SRI LANKA STANDARD 1208 : 2001

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# SPECIFICATION FOR THE VAPORIZER AND REGULATOR FOR CONVERSION OF AUTOMOTIVES TO BI-FUEL (PETROL - LPG) PROPULSION SYSTEM

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# SPECIFICATION FOR THE VAPORIZER AND REGULATOR FOR CONVERSION OF AUTOMOTIVES TO BI-FUEL (PETROL - LPG) PROPULSION SYSTEM

SLS 1208 : 2001

Gr.4



SRI LANKA STANDARDS INSTITUTION
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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 THE VAPORIZER AND REGULATOR FOR CONVERSION OF AUTOMOTIVES TO BI-FUEL (PETROL - LPG) PROPULSION SYSTEM

## FOREWORD

This Sri Lanka Standard was approved by Technical Advisory Committee on Conversion of Automotives to Bi-fuel (Petrol-LPG) Propulsion Systems 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.

In this standard the requirements for vaporizer and regulator used in automotives having bi-fuel (Petrol - LPG) propulsion systems are specified.

Any alternative materials, equipment, designs, method of assembly or procedures, which do not comply with the specific requirements of this standard, or are not mentioned in it, but which gives equivalent results to those specified, may be acceptable. Under such conditions the regulatory authority can give advice on the procedure for approval.

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 places 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) **UN Regulation No. 67**

b) **AS/NZS/1425 : 1999** LP gas fuel systems for vehicle engines

## 1 SCOPE

This standard specifies the requirements for vaporizer and regulator used in the conversion of automotives to bi-fuel (Petrol - LPG) propulsion systems. It covers requirements for design, selection of materials, marking and testing.

## 2 REFERENCES

ISO 188 Rubber, vulcanized or thermoplastic - Accelerated ageing and heat resistance tests

ISO 1431 Rubber, vulcanized or thermoplastic - Resistance to ozone cracking
Part 1 : Static strain test

ISO 9227 Corrosion tests in artificial atmospheres - Salt spray tests

CS 102 Presentation of numerical values

SLS 1204 Classification of LPG components used for conversion of automotive to bi-fuel (Petrol-LPG) propulsion system

SLS .....* Methods of test for components used in conversion of automotive to bi-fuel (Petrol-LPG) propulsion system

## 3 DEFINITIONS

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

**3.1 bi-fuel system :** A system where two alternative fuels are intermittently provided for the propulsion.

**3.2 classification pressure :** The maximum allowable operating pressure in a component according to its classification.

**3.3 maximum operating pressure :** The maximum pressure in a component which might arise during operation.

**3.4 operating temperature :** The temperature under normal operating condition.

**3.5 pressure regulator :** A device intended for reducing and regulating the pressure of LPG.

**3.6 regulatory authority :** Any state regulatory authority in Sri Lanka with the jurisdiction for control the design, manufacture and installation of equipment described in this standard and includes an officer of that authority with delegated responsibility by that authority.

**3.7 service coupling :** A coupling in the fuel line between the fuel container and the vaporizer and regulator.

**3.8 shut-off valve :** A device to cut-off the flow of LPG.

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* Under preparation

**3.9 vaporizer** : A device intended to vaporize LPG from a liquid to a gaseous state.

**3.10 working pressure** : The maximum pressure to which the component is designed to be subjected and on the basis of which its strength is designed.

## 4 REQUIREMENTS

### 4.1 Materials

The materials used for pressure reducers shall have specifications that at least fulfill or exceed the test requirements laid down in this standard with respect to following :

a) Temperature ;
b) Pressure ;
c) LPG compatibility (only for non metallic synthetic materials) ; and
d) Durability.

Aluminium alloys may be used for the metallic parts of the pressure reducers. Metallic materials having a melting point lower than 500 $^{0}$C shall not be used in any application where failure may result in gas escape.

### 4.2 Design

**4.2.1** The vaporizer/regulator shall be so designed that it is capable of vaporizing liquid LPG efficiently at constant pressure and metering the optimum LPG supply to the engine at least at :

a) Engine idling speed condition ;
b) Engine part load condition ; and
c) Engine full load condition.

**4.2.2** Electrical operated devices containing LPG shall have the following provisions in order to prevent electric sparks on the surface of fracture in case of fracture of the component:

a) Insulated in a manner that no current is led through, LPG containing parts ;
b) The electrical system of the device isolated from the body and, in case equipped with fuel pump, from the container for the fuel pump ; and
c) The isolation resistance is not less than 10 MΩ.

**4.2.3** In the case of valves associated with the vaporizer and regulator are activated by an electric/external power those valves shall be in "closed" position when their power is switched off.

**4.2.4** Components consisting of both high pressure and low pressure parts shall be so designed to prevent a pressure build up in the low pressure part above 2.25 times the maximum working

pressure for which it has been tested. Components connected directly to the tank pressure shall be designed for the classification pressure of 3 MPa (see **SLS 1204**).

**4.2.5** The pressure of vaporizer /regulator shall be so designed as to prevent any gas flow when the vaporizer/regulator unit is supplied with LPG at a pressure not greater than 4.5 MPa when the regulator is not operating.

**4.2.6** *Heat exchange medium*

The materials which are in contact with the heat exchange medium when operating, shall be compatible with that fluid and shall be designed to withstand a pressure of 200 kPa of the heat exchange medium.

The compartment containing the heat exchange medium of the vaporizer/regulator shall be leak proof at a pressure of 200 kPa.

**4.2.7** *Automatic fuel shut-off device at regulator*

This device shall be designed in such a way that the device shall automatically act to prevent the flow of liquid into the vaporizer unless both the following conditions are satisfied:

a) The ignition is on ; and
b) The engine is turning.

