

Australian/New Zealand Standard®

Methods of test for PVC pipes and fittings

Method 20: Method for the determination of long-term failure stress of PVC moulding compounds

PREFACE

This Standard was prepared by the Joint Australian/New Zealand Standards Committee PL/21 on Unplasticized PVC Pipe Systems.

METHOD

1 SCOPE This Standard sets out the method for determining the long-term failure stress of PVC injection moulding compound.

2 REFERENCED DOCUMENT The following document is referred to in this Standard:

AS

1145 Determination of tensile properties of plastics materials

3 PRINCIPLE Moulded test specimens of PVC compound are subjected to varying stresses by loading with dead weights to produce rupture within selected time periods. The 50-year long-term tensile stress of the material is determined from regression analysis of the test results.

4 APPARATUS The following apparatus is required:

- (a) *Testing machine*—a testing machine capable of applying the required calculated axial test loads to the test specimen.
- (b) *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. The timing device shall stop automatically if the test load or test temperature exceeds the specified tolerances.
- (c) *Dimensional measuring equipment*—equipment consisting of micrometers or vernier callipers conforming to the requirements of AS 1145.

5 TEST SPECIMENS Each test specimen shall be injection-moulded from PVC moulding compound and meet the requirements of the Type 1 specimens of AS 1145.

If present, all 'flash' shall be removed from the moulded test specimen; care shall be taken not to damage the moulded surface.

Sufficient specimens shall be chosen to provide the required spread of data points shown in Table 1.1.

6 CONDITIONING Each test specimen shall be conditioned in air at $20 \pm 2^\circ\text{C}$ for 15 min immediately prior to testing.

7 PROCEDURE The procedure for the determination of tensile properties shall be as follows:

- (a) Measure the width and thickness of the central parallel portion of specimens, to the nearest 0.01 mm, at the mid-point and at 5 mm from each end of the gauge length of the specimen, and calculate the mean cross-sectional area.
- (b) Estimate the tensile stress required to cause the failure of the test specimen in the desired test time span, and calculate the test load to be applied.
- (c) Mount the test specimen in the testing machine in axial alignment with the direction of pull. Tighten the grips evenly and firmly, to the degree necessary to prevent the test specimen from slipping during test but not to the point where the specimen would be crushed.
- (d) Apply the test load to the specimen without impulse.
- (e) When conditions have stabilized at the required test temperature of $20 \pm 2^\circ\text{C}$ and within the tolerance of +5, -2% of the set load value, commence timing.
- (f) Continuously maintain the test load and the temperature of the test environment in contact with the test specimen at $20 \pm 2^\circ\text{C}$ for the test period. In the event of a change in test load or temperature which results in the specified tolerances being exceeded, timing, which will have stopped, shall only be recommenced when the test conditions have been reset within the required limits.
- (g) Record the time for each test specimen to rupture.
- (h) Discard any dumbbell specimen that does not break within the parallel portion and replace with another specimen. Discard specimens that slip in the grips, or break at a distance less than 10 mm from the grips, and test further specimens.
- (i) Obtain at least 18 test results for the calculation of the log time versus log stress regression time with a data point distribution as per Table 1.1.

8 ASSESSMENT OF RESULTS

8.1 Notation The following symbols are used:

n = is the number of observations.

f_i = is the log of stress (in MPa) of observation i ; $i = 1, \dots, n$.

h_i = is the log of time (in h) of observation i ; $i = 1, \dots, n$.

$\bar{f}$ is the arithmetic mean of all f_i values $= \frac{1}{n} \sum_{i=1}^n f_i$. . . (1)

$\bar{h}$ is the arithmetic mean of all h_i values $= \frac{1}{n} \sum_{i=1}^n h_i$. . . (2)

The regression equation of log time (h) on log stress (f) is:

$h = a + bf$. . . (3)

NOTES:

- 1 References in this Section to logarithms relate to base 10.
- 2 A straight line should be fitted to the data using the method of least squares, regressing log time on log stress as the independent variable.