

Australian/New Zealand Standard™

**Hose and hose assemblies for liquefied
petroleum gases (LP Gas), natural gas
and town gas**



AS/NZS 1869:2012

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee AG-013, Components used for Gas Appliances and Equipment. It was approved on behalf of the Council of Standards Australia on 3 February 2012 and on behalf of the Council of Standards New Zealand on 10 February 2012. This Standard was published on 28 February 2012.

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Australian/New Zealand Standard™

Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee AG-013, Components used for Gas Appliances and Equipment, to supersede AS 1869—1996, *Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas*.

The objective of this Standard is to ensure performance, safety, durability and fitness for purpose of hose and hose assemblies in the gas industry.

The principal changes from the 1996 edition are as follows:

- (a) Re-assessment of the allowable levels of extractable material in each class of hose.
- (b) The introduction of a new method of test for hose extractables for most of the high pressure hose and hose assemblies.
- (c) A guide on pre-conditioning of hoses to lower the amount of residue that will be extracted in service.
- (d) An increase in the upper temperature for the high temperature Accelerated Ageing method of test.
- (e) The addition of a new class of hose.
- (f) The increase in working pressure limit for low pressure hoses.
- (g) The need for a new very high pressure, high temperature hose for automotive liquid injection systems. Refer to Appendix X.

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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Australian/New Zealand Standard**Hose and hose assemblies for liquefied petroleum gases (LP Gas),
natural gas and town gas**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for hose and hose assemblies for liquefied petroleum gases (LP Gas) (liquid and gaseous phases), natural gas, town gas manufactured from oil products, tempered liquefied petroleum gas and simulated natural gas in transport, automotive, industrial and domestic applications. It provides for hose up to and including 100 mm inside diameter and 2.6 MPa maximum working pressure.

NOTES:

- 1 Appendix A contains recommendations and advice on information which should be provided by the purchaser at the time of placing an enquiry or order.
- 2 A guide to the user for continued in-service performance of the hose assembly has been included as Appendix B. For the convenience of personnel undertaking in-service testing, the limits for continued acceptable performance of hose assemblies have been stated in the Appendix.
- 3 This Standard does not specify requirements for LP Gas hose for welding, which is dealt with in AS 1335.
- 4 Appendix X provides guidance for the use of hoses in LP Gas liquid injection systems that operate above 2.6 MPa.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this

AS

- | | |
|---------|--|
| 1179 | Glossary of terms for rubber hose |
| 1257 | Bore sizes, test pressures and tolerances on lengths of elastomeric hose |
| 1335 | Hose and hose assemblies for welding, cutting and allied processes |
| 1683 | Methods of test for elastomers |
| 1683.20 | Part 21: Methods of test for rubber—Standard temperatures, humidities and times for conditioning and testing |
| 1683.23 | Part 23: Rubber—Vulcanized—Determination of resistance to liquids |
| 2103 | Dial gauges and dial test indicators (metric series) |
|
ISO | |
| 37 | Rubber, vulcanized or thermoplastic—Determination of tensile stress-strain properties |
| 4661 | Rubber, vulcanized or thermoplastic—Preparation of samples and test pieces |
| 4661-1 | Part 1: Physical tests |
| 4671 | Rubber and plastics hoses and hose assemblies—Methods of measurement of the dimensions of hoses and the lengths of hose assemblies |

ISO

23529 Rubber—General procedures for preparing and conditioning test pieces for physical test methods

ASTM

D1149 Standard test methods for rubber deterioration cracking in an ozone controlled environment

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 1179 apply.

1.4 CLASSIFICATION

Hose and hose assemblies are classified according to maximum working pressure, working temperature range and oil resistance as given in Table 1.1.

NOTES:

- 1 Some classes of hose assembly are specific to identified applications, and their use in alternative applications should be carefully considered to ensure their suitability for the chosen duty.
- 2 Appendix X refers to a new type of hose that are specific for liquid injection systems used in vehicles. In future revisions of this Standard these may be included in a new classification of hose and the scope of the Standard be amended accordingly.

1.5 ELECTRICAL CONTINUITY

Where electrically continuous hose is specified (see Paragraph A2(c), Appendix A), unless the hose contains a body wire, it shall be made electrically continuous by a 16/0.20 mm (or an equivalent cross-sectional area) of copper or other corrosion-resistant, flexible conductor. The conductor shall be spirally installed so that it is not over-tensioned by kinking or flexing the hose and fixed to the end connections by soldering, brazing, welding, peening or other mechanical methods. Body wires, intended to be the electrically conducting medium, shall be similarly attached to end connections.

