BS EN 14678-1:2013

BSI Standards Publication

LPG equipment and accessories — Construction and performance of LPG equipment for automotive filling stations

Part 1: Dispensers

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National foreword

This British Standard is the UK implementation of EN 14678-1:2013. It supersedes BS EN 14678-1:2006+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PVE/19, LPG containers and their associated fittings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Foreword

This document (EN 14678-1:2013) has been prepared by Technical Committee CEN/TC 286 “Liquefied petroleum gas equipment and accessories”, the secretariat of which is held by NSAI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2013, and conflicting national standards shall be withdrawn at the latest by September 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14678-1:2006+A1:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

Differences between this document and EN 14678-1:2006+A1:2009 include:

— The addition of test requirements to 5.7.1 and 5.8.1;

— The definition of unattended filling stations; and

— The addition of an environmental checklist.

EN 14678 consists of the following parts:

— EN 14678-1, LPG equipment and accessories — Construction and performance of LPG equipment for automotive filling stations — Part 1: Dispensers;

— EN 14678-2, LPG equipment and accessories — Construction and performance of LPG equipment for automotive filling stations — Part 2: Components other than dispensers and installation requirements;

— EN 14678-3, LPG equipment and accessories — Construction and performance of LPG equipment for automotive filling stations — Part 3: Refuelling installations at private and industrial premises.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document is a type C standard as stated in EN ISO 12100:2010. When provisions of this type C standard differ from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards.

This European Standard calls for the use of substances and procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Protection of the environment is a key political issue in Europe and elsewhere. Protection of the environment is taken in a very broad sense. What is meant is the total life cycle aspects of, e.g. a product on the environment, including expenditure of energy and during all phases from mining of raw materials, fabrication, packaging, distribution, use, scrapping, recycling of materials, etc.

NOTE Annex D indicates which clauses in this European Standard address environmental issues. Clauses addressing environmental issues are restricted to a general guidance. Limiting values can be specified in national laws.

It is recommended that companies using this European Standard develop an environmental management policy. For guidance see ISO 14000 series [15], [16] and [17].

It has been assumed in the drafting of this European Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

All pressures are gauge unless otherwise specified.

The PED, Directive 97/23/EC [20], applies to any assembly with a component defined as category II or higher in this Directive:

— Article 1, 3.6 of the PED excludes equipment classified as no higher than category I under article 9 if it is covered by Directive 94/9/EC (ATEX).

— The category I limit is defined in Annex II Table 6 of the PED. It applies to piping for liquids whose vapour pressure at the maximum allowable temperature is greater than 0,5 bar (50 kPa) above DN 100 or, in the case of maximum allowable pressures greater than 10 bar (1 kPa), is above the product of DN and PS of 1 000.

— Because the maximum allowable pressure (PS) in this document is 25 bar (2 500 kPa) and the DN of the intended piping is less than 40, the product of DN and PS of 1 000 in Table 6 of the PED is not reached.

— The category I limit for vessels is defined in Annex II Table 1 of the PED. It also applies to vessels for liquids whose vapour pressure at the maximum allowable temperature is greater than 0,5 bar (50 kPa) above volumes (V) of 1 l up to a pressure of 200 bar or, in the case of the product of V and PS of 50.

— Because the maximum allowable pressure (PS) in this document is 25 bar (2 500 kPa) and if the V of the intended vessel is less than 2 l, the product of V and PS of 50 in Table 1 of the PED is not reached.

1 Scope

This European Standard covers the requirements for the design, manufacture, testing and marking of LPG dispensers for automotive LPG filling stations with a maximum allowable pressure of 25 bar (2 500 kPa), where the piping has a maximum DN 40 and any vessel fitted has a volume less than 2 l.

This European Standard covers the requirements for the LPG parts in multi-fuel dispensers.

This European Standard does not cover dispensers with integral pumps.

This European Standard may also be used for piping greater than DN 40 and/or vessels greater than 2 l, but then the PED [20] should also be consulted.

This European Standard does not include any requirement for metering performance.

2 Normative references

The following 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.

EN 549, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 837-1, *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

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

EN 1775, *Gas supply — Gas pipework for buildings — Maximum operating pressure less than or equal to 5 bar — Functional recommendations*

EN 13463-1, *Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements*

EN 13480-1, *Metallic industrial piping — Part 1: General*

EN 13480-2, *Metallic industrial piping — Part 2: Materials*

EN 13480-3, *Metallic industrial piping — Part 3: Design and calculation*

EN 13480-4, *Metallic industrial piping — Part 4: Fabrication and installation*

EN 13480-5, *Metallic industrial piping — Part 5: Inspection and testing*

EN 13617-1, *Petrol filling stations — Part 1: Safety requirements for construction and performance of metering pumps, dispensers and remote pumping units*

EN 13760, *Automotive LPG filling system for light and heavy duty vehicles — Nozzle, test requirements and dimensions*

EN 15001-1, *Gas Infrastructure — Gas installation pipework with an operating pressure greater than 0,5 bar for industrial installations and greater than 5 bar for industrial and non-industrial installations — Part 1: Detailed functional requirements for design, materials*

EN 50525-2-21, *Electric cables — Low voltage energy cables of rated voltages up to and including 450/750 V (U_0/U) — Part 2-21: Cables for general applications — Flexible cables with crosslinked elastomeric insulation*

EN 50525-2-51, *Electric cables — Low voltage energy cables of rated voltages up to and including 450/750 V (U_0/U) — Part 2-51: Cables for general applications — Oil resistant control cables with thermoplastic PVC insulation*

EN 60079-0, *Explosive atmospheres — Part 0: Equipment — General requirements (IEC 60079-0)*

