SLOVENSKI STANDARD
SIST EN 10288:2003

01-april-2003

Jeklene cevi in fitingi za cevovode v zemlji in pod vodo - Zunanja dvoplastna prevleka iz polietilena, izdelana z iztiskovanjem

Steel tubes and fittings for onshore and offshore pipelines - External two layer extruded polyethylene based coatings

Stahlrohre und -formstücke für erd- und wasserverlegte Rohrleitungen - Im Zweischichtverfahren extrudierte Polyethylenumhüllungen

Tubes et raccords en acier pour canalisations enterrées et immergées - Revetements externes double couche a base de polyéthylene extrudé

Ta slovenski standard je istoveten z: EN 10288:2002

ICS:

25.220.60	Organske prevleke	Organic coatings
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Steel tubes and fittings for onshore and offshore pipelines - External two layer extruded polyethylene based coatings

Tubes et raccords en acier pour canalisations enterrées et immergées - Revêtements externes double couche à base de polyéthylène extrudé

Stahlrohre- und Formstücke für erd- und wasserverlegte Rohrleitungen - Im Zweischicht-Verfahren extrudierte Polyethylenbeschichtungen

This European Standard was approved by CEN on 26 December 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document EN 10288:2002 has been prepared by Technical Committee ECISS/TC 29 "Steel tubes and fittings for steel tubes", the secretariat of which is held by UNI.

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 October 2002, and conflicting national standards shall be withdrawn at the latest by October 2002.

During the 6 months enquiry, it appeared that two tests were omitted:

— long term performance;

— stress cracking.

After discussions, the conclusions were that there was insufficient data for standardization of test conditions and required properties.

ECISS/TC 29/SC 4 agreed to leave the standards as they are and to create an Ad Hoc Group to study these problems in order to be able to introduce these tests in the 5 years revision.

The annexes A, B, C, D, E, F, G, H, J and K are normative.

The annex L is informative.

This standard includes a Bibliography.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard defines the application of factory applied external two layer extruded polyethylene based coatings for the corrosion protection of tubes and pipeline components.

External extruded polyethylene coating can be used for the protection of buried or submerged tubes service at temperatures up to + 60 °C for type 1 and + 30 °C for type 2.

The coatings in this standard can be applied to longitudinally or spirally welded and to seamless steel tubes and components used for the construction of pipelines for conveying liquids or gases.

Tubes coated with this type of coating may be further protected by means of cathodic protection.

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 amendments or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

prEN 10224, *Steel tubes and steel fittings for the conveyance of aqueous liquids including water for human consumption - Technical delivery conditions.*

ISO 527-2:1993, *Plastics - Determination of tensile properties – Part 2 : Test conditions for moulding and extrusion plastics.*

ISO 1133, *Plastics - Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics.*

ISO 1183, *Plastics - Methods for determining the density and relative density of non-cellular plastics.*

ISO 4287, *Geometrical Product Specification (GPS) – Surface texture : Profile method – Terms, definitions and surface texture parameters.*

ISO 4892-2:1994, *Plastics - Methods of exposure to laboratory light sources – Part 2 : Xenon-arc sources.*

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.*

ISO 11420, *Method for the assessment of the degree of carbon black dispersion in polyolefin pipes, fittings and compounds.*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1.1
product manufacturer
supplier of the coating material in a condition suitable for application to the product to coat

3.1.2
coater
person responsible for applying the coating material to the components to coat in accordance with the provisions of this European Standard or the special requirements given in the tender specification and in the order

3.1.3
purchaser
company which buys the coated products

3.2 Symbols

R_z roughness parameter (the average roughness from five successive evaluation areas measured according to ISO 4287);

R_s specific electrical insulation resistance, expressed in ohms.square metres (Ω·m²);

k correction factor.

4 Classification of coatings

The coating shall consist of two layers: an adhesive and an extruded polyethylene outer sheath. The type 1 adhesive can either be applied as a powder or by extrusion, the type 2 adhesive is applied by flood coating.

5 Information to be supplied by the purchaser

5.1 Mandatory

The purchaser shall state in his enquiry and order the following minimum information:

— tubes and components coated in accordance with this European Standard shall be designated by reference to this standard followed by the thickness class of the coating, the type and the category for type 1. If applicable, the reference to the standard for the tube to which the coating is applied shall be added to this designation;

EXAMPLE : 5 000 m of tube - EN 10224 of 406, 4-4, 0

external coating EN 10288 Class 1, Type 1, category A;

— maximum number and dimensions of repairs;

— maximum service temperature.