TABLE 1.1
CLASSIFICATION

Class	Typical application	Maximum working pressure at 23 ±2 °C	Working temperature range °C	Oil resistant lining and cover
A	Low pressure appliance hose	14 kPa	–20 to +65	
B	Low pressure high temperature appliance hose	14 kPa	–20 to +125	Y
C	High pressure appliance and gas tool hose	2.6 MPa	–20 to +65	
D	High pressure high temperature appliance and gas tool hose	2.6 MPa	–20 to +125	Y
E	High pressure hose—General Use (up to 15 mm ID)	2.6 MPa	–50 to +65	
F	Flexible cylinder connectors (Pigtails)	2.6 MPa	–20 to +100	Y
G	Automotive, including under bonnet	2.6 MPa	–20 to +125	Y
H	Transfer hoses (above 15 mm ID)	2.6 MPa	–50 to +65	Y

1.6 MATERIALS AND CONSTRUCTION

1.6.1 General

Internal and external surfaces shall be uniform and concentric.

1.6.2 Materials

The internal surface of the hose shall be fabricated of material that is resistant to LP Gas, natural gas and town gas. Any reinforcing or armouring wire shall be of corrosion-resistant material, e.g. galvanized steel. Any earthing wire shall be corrosion-resistant, e.g. stainless steel or tinned copper.

The hose shall be formulated so as to be resistant to, or protected from, UV degradation.

1.6.3 Gas permeation

Hose shall permit the free release of permeating gas during service to prevent blistering or separation of components due to any penetration of gas through the lining.

NOTE: Pricking through the cover at suitable intervals along its length is a common acceptable procedure.

Couplings used on hose assemblies shall be designed, constructed and fitted so that an assembly complies with the minimum burst pressure specified in Clause 2.3.2 and withstands the minimum tensile force specified in Clause 2.14 without showing any sign of failure or leakage.

NOTE: Care should be taken to ensure that couplings are properly fitted so as not to damage the reinforcement or other vital parts of the hose.

1.6.4 Dimensions and tolerances

1.6.4.1 *Internal diameter of hose*

When measured in accordance with Appendix L, the internal diameter of hose shall conform to the value given in Table 1.2, as appropriate.

1.6.4.2 *Length of hose*

The tolerance on cut lengths of hose shall be as specified in AS 1257.

1.7 COLOUR

The colour of the cover may be any colour.

1.8 HOSE FOR DOMESTIC APPLIANCES

End fittings for hose for connection to domestic appliances shall be of the permanently attached (non-reusable) type.

Where a hose assembly complete with terminations carries certification/approval it shall not be repaired unless the conditions of the original certification can be met.

1.9 MARKING

Each manufactured length of hose or hose assembly shall be permanently and clearly marked with the following information:

- (a) Class (see Clause 1.4) and maximum working pressure.
- (b) Year of manufacture.
- (c) The words 'Electrically continuous', where relevant (see Clause 1.5).
- (d) Nominal internal diameter of the hose, in millimetres.
- (e) Name or identification of the manufacturer or supplier.
- (f) Designation of the hose.

Example: AS/NZS 1869/A-WP 14 kPa—1990 20 mm—Smith Hoses—'designation'.

For uncoupled hoses, marking shall be continuous on the hose, where practicable, at intervals not greater than 600 mm. If continuous marking is not practicable due to the hose construction, an inscribed tag or sleeve shall be securely fixed to each end of the hose length.

Coupled hose assemblies shall be permanently marked in accordance with Clause 1.9 Items (a) to (f) above, and also with the assembler's name or identification. Alternatively, where the assembler is also the hose manufacturer, a single tag or sleeve, securely fixed to the assembly, and incorporating the requirements of Items (a) to (f) above, may be used.

NOTE: Certain authorities may have an approval scheme which requires hose assemblies to be identified by their approval number.

TABLE 1.2
INTERNAL DIAMETER, TOLERANCE AND DYNAMIC
BEND RADIUS OF HOSE

millimetres		
Internal diameter	Tolerance	Dynamic bend radius
5	±0.50	125
6.3	±0.75	125
8	±0.75	160
(9.5)	±0.75	160
10	±0.75	160
12.5	±0.75	210
16	±0.75	230
(19)	±0.75	240
20	±0.75	240
25	±1.25	300
31.5	±1.25	378
(38)	±1.50	456
40	±1.50	480
50	±1.50	600
63	±1.50	756
(76)	±2.00	912
80	±2.00	960
100	±2.00	1200

NOTES:

- 1 The above values for internal diameter and tolerance are in accordance with AS 1257.
- 2 The values in parentheses are non-preferred imperial equivalents which provide a concession for existing manufacturing conditions and may be necessary for a period of transition. These values also accommodate existing fittings.
- 3 Outside diameters and their tolerances are intentionally omitted from this Table to permit flexibility in the choice of various end fittings and to allow for new developments in both hose and couplings. The outside diameter may be requested by the purchaser to ensure compliance with Clause 2.14.

