

ISBN 978-0-626-23806-3

SANS 10087-4:2011

Edition 3

SOUTH AFRICAN NATIONAL STANDARD

The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations

Part 4: The transportation of LP gas including the design, construction, inspection, fittings, filling, maintenance and repair of LP gas bulk vehicles and rail tank cars

Published by SABS Standards Division
1 Dr Lategan Road Groenkloof ☒ Private Bag X191 Pretoria 0001
Tel: +27 12 428 7911 Fax: +27 12 344 1568
www.sabs.co.za
© SABS

SABS

SANS 10087-4:2011

Edition 3

Table of changes

Change No.	Date	Scope

Acknowledgement

The SABS Standards Division wishes to acknowledge the valuable assistance derived from publications of the following organizations:

British Standards Institution
National Fire Protection Association (USA)
Shell and BP Service Company (Proprietary) Ltd
LP Gas Association (UK)

Foreword

This South African standard was approved by National Committee SABS SC 1019A, *Gas supply, handling and control (fuel and industrial gases) – Fuel gases*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in January 2011.

This document supersedes SABS 10087-4:1979 (edition 2, reprinted 1985).

Reference is made in NOTE 1 and NOTE 3 to 1.4 to "relevant national legislation". In South Africa this means the Road Transportation Act, 1977 (Act No. 74 of 1977).

Reference is made in 3.2.1 to "relevant national legislation". In South Africa this means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (as amended from time to time).

Reference is made in 3.2.2, 5.2 and 7.1.1 to "relevant national legislation". In South Africa this means the National Road Traffic Act, 1996 (Act No. 93 of 1996).

Reference is made in 3.2.3 and 8.2.1 to "relevant national legislation". In South Africa this means the Trade Metrology Act, 1973 (Act No. 77 of 1973).

Reference is made in 5.1, 5.4.4.6, 5.5.2, 11.5, annex D (two references) and annex E (two references) to "relevant national legislation". In South Africa this means the Pressure Equipment Regulations of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 5.6.2 to "relevant national legislation". In South Africa this means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and the National Road Traffic Act, 1996 (Act No. 93 of 1996).

SANS 10087 consists of the following parts, under the general title, *The handling, storage distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations*:

Part 1: *Liquefied petroleum gas installations involving gas storage containers of individual water capacity not exceeding 500 L and a combined water capacity not exceeding 3 000 L per installation.*

Part 2: *Installations in mobile units and small non-permanent buildings.*

SANS 10087-4:2011
Edition 3

Foreword *(concluded)*

Part 3: *Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 500 L.*

Part 4: *The transportation of LP gas including the design, construction, inspection, fittings, filling, maintenance and repair of LP gas bulk vehicles and rail tank cars.*

Part 6: *The application of liquefied petroleum and compressed natural gases as engine fuels for internal combustion engines.*

Part 7: *Storage and filling premises for refillable liquefied petroleum gas (LPG) containers of gas capacity not exceeding 9 kg and the storage of individual gas containers not exceeding 48 kg.*

Part 8: *Filling containers for LP gas operated fork lift vehicles in-situ.*

Part 10: *Mobile filling stations for refillable liquefied petroleum gas (LPG) containers of capacity not exceeding 9 kg.*

Annexes A to F are for information only.

Introduction

This document has been revised under a new title and, apart from the substitution of metric values for non-metric units, it has been amplified and updated to bring it into line with current practice (particularly by the inclusion for the transport of LP gas in container and bulk including road and rail).

This document represents a minimum standard. Compliance with it does not confer immunity from relevant legal requirements, and the authority having jurisdiction, i.e. the approving authority (see 3.2) should be approached in circumstances where mandatory requirements are applicable.

This document is called up in the Pressure Equipment Regulations of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (as amended from time to time) making the requirements of this document mandatory.

SANS 10087-4:2011

Edition 3

Contents

	Page
Acknowledgement	
Foreword	
Introduction	1
1 Scope	3
2 Normative references	3
3 Definitions	4
4 Design and construction requirements for road vehicles	5
5 Design, construction and testing of the pressure vessels for road and rail transport	7
6 Filling by volume	11
7 Vehicles	12
8 Ancillary equipment	14
9 Driver instructions and training	16
10 Loading and decanting of LPG bulk delivery vehicles	16
11 Parking and garaging of vehicles used to carry LPG	17
12 Decanting of LPG from rail tank cars	17
Annex A (informative) Typical rail tank car discharge procedure	18
Annex B (informative) Check sheet for the road transport of containers from 0,5 L to 113 L (water capacity) by truck or light delivery vehicle of gross vehicle mass less than 3 501 kg	22
Annex C (informative) Check sheet for the road transport of containers from 0,5 L to 113 L by truck of gross vehicle mass exceeding 3 500 kg	25
Annex D (informative) Check sheet for the transport of LPG bulk delivery by road vehicles	28
Annex E (informative) Check sheet for the transport of LPG bulk delivery by rail	31
Annex F (informative) Rate of discharge of pressure relief devices	33
Bibliography	35

The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations

Part 4:

The transportation of LP gas including the design, construction, inspection, fittings, filling, maintenance and repair of LP gas bulk vehicles and rail tank cars

1 Scope

1.1 This part of the SANS 10087 gives requirements for the design, construction, inspection, fittings and the filling ratio of pressure vessels (mounted onto vehicles or rail wagons), including ISO containers and skid tanks, used in the transportation of liquefied petroleum gas (LPG), the design of vehicles and ancillary equipment, and operating practice.

1.2 It also gives the requirements for the transfer of the contents of supply vehicles to or from storage tank(s).

1.3 It also gives requirements for the transfer of the contents to and from rail tank cars to storage tank(s).

1.4 It also gives requirements for the transport of containers with a water capacity not exceeding 500 L.

NOTE 1 The transport of gas containers should comply with the requirements of relevant local legislation as listed under the relevant national legislation (see foreword).

NOTE 2 Cognisance should be taken of the 100 kg exempt quantity given in SANS 10231.

NOTE 3 Drivers of vehicles transporting LPG need to comply with the training and licensing requirements of local legislation as listed under the relevant national legislation (see foreword).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

EN 1762, *Rubber hoses and hose assemblies for liquefied petroleum gas, LPG (liquid or gaseous phase), and natural gas up to 25 bar (2,5 MPa) – Specification.*

EN 10216-2, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties.*

SANS 10087-4:2011

Edition 3

EN 10217-2, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN 10217-3, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 3: Alloy fine grain steel tubes.*

EN 10217-5, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties.*

IP 250/69, *Petroleum measurement tables – Metric units of measurement based on a reference temperature of 20 °C.*

ISO 3874, *Series 1 freight containers – Handling and securing.*

PD 5500, *Specification for unfired fusion welded pressure vessels.*

SANS 1156-1, *Hose for liquid petroleum gas (LPG) – Part 1: Hose used in road and rail transport.*

SANS 1186-1, *Symbolic safety signs – Part 1: Standard signs and general requirements.*

SANS 1518, *Transport of dangerous goods – Design, construction, testing, approval and maintenance of road vehicles and portable tanks.*

SANS 10086-1, *The installation, inspection and maintenance of equipment used in explosive atmospheres – Part 1: Installations including surface installations on mines.*

SANS 10089-2, *The petroleum industry – Part 2: Electrical installations in the distribution and marketing sector.*

SANS 10187-8, *Load securement on vehicles – Part 8: Dangerous goods.*

SANS 10231, *Transport of dangerous goods – Operational requirements for road vehicles.*

SANS 10232-1, *Transport of dangerous goods – Emergency information systems – Part 1: Emergency information system for road transport.*

SANS 15614-1/ISO 15614-1, *Specification and qualification of welding procedures for metallic materials – Welding procedure test – Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys.*

3 Definitions

For the purposes of this document, the following definitions apply.

