SLOVENSKI STANDARD
SIST EN 1393:1997

01-februar-1997

Cevni sistemi iz polimernih materialov - Cevi iz duromernih materialov, ojačenih s steklenimi vlakni (GRP) - Določanje začetnih nateznih lastnosti v vzdolžni smeri

Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Determination of initial longitudinal tensile properties

Kunststoff-Rohrleitungssysteme - Rohre aus glasfaserverstärkten duroplastischen Kunststoffen (GFK) - Bestimmung der Anfangs-Zugeigenschaften in Längsrichtung

Systemes de canalisations en plastiques - Tubes en plastiques thermodurcissables renforcés de verre (PRV) - Détermination des propriétés initiales en traction longitudinale

Ta slovenski standard je istoveten z: **EN 1393:1996**

ICS:

23.040.20	Cevi iz polimernih materialov	Plastics pipes
83.120	Ojačani polimeri	Reinforced plastics

SIST EN 1393:1997 **en**

EUROPEAN STANDARD **EN 1393**

NORME EUROPÉENNE

EUROPÄISCHE NORM September 1996

ICS 23.040.20

Descriptors: pipelines, plastic tubes, thermoplastic resins, reinforced plastics, glass, tests, determination, tensile strength, elongation at break, modulus of elasticity, computation

English version

Plastics piping systems - Glass-reinforced thermosetting plastics (GRP) pipes - Determination of initial longitudinal tensile properties

Systèmes de canalisations en plastiques - Tubes en plastiques thermodurcissables renforcés de verre (PRV) - Détermination des propriétés initiales en traction longitudinale

Kunststoff-Rohrleitungssysteme - Rohre aus glasfaserverstärkten duroplastischen Kunststoffen (GFK) - Bestimmung der Anfangs-Zugeigenschaften in Längsrichtung

This European Standard was approved by CEN on 1996-05-09. 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 Central Secretariat or to any CEN member.

The European Standards exist 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

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 standard is based on the Draft International Standard ISO/DIS 8513 "Pipes made of glass-reinforced thermosetting plastics (GRP) - Initial longitudinal tensile properties - Test methods using a strip test piece and a pipe test piece", prepared by the International Organization for Standardization (ISO). It is a modification of ISO/DIS 8513 for reasons of alignment with texts of other standards on test methods.

The modifications are:

- test parameters (pressure, time, temperature) are not specified;
- material-dependent or performance requirements are not given;
- editorial changes have been introduced.

The material-dependent and performance requirements are incorporated in the referring standard.

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

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 March 1997, and conflicting national standards shall be withdrawn at the latest by March 1997.

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

1 Scope

This standard specifies three test methods for determining the longitudinal tensile properties of pipes of glass-reinforced thermosetting plastics (GRP). The properties which can be determined are:

- the longitudinal tensile strength;
- the percentage ultimate elongation;
- the longitudinal modulus of elasticity.

Method A uses for the test piece(s) a longitudinal strip cut from a pipe. Method B uses a specified length of the full cross section of the pipe. Method C uses a notched plate cut from a pipe wall section.

Method A is applicable to pipes with a nominal size DN 50 or greater with circumferentially wound filaments, with or without chopped glass and/or woven rovings and/or fillers, and to centrifugally cast pipes. It is applicable to those pipes with helically wound filaments with a nominal size DN 200 or greater.

Method B is applicable to all types of GRP pipes. It is usually used for pipes with a nominal size up to DN 300.

Method C is primarily intended for use for helically wound pipes with a winding angle other than approximately 90°. This method may also be used for other types of pipe.

Results from one method are not necessarily equal to the results derived from any of the alternative methods. However, all methods have equal validity.

2 Definitions

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

2.1 initial longitudinal tensile strength (σ_{1A}^*, σ_{1B}^*, σ_{1C}^*): The maximum tensile force in the longitudinal direction per unit mean circumference (see 2.6) at failure (the upper-case subscripts denote the method of test used).

It is expressed in newtons per millimetre of circumference.

2.2 ultimate longitudinal tensile stress (σ_l): The maximum longitudinal tensile force per unit cross-sectional area at failure.

It is expressed in newtons per square millimetre.

2.3 ultimate elongation (ε_l): The elongation coincident with the ultimate longitudinal tensile stress (see 2.2).

It is expressed as a percentage of an initial gauge length or free length of a test piece.

2.4 longitudinal modulus of elasticity (E_l): The longitudinal tensile force per unit cross-sectional area divided by the strain.

It is expressed in newtons per square millimetre.

2.5 mean diameter (d_m): The diameter of the circle corresponding with the middle of the pipe wall cross section.

It is given by any of the following:

a) the average of the external diameter of the pipe minus the average of the wall thickness;

b) the external circumference of the pipe divided by π ($\pi \approx 3,1416$) minus the average of the wall thickness;

c) the average of the internal diameter of the pipe plus the average of the wall thickness.

It is expressed in millimetres.

2.6 mean circumference: The circumference corresponding to the mean diameter (see 2.5) multiplied by π ($\pi \approx 3,1416$).

It is expressed in millimetres.

3 Principle

Test pieces comprising either strips cut longitudinally from a pipe wall segment (method A), a specified length of pipe (method B) or a notched plate cut from a pipe wall section (method C) are subjected to extension in the longitudinal direction at a constant speed such that fracture occurs within a specified time.