1.10 HOSE ASSEMBLIES

1.10.1 Couplings for screwed ends

Couplings shall be of fire resistant and corrosion resistant material, preferably of brass or steel. Design of the couplings shall be such that the assembly can be secured at one end without the necessity of turning the hose relative to its mating piece and without the use of additional fittings.

The inlet connection shall be fully compatible with the Gas Supply connection and provide a reliable gas tight seal without the use of additional fittings.

NOTE: Other aspects of the design should be agreed between purchaser and supplier.

1.10.2 Complete assemblies (hoses including couplings)

The hose shall be secured to end fittings by means of swaging, crimping or the use of other suitable permanently fitted clips. The use of reusable worm drive clamps or screw clamps is not permitted. Couplings shall be properly fitted so as not to damage the reinforcement or other vital parts of the hose.

The use of approved automotive re-usable fittings is acceptable for Class G.

Hose assemblies for Class F flexible pigtails shall use inlet couplings compatible with the cylinder valves for which they are intended. The use of additional adapters is not permitted.

NOTE: For vapour phase duty only these couplings may include an integral non-return valve to minimize the release of LP Gas vapours or liquid when disconnecting.

An integral excess flow valve shall be used to limit LP Gas release in the case of hose failure. Care must be exercised when selecting these assemblies to consider demand flow rate against the design shut-off rate.

1.10.3 Marking of assemblies

Coupled hose assemblies shall be permanently marked in accordance with Clause 1.9 Items (a) to (f) above, and also with the assembler's name or identification. Alternatively, where the assembler is also the hose manufacturer, a single tag or sleeve, securely fixed to the assembly, and incorporating the requirements of Clause 1.9 Items (a) to (f) above, may be used.

NOTE: Certain authorities may have an approval scheme which requires hose assemblies to be identified by their approval number also.

1.10.4 Testing of hose assemblies

Separate complete assemblies shall be supplied for compliance testing purposes along with the hose assembly specifications as described in Appendix J.

Couplings used on hose assemblies shall be designed, constructed and fitted so that an assembly complies with the minimum burst pressure specified in Clause 2.3.2, and withstands the minimum tensile force specified in Clause 2.14, without showing any sign of failure or leakage.

SECTION 2 PERFORMANCE REQUIREMENTS

2.1 RESISTANCE TO GAS

2.1.1 Lining

When Classes A, B, C and D are tested in accordance with Appendix C and Classes E, F, G and H are tested in accordance with Appendix K, hose lining shall comply with the requirements outlined in Table 2.1.

TABLE 2.1
MAXIMUM ALLOWABLE EXTRACTABLES

Class	Maximum allowable extractables ($E_{\max}$)
A, B, C, D	10% change from initial mass, using Appendix C
E, F	900 mg/m of hose length, using Appendix K
G	25 mg/m of hose length, using Appendix K
H	Refer to Figure K1. using Appendix K

NOTES:

- 1 Plasticizers may be removed from hose linings by the actions of condensation and subsequent vaporization of LP Gas, particularly in the case of Class E and F hoses. For Class F in particular a limit of 25 mg/m is preferred as at such level any issue with extractables is avoided. Furthermore plasticizers that have a viscosity below 0.07 Pa.s should not be used as the major component of the extractables as they are more likely to pass through small orifices and cause damage to components further downstream.
- 2 The maximum allowable extractable levels will be reviewed in future editions of the Standard.

Reduction of extractable hose and hose assemblies is also outlined in Appendix W.

2.1.2 Hose assembly

When tested in accordance with Appendix D, the hose assembly shall show no visible signs of fracture, cracks, leakage, or movement between hose and fittings.

2.2 RESISTANCE TO OIL

2.2.1 Cover

When tested in accordance with Appendix V in Oil No. 3 at 125°C for 70 h, covers of Classes B, D and G hose shall not suffer a change in volume in excess of 80%.

2.2.2 Lining

When tested in accordance with Appendix V in Oil No. 3 at 100°C for 70 h, linings of Classes B, D and G hose shall not suffer percentage changes in volume, tensile strength, and elongation in excess of 40%.

The tensile strength and elongation, before and after immersion, shall be measured in accordance with Appendix T.

2.3 HYDROSTATIC PRESSURE

2.3.1 Proof pressure

When tested in accordance with Appendix M, hose or hose assemblies shall show no sign of leakage or any other indication of failure at the following pressures:

- (a) For Classes A and B

- (b) For Classes C, D, E, F, G and H.....5.2 MPa.

Classes F and G samples shall first undergo testing in accordance with Appendix K prior to this test and the same hose sample being used.

2.3.2 Burst pressure

When tested in accordance with Appendix M, hose or hose assemblies shall not burst below the following pressures:

- (a) For Classes A and B 56 kPa.

- (b) For Classes C, D, E, F, G and H..... 10.4 MPa.

Classes F and G samples must first undergo testing in accordance with Appendix K prior to this test and the same hose sample being used.

