

Australian/New Zealand Standard™

**Acrylonitrile butadiene styrene (ABS)
compounds, pipes and fittings for
pressure applications**



AS/NZS 3518:2013

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee PL-021, PVC, ABS and Polyamide Pipe Systems. It was approved on behalf of the Council of Standards Australia on 4 February 2013 and on behalf of the Council of Standards New Zealand on 25 January 2013.

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Local Government New Zealand
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This Standard was issued in draft form for comment as DR AS/NZS 3518.

Australian/New Zealand Standard™

Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee PL-021, PVC, ABS and Polyamide Pipe Systems, to supersede AS/NZS 3518:2004, *Acrylonitrile butadiene styrene (ABS) pipes, compounds and fittings for pressure applications*.

This Standard incorporates Amendment No. 1 (December 2018). 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 these products.

This revision updates the references to some of the test methods and changes the frequency at which type tests are to be performed on pipes and moulded fittings.

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

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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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the performance requirements for acrylonitrile butadiene styrene (ABS) compounds (ABS 120, ABS 140, ABS 160 and ABS 180), pipes and fittings for the conveyance of liquids under pressure in applications above and below ground. The Standard contains dimensions for three ranges of pipe sizes, Series 1, Series 2 and Series 3.

Series 1 and 3 pipes are compatible with ISO 161 size series diameters, Series 2 are cast iron compatible sizes in accordance with AS/NZS 2280.

NOTE: Pipes and fittings manufactured to this Standard should be used and installed only in accordance with AS/NZS 3690, AS/NZS 2566.2 and AS 4041, as applicable.

Methods of demonstrating compliance with this Standard are given in Appendix A.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|--------|--|
| 1199 | Sampling procedures and tables for inspection by attributes |
| 1199.1 | Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection |
| 1722 | Pipe threads of Whitworth form |
| 1722.1 | Part 1: Sealing pipe threads |
| 1722.2 | Part 2: Fastening pipe threads |
| 2129 | Flanges for pipes, valves and fittings |
| 2888 | Methods of testing plastics waste fittings |
| 2888.1 | Method 1: Method for determining the suitability of connection threads of BSP form |
| 4041 | Pressure piping |

AS/NZS

- | | |
|---------|--|
| 1462 | Methods of test for plastics pipes and fittings |
| 1462.1 | Method 1: Method for determining the dimensions of pipes and fittings |
| 1462.3 | Method 3: Method for determining the impact characteristics of pipes |
| 1462.4 | Method 4: Method of determining reversion of UPVC pipes |
| 1462.6 | Method 6: Thermoplastics pipes, fittings and assemblies for the transport of fluids under pressure—Resistance to internal pressure |
| 1462.8 | Method 8: Method of testing the leaktightness of assemblies |
| 1462.11 | Method 11: Method for high temperature stress-relief testing of fittings |
| 1462.16 | Method 16: Method for high temperature testing of pipe |
| 1462.28 | Method 28: Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds |

AS/NZS

- 1462.29 Method 29: Plastic piping and ducting systems—Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation (ISO 9080:2003, MOD)
- 1477 PVC pipes and fittings for pressure applications
- 2280 Ductile iron pipes and fittings
- 2544 Grey iron pressure fittings
- 2566 Buried flexible pipelines
- 2566.2 Part 2: Installation
- 3500 Plumbing and drainage
- 3500.0 Part 0: Glossary of terms
- 3690 Installation of ABS pipe systems
- 3879 Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
- 4020 Testing of products for use in contact with drinking water
- 4087 Metallic flanges for waterworks purposes
- 4331 Metallic flanges
- 4331.1 Part 1: Steel flanges
- 4331.2 Part 2: Cast iron flanges
- 4331.3 Part 3: Copper alloy and composite flanges
- 4765 Modified PVC (PVC-M) pipes for pressure applications

A1

AS ISO/IEC

- 17025 General requirements for the competence of testing and calibration laboratories

SA

- HB 18.28 Conformity assessment—Guidance on a third-party certification system for products (ISO/IEC Guide 28:2004)

SNZ

- HB 18 Guidelines for third-party certification and accreditation
- HB 18.28 Guide 28: General rules for a model third-party certification scheme for products (ISO/IEC Guide 28:1982)

