SRI LANKA STANDARD 1209 : 2001

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SPECIFICATION FOR RUBBER/SYNTHETIC HOSES AND HOSE ASSEMBLIES FOR LIQUEFIED PETROLEUM GAS IN AUTOMOTIVES

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SLS 1209 : 2001

Gr. 3

SRI LANKA STANDARDS INSTITUTION
No. 17 Victoria Place,
Elvitigla Mawatha,
Colombo 08
SRI LANKA

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This standard does not purport to include all the necessary provisions of a contract.

Sri Lanka Standard
SPECIFICATION FOR RUBBER/SYNTHETIC HOSES AND HOSE ASSEMBLIES FOR LIQUEFIED PETROLEUM GAS IN AUTOMOTIVES

FOREWORD

This Sri Lanka Standard was approved by the Technical Advisory Committee on Conversion of Automotive to bi-fuel (Petrol/LPG) propulsion system and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2001-03-20

This Sri Lanka Standard specifies the requirements for rubber/synthetic hoses and hose assemblies, up to a maximum bore diameter of 20 mm, for use in motor vehicles with Liquefied Petroleum Gas (LPG) installations. The hoses are designed for use up to a maximum pressure of 3 MPa and a working temperature between - 40 ^{0}C and + 80 ^{0}C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or an analysis shall be rounded off in accordance with **CS 102**. The number of significant figures to be retained in the rounded off value shall be the same as that of the specified value in this standard.

The Sri Lanka Standards Institution gratefully acknowledges the use of the following publications in the preparation of this standard;

a) ISO 8789 : Rubber hoses and hose assemblies for LPG in motor vehicles.
b) AS/NZS 1869 : Hose assemblies for liquefied petroleum gas (LPG), Natural gas and town gas
c) UN Regulation No. 67

NOTE

If hoses are used at temperatures higher than 80 ^{0}C. i.e. in an engine compartment and/or as connecting hoses with exhaust-pins (used by air-cooled engines for the evaporation of the gas) it will have to be shown that these hoses can withstand the higher temperatures.

1 SCOPE

This Sri Lanka Standard specifies the requirements of rubber hoses and hose assemblies and synthetic hoses and hose assemblies, up to a maximum bore diameter of 20 mm,, for use in motor vehicles operated by Liquefied Petroleum gas installation. It covers the hoses and hose assemblies designed for use up to maximum operating pressure of 3 MPa and working temperature between -40 °C and + 80°C.

NOTE

This standard does not preclude the use of alternative designs , materials and methods where they could provide equivalent of better standard of safety as judged by a competent person.

2 REFERENCES

ISO 37	Rubber, vulcanized or thermoplastic Determination of tensile stress-strain properties
ISO 188	Rubber, vulcanized - Accelerated ageing or heat-resistance tests
ISO 471	Rubber - Times, temperatures and humidities for conditioning and testing
ISO 1402	Rubber and plastics hoses and hose assemblies - Hydrostatic testing
ISO 1431/1	Rubber, vulcanized or thermoplastic - Resistance to ozone cracking
ISO 1817	Rubber, vulcanized - Determination of the effect of liquids
ISO 4080	Rubber and plastic hoses and hose assemblies -Determination of permeability to gas
ISO 4672	Rubber and plastics hoses - Sub ambient temperature flexibility tests
ISO 6803	Rubber or plastics hoses and hose assemblies - Hydraulic-pressure impulse test with out flexing)
ISO 7326	Rubber and plastics hoses - Assessment of ozone resistance under static conditions
CS 102	Presentation of numerical values

3 DEFINITIONS

For the purpose of this standard the following definitions shall apply:

3.1 ageing : Irreversible change of material properties after exposure to an environment for a period of time.

3.2 burst pressure : The pressure at which any part of the hose assembly fails.

3.3 **elongation at break** : Percentage elongation of the test length of a test piece at the moment of rupture.

3.4 **lining** : Innermost layer of a hose.

3.5 **maximum working pressure** : The maximum pressure at which a rubber or composite hose is designed to be serviceable.

3.6 **tensile strength** : Maximum tensile stress applied during stretching a test piece to rupture.