2.3.3 Change in length

When tested in accordance with Appendix M at the relevant proof pressure, hose shall not change in length by more than 8%.

2.4 RESISTANCE TO OZONE

When tested in accordance with Appendix N, hose shall not split or crack.

NOTE: This requirement only applies to rubber hose.

2.5 RESISTANCE TO FLEXING AND MECHANICAL LOADS

2.5.1 Hose not exceeding 20 mm ID

When hose assemblies incorporating hose of internal diameter not exceeding 20 mm are subjected to the appropriate test described in Appendix E, there shall be no visible signs of leakage of the hose assembly and no visible signs of fracture, cracks or leakage in the hose lining or cover.

2.5.2 Hose exceeding 20 mm ID

When hose of internal diameter exceeding 20 mm ID is subjected to the appropriate test described in Appendix E, the hose shall show no visible signs of fracture, cracks or leakage.

2.6 ELECTRICAL PROPERTIES

2.6.1 Hose

Where electrical continuity is specified (see Paragraph A2(c), Appendix A), when such hose, other than that constructed with stainless steel reinforcing wire(s) is tested in accordance with Appendix O using electrodes connected to the body conductor(s), the resistance of the conductors shall be not greater than 0.3 Ω /m.

Where electrical continuity is specified (see Paragraph A2(c), Appendix A), where such hose constructed with stainless steel reinforcing wire(s) is tested in accordance with

Appendix O using electrodes connected to the body conductor(s), the resistance of the conductors shall be not greater than 2.0 Ω /m.

2.6.2 Hose assembly

Where electrical continuity is specified (see Paragraph A2(c), Appendix A), when such a hose assembly is tested in accordance with Appendix P, the resistance of the conductors shall be not greater than the values specified in Clause 2.6.1, plus an allowance of 0.1 Ω for each flange or coupling.

2.6.3 Retention of electrical properties

Where electrical continuity is specified (see Paragraph A2(c), Appendix A), after such a hose assembly is subjected to the appropriate treatment prescribed in Appendix E, it shall retain the relevant properties specified in Clause 2.6.2, with the test specimen in both the straight and fully bent positions.

2.7 RESISTANCE TO COLD BENDING

When tested in accordance with Appendix Q, except that the temperature of the cold chamber and the test temperature shall be -20 ± 0 , -2°C for Classes A, B, C, D, F and G and -50 ± 0 , -4°C for Classes E and H hose, and the mandrel diameter shall be 12 times the nominal internal diameter of the hose, the hose shall not show visible signs of cover cracks, leakage or other defects.

2.8 RESISTANCE TO KINKING

When tested in accordance with Appendix F, hose of internal diameter not exceeding 12.5 mm shall not suffer a pressure drop in excess of 1 kPa.

2.9 RESISTANCE TO CRUSHING

2.9.1 Hose without gas

When hose of internal diameter not exceeding 12.5 mm which does not contain gas, is subjected to a crushing force of 340 N applied evenly over a length of 25 mm for 30 s, it shall, after removal of the force, comply with the requirements of Clause 2.3.1.

2.9.2 Hose containing gas

When hose containing gas is tested in accordance with Appendix G, the condition of the hose shall be such that the gas flow rate is not less than 25% of its initial value.

2.10 PERMEABILITY

When Classes C, D, E, F, G and H are tested in accordance with Appendix H, the hose shall not exhibit permeability greater than 25 mL/m/h.

2.11 FLAME PROPAGATION CHARACTERISTICS OF HOSE

When hose is tested in accordance with Appendix I, any flame propagation distance, after 47 s from the time of initial flame application, shall be less than 50 mm each side of the centre point and the flame shall not penetrate the hose wall.

2.12 ADHESION

When hose components are tested in accordance with Appendix R, the adhesion at all interfaces between lining, reinforcement plies and cover shall be at least 1.75 kN/m before ageing and at least 1.25 kN/m after ageing at $70 \pm 2^\circ\text{C}$ for 70 ± 1 h in accordance with Appendix S. As ply adhesion is particularly sensitive to temperatures, conduct the test under conditions of $20 \pm 2^\circ\text{C}$ and $65 \pm 10\%$ RH.

The hose shall also meet the above requirements after it has been tested in accordance with Appendix H.

NOTE: The above requirements are not applicable to hose specifically designed to be of non-bonded wall construction.

2.13 ACCELERATED AGEING

2.13.1 Classes A, C, E, and H hose

When Classes A, C, E and H hose are aged at $70 \pm 2^\circ\text{C}$ for 72 h in accordance with Appendix S, and then tested in accordance with Appendix T, the tensile strength and elongation at break of the lining and cover shall not vary by more than 35% from the corresponding values determined by applying the test to un-aged control samples.