ISO

- 161 Thermoplastics pipes for the conveyance of fluids—Nominal outside diameters and nominal pressures (series)
- 727 Fittings made from unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) or acrylonitrile/butadiene/styrene (ABS) with plain sockets for pipes under pressure (series)
- 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 (series)
- 7245 Pipes and fittings of acrylonitrile-butadiene-styrene (ABS)—General specification for moulding and extrusion materials
- 12162 Thermoplastics materials for pipes and fittings for pressure applications—Classification, designation and design coefficient

ISO

- 15493 Plastic piping systems for industrial applications—Acrylonitrile-butadiene-styrene (ABS), unplasticized poly(vinyl chloride) (PVC-U) and chlorinated poly(vinyl chloride) (PVC-C)—Specifications for components and the system—Metric series
- 18553 Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds

1.3 DEFINITIONS

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

1.3.1 Compounds

Either pre-compounded ABS resins or ABS resins to which masterbatch, containing additives such as UV inhibitors, heat stabilizers and antioxidants, has been added.

1.3.2 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).

1.3.3 Elevated temperature

Any temperature above 20°C.

1.3.4 Hoop stress (S)

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

1.3.5 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 coefficient to the minimum required strength (MRS).

1.3.6 Long-term hydrostatic stress

The continuously applied hoop stress that is estimated will cause failure at a specified time and temperature.

1.3.7 Lower prediction limit long term hydrostatic strength (σ_{LPL})

The 97.5% lower prediction limit (σ_{LPL}) value of hoop stress, applied at a specified temperature, which the material in pipe form can support for a specified time. This value is calculated using the statistical procedures outlined in the standard extrapolation method of AS/NZS 1462.29.

1.3.8 Maximum allowable operating pressure ($MAOP$)

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

1.3.9 Minimum required strength (MRS)

The required value of σ_{LPL} for a temperature T of 20°C and a time t of 50 years.

1.3.10 Moulded fittings

A fitting manufactured entirely by injection moulding.

1.3.11 Nominal pressure (*PN*)

An alphanumeric designation specifying the nominal operating pressure in bar at 20°C which is related to the mechanical characteristics of the components of a piping system and used for reference purposes.

1.3.12 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.

1.3.13 Overall service (design) coefficient (*C*)

Overall coefficient with a value greater than 1, which takes into consideration service conditions as well as properties of the components of a piping system other than those represented in the lower prediction limit.

1.3.14 Own re-processable material

Material prepared from rejected unused pipes, fittings and valves, including trimmings from the production of pipes fittings or valves, that will be reprocessed in a manufacturers plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation or material specification is known.

1.3.15 Post-formed bend

A bend produced from pipe conforming to this Standard.

1.3.16 Pressure re-rating

The change in LPL of a pipe and fitting material for operation at temperatures other than 20°C. This is a direct consequence of the change in the specified temperature.

1.3.17 Standard dimensions ratio (*SDR*)

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

1.3.18 Test pressure

The pressure applied internally to pipes or fittings when being tested for strength and watertightness.

1.3.19 Virgin material

Material in such a form as granules or powder that has not been subjected to use or processing other than that required for its initial manufacture and to which no reprocessible or recyclable materials have been added.

1.4 NOTATION

The following symbols are used in this Standard:

$A_{\min.}$	=	minimum socket depth, in millimetres
d	=	maximum internal dimension of fitting (see Clause 3.2.2.2), in millimetres
DN	=	nominal size (based on nominal bore), in millimetres
D_m	=	mean outside diameter, in millimetres
D_i	=	socket mouth mean inside diameter, in millimetres
D_r	=	socket root mean diameter, in millimetres
ε_d	=	maximum diametral strain
F	=	extrapolated 50-year failure stress, in megapascals

L	= socket length, in millimetres
P	= maximum static working pressure of the pipe or fitting, in megapascals
PN	= nominal working pressure at 20°C, designated in bar but normally referenced in megapascals
t	= pipe material temperature range, in degrees
T	= wall thickness, in millimetres
HDS	= hydrostatic design stress, in megapascals
MRS	= minimum required strength in megapascals
$MAOP$	= maximum allowable operating pressure in megapascals
C	= 1.6 service design coefficient (see ISO 12162)
S	= hoop stress, in megapascals

1.5 CLASSIFICATION

1.5.1 Compounds

ABS pipe and fitting compounds extruded into pipe form shall be classified ABS 120 to ABS 180 in accordance with the MRS value given in Table 1.1.