EN 60079-7:2007, *Explosive atmospheres — Part 7: Equipment protection by increased safety "e" (IEC 60079-7:2006)*

EN 60079-10-1, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres (IEC 60079-10-1)*

EN 60079-14, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection (IEC 60079-14)*

EN 60079-15, *Explosive atmospheres — Part 15: Equipment protection by type of protection "n" (IEC 60079-15)*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, mod.)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 60730-2-10, *Automatic electrical controls for household and similar use — Part 2-10: Particular requirements for motor-starting relays (IEC 60730-2-10)*

EN 60947-3, *Low-voltage switchgear and controlgear — Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units (IEC 60947-3)*

EN 60950-1, *Information technology equipment — Safety — Part 1: General requirements (IEC 60950-1)*

3 Terms and definitions

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

3.1
liquefied petroleum gas
LPG
low pressure gas composed of one or more light hydrocarbons which are assigned to UN 1011, UN 1075, UN 1965, UN 1969 or UN 1978 only and which consists mainly of propane, propene, butane, butane isomers, butene with traces of other hydrocarbon gases

Note 1 to entry: For the specification of automotive LPG see EN 589.

3.2
maximum allowable pressure
maximum pressure for which the equipment is designed

3.3
excess flow valve
valve designed to close automatically, with a small residual flow, when the fluid flow passing through it exceeds a predetermined value, and to re-open when the pressure differential across the valve has been restored below a certain value

3.4
hydrostatic relief valve
self-closing valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges fluid at a predetermined pressure

3.5
shear valve
normally open valve activated by impact which closes both sides of the break point to prevent flow and remains closed after activation

Note 1 to entry: Also referred to as an impact check valve.

3.6
dead man's push button
manually operated non latching device which immediately stops the flow when released

3.7
hazardous area
area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment

3.8
dispenser
delivery and measuring unit for LPG in the liquid phase

3.9
breakaway coupling
coupling which separates at a predetermined section when required and each separated section contains a self-closing shut-off valve, which seals automatically

Note 1 to entry: Also referred to as a safe break.

3.10
nozzle boot
partially enclosed housing where the filling nozzle is located when not in use

3.11
LPG system
installation of piping and components in contact with LPG

3.12
break point
weakened section in a pipe or fitting intended to break when excessive force is applied

3.13
sight glass
device to allow checking that all, or part, of the measuring system is completely filled with liquid

3.14
screen
perforated cladding fabrication which may be provided to enhance the visual appearance of a pump or dispenser or to provide another related function

3.15
standard temperature and pressure
STP
15,6 °C (288,7 K), 1,013 bar absolute (0,1013 MPa absolute)

3.16
vapour trap
unventilated part of a structure where vapours can accumulate creating an area of greater hazard than its immediate surroundings

3.17
excess flow protection system
system, including software and hardware arrangements, designed to assess flow rate and close valves to stop the fluid flow when the flow rate exceeds a predetermined value

4 Requirements

4.1 Environmental

4.1.1 The manufacturer shall endeavour to acquire materials and components from suppliers who have a declared environmental policy, see EN ISO 14021, EN ISO 14024 and EN ISO 14025.

4.1.2 Materials should be selected to optimise product durability and lifetime and consideration should be made to avoiding the selection of rare or hazardous materials.

4.1.3 Consideration should be made to use recycled or reused materials, and to the selection of materials which can then be subsequently recycled.

4.1.4 The installer shall endeavour to minimise use and wastage of material during all the installation process, with particular attention to welding and allied processes. Unavoidable waste/scrap material shall be recycled.

4.1.5 Noise levels from installation process shall be evaluated and measures put in place to minimise the impact upon the external environment.

4.2 Electrical equipment

4.2.1 General

The electrical equipment is deemed to fulfil minimum electrical requirements for the continuity of the protective bonding circuit, its insulation and the voltage if it fulfils the requirements of 5.6.

The provisions of EN 60079-14, EN 60079-0, EN 60204-1 and EN 60950-1, as appropriate, shall apply.

Electrical equipment should be selected to maximise the energy efficiency.

4.2.2 Cabling insulation resistance

The power supply shall have a means of disconnection within the dispenser to allow a 500 V DC insulation test to be applied from the non-hazardous area to all power cables connecting the dispenser to the power supply (PELV, Protective Extra-Low Voltage, cables are not included).

Access to any manual means of disconnection shall be provided, removable cladding or covers are permitted.

Any manual means of disconnection shall be readily accessible by designated and trained personnel.

The means of disconnection shall ensure that:

a) all external power cables up to the means of disconnection can be tested between any phase and earth and between phases; and

b) all dispenser power cables and equipment within the hazardous area can be tested between the power circuit and the earth.

4.2.3 Cables used in hazardous area

Unarmoured elastomeric and/or plastic insulated cables, with a semi-rigid or tough sheath, are suitable for use in pumps, dispensers and remote pumping units electrical cables used in hazardous areas shall comply with either:

a) EN 60079-14 and EN 50525-2-51; or

b) EN 60079-14 and EN 50525-2-21; or

c) the requirements of 5.4.

4.2.4 Dead man's push button

The dead man's push button shall be in accordance with the requirements of EN 60947-3, see 4.5.8.

4.2.5 Insulation and isolation

In order to avoid danger from sources of electrical energy capable of causing shock, and also, in hazardous areas, from non-intrinsically safe energy sources capable of causing incentive sparks, all such sources of energy and conductive components which are intended to remain live during maintenance, testing or inspection, shall be insulated or shielded in accordance with Clause 6 of EN 60204-1:2006 so as to prevent accidental contact.

