

Australian/New Zealand Standard™

Cross-linked polyethylene (PE-X) pipes for pressure applications



AS/NZS 2492:2007

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 8 June 2007 and on behalf of the Council of Standards New Zealand on 9 March 2007.

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee PL-006, Polyolefin Pipe Systems, to supersede, in part, AS 2492—1994, *Cross-linked polyethylene (PE-X) pipe for hot and cold water applications*, which is withdrawn.

The objective of this Standard is to provide a standard specification for manufacturers and purchasers of cross-linked polyethylene pipes to be used in pressure applications.

The objective of this revision is to revise the Australian Standard and issue it as a joint Australian/New Zealand Standard. This revision extends the product applications to general pressure, including fuel gas, and includes sizes up to DN 1000.

This Standard is based on the latest ISO documents for gas and water applications and, where appropriate, the principles of AS/NZS 4130 *Polyethylene (PE) pipes for pressure applications* and AS/NZS 4131, *Polyethylene (PE) compounds for pressure pipes and fittings* have been followed. One exception is the inclusion of the optional addition of pigment or carbon black masterbatch during extrusion. Appendix A incorporates increased BRT frequency related to use of the option.

The overall service (design) coefficient of 1.25, taken from ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications—Classification and designation—Overall service (design) coefficient*, has been applied to establish the hydrostatic design stress.

The requirements for resistance to slow crack growth and rapid crack propagation are intended to facilitate the use of PE-X pipes for fuel gas at pressures up to 16 bar and for general pressure applications without special granular bedding.

The means for demonstrating compliance with this Standard (Appendix A) have been included for minimum sampling and testing frequency plans to include batch release tests, process verification tests and type tests requirements, to simplify and improve product quality verification.

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 and figures are deemed to be requirements of this Standard.

Notes to text contain information and guidance. They are not an integral part of the Standard.

CONTENTS

	<i>Page</i>
FOREWORD.....	4
 SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 MEANS FOR DEMONSTRATING COMPLIANCE	5
1.3 APPLICATION	5
1.4 REFERENCED DOCUMENTS	5
1.5 DEFINITIONS	5
1.6 MARKING	7
 SECTION 2 MATERIALS	
2.1 BASE MATERIAL.....	9
2.2 TECHNICAL FILE	9
2.3 PERFORMANCE.....	9
2.4 MATERIAL CLASSIFICATION	9
2.5 REPROCESSABLE MATERIAL.....	11
2.6 SURFACE COATINGS AND STRIPES	12
 SECTION 3 PIPES	
3.1 FREEDOM FROM DEFECTS	13
3.2 EFFECT ON FLUID OTHER THAN WATER AND FUEL GAS	13
3.3 EFFECT ON WATER.....	13
3.4 COLOUR.....	13
3.5 OPACITY.....	14
3.6 PRESSURE CLASSIFICATION	14
3.7 DIMENSIONS.....	14
3.8 MECHANICAL PROPERTIES.....	14
3.9 PHYSICAL PROPERTIES.....	15
 APPENDICES	
A MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD	20
B OPERATING CONDITIONS FOR PE-X 80 PIPES USED FOR CONVEYANCE OF HOT AND COLD WATER WITHIN BUILDINGS.....	25
C REFERENCED DOCUMENTS	26

FOREWORD

This Standard describes pipes in terms of dimensional requirements, PE-X material, and PN rating.

Appendix B tabulates operating parameters for PE-X pipes when used for the conveyance of hot and cold water within buildings. These parameters are taken from ISO 15875-2, *Plastics piping systems for hot and cold water installations—Crosslinked polyethylene (PE-X)*, Part 2: *Pipes*, along with the pressure test requirements for PE-X 80. Other test requirements are taken from ISO 14531-1, *Plastics pipes and fittings—Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels—Metric series—Specifications*, Part 1: *Pipes*.

In this Standard, there is a partial pressure limitation for liquefied petroleum gas (LPG). The aim of this limitation is to prevent the formation of aliphatic hydrocarbon liquids under normal service conditions and subsequent deleterious effects on the long-term performance of the pipe. At a partial pressure of 300 kPa absolute, the dewpoint for a typical propane LPG is below 0°C. The designer of a cross-linked polyethylene reticulation system should be aware that if service temperatures lower than this are likely to occur or if LPG containing significant quantities of butane gases are to be reticulated, the partial pressure limitation must be revised to avoid condensation of hydrocarbon liquids.

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Australian/New Zealand Standard
Cross-linked polyethylene (PE-X) pipes for pressure applications

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for cross-linked 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. The partial pressure of the LPG is not to exceed 300 kPa absolute.

Pipes intended for the transmission of fuel gas are hereinafter referred to as 'gas pipes' and are not to be operated at pressures above 1600 kPa gauge.

1.2 MEANS FOR DEMONSTRATING COMPLIANCE

Compliance with this Standard shall be demonstrated in accordance with Appendix A.

1.3 APPLICATION

This Standard does not apply to gas pipes for use with petroleum liquids, including liquid LPG and liquid pentane, or with manufactured or mixed gas distribution systems, which may contain more than 1% aromatics by volume, unless resistance to aromatic constituents has been demonstrated, as required in Clause 2.3.

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

PE-X pipe is suitable for use at temperatures up to 100°C as described in Appendix B; however, continuous long-term operation should be between -50°C and +70°C.

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.

