

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

The European Standard EN 12068:1998 has the status of a
British Standard

ICS 23.040.99; 25.220.60; 77.060

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English version

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

Protection cathodique — Revêtements organiques extérieurs pour la protection contre la corrosion de tubes en acier enterrés ou immergés en conjonction avec la protection cathodique — Bandes et matériaux rétractables

Kathodischer Korrosionsschutz — Organische Umhüllungen für den Korrosionsschutz von in Böden und Wässern verlegten Stahlrohrleitungen im Zusammenwirken mit kathodischem Korrosionsschutz – Bänder und schrumpfende Materialien

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European Committee for Standardization
Comité Européen de Normalisation
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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 219, Cathodic protection, the Secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by February 1999, and conflicting national standards shall be withdrawn at the latest by February 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

This European Standard gives requirements for organic coatings based on tapes or shrinkable materials for corrosion protection of buried or immersed pipelines, used in conjunction with cathodic protection.

This European Standard has been taken over from WG 6 of CEN/TC 262/SC 2, Cathodic protection, the Secretariat of which is held by DIN. There is a liaison between CEN/TC 262/SC 2/WG 6 and ECISS/TC 29/SC 4, to harmonize the standards prepared in both committees.

This is primarily a functional standard giving the requirements for the material properties necessary to ensure the function of the coating.

To ensure compatibility of the organic coatings with cathodically protected pipelines, tests of cathodic disbonding resistance at continuous operating temperature are specified. Test requirements are given for 23 °C but due to limited data available to WG 6 it is intended that values for higher temperatures will be established after five years.

Attention is drawn to the fact that degradation of the properties of a coating may occur following attack from microbiological matter. Work is to be undertaken in Europe to produce a suitable test method but this may take several years. It is considered that a burial in soil is the only satisfactory test method. The described test method is proposed for the interim period of five years.

1 Scope

This standard specifies the functional requirements and test methods for external organic coatings based on tapes or shrinkable materials to be used for corrosion protection of buried and immersed steel pipelines in conjunction with cathodic protection.

It classifies coatings by increasing mechanical resistance and operating temperatures. Coatings for special installation conditions are also considered. A comprehensive classification of coatings in relation to functional requirements is defined. Tapes and shrinkable materials which meet the requirements of these classes can belong to various types defined in this standard.

This European Standard is not applicable to special applications in off-shore and stress loads caused by frequent temperature changes.

Specifications of fillers are outside the scope of this European Standard.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

prEN 1427, *Petroleum products — Bitumen and bituminous binders — Determination of the softening point — Ring and ball method.*

EN ISO 527-3:1995, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets.*

(ISO/DIS 527-3:1995)

EN ISO 8503-2, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel — Comparator procedure.*

(ISO 8503-2:1988)

EN ISO 9000-1, *Quality management and quality assurance standards — Guidelines for selection and use.*

EN ISO 9000-2, *Quality management and quality assurance standards — Generic guidelines for the application of ISO 9001, ISO 9002 and ISO 9003.*

EN ISO 9001, *Quality systems — Model for quality assurance in design/development, production, installation and servicing.*

EN ISO 9002, *Quality systems — Model for quality assurance in production, installation and servicing.*

EN ISO 9003, *Quality systems — Model for quality assurance in final inspection and test.*

ISO/DIS 188, *Rubber, vulcanized — Accelerated ageing and heat resistance tests.*

ISO 1523, *Paints, varnishes, petroleum and related products — Determination of flashpoint — Closed cup equilibrium method.*

ISO 2808, *Paints and varnishes — Determination of film thickness.*

ISO 2811, *Paints and varnishes — Determination of density.*

ISO 3251, *Paints and varnishes — Determination of non-volatile matter of paints, varnishes and binders for paints and varnishes.*

ISO 3303:1990, *Rubber- or plastics-coated fabrics — Determination of bursting strength.*

ISO 3801, *Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area.*

ISO 4591, *Plastics — Film and sheeting — Determination of average thickness of a sample, and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness).*

ISO 4593, *Plastics — Film and sheeting — Determination of thickness by mechanical means.*

ISO 4626, *Volatile organic liquids — Determination of boiling range.*

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance.*

ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc sources.*

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (consistent rate of traverse) — Description.*

ISO 7254, *Paints and varnishes — Assessment of natural spreading rate — Brush application.*

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.*

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1 external organic coatings

3.1.1

coating

one or several layers of materials applied to the pipe in the form of tapes (spiral or “cigarette” wrapping), shrinkable materials (as delivered or constituted just prior to application) or repair materials

Coatings can consist of one or more basic types of coating materials as described in 3.2.