In order to prevent electrostatic discharges between the nozzle and the filler connection that could cause ignition, materials and components shall be selected to ensure that the resistance between nozzle and earth is less than 10^6 ohms when measured with a low voltage ohm-meter.

Power sources such as batteries, and capacitors which do not decay to a stored energy level of less than 0,2 mJ within 10 s, shall be considered as potential ignition sources and therefore shall be insulated or isolated.

The means of isolation shall:

a) apply to all phase conductors. Neutral/negative conductors should be considered as phase conductors;

b) be operable prior to access to the internals of any electrical enclosure in a hazardous area, and be suitable for the hazardous area in which it is mounted; and

   1) for sources of energy not exceeding 24 V, be in accordance with either EN 60947-3 or include a gap between contacts in accordance with EN 60730-2-10 or be capable of satisfying a 500 V dielectric test across the contacts; or

   2) for sources of energy exceeding 24 V, be in accordance with EN 60947-3.

4.2.6 Chemical cells in non-hazardous areas

There is a possibility of explosive atmosphere generation from chemical cells used to supply electrical power to the display head or other equipment attached to the dispenser; thus producing its own hazardous area.

Chemical cells shall be located in a ventilated area. If the chemical cells are located in an enclosure with no internal hazardous area, low and high level ventilation shall be provided consistent with a degree of protection IP33 according to EN 60529 or more open.

The means of construction of the cells and their enclosure shall be in accordance with Clause 4 of EN 60079-7:2007 for emission of gas and method of connection of cells. Conformity shall be demonstrated by the supplier's declaration.

These provisions apply to all cells and batteries of cells except for primary cells operated in the discharge mode only.

4.3 Design

4.3.1 Maximum allowable pressure

The maximum allowable pressure, for the LPG pressure containing parts, shall be at least 25 bar (2 500 kPa).

4.3.2 Design temperature

The maximum design temperature shall be 40 °C.

The minimum design temperature shall be -20 °C.

For operating conditions outside the above range, different design temperature(s) shall be agreed with the manufacturer and suitably marked.

For some parts of Europe and certain applications, temperatures lower than -20 °C can be encountered and for these applications the minimum design temperature shall be -40 °C.

However, where a design temperature outside the above range is required, the manufacturer shall demonstrate the suitability of the design at this temperature and the temperature shall be marked in accordance with 8.2.

4.3.3 Materials

4.3.3.1 All materials in contact with LPG shall be physically and chemically compatible with LPG under all the normal operating conditions for which the dispenser is intended.

4.3.3.2 Materials exposed to corrosive conditions shall be corrosion resistant or protected against corrosion.

NOTE Materials complying with the requirements of EN 13175 may be used.

4.3.3.3 The component manufacturer shall maintain, and provide if requested, the following records of the materials used in construction of the parts subjected to pressure:

— chemical analysis certificates,

— mechanical property data, and

— results of metallurgical and mechanical tests and analysis.

4.3.3.4 All elastomeric materials in contact with LPG shall be compatible with LPG and shall not distort, harden or adhere to other components to such an extent as to impair the function of those components. Rubber materials shall conform to the requirements of EN 549. For guidance on selection of non-metallic materials see EN ISO 11114-2.

4.3.3.5 The component manufacturer shall maintain a system for the identification and tracing of materials used in the fabrication of parts under pressure.

4.3.3.6 Materials should be selected to optimise product durability and lifetime and consideration should be made to avoiding the selection of rare or hazardous materials.

4.3.3.7 Consideration should be made to using recycled or reused materials, and to the selection of materials which can then be subsequently recycled.

4.3.4 Pressure gauges

Where fitted, pressure gauges shall comply with EN 837-1.

4.3.5 Trapped liquid

Where LPG in liquid phase can be trapped, means shall be provided to prevent the pressure exceeding the maximum allowable pressure of the LPG system.

4.3.6 Joints

All joints other than welded joints shall be accessible for inspection.

Pipe connections within the dispenser shall be such that unacceptable mechanical stresses shall not occur.

EXAMPLE By use of flexible steel joints.

The number of joints shall be kept to a minimum.

4.3.7 Seals and gaskets

Seals and gaskets shall be compatible with LPG.

4.3.8 Sight glass

Where a sight glass is fitted, it shall be of sufficient strength and tested according to the requirements of 5.2.

4.3.9 LPG system

Piping and pipe fittings through which liquid or vapour LPG flows shall be constructed from materials:

— compatible with LPG;

— which do not directly contribute to the development of fire; and

— which shall not be degraded by the external environment in which the materials are used.

For guidance on selection of materials, see EN ISO 11114-1 and/or EN ISO 11114-2.

The piping and pipe fittings of the LPG system shall be designed and assembled in accordance with a suitable standard such as EN 1775, EN 15001-1 and EN 13480 parts 1 to 5.

Components intended to move in normal use should be selected and mounted to minimise noise and vibration.

4.4 Explosion protection measures

4.4.1 General

For specifying explosion protection measures, see Annex C.

Equipment, components and protective systems used within hazardous areas, shall be suitable for at least Explosion Group IIA with temperature class T3 as defined in EN 60079-0 and EN 13463-1.

4.4.2 Avoidance or reduction of ignition sources

4.4.2.1 General

All electrical and non-electrical equipment and components, intended for use in potentially explosive atmospheres, shall be designed and constructed according to good engineering practice and in conformity with the required categories for group II equipment to ensure avoidance of any ignition sources as detailed in EN 1127-1. To classify the category of the equipment, it shall be subjected to an ignition hazard assessment in accordance with EN 13463-1.

