

Australian/New Zealand Standard™

Gas distribution networks

Part 3: Plastics pipe systems



AS/NZS 4645.3:2018

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Australian/New Zealand Standard™

Gas distribution networks

Part 3: Plastics pipe systems

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee AG-008 Gas Distribution, to supersede AS/NZS 4645.3:2008.

The objective of this Standard is to provide for the protection of the general public, operating personnel and the environment, and to ensure safe and reliable operation of gas distribution networks that reticulate gas to consumers.

This Standard covers plastics pipe systems within gas distribution networks in accordance with AS/NZS 4645.1 for operating pressures up to 1050 kPa.

AS/NZS 4645.1 provides a means by which such systems can be planned, designed, constructed and maintained.

The AS/NZS 4645 series of Standards includes the following parts:

AS/NZS

- 4645 Gas distribution networks
- 4645.1 Part 1: Network management
- 4645.2 Part 2: Steel pipe systems
- 4645.3 Part 3: Plastics pipe systems (this Standard)

This Standard is not a design handbook, nor a manual on distribution practices. It does not remove the need for qualified and experienced engineering design, installation and operation or for competent engineering judgement, and does require interpretation and implementation by competent engineers.

The Australian and New Zealand Technical Regulators have advised that this Standard will only apply to the life cycle of new gas distribution networks and modifications or augmentations to existing assets within gas distribution networks. However, the Sections on operations, maintenance, repair, decommissioning, gas quality and risk assessment may be suitable for application to existing assets in existing networks.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard. Alternative means of conformance may be acceptable provided the required safety outcomes can be demonstrated with AS/NZS 4645.1.

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.

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FOREWORD

This Standard achieves its purpose through five fundamental principles as follows:

- (a) A gas distribution network is designed and constructed to have sufficient controls to withstand the threats to which it may be subjected during construction, testing and operation.
- (b) Before a gas distribution network is placed into operation it needs to be inspected and tested to prove its integrity.
- (c) Important matters relating to safety, engineering design, materials, testing, operation and inspection needs to be reviewed, documented and approved by a responsible person(s). The responsible person(s) is defined in each case.
- (d) Operations and maintenance needs to provide for continued monitoring and safe operation of the gas distribution network.
- (e) Where changes occur in or to a gas distribution network, which alter the design assumptions or affect the original integrity, appropriate steps need to be taken to assess the changes, to ensure continued safe operation of the network.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Gas distribution networks

Part 3: Plastics pipe systems

SECTION 1 SCOPE AND GENERAL**1.1 SCOPE**

This Standard specifies materials, design, construction, installation, testing and maintenance requirements for below ground plastics gas distribution networks for use in conjunction with AS/NZS 4645.1, for the distribution of fuel gas suitable for domestic, commercial or industrial uses, where—

- (a) plastics gas distribution networks include those constructed from materials including polyamide (PA), polyethylene (PE) and polyvinyl chloride (PVC); and
- (b) the maximum allowable operating pressure (MAOP) of the gas distribution network is not greater than 1050 kPa.

1.2 EXCLUSIONS

This Standard does not apply to new PVC networks.

1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

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

AS

1110	ISO metric hexagon precision bolts and screws—Product grades A and B
1110.1	Part 1: Bolts
1111	ISO metric hexagon bolts and screws—Product grade C
1111.1	Part 1: Bolts
1112	ISO metric hexagon nuts
1112.1	Part 1: Style 1—Product grades A and B
1112.2	Part 2: Style 2—Product grades A and B
1112.3	Part 3: Product grade C
1112.4	Part 4: Chamfered thin nuts—Product grades A and B
1210	Pressure vessels
1464	Plastics pipes and fittings for gas reticulation—Unplasticized PVC (UPVC)
1464.1	Part 1: Pipes
1464.2	Part 2: Fittings
2129	Flanges for pipes, valves and fittings
2528	Bolts, studbolts and nuts for flanges and other high and low temperature applications
2943	Plastics pipes and fittings for gas reticulation—Polyamide compounds