3.7 **tube** : A plain uncorrugated meter cylinder which may be processed during manufacture to become flexible metallic hose

4 REQUIREMENTS

4.1 Bore diameters and tolerances

Bore diameters and tolerances of hoses, shall comply with the requirements in Table 1.

TABLE 1 - **Bore diameters and tolerances**

Nominal bore mm (1)	**Tolerance** mm (2)	(3)
6.4	-0.6	+0.2
9.5	-0.6	+0.2
12.7	-0.8	+0.2
15.8	-0.8	+0.2
19.0	-0.8	+0.2

4.2 Hose construction

4.2.1 *High Pressure Rubber Hoses, Class 1 Classification, Filling Hose*

4.2.1.1 The hoses shall be designed to withstand a maximum operating pressure of 3.0 MPa .

4.2.1.2 The hose shall consist of smooth bore lining and cover of suitable rubber material, reinforced with one or more interlayer.

4.2.1.3 The cover and lining shall be smooth and free from visible defects and contamination.

4.2.1.4 If corrosion-resistant material (i.e. stainless steel) is used for the reinforcement, no cover is required.

4.2.1.5 Reinforcement may be by cotton, synthetic fibre or corrosion-resistant material (i.e stainless steel). Reinforcement materials which are not corrosion-resistant will require additional protection against the external environment.

4.2.1.6 To avoid the formation of bubbles due to gas permeation the cover shall be pin-pricked.

4.2.1.7 When the cover is punctured and the interlayer is made of a non-corrosion resistant material, the nterlayer has to be protected against corrosion.

4.2.1.8 The construction of the hose shall be such that it is not necessary to peel back the cover before mounting the fitting.

4.2.2 *Low Pressure Rubber Hoses, Class II Classification*

4.2.2.1 The hose shall be designed to withstand a maximum pressure of 450 kPa and temperatures between -20 ^{0}C to 80 ^{0}C.

4.2.2.2 The construction of hoses shall be as stated in **4.2.1.2** up to **4.2.1.6.**

4.2.3 *High Pressure Synthetic Hoses, Class I Classification*

4.2.3.1 The hoses shall be designed to withstand a maximum operating pressure of 3.0 MPa and to withstand temperatures between -25 ^{0}C to 125 ^{0}C.

4.2.3.2 The synthetic hose shall consist of a smooth thermoplastic tube and a cover of suitable thermoplastic material, oil and weatherproof, reinforced with one or more synthetic interlayer(s).

4.2.3.3 The cover and lining shall be smooth and free from visible defects and contamination.

4.2.3.4 Intentionally provided puncture in the cover shall not be considered as an imperfection.

4.3 Lining and cover materials

4.3.1 *Preparation of test pieces*

Test pieces shall be taken from the hose. No tests shall be carried out within 24 h after manufacture of the hose.

4.3.2 *Physical requirements for the lining and the cover*

When tested in accordance with the methods of test indicated in Table 2 the lining and the cover shall comply with the requirements specified.

TABLE 2 - Physical requirements for the lining and the cover

Property	Requirement						Method of Test
	Rubber hoses Class 1		Rubber hoses Class II		Synthetic hoses Class I		
	lining	cover	lining	cover	lining	cover	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tensile strength (MPa), min.	10	10	10	10	20	20	ISO 37
Elongation at break %' min.	250	250	250	250	250	200	ISO 37
Accelerated ageing	at 70 °C for 168 h	at 70 °C for 336 h	at 115 °C for 168 h	at 115 °C for 336 h	at 115 °C for 336 h	at 70 °C for 168 h	ISO 188
Change in tensile strength after ageing (%), max.	25	25	25	25	35	25	ISO 37
Change in elongation at break after ageing (%),max.	(-30 to+10)	(-30 to+10)	(-30 to+10)	(-30 to+10)	(-30 to+10)	(-30 to+10)	ISO 37

4.3.3 *Resistance to n-pentane and n-hexane*

When tested in accordance with the methods of test indicated in Table 3, a test piece of the lining and/or cover immersed in n-pentane and/or n-hexane as appropriate for given period of relevant temperature in accordance with **ISO 1817**, shall comply with the requirements specified in Table **3**.