5.2 Options to be indicated by the purchaser

— definition of surface preparation (see Table 8);

— cut back at the ends (see Table 8);

— electrical insulation resistance (see Table 8);

— resistance to ultraviolet irradiation (see Table 8);

— thermal stability (see Table 8);

— cathodic disbondment (see Table 8);

— flexibility (see Table 8);

— scheme of procedure qualification;

— type of inspection document required, if different to the one of clause 9;

— colour of the top coat.

6 Documents

See 9.1.

7 Application of the coating

7.1 Surface preparation

Two kinds of surface preparation can be applied according to the type of coating.

7.1.1 Type 1

7.1.1.1 The tube and components shall be abrasive blast cleaned. The degree of cleanliness shall be Sa 2 1/2 in accordance with ISO 8501-1.

7.1.1.2 Prior to abrasive blast cleaning, the steel surface shall be dry and free from contamination (oil, grease, temporary corrosion protection, etc.) and surface defects (slivers, laminations, etc.) detrimental to the surface preparation or to the adhesion of the coating.

7.1.1.3 After blast cleaning, the surface of the tube shall be inspected. All slivers, laminations, weld spatter and other surface imperfections made visible by the blast cleaning process shall be removed.

After removal of these defects, the residual thickness of tube and components shall satisfy the minimum tolerance requirements specified by the relevant standard. All treated areas greater than 10 cm^2 shall be prepared to provide a profile to satisfy the provisions of 7.1.

7.1.1.4 Tube and components shall be maintained at least 3 °C above the dew point temperature prior to coating.

7.1.1.5 Contaminants (e.g. residual abrasive dust) shall be removed prior to coating.

Chemical treatment of the steel may be used in addition to abrasive blast cleaning, by agreement.

7.1.1.6 At the time of application, the temperature range at the surface of the tube to be coated shall be determined in agreement with the manufacturers of the products.

The temperature holding time of the tube shall not result in oxidation of its surface, detrimental to the good quality and adhesion of the coating.

The temperature of the tube shall be monitored using suitable means in order to make sure that the application conditions are fully satisfied.

7.1.2 Type 2

This method may only be used for type 2 coatings. Where a type 2 system is specified, a chemical cleaning and passivation process may be used as an alternative to blast cleaning.

7.2 Composition of the coating

The coating shall consist of two layers and shall be applied in the factory in accordance with the established procedure.

The constituent material data sheets shall contain the items required in Table 1.

7.2.1 Layer 1

7.2.1.1 Type 1

The layer shall be formed by a polymer intended to provide adhesion between the steel substrate and layer 2. Its thickness shall be uniform and its minimum value shall make it possible to satisfy the requirements of clause 8.

7.2.1.2 Type 2

The layer shall be formed by a mastic adhesive characterized by its ability to flow at relatively low ambient temperatures and which provides adhesion between the steel substrate and layer 2. Its thickness shall be uniform and its minimum value shall make it possible to satisfy the requirements of clause 8.

7.2.2 Layer 2

The layer shall be formed by the polyethylene outer sheath. The thickness shall be uniform with a minimum sufficient to meet the total system thickness requirements given in Table 2.

Pigments and additives may be added to the basic polyethylene, provided that all the required properties of the coating are obtained. The pigments shall be dispersed uniformly.

Unless otherwise agreed the coater can add pigments and additives to the basic polyethylene. The required properties shall be certified by a documented quality programme. The following tests shall be undertaken as a minimum:

— quantitative analysis of the raw-material components immediately before coating;

— determination of dispersion of pigments and additives in accordance with ISO 11420.

8 Requirements of the applied coating

8.1 General

The required properties of the applied coatings are given below:

— appearance and continuity;

— thickness of the coating system;

— cut back at the ends;

— holiday detection;

— impact resistance;

— peel force;

— indentation resistance;

— electrical insulation resistance;

— elongation at break;

— resistance to ultraviolet irradiation;

— thermal stability;

— cathodic disbondment;

— flexibility.

Other properties can be specified at the time of enquiry and order.

A summary of the required properties is given in Table 7.

8.2 Appearance and continuity

The appearance and continuity of the coating system shall be inspected visually over the total length of all tubes.

The coating shall be of uniform colour, have a smooth appearance and be free of holidays, defects and laminations detrimental to the quality of the coating.

8.3 Thickness of the coating system

Coating thickness shall be measured in accordance with the method defined in annex A.

Unless otherwise agreed by the purchaser, the minimum thickness of the coating system at any point shall correspond to the value given in Table 2 depending on the class (1, 2, 3) specified.

