ISBN 978-0-626-44363-4

SANS 10087-1:2026

Edition 7.1

SOUTH AFRICAN NATIONAL STANDARD

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

WARNING
This document references other documents normatively.

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Table of changes

Change No.	Date	Scope
Amdt 1	2026	Amended to update the clauses on containers, piping, fittings, and other components, inspection, testing, and instruction to users, electronical equipment and other sources of ignition, and on decommissioning of LPG installations, and the annex on determination of pipe sizes.

Foreword

This South African standard was prepared by National Committee SABS/TC 1019, *Gas supply, handling and control (fuel, industrial and medical gases)*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in February 2026.

This document supersedes SANS 10087-1:2024 (edition 7).

A vertical line in the margin shows where the text has been technically modified by amendment No. 1.

This document is referenced in the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 3.5(a) and 7.3.1.1 to the "relevant national legislation". In South Africa this means the Legal Metrology Act,2014 (Act No. 9 of 2014).

Reference is made in 3.5(b), 3.31, 5.2.2.12, 5.2.4.7, and 5.6.10, to the "relevant national legislation". In South Africa this means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in 3.5(c), 5.2.2.14, 5.3.1 to the "relevant national legislation". In South Africa this means the National Building Regulations and Building Standards Act, 1977 (Act 103 No. of 1977).

Reference is made in 3.5(d) to the "relevant national legislation". In South Africa this means the Mine Health and Safety Act, 1996 (Act No. 29 of 1996).

Reference is made in 5.3.3 to the "relevant national legislation". In South Africa this means the Sectional Titles Act, 1986 (Act 95 No. of 1986).

Reference is made in 5.5.1.4, 5.5.2.2, and 7.1.1 to the "relevant national regulation". In South Africa this means the Pressure Equipment Regulation, 2009.

Reference is made in 7.3.1.1 to the "relevant regulatory authority". In South Africa this means the National Regulator for Compulsory Specifications.

Reference is made in 9.2 and 11.4 to the "relevant national department". In South Africa this means the Department of Labour.

Reference is made in A.5(a) to the "relevant national legislation". In South Africa this means 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.

Foreword *(concluded)*

Part 2: Installation of LPG systems in mobile units, including but not limited to caravans, motor homes, park homes and mobile kitchens.

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 19 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.

Annex A and E forms an integral part of this document. Annexes B, C, and D are for information only.

Compliance with this document cannot confer immunity from legal obligations.

Contents

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

1 Scope

1.1 This part of SANS 10087 specifies requirements for the materials, the methods of construction and the installation of equipment used in liquefied petroleum gas applications that involve gas containers of individual water capacity not exceeding 500 L and of a combined water capacity not exceeding 3 000 L.

1.2 It also specifies the maintenance, inspection, and testing of the various components of the equipment.

1.3 It covers the installation of appliances, piping, fittings and other components.

NOTE 1 For installations of containers of individual water capacity exceeding 500 L or of a combined water capacity exceeding 3 000 L, see SANS 10087-3.

NOTE 2 For the storage of containers for retail and exchange purposes, see SANS 10087-3 or SANS 10087-7, as applicable.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 South African Bureau of Standards.

ANSI LC-1/CSA 6.26, *Fuel gas piping systems using corrugated stainless steel tubing (CSST).*

API Spec 5 L, *Specification for line pipe.*

AS/NZS 1869, *Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas.*

AS 3688, *Water supply and gas systems – Metallic fittings and end connectors*.

AS 4176, *Polyethylene/aluminium and cross-linked polyethylene/aluminium macro-composite pipe systems for pressure applications.*

ASTM BS16.22, *Wrought copper and copper alloy solder-joint pressure fittings.*

ASTM A53/A53M, *Carbon steel seamless pipe specifications.*

ASME B16-5, *Pipe flanges and flanged fittings: nps 1/2 through nps 24, metric/inch standard*.

ASME B16.9, *Factory-made wrought steel buttwelding fittings.*

ASME B16.11, *Forged fittings, socket-welding and threaded.*

ASME B31.3, *Process piping.*

ASME B36.10, *Welded and seamless wrought steel pipe.*

ASME B36.19, *Stainless steel pipe.*

ASME/ASTM SA/A234, *standard specification for piping fittings of wrought carbon steel and alloy steel for moderate and high temperature service.*

ASME/ASTM SA/A105, *Standard specification for carbon steel forgings for piping applications.*

ASME/ASTM SA/A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.*

ASME/ASTM SA/A403 SA /A815, *Standard specification for wrought austenitic stainless steel piping fittings.*

ASME/ASTM SA/A182, *Standard specification for forged or rolled alloy and stainless steel pipe flanges, forged fittings, and valves and parts for high-temperature service.*

ASME/ASTM SA/A240, *Flanges.*

ASTM A269, *Standard specification for seamless and welded austenitic stainless steel tubing for general service.*

ASTM B 280, *Seamless copper tube for air conditioning refrigeration.*

ASTM F 1281, *Standard specification for crosslinked polyethylene/aluminium/crosslinked polyethylene (PEX-AL-PEX) pressure pipe.*

ASTM F 1282, *Standard specification for polyethylene/aluminium/polyethylene (PE-AL-PE) composite pressure pipe.*

BS 10, *Flanges.*

BS EN 853, *Rubber hoses and hose assemblies – Wire braid reinforced hydraulic type – Specification*.

BS 8537, *Copper and copper alloys – Plumbing fittings – Specification for press ends of plumbing fittings for use with metallic tubes.*

BS EN 16436-1, *Rubber and plastics hoses, tubing and assemblies for use with propane and butane and their mixtures in the vapour phase-Hoses and tubings.*

BS EN 16436-2, *Rubber and plastics hoses, tubing and assemblies for use with propane and butane and their mixture in the vapour phase-assemblies.*

EN 1092-1, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges.*

EN 1359, *Gas meters – Diaphragm gas meters.*

EN 1555-2, *Plastics piping systems for the supply of gaseous fuels – Polyethylene (PE) – Part 2: Pipes.*

EN 1555-3, *Plastics piping systems for the supply of gaseous fuels – Polyethylene (PE) – Part 2: Fittings.*

EN 10241, *Steel threaded pipe fittings.*

EN 14800, *Corrugated safety metal hose assemblies for the connection domestic appliance using gaseous fuels.*

EN 15266, *Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0,5 bar.*

EN 12735-1, *Copper and copper alloys – Seamless, round tubes for air conditioning and refrigeration – Part 1: Tubes for piping systems.*

ISO 10380, *Pipework – Corrugated metal hoses and hose assemblies.*

JIS BS 2311, *Steel butt welding pipe fittings for ordinary use.*

OIML R137-1, *Gas meters – Part 1: Metrological and technical requirements.*

SANS 24, *Soft solders*.

SANS 62-1, *Steel pipes – Part 1: Pipes suitable for threading and of nominal size not exceeding 150 mm.*

SANS 62-2, *Steel pipes – Part 2: Screwed pieces and pipe fittings of nominal size not exceeding 150 mm.*

SANS 199, *Shut-off valves for refillable liquefied petroleum gas cylinders*.

SANS 347, *Categorization and conformity assessment criteria for all pressure equipment.*

SANS 460, *Plain-ended solid drawn copper tubes for potable water.*

SANS 1067-1, *Copper-based fittings for copper tubes – Part 1: Compression fittings.*

SANS 1067-2, *Copper-based fittings for copper tubes – Part 2: Capillary solder fittings*.

SANS 1067-3, *Copper-based fittings for copper tubes – Part 3: Push-fit fittings.*

SANS 1123, *Pipe flanges*.

SANS 1156-2, *Hose for natural gas and liquefied petroleum gas (LPG) – Part 2: Hose and tubing for use in natural gas and liquefied petroleum gas vapour phase.*

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

SANS 1237, *Single-stage regulators for liquefied petroleum gas (LPG)*.

SANS 1453, *Copper tubes for medical gas and vacuum services.*

SANS 1539, *Appliances operating on liquefied petroleum gas (LPG) or natural gas (NG) – Safety aspects*.

SANS 1910, *Portable refillable fire extinguishers*.

SANS 4437-2/ISO 4437-2*, Plastics piping systems for the supply of gaseous fuels – Polyethylene (PE) – Part 2: Pipes.*

SANS 4437-3/ISO 4437-3, *Plastics piping systems for the supply of gaseous fuels – Polyethylene (PE) – Part 3: Fittings.*

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 10087-4, *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.*

SANS 10087-7, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations – Part 7: Storage and filling premises for refillable liquefied petroleum gas (LPG) containers of gas capacity not exceeding 19 kg and the storage of individual gas containers not exceeding 48 kg*.

SANS 10105-1, *The use and control of fire-fighting equipment – Part 1: Portable and wheeled (mobile) fire extinguishers.*

SANS 10140-3, *Identification colour markings – Part 3: Contents of pipelines*.

SANS 10177-2, *Fire testing of materials, components and elements used in buildings – Part 2: Fire resistance test for building elements.*

SANS 10177-5, *Fire testing of materials, components and elements used in buildings – Part 5: Non-combustibility at 750 °C of building materials.*

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

SANS 10252-1, *Water supply and drainage for buildings – Part 1: Water supply installations for buildings.*

SANS 10260-1, *Industrial gas pipelines – Part 1: Design, Construction, Installation, Operation, Examination and Maintenance (Excluding Acetylene).*

SANS 10260-3, *Industrial gas pipelines – Part 3: Distribution of acetylene at consumer sites.*

SANS 10268-1, *Welding of thermoplastics – Welding processes – Part 1: Heated-tool welding.*

SANS 10268-2, *Welding of thermoplastics – Welding processes – Part 2: Electrofusion welding.*

SANS 10269*, Welding of thermoplastics – Testing and approval of welders.*

SANS 10400-A, *The application of the National Building Regulations – Part A: General principles and requirements.*

SANS 10400-J, *The application of the National Building Regulations – Part J: Floors.*

SANS 10400-T, *The application of the National Building Regulations – Part T: Fire protection.*

SANS 10400-V, *The application of the National Building Regulations – Part V: Space heating.*

SANS 17484-1/ISO 17484-1, *Plastics piping systems – Multilayer pipe systems for indoor gas installations with a maximum operating pressure up to and including 5 bar (500 kPa) – Part 1: Specifications for systems.*

SANS 18225, *Plastics piping systems – Multilayer piping systems for outdoor gas installations – Specifications for systems.*

UNI 11353, *Stainless steel corrugated flexible safety hose assemblies for the connection of gas appliances for domestic and similar uses – Safety requirements.*

3 Definitions

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

3.1
acceptable
acceptable to the authority administering this part of SANS 10087, or to the parties concluding the purchase contract, as relevant

3.2
appliance
gas unit that uses liquefied petroleum gas or natural gas as an energy source

3.3
appliance technician
registered person that has the ability, appropriate training, knowledge and experience to carry out work on specific appliances

3.4
approved
approved by the approving authority

3.5
approving authority
appropriate of the following:

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

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

c) within the scope of the relevant national legislation (see foreword) and in respect of the evaluation and control of installations in accordance with this part of SANS 10087: the local authority in whose area of jurisdiction the installation is installed;

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

3.6
assembly
system that includes connection by pipe or similar ducts, fittings and valves that operate under gauge pressure and are used for the conveyance of liquid or vapour

3.7
bathroom
domestic-type room used for bathing, showering, or personal cleansing, as distinct from the larger and better-ventilated ablution centres commonly provided in factories, camping areas and sporting facilities, etc.

3.8
bedroom
room used or intended to be used for sleeping

3.9
buried
placed in the ground that is covered with soil

3.10
competent person
any person that has the knowledge, training, and experience specific to the work or task being performed

3.11
container
cylinder that complies with SANS 10019 and that is approved for the storage and conveyance of liquefied petroleum gas of individual water capacity not exceeding 500 L

3.12
critical location
area that is not ventilated for the dispersal of LPG

3.13
division
portion of a building, separated from the remainder of such building by one or more separating elements

3.14
diversion wall
solid non-combustible wall erected with the specific purpose of ensuring and maintaining the appropriate safety distances between the point of gas release and any drains, doors and windows in buildings, and possible sources of ignition

3.15
embedded
encased in walls, concrete floors, or similar materials

3.16
equipment
combination of pipes, pipe fittings, appliances and any appurtenances connected to the system

3.17
firewall
solid non-combustible wall with a fire rating of 240 min and height of at least 1,8 m, constructed and placed with the specific purpose of preventing the spread of fire as a result of the radiation of heat or direct flame impingement as per SANS 10400 a double brick wall of minimum 190 mm width or reinforced concrete wall of 150 mm width or other barrier with a fire rating of at least 240 min

3.18
fixed appliance
any appliance that is connected to permanent, fixed pipework of an installation, for example, a stove, water heater or a fireplace

3.19
flue
passage through which the products of combustion or flue gases are conveyed to the outside of the building

3.20
flued appliance
appliance designed to be operated with a flue

3.21
flueless space heater
permanently installed or portable appliance designed without a flue where the products of combustion are discharged into the room in which the appliance is installed or used

3.22
gas enclosure
structure built to enclose a gas container that may influence ventilation and firefighting interventions

3.23
installation
single or combination of one or more containers connected to a manifold system, including pipework and appliances

3.24
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

3.25
mechanical joint
joint in which gas tightness is achieved by compression with or without a seal that can be readily disassembled and reassembled (see EN 16125 and BS 6891)

3.26
non-combustible
classified as non-combustible when tested in accordance with SANS 10177-5 or deemed to be in accordance with SANS 10400-T

3.27
operating pressure

3.27.1
high pressure
pressure that exceeds 150 kPa (gauge pressure)

3.27.2
intermediate pressure
pressure that exceeds 5 kPa but that does not exceed 150 kPa

3.27.3
low pressure
pressure that does not exceed 5 kPa

3.28
pigtail
hose assembly that comprises a cylinder connection and a threaded connection

3.29
pressure regulator
device that reduces the pressure of the gas from a higher pressure to a constant lower pressure

3.30
quick release coupling
quick connect device
two-part mating plug and socket assembly for connecting a gas appliance to a gas supply without the use of tools

3.31
registered installer
person that has the ability, appropriate training, knowledge and experience to carry out the work that is undertaken in a safe and proper manner, and who is registered in accordance with the requirements of the relevant national legislation (see foreword)

3.32
room sealed appliance
appliance that takes in air for combustion from the outside and vents combustion gases back outside, ensuring no air or gases enter the room where the appliance is located

3.33
separating element
wall or floor which has a specific fire resistance used between divisions, occupancies, or tenancies in a building

3.34
sleeve
protective pipe through which a gas pipe passes, and which should be impermeable to LPG

3.35
user
person who uses the equipment for their own benefit, or has the right of control over the use of the equipment, but does not include a lessor or any person employed in connection with that equipment

3.36
ventilation
supply and removal of air (by natural or mechanical means (or both)) to and from a space or spaces in a building

3.36.1
permanent ventilation
opening to the outside atmosphere that is permanently fixed in the open position

3.36.2
ventilation opening
any means of purpose-provided ventilation (whether it is permanent or closable), which opens directly to external air, such as the openable parts of a window, a louvre, or a background ventilator

4 Properties of LPG and precautions to be observed

4.1 The location of LPG containers shall be planned and put into effect with full regard for the properties of the gas and the construction of installations for conveying this gas in buildings.

4.2 All persons concerned with the installation of containers and appliances shall be registered installers and shall be familiar with the characteristics and precautions of gas as outlined in 4.3 to 4.10 (inclusive).

4.3 The gas is stored as liquid under pressure.

4.4 Leakage, especially of liquid, will release large volumes of highly flammable gas.

4.5 A gas-air mixture that contains approximately 1,5 % to 10 % of LPG is flammable. If a large enough volume of gas is so dispersed in the atmosphere as to reach flammable proportions throughout, ignition of the mixture will result in a rate of combustion of near-explosive force.

4.6 LPG is denser than air and will flow along the ground or through drains. It can be ignited at a considerable distance from the source of leakage, therefore permanent low-level ventilation of buildings shall be provided.

4.7 LPG is non-toxic, but since it can induce headaches and dizziness when inhaled, inhalation of LPG should be avoided whenever possible.

4.8 LPG liquid, by its rapid vaporization and consequent lowering of the temperature, can cause severe cold burns when it comes into contact with the skin. Appropriate protective clothing, such as gloves, goggles, aprons, and gumboots, shall be worn when there is any possibility of such contact. Because of the hazard of the generation of static electricity, the soles of gumboots shall be made of leather or conductive rubber, and clothing shall not be made of fabrics that contain artificial fibres.

4.9 A container that has held LPG and is presumed to be "empty" can still be hazardous. In this state, the internal pressure is approximately atmospheric and, if the valve leaks or is left open, air can diffuse into the container and form a flammable or explosive mixture. Furthermore, even an "empty" container that does not yield gas when the valve is opened, might in fact not be quite empty. In cold weather, the heavier fractions of the liquid might not vaporize and will therefore remain in the container. All containers that are (or appear to be) empty shall be handled with the same care as a full container, and valves shall be kept fully closed at all times when containers are not in use.

4.10 There are hazards involved with the filling of containers (in accordance with annex A).

5 Containers

5.1 Number and size of containers

5.1.1 General

5.1.1.1 The number and the size of containers recommended for an LPG installation depend on the maximum hourly consumption of the appliances served and the lowest ambient temperature expected. When an installation is designed, care shall be taken to guard against possible failure of the gas supply due to vaporization problems.

5.1.1.2 If a supply has to be maintained over a period exceeding 20 min, the discharge of gas diminishes slowly until it reaches a state of equilibrium with the vaporization rate of the LPG in the container. This vaporization rate, in turn, depends on the size of the container, the amount of LPG that remains in the container, and the ambient temperature (see also table 1).

5.1.2 Calculation of container details

5.1.2.1 Table 1 gives the approximate vaporization rates of the larger containers currently available.

5.1.2.2 The calculation of the number of containers (including manifold and pipe sizing) required for any installation is based on the maximum consumption of the appliance for the complete installation. This information can be found on the appliance data plate.

NOTE The container requirements may be scaled down if it is unlikely that all appliances will be used simultaneously for long periods of time and the user advised accordingly and recorded on the report (see 8.1.1). Scaling down may be limited to the maximum demand of the appliance with the highest demand where multiple appliances are installed.

Table 1 — Approximate vaporization rates for containers

1	2	3
Nominal size of container		**Approximate vaporization rates**
Water capacity	**Nominal mass of gas**	
L	kg	g/h
22	9	230
34	13 to 14	320
45	19	460
113	48	920
454	196	2 300
NOTE For the convenience of users of this part of SANS 10087, the LPG mass capacity equivalents for the various container sizes are given in this table. It may, however, be stressed that these are only nominal equivalents and that the exact mass equivalents will depend on the actual density of the product filled into the containers.		

5.2 Location of containers

5.2.1 General

5.2.1.1 Installation of a container(s), including all associated equipment, pipework, and appliances, as well as any subsequent repair or modifications, shall be done by a registered installer qualified to the appropriate grade (domestic, commercial, or industrial). This does not apply to the replacement of containers.

5.2.1.2 Each container shall be located in an upright position with the valve uppermost, and shall be so placed on a solid level base, that there can be no danger of the container tilting or falling over.

5.2.1.3 Containers shall be so located in an accessible position that

a) full and empty containers can be changed easily,

b) they can be disconnected and removed quickly in case of an emergency, and

c) the container valve can be easily operated.

5.2.1.4 In the selection of a location for containers, the following locations shall be avoided:

a) any position in which the containers are likely to cause obstruction, become damaged, or be exposed to conditions likely to affect their safety;

b) any position that is subject to extreme temperature (excluding natural elements);

c) any position near corrosive or readily combustible substances;

d) any position adjacent to cellars, drains, hollows, etc., where escaping gas might collect;

e) under a stairway, or within 3 m of a stair discharge;

f) any position where the container or an incident involving the container and its contents could obstruct the safe egress of persons from a building; and

g) under a building, unless permitted in accordance with 5.2.5.2.

5.2.1.5 Not all situations that may be encountered by the registered installer can be adequately addressed in this part of SANS 10087. The registered installer shall therefore take cognisance of any deficiencies in the prescribed requirements as applicable to the specific installation in question and take adequate steps to mitigate such deficiency.

NOTE Examples of deficiencies may include an installation which although 2 m from a drain, the lay of the ground may funnel gas to such drain, in this situation it would be prudent to increase the distance or provide for a diversion wall.

5.2.2 Fire prevention

5.2.2.1 Deleted by amendment No. 1.

5.2.2.2 The user shall be advised regarding the use of approved fire extinguishers. The acquisition and installation of dry powder fire extinguisher of at least 9 kg total capacity (i.e. 2 × 4,5 kg or 1 × 9 kg extinguisher) that complies with SANS 1910 shall be required for installations of combined capacity in excess of 100 kg of gas, and each installation shall have its own extinguisher. The extinguisher shall be installed near to the installation in an accessible position to the satisfaction of the local fire department. It shall be securely mounted in accordance with SANS 10105-1. Where such extinguisher is not readily visible its position shall be indicated with signage that complies with SANS 1186.

5.2.2.3 The site and its surroundings shall be clear of combustible materials for a radius of 3 m around the containers, including long grass and weeds.

5.2.2.4 Access to and around the installation shall be provided for fire-fighting purposes and this area shall be kept free of obstacles at all times.

5.2.2.5 Where relevant, dikes, diversion wall(s), or grading shall be used to prevent the accumulation or flow of liquids that have flash points below 93 °C under or near LPG containers.

5.2.2.6 A diversion wall is used to divert the flow of gas and may, therefore, be used to meet the safety distance requirements for potential point of gas release to any drain, door, window or electrical sources. The measurement shall be taken from the potential point of gas release such as a cylinder valve, horizontally around the wall to the drain, door, window, or electrical source.

5.2.2.7 Where a potential point of gas release is higher than the diversion wall, the safety distance shall also be measured from the point of gas release directly over the wall to the area of concern.

NOTE SANS 10400-K provides the requirements for wall construction.

5.2.2.8 LPG containers shall be located at least 3 m from the centre line of the bund wall of areas containing flammable liquids that have flash points below 93 °C.

5.2.2.9 Where LPG installations are closer than 3 m to any other compressed gas, special fire protection precautions shall be considered (for example, a firewall).

5.2.2.10 An LPG container shall not be located in an area within 1,8 m horizontally from a vertical plane beneath overhead electric power lines exceeding 600 V.

5.2.2.11 A firewall shall be used to prevent potential fire spread to or from an installation into building or other elements that could be ignited due to radiated heat or direct flame impingement. Safety distances shall be measured horizontally around such firewall and over such firewall for potential sources of ignition higher than the firewall.

NOTE A firewall can fulfil the function both a diversion wall and firewall. However, a diversion wall can only be used to divert gas release and not as a firewall.

5.2.2.12 Any person who manufactures, imports, sells or supplies LPG or related equipment as well as those responsible for premises where LPG is stored or used shall ensure that they are familiar with the relevant national legislation (see foreword). This is to ensure that they are not exposed to any hazards to their health or safety and for those affected by their activities.

5.2.2.13 The planning for effective measures for the control of inadvertent LPG release or fire shall be coordinated with local emergency handling agencies, such as fire departments. Planning shall consider the safety of emergency personnel.

5.2.2.14 Where this part of SANS 10087 cannot be complied with or where the Local Authority deems that a specific installation is not adequately addressed in this part of SANS 10087, a Rational design, as contemplated in the relevant national legislation (see foreword) shall be submitted to the Local Authority for consideration.

5.2.2.15 A risk assessment is not necessary unless required by other laws, regulations, standards, or identified risks, or if advised by the local authority. If the requirements of this part of SANS 10087 are met, a risk assessment will not be required.

5.2.2.16 For any installation, excluding those at dwelling houses (H4) or domestic residences (H3) where each unit has direct and exclusive access to its own yard (not communal space), and which consists of individual containers not exceeding 50 kg with a total capacity not exceeding 100 kg or 2 containers, signage shall be fitted. This signage shall indicate no smoking, no naked flames, no unauthorized entry, and no cellular phones allowed, using pictograms PV 1, PV 2, PV 3, and PV 27 in accordance with SANS 1186-1. The sign dimension shall at least be 150 mm × 150 mm.

5.2.2.17 For special events the local authority shall be consulted.

5.2.3 Indoor location

5.2.3.1 When LPG containers are located inside a building, whether stored, connected to a fixed installation, or mounted in a portable/mobile appliance, the total gas quantity listed in in table 2 shall not be exceeded.

Table 2 — Maximum quantities of gas inside buildings

1	2	3
Class of Occupancy	**Occupancy**	**Maximum**
A1	Entertainment and public assembly	19 kg per division
A2	Theatrical and indoor sport	19 kg per division
A3	Places of instruction	19 kg per division
A4	Worship	19 kg per division
A5	Outdoor sport	19 kg per division
B1	High risk commercial service	19 kg per division
B2	Moderate risk commercial service	19 kg per division
B3	Low risk commercial service	19 kg per division
C1	Exhibition hall	19 kg per division
C2	Museum	19 kg per division
D1	High risk industrial	19 kg per $600m^3$ building volume to a maximum of 100 kg
D2	Moderate risk industrial	19 kg per $600m^3$ building volume to a maximum of 100 kg
D3	Low risk industrial	19 kg per $600m^3$ building volume to a maximum of 100 kg
D4	Plant room	19 kg per $600m^3$ building volume to a maximum of 100 kg
E1	Place of detention	9 kg per division
E2	Hospital	9 kg per division
E3	Other institutional (residential)	9 kg per division
E4	Health care	9 kg per division

Table 2 *(concluded)*

1	2	3
Class of Occupancy	**Occupancy**	**Maximum**
F1	Large shop	19 kg per division
F2	Small shop	19 kg per division
F3	Wholesalers' store	19 kg per division
G1	Offices	19 kg per division
H1	Hotel	19 kg per division
H2	Dormitory	9 kg per division
H3	Domestic residence	
	Flats (irrespective of height) and Clusters, Town houses or Semi-Detached Houses exceeding 2 storeys	9 kg per unit (including balconies)
	Clusters, Town houses or Semi-Detached Houses not exceeding 2 storeys	19 kg per unit (including balconies)
H4	Dwelling house	19 kg per house (including any attached garage or other attached outbuildings)
H5	Hospitality	19 kg per division
J1	High risk storage	Consult local Fire Department
J2	Moderate risk storage	19 kg per division
J3	Low risk storage	19 kg per division
J4	Parking garage	19 kg per division
NOTE 1 The above limits are based on buildings provided with separating elements and safety distances that comply with the requirements of SANS 10400-T. Where uncertainty exists, the Local Authority may be consulted. NOTE 2 For a full description of the occupancy types see annex B.		

5.2.3.2 LPG containers shall not be installed inside a garage.

5.2.3.3 For special events the local authority shall be consulted.

5.2.3.4 Containers shall not be located below ground level in a building, for example, in cellars or basements.

5.2.3.5 Containers shall not be located above or on top of any appliance used for cooking or heating.

5.2.3.6 Containers shall be positioned in a location with floor-level ventilation that connects to the outside air to reduce the risk of gas accumulation in case of a leak. Sufficient ventilation can be provided by airbricks near the bottom of an external wall (up to 300 mm from the floor to the top of the airbricks) or a gap of at least 6 mm under an external door, or a combination of these methods.

5.2.3.7 A gas container shall be placed as close as possible to a door leading to the outside of the building, when not placed in a cupboard. Where this location cannot be attained, there shall be low level permanent ventilation near the container. This can be achieved by having at least two airbricks close to the container on the external wall, positioned as low as possible to the floor. For LPG capacities exceeding 9 kg, additional air bricks or ventilation openings shall be provided (see figure 1).

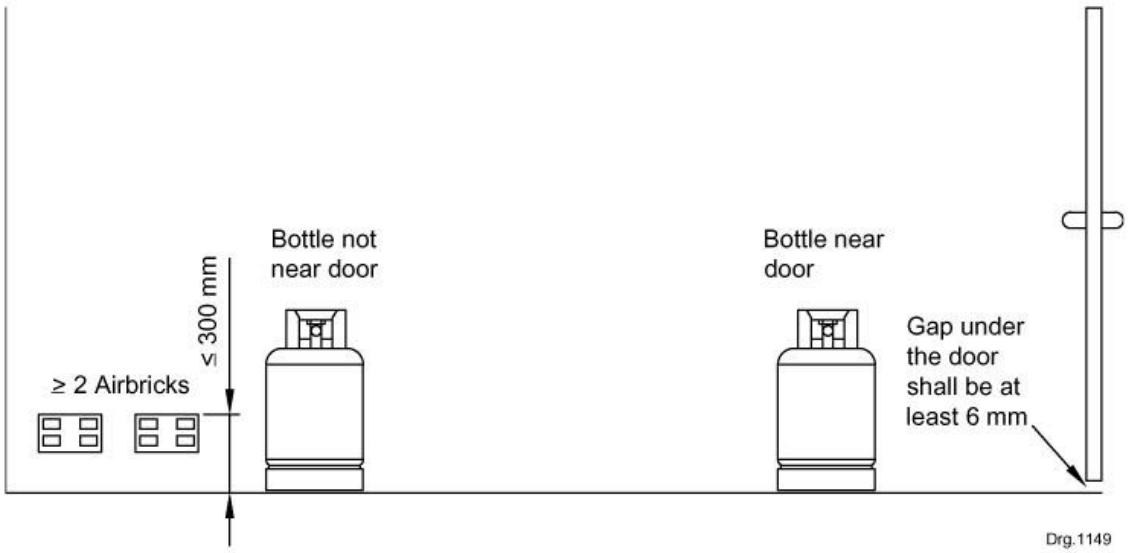


Figure 1 — Ventilation Requirement for a container located indoors

5.2.3.8 Containers shall be located at least 300 mm away from a gas stove (see figure 2).

5.2.3.9 Containers shall be located at least 2 m away from heat sources such as stoves, braais, and fireplaces that operate on fuels other than fuel gas. This distance can be reduced to 1 m if a non-combustible insulating barrier is installed between the container and the stove (see figure 2).

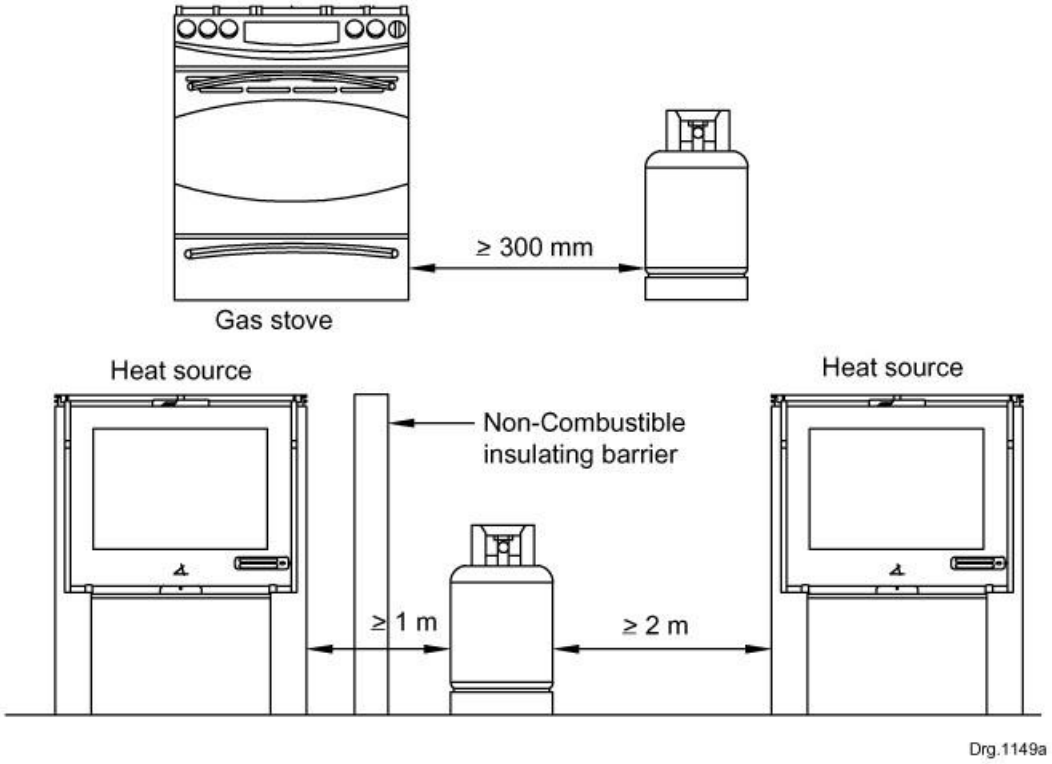


Figure 2 — Location of containers relative to gas stoves and other heat sources

5.2.3.10 Where a container is required to be placed below or to the side of a solid fuel or gas braai, a firewall, concrete lintel or a non-combustible insulating steel structure shall be installed between the braai and the container. This barrier should be sufficient to maintain the container temperature at ambient levels, that are sufficient to keep the container temperature at ambient temperature. (see figure 3).

