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**JIS K 7037** : 1998

(ISO/FDIS 8521 : 1997)

**Plastics piping systems—  
Glass-reinforced thermosetting  
plastics (GRP) pipes—  
Determination of the apparent initial  
circumferential tensile strength**

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**Descriptors** : thermosetting polymers, plastics, reinforcing materials, glass, pipework systems, pipes, tensile strength

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## 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—Glass-reinforced thermosetting plastics (GRP) pipes—Determination of the apparent initial circumferential tensile strength

**Introduction** This Japanese Industrial Standard has been prepared based on ISO/FDIS 8521 issued in 1997, "*Plastics piping systems—Glass-reinforced thermosetting plastics (GRP) pipes—Determination of the apparent initial circumferential tensile strength*," without changing the technical contents.

In addition, items with dotted underline in this Standard are items which are not contained in the original International Standard.

**1 Scope** This standard specifies six test methods for the determination of the apparent initial tensile strength in the circumferential direction per unit length of glass-reinforced thermosetting plastics (GRP) pipes.

The burst test (method A) is suitable for all types and sizes of pipes. It is the reference method.

The split disc test (method B) may not be suitable for pipes with helically wound reinforcing layers.

The strip test (method C) and the modified strip test (method D) are suitable for pipes with a nominal size of DN 500 and greater. And, it is suitable, when the split disc test is not suitable.

The restrained strip test (method E) is suitable for all types of pipes with a nominal size greater than DN 500.

The notched plate test (method F) is primarily intended for use for helically wound pipes of nominal size greater than DN 500 with a winding angle other than approximately 90°.

Results from one method are not necessarily equal to the results derived from any of the alternative methods.

**2 Definitions** For the purposes of this standard, the following definitions apply:

**2.1 apparent initial circumferential strength** ( $\sigma_{cA}^*$ ,  $\sigma_{cB}^*$ ,  $\sigma_{cC}^*$ ,  $\sigma_{cD}^*$ ,  $\sigma_{cE}^*$ ,  $\sigma_{cF}^*$ ): Ultimate circumferential tensile force per unit length in the circumferential direction (the upper-case subscripts denote the method of test used).

It is expressed in newtons per millimetre of circumference.

**2.2 burst pressure** ( $P_{ult}$ ) The internal pressure at bursting. (MPa)

**2.3 bursting** Failure by rupture of the pipe wall.

**2.4 ultimate tensile force** ( $F_{ult}$ ) The tensile force at failure. (N)

**2.5 width** ( $b$ ) The width of the test piece in the notched area. (mm)

**2.6 winding angle ( $\theta$ )** The angle between the direction of the reinforcement and the longitudinal axis of the pipe. (degree)

### 3 Principle

**3.1 Method A** The apparent initial circumferential strength,  $\sigma_{cA}^*$ , is determined by a burst test.

Cut lengths of pipe are subjected to an increasing internal pressure which, within a specified time, causes bursting (see 2.3).

The test conditions are such that a mainly uniaxial circumferential stress is obtained.

**3.2 Method B** The apparent initial circumferential strength,  $\sigma_{cB}^*$ , is determined by a split disc test.

Rings cut from the pipe are subjected to an increasing tensile force by means of a split disc within the ring until rupture occurs, within a specified time.

**3.3 Methods C, D and E** The apparent initial circumferential strength,  $\sigma_{cC}^*$ ,  $\sigma_{cD}^*$ ,  $\sigma_{cE}^*$ , is determined by a strip test.

Strips cut from the pipe wall in the circumferential direction are subjected to an increasing tensile force until rupture occurs within a specified time.

**3.4 Method F** The apparent initial circumferential strength,  $\sigma_{cF}^*$ , is determined by a notched plate test.

Plates cut from the pipe wall are subjected to an increasing tensile force until rupture occurs within a specified time.

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

- a) for method A the length between the end sealing devices (see 5.1);
- b) for methods B, C, D and E the width of the test piece (see 5.2, 5.3, 5.4 and 5.5);
- c) for methods C and E the total width of the test piece (see 5.3 and 5.5);
- d) for method F the dimensions of the plate to be tested (see 5.6);
- e) the number of test pieces (see 5.7);
- f) the requirements for conditioning (see clause 6);
- g) the test temperature (see clause 7).

### 4 Apparatus

#### 4.1 For method A

**4.1.1 Hydrostatic pressurizing system** For pipes of up to DN 500, capable of causing failure of the test piece between 1 min and 3 min after commencing the pressurization. For nominal sizes greater than DN 500 the duration of the test may have to be increased.

The pressurizing system shall prevent air entering the test piece during pressurization to failure.

**4.1.2 Pressure measurement device** Capable of measuring with an accuracy of  $\pm 2.0\%$  of the applied pressure.

**4.1.3 End sealing devices for the test pieces** Such that a mainly uniaxial state of stress in the circumferential direction will be induced (Example: type 1 or type 2 in Fig. 1).

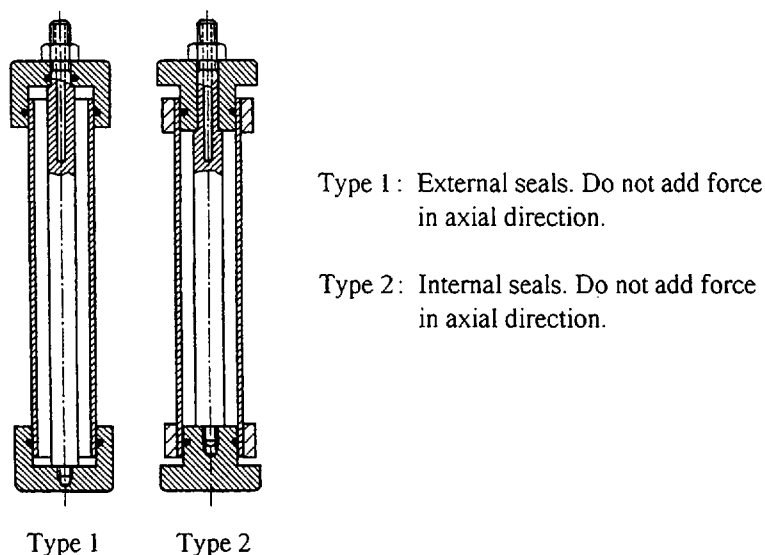


**Fig. 1 Typical arrangement for pressure testing of pipes**

**4.1.4 Test piece support** To minimize deformation due to the weight of the test piece and its contents.

**4.1.5 Flexible membrane** (if used as a barrier system to prevent weeping) Which does not reduce the stress in the pipe wall by more than 1 %.

The flexible membrane may be of a different material from the pipe, e.g. elastomeric or thermoplastic sheet or a flexible coating.

## **4.2 For method B**

**4.2.1 Test machine** Of the type capable of producing a progressive separation of the split disc, incorporating the following components:

- a) a fixed or virtually fixed part;
- b) a moveable part;
- c) a drive mechanism capable of imparting a constant speed to the moving part so that rupture can be reached between 1 min and 3 min after initial loading;
- d) a load indicator capable of measuring the force applied. This shall be virtually free from inertia at the specified rate of testing and shall indicate the force to an accuracy of within 1 % of the measured value.