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DEUTSCHE NORM

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Thermoplastics sealing strips for sealing joints in in-situ concrete

Requirements, testing and inspection

DIN 18 541 Part 2

Fugenbänder aus thermoplastischen Kunststoffen zur Abdichtung von Fugen in Ortbeton; Anforderungen, Prüfung, Überwachung

Supersedes January 1991 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

1 Scope and field of application

This standard specifies requirements and methods of test for thermoplastics sealing strips ('sealing strips', for short) as specified in DIN 18 541 Part 1.

2 Requirements

Sealing strips are classified according to their compatibility with bitumen, those which are compatibile being denoted 'BV' and those which are incompatible, 'NB'.

Sealing strips shall comply with the requirements specified in table 1. Mean values are not to be used unless otherwise specified.

Where sealing strips come into contact with drinking water or are located in the vicinity of substances which are liable to contaminate water, requirements shall be subject to agreement.

3 Testing

3.1 Sampling and sample preparation

Prior to testing for compliance with requirements as specified in clause 2, one sample complying with DIN 53 502 shall be taken at each of five points along the central web of the sealing strip. The thickness of the samples shall not be altered. The samples shall be conditioned in DIN 50 014 – 23/50-2 standard atmosphere for a period of at least 24 hours, and shall also be tested in the same atmosphere unless otherwise specified.

3.2 Overall condition

The overall condition of the sealing strip shall be tested by inspection of its surface and the cut faces of the specimens, making use of conventional visual aids.

3.3 Dimensions

The thickness of the central web, c, shall be determined as specified in DIN 53 353, with a diameter of 10 mm for the upper platen but a pressure of 0,02 N/mm^2.

The other dimensions shall be measured using suitable devices.

3.4 Shore hardness

The Shore hardness shall be tested as specified in DIN 53 505.

Table 1: Requirements

No.	Property	Requirement	Testing to subclause
1	Overall condition	Free of blisters, tears and voids	3.2
2	Dimensions	[1])	3.3
3	Shore hardness	(67 ± 5) Shore A	3.4
4	Tensile strength	≥ 10 N/mm^2	3.5
5	Elongation under max. load	≥ 350 %[2])	3.5
6	Tear strength	≥ 12 N/mm	3.6
7	Effect of low temperatures: elongation under maximum load	≥ 200 %[2])	3.7
8	Effects of: a) laitance b) thermal ageing c) microbiologically active soil d) weathering Permissible change in mean values of: – tensile strength – elongation under maximum load – elastic modulus	 ≤ 20 % ≤ 20 %[3]) ≤ 50 %	 3.8 3.9 3.10 3.11
9	Weldability	≥ 0,6	3.12
10	Fire behaviour to DIN 4102 Part 1	B2	3.13
11	Compatibility with bitumen[4]) Permissible change in mean values of: – tensile strength – elongation under maximum load – elastic modulus	 ≤ 20 % < 20 %[5]) ≤ 50 %	3.14

[1]) As specified in DIN 18 541 Part 1.
[2]) Mean from five values.
[3]) Relative to property No. 5
[4]) For 'BV' sealing strips only.
[5]) Relative to property No. 8b.

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3.5 Tensile strength and elongation under maximum load

Tensile strength and elongation under maximum load shall be tested on No. 3 type specimens complying with DIN 53455, the rate of testing being 200 mm/min ± 10 %.

NOTE: Any cambering of the cut faces of punched specimens shall be taken into consideration when determining their width.

3.6 Tear strength

The tear strength shall be tested as specified in DIN 53507 on a type A specimen, which shall retain the thickness of the central web prior to being cut out of the sealing strip.

3.7 Effect of low temperatures

The effect of low temperatures on sealing strips shall be tested following the test of elongation under maximum load as specified in subclause 3.5, by conditioning the specimens at (−20 ± 2) °C and retesting them at the same temperature.

3.8 Effect of laitance

The effect of laitance on sealing strips shall be tested by first conditioning them for 28 days in laitance, $Ca(OH)_2$, with sediment, followed by rinsing in water and drying, immediately after which their tensile strength and elongation under maximum load shall be determined as specified in subclause 3.5 and their elastic modulus, as specified in subclause 3.14.3.2. The results obtained shall then be compared with those for untreated specimens and the percentage change as a result of conditioning in laitance shall be recorded. The dimensions of the specimens required for the tensile test shall be determined before they are conditioned.

3.9 Effect of thermal ageing

Thermal ageing of specimens shall be carried out by subjecting them to an atmospheric pressure at 70 °C over 28 days as specified in DIN 53508. The tensile strength and elongation under maximum load shall then be determined as specified in subclause 3.5 and their elastic modulus, as specified in subclause 3.14.3.2, after which the results shall be compared with those obtained using untreated specimens and the percentage change after thermal ageing determined.

3.10 Effect of microbiologically active soil

The effect of microbiologically active soil on sealing strips shall be determined by testing their resistance by completely burying them as in method D in DIN 53739. Specimens shall be conditioned for a period of 12 months after which their tensile strength and elongation under maximum load shall be determined as specified in subclause 3.5 and their elastic modulus as specified in subclause 3.14.3.2. The results obtained shall be compared with those for untreated specimens, and the percentage difference after microbiological action determined.