TABLE 1.1
COMPOUND CLASSIFICATIONS

Classification	MRS MPa
ABS 120	12.0
ABS 140	14.0
ABS 160	16.0
ABS 180	18.0

1.5.2 Pipes and fittings

1.5.2.1 Series 1 and 2 pipe fittings

Pipe and fittings shall be classified by nominal pressure as follows:

PN 4.5	Nominal pressure of 0.45 MPa at 20°C.
PN 6	Nominal pressure of 0.6 MPa at 20°C.
PN 9	Nominal pressure of 0.9 MPa at 20°C.
PN 12	Nominal pressure of 1.2 MPa at 20°C.
PN 15	Nominal pressure of 1.5 MPa at 20°C.
PN 18	Nominal pressure of 1.8 MPa at 20°C.
PN 20	Nominal pressure of 2.0 MPa at 20°C.

NOTES:

- 1 Selection of class should be based on consideration of all factors that may affect the operation of the pipe, e.g. temperature of operation, fluctuating pressure, and external loading.
- 2 Reference should be made to AS/NZS 3690 for the design and installation of ABS systems.

1.5.2.2 Series 3 pipe and fittings

Series 3 pipe and fittings shall be classified by nominal pressure as follows:

PN 4	Nominal pressure of 0.4 MPa at 20°C.
PN 6.3	Nominal pressure of 0.63 MPa at 20°C.
PN 8	Nominal pressure of 0.8 MPa at 20°C.
PN 10	Nominal pressure of 1.0 MPa at 20°C.
PN 12.5	Nominal pressure of 1.25 MPa at 20°C.
PN 16	Nominal pressure of 1.6 MPa at 20°C.

NOTES:

- 1 Selection of class should be based on consideration of all factors that may affect the operation of the pipe, e.g. temperature of operation, fluctuating pressure, and external loading.
- 2 Reference should be made to AS/NZS 3690 for the design and installation of ABS systems.

1.6 MARKING

1.6.1 Pipes

All pipes shall be legibly and durably marked with letters of a minimum height of 3 mm for pipe of DN 100 or less, and a minimum height of 5 mm for pipes of greater diameter, using a distinctive colour. Such marking shall be repeated at intervals such that the length of any unmarked pipe shall not exceed 1 m.

The marking shall show the following:

- (a) Manufacturer's name or registered trademark.
- (b) Pipe series number in the form 'S1', as appropriate.
- (c) Compound classification in the form 'ABS 160', as appropriate.
- (d) Nominal diameter in form 'DN 50' or '50', as appropriate.
- (e) Pipe classification in the form 'PN 12', as appropriate.
- (f) SDR in the form 'SDR 26', as appropriate.
- (g) For pipes designed with deflection joints, the maximum allowable angular deflection in degrees, in the form '3°' as appropriate.
- (h) Date of manufacture in the form '010515' (i.e. 2001 May 15), as appropriate.
- (i) Identification of place of manufacture. The manufacturer's code is acceptable, e.g. P1.
- (j) The number of this Standard, i.e. AS/NZS 3518.

Examples:

TRADE NAME S1 ABS 160 DN 50 PN 12 SDR 26 010515 P1 AS/NZS 3518

or

TRADE NAME S2 ABS 160 DN 50 PN 12 SDR 26 3° 010515 P1 AS/NZS 3518

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.

1.6.2 Fittings

All fittings or packaging as appropriate, shall be legibly and durably marked, labelled or moulded with the following information:

- (a) Manufacturer's name or registered trademark.
- (b) Material in the form 'ABS 160'.
- (c) Nominal diameter in the form 'DN 50' or '50', as appropriate.
- (d) Fitting classification in the form 'PN 12', as appropriate (see Note 2).
- (e) The number of this Standard, i.e. AS/NZS 3518.
- (f) For fittings with parallel sockets—
 - (i) The words 'Parallel Socket'.
 - (ii) A note stipulating the type of gap filling solvent to be used with the fitting.

Example:

Tapered socket fittings: TRADE NAME ABS 160 DN 50 PN 12 AS/NZS 3518

Parallel socket fittings: TRADE NAME ABS 160 DN 50 PN 12 AS/NZS 3518

Parallel socket Gap filler XXX.

NOTES:

- 1 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.
- 2 Fittings produced with deflection joints should have the maximum allowable angular deflection in degrees marked on the socket, using a sticker or other means.