AS	
2944	Plastics pipes and fittings for gas reticulation
2944.1	Part 1: Polyamide pipes
2944.2	Part 2: Polyamide fittings
4617	Manual shut off gas valves
5200	Plumbing and drainage products
5200.458	Part 458: Universal plastic-bodied transition couplings
AS/NZS	
1252	High-strength steel fastener assemblies for structural engineering—Bolts, nuts and washers
1252.1	Part 1: Technical requirements
1477	PVC pipes and fittings for pressure applications
2566	Buried flexible pipelines
2566.2	Part 2: Installation
3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
4129	Fittings for polyethylene (PE) pipes for pressure applications
4130	Polyethylene (PE) pipes for pressure applications
AS ISO	
6993	Buried, high-impact poly(vinyl chloride) (PVC-HI) piping systems for the supply of gaseous fuels
6993.1	Part 1: Pipes for a maximum operating pressure of 1 bar (100 kPa) (ISO 6993-1:2006, MOD)
ISO	
1452	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure—Unplasticized poly(vinyl chloride) (PVC-U)
1452-3	Part 3: Fittings
2536	Unplasticized polyvinyl chloride (PVC) pressure pipes and fittings, metric series—Dimensions of flanges
3460	Unplasticized polyvinyl chloride (PVC) pressures pipes—Metric series—Dimensions of adapter for backing flange
4014	Hexagon head bolts — Product grades A and B
4034	Hexagon regular nuts (style 1)—Product grade C
4437	Plastic piping systems for the supply of gaseous fuels—polyethylene (PE)
4437-4	Part 4: Valves
7005	Pipe flanges
7005-1	Part 1: Steel flanges for industrial and general service piping systems
7005-2	Part 2: Cast iron flanges
7005-3	Part 3: Copper alloy and composite flanges
7483	Dimensions of gaskets for use with flanges to ISO 7005
9624	Thermoplastics pipes for fluids under pressure—Mating dimensions of flange adapters and loose backing flanges
13953	Polyethylene (PE) pipes and fittings—Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

ISO

- 13954 Plastics pipes and fittings—Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm
- 13955 Plastics pipes and fittings—Crushing decohesion test for polyethylene (PE) electrofusion assemblies
- 13957 Plastics pipes and fittings—Polyethylene (PE) tapping tees—Test method for impact resistance
- 15761 Steel gate, globe and check valves for sizes DN 100 and smaller, for the petroleum and natural gas industries
- 16135 Industrial valves—Ball valves of thermoplastics materials
- 16136 Industrial valves—Butterfly valves of thermoplastics materials
- 16137 Industrial valves—Check valves of thermoplastics materials
- 16486 Plastics piping systems for the supply of gaseous fuels—Unplasticized polyamide (PA-U) piping systems with fusion jointing and mechanical jointing
- 16486-4 Part 4: Valves
- 17467 Plastics piping systems for the supply of gaseous fuels—Unplasticized polyamide (PA-U) piping systems jointed by solvent cement
- 21751 Plastics pipes and fittings—Decohesion test of electrofusion assemblies—Strip-bend test

EN

- 682 Elastomeric seals—Material requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids
- 1515 Flanges and their joints—Bolting
- 1515-1 Part 1: Selection of bolting
- 1515-3 Part 3: Classification of bolt materials for steel flanges, class designated
- 1555 Plastics piping systems for the supply of gaseous fuels—Polyethylene (PE)
- 1515-4 Part 4: Valves

PIPA

- POP007 Metal backing flanges for use with polyethylene (PE) pipe flange adaptors

CSA

- B137 Series 137: Thermoplastic pressure piping compendium

DIN

- 603 Mushroom head square neck bolts
- 8063 Pipe joint assemblies and fittings for unplasticized polyvinyl chloride (U-PVC) pressure pipes
- 8063-4 Part 4: Bushings, flanges, seals; dimensions

