

Australian Standard™

AS 3572.12

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

Method 12: Determination of initial failure pressure and initial hoop strength of glass filament reinforced plastics pipes

1 SCOPE

This Standard sets out four alternative methods for determining the initial failure pressure and the initial hoop strength of glass filament reinforced plastics (GRP) pipes.

2 PRINCIPLE

2.1 Internal pressure tests

Two test methods use internal hydraulic pressure as follows:

- (a) *24-hour test* A specimen is subjected to an internal hydraulic pressure for 24 h, which represents the minimum acceptable performance level of the pipe. The specimen is then subjected to higher pressure until failure.
- (b) *0.1 hour test* A specimen is subjected to an internal hydraulic pressure in a defined procedure until failure occurs.

2.2 Mechanical tests

Two mechanical test methods, the split disc and tensile plate tests, introduce a simulated hoop stress in a pipe wall to determine a failure stress and to permit the calculation of a failure pressure.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1349	Bourdon tube pressure and vacuum gauges
1984	Vernier callipers (metric series)
2102	Micrometre callipers for external measurement
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

4 CONDITIONING

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



5 TEST CONDITIONS

The test may be conducted at ambient temperature. Referee tests shall be performed at a temperature of $23 \pm 2^\circ\text{C}$.

6 24-HOUR PRESSURE TEST

NOTE: By agreement between the purchaser and manufacturer, the 0.1-hour test may be performed in lieu of the 24-hour test.

6.1 Apparatus

The following is required:

- (a) *Pressurizing system* A hydraulic pressure system capable of producing a pressure in the pipe sufficient to result in failure, and able to increase the pressure within the specimen at a rate of PN/10 MPa/min to 2(PN/10) MPa/min.
- (b) *End connections* Fittings that will make a water-tight connection to the test specimen and to the pressurizing system. Three types of fittings are permitted, as follows:
 - (i) Caps, provided with ring joints sealing onto the external surface of the test specimen and connected to one another by a metal rod allowing some longitudinal movement at the ends of the test specimen. Pressure is applied through one cap end, or through the connecting rod (see Figure 1(a)).
 - (ii) Metal plugs provided with ring joints sealing onto the internal surface of the test specimen, and connected to one another by a metal rod with a central bore allowing some longitudinal movement at the ends of the test specimen (see Figure 1(b)).
 - (iii) End caps, or end plugs, incorporating standard joint couplings.
- (c) *Timing devices* A timing device on each test station to register the duration of the test on each test specimen until the moment of failure.
- (d) *Pressure measurement* An industrial pressure gauge or gauges as necessary, complying with AS 1349, which will indicate the pressure in the test specimen to an accuracy of $\pm 2\%$.

NOTE: Digital or analogue pressure transducers, which can be shown to provide indicating capabilities and accuracy characteristics of the same or a higher degree, may be used.

6.2 Number of test specimens

One test specimen shall be tested.

6.3 Preparation of test specimen

The test specimen shall be taken from normal production pipes with a minimum free length (L) between end connections as specified in Table 1.

Before testing, the test specimen shall have its ends squared and cleaned. It shall have no burrs, notches or other markings which may cause premature failure.