3.1

approved

approved by the approving authority

3.2

approving authority

appropriate of the following:

3.2.1

within the scope of the relevant national legislation (see foreword) and in respect of the control of general safety: the Chief Inspector;

4

SANS 10087-4:2011

Edition 3

3.2.2

within the scope of the relevant national legislation (see foreword); and in respect of the regulations of traffic: the Chief Traffic Inspector;

3.2.3

within the scope of the relevant national legislation (see foreword); and in respect of the mass of gas sold: the Director of Trade Metrology; and

3.2.4

within the scope of jurisdiction of local authority: the local authority concerned

3.3

filling ratio

ratio of the mass of LPG introduced into a tank to the mass of water (determined at, or corrected to 20 °C that would fill the tank

3.4

inter-link

combination of two semi-trailers

3.5

ISO container

pressure vessel specifically designed to be transported with product and placed into an ISO Frame for the purpose of transportation by means of various transport methods

3.6

liquefied petroleum gas

LPG

commercial butane, commercial propane, or a mixture of light hydrocarbons (predominantly propane, propene, butane and butene) that is gaseous under conditions of ambient temperatures and pressure, and that is liquefied by an increase of pressure or a lowering of temperature

3.7

maximum permissible service pressure

maximum internal pressure that is permitted for a tank during service

3.8

nominally empty

vessel that contains no liquid gas but can still contain vapour

3.9

pressure vessel

pressure vessel designed for the conveyance of LPG by road and rail

3.10

skid tank

pressure vessel mounted on skids for the purpose of being dragged

4 Design and construction requirements for road vehicles

4.1 Road vehicles

4.1.1 For transport of LPG in bulk, the vehicles shall be designed in accordance with the requirements as applicable in the national legislation for example SANS 1518.

SANS 10087-4:2011

Edition 3

4.1.2 A vehicle shall be in possession of a permit commonly issued by the Fire Brigade Services for the transportation of flammable materials. An example of a check sheet to obtain this permit is provided in annexes A to D.

4.1.3 For the transport of portable containers with vehicles less than 3,5 tons carrying capacity, including flat bed type vehicles, the following requirements shall apply:

- a) the carrying load bed of the vehicle shall have sides attached and these sides shall be at least three quarters of the height of the tallest or stacked containers being transported;
- b) provision shall be made for securing the containers to prevent them from toppling over or moving about while being transported. (See SANS 10187-8);
- c) all containers including "nominally empty" containers shall be transported in the upright position i.e. the valve and fittings remain in the vapour space. New or purged containers may be stacked or transported on their sides; and
- d) containers of 9 kg and less may be stacked but shall not be more than 2 high. Cylinders of water capacity of 6 kg and less may be stacked 4 high in double rows, provided they are designed to be stacked.

4.2 Rail tankers

4.2.1 For transport of LPG in bulk, the rail tankers shall be designed in accordance with the requirements as applicable in the national legislation for example PD 5500, RID and DOT.

4.2.2 The design test pressure for rail tank cars shall not exceed 2 412 kPa. The working pressure shall not exceed 1 930 kPa.

4.2.3 Unless otherwise allowed by the railway safety regulator, the axle loading of rail tank cars shall be in accordance with the railway regulations. The load per axle of the rail tank car for class "D", Mk 3 and Mk 7 bogies shall not exceed 20 tons, while the load per axle for a class "C" bogie shall not exceed 16 tons.

4.2.4 For a typical valve arrangement on rail tank cars manway see figure 1. Manway gasket seals should not be manufactured from lead. These seals lead to possible leaks in various climatic conditions.

4.3 ISO containers

For transport of LPG in bulk, using ISO containers the design shall be in accordance with the requirements as applicable in the national legislation for example the International Maritime Organization.



Figure 1 — Typical valve arrangement on rail tank cars

5 Design, construction and testing of the pressure vessels for road and rail transport

5.1 General

Pressure vessels shall be designed and constructed in compliance with a recognized pressure vessel design code as referenced in the schedule given in the national legislation. (See the relevant national legislation (see foreword).)

All appurtenances shall be fitted in such a manner that in the event of an accident or rollover they shall not be damaged.

5.2 Capacity

The gross laden mass of the tank is determined by the design capacity of the vehicle. Unless otherwise allowed, the axle loading of road vehicles shall be in accordance with the regulations as stipulated under the relevant national legislation (see foreword).

5.3 Pressure vessel outlet/inlet points and inspection ports

5.3.1 Connecting points and manholes shall be provided with studs for flanged fittings, joints for pipework up to and including screwed connections nominal size not exceeding 50 mm, or for proprietary items such as pumps, valves and meters up to 80 mm nominal bore, can be threaded.

Connections shall be designed to withstand the most severe combined stresses to which they may be subjected by the pressure of the LPG, pumping pressure and shock loadings caused by transport conditions.

SANS 10087-4:2011

Edition 3

5.3.2 Each vessel shall be provided with access so that the whole of the interior can be examined.

5.3.3 Fixtures or connections that may trap water should be avoided.

5.4 Gauges and fittings

5.4.1 General

5.4.1.1 All gauges and fittings shall be:

- a) suitable for use in the range of temperatures and pressures for which the tank has been designed;
- b) able to withstand normal road shocks; and
- c) protected against physical damage.

5.4.1.2 Gauges should be so placed that they can be read from the ground level.

5.4.1.3 Instrument drain cocks, sampling valves and other shut-off valves that communicate directly with the outer atmosphere and that are not in use shall be fitted with caps or blank flanges.

5.4.2 Contents gauge

Each vessel shall be equipped with the contents gauging device that is subject to the relevant of the following precautions:

- a) each gauging device (such as rotary tube, fixed tube or slip tube) that relies on bleeding to the atmosphere shall be so designed that:
 - 1) unless it is provided with an emergency shut-off valve, the maximum opening of the bleed hole does not exceed 1,4 mm; and
 - 2) it cannot be withdrawn completely during normal gauging operations;
- b) any maximum liquid level indicator should be located as near to the mid-point (front to rear) of the pressure vessel as it is practicable and should be readily accessible;
- c) if the contents of the pressure vessel are to be measured with a rotary tube, magnetic or slip-tube gauge, at least one fixed tube gauge, set at the fill ratio $\pm 2\%$ of the tank, should in addition be provided for checking the accuracy of the variable gauge.

5.4.3 Pressure gauge

5.4.3.1 Each vessel shall be equipped with a pressure gauge connected to the vapour space of the vessel.

5.4.3.2 Pressure gauge connections shall be protected internally by means of an excess flow valve, or by a pressure tapping reduced internally to a bleed hole of diameter not exceeding 1,4 mm.

5.4.3.3 A manually operated isolating valve shall be fitted externally between the vessel and the pressure gauge.

5.4.4 Pressure relief valves

5.4.4.1 Each vessel shall be equipped with at least two certified pressure relief valves of an internal, or semi-internal structure, each having direct communication with the vapour space of the vessel.

SANS 10087-4:2011

Edition 3

If any one valve is inoperative, the number and size of the remaining pressure relief valves shall be sufficient to provide the full relief flow capacity (see annex E) required for the pressure vessel.

5.4.4.2 The maximum start-to-discharge pressure of the relief valve shall not be higher than 110 % of the design pressure of the pressure vessel. Each pressure relief valve shall be of such design that it reseals at a pressure not less than 90 % of the start-to-discharge pressure (see annex F).

5.4.4.3 Pressure relief valves shall be such that it is not possible to tamper with the relief valve settings.

5.4.4.4 Shut-off valves shall not be installed between a vessel and any pressure relief valve.

5.4.4.5 Each pressure relief valve shall be legibly and permanently marked with the following:

- a) the pressure at which the valve is designed to start to discharge;
- b) the actual air discharge rate of the valve, in cubic metres of air per minute at normal temperatures and pressure; and
- c) a serial number.

5.4.4.6 Each pressure relief valve should be recertified within a period as determined by the relevant national legislation (see foreword), and shall be sealed and stamped with the date of testing and the identification mark of the testing station.

5.4.4.7 The pressure relief valve(s) should vent upward, away from the vessel, along an unobstructed path and into the open air. The outlet should be protected against the ingress of foreign substances or materials.

5.4.5 Emergency shut-off valve (Emergency shut-off system)

5.4.5.1 Subject to the provisions of 5.4.5.2 below, all liquid and vapour connections in the vessel, other than those for pressure relief valves and gauges for measuring temperature, pressure and liquid content and those permanently fitted with blank flanges, shall be fitted with an emergency shut-off valve (for example an automatically operated valve, a remotely controlled valve) or a non-return valve. An excess flow valve used on its own does not constitute an emergency shut-off valve.

5.4.5.2 As sludge, scale, dirt etc. can cause excess flow valves and non-return valves to stick in the open position, drain outlets need not be fitted with such valves, provided that the drain is fitted with a valve.

5.4.5.3 Where the emergency shut-off valve incorporates an excess flow valve, the rate of flow required to close it should be less than that likely to result from a complete fracture of the line it is protecting (calculated under the most adverse conditions likely to be experienced) and in no case should it exceed 1,5 times the design flow for the line.

