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(ISO/DIS 8513 : 1996)

Plastics piping systems— Pipes made of glass-reinforced thermosetting plastics (GRP)— Determination of initial longitudinal tensile properties

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Descriptors : plastic pipelines, plastics, reinforcing materials, glass fibres, pipes, pipe fittings, tensile strength, tensile strain, tensile stress

Reference number : **JIS K 7033 : 1998 (E)**

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

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Plastics piping systems — Pipes made of glass-reinforced thermosetting plastics (GRP) — Determination of initial longitudinal tensile properties

Introduction This Japanese Industrial Standard has been prepared based on ISO/DIS 8513, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) — Determination of initial longitudinal tensile properties* issued in 1996 without changing its technical contents.

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 filametns, 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 an including 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 Term(s) and definition(s)

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

a)
initial longitudinal tensile strength (σ_{tA}^*, σ_{tB}^*, σ_{tC}^*)
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.

b)
ultimate longitudinal tensile stress (σ_t)
The maximum longitudinal tensile force per unit cross-sectional area at failure.

It is expressed in newtons per square millimetre.

c)
ultimate elongation (ε_t)
The elongation coincident with the ultimate longitudinal tensile stress.

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

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

It is expressed in newtons per square millimetre.

e)
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.

f)
mean circumference
The circumference corresponding to the mean diameter [see e)] 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 methods 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 1mm/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 figure1.

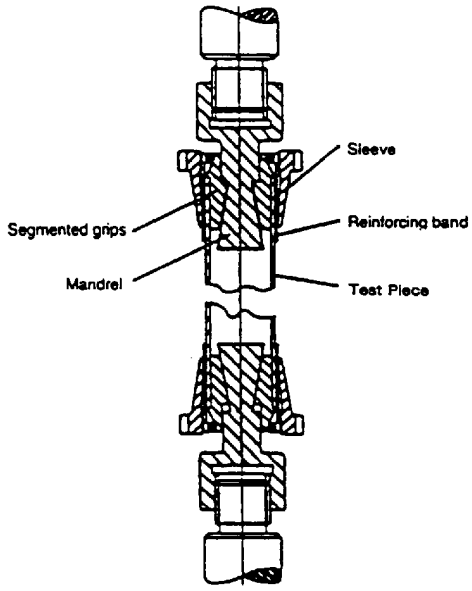

Figure 1 — Typical grips for a pipe section test piece (method B) (see 5.3)

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 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.