1.4 REFERENCED DOCUMENTS

The documents referred to in this Standard are listed in Appendix C:

1.5 DEFINITIONS

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

1.5.1 Liquefied petroleum gas (LPG)

A hydrocarbon fluid composed predominantly of any of the following hydrocarbons or mixtures of all or any of them: propane (C_3H_8), propylene (C_3H_6), butane (C_4H_{10}) or butylenes (C_4H_8) (see Note 1).

NOTES:

- 1 Unless specifically stated otherwise, any reference to 'propane', 'butane', or similar means the commercial grade of that product.
- 2 The characteristics of the various LP gases, either pure or commercial grades, together with methods for their determination, are given in the ALPGA publication '*Liquefied Petroleum Gas—Specifications and Test Methods*'.

1.5.2 Nominal outside diameter (DN)

Numerical designation of size, which is common to all components in a thermoplastics piping system other than flanges and components designated by thread size.

NOTES:

- 1 It is a convenient round number for reference purposes.
- 2 The nominal outside diameter expressed in millimetres is the minimum mean outside diameter ($d_{em,min}$) defined in Clause 1.5.4.

1.5.3 Mean outside diameter (d_{em})

Value of the outer circumference of the pipe at any cross-section divided by π , rounded up to the nearest 0.1 mm.

NOTE: The value for π taken to be 3.142.

1.5.4 Minimum mean outside diameter ($d_{em,min}$)

Minimum value of the mean outside diameter of the pipe specified for a given nominal outside diameter.

1.5.5 Maximum mean outside diameter ($d_{em,max}$)

Maximum value of the mean outside diameter of the pipe specified for a given nominal outside diameter.

1.5.6 Out-of-roundness (ovality)

Difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross-sectional plane of the pipe.

1.5.7 Nominal wall thickness (e_n)

Wall thickness, in millimetres, tabulated in ISO 4065, corresponding to the minimum wall thickness at any point ($e_{y,min}$).

1.5.8 Wall thickness at any point (e_y)

Measured wall thickness at any point around the circumference of the pipe.

1.5.9 Minimum wall thickness ($e_{y,min}$)

Minimum permissible value of the wall thickness (e_y) at any point around the circumference of the pipe.

1.5.10 Standard dimension ratio SDR

Ratio of the nominal outside diameter of the pipe to its nominal wall thickness, $SDR = d_n/e_n$.

1.5.11 Cross-linked polyethylene (PE-X)

Structures within the polyethylene polymer chains that are interconnected by chemical bonds to create a three-dimensional polymer network.

NOTE: The properties of the three-dimensional structure ensure that it is not possible to melt or dissolve the polymer. The extent of cross-linking is related to the mass of insoluble material remaining following solvent extraction and can be determined by measurement of the gel content.

1.5.12 Base material

Physical blend of non-cross-linked polyethylene(s) and additives formulated to facilitate conversion to PE-X during the production of pipe to meet the requirements of this Standard.

1.5.13 Lower confidence limit of the predicted hydrostatic strength (σ_{LPL})

Quantity with the dimension of stress, which represents the 97.5% lower confidence limit of the predicted hydrostatic strength at a temperature θ and a time t in water.

NOTE: It is denoted as $\sigma_{LPL} = \sigma_{\theta, t, 0.975}$.

1.5.14 Long-term hydrostatic strength (σ_{LTHS})

Quantity, with the dimensions of stress, which represents the predicted mean strength at a temperature (θ) and time (t) in water.

1.5.15 Minimum required strength (MRS)

Value of σ_{LPL} at a temperature of 20°C and a time of 50 years [$\sigma(20^\circ\text{C}, 50 \text{ years}, 0.975)$], rounded down to the nearest lower value of the R10 or R20 series as specified in ISO 3 and ISO 497, depending on the value of σ_{LPL} .

1.5.16 Nominal pressure (PN)

A numerical designation used for reference purposes, related to the mechanical characteristics of the component of a piping system. For plastics piping systems conveying water it corresponds to the maximum continuous operating pressure in bar, which can be sustained with water at 20°C, based on the minimum design coefficient.

1.5.17 Overall service (design) coefficient (C)

Overall coefficient, with a value greater than 1, that takes into consideration service conditions as well as properties of the components of a piping system other than those represented in σ_{LPL} .

NOTE: ISO 12162 specifies a minimum permissible service (design) coefficient of 1.25 for PE-X pipes.

1.6 MARKING

Marking details shall be legibly printed or formed directly on the pipe. Marking of pipes shall 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 pipes.

Letters shall be of a minimum height 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:

- Manufacturer's name or registered trademark.
- For gas pipes, nominal diameter and SDR, in the form 'DN 25 SDR 9 GAS', as appropriate.
- For pipes other than gas pipes, nominal diameter, classification and SDR, in the form 'DN 25 PN 16 SDR 9'.

- (d) PE-X material classification number in the form 'PE-X* 100', as appropriate, where '*' represents material cross-linked by—
 - (i) peroxide—PE-Xa
 - (ii) silane—PE-Xb
 - (iii) electron beam—PE-Xc
- (e) Date of manufacture in the form '070515', i.e., the 15th of May, 2007, as appropriate.
- (f) Identification of the place of manufacture.
- (g) The number of this Standard, i.e., AS/NZS 2492.

NOTES:

- 1 The manufacturer's code is acceptable, e.g., F1.
- 2 For specific applications additional marking may be required as specified in the relevant installation code.
- 3 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:

TRADE MARK DN 25 PN 16 SDR 9 PE-Xa 100 040515 F1 AS/NZS 2492.