2.13.2 Classes B, D and G hose

When Classes B, D and G hose are aged at $135 \pm 2^\circ\text{C}$ for 72 h in accordance with Appendix S, and then tested in accordance with Appendix T, the tensile strength and elongation at break of the lining and cover shall not vary by more than 40% from the corresponding values determined by applying the test to un-aged control samples.

2.13.32 Class F

When Class F hose is aged at $125 \pm 2^\circ\text{C}$ for 72 h in accordance with Appendix S, and then tested in accordance with Appendix T, the tensile strength and elongation at break of the lining and cover shall not vary by more than 40% from the corresponding values determined by applying the test to un-aged control samples.

2.14 HOSE AND COUPLING COMPATIBILITY

When a hose assembly is tested in accordance with Appendix U there shall be no movement or separation between the hose and coupling at less than the tensile force value shown in Table 2.2 for the size of hose as appropriate.

When further tested in accordance with Appendix M, there shall be no sign of leakage or other observed defect at less than the proof pressure specified in Clause 2.3.1 for the appropriate Class of hose.

TABLE 2.2
TENSILE FORCE RELATIVE TO NOMINAL
INTERNAL DIAMETER OF HOSE

Internal diameter mm	Minimum tensile force	
	Classes A and B	Classes C, D, E, F and G
5	400 N	650 N
6.3	400 N	650 N
8	400 N	650 N
(9.5)	400 N	650 N
10	400 N	650 N
12.5	400 N	650 N
16	1.3 kN	1.3 kN
(19)	1.3 kN	1.8 kN
20	1.8 kN	1.8 kN
25	2.0 kN	2.0 kN
31.5	2.5 kN	2.5 kN
(38)	3.0 kN	3.0 kN
40	3.0 kN	3.0 kN
50	4.0 kN	4.0 kN
63	5.5 kN	5.5 kN
(76)	7.0 kN	7.0 kN
80	7.0 kN	7.0 kN
100	13.0 kN	13.0 kN

NOTE: See Note 2 to Table 1.2 regarding the parenthesized values.

APPENDIX A
PURCHASING GUIDELINES
(Informative)

A1 GENERAL

Australian and New Zealand Standards are intended to include the technical provisions necessary for the supply of material referred to in the particular Standard but do not purport to comprise all necessary provisions of a contract.

This Appendix contains advice and recommendations on the information to be supplied by the purchaser at the time of enquiry or order.

Its aims are to avoid misunderstanding, and to result in the purchaser receiving satisfactory material and service.

A2 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser should specify details on the following items at the time of enquiry or order:

- (a) Quantity and delivery instructions.
- (b) Class.
- (c) Whether electrical continuity is required.
- (d) Internal diameter, outside diameter and the limits of concentricity, if necessary.
- (e) The length(s) and any end terminations.
- (f) Whether a test certificate, showing the results of tests carried out for the purpose of establishing compliance with this Standard, is required.

APPENDIX B

GUIDE TO TESTING IN-SERVICE PERFORMANCE OF HOSE ASSEMBLIES

(Informative)

B1 SCOPE

This Appendix sets out methods for determining the performance of hose assemblies which are in-service, in relation to electrical and hydraulic properties.

Recommended limits on electrical properties for continued acceptable performance of hose are also provided.

B2 PRINCIPLE

The retained electrical and hydraulic properties of the hose assemblies are determined by adopting standard test methods.

B3 APPARATUS

Equipment and test materials as specified in the relevant test methods, are required.

B4 FREQUENCY OF TESTING

The frequency of testing is as required by regulatory authorities, or, in the absence of such requirements, as advised by the manufacturer.

B5 PROCEDURE

B5.1 Hydraulic test

The procedure is as follows:

- (a) Remove the hose from service.
- (b) Drain and degas the hose.
- (c) Using the method specified in Appendix M carry out and record elongation at the hose's rated working pressure, and then the leakage at 1.25 times the hose's rated working pressure.

If the hose assembly meets the test pressure in Item (c) above, it may be reinstalled after draining to ensure that all product contaminants are removed.

NOTE: It may be necessary with some hose to maintain records of elongation under test conditions in order to ascertain potential failure of a hose when elongation becomes excessive.

B5.2 Electrical continuity test

The procedure is as follows:

- (a) Using the method specified in Appendix P, measure the resistance between the two couplings/flanges of the assembly.
- (b) Bend each coupling at a radius of approximately 5 times the internal diameter of the hose, as close as possible to the coupling/flange, and in four directions at approximately 90° increments circumferentially. Measure the resistance from flange/coupling to flange/coupling while the hose is bent.

Nine measurements per hose should be made.

NOTES:

- 1 The hose may remain connected in the system provided one end is free and insulated from the other, e.g. a truck loading hose or a meter pump hose has a free end which can be easily suspended free of the basic pipework or pumping unit.
- 2 A hose used to cross-connect two pipes in a piping system may be bypassed by other metallic elements of the system. Under such circumstances one end of the hose has to be disconnected.