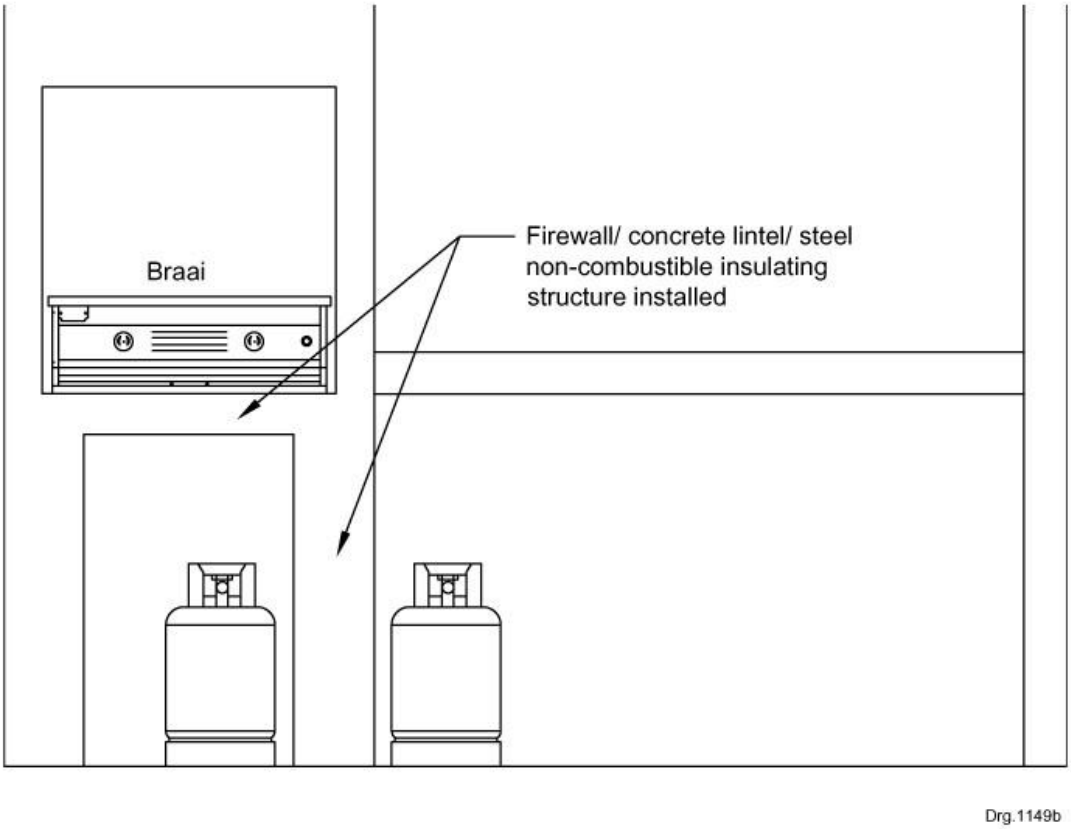


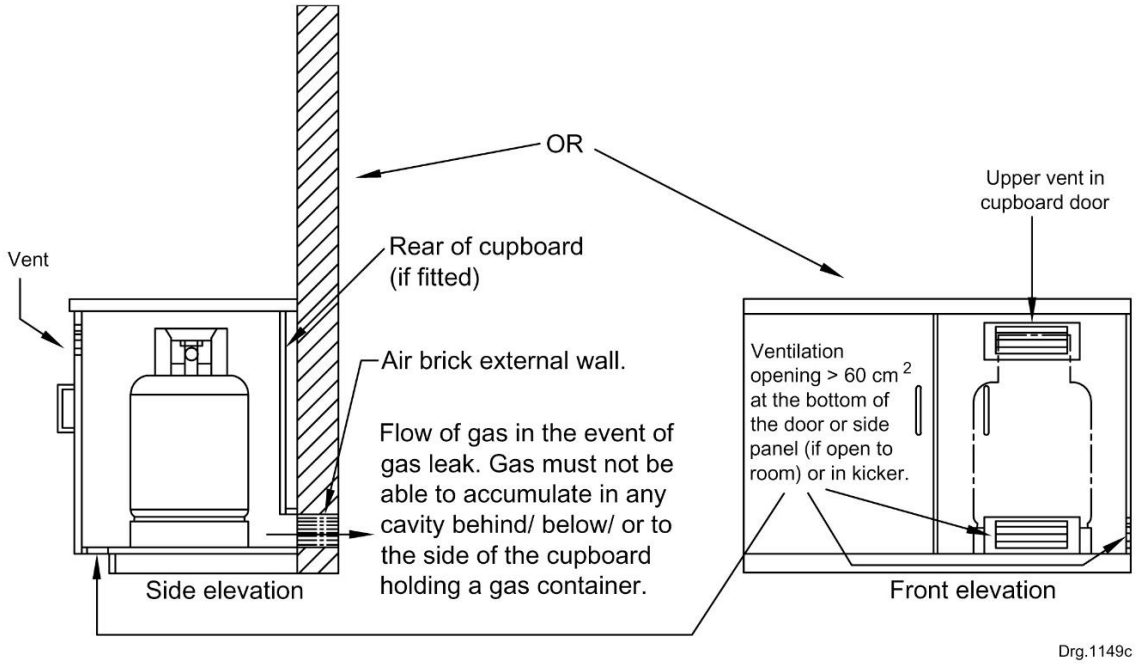
Figure 3 — Container located under or to the side of a built in braai

5.2.3.11 Where a gas container needs to be placed inside a cupboard, the cupboard shall have permanent ventilation available, for example airbricks, lattice door(s), or ventilation slots. The back of the cupboard shall preferably be ventilated to the outside atmosphere. Where this is not feasible, the cupboard door (or side wall if this is open to the room) shall have at least 60 cm^2 of ventilation located at the floor and upper level of the cupboard.

5.2.3.12 No electrical connections or plug points shall be allowed in the same section as the gas container. The cupboard shall be sealed to prevent gas from leaking from one section of the cupboard to another. Only one container with a maximum capacity of 9 kg may be installed per cupboard, and no other items shall be stored in the section of the cupboard containing the gas container.

5.2.3.13 Care shall be taken to prevent gas accumulation inside the cupboard or in any cavity associated with the cupboard, as referenced in 5.2.3.6 (see figure 4, figure 36, and figure 37).

5.2.3.14 Single change over container connections or manifolded container connections shall not be allowed inside a building.



Amdt 1

Figure 4 — Container located in a cupboard

5.2.4 Outdoor location (see figure 6 to figure 11 (inclusive))

5.2.4.1 Containers shall be

a) located on a firm, clean, well-drained and level non-combustible base, preferably of concrete or a screed plinth raised above the level of the surrounding ground, and

b) protected against tampering by unauthorized persons, as well as damage and interference by, for example, animals and vehicles (see 5.2.5.1).

5.2.4.2 Containers shall be positioned at least

a) 3 m away from the property boundary, provided that

1) where the boundary is a firewall, containers can be located at any point right up to the boundary,

2) where not more than two containers are used, the minimum distance from a boundary is 1 m. Where a firewall is installed between the containers and the boundary, the distance along or around the firewall between the container and the boundary shall be a minimum of 1 m (see figure 5), and

3) where more than two containers are used, the minimum distance from a boundary is 3 m. Where a firewall is installed between the containers and the boundary, the distance along or around the firewall between the container and the boundary shall be a minimum of 3 m (see figure 5),

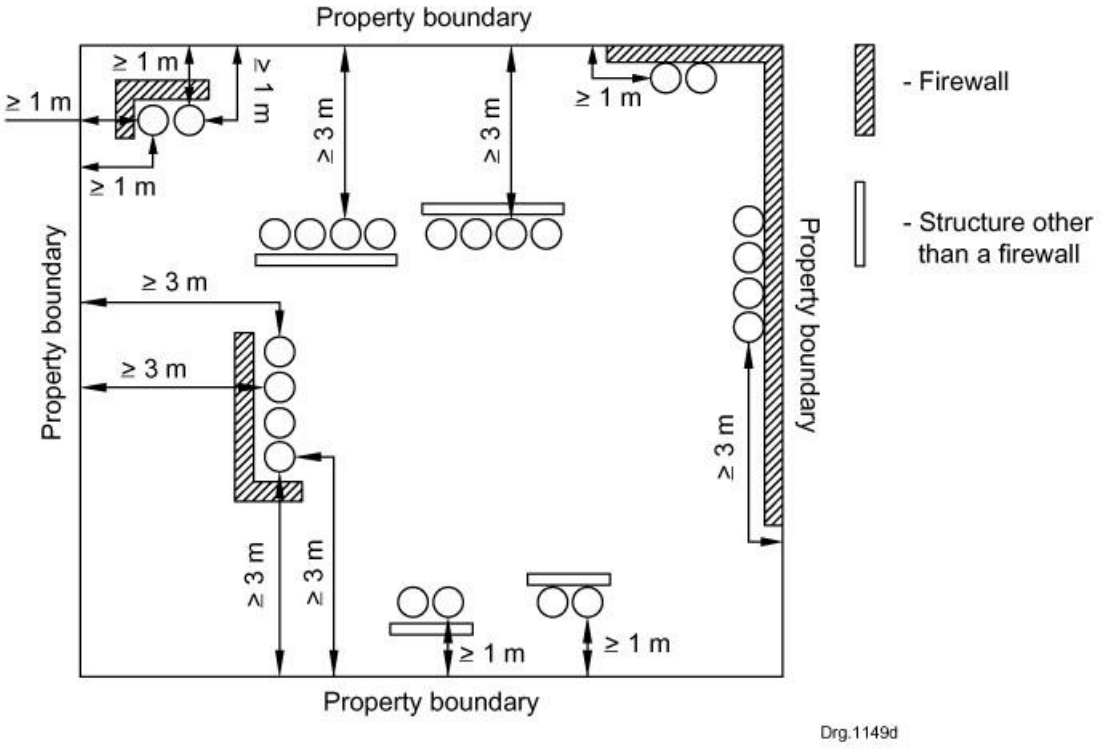


Figure 5 — Container location relative to property boundary

b) 1 m from any building opening that is below the level of the container valve, such as doors, windows, and airbricks, when measured horizontally (see figure 6).

c) 0,5 m away from a window that is located at least 300 mm vertically above the container valve, when measured horizontally (refer to figure 6).

d) 2 m measured horizontally away from any drain, pit, manhole, or forced draught inlet for an air conditioner or similar (see figure 6).

e) 3 m away from any opening or window directly above them. This distance can be reduced to 300 mm from the top of the container, valve connection, or manifold (whichever is higher), provided that

1) a non-combustible roof (see 5.2.5.2 to 5.2.5.4 (inclusive)) is installed between the containers and the opening. The roof shall extend beyond the containers such that when measured from the valve connection and around the roof to the nearest point of the window or opening a minimum of 1,5 m safety distance shall be obtained (see figure 6(a) and figure 7), or

2) the window frames shall be made of steel, and the total size of the glazing does not exceed 1 m^2. Individual glazing panes shall be of wire woven glass not larger than 450 mm × 450 mm per pane. Such windows shall not be openable.

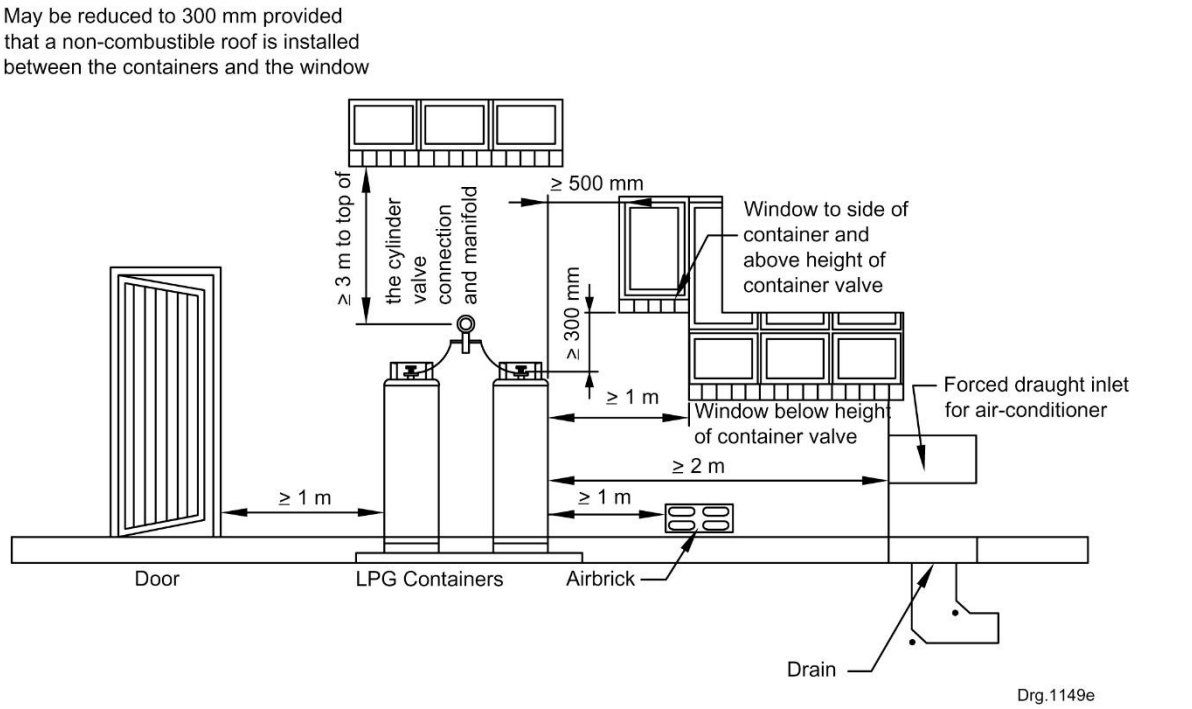


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Figure 6(a) — Minimum distance to doors, windows and other openings into buildings

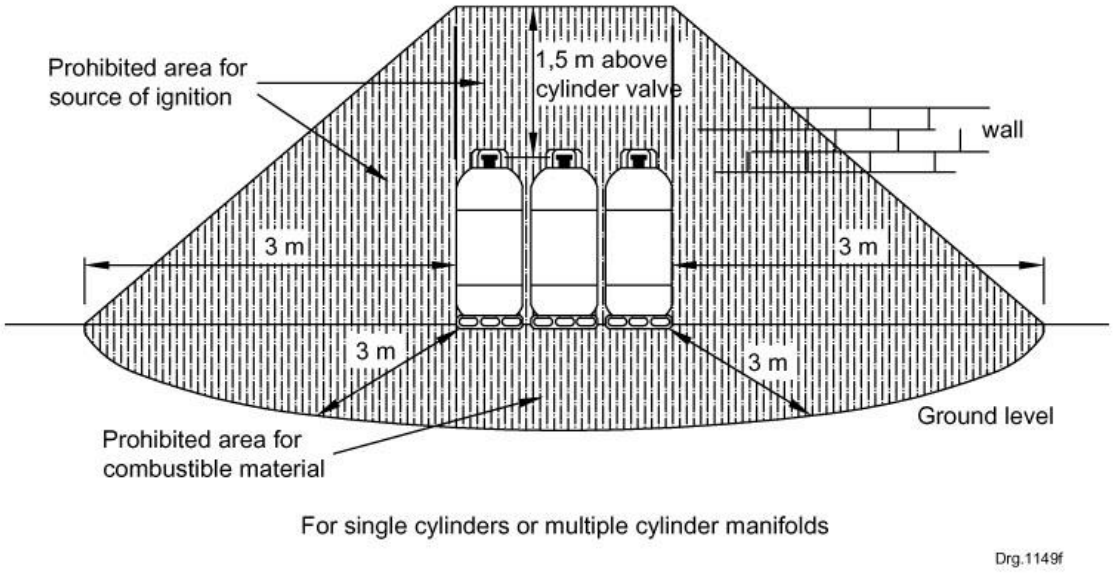
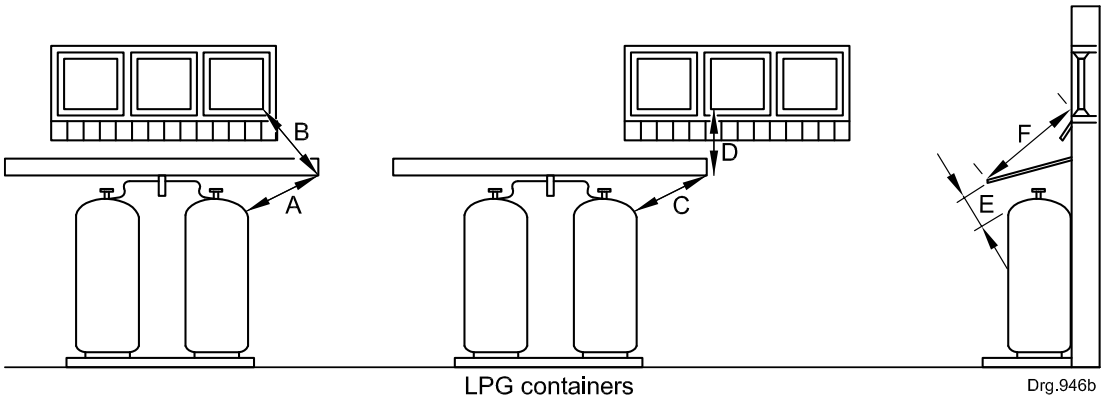


Figure 6(b) — Prohibited areas for sources of ignition and combustible materials

Figure 6 — Safety distances

5.2.4.3 No electrical equipment, capable of being able to provide a source of ignition to any gas leak, shall be located within the prohibited area shown in figure 6(b).

NOTE This refers to typical appliances such as electrical switches, lights, air-conditioners, geysers, switchboards, distribution boards or similar.

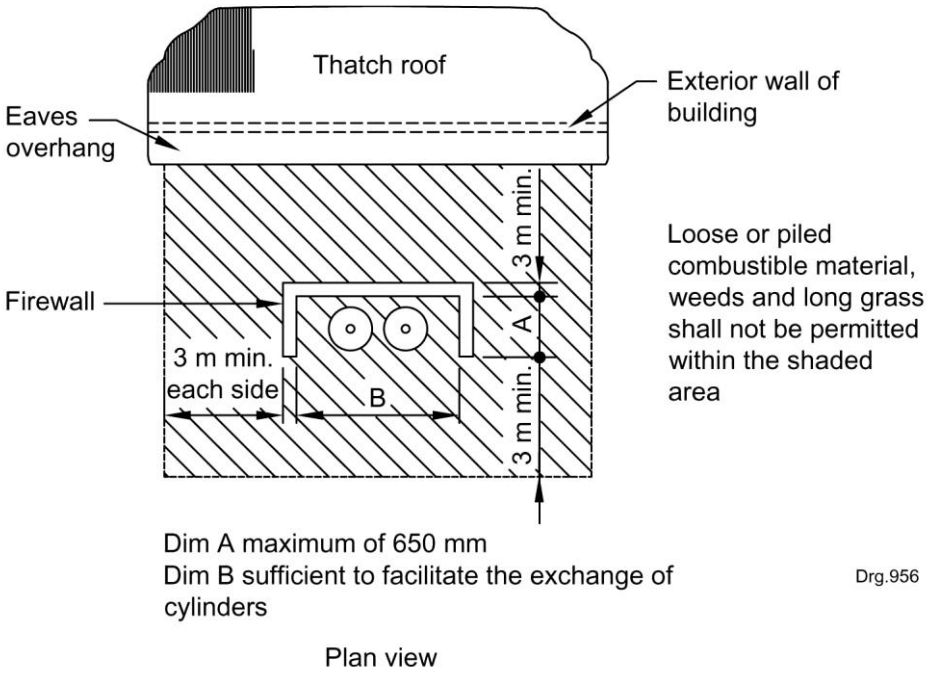


The distances A + B or C + D or E + F shall not be less than 1,5 m

Figure 7 — Windows over container roof

5.2.4.4 Containers shall not be installed within 5 m from the eaves of a thatched roof. This distance may be reduced to 3 m if the containers are protected behind a firewall (see figure 8), or if the containers are protected by a firewall being at least 0,5 m above the eaves of the thatched roof (e.g. a gable wall) and extending 1 m past the sides of the thatch roof (see figure 9). **Amdt 1**

NOTE This requirement is applicable to all thatch roofs whether clad, covered, protected, or treated.

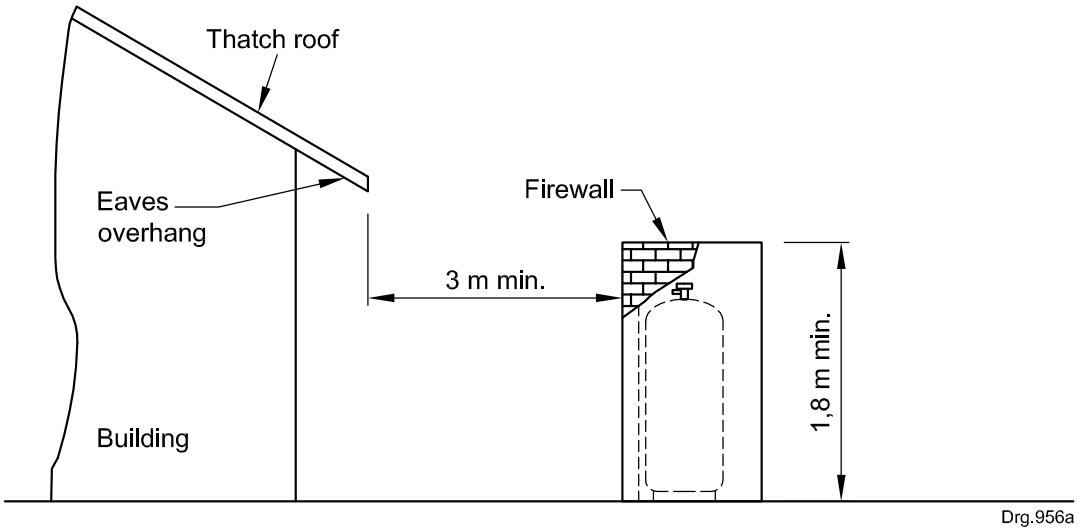


Plan view

NOTE A fire wall can be a straight line extended to both sides of cylinders.

Figure 8(a) — Plan view

Amdt 1



Side elevation

Figure 8(b) — Side elevation

Figure 8 — Container placement in relation to thatched roofs

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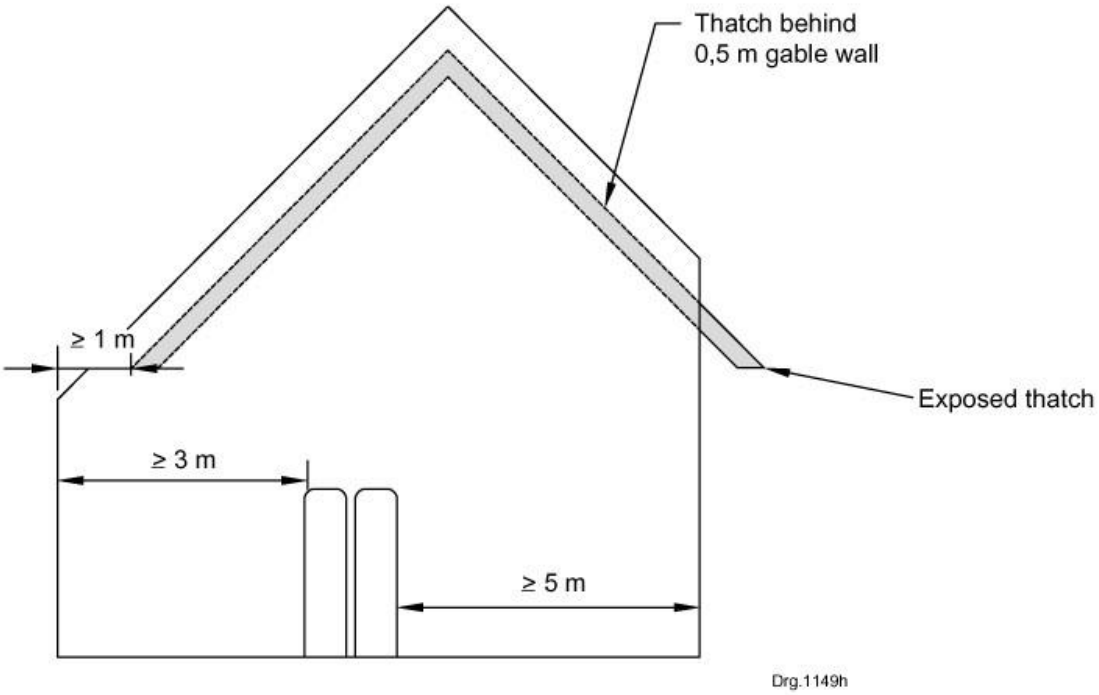

Figure 9 — Container location on gable wall of thatched dwelling

Amdt 1

5.2.4.5 Containers shall only be installed against a building of which the wall has a fire resistance rating of at least 30 min.

5.2.4.6 Where containers are installed against a building, of which the wall does not have a fire resistance rating of at least 30 min, the following shall apply:

a) a wall with a fire resistance of at least 30 min shall be erected between the building and the containers at a distance of 3 m, ensuring that:

   1) the wall extends at least 1 m past the side of the containers; and

   2) the wall extends 300 mm above the containers or 500 mm above the building roof height, whichever is lesser; or **Amdt 1**

   3) the wall is provided with a roof as described in 5.2.4.2; or

b) a wall shall be installed in accordance with 5.2.4.4.

5.2.4.7 Where containers are placed adjacent to a wall on top of which is an electric fence, compliant with the relevant national legislation (see foreword), a non-combustible roof (subject to 5.2.4.2(e) or 5.2.5.3) shall be installed between the containers and the electric fence. The roof shall extend beyond the containers such that when measured from the valve connection and around the roof to the nearest point of the electric fence a minimum of 1,5 m safety distance shall be obtained (see figure 10). **Amdt 1**

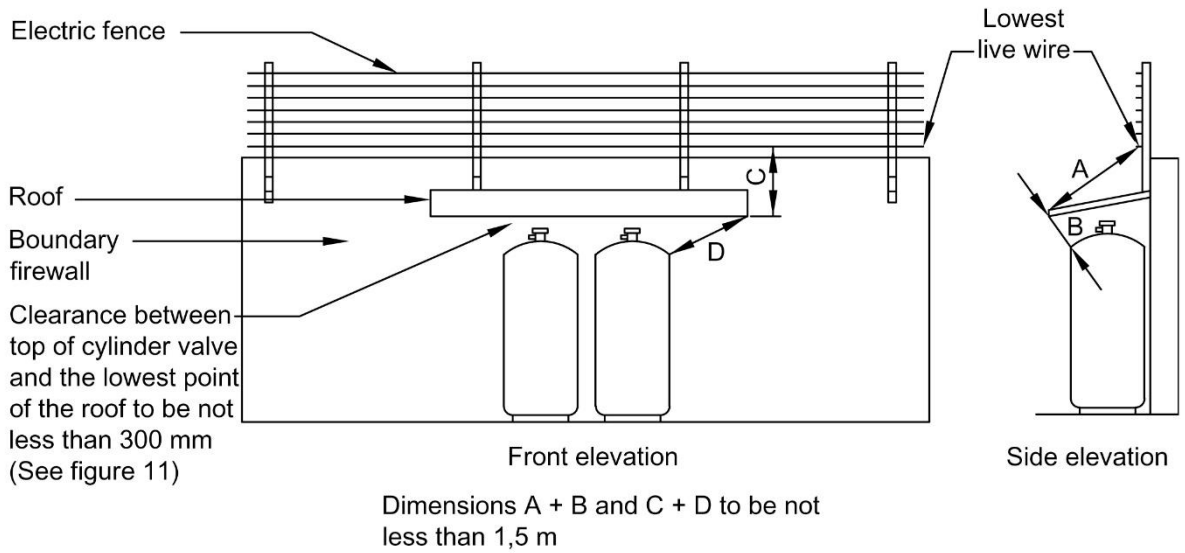

Figure 10 — Containers placement in relation to electric fence

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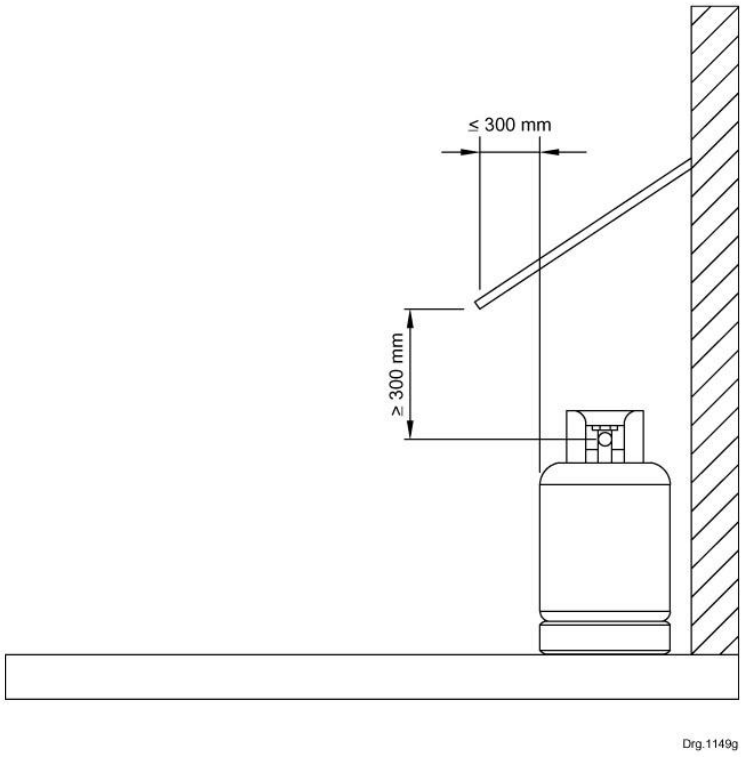

Figure 11 — Light weight non-combustible roof over container

Amdt 1

5.2.4.8 Where bollards are required for vehicular protection it shall be installed to the following requirements (see figure 12):

a) a raised curb of 150 mm high, that shall project at least 300 mm past any part of the installation, in all directions and at least 900 mm to any side perpendicular to the expected vehicle movement; or

b) bollards or crash barriers, provided that:

1) They shall be constructed of steel not less than 100 mm in diameter and shall be filled with concrete;

2) They shall be spaced not more than 1200 mm on centre;

3) They shall be set not less than 900 mm deep in a concrete footing of not less than 380 mm diameter;

4) They shall be set with the top not less than 900 mm above ground; and

5) They shall project at least 300 mm past any part of the installation, in all directions and at least 900 mm to any side perpendicular to the expected vehicle movement.

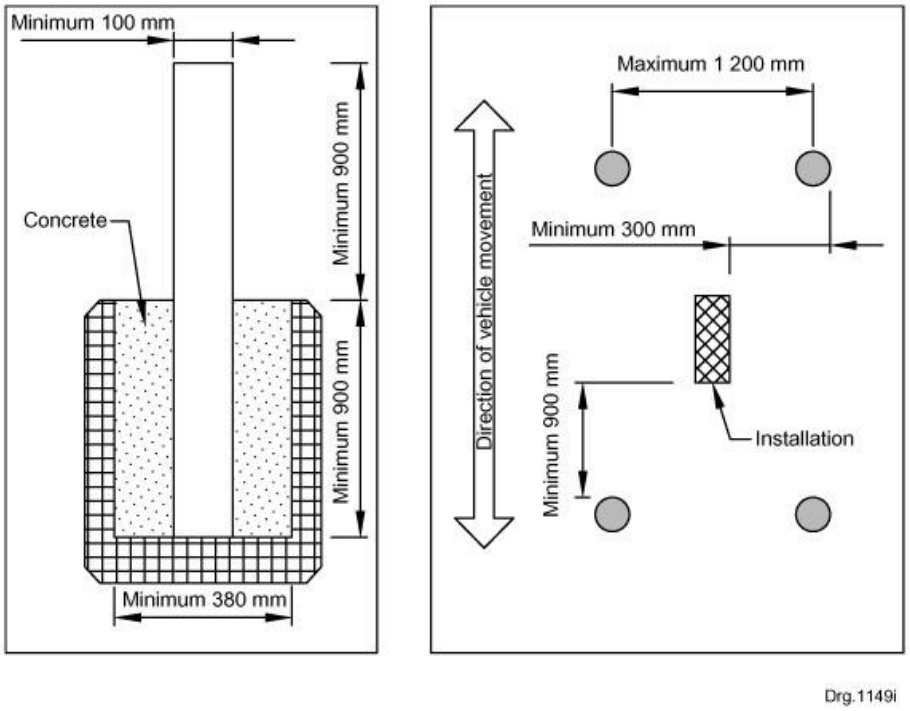

Figure 12 — Bollards details around gas installations

5.2.5 Gas enclosures

5.2.5.1 The gas containers installed shall be placed in a gas enclosure.

5.2.5.2 The exception to this requirement is an installation at a dwelling house (H4) or domestic residence (H3) where each unit has direct and exclusive access to its own yard, not being communal space; and where no public access to such installation is possible, which shall not require a gas enclosure.

5.2.5.3 Any enclosure, whether required by the standard or elected to be used shall meet the requirements of 5.2.5.1 to 5.2.5.5 (as applicable).

5.2.5.4 Structures such as firewalls, concrete barriers, and other similar structures shall be avoided around or over installed containers. The following are exceptions to these requirements:

a) Where concrete barriers, and other similar structures are unavoidable above the installed containers, the distance between container valves, manifold or regulator (whichever is the highest) and such structure, shall not be less than 400 mm (see figure 13).

b) The space created by the structure shall not be deeper than 650 mm and such enclosure shall meet the requirements of 5.2.4.2 and 5.2.5.3 (as applicable) (see figure 13).

c) Where persons have access to such a structure i.e. a room, balcony, and walkway etc., the structure shall have a fire resistance of at least 120 min.

d) If a door or gate is required for the enclosure, the ventilation requirements in 5.2.5.5 shall be met.

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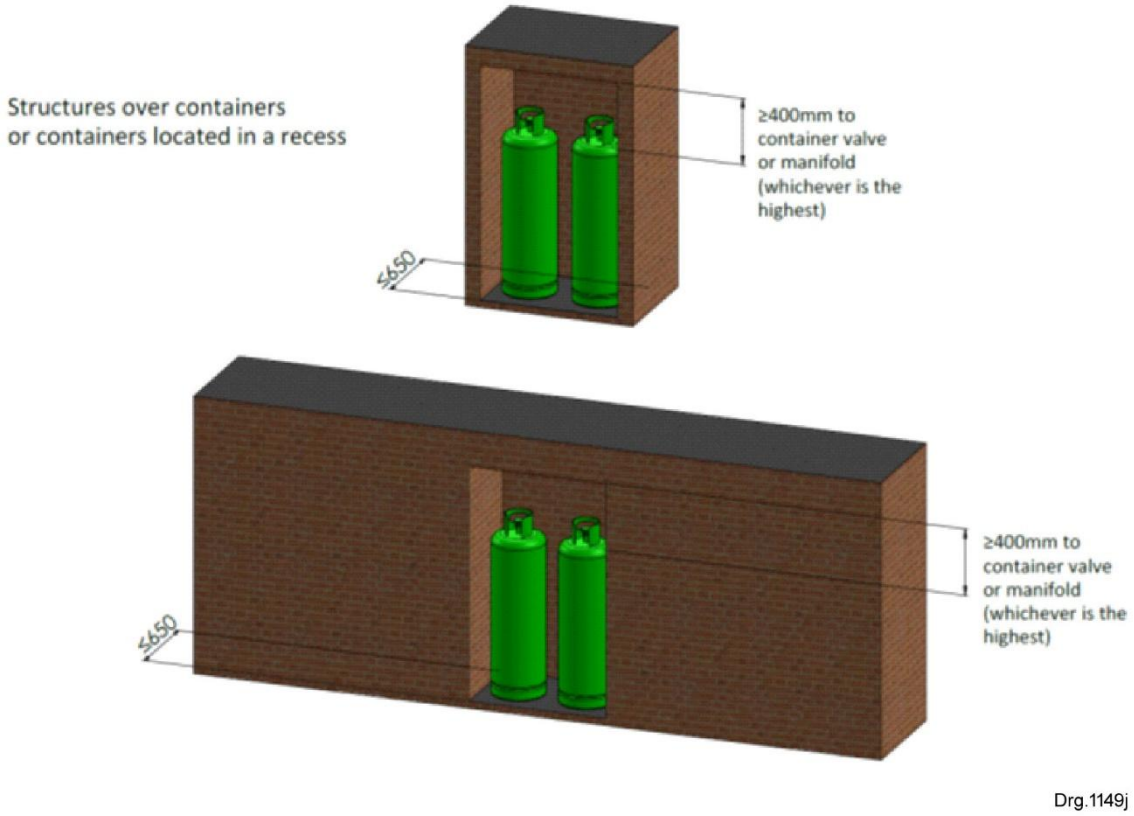


Figure 13 — Structures over containers or containers located in a recess

5.2.5.5 For installations consisting of individual containers not exceeding 50 kg and the total capacity not exceeding 100 kg or 2 containers, the enclosure shall provide for;

a) a minimum permanent ventilation area of 10 % of the gross area of each side and front panel; located in the top of that side or front panel and centred to see the container valve(s) clearly,

b) at least one opening per container, at the top of the cage, shall be left open so that the container valve can be easily closed by hand, through that opening,

c) in addition to (a) above, a minimum permanent ventilation area of 60 cm² for each side of the enclosure and of 60 cm^2 per container on the front of the enclosure, located as low as possible on the enclosure, and spread over the width of each side and front to vent gas from any gas leak (see figure 14), and

d) any roof over the containers shall comply with 5.2.4.2(e).