1.6.3 Post-formed bends

All post-formed bends and couplings shall be legibly and durably marked using lettering of 5 mm minimum height, with the following information:

- (a) Manufacturer's name or registered trademark.
- (b) Material in the form 'ABS 160'.
- (c) Nominal diameter in the form 'DN 50' or '50', as appropriate.
- (d) Fitting classification in the form 'PN 12', as appropriate.
- (e) SDR in the form 'SDR 26', as appropriate.
- (f) Angle of bend, for post formed bend only, in the form '45°', as appropriate.
- (g) Date of manufacture, in the form '010515' (i.e. 2001 May 15), as appropriate.
- (h) Identification of place of manufacture. The manufacturer's code is acceptable, e.g. P1.
- (i) The number of this Standard, i.e. AS/NZS 3518.

Example:

TRADE NAME ABS 160 DN 50 PN 12 SDR 26 45° 010515 P1 AS/NZS 3518.

NOTES:

- 1 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.
- 2 Post-formed bends produced with deflection joints should have the maximum allowable angular deflection in degrees marked on the socket, using a sticker or other means.

1.7 SOLVENT CEMENTS

Pipes and fittings manufactured to this Standard, suitable for solvent cement jointing, are intended for use with solvent cements and priming fluids complying with AS/NZS 3879.

1.8 ELASTOMERIC JOINTING SEALS

The elastomeric jointing seals shall comply with AS 1646.

NOTE: It is recommended that elastomeric jointing seals, for use with pipe and fittings manufactured to this Standard, be obtained only from the pipe or fittings manufacturer.

1.9 STORAGE AND TRANSPORT

All pipes shall be stored and transported in accordance with AS/NZS 3690 or AS/NZS 2566.2 while under the manufacturer's control.

SECTION 2 PERFORMANCE REQUIREMENTS

2.1 SCOPE OF SECTION

This Section specifies the minimum performance requirements for ABS compound, pipes and fittings at the time of manufacture.

NOTE: Test requirements given in this Section are intended for products at their place of manufacture and not for products in service.

2.2 COMPOSITION

2.2.1 Compounds

ABS pipe and fitting compounds shall be ABS resins to which are added additives that are needed to facilitate the manufacture of pipes, fittings and valves.

ABS pipe and fitting compounds shall comply with the scope, designation of properties and test methods defined in ISO 7245.

The properties chosen to designate ABS plastics include:

- (a) Acrylonitrile content in the continuous phase.
- (b) Intended application or method of processing.
- (c) Vicat softening temperature.
- (d) Melt flow rate.
- (e) Impact strength.
- (f) Flexural modulus.

2.2.2 Colour

Unless other colours are agreed between the purchaser and manufacturer, the colour of Series 1, 2 and 3 shall be grey.

2.2.3 Additives

2.2.3.1 Limitations

If additives are used they shall be evenly dispersed (see Clause 2.2.3.2). The additives shall not be used separately or together in quantities sufficient to—

- (a) impair the fabrication or solvent cementing characteristics of the component; or
- (b) impair the chemical, physical or mechanical characteristics and in particular the long term mechanical strength and impact strength of the compounds (see Clause 2.2.5).

2.2.3.2 Dispersion of additives

Anti-oxidants, ultraviolet stabilizers, and pigments including carbon black shall be evenly dispersed in the compounds.

When compounds containing carbon black or other pigments are tested in accordance with AS/NZS 1462.28, the rating of appearance shall not be worse than Micrograph B in Appendix 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 anti-oxidants and ultraviolet stabilizers is difficult to assess, it is assumed that if the pigment is evenly dispersed, the other additives will also be evenly dispersed.

2.2.4 Stabilization

ABS compounds for pipes and fittings shall contain anti-oxidants such that when test specimens, in the form of pipes, are exposed for 500 h at a temperature of $100 \pm 2^\circ\text{C}$ and tested in accordance with AS/NZS 1462.3, their true impact rate shall be below 10% at a confidence level of 90%. The impact test conditions shall be as specified in Clause 2.7.2, with the exception that the total mass shall be reduced to 50% of the value specified in Table 2.1.

2.2.5 Minimum required strength (*MRS*)

ABS compounds for pipes and fittings shall be evaluated at 20°C according to AS/NZS 1462.29. The 97.5% σ_{LPL} value obtained from AS/NZS 1462.29 is then used to determine the *MRS*, by rounding it down to the next lowest level listed in Table 1.1. For the classification of a material intended only for the manufacture of fittings and valves, the test piece shall be an injection moulded or extruded test piece in the form of a pipe.