B6 LIMITS FOR CONTINUED ACCEPTABLE PERFORMANCE

The limits for continued acceptable performance are as follows:

- (a) Less than, or equal, to 0.3 Ω /m for the hose assembly without stainless steel reinforcing wire.
- (b) Less than, or equal, to 2.0 Ω /m for the hose assembly with stainless steel reinforcing wire.

B7 HOSE SUPPORTS AND CLIPPING

In vehicular applications with liquid withdrawal systems, hoses when filled with liquid LP Gas, could be subjected to high operating temperatures, e.g. elevated summer road surface temperatures. The hose supplier should provide guidance in the support requirements of the product to achieve a maximum centre deflection of 5 mm between supports, when the hose is liquid full and at an operating temperature of 65°C.

APPENDIX C

METHOD FOR DETERMINING RESISTANCE OF LINING TO GAS FOR CLASSES A, B, C AND D

(Normative)

C1 SCOPE

This Appendix sets out a method for determining the resistance of the lining of a hose to gas.

C2 PRINCIPLE

The hose lining is immersed in liquid pentane, the liquid is absorbed, and any extractable matter is measured.

C3 REAGENT

Liquid pentane, commercial grade, is required.

C4 APPARATUS

A balance, capable of reading to within 0.1 mg, is required.

C5 PROCEDURE

The procedure shall be as follows:

- (a) Weigh a portion of the hose lining (m_0) and immerse in liquid pentane at a temperature of $23 \pm 2^\circ\text{C}$ for 72 h.
- (b) Remove the hose lining from the liquid, allow to stand at $23 \pm 2^\circ\text{C}$ for 60 s and then reweigh immediately (m_1).
- (c) Allow the hose lining to stand at $23 \pm 2^\circ\text{C}$ for a further 24 h, and then reweigh immediately (m_2).

C6 CALCULATION

The percentage liquid absorbed and the percentage liquid extractable matter shall be calculated using the following equations:

$$(a) \quad \text{Percentage liquid absorbed} = \frac{m_1 - m_2}{m_0} \times 100 \quad \dots \text{C6(1)}$$

$$(b) \quad \text{Percentage extractable matter} = \frac{m_0 - m_2}{m_0} \times 100 \quad \dots \text{C6(2)}$$

where

m_1 = mass of the hose lining after immersion and subsequent standing for 60 s, in grams

m_2 = mass of the hose lining after standing for a further 24 h, in grams

m_0 = mass of the representative portion of the hose lining, in grams

C7 REPORT

The report shall include the following information:

- (a) Percentage of liquid absorbed.
- (b) Percentage of extractable matter.
- (c) Reference to this test method, i.e. AS/NZS 1869, Appendix C.

APPENDIX D

METHOD FOR DETERMINING RESISTANCE OF HOSE ASSEMBLY TO GAS

(Normative)

D1 SCOPE

This Appendix sets out a method for determining the resistance of a hose assembly to gas.

D2 PRINCIPLE

The hose assembly is treated with propane gas or liquid propane and then subjected to a proof test.

D3 REAGENTS

The following reagents are required:

- (a) Propane gas.
- (b) Liquid propane.

D4 TEST SAMPLE

A hose assembly having a free length of hose of 150 mm is required.

D5 PROCEDURE

The procedure shall be as follows:

- (a) Fill the sample assembly—
 - (i) for Classes A and B hose with propane gas at a pressure of 7.0 kPa, and
 - (ii) for Classes C, D, E, F, G and H hose with liquid propane.
- (b) Seal and allow to stand at $23 \pm 2^\circ\text{C}$ for 28 d.
- (c) Suspend the hose assembly with an applied load—
 - (i) for sizes up to and including 10.0 mm internal diameter, for 30 min the load being 22.5 kg and attached to its lower end; and
 - (ii) for larger sizes, for 30 min the load being calculated as 2.5 times (internal diameter in millimetres) and expressed in kilograms, and attached to the hose.
- (d) Remove the propane and subject the hose assembly to a proof test in accordance with Appendix M at a proof pressure as follows:
 - (i) For Classes A and B hose 28 kPa.
 - (ii) For Classes C, D, E, F, G and H hose 5.2 MPa.
- (e) Visually examine the hose lining and cover for signs of fracture, cracks, leakage or movement between the hose and coupling.

D6 REPORT

The report shall include the following information:

- (a) Any visible signs of fracture, cracks, leakage or movement between hose couplings.
- (b) Reference to this test method, i.e. AS/NZS 1869, Appendix D.

APPENDIX E

METHOD FOR DETERMINING RESISTANCE TO FLEXING AND MECHANICAL LOADS

(Normative)

E1 SCOPE

This Appendix sets out methods for determining the resistance to flexing and mechanical loads of a hose assembly incorporating hose not exceeding 20 mm internal diameter and of a hose exceeding 20 mm internal diameter.