API

- Std 602 Steel Gate, Globe and Check Valves for Sizes DN 100 and Smaller for the Petroleum and Natural Gas Industries

ASME

- B16.5 Pipe flanges and flanged fittings
- B16.21 Nonmetallic flat gaskets for pipes flanges
- B16.34 Valves Flanged, Threaded and Welding End

ASME	
B16.40	Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASTM	
A182 F316	Stainless steel flanges
A193/ A193M	Standard specification for alloy-steel and stainless steel bolting materials for high-temperature or high pressure service and other special purpose applications
A194/ A194M	Standard specification for carbon steel, alloy steel, and stainless steel nuts for bolts for high-pressure or high-temperature service, or both
A307	Standard specification for carbon steel bolts, studs, and threaded rod 60 000 PSI tensile strength
A320/ 320M	Standard specification for alloy-steel and stainless steel bolting for low-temperature service
A325	Standard specification for structural bolts, steel, heat treated, 120/105 ksi minimum tensile strength
A354	Standard specification for quenched and tempered alloy steel bolts, studs, and other externally threaded fasteners
A449	Standard specification for hex cap screws, bolts and studs, steel, heat treated, 120/105/90 ksi minimum tensile strength, general use
D2000	Standard Classification System for Rubber Products in Automotive Applications
D2464	Standard specification for threaded poly(vinyl chloride) (PVC) plastic pipe fittings, Schedule 80
D2467	Standard specification for poly(vinyl chloride) (PVC) plastic pipe fittings, Schedule 80
D2513-14e1	Standard specification for polyethylene (PE) gas pressure pipe, tubing, and fittings
D7999	Standards classification for rubber products in natural gas pipeline applications
F1563	Standard Specification for Tools to Squeeze-off Polyethylene (PE) Gas Pipe or Tubing
F1973-13e1	Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems
F2945	Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings
KiwiRail	
Specification	Specification for Installation of Pipelines on Railway Land
E1322	

1.4 RECORDS

Records shall be maintained in accordance with AS/NZS 4645.1.

1.5 DEFINITIONS

For the purpose of this Standard, the definitions in AS/NZS 4645.1, AS/NZS 4129, AS/NZS 4130, AS ISO 6993, AS/NZS 2032 and AS 2944 apply.

Where a term is defined in both AS/NZS 4645.1 and any of the relevant Standards, the definition in AS/NZS 4645.1 shall take precedence.

1.6 ABBREVIATIONS

DN	Nominal pipe diameter (mm)
FSA	Formal safety assessment
MAOP	Maximum allowable operating pressure
MFR	Melt flow rate
MRS	Minimum required strength
OD	Outside diameter
PA	Polyamide
PE	Polyethylene
PVC	Polyvinyl chloride
SDR	Standard dimension ratio

SECTION 2 MATERIALS AND COMPONENTS

2.1 NEW MATERIALS AND NEW COMPONENTS

New materials and new components shall conform with one or more of the relevant Standards listed in Tables 2.1, 2.2 and 2.3.

