

Australian/New Zealand Standard™

Methods of test for plastics pipes and fittings

Method 25: Determination of slow-crack-growth of PE (polyethylene) resins—Notched, constant ligament-stress (NCLS) method

1 SCOPE

This Standard sets out a method to determine the susceptibility of polyethylene resins to slow-crack-growth under a constant ligament-stress in an accelerating environment.

This test method is intended as an index test to assess slow-crack-growth (SCG) resistance for PE compounds. It measures the failure time associated with a given test specimen at a constant, specified, ligament-stress level.

NOTE: This test method does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 PRINCIPLE

A dumbbell-shaped, notched test-specimen is subjected to a constant ligament-stress in the presence of a surface-active agent at an elevated temperature.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

ASTM

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|-------|---|
| D5397 | Standard Test Method for the Evaluation of Stress Crack Resistance of Polyolefin Geomembranes using Notched Constant Tensile Load |
| D4703 | Standard Practice for Preparation of Compression-Moulded Polyethylene Test Sheets and Test Specimens |
| E691 | Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method |

4 APPARATUS

The following is required:

- (a) *Blanking die* Suitable blanking die for cutting test specimens to the dimensions and tolerances specified in Figure 1 (see Clause 6.1).
- (b) *Stress crack testing apparatus* Equipment suitable for subjecting test specimens to a tensile stress of up to 13.8 MPa. The specimens shall be maintained at a constant temperature of $50 \pm 1^\circ\text{C}$ while being totally immersed in a surface-active agent. The solution should be constantly agitated to provide a uniform concentration throughout the bath.

NOTE: A suitable apparatus is described in ASTM D5397.

- (c) *Micrometer* Capable of measuring to ± 0.25 mm.

- (d) *Microscope* Equipped with micrometer or an equivalent device capable of accurately measuring the notch depth.
- (e) *Compression moulding press* Compression-moulding press and a suitable chase for compression-moulding the specimens, compliant with ASTM D4730.
- (f) *Metal shot* For weight tubes.
- (g) *Balance* Balance capable of measuring to an accuracy ± 1 g, for measuring shot weight tubes.
- (h) *Timing device* Capable of recording failure time to the nearest 0.1 hour.

5 REAGENT

Stress-cracking reagent consisting of 10% Igepal CO-630 by volume in 90% de-ionized water. Solution level is to be checked daily and de-ionized water used to keep the bath at a constant level. For testing at 50°C, the solution shall be replaced every four (4) weeks.

6 PROCEDURE

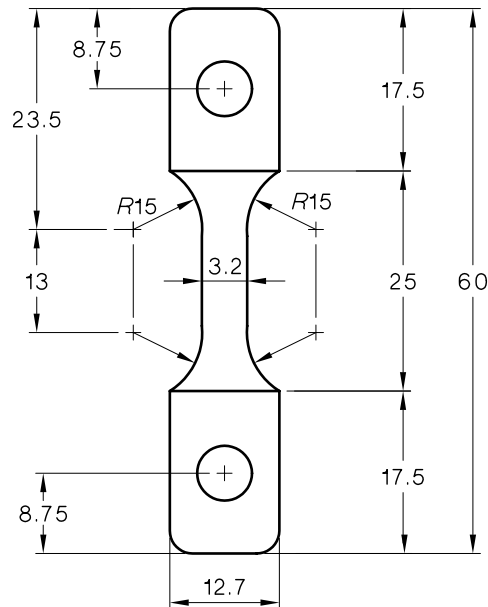
6.1 Specimen preparation

Specimens may be machined or prepared with a die.

Pellet specimens (virgin resin or chopped pipe) shall be compression-moulded into 1.9 mm sheet as specified in ASTM D4703, except that the pellets do not have to be roll-milled prior to being compression-moulded. If desired, the sheet may be trimmed by 15 mm on each side in order to avoid any edge effects.

Test specimens shall be punched, cut or machined from the sheet, and holes shall be punched, cut or machined into the specimen as shown in Figure 1.

The length of the specimen may be changed to suit the design of the test apparatus; however, there shall be a constant neck section with length at least 13 mm long.



NOTES:

- 1 The test specimen is intended to have the same geometry used for ASTM D5397 specimens.
- 2 It is preferable to modify the specimen die so that the attachment holes are punched or cut out at the same time as the specimen rather than punching, cutting or machining them into the specimen at a later time. If the attachment hole is introduced at a later time, it is extremely important that the specimens be carefully aligned so as to avoid adding a twisting component to the stress being placed on the specimen.

DIMENSIONS IN MILLIMETRES

FIGURE 1 SPECIMEN GEOMETRY—TEST SPECIMEN

The specimen dimensions (in millimetres) are minimum values except for the following:

- (a) Width.....3.20 +0.2, -0 mm.
- (b) Thickness.....1.90 +0.2, -0 mm.

Five (5) specimens at the nominated single ligament-stress level of 15% yield stress shall be tested and the results averaged. The arithmetic average is reported as the NCLS value of the resin under test.

6.2 Notching

Specimens shall be notched in a direction normal to thickness with a notch depth of 20% of thickness (see Figure 2) using a razor blade. The maximum notch-cutting rate shall be 2.5 mm/min. Notch depth shall be controlled to ± 0.025 mm.

NOTES:

- 1 Notch depth is an important variable that has to be carefully controlled by periodically measuring the notch depth with a microscope.
- 2 As this is an index test, any effect of notch angle on SCG resistance can be disregarded.