Undesirable electrostatic discharges shall be avoided by earthing and interconnecting all the metallic components of electrical and non-electrical equipment.

NOTE Further information on electrostatics is given in CLC/TR 50404.

4.4.2.2 Electrical equipment

Any electrical equipment, intended to be installed and located in Zone 1 shall be at least Category 2 and shall comply with the requirements of EN 60079-0.

NOTE EN 60079-0 is supplemented or modified by EN 60079-1, EN 60079-2, EN 60079-5, EN 60079-7, EN 60079-11, EN 60079-15, EN 60079-18, and EN 60079-25 as appropriate.

Any electrical equipment intended to be installed and located in Zone 2 shall be at least Category 3 and shall comply with the requirements of EN 60079-0 and EN 60079-15. Electrical installations used in potentially explosive atmospheres shall comply with the requirements of EN 60079-14.

4.4.2.3 Non electrical equipment

Non-electrical equipment, intended for use in a potentially explosive atmosphere, shall comply with the requirements of EN 13463-1 and where relevant, the selected European Standard for the specific type of ignition protection.

Category 3 equipment for use in Zone 2 shall not contain any effective ignition source in normal operation.

Category 2 equipment for use in Zone 1 shall not contain any effective ignition source during foreseeable malfunctions or rare malfunctions.

4.4.3 Construction measures to limit explosive atmospheres

4.4.3.1 Hazardous areas considered in this standard are only those created by an individual LPG dispenser in open air, see Annex A.

4.4.3.2 Where hazardous areas need to be limited by the use of Type 1 or Type 2 vapour barriers, they shall be designed in accordance with Annex B. A wall is classified as non-permeable if the permeation is less than 0,1 g/m^2/day.

4.4.3.3 Enclosures within hazardous areas shall:

a) if totally immersed in a Zone 2 area, be in accordance with EN 60079-15; or

b) have a minimum level of ventilation such that the breathing area of the enclosure shall have at least 80 % of its surface in a non-hazardous area and shall meet the ventilation requirements of 4.5.4 from inside the enclosure to a non-hazardous area.

When the enclosure has a minimum level of ventilation such that the breathing area of the enclosure has less than 80 % of its surface in a non-hazardous area, the enclosure shall be in accordance with EN 60079-15.

4.4.3.4 The inside of the LPG system housing of the dispenser shall be considered to be Zone 1 or established in accordance with EN 60079-10-1.

4.4.3.5 The hazardous area that is external to the housing is determined by the following:

a) on a housing constructed to not less than IP23 and containing a Zone 1 area, a Zone 2 area is defined as 200 mm in all sides and down to the ground, but limited upwards to 50 mm (see also B.6),

b) on a housing constructed to not less than IP54 and containing a Zone 1 area, a Zone 2 area is defined as 50 mm in all sides and down to the ground (see also B.5),

c) on a housing constructed to not less than IP67 and containing a Zone 1 area, no hazardous area is defined (see also B.1 and Figure B.2 – B.2).

NOTE Clarification on the Ingress Protection (IP) Codes is given in EN 60529.

4.4.3.6 A continuous non-permeable wall (as defined in 4.4.2.3) shall provide separation of hazardous areas.

4.4.3.7 When the nozzle is not in use, the area classifications of Annex A shall apply.

4.5 Construction

4.5.1 Mechanical strength

4.5.1.1 Breakaway coupling

A break-away coupling connection shall be fitted between the nozzle and the dispenser.

The device, mounted in its normal operating position, shall break and close both ends. Unless justified by a risk assessment, it shall be installed in such a position that no moments are applied. It shall be tested in accordance with 5.7.

If a breakaway coupling is designed to be anchored to the dispenser or ground, the anchorage shall be able to withstand a force of 750 N.

4.5.1.2 Shear valve / break point

The vapour return pipe shall be provided with a means to prevent the flow of LPG from the piping to the atmosphere in the event of a fracture.

The liquid line for delivery of LPG shall be fitted with a means to ensure the flow is automatically stopped in the event of a fracture. This may be achieved by either:

a) a break point combined with excess flow valves; or

b) a break point combined with excess flow protection system; or

c) a shear valve; or

d) other suitable means.

The shear valve shall be tested in accordance with 5.8.

The shear valve or break point shall be fixed rigidly to the dispenser and to the ground. The dispenser shall be provided with a means for mounting on a plinth or other foundation.

4.5.2 Housing

The dispenser housing shall provide mechanical protection for the internal equipment.

No part of the pressure containment system shall form part of the frame.

Surfaces likely to be handled shall be free of sharp edges.

4.5.3 Stability

The dispenser shall be deemed to be sufficiently stable if it fulfils the following requirements when tested in accordance with 5.5:

— it shall not break free of its anchorage;

— it shall not suffer catastrophic failure; and

— electrical safety shall not be degraded.

4.5.4 Ventilation

Enclosures partially in a hazardous area shall be provided with well distributed cross ventilation in the non-hazardous area of at least 10 mm^2 in a position as low as possible.

Cross ventilation of the inside of the housing for the LPG system of a dispenser shall be provided and the total effective area of the ventilation openings shall be not less than the greater of 8 000 mm^2 or 3,5 % of the maximum horizontal internal cross-sectional area of the housing for the LPG system at the base of the dispenser. At least 50 % of this minimum ventilation area shall be in the lower part of the housing. The total minimum area shall be divided between opposite sides of the housing such that the ratio of the areas is in the range of between 0,9 and 1,1.

Vapour traps shall be avoided.

4.5.5 Delivery hose assembly

The delivery hose assembly shall be in accordance with EN 1762.

The length of the hose shall not exceed 7 m, with a maximum liquid content of 1,5 l.