TABLE 3 - Resistance to n-pentane/n-hexane

Property	**Requirement**						**Method of Test**
	Rubber hoses Class 1		**Rubber hoses Class II**		**Synthetic hoses Class I**		
	lining	**cover**	**lining**	**cover**	**lining**	**cover**	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Change in tensile strength (%)	25	35	25	35	25	35	ISO 37
Change in elongation at break %	30	35	30	35	30	35	ISO 37
Change in volume ,%	20	30	20	30	20	20	ISO1817
Testing condition	at 23 ^{0}C for 72 h	at 23 ^{0}C for 72 h	at 23 ^{0}C for 72 h	at 23 ^{0}C for 72 h	at 23 ^{0}C for 72 h	at 23 ^{0}C for 72 h	

NOTE

The tests should be conducted at a temperature of 23^{0}C for an immersion period of 72 h.

4.3.4 *Ozone resistance*

Hoses and hose assemblies when tested according to **ISO 7326** , Method **3**, a test piece of the cover, or complete hose in the case of tubing reinforced with corrosion-resistant material, shall show no visible cracks.

4.4 Hoses

4.4.1 *Permeability to gas*

Hoses when tested in accordance with Method 3 of ISO 4080, the permeability to propane shall not exceed 0. 0528 $cm^3/m^2/s$, calculated as permeation through the exposed lining area.

4.4.2 *Low-temperature resistance*

When hoses are tested in accordance with **ISO 4672** at -25 $^0C \pm 3\ ^0C$, no cracks or ruptures shall be visible in the cover or lining.

4.4.3 *Hydrostatic proof pressure and minimum burst pressure*

4.4.3.1 The hoses shall be designed for a maximum working pressure according to their classification as specified in 4.2

TABLE 4 - Hydrostatic test pressure and burst-pressures of hoses

Type of the hoses (1)	Test pressure MPa (2)	Period/duration of test pressure min (3)	Burst pressure MPa (4)
High pressure rubber hose; Class I	6.75	10	10.0
Low pressure rubber hose; Class II	1.015	10	1.8
High pressure synthetic hose; Class I	6.75	10	10.0

4.4.3.2 No leaks or signs of failures shall occur when relevant test pressures given in Column 2 of Table 4 are applied to the hose in accordance with ISO 1402; except that the test pressure shall be held for a period of 10 min.

4.4.3.3 When tested in accordance with ISO 1402 the minimum burst pressure shall not be less than the relevant values given in Column 4 of Table 4.

4.5 Fittings

4.5.1 The fittings shall be made of stainless steel, brass or plated ferrous material to prevent corrosion.

4.5.2 Fittings of the crimp-on type or the screw-together reusable type shall be used. The swivel nut shall be provided with a UNF* thread, and sealing shall be by means of a 45^0 cone.

4.6 Hose assemblies

4.61 *Impulse testing*

4.6.1.1 After treatment in accordance with 4.6.1.2 the assembly shall withstand a proof test as described in 4.4.3.2

4.6.1.2 Subject the hose assembly to an impulse test in accordance with ISO 6803. The test shall be performed with circulating oil at 93 ^{0}C and at a minimum pressure of 2.5 MPa for 150 000 impulses.

4.6.2 *Gas tightness*

After application, using nitrogen gas, of an internal pressure of 3.0 MPa to the test assembly, the assembly shall not show any leak when submerged in water for 5 min.

* Unified Screw Thread (Fine Series)

5 MARKING

5.1 Hoses and hose assemblies shall be legibly and indelibly marked, at intervals of not greater than 0.5 m, with the following:

a) the manufacturer's name or trade-mark;
b) the quarter and year of manufacture;
c) the size and type of hose; and
d) the identification "LPG".

5.2 Hose assemblies shall bear the name or trade mark of the assembling manufacturer, and the thread size.

NOTE

Attention is drawn to the certification marking facilities offered by the Sri Lanka Standards Institution. See the inside back cover of this standard.

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SRI LANKA STANDARDS INSTITUTION

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

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