SLOVENSKI STANDARD
SIST EN 1989:2002

01-junij-2002

Plastomerni cevni sistemi - Spoji za v zemljo položene kanalizacijske sisteme, ki delujejo po težnostnem principu - Preskusna metoda za ugotavljanje dolgotrajnih tesnilnih lastnosti spojev s plastomernimi elastomernimi tesnili pri oceni tesnilnega tlaka

Thermoplastics piping systems - Joints for buried non-pressure sewerage applications - Test method for long-term sealing performance of joints with thermoplastic elastomer (TPE) seals by estimating the sealing pressure

Rohrleitungen aus thermoplastischen Kunststoffen - Verbindungen für erdverlegte drucklose Kanal-Anwendungen - Prüfverfahren für das Langzeitverhalten von Verbindungen mit thermoplastischen Elastomer (TPE)-Dichtungen durch Abschätzen des Abdichtdruckes

Systemes de canalisations en plastiques - Jonctions pour canalisations d'assainissement sans pression et enterrées - Méthode d'essai pour la performance a long terme des assemblages avec bague d'étanchéité en élastomere thermoplastique (TPE) par l'estimation de la pression exercée par le joint

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23.040.80	Tesnila za cevne zveze	Seals for pipe and hose assemblies

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EUROPEAN STANDARD
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English version

Thermoplastics piping systems - Joints for buried non-pressure sewage applications - Test method for long-term sealing performance of joints with thermoplastic elastomer (TPE) seals by estimating the sealing pressure

Systèmes de canalisations en plastiques - Jonctions pour canalisations d'assainissement sans pression et enterrées - Méthode d'essai de performance à long terme des assemblages avec bague d'étanchéité en élastomère thermoplastique (TPE) par l'estimation de la pression exercée par le joint

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This European Standard was approved by CEN on 9 December 1999.

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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 Central Secretariat 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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 155 "Plastics piping systems and ducting systems", the secretariat of which is held by NNI.

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 August 2000, and conflicting national standards shall be withdrawn at the latest by August 2000.

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.

This standard is one of a series of standards on test methods which support System Standards for plastics piping systems and ducting systems.

Annex A of this European Standard is informative.

1 Scope

This standard specifies a method for determining the long-term sealing performance of joints with thermoplastic elastomers (TPE) seals for plastics piping systems for buried non-pressure sewerage.

This method, which estimates the sealing pressure for the seal, is intended to be used only for joints with sealing rings located in a socket.

2 Normative references

This 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 Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 471, *Rubber — Temperatures, humidities and times for conditioning and testing*

3 Principle

The radial specific sealing force, F_S, and sealing width, S_W, of a TPE seal are measured with the seal located in an applicable socket. Both these parameters are measured at increasing time intervals within a period of time of at least 2200 h. The regression lines for F_S and S_W are used to calculate the sealing pressure, P_S, at 90 days. The extrapolated regression lines for F_S and S_W are used to calculate the estimated value of P_S at 100 years (see clause 8).

NOTE It is assumed that the following test parameters are set by the standard making reference to this standard:

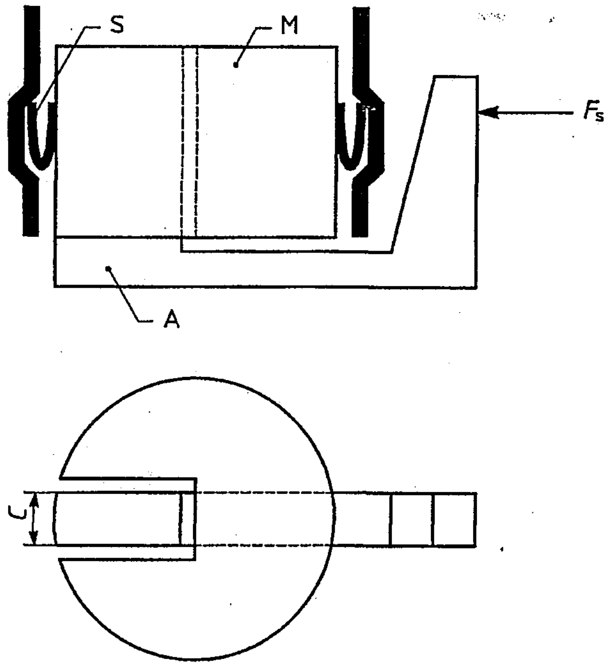
a) the number of sample pairs and the sampling procedure (see 5.1 and 5.3);

b) if applicable, any change to the limit(s) between the time of production of the seal and the start up of testing (see 6.1).