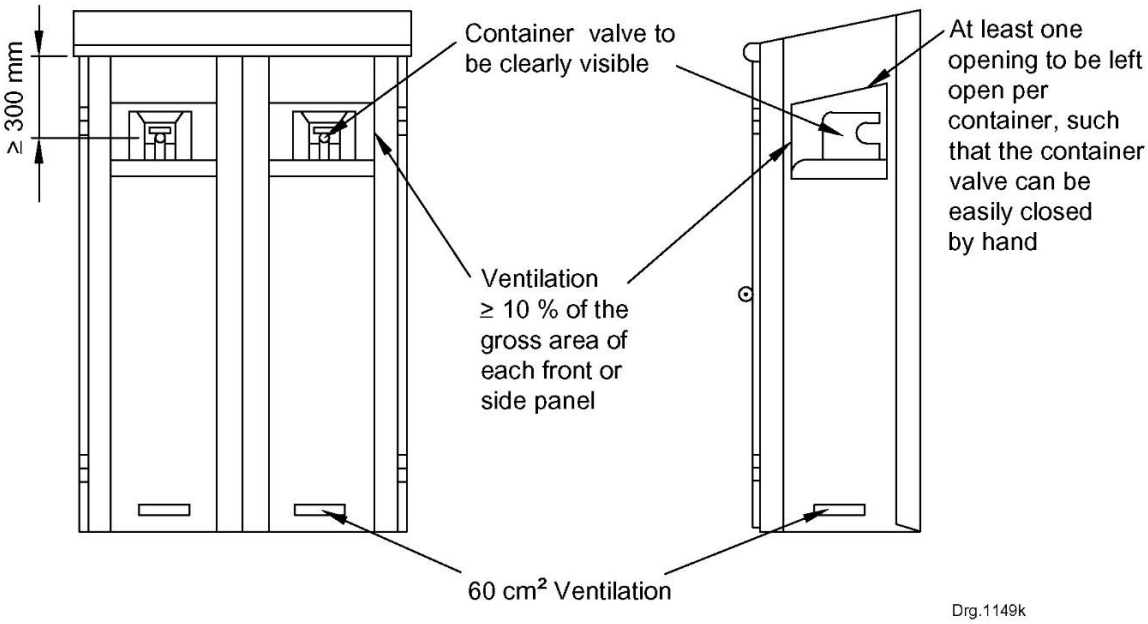


Figure 14 — Enclosure requirements for installations consisting of individual containers not exceeding 50 kg and the total capacity not exceeding 100 kg or 2 containers

5.2.5.6 For installations consisting of individual containers exceeding 50 kg or the total capacity exceeding 100 kg or more than two containers, the enclosure shall provide for the following:

a) the area of the enclosure frame/skeleton shall not exceed 20 % of the gross area on each side, door or panel;

b) the remainder of the cage shall be made with either expanded metal, heavy gauge wire or metal sheets with a pierced through hole pattern with a minimum air penetration of 70 %. The container valves and the containers shall be clearly visible through this (see figure 15); and

c) any roof over the containers shall comply with 5.2.4.2(e).

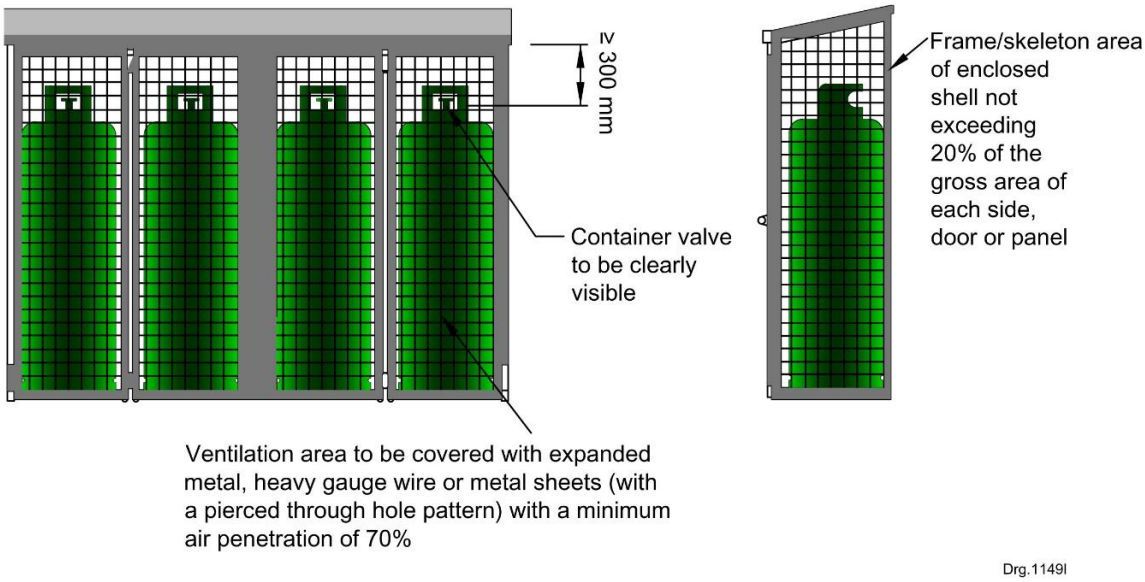


Figure 15 — Enclosure requirements for installations consisting of individual containers exceeding 50 kg or the total capacity exceeding 100 kg or 2 containers

5.2.5.7 In addition to ventilation, these openings in enclosures are required to facilitate the provision of water from a fire hose for cooling of containers, as well as, to monitor container condition in a fire (see also 5.2.2.4 and 5.2.2.12).

5.2.5.8 A straight installation against a firewall, that is enclosed only with brick walls at the ends of the containers shall be permissible if

a) the side walls are of depth not exceeding 650 mm, and

b) there is a clearance of at least 3 m to the left, front and right of the enclosure (see figure 16).

5.2.5.9 Should this installation legally require or is elected to put an enclosure over the top or front of this brick structure, this enclosure shall comply with the requirements of 5.2.5.1, 5.2.5.2, and 5.2.4.2(e).

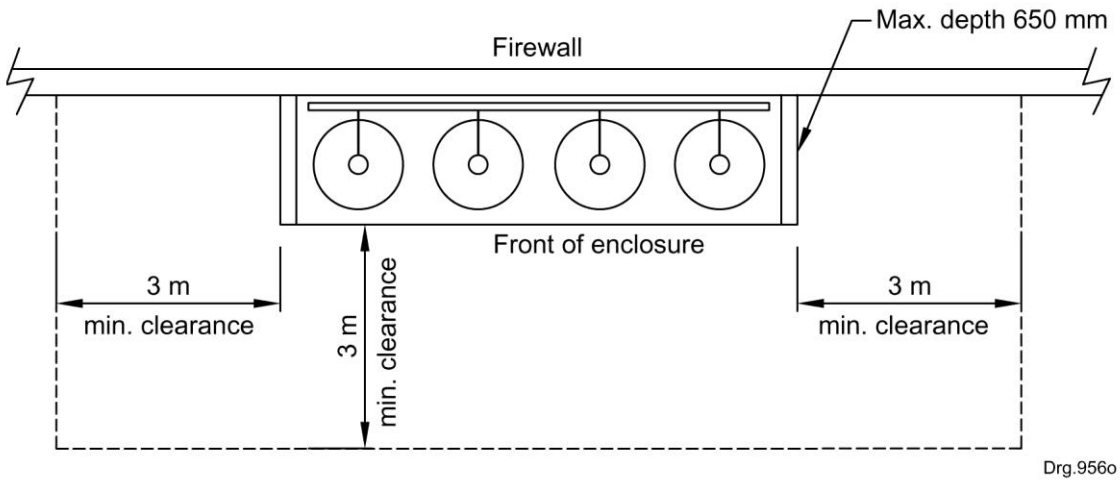


Figure 16 — Straight installation against a firewall

5.2.5.9 No installation shall be into a recess in a building or structure unless the recess structure complies with the requirements of 5.2.5.2 and 5.2.5.4 (as applicable).

5.2.5.10 There shall be no angle of less than 90° formed by two walls enclosing an installation. A third wall of any construction shall not be allowed.

5.2.5.11 Where a third perpendicular wall is located 3 m from the shell of the nearest LPG container or a distance equal to the length of the installation (dimension A), whichever is the greater, and complies with the requirements of 5.2.5.4, it shall not be deemed to be a third wall (see figure 17).

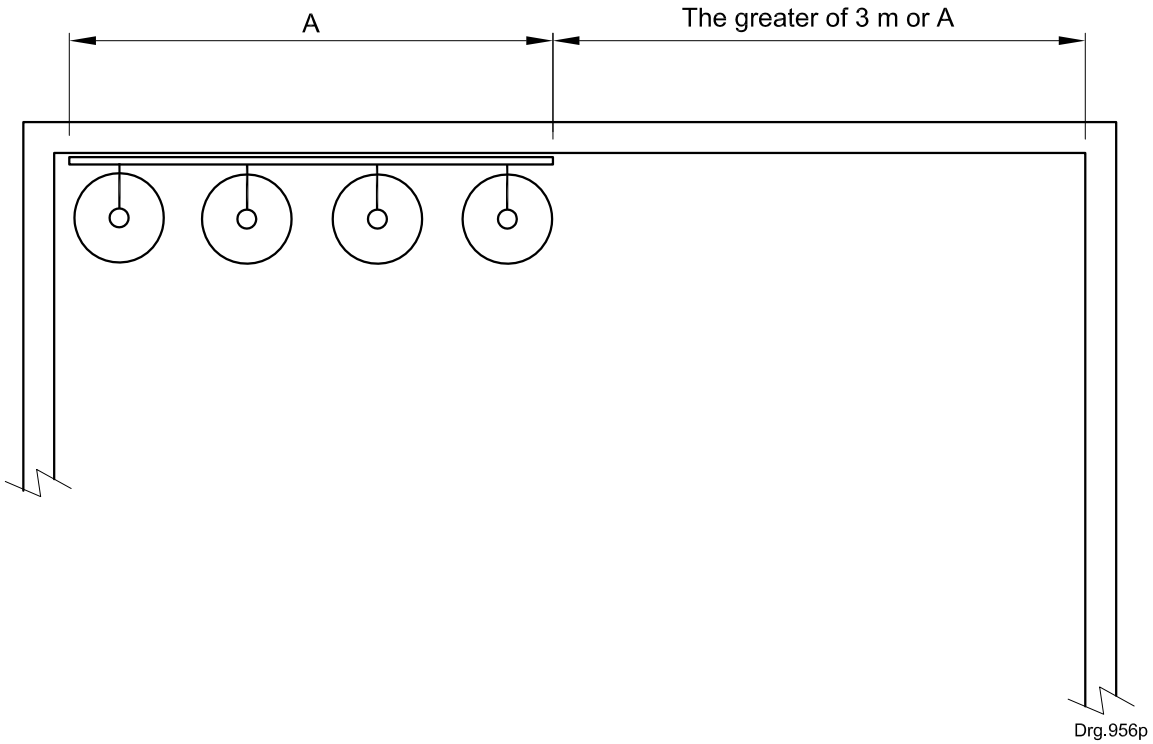


Figure 17 — Safe distance for installation from wall

5.2.5.12 Containers shall be installed in an L shape or back to back, a maximum of two walls joined perpendicularly shall be permitted (see figure 18).

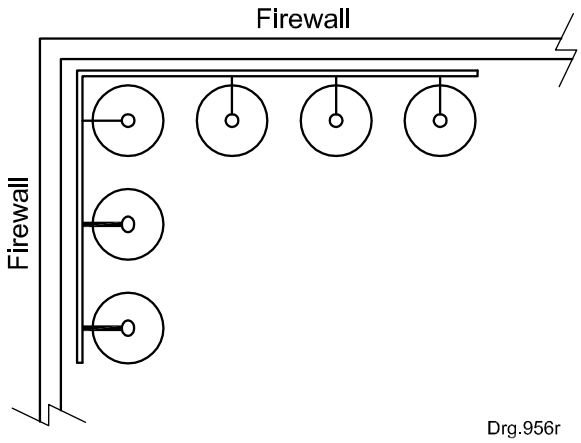


Figure 18 — L shape or back to back installation against a firewall

5.2.5.13 Where entry into the enclosure is possible, sufficient room shall be allowed within the enclosure to permit the unimpeded exchange of containers. Where entry into the enclosure is necessary to exchange containers and the area of the enclosure exceeds 10 m^2, a second means of escape, openable from the inside without the use of a key, shall be provided.

5.2.6 Containers located on building roofs

5.2.6.1 Containers may be installed on the roof of a building where the height measured from the natural ground level to the bottom of the container does not exceed 10 m, while taking into consideration that

a) such roof is of fire-resistant construction complying with the stability requirement of such building (see SANS 10400-T),

b) such roof is of non-combustible construction and the building has an occupancy classification of B3, D3, D4, J3, J4, or

c) such building is protected with an automatic sprinkler system that complies with SANS 10287, should such roof be of combustible construction or the building is of an occupancy classification other than that contained in 5.2.6(b).

5.2.6.2 Such installation shall comply with the provisions of 5.2.4 and the

a) total capacity of containers shall not be greater than 500 kg. If there is more than one container or manifolded group located on the roof, the distance between each container or group and any other container or group shall be at least 15 m,

b) containers shall be located in areas where there is free air circulation, at least 3 m from building openings (for example, windows, doors or skylights), and at least 6 m from air intakes and air conditioning and ventilation systems,

c) containers are not located on a roof that is entirely enclosed by parapets of height more than 0,45 m unless:

1) the parapets are breached with low-level permanent ventilation inlet openings that are not more than 6 m apart, or

2) all openings that communicate with the interior of the building are at or above the top of the parapet,

d) containers shall not be filled on the roof,

e) each container valve outlet shall be tightly closed during movement of the containers within the building, and that the only means of access used shall be stairways not generally used by the public, or freight or passenger lifts not occupied by the public, and

f) that all precautions shall be taken to avoid damage to containers when they are being taken to and from the roof, and to prevent them from being allowed to fall down stairways or from the roof.

5.2.7 Safety distances

5.2.7.1 The distance between the shell of any one container in an LPG installation and the shell of any one container in another LPG installation shall be at least 6 m. Where there is a firewall between them with a fire rating of at least 240 min and a height of at least 1,8 m, the distance measured from shell to shell around the wall shall be at least 3 m.

5.2.7.2 Where a container storage enclosure is to be placed next to an LPG installation, the storage enclosure shall comply with the safety distance requirements in accordance with SANS 10087-7. The safety distances shall be calculated on the total amount of gas installed on the LPG installation and stored within the enclosure. These containers shall not be stored within the same enclosure as the LPG installation.

5.2.7.3 The distance between any LPG container and other compressed gas containers shall be in accordance with SANS 10260-1 and SANS 10260-3. The absolute minimum acceptable distances are as follows, from the shell of an LPG container to the shell of:

a) any other type of flammable gas container, including acetylene, or an oxidizing compressed gas container shall be at least 5 m; and

b) any inert compressed gas container shall be at least 3 m.

5.2.7.4 Where there is conflicting information in other standards that may be applicable, the greater of the distances shall be used.

5.3 Drawings, plans and the relevant local authority authorisation

5.3.1 Any LP gas installation is classified as a building according to the relevant national legislation (see foreword), building plans shall be submitted to the Local Authority for approval before initiating the installation, and for any installation where:

a) the installation capacity is likely to exceed 100 kg;

b) the installation exceeds 2 containers;

c) multiple installations are located on the same premises where the total amount of gas exceeds 100 kg;

d) the installation is located on a roof;

e) pipes are routed through an emergency route; or

g) Insitu filling of containers are proposed (in accordance with annex A).

5.3.2 Notwithstanding the above where the Local Authority requires plans, plans shall be submitted. Cognisance shall be taken of Local Authority by-laws and where uncertainty exist about the submission of plans the Local Authority shall be consulted before commencing with the installation.

5.3.3 For premises falling under the relevant national legislation (see foreword), "premises" shall be divided into common property and sections. The common property and each section (private use) shall be counted as a separate premise. The safety distances to boundaries in this part of SANS 10087 will have to be complied with as if boundaries between sections and between section and common property is the property boundary, for this dispensation to be applicable.

5.3.4 Where permission has been granted by the local authority, a marked-up drawing or diagram that indicates the container, manifold, pipeline, and shut-off valve(s), along with the required notes for this part of SANS 10087, shall be acceptable. Where plans and drawings are required by the local authority, they shall be drawn to one of the following scales:

a) Site plans: 1:1 000, 1:500, 1:300, 1:200, or 1:100.

b) Layout drawings: 1:100, 1:50 or 1:20, provided that in the case of elevations 1:200 may be used.

Where the local authorities require plans and drawings, they shall be drawn to one of the following scales:

a) Site plans: 1:1 000, 1:500, 1:300, 1:200, or 1:100.

b) Layout drawings: 1:100, 1:50, or 1:20. For elevations, 1:200 may be used.

NOTE The local authority may, in circumstances deemed exceptional by it, accept a scale not provided for in this subclause.

5.3.5 For other information regarding building regulations, refer to the relevant part of SANS 10400-A, SANS 10400-J, SANS 10400-K, SANS 10400-T and SANS 10400-V.

5.3.6 Where pipes are routed through critical locations and embedded in floors and walls, plans are not required to be submitted to the local authority in terms of 5.3.1. The receiving signatory of the installation report for the premises shall be provided with a scale drawing attached to and noted on the installation report accurately detailing the pipe route and the following:

a) ducts or trenches of approved depth;

b) sleeves;

c) fully embedded pipes; and

d) pipes are routed through a critical location;

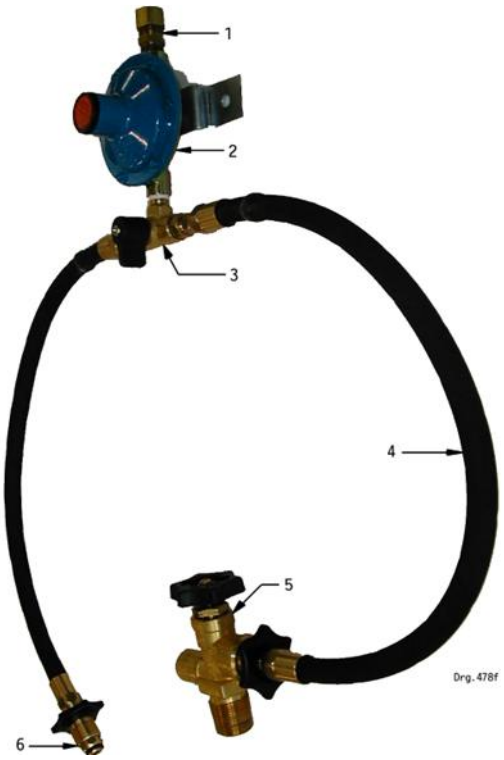
5.3.7 Where plans are required to be submitted to the local authority for approval in accordance with of 5.3.1, such premises shall, upon completion, be inspected by and registered with the local authority. Cognisance shall be taken of the local authority by-laws and where uncertainty exist about registration requirements, the local authority shall be consulted before commencing with the installation.

5.4 Container connections

5.4.1 When connecting two containers (1 on 1 off) to a vapour system, they shall share a single wall mounted regulator, situated 100 mm above the container shroud, with the pigtails each connected to a changeover device which itself is connected to the inlet side of the regulator. This setup ensures that only one container supplies gas to the system at a time, with the other container connected but in standby. This allows for a quick container change when required without disrupting the gas supply to the system. This type of connection is considered as a single changeover device and not a manifold connection (see figure 19). When two or more containers are connected to one pipe (see 5.5) and supplying gas simultaneously, it is deemed to be a manifold (see 5.4.2). T-pieces shall not be used to connect two containers together to draw gas simultaneously. **Amdt 1**

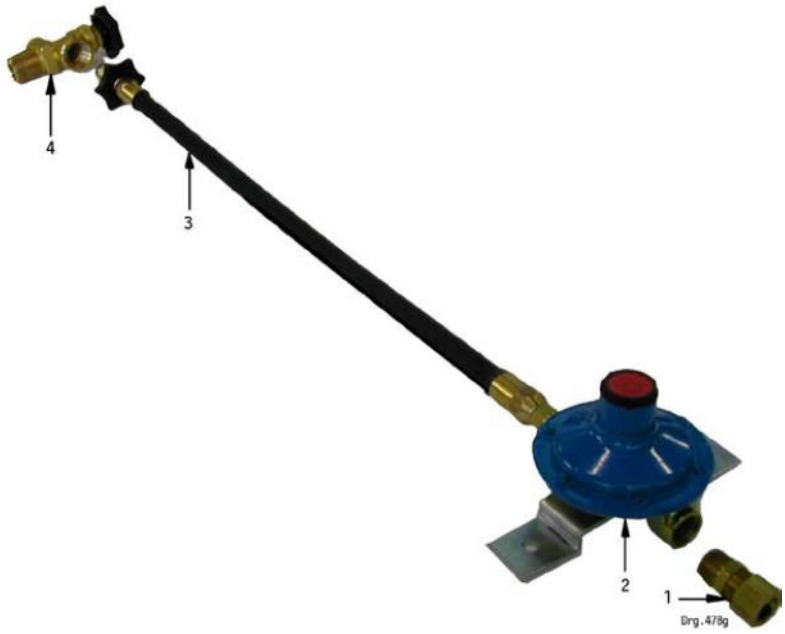
5.4.2 Where the container is located outdoors, the regulator and changeover device shall be wall mounted, with the gas supply from each container being by means of individual pigtails as shown in figure 19 and figure 20.

5.4.3 Flexible hoses shall not be used for connecting containers in fixed installations, where the container is located outdoors.



Key
1 Pipe connector or nipple and ball valve
2 Regulator
3 Changeover device
4 Pigtail
5 Container valve
6 Connection into container valve (bullnose)

Figure 19 — Application for dual container connection with changeover device



Key
1 Pipe connector or nipple and ball valve
2 Regulator
3 Pigtail
4 Container valve

Figure 20 — Single container connection with wall mounted regulator

5.4.4 Any double manifold shall be constructed so that the operating group of containers is duplicated on the other half of the manifold. It shall be controlled by means of changeover system using devices, valves, and or regulators, this ensures easy switching from the operating containers to the standby group.

5.4.5 Manifold containers shall be connected to the manifold system by one of the following methods:

a) For a single branch, up to ten containers not exceeding 120 L (50 kg) each, with a maximum of 20 containers per installation.

b) For single or multiple branches, with containers of size exceeding 120 L (50 kg) and up to and including 300 L (128 kg) with a maximum of 10 containers per installation.

c) For single or multiple branches, with containers of size exceeding 301 L (129 kg) and up to and including 500 L (196 kg) with a maximum of 6 containers per installation.

d) All containers larger than 120 L shall only be filled in-situ, (in accordance with annex A).

5.4.6 Only containers of the water capacity for which the manifold installation was designed shall be used.

5.4.7 Typical arrangements of manifolded containers are indicated in figures 21(a) to (d) (inclusive).

5.4.8 Where the pigtail connections are on a manifold system, the distance between these connections shall not be more than 1 m (see figure 22 and figure 23).

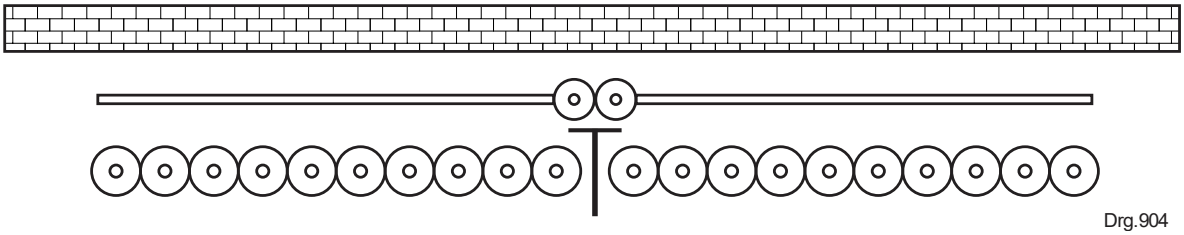


Figure 21 (a) — Wall Straight Mounted Straight

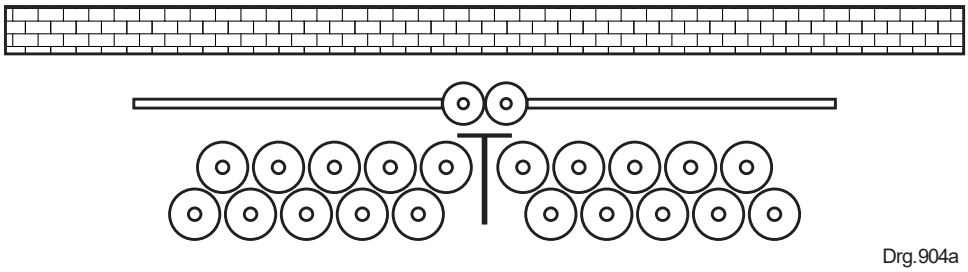


Figure 21 (b) — Wall mounted staggered container manifold

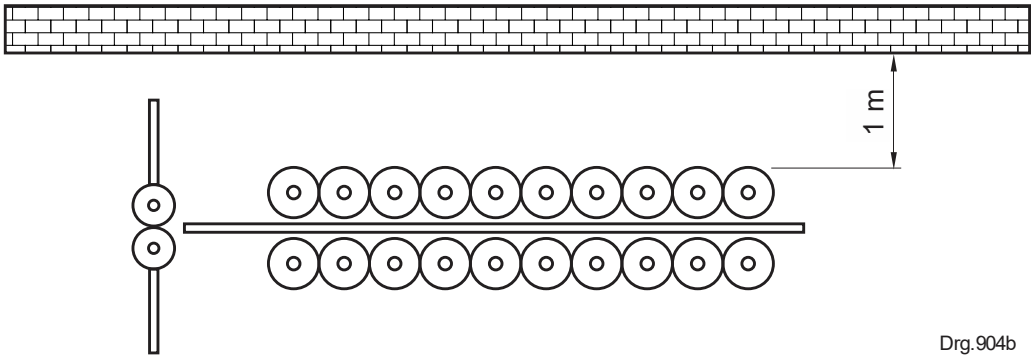


Figure 21 (c) — Free standing back to back straight container manifold

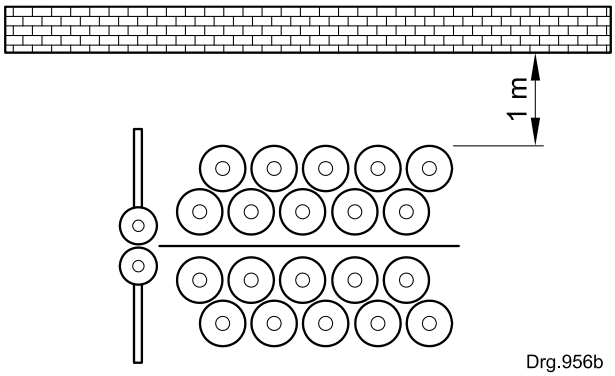


Figure 21 (d) — Free standing back to back staggered container manifold

Figure 21 — Typical arrangements of manifolded containers

5.5 Manifold design and construction

5.5.1 General

5.5.1.1 If the installation consumption demand exceeds the evaporation capabilities of the containers allowed on a site in accordance with this part of SANS 10087 (see table 1), alternative supply methods such as liquid manifolds (see figure 21) shall be considered. In liquid manifolds, the liquid shall be withdrawn from containers equipped with eductor tubes, and a vaporizer shall be used after the manifold to supply vapour to the appliances.

5.5.1.2 LPG manifolds shall be manufactured from

a) seamless carbon steel piping that complies with the requirements as specified in table 5 (see 7.1). Where screwed pipes are used in the construction of the manifold, at least schedule 80 piping shall be used. Where the steel manifold is of welded or flanged construction, at least schedule 40 piping shall be used, or

b) seamless stainless steel piping that complies with the requirements as specified in table 6 (see 7.1).

5.5.1.3 Steel manifold pipes can be connected to the regulator or changeover device using a direct screwed connection, a mechanical union, or a flexible pigtail (see figure 19). When using a flexible pigtail, the following guidelines shall apply:

a) the pigtails shall be a pre-manufactured hose assembly that complies with the requirements for pigtails as indicated in 5.6;

b) the male and female connections to the manifold pipes shall be G5/8 LH bullnose fittings that comply with the requirements of SANS 199; and

c) the outlet side of each manifold pipe shall be fitted with an isolation valve of at least PN 30 pressure rating that is certified for use with LPG (see figure 22).

5.5.1.4 Where the manifold pipes for vapour use are connected to the regulator, the outlet side of the manifold shall be fitted with an isolation valve (see figure 23) or a suitable L port changeover valve designed in a way that ensures vapour is supplied from one side only. This valve shall be certified for use with LPG in accordance with the relevant national regulation (see foreword).

5.5.1.5 All manifolds shall be tested to withstand a test pressure of 3 000 kPa $^{+50}_{0}$ kPa and a test certificate for the pressure test shall be issued by the competent person.

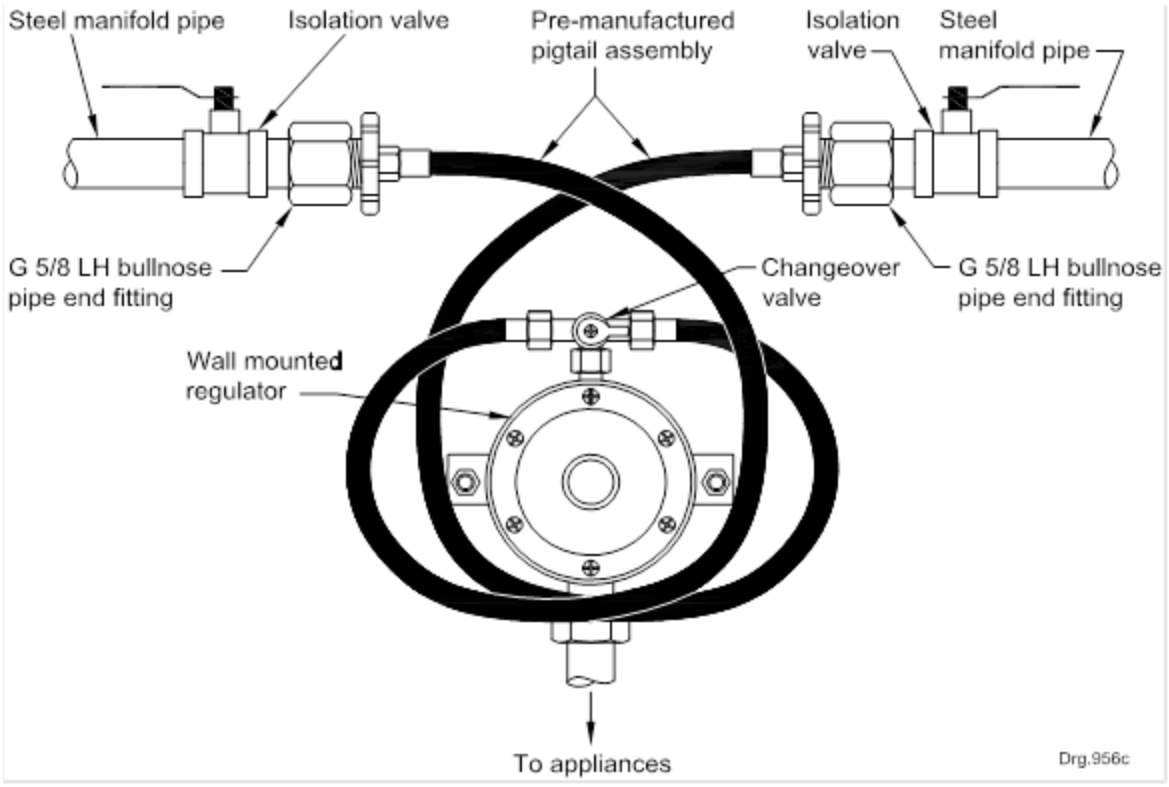


Figure 22 — Manifold — Flexible connections

5.5.1.6 Each side of the manifold shall be permanently marked with

a) a unique serial number,

b) the test pressure in kilopascals,

c) the manufacturer's name or identification symbol, and

d) the date of manufacture.

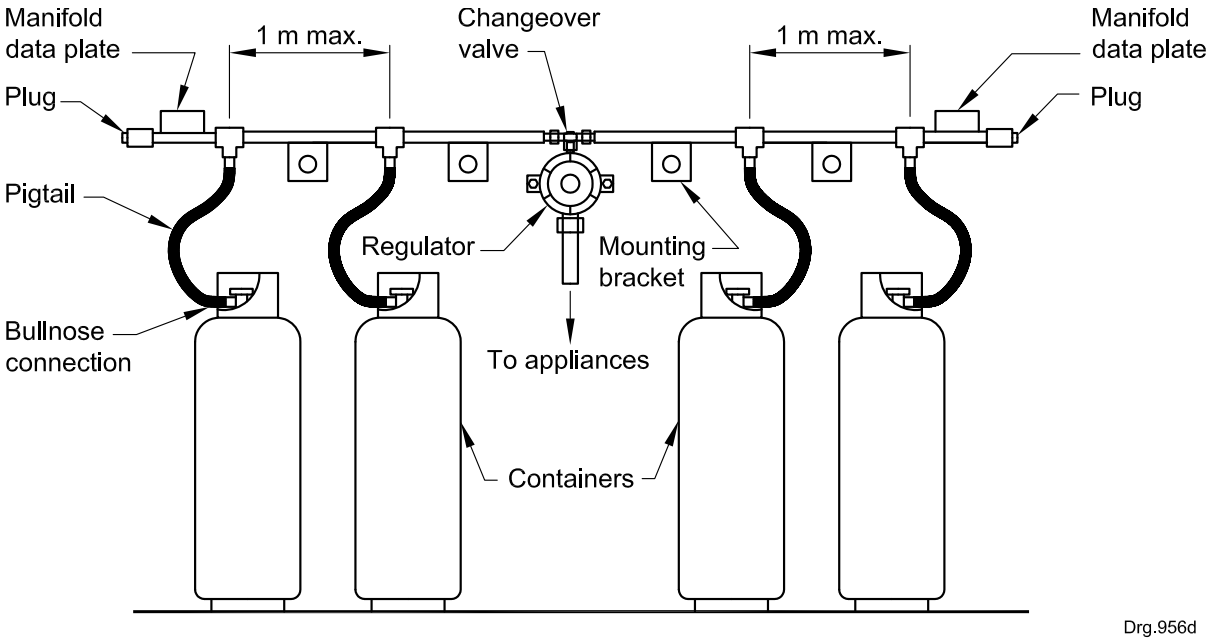


Figure 23(a) — Vapour manifold with changeover device

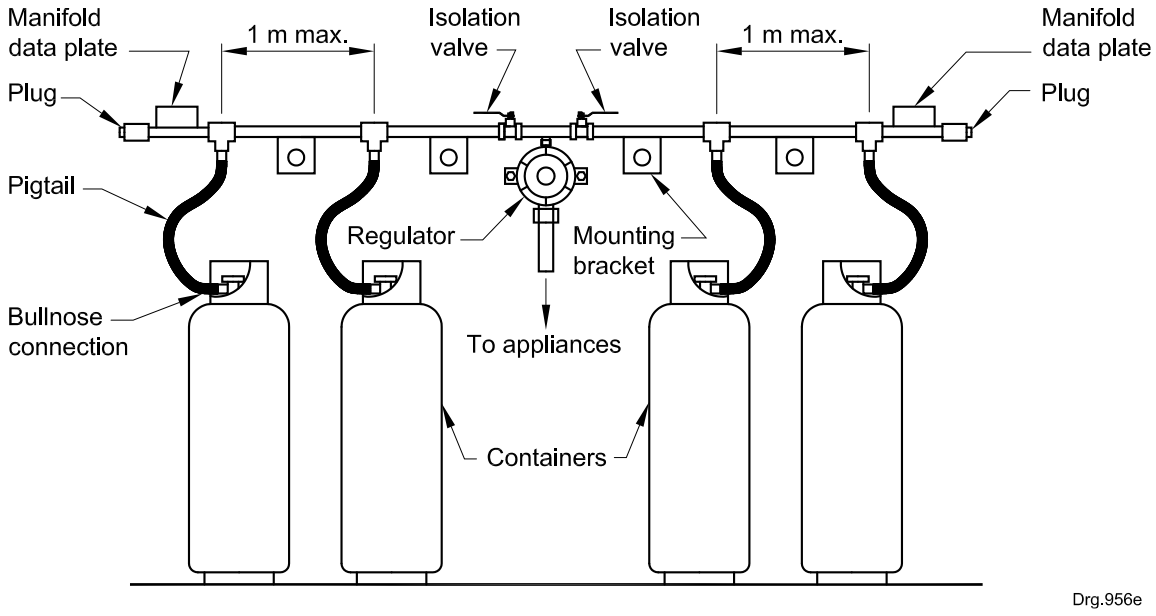


Figure 23(b) — Vapour manifold with isolation valves

Figure 23 — Vapour manifolds

5.5.1.7 The manifold shall be cleaned internally and externally and shall be free from contaminants such as grease, oily deposits, and welding slag.