NOTE Emergency shut-off valves are not considered necessary if the bore of the connection to the vessel does not exceed 3 mm in the case of liquid and 8 mm in the case of vapour.

5.4.5.4 Excess flow valves shall have a rated closing capacity sufficiently above normal flow requirements to prevent valve chatter.

5.4.5.5 Emergency shut-off valves shall not be in the open position while the vehicle is in motion.

5.4.5.6 These valves shall be so interlocked that it is not possible to drive the vehicle while they are in the open position.

5.4.5.7 Manually operated emergency shut-off valves shall incorporate excess flow devices.

SANS 10087-4:2011

Edition 3

5.4.5.8 Emergency shut-off valves shall not be located at the rear of the vessel where they are vulnerable to rear collision damage, unless the risk of such damage can be mitigated by adequate protection.

5.4.5.9 Emergency shut-off valves are valves or series of valves attached to the vessel shell, which serve to ensure the integrity of the vessel and security of its contents.

5.4.5.10 They shall be of a design intended to leave a closure mechanism intact in the event of external damage.

5.4.6 Excess flow valves (Primary shut-off system)

5.4.6.1 The closing flow rate should be below that likely to result from a complete fracture of the line it is protecting (calculated under the most adverse conditions likely to be experienced) but in no case should it exceed 1,5 times the design flow rate for the line.

5.4.6.2 Excess flow valves shall have a rated closing capacity sufficiently higher than the normal flow requirements as to prevent valve chatter.

5.4.6.3 Safety systems

The primary shut-off system required depends upon the purpose of the vessel connection as follows:

a) Liquid discharge: A normally closed internal shut-off valve opened by hydraulic, pneumatic or mechanical power from the vehicle. The valve shall be designed for rapid closure on command by one of at least two manual devices located at convenient remote positions on the vehicle and labelled to indicate their use. The system shall incorporate a thermally sensitive device that will ensure positive closure in the event of a fire and shall incorporate an excess flow valve facility.

LPG equipment on the vehicle shall include an emergency shut-down (ESD) system initiated by a minimum of two manual devices located on the vehicle, or one manual device located on the vehicle combined with either:

- i) a rip cord (emergency cord) laid down on the ground beside the LPG tanker during filling and discharge; or
- ii) a pneumatic or mechanical system; or
- iii) an electronic system that activates the pneumatic or mechanical system.

b) In the liquid discharge line, at least one hand operated or remotely operated valve shall be positioned as close as reasonable to the vessel outlet.

5.4.7 Protection of valves and accessories

5.4.7.1 All valves and accessories should be safeguarded against interference and accidental damage.

5.4.7.2 They should be mounted and protected in such a way that the risk of accidental rupture of the branch to which they are connected is minimized.

5.4.7.3 Valves at the rear of the vehicle should be so mounted that they are protected from damage by the rear cross-member of the frame of the vehicle.

5.5 Finish and marking of bulk vessels

5.5.1 Finish

The outside of vessels shall be corrosion protected.

NOTE LPG is not corrosive to steel and consequently the inside of storage vessels need not have a corrosion-resistant coating.

5.5.2 Permanent marking of bulk vessels

A plate, securely attached to the shell of the vessel, shall be permanently marked (by the manufacturer) in accordance with the requirements of the relevant national legislation (see foreword).

5.6 Inspection and testing

5.6.1 Initial

The inspection, testing and certification of vessels shall be under the supervision of an approved inspecting authority who shall furnish each vessel with a certificate giving, in addition to the information required in 5.6.2, the following information:

- a) date of test;
- b) pressure at which tested;
- c) the stamp of approving authority; and
- d) any other data considered necessary.

5.6.2 Periodic inspection and testing

Each vessel shall be subjected to periodic inspection and testing in accordance with the appropriate national regulations framed under the relevant national legislation (see foreword), as relevant.

6 Filling by volume

Because the contents of a vessel cannot normally be controlled by mass, some means is required for calculating the maximum volume of liquid that may be placed in a vessel at any liquid temperature. When the temperature of the liquid (obtained by measuring the temperature of the LPG by means of a temperature measuring instrument placed in a pocket installed in the vessel) and the filling ratio are known, the maximum volume of liquid that can be placed in the vessel can be determined from the following formula:

$$V_T = \frac{D \times 100}{G \times F}$$

where

V_T is the maximum liquid volume (expressed as a percentage of the total storage vessel capacity) that can be placed in a storage vessel when the liquid temperature is T ;

D is the filling ratio;

SANS 10087-4:2011

Edition 3

G is the relative density of the LPG at 20 °C;

F is the liquid volume correction factor (in accordance with IP 250/69); and

T is the temperature of liquid LPG in the storage vessel, in °C.

The actual maximum quantity, in litres, of LPG that can be placed in a vessel is obtained by multiplying the water capacity of the vessel by $\frac{V_T}{100}$.

The maximum fill by volume shall be 85 % ± 2 %.

7 Vehicles

7.1 General

7.1.1 Vehicles used for the transportation of LPG shall comply with the appropriate requirements of the relevant regulations of the relevant national legislation (see foreword) or in the case of the rail tank cars: the Railways Safety regulator.

7.1.2 LPG shall not be transported in a vessel mounted on a conventional draw-bar four-wheel trailer.

7.1.3 Separate hand-operated rear-wheel braking, controlled from the cab, is not recommended for semi-trailers.

7.1.4 An ISO container vessel designed for the conveyance of LPG, shall be properly secured (in compliance with ISO 3874) to the carrying vehicle through its bottom corner fittings by means of acceptable securing devices, e.g. twist locks or pin securing devices.

7.2 Protection against fire and electrical hazards

7.2.1 Fire precautions

7.2.1.1 A quick action cut-off valve shall be fitted to any vehicle that has a gravity fed fuel supply system. A valve shall not be required if the fuel supply is not fed by gravity but rather by a pump directly driven by the engine of the vehicle.

7.2.1.2 If the fuel used to propel the vehicle gives off a flammable vapour at a temperature below 55 °C, the fuel vessel should not be behind the cab unless:

- a) the fuel vessel is protected by a stout steel guard or by the frame of the vehicle; or
- b) a fuel pump placed in front of the cab is used to lift the fuel to the engine.

7.2.1.3 If a window is provided in the back of the cab, it should be non-opening and of wired glass (or other type of heat-resistant material) fitted in fire-resistant framing.

7.2.1.4 The exhaust system of the vehicle, including the muffler and the exhaust pipe, should have ample clearance from the fuel system and any combustible material in the vehicle. The exhaust discharge should be directed away from any vessel and its appurtenances, and to the outside of the frame of the vehicle and any skirting of the vehicle. A muffler cut out should not be used.

7.2.1.5 Stout steel guards or the frame of the vehicle should be used to protect the lower part of the rear of the vessel from damage.

SANS 10087-4:2011

Edition 3

7.2.1.6 At least two 9 kg serviceable fire extinguishers of the dry chemical type, located in an accessible position, shall be carried on the vehicle.

7.2.1.7 Vehicle drivers and their assistants shall not smoke or allow smoking on or near the vehicle whether it is stationary or in motion, or while deliveries are being made, or the filling of the vessel(s) is in progress, or while any repairs to the vehicle are being carried out. The driver shall ensure that no open flames are within 7,5 m perimeter of the vehicle.

7.2.1.8 Each vehicle shall carry chocks which shall be used to prevent rolling of the vehicle when parked for any purposes.

7.2.2 Electrical precautions

Electrical equipment installed on road vessels and rail tank cars shall comply with the relevant requirements as given in SANS 1518.

7.2.2.1 Vehicles shall not be equipped with any artificial lights other than electrical lights.

7.2.2.2 Lighting circuits shall have suitable over-current protection such as fuses or automatic circuit breakers.

7.2.2.3 All electrical circuits shall be heavily insulated and independent of the chassis except that the chassis may be used as the earth return for starter and ignition high voltage circuits.

7.2.2.4 The wiring shall have adequate carrying capacity and mechanical strength and shall be so fixed, insulated and protected as to minimize accidental damage and undue wear.

7.2.2.5 The battery shall be easily accessible.

7.2.2.6 It shall be possible (by means of a double pole switch or other suitable means located as close as possible to the battery) to isolate all electrical circuits.

7.2.2.7 The generator, switches and fuses should be in front of the cab, but where this is impracticable, adequate precautions should be taken.

