

Australian Standard™

Methods of test for plastics pipes and fittings

Method 24: Determination of resistance to crack propagation—Test methods for slow crack growth in notched pipes (notch test)

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee PL-045, Plastics Pipe Systems Test and Calculation Methods.

This Standard is equivalent to and has been reproduced from ISO 13479:1997, *Polyolefin pipes for the conveyance of fluid—Determination of resistance to crack propagation—Test method for slow crack growth on notched pipes (notch test)*.

Under arrangements made between Standards Australia and the international Standards bodies, ISO and IEC, as well as certain other Standards organisations, users of this Australian Standard are advised of the following:

- (a) Copyright is vested Standards Australia.
- (b) Its number does not appear on each page of text and its identity is shown only on the cover and title page.
- (c) In the source text 'this International Standard' should read 'this Australian Standard'.
- (d) A full point substitutes for a comma when referring to a decimal marker.
- (e) Reference to International Standards should be supplemented by references to equivalent Australian Standards, as follows:

<i>Reference to International Standard</i>		<i>Australian/New Zealand Standard</i>	
ISO		AS/NZS	
161	Thermoplastics pipes for the conveyance of fluids—Nominal outside diameters and nominal pressures		
161-1	Part 1: Metric series		
1167	Thermoplastics pipes for the conveyance of fluids—Resistance to internal pressure—Test method	1462	Methods of tests for plastics pipes and fittings
		1462.6	Method 6: Method for hydrostatic pressure testing of pipes
6108	Double equal angle cutters with plain bore and key drive		
11922	Thermoplastics pipes for the conveyance of fluids—Dimensions and tolerances		
11922-1	Part 1: Metric series	4130	Polyethylene (PE) pipes for pressure applications



NOTES

METHOD

1 Scope

This International Standard specifies a method of test for determining the resistance to slow crack growth of polyolefin pipes, expressed in terms of time to failure in a hydrostatic pressure test on a pipe with machined longitudinal notches in the outside surface. The test is applicable to pipes of wall thickness greater than 5 mm.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 161-1:1996, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series.*

ISO 1167:1996, *Thermoplastics pipes for the conveyance of fluids — Resistance to internal pressure — Test method.*

ISO 6108:1978, *Double equal angle cutters with plain bore and key drive.*

ISO 11922-1:1997, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 161-1 and ISO 11922-1 apply.

4 Principle

Lengths of pipe with four machined longitudinal external notches are subject to a constant-pressure hydrostatic pressure test whilst immersed in a water tank at 80 °C. The time to failure is recorded.

5 Apparatus

5.1 Pipe pressure-testing equipment, as specified in ISO 1167.

5.2 Notch-machining equipment, i.e. a milling machine with a horizontal mandrel rigidly fixed to the bed to enable the pipe to be securely clamped to give a straight test piece. The mandrel shall support the pipe bore beneath and along the full length of the notch to be machined. The milling cutter mounted on a horizontal arbor shall be a 60°-included-angle “V”-cutter conforming to ISO 6108, having a cutting rate of $(0,010 \pm 0,002)$ (mm/rev)/tooth (see example below).

The milling cutter shall be carefully protected against damage. The cutter shall be subject to a running-in treatment amounting to 10 m of notching prior to its first use for preparation of test pieces. It shall not be used for any other material or purpose and shall be replaced after 100 m of notching.

EXAMPLE

A cutter with 20 teeth rotating at 700 rpm, traversed at a speed of 150 mm/min, has a cutting rate of $150/(20 \times 700) = 0,011$ (mm/rev)/tooth.

6 Test piece preparation

6.1 Test pieces

Each test piece shall comprise a length of pipe sufficient to give a minimum free length of pipe of $(3d_n \pm 5)$ mm between the end caps, when fitted for pressure testing in accordance with ISO 1167, where d_n is the nominal outside diameter of the pipe. For pipes with a nominal outside diameter greater than 315 mm, a minimum free length of $(3d_n \pm 5)$ mm shall be used where practical; otherwise a minimum free length of greater than or equal to 1 000 mm shall be used.

6.2 Notch location

Positions shall be marked for machining four notches equally spaced around the pipe circumference (see figure 1).

6.3 Machining the notches

6.3.1 If the wall thickness of the test piece is greater than 50 mm, the material shall be machined with a slot drill of 15 mm to 20 mm diameter to leave approximately 10 mm to be removed by the “V”-cutter used in accordance with 6.3.2.

6.3.2 Each notch shall be machined by climb milling to a depth so as to produce a pipe wall ligament of thickness between 0,78 and 0,82 times the minimum wall thickness, as specified in ISO 11922-1, for the diameter and pressure series of the pipe as shown in table 1 (see note). The ends of each notch shall be aligned circumferentially as shown in figures 1 and 2.

The length of each notch, at full depth, shall be equal to the pipe nominal outside diameter ± 1 mm. For pipes with a free length of pipe of less than $(3d_n \pm 5)$ mm, the length of each notch, at full depth, shall be equal to the free length minus (500 ± 1) mm.

