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AS/NZS 4130:2009 Polyethylene (PE) pipes for pressure applications

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Date: Friday, August 19, 2011 1:22 PM

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AS/NZS 4130:2009
(Incorporating Amendment No. 1)

Australian/New Zealand Standard™

Polyethylene (PE) pipes for pressure applications

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee PL-006, Polyolefin Pipe systems. It was approved on behalf of the Council of Standards Australia on 3 April 2009 and on behalf of the Council of Standards New Zealand on 3 April 2009.
This Standard was published on 4 June 2009.

The following are represented on Committee PL-006:

Certification Interests (Australia)
Energy Networks Association
Engineers Australia
Master Plumbers, Gasfitters and Drainlayers New Zealand
National Plumbing Regulators Forum
New Zealand Water and Waste Association
Plastics Industry Pipe Association of Australia
Plastics New Zealand
Plumbing Products Industry Group
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This Standard was issued in draft form for comment as DR 07399.

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(Incorporating Amendment No. 1)

Australian/New Zealand Standard™

Polyethylene (PE) pipes for pressure applications

Originated in Australia in part as AS K119—1962.
Originated in New Zealand in part as 1189—1953.
Previous edition AS/NZS 4130:2003.
Fifth edition 2009.
Reissued incorporating Amendment No. 1 (October 2009).

Jointly published by Standards Australia, GPO Box 476, Sydney, NSW 2001 and Standards New Zealand, Private Bag 2439, Wellington 6020

ISBN 0 7337 9161 1

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee PL-006, Polyolefin Pipe Systems, to supersede AS/NZS 4130:2003, *Polyethylene (PE) pipes for pressure applications*.

This Standard incorporates Amendment No. 1 (October 2009). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this document is to provide a standard specification for manufacturers and purchasers of polyethylene pipes used for pressure applications.

This revision is based largely on the latest ISO documents. The notable exception is the inclusion of Series 3 gas pipes, which are included for reasons of compatibility with existing systems. Series 2 gas pipe dimensions are such as to ensure compatibility with existing systems that conform to the ISO 11922-1 size series. Series 1 pressure pipes are for general pressure applications and are compatible with the ISO 11922-1 size series dimensions.

Installation requirements are covered by AS 2033, *Installation of polyethylene pipe systems* and AS/NZS 4645, *Gas distribution networks*.

Changes in this revision include:

(i) Larger pipe sizes, up to DN 2000, in line with ISO 4427.

(ii) Stripe widths changed to include percent coverage of external surface to facilitate identification.

(iii) Removal of PE 80C material designation as this material is no longer commonly used in practice for pressure pipes.

(iv) The requirements for decohesion testing of stripe/jacketing material has been removed.

(v) Definition of fuel gas changed to align with ENA requirements.

(vi) For series 2 gas pipes, SDR 9, SDR 21 and SDR 26 included, SDR 17.6 replaced with SDR 17.

(vii) A new design factor of 1.2 has been added for pipe cracking without liner pipe.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard. Other notes are for information only.

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FOREWORD

This Standard covers three series of pipe dimensions. Series 1 for general pressure applications and Series 2 and 3 for fuel gas applications.

Pipes made from similar polyethylene compounds from different manufacturers may need to be evaluated to ensure compatibility in welding and similar operations (see AS 2033).

Resistance to rapid crack propagation (RCP) has not been included as a requirement in this Standard. RCP is a potential failure mode in thick wall pipes carrying compressible fluids and operating at high stresses and low temperatures.

Wall thicknesses for the specified pipes have been calculated from equations that take into account the hydrostatic design stress (HDS) of the material and the working pressure and diameter of the pipe. HDS values for Series 1 pipes (C = 1.25) are given in the table below. In the interest of serviceability of the pipe and irrespective of the calculated minimum wall thickness, this Standard does not provide for a wall thickness of less than 1.6 mm.

HDS VALUES FOR SERIES 1 (C = 1.25)

Compound	Series 1 HDS (MPa)
PE 80	6.3
PE 100	8.0

By convention, plastics pipe systems are often designed on the basis of 50 year extrapolated test data. This is established international practice but is not intended to imply the service life of pressure pipe is limited to 50 years. For correctly manufactured and installed systems, the actual life cannot be predicted, but can logically be expected to be well in excess of 100 years before major rehabilitation is required.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand
Polyethylene (PE) pipes for pressure applications

1 SCOPE AND APPLICATION

1.1 Scope

This Standard specifies requirements for polyethylene pipes for the conveyance of fluids under pressure. Such fluids include, but are not restricted to, water, wastewater, slurries, compressed air, and fuel gas. Fuel gas includes natural gas, liquefied petroleum gas (LPG) in the vapour phase and LPG/air mixtures. A1

Pipes that do not contain carbon black, in compliance with this Standard, are not intended for extended exposure in direct sunlight.

1.2 Application

Means for demonstrating compliance with this Standard shall be in accordance with Appendix A.

Pipes intended for the transmission of fuel gas are hereinafter referred to as ‘gas pipes’ and shall be operated up to a MAOP of 1050 kPa gauge.

The test requirements specified in this Standard may be achieved by alternative test methods if such methods can be shown to provide equal or greater accuracy than those specified herein. In all cases of dispute, the methods specified in this Standard shall be considered the reference test methods.

2 NORMATIVE REFERENCES

The following documents are indispensable for the application of this Standard.

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS

1199	Sampling procedures for inspection by attributes
1199.1	Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
1462	Methods of test for plastics pipes and fittings
1462.24	Part 24: Determination of resistance to crack propagation—Test methods for slow crack growth in notched pipes (notch test)

AS/NZS

1462	Methods of test for plastics pipes and fittings
1462.1	Part 1: Method for determining the dimensions of pipes and fittings
1462.4	Part 4: Method of determining reversion UPVC pipes
1462.6	Part 6: Thermoplastic pipes, fittings and assemblies for the transport of fluids under pressure—Resistance to internal pressure
1462.26	Part 26 Determination of weathering resistance of plastics pipes for external storage
1462.28	Part 28: Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds
2566	Buried flexible pipes
2566.1	Part 1: Structural design

AS/NZS	
3500	Plumbing and Drainage
3500.0	Part 0: Glossary of terms
4020	Testing of products for use in contact with drinking water
4131	Polyethylene (PE) compounds for pressure pipes and fittings
SA	
HB18	Conformity assessment
HB18.28	Guidance on a third-party certification system for products
ISO	
11357	Plastics—Differential scanning calorimetry (DSC)
11357-6	Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)

3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 3500.0, AS/NZS 4131, and those below apply.

3.1 Brittle failure

The type of failure of the material in pipe form during pressure testing, where the pipe exhibits no plastic deformation visible to the naked eye (normal or corrected vision).

3.2 Co-extruded 'jacket' pipes

A pipe comprising two layers, where the layers are bonded simultaneously in a die head as part of the extrusion process.

3.3 Ductile mode

The type of failure of the material in pipe form during pressure testing, where the pipe exhibits plastic deformation visible to the naked eye (normal or corrected vision).

3.4 Fuel gas

Any fuel that is supplied through pipes or in containers and is a gas at a temperature of +15°C and an absolute pressure of 101.325 kPa.

3.5 Hoop stress

The stress in a pipe or fitting under pressure acting tangentially to the perimeter of a transverse section.

3.6 Hydrostatic design stress (HDS)

Hoop stress due to internal hydrostatic pressure, which can be applied continuously at a specified temperature, and which is obtained by the application of a design factor to the minimum required strength (MRS).

3.7 Maximum allowable operating pressure (MAOP)

The maximum pressure that can be sustained, with a design factor, by the type or class of pipe for its estimated useful life under the anticipated operating conditions.