7.2.2.8 The vessel, ancillary equipment, pipe circuits and hoses shall have electrical continuity with the chassis, including the axles and spring.

7.3 Warning notices

Each vehicle shall display at least two notices that comply with the requirements for PV₁ signs (smoking prohibited), PV₂ signs (fire or lights (or both) prohibited) and PV₃ signs (thoroughfare for pedestrians prohibited) given in SANS 1186-1, one on each side of the vehicle, that are painted on or securely attached to the sides of the vehicle, in letters of height at least 60 mm in the case of the word "DANGER" and of heights at least 30 mm in the case of the remainder of the wording.

7.4 Inspection

The following shall be checked on a daily operational basis as applicable:

- a) the roadworthiness of the vehicle in general (tyre pressures, etc);
- b) all valves and pipe circuits;
- c) hoses;
- d) accessories such as warning notices, wheel chocks and earthing connections; and
- e) fire extinguishers.

SANS 10087-4:2011

Edition 3

8 Ancillary equipment

8.1 Pumps

8.1.1 The design and construction of each pump shall be appropriate for the intended duty for which it is required.

8.1.2 The pump body should be made of non-porous, non-flammable materials capable of withstanding the jarring and vibration effects incident to heavy vehicular use.

8.1.3 The rotational speed of the drive should be suitably controlled to prevent the rating of the pump from being exceeded.

8.1.4 Pumps shall be protected from accidental damage by suitable positioning.

8.1.5 If electrically operated pumps are used, the electrical installation shall be flameproof (see also SANS 10089-2 and SANS 10086-1).

8.1.6 In the case of the hose that is carried on the vehicle and that is connected to the pump discharge, an automatic device (such as differential regulator or equivalent device) should be installed between the discharge piping and the hose connection to prevent discharge of liquid when the pump is not in operation. If a meter is fitted to the discharge piping, the device should be installed between the meter outlet and the hose connection. An excess flow valve may also be used but should not be the exclusive means of putting the recommendations mentioned above into practice.

8.2 Meters

8.2.1 The design and construction of each meter shall be suitable for the duty for which it is required. All meters shall be approved to the requirements as required by the relevant national legislation (see foreword).

8.2.2 The meter body shall be made of non-porous, non-flammable materials capable of withstanding the jarring and vibration effects incident to vehicular use.

8.2.3 Meters shall be protected from accidental damage by suitable positioning or guarding.

8.3 Pipework and pipe fittings

8.3.1 All pipework and pipe fittings shall be designed in accordance with an approved code for piping systems carrying fluids subject to pressure, such as EN 10216-2, EN 10217-2, EN 10217-3 and EN 10217-5.

The purchaser shall specify the applicable standard with which the pipework and pipe fittings are to comply. Piping should be so sized as to provide for the required flow rate.

8.3.2 Any portion of piping between a vessel and a pipe inlet, and any hose or piping that contains liquid and that may at any time be closed at each end, should be provided with a hydrostatic relief valve having a pressure setting not above the design pressure of the equipment being protected.

8.3.3 Pipe joints may be screwed, flanged or welded. Adequate provision should be made for movement between the vessel and the chassis that may affect connections. This may be accomplished by using flexible connections.

8.3.4 All welded joints shall be subject to examinations and tests during and after production, as prescribed in the relevant specification. The quality of each weld shall be at least equal to that

SANS 10087-4:2011

Edition 3

prescribed for grade "A" weld in SANS 15614-1. The quality of the welds shall be established by examination of at least 10 % of all welded joints by radiographic examination or ultrasonic methods for butt welds or magnetic particle and dye penetrate methods where radiography cannot be applied.

NOTE It is advisable to lay down a specific procedure for additional examinations in case the initial examination shows unsatisfactory results.

8.3.5 All piping and fittings (as well as pumps and meters) permanently mounted on a vehicle shall be designed to withstand the most severe combined stresses imposed by the following:

- a) the vapour pressure of the product under maximum temperature conditions; and either
- b) the superimposed pumping pressure; or
- c) the shock loadings caused by road movements.

8.3.6 Neither piping nor fittings should project beyond the sides or the ends of the vehicle. All piping equipment shall be protected to minimize accidental damage that might be caused by rough usage, collision or overturning.

8.3.7 All piping and fittings shall be tested (hydraulic pressure test to 1,25 times the maximum operating pressure) after assembly and should not be put in service until certified free from leakage.

8.3.8 Aluminium or aluminium alloy pipe or tubing shall not be used.

8.4 Hoses

8.4.1 Hoses shall be made of material suitable for LPG service and designed for a pressure at least equal to the design pressure of the pipework. Hoses shall be in one manufactured length without intermediate joints or couplers and shall not exceed 60 m. Hoses shall comply with EN 1762 and the electrical resistance shall not exceed 100 Ω . (See also SANS 1156-1.)

8.4.2 Hoses in service shall be visually examined daily for the following:

- a) wear caused by the abrasion of the outer cover;
- b) wear, cuts, gouges, tears, and other damage that may affect the condition of the hose braiding;
- c) chafing and kinking;
- d) damage that causes leakage and insecurity of end-couplings;
- e) damage to any part of the hose-carcass that may cause leakage; and
- f) bulges, ballooning or unusual soft spots.

Where any such damage is noticed, the hose shall be replaced.

8.4.3 The following test shall be conducted on all LPG hoses (including the end couplings) where fitted to any road or rail tank cars at intervals not exceeding 12 months:

- a) a hydraulic test at 1,25 times the design pressure and the results recorded; and
- b) when applicable, a test for electrical continuity.

Hoses shall be rejected at the end of a service period not exceeding 3 years.

8.4.4 On a vehicle, hoses shall be so carried that they are protected from accidental damage.

SANS 10087-4:2011

Edition 3

8.4.5 Delivery hoses shall be serialized and certified as being fit for purpose. The date of certification of the hose shall be evident in a manner as to facilitate their replacement every 36 months.

9 Driver instructions and training

Driver instructions, training and qualifications shall be in accordance with the requirements of the dangerous goods code (see SANS 10231) as relevant and also include the handling, use and storage of LPG.

10 Loading and decanting of LPG bulk delivery vehicles

10.1 Filling of vessels with LPG and the discharge of LPG

10.1.1 The vehicle shall be so positioned that its hose is within easy reach of the filling/decanting connection point.

10.1.2 The hand brake of the vehicle shall be on, and the engine of the vehicle shall not be running, except when the engine is being used to run the pump, and the bonding cable shall be attached.

10.1.3 One of the extinguishers shall be removed from its mounting and kept at a ready position whilst the driver remains in attendance.

10.1.4 The surroundings, the vessel and the connections shall be visually checked to ascertain that there are no unusual or dangerous situations.

10.1.5 Warning notices (or the appropriate pictograms) shall be displayed where necessary.

10.1.6 When operations are commenced, a further examination of leakage at connection points shall be carried out.

10.1.7 When gauges indicate that an amount of LPG just short of the required load has been transferred to the storage vessel or supplied to the vehicle vessel, as relevant, the flow rate shall be reduced.

10.1.8 After the completion of the transfer of LPG, all connections shall be disconnected and a full examination shall be made to ensure that the vehicle is in a fit condition to be driven away.

10.2 Vehicle bonding and earthing

10.2.1 Earthing

10.2.1.1 The pipework at the bulk vehicle loading/decanting point shall be earthed.

10.2.1.2 The earthing conductor shall be attached to the pipes as close as possible to the coupler to which the hose will be connected.

10.2.1.3 This earthing can either be in the form of an earth spike driven into the ground at a convenient position as close as possible to the loading/decanting point or an earthing conductor connected to the pipework and to the equipotential earthing system.

10.2.2 Bonding

10.2.2.1 A bonding cable shall be attached to bulk delivery vehicles during loading and decanting procedures.

10.2.2.2 The bonding cable shall be the first connection made to the vehicle (before any hoses are attached) and it shall only be removed after all hoses have been disconnected.

NOTE See SANS 10089-2:2007, annex C figure C.6.

10.3 Hazardous area classification

The area surrounding the bulk vehicle being loaded/decanted shall be classified as a zone 1 location for 1 m above the dip hatches down to ground level and a volume 2,2 m vertical from ground level with a radius of 5 m from the hose connecting point.