ABS compounds for pipes and fittings shall be evaluated at 60°C to validate the presence or otherwise of a knee. A minimum of 10 points shall be established, with at least two points being at a time longer than that required for valid extrapolation to 50 years at 20°C according to AS/NZS 1462.29. For this assessment ABS shall be classified as a glassy amorphous polymer. Where a knee is detected at 60°C a full test regime according to AS/NZS 1462.29 at three temperatures is required (90 points at the issue date of this Standard).

Prior to establishment of a test point beyond 10 000 h in the determination of the *MRS*, provisional qualification of an ABS compound may be obtained by sustaining a specific hoop stress (σ) for 1000 h at 60°C without failure. The 60°C , 1000 h hoop stress (σ) shall be determined by derating the 20°C , 1000 h mean rupture hoop stress established by regression analysis using Equation 2.1. If the full data set for calculating the *MRS* according to AS/NZS 1462.29 is not available, a regression line shall be generated using a 7 point regression line, with failure points distributed 2,2,2 in the time ranges 3–30, 30–300, and 300+ h and including a point at the 50 year ordinate equal to the *MRS* value targeted plus 5%. Alternatively if the full data set for calculating the σ_{LPL} at 60°C is available, the 99.5% *LPL* value established from analysis of this 60°C test data in accordance with AS/NZS 1462.29 shall be taken as the specific hoop stress (σ).

Provisional qualification is conditional on the establishment of the longest term tests at all required temperatures required for full qualification, and is limited in time to a maximum of 18 months, and is non-renewable.

Where data is used to establish re-rating factors for elevated service temperatures, a full three temperature 90 point multiple regression is required.

For all analyses, unfailed points may be used provided they improve the long term *LPL* from the simple regression line.

$$\sigma_{60, 1000} = 0.33 \sigma_{20, 1000} \quad \dots 2.1$$

where

$$\sigma_{60, 1000} = 1000 \text{ h hoop stress at } 60^\circ\text{C}$$

$$\sigma_{20, 1000} = 1000 \text{ h hoop stress at } 20^\circ\text{C}$$

2.2.6 Rework material

Only rework material of the same composition generated from the manufacturer's own production of product made to this Standard may be used. When rework material is added to a production run, the manufacturer shall treat this run as a new batch.

2.3 RERATING AT ELEVATED TEMPERATURES

ABS pipe and fitting compounds may be rerated to higher or lower temperatures, according to their ABS classification, within the temperature range of 0°C to 60°C. Reference should be made to the manufacturer for ratings at temperatures other than 20°C. Such rerating shall be determined from the 97.5% σ_{LPL} value obtained from testing to AS/NZS 1462.29 at the rerated temperature. Rerated values may be interpolated between two temperatures provided the interpolation is no more than 10°C. Extrapolation is not allowed.

2.4 DIMENSIONS

The dimensions of the pipes and fittings, measured in accordance with AS/NZS 1462.1, shall comply with Section 3 of this Standard.

Out-of-roundness of the outside diameter shall be measured within 24 h from the time of manufacture.

Out-of-roundness tolerances do not apply where $SDR \geq 26.0$. Thinner wall pipes may easily be re-rounded when inserted into sockets.

2.5 FREEDOM FROM DEFECTS

2.5.1 Cleanliness

Pipes and fittings shall be clean and free from any manufacturing debris.

2.5.2 Pipes and fittings

Defects shall not affect the performance or function of the pipes and fittings in service.

Pipes shall not have any blisters and heat marks. When grooves, wrinkles, rippling, dents or projections are present, the pipe shall comply with the dimensional requirements of Section 3, as appropriate.

2.5.3 Pipes and fitting ends

Pipes and fitting ends shall not have any chips and rough edges. Jointing surfaces shall be smooth. The axis of sockets formed on the ends of pipes and fittings shall be parallel within 2° to the axis of the fitting. D_r shall not be greater than D_i .

The jointing surfaces of sockets on pipes for solvent cement jointing shall taper uniformly from the mouth to the root of the socket.

NOTE: The defects described in Clause 2.5.2 and Clause 2.5.3 cannot be completely quantified. Where the presence, size or frequency of any such defects are considered to be of concern, arrangements for acceptable product quality should be made between purchaser/statutory authority/certifying body (as appropriate) and the manufacturer. This may be achieved by the provision of acceptable type samples.

2.5.4 Fitness for purpose

Where defects are present and the product is submitted for acceptance, the manufacturer shall be able to demonstrate fitness for purpose.