5.5.1.8 Manifolds and their supporting structure shall be protected against corrosion. Manifolds shall be painted or coated for identification and protection with the finish colour "light stone" in compliance with SANS 10140-3. Labelling to differentiate vapour and liquid manifolds and flow direction shall be in accordance with SANS 10140-3.

5.5.1.9 Manifold(s) shall be mounted against a solid wall or a non-combustible structure at an appropriate height using an approved method of bracketing. All manifolds shall be sited at least 100 mm above the valve guard.

5.5.1.10 Pipe clamps shall clasp the manifold tube securely (at least two clamps per branch). The anchor of the pipe clamp bracket shall be at least 40 mm into the wall or securely fixed to non-combustible structure. Pipe clamps and bracketing shall be made of metal.

5.5.1.11 If filling operations are intended to be performed on site, the manifold installation shall be effectively connected to earth.

5.5.2 Liquid manifolds (see figure 24)

5.5.2.1 Manifolds for liquid use shall be constructed from schedule 80 carbon steel pipe or schedule 80 stainless steel pipe. A hydrostatic relief valve shall be situated between any two points of the system that might cause liquid containment. The relief valve shall be set to start to discharge at a pressure of 2 400 kPa $^{+10}_{0}$ %.

5.5.2.2 Each outlet side of the manifold shall be fitted with an isolation valve of minimum rated pressure of 3000 kPa or a suitable L port changeover valve. These shall be certified for use with LPG in accordance with the relevant national regulation (see foreword).

5.5.2.3 Manifolds for liquid use shall use check valves on every pigtail connection (non-return valves) to protect the system in the event of any flexible pigtail rupture.

NOTE In the event of a flexible pigtail rupture, the excess flow valve incorporated in the liquid withdrawal valve will reduce the escape of liquid through the container attached to the pigtail. However, the reverse flow through the system from other manifolded containers might not be sufficient to operate all excess flow valves in the remaining containers.

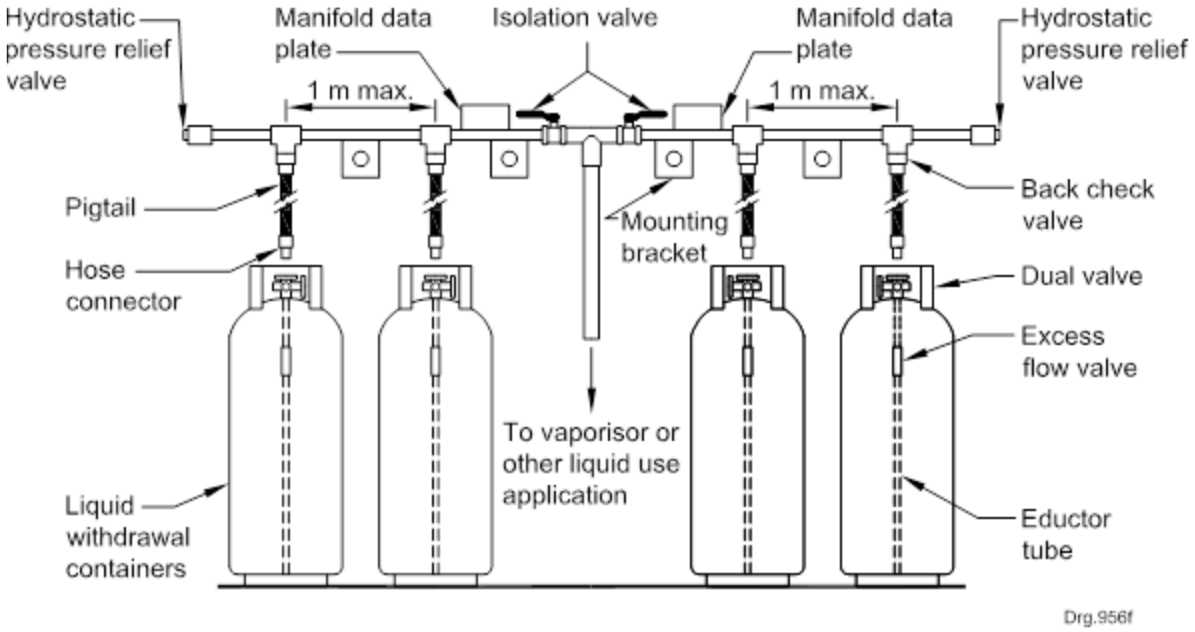


Figure 24 — Liquid manifold

5.6 Pigtails

5.6.1 Pigtails shall be manufactured from a reinforced rubber hose. The hose shall comply with the applicable standard listed in table 10 under pigtail hose. The end connections of pigtails shall either be machine crimped onto the hose or of machine threaded re-usable type, (for threaded and crimped pigtail connections see figure 25 to figure 28 (inclusive)). The use of hose clamps shall not be prohibited.

5.6.2 Pigtails shall be supplied with end fittings for direct connection to a container valve, pipework terminal or manifold inlet as required, without the need for intermediary adaptors.

5.6.3 Pigtails shall not exceed 1 m in length.

5.6.4 Pigtails for liquid use shall be so constructed that their electrical resistance does not exceed 0,75 Ω/m.

5.6.5 Pigtails for liquid shall be of internal diameter of at least 8 mm in order to ensure closure of the container excess flow valve.

5.6.6 Pigtails for vapour and liquid applications shall withstand a test pressure of 3 000 kPa.

5.6.7 The fitting used to connect the container to the pigtail shall comply with the valve connection requirements as indicated in SANS 199 for liquids or vapour, depending on whichever is applicable.

5.6.8 Pigtail assemblies shall be clearly and permanently marked with the following information:

a) date of manufacture;

b) batch identification; and

c) name of manufacturer.

5.6.9 All pigtails shall be pinpricked to allow the release of permeated gas.

5.6.10 The manufacturer shall present a certificate of manufacture on demand in accordance with the relevant national regulation (see foreword).

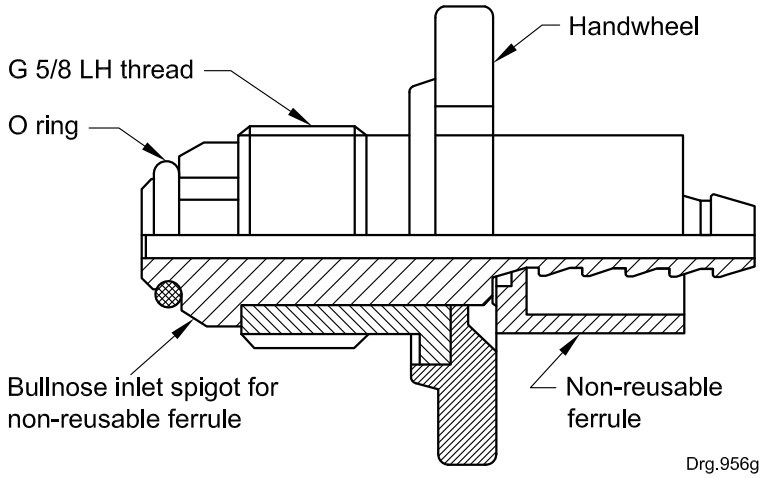


Figure 25 — Bullnose pigtail connection with non-reusable ferrule

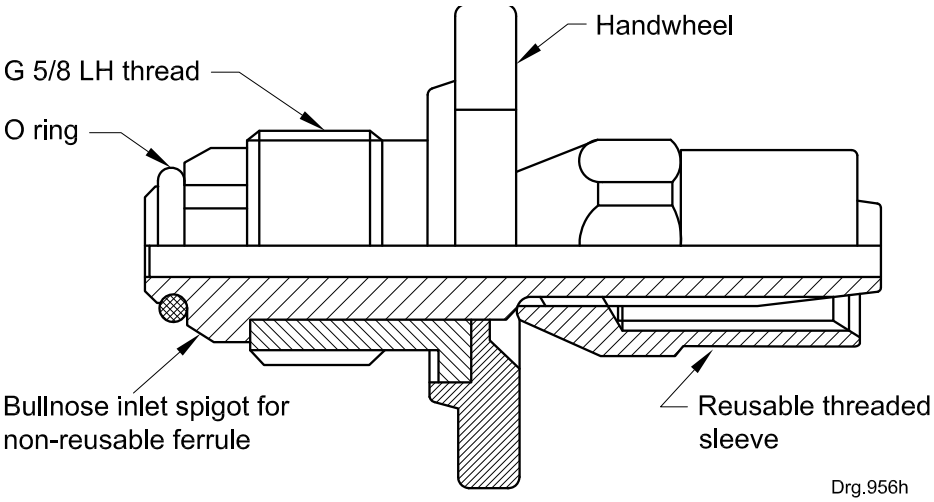


Figure 26 — Bullnose pigtail connection with reusable threaded sleeve

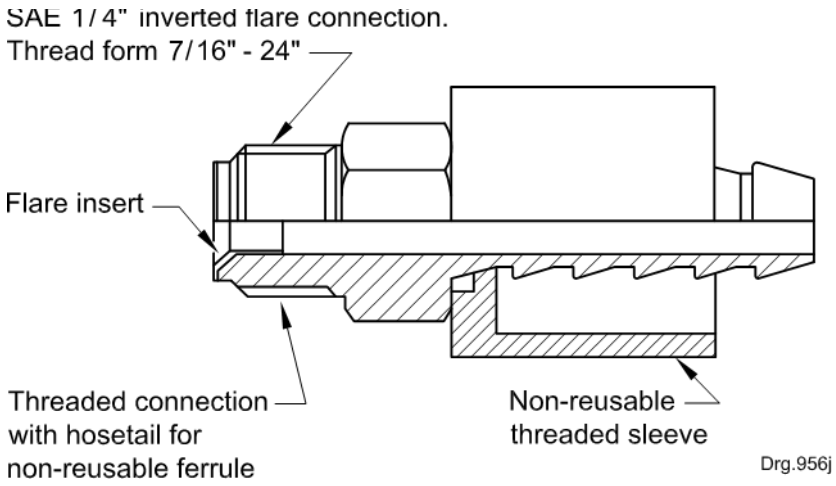


Figure 27(a) — 1/4 SAE inverted flare connection

Amdt 1

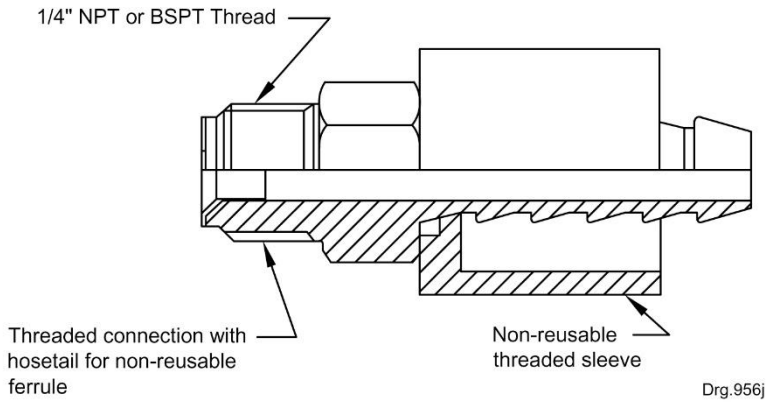
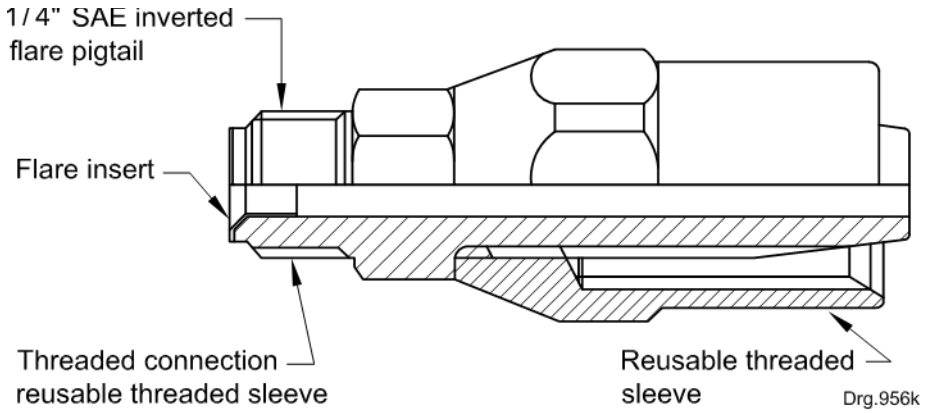


Figure 27(b) — 1/4 NPT/BSPT thread

Figure 27 — Pigtail connection with non-reusable ferrule

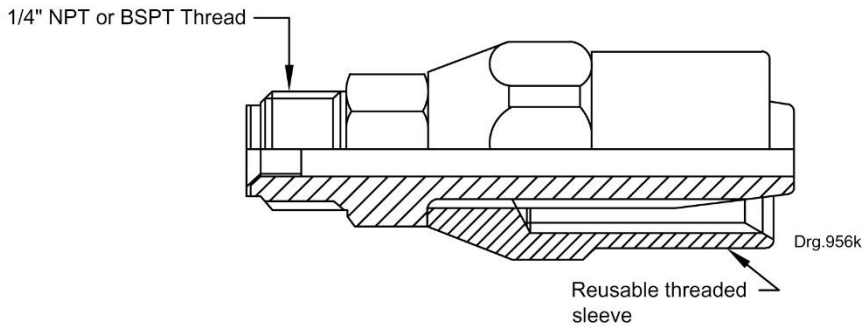
Amdt 1



NOTE For detailed dimensions, see SANS 199 and SANS 1237.

Figure 28(a) — 1/4 SAE inverted flare pigtail

Amdt 1



NOTE For detailed dimensions, see SANS 199 and SANS 1237.

Figure 28(b) — 1/4 NPT/BSPT thread

Figure 28 — Pigtail connection with reusable threaded sleeve

Amdt 1

5.7 Records

Manufacturers of manifold systems and pigtails shall retain all original manufacturing records for a period of 12 y.

6 Appliances

6.1 General

6.1.1 Appliances with a consumption rate that does not exceed 10 kg/h shall comply with the requirements of SANS 1539.

6.1.2 If the registered installer completes a connection to the appliance, the responsibility for ensuring that the appliance operates in safe manner lies with the registered installer and shall be stated on the installation report.

6.1.3 If an appliance through age, wear and tear or similar, has become damaged to an extent that it cannot perform safely, it shall be removed/disconnected from the installation.

6.1.4 The registered installer shall ensure that the appliance;

a) If a new appliance, has a safe appliance permit number issued by the approving authority, that is no more than 6 months past expiry date.

b) If an older appliance, had a safe appliance permit number issued by the approving authority in the past. This safe appliance permit number is valid for the working life the appliance even though the permit itself has expired.

6.1.5 These permit numbers are verifiable by utilising the approving authority website and inputting the name of the manufacturer/brand name/model number under the section dealing with safe appliances.

6.2 Installation of appliances

6.2.1 Fixed appliances shall be installed by a registered installer. When positioning an appliance, due regard shall be paid to convenience in use, protection from draughts and damage, and the layout of the gas piping system. Pipe runs shall be as neat, tidy, and as short as possible. Pressure regulators shall be of an approved type as indicated in 7.4.2.

6.2.2 Gas appliances shall be installed in accordance with the manufacturer's instructions. Where the appliance is not equipped with a test point, a permanent test point shall be fitted downstream of the isolation valve within 1m of the inlet connection of the appliance. A permanently installed pressure indicator is also acceptable.

6.2.3 Appliances shall be installed on a firm and level base (this is especially important in the case of refrigerators which require checking with a spirit level during installation). A table or shelf used as a support for an appliance shall be large enough to accommodate the appliance. Unless the support has edges that are flanged upwards, it shall provide margins wide enough to prevent the appliance from slipping off. All appliance supports (including floors, walls and ceilings) shall be strong enough to carry the appliance(s) and any additional loads placed upon them.

6.2.4 Appliances shall be connected to the pipework of an installation in a manner that prevents undue strain on the pipework and fittings. If rigid connections are used, the appliances shall also be securely fixed to prevent movement after installation. However, if an appliance requires occasional movement for cleaning or maintenance, it shall be connected to the pipework using flexible tubing or hose, with a maximum length of 2 m. To prevent the hose or tubing from being ruptured or torn from its mountings, the appliance shall have a restraining mechanism of a length that is shorter than the hose or tube. All tubing and hoses shall comply with the relevant requirements given in the table 4 to table 10 (inclusive).

6.2.5 Appliances shall be installed in such a way as to avoid draughts that are strong enough to extinguish the burners when they are set on "low" flame.

6.2.6 Appliances shall not be installed in small, confined spaces that are poorly ventilated. When an appliance is being built in, the supply of fresh air for combustion shall not be impeded. Provisions shall be made at the lowest level possible for any accumulation of unburnt gas to disperse safely and also for the free escape of products of combustion at high level.

6.2.7 Gas burners require an unrestricted supply of fresh air. When an appliance is being built-in, the supply of fresh air for combustion shall not be diverted to provide air for other purposes. For proper installation of fireboxes or other structures containing gas grates, see figure 29.

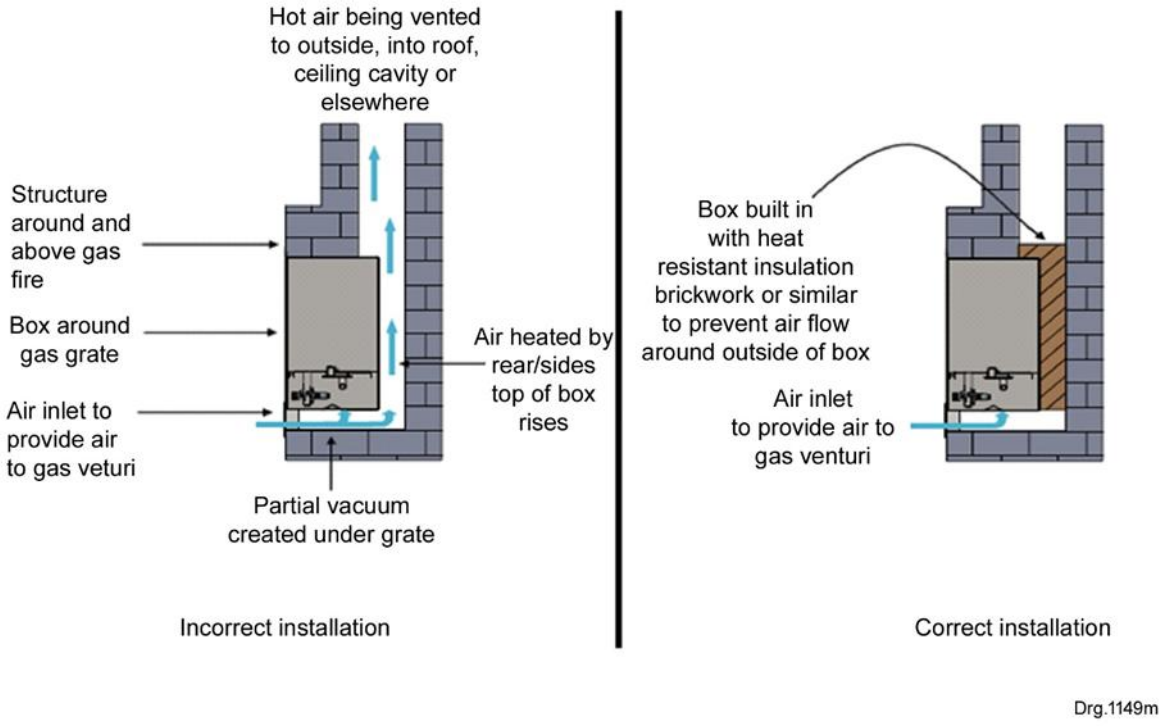


Figure 29 — Installation of fireboxes for gas fires

6.2.8 Gas water heaters installed in bathrooms shall be room sealed appliances. Flueless space heaters, Type A instantaneous water heaters, and flued instantaneous water heaters shall not be installed in bathrooms, bedrooms, toilets or saunas. Where these types of appliances in other rooms are permitted to be installed refer to 6.3. and its relevant sub-clauses for room ventilation requirements.

6.2.9 Appliances shall be so sited in a room that there is no danger that they could set fire to furnishings (for example, a gas stove shall not be placed directly below a combustible shelf or in a position where curtains could be near its cooking top.

6.2.10 Where combustible or ignitable material near an appliance is liable to attain ignition temperature or to be exposed to heat damage, provisions shall be made to protect such material.

6.2.11 To protect the material, an insulating non-combustible material shall be installed between the appliance and the combustible material, leaving an air space of at least 15 mm. Where built-in equipment is used, the surfaces of adjacent structures in contact with an appliance shall be of materials that will not deteriorate at temperatures of up to 150 °C.

6.2.12 A water heater shall be conveniently located close to the point of use to minimize heat loss, with the hot-water piping run kept as short as possible. A water heater is considered a source of ignition and shall comply with the requirement in 6.2.14.

6.2.13 Lighting appliances shall not be installed in positions likely to cause overheating of walls and ceilings. Deflector plates shall be used where necessary to mitigate any risks.

6.2.14 Open flame fixed appliances installed outdoors, shall be positioned in accordance with the figure 6(b).

6.3 Room ventilation requirements

6.3.1 General

6.3.1.1 LPG appliances consume oxygen and, in enclosed or restricted spaces, this will cause the depletion of the oxygen content of the available air.

6.3.1.2 Although the exhaust gases from an LPG burner (i.e. nitrogen, water vapour and carbon dioxide) are clean, colourless and non-toxic, they can cause heavy water condensation inside a room if the ventilation is inadequate. Additionally, excessive carbon dioxide levels in the air can disrupt the performance of an LPG appliance and result in the production of highly toxic carbon monoxide.

6.3.1.3 An appliance shall be installed in a location with adequate ventilation for complete combustion of gas, proper flueing (where applicable), and to maintain the ambient temperature of the immediate surroundings within safe limits under normal operating conditions.

6.3.1.4 Furthermore, appliances shall not be installed into any area where the air supply can become contaminated with combustion products or contain chemicals or flammable vapours which could affect combustion.

6.3.1.5 The incorrect installation or use of LPG appliances in buildings can lead to a variety of hazardous conditions, such as the accumulation of unburnt gas, high concentrations of carbon monoxide, carbon dioxide, and aldehydes, which can deplete oxygen levels. The provision of ventilation is therefore of vital importance, and in this regard, special notice shall be taken of the warnings and recommendations given in the use and installation manuals supplied with the appliance by the manufacturer.

6.3.1.6 Permanent ventilation is required if the oxygen in a room will be used up by flames, burning, people breathing etc. If sufficient ventilation is not provided, the existing oxygen in the air will be used up, the flames will start to smoke and eventually go out and the people will lapse into unconsciousness and eventually suffocate. These processes typically begin when the normal oxygen content in the air of a room is reduced to approximately 16 %.

NOTE Normal air is approximately 21 % and 79 % nitrogen.

6.3.1.7 All appliances shall be installed to meet or exceed the ventilation requirements of the manufacturer (usually detailed in the use and installation manual) and the requirements in 6.3.3.

6.3.2 Installation of permanent ventilation openings

Permanent ventilation openings shall be installed in such a way that they cannot be blocked or closed.

NOTE An openable window or door is not considered as permanent ventilation.

6.3.3 Size of permanent ventilation openings

6.3.3.1 The size of permanent ventilation openings is related to the total maximum heat input of all the fuel burning appliances installed in the room (see table 3). This includes all gas, paraffin, ethanol, wood, coal or similar appliances, with the exception of those that are room sealed.

6.3.3.2 Flued appliances including space heaters and water heaters

Where a flued appliance is designed and permitted to be installed indoors, permanent ventilation openings equivalent or greater in size to the minimum cross-sectional area of the installed flue(s) shall be provided. From a room heat retention aspect, the permanent ventilation should preferably be installed at low level.

6.3.3.3 Flueless space heaters and type A instantaneous water heaters

6.3.3.3.1 Flueless space heaters, type A instantaneous water heaters, and flued instantaneous water heaters shall not be installed in bathrooms, bedrooms, toilets or saunas.

6.3.3.3.2 Where a flueless space heater or type A instantaneous water heater is installed (in rooms other than bathrooms, bedrooms, toilets or saunas), cognisance shall be taken of the size of room.

6.3.3.3.3 Permanent ventilation is required when the heat input exceeds 0,20 MJ/hr per cubic metre of room volume.

6.3.3.3.4 For rooms requiring permanent ventilation, two openings shall be installed with one at high level and one at low level. Each opening shall have a free cross-sectional area of not less than 6,5 cm^2 per MJ/hr of heat input.

6.3.3.3.5 Where an adjoining room shares a common permanent opening exceeding 1,5 m^2 in floor size, with the room in which the appliance is to be installed; then 50 % of the volume of the adjoining room may be added to the volume of the room in which the flueless space heater or type A instantaneous water heater is to be installed. This total volume may be used in the minimum room size calculation.

6.3.3.3.6 Where a double sided flueless space heater is installed between two rooms, the total volume of both rooms is considered in the calculation of the minimum room size.

6.3.3.4 Kitchen appliances

Where gas stoves, hot plates, and type A instantaneous water heaters are installed in a kitchen, cognisance shall be taken of the size of the room. Where the heat input is greater than 0,4 MJ/hr per cubic metre of room volume, permanent ventilation is required. Where required, two permanent ventilation openings with a free cross-sectional area of at least 3,25 cm^2 per MJ/hr of heat input shall be installed, one at high level and one at low level.

Table 3 — Minimum room sizes and ventilation requirements

1	2	3	4	5	6
Types of heaters	**Total gas consumption of appliances** g/h	**Total heat input of appliances** MJ/hr	**Minimum room volume** M^3	**Approx room size with 2,7 m ceiling height** M^2	**Permanent ventilation, required if room is smaller than minimum room volume** cm^2 × 2 openings
Flueless space heaters /Type A Instantaneous water heaters	200	10	50	18	65
	300	15	75	27	98
	400	20	100	37	130
	500	25	125	46	162
	600	30	150	55	195
	700	35	175	65	227
	800	40	200	74	260
	900	45	225	83	292
	1000	50	250	93	325
Gas Stoves, hotplates and yype A instantaneous water heaters installed in a kitchen	200	10	25	9	32
	300	15	37	14	49
	400	20	50	18	65
	500	25	62	23	81
	600	30	75	27	98
	700	35	87	32	114
	800	40	100	37	130
	900	45	112	42	146
	1000	50	125	47	163

7 Piping, fittings, and other components

7.1 General

7.1.1 The information in this section shall be used in conjunction with the relevant national regulation (see foreword) and SANS 347.

7.1.2 No piping is permitted under a building. Piping that is embedded in the building floor shall not be considered as being under the building.

7.1.3 The use of hot-dip galvanised materials and malleable cast iron is prohibited.

7.1.4 All fabricated piping systems shall be pressure tested in accordance with clause 8. Following the pressure test, a leak test shall be conducted for all components up to the appliances connected to the system.

7.1.5 Piping should be adequately supported in accordance with 7.4.3.5.

7.1.6 Care shall be taken to ensure metal to metal contact is prevented where components and pipes are of dissimilar metals (galvanic reaction).

7.1.7 Care shall be taken to minimise operating pressure losses incurred due to pipeline length, internal pipe diameter, including minimum diameters of joints, fittings and components connected to the system (see annex D).

7.1.8 During installation, precautions shall be taken to prevent ingress of dirt, water, or any foreign materials into the pipework.

7.1.9 For welded and brazed joints, attention shall be given to the requirements for permanent joining in accordance with SANS 347.

7.1.10 For piping systems (CSST/PEX- AL-PEX), all tooling used in the installation of pipework and related fittings shall be regularly checked and maintained in good working order in line with manufacturer's specifications.

7.1.11 Appropriate colour coding is applicable to all piping in accordance with SANS 10140-3.

7.1.12 Quick release couplings shall not be installed in bedrooms or bathrooms.

Table 4 — Copper tubes

1	2	3	4	5	6	7	8
MOP	**Pipe**		**Environment**	**Fittings**		**Jointing method**	
KPa	**Type**	**Limiting conditions**		**Type**	**Limiting conditions**	**Jointing**	**Limiting conditions**
Storage pressure	SANS 460: Plain Ended Copper tubes Class 1 or better SANS 1453: Copper Tubes for medical gas and vacuum services	Buried tubing will be corrosion protected using an approved petroleum tape applied in an approved manner. Embedded tubing will be corrosion protected by wrapping with brown paper lagging as per SANS 10252-1.	Tubing that pass through walls shall be sleeved (See7.4.3.3.5. Not approved for critical locations such as lift shafts, flues, ceilings or air ducts	Capillary soldered fittings to SANS 1067-2 Compression fittings to SANS 1067-1 Press fitting connectors complying with SANS 1067-3, AS 3688, BS 8537, EN 12735-1 and other recognised standards	Compression fitting is not for liquid use Compression fittings (mechanical fittings) are not permitted in buried, embedded or critical locations All press fittings shall be dimensionally compatible with the tubing used and sealing rings shall be compatible to LPG to the applicable standard.	All joints shall be brazed, silver soldered or soft soldered using class 97/3 soft solder (S19 and S20 of SANS 24 may also be used) For flared type compression jointing, only type B fittings are permitted in accordance with SANS 1067-1.	~~For permanent joints, only suitably qualified persons using suitable joining procedures is acceptable.~~ ~~When using flux it is important you apply it sparingly, never inside the fitting. Always wipe off all excess flux after joint is completed.~~
150	ASTM B 280: Seamless Copper Tube for air conditioning refrigeration NOTE All tubing in imperial sizes).			Capillary soldered fittings to ASTM BS16.22 Olive and Flared type compression fittings			

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Table 5 — Carbon steel

1	2	3	4	5	6	7	8
MOP	**Pipe**			**Fittings**		**Joining method**	
KPa	**Type**	**Limiting conditions**	**Environment**	**Type**	**Limiting conditions**	**Jointing**	**Limiting conditions**
Storage pressure	API Spec 5 L Grade B ASTM A53/A53M Grade B ASME/ASTM SA/A106 Grade A or B, Seamless Pipe Plain ends. Pipe dimensions to ASME B36.10 (Min SCH 40)	Not permitted in the ground beneath a building For pipe suitability for liquid and vapour applications (see 7.4.3.1.1)	All pipework shall be treated for corrosion protection in an acceptable manner. Buried piping will be corrosion protected using an approved method (e.g. petroleum tape applied in an approved manner).	Fittings – Butt weld ASME/ASTM SA/A234 WPB Dimensions to ASME B16.9 Fittings – Forged (Socket Weld/Threaded) ASME/ASTM SA/A105 Dimensions to ASME B16.11 Flanges S235JR (Plate) ASME SA/A105 (Forged) Dimensions to ASME B16-5, EN 1092-1, SANS 1123, BS 10 Victaulic couplings to ASME B31.3 (Mechanical joint)	No mechanical joints are permitted in buried, embedded or critical locations. All fittings shall suit the design pressures of the piping system. ~~For butt welded joints, only seamless fittings shall be used with seamless pipe.~~ Stub-in T joints are allowed for branch connections up to DN 50 provided that the coupling has a minimum class 2000 rating.	All threaded joints shall have matching threads. All welded joints shall be performed by suitable qualified persons	All threaded joints shall be leak tight. All welded jointing to be cleaned property (e.g. wire brush) to ensure the proper removal of any spatter or contaminants due to welding. See 7.4.3.1.1 for detailed information on jointing (threading and welding). NOTE Gaskets between flanges to be suitable for LPG services
150 Kpa	SANS 62-1 Medium Class or better longitudinal welded pipe (non-galvanised)			Fittings – Butt weld SANS 62-2, JIS BS 2311 Fittings – Forged (Socket Weld / Threaded) ASME/ASTM SA/A105 Dimensions to ASME B16.11 Threaded fittings SANS 62-2, EN 10241 Flanges S235JR (plate) ASME SA/A105 (Forged) Dimensions to ASME B16-5, EN 1092-1, SANS 1123, BS 10			

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Table 6 — Stainless steel

1	2	3	4	5	6	7	8
MOP	**Pipe**		**Environment**	**Fittings**		**Jointing method**	
Kpa	**Type**	**Limiting conditions**		**Type**	**Limiting conditions**	**Jointing**	**Limiting condition**
Storage Pressure (See limiting conditions)	SA/A312 SA/A790 longitudinal welded and seamless pipe Dimensions to ASME B36.19	Not permitted in the ground beneath a building. Buried or embedded pipe shall be corrosion protected in an acceptable manner. For pipe suitability for liquid and vapour applications, see 7.4.3.1.1.	Installed pipes shall be free from contamination and be in a pickled and passivated condition. Contact with dissimilar metals shall be avoided (e.g. piping supports made of carbon steels in contact with the SS pipe). If stainless is painted, paint used shall be chloride free.	Fittings – Buttweld ASME/ASTM SA /A403 SA /A815 (WP-W / WP-WX / WP-S) Dimensions to ASME B16.9 Fittings – Forged (Socket Weld/Threaded) ASME/ASTM SA /A182 Dimensions to ASME B16.11 Flanges ASME / ASTM SA/A240 (plate) ASME/ASTM SA/A182 (Forged) Dimensions to ASME B16-5, EN 1092-1,SANS 1123,BS 10	No mechanical joints are permitted in buried, embedded or critical locations. All fittings shall suit the design pressures of the piping system. For buttweld fittings, only seamless (WP-S) fittings shall be used with seamless pipe.	All threaded joints shall have matching threads All welded joints shall be performed by suitably qualified persons.	Threaded joints shall be leak tight. Welded joints to be cleaned to ensure the proper removal of any splatter etc, followed by pickling and passivation in a manner appropriate for stainless steel. See 7.4.3.1.1 for detailed information on jointing (threading and welding) NOTE Gaskets between flanges shall be suitable for LPG service.

Table 6 (*continued*)

1	2	3	4	5	6	7	8
MOP	**PIPE**		**Environment**	**Fittings**		**JOINTING METHOD**	
Kpa	**Type**	**Limiting conditions**		**Type**	**Limiting conditions**	**Jointing**	**Limiting conditions**
150	Press fit piping system SA/A312 longitudinal welded and seamless pipe Dimensions to ASME B 36.19 or AS 5200.053	Not permitted beneath a building. Not for liquid applications Buried or embedded shall be protected in an acceptable manner.		Press-fit end connectors complying with AS 3688.	Press-fit End Connectors: shall be compatible with the pipe material, shall have yellow NBR ‘O’ rings, shall not to be used for applications where the operating temperature exceeds 70 °C unless the manufacturer’s specification warrants a higher temperature, are not permitted in critical locations, are not permitted for use as a final connection to an appliance where the final connection has to be destroyed to disconnect the appliance.		Buried or embedded joints and fittings shall be protected and made gas tight (No mechanical joints allowed in these areas).