Primer(s) and/or filler(s) can be used in conjunction with these coating materials to improve adherence or facilitate application.

3.1.2

inner layer

coating primarily constituted to protect the pipe surface from corrosion damage

3.1.3

outer layer

coating primarily constituted to protect the inner layer from mechanical stresses

3.2 basic types of coating materials

3.2.1

petrolatum tape (cold applied)

corrosion protection tape consisting of a synthetic reinforcement coated on both sides with a semi-solid petrolatum compound mouldable at ambient temperature; it may contain an additional backing film

3.2.2

bituminous tape (hot applied)

corrosion protection tape consisting of glass or synthetic reinforcement coated on both sides with a bituminous compound.

3.2.3

polymeric tape (cold or hot applied)

corrosion protection tape consisting of a compound highly adhesive to steel and generally bonded to a flexible polymer film and may contain a synthetic reinforcement, these tapes can be subdivided into the following types:

3.2.3.1

laminate polymeric tape

corrosion protection tape consisting of a flexible polymer film, coated on one or both sides with an adhesive compound; the adhesive compound may be reinforced with synthetic fibres

3.2.3.2

reinforced polymeric tape

corrosion protection tape consisting of a synthetic reinforcement, coated on both sides with an adhesive compound and containing an additional polymer film

3.2.3.3

low strength polymeric tape

corrosion protection tape consisting only of an adhesive compound; it may contain a flexible polymer film (thickness $\leq 0,15$ mm) to avoid overstretching during application

3.2.4

shrinkable material

corrosion protection product consisting of a polymer backing capable of controlled shrinking, generally precoated on one side with an adhesive, the polymer backing can be reinforced.

Shrinkable materials are available as:

- tubular sleeves;
- wraparound sleeves with either separate or attached closure;
- tapes;
- pre-shaped materials.

3.3 complementary materials

3.3.1

primer

material applied (generally in a liquid form) as a thin film over a prepared metal surface and the adjacent pipe coating in order to ensure maximum adherence of the subsequent coating material

3.3.2

filler

mouldable material for smoothing out uneven surfaces or cavities (e.g. complicated shapes) to allow for the void-free application of tapes or shrinkable materials

NOTE Fillers will be selected by mutual agreement between manufacturer and user.

3.3.3

additional mechanical protection materials

various materials to enhance impact and indentation resistance and/or isolate movements between coated pipelines and surrounding soil

Any additional mechanical protection not completely bonded to the coating below is either perforated or electrical conductive under operating conditions to avoid screening of cathodic protection.

3.4

repair material

material used to reconstitute the coating at places where mechanical damage has occurred. It may be hot or cold applicable material; primer(s) and/or filler(s) can be applied prior to repair material if necessary

3.5 other definitions

3.5.1

maximum continuous operating temperature $T_{\max}$

maximum continuous temperature of the medium transported through the buried or immersed coated pipeline

3.5.2

factory coating (mill coating)

coating applied to pipe length in a factory or yard before delivery

4 Classification and designation

4.1 Classification

4.1.1 General

Coatings are classified according to resistance to mechanical damage, operating temperature or special installation conditions.

4.1.2 Mechanical resistance classes

4.1.2.1 General

Coatings are classified according to their mechanical characteristics measured by the following tests (where applicable):

- impact resistance;
- indentation resistance;
- specific electrical insulation resistance;
- cathodic disbondment resistance;
- peel strength layer to layer;
- peel strength to pipe surface and factory coating.

Coatings shall meet requirements for the following classes as specified in Table 1.

4.1.2.2 Class A

Coating which has a low mechanical resistance.

4.1.2.3 Class B

Coating which has a medium mechanical resistance.

4.1.2.4 Class C

Coating which has a high mechanical resistance.

Three alternative combinations of requirements are specified for cathodic disbondment resistance, peel strength layer to layer and peel strength to pipe surface and factory coating.

