SLOVENSKI STANDARD
SIST-TP CEN/TR 15729:2010

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Cevni sistemi iz polimernih materialov - S steklenimi vlakni ojačeni duromerni materiali (GRP), ki temeljijo na nenasičeni poliestrski smoli (UP) - Poročilo o določanju srednje vrednosti abrazijske obrabe po definiranem številu abrazijskih ciklov

Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) - Report on the determination of mean abrasion after a defined number of test cycles

Kunststoff-Rohrleitungssysteme - Glasfaserverstärkte duroplastische Kunststoffe (GFK) auf der Grundlage ungesättigten Polyesterharzes (UP) - Bericht über die Bestimmung des mittleren Abriebs nach einer festgelegten Anzahl von Durchläufen

Systèmes de canalisations en plastique - Plastiques thermodurcissables renforcés par du verre (PRV) à base de résine de polyester non saturé (UP) - Rapport sur la détermination de l'abrasion moyenne après un nombre défini de cycles d'essai

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TECHNICAL REPORT

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Foreword

This document (CEN/TR 15729:2010) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

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Introduction

The procedure described in this Technical Report is intended to be used as a means of assessing and comparing the performance of GRP pipes after being subject to a specified regime of abrasion. The main difference between this regime and other similar procedures is the use of a graded man-made abrasive, Corundum.

The specification of the abrasive, ISO 8486-1, specifies the designation and determination of grain size distribution of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasives and for general industrial applications. This document, which is indispensable for the application of the proposal, is an ISO standard, which is recognised by the abrasive manufacturing industry throughout the world. The use of corundum addresses some of the vital issues for abrasion testing, namely particle shape or structure by being a man-made material with consistent chemical formulation and fracture characteristics.

The abrasive to be used, i.e. corundum, a crystalline oxide of aluminium that has crystallized in a Trigonal system, may not be similar to some materials found in sewer piping systems but is used because of its availability world-wide and thereby ensures the consistency of the abrasive used in the test. The test is not intended to simulate any particular conditions in piping systems for which pipes conforming to EN 14364 are intended to be used but is merely intended to be a reproducible test procedure for use in a testing laboratory that can be used to provide data for the assessment of abrasion resistance.

GRP pipes complying with EN 14364 have not been found to be susceptible to abrasion in typical sewerage or drainage applications. In the small number of situations where abrasion has been found to be a problem the conditions on site are found to be unusual and also difficult to reproduce in a laboratory and this leads to major difficulties in correlating the performance in the laboratory with those existing on such sites. Data is not currently available which shows a definite relationship between the test and actual pipe operation. However data obtained from this test could be used to establish the relationship if it exists.

With the limited amount of testing already carried out it is considered that there is an improvement in repeatability of the test compared to DIN 19565-1 (no longer published) and testing is continuing to confirm these early findings.

1 Scope

This Technical Report describes a method for determining the mean abrasion of the inner surface of glass-reinforced thermosetting polyester resin (GRP) pipes conforming to EN 14364, measured after a defined number of test cycles of a specified water/abrasive mixture.

NOTE The test is performed on a semi-circular channel-pipe test-piece.

2 Terms and definitions

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

2.1
abrasion
a
reduction in wall thickness, along the test length at the invert of the channel-pipe test-piece, caused by the test piece being abraded by abrasive during a number of test cycles

NOTE It is expressed in millimetres (see Clause 9).

2.2
abrasive
particles of a specified inorganic material (i.e. corundum), which is used for abrading the inner surface of the test-piece

2.3
corundum
crystalline oxide of aluminium ($Al_2 O_3$), that has crystallized in a Trigonal system

NOTE Corundum has a hardness which is next to diamond, which accounts for its use as an abrasive.

2.4
mean abrasion
a_{mean}
mean value of the set of data recording the reduction in wall thickness at predefined points along the test length at the invert of the channel test-piece

NOTE It is expressed in millimetres (see Clause 9).

2.5
test cycle
cycle which is a double traverse of the abrasive along the test length at the invert of the test piece, caused by the test piece covering an angle from either + 22,5° to - 22,5° or - 22,5° to + 22,5° and then returning to the starting position

NOTE See Figure 1.