The fuel shut-off device may be permitted to open for a period of upto three seconds when the ignition is first turned on so as to allow for priming of the system. A maximum of three seconds of 'on period' is permitted for when the engine is stalled as opposed to when the engine is turned off.

The automatic fuel shut-off device shall not be directly activated by switching to earth. Indirect switching to earth when interfacing with an electronic control module would be allowed provided that a relay is used to switch the positive power supply to the automatic fuel shut-off device. This relay shall be located as close as possible but not more than 300 mm from the electronic control module. The wiring between the electronic control module and the relay shall be suitably protected to prevent accidental short to earth conditions. Any component of the fuel shut-off device that is subject to liquid LP Gas shall be located so as to be reasonably protected from impact in a collision.

## 5 MARKING

Each vaporizers shall be legibly and indelibly marked with :

a) The manufacturer's name and trade mark ;
b) A definitive model, mark, or series identification ; and
c) The serial number or month and year of manufacture.

## 6 TESTING

### 6.1 For the parts of Class 1 (see SLS 1204)

#### 6.1.1 *Over pressure test*

Vaporizer/regulator unit shall withstand without any visible evidence of rupture or permanent distortion when subjected to a hydraulic pressure of 2.25 times the maximum classification pressure as given in **SLS 1204** all the outlets including those of the coolant compartment shall be closed off.

The test shall be carried out in accordance with **SLS** .....*

#### 6.1.2 *External leakage test*

Vaporizer/regulator unit shall be free from leakage through stem or body seals or other joints, and shall not show evidence of porosity in casting when tested as described in **SLS** .....*.

#### 6.1.3 *High temperature test*

Vaporizer/regulator unit shall not leak more than 15 ml/hour with the outlet plugged when submitted to a gas pressure of 1.5 times the classification pressure (see **SLS 1204**) at the maximum operating temperature of 120 $^{0}$C. The component shall be conditioned for at least 8 hours at this temperature.

#### 6.1.4 *Low temperature test*

Component shall not leak more than 15 ml/hour with the outlet plugged when submitted to a gas pressure of 1.5 times the classification pressure (see **SLS 1204**) at the minimum operating temperature of - 20 $^{0}$C.

The test shall be carried out in accordance with **SLS** ..... *.

#### 6.1.5 *Seat leakage test*

All the seats of service couplings (if any) when in the closed position, shall be free from leakage at any aerostatics pressure between 0 to 3 MPa.

The test shall be carried out in accordance with **SLS** ..... *.

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* Methods of test for conversion of automobiles to bi-fuel (petrol-LPG) propulsion system (under preparation)

The seat of a shut-off valve (if integrated in the vaporizer/regulator) when in the closed position. shall be free from leakage at any aerostatics pressure between 0 to 3 MPa.

6.1.6 *Endurance test*

The shut-off valve (if integrated) shall be capable of conforming to the applicable leakage test requirements after being subjected to a 100 000 cycles of opening and closing.

Seat leakage test and the external leakage test are to be conducted immediately following the endurance test.

The test shall be carried out in accordance with **SLS** ..... *.

6.1.7 *LPG compatibility test for synthetic materials*

A synthetic part in contact with LPG liquid shall not show excessive volume change or loss of weight.

When the samples are immersed in n - pentane at a temperature of 23 $^{0}$C for a period of 72 hours. the following requirements shall be satisfied:

a) Maximum change in volume 20 per cent ; and
b) After storage in air with a temperature of 40 $^{0}$C for a period of 48 hours the mass compared to the original value may not decrease more than 5 per cent.

The test shall be carried out in accordance with **SLS** ..... * .

6.1.8 *Corrosion resistance test*

Metal LPG containing components shall comply with the tests mentioned in 6.1, 6.2, 6.3 and 6.4 after having been submitted to a salt spray test according to **ISO 9227.**

6.1.9 *Resistance to dry heat*

The test shall be carried out in compliance with **ISO 188.**

The test pieces shall be exposed to air at a temperature equal to the maximum operating temperature for 168 hours.

The allowable change in tensile strength shall not exceed +25 per cent.

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The allowable change in ultimate elongation shall not exceed the following values :

a) Maximum increase 10 per cent ; and
b) Maximum decrease 30 per cent.

**6.1.10** *Ozone ageing test*

The non metallic test piece, which has to be stressed to 20 per cent elongation shall be exposed to air at 40 $^{0}$C with an ozone concentration of 50 parts per hundred million during 120 hours, and no cracking of the test piece is allowed.

The test shall be carried out in accordance with **ISO 1431-1.**

**6.1.11** *Creep test*

A non metallic part containing liquid LPG shall comply with the leakage tests mentioned in **6.2, 6.3,** and **6.4** after having been subjected to a hydraulic pressure of 2.25 times the maximum operating pressure at a temperature of 120 $^{0}$C during minimal 96 hours.

Water or any other suitable hydraulic fluid may be used as a test medium.

The test shall be carried out in accordance with **SLS .....*** .

**6.1.12** *Temperature cycle test*

A non metallic part containing liquid LPG shall comply with the leakage tests mentioned in **6.2, 6.3,** and **6.4** after having been subjected to a 96 hours temperature cycle from 20 $^{0}$C operating temperature up to the 120 $^{0}$C temperature with a cycle time of 120 minutes, under maximum working pressure.

The test shall be carried out in accordance with **SLS .....*** .

**NOTE**

*See SLS **1204** for classification parts under various pressures.*

**6.2 For the parts of Class 2 and/or 2A (see SLS 1204)**

The tests mentioned in **6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.1.7** and **6.1.8** shall only be carried out appropriately for the above components.

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## SRI LANKA STANDARDS INSTITUTION

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