TABLE 2.1
MATERIALS—PE PIPE NETWORKS

Pipe	Standard	Additional limitations and specific requirements
PE 80 and PE 100	AS/NZS 4130	MAOP ≤ 1050 kPa and gas temperature of $> -20^{\circ}\text{C}$ and $< 40^{\circ}\text{C}$
Component	Standard	
Fittings	AS/NZS 4129, AS 5200.458	
	ASTM D2513-14e1	
	CSA B137 Series-13	
	ISO 4437	
	ASTM F1973-13e1	
Valves	ASME B16.34, API Standard 602, ISO 15761, MSS SP67, ISO 16135, ISO 16136, ISO 16137	
	AS 4617	
	ASME B16.40	
	EN 1555-4	
Flanges	ISO 4437-4	
	PIPA Industry Guideline POP007 Issue 2.5, AS 2129, ISO 2536, ISO 3460, ISO 7005.1, ISO 7005.2, ISO 7005.3, ISO 7483, ISO 9624, DIN 8063.12, DIN 8063.4, ASME B16.5	
Gaskets (Nitrile and Viton)	ASME B16.21, ASTM D2000	
	ASTM D7999-15	
	DIN EN 682	
Bolting	AS/NZS 1252, ASTM A325, EN 1515-1, EN 1515-3, AS 1110.1*, AS 1111.1, AS 1112.1, AS 1112.2, AS 1112.3, AS 1112.4, AS 2528, ASME B18.2.1, ASME B18.2.2, ASTM A193/A193M, ASTM A194/A194M, ASTM A307, ASTM A320, ASTM A354, ASTM A449	

NOTES:

- 1 Bolting standards in the group marked ‘*’ describe fasteners with standard flat-to-flat hexagonal sections. Because flanges have relatively large holes, special care is needed when these fasteners are used on flanges. The result can be that the edges of the holes and mating areas of the fasteners may be loaded excessively even at moderate torques.
- 2 The manufacturer’s nominated gasket crush forces often result in relatively high loads when gaskets are used in gas applications. It may be necessary to apply specialized lubricants, torque spanners and specially machined washers to prevent flange and fastener damage.
- 3 For flanged systems, attention should be given to uniformity of torque.
- 4 Fasteners that conform with ASTM A325 (imperial threads) and AS/NZS 1252 (metric threads) have much larger flat-to-flat dimensions and may not require machined washers to prevent damage. Thread lubricants and torque spanners are still required when so established from engineering considerations.

TABLE 2.2
MATERIALS—PVC PIPE NETWORKS

Pipe	Standard	Additional limitations and specific requirements
PVC	AS ISO 6993	MAOP ≤100 kPa and gas temperature of >−0°C and <30°C
Component	Standard	
Solvent cement and priming fluid	AS/NZS 3879	
Fittings	If compression fittings are required, a formal safety assessment (FSA) review (refer to AS 4645.1) is required prior to their use, see also Clause 4.5 AS 1477, ISO 6993.3, AS 1464.1, AS 5200.458 ASTM D2513-14 ASTM D2464 ASTM D2467 AS 1464.2 ISO 4014/4034 ASTM A182 F316 ISO 1452.3	
Valves	ASME B16.34, API Standard 602, ISO 15761, MSS SP67, ISO 16135, ISO 16136, ISO 16137 ASME B16.40	
Flanges	PIPA Industry Guideline POP007 Issue 2.45 AS 2129, ISO 2536, ISO 3460, ISO 7005.1, ISO 7005.2, ISO 7005.3, ISO 7483, ISO 9624, DIN 8063.12, DIN 8063.4, ASME B16.5	
Gaskets (Nitrile and Viton)	ASME B16.21, ASTM D 2000, ASTM D7999, DIN EN 682	
Bolting	AS/NZS 1252, ASTM A325, EN 1515-1, EN 1515-3, AS 1110.1*, AS 1111.1, AS 1112.1, AS 1112.2, AS 1112.3, AS 1112.4, AS 2528, ASME B18.2.1, ASME B18.2.2, ASTM A193/A193M, ASTM A194/A194M, ASTM A307, ASTM A320, ASTM A354, ASTM A449, DIN 603	

NOTES:

- 1 Bolting standards in the group marked ‘*’ describe fasteners with standard flat-to-flat hexagonal sections. Because flanges have relatively large holes, special care is needed when these fasteners are used on flanges. The result can be that the edges of the holes and mating areas of the fasteners may be loaded excessively even at moderate torques.
- 2 The manufacturer’s nominated gasket crush forces often result in relatively high loads when gaskets are used in gas applications. It may be necessary to apply specialized lubricants, torque spanners and specially machined washers to prevent flange and fastener damage.
- 3 For flanged systems, attention should be given to uniformity of torque.
- 4 Fasteners to ASTM A325 (imperial threads) and AS/NZS 1252 (metric threads) have much larger flat-to-flat dimensions and may not require machined washers to prevent damage. Thread lubricants and torque spanners are still required when so established from engineering considerations.