NOTE — To achieve a remaining ligament within the required tolerance range, it is advisable to aim for a remaining ligament at the top of the tolerance range. This is because the pipe wall can move due to release of residual stresses, resulting in a deeper than anticipated notch.

6.3.3 The test piece shall have end caps fitted which ensure that any longitudinal internal pressure load will act fully on the pipe (e.g. as shown for the type A arrangement in ISO 1167).

Table 1 — Remaining ligament thicknesses for pipe series

Dimensions in millimetres

Nominal outside diameter d_n	SDR6 S2,5		SDR7,4 S3,2		SDR9 S4		SDR11 S5		SDR13,6 S6,3		SDR17 S8		SDR17,6 S8,3		SDR21 S10		SDR26 S12,5		SDR33 S16		SDR41 S20	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
32	4,2	4,4																				
40	5,2	5,5	4,3	4,5																		
50	6,5	6,8	5,4	5,7	4,4	4,6																
63	8,2	8,6	6,7	7,1	5,5	5,8	4,5	4,8														
75	9,8	10,3	8,0	8,4	6,5	6,9	5,3	5,6	4,3	4,5												
90	11,7	12,3	9,6	10,1	7,9	8,3	6,4	6,7	5,1	5,4	4,2	4,4	4,0	4,2								
110	14,3	15,0	11,8	12,4	9,6	10,1	7,8	8,2	6,3	6,6	5,1	5,4	4,9	5,2	4,1	4,3						
125	16,2	17,1	13,3	14,0	10,9	11,5	8,9	9,3	7,2	7,5	5,8	6,1	5,5	5,8	4,7	4,9						
140	18,2	19,1	15,0	15,7	12,2	12,9	9,9	10,4	8,0	8,4	6,5	6,8	6,2	6,6	5,2	5,5	4,2	4,4				
160	20,7	21,8	17,1	18,0	14,0	14,7	11,4	12,0	9,2	9,7	7,4	7,8	7,1	7,5	6,0	6,3	4,8	5,1				
180	23,3	24,5	19,2	20,2	15,7	16,5	12,8	13,4	10,4	10,9	8,3	8,8	8,0	8,4	6,7	7,1	5,4	5,7	4,3	4,5		
200	25,9	27,2	21,4	22,5	17,5	18,4	14,2	14,9	11,5	12,1	9,3	9,8	8,9	9,3	7,5	7,9	6,0	6,3	4,8	5,1		
225	29,2	30,7	24,0	25,3	19,6	20,6	16,0	16,8	12,9	13,6	10,5	11,0	10,0	10,5	8,4	8,9	6,7	7,1	5,4	5,7	4,3	4,5
250	32,4	34,0	26,7	28,0	21,8	22,9	17,7	18,6	14,4	15,1	11,5	12,1	11,1	11,6	9,3	9,8	7,5	7,9	6,0	6,3	4,8	5,0
280	36,3	38,1	29,9	31,4	24,3	25,6	19,8	20,8	16,1	16,9	12,9	13,6	12,4	13,0	10,5	11,0	8,3	8,8	6,7	7,1	5,4	5,7
315	40,8	42,9	33,6	35,3	27,3	28,7	22,3	23,5	18,2	19,1	14,6	15,3	14,0	14,7	11,7	12,3	9,4	9,9	7,6	8,0	6,0	6,3
355	46,0	48,4	37,8	39,8	30,8	32,4	25,2	26,5	20,4	21,4	16,5	17,3	15,8	16,6	13,2	13,9	10,6	11,2	8,5	8,9	6,8	7,1
400			42,7	44,9	34,7	36,5	28,4	29,8	22,9	24,1	18,5	19,4	17,8	18,7	14,9	15,7	11,9	12,5	9,6	10,1	7,6	8,0
450			48,1	50,6	39,0	41,0	31,9	33,5	25,8	27,1	20,8	21,9	19,9	21,0	16,8	17,6	13,4	14,1	10,8	11,3	8,6	9,0
500					43,4	45,6	35,5	37,3	28,7	30,2	23,1	24,3	22,2	23,3	18,6	19,6	14,9	15,7	11,9	12,5	9,5	10,0
560							39,7	41,7	32,1	33,8	25,9	27,2	24,9	26,2	20,8	21,9	16,7	17,5	13,4	14,1	10,7	11,2
630							44,7	47,0	36,2	38,0	29,1	30,6	27,9	29,4	23,4	24,6	18,8	19,8	15,1	15,8	12,0	12,6
710									40,8	42,9	32,8	34,5	31,4	33,0	26,4	27,8	21,2	22,3	17,0	17,9	13,6	14,3
800									45,9	48,3	37,0	38,9	35,3	37,1	29,7	31,2	23,9	25,1	19,1	20,1	15,3	16,1
900											41,7	43,9	39,8	41,8	33,5	35,2	27,1	28,5	21,5	22,6	17,2	18,0
1 000											46,3	48,6	44,1	46,4	37,2	39,1	30,0	31,6	23,9	25,1	19,0	20,0
1 200															44,6	46,9	36,0	37,9	28,4	29,8	22,8	24,0
1 400																	42,0	44,2	33,1	34,8	26,7	28,0
1 600																	48,0	50,4	37,8	39,8	29,5	31,1