3.8 Out-of-roundness (ovality)

The difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross-section of the pipe.

3.9 Pipe material temperature

Average temperature estimated as applying through the full wall thickness.

3.10 Standard dimension ratio (SDR)

A nominal ratio of the pipe outside diameter to its wall thickness.

3.11 Nominal working pressure

Maximum pressure that can be sustained by the class of pipe for its estimated useful life under the expected working conditions.

4 NOTATION

The following apply to this Standard:

D_m = mean outside diameter, in millimetres

DN = nominal size, in millimetres

D_I = mean inside diameter, in millimetres

C = overall service (design) coefficient

HDS = MRS/C

σ_{LPL} = lower prediction limit

MRS = minimum required strength, in megapascals

PN = nominal working pressure designated in bar but normally referenced in MPa $\left(\text{that is, } \frac{\text{PN (in bar)}}{10} = \text{MPa}\right)$

SDR = standard dimension ratio

T = wall thickness, in millimetres

T_{max} = maximum wall thickness, in millimetres

$T_{min.}$ = minimum wall thickness, in millimetres

5 OVERALL SERVICE (DESIGN) COEFFICIENT

The service (design) coefficient (C), used to determine the nominal pressure rating (PN) for Series 1 pipes, is 1.25. Calculation of maximum allowable operating pressure (MAOP) for Series 1 pipes with increased design coefficient shall be in accordance with Appendix B.

NOTES:

1 Advisory information on the selection of design factors for water pipes is given in Appendix C.

2 For Series 2 and Series 3 pipes refer AS/NZS 4645 Part 3.

6 CLASSIFICATION

Series 1 pipes are classified in terms of the nominal pressure rating (PN). The number used to describe PN is 10 times the value of the maximum allowable operating pressure (MAOP) at 20°C based on C = 1.25 and given in megapascals.

The classifications for Series 1 pipes shall be as follows:

PN 3.2 Nominal working pressure of 0.32 MPa

PN 4 Nominal working pressure of 0.40 MPa

PN 6.3 Nominal working pressure of 0.63 MPa

PN 8 Nominal working pressure of 0.80 MPa

PN 10 Nominal working pressure of 1.00 MPa

PN 12.5 Nominal working pressure of 1.25 MPa

PN 16 Nominal working pressure of 1.60 MPa

PN 20 Nominal working pressure of 2.00 MPa

PN 25 Nominal working pressure of 2.50 MPa

Series 2 and Series 3 pipes shall be classified according to SDR.

Standard dimension ratios for Series 1 pipes made from PE 80 and PE 100 compounds shall be as given in Table 1.

Series 1 pipe dimensions shall be as given in Table 2, Series 2 in Table 3, and Series 3 in Table 4.

TABLE 1

STANDARD DIMENSION RATIOS (SDRs) FOR SERIES 1 PIPES

Compound	PN 3.2	PN 4	PN 6.3	PN 8	PN 10	PN 12.5	PN 16	PN 20	PN 25
PE 80	41	33	21	17	13.6	11	9	7.4	—
PE 100	—	41	26	21	17	13.6	11	9	7.4

TABLE 2

DIMENSIONS FOR SERIES 1 PIPES FOR STANDARD DIMENSION RATIOS

millimetres

SDRs 41, 33 and 26															
Nominal outside diameter (DN)	Mean outside diameter (D_m)		Maximum out-of-roundness	SDR 41				SDR 33				SDR 26			
				Wall thickness (T)		Mean inside diameter (D_I)		Wall thickness (T)		Mean inside diameter (D_I)		Wall thickness (T)		Mean inside diameter (D_I)	
	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
16	16.0	16.3	1.2	—	—	—	—	—	—	—	—	—	—	—	—
20	20.0	20.3	1.2	—	—	—	—	—	—	—	—	—	—	—	—
25	25.0	25.3	1.2	—	—	—	—	—	—	—	—	—	—	—	—
32	32.0	32.3	1.3	—	—	—	—	—	—	—	—	—	—	—	—
40	40.0	40.4	1.4	—	—	—	—	—	—	—	—	—	—	—	—
50	50.0	50.5	1.4	—	—	—	—	—	—	—	—	—	—	—	—
63	63.0	63.6	1.5	—	—	—	—	—	—	—	—	2.4	2.8	57.4	58.8
75	75.0	75.7	1.6	—	—	—	—	2.3	2.7	69.6	71.1	2.9	3.3	68.4	69.9
90	90.0	90.9	1.8	—	—	—	—	2.8	3.2	83.6	85.3	3.5	4.0	82.0	83.9
110	110.0	111.0	2.2	2.7	3.1	103.8	105.6	3.4	3.9	102.2	104.2	4.3	4.9	100.2	102.4
125	125.0	126.2	2.5	3.1	3.6	117.8	120.0	3.9	4.4	116.2	118.4	4.8	5.4	114.2	116.6
140	140.0	141.3	2.8	3.5	4.0	132.0	134.3	4.3	4.9	130.2	132.7	5.4	6.1	127.8	130.5
160	160.0	161.5	3.2	4.0	4.5	151.0	153.5	4.9	5.5	149.0	151.7	6.2	7.0	146.0	149.1
180	180.0	181.7	3.6	4.4	5.0	170.0	172.9	5.5	6.2	167.6	170.7	6.9	7.7	164.6	167.9
200	200.0	201.8	4.0	4.9	5.5	189.0	192.0	6.2	7.0	186.0	189.4	7.7	8.6	182.8	186.4
225	225.0	227.1	4.5	5.5	6.2	212.6	216.1	6.9	7.7	209.6	213.3	8.6	9.6	205.8	209.9
250	250.0	252.3	5.0	6.2	7.0	236.0	239.9	7.7	8.6	232.8	236.9	9.6	10.7	228.6	233.1
280	280.0	282.6	9.8	6.9	7.7	264.6	268.8	8.6	9.6	260.8	265.4	10.7	11.9	256.2	261.2
315	315.0	317.9	11.1	7.7	8.6	297.8	302.5	9.7	10.8	293.4	298.5	12.1	13.5	288.0	293.7
355	355.0	358.2	12.5	8.7	9.7	335.6	340.8	10.9	12.1	330.8	336.4	13.6	15.1	324.8	331.0
400	400.0	403.6	14.0	9.8	10.9	378.2	381.8	12.3	13.7	372.6	379.0	15.3	17.0	366.0	373.0
450	450.0	454.1	15.6	11.0	12.2	425.6	432.1	13.8	15.3	419.4	426.5	17.2	19.1	411.8	419.7
500	500.0	504.5	17.5	12.3	13.7	472.6	479.9	15.3	17.0	466.0	473.9	19.1	21.2	457.6	466.3
560	560.0	565.0	19.6	13.7	15.2	529.6	537.7	17.2	19.1	521.8	530.7	21.4	23.7	512.6	522.3
630	630.0	635.7	22.1	15.4	17.1	595.8	604.9	19.3	21.4	587.2	597.1	24.1	26.7	576.6	587.5
710	710.0	716.4	24.9	17.4	19.3	671.4	681.6	21.8	24.1	661.8	672.8	27.2	30.1	649.8	662.0
800	800.0	807.2	28.0	19.6	21.7	756.6	768.0	24.5	27.1	745.8	758.2	30.6	33.8	732.4	746.0
900	900.0	908.1	31.5	22.0	24.3	851.4	864.1	27.6	30.5	839.0	852.9	34.4	38.0	824.0	839.3
1 000	1 000.0	1 009.0	35.0	24.5	27.1	945.8	960.0	30.6	33.8	932.4	947.8	38.2	42.2	915.6	932.6
1 200	1 200.0	1 210.0	42.0	29.4	32.5	1 135.0	1 151.2	36.7	40.5	1 119.0	1 136.6	45.9	50.6	1 098.8	1 118.2
1 400	1 400.0	1 410.0	49.0	34.4	38.0	1 324.0	1 341.2	42.9	47.3	1 305.4	1 324.2	53.2	58.7	1 282.6	1 303.6
1 600	1 600.0	1 610.0	56.0	39.3	43.3	1 513.2	1 531.4	49.0	54.0	1 492.0	1 512.0	61.3	67.6	1 464.8	1 487.4
1 800	1 800.0	1 816.2	—	43.8	48.3	1 703.4	1 728.6	54.5	60.1	1 679.8	1.707.2	69.1	76.2	1.647.6	1 677.4
2 000	2 000.0	2 018.0	—	48.8	53.8	1 892.4	1 920.4	60.6	66.8	1 866.4	1 896.8	76.9	84.7	1 830.6	1 864.2