TABLE 2.3
MATERIALS—PA PIPE NETWORKS

Pipe	Standard	Additional limitations and specific requirements
PA (Class 300)	AS 2944.1, ISO 17467	MAOP $\leq$ 300 kPa and gas temperature of $>-20^{\circ}\text{C}$ and $<40^{\circ}\text{C}$
PA (Class 400)	AS 2944.1, ISO 17467	MAOP $\leq$ 400 kPa and gas temperature of $>-20^{\circ}\text{C}$ and $<40^{\circ}\text{C}$
Component	Standard	
Glue	To be specified and tested by network operator to ensure fit for purpose	
Fittings	If compression fittings are required, a FSA review (refer to AS/NZS 4645.1) is required prior to their use, see also Clause 4.5. AS 2944.2, ISO 17467 ASTM F2945-15 ASTM F1973-13e1	
Valves	ASME B16.34, API Standard 602, ISO 15761, MSS SP67, ISO 16135, ISO 16136, ISO 16137 ASME B16.40 BS ISO 16486-4	
Flanges	PIPA (Plastics Industry Pipe Association of Australia) Guideline POP007 AS 2129, ISO 2536, ISO 3460, ISO 7005.1, ISO 7005.2, ISO 7005.3, ISO 7483, ISO 9624, DIN 8063.12, DIN 8063.4, ASME B16.5	
Gaskets (Nitrile and Viton)	ASME B16.21, ASTM D 2000, ASTM D7999, DIN EN 682	
Bolting	AS/NZS 1252, ASTM A325, EN 1515-1, EN 1515-3, AS 1110.1*, AS 1111.1, AS 1112.1, AS 1112.2, AS 1112.3, AS 1112.4, AS 2528, ASME B18.2.1, ASME B18.2.2, ASTM A193/A193M, ASTM A194/A194M, ASTM A307, ASTM A320, ASTM A354, ASTM A449	

NOTES:

- 1 Bolting standards in the group marked “*” describe fasteners with standard flat-to-flat hexagonal sections. Because flanges have relatively large holes, special care is needed when these fasteners are used on flanges. The result can be that the edges of the holes and mating areas of the fasteners may be loaded excessively even at moderate torques.
- 2 The manufacturers nominated gasket crush forces often result in relatively high loads when gaskets are used in gas applications. It may be necessary to apply specialized lubricants, torque spanners and specially machined washers to prevent flange and fastener damage.
- 3 For flanged systems, attention should be given to uniformity of torque.
- 4 Fasteners to ASTM A325 (imperial threads) and AS/NZS 1252 (metric threads) have much larger flat-to-flat dimensions and may not require machined washers to prevent damage. Thread lubricants and torque spanners are still required when so established from engineering considerations.

2.2 MATERIALS AND COMPONENTS IDENTIFICATION

Materials and components shall be identified in accordance with AS/NZS 4645.1.

2.3 VALVES, FITTINGS AND ACCESSORIES

2.3.1 General

Valves, fittings and accessories shall be manufactured in accordance with a design based on a Standard nominated in Table 2.1, Table 2.2 or Table 2.3.

Fittings and accessories shall be compatible with pipe material to which they are joined.

Valves, fittings and accessories shall be capable of withstanding the operational conditions for which the gas distribution network is designed, and where they are to be incorporated in the gas distribution network after it has been pressure tested, shall—

- (a) be pressure tested to the same test pressure as the gas distribution network;
- (b) have pressure and temperature ratings equivalent to those of the main or service to which they are to be joined; or
- (c) have pressure and temperature ratings greater than those of the main or service to which they are to be joined if, due to tie-ins, they are not subjected to field pressure test verification.