The tensile properties are determined using the initial dimensions of the test piece, the tensile force and the elongation.

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

a) the method to be used, i.e. method A, method B or method C;

b) the number of test pieces (see 5.5);

c) if applicable, the requirements for conditioning, e.g. temperature, humidity, time and associated tolerances (see clause 6);

d) the test temperature and its tolerance (see clause 7).

e) the properties to be measured (see clause 8);

4 Apparatus

4.1 Tensile testing machine, of the constant rate of cross-head movement type, incorporating the following features:

a) a fixed part, fitted with a grip to hold one end of the test piece without permitting any longitudinal movement thereof, and a moveable part, incorporating a grip to hold the other end of the test piece during extension. The fixed and moving parts and their associated grips (see 4.2) shall enable the test piece to be aligned when a force is applied so that its longitudinal axis coincides with the direction of this force;

b) a drive mechanism, capable of imparting a constant speed of 1 mm/min to the moving part;

c) force indicator, capable of measuring the force applied to a test piece which is held in the grips. The mechanism shall be free from significant inertia lag at the necessary speed of testing and shall indicate or record force, or consequent stress, with an accuracy of within ± 1 % of the value to be measured.

4.2 Grips, for holding a test piece. Each of two grips shall be capable of holding one end of the test piece without slip or crushing to an extent that will affect the results obtained. (Grips which tighten automatically may be suitable.) Typical grips for a pipe section test piece (see 5.3) are shown in figure 1.

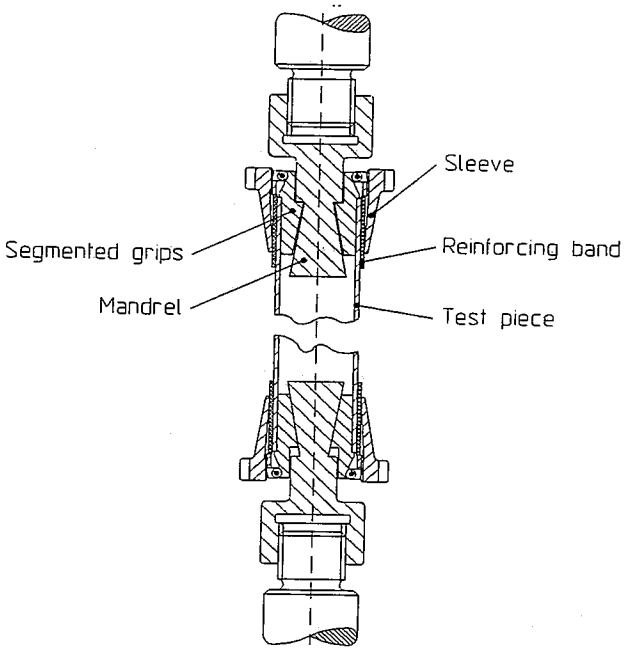

Figure 1: Typical grips for a pipe section test piece (method B)

4.3 Dimension measurement devices, capable of measuring the necessary dimensions of the test piece (e.g. length, width, wall thickness) to an accuracy of half the accuracy required in clause 8 for measurements, e.g. measuring accuracy ± 0,1 mm requires a device accuracy of ± 0,05 mm.

4.4 Extension indicator, capable of measuring the distance between two fixed points located within the gauge length of the test piece at any time during the test so that the elongation in the gauge section can be determined. The device shall be free of any significant inertia lag at the relevant speed of testing (see 8.4) and shall be accurate to within ± 1 % of the indicated value.

If strain gauges are used, these shall be mounted on both sides of the test piece, on the centreline, and the average value shall be used for the calculation of the modulus and the percentage elongation.

NOTE 1: An extension indicator is only necessary if the referring standard specifies that the elongation and/or any modulus of elasticity of the test piece is to be determined.

NOTE 2: It is desirable, but not essential, that this instrument automatically records this distance (or any change in it) as a function of the load on the test piece or of the elapsed time from the start of the test, or both. If only the latter is obtained, load/time data should be recorded as well.

5 Test pieces

5.1 General

The test piece shall be a strip or dumb-bell conforming to 5.2, or a pipe section conforming to 5.3, or a plate conforming to 5.4.

The test piece shall be obtained in such a way that it is not damaged.

5.2 Strip test pieces (method A)

5.2.1 Shape

Each test piece shall be a strip cut in the longitudinal direction of the pipe and shaped to the dimensions of the applicable dumb-bell as shown in figure 2, unless a parallel-sided (rectangular plan) test piece is selected in accordance with one of the following conditions:

a) where it is required only to determine conformity to a minimum tensile property requirement, a parallel-sided strip without shaped ends (see 5.2.2.3) may be used;

b) for nominal sizes greater than DN 400, parallel-sided strips (see 5.2.2.3) may be used.

The test pieces may be cut from a ring previously used for the determination of the initial specific ring stiffness.

5.2.2 Dimensions

5.2.2.1 Length

The length, l, of the test piece shall be (300 ± 15) mm (see figure 2 and figure 3).

5.2.2.2 Shaped strip

The gauge length, l_G, of the test piece shall be as follows (see figure 2):

$$100 \text{ mm} \leq l_G \leq 150 \text{ mm}.$$

The radius, R, shall be machined to conform to the following limits (see figure 2):

$$50 \text{ mm} \leq R \leq 70 \text{ mm}.$$