(continued)

TABLE 2 (*continued*)

millimetres

Nominal outside diameter (DN)	Mean outside diameter (D_m)		Maximum out-of-roundness	SDR 21				SDR 17				SDR 13.6			
				Wall thickness (T)		Mean inside diameter (D_I)		Wall thickness (T)		Mean inside diameter (D_I)		Wall thickness (T)		Mean inside diameter (D_I)	
	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
SDRs 21, 17 and 13.6															
16	16.0	16.3	1.2	—	—	—	—	—	—	—	—	—	—	—	—
20	20.0	20.3	1.2	—	—	—	—	—	—	—	—	1.6	1.9	16.2	17.1
25	25.0	25.3	1.2	—	—	—	—	1.6	1.9	21.2	22.1	1.9	2.2	20.6	21.5
32	32.0	32.3	1.3	1.6	1.9	28.2	29.1	1.9	2.2	27.6	28.5	2.4	2.8	26.4	27.5
40	40.0	40.4	1.4	1.9	2.2	35.6	36.6	2.4	2.8	34.4	35.6	3.0	3.4	33.2	34.4
50	50.0	50.5	1.4	2.4	2.8	44.4	45.7	3.0	3.4	43.2	44.5	3.7	4.2	41.6	43.1
63	63.0	63.6	1.5	3.0	3.4	56.2	57.6	3.8	4.3	54.4	56.0	4.7	5.3	52.4	54.2
75	75.0	75.7	1.6	3.6	4.1	66.8	68.5	4.5	5.1	64.8	66.7	5.5	6.2	62.6	64.7
90	90.0	90.9	1.8	4.3	4.9	80.2	82.3	5.4	6.1	77.8	80.1	6.6	7.4	75.2	77.7
110	110.0	111.0	2.2	5.3	6.0	98.0	100.4	6.6	7.4	95.2	97.8	8.1	9.1	91.8	94.8
125	125.0	126.2	2.5	6.0	6.7	111.6	114.2	7.4	8.3	108.4	111.4	9.2	10.3	104.4	107.8
140	140.0	141.3	2.8	6.7	7.5	125.0	127.9	8.3	9.3	121.4	124.7	10.3	11.5	117.0	120.7
160	160.0	161.5	3.2	7.7	8.6	142.8	146.1	9.5	10.6	138.8	142.5	11.8	13.1	133.8	137.9
180	180.0	181.7	3.6	8.6	9.6	160.8	165.4	10.7	11.9	156.2	160.3	13.3	14.8	150.4	155.1
200	200.0	201.8	4.0	9.6	10.7	178.6	182.6	11.9	13.2	173.6	178.0	14.7	16.3	167.4	172.7
225	225.0	227.1	4.5	10.8	12.0	201.0	205.5	13.4	14.9	195.2	200.3	16.6	18.4	188.2	193.9
250	250.0	252.3	5.0	11.9	13.2	223.6	228.5	14.8	16.4	217.2	222.7	18.4	20.4	209.2	215.5
280	280.0	282.6	9.8	13.4	14.9	250.2	255.8	16.6	18.4	243.2	249.4	20.6	22.8	234.4	241.4
315	315.0	317.9	11.1	15.0	16.6	281.8	287.9	18.7	20.7	273.6	279.5	23.2	25.7	263.6	271.5
355	355.0	358.2	12.5	16.9	18.7	317.6	324.4	21.1	23.4	308.2	316.0	26.1	28.9	297.2	306.0
400	400.0	403.6	14.0	19.1	21.2	357.6	365.4	23.7	26.2	347.6	356.2	29.4	32.5	335.0	344.8
450	450.0	454.1	15.6	21.5	23.8	402.4	411.1	26.7	29.5	391.0	400.7	33.1	36.6	376.8	387.9
500	500.0	504.5	17.5	23.9	26.4	447.2	456.7	29.6	32.7	434.6	445.3	36.8	40.6	418.8	430.9
560	560.0	565.0	19.6	26.7	29.5	501.0	511.7	33.2	36.7	486.6	498.7	41.2	45.5	469.0	482.7
630	630.0	635.7	22.1	30.0	33.1	563.8	575.7	37.3	41.2	547.6	561.1	46.3	51.1	527.8	543.1
710	710.0	716.4	24.9	33.9	37.4	635.2	648.6	42.1	46.5	617.0	632.2	52.2	57.6	594.8	612.0
800	800.0	807.2	28.0	38.1	42.1	715.8	731.0	47.4	52.3	695.4	712.4	58.8	64.8	670.4	689.6
900	900.0	908.1	31.5	42.9	47.3	805.4	822.3	53.5	59.0	782.2	801.1	66.2	73.0	754.0	775.7
1 000	1 000.0	1 009.0	35.0	47.7	52.6	894.8	913.6	59.3	65.4	869.2	890.4	72.5	79.9	840.2	864.0
1 200	1 200.0	1 210.0	42.0	57.2	63.1	1 073.8	1 095.6	67.9	74.8	1 050.4	1 075.0	88.2	97.2	1 005.6	1 034.4
1 400	1 400.0	1 410.0	49.0	66.7	73.5	1.253.0	1 279.2	82.4	90.8	1 218.4	1 247.8	102.9	113.3	1 173.4	1 206.8
1 600	1 600.0	1 610.0	56.0	76.2	84.0	1 432.0	1 462.0	94.1	103.7	1 392.6	1 426.2	117.6	129.5	1 341.0	1 379.2
1 800	1 800.0	1 816.2	—	85.7	94.4	1 611.2	1 644.8	105.9	116.6	1 566.8	1 604.4	—	—	—	—
2 000	2 000 0	2 018.0	—	95.2	104.9	1 790.2	1 827.6	117.6	129.5	1 741.0	1 782.8	—	—	—	—

(continued)