4.5.6 Nozzle

If a nozzle is provided, it shall be selected so that it can only be opened after the nozzle is connected to the receiving filling unit and automatically closes before disconnecting the nozzle from the receiving filling unit. Nozzles in accordance with EN 13760 meet this requirement.

In unattended filling stations a means shall be provided to ensure the correct relocation of the nozzle after refuelling

4.5.7 Nozzle boot

A nozzle boot shall ventilate to the outside of the dispenser.

4.5.8 Control provisions

For dispensers intended for self-service operations, a means shall be provided to ensure that the filling operation can only be started and maintained by pressing a dead man's push button. Release of this button shall immediately stop the flow of LPG.

NOTE In attended filling operation, any other means for starting and maintaining the filling operation can be used provided they ensure equivalent safety levels.

5 Type tests

5.1 General

5.1.1 All tests from 5.2 to 5.8 shall be carried out in the sequence shown.

5.1.2 All tests, unless otherwise stated, shall be carried out at STP.

5.1.3 The tests may convey a certain risk and involve substances than can be harmful to health and the environment. Precautions shall be taken to protect the environment, taking into account the final deposition of both the used products and the waste generated. Test fluids should be used and disposed of in accordance with manufacturer's instructions.

5.2 Sight glass tests

5.2.1 Impact test

5.2.1.1 Test procedure

The test shall be carried out in accordance with EN 60079-0 for Group II guarded and unguarded light transmitting parts.

The impact shall be:

— 4 J for sight glasses without guards; and

— 2 J for sight glasses with guards.

After the test, the sight glass shall be visually inspected for damage and the results shall be recorded.

5.2.1.2 Test interpretation

The sight glass shall only pass the test if it shows no visible crack.

5.2.2 Pressure test 1

5.2.2.1 Test procedure

The sight glass tested in 5.2.1, assembled in the normal manner with its mounting parts, shall be subjected to a pressure of 3 times the maximum allowable pressure for $(60\,^{+5}_{0})$ s. At the end of the $(60\,^{+5}_{0})$ s, the pressure shall be released. The test fluid shall be water or any other suitable liquid.

After the test, the sight glass shall be visually inspected for damage and the results shall be recorded.

5.2.2.2 Test interpretation

The sight glass shall only pass the test if it shows no visible crack.

5.2.3 Pressure test 2

5.2.3.1 Test procedure

The sight glass tested in 5.2.1, assembled in the normal manner with its mounting parts, shall be subjected to a pressure of 1,5 times the maximum allowable pressure for not less than $(60\,^{+5}_{0})$ s. The test fluid shall be water or any other suitable liquid.

After the test, the sight glass shall be inspected for leakage and the results shall be recorded.

5.2.3.2 Test interpretation

The sight glass shall only pass the test if it shows no visible leakage.

5.3 Pressure tests for LPG system

5.3.1 Pressure test 1

5.3.1.1 Test procedure

The LPG system shall be tested as follows:

a) with the hose end plugged, pressurise the system to 3 times the maximum allowable pressure at ambient temperature for not less than $(60\,^{+5}_{0})$ s; the test medium shall be water or any suitable liquid;

b) repeat the above at the lowest temperature as declared by the manufacturer $\pm$ 2 °C; and

c) after the test, the LPG system shall be visually inspected for damage and the results shall be recorded.

5.3.1.2 Test interpretation

The LPG system shall only pass the test if it shows no catastrophic failure such as rupture.

5.3.2 Pressure test 2

5.3.2.1 Test procedure

With the hose end plugged, pressurise the system to 1,5 times the maximum allowable pressure for not less than $(60\,^{+5}_{0})$ s; the test medium shall be water or any suitable liquid.

After the test, the LPG system shall be visually inspected for leakage and the results shall be recorded.

5.3.2.2 Test interpretation

The LPG system shall only pass the test if it shows no visible leakage.

5.3.3 Environmental provisions

Consideration should be made to reducing the volume of water required for production operations, for example washing and cooling processes. The output water should be of a quality to meet normal drainage requirements.

5.4 Tests for electric cables used in hazardous areas

Cables not in accordance with EN 60079-14 and EN 50525-2-51 or EN 60079-14 and EN 50525-2-21 shall be subjected to the tests contained in EN 13617-1.

The solvent test shall be carried out with:

— methanol;

— ethanol; and

— LPG or hexane or pentane.

5.5 Stability test

5.5.1 Test procedure

The dispenser shall be mounted according to the manufacturer's instructions and shall be delivering LPG or tested under simulated delivery.

A force of 500 N shall be gradually applied within 50 s to 70 s and then be held for between 120 s to 130 s in such a direction as to generate maximum bending moment in relation to its anchorage.

Behaviour of the dispenser shall be observed and the results shall be recorded.

5.5.2 Test interpretation

The dispenser shall only pass the test if it satisfies the requirements of 4.5.3.

5.6 Electrical tests

5.6.1 Continuity of the protective bonding circuit

5.6.1.1 Test procedure

The continuity of the protective bonding circuit test method is described in EN 60204-1.

The test shall be carried out for each connection for 10 s.

The test shall be performed between the main PE terminal and various metal parts that are part of the protective bonding circuit, such as frames, etc.

5.6.1.2 Test interpretation

The dispenser shall only pass the test if the resistance between the measured point and the main PE terminal is $\leq$ 0,1 Ω (1 V voltage drop).

5.6.2 Insulation resistance test

5.6.2.1 Test procedure

The insulation resistance tests shall be carried out in accordance with EN 60204-1.

5.6.2.2 Test interpretation

The dispenser shall only pass the test if the insulation resistance is in accordance with Table 1.