2.3.2 Flanges and flanged fittings

Flanges and flanged fittings shall conform with a Standard nominated in Table 2.1, Table 2.2 or Table 2.3.

The bolting of steel flanges in accordance with ASME B16.5, shall conform with ASME B16.5 or EN 1515 series. Bolting of flanges in accordance with AS 2129, shall conform with AS 2528.

2.3.3 Gaskets and ring joints

Gaskets and ring joints shall conform with a Standard nominated in Table 2.1, Table 2.2 or Table 2.3 and shall have the following properties:

- (a) Resistance to the gases that will be distributed.
- (b) Rated to withstand the MAOP of the section of the gas distribution network.
- (c) Rated to the full range of operating temperatures of the gas distribution network.
- (d) Retain the physical and chemical properties necessary for safe use.

2.3.4 Glues, solvent adhesives and cleaning or priming

Glues, solvent adhesives and cleaning or priming fluids shall be suitable for use with the pipe materials and shall be used in accordance with the manufacturer's instructions.

2.3.5 Valves

Valves shall conform with the Standards nominated in Table 2.1, Table 2.2 or Table 2.3 and the following requirements:

- (a) Lubricants and sealants shall be suitable for the operational conditions.
- (b) Working pressure ratings of valves shall be calculated based upon the temperature range of -20°C to $+40^{\circ}\text{C}$.
- (c) Resilient plastics materials used for seats and seals shall be capable of withstanding the design pressure and temperature.
- (d) Parts in contact with gas shall be of materials that are compatible with the gas.
- (e) Valves shall be clearly and durably marked, on the body or on a permanently attached nameplate, giving the following information:
 - (i) Manufacturer's name and/or trademark.
 - (ii) Class designation or the maximum working pressure for which the valve has been designed.
 - (iii) Body material designation (and the end connection material where more than one type is used).
 - (iv) Nominal valve size.

SECTION 3 DESIGN

3.1 GENERAL

The requirements of this Section shall be in accordance with the general design requirements of AS/NZS 4645.1.

3.2 MAXIMUM ALLOWABLE OPERATING PRESSURE (MAOP)

The MAOP of a plastic main or service shall be no greater than—

- (a) the test pressure divided by 1.4;
- (b) the MAOP as determined in Clauses 3.3, Clause 3.4 or Clause 3.5; and
- (c) the maximum pressure in accordance with the rating of the material used to construct the main or service.

The MAOP shall be determined or calculated (see Clauses 3.3 to 3.5), and recorded for each pressure system.

3.3 POLYETHYLENE MAINS AND SERVICES

3.3.1 Design factor (*C*)

The minimum design factor for polyethylene (PE) mains and services shall be calculated in accordance with Table 3.1.

TABLE 3.1
DESIGN FACTORS FOR PE GAS MAIN OR SERVICE

Condition	Installation	Factor	Index
Fluid	Natural gas	2.0	f_0
	LP Gas	2.2	
	Manufactured gas	(see Note 2)	
Operating temperature (<i>t</i>) °C	$-20 < t < -10$	(see Note 3)	f_1^*
	$-10 < t < 0$	1.2	
	$0 < t < 20$	1.0	
	$20 < t < 30$	1.1	
	$30 < t < 40$	1.3	
Installation method	Open trench with padding	1.0	f_2
	Other	1.1	
Population density	Open field area	0.9	f_3
	Residential area	1.05	
	High density community use	1.2	

* If a gas heater is used to heat up the gas flowing through the main or service there shall be safeguards or active (and redundant) controls to ensure the heater will not allow the main or service temperature to exceed the design temperature at any flow conditions.