E2 PRINCIPLE

For a hose assembly with hose not exceeding 20 mm ID, the assembly is treated with liquid pentane, then subjected to 7500 flexing cycles and tested for leakage.

For hose exceeding 20 mm ID, the hose is treated with liquid pentane, then subjected to 1000 flexing cycles and tested for leakage.

E3 REAGENT

Liquid pentane, commercial grade, is required.

E4 APPARATUS

For the procedure specified in Paragraph E6.1, a flexing apparatus, consisting of the following, is required:

- (a) A block, which can be adjusted both vertically and horizontally, the amount of movement in both directions being 75 mm.
- (b) Spring balance.
- (c) Adaptor, rigidly attached to the spring balance.

A typical flexing test apparatus for hose of internal diameter up to and including 20 mm is shown in Figure E1.

For the procedure specified in Paragraph E6.2, a test apparatus as shown in Figure E2 is required.

E5 TEST SAMPLE

A hose assembly, having a free length of hose such that the hose can be flexed through 90° at the dynamic bend radius, specified in Table 1.2, is required.

E6 PROCEDURE

E6.1 For hose assembly with hose not exceeding 20 mm ID

The procedure shall be as follows:

- (a) Fill the test sample with liquid pentane and allow to stand for 72 h.
- (b) Empty the hose assembly and allow it to stand at $23 \pm 2^\circ\text{C}$ for 24 h.

- (c) Support the assembly rigidly at one end and subject it to—
 - (i) for hose not exceeding 12.5 mm ID, 7500 right-angle pulls of 30 N applied at the rate of 30 pulls per minute (see Figure E1) at the dynamic bend radius specified in Table 2.1; and
 - (ii) for hose exceeding 12.5 mm ID, but not exceeding 20 mm ID, 7500 right-angle pulls of 50 N applied at the rate of 30 pulls per minute (see Figure E1) at the dynamic bend radius specified in Table 2.1.
- (d) Suspend the assembly vertically with a weight having a mass of 22.5 kg attached to its lower end for 48 h.
- (e) Test the assembly hydrostatically at 1.5 times the maximum rated working pressure for 5 min.
- (f) Visually examine the assembly for signs of leakage and visually examine the lining and cover for signs of fracture, cracks or leakage and signs of separation between the hose and coupling.

E6.2 For hose exceeding 20 mm ID

The procedure shall be as follows:

- (a) Fill the test sample with liquid pentane and allow to stand for 72 h.
- (b) Empty the hose and allow it to stand at $23 \pm 2^\circ\text{C}$ for 24 h.
- (c) Attach the hose to the test apparatus and fit the radius blocks at a distance of 500 mm from the base, as shown in Figure E2.
NOTE: The radius of the blocks is given in Table 2.1.
- (d) Adjust the spring tension to apply a force calculated as $2 \times (\text{ID in millimetres})$ and expressed in newtons, to the hose when in the flexed position.
- (e) Subject the hose to 1000 flexing cycles through an angle of 180° at a rate not exceeding 10 cycles/min.
- (f) Test the hose hydrostatically at 1.5 times the maximum working pressure for 5 min.
- (g) Visually examine the hose for signs of fracture, cracks or leakage.

