AR 87
Oktober 2019

Approval requirement 87

External coatings for the corrosion protection of buried or immersed pipelines and joints

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Foreword

This GASTEC QA Approval requirement has been approved by the Board of Experts product certification GASTEC QA, in which relevant parties in the field of gas related products are represented. This Board of Experts supervises the certification activities and where necessary require the GASTEC QA Approval requirement to be revised. All references to Board of Experts in this GASTEC QA Approval requirement pertain to the above mentioned Board of Experts.

This GASTEC QA Approval requirement will be used by Kiwa Nederland BV in conjunction with the GASTEC QA general requirements and the KIWA regulations for certification.

Approved by Board of Experts : 15-10-2019

Accepted by Kiwa Nederland B.V. : 28-10-2019

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Contents

1 Introduction

1.1 General

This GASTEC QA approval requirement in combination with the GASTEC QA general requirements include all relevant requirements, which are adhered by Kiwa as the basis for the issue and maintenance of a GASTEC QA certificate for external coatings for the corrosion protection of buried or immersed pipelines and joints.

This GASTEC QA Approval requirement replace the GASTEC QA Approval Requirements 87, for tapes and shrinkable materials, dated November 2012.

List of changes:

- Update to the new format for GASTEC QA approval requirements
- These approval requirements have been fully reviewed textually.
- All general requirements have been deleted and included in the GASTEC QA general requirements document
- Change of paragraphs
- Update of list of referenced documents
- Requirements for non-crystalline low-viscosity polyolefin based coatings are added to this approval requirement

The product requirements external organic coatings bases on tapes and shrinkable materials have not changed (Approval requirement 87, dd November 2012)

1.2 Scope

These approval requirements specify the requirements for external coating materials for the corrosion protection of buried or immersed steel pipelines. This approval requirements is applicable for:

- External organic coatings based on tapes and shrinkable materials according to mechanical resistance (Class A, B or C) and to the maximum continuous operating temperature of 30 °C or 50 °C.
- Non-crystalline low-viscosity polyolefin based coatings (Class 13A or 13B) and to maximum continuous operating temperature of 50°C, 70 °C or 95 °C.

2 Definitions

In this approval requirement, the following terms and definitions are applicable:

Board of Experts: The Board of Experts Gastec QA.

3 Product requirements

3.1 General for external organic coatings (tapes and shrinkable materials)

The product shall comply with the requirements specified in:

- EN 12068:1998 “Cathodic protection – External organic coatings for the corrosion protection of buried or immersed steel pipelines used in conjunction with cathodic protection – Tapes and shrinkable materials”

In addition it shall comply with the following requirements.

3.1.1 Dimensions

The manufacturer of the tape, shrinkable material shall create a listing, if applicable, of the following data:

a) Length of the tape on a roll in meters
b) Width of the tape in millimetres
c) Nominal thickness of the tape/shrinkable material

The length of the tape shall not be shorter than stated by the manufacturer.
The width shall not deviate more than plus or minus 5 mm.
The thickness of the tape shall not be less than stated by the manufacturer. In case of a multilayer structure, the manufacturer shall state the nominal thickness of each layer.

3.1.2 Saponification value

The polymeric film or reinforcement shall have a maximum saponification value of 10 mg KOH/g determined according to Annex L of EN 12068.
Coating materials shall be separated from the polymeric film or reinforcement for testing

Primers (solids), coating materials or fillers shall have a maximum saponification value of 25 mg KOH/g determined according to Annex L of EN 12068.

Tapes and shrinkable materials, of which the polymeric film or reinforcement does not meet the above mentioned requirement, are supposed to meet these approval requirements if the requirements in paragraph 3.1.3 Resistance against ageing , are met.

3.1.3 Resistance against ageing

This requirement is only applicable for tapes and shrinkable material that does not meet the requirements of the saponification value, as stated in paragraph 3.1.2.
After ageing of tape and shrinkable material in caustic soda during 100 days at 50 ºC, it is accepted that:

a) For tapes with laminate polymeric tapes and non-reinforced shrinkable material the alteration in tape strength or in burst strength and elongation at break is 25% at most;
b) For reinforced polymeric tapes and shrinkable material with reinforced polymer backing, the change in tape strength or burst strength and elongation at break is 25% at most.

When tested according to paragraph 4.1.2, determination of resistance against ageing under action of caustic soda at 50 ºC, the following requirements have to be met:
$E_{100}/E_{70} > 0,8$
and
$S_{100}/S_{70} > 0,8$

3.2 General for non-crystalline low-viscosity polyolefin based coating

The product shall comply with the requirements specified in clause 13 of:

- ISO 21809-3:2016 “Petroleum or natural gas industries – External coatings for buried or submerged pipelines used in pipeline transportation systems – Part 3: Field joint coatings”

In addition it shall comply with the following requirements.