11 Parking and garaging of vehicles used to carry LPG

11.1 Except during an emergency, or stops made in connection with a delivery, or a stop made for a rest or meal, a vehicle containing LPG shall not be left unattended by day or by night on any street, highway, avenue or alley. A vehicle when unattended should be securely and safely parked and garaged and the parking area should be well lit.

11.2 Vehicles containing LPG shall not be stored, parked or garaged for any reason other than maintenance in any building other than a building designed for or specifically approved by the local authority for such use. (See SANS 10232-1.)

11.3 When it is necessary to garage LPG vehicles for maintenance of the chassis or engine, the vehicle shall be made safe through purging of the system.

11.4 When it is necessary to garage LPG vehicles for general maintenance the following essential precautions shall be taken:

- a) All primary emergency shut-off valves shall be closed, and the liquid vapour in the hose and piping should be vented to a safe location before the vehicle is moved inside the building.
- b) The system shall be checked for leaks and should any be found it is essential that they be repaired before the vehicle is moved inside the building for maintenance.
- c) The cargo vessel shall be gauged to ensure that it is not filled beyond its maximum filling ratio. If it is found to be so filled, this should be corrected before the vehicle is moved inside the building.
- d) The vehicle shall not be parked near a source of heat, near an open flame or near a similar source of ignition, or within a path of hot air being blown from a blower type heater.
- e) Unless the LPG is removed from the cargo vessel and the pressure is reduced to atmospheric pressure, the driver shall inform the responsible people in the garage as to the nature of the contents of the vessel and shall inform them not to tamper with the valves and fittings.

11.5 Repair work shall not be carried out on a vessel or its primary shut-off valves if the vessel contains LPG. All work shall be done by trained and authorized persons, registered in terms of the requirements of the relevant national legislation (see foreword).

11.6 Gas atmospheric detectors (with appropriate alarm systems) should be installed wherever LPG vehicles carrying unstenched gas are parked or garaged.

12 Decanting of LPG from rail tank cars

Any company decanting LPG from road tankers or rail tank cars shall have procedures in place for the decanting operations. An example of a decanting procedure is given in annex A.

SANS 10087-4:2011
Edition 3

Annex A
(informative)

Typical rail tank car discharge procedure

A.1 Discharge

- a) Ensure that all general and safety precautions have been complied with.
- b) Open the rail tank car dome cover, dip and record. Ensure that there is sufficient ullage in storage tank to accommodate contents of rail tank car.
- c) Connect the two liquid hoses between the two red valves of the tank car and the red V-piece on the rack. This V-piece is controlled by the red valve No. 1 on the rack. Check the connections.
- d) Connect the vapour hose from the yellow valve on the tank car to the yellow connection on the rack controlled by valve No. 11. Check the connections.

NOTE The following colour codes are used:

LPG type	Spoornet	Depot
Liquid	Red	Blue ^a
Vapour	Yellow	Yellow

^a The valves at the tank car discharge rack on the liquid lines are coloured red to match the Spoornet markings.

- e) Bleed all hoses of air by cracking the tank car valves and opening the blue liquid and yellow vapour bleed valves (III) and (IV) on the rack until liquid and vapour respectively issue. Thereafter close the bleed valves.

A.2 Procedure

1. Slowly open the three valves on the tank car.
2. Slowly open the red (liquid) and yellow (vapour) valves on the rack.
3. Slowly open the vapour outlet valve and liquid inlet valve on the storage tank.

NOTE If any valve opens with a click, close it again and re-open more slowly.

4. Check the lubricating oil level in the compressor and top up if necessary.
5. Set the compressor 4-way valve to the fill position.
6. Start the compressor.
7. Check that LPG is flowing through the sight flow indicator.
8. Check the storage tank contents gauge at intervals. If it indicates that the tank is full, stop the compressor and close all valves immediately. Carry out steps (26) to (36) in annex D.
9. When liquid stops flowing through the sight flow indicator, stop the compressor. Dip the tank car to check that it is empty.

SANS 10087-4:2011
Edition 3

10. Close the red liquid valve on the tank car rack.
11. Close the storage tank vapour outlet valve and liquid inlet valve.
12. Open the storage tank vapour inlet valve.
13. Reset the compressor 4-way valve to the drain position.
14. Restart the compressor.
15. Run the compressor until the pressure in the tank car falls to 15 P.S.I.
16. Close the yellow vapour valve on the rack.
17. Stop the compressor.
18. Close all 3 valves on the tank car.
19. Close the vapour inlet valve on the storage tank.
20. Check that the red liquid valve and yellow vapour valve on the rack are tightly closed.
21. Carefully and slowly open the blue liquid and yellow vapour bleed valves on the rack.
22. When the pressure in the hoses has been released, close the blue and yellow bleed valves on the rack.
23. Disconnect the hoses, replace the caps on both ends of each hose and put the hoses away.
24. Replace the caps on the tank car valves.
25. Disconnect earthing cable from tank car and coil safely away.
26. Close tank car dome.
27. Dip the storage tank.
28. Record all relevant data including:
 - a) tank car number;
 - b) date and place of filling;
 - c) quantity;
 - d) date received and discharged;
 - e) density and temperature if measured;
 - f) tank dips before and after discharge.

NOTE Always stand to the side and behind tank car hose when disconnecting to prevent injury should the pressure in the hose not be released.

For diagrammatic layout of valves see figure 1.

SANS 10087-4:2011

Edition 3

A.3 Emergency shutdown procedures

Although correct observations of the safety procedures prescribed in this manual will minimize the incidence of LPG emergencies, planning and training to deal with emergencies is essential.

A.3.1 Basic action

Basic action in an emergency is as follows:

- a) Ascertain the nature of the emergency.
- b) Raise the alarm.
- c) Shut down operations in the affected plant/area, muster personnel and evacuate those not needed for emergency action.
- d) Isolate the affected part of the facility to limit the spread of leaking or burning product.
- e) Evacuate any mobile equipment at risk (without starting engines in a gas affected area), ensuring that access routes are not blocked.
- f) In cases of product leakage, eliminate all sources of ignition in areas affected or likely to be affected, and evacuate personnel other than those authorized to deal with the emergency; post guards to prevent re-entry.
- g) Assess the magnitude of the emergency as soon as possible, taking into account that LPG vapour clouds are a major hazard until safely dispersed.
- h) Contact local public emergency services for assistance if required, e.g. fire police, ambulance. Inform management and ensure that neighbours and local authorities are informed if necessary.

A.3.2 Action in the event of leakage without fire

The procedure is as follows:

- a) Act as detailed in (h), paying special attention to actions which stop or minimize the escape of product.
- b) Approach sources of leakage and vapour clouds from upwind.
- c) Use fire-water-hose streams which induce air movement to deflect, disperse, and dilute vapour clouds.
- d) Provide water hose operators with protective clothing and a water spray, as a precaution against the effects of accidental ignition of vapour. Hose operators should try to keep outside the vapour cloud.
- e) Personnel required to enter a vapour cloud should be protected in the same way as hose operators and equipped with a safety harness and manned lifeline in addition.
- f) If possible, move leaking small containers or vehicles to a location such as a blocked-off road or open area, where they can be allowed to leak in relative safety under supervision. They should be moved carefully to avoid ignition of escaped product and to minimize damage to tank and fittings. In moving and final positioning it should be ensured that any leakage is of vapour rather than liquid.

A.3.3 Action in the event of fire

A.3.3.1 Instructions to personnel

Plant managers should ensure that written instructions based on the foregoing recommendations are issued to all personnel to cover the actions they are required to take in the event of emergencies arising during operations. This applies equally to company and contract/casual personnel, whether working within the plant or engaged in outside LPG deliveries, etc.

A.3.3.2 Accident reporting

Incidents involving LPG spillage or leakage (with or without fire) which require emergency action should be treated as accidents. Each incident should be fully investigated by the plant manager, with the assistance of local head office if required. Reasons for the occurrence should be established as far as possible. The reasons for incidents and steps to prevent their recurrence should be explained to and discussed with the personnel involved. All incidents should be reported by the plant manager to local head office, with full supporting details and recommendations for preventing recurrence.