3 Principle

A semi-circular channel pipe, with a length of (1 000 ± 10) mm, is closed at its ends by end plates to form watertight seals. The test piece is filled with a specified water/corundum mixture and then covered with a plate. The channel-pipe test-piece is tilted alternately with a uniform rate in the longitudinal direction, covering an angle from either + 22,5° to - 22,5° or - 22,5° to + 22,5° and then returning to the starting position thereby completing a test cycle (see 2.5 and Figure 1). During each tilt the abrasive slides from one end of the test-

piece to the other over the channel's inner surface at the invert and thereby causes wear on the inner surface (see Figure 1). After 50 000 cycles the tilting is interrupted, the water and abrasive is removed and measurements are taken over the central 700 mm of the invert at 20 mm intervals to determine the amount of wear which has occurred. The test-piece is then refilled with a fresh abrasive charge and clean water to continue the test a further number of cycles until a total of 200 000 cycles (see 8.3.2) is completed.

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

a) conditioning temperature and period; see Clause 7;

b) number of cycles, if required; see 8.3.2 and item h) of Clause 10.

4 Apparatus

4.1 Tilting frame.

The frame should be capable of holding a test piece in a fixed position for the duration of test and tilting the test piece through a 45° arc at a uniform rate of (10 ± 2) cycles per minute (see 2.5). The frame should allow adjustments to be made to the speed of cycling and angle of tilt, to achieve and maintain the requirements of the test procedure. An example of a tilting frame with a test-piece fixed in position is shown in Figure 1. The tilting frame should incorporate equipment capable of:

a) recording the number of cycles elapsed for the duration of the test; and

b) stop the test after a preset number of cycles.

4.2 Measuring equipment.

Device capable of determining changes to the inner surface of the test-piece, with an accuracy of ± 0,02 mm or better, along the invert at equidistant intervals not greater than 20 mm. The device should position the test piece at the same location for each series of measurements.

If the test-piece is clamped into the measuring device small deformations or horizontal deviations may occur, which are of the same magnitude as the change in thickness. Such effects will therefore affect the accuracy of the measurement. In order to minimize these influences, reference points should be incorporated on both pipe spigots. Such reference points can be achieved by gluing thin hard metal strips, which are not susceptible to wear (e.g. knife blades), on the inner surface of the test-piece before starting the test procedure. Both reference points enable the pipe test-piece to be fixed in the measuring equipment at the same position, thereby minimizing potential measurement errors.

4.3 Weighing equipment.

Equipment capable of determining the mass of abrasive material, with an accuracy of ± 0,02 kg or better.

5 Abrasive

To help ensure the reproducibility of test results a man-made abrasive, corundum, should be used. The material should conform to Grade F4 of ISO 8486-1:1996.

The corundum grade F4 when tested in accordance with ISO 8486-1:1996 should have a particle size distribution conforming to Table 1 and a bulk density between 1,5 g/cm^3 and 1,7 g/cm^3.

Table 1 — Particle size distribution of Grade F4

Sieve 1		Sieve 2		Sieve 3		Sieve 4		Sieve 5	
Mesh size	Residual mass, Q_1	Mesh size	Residual mass, Q_2	Mesh size	Residual mass, Q_3	Mesh size	Residual mass, Q_3+Q_4	Mesh size	Residual mass, Q_5
mm	/m-%	mm	/m-%	mm	/m-%	mm	/m-%	mm	/m-%
8	0	5,6	≤ 20	4,75	≥ 40	4	≥ 70	≤ 3,35	≤ 3

6 Test-pieces

6.1 Geometry

Test pieces should be obtained from GRP pipes, having a nominal size between DN 300 and DN 600 inclusive, conforming to EN 14364. The test piece should be a semi-circular channel pipe with a length of (1 000 ± 10) mm. Prior to the test the test-piece's length, inside diameter and wall-thickness should be determined to an accuracy of ± 0,5 mm.

6.2 Number of test-pieces

For each test use one test-piece.

7 Conditioning

If applicable, condition the test piece in accordance with the referring standard. Unless otherwise specified the test piece should be kept for at least 16 h at the ambient test temperature before commencing the test. The test and measurements should be performed at the ambient temperature ± 5 °C.

8 Procedure

8.1 Determination of dimensions

Determine and record the geometrical characteristics of the test piece in accordance with 6.1 and the referring standard.

For reference purposes, measure the distance from the measurement plane to the invert surface at at least 35 measuring points, using an appropriate measuring device with an accuracy of ± 0,02 mm, along the invert of the sample in equidistant intervals not greater than 20 mm. A distance of 150 mm from both ends of the test piece should be disregarded for the evaluation so as to avoid errors arising from the non-standard flow of the abrasive at these locations.

Record the obtained values.

8.2 Assembling and filling

8.2.1 Position the tilting frame so that the test piece is horizontal (see Figure 1). Remove the lid covering the test-piece.

8.2.2 The corundum and water quantities should conform to Table 2.

8.2.3 Weigh the required amount of corundum and place evenly along the invert of the test piece.