E7 REPORT

E7.1 For hose assembly with hose not exceeding 20 mm ID

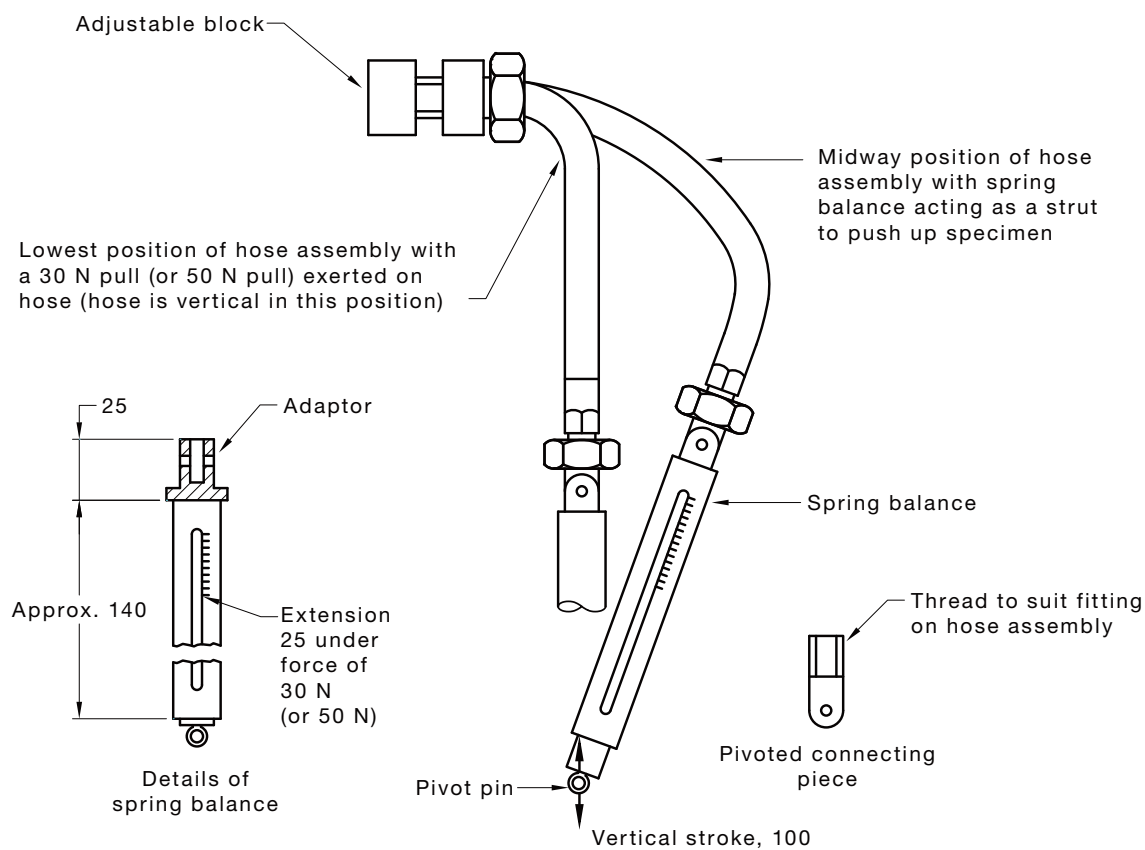
The following shall be reported:

- (a) Any visible signs of leakage of the hose assembly and any fracture, cracks or leakage in the hose lining and cover, and any signs of separation between the hose and coupling.
- (b) Reference to this test method, i.e. AS/NZS 1869, Appendix E.

E7.2 For hose exceeding 20 mm ID

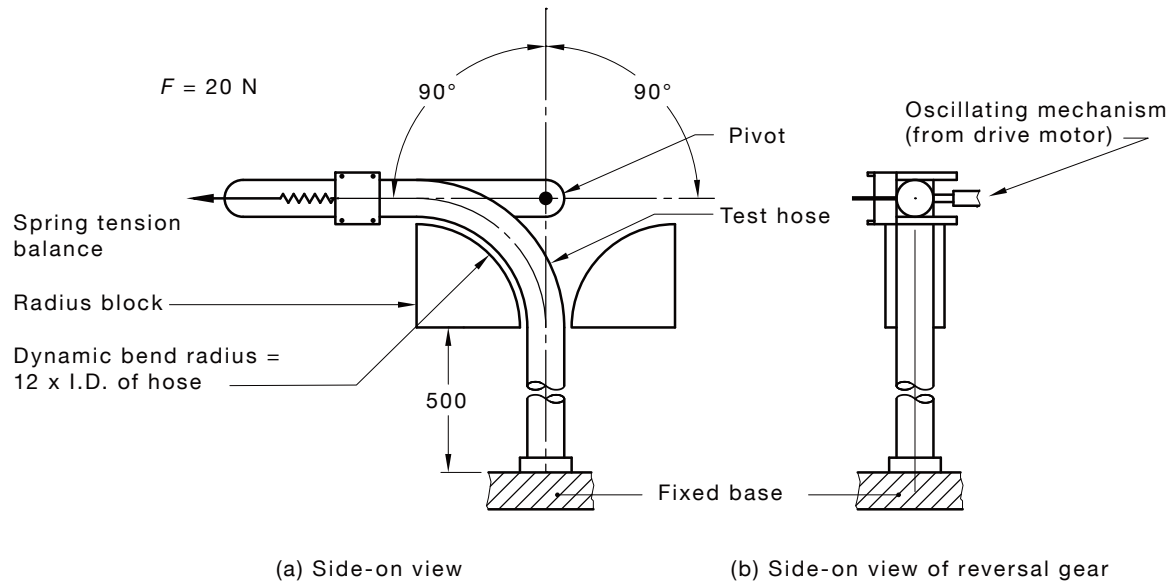
The following shall be reported:

- (a) Any visible signs of fracture, cracks or leakage of the hose.
- (b) Reference to this test method, i.e. AS/NZS 1869, Appendix E.



DIMENSIONS IN MILLIMETRES

FIGURE E1 TYPICAL FLEXING TEST APPARATUS FOR HOSE ASSEMBLY
WITH HOSE NOT EXCEEDING 20 mm ID



DIMENSIONS IN MILLIMETRES

FIGURE E2 FLEXING TEST APPARATUS FOR HOSE EXCEEDING 20 mm ID