SANS 10087-4:2011

Edition 3

Annex B

(informative)

Check sheet for the road transport of containers from 0,5 L to 113 L (water capacity) by truck or light delivery vehicle of gross vehicle mass less than 3 501 kg

Liquefied Petroleum Gas					
CHECK SHEET FOR THE ROAD TRANSPORT OF CONTAINERS FROM 0,5 L TO 113 L BY TRUCK OR LIGHT DELIVERY VEHICLE OF GROSS VEHICLE MASS LESS THAN 3 501 kg.					
DATE OF INSPECTION		REFERENCE NUMBER			
MAKE AND MODEL		REGISTRATION NUMBER			
ENGINE NUMBER		CHASSIS NUMBER			
TARE (kg)		GROSS MASS (kg)			
MULTI-LOAD – YES/NO		SINGLE LOAD – S.I.N			
COMPATIBLE – YES/NO		CLASS			
No.	Description	Yes	No	N/A	Comments
1	Driver in possession of:				
1.1	Professional driving permit PrDP-D				
1.2	Dangerous goods certificate (Inspected)				
1.3	Tremcard (Inspected)				
2	Vehicle				
2.1	Vehicle engine of the compression ignition type (diesel) (Spark ignition engines are acceptable as long as the vehicle does not enter a LPG facility)				
2.2	All electrical system, light and all fitted appliances to meet safety standards				
2.3	Vehicle stability, e.g. is the centre of gravity below 95 % of vehicle width measured between outer wall of rear tyres?				
2.4	Window at rear of cab to be non-openable and of safety glass				
2.5	The tare mass and maximum gross vehicle weight displayed on vehicle				
2.6	Valid certificate of fitness (COF) issued by approved testing station				
3	Inside vehicle				
3.1	Designated space for paper work				
3.2	Emergency warning triangles and static free wheel chocks				
4	Warning diamonds				
4.1	Front of vehicle (Plastic/Metal)				
4.2	Danger – Warning diamond, small (100 mm orange)				
5	Battery				
5.1	Enclosed with cover				
5.2	Double pole isolating switch and easy access to switch				

SANS 10087-4:2011

Edition 3

Annex B (continued)

Liquefied Petroleum Gas (continuation)					
CHECK SHEET FOR THE ROAD TRANSPORT OF CONTAINERS FROM 0,5 L TO 113 L BY TRUCK OR LIGHT DELIVERY VEHICLE OF GROSS VEHICLE MASS LESS THAN 3 501 kg.					
No.	Description	Yes	No	N/A	Comments
6	Exhaust				
	Exhaust 1 m away from nearest container base				
7	Fire extinguishers				
7.1	Two dry powder fire extinguishers of 4,5 kg capacity. Easily accessible from both sides of vehicle				
7.2	Mounting brackets strong enough to hold fire extinguisher in place				
7.3	Service (Date) Extinguisher to be serviced annually				
7.4	Seals in place (Not tampered with)				
7.5	General condition (Overall)				
8	Dangerous goods placard				
8.1.	Correct type (350 mm × 200 mm)				
8.2	Not obstructed or damaged				
8.3	Product identification number (a) Single load				
8.4	Product identification number (b) Multi-load				
8.5	Operator advice (Tel number)				
8.6	Specialist advice (Tel number)				
8.7	Primary hazard class warning diamond				
8.8	(a) Single load (b) Multi-load				
8.9	Class				
8.10	Subsidiary hazard class warning diamond				
9	Container storage area				
9.1	The vehicle sides and end restraints designed to prevent containers/pallets leaving the vehicle under safe braking conditions or vehicle manoeuvring (or both)				
9.2	If mixed products are carried, are the LPG cylinders carried in a separate, dedicated, well ventilated area?				
9.3	Does the container containing structure give good high and low level ventilation? (Height of structure to be minimum of three quarters of the tallest container or stacked containers). Closed containment area not permissible				
9.4	The floor covered with wood or rubber mat.				
9.5	The containers secured during transport – secured by fit for purpose ropes and straps				

SANS 10087-4:2011

Edition 3

Annex B (concluded)

Liquefied Petroleum Gas (continuation)					
CHECK SHEET FOR THE ROAD TRANSPORT OF CONTAINERS FROM 0,5 L TO 113 L BY TRUCK OR LIGHT DELIVERY VEHICLE OF GROSS VEHICLE MASS LESS THAN 3 501 kg.					
No.	Description	Yes	No	N/A	Comments
9.6	Precautions taken against overloading (e.g. information about maximum number of containers loading diagrams)				
9.7	A rubber mat to serve as protection during offloading of containers				
10	Symbolic signs				
10.1	No smoking				
10.2	No naked lights				
Further that the vehicle listed above has been inspected in respect of all relevant listed safety features which have been found to be fully operational and in order.					
DATE		TIME			
DESIGNATION		SIGNATURE			
PRINT NAME					

Annex C
(informative)

Check sheet for the road transport of containers from 0,5 L to 113 L by truck of gross vehicle mass exceeding 3 500 kg

Liquefied Petroleum Gas					
CHECK SHEET FOR THE ROAD TRANSPORT OF CONTAINERS FROM 0,5 L TO 113 L BY TRUCK OF GROSS VEHICLE MASS EXCEEDING 3 500 kg.					
DATE OF INSPECTION		REFERENCE NUMBER			
MAKE AND MODEL		REGISTRATION NUMBER			
ENGINE NUMBER		CHASSIS NUMBER			
TARE (kg)		GROSS MASS (kg)			
MULTI-LOAD – YES/NO		SINGLE LOAD – S.I.N			
COMPATIBLE – YES/NO		CLASS			
No.	Description	Yes	No	N/A	Comments
1	Driver in possession of:				
1.1	Professional driving permit PrDP-D				
1.2	Dangerous goods certificate (Inspected)				
1.3	Tremcard (Inspected)				
2	Vehicle				
2.1	Vehicle engine of the compression ignition type (diesel) (Spark ignition engines are acceptable as long as the vehicle does not enter a LPG facility)				
2.2	All electrical system, light and all fitted appliances to meet safety standards				
2.3	Vehicle stability, e.g. is the centre of gravity below 95 % of vehicle width measured between outer wall of rear tyres?				
2.4	Window at rear of cab to be non-openable and of safety glass				
2.5	The tare mass and maximum gross vehicle weight displayed on vehicle				
2.6	Valid certificate of fitness (COF) issued by approved testing station				
3	Inside vehicle				
3.1	Designated space for paper work				
3.2	Emergency warning triangles and static free wheel chocks				
4	Warning diamonds				
4.1	Front of vehicle (Plastic/Metal)				
4.2	Danger – Warning diamond, Large (250 mm orange)				
5	Battery				
5.1	Enclosed with cover				
5.2	Double pole isolating switch and easy access to switch				

SANS 10087-4:2011

Edition 3

Annex C (continued)

Liquefied Petroleum Gas (continuation)					
CHECK SHEET FOR THE ROAD TRANSPORT OF CONTAINERS FROM 0,5 L TO 113 L BY TRUCK OF GROSS VEHICLE MASS EXCEEDING 3 500 kg.					
No.	Description	Yes	No	N/A	Comments
6	Exhaust				
	Exhaust 1 m away from nearest container base				
7	Fire extinguishers				
7.1	Two dry powder fire extinguishers of 9 kg capacity. Easily accessible from both sides of vehicle				
7.2	Mounting brackets strong enough to hold fire extinguisher in place				
7.3	Serviced (Date): Extinguisher to be serviced annually				
7.4	Seals in place (Not tampered with)				
7.5	General condition (Overall)				
8	Dangerous goods placard				
8.1	Correct type (700 mm × 400 mm)				
8.2	Not obstructed or damaged				
8.3	Product identification number (a) Single load				
8.4	Product identification number (b) Multi-load				
8.5	Operator advice (Tel number)				
8.6	Specialist advice (Tel number)				
8.7	Primary hazard class warning diamond				
8.8	(a) Single load (b) Multi-load				
8.9	Class				
8.10	Subsidiary hazard class warning diamond				
9	Container storage area				
9.1	The vehicle sides and end restraints designed to prevent containers/pallets leaving the vehicle under safe braking conditions or vehicle manoeuvring (or both)				
9.2	If mixed products are carried, are the LPG cylinders carried in a separate, dedicated, well ventilated area?				
9.3	Does the container containing structure give good high and low level ventilation? (Height of structure to be minimum of three quarters of the tallest container or stacked containers). Closed containment area not permissible				
9.4	The floor covered with wood or rubber mat.				
9.5	The containers secured during transport – secured by fit for purpose ropes and straps				

SANS 10087-4:2011
Edition 3

Annex C (concluded)

