation of factory production control** | | | | | |
| 2 | The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.<br>In addition, where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 in the Decisions regarding reaction to fire are fulfilled, the notified body will consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire retardants or a limiting of organic material). | Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1 | According to Control plan | According to Control plan | 1/year |

# 4 REFERENCE DOCUMENTS

| | |
|---|---|
| EAD 350141-00-1106:<br>Edition September 2017 | Fire sealing and fire stopping products – Linear joint and gap seals |
| EN 13238:2010 | Reaction to fire tests for building products – Conditioning procedures and general rules for selection of substrates |
| EN 13501-1:2018 | Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests |
| EN 13823:2020 | Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item |
| EN ISO 1182:2020 | Reaction to fire tests for products - Non-combustibility test (ISO 1182:2020) |
| EN ISO 1183-<br>1:2019EN ISO 1716:2018 | Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value) (ISO 1716:2018) |
| EN ISO 11925-2:2020ISO 37:2017 | Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties |
| ISO 48-2:2018 | Rubber, vulcanized or thermoplastic –Determination of hardness – Part 2: Hardness between 10 IRHD and 100 IRHD) |
| ISO 188:2011 | Rubber, vulcanized or thermoplastic - Accelerated ageing and heat resistance tests |
| ISO 815-1:2019 | Rubber, vulcanized or thermoplastic - Determination of compression set - Part 1: At ambient or elevated temperature |
| ISO 3302-1:2014 | Rubber — Tolerances for products — Part 1: Dimensional tolerances |
| ISO 3384-1:2019 | Rubber, vulcanized or thermoplastic - Determination of stress relaxation in compression - Part 1: Testing at constant temperature |
| ISO 23529:2016 | Rubber - General procedures for preparing and conditioning test pieces for physical test methods |

# ANNEX A: DEFINITIONS OF TERMS

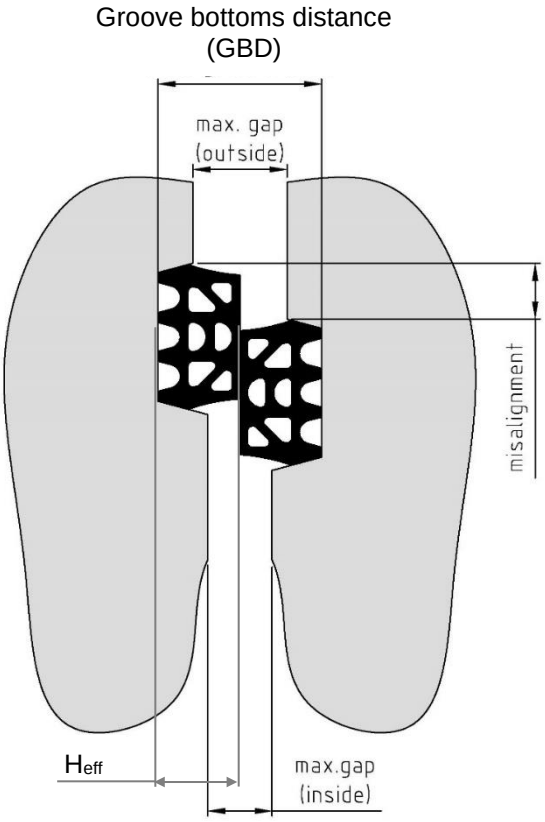


**Figure A.1:** Example of sealing gaskets which are glued on the concrete segments (tubbings), as well as definition of "misalignment"