NOTES:

- 1 Minimum $C = 2.0$ for natural gas, minimum $C = 2.2$ for LP Gas.
- 2 To be evaluated for each case taking into account the various constituents of that gas with special reference to liquefiable hydrocarbons and aromatics.
- 3 If the operating temperature is less than -10°C , then consult with the manufacturer.
- 4 Design factor $C = f_0 \times f_1 \times f_2 \times f_3$.

Example:

For a natural gas distribution main in a residential area, operating at 15°C and laid in an open trench with padding:

Design factor $C = 2.0 \times 1.0 \times 1.0 \times 1.05 = 2.1$.

3.3.2 Minimum required strength (MRS)

The MRS for PE is as follows:

- (a) For PE 80, MRS = 8.0 MPa.
- (b) For PE 100, MRS = 10.0 MPa.

3.3.3 Maximum allowable operating pressure (MAOP)

The MAOP shall be calculated from the following Equation 3.1:

$$\text{MAOP} \leq \frac{2 \text{ MRS } T_{\min}}{C (D_{\text{m min}} - T_{\min})} \quad \dots 3.1$$

where

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

$D_{\text{m min}}$ = minimum mean outside diameter, in millimetres

MRS = minimum required strength, of the specified material in MPa

C = design factor determined in accordance with Table 3.1

NOTE: For further information on these parameters, refer to AS/NZS 4130.

3.4 POLYVINYL CHLORIDE (PVC) MAINS AND SERVICES

The MAOP for PVC mains and services is 100 kPa.

3.5 POLYAMIDE (PA) MAINS AND SERVICES

The MAOP for PA mains and services is 300 kPa for Class 300 (SDR 33) systems and 400 kPa for Class 400 (SDR 25) systems.

3.6 BENDS

Where a change in direction of the main or service run is required, fabricated bends or elbows should be used, otherwise bending of mains or services shall be undertaken in accordance with Table 3.2 or Table 3.3.

TABLE 3.2
MINIMUM BEND RADIUS PE

SDR	Min. bending radius	Min. bending radius
	For plain pipe and butt fusion joint mm	For electrofusion fittings mm
9	12 × DN	100 × DN
11	15 × DN	100 × DN
13.6	21 × DN	100 × DN
17	25 × DN	100 × DN
21	35 × DN	100 × DN

TABLE 3.3
MINIMUM BEND RADIUS
PA AND PVC

Pipe type	Min. bending radius mm
PA	$25 \times \text{DN}$
PVC	$130 \times \text{DN}$

3.7 DESIGN FOR HIGH DENSITY COMMUNITY USE

In high density community areas the design parameters shall be in accordance with Table 3.4 and be laid to at least the minimum depth in accordance with Table 3.7.

TABLE 3.4
DESIGN PARAMETERS
FOR HIGH DENSITY COMMUNITY USE AREAS

Diameter DN	MAOP kPa			
	≤ 210	$>210 \leq 420$	$>420 \leq 600$	>600
≤ 110	Acceptable	Acceptable	Acceptable	Unacceptable
$>110 \leq 160$	Acceptable	Acceptable	Unacceptable	Unacceptable
>160	Acceptable	Unacceptable	Unacceptable	Unacceptable

3.8 WARNING MARKERS FOR MAINS AND SERVICES

The purpose of markers is to alert parties contemplating excavation or drilling in the area, of the presence of significant infrastructure. The design of mains and services shall provide for marking of the main in accordance with the following requirements:

- (a) Marker signs or ground markers shall be installed as required by Table 3.5.
NOTE: The marker signs or marker stones for mains should indicate any changes in direction.
- (b) Marker signs shall be installed on other mains in locations where gas mains are not expected, for example, in paddocks or along roads where there is no buildings.
- (c) Marker tape or an equivalent shall be installed above the main or service when laid in an open trench to indicate for future excavations the presence of the main or service.
NOTE: The marker tape or equivalent should be installed at least 200 mm above the main or service. Marker tape should be in accordance with AS 2648.1.
- (d) Tracer wire shall be installed with mains and services. Tracer wires shall not be electrically connected to a source of electrical current for which they are not designed.