Liquefied Petroleum Gas (<i>continuation</i>)					
CHECK SHEET FOR THE ROAD TRANSPORT OF CONTAINERS FROM 0,5 L TO 113 L BY TRUCK OF GROSS VEHICLE MASS EXCEEDING 3 500 kg.					
No.	Description	Yes	No	N/A	Comments
9.6	Precautions taken against overloading (e.g. information about maximum number of containers loading diagrams)				
9.7	A rubber mat to serve as protection during offloading of containers				
10	Symbolic signs				
10.1	No smoking				
10.2	No naked lights				
Further that the vehicle listed above has been inspected in respect of all relevant listed safety features which have been found to be fully operational and in order.					
DATE		TIME			
DESIGNATION		SIGNATURE			
PRINT NAME					

SANS 10087-4:2011
Edition 3

Annex D
(informative)

Check sheet for the transport of LPG bulk delivery by road vehicles

Liquefied Petroleum Gas					
CHECK SHEET FOR THE TRANSPORT OF LPG BULK DELIVERY BY ROAD VEHICLES					
DATE OF INSPECTION		REFERENCE NUMBER			
MAKE AND MODEL		REGISTRATION NUMBER			
ENGINE NUMBER		CHASSIS NUMBER			
TARE (kg)		GROSS MASS (kg)			
COMPATIBLE – YES/NO		SINGLE LOAD – S.I.N			
No.	Description	Yes	No	N/A	Comments
Road tanker, design of pressure vessel					
1	Is documentation of the vessel design and manufacture available, and does it correspond with the nameplate details as provided for in the relevant national legislation (see foreword)?				
2	Is the vessel manufactured to an approved standard (e.g. BS 7122, ASME VIII, ADR)?				
3	Are the vessel design pressure and temperature correct for the product being transported?				
4	Does the design take into account dynamic loading as follows: direction of travel 1 g horizontal transverse 2 g vertical up and down 5 g empty 3 g full?				
5	Is the vessel continuously welded to support structure with local reinforcement of the vessel shell?				
6	Is the support structure and bolting to the chassis designed for dynamic loading?				
7	Are anti-surge baffle plates fitted inside the vessel?				
8	Is there an adequately-sized pressure relief valve, set at the vessel design pressure?				
9	Is the PRV of the internal-mounting type?				
10	Is the vessel instrumentation acceptable, as a minimum: adjustable level gauge pressure gauge temperature gauge?				
11	Is the vessel fitted with an electronic HH level gauge?				
12	Is there a manhole, recessed to avoid damage in a roll-over accident?				
13	Are all connections clearly labelled with their purpose?				
14	Is there a vapour connection?				
15	Is there a drain connection, less than 50 mm diameter and fitted with an internally-mounted ESD valve?				

SANS 10087-4:2011
Edition 3

Annex D (continued)

Liquefied Petroleum Gas (continuation)					
CHECK SHEET FOR THE TRANSPORT OF LPG BULK DELIVERY BY ROAD VEHICLES					
No.	Description	Yes	No	N/A	Comments
16	Are all connections of greater than 3 mm dia (liquid) or 8 mm dia. (vapour) provided with a fire-safe manual shut-off valve AND an emergency valve (e.g. Excess flow valve or remote-operated ESD valve)?				
17	Are all smaller connections (but greater than 1,4 mm dia) provided with a fire-safe manual shut-off valve?				
Pipework and accessories					
18	Is the pipework free from flanges, or are all flanges fitted with spiral-wound metal gaskets?				
19	Are all the valves, accessories, pipework and fuel tank protected from damage in the case of a rollover, crash impact or grounding (by counter-sinking, provision of shrouding etc, and with no part extending beyond the buffer frame)?				
20	Are thermal expansion valves (TEVs) fitted on all sections of pipework that can have liquid closed between valves?				
21	Is the design of the earthing/bonding connection system satisfactory?				
Delivery tanker fittings					
22	Is the pump mounted beneath the vessel with a suction strainer and a by-pass line back to the vessel fitted with a by-pass relief valve?				
23	Are the hoses of an acceptable design?				
Vehicle					
24	Is the centre of gravity height at or below 95 % of the vehicle width, measured between the outer walls of the rear tyres?				
25	Is there a satisfactory drive away protection system (e.g. brakes or engine starting interlocked with hose box or ESD system)?				
26	Is the cabin fitted with a tachograph of a CCE approved type?				
27	Does the vehicle carry wheel chocks?				
28	Can the vehicle's electrical system be isolated from the battery by a single Zone 2 switch, operable from the driver's seat and accessible from outside of the cab?				
29	Are the engine intake and exhaust located at a high level?				
30	Does the vehicle carry at least two 9 kg dry powder fire extinguishers?				
31	Is the vehicle clearly labelled with mandatory warning signs, hazardous cargo markings and emergency contact telephone numbers?				
Operation					
32	Does the vehicle carry instructions for operational and emergency procedures?				
33	Are the drivers trained and tested?				
34	Are rubber hoses protected from prolonged exposure to sunlight?				

SANS 10087-4:2011

Edition 3

Annex D (concluded)

Liquefied Petroleum Gas (continuation)					
CHECK SHEET FOR THE TRANSPORT OF LPG BULK DELIVERY BY ROAD VEHICLES					
No.	Description	Yes	No	N/A	Comments
Emergency					
35	Does the chassis carry at least two ESD switches accessible from two different sides of the vehicle?				
36	Does the ESD shut down the engine, disconnect the pump power (take-off) and close the tank valves?				
37	Is the vehicle fitted with a remote deadman system operable from the receiving customer tank?				
Maintenance					
38	Is there a maintenance plan for the vehicle fleet?				
39	Is there evidence that maintenance is performed (condition of vehicles, existence of records)?				
40	Are extinguishers regularly serviced (on a yearly basis as per SANS 1475-1 requirements) and marked with the last service date?. (However it is recommended to service an extinguisher every 6 months due to compacting of the powder).				
41	Have the vessels and relief valves been inspected/tested by an acceptable authority at the correct frequency as provided in the relevant national legislation (see foreword) and are they within test date?				
42	Are the vessel instruments in serviceable condition?				
43	Does all pipework (including valves) appear in good condition, free from corrosion or damage, and is it pressure tested regularly?				
44	Is the ESD system in good condition and tested regularly?				
45	Is the earthing/bonding point in good condition, and tested regularly?				
46	Are the hoses inspected for wear and damage at least once a month?				
47	Are hoses and associated equipment in good condition and regularly inspected and tested?				
48	Is written record kept of these checks?				
49	Does the vehicle appear generally roadworthy (brakes, lights, steering, bodywork etc.)?				
50	Are all the tyres in good condition (at least 2 mm of tread, no cuts or bulges, no retreads except in certain circumstances – ref SMAD/31 note)?				
51	Miscellaneous				
Further that the vehicle listed above has been inspected in respect of all relevant listed safety features which have been found to be fully operational and in order.					
DATE		TIME			
DESIGNATION		SIGNATURE			
PRINT NAME					

Annex E
(informative)

Check sheet for the transport of LPG bulk delivery by rail

Liquefied Petroleum Gas					
CHECK SHEET FOR THE TRANSPORT OF LPG BULK DELIVERY BY RAIL					
DATE OF INSPECTION		REFERENCE NUMBER			
MAKE AND MODEL		REGISTRATION NUMBER			
ENGINE NUMBER		CHASSIS NUMBER			
TARE (kg)		GROSS MASS (kg)			
COMPATIBLE – YES/NO		SINGLE LOAD – S.I.N			
No.	Description	Yes	No	N/A	Comments
Rail Tanker, design of pressure vessel					
1	Is documentation of the vessel design and manufacture available, and does it correspond with the nameplate details and is it in line with the relevant national legislation (see foreword) requirements?				
2	Is the vessel manufactured to an approved standard (e.g. BS 7122, ASME-BPVC Section VIII Division 1, ADR)?				
3	Are the vessel design pressure and temperature correct for the product being transported?				
4	Does the design take into account dynamic loading as follows: direction of travel 7 g horizontal transverse 2 g vertical up and down 5 g empty 3 g full?				
5	Is the vessel continuously welded to support structure with local reinforcement of the vessel shell?				
6	Is the support structure and bolting to the chassis designed for dynamic loading?				
7	Are anti-surge baffle plates fitted inside the vessel?				
8	Is there an adequately-sized pressure relief valve, set at the vessel design pressure?				
9	Is the pressure relief valve of the internal-mounting type?				
10	Is the vessel instrumentation acceptable, as a minimum: adjustable level gauge pressure gauge temperature gauge fixed ullage gauge?				
11	Is there a manhole, recessed to avoid damage in a roll-over accident?				
12	Are all connections clearly labelled with their purpose?				
13	Is there a vapour connection?				
14	Is there a drain connection, less than 50 mm diameter and fitted with an internally-mounted ESD valve?				