Table 1 - Content of data sheets and certificates

Items	Standard test reference	Layer 1	Layer 2
Date of issue		+ o	+ o
Name of manufacturer		+ o	+ o
Name and type of product		+ o	+ o
Factory of origin		o	o
Batch or production lot number		o	o
Shelf life		+	
Physical state of the delivered product		+	+
Packaging		+	+
Storage conditions		+	+
Sieve analysis		+ o (powder only)	
Density	ISO 1183 adhesive and PE	+ o	+ o
Melt index	ISO 1133	+ o	+ o
Recommended processing temperature		+	+
Content of pigment	ISO 11420		+ o
Dispersion of pigment	ISO 11420		o
Maximum service temperature		+	+
Elongation at break	ISO 527-2	+	+
Maximum moisture content		+	+
Softening point	ISO 306	+	+

NOTE 1 + Technical data sheet

NOTE 2 o Test certificate

Table 2 - Minimum thickness of the coating system

Tube diameter *D* mm	**Thickness** [a] mm		
	Classes		
	1	**2**	**3**
$D \leq 114{,}3$	1,5	1,8	2,5
$114{,}3 < D \leq 273$	1,8	2,0	2,7
$273 < D \leq 508$	2,0	2,2	2,9
$508 < D \leq 762$	2,2	2,5	3,2
$762 < D$	2,5	3,0	3,7

[a] The thicknesses given in this Table can be reduced by 10 % for submerged arc welded tubes, at the weld reinforcement.

8.4 Cut back at the ends

The length of the cut back shall be (150 ± 20) mm and the coating shall be bevelled at the cut back forming a bevel angle of ≤ 30° unless otherwise specified by the purchaser.

When removing the coating, the surface of the tube shall not be damaged.

8.5 Holiday detection

Holiday detection shall be carried out in accordance with the method defined in annex B.

The coating shall be free from holidays.

8.6 Impact resistance

The minimum impact energy, in joules, shall be determined in accordance with the method defined in annex C and shall correspond to 5 J × *k* for each millimetre of nominal coating thickness. The values of *k* are given in Table 3.

Table 3 - Correction factor

Diameter mm	***k***
$D > 219{,}1$	1,00
$76{,}1 < D \leq 219{,}1$	0,85
$D \leq 76{,}1$	0,70

8.7 Peel force

8.7.1 Type 1

The level of adhesion is dependent on the test temperature.

Peel force shall be determined in accordance with annex D. The average and the minimum average values are defined in annex D.

Other test method can be used after agreement between the purchaser and coater.

The minimum requirements for the peel force shall be as given in Table 4, according to the category specified.

Table 4 - Minimum peel force

Category	Force (in N/10 mm) at room temperature (23 ± 2) °C		Force (in N/10 mm) at (60 ± 2) °C	
	Minimum average	Average	Minimum average	Average
A	20	30	5	10
B	30	40	5	10
C	60	80	15	20
NOTE 1 If the top coat cannot be peeled from the tube, the measured tensile force at yield should be recorded and the force of adhesion rated as greater than the tensile force at yield. NOTE 2 Higher values may be agreed.				

8.7.2 Type 2

Where the coating system is classified as type 2, the resistance to peeling shall be determined in accordance with the method defined in D.2.

The peeling resistance shall be such that the measured peel rate falls below the curve in D.2 - Figure D.5.

8.8 Indentation resistance

Indentation resistance shall be assessed by testing in accordance with the method defined in annex E.

The indentation shall not be more than the values given in Table 5.

Table 5 - Indentation

Type	Indentation at (23 ± 2) °C mm	Indentation at (60 ± 2) °C mm	Indentation at (30 ± 2) °C mm
Type 1	0,3	0,5	-
Type 2	0,3	-	0,3

8.9 Electrical insulation resistance

The specific electrical resistance of the coating, R_S, shall be measured in accordance with the method defined in annex F, after being immersed for 100 days. The coating shall satisfy the following requirements:

1) the R_S value after 100 days shall be equal or greater than 10^8 Ω·m² ;

2) when the R_S value after 70 days remains only a power of ten above the permissible 100 days value then the ratio:

$$\alpha = \frac{R_s(100\text{ days})}{R_s(70\text{ days})} \geq 0{,}8$$

8.10 Elongation at break

This test shall be carried out in accordance with the method defined in annex G, at (23 ± 2) °C. The value of the elongation at break shall be equal or greater than the value given in Table 6.

Table 6 - Elongation at break

Minimum %
350

8.11 Resistance to ultraviolet irradiation

This test shall be carried out in accordance with the method defined in H.1. The value of elongation, after exposure to radiation from a xenon lamp, shall be greater than 50 % of the original value measured from the same unexposed coating.

Alternatively, the melt flow index after exposure to radiation from a xenon lamp shall not vary by more than ± 35 % relative to the melt flow index of the unexposed coating.

8.12 Thermal stability

This test shall be carried out in accordance with the method defined in H.2. The melt flow rate after exposure to heat shall not vary by more than ± 35 % relative to the melt flow rate of the unexposed coating.