4.1.3 Maximum continuous operating temperature classes

4.1.3.1 General

Coatings are classified according to their maximum continuous operating temperature specified by the following tests (where applicable):

- indentation resistance;
- cathodic disbondment resistance;
- peel strength layer to layer;
- peel strength to pipe surface and factory coating;
- lap shear strength;
- thermal ageing resistance.

Coatings shall meet the requirements for the maximum continuous operating temperature classes as specified in Tables 1 and 2.

4.1.3.2 Class 30

In the absence of any specific indication, coatings shall be considered suitable for use at maximum continuous operating temperature $T_{\max}$ up to 30 °C.

4.1.3.3 Class 50

Coatings in this class shall be suitable for use at maximum continuous operating temperature $T_{\max} = 50$ °C.

4.1.3.4 Class HT

Coatings in this class shall be suitable for use at maximum continuous operating temperature $T_{\max} > 50$ °C in increments of 10 °C. This temperature shall be stated in brackets.

4.1.4 Classes for special application conditions

4.1.4.1 Class L/Class VL

4.1.4.1.1 General

For these classes of coatings it shall be possible to handle products and the coated pipe at temperatures below –5 °C. They shall meet the requirements specified in Table 2.

4.1.4.1.2 Class L

For low temperatures between –20 °C and –5 °C.

4.1.4.1.3 Class VL

For very low temperatures lower than –20 °C.

In this case, the minimum handling and laying temperature shall be agreed between user and manufacturer. This temperature shall be stated in brackets.

4.1.4.2 Class UV

Coatings in this class shall be suitable for storage for prolonged periods while exposed to sunlight and shall comply with the resistance to ultraviolet irradiation required in Table 2.

4.2 Designation

Coatings shall be designated as follows:

EN 12068 — Mechanical resistance class — Maximum continuous operating temperature class — Class for special application conditions (if applicable).

EXAMPLE 1

Designation of a coating of medium mechanical resistance (class B) for temperatures up to 30 °C (class 30):

coating EN 12068-B 30.

EXAMPLE 2

Designation of a coating of high mechanical resistance (class C) which is suitable for use up to 50 °C (class 50) and for handling and laying at low temperatures between -20 °C and -5 °C (class L):

coating EN 12068-C 50 L.

EXAMPLE 3

Designation of a coating of high mechanical resistance (class C) which is suitable for use up to 60 °C (class HT) with proven ultraviolet irradiation resistance (class UV):

coating EN 12068-C HT 60 UV.

5 Requirements

5.1 Requirements for coatings

Coatings shall meet the requirements for the particular class as specified in Tables 1 and 2.

Table 1 — Requirements for coatings

No.	Property	Operating temperature class	Unit	Mechanical resistance classes					Test method
				A	B	C ¹⁾			
1	Impact resistance at 23 °C	30/50/HT	J	≥ 4	≥ 8	≥ 15	≥ 15	≥ 15	Annex H
2	Indentation resistance pressure (test condition) at 23 °C	30/—/—	N/mm ²	0,1	1,0	10,0	10,0	10,0	Annex G
	at T _{max}	—/50/HT	N/mm ²	0,1	1,0	10,0	10,0	10,0	
	Holiday detection or or residual thickness	— mm	pass ≥ 0,6	pass ≥ 0,6	pass ≥ 0,6	pass ≥ 0,6	pass ≥ 0,6	pass ≥ 0,6	
3	Specific electrical insulation resistance	30/50/HT							Annex J
	R _{s100} R _{s100} /R _{s70} ²⁾		Ω·m ² —	≥ 10 ⁶ ≥ 0,8	≥ 10 ⁸ ≥ 0,8	≥ 10 ⁸ ≥ 0,8	≥ 10 ⁸ ≥ 0,8	≥ 10 ⁸ ≥ 0,8	
4	Cathodic disbondment resistance								Annex K
	at 23 °C at T _{max}	30/50/HT —/50/HT	mm mm	≤ 20	≤ 20	≤ 10 3)	≤ 15	≤ 20	
5	Peel strength ^{4) 5)} layer to layer — inner to inner + outer to inner at 23 °C at T _{max} — outer to outer at 23 °C at T _{max}		N/mm						Annex B
		30/50/HT —/50/HT 30/50/HT —/50/HT		≥ 0,8 ≥ 0,2 ≥ 0,2 ≥ 0,2	≥ 0,8 ≥ 0,2 ≥ 0,2 ≥ 0,2	≥ 1,0 ≥ 0,2 ≥ 0,2 ≥ 0,2	≥ 1,5 ≥ 0,2 ≥ 0,2 ≥ 0,2	≥ 1,5 ≥ 0,2 ≥ 0,2 ≥ 0,2	
6	Peel strength ^{6) 7)} to pipe surface		N/mm						Annex C
	at 23 °C	30/50/HTE		≥ 0,4	≥ 0,4	≥ 0,5	≥ 0,75	≥ 1,0	
	at T _{max}	—/50/HTE		≥ 0,04	≥ 0,04	≥ 0,05	≥ 0,075	≥ 0,1	
	to factory coating	30/50/HTE		≥ 0,2	≥ 0,2	≥ 0,4	≥ 0,4	≥ 0,4	
	at T _{max}	—/50/HTE		≥ 0,02	≥ 0,02	≥ 0,04	≥ 0,04	≥ 0,04	
7	Lap shear strength ⁴⁾		N/mm ²						Annex D
	at 23 °C	30/—/—		≥ 0,05	≥ 0,05	≥ 0,05	≥ 0,05	≥ 0,05	
	at T _{max}	—/50/HTE		≥ 0,05	≥ 0,05	≥ 0,05	≥ 0,05	≥ 0,05	