Table 6 (*concluded)*

1	2	3	4	5	6	7	8
MOP	**PIPE**		**Environment**	**Fittings**		**Jointing method**	
Kpa	**Type**	**Limiting conditions**		**Type**	**Limiting conditions**	**Jointing**	**Limiting conditions**
Storage pressure	ASTM A269 Seamless and Welded Austenitic stainless steel tubing for general applications	Not permitted in the ground beneath a building. Buried or embedded pipe shall be corrosion protected in an acceptable manner. For pipe suitability for liquid and vapour applications, see 7.3.3.1.			Fittings to be compatible with pipe material. No compression fittings permitted in buried, embedded or critical locations. Compression fitting not allowed for use liquid use. Compression fittings not permitted for use as a final connection to an appliance. Where the final connection has to be destroyed to disconnect the appliance.	All welded joints shall be performed by suitably qualified persons	Torqueing of compression fittings to be according to the manufacturer's recommendations.

Table 7 — Corrugated stainless steel tubing (CSST)

1	2	3	4	5	6	7	8
MOP	**PIPE**		**Environment**	**Fittings**		**Jointing method**	
Kpa	**Type**	**Limiting conditions**		**Type**	**Limiting conditions**	**Jointing**	**Limiting condition**
150	ANSI LC-1/CSA 6.26	Not approved for LPG liquid service NOTE Only piping rated and marked over 150 kPa service may be used in this service.	Piping system is suitable for indoor and outdoor installations. Open corrugations shall be sealed with manufacturer approved insulation. Piping may be buried, embedded or used in critical locations in accordance with OEM instructions. In addition, buried, embedded and piping in critical shall be sleeved in a non-metallic sleeve.	Only components designed for the piping system and provided by the manufacturer with the correct markings and specifications are permitted.	Mechanical fittings are not approved to be buried embedded or used in critical locations. Fittings are pipe system specific. Fittings shall be wrapped according to manufacturer's instructions and approved material.	The manufacturer's instruction for proper sizing, installation, inspection and repair shall be followed.	No other jointing method may be permitted other than that approved by the manufacturer.
50	EN 15266	The manufacturer shall provide full and detailed instruction for the assembly and installation of CSST.					

Table 8 — Composite/Multylayer piping

1	2	3	4	5	6	7	8
MOP	**PIPE**		**Environment**	**Fittings**		**Jointing method**	
kPa	**Type**	**Limiting conditions**		**Type**	**Limiting conditions**	**Jointing**	**Limiting condition**
150	SANS 17484-1, AS 4176, ASTM F 1281, ASTM F 1282, SANS 18225, PEX/AL/PEX and PE/AL/PE composite pipe systems up to diameter 76 mm	For vapour service only. Not allowed in direct sunlight unless covered with UV protection with a protection rating of at least 5 y. The pipe shall not be, connected to an appliance that needs to be moved. Installation instructions shall be adhered to as per manufacturer's requirements. For additional limiting conditions for composite pipe see 7.3.3.1.	Contact with solvents shall be avoided. The pipe shall not be exposed to temperatures exceeding: a) 60 °C – PE/AL/PE; and b) 80 °C – PEX/AL/PEX. The pipe shall be kept away 150 mm away from a heat source. The pipe shall not be allowed in areas where it will be in contact with corrosive chemical.	Crimp and compression fittings according to the matching pipe system standards.	Mechanical joints are not permitted in buried, embedded or critical locations. For repairs in buried or embedded areas, crimped fittings may be used. All fittings installed as above in these areas shall be wrapped for corrosion protection. Any buried or embedded fitting joints will require a pressure test of 3 bar for 10 min period. O-rings shall be suitable for gas service (e.g. NBR) and as specified in the system standards mentioned (NOTE PEX fittings reduce effective internal diameter creating pressure loss) When embedded in walls or floors, no joints shall be allowed in the embedded sections. In case of repair an inspection box shall be used for future inspection or full metal pressed fittings without inspection box.	For crimped joints, crimps shall be performed in accordance with the manufacturer's specifications. The "U" Type Crimp tool or a tool as specified by the manufacturer is to be used.	No joints (mechanical nor fully crimped) are allowed in pipe sections going through critical locations, confined spaces or imbedded in concrete. Tools shall be in proper working order (calibrated in accordance with manufacturer's specification).

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Table 9 — HDPE

1	2	3	4	5	6	7	8
MOP	**PIPE**		**Environment**	**Fittings**		**Jointing method**	
kPa	**Type**	**Limiting conditions**		**Type**	**Limiting conditions**	**Jointing**	**Limiting condition**
100	EN 1555-2 High Density Polyethylene (HDPE) SANS 4437-2	Pipe Specification to: PE 100 SDR 11 Orange in colour, or Black with orange stripe PE100.	Pipe and fittings shall not be used above ground and shall be buried (see 7.4.3.2). Not permitted to pass under a building.	Electrofusion Joints	Fittings shall comply with SANS 4437-3 and EN 1555-3 Full range of joint sizes are acceptable. Fittings shall be buried but are not allowed under a building. Electrofusion sockets and fittings shall be used only on pipes of the same material (see SANS 10268-2).	Electrofusion in accordance with SANS 10269-2. Buttwelding in accordance with SANS 10269-1.	Welders shall be trained and certified as competent in accordance with SANS 10269. Only approved processes and equipment for the application may be used. Buttwelding only for non-coiled pipe.

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Table 10 — Hoses

1	2	3	4	5	6	7	8
MOP	**Hoses/Tubing**		**Environment**	**Fittings**		**Jointing**	
kPa	**Hose/Tubing**	**Limiting conditions**		**Fittings**	**Limiting conditions**	**Method**	**Limiting Conditions**
150	**Hose** SANS 1156-2 (Orange hose) BS EN 16436-1 Class 2 (Orange Hose) AS/NZS 1869 Type C, D, E	Hose for appliance connections Minimum Internal Diameter shall be 8 mm Maximum installation length – 2 m Max Temp 50 °C	Indoor use only	Hosetails for appliance connections i.a.w the requirements of SANS 1539.	Threads on fittings to match appliance connection threads. Only single appliance connections per hose are permitted. Hoses shall be secured to end fittings by means of swaging, crimping or hoseclamps (No wire, cable ties etc.)	No joints are allowed in the hose length.	No branching joints (T, Y or cross) are permitted.
150	**Hose Assemblies** SANS 1156-2 (Orange hose) BS EN 16436-2 Class 2 (Orange hose) AS/NZS 1869 Type C, D, E			Machine crimped fittings according to applicable standard.	Fitting threads to match appliance connection threads. Only single appliance connections are permitted.		

Table 10 *(continued)*

1	2	3	4	5	6	7	8
MOP	**Hoses/Tubing**		**Environment**	**Fittings**		**Jointing**	
kPa	**Hose/Tubing**	**Limiting conditions**		**Fittings**	**Limiting conditions**	**Method**	**Limiting conditions**
50 kPa	**Corrugated SS Appliance Connectors** EN 14800 (50 kPa)(Domestic) UNI 11353 (Stainless Steel Crimped or welded fittings, union type fittings with washer)	Avoid chloride and Ammonia, an any other chemicals in the same area.	Indoor/Outdoor	Machined for permanent fitted end fittings			
Cylinder pressure	**Pigtail assembly** AS/NZS 1869 Class D and F	For liquid and vapour applications. For liquid applications, suitable means for electrical conductivity shall be allowed for to meet the electrical resistance requirements as per 5.6 of this part of SANS 10087	For outdoor use	In accordance with 5.6 of this part of SANS 10087	G5/8" LH threaded bull-nose Connections on one end and a 1/4" RH NPT threaded or 1/4" SAE inverted flare connection on the other end.	No joints permitted	No joints permitted
	Pigtail Assemblies ISO 10380 (Stainless Steel) (Specified for Gas use only	For liquid applications, suitable means for electrical conductivity shall be allowed for to meet the electrical resistance requirements as per 5.6 of this part of SANS 10087. Avoid chloride and Ammonia, an any other chemicals in the same area	For outdoor use	In accordance with 5.6 of this part of SANS 10087	G5/8" LH threaded bull-nose Connections on one end and a 1/4" RH NPT threaded or 1/4" SAE inverted flare connection on the other end.	No joints permitted	No Joints Permitted

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Table 10 *(concluded)*

1	2	3	4	5	6	7	8
MOP	**Hoses/Tubing**		**Environment**	**Fittings**		**Jointing**	
kPa	**Hose/Tubing**	**Limiting conditions**		**Fittings**	**Limiting conditions**	**Method**	**Limiting conditions**
Cylinder pressure	**Pigtail assembly** BS EN 16436 Class 3	For vapour applications only. Refer also to 5.6 of this part of SANS 10087	For outdoor use	In accordance with 5.6 of this part of SANS 10087.		No joints permitted	No joints permitted
	Pigtail hose BS EN 853 Note: The use of this hose for Pigtails will be discontinued)	Braided hose for liquid and vapour application. Shall be subject to n-pentane test as per procedure of SANS 1156-2. **Tests shall not be older than 3 y / or batch tests** for compatibility with LPG. For liquid applications, suitable means for electrical conductivity shall be allowed to meet the electrical resistance in accordance with 5.6 of this part of SANS 10087.	For outdoor use	Bullnose in accordance with 5.6 of this part of SANS 10087		No joints permitted	

7.2 Valves

7.2.1 General

Where valves are intended for shutting off the gas supply to (or in) a gas supply line, the valve seats shall be compatible with LPG and certified for use with LPG.

7.2.2 Emergency shut-off valves

7.2.2.1 Every fixed LPG installation shall have an emergency shut-off valve. Emergency shut-off valves shall be accessible and unobstructed at all times and should be placed as close as possible to where the main gas pipe enters the building. It may be placed inside or outside of the building, provided that it is located outside of the occupancy. **Amdt 1**

7.2.2.2 Emergency shut-off valves shall not be placed inside a cage.

NOTE 1 An emergency shut-off valve may be used as an isolation valve on a single appliance installation.

NOTE 2 Where a single appliance and container are located within the same room not exceeding 3 m apart, the container valve may be considered as the emergency shut-off valve.

7.2.3 Isolation valves

7.2.3.1 Every fixed appliance shall be equipped with an isolation valve to isolate the individual appliance from the system.

7.2.3.2 Where a gas pipeline between the emergency shut-off valve and the appliance is longer than 5 m for a single appliance installation, an additional isolation valve shall be placed as close as possible to the appliance.

7.2.4 Change over valve

7.2.4.1 Manual change over valve shall be of L port type and shall be of the double valve stem sealed design.

7.2.4.2 Automatic change over valve shall comply to a recognised relevant standard.

7.3 Gas meters

7.3.1 General

7.3.1.1 Where gas usage is billed through the use of a gas meter (custody transfer meter), it shall be in compliance with EN 1359 or OIML R137-1 (2012) and, shall be in accordance with the relevant national legislation a (see foreword), as approved by the relevant regulatory authority (see foreword).

7.3.1.2 Due to the various metering types (diaphragm, rotary, and turbine), it is imperative to follow the manufacturer’s installation instructions, as it could affect the meter accuracy.

7.3.1.3 The inlet pressure shall not exceed the maximum operating pressure indicated on the meter manufacturer’s data plate (the pressure and maximum flow shall be displayed on the meter).

7.3.1.4 When the meter is used with gases high in contaminants, it is recommended that a suitable filter is installed on the inlet side of the meter. A suitable stop valve should be installed before the inlet of the meter for maintenance purposes.

7.3.1.5 Gas mains, services and meters transporting gas at pressure exceeding 150 kPa are not permitted inside the building of occupied premises.

7.3.1.6 Gas meters at a meter station, that manifold into a single outlet line, may not be connected in parallel without the use of backcheck or non-return valves within a distance of 5 times pipe diameter of the meter, to prevent reverse flow.

7.3.2 Gas meter locations (see figure 30)

Meter installations shall consider the following when selecting a site:

a) identification of possible sources of ignition;

b) avoidance of any location where meter may be subject to interference or vandalism;

c) avoidance of any location where meter may be subject to vehicular damage;

d) avoidance of any location where meter may prove to be a tripping hazards;

e) avoidance of any location where the meter may be subject to a natural hazards (bushfire, flooding);

f) allowance for adequate ventilation;

g) avoidance of any location beneath a habitable area including balconies (unless in a fire rated alcove or a separate meter room);

h) avoidance of any location where escaping gas may become trapped i.e. below closed canopies or rooms where gas cannot disperse into the atmosphere; and

i) avoidance of any shafts or service ducts where hose reels or fire extinguishers are fitted.

7.3.3 Prohibited meter locations

7.3.3.1 Prevent the installation of meters in locations where the meter casing is in direct contact with soil or concrete walls. Alkali in concrete as well as other corrosive elements in soil can cause premature corrosion of the meter casing.

7.3.3.2 The gas meter assembles shall not be installed in any of the following locations:

a) a bedroom;

b) a lift shaft or lift motor room;

c) a room specifically intended for electrical switchgear;

d) a fire-isolated stairway or passage;

e) a fire hydrant duct or hose reel cabinet;

f) sprinkler or hydrant pump room;

g) 1 m from a source of ignition;

h) in such a position that would obstruct egress from a building;

i) in such a position where the meter would be subject to physical damage unless adequately protected;

j) in an area where excessive temperatures or sudden excessive changes in temperature may occur;

k) in the foundation area under a building;

l) in a cavity wall, unless installed in a fully sealed ventilated enclosure;

m) in a position where access for meter reading or maintenance is restricted;

n) in an unventilated area;

o) on the ground (directly);

p) on a floor which is frequently wetted;

q) on a floor which contains material which may corrode the metre; and

r) within 1 m of an openable window or air vent or opening.

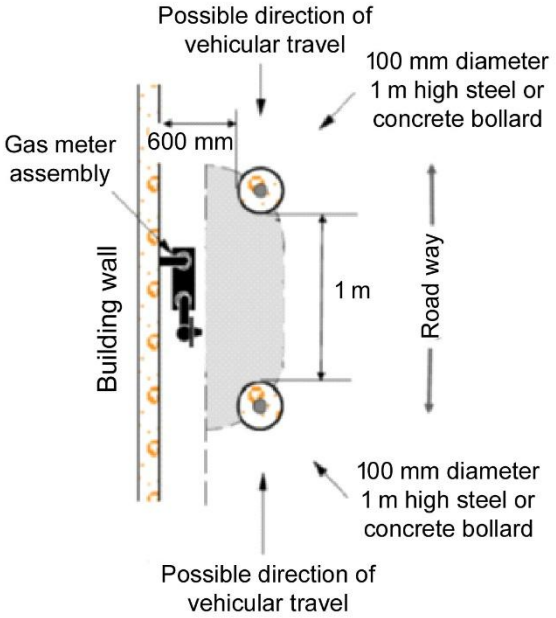
7.3.4 Meters installed on the boundary may not be installed

a) within 600 mm from a property driveway,

b) further than 1 m inside the property boundary,

c) where it cannot be read from outside the boundary, and

d) where the necessary protection cannot be constructed.



Top view example of guard post locations that provide protection from all possible directions of vehicular travel

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Figure 30 — Gas meter assembly protection

7.3.5 Meter assembly clearances

The gas meter and its associated assembly (e.g. regulator and relief valve) (or both) shall maintain the following minimum clearances from the centreline of the attached regulator vent:

a) 1 m from any door, openable window, natural ventilation points or any other opening into the building or enclosed space (excluding sub-floor ventilation openings),

NOTE Refer to figure 31 for reference point measurements.

b) 1 m from a source of ignition or a flue terminal,

c) 1 m from electrical equipment unless otherwise permitted,

d) 500 mm below an electricity meter box,

e) 300 mm from communication equipment unless otherwise permitted,

f) 500 mm from earth stakes,

g) the minimum distance between any building opening and the relief venting device of a gas installation shall be 1 m,

h) 2 m from mechanical air inlet (Note that the outdoor component of an air conditioner is not a mechanical air inlet,

i) 3 m to any flammable materials storage area without approved protection against spillage and leakage, and

j) 3 m from open fire appliances and barbeques (BBQ).

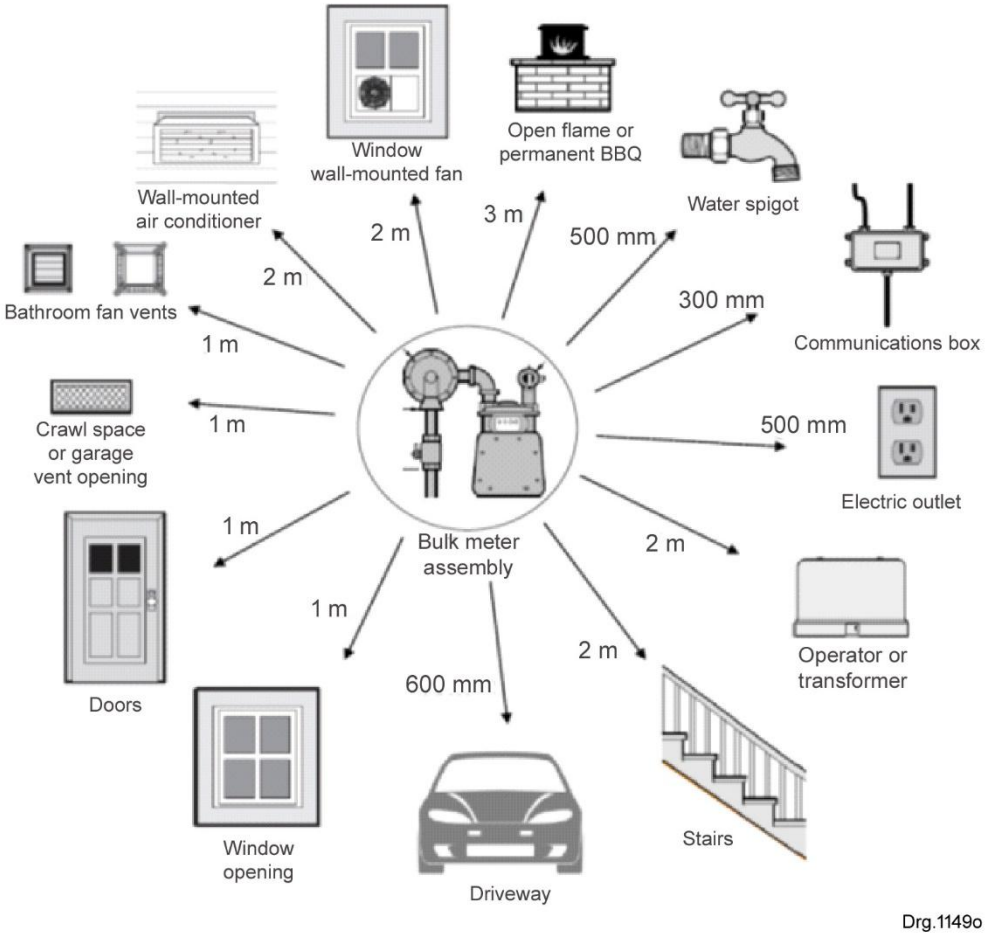


Figure 31 — Gas meter safety distances

7.3.6 Multiple meter assembly (see figure 32)

7.3.6.1 Where multiple meter are positioned in the same metering containment, each meter shall be clearly and permanently marked indicating the dwelling number it services.

7.3.6.2 All meters shall be readily readable and be separated at least 40 mm apart.

7.3.6.3 Gas meters mounted above each other shall be spaced 200 mm above each other for ease of maintenance (see figure 32).

7.3.6.4 The Main gas regulator may not be closer than 200 mm from finished ground or floor level as applicable. The ground or floor level below the multi-meter assembly shall be of an impervious (impenetrable) finish at least 500 mm beyond the foot print meter assembly.

7.3.6.5 The main isolation valve shall be a minimum of 100 mm from finished ground level for ease of operation and shall be marked as "EMERGENCY GAS VALVE" in 50 mm high red letters on a white background.

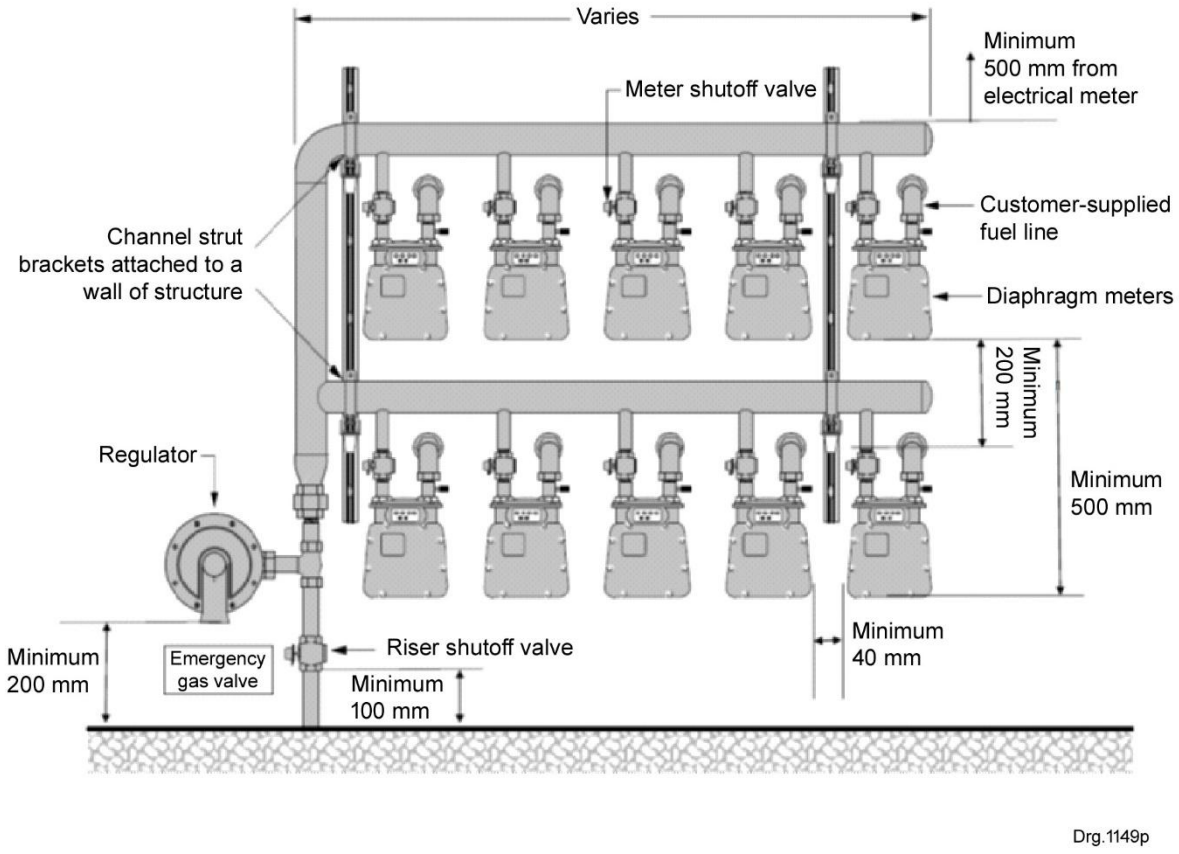


Figure 32 — Multi meter assembly

7.3.6.6 The distance between vent outlets of any single meter gas compartment and electrical equipment shall be a minimum of 1 m.

7.3.6.7 It is permissible to locate gas and water meters in the same compartment or in close proximity to each other. However, a minimum clearance of 150 mm shall be maintained between any component of the gas and water installations.

7.3.7 Metering panels and multi service ducts and enclosures

7.3.7.1 Gas meters may be fitted in suitable non-combustible gas meter panels, provided that they are equipped with top and bottom ventilation. These panels shall be clearly marked to indicate the presence of a gas meter. The gas meter box may not contain any electrical or water meters, however, meter boxes may contain electronic gas billing equipment that complies with EN 16314.

7.3.7.2 Gas meter enclosures located inside walls, alcoves, pillars, boxes, and front wall compartments shall have walls made of fire-rated material with a minimum fire resistance rating of 60 min. These walls shall be gas tight, with only specific perforations in front cavity doors allowed for direct venting to the outside.

7.3.7.3 Where gas meters are installed in vertical multi services ducts, the following requirements shall be complied with to protect all services in the duct:

a) Flues of any appliances or heat sources may not expose the meter casing to temperatures exceeding 50 °C.

b) Water meters may not be installed directly above the gas meter.

c) Drain or sewer inspection ports may not be directly above gas meters.

d) Electrical meter shall be a minimum of 500 mm from any gas meter.

e) Fire water piping shall be a minimum of 200 mm from a gas meter.

f) Gas meter shall be readable from the front of the service duct or enclosure.

g) Gas meter shall be permanently marked with the dwelling number that it serves.

h) Electrical cabling or earthing connection may not be connected to gas meters or its connection.

7.3.8 Gas meter pipework

7.3.8.1 Ensure that installation pipe work before the meter is thoroughly clean. Foreign materials such as pipe scale, rust flakes, excessive plumbing tape, and excessive thread sealant shall be removed prior to installing the meter.

7.3.8.2 The gas meter should be installed as close to level as possible in order to ensure accurate operation. The direction of gas flow shall correspond to the arrow marked on the meter body.

7.3.8.3 Hand tighten the inlet and outlet swivel cap. Using a pipe wrench, alternate between both swivel caps nuts and tighten approximately three flats (approximately 15 Nm to 25 Nm). "DO NOT OVER TIGHTEN". Damage to the rubber gasket inside the swivel cap nut may result.

7.3.8.4 Never pressure test the pipeline against a metre.

7.3.8.5 Line operating pressure may not exceed 80 % of the maximum rated operating pressure of the meter.

7.3.8.6 When installing a meter by-pass the bypass shall be equipped with a lockable valve.

7.3.8.7 Meter shall be supported with a suitable brackets and not cause undue strain on the connecting pipework.

7.3.8.8 Due to the variances on inlet and outlet threads of meters, they shall be supplier with suitable couplings that fit standard pipe fittings or valves.

7.3.9 Meter operation

Consider the following for proper meter operation:

a) Before turning the gas on, check the system downstream of the meter to be sure that all connections are made up and tight or that the downstream valve, if there is one, is closed.

b) Care shall be taken to prevent excessive flows and high pressure drops across the meter.

c) If care is not exercised when pressurising the meter over-speeding of the meters internal mechanism may result in internal damage to the meter. To prevent over-speeding the pressure drop across the meter should not exceed 125 Pa or (0,5 wc). This can be achieved by pressurising the meter and the downstream pipe volume to appliances as slowly as is possible.

d) To avoid high differential pressure across the meter, open the upstream and downstream valves "VERY SLOWLY" to prevent any pressure surges into or out of the meter.

7.4 Fixed pipe system

7.4.1 General

7.4.1.1 The size of a pipe system shall be determined by the maximum gas consumption rate of the appliance(s) to be connected, considering any potential simultaneous demand. The pipe shall be large enough to carry the maximum gas flow without experiencing excessive pressure loss in the line.

7.4.1.2 Figure 1 to figure 4 (inclusive) and figure 10 to figure 16 (inclusive) are examples of how the gas pipeline can be connected. **Amdt 1**

NOTE For typical sizes of connecting pipes that are connected to individual appliances, see annex D.

7.4.2 Regulators

7.4.2.1 General

7.4.2.1 All regulators shall have a valid permit as issued by the safe appliance scheme or the safe gas equipment scheme as applicable.

7.4.2.2 Single-stage low-pressure regulators shall comply with the requirements as given in SANS 1237.

7.4.2.2 First-stage regulator

A first-stage regulator delivering an intermediate pressure is normally required where gas draw-off points in an installation are a considerable distance from the container position and the gas demand is high. The pressure regulator at the container is set to deliver at a pressure higher than the appliance operating pressure. This regulator shall be fitted outside of the building directly to the gas supply or manifold system. Cognisance shall be taken of the vapour pressure of LPG and the lowest ambient temperature of the area to ensure that the LPG vapour does not reliquefy. Gas pressure regulators for inlet pressures up to 100 bar shall comply to relevant regulator standard.

7.4.2.3 Second-stage regulator

A second-stage regulator shall only be installed between the first-stage regulator and the appliance. This second-stage regulator may be installed inside a building, however, if it has a pressure relief valve for gas release, it shall be piped to the outside of the building. The breather hole in a regulator casing does not need to be piped to the outside.

7.4.2.4 Single-stage regulator

7.4.2.4.1 Single stage regulators shall not be installed inside the building unless they are fitted directly to a gas container.

7.4.2.4.2 Any low pressure regulator shall be renewed at least every 10 y.

7.4.3 Installation and layout of pipework

7.4.3.1 General

7.4.3.1.1 The following requirements shall be considered and applied in addition to any similar specific details that might be introduced by the registered installer:

a) HDPE pipes shall be used for the conveyance of LPG vapour only, and shall be buried;

b) composite pipe is subject to the limiting conditions as stated in table 8 and in addition:

   1) use in ceilings is prohibited unless such pipes are enclosed in a steel sleeve that has no open joints; and

   2) the pipe shall not be used as a pigtail or connected directly to a container or be used as flexible piping;

   NOTE The preferred type of crimp style for use in South Africa is the "U" type.

c) for liquid applications up to and including 32 mm, nominal bore (NB) the pipe shall be schedule 80 for carbon steel or schedule 80S for stainless steel; and may be threaded;

d) for vapour applications, schedule 80 carbon steel and schedule 80S stainless steel pipes may, for sizes up to and including 80 mm, be threaded;

e) schedule 40 and SANS 62-1 (medium) carbon steel and schedule 40S stainless steel pipes may, for sizes up to and including 32 mm, together with all attached fittings, be threaded for vapour application only. For sizes above 32 mm, pipes shall only be joined by welding or flange;

f) where electrical cables are being run on the same wall, gas pipes shall be at least 150 mm apart from the electrical cables and other electrical apparatus (see also 7.4.3.4.8). This excludes electric cables in appliances.

7.4.3.1.2 If the building shows any sign of settlement or cracking and, in places where expansion joints are applied, the pipework shall be protected against stresses caused by further movement of the building. For example, the pipework should be mounted on wooden battens or consist of ample bends that will allow the pipe to flex without being excessively stressed in the affected area.

7.4.3.1.3 Gas piping shall not be used as an earth for electrical circuits.

7.4.3.1.4 In buildings with wooden floors that consist of floor boards supported on joists and in which the piping is installed before the boards are laid, the pipes shall run between and parallel to the joists and shall be provided with proper supports.

NOTE 1 The usual method of securing the pipes to the side of a joist with clips is recommended.

NOTE 2 Where this is not possible, they can be laid across the joists in notches, provided that the depth of the notches does not exceed one-fifth of the depth of a joist and their distance from the edge of the nearest support for the joist does not exceed one-sixth of the span between joist supports.

7.4.3.1.5 Where practicable, notches shall have radiused corners, for example, the notches should be formed by cutting into drilled holes.

7.4.3.1.6 Where pipes cannot be laid parallel to joists and the depth of the joists and the depth of the required notches do not allow the use of a pipe of the required size, a number of smaller pipes of equivalent total capacity can be used (see also 7.4.3.3). Spaces below wooden floors without sufficient cross ventilation shall be considered a critical location.

7.4.3.1.7 Burrs formed when a pipe is cut, shall be removed, and any dust, dirt and scale inside the piping and pipe fittings shall be cleaned out before assembly.

7.4.3.1.8 During the installation stage, care shall be taken to ensure that the bore of a pipe is not restricted by the entry of any material.

7.4.3.1.9 While pipe fitting is in progress, all open pipe ends shall be temporarily capped or plugged (with a screwed plug or a cap specifically designed for the purpose) pending extension or completion of the installation.

7.4.3.1.10 The use of wooden and similar plugs are not acceptable.

7.4.3.1.11 Emphasis shall be placed on the need to

a) avoid interference with other installed services,

b) provide reasonable access for inspection, and

c) avoid the exposure of the pipes to abnormally high or low temperatures.

7.4.3.1.12 When piping will be laid in positions where abnormally low temperatures can occur, the piping shall be lagged.

7.4.3.1.13 A pipe, conduit, sleeve, or other equipment recessed into any structural or separating element which is required to have a fire resistance, shall be set into such element in such a manner that such fire resistance is not reduced to below the required fire resistance (see SANS 10400-T).

7.4.3.1.14 When pipes pass through sleeves or apertures in a separating element or any other fire-resistant structure, the space between the pipe and the sleeve or aperture shall be fire stopped with a suitable system of the same rating of the element it passes through. Such system shall have a test report prepared in accordance with the requirements of SANS 10177-2 and shall be installed in accordance with the provisions relating thereto. Every filling or seal subsequently disturbed shall be restored to its original condition. Provision shall be made for the expansion of pipes between fixed points. PVC sleeves shall not be used in this instance.

7.4.3.1.15 The proposed system should have a technical report for the intended application, installation instructions and certification on completion.

7.4.3.1.16 Metallic pipes that pass through separating elements should be suitably insulated to prevent fire spread through conduction.

7.4.3.2 Buried pipelines

7.4.3.2.1 All pipes shall be installed to a depth of at least 500 mm, measured from the surface to the top of the pipe. For separation distances to other services, see figure 33. For buried pipelines, the backfill shall incorporate an underground warning tape, which shall consist of a yellow inert plastic film with the words "DANGER: BURIED GAS LINE BELOW" or similar in contrasting coloured letters, measuring at least 40 mm high. The tape shall be formulated to resist degradation due to acids and alkalis found in soils, such as polyethylene. For non-metallic buried pipes, the tape should include a metallic component, such as an aluminium wire or tape, to identify the existence of the pipe.

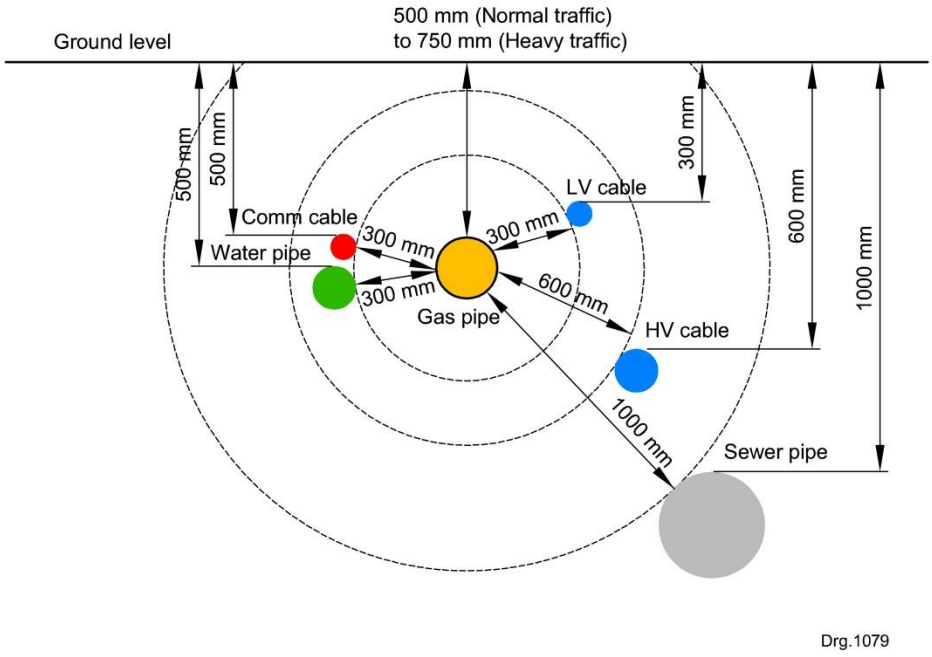


Figure 33 — Minimum separation distances of other services from gas piping

7.4.3.2.2 One of the following materials shall be used as backfill:

a) sand: clean, free from any organic material, for example:

   1) plaster sand,

   2) building sand, and

   3) river sand;

b) gravel: clean and free flowing naturally rounded cohesionless gravel of nominal diameter 6 mm and of particle size diameter in the range 3 mm to 10 mm. A washed river sand would also fall under this classification.

c) Native soil from the excavation shall not be used for backfilling unless it is sifted with a maximum 6 mm sieve.

d) Clay, silts, slags, and cinders shall not be used.