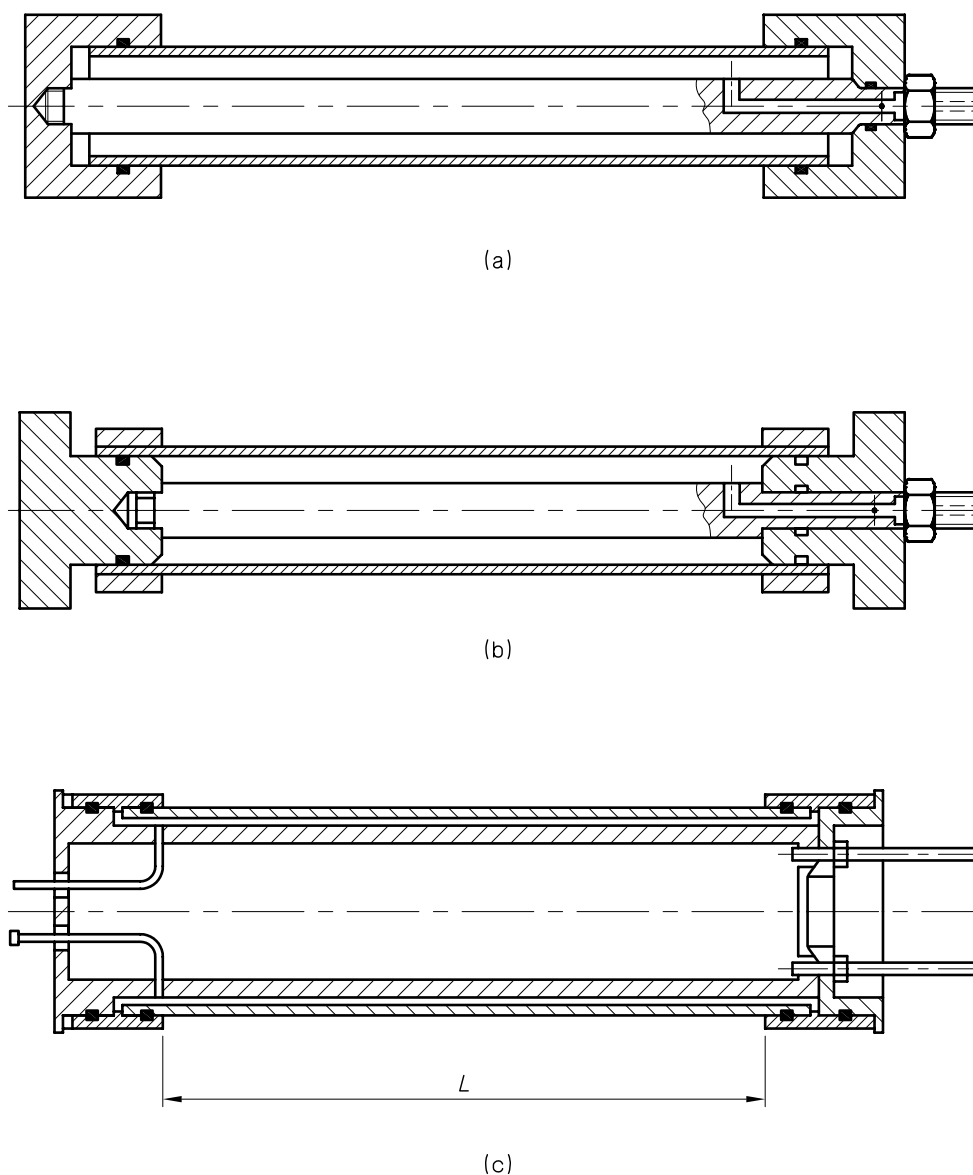


FIGURE 1 SUITABLE END CONNECTIONS FOR PRESSURE TESTS

TABLE 1
LENGTH OF TEST SPECIMENS

Nominal size of pipe (DN)	millimetres
	Length min. (L)
≤ 250	$3DN + 250$
> 250	$DN + 1\,000$

6.4 Measurement of wall thickness, length and outside diameter

The wall thickness, length, and outside diameter of the test specimen shall be measured in accordance with the relevant sections of AS 3572.4.

6.5 Procedure

The procedure shall be as follows:

- (a) Connect a test specimen to the apparatus provided, fill with water and ensure that all air is excluded.
- (b) Apply pressure to the test specimen in the following manner:
 - (i) Increase the pressure at a rate so that nominal working pressure is reached within 30 s to 60 s. Maintain the pressure for 1 min to allow inspection for leaks or weeping.
 - (ii) Increase the pressure at the same rate of between PN/10 MPa/min and 2(PN/10) MPa/min until the required test pressure is reached. Maintain this pressure for 24 h.
 - (iii) At completion of the 24-hour test, increase pressure at a rate of between PN/10 MPa/min and 2(PN/10) MPa/min until failure occurs.
- (c) Record the test pressure, the time to failure if the specimen does not pass the 24-hour test, and the final failure pressure.

The test specimen shall be deemed to have failed when it develops a leak, weeps or ruptures. In the event of a failure of an end connection, or if failure occurs within $1.3\sqrt{(D_o T)}$ from the end sealing device, where D_o is the outside diameter, in millimetres and T is the wall thickness, in millimetres, a further test specimen shall be selected and the test repeated.

6.6 Calculation

The short-term hoop stress shall be calculated from the following equation:

$$\sigma = \frac{PD_i}{2T} \quad \dots 1$$

where

- σ = short-term hoop stress, in megapascals
- P = failure pressure, in megapascals
- D_i = inside diameter of test specimen, in millimetres
= $(D_o - 2T)$
- T = wall thickness of specimen, in millimetres

6.7 Report

The following information shall be reported:

- (a) Full identification of the pipe tested, and end connections used.
- (b) Date of test.
- (c) The individual and mean values of length, diameter and thickness of the test specimens.
- (d) Temperature during testing.
- (e) Mode of failure.
- (f) The value of the sustained pressure, the time to failure if less than 24 h and the final failure pressure of the pipe.
- (g) The calculated short-term hoop strength.