3.11 Effect of weathering

Weathering shall be carried out in the form of the test designated DIN 53387 − 1 − B − X, the specimens being exposed to a radiant exposure of 4500 MJ/m^2. The tensile strength and elongation under maximum load shall then be determined as specified in subclause 3.5 and the elongation under maximum load, as specified in subclause 3.14.3.2. The results obtained shall be compared with those for untreated specimens and the percentage difference as a result of weathering established.

3.12 Weldability

Specimens shall be tested for weldability by being subjected to tensile testing as specified in DIN 53455, using 10 No. 3 specimens, half of which shall have a butt weld at mid-length made with a heating wedge. The rate of testing shall be 200 mm/min ± 10 %. The mean tear strength of the welded specimens shall be divided by that of the unwelded specimens and the ratio determined.

Testing shall be carried out on welded specimens made under laboratory conditions on behalf of the manufacturer.

3.13 Fire behaviour

The fire behaviour shall be tested as specified in DIN 4102 Part 1.

3.14 Compatibility with bitumen

3.14.1 General

Compatibility with bitumen shall be tested by subjecting specimens to heat treatment and conditioning, after which their tensile strength, elongation under maximum load and their elastic modulus shall be determined.

3.14.2 Preparation of specimens

Specimens shall be prepared by cutting out sections of sealing strip as specified in subclause 3.1. These shall be not less than 170 mm long and at least 20 mm wide (ideally, 50 mm). A coating of bitumen shall be poured onto half of the sections so so that they are coated on all sides with 85/25*) bitumen at least 3 mm thick and at a temperature of (175 ± 5) °C. It shall be ensured that the bitumen is not kept at this temperature for longer than four minutes. The coated sections shall be left to cool, after which they shall be suspended in an oven with forced ventilation, where they shall remain for a period of 28 days at a temperature of (70 ± 2) °C. The untreated specimens shall be conditioned in another oven under the same conditions.

After their removal from the oven, the bitumen coating shall be carefully removed from the sections by cooling them to −20 °C and bending them to and fro, whilst in some cases it may prove more effective to remove the bitumen en bloc from the warm sections. These, together with the untreated specimens, shall be conditioned for a further seven days in DIN 50014 − 23/50-2 standard atmosphere. Five No. 3 samples conforming to DIN 53455 shall then be cut parallel to the long edge of the sections and, ideally, 20 mm from their edges. These shall be conditioned for a further 24 hours in DIN 50014 − 23/50-2 standard atmosphere.

3.14.3 Procedure

3.14.3.1 Tensile strength and elongation under maximum load

The tensile strength and elongation under maximum load shall be determined using samples conforming with subclause 3.5 which have first undergone heat treatment and been conditioned in bitumen. The change shall be determined as a percentage from the mean values calculated.

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*) According to bitumen industry analysis tables.

3.14.3.2 Elastic modulus

The elastic modulus shall be determined using specimens which have first undergone heat treatment and been conditioned in bitumen. It shall be determined from either diagrams showing the relationship between force/displacement or stress/strain diagrams as secant moduli between 1 and 2 % elongation using No. 3 samples conforming to DIN 53 457, with a rate of testing of 5 mm/min, after which the percentage change as a result of conditioning in bitumen shall be established.

4 Inspection

Inspection procedures as specified in DIN 18 200, consisting of internal control and third-party inspection shall ensure that each place of production satisfies the requirements specified in clause 2 of the present standard. Where the constituent materials making up the sealing strips vary, separate inspection measures shall be foreseen.

Table 2 lists the number and type of tests required for inspection purposes.

Table 2: Scope of internal control and third-party inspection

Property	Testing to subclause	Internal control	Third-part inspection
Overall condition	3.2	Once per day of production.	Twice yearly.
Dimensions *a* and *c*	3.3		
Shore hardness	3.4		
Tensile strength	3.5		
Elongation under maximum load	3.5		
Tear strength	3.6	–	At initial inspection.
Effect of – low temperatures	3.7		
– laitance	3.8		
– thermal ageing	3.9		
– microbiologically active soil	3.10		
– weathering	3.11		
Weldability	3.12	Once per week of production.	Twice yearly.
Fire behaviour	3.13	–	At initial inspection.
Compatability with bitumen	3.14		

Standards referred to

DIN 4102 Part 1	Fire behaviour of building materials and elements; concepts, requirements and testing
DIN 18 200	Inspection of construction materials, structural members and types of construction; general principles
DIN 18 541 Part 1	Thermoplastic joint sealing strips for sealing joints in in-situ concrete; concepts, geometry and dimensions
DIN 50 014	Artificial climates in technical applications; standard atmospheres
DIN 53 353	Testing of artificial leather and similar sheet materials; determination of thickness using mechanical devices
DIN 53 387	Artificial weathering and ageing of plastics and elastomers by exposure to filtered xenon arc radiation
DIN 53 455	Tensile testing of plastics
DIN 53 457	Determination of elastic modulus of plastics by tensile, compression and bend testing
DIN 53 505	Shore A and D hardness testing of rubber and plastics
DIN 53 507	Testing of rubber and elastomers; Determination of tear strength of rubber using trouser test piece
DIN 53 508	Accelerated ageing of rubber
DIN 53 739	Testing the effect of fungi and bacterial growth on plastics; visual check and evalution of change in mass or physical properties
ISO 4661 Part 1	Vulcanized rubber; sample preparation; physical tests

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