TABLE 2 (*continued*)

millimetres

SDRs 11, 9 and 7.4															
Nominal outside diameter (DN)	Mean outside diameter (D_m)		Maximum out-of-roundness	SDR 11				SDR 9				SDR 7.4			
				Wall thickness (T)		Mean inside diameter (D_1)		Wall thickness (T)		Mean inside diameter (D_1)		Wall thickness (T)		Mean inside diameter (D_1)	
	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
16	16.0	16.3	1.2	1.6	1.9	12.2	13.1	1.8	2.1	11.8	12.7	2.2	2.6	10.8	11.9
20	20.0	20.3	1.2	1.9	2.2	15.6	16.5	2.3	2.7	14.6	15.7	2.8	3.2	13.6	14.7
25	25.0	25.3	1.2	2.3	2.7	19.6	20.7	2.8	3.2	18.6	19.7	3.5	4.0	17.0	18.3
32	32.0	32.3	1.3	2.9	3.3	25.4	26.5	3.6	4.1	23.8	25.1	4.4	5.0	22.0	23.5
40	40.0	40.4	1.4	3.7	4.2	31.6	33.0	4.5	5.1	29.8	31.4	5.5	6.2	27.6	29.4
50	50.0	50.5	1.4	4.6	5.2	39.6	41.2	5.6	6.3	37.4	39.3	6.9	7.7	34.6	36.7
63	63.0	63.6	1.5	5.8	6.5	50.0	52.0	7.1	8.0	47.0	47.0	8.6	9.6	43.8	46.4
75	75.0	75.7	1.6	6.8	7.6	59.8	62.1	8.4	9.4	56.2	56.2	10.3	11.5	52.0	55.1
90	90.0	90.9	1.8	8.2	9.2	71.6	74.5	10.1	11.3	67.4	67.4	12.3	13.7	62.6	66.3
110	110.0	111.0	2.2	10.0	11.1	87.8	91.0	12.3	13.7	82.6	86.4	15.1	16.8	76.4	80.8
125	125.0	126.2	2.5	11.4	12.7	99.6	103.4	14.0	15.5	94.0	98.2	17.1	19.0	87.0	92.0
140	140.0	141.3	2.8	12.7	14.1	111.8	115.9	15.7	17.4	105.2	109.9	19.2	21.3	97.4	102.9
160	160.0	161.5	3.2	14.6	16.2	127.6	132.3	17.9	19.8	120.4	125.7	21.9	24.2	111.6	117.7
180	180.0	181.7	3.6	16.4	18.2	143.6	148.9	20.1	22.3	135.4	141.5	24.6	27.2	125.6	132.5
200	200.0	201.8	4.0	18.2	20.2	159.6	165.4	22.4	24.8	150.4	157.0	27.3	30.2	139.6	147.2
225	225.0	227.1	4.5	20.5	22.7	179.6	186.1	25.1	27.8	169.4	176.9	30.8	34.0	157.0	165.5
250	250.0	252.3	5.0	22.7	25.1	199.8	206.9	27.9	30.8	188.4	196.5	34.2	37.8	174.4	183.9
280	280.0	282.6	9.8	25.4	28.1	223.8	231.8	31.3	34.6	210.8	220.0	38.3	42.3	195.4	206.0
315	315.0	317.9	11.1	28.6	31.6	251.8	260.7	35.2	38.9	237.2	247.5	43.0	47.4	220.2	231.9
355	355.0	358.2	12.5	32.2	35.6	283.8	293.8	39.6	43.7	267.6	279.0	48.5	53.5	248.0	261.2
400	400.0	403.6	14.0	36.3	40.1	319.8	331.0	44.7	49.3	301.4	314.2	54.6	60.2	279.6	294.4
450	450.0	454.1	15.6	40.9	45.1	359.8	372.3	50.2	55.4	339.2	353.7	61.5	67.8	314.4	331.1
500	500.0	504.5	17.5	45.4	50.1	399.8	413.7	55.8	61.5	377.0	392.9	—	—	—	—
560	560.0	565.0	19.6	50.8	56.0	448.0	463.5	62.5	68.9	422.2	438.4	—	—	—	—
630	630.0	635.7	22.1	57.2	63.1	503.8	521.3	70.3	77.5	475.0	493.2	—	—	—	—
710	710.0	716.4	24.9	64.5	71.1	567.8	587.4	79.3	87.4	535.2	557.8	—	—	—	—
800	800.0	807.2	28.0	72.5	80.0	640.0	662.0	89.3	98.4	603.2	628.6	—	—	—	—
900	900.0	908.1	31.5	81.7	90.0	720.0	744.7	—	—	—	—	—	—	—	—
1 000	1 000.0	1 009.0	35.0	90.2	99.4	801.2	828.6	—	—	—	—	—	—	—	—
1 200	1 200.0	1 210.0	42.0	—	—	—	—	—	—	—	—	—	—	—	—
1 400	1 400.0	1 410.0	49.0	—	—	—	—	—	—	—	—	—	—	—	—
1 600	1 600.0	1 610.0	56.0	—	—	—	—	—	—	—	—	—	—	—	—
1 800	1 800.0	1 816.2	—	—	—	—	—	—	—	—	—	—	—	—	—
2 000	2 000.0	2 018.0	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE: In the interest of pipe serviceability and irrespective of calculated wall thicknesses, the minimum pipe wall thickness for Series 1 pipes shall be 1.6 mm.

TABLE 3

DIMENSIONS FOR SERIES 2 PIPES—GAS (NOMINAL OUTSIDE DIAMETER SERIES)

millimetres

Nominal outside diameter (DN)	Mean outside diameter (D_m)		Maximum out of roundness	Wall thickness (T)							
				SDR 26		SDR 21		SDR 17		SDR 13.6	
	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
16	16.0	16.3	1.2	2.5	2.9	2.4	2.8	2.4	2.8	3.0	3.4
20	20.0	20.3	1.2	2.5	2.9	2.4	2.8	2.4	2.8	3.0	3.4
25	25.0	25.3	1.2	2.5	2.9	2.4	2.8	2.4	2.8	3.0	3.4
32	32.0	32.3	1.3	2.5	2.9	2.4	2.8	2.4	2.8	3.0	3.4
40	40.0	40.4	1.4	2.5	2.9	2.4	2.8	2.4	2.8	3.0	3.4
50	50.0	50.4	1.4	2.5	2.9	2.4	2.8	3.0	3.4	3.7	4.2
63	63.0	63.4	1.5	2.5	2.9	3.0	3.4	3.8	4.3	4.7	5.3
75	75.0	75.5	1.6	2.9	3.3	3.6	4.1	4.5	5.1	5.5	6.2
90	90.0	90.6	1.8	3.5	4.0	4.3	4.9	5.4	6.1	6.6	7.4
110	110.0	110.7	2.2	4.2	4.8	5.3	6.0	6.6	7.4	8.1	9.1
125	125.0	125.8	2.5	4.8	5.4	6.0	6.7	7.4	8.3	9.2	10.3
140	140.0	140.9	2.8	5.4	6.1	6.7	7.5	8.3	9.3	10.3	11.5
160	160.0	161.0	3.2	6.2	7.0	7.7	8.6	9.5	10.6	11.8	13.1
180	180.0	181.1	3.6	6.9	7.7	8.6	9.6	10.7	11.9	13.3	14.8
200	200.0	201.2	4.0	7.7	8.6	9.6	10.7	11.9	13.2	14.7	16.3
225	225.0	226.4	4.5	8.6	9.6	10.8	12.0	13.4	14.9	16.6	18.4
250	250.0	251.5	5.0	9.6	10.7	11.9	13.2	14.8	16.4	18.4	20.4
280	280.0	282.6	9.8	10.7	11.9	13.4	14.9	16.6	18.4	20.6	22.8
315	315.0	317.9	11.1	12.1	13.5	15.0	16.6	18.7	20.7	23.2	25.7
355	355.0	358.2	12.5	13.6	15.1	16.9	18.7	21.1	23.4	26.1	28.9
400	400.0	403.6	14.0	15.3	17.0	19.1	21.2	23.7	26.2	29.4	32.5
450	450.0	454.1	15.6	17.2	19.1	21.5	23.8	26.7	29.5	33.1	36.6
500	500.0	504.5	17.5	19.1	21.2	23.9	26.4	29.7	32.8	36.8	40.6
560	560.0	565.0	19.6	21.4	23.7	26.7	29.5	33.2	36.7	41.2	45.5
630	630.0	635.7	22.1	24.1	26.7	30.0	33.1	37.4	41.3	46.3	51.1

(continued)