7.4.3.2.3 All buried pipework shall be covered by backfill of thickness at least 300 mm. Only clean backfill shall be used around piping.

Ensure that the bottom of the excavation is flat, level and free from rocks and other foreign objects, and that the highest point of the excavation is covered with at least 150 mm of backfill material.

7.4.3.2.4 All other joints that are not welded, soldered or electrofusion joints (for example mechanical joints) shall be available for maintenance and shall not be buried.

7.4.3.2.5 HDPE pipes and fittings shall not be used above ground. When used underground these assembled joints shall be electrofusion welded to the pipe. Mechanical joints shall not be used underground. Where a riser is used the mechanical joint shall be above ground with the riser section not being more than 500 mm. Such risers shall be physically covered against the effect of direct sunlight and protected against physical damage.

7.4.3.2.6 Where underground piping is beneath driveways, roads, or streets, possible damage by vehicles shall be taken into account.

NOTE Welded, soldered or, in the case of HDPE piping, electro-fused jointing are excluded and not considered mechanical joints.

7.4.3.2.7 Underground installations shall be at least 300 mm from gas lines (see figure 34). This distance shall be maximised to facilitate future excavation. Under exceptional circumstances, if a distance of 300 mm cannot be achieved, the distance may be reduced provided that rubber pads are installed.

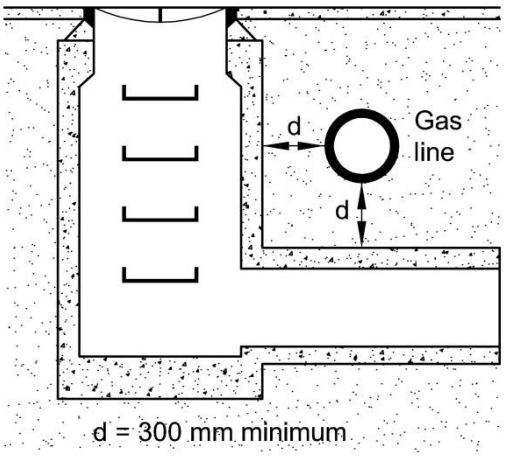


Figure 34 — Crossing of underground installation

7.4.3.3 Concealed pipework

7.4.3.3.1 When pipes are chased in a concrete floor

a) any portion of the pipe shall be placed at least 50 mm measured from the top, or bottom of the floor to the closest surface of the pipe, as appropriate (also see 7.4.3.1.7),

b) all joints in steel pipes shall be welded,

c) all joints in copper pipes shall be soldered,

d) no mechanical joints shall be buried or embedded in floors or walls, and

e) steel and copper pipes shall be protected against corrosion in an approved manner.

NOTE Protection may mean an electrical conduit for copper tubing, or a wrapping for copper or steel piping, or plastic coating, etc.

7.4.3.3.2 Pipes that are to be embedded in concrete before the completion of a floor shall

a) not have any type of mechanical joint,

b) when steel or copper piping is used for this purpose, be protected against corrosion in an approved manner,

c) be placed at least 50 mm below the top of the floor, and

d) be pressure tested.

7.4.3.3.3 If a system of ducts is used, ventilation to open air shall be provided at the lowest point.

7.4.3.3.4 Branches in pipelines shall be developed with the use of standard wrought steel pipe fittings.

7.4.3.3.5 Copper pipes passing through any wall or ceiling shall be sleeved.

7.4.3.4 Pipes in critical locations

7.4.3.4.1 Critical locations are locations where gas cannot be vented freely to the atmosphere. Examples of these locations are basements, the cavities of cavity walls, lift shafts, flues, ceiling voids, roof voids, floor voids or air ducts.

7.4.3.4.2 With the exception of steel pipes listed in 7.1, all pipes passing through lift shafts, flues, ceiling voids or floor voids and air ducts shall be sleeved (see 7.4.3.1.1(b) and 7.4.3.3.5).

7.4.3.4.3 Where pipes pass through cavity walls, such pipes shall be sleeved. Pipes shall not be placed vertically or horizontally in the void of a cavity wall.

7.4.3.4.4 Where copper tubes are used, they shall have no mechanical joints and shall be sleeved.

7.4.3.4.5 Care shall be taken to ensure metal to metal contact is prevented where sleeve and pipe are of dissimilar metals.

7.4.3.4.6 Gas pipelines should not be installed in any dedicated emergency route. However, where approval from the local authority has been granted for installation in emergency routes, the pipe shall be schedule 40 piping, be of welded construction (see also 7.4.3.4.8), have no joints and shall be for vapour use only.

7.4.3.4.7 The steel pipes listed in 7.1 may be installed in critical locations, provided that no mechanical joints shall be made within these areas. Where pipes are to be welded, a competent person (welder) shall undertake this work.

7.4.3.4.8 Where pipes are installed in accordance with the requirements of 7.4.3.4.6, a pressure test of at least 400 kPa shall be done to ensure that no leaks are in the system. The pressure shall be maintained for at least 1 h to ensure that no pressure drop occurs.

7.4.3.4.9 Gas piping shall not be laid in the same service as "Electrical Bus-Bars".

7.4.3.4.10 Gas piping shall be at least 150 mm away from any electrical cables where they run parallel to each other (see also 7.4.3.1.1(f)). Gas piping may cross electric cables or vice versa, provided that these do not come into contact with each other and there are no joints in either line within 150 mm of such crossings.

7.4.3.5 Supports and fixings for pipework

7.4.3.5.1 Piping shall be firmly supported, and particular attention shall be given to the strength and security of hangers and similar supports.

7.4.3.5.2 The intervals between supports and fixings shall be as given in table 11 and table 12.

Table 11 — Intervals between pipe supports for rigid steel pipes

1	2	3
Nominal size of pipe mm	**Maximum interval between pipe supports** m	
	Vertical runs	**Horizontal runs**
10	1,8	1,2
15	2,4	1,8
20	3,0	2,4
25	3,0	2,4

Table 12 — Intervals between pipe supports other than rigid steel pipes

1	2	3
Nominal size of pipe mm	**Maximum interval between pipe supports** m	
	Vertical runs	**Horizontal runs**
8	1,2	0,6
10	1,5	0,9
15	1,8	1,1
20	2,4	1,8

7.4.3.5.3 A support shall be provided within 150 mm of each pipe fitting. Supports shall be provided adjacent to each bend in a pipe. Heavy components installed in the pipeline (for example, regulators, changeover device, and manifold valves) shall be supported independently of the pipeline. On single applications where the joint is made between the hose and the pipe, the pipe shall be supported at that joint. Metal saddles should be used. Care shall be taken to ensure metal to metal contact is prevented where saddle and pipe are of dissimilar metals. PVC saddles should not be used outdoors as these become brittle due to UV radiation and break easily.

7.4.3.5.4 To allow for the use of tools on a joint without damaging the supporting surface, pipework and supports shall be so arranged that joints stand clear of the surface on which they are supported.

7.4.3.6 Disconnection and clearing

Pipe runs require enough connectors or unions to allow the removal or alteration of lengths of pipe with minimum damage to the structure and surrounding decorations. To effectively purge a pipeline, appropriate gas bleeding arrangements shall be included in the pipeline, if not available on the appliance.

7.4.3.7 Reduction of resistance to flow

To prevent restriction of gas flow, the number of pipe fittings shall be kept to a minimum, and sharp changes of direction shall be avoided. A bend in a pipe shall be of radius at least five times the diameter of the pipe and shall be free from kinks. When fittings are used to cause a change of direction, bends shall be preferred.

7.4.3.8 Position of fixed gas supply points

7.4.3.8.1 Each gas supply point shall be situated to suit the position of the appliance that it serves, and shall allow for convenient coupling to the appliance. Until the appliances are connected, each point shall be securely capped or plugged, and so marked as to indicate that it is a gas point. Where the appliance is removed from the system in use, such a gas point shall also be capped or plugged.

7.4.3.8.2 The gas supply point to a built-in space heater shall be as recommended by the manufacturer.

7.4.3.8.3 Each point intended for connection to an appliance shall have a shut-off valve.

7.4.3.8.4 Shut-off valves shall be accessible at all times.

7.4.4 Identification of pipework

Above ground piping shall be identified as gas pipe and comply with the requirements as given in SANS 10140-3. Gas piping shall be identified for type of use and appropriately marked with "LPG-vapour or LPG-liquid" as applicable every 2 m.

7.5 Joints and fittings (cocks, valves and unions)

NOTE See also tables 4 to table 10 for specific requirements.

7.5.1 Except for welded, soldered or electro fused joints, all joints, cocks, valves and unions (including the unions on gaslight fittings) shall be readily accessible for maintenance and repair, and all joints shall be so made as to avoid undue strain in the pipe system.

7.5.2 Joints in steel pipes can be made by welding, brazing or screwed connection (see also 7.3.3.1). Only a competent person, who can provide proof of competency in welding, shall carry out welding and brazing.

7.5.3 Screwed connections, both male and female threads shall be of matching type. Particular care shall be taken to ensure that mating screw threads are of the same type, form and designation. No joint shall be made by over-torque of unmating threads or by relying on the jointing compound for sealing. All threaded connection shall be of metallic construction.

7.5.4 Only approved jointing material shall be used on male threads of screwed components. Hemp shall not be used. Liquid sealants that become rigid when cured shall not be used.

7.5.5 Washers, gaskets and joint rings used for flanged joints shall be strong, gas-tight and durable.

7.5.6 In installations involving a number of branch lines, each branch line that supplies a different occupancy, tenancy or division or group thereof, shall have a shut-off valve to allow its repair without shutting off the whole installation. This shut-off valve can also be designated as in 7.2.2.

7.6 Flexible tubing and hose

7.6.1 Appliances that have to be moved for cleaning shall be connected to the gas system by flexible tubing or hose (see 6.2.4).

7.6.2 Flexible tubing or hose can also be used for simple single container installations in which the container is located indoors and directly connected to one appliance by means of a gas-pressure regulator.

7.6.3 The length of a flexible tube or hose shall not exceed 2 m, and flexible piping shall not extend from one room to another or pass through any wall, ceiling, window or floor. **Amdt 1**

7.6.4 Flexible tubing and hose shall be installed away from any position of mechanical damage and in a position where it can be inspected at appropriate intervals (see 10.1).

7.6.5 Only approved types of nozzle (see SANS 1237) shall be used as end connections. The ends of the tubes or hoses shall fit tightly over the inlet part of the nozzle.

7.6.6 All hose shall be clamped in position on the nozzle with a hose clamp.

7.6.7 Flexible tubing and hose shall not be exposed to heat in excess of 50 °C. Particular care shall be taken when connecting a gas stove or a hotplate to ensure that the run of tubing or hose is kept well below the level of the open burners. The tubing or hose shall also be kept well clear of the oven vent and should not be taken around the back of the stove or flue outlet.

7.6.8 Each connecting tube or hose shall be in one piece and shall supply only one appliance, i.e. there shall be no joints or T-junctions along its length.

7.6.9 Flexible tubing and hose shall be checked for signs of rupture, cracking and perishing, and shall be replaced if necessary but at least every 5 y from date of installation.

7.6.10 For flexible hose and tube assemblies see 6.2.4 and table 11. **Amdt 1**

7.6.11 For manifold pigtail hoses see 5.6.

7.7 Provision of flues

7.7.1 Where an appliance is designed and permitted to be installed indoors with a functioning flue, a flue meeting or exceeding the manufacturer's requirements shall be installed to comply with SANS 10400-V.

7.7.2 Flues shall be designed as described in annex E and permanent ventilation shall be installed in accordance with 6.4.

7.7.3 The provision of flues on appliances is covered in SANS 1539 and flues shall be installed in accordance with the requirements of SANS 1539.

7.7.4 A flue shall not be connected to an existing chimney leading from a fireplace unless:

a) the opening of the fire place is permanently sealed and the existing chimney free of soot; or

b) the flue is installed through the total height of the existing chimney to the outside, capable of removing the combustion gases to the outside, whilst ensuring the existing chimney for the open fire still functions adequately.

7.7.5 A flue shall be clear of all obstructions that might impede the flow of exhaust gases, and the cross-sectional area of the flue shall nowhere be less than that of the flue collar on the appliance. A flue pipe shall not enter into a draught diverter far enough to cause an obstruction.

7.7.6 Bends or sudden changes in the size and shape of the cross section of flues shall not impede the draw of the flue.

7.7.7 Where two or more appliances are vented into a common flue, the individual flue pipes shall be joined by Y-pieces situated at the greatest practicable height above the appliances. The cross-sectional area of the common flue pipe shall be at least equal to the combined area of the flue collars on the individual appliances.

7.7.8 A flue pipe shall run as near to the vertical as possible throughout its full length. Horizontal runs are not recommended and shall be kept to a minimum and be as short as possible. Joints in the flue shall be so constructed that condensate cannot seep through the joint and out of the flue.

7.7.9 Where horizontal runs cannot be avoided entirely, the horizontal sections shall be positioned as far above the appliance as the layout will allow, and their total length shall not exceed 75 % of the total vertical run. The horizontal pipes shall also rise slightly towards the flue outlet (enough to ensure that any water that might condense in the flue will drain back towards the appliance). If the use of bends in a flue is unavoidable, a bend of 45° is preferred. Where, however a 90° change in direction is unavoidable, a 90° bend with a radius of at least three times the flue diameter shall be used.

7.7.10 The flue outlet shall be so positioned as to prevent down draughts. Frequently this means that the outlet shall be above the highest point on the building, for example, approximately 1 m above the roof ridge or, in the case of a flat-roofed building, 1 m above the parapet. The outlet shall have a rainproof terminal or cowl of a type that does not restrict the flue. This cowl shall be screened to prevent birds from nesting in it (see also annex E).

7.7.11 Excessive cooling of flue pipes can lead to reduced draught or heavy condensation inside the pipes (or both). Flues shall be routed indoors as much as possible and thermally insulated where needed. If cooling and condensation are expected to be problematic, a condensate trap shall be fitted at a suitable low point in the flue.

7.7.12 The entire flue installation shall be completely fire resistant. Flue pipes shall be securely fastened to stand clear of walls and ceilings. Where flue pipes pass through a ceiling, sleeves and ceiling plates shall be fitted.

7.7.13 When a flue pipe system is designed, careful consideration shall be given to the danger of a flue causing fire in the woodwork or other combustible material in a building. No fluepipe system shall pass through or within 75 mm of any combustible material, such as thatch roof, timber floor joist, trimmer or roof truss, or batten unless a fire resistant, heat-insulating screen is fixed between the flue pipe(s) and the combustible materials to ensure that the surface temperatures of the latter do not rise above 50 °C. The clearance between any such screen and the flue pipe(s) shall be at least 25 mm. Alternatively a suitable double skin insulated flue may be used.

7.7.14 Flue pipes shall be securely fixed and supported, and shall convey the flue gases to the outside of the building. When a flue pipe passes through a roof or an outside wall, the junction shall be fully resistant to weather and fire, and the materials used for this purpose shall also be resistant to corrosion.

NOTE If it is inconvenient or impossible for a flue pipe to pass through a roof (i.e. if it has to be taken through a wall), a vent tile or other approved wall terminal may be used provided that it is properly positioned. Alternatively, where the eaves permit, the flue may have a vertical section (riser) that is fitted with a suitable terminal that does not obstruct or reduce the effective cross-sectional area of the flue or vent outlet.

8 Inspection, testing, and instructions to users

8.1 Inspection and testing of new vapour installations

8.1.1 General

8.1.1.1 On completion, and before commissioning, the installation shall be inspected, tested, and approved by the registered gas practitioner. The user shall be issued with a report that indicates that the installation has been tested and that it complies with this part of SANS 10087.

8.1.1.2 The installation of new vapour installations shall be tested in the following sequence:

a) high-pressure stage;

b) intermediate-pressure stage (when used); and

c) low-pressure stage.

NOTE For inspection and testing of new liquid installations, see SANS 10087-3.

8.1.2 High-pressure stage

The valves and high-pressure connections shall be tested for leaks. For a twin container installation, the following shall be carried out:

a) Close off the reticulation line.

b) Open the gas container(s) and use a soapy solution to test the manifold and pigtails connection(s) for leaks.

8.1.3 Intermediate-pressure stage (when used)

Before conducting the test, the outlet of the secondary pressure regulator shall be closed. The intermediate-pressure stage should then be tested with inert gas, air, or nitrogen at a pressure of 1,5 times the operating pressure for a minimum duration of 30 min, as described below:

a) Ensure that a test point or valve connection is available in the section of the line being pressure tested.

b) Check the operating pressure of in-line equipment prior to testing. Isolate such equipment where the equipment is not able to withstand the required test pressure.

c) Connect the pump to the test point and pressurize the pipeline to 1,5 times the operating pressure.

d) Isolate the pump once the correct pressure has been attained.

e) Leave the pipeline under pressure for at least 30 min and check for a pressure drop.

f) Depressurize the system.

g) Components in the line that are not rated at 1,5 times the operating pressure shall be isolated before testing.

8.1.4 Low-pressure stage

8.1.4.1 The complete low-pressure stage shall be tested in accordance with an acceptable method.

8.1.4.2 To conduct the test, isolate the downstream regulator at the outlet. Use the test method described for the intermediate-pressure stage, with the exception that the pressure for this test shall be at least 22 kPa.

8.1.4.3 Leave the pipeline under pressure for at least 30 min and check for any leaks in the system.

8.1.5 Commissioning an appliance

An appliance shall be commissioned as follows:

a) Turn on the gas supply and purge the air from the system into a well-ventilated area.

b) Connect a manometer or an approved tester (see figure 35) to the appliance test point (see 6.2.2 for the installation of test points).

c) Check and note the gas pressure with

1) all the burners alight,

2) only the smallest burner in the installation alight, and

3) all the burners turned off.

NOTE For additional information, see annex C.

d) The type and size of the regulator and the performance of a low-pressure system can be regarded as satisfactory if there is no fluctuation of pressure in 8.1.5(c)(1) and 8.1.5(c)(2) above, and if the pressure

1) does not fall below 2,8 kPa in 8.1.5(c)(1),

2) does not exceed 3,5 kPa in 8.1.5(c)(2), and

3) does not exceed 3,8 kPa in 8.1.5(c)(3).

e) The type and size of the regulator and the performance of a high-pressure system can be regarded as satisfactory if there is no fluctuation of pressure in 8.1.5(c)(1) and 8.1.5(c)(2), and if the pressure

1) does not fall below 2,8 kPa in 8.1.5(c)(1),

2) does not exceed 3,5 kPa in 8.1.5(c)(2), and

3) does not exceed 3,8 kPa in 8.1.5(c)(3).

NOTE Certain appliances operate at a different pressure; therefore, cognisance of the operating pressure of the appliance is to be considered. The correct type of regulator is to be used (for example, adjustable high-pressure regulator) for these appliances.

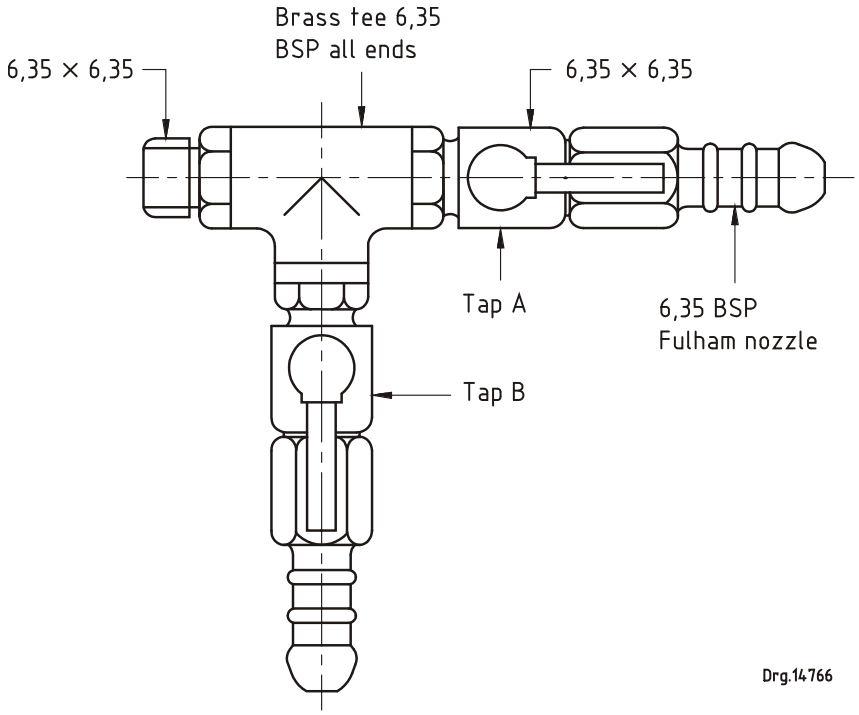


Figure 35(a) — Test fitting

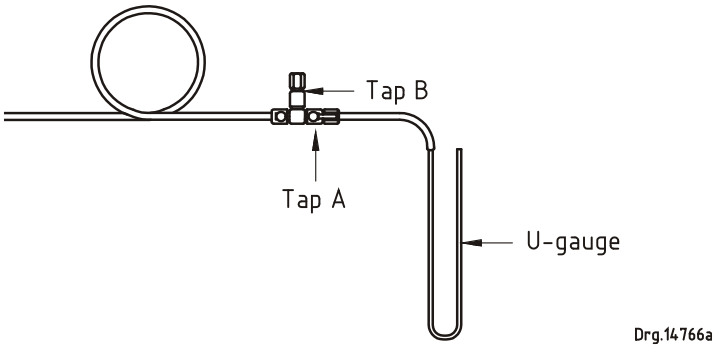


Figure 35(b) — Test arrangement

Figure 35 — U-gauge test

8.2 Instructions to users

8.2.1 On completion of the installation, the registered installer shall provide a certificate to the user as well as all relevant certificates that may be required as part of the installation.

8.2.2 The following markings shall be permanently displayed in a prominent position on or near the installation:

a) the registered installer's name;

b) the date of installation;

c) the registered installer's registration number;

d) whether it is LPG vapour/LPG liquid (whichever is applicable);

e) the registered installer’s telephone number; and

f) safety signs as indicated in 5.2.2.16. **Amdt 1**

8.2.3 The registered installer or authorized company representative shall provide the user with a printed instruction sheet or a booklet that details the correct and safe handling of the LPG systems and appliances, as well as appropriate general emergency procedures.

Particular attention shall be drawn to

a) the changing of containers and the risks involved,

b) the fact that the standby side of the installation shall not be left disconnected from the containers,

c) the action to be taken to disperse accidental accumulation of gas,

d) the action to be taken in case of fire,

NOTE LPG fires may not normally be extinguished unless the source of the LPG can be isolated.

e) the fact that the so-called "empty" containers can be dangerous and shall be kept closed at all times,

f) the premises where gas is installed or used in quantities exceeding of 100 kg shall be registered with the local authority. The registered installer shall ensure that the user or occupier is informed of such requirements before commissioning the installation, and

g) the service intervals and maintenance requirements as indicated in 10.1.

8.2.4 All the above details shall be discussed with users to ensure that they fully understand all the details. Their attention shall also be drawn to the information and warnings (when relevant) given in the product brochures supplied with the appliance.

9 Electrical equipment and other sources of ignition

9.1 For appliances that have an open burner, electrical equipment, such as light switches; plugs and isolators shall be at least 200 mm horizontally from the edge of the closest burner or at least 1,5 m measured from the floor. If a heat deflector is installed above the burner, such as a cooker hood (at least 600 mm from the burner), the electrical point can be installed above or behind the heat deflector (see figure 36 and figure 37). **Amdt 1**

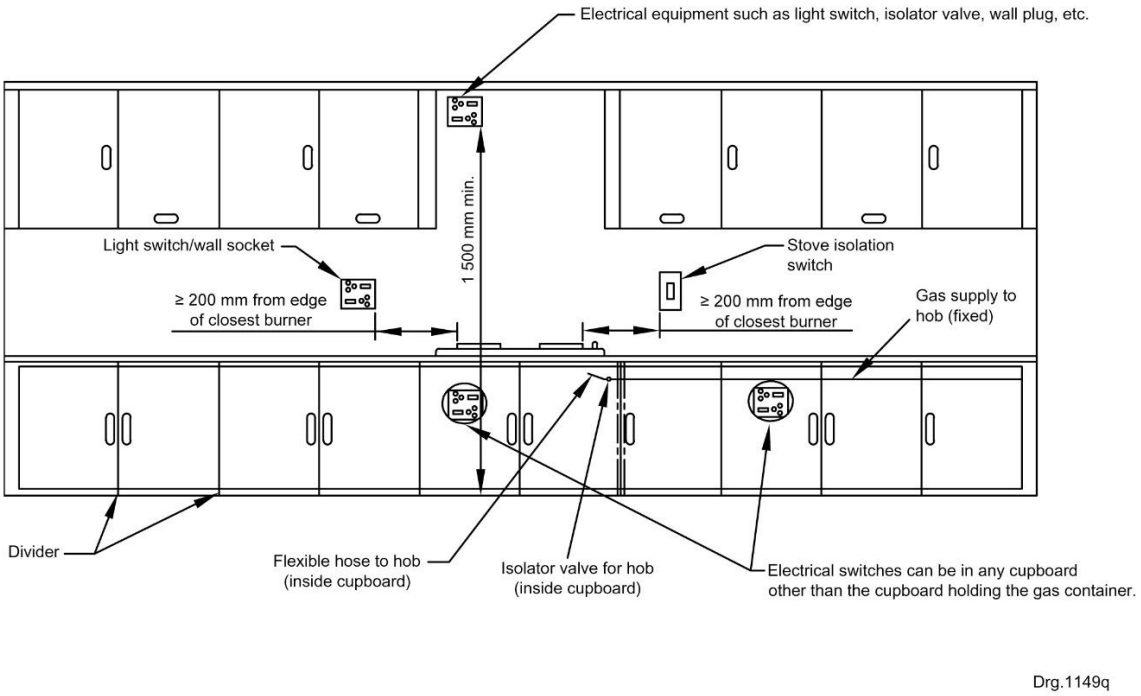
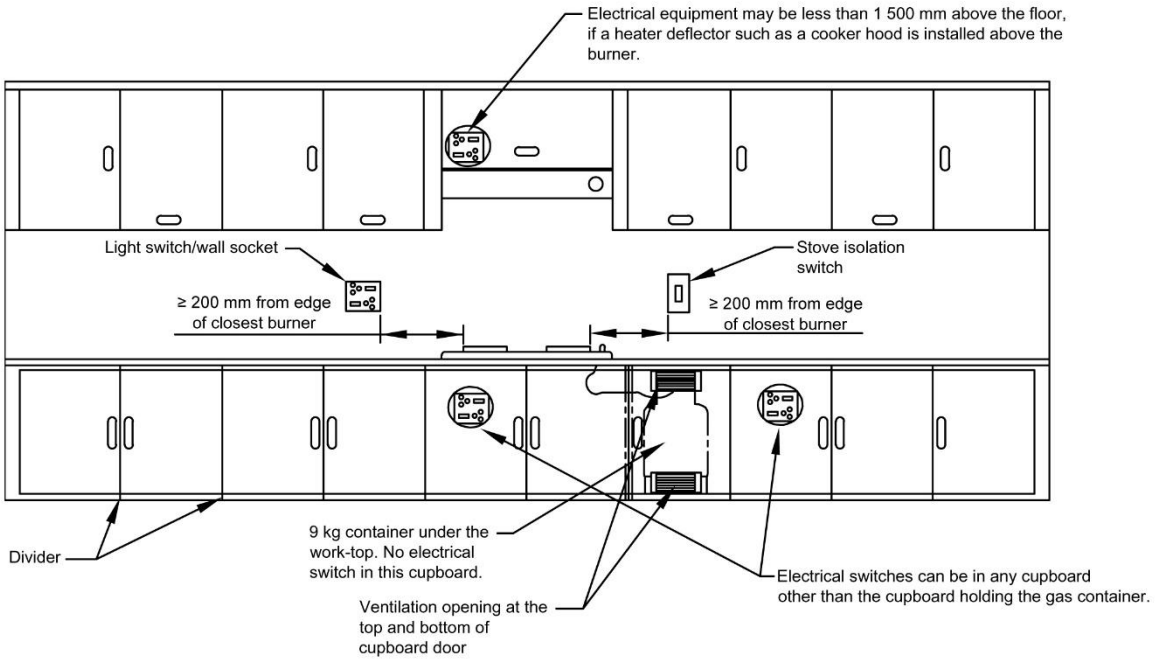


Figure 36 — Typical Installation using a flexible hose and solid pipe



Amdt 1

Figure 37 — Typical installation for gas container directly connected to hob by means of a flexible hose

9.2 All electrical installations shall be carried out by a registered electrical person as required by the relevant national department (see foreword).

10 Ongoing inspection and repair

10.1 Inspection

The user shall be informed that appliances, components, of the installation and the distributing system shall be inspected at regular intervals (not exceeding five years). These inspections are necessary to ensure that all components are operating effectively, and that the system is leak-free.

10.2 Repair

10.2.1 Improper repair or adjustment of LPG installation components can result in hazardous conditions. Only a registered installer or a registered appliance technician, appropriate to the appliance being installed, shall therefore carry out such repairs. This is inclusive of the removal of appliances from a gas system.

10.2.2 Where such appliances are removed from the installation or where an installation has not been completed, all open ends shall be permanently capped using a screwed plug or a cap specifically designed for the purpose, pending the extension or completion of the installation. The use of wooden and similar plugs shall be strictly prohibited.

10.2.3 The manifold system shall be maintained on a planned inspection basis at intervals not exceeding five years starting from the date of manufacture.

10.2.4 Repair and maintenance shall only be carried out by a registered installer and the defects in the installation shall be rectified in accordance with the requirements of this part of SANS 10087.

10.2.5 Flexible pigtails shall be inspected for signs of rupture, cracking, chafing, and perishing and shall be replaced if necessary. Pigtails that are over 5 y (as indicated by the date mark on the hose/brass fitting, also refer to 5.6) shall be replaced.

10.2.6 The brackets that secure the manifold shall be checked for soundness.

10.2.7 The pipework shall be checked for corrosion and identification.

10.2.8 All valves shall be checked for free and full range of movement, leakage, positive shut off, corrosion and mechanical damage.

10.2.9 The hydrostatic relief valve on liquid manifolds shall be inspected for corrosion and for any ingress of foreign bodies into the operating mechanism. The relief valve shall be replaced if it exceeds 5 y from the date of manufacture.

10.2.10 The regulator shall be checked for corrosion and mechanical damage. Where corrosion or mechanical damage is found, the regulator shall be replaced or refurbished.

10.2.11 If gauges are fitted, they shall be checked for correct operation, and the gauge faces shall be cleaned.

10.2.12 The system shall be leak-tested at all joints using a leak detection solution or system. All joints where leaks become evident, shall be tightened or remade after the system has been depressurized.

11 Decommissioning of LPG installations

11.1 Where an installation or part of an installation is no longer in use, any associated equipment shall be removed from such premises by a registered installer.

11.2 Before the removal of an installation or part of an installation, the registered installer shall ensure that the removal of such a system shall not affect the safety of any person, the safe working of any part of the installation (should it only be removed in part), or any other LPG installation.

11.3 Removing the entire installation involves removing at least the container, regulator, manifold, vaporizer, appliance connection, and any related signage. As much of the pipework as possible shall be removed and all open ends of any remaining pipes shall be permanently capped using a screwed plug or a cap specifically designed for the purpose.

11.4 On completion of the decommissioning, the registered installer shall notify the body appointed by the Chief Inspector of the relevant national department (see foreword), as well as the local authority if such installation was required to be registered (see 5.3.7), of such removal. **Amdt 1**

11.5 For such modification or the removal of an installation, an installation report shall be issued.

Annex A
(normative)

In-situ container filling requirements

A.1 General

This part of SANS 10087 applies to situations where the containers are installed on a customer's premises in their normal fixed location and are filled on site directly from a road tanker.

A.2 Containers

Containers can be filled in situ, subject to the following conditions:

a) an individual container shall have a water capacity exceeding 120 L, up to and including 500 L;

b) each container shall be fitted with an approved pressure relief device;

c) each container shall have an automatic shut-off valve which shall operate at the maximum allowed liquid level (80 %) applicable to the container being filled;

d) each container may be fitted with a float level gauge device;

e) vent filling should not be allowed;

f) In the case of direct filling, such containers shall be restrained that they remain upright in the event of a break away. In the case of remote filling, the filling point shall be firmly secured; and

g) Each container shall be placed at least 100 mm from any wall or obstruction, including another container, so as to allow for the inspection of the container (see A.3) to be conducted and shall have a clearance of at least 1 m to the front of the container for accessibility.

A.3 Filling

A.3.1 General

A.3.1.1 Any person filling a dumpy container shall be fully trained.

A.3.1.2 The pre-filling inspection and actual filling of containers shall be done in accordance with the relevant clauses of SANS 10087-7.

A.3.1.3 The dumpy container shall not be due for a periodic inspection or testing.

A.3.1.4 Any permission to fill the container shall be granted by the owner of the container in writing, since the container history is an essential reference for correct filling.

A.3.2 In-situ container filling

A.3.2.1 Filling operations shall not be conducted by a single operator unless the container being filled is visible to the operator while positioned on the truck. All persons carrying out the filling operation shall be fully trained in accordance with SANS 10087-3 and SANS 10087-4.

A.3.2.2 Filling of containers shall not be carried out at night or in poor lighting conditions, unless all essential gauges, connections, and valves are illuminated by suitable lighting. The lighting shall comply with electrical standards for the defined hazardous atmosphere zones.

A.3.2.3 The vehicle shall be so positioned that its hose is within easy reach of the filling connection point.

A.3.2.4 The hand brake of the vehicle shall be on, and shall carry chocks which shall be used to prevent the vehicle from rolling when parked. The engine of the vehicle shall not be running, except when it is needed to operate the pump, and the bonding cable shall be attached.

A.3.2.5 One of the extinguishers shall be removed from its mounting and kept at a ready position whilst the operator remains in attendance.

A.3.2.6 Before starting the filling operation, the surroundings, the vessel, and the connections shall be visually inspected to ensure that there are no unusual or hazardous situations and conditions.

A.3.2.7 Warning notices, in accordance with SANS 1186-1, PV1 (smoking prohibited), PV2 (fire or light or both prohibited), PV3 (thoroughfare for pedestrians prohibited) shall be prominently displayed in addition to signage fitted to the vehicle.

A.3.2.8 Before connecting an LPG delivery hose, it is important to ensure that the operator and the storage container are at the same electrical potential. The operator will achieve this by touching the container with a bare hand while holding the nozzle of the hose delivering the LPG. This precaution prevents the possibility of an ignition spark caused by the discharge of static electricity that may have built up in the operator's body.

A.3.2.9 When filling operations are commenced, a further examination for leakage at connection points shall be carried out.

A.3.2.10 When gauges indicate that nearly the required amount of LPG has been transferred to the storage vessel, the flow shall be shut off.

A.3.2.11 After the completion of the transfer of LPG, all connections shall be disconnected and a full inspection shall be made to ensure that the facility is safe, and the vehicle is in a fit condition to be driven away.