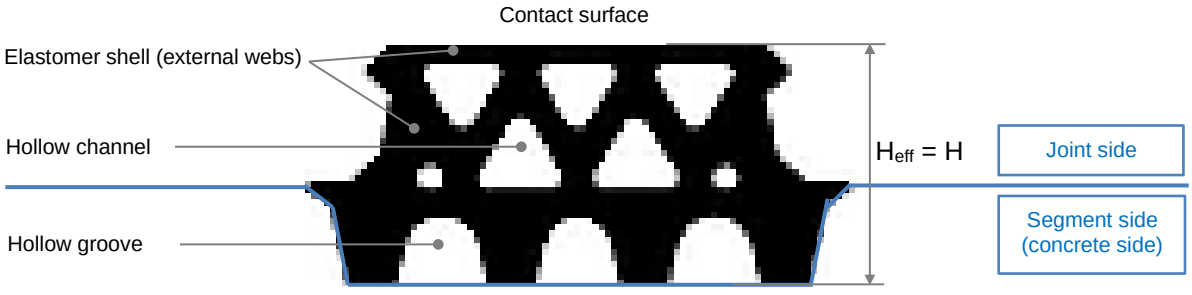


**Figure A.2:** Example of sealing gaskets which are glued on the concrete segments (tubbings ) with general definitions

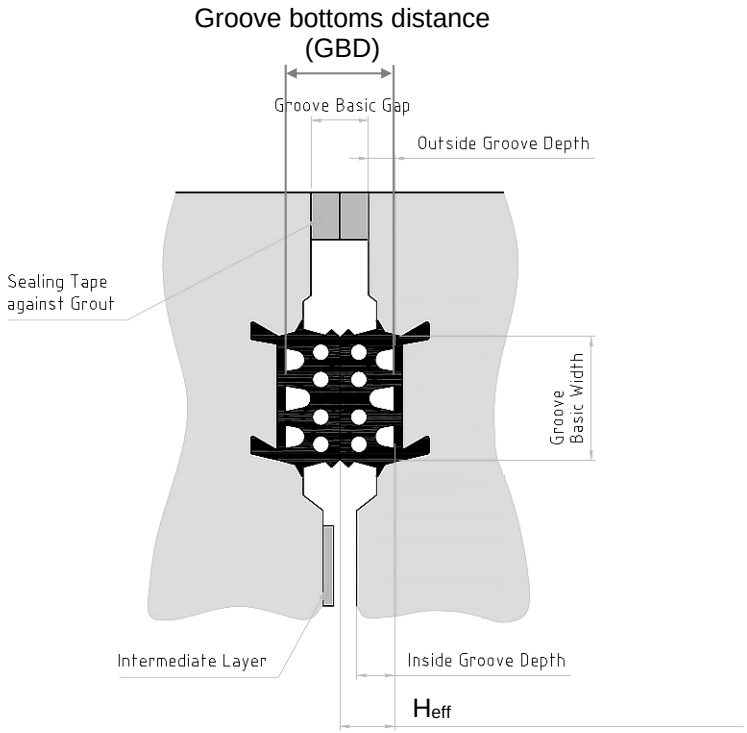


**Figure A.3:** Example of sealing gaskets which are anchored in the concrete segments (tubbings) during the production/concreting of the segments, as well as definition of "no misalignment"

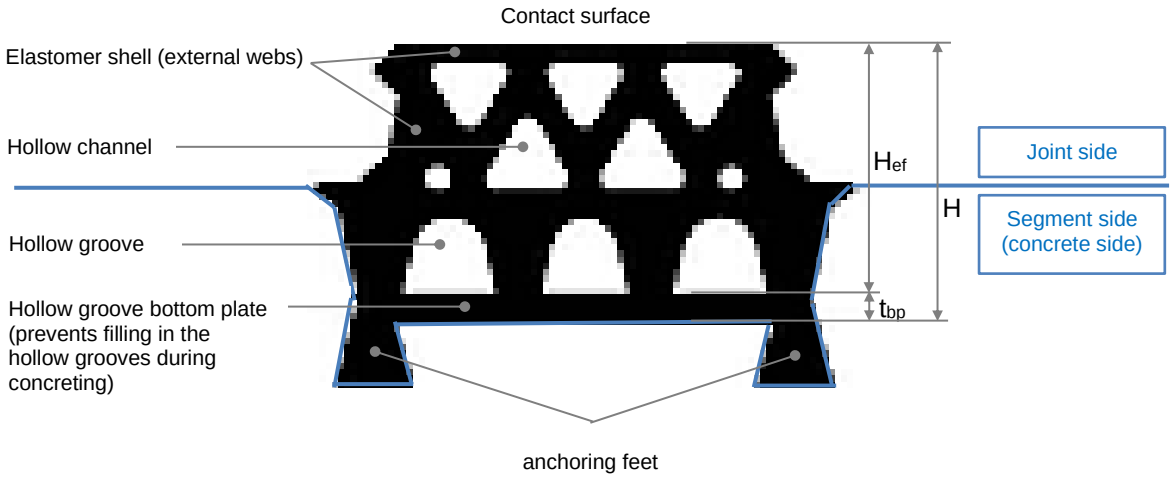


**Figure A.4:** Example of sealing gaskets which are anchored in the concrete segments (tubbings) during the production/concreting of the segments with general definitions

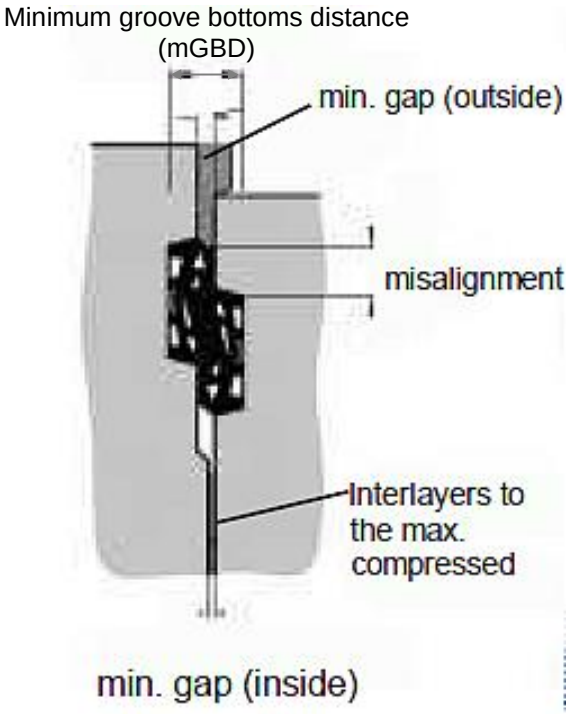


**Figure A.5** Definition of the minimum groove bottoms distance (mGBD) in the "real installation situation"