TABLE 3 (*continued*)

millimetres

Nominal outside diameter (DN)	Mean outside diameter (D_m)		Maximum out of roundness	Wall thickness (T)			
				SDR 11		SDR 9	
	Min.	Max.		Min.	Max.	Min.	Max.
16	16.0	16.3	1.2	3.0	3.4	3.0	3.4
20	20.0	20.3	1.2	3.0	3.4	3.0	3.4
25	25.0	25.3	1.2	3.0	3.4	3.0	3.4
32	32.0	32.3	1.3	3.0	3.4	3.6	4.1
40	40.0	40.4	1.4	3.7	4.2	4.5	5.1
50	50.0	50.4	1.4	4.6	5.2	5.6	6.3
63	63.0	63.4	1.5	5.8	6.5	7.1	8.0
75	75.0	75.5	1.6	6.8	7.6	8.4	9.4
90	90.0	90.6	1.8	8.2	9.2	10.1	11.3
110	110.0	110.7	2.2	10.0	11.1	12.3	13.7
125	125.0	125.8	2.5	11.4	12.7	14.0	15.5
140	140.0	140.9	2.8	12.7	14.1	15.7	17.4
160	160.0	161.0	3.2	14.6	16.2	17.9	19.8
180	180.0	181.1	3.6	16.4	18.2	20.1	22.3
200	200.0	201.2	4.0	18.2	20.2	22.4	24.8
225	225.0	226.4	4.5	20.5	22.7	25.2	27.9
250	250.0	251.5	5.0	22.7	25.1	27.9	30.8
280	280.0	282.6	9.8	25.4	28.1	31.3	34.6
315	315.0	317.9	11.1	28.6	31.6	35.2	38.9
355	355.0	358.2	12.5	32.3	35.6	39.7	43.8
400	400.0	403.6	14.0	36.4	40.1	44.7	49.3
450	450.0	454.1	15.6	41.0	45.1	50.3	55.5
500	500.0	504.5	17.5	45.5	50.1	55.8	61.5
560	560.0	565.0	19.6	51.0	56.2	—	—
630	630.0	635.7	22.1	57.3	63.1	—	—

NOTES:

1 The pipe series is based on ISO metric sizes.

2 In the interest of pipe serviceability and irrespective of the calculated wall thickness, this Standard does not provide for a wall thickness of less than 2.4 mm for SDR 26, SDR 21 and SDR 17, and 3.0 mm for SDR 13.6, SDR 11 and SDR 9.

TABLE 4

DIMENSIONS FOR SERIES 3 PIPES—GAS (NOMINAL INSIDE DIAMETER SERIES)

millimetres

Nominal inside diameter (DN)	Mean outside diameter (D_m)		Maximum out of roundness	Wall thickness (T)													
				SDR 9.9		SDR 11		SDR 15		SDR 17		SDR 21		SDR 26		SDR 32	
	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
10	15.7	16.0	0.7	2.3	2.5	2.3	2.5	—	—	—	—	—	—	—	—	—	—
13	18.9	19.2	0.7	2.3	2.5	—	—	—	—	—	—	—	—	—	—	—	—
15	21.4	21.7	0.7	2.3	2.5	2.3	2.5	—	—	—	—	—	—	—	—	—	—
18	22.5	22.8	0.7	2.3	2.5	—	—	—	—	—	—	—	—	—	—	—	—
20	26.6	26.9	0.9	2.7	3.0	2.4	2.7	2.3	2.5	2.3	2.5	—	—	—	—	—	—
25	33.4	33.7	0.9	3.4	3.7	3.1	3.4	2.3	2.5	2.3	2.5	—	—	—	—	—	—
32S	42.1	42.4	1.1	—	—	—	—	2.8	3.1	—	—	—	—	—	—	—	—
32	42.1	42.4	1.1	4.3	4.7	3.9	4.2	3.4	3.7	2.3	2.5	—	—	—	—	—	—
40	48.1	48.4	1.3	4.9	5.4	4.4	4.8	3.4	3.7	2.7	2.9	—	—	—	—	—	—
50	60.2	60.5	1.5	6.1	6.7	5.5	6.1	4.0	4.4	3.6	3.9	—	—	—	—	—	—
65	76.0	76.7	1.5	—	—	6.9	7.6	—	—	4.5	4.9	—	—	—	—	—	—
80	88.7	89.2	2.3	—	—	8.1	8.9	—	—	5.2	5.8	4.2	4.7	—	—	—	—
100	114.1	114.7	2.9	—	—	10.4	11.4	—	—	6.7	7.4	5.4	6.0	—	—	—	—
150	168.0	168.9	3.3	—	—	15.3	16.8	—	—	9.9	10.9	8.0	8.8	6.5	7.1	—	—
200	218.8	219.9	3.3	—	—	19.9	21.9	—	—	13.0	14.3	10.4	11.5	8.4	9.3	6.8	7.5
250	272.6	274.0	3.8	—	—	24.9	27.3	—	—	16.1	17.7	13.0	14.3	10.5	11.6	8.5	9.4
300	323.4	326.7	4.7	—	—	29.5	32.4	—	—	19.1	21.0	15.4	17.0	12.5	13.7	10.1	11.1

NOTES:

1 This pipe series is based on the iron pipe sizes (IPS).

2 In the interests of serviceability of the pipe and irrespective of the calculated wall thickness, this Standard does not provide for a wall thickness of less than 2.3 mm for Series 3 pipes.

3 Hot tool saddle fusion should only be used on Series 3 pipe with a minimum wall thickness of 3.4 mm for SDR 21 and 4.3 mm for SDR 9.9.

4 Nominal diameter DN 32S Series 3 pipe should only be used for low pressure services.

5 SDR 9.9 was formerly called Class 575, and sizes up to DN 80 of SDR 15 and SDR 21 were formerly called Class 250.

7 COMPOSITION

7.1 General

Pipes shall be manufactured from fully pre-compounded pipe extrusion compounds that comply with AS/NZS 4131.

Additives containing compounds based on lead (Pb), cadmium (Cd) or mercury (Hg) shall not be used.

7.2 Rework material

Clean rework, which is generated from the manufacturer's own production of pipe in accordance with this Standard, may be used if it is derived from the same grade of resin as used for the relevant production.

When rework material is added to a production run, the manufacturer shall treat this run as a new batch.

7.3 Striping and jacket compounds

7.3.1 *General*

The base resin, to which colour masterbatch is added for striping and jacket compounds, shall be a base resin used to produce a compound conforming to AS/NZS 4131.

The MRS classification of the base resin used for stripes or jackets shall be greater than or equal to the MRS classification of the compound used for the parent pipe.

Striping and jacket compounds shall be fully pre-compounded and shall comply with the test requirements of Clauses 7.3.2 and 7.3.3.

Coloured striping and jacket compounds shall be UV-stabilized with a minimum of 0.2% of a hindered amine light stabilizer (HALS). Alternatively, the striping or jacket compound shall meet the requirements of Clause 7.3.4.

7.3.2 *Thermal stability of striping compounds*

Striping and jacket compounds shall contain antioxidants, either singly or in combination, such that when determined in accordance with ISO 11357-6 using oxygen, the oxidation induction time shall be not less than 40 min at a test temperature of 200°C or a demonstrated equivalent time at a higher temperature.

7.3.3 *Dispersion*

Antioxidants, ultraviolet light stabilizers and pigments shall be evenly dispersed in the striping or jacket compounds.

When striping or jacket compounds containing carbon black or other pigments are tested in accordance with AS/NZS 1462.28, the rating of appearance shall be not worse than Micrograph B in Annex B of AS/NZS 1462.28, and the arithmetic average of the maximum sizes of pigment agglomerations or foreign bodies shall not exceed 60 μm (corresponding to Grade 3 of AS/NZS 1462.28).

NOTE: Because the dispersion of antioxidants and ultraviolet light stabilizers is difficult to assess, it is assumed that if the pigment is evenly dispersed, the other components will also be evenly dispersed.