3.2.1 Dimensions

The manufacturer of low-viscosity material shall create a listing, if applicable, of the following data:

a) Length of the tape on a roll in meters
b) Width of the tape in millimetres
c) Nominal thickness of the tape/shrinkable material

The length of the tape shall not be shorter than stated by the manufacturer.
The width shall not deviate more than plus or minus 5 mm.
The thickness of the tape shall not be less than stated by the manufacturer. In case of a multilayer structure, the manufacturer shall state the nominal thickness of each layer.

4 Performance requirements and test mothods

4.1 General for external organic coatings (tapes and shrinable materials)

The performance requirements are specified in EN 12068. There are no additional performance requirements.

4.1.2 Determination of resistance against ageing

20 test pieces according to 4.1.2.1 resp. 4.1.2.2 are aged by hanging them freely in a caustic soda solution $C_{[NaOH]}$ = 0,1 mol/l at 50ºC. After 70, resp. 100 days, in each case 10 test pieces are taken, flushed with distilled water end hung in distilled water for 24 hours. Determination of tape strength (see 4.1.2.2) and elongation at break (see 4.1.2.1) takes place after the test pieces have stayed for at least 48 hours in air (20 ± 5ºC and RH between 45 and 75%).

4.1.2.1 Testing of elongation at break (Annex A1 of EN 12068)

Determination of elongation at break of polymeric tapes and non-reinforced shrinkable materials is performed according to ISO 527-3. For testing, specimen type 5 shall be used. 10 test pieces shall be tested.

For tapes, the test pieces are in circumferentially punched out of three different rolls. For shrinkable materials, the test pieces must be circumferentially punched out of three different batches.

Measuring length and pulling speed must conform to the values given in table 1. The value for elongation at break must be related to measuring length L_0.

When testing, no break shall occur outside of measuring length L_0. It is allowed to remove the coating near the clamps

4.1.2.2 Testing of tape strength

a) **Testing of tape strength of laminate polymeric tape and non-reinforced shrinkable material**.
See A1 in Annex A of EN 12068. Testing is performed according to ISO 527-3. For testing, specimen type 5 must be used. Ten test pieces must be put to the test, prepared according to 5.1.1. Measuring length and pulling speed must conform to the values given in table 1. The value for elongation at break must be related to measuring length L_0.
When testing, no break shall occur outside of measuring length L_0. It is allowed to remove the coating near the clamps.

Test piece	Test pieces (4.1.2.1 /4.1.2.2 a)	Test strips (4.1.2.2 b)
Measuring length L_0 [mm]	25	50
Pulling speed [mm/min]	200	50

Table 1: Determination of elongation at break, resp. tape strength of tapes and shrinkable materials

b) **Testing of tape strength of reinforced polymeric tapes and shrinkable material with reinforced polymer backing.**
See A1 in Annex A of EN 12068. Testing is performed according ISO 527-3. For testing, specimen type 5 must be used. Ten test strips must be used, width 50 mm at least and length 150 mm at least. These strips are in circumferentially cut out of three different rolls and prepared according to paragraph 5.1.1. Measuring length and pulling speed must conform to the values given in table 1. When testing, it is not allowed to pull out parts of the reinforcement out of the clamps.

4.2 General for non-crystalline low-viscosity polyolefin based coating

The performance requirements are specified in ISO 21809-3, table 12. There are no additional performance requirements.

5 Marking and instructions

5.1 Marking

In addition to paragraph 4.2 of NEN-EN 12068 and table 11 of ISO 21809-3, the following information shall be permanently marked on the tapes and shrinkable materials and low-viscosity material:

- the products shall be marked with GASTEC QA word mark or logo.

5.2 Instructions

In addition to paragraph 5.2 of NEN-EN 12068 and table 14 of ISO 21809-3 this information shall be written in Dutch.

In the documentation shall be stated clearly whether the product has been tested and approved for microbiological resistance, according to NEN-EN 12068, table 2, no 1.

6 Quality system requirements

The supplier shall make a risk assessment of the product and production process according to chapter 3.1.1.1 and 3.1.2.1 of the GASTEC QA general requirements. The risk assessments shall be available to Kiwa for review.