¹⁾ See 4.1.2.4: coatings shall meet all requirements in one column.

²⁾ If the specific electrical insulation resistance after 70 days is less than a factor 10 greater than the specified value for 100 days.

³⁾ By agreement between manufacturer and user.

⁴⁾ No requirement for petrolatum tapes in class A.

⁵⁾ No requirement for bituminous tapes in class A and class B.

⁶⁾ If the result for bituminous tapes or reinforced polymeric tapes is less than 0,4 N/mm, residual thickness of bituminous compound or of adhesive compound on the pipe surface or factory coating shall be E 0,25 mm.

⁷⁾ Petrolatum tapes shall be capable of adhering and remain attached to all clean metal surfaces and shall leave a film of compound on the metal when peeled off at an angle of 180°, 30 min after application.

Table 2 — Requirements for coatings

No.	Property	Classes	Requirements	Test method
1	Microbiological resistance	all classes	by convention ¹⁾	Annex M
2	Thermal ageing resistance ^{2) 3)} Ratio of — tape strength or — bursting strength — elongation at break — peel strength layer to layer — peel strength to pipe surface	all classes ^{2) 3)}	$1,25 \geq S_{100}/S_0 \geq 0,75$ $S_{100}/S_{70} \geq 0,8$ $1,25 \geq B_{100}/B_0 \geq 0,75$ $B_{100}/B_{70} \geq 0,8$ $1,25 \geq E_{100}/E_{70} \geq 0,75$ $E_{100}/E_{70} \geq 0,8$ $P_{100}/P_T \geq 0,75$ $P_{100}/P_{70} \geq 0,8$ $A_{100}/A_T \geq 0,75$ $A_{100}/A_{70} \geq 0,8$	Annex E
3	Ultraviolet irradiation resistance Ratio of — elongation break — tape strength or — bursting strength	class UV only	$1,25 \geq E_X/E_0 \geq 0,75$ $1,25 \geq S_X/S_0 \geq 0,75$ $1,25 \geq B_X/B_0 \geq 0,75$	Annex F
4	Low temperature flexibility at -20°C at lower than -20°C (agreed temperature)	class L class VL	no separation, tears or cracks	Annex N
5	Low temperature unrolling test at -5°C /ambient temperature ⁴⁾ at -20°C at lower than -20°C (agreed temperature)	all classes ⁴⁾ class L class VL	no separation, tears or cracks	Annex P
6	Drip resistance of petrolatum tapes	all classes	no dripping of components	Annex Q
¹⁾ By convention between manufacturer and user. ²⁾ No requirement for petrolatum tapes in class A. ³⁾ No requirement for bituminous tapes in class A and class B. ⁴⁾ -5°C or minimum ambient temperature, as given by the manufacturer, during product handling and laying of the pipeline. No requirement for hot applied materials described in 3.2.2, 3.2.3 and 3.2.4.				