5.6.3 Voltage test

5.6.3.1 Test procedure

The voltage test shall be carried out in accordance with EN 60204-1.

A voltage of 1 000 V at 50 Hz between the power supply connections and the PE terminal shall be applied for 1 s. The test requirement is given in Table 1.

5.6.3.2 Test interpretation

The dispenser shall only pass the test if the insulation is in accordance with Table 1.

5.6.4 Functional tests

The functions of the electrical equipment shall be tested according to the manufacturers' specifications for the configuration under test. Particular attention shall be paid to safety related functions.

5.7 Operational test for the breakaway coupling

5.7.1 Test procedure

The breakaway coupling (safe break) installed as specified shall be tested by applying a force increasing from 0 N to 200 N to the hose in its normal operating position and then increasing it from 200 N to 500 N at a rate of (20 ± 10) N/s.

The test shall be carried out on an un-pressurised hose and on a hose pressurised at maximum allowable pressure.

5.7.2 Test interpretation

The dispenser shall only pass the test if:

— the device breaks at a force between 200 N and 500 N, and

— the valves in both parts automatically stop the liquid flow in the downstream as well as the upstream direction.

5.8 Operational test for the shear valve / break point

5.8.1 Test procedure

The test shall be carried out on an un-pressurised pipe and on a pipe pressurised at maximum allowable pressure.

5.8.2 Test interpretation

The dispenser shall only pass the test if:

— the device breaks at a bending moment between 300 Nm and 600 Nm, and

— the valves in both parts automatically stop the liquid flow in the downstream as well as the upstream direction.

6 Production tests

6.1 General

The production tests specified in 6.2 and 6.3 shall be performed on each dispenser on completion of manufacture.

The tests can convey a certain risk and involve substances than can be harmful to health and the environment. Precautions shall be taken to protect the environment, taking into account the final deposition of

both the used products and the waste generated. Test fluids should be used and disposed of in accordance with manufacturer's instructions.

6.2 Electrical tests

Electrical tests shall be carried out as listed in Table 1 in accordance with EN 60204-1.

Table 1 — Routine electrical tests

Test	Requirement	Test method
Continuity of the protective bonding circuit	The resistance shall be $\leq$ 0,1 Ω	5.6.1
Insulation resistance	Insulation resistance shall be $\geq$ 1 MΩ	5.6.2
Voltage test	Insulation, no failure at 1 000 Uac = 1 000V	5.6.3
Functional Test	Functional correctly according manufacturers specification	5.6.4
Resistance of nozzle to earth	The resistance shall be < 1 MΩ	Low voltage Ohm meter

6.3 LPG system tests for dispensers

6.3.1 General

Each dispenser shall be subjected to the following tests to ensure that there are no leaks.

6.3.2 Test procedures

6.3.2.1 Either the test specified in a) or b) shall be carried out:

a) Isolate the LPG system including any vulnerable instrumentation, open all valves, remove the hydrostatic relief valves and pressurise all sections of the system, with any suitable medium, to 1,1 times the maximum allowable pressure. Using pressure measurement equipment with an accuracy of ± 0,1 bar (± 10 kPa), record the initial pressure. Take and record another pressure reading after waiting at least 15 min.

b) Isolate the LPG system including any vulnerable instrumentation, open all valves, leave the hydrostatic relief valves fitted and pressurise all sections of the system, with any suitable medium, to 0,9 times the hydrostatic relief valve opening pressure. Using pressure measurement equipment with an accuracy of ± 0,1 bar (± 10 kPa), record the initial pressure. Take and record another pressure reading after waiting at least 15 min.

6.3.2.2 Reduce all sections of the LPG system to their working pressure. Maintain this pressure for at least 20 s.

6.3.3 Test interpretation

The dispenser shall only pass the test if:

— for the test in 6.3.2.1, the initial pressure reading does not exceed the final pressure reading by more than 0,5 bar (50 kPa); and

— for the test in 6.3.2.2, there is no leakage.

7 Documentation

7.1 Instructions shall be provided by the manufacturer to minimise the environmental impact of use, maintenance and disposal of the dispenser with particular reference to harmful emissions into air, water and soil as well as their impacts on human health. Instructions shall comply with local regulations. Recycling shall be addressed as the preferred means of disposal when carried out by a qualified contractor.

7.2 Instructions shall be provided by the manufacturer for the safe installation, operation and maintenance of the dispenser. User instructions shall fully accommodate the needs of both the end user of the equipment and of the service station personnel.

7.3 Guidance on linking the dispenser to electrical equipment fitted with a stop function according to Category 0 or Category 1 of EN 60204-1 shall be given in manufacturer's documentation.

7.4 A drawing defining the classification and the extent of the zones according to EN 60079-10-1 shall be provided by the manufacturer.

7.5 In some installation configurations, delivery hoses can lie on the ground when not in use. Instructions on how these delivery hoses should be protected from damage should be given in manufacturer's documentation.

7.6 It is recommended that the following warning is given in the documentation:

WARNING - Any modification to this equipment may invalidate the equipment certification. Consult certification documents and manufacturer's instructions if any modification to the electrical installation and/or the equipment is contemplated.

7.7 Manufacturers' documentation should give advice on minimum levels of illumination.

NOTE EN 14678-2 gives information and requirements for the installation.

7.8 Guidance on how to dispose of packaging materials in an environmentally sound manner shall be given in manufacturer's documentation.

8 Markings and signs

8.1 User signage

Dispensers shall bear the following information for the user of the equipment at an appropriate place(s) on the unit:

a) essential operating instructions;

b) warning signs (pictograms).