7.3.4 *Weathering resistance*

The weathering resistance test shall apply to all coloured striping and jacket compounds with less than 0.2% by mass of HALS. The weathering resistance, including resistance to ultraviolet light radiation, determined in accordance with AS/NZS 1462.26 on samples exposed to at least 3.5 GJ/m^2, shall be such that the mean elongation at break is ≥350%.

NOTE: The intent of the weathering test is to provide assurance of resistance to weathering encountered during storage and transport of pipes. The test does not provide similar assurance for installations exposed to the elements long term. Reference should be made to AS 1745.2 for typical incident energy at various sites around Australia.

8 COLOUR

8.1 General

Pipes that are not intended for fuel gas application shall not be visibly coloured yellow in whole or in part. There are separate colour requirements for pipes supplied into Australia or New Zealand.

Series 1 pipes shall be black or blue, or black with blue stripes or jacket. For recycled water, Series 1 pipes shall be purple, or black with purple stripes or jacket.

Series 2 and Series 3 pipes (fuel gas) shall be yellow, or black with yellow stripes or jacket.

NOTE: Pipes of other colours may be supplied by agreement between the purchaser and the manufacturer.

8.2 Colour requirements for pipes used in Australia

8.2.1 *Stripes and jackets*

8.2.1.1 *General*

A1 Yellow, blue, purple and cream stripes and jackets shall meet the colour requirements of Clauses 8.2.1.2, 8.2.1.3, 8.2.1.4 and 8.2.1.5, respectively. Alternative colour requirements for stripes and jackets shall be as agreed between the purchaser and the manufacturer.

8.2.1.2 *Yellow*

The colour of yellow stripes or jackets shall be yellow no darker than RAL 1018.

8.2.1.3 *Blue*

The colour of blue stripes or jackets shall be blue no darker than RAL 5012.

8.2.1.4 *Purple*

The colour of purple stripes or jackets shall be purple neither lighter than RAL 310 70 15, nor darker than RAL 330 40 40 or RAL 310 50 30.

8.2.1.5 *Cream*

The colour of stripes or jackets for pipes for pressure sewer applications shall be cream. The colour shall be neither lighter than RAL 080 90 20, nor darker than RAL 075 80 20.

8.3 Colour requirements for pipes used in New Zealand

8.3.1 *Stripes and jackets*

8.3.1.1 *General*

A1 Stripes and jackets shall meet the colour requirements of Clauses 8.3.1.2, 8.3.1.3, 8.3.1.4 and 8.3.1.5 respectively. Colour requirements for stripes and jackets of other colours shall be as agreed between the purchaser and the manufacturer.

8.3.1.2 *Yellow*

The colour of yellow stripes or jackets on pipes shall be as follows:

(a) PE 80, no darker than RAL 1018.

(b) PE 100, no lighter than RAL 1033.

8.3.1.3 *Blue*

The colour of blue stripes or jackets on pipes shall be as follows:

(a) PE 80, no darker than RAL 5012.

(b) PE 100, no lighter than RAL 5005.

8.3.1.4 *Purple*

A1 The colour of purple stripes or jackets on pipes shall be as follows:

PE 80 and PE 100 shall be neither lighter than RAL 310 70 15, nor darker than RAL 330 40 40 or RAL 310 50 30.

8.3.1.5 *Cream*

The colour of stripes or jackets for pipes for pressure sewer applications shall be cream. The colour shall be neither lighter than RAL 080 90 20, nor darker than RAL 075 80 20.

NOTE: Information on the RAL colour range may be obtained from RAL Deutsches Institut für Gütesicherung und Kennzeichnung e.V., Siegburger Strasse 39 D-53757 Sankt Augustin, Telephone 49-2241-1605-60, Fax 49-2241-1605-16, www.ral.de

9 GENERAL REQUIREMENTS

9.1 Diameter and wall thickness

9.1.1 *Tables 2, 3 and 4*

The thickness at any point shall not fall below the minimum specified in Tables 2, 3 or 4, as appropriate to the DN and SDR, and the average thickness shall not exceed the maximum specified. When measured at a distance not less than 5% of DN from the cut end of the pipe, in accordance with AS/NZS 1462.1, the mean outside diameter (D_m) shall comply with the requirements of Table 2, 3 or 4, as appropriate. The mean inside diameter may be determined by subtracting the mean wall thickness from the mean outside diameter.

9.1.2 *Special applications*

Where it is desired to determine the wall thickness appropriate for a special application, the calculation in Appendix D shall be used.

9.2 Length

Straight pipe shall be supplied in nominated lengths with a tolerance of +0.05, −0 m. The length of pipes supplied in coils shall be not less than that designated by the manufacturer.

NOTE: All measurements should be adjusted to an equivalent length at 20°C. The coefficient of thermal expansion for PE may be taken for reference purposes as 2×10^{-4}/°C.

9.3 Coiled pipe

The internal diameter for a coil of pipe shall be such that kinking is prevented.

9.4 Out of roundness

Ovality requirements shall apply at the time of manufacture and before coiling. These requirements are applicable to pipe of SDR 17 and less.

9.5 Freedom from defects

9.5.1 *General*

Defects shall not affect the performance or function of the pipe in service. Pipes shall not have any blisters, voids, burnt particles, heat marks or delamination of stripes or jackets. When grooves, wrinkles, rippling, dents or projections are present, the pipe shall comply with the dimensional requirements of Tables 2, 3 or 4, as appropriate. Where defects are present and the product is submitted for acceptance, the manufacturer shall be able to demonstrate its conformance to this Standard.

9.5.2 *Pipe ends*

Pipe ends shall not have any chips, burrs or rough edges and shall be nominally square.

9.5.3 *Cleanliness*

Pipes shall be internally clean and free from swarf and other manufacturing debris.

NOTE: The defects described in Clause 9.5 cannot be completely quantified. Where the presence, size or frequency of any of these are considered to be of concern, acceptance criteria should be agreed between the purchaser/approving authority/certifying body (as appropriate), and the manufacturer. This may be achieved by the provision of acceptable type samples or methods of test.

9.6 Effect on water

Series 1 pipes for the use of potable water shall comply with AS/NZS 4020.

9.7 Stripes

Striped pipes shall have a minimum of four stripes. For pipes less than DN 280, not less than 15% of the external pipe surface shall be covered by striping material.

For pipes equal to or larger than DN 280 and less than DN 630, the percent coverage shall be not less than 10% of the external pipe surface.

For pipes equal to or larger than DN 630 the coverage shall be not less than 8% of the external pipe surface.

These requirements apply unless alternative arrangements are made between the customer and the manufacturer.

10 PERFORMANCE REQUIREMENTS

10.1 Resistance to internal pressure

When tested in accordance with AS/NZS 1462.6, at 80 ±1°C, using conditioning times as defined in Table 5, pipe specimens shall withstand the test parameters shown in Table 6 without failure.

NOTE: Failure is defined as leaking, weeping or rupturing of the test specimen.

A1

TABLE 5

CONDITIONING OF TEST SPECIMENS

Minimum wall thickness mm	Conditioning time in water h
≤10	1
>10 ≤20	3
>20 ≤30	6
>30 ≤40	12
>40 ≤50	18
>50 ≤65	21

TABLE 6

80°C TEST

Compound classification	Applied stress MPa	Min. time to rupture h
PE 80 B	4.5	165
	4.0	1000
PE 100	5.4	165
	5.0	1000

10.2 Reversion

The reversion properties of pipe shall be determined in accordance with the requirements of AS/NZS 1462.4. Calculated reversion shall not exceed 3%.