NOTE: This includes consumer piping, steel mains and any earthing or grounding systems.

TABLE 3.5
MARKER SIGNS/GROUND MARKERS

Diameter DN	MAOP kPa			
	≤210	>210 ≤420	>420 ≤600	>600
≤110	Optional	Optional	Optional	Required
>110 ≤160	Optional	Optional	Optional	Required
>160	Optional	Required	Required	Required

3.9 OFFSET DISTANCES

Gas mains shall be offset from the expected predominant building line at least at a distance in accordance with Table 3.6.

NOTE: Building line relates to the façade of the building, not necessarily the property boundary.

TABLE 3.6
MINIMUM OFFSET DISTANCES

Diameter DN	MAOP kPa			
	≤210	>210 ≤420	>420 ≤600	>600
≤110	0.5 m	0.5 m	0.5 m	3 m
>110 ≤160	0.5 m	0.5 m	3 m	5 m
>160	0.5 m	3 m	3 m	8 m

NOTE: Indicated offset should be considered typical or average for the specific gas main in the area in which it is installed. Unique individual building setbacks over short distances (such as corner blocks of intersecting streets) do not need to be considered.

3.10 DEPTH OF COVER

Gas mains shall be buried at least at a depth in accordance with Table 3.7.

Gas services shall be buried at least at a depth in accordance with Table 3.8.

Additional cover in excess of that required in Table 3.7 or Table 3.8 or additional protection should be specified for—

- (a) critical supply mains to large numbers of consumers or special high reliability supplies;
- (b) circumstances where external loads or vibrations could be excessive; and
- (c) unusual conditions such as may arise at road, rail or river crossings, bridges, areas of heavy traffic, from vibration, or the possibility of ground subsidence or other abnormal forces.

Extra protection shall be designed in accordance with the processes in AS/NZS 4645.1 and may include casing or bridging of the main or service.

Where the requirements for cover below the bottom of any irrigation channel or drainage ditch cannot be attained, special design and construction shall be used.

TABLE 3.7
MINIMUM DEPTH OF COVER—MAINS

Location	Type of main		
	MAOP below 210 kPa	MAOP above 210 kPa	
		≤DN 125	>DN 125
	Cover mm		
High density community use areas			
Sandy/clay areas	600	750	750
Rock	450	450	600
All other areas			
Sandy/clay areas	500	600	750
Rock	450	450	500
Railways			
	Note 1: In Australia, refer to AS 4799 and relevant rail authority in Australia. Note 2: In New Zealand, refer to KiwiRail Specification E1322.		
Major roadways			
	Refer to relevant road authority		

NOTES:

- 1 In some locations, ground temperatures may be such that they will determine the depth of burial through the design aspects of temperature (see f_2 in Table 3.1).
- 2 Depth of cover should not exceed 1.5 m to enable access during emergencies.

TABLE 3.8
MINIMUM DEPTH OF COVER—SERVICES

Location	Type of service for various MAOPs		
	≤ DN 50	>DN 50≤DN 110	
		≤ 210 kPa	> 210 kPa
	Cover mm		
Roadways	450	450	600
Private property	300	300	450
Rock	300	300	375

NOTES:

- 1 Minimum depth for rock applies in roadways/private property.
- 2 For gas services >DN 110, the depth of cover for mains shall apply.

3.11 SEPARATION FROM OTHER UTILITY ASSETS

Location of all other utilities shall be identified during either design and/or pre-construction phase using the available 'one-call' system, e.g. Dial Before You Dig or equivalent.

Where a plastic main or service is laid parallel to other utility assets, a minimum separation distance is required in order to effect repairs. The minimum separation distance shall be 250 mm.

Where a plastic main or service is crossed by other services, the minimum separation distance shall be 150 mm. Additional separation may be required for large utility assets in order to effect repairs.