

Australian Standard™

AS 3572.13

Plastics—Glass filament reinforced plastics (GRP)—Methods of test

Method 13: Determination of the initial longitudinal tensile strength of glass filament reinforced plastics pipes

1 SCOPE

This Standard sets out two methods for determining the initial longitudinal tensile strength and percentage elongation at failure of glass filament reinforced plastics (GRP) pipes.

The initial longitudinal tensile strength may be determined by either Method 13A or Method 13B.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1984	Vernier callipers (metric series)
2102	Micrometre callipers for external measurements
3572	Plastics —Glass filament reinforced plastics (GRP) —Methods of test
3572.1	Method 1: Preparation of glass filament reinforced plastics test specimens
3572.4	Method 4: Determination of the dimensions of glass filament reinforced plastics pipes
3572.8	Method 8: Determination of long-term ring stiffness of glass filament reinforced plastics pipes

3 METHOD 13A

3.1 Principle

A specimen cut from the pipe parallel to the axis of the pipe is subjected to a tensile force. Force and elongation at rupture are measured.

3.2 Apparatus

The following apparatus is required:

- A tensile testing machine capable of indicating the force applied to the test specimen with an accuracy of ± 0.01 mm. The machine shall be equipped with a means of measuring the elongation of the test specimen during the test and with an accuracy of $\pm 1\%$ of the indicated value.
- Micrometer complying with AS 2102 or vernier callipers complying with AS 1984.

3.3 Number of test specimens

Five test specimens shall be tested.



3.4 Preparation of test specimens

Test specimens shall be prepared from strips cut from the pipe under test in a longitudinal direction.

Test specimens may consist of a parallel strip 25 mm wide, or profiled as shown in Figure 1. The test specimens may be cut from a previously tested undamaged ring used for the determination of the initial stiffness (see AS 3572.10). For referee tests, the test specimen shall be profiled to the dimensions shown in Figure 1.

The thickness at the ends of the profiled test specimens may be built up with a suitable thermosetting resin. When cured, the ends may be trimmed flat while ensuring that the centroid of the curved pipe wall thickness lies on the loading centre-line when gripped in the testing machine.

Suitably curved testing machine jaws may be used as an alternative.

3.5 Conditioning

Test specimens shall be conditioned in accordance with AS 3572.1. Except for referee tests, conditioning shall be at ambient conditions.

3.6 Test conditions

The test shall be conducted in air at a temperature of $23 \pm 2^\circ\text{C}$.

3.7 Measurement of length and width

Measure the length and width of each test specimen to an accuracy of 1 mm and 0.1 mm respectively. The width shall be measured in the centre of the test specimen.

3.8 Procedure

The procedure shall be as follows:

- (a) Place each test specimen in the testing machine with the centre-line along the loading axis of the machine.
- (b) Apply the tensile force to the specimen, at the rate corresponding to a grip separation rate of 5.0 mm/min to 6.4 mm/min when running under no load, and measure force and elongation until the specimen fails.

Measure the elongation of each specimen, using an extensometer or other suitable means.

NOTE: Practical difficulties may complicate accurate measurement of the elongation at failure (e.g., removal of extensometer, local load/elongation non-linearity at failure). Calculation may, therefore, be used.

- (c) Plot force versus percentage elongation up to 80% of the expected failure load, or up to an elongation of 0.4%, whichever is the lesser.
- (d) Record the maximum force at rupture and the elongation associated with that force.

If rupture occurs outside the gauge length, prepare another test specimen and repeat the test.

3.9 Calculations

Calculations are as follows:

- (a) For each test specimen, calculate the initial longitudinal tensile strength (LTS_I), in newtons per millimetre of circumference from the following equation:

$$LTS_I = \frac{F}{W}$$

where

F = maximum force at rupture, in newtons

W = circumference of the test specimen, in millimetres

- (b) Using the slope of force versus elongation line obtained in Clause 3.8(c), estimate the elongation at rupture for each test specimen. Calculate the mean.

3.10 Report

The following shall be reported:

- (a) Full identification of pipe tested.
- (b) Date of test.
- (c) The width of test specimens and whether the test specimens were straight or had profiled ends, built-up or not.
- (d) Number of test specimens tested.
- (e) Initial longitudinal tensile strength, LTS_i , and elongation at rupture of each specimen.
- (f) Mean initial longitudinal tensile strength, LTS_i , and mean elongation at rupture.
- (g) The number of this Australian Standard and the method used, AS 3572.13, Method 13A.

4 METHOD 13B

4.1 Principle

A pipe of 150 mm nominal size is subjected to a tensile force. The force and elongation at rupture are measured.

4.2 Apparatus

The following is required:

- (a) *Load application system* A tensile testing machine capable of applying a load of 10 times the required allowable tensile load of the pipe specimen in newtons/millimetre of diameter.
- (b) *End clamps* Suitable for the application of load via the shear collar on the end of each sample. Figure 2 shows a typical clamp.
- (c) *Load measurement device* Suitable for measurement of the above load to within $\pm 1\%$ accuracy.
- (d) *Elongation measurement device* An extensometer suitable for attachment to the pipe, and accurate to within ± 0.01 mm of the strain indicated.

4.3 Number of test specimens

Five test specimens shall be tested.

4.4 Preparation of test specimens

Five test specimens shall be tested, each consisting of a 400 mm length of 150 mm nominal size pipe. Test specimens shall be fabricated using exactly the same laminate construction as the pipe proposed for service, including internal and external corrosion barriers.

The samples shall have a shear collar at each end, the length of which shall be determined using an allowable shear stress of 2.3 MPa. The thickness of the collar shall suit the clamping mechanism being used.