2.6 EFFECT ON WATER

ABS pipes, fittings, lubricant and elastomeric jointing seals shall comply with AS/NZS 4020. A scaling factor of 1 shall apply to pipes and a scaling factor of 0.05 shall apply to fittings.

2.7 PIPE TESTS

2.7.1 Short-term hydrostatic pressure

When tested in accordance with AS/NZS 1462.6 at 20°C, ABS pipe shall withstand the hoop stress given below for at least one hour without failure. Failure is defined as weeping, leaking or rupturing of the test specimen.

The hoop stress (S) shall be the 99.5% (σ_{LPL}) value (determined in Appendix F) at one hour developed from the 50 year, 20°C linear regression data determined in accordance with AS/NZS 1462.29.

NOTE: The stress value used in this analysis is the 99.5% (σ_{LPL}) rather than the 97.5% (σ_{LPL}) normally used in regression analysis.

The test pressure shall be determined from the following equation:

$$P = \frac{2ST_{\min.}}{D_m - T_{\min.}} \quad \dots 2.2$$

where

P = internal hydrostatic pressure to be applied, in MPa

S = hoop stress, in MPa

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

D_m = minimum mean outside diameter, in mm

2.7.2 Impact characteristics at 0°C

When tested in accordance with the 0°C impact test procedure of AS/NZS 1462.3, the pipe shall have a true impact rate (TIR) below 10% at a confidence level of 90%.

The testing parameters shall be as follows:

- (a) Mass shall be as specified in Table 2.1. The tolerance shall be +0.05, −0.0 kg.
- (b) Maximum number of impacts per specimen as specified in Table 2.2.
- (c) Drop height 2 +0.1, −0.0 m.

TABLE 2.1
TEST MASSES FOR 0°C IMPACT TEST

Series 1 and 2 pipes				Series 3 pipes			
Nominal diameter DN	Total mass kg	Nominal diameter DN	Total mass kg	Nominal diameter DN	Total mass kg	Nominal diameter DN	Total mass kg
10	0.5	80	5.0	12	—	90	5.0
15	1.0	100	6.0	16	0.5	110	6.0
20	1.25	125	6.5	20	1.0	125	6.0
25	2.0	150	7.0	25	1.25	140	6.5
32	2.25	175	8.0	32	2.0	160	7.0
40	2.5	≥200	9.0	40	2.25	180	7.0
50	3.0	—	—	50	2.5	200	8.0
65	4.0	—	—	63	3.0	≥225	9.0
—	—	—	—	75	4.0	—	—

TABLE 2.2
MAXIMUM NUMBER OF IMPACTS PER SPECIMEN FOR 0°C IMPACT TEST

Series 1 and 2 pipes				Series 3 pipes			
Nominal diameter	Maximum number of impacts per specimen	Nominal diameter	Maximum number of impacts per specimen	Nominal diameter	Maximum number of impacts per specimen	Nominal diameter	Maximum number of impacts per specimen
DN		DN		DN		DN	
<50	1	150	8	<63	1	160	8
50	3	175	10	63	3	180	9
65	3	200	12	75	3	200	10
80	4	225	14	90	4	225	12
100	6	250	16	110	6	250	14
125	8	≥300	20	125	6	280	16
—	—	—	—	140	8	≥315	20

2.7.3 Reversion

When tested in accordance with AS/NZS 1462.4, at $150 \pm 4^\circ\text{C}$, the reversion of the pipe shall not exceed 5.0%, nor shall the pipe show any signs of cracks, cavities or blisters resulting from the immersion.

2.7.4 High temperature

When tested in accordance with AS/NZS 1462.16, at a temperature of $150 \pm 4^\circ\text{C}$ for 30 minutes for wall thickness ≤ 3 mm and 60 minutes for wall thickness > 3 mm, the pipe shall show no evidence of—

- (a) inclusions; or
- (b) delamination, damage or porosity at the axially cut surfaces.

NOTE: Absorbed water can affect results and, hence, caution is to be used when applying this test to pipes that have been stored or used in service.

2.8 FITTINGS TESTS

2.8.1 Threaded fittings tightening torque

When tested in accordance with AS 2888.1, threaded fittings shall be capable of being tightened to the torque specified in Table 2.3 without damage.

TABLE 2.3
THREAD TIGHTENING TORQUES

Nominal size of thread mm	Thread tightening torque Nm
≤32	15
>32 ≤40	20
>40 ≤50	25
>50 ≤65	40
>65 ≤80	50
>80 ≤100	60