This information shall be readily understandable and unambiguous. Pictograms shall be used in preference to written warnings where possible. Written warnings shall be drawn up in the language(s) of the country in which the dispenser is to be used.

8.2 Minimum markings

8.2.1 Dispensers shall bear at least the following markings:

— name and address of the manufacturer;

— mandatory markings as defined in the applicable EU Directives;

NOTE See also CEN Guide 414 [18].

— year of construction;

— designation of series or type;

— serial number if any;

— design specification: EN 14678-1; and

— ambient temperature range.

8.2.2 The information printed directly on the dispenser shall be permanent and remain throughout the expected life of the equipment.

8.2.3 The possibility of marking components to aid to their sorting for disposal/recycling at end of life should also be reviewed.

9 Packaging

9.1 Packaging design should consider using recycled materials, and materials that need little energy for their manufacture, and should minimise waste.

9.2 Packaging design should consider subsequent reuse and recycling.

9.3 The size and weight of packaging should be minimised whilst protecting the products to minimise waste through damage. Packaging should be designed to optimise capacity of transportation vehicles whilst facilitating safe loading and unloading.

Annex A
(normative)

Classification of hazardous areas in and adjacent to the dispenser

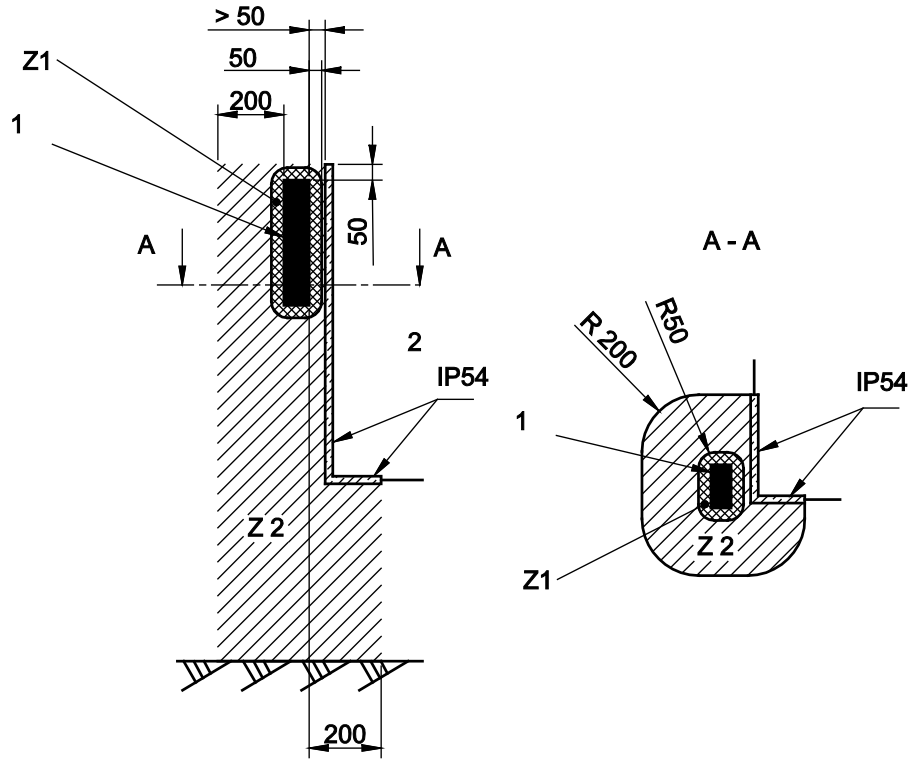
A.1 General

The requirements for classification of zones are not intended to release the user of the equipment from his obligation to verify the correct classification as far as workplaces are concerned, and to implement additional health and safety arrangements if necessary.

A.2 Nozzle area – vapour releases only

Nozzle outside the housing but positioned > 50 mm from the dispenser wall. If the wall is IP67 within 200 mm horizontally and 50 mm vertically upwards and downwards to ground level from the nozzle-outlet then the area on the other side of the IP67 barrier is not classified due to the nozzle. See Figure A.1 and Figure A.2.

Dimensions in millimetres



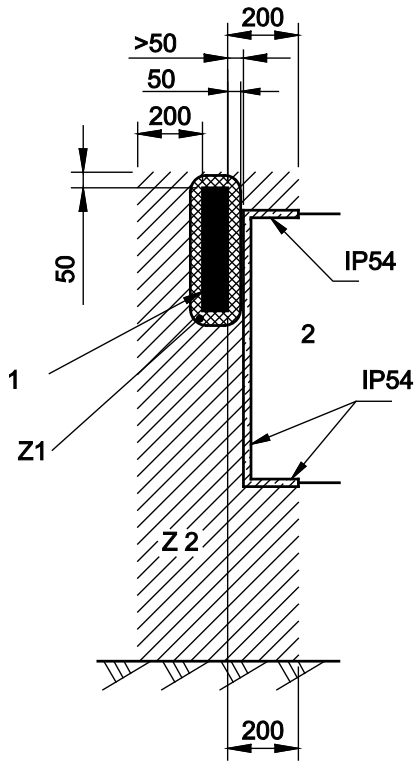
Key

1 nozzle
2 non hazardous area
Z1 zone 1 – category 2 equipment
Z2 zone 2 – category 3 equipment

Figure A.1 — Nozzle outside and below a housing at distance > 50 mm and ≤ 200 mm

Figure A.2 shows the situation where the nozzle extends above the top of the housing and the extent of the IP54 wall.