A.4 Vehicle bonding and earthing

A.4.1 Earthing

A.4.1.1 The pipework at the bulk vehicle off-loading point shall be earthed.

A.4.1.2 The earthing conductor shall be attached to the pipes as close as possible to the coupler where the hose will be connected.

A.4.1.3 This earth point 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 point or an earthing conductor connected to the pipework and to the equipotential earthing system.

A.4.2 Bonding

A.4.2.1 The vehicle bonding cable shall be attached to the off-loading earth point.

A.4.2.2 The bonding cable shall be the first connection made to the earth point (before any hoses are attached) and it shall only be removed after all hoses have been disconnected.

A.5 Positioning of vehicle during in-situ filling

The road tanker shall be positioned as follows:

a) All practical steps shall be taken to park the tanker away from public roads. Only rigid tankers may be used to fill from the roadway, and cognisance shall be taken of the restrictions contained in the relevant national legislation (see foreword),

b) Warning signs complying with SANS 1186-1 shall be displayed indicating no smoking, no naked flame, no unauthorized entry, and no cellular phones allowed,

c) Road tankers shall be at least 3 m away from any container and fill point (or both),

d) Consideration shall be given for electrical zoning (see SANS 10087-3),

e) The tanker shall be parked so that it can be readily driven or towed away in an emergency without recourse to reversing,

f) The tanker shall not obstruct entrances to buildings or obstruct fire escapes and shall be located as far as practical from open doorways,

g) No delivery hoses shall pass through any buildings or over, or under any wall or fence, and

h) Filling across a pavement or public walkway is only permitted when approved by the local authority and under conditions specified by the local authority.

A.6 Supervision of road tanker

Any road tanker exceeding 10 000 kg of LP gas shall be under constant supervision in accordance with SANS 10231.

Annex B
(informative)

Occupancy classification in accordance with SANS 10400-A

Table B.1 gives the occupancy or building classifications in accordance with SANS 10400-A.

Table B.1 — Occupancy or building classifications in accordance with SANS 10400-A

1	2
Class of occupancy	**Occupancy**
A1	**Entertainment and public assembly** Occupancy where persons gather to eat, drink, dance or participate in other recreation.
A2	**Theatrical and indoor sport** Occupancy where persons gather for the viewing of theatrical, operatic, orchestral, choral, cinematographical or sport performances.
A3	**Places of instruction** Occupancy where school children, students or other persons assemble for the purpose of tuition or learning.
A4	**Worship** Occupancy where persons assemble for the purpose of worshipping.
A5	**Outdoor sport** Occupancy where persons view outdoor sports events.
B1	**High risk commercial service** Occupancy where a non-industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions.
B2	**Moderate risk commercial service** Occupancy where a non-industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.
B3	**Low risk commercial service** Occupancy where a non-industrial process is carried out and where neither the material handled nor the process carried out falls into the high or moderate risk category.
C1	**Exhibition hall** Occupancy where goods are displayed primarily for viewing by the public.
C2	**Museum** Occupancy comprising a museum, art gallery or library.
D1	**High risk industrial** Occupancy where an industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions.
D2	**Moderate risk industrial** Occupancy where an industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.
D3	**Low risk industrial** Occupancy where an industrial process is carried out and where neither the material handled nor the process carried out falls into the high or moderate risk category.
D4	**Plant room** Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building.

Table B.1 (*concluded*)

1	2
Class of occupancy	**Occupancy**
E1	**Place of detention** Occupancy where people are detained for punitive or corrective reasons or because of their mental condition.
E2	**Hospital** Occupancy where people are cared for or treated because of physical or mental disabilities and where they are generally bedridden.
E3	**Other institutional (residential)** Occupancy where groups of people who either are not fully fit, or who are restricted in their movements or their ability to make decisions, reside and are cared for.
E 4	**Health care** Occupancy which is a common place of long term or transient living for a number of unrelated persons consisting of a single unit on its own site who, due to varying degrees of incapacity, are provided with personal care services or are undergoing medical treatment.
F1	**Large shop** Occupancy where merchandise is displayed and offered for sale to the public and the floor area exceeds 250 m^2.
F2	**Small shop** Occupancy where merchandise is displayed and offered for sale to the public and the floor area does not exceed 250 m^2.
F3	**Wholesalers' store** Occupancy where goods are displayed and stored and where only a limited selected group of persons is present at any one time.
G1	**Offices** Occupancy comprising offices, banks, consulting rooms and other similar usage.
H1	**Hotel** Occupancy where persons rent furnished rooms, not being dwelling units.
H2	**Dormitory** Occupancy where groups of people are accommodated in one room.
H3	**Domestic residence** Occupancy consisting of two or more dwelling units on a single site.
H4	**Dwelling house** Occupancy consisting of a dwelling unit on its own site, including a garage and other domestic outbuildings, if any.
H5	**Hospitality** Occupancy where unrelated persons rent finished rooms on a transient basis within a dwelling house or domestic residence with sleeping accommodation for not more than 16 persons within dwelling unit.
J1	**High risk storage** Occupancy where material is stored and where the stored material is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions.
J2	**Moderate risk storage** Occupancy where material is stored and where the stored material is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.
J3	**Low risk storage** Occupancy where the material stored does not fall into the high or moderate risk category.
J4	**Parking garage** Occupancy used for storing or parking of more than 10 motor vehicles.

Annex C
(informative)

Testing the adjustment of burners

C.1 Check the operation of each burner in every appliance and ensure that the aeration controls are correctly adjusted and locked.

C.2 Check the performance of the thermostats on ovens with a suitable thermometer.

C.3 Ensure that the pilot burner and flame failure devices function correctly.

C.4 Check all water heaters for water discharge temperature and ensure that their adjustments are correctly set.

Annex D
(informative)

Determination of pipe sizes

D.1 Calculation of pipe size in relation to demand rate

D.1.1 To determine the size(s) of pipe required in a gas pipe system, it is necessary to establish the amount of gas (expressed in terms of MJ/h) that passes through each section of pipe when all the appliances are turned full-on.

D.1.2 The rating of each appliance is given in the manufacturer's service manual or on the appliance data plate. The ratings given in table D.1 may be used as a guide.

D.1.3 The principles used to establish the required pipe diameter is commonly called the "Index Length Method". Another term for this is the "Longest Length Method". As the descriptive name indicates, it uses as the starting point for establishing the pipe diameter required per section, the pipe run in metres to the most remote appliance from the low-pressure regulator.

The pipe size for each section shall be determined using the longest length of piping from the point of delivery to the most remote outlet and the load of the section. This means from the outlet of the low-pressure regulator to the connection point of the appliance furthest from the regulator outlet.

D.1.4 The practical effect of this is that if there are three appliances to be installed, measure the distance that each appliance is from the low-pressure regulator. For example, we have one at 10 m, one at 5 m and one at 12 m. Then the Index Length to be applied when using the pipe sizing tables below would be 12 m. This figure would be used for all the individual appliances, with the only difference between them when reading the tables being the actual gas demand for each appliance.

D.1.5 In the following examples, the pipe length per section is given. However, this is only given to easily identify the longest total run in order to establish the Index Length that is used in reading the pipe sizing tables. The individual pipe section lengths are not referred to when determining from the pipe sizing tables the actual pipe diameter required per section. Only the Index Length is used.

D.1.6 The important figure per individual section is the total gas demand that each section is required to carry.

D.1.7 Always carry out this exercise on each installation to ensure that the pipe diameter per section has enough capacity to carry the gas demand. Failure to do this can easily result in the pipe being too small to supply sufficient gas to meet the appliance demand.

D.1.8 When a pipework system is designed, provision should be made for additional appliances which might be installed at a later date, and pipe sizes should, therefore, be large enough to cater for such future extensions.

D.1.9 The pipe sizing tables below refer only to copper or steel pipe. For information on pipe sizing tables for other pipe materials such as composite pipe or corrugated stainless steel pipe, refer to the manufacturer's published tables.

Table D.1 — Appliance ratings

1	2
Appliance	**Typical rating MJ/h**
Gas stove, normal domestic	42
Gas stove, large domestic	63
Gas hob	35
Portable hotplate (2 burner)	16
Instantaneous water heater-multi point heater (14 L)	117
Instantaneous water heater-multi point heater (11 L)	90
Instantaneous water heater-single point or sink heater	37
Storage water heater – large (135 L)	95
Storage water heater – medium (80 L)	90
Storage water heater – small (60 L)	58
Gas light	2
Refrigerator	2
Space heater – large size with flue	40
Space heater – size flueless	30
Space heater – portable e.g. roll about heater	15
NOTE 50 MJ/h = 1 000 g/h (1 000 g/h lpg = 50 MJ/h heat output).	

Example A is a fully worked example of a basic layout involving three different appliances each with its own gas demand.

NOTE An allowance for bends, elbows, and T-pieces, is included in tables D.2 to D.6 (inclusive). **Amdt 1**

Example B

The objective of this example is to

a) explain the process to establish the index length, and

b) having established the Index Length, identify the minimum pipe diameter per identified pipe section by using the relevant pipe sizing table.

For the purposes of the exercise it is to be assumed that

a) the installation is low pressure, and

b) the piping material is copper.

NOTE The information below refers to figure D.1.

Step 1

Find Index Length =AB + BC + CE + EF = 13 m

Ignore the lengths CD and EG as these branches do not contribute to the calculation of the index length.

Step 2

Find total gas demand for each section

AB + BC = AC = 95 + 35 + 2 = 132 MJ/h

CD = 95 MJ/h

CE = 35 + 2 = 37 MJ/h

EF = 2 MJ/h

EG = 35 MJ/h

Step 3

Find the row to match the Index length using table D.2 for a low-pressure installation in copper pipe. As our index length is 13 m we shall use the row for 15 m. Never size down always use the next higher figure if your measured index length falls between two figures.

The index length is used to all the succeeding length references. The section lengths are not used in determining the pipe diameter to be used.

Step 4

Now that we have identified the row in table D.2 select the pipe diameter for the sections as listed in step 2.

Then: AB + BC = 132 MJ/h

Reading along the row for 15 m in table D.2 and taking note that the rule is to always go to the next higher figure if the rating you are trying to match falls between two figures, we require a pipe diameter for that section of 22 mm.

Then: CD = 95 MJ/h

Reading along the row for 15 m in table D.2 we require a pipe diameter for that section of 22 mm.

Then CE = 37 MJ/h

Reading along the row for 15 m in table D.2 we require a pipe diameter for that section of 15 mm.

Then EF = 2 MJ/h

Reading along the row for 15 m in table D.2 we require a pipe diameter for that section of 9,5 mm.

Then EG = 35 MJ/h

Reading along the row for 15 m in table D.2 we require a pipe diameter for that section of 15 mm.

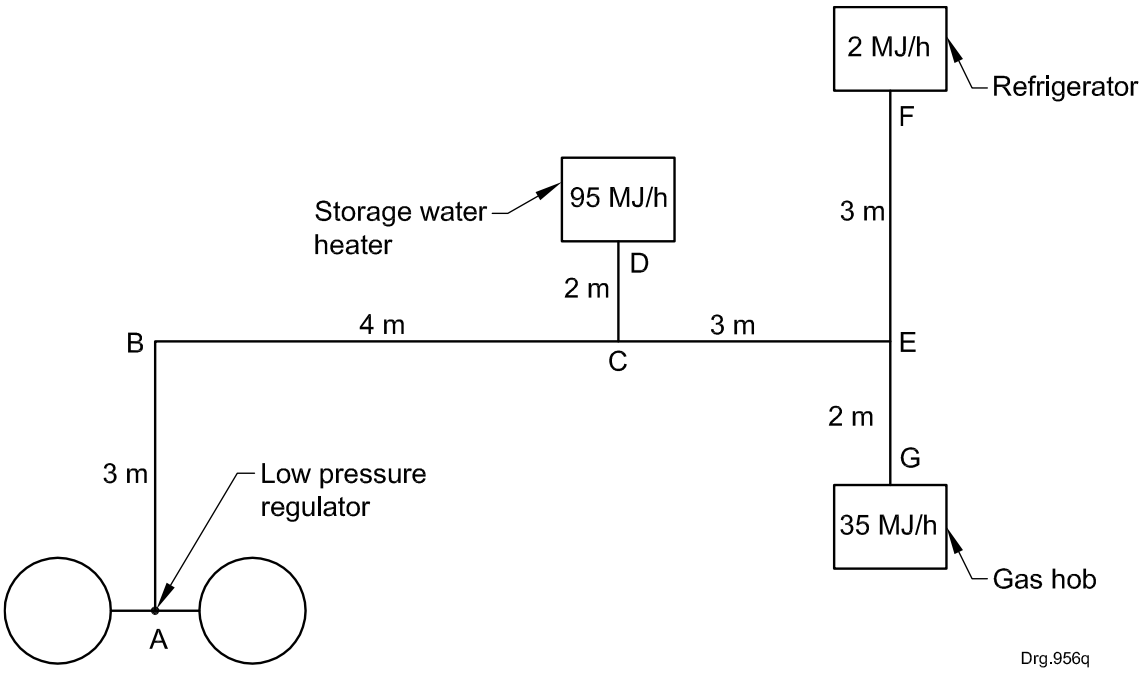


Figure D.1 — Pipe sizing

Table D.2 — Low pressure pipe sizing — Copper pipe pressure drop 0,25 kPa

1	2	3	4	5
Index length	**Pipe diameter in mm**			
	9,5	15	22	28
m	MJ/h	MJ/h	MJ/h	MJ/h
3	48	199	495	1 057
6	33	137	340	726
9	27	110	273	583
12	22	94	233	499
15	20	84	207	442
18	18	75	188	401
21	17	70	173	369
24	16	65	161	343
27	15	60	151	322
30	14	57	142	304
38	12	51	126	269
45	11	47	114	244
53	N/A	42	105	225
60	N/A	39	98	209
75	N/A	35	87	186
90	N/A	32	78	167

NOTE 1 The flowrates above do not include any loses for bends and fittings.

NOTE 2 For pipe runs with bends or fittings, the following can be added:

a) 1 m per elbow tee; and

b) 0,6 m per long bend.

Table D.3 — Low pressure pipe sizing — Schedule 40 pipe pressure drop 0,25 kPa

1	2	3	4
Index length m	**Pipe diameter in mm**		
	15 (1/2)	19 (3/4)	25 (1)
	MJ/h	MJ/h	MJ/h
3	308	644	1 219
6	212	443	834
9	170	356	670
12	145	304	573
15	129	270	509
18	117	245	460
21	107	225	424
24	100	209	394
27	94	196	370
30	89	186	350
38	78	164	310
45	71	148	281
53	66	137	258
60	61	127	241

NOTE 1 The flowrates above do not include any loses for bends and fittings.

NOTE 2 For pipe runs with bends or fittings, the following can be added:

a) 1 m per elbow Tee; and

b) 0,6 m per long bend.

Table D.4 — Low pressure pipe sizing — Corrugated stainless steel pipe pressure drop of 0,250 kPa

1	2	3	4	5	6	7	8	9	10
Length of straight pipe in metres									
DN mm	**2**	**5**	**6**	**8**	**10**	**15**	**20**	**25**	**30**
	LP Gas flow — MJ/h								
12	120	77	70	61	55	45	39	25	32
15	268	173	159	138	124	103	89	80	74
22	591	379	347	301	271	222	193	173	159
28	1 070	676	617	534	477	390	337	301	275
35	1 903	1 145	1 035	883	780	623	531	469	424
40	3 701	2 329	2 124	1 831	1 640	1 336	1 155	1 032	941
50	8 535	5 410	4 941	4 282	3 832	3 132	2 714	2 429	2 218
DN mm	**35**	**40**	**45**	**50**	**55**	**60**			
12	30	28	26	25	24	23			
15	68	64	61	58	55	53			
22	147	138	130	124	118	113			
28	255	238	224	213	203	194			
35	389	362	339	319	303	289			
40	871	814	767	727	693	663			
50	2 054	1 922	1 813	1 720	1 641	1 571			
For high pressure requirements the supplier shall be consulted.									
NOTE 1 The flow rates above include losses for four 90 ° bends and two end fittings.									
NOTE 2 For tubing runs with additional bends or fittings, add 1 m per fitting or bend.									

Table D.5 — Low Pressure pipe sizing — Pex composite pipe pressure drop of 0,250 kPa

1	2	3	4	5	6	7	8	9	10	11
Pipe Nom. Dia. (mm)[a]	**LP Gas flow — MJ/h**									**(+) metres per fitting**
	Length of straight pipe in meters									
	2	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	
16 (8,5)	168	102	76,3	62,1	52,9	46,4	41,5	37,7	34,7	1,7
20 (11,0)	374	230	173	141	121	106	95,4	86,9	80	1,4
25 (14,2)	663	440	346	291	255	229	209	193	180	0,8
32 (20,0)	1 240	861	693	594	527	478	440	409	384	0,6
40 (26,0)	2 920	1 880	1 450	1 210	1 050	939	852	783	727	N/A
50 (34,5)	5 270	3 540	2 800	2 370	2 090	1 880	1 720	1 590	1 490	N/A
***Size (mm)**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**(+) metres per fitting**
16 (8,5)	32,2	27,4	24	21,5	19,6	18	16,7	15,6	14,6	1.7
20 (11,0)	74,3	63,5	55,9	50,2	45,7	42	39	36,5	34,4	1,4
25 (14,2)	169	148	133	121	112	105	98.3	92,9	88,3	0,8
32 (20,0	363	322	292	269	251	235	222	211	202	0,6
40 (26,0)	680	590	526	477	438	406	380	358	339	N/A
50 (34,5)	1 400	1 230	1 110	1 010	942	880	829	784	746	N/A

[a] The values in brackets indicate the PEX fittings mean bore sizes in mm.

Table D.6 — Low pressure pipe sizing — HDPE pipe pressure drop — 0,25 KPA
(MJ/h)

1	2	3	4	5	6	7	8	9	10
Nom Diam (DM)	**Length of straight pipe** m								
	2	4	6	8	10	12	14	16	18
20	569	384	305	259	228	205	188	174	163
40	3966	2698	2151	1831	1615	1458	1336	1239	1160
63	13496	9211	7359	6273	5541	5006	4593	4263	3992
90	44511	30468	24386	20814	18404	16641	15281	14192	13295
110	75340	51635	41358	35319	31242	28258	25957	24113	22595
160	204280	140313	112534	96191	85149	77065	70825	65825	61705
	Length of straight pipe m								
	20	25	30	35	40	45	50	55	60
20	153	135	121	111	102	96	90	85	81
40	1093	963	868	796	737	690	649	615	585
63	3763	3321	2998	2749	2550	2387	2249	2131	2029
90	12541	11080	10012	9188	8529	7987	7531	7140	6801
110	21317	18841	17031	15636	14519	13599	12825	12163	11587
160	58236	51513	46594	42800	39761	37258	35151	33347	31781
	Length of straight pipe m								
	65	70	75	80	85	90	100	120	140
20	77	74	71	69	68	66	63	58	54
40	559	536	515	496	479	464	437	393	360
63	1940	1860	1789	1725	1667	1613	1520	1370	1256
90	6504	6239	6003	5790	5596	5420	5109	4612	4229
110	11082	10633	10232	9870	9542	9242	8714	7869	7218
160	30404	29181	28087	27101	26205	25387	23946	21640	19862
	Length of straight pipe in metre m								
	160	180	200	220	240	260	280	300	320
20	51	49	47	45	43	41	40	39	38
40	333	311	293	277	264	252	241	232	223
63	1164	1088	1025	970	923	882	845	813	783
90	3922	3670	3459	3277	3120	2982	2860	2750	2652
110	6697	6269	5909	5601	5333	5098	4890	4703	4535
160	18440	17269	16284	15441	14709	14066	13495	12985	12524

NOTE 1 The flow rates indicated above do not include any losses due to bends and fittings.

NOTE 2 For pipe runs with bends or fittings, the following may be added:

a) 1 m per elbow or Tee; and

b) 0,6 m per long bend.

D.2 Two-stage regulation

D.2.1 The installation of a two-stage system with one high-pressure regulator at the container to compensate for varied inlet pressures, and one low pressure regulator at the building to supply a constant delivery pressure to the appliances, helps ensure maximum efficiency and trouble-free operation. This type of installation is preferred when the appliances are a long way from the containers. In a single stage system, the transmission line piping between the container and the appliances shall be large enough to accommodate the required volume of gas at a maximum pressure drop of 0,28 kPa.

D.2.2 In contrast, the line between the first and second stage regulators in two-stage systems can be a smaller diameter as it delivers gas up to 150 kPa to the second stage regulator. Therefore, in addition to the improved performance reliability regarding pressure at the appliance(s), the savings in piping costs would often be found sufficient to pay for the second regulator.

D.2.3 Table D.7 to table D.10 (inclusive) give pipe sizes for first stage high pressure installation with an assumed inlet pressure of 100 kPa and a 10 % pressure drop at the end of the line.

NOTE The total length of piping given is from the outlet of the first stage regulator to the inlet of the second stage regulator (or to the inlet of the second stage regulator furthest away where multiple second stage regulators are installed).

Table D.7 — High pressure pipe sizing — Copper pipe pressure drop 10 kPa

1	2	3	4	5
Index length m	**Pipe diameter** mm			
	9,5	15	22	28
	MJ/h	MJ/h	MJ/h	MJ/h
3	544	2 279	5 650	12 084
6	373	1 569	3 890	8 300
9	300	1 261	3 116	6 667
12	257	1 081	2 671	5 703
15	228	955	2 364	5 056
18	206	865	2 141	4 579
21	190	796	1 972	4 219
24	176	741	1 834	3 992
27	165	694	1 728	3 678
30	156	656	1 632	3 447
38	139	582	1 442	3 085
45	125	527	1 304	2 788
53	116	484	1 198	2 565
60	107	452	1 124	2 385
75	95	400	991	2 120
90	86	363	898	1 919

Table D.8 — High Pressure Pipe Sizing – Schedule 40 pipe pressure drop 10 kPa

1	2	3	4
Index Length m	**Pipe diameter** mm		
	15 (½") MJ/h	**19(¾")** MJ/h	**25(1")** MJ/h
3	3 519	7 367	1 3886
6	2 417	5 067	9 540
9	1 940	4 070	7 653
12	1 664	3 477	6 551
15	1 473	3 085	5 809
18	1 336	2 798	5 268
21	1 230	2 576	4 844
24	1 145	2 396	4 505
27	1 071	2 247	4 229
30	1 013	2 120	3 996
38	899	1 876	3 540
45	814	1 707	3 201
53	748	1 569	2 947
60	696	1 452	2 745
75	617	1 293	2 427
90	560	1 166	2 505

Table D.9 — High pressure pipe sizing — Composite pipe
Pressure drop – 10 kPa

1	2	3	4	5
Length of pipe run m	**Pipe nominal size** mm[a]			
	16	20	25	32
	LP gas flow (MJ/h)			
2	2 255	3 617	8 538	1 6495
4	1 525	2 421	5 774	1 1042
6	1 211	1 932	4 584	8 766
8	1 021	1 637	3 923	7 578
10	909	1 444	3 409	6 586
12	810	1 294	3 099	5 927
14	752	1 182	2 817	5 443
16	683	1 096	2 626	5 048
18	646	1 037	2 436	4 705
20	609	966	2 305	4 409
25	542	848	2 013	3 889
30	483	764	1 830	3 500
35	444	700	1 661	3 246
40	411	659	1 541	3 019
45	381	605	1 465	2 801
50	357	573	1 359	2 664
55	343	539	1 286	2 495
60	325	515	1 223	2 397
70	300	511	1 135	2 197
80	275	441	1 042	1 998
90	259	409	981	1 872
100	241	383	919	1 773
120	216	346	828	1 596
140	201	318	752	1 451
160	184	298	698	1 345

[a] The values in brackets indicate the PEX fittings mean bore sizes in millimetres.

Table D.10 — High pressure pipe sizing — HDPE pipe
Pressure drop — 10,0 Kpa
(MJ/h)

1	2	3	4	5	6	7	8	9	10
Nom Diam (DM)	**Length of straight pipe m**								
	2	4	6	8	10	12	14	16	18
20	3251	2240	1801	1542	1368	1240	1141	1062	998
25	7696	5303	4264	3652	3239	2936	2702	2515	2363
32	18198	12548	10088	8641	7663	6947	6394	5950	5597
40	33387	23024	18510	15855	14061	12747	11732	10918	10272
50	60957	42047	33803	28954	25678	23278	21424	19939	18767
63	112984	77970	62684	53692	47616	43165	39729	36974	34827
75	181952	125593	100970	76699	76699	69530	63994	59557	56121
90	292918	202262	162607	123520	123520	111975	103060	95913	90435
110	497178	343591	276228	209829	209829	190217	175072	162932	153843
160	1333879	922538	741668	563388	563388	510730	470067	437469	413613
	Length of straight pipe m								
	20	25	30	35	40	45	50	55	60
20	943	837	760	700	652	611	578	549	542
25	2233	1984	1801	1659	1545	1449	1370	1302	1242
32	5291	4708	4283	3950	3677	3448	3261	3100	2959
40	9711	8642	7864	7253	6753	6332	5988	5693	5435
50	17742	15799	14386	13273	12359	11585	10958	10419	9949
63	32931	29357	26766	24713	23015	21566	20404	19405	18534
75	53069	47336	43184	39885	37149	34803	32933	31324	29921
90	85529	76358	69731	64441	60027	56220	53211	50622	48363
110	145538	130205	119182	110286	102763	96177	91082	86689	82852
160	391388	350844	321854	298204	277943	259956	246315	234539	224240
	Length of straight pipe m								
	65	70	75	80	85	90	100	120	140
20	502	483	465	449	435	422	399	362	333
25	1190	1144	1102	1065	1031	1000	945	857	790
32	2836	2726	2628	2539	2458	2384	2255	2047	1886
40	5209	5007	4827	4664	4515	4379	4142	3761	3466
50	9535	9167	8837	8539	8267	8019	7585	6890	6351
63	17766	17083	16470	15915	15411	14950	14145	12856	11855
75	28684	27583	26594	25701	24888	24145	22848	20772	19158
90	46370	44595	43001	41560	40249	39050	36961	33620	31018
110	79463	76443	73730	71274	69039	66993	63447	57775	53346
160	215137	207016	199714	193103	187081	181567	172052	156841	144933

Table D.10 *(concluded)*

1	2	3	4	5	6	7	8	9	10
Nom Diam (DM)	**Length of straight pipe** m								
	160	180	200	220	240	260	280	300	320
20	310	291	275	261	249	239	230	221	214
25	735	690	652	620	592	567	545	525	507
32	1757	1650	1560	1483	1415	1356	1303	1256	1214
40	3229	3032	2867	2725	2601	2492	2396	2309	2230
50	5917	5558	5255	4995	4769	4570	4392	4233	4090
63	11048	103981	9817	9333	8911	8540	8210	4913	7646
75	17857	16781	15871	15089	14409	13809	13275	12797	12364
90	28919	27181	25712	24449	23349	22379	21516	20742	20042
110	49768	46799	44287	42125	40239	38577	37096	35768	34567
160	135292	127282	120494	114647	109545	105042	101030	97428	94170

Annex E
(Normative)

Flue design

E.1 Flue design for appliances with atmospheric burners

E.1.1 Introduction

E.1.1.1 Table E.1 to table E.10 (inclusive) have been calculated to allow for approximately 50 % burner excess air and approximately 100 % draught diverter dilution air.

E.1.1.2 Flues required to convey flue gases with greater quantities of excess air, dilution air, or other combustion products are to be designed for the total quantity of flue gas discharge, using sound engineering practice.

E.1.1.3 Table E.1 to table E.7 (inclusive) show the extent and limitations of natural draught flues, relative to the thermal input, height, total length, diameter and other important factors to suit a wide variation in flue configuration.

E.1.1.4 Table E.8 shows equivalent sizes for round and rectangular flues.

E.1.1.5 Table E.9 shows the relationship between percentage carbon dioxide (% CO_2), volume of flue gases and amount of excess air.

E.1.2 Factors influencing flue design

E.1.2.1 Heat loss

E.1.2.1.1 In determining the correct size and configuration for a flue, the heat losses that will occur due to the materials used and the environment in which the flue will be located shall always be considered. Since the motive force in a flue is due to the heat of the flue gases, the ideal conditions are those in which heat losses from the flue are very low.

E.1.2.1.2 Materials which are insulated against heat loss (e.g. certified twin-wall flue) or materials of low thermal conductivity are particularly suitable when the flue is located outdoors or if it is very long.

E.1.2.1.3 Non-insulated flue materials, when located indoors and not exposed to draught, can be classified as ‘low heat loss’ when applying the flue tables indicated in this part of SANS 10087. When located outdoors, the same materials are classified as "high heat loss".

E.1.2.2 Resistance to flow of flue gases

E.1.2.2.1 The resistance to the flow of flue gases shall be considered in the design of the flue. The capacities shown in table E.1 to table E.9 (inclusive) with laterals make an allowance for two 90° changes of direction.

E.1.2.2.2 When more than two 90° changes of direction are required, the flue shall be sized using one of the following methods:

a) A 10 % capacity reduction is made to the table for each additional bend or change of direction (e.g. one additional change, 90 % of table capacity or two additional changes, 80 % of table capacity).

b) Increase the flue diameter from the draught diverter outlet size to one size larger.

NOTE For calculation purposes, the flue capacity will be increased by approximately 60 % of the difference in capacity of the actual appliance or draught diverter flue size, and the capacity of a similar flue one size larger. Any further increase in size is not recommended because it will not have a similar corresponding effect.

E.1.2.2.3 When using the tables to determine the flue size for wall furnaces and room heaters (excluding forced air central heaters), the appliance gas consumption should be regarded as 40 % greater than the nominal figure on the data plate. For example, a wall furnace with a gas consumption of 40 MJ/h would need to be sized for 40 × 1,4, that is, 56 MJ/h.

E.1.3 Designing individual appliance flues

E.1.3.1 Design procedure

E.1.3.1.1 The procedures for using the tables E.1 to E.9 (inclusive), whether for low heat loss or high heat loss, are identical.

E.1.3.1.2 Use table E.2 or table E.3, as appropriate, based on the type of material selected and the location of the flue in regards to heat loss.

STEP 1 Determine the total flue height (H) of the system and the length of any lateral (see figure E.1.)

STEP 2 Refer to table E.2 for low heat loss situations or table D.3 for high heat loss situations. Read down the ‘Total height of flue’ column at the left of the appropriate table until a height equal to the height of the flue or the next lower flue height figure is listed.

STEP 3 Select the horizontal row for the appropriate 'Length of lateral' (L). (Zero for straight vertical systems).

STEP 4 Read across to the first column that shows a capacity equal to or greater than the appliance gas consumption (after any factor indicated by E.1.2.2 has been applied).

STEP 5 If the flue diameter shown at the top of the column listing the appliance gas consumption (or corrected gas consumption) is equal to or larger than the appliance flue outlet, use the diameter indicated in the table.

If the diameter indicated is less than the appliance flue outlet size, the smaller diameter may be used only where

a) the flue height is greater than 3 m,

b) flues exceeding 300 mm in diameter are not reduced by more than two sizes (600 mm to 500 mm is a two size reduction), or

c) flues 300 mm in diameter or less are not reduced by more than one size (200 mm to 175 mm is a one size reduction).

However, under no circumstances shall a 75 mm flue be connected to an appliance having a 100 mm flue outlet. Contact should be made with the technical regulator if a greater heat input into a flue is required.

E.1.3.2 Example of flue design for individual appliance flue

E.1.3.2.1 Water heaters should be installed with a flue configuration as shown in figure E.1. The total height shall be 2,5 m while the lateral length is 600 mm, and the gas consumption of the appliance is 120 MJ/h.

E.1.3.2.2 The appliance flue connection (draught diverter) is 125 mm diameter. The flue will be located in a duct within the building except for 600 mm through the roof.

STEP 1 Because the flue will be inside the building, the appropriate table will be table E.2.

STEP 2 Under the column headed ‘Total height of flue’ locate 2,5 m.

STEP 3 Locate the line in the next column corresponding to a lateral of 0,6 m.

STEP 4 Reading across the line to the right, note that the figures in the first two columns (i.e. 42 and 79) are less than the appliance gas consumption (120 MJ/h). The figure in the third column is greater than the appliance gas consumption and so the diameter (125 mm) at the top of this column would be suitable. Therefore a 125 mm diameter flue would be used.

E.1.3.2.3 If it is essential to locate the 2,5 m vertical flue on an external wall using non-insulated materials, then table E.3 should be consulted. Adopting the former procedure, table D.3 indicates that a 150 mm diameter flue would be required.

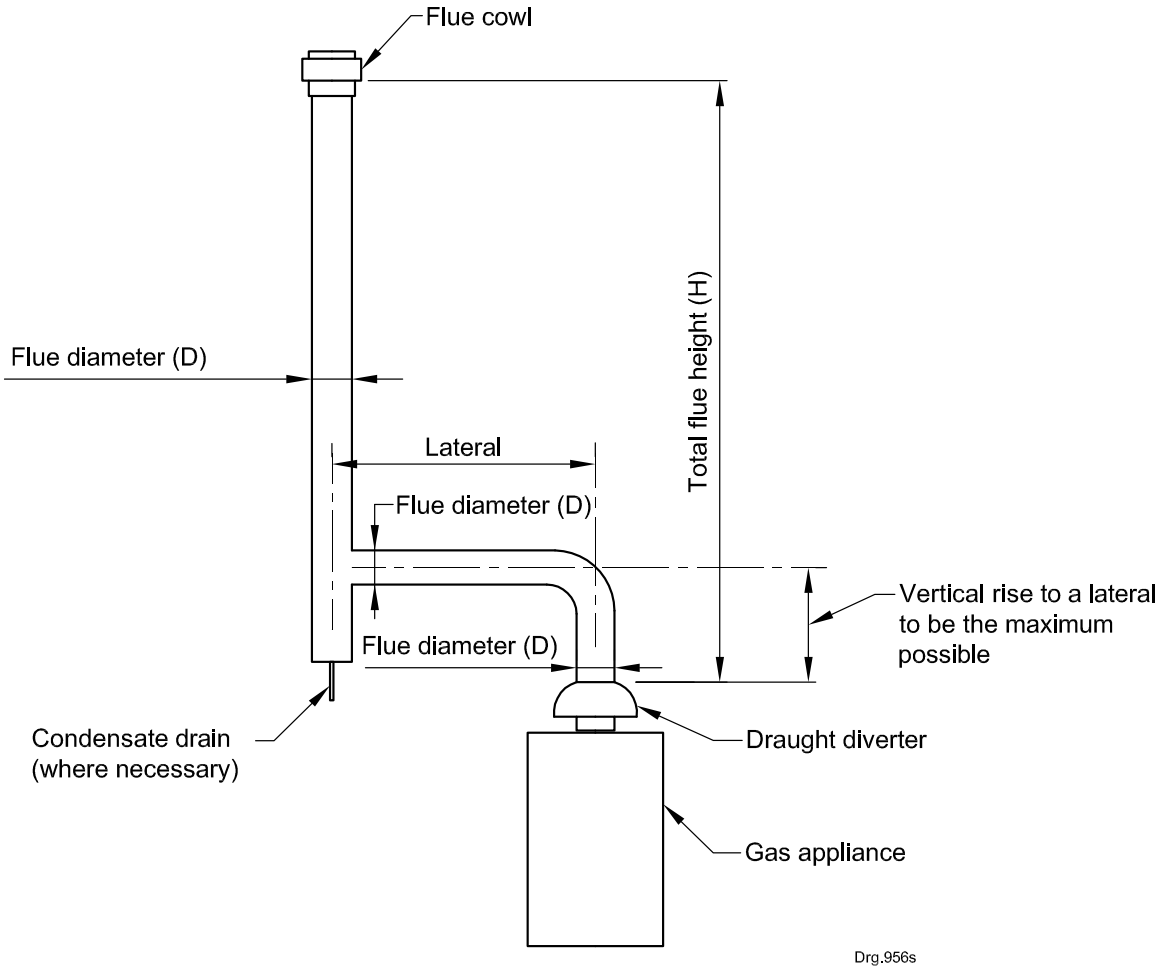


Figure E.1 — Individual appliance flue

E.1.3.2.4 The common flue tables, table E.4 to table E.7 (inclusive), apply when the individual draught diverter outlets from appliances connected to the common flue are within range of table E.1. Use table E.4 to table E.7 (inclusive) as appropriate for low heat loss or high heat loss situations.

