

Australian Standard™

AS 3572.15

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

Method 15: Determination of resistance to long-term strain corrosion of glass filament reinforced plastics pipes

1 SCOPE

This Standard sets out a method for determining the resistance to strain corrosion by subjecting specimens of GRP pipe to long-term ring deflection in an aggressive environment.

2 PRINCIPLE

Not less than 18 test specimens are subjected to a range of constant vertical deflections, with sections of the pipe exposed to a corrosive test solution. The long-term resistance of pipe to the test solution is obtained by an extrapolation to 50 years of a linear regression line of logarithm deflection versus logarithm time to failure.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

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| 3572 | Plastics —Glass filament reinforced plastics (GRP) —Methods of test |
| 3572.1 | Method 1:Preparation of glass filament reinforced plastics test specimens |
| 3572.3 | Method 3:Determination of loss on ignition of glass filament reinforced plastics |
| 3572.4 | Method 4:Determination of dimensions of glass filament reinforced plastics pipes |
| 3572.9 | Method 9:Determination of pressure regression characteristics as a function of time for glass filament reinforced plastics pipes |

4 DEFINITIONS

For the purpose of this Standard the definitions below apply.

4.1 Strain corrosion

The mechanism of failure of the pipe wall caused by the exposure of the inside surface, while in a deflected condition, to a nominated corrosive environment for a period of time.

4.2 Failure point

The passage of a fluid through the pipe wall or the rupture of the wall, whichever occurs first.

NOTE: The failure mode may be catastrophic, characterized by a sudden fracture parallel to the axis of the pipe, with the filament reinforcement cleanly broken at the edge of the fracture. Visual evidence of surface etching or pitting may or may not be present.

5 APPARATUS

5.1 Parallel beam apparatus

The apparatus shall be capable of maintaining a constant deflection on the pipe. Elastomeric pads may be used between the parallel beam surfaces and the pipe ring in order to achieve uniform deflection. A typical test apparatus is shown in Figure 1.

For large deflections (28% and greater), where flattening of the pipe may occur against wide bearing surfaces, loading beam types 1 or 2, as shown in Figure 2, shall be used. Only one type of loading beam shall be used in a test series.

The beams shall be rigid and provide a smooth, clean load bearing surface. The length of the beams shall be equal to, or greater than, the length of the test specimen.

6 TEST SPECIMENS

Test specimens shall be ring sections with a minimum length of one pipe diameter or 300 mm, whichever is the lesser.

7 CONDITIONING

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

8 TEST CONDITIONS

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

9 DETERMINATION OF TEST DEFLECTIONS

The initial stiffness is determined in accordance with AS 3572.10, and deflection levels for test specimens are selected so that at least 18 specimens fail. The failure values shall be distributed as uniformly as possible between 10 and 10 000 h on a logarithmic scale. Minimum distribution requirements are given in Table 1.

TABLE 1
TEST DATA DISTRIBUTION

Test time h	Minimum number of failure points
$\geq 10 < 1\ 000$	4
$\geq 1\ 000 < 6\ 000$	3
$\geq 6\ 000 < 10\ 000$	4
$\geq 10\ 000$	1

10 PROCEDURE

The procedure shall be as follows:

- Determine the outside diameter and wall thickness in accordance with AS 3572.4. Calculate the mean inside diameter from, $D_i = D_o - 2T$.
- Measure the length of the test specimen to an accuracy of 1 mm at six places equally spaced around the circumference. The length (L) shall be the mean of these measurements.

- (c) Place the test specimen in the test apparatus and apply force to the apparatus to deflect the specimen, while keeping the top and bottom beams as near parallel as possible. When the desired deflection is obtained, lock the apparatus to maintain the specimen in the deflected condition.

NOTE: Alignment of the specimen within the beams is critical. The beams should not only be parallel with the load points 180° opposite, but the pipe should also be centred between the beams.

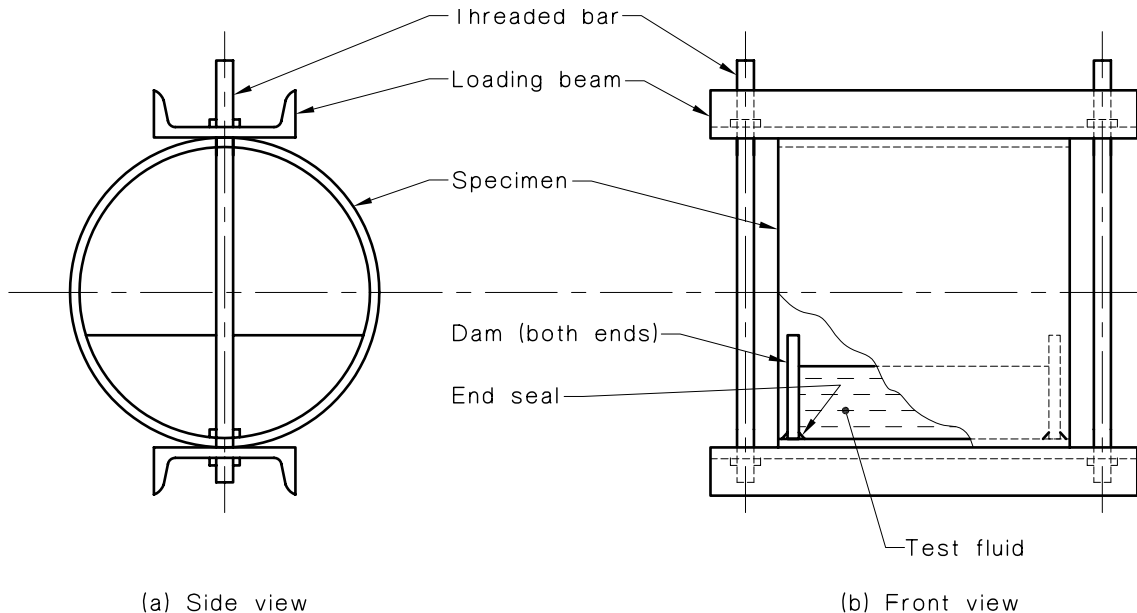


FIGURE 1 TYPICAL APPARATUS

- (d) Measure the vertical inside diameter of the deflected test specimen at both ends to the nearest 0.25 mm. Average the measurements, and determine the deflection by subtracting the mean inside diameter after deflection from the measurement determined in Item (a) above. The deflection shall be expressed as a percentage of the mean diameter.
- (e) After the initial deflection has been determined using Step (d), install chemically inert dams in the lower section of the test specimen using a flexible sealant, ensuring that only the interior surface of the specimen will be exposed to the test environment. The dams shall not add support to the test specimen.

- (f) Place the apparatus containing the specimen in a chemically resistant trough or pan and introduce the test solution to the lower section of the specimen.

WARNING: As the failure mode could be catastrophic, precautions should be taken to protect staff, and to contain any leakage that may occur.

- (g) Check and maintain the test solution within 5% of the specified concentration for the duration of the test. Maintain the level at a depth of not less than 25 mm during the period of test.

NOTE: As some solutions become more concentrated with the evaporation of water, care should be exercised in replenishment to prevent an increase in concentration. It may be necessary to clean the deflected test specimen periodically and renew the test solution.

- (h) Inspect the test specimens as specified in Table 2.
- (i) Record the time to failure.

NOTE: Results for specimens that have passed the test may be included in the regression calculation.