4 Apparatus

4.1 A device, capable of measuring the specific radial sealing force exerted by a seal onto a mandrel. The apparatus consists of a steel cylinder, the mandrel, of which a segment can compress the seal in the radial direction (see 7.2.2). The surface width, C, of the segment (see Figure 1) shall have a value lying between 5 % and 10 % of the circumference of the mandrel. The segment is linked to an instrument capable of measuring the compression forces with an accuracy to within ± 5 % of the measured value, and with a means of measuring displacements greater than 10 micrometres (10 µm) with an accuracy of ± 1 µm.

A typical arrangement of the mandrel and segment is shown in Figure 1. The mandrel shall have the minimum specified outside diameter of the pipe or spigot (tolerance: $^{+0,01}_{0}$ mm on the diameter) for which the socket is intended.



Key:
F_S: radial force connected to a force measuring device
A: segment
M: mandrel
S: seal
C: surface width of the segment

Figure 1 — Typical arrangement of mandrel and segment

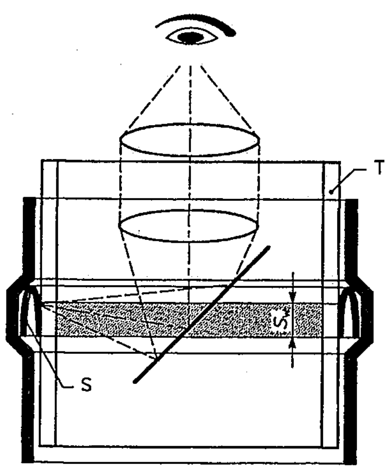
4.2 Sealing width measuring device, capable of measuring the sealing width, to an accuracy to within ± 0,1 mm. The sealing width comprises the width of the circular contact area formed between the sealing ring and the pipe or fitting spigot, as shown in Figure 2. This shall include the following:

a) a transparent pipe spigot having an outside diameter equal to the minimum specified outside diameter (tolerance: $^{+0,2}_{0}$ mm on the diameter) of the pipe for which the socket with the sealing ring is designed, and having a length of at least the depth of the socket;

b) an optical device with a light source for viewing and measuring the sealing width.

NOTE 1 A typical apparatus for measuring sealing width is shown in Figure 2. This shows a mirror placed in the pipe socket at an angle of (45 ± 0,5)° to the axial direction of the socket such that the image of the seal in contact with the spigot is reflected into a microscope with a graduated scale.

NOTE 2 If the seal has multiple lips, each individual lip will produce a circular contact area. The total width of the circular contact areas shall be measured.



Key:
S: seal
T: transparent spigot
S_W: sealing width

Figure 2 — Typical apparatus for measurement of the sealing width

5 Test pieces

5.1 Sampling

Unless otherwise specified [see clause 3, note a)], samples shall be taken at random.

5.2 Preparation

At least one pair of test pieces is needed, of which one test piece shall be used for measuring the radial specific sealing force and the other test piece for measuring the sealing width. Each test piece shall consist of at least a complete socket cut from a pipe or a fitting, together with its TPE seal.

5.3 Number

Unless otherwise specified [see clause 3, note a)] one pair of test pieces shall be used.

6 Conditioning

6.1 Time limits

Unless otherwise specified in the referring standard, the time between production of the seal and start up of the test shall be between 24 h and 90 days.

6.2 Test temperature

Tests shall be carried out at (23 ± 2) °C in accordance with ISO 471.

7 Procedure

7.1 General

Carry out the following procedures using the following schedule.

Carry out the first measurements of both the radial specific sealing force (see 7.2) and the sealing width (see 7.3) between 30 min and 60 min after assembling the test pieces with the apparatus.