E.1.3.2.5 If the largest draught diverter outlet exceeds the range specified in table E.1, increase the flue connector rise by an additional 300 mm beyond what is indicated in table E.4 and table E.6, (see figure E.4).

Table E.1 — Common flue-maximum draught-diverter size

1	2
When the smaller draught diverter diameter is mm	**The larger diverter diameter shall not exceed** mm
75	200
100	250
125	300
150	400
175	450
200	500
250	600

E.1.4 Performance of common flue

E.1.4.1 General

E.1.4.1.1 The effective functioning of a common flue system depends on the precise design of the flue connector. This component connects each appliance from the draught diverter outlet to the common flue (see figure E.2 and figure E.3).

E.1.4.1.2 The flue connector configuration in diameter, lateral, rise and total length is of major importance not only to prevent spillage at the appliance draught diverter but also to contribute to the correct performance of the common flue. In all cases the flue connector diameter shall be equal to or larger than the draught diverter outlet size.

E.1.4.2 Flue connector-change of direction

Tables E.4 and E.6 allow for two 90° changes of direction, and if a further change of direction is necessary,

a) provide the next size larger flue connector,

b) increase the flue connector rise by 300 mm, or

c) deduct 10 % for each additional change of direction from the listed capacity in the relevant table.

E.1.4.3 Resistance to flow of flue gases — Manifolds and laterals

E.1.4.3.1 Where a common flue has a manifold or lateral at the base (see figure E.3) the design shall allow for additional resistance to flow due to the change of direction. The (L) lines in table E.5 include an allowance for this increased resistance.

E.1.4.3.2 The length of a manifold or lateral shall be as short as possible, and designed in accordance with tables E.2 and E.3. Where these tables do not cover the particular installation, the lateral flue shall not exceed 50 % of the total flue height.

E.1.4.3.3 Where two or more appliances are installed to operate simultaneously, and not independently, the manifold and vertical flue can be designed as an individual appliance flue using table E.2 or table E.3. In this instance, the manifold is treated as a lateral length in design.

E.1.5 Design of common flue — Appliances at different levels

E.1.5.1 Design factors

E.1.5.1.1 The flue extending from the first or lowest appliance connector to the common flue can be designed as an individual flue up to the first interconnection or tee. The flues from other appliances connecting to the common flue should be designed using the common flue tables (see table E.5 and table E.7).

E.1.5.1.2 In applying the tables to several appliances installed at different levels, the ‘total height of flue’ is the rise in the flue connector plus the vertical height between the connection to the common flue and the next connection above (see figure E.2). The top floor appliance has a total flue height that is the rise in the flue connector plus the vertical height from the connection with the common flue to the flue terminal.

E.1.5.1.3 When using the tables for several appliances installed at varying levels, the "total height of flue" includes the rise in the flue connector plus the vertical height between the connection to the common flue and the next connection above (see figure E.2). For the top floor appliance, the total flue height comprises the rise in the flue connector plus the vertical height from the connection with the common flue to the flue terminal.

E.1.5.1.4 If the total height of the top appliance’s flue is insufficient, consideration should be taken to providing a separate flue for that appliance.

E.1.5.1.5 Where the diameter of the common flue is more than seven times the diameter of the flue connector, the rise of the flue connector is to be increased by 300 mm as indicated in figure E.4.

E.1.5.2 Example of flue design for appliances at different levels

E.1.5.2.1 Water heaters are to be installed on each of the four levels in a building (see figure E.2). The height between floors shall be 3 m and each appliance shall have a 100 mm flue outlet and a gas consumption of 50 MJ/h. The length of each lateral is 600 mm.

STEP 1 The lowest appliance flue is designed using table E.2. For 0,6 m lateral and 3 m total height, a 100 mm flue diameter has a capacity for a gas consumption up to 85 MJ/h which is above that required (i.e., 50 MJ/h).

STEP 2 The tee connection to receive the second appliance flue and the next section of common flue shall have capacity to serve the two appliances i.e. 100 MJ/h, but first the flue connector size is determined.

E.1.5.2.2 From table E.4, under 'Least total height' locate 3,0 m. Reading across, note that with 0,3 m flue connector rise, a 100 mm flue has capacity for 53 MJ/h, which is adequate.

STEP 1 The common flue size to carry 100 MJ/h is determined next. From table E.5, under 'Least total height', locates 3,0 m. As the common flue is vertical, without change of direction and the appliances are individually attached, Type V (for vertical) applies.

Read across to the right to find that a 125 mm common flue is satisfactory up to 131 MJ/h.

STEP 2 The third appliance is now considered for addition to the common flue, which then requires capacity for 150 MJ/h. Two alternatives may be considered:

a) Design the third section of common flue using the same total height between connections as previously, i.e., 3 m on the assumption that the top floor appliance will be connected to the common flue.

b) Design on the basis that the top floor appliance will not be joined to the common flue but flued separately.

E.1.5.2.3 After the increase in the total flue height above the third appliance. With the assumption that it is now 6 m, according to table E.5, the following alternatives shall be considered:

a) For alternative (a) with a 'Least total height' of 3.0 m, a 150 mm common flue would be suitable, with a capacity of up to 188 MJ/h.

b) For alternative (b) with a 'Least total height' of 6,0 m, a 125 mm common flue would be suitable, with a capacity of up to 169 MJ/h.

NOTE This illustrates the increase in capacity through additional total height. The choice between the two alternatives may be decided on the grounds of economy and availability of space.

E.1.5.3 Alternative method using oversize common flue

E.1.5.3.1 An alternative approach to designing flues for high-rise buildings is to install an oversized common flue with a constant diameter along its entire length. The connectors are then designed as individual flues, classified as self-venting (see figure E.2).

E.1.5.3.2 The common flue acts as a duct for the conveyance of flue gases but not necessarily contributing to satisfactory draught in the flue connectors.

E.1.6 Design of common flue — Appliances at same level

E.1.6.1 Total flue height

When applying the tables to multiple appliances installed at the same level, the "total flue height" is calculated as the rise in the flue connector to the manifold, plus the vertical height between the flue connector and the top of the common flue (see figure E.3).

E 1.6.2 Example of flue design for appliances at same level

Four water heaters are to be installed on the ground floor of a four-level building, connected through a manifold to a common flue (see figure E.3). Each appliance has a 100 mm flue outlet, a gas consumption of 50 MJ/h, and will operate independently.

Due to space constraints, the flue connector rise is limited to 600 mm, with a spacing of 750 mm between connectors.

STEP 1 The flue connector size is determined from table E.4. The total height from the appliance draught diverter to the flue terminal is 18 m. In order to have a rise in the manifold it is assumed that the connector rise of the appliance farthest from the common flue is 300 mm.

From table E.4, with a total height of 18 m and a rise of 0,3 m, a 100 mm diameter flue connector has a capacity of 70 MJ/h, which is adequate.

STEP 2 The manifold shall be sized as a common flue since all appliances do not operate simultaneously. Using table E.5, the type L line is used. For a total height of 18 m, on the L line, a 150 mm diameter flue has a capacity of 273 MJ/h that is greater than the total appliance gas consumption of 200 MJ/h. A 125 mm diameter flue cannot be used as it has a capacity of only 188 MJ/h.

STEP 3 Ensure the manifold length 'A' (see figure E.3.) does not exceed 50 % of total flue height.

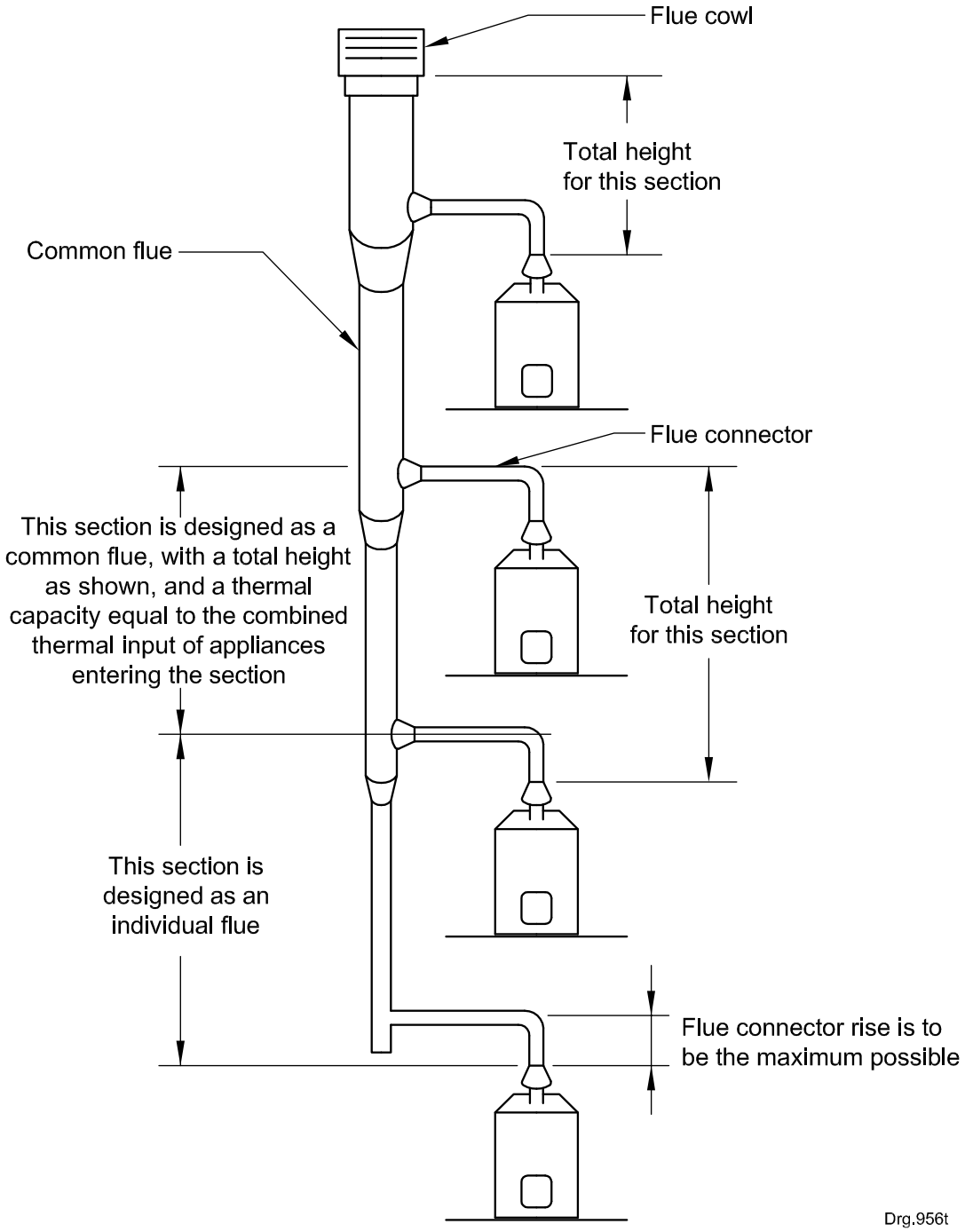


Figure E.2 — Common flue for several appliances installed at different levels and using self-venting flue connectors

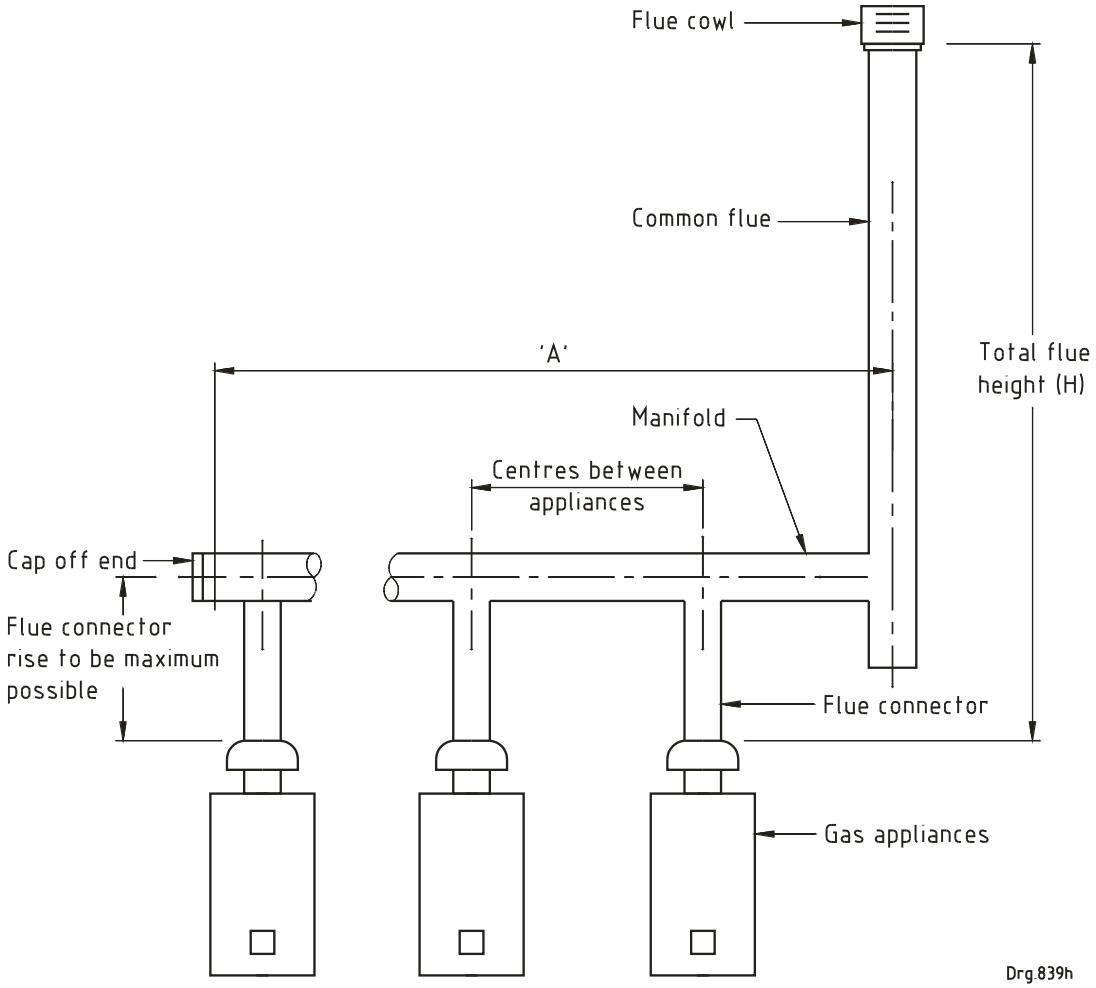


Figure E.3 — Common flue for several appliances installed at the same level

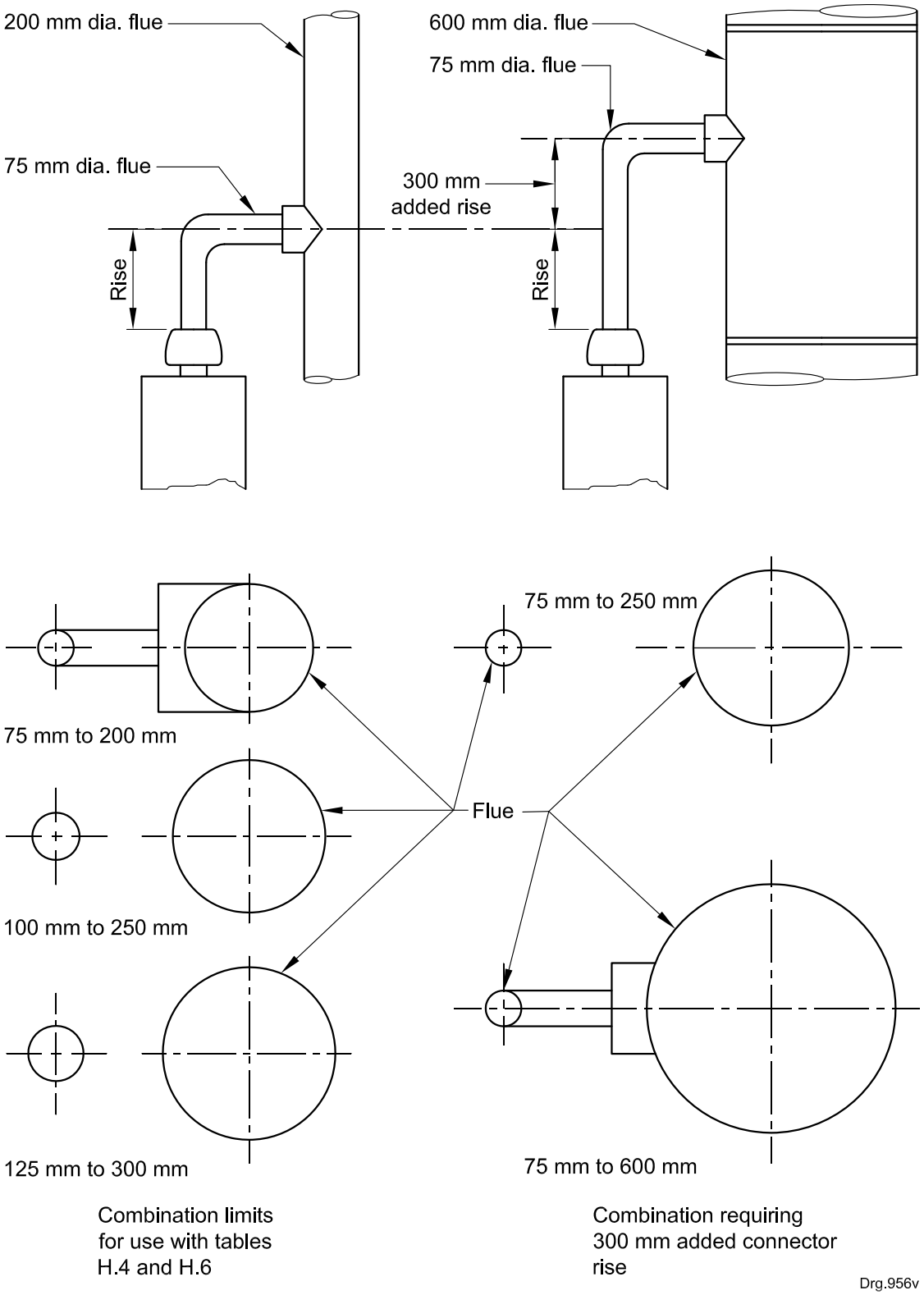


Figure E.4 — Combining a small flue into a large flue

Table E.2 — Individual appliance flues low heat loss materials and environments (indoor locations or insulated flues)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total height of flue	**Length of lateral**	**Capacity of flue** MJ/h													
		Diameter of flue (D) mm													
m	m														
H	**L**	**75**	**100**	**125**	**150**	**175**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**
2	0	49	91	149	216	301	390	601	897	1234	1614	2068	2564	3112	3714
	0,6	38	71	111	166	229	301	480	686	939	1234	1561	1952	2342	2817
	1,5	34	64	106	157	216	288	459	665	918	1213	1551	1920	2332	2796
2,5	0	53	99	164	248	338	438	696	1023	1393	1836	2342	2901	3545	4231
	0,6	42	79	127	190	261	340	543	786	1076	1414	1794	2226	2701	3218
	1,50	40	74	121	181	252	329	531	772	1066	1403	1778	2205	2685	3210
3,0	0	56	106	175	269	364	475	760	1118	1530	2031	2585	3218	3914	4695
	0,6	44	85	136	206	288	375	591	897	1192	1561	1994	2469	2996	3576
	1,5	42	81	131	197	279	364	578	879	1173	1541	1974	2443	2971	3566
4,5	0	61	118	197	301	411	554	886	1308	1815	2395	3060	3819	4653	5592
	0,6	51	98	158	237	333	437	712	1039	1424	1867	2384	2954	3598	4304
	1,5	47	94	154	231	323	422	696	1029	1396	1844	2358	2930	3571	4280
	3,0	44	87	147	220	307	399	670	1013	1359	1805	2314	2889	3526	4239
6	0	64	126	213	324	454	607	981	1424	2005	2659	3429	4283	5254	6330
	0,6	54	106	175	263	365	496	797	1161	1604	2110	2711	3376	4125	4959
	1,5	51	101	169	254	356	482	779	1142	1578	2085	2683	3348	4093	4919
	3,0	46	94	158	241	339	467	749	1102	1540	2047	2638	3302	4041	4853
	4,5	41	89	151	230	329	450	728	1076	1504	2018	2605	3261	4010	4844
9	0	68	135	232	354	501	686	1118	1635	2289	3081	3977	5011	6172	7488
	0,6	59	118	195	295	416	564	913	1382	1899	2511	3218	4020	4906	5908
	1,5	55	114	190	288	406	553	898	1360	1873	2479	3186	3991	4876	5857
	3,0	51	106	180	275	391	536	875	1323	1828	2427	3133	3945	4826	5772
	4,5	–	100	172	263	377	517	850	1287	1785	2374	3081	3897	4776	5686
	6,0	–	95	162	250	362	499	827	1250	1741	2321	3028	3851	4726	5602

Table E.2 *(concluded)*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total height of flue m	**Length of lateral** m	**Capacity of flue** MJ/h													
		Diameter of flue (D) mm													
H	**L**	**75**	**100**	**125**	**150**	**175**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**
12	0	70	139	241	372	528	723	1203	1825	2532	3408	4110	5560	6858	8292
	0,6	62	124	209	314	443	611	1013	1498	2110	2806	3608	4537	5549	6668
	1,5	57	120	203	306	435	599	1005	1478	2079	2767	3569	4492	5502	6623
	3,0	54	114	194	296	422	581	965	1457	2031	2703	3505	4418	5427	6549
	4,5	50	108	184	286	410	562	936	1414	1875	2639	3401	4346	5351	6477
	6,0	–	101	176	275	398	544	907	1382	1931	2595	3376	4273	5275	6404
18	0	–	143	249	394	564	770	1319	2026	2847	3851	5001	6330	7786	9495
	0,6	–	132	225	348	496	686	1118	1693	2374	3186	4136	5233	6467	7803
	1,5	–	126	217	342	487	674	1104	1674	2351	3159	4104	5203	6422	7762
	3,0	–	120	207	331	474	656	1078	1643	2313	3113	4051	5154	6346	7680
	4,5	–	115	196	321	460	638	1054	1612	2276	3068	3998	5105	6292	7611
	6,0	–	–	186	310	446	621	1030	1518	2238	3033	3946	5056	6195	7536
	7,6	–	–	175	300	433	603	1005	1550	2200	2977	3893	5005	6120	7640
24	0	–	–	252	405	580	797	1361	2131	3038	4115	5381	6805	8440	10286
	0,6	–	–	229	369	522	721	1208	1836	2595	3503	4547	5750	7111	8651
	1,5	–	–	217	363	514	711	1194	1817	2571	3474	4514	5712	7071	8605
	3,0	–	–	206	352	501	695	1171	1785	2533	3427	4459	5650	7006	8529
	4,5	–	–	–	331	476	664	1125	1723	2455	3333	4352	5524	6875	8376
	6,0	–	–	–	342	488	679	1148	1757	2492	3379	4406	5587	6941	8452
	7,6	–	–	–	321	464	648	1102	1691	2416	3285	4298	5462	6810	8300
30	0	–	–	–	422	591	812	1382	2163	3112	4273	5592	7069	9073	10867
	0,6	–	–	–	396	538	739	1234	1920	2690	3693	4853	6119	7596	9284
	1,5	–	–	–	382	531	730	1223	1902	2670	3666	4816	6085	7556	9238
	3,0	–	–	–	368	519	716	1204	1873	2638	3622	4756	6030	7991	9161
	4,5	–	–	–	354	507	703	1186	1842	2604	3578	4696	5976	7424	9084
	6,0	–	–	–	–	496	689	1167	1812	2571	3534	4635	5921	7359	9007
	7,6	–	–	–	–	484	675	1148	1783	2538	3490	4574	5866	7292	8930
	9,1	–	–	–	–	473	661	1129	1753	2506	3446	4515	5806	7227	8853

Table E.3 — Individual appliance flues high heat loss materials and environments (outdoor locations with non-insulated flues)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total height of flue	Length of lateral	Capacity of flue MJ/h													
m	m	Diameter of flue (D) mm													
H	L	75	100	125	150	175	200	250	300	350	400	450	500	550	600
2	0	41	74	122	179	245	329	528	791	–	–	–	–	–	–
	0,6	33	58	99	149	205	274	438	654	–	–	–	–	–	–
	1,5	30	54	93	135	187	255	411	633	–	–	–	–	–	–
2,5	0	44	80	133	195	266	359	572	860	1224	1604	–	–	–	–
	0,6	34	64	108	162	222	300	476	717	1023	1340	–	–	–	–
	1,50	31	59	100	149	205	279	454	684	995	1308	–	–	–	–
3,0	0	47	89	146	213	294	392	639	962	1393	1846	2279	3102	–	–
	0,6	37	71	117	177	246	328	563	802	1161	1540	2005	2585	–	–
	1,5	34	64	110	161	227	305	506	764	1129	1505	1965	2541	–	–
4,5	0	52	96	159	235	329	445	722	1097	1530	2099	2722	3418	4241	5180
	0,6	41	76	129	196	274	369	601	913	1277	1751	2268	2849	3534	4326
	1,5	37	71	116	179	253	343	570	870	1242	1712	2236	2801	3479	4271
	3,0	32	61	109	167	235	325	542	839	1182	1646	2152	2722	3387	4178
6	0	56	107	172	266	361	496	812	1255	1772	2416	3165	3988	4937	6066
	0,6	44	84	143	222	302	414	676	1044	1477	2015	2638	3323	4115	5064
	1,5	40	78	130	203	279	384	644	997	1438	1973	2587	3264	4051	4998
	3,0	34	69	121	188	260	364	602	960	1372	1899	2500	3165	3946	4885
	4,5	—	58	110	172	241	344	580	918	1319	1825	2416	3075	3890	4779
9,0	0	59	114	193	291	405	558	926	1445	2026	2775	3608	4558	5697	7227
	0,6	46	89	156	243	338	665	770	1203	1688	2310	3007	3798	4748	6014
	1,5	–	82	145	222	312	433	732	1139	1646	2260	2948	3735	4677	5934
	3,0	–	72	132	207	289	409	692	1108	1572	2173	2849	3629	4558	5803
	4,5	–	–	119	187	272	386	659	1055	1509	2094	2754	3518	4442	5676
	6,0	–	–	109	172	253	363	629	1013	1445	2015	2659	3408	4326	5549
15	0	–	127	222	327	467	622	1034	1635	2321	3165	4115	5275	6583	8229
	0,6	–	100	180	274	390	519	865	1361	1931	2638	3429	4399	5486	6858
	1,5	–	–	168	247	361	500	823	1298	1880	2578	3362	4333	5407	6763
	3,0	–	–	154	233	335	481	770	1255	1794	2479	3249	4220	5275	6604
	4,5	–	–	–	211	308	429	744	1192	1725	2384	3139	4093	5138	6467
	6,0	–	–	—	195	291	405	707	1139	1656	2289	3028	3967	5001	6330
24	0	–	–	–	–	–	–	–	–	2659	3587	4695	5855	7332	9115
	0,6	–	–	–	–	–	–	–	–	2216	2986	3904	4959	6119	7638
	1,5	–	–	–	–	–	–	–	–	2156	2919	3776	4879	6024	7524
	3,0	–	–	–	–	–	–	–	–	2057	2806	3703	4748	5866	7332
	4,5	–	–	–	–	–	–	–	–	1978	2701	3576	4600	5718	7174
	6,0	–	–	–	–	–	–	–	–	1899	2595	3450	4452	5570	7016

Table E.4 — Maximum flue connector pipe carrying capacity — Low heat loss materials and environments

1	2	3	4	5	6	7	8	9	10	11	12	13
Least total height m	**Common flue type** m	**Capacity of flue** MJ/h										
		Diameter of flue (D) mm										
H	**L or V**	**100**	**125**	**150**	**175**	**200**	**250**	**300**	**350**	**400**	**450**	**500**
1,5	L	51	80	115	157	206	327	480	665	876	1118	1403
	V	63	100	145	196	255	404	578	793	1036	1308	1614
1,8	L	55	87	123	169	222	343	494	747	976	1234	1524
	V	69	109	155	211	274	433	620	860	1124	1419	1751
2,4	L	61	96	137	188	243	385	549	837	1092	1382	1709
	V	77	120	172	235	306	491	688	962	1255	1593	1962
3,0	L	66	103	150	204	264	417	599	913	1192	1509	1862
	V	83	131	188	255	332	522	751	1050	1372	1735	2142
4,5	L	77	120	173	236	306	485	692	1063	1387	1757	2173
	V	96	152	217	295	385	596	870	1222	1593	2015	2490
6,0	L	85	134	192	264	343	538	768	1188	1551	1962	2427
	V	108	169	242	327	427	675	966	1361	1783	2258	2785
9	L	99	155	223	306	396	622	890	1400	1830	2310	2859
	V	124	195	281	380	496	781	1081	1609	2099	2659	3281
12	L	111	173	249	338	443	696	997	1574	2057	2606	3218
	V	138	214	311	427	554	865	1245	1809	2363	2986	3693
18	L	–	188	273	371	485	760	1161	1846	2405	3049	3766
	V	–	236	342	464	607	950	1456	2121	2764	3505	4326
24	L	–	–	290	395	515	807	1300	2057	2690	3408	4199
	V	–	–	363	494	644	1008	1625	2374	3091	3914	4842
30	L	–	–	–	404	528	823	1408	2258	2943	3724	4600
	V	–	–	–	505	659	1029	1762	2585	3376	4273	5275

Table E.5 — Maximum common flue carrying capacity — Low heat loss materials and environments

1	2	3	4	5	6	7	8	9	10	11	12	13
Least total height m	**Common flue type**	**Capacity of flue** MJ/h										
		Diameter of flue (D) mm										
H	**L or V**	**100**	**125**	**150**	**175**	**200**	**250**	**300**	**350**	**400**	**450**	**500**
1,5	L	51	80	115	157	206	327	480	665	876	1118	1403
	V	63	100	145	196	255	404	578	793	1036	1308	1614
1,8	L	55	87	123	169	222	343	494	747	976	1234	1524
	V	69	109	155	211	274	433	620	860	1124	1419	1751
2,4	L	61	96	137	188	243	385	549	837	1092	1382	1709
	V	77	120	172	235	306	491	688	962	1255	1593	1962
3,0	L	66	103	150	204	264	417	599	913	1192	1509	1862
	V	83	131	188	255	332	522	751	1050	1372	1735	2142
4,5	L	77	120	173	236	306	485	692	1063	1387	1757	2173
	V	96	152	217	295	385	596	870	1222	1593	2015	2490
6,0	L	85	134	192	264	343	538	768	1188	1551	1962	2427
	V	108	169	242	327	427	675	966	1361	1783	2258	2785
9	L	99	155	223	306	396	622	890	1400	1830	2310	2859
	V	124	195	281	380	496	781	1081	1609	2099	2659	3281
12	L	111	173	249	338	443	696	997	1574	2057	2606	3218
	V	138	214	311	427	554	865	1245	1809	2363	2986	3693
18	L	–	188	273	371	485	760	1161	1846	2405	3049	3766
	V	–	236	342	464	607	950	1456	2121	2764	3505	4326
24	L	–	–	290	395	515	807	1300	2057	2690	3408	4199
	V	–	–	363	494	644	1008	1625	2374	3091	3914	4842
30	L	–	–	–	404	528	823	1408	2258	2943	3724	4600
	V	–	–	–	505	659	1029	1762	2585	3376	4273	5275

Table E.6 — Maximum flue connector pipe carrying capacity — High heat loss materials and environments

1	2	3	4	5	6	7	8
Least total height m	**Common flue type**	**Capacity of flue** MJ/h					
		Diameter of flue (D) mm					
H	**L**	**75**	**100**	**125**	**150**	**175**	**200**
1,8 to 2,4	0,3	22	42	72	108	154	216
	0,6	30	56	91	131	188	248
	0,9	36	64	103	155	215	290
4,5	0,3	24	46	81	123	189	253
	0,6	32	59	97	141	205	280
	0,9	37	68	108	164	228	314
9,0 and over	0,3	26	52	89	136	200	285
	0,6	33	61	102	153	223	311
	0,9	38	72	113	173	245	339

Table E.7 — Maximum common flue carrying capacity — High heat loss materials and environments

1	2	3	4	5	6	7	8
Least total height m	**Capacity of flue** MJ/h						
	Diameter of flue (D) mm						
H	**100**	**125**	**150**	**175**	**200**	**250**	**300**
1,8	51	82	117	164	216	338	–
2,4	58	94	135	185	247	385	533
3,0	62	100	143	200	264	417	591
4,5	75	121	177	241	322	506	728
6,0	84	136	196	274	359	580	833
9,0	–	155	227	317	422	686	992
15,0	–	–	–	380	517	855	1255

Table E.8 — Equivalent sizes for round and rectangular flues

1	2	3	4	5	6	7	8	9	10
Round flue diameter mm	**Rectangular flue sizes** mm								
100	100 × 100	–	–	–	–	–	–	–	–
125	125 × 100	100 × 125	–	–	75 × 200	–	–	–	–
150	200 × 100	150 × 125	125 × 150	100 × 175	100 × 200	–	–	–	–
175	275 × 100	200 × 125	175 × 150	150 × 175	125 × 200	–	–	–	–
200	375 × 100	275 × 125	225 × 150	225 × 175	175 × 200	150 × 225	–	–	–
225	500 × 100	375 × 125	300 × 150	250 × 175	225 × 200	200 × 225	–	–	–
250	–	475 × 125	375 × 150	300 × 175	275 × 200	250 × 225	200 × 250	–	–
300	–	–	500 × 150	425 × 175	350 × 200	350 × 225	300 × 250	250 × 300	–
350	–	–	–	600 × 175	500 × 200	475 × 225	450 × 250	350 × 300	300 × 350
400	–	–	–	–	700 × 200	600 × 225	575 × 250	450 × 300	400 × 350
450	–	–	–	–	–	850 × 225	725 × 250	575 × 300	500 × 350
500	–	–	–	–	–	–	975 × 250	750 × 300	625 × 350
NOTE Sizes outside of those indicated are not normally used.									

Table E.9 — Flue gases — Relationship between % CO_2, volume flow rate and % excess air

1	2	3
CO_2 **%**	**Volume** L/s/MJ/h	**Excess air** **%**
10	0,10	33
9	0,11	50
8	0,13	67
7	0,14	90
6,7	0,15	100
6	0,17	120
5	0,20	170
4,4	0,23	200
4	0,25	230
3,3	0.30	300
3	0,33	400
2,2	0,45	500
2	0,50	570
1,7	0,60	700
1,2	0,80	1 000
1,0	1,00	1 200
0,8	1,20	1 500
0,6	1,60	2 000
0,5	2,00	2 600

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