Dimensions in millimetres



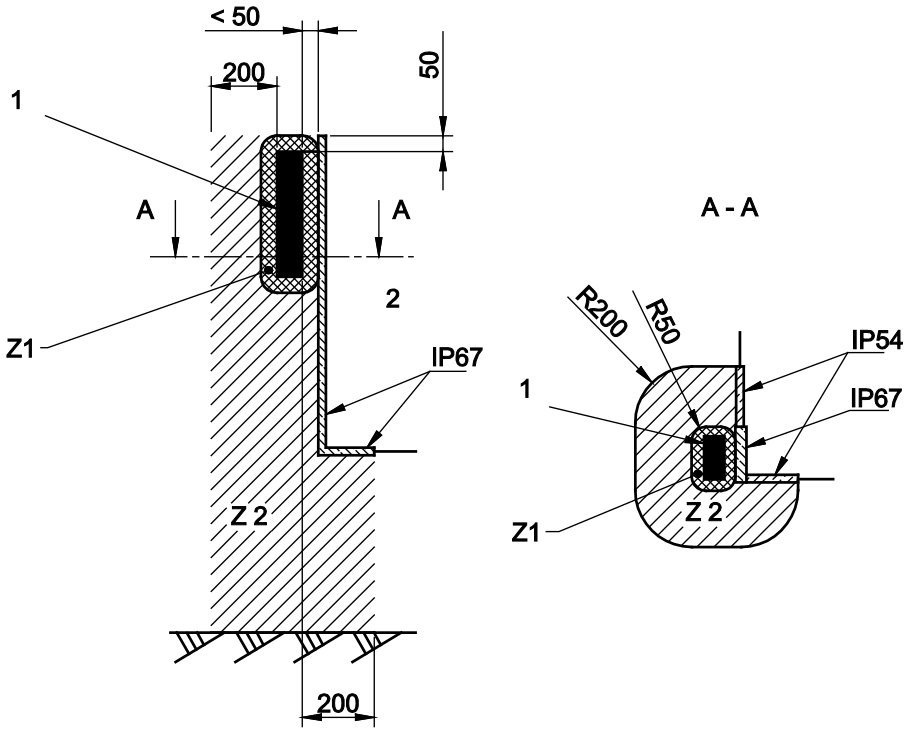
Key

1 nozzle
2 non hazardous area
Z1 zone 1 – category 2 equipment
Z2 zone 2 – category 3 equipment

Figure A.2 — Nozzle outside and above a housing at distance > 50 mm and ≤ 200 mm

Nozzle outside the housing but positioned ≤ 50 mm from a barrier. If the wall is IP67 within 200 mm horizontally and 50 mm vertically upwards and downwards to ground level from the nozzle outlet then the area on the other side of the IP67 barrier is not classified due to the nozzle. See Figure A.3.

Dimensions in millimetres



Key

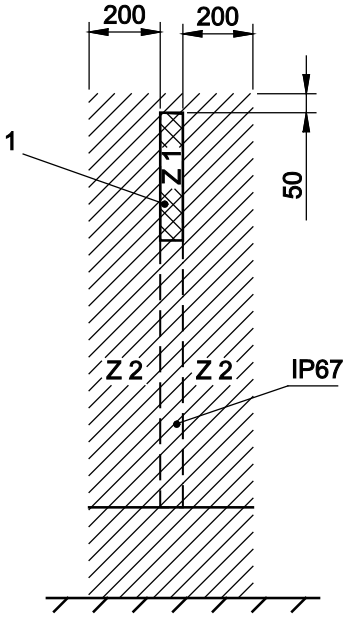
1 nozzle
2 non hazardous area
Z1 zone 1 – category 2 equipment
Z2 zone 2 – category 3 equipment

Figure A.3 — Nozzle outside a housing at distance ≤ 50 mm

A.3 Nozzle boot area

Nozzle outside the housing but positioned > 200 mm from any side non hazardous zone. The nozzle boot is set on one of the fascias of the non hazardous enclosure. See Figure A.4, Figure A.5 and Figure A.6.

Dimensions in millimetres

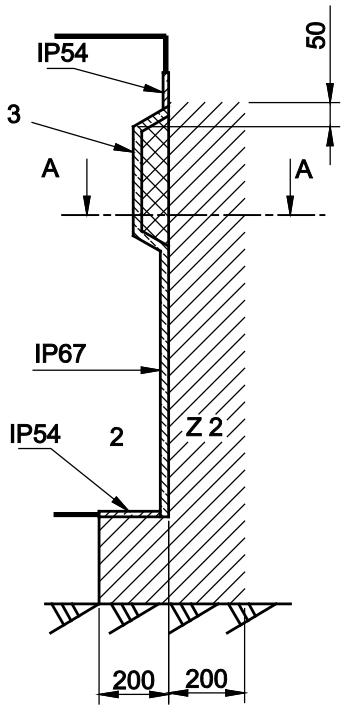


Key

1 nozzle boot
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure A.4 — Nozzle boot area – front view

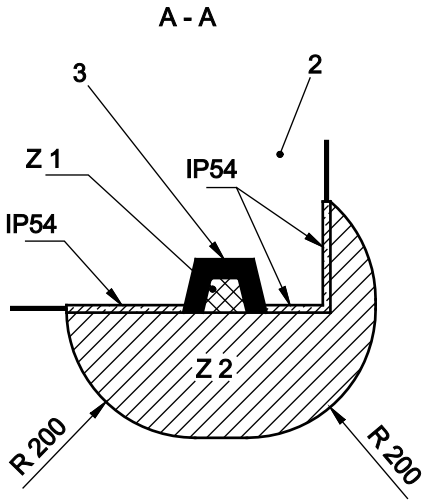
Dimensions in millimetres