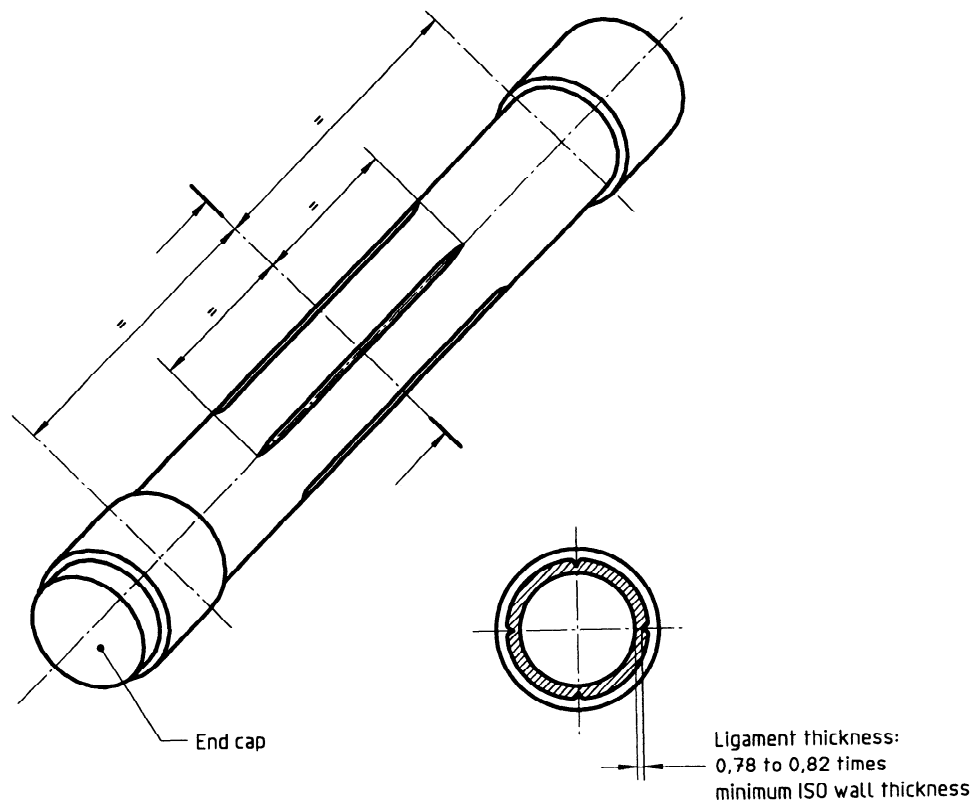


Figure 1 — Pipe test piece

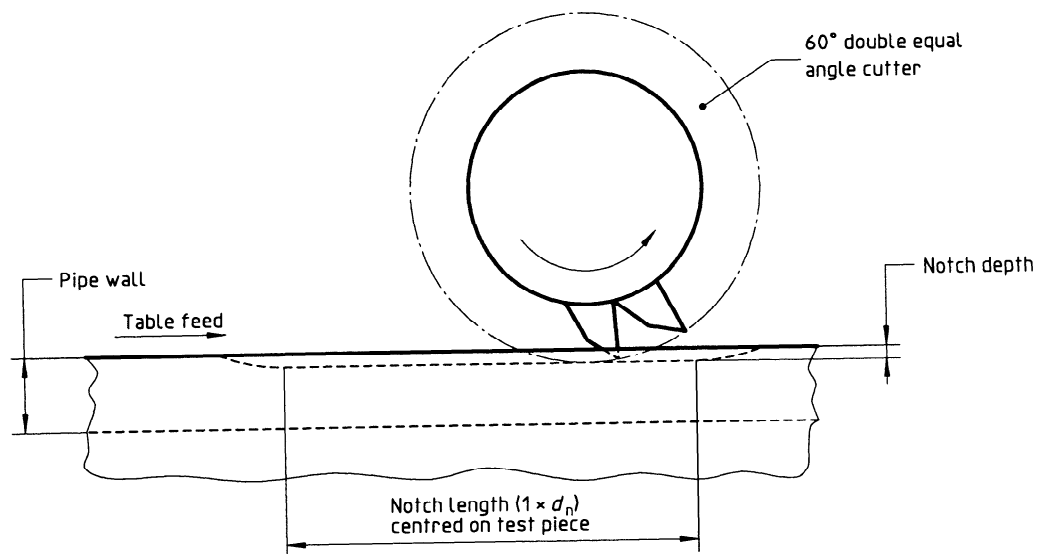


Figure 2 — Notching method

6.4 Number of test pieces

Prepare a minimum of three test pieces unless specified otherwise in the referring standard.

7 Conditioning

The test pieces shall be filled with water, immersed in a water tank at 80 °C and allowed to condition for 24 h for pipes of wall thickness up to 25 mm and 48 h for greater wall thicknesses.