10.3 Thermal stability

When tested in accordance with ISO 11357-6 using oxygen at a test temperature of 200°C, the oxidation induction time shall be equal to or greater than 20 min. The test specimen shall be taken from the inside surface of the pipe. Other test methods and procedures for determining the oxidation induction time may be used, provided they have been demonstrated to give an accuracy of the same or higher degree than that given in ISO 11357-6 using oxygen.

10.4 Slow crack growth resistance

When SDR 11 pipe is tested in accordance with AS 1462.24 to the values given in Table 7, the pipe shall not rupture.

TABLE 7

SLOW CRACK GROWTH TEST VALUES

Test criteria	PE 80B	PE 100
Pressure, kPa	800	920
Minimum test time, h	500	500

11 MARKING

Marking details shall be legibly printed or formed directly on the pipe in such a way that the marking does not initiate cracks or other types of failure and with normal storage, weathering and processing, and the permissible method of installation and use, legibility shall be maintained for the life of the pipe.

NOTE: Marking of the pipe by embossing may result in initiation points for slow crack growth. Manufacturers should demonstrate that embossing is not detrimental to the performance of the pipe over its service life.

The letters of the marking shall be minimum heights of 3 mm for pipes up to and including nominal outside diameter 32 mm, and 5 mm for larger sizes. Marking shall be repeated at intervals such that the distance between markings is not greater than 1 m. Marking shall show the following:

(a) Manufacturer's name or registered trademark, and pipe series number, in the form TRADEMARK S1, as appropriate. 'SA' shall be used for special applications in accordance with Appendix D.

(b) For Series 1 pipes: DN, classification and SDR, in the form 'DN 25 PN 4 SDR 33', as appropriate.

(c) For Series 2 pipes: DN and SDR, in the form 'DN 160 SDR 11', as appropriate, and the word 'GAS'.

(d) For Series 3 pipes: DN, $T_{min.}$ and SDR, in the form 'DN 40 × 4.4 SDR 11', as appropriate, and the word 'GAS'.

(e) For pipes dimensions in accordance with Appendix D: DN and T_{min}, in the form 'DN 250 × 11.2', as appropriate.

(f) PE material classification number in the form 'PE 80B', as appropriate.

(g) Date of manufacture in the form '081015', i.e. the 15th of October, 2008, as appropriate.

(h) Identification of the place of manufacture. The manufacturer's code is acceptable, (e.g. F1).

(i) The number of this Standard, i.e. AS/NZS 4130.

(j) For Series 1 pipes for compressed air applications: DN, classification, SDR and compressed air pressure rating in kilopascals, in the form DN 25 PN 4 SDR 33 400 kPa, as appropriate, and the words 'COMPRESSED AIR'.

(k) For recycled water applications 'RECYCLED OR RECLAIMED WATER—DO NOT DRINK'.

(l) For pressure sewerage applications 'SEWAGE'.

NOTE: Manufacturers making a statement of compliance with this Australian/New Zealand Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

Examples of mandatory marking:

Series 1: TRADEMARK S1 DN 25 PN 4 SDR 33 PE 80B 010515 F1 AS/NZS 4130

Series 2: TRADEMARK S2 DN 110 SDR 11 GAS PE 80B 010515 F1 AS/NZS 4130

Series 3: TRADEMARK S3 DN 40 × 4.4 SDR 11 GAS PE 80B 010515 F1 AS/NZS 4130

Special applications: TRADEMARK SA DN 250 × 11.2 PE 100 010515 F1 AS/NZS 4130

Series 1: TRADEMARK S1 DN 25 PN 4 SDR 33 1600 kPa COMPRESSED AIR PE 80B 050515 F1 AS/NZS 4130

Series 1: TRADEMARK S1 DN 25 PN 4 SDR 33 PE 80B 050515 F1 AS/NZS 4130 RECYCLED OR RECLAIMED WATER—DO NOT DRINK

Series 1: TRADEMARK S1 DN 315 PN 8 SDR 21 PE 100 010515 F1 AS/NZS 4130 SEWAGE

APPENDIX A

MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Normative)

A1 SCOPE

This Appendix sets out two means by which compliance with this Standard shall be demonstrated by a manufacturer, as follows:

(a) The use of a product certification scheme.

(b) The use of a minimum sampling and testing frequency plan.

A2 RELEVANCE

The long-term performance of pipeline systems is critical to the operating efficiency of water agencies in terms of operating licences and customer contracts. The long-term performance of plumbing systems is similarly critical to the durability of building infrastructure, protection of public health and safety and protection of the environment.

A3 DEFINITIONS

A3.1 Acceptable quality level (AQL)

When a continuous series of lots or batches is considered, the quality level, for the purpose of sampling inspection, is the limit of a satisfactory process average (see ISO 2859.1 and ISO 3951).

NOTE: The designation of an AQL does not imply that a manufacturer has the right to knowingly supply any non-conforming unit of product.

A3.2 Batch

Schedule of pipes, all of the same nominal diameter, wall thickness and marking, manufactured from the same material or compound on the same machine.

NOTE: The batch is defined and identified by the pipe manufacturer.

A3.3 Batch release test (BRT)

A test performed on a sample from the batch or lot to confirm conformance to the requirements of this Standard, before the batch can be released.

A3.4 Inspection level

The relationship between the batch or lot size and the sample size (see ISO 2859-1).

A3.5 Lot

A clearly identifiable subdivision of a batch for inspection purposes.

A3.6 New formulation

A change in material or compound formulation that exceeds the limits given in Appendix A of AS/NZS 4131.

A3.7 Process verification test (PVT)

A test performed on a sample at specific intervals, to confirm conformance to the requirements of this Standard before further batches can be released.

A3.8 Sample

One or more units of product drawn from a batch or lot, selected at random without regard to quality.

NOTE: The number of units of product in the sample is the sample size.

A3.9 Sampling plan

A specific plan that gives the number of samples and the frequency of inspection or testing.

A3.10 Type test (TT)

A test performed on a sample to confirm conformance to the requirements of this Standard before any batches can be released.

A4 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with this Standard.

The certification scheme shall meet the criteria described in HB 18.28/SANZ HB 18.28 (ISO/IEC Guide 28) in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of this Standard.

Product certification shall be conducted by a certification body accredited by the Joint Accreditation System for Australia and New Zealand (JAS-ANZ) or by another certification body that is acceptable to JAS-ANZ.

The frequency of the sampling and testing plan, as detailed in Paragraph A5, shall be used by the certifying body for product compliance auditing. However, where the manufacturer can demonstrate adequate process control to the certifying body, the frequency of sampling and testing nominated in the manufacturer's quality and/or documented procedures shall take precedence for the purpose of product certification.

A5 MINIMUM SAMPLING AND TESTING FREQUENCY PLAN

A5.1 General

Table A1 sets out the minimum sampling and testing frequency plan for a manufacturer to demonstrate compliance of product(s) to this Standard.

A5.2 Retesting

In the event of a test failure, the products manufactured since the previous test(s) conforming to the requirements outlined in Table A1, shall be quarantined as a batch. A further set of samples shall be selected randomly from the quarantined batch using a sampling plan to AS 1199.1 for an acceptable quality level (AQL) of 2.5 and an inspection level of S3, unless otherwise specified. If the retest requirements are met, the batch may be released and compliance with this Standard for the quarantined batch may be claimed.

Should a failure occur on retesting, then the quarantined batch shall be rejected and claims and/or marking indicating compliance to this Standard shall be suspended until the cause of the failure has been identified and corrected.

A5.3 Rejection after test

In the event of a quarantined batch being rejected after retesting in accordance with the procedures set out in Paragraph A5.2, it may be subjected to 100% testing for the failed requirement(s), and only those items found to comply may be claimed and/or marked as complying with this Standard.