To enable extrapolation, measure and record the radial specific sealing force and the sealing width at periods which include approximately 1 h, 4 h, 24 h, 168 h, 336 h, 504 h, 600 h, 696 h, 840 h, 1008 h, 1200 h, 1400 h, 1680 h, 2000 h, 2200 h, after the first measurement.

Where it is not possible to make a measurement at the appropriate times between 500 h and 1008 h, it is permitted to deviate by ± 24 h, providing the actual measurement time is recorded and used for the regression calculations.

7.2 Procedure for determining the radial specific sealing force

7.2.1 Assemble a socket, including the TPE seal, with the mandrel (see Figure 1). Ensure that the outer surface of the segment is flush by feel with the outer surface of the mandrel. To ease assembly, dry lubricants (e.g. talc) or distilled water may be used to lubricate the seal surface.

7.2.2 Measure the radial force, F, necessary to move the segment outward over a distance of not more than 0,01 % of the nominal diameter, with a minimum of 10 µm. The accuracy of the displacement shall be ± 10 % of the displacement. Calculate the corresponding force in newtons per millimetre of the circumference of the mandrel, i.e.: F/C (see Figure 1) and record the result as the radial specific sealing force, F_S, in newtons per millimetre of the spigot. The segment should be moved outward over the same distance for all subsequent readings.

7.2.3 Bring the segment back into its original position such that its outer surface is again flush with the outer surface of the mandrel, as in 7.2.1. The socket and mandrel are kept in this position at (23 ± 2) °C until the next measurement, see 7.2.2.

7.3 Procedure for determining the sealing width

7.3.1 Assemble a socket, including the TPE seal, with the transparent pipe (see 4.2). To reduce the efforts during assembly, dry lubricants (e.g. talc) or distilled water may be used to lubricate the seal surface.

7.3.2 Measure the average width (see Figure 2) of the circular area formed between the seal and the transparent pipe, with an accuracy of ± 0,1 mm. Record the result as the sealing width S_W.

If the apparatus described in Figure 2 is used, bring the assembled test piece into view (e.g. under a microscope). Use sufficient light to illuminate the test piece.

8 Calculation and expression of the results

Using the values of respectively radial specific sealing force F_S and sealing width S_W obtained at each period in accordance with 7.1, determine the best fit straight lines on a logarithmic time scale, by using least square analysis. The correlation coefficient shall be minimum 0,990.

Calculate the sealing pressure P_S at 90 days, using the following equation:

$$P_S = 10 F_S / S_W$$

where:

P_S is the sealing pressure, in bars (1 bar = 10^5 N/m^2);

F_S is the radial specific sealing force, in newtons per millimetre circumference of the spigot;

S_W is the sealing width, in millimetres.

The values for F_S and S_W shall be those derived from the regression lines for 90 days.

Similarly, to calculate the sealing pressure P_S at 100 years, the values for F_S and S_W shall be those derived from the extrapolation of the regression lines.

If more than one sample pair is used, an average of the extrapolated sealing pressures must be calculated.

NOTE Extrapolation of test results for an estimate of the long-term sealing pressure is not an unequivocal indication of the performance of the seal over the years.

9 Continuation of the test

When even the use of the last 10 data points does not lead to a correlation coefficient higher than 0,990 in the regression analysis, continue the test by making additional measurement at 2818 h, 3400 h, 4000 h, 8000 h, 12000 h, or until the correlation coefficient exceeds 0,990 using the last 10 measurements.

10 Test report

The test report shall include the following information:

a) a reference to this standard and the referring standard;

b) the identity of the components forming the test piece (fittings or pipes, type of seal, seal ring material);

c) at each test period the radial specific sealing force, F_S, in newtons per millimetre of the circumference of the pipe spigot;

d) at each test period the sealing width, S_w, in millimetres;

e) the sealing pressure at 90 days and at 100 years, in bars;

f) any factor which may have affected the results, such as any incident or any operating detail not specified in this standard;

g) the date of the test.

11 Storage

See Annex A.