7 Summary of tests

This chapter contains a summary of tests to be carried out during:

- The initial product assessment;
- The periodic product verification;

7.1 Test matrix for external organic coatings (tapes and shrinable materials)

Description of requirement	**Clause** NEN-EN 12068	**Test within the scope of**		
		Initial product assessment	**Product verification**	
			Verification	**Frequency**
Impact resistance	table 1, Nº 1	X	X	Once a year
Indentation resistance: - holiday detection and/or - residual thickness	table 1, Nº 2	X	X	Once a year
Specific electrical insulation resistance	table 1, Nº 3	X	X	Once a year
Cathodic disbondment resistance	table 1, Nº 4	X	X	Once a year
Peel strength layer to layer	table 1, Nº 5	X	X	Once a year
Peel strength to pipe surface	table 1, Nº 6	X	X	Once a year
Lap shear strength	table 1, Nº 7	X		
Microbiological resistance (by convention between manufacturer and user)	table 2, Nº 1	X		
Thermal aging resistance (no requirement for petrolatum tapes class A)	table 2, Nº 2	X		
Ultraviolet irradiation resistance (outer layer, class UV only)	table 2, Nº 3	X		
Low temperature flexibility (class L and class VL only)	table 2, Nº 4	X		
Low temperature unrolling test (no requirement for hot applied materials)	table 2, Nº 5	X		
Drip resistance (petrolatum tapes only)	table 2, Nº 6	X	X	Once a year
Polymeric film/reinforcement - Minimum total thickness or Mass per unit area	table 6: 4a or 4b	X		
Polymeric film/reinforcement - Nominal thickness or Mass per unit area	table 6: 5.3a or 5.3b	X		
Adhesive: - Nominal thickness or Mass per unit area	table 6: 6.2a or 6.2b	X		
Adhesive: Saponification value	table 6: 6.3	X		
Adhesive: Softening point ring and ball (if applicable)	table 6: 6.4	X		
- Tape strength or Bursting strength	table 6: 7.1a or 7.1b	X		
Modulus at 10% elongation (if applicable)	table 6:7.2	X		
Elongation at break (if applicable)	table 6:7.3	X		
Shrinkage (shrinkable material only)	table 6:7.5	X		
Additional GASTEC QA approval requirements				
Dimensions	3.1.1	X	X	Once a year
Saponification value	3.1.2	X		
Resistance against ageing	3.1.3	X		
Marking and instructions	5	X	X	Once a year

7.2 Test matrix for non-crystalline low-viscosity polyolefin based coating

Description of requirement	Clause ISO 21809-3	Test within the scope of		
		Initial product assessment	Product verification	
			Verification	Frequency
Coating identification	13.1	X	X	Once a year
Description of the coating	13.2	X		
Surface preparation	13.3	X		
Application of the coating	13.4	X		
Non-crystalline low-viscosity polyolefin compound				
Minimum thickness	Table 12	X	X	Once a year
Glass transition temperature	Table 12	X		
Crystallisation temperature	Table 12	X	X	Once a year
Holiday detection	Table 12	X	X	Once a year
Drip resistance	Table 12	X	X	Once a year
Adhesion reinforced compound	Table 12	X	X	Once a year
Adhesion compound with reinforcement	Table 12	X	X	Once a year
Lap shear resistance	Table 12	X		
Specific electrical insulation resistance	Table 12	X	X	Once a year
Complete coating				
Impact resistance	Table 12	X	X	Once a year
Indentation resistance	Table 12	X		
Cathodic disbondment	Table 12	X	X	Once a year
Outer wrap – polymeric tape				
Peel strength outer to outer	Table 12	X	X	Once a year
Peel strength plant coating	Table 12	X	X	Once a year
Peel strength outer to outer at T_{max}	Table 12	X		
Peel strength plant coating at T_{max}	Table 12	X		
Elastic modulus at Tmax	Table 12	X		
Peel strength outer to outer at T_{max} + 20°C	Table 12	X		
Peel strength plant coating at T_{max} + 20°C	Table 12	X		
Outer wrap – heat-shrinkable material				
Peel strength outer to outer	Table 12	X	X	Once a year
Peel strength plant coating	Table 12	X	X	Once a year
Peel strength outer to outer at T_{max}	Table 12	X		
Peel strength plant coating at T_{max}	Table 12	X		
Elastic modulus at Tmax	Table 12	X		
Peel strength outer to outer at T_{max} + 20°C	Table 12	X		
Additional GASTEC QA approval requirements				
Dimensions	3.2.1	X	X	Once a year
Marking and instructions	5	X	X	Once a year

8 List of referenced documents and source

8.1 Standards / normative documents

All normative references in this Approval Requirement refer to the editions of the standards as mentioned in the list below.

NEN-EN 12068: 1998	Cathodic protection – External organic coatings for the corrosion protection of buried or immersed steel pipelines used in conjunction with cathodic protection – Tapes and shrinkable materials
NEN EN ISO 527-3: 1995	Plastics. Determination of tensile properties. Part 3: Test conditions for films and sheets
ISO 21809-3:2016	Petroleum or natural gas industries – External coatings for buried or submerged pipelines used in pipeline transportation systems – Part 3: Field joint coatings