TABLE A1

MINIMUM SAMPLING AND TESTING FREQUENCY PLAN

Characteristics	Clause	Requirement	Test method	Frequency
TYPE TESTS (TTs)				
Material property	7	Composition	Process control	Any new material formulation or design or once every 5 years, whichever occurs first
	8, 9.5	Colour and freedom from defects	Visual inspection	Any new material formulation or design
	9.6	Effect on water	AS/NZS 4020	Any new material formulation or once every 5 years, whichever occurs first
Performance	9.1–9.4	Dimensions	AS/NZS 1462.1	Any new material formulation
	10.1	Resistance to internal pressure at 80°C	AS/NZS 1462.6	
	10.2	Reversion	AS/NZS 1462.4	
	10.3	Thermal stability	ISO 11357-6	
	10.4	Slow crack growth	AS 1462.24	
	11	Marking	Visual inspection	
PROCESS VERIFICATION TESTS (PVTs)				
Performance	10.1	Resistance to internal pressure at 80°C	AS/NZS 1462.6	To manufacturer's sampling plan. Samples to be evenly selected from all pressure groups in such a way that units of each DN produced are tested regularly and continuously, at least once every 3 years
BATCH RELEASE TESTS (BRTs)				
Material property	8.1, 8.2	Colour	Visual inspection	Once per batch
Performance	7.3.3	Dispersion	AS/NZS 1462.28	Once per batch of compound
	9.5	Freedom from defects	Visual inspection	Once per 4 h
	10.1	Resistance to internal pressure at 80°C and 165 h	AS/NZS 1462.6	Once per batch
	10.2	Reversion	AS/NZS 1462.4	Once per batch
	10.3	Thermal stability	ISO 11357-6	Once per batch
Dimensions	9.1	Diameter and wall thickness	AS/NZS 1462.1*	Once per hour or start and end of coil
	9.2	Length	AS/NZS 1462.1	Once per 4 h
	9.3	Coiled pipe ID	Visual inspection	Once per 4 h
	9.4	Out of roundness	AS/NZS 1462.1*	Once per 4 h
	11	Marking	Visual inspection	Once per 4 h

* May also be tested by attributes (e.g. no and no-go gauges)

APPENDIX B

CALCULATION OF MAXIMUM ALLOWABLE OPERATING PRESSURE (MAOP) AT 20°C FOR SERIES 1 PIPES

(Normative)

B1 SCOPE

This Appendix sets out equations to calculate the maximum allowable operating pressure (MAOP) at 20°C for Series 1 pipes.

B2 SERIES 1 PIPES

MAOP shall be calculated from the following equation:

$$\text{MAOP} = \frac{0.125\ \text{PN}}{C} \qquad \ldots \text{B1}$$

C shall be not less that 1.25 for general pressure applications and not less than 2.0 for transmission of compressible fluids, such as compressed air. MAOP shall be not greater than the nominal working pressure given in Clause 6.

NOTE: Guidance on the selection of design factors is given in Appendix C of this Standard.

Example:

A PN 12.5 water supply pipe is to be installed by directional drilling under the pavement of a major urban road. Normal operating temperature is to be taken as 16°C. Determine the MAOP for the pipeline.

From Appendix C, Table C2, the design factor $C = f_0 \times f_1 \times f_2 \times f_3$. f_0 = 1.25 (water); f_1 = 1.0 (16°C); f_2 = 1.2 (under major urban road); f_3 = 1.2 (directional drilling)

$C = 1.25 \times 1.0 \times 1.2 \times 1.2 = 1.8 > 1.25$

$$\text{MAOP} = \frac{0.125 \times 12.5}{1.8} = 0.87\ \text{MPa} < 1.25\ \text{MPa}$$

APPENDIX C

DESIGN FACTORS

(Informative)

Recommendations on the selection of appropriate factors for the design of water and sewerage pipes are given in Table C1.

TABLE C1

DESIGN FACTORS FOR WATER AND SEWERAGE PIPE SYSTEMS

Condition	Installation	Factor	Index
Fluid (see Note 5)	Water Domestic sewage Industrial sewage	1.25 1.25 1.25	f_o
Soil, fluid or pipe temperature (average t °C)	$-20 < t \leq -10$ $-10 < t \leq 0$ $0 < t \leq 20$ $20 < t \leq 30$ $30 < t \leq 35$ $35 < t$	Refer manufacturer 0.6 1.0 1.1 1.25 Refer manufacturer	f_1
Location based on minimum depth of cover specified in AS/NZS 2566.1	Open field Minor country road shoulder Major country road shoulder Minor country road—Under pavement Major country road—Under pavement Residential—Paved and unpaved nature strip (footpath) Residential roadway—Under pavement Major urban road—Under pavement Commercial/Industrial paved and unpaved nature strip (footpath) Commercial/Industrial roadway—Under pavement Central Business District Private land—Easement Above ground Submarine crossings	1.0 1.0 1.0 1.1 1.2 1.0 1.1 1.2 1.1 1.2 1.4 1.0 1.0 1.4	f_2
Installation method	Standard trenching Plough-in Directional drilling Slip line with back grouting Slip line without back grouting Pipe cracking—With liner pipe in situ Pipe cracking—With liner pipe removed Pipe cracking—Without liner pipe	1.0 1.1 1.2 1.0 1.2 1.0 1.1 1.2	f_3

NOTES TO TABLE C1:

1 Choose only one factor from each condition.

2 This table applies to PE 80B and PE 100 pipe with a life expectancy of >100 years.

3 Pumped installations require further design consideration.

4 Design factor $C = f_0 \times f_1 \times f_2 \times f_3$
Example:
For a water reticulation pipeline in a commercial area paved mall used primarily for pedestrian traffic, operating at maximum summer water temperature of 24°C, and laid using pipe cracking with liner pipe removed:
f_0 =1.25; f_1 =1.1; f_2 =1.1; f_3 =1.2.
Design Factor C = 1.25×1.1×1.1×1.2 = 1.8

5 Where contaminants capable of damaging PE compounds are identified, the risk of using a PE system shall be carefully evaluated.

APPENDIX D

DIMENSIONAL REQUIREMENTS OF PIPES FOR SPECIAL APPLICATIONS

(Normative)

For special applications, the pipe wall thickness requirements shall be calculated from the following equations:

$$T_{\text{min.}} = \frac{PD_{\text{m min.}}}{2S + P} \quad \ldots \text{D1}$$

where

$D_{\text{m min.}}$ = minimum mean outside diameter from Table 2, 3 or 4, as appropriate, in millimetres

P = maximum design operating pressure of pipe, in megapascals

S = MRS/C

MRS = minimum required strength, in megapascals

C = overall service (design) coefficient

$T_{\text{max.}}$ = 1.10 $T_{\text{min.}}$ + 0.1 . . . D2

All other provisions of this shall Standard apply.

NOTES:

1 Guidance on the selection of design factors is given in Appendix C of this Standard.

2 Where saddle fusion is used with pipe designed for special application, the wall thickness may need to be greater than the value calculated above.

APPENDIX E

BIBLIOGRAPHY

(Informative)

AS

1745 Outdoor weathering of plastics in the Australian environment

1745.2 Part 2: Guide for design purposes

ISO

2859 Sampling procedures for inspection by attributes

2859-1 Part 1: Sampling schemes indexed by acceptable quality limit (AQL) for lot-by-lot inspection

3951 Sampling procedures for inspection by variables

9080 Plastics piping and ducting systems—Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation

AMENDMENT CONTROL SHEET

AS/NZS 4130:2009

Amendment No. 1

CORRECTION

SUMMARY: This Amendment applies to Clauses 1.1, 8.2.1.1, 8.3.1.1, 8.3.1.4 and Table 5.

Published on 27 October 2009.

NOTES

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NOTES

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Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

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ISBN 0 7337 9161 1

Printed in Australia