SANS 10087-4:2011

Edition 3

Annex E (concluded)

Liquefied Petroleum Gas (continuation)					
CHECK SHEET FOR THE TRANSPORT OF LPG BULK DELIVERY BY RAIL					
No.	Description	Yes	No	N/A	Comments
15	Are all connections of greater than 3 mm dia. (liquid) or 8 mm dia. (vapour) provided with a fire-safe manual shut-off valve AND an emergency valve (e.g. Excess flow valve or remote-operated ESD valve)?				
16	Are all smaller connections (but greater than 1,4 mm dia.) provided with a fire-safe manual shut-off valve?				
Pipework and accessories					
17	Is the pipework free from flanges, or are all flanges fitted with spiral-wound metal gaskets?				
18	Are all the valves, accessories, pipework and fuel tank protected from damage in the case of a rollover, crash impact or grounding (by counter-sinking, provision of shrouding etc, and with no part extending beyond the buffer frame)?				
19	Are thermal expansion valves (TEVs) fitted on all sections of pipework that can have liquid closed between valves?				
20	Is the design of the earthing/bonding connection system satisfactory?				
General					
21	Is the rail tanker clearly labelled with mandatory warning signs, hazardous cargo markings and emergency contact telephone numbers?				
22	Does the rail tanker carry instructions for operational and emergency procedures?				
Operation/Maintenance					
23	Is there a maintenance plan for rail tanker fleet?				
24	Is there evidence that maintenance is performed (condition of vehicles, existence of records)?				
25	Are extinguishers regularly serviced (on a yearly basis as per SANS 1475-1 requirements) and marked with the last service date? (However it is recommended to service an extinguisher every 6 months due to compacting of the powder).				
26	Have the vessels and relief valves been inspected/tested by an acceptable authority at the correct frequency as provided in the relevant national legislation (see foreword) and are they within test date?				
27	Are the vessel instruments in serviceable condition?				
28	Does all pipework (including valves) appear in good condition, free from corrosion or damage, and is it pressure tested regularly?				
29	Is the ESD system in good condition and tested regularly?				
30	Is the earthing/bonding point in good condition, and tested regularly?				
31	Does the vehicle carry instructions for operational and emergency procedures?				
32	Are the drivers trained and tested?				
33	Are rubber hoses protected from prolonged exposure to sunlight?				

Annex F
(informative)

Rate of discharge of pressure relief devices

The minimum rate of discharge, in cubic metres of air per minute, of pressure relief devices at 120 % of the start-to-discharge pressure is given in table F.1 for storage vessels of surface area up to 200 m².

For storage vessels with a total outside surface area greater than 200 m², the required flow rate in cubic metres of air per minute can be calculated from the following:

$$10,658 A^{0,82}$$

where

A is the surface area of the storage vessel, in square metres.

Table F.1 — Minimum rate of discharge for surface mounted storage vessels

1	2	3	4	5	6
Surface area of storage vessel m ²	Flow rate m ³ of air per min.	Surface area of storage vessel m ²	Flow rate m ³ of air per min.	Surface area of storage vessel m ²	Flow rate m ³ of air per min.
1,5 2,0	14,9 18,8	16,5 17,0	106,2 108,8	55,0 60,0	285,0 306,0
2,5 3,0 3,5 4,0 4,5	22,6 26,2 29,8 33,2 36,6	17,5 18,0 18,5 19,0 19,5	111,4 114,0 116,6 119,6 121,8	65,0 70,0 75,0 80,0 85,0	326,8 347,3 367,5 387,4 407,2
5,0 5,5 6,0 6,5 7,0	39,9 43,1 46,3 49,5 52,6	20,0 21,0 22,0 23,0 24,0	124,3 129,4 134,4 139,4 144,4	90,0 95,0 100,0 105,0 110,0	426,7 446,1 465,2 484,2 503,1
7,5 8,0 8,5 9,0 9,5	55,6 58,6 61,7 64,6 67,5	25,0 26,0 27,0 28,0 29,0	149,3 154,2 159,0 163,8 168,6	115,0 120,0 125,0 130,0 135,0	521,7 540,3 558,7 576,9 595,0
10,0 10,5 11,0 11,5 12,0	70,4 73,3 76,1 79,0 81,8	30,0 31,0 32,0 33,0 34,0	173,3 178,1 182,8 187,4 192,1	140,0 145,0 150,0 155,0 160,0	613,1 631,0 648,7 666,4 684,0

SANS 10087-4:2011

Edition 3

Annex E (concluded)

1	2	3	4	5	6
Surface area of storage vessel m ²	Flow rate m ³ of air per min.	Surface area of storage vessel m ²	Flow rate m ³ of air per min.	Surface area of storage vessel m ²	Flow rate m ³ of air per min.
12,5	84,6	35,0	197,7	165,0	701,5
13,0	87,3	36,0	201,3	170,0	718,9
13,5	90,1	37,0	205,9	175,0	736,2
14,0	92,8	38,0	210,4	180,0	753,4
14,5	95,5	39,0	215,0	185,0	770,5
15,0	98,2	40,0	219,5	190,0	787,5
15,5	100,9	45,0	241,7	195,0	804,5
16,0	103,5	50,0	263,5	200,0	821,3

Bibliography

ASME B31.1, *Power piping*.

ASME-BPVC Section VIII Division 1, *Boiler and pressure vessel code – Section VIII: Rules for construction of pressure vessels – Division 1: Pressure vessels*.

BS 7122, *Specification for welded steel tanks for the road transport of liquefiable gases*.

AD-Merkblätter, *Technical rules for pressure vessels*, Published by Vereinigung der Technischen Überwachungs – Vereine.

SANS 1475-1, *The production of reconditioned fire-fighting equipment – Part 1: Portable and wheeled (mobile) rechargeable fire extinguishers*.

SANS 10087-1, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations – Part 1: Liquefied petroleum gas installations involving gas storage containers of individual water capacity not exceeding 500 L and a combined water capacity not exceeding 3 000 L per installation*.

SANS 10087-3, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations – Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 500 L*.

SANS 10108, *The classification of hazardous locations and the selection of apparatus for use in such locations*.

This page has been left blank intentionally

SABS – Standards Division

The objective of the SABS Standards Division is to develop, promote and maintain South African National Standards. This objective is incorporated in the Standards Act, 2008 (Act No. 8 of 2008).

Amendments and Revisions

South African National Standards are updated by amendment or revision. Users of South African National Standards should ensure that they possess the latest amendments or editions.

The SABS continuously strives to improve the quality of its products and services and would therefore be grateful if anyone finding an inaccuracy or ambiguity while using this standard would inform the secretary of the technical committee responsible, the identity of which can be found in the foreword.

Tel: +27 (0) 12 428 6666 Fax: +27 (0) 12 428 6928

The SABS offers an individual notification service, which ensures that subscribers automatically receive notification regarding amendments and revisions to South African National Standards.

Tel: +27 (0) 12 428 6883 Fax: +27 (0) 12 428 6928 E-mail: sales@sabs.co.za

Buying Standards

Contact the Sales Office for South African and international standards, which are available in both electronic and hardcopy format.

Tel: +27 (0) 12 428 6883 Fax: +27 (0) 12 428 6928 E-mail: sales@sabs.co.za

South African National Standards are also available online from the SABS website <http://www.sabs.co.za>

Information on Standards

The Standards Information Centre provides a wide range of standards-related information on both national and international standards, and is the official WTO/TBT enquiry point for South Africa. The Centre also offers an individual updating service called INFOPLUS, which ensures that subscribers automatically receive notification regarding amendments to, and revisions of, international standards.

Tel: +27 (0) 12 428 6666 Fax: +27 (0) 12 428 6928 E-mail: info@sabs.co.za

Copyright

The copyright in a South African National Standard or any other publication published by the SABS Standards Division vests in the SABS. Unless exemption has been granted, no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means without prior written permission from the SABS Standards Division. This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any purpose other than implementation, prior written permission must be obtained.

Details and advice can be obtained from the Senior Manager.

Tel: +27 (0) 12 428 6666 Fax: +27 (0) 12 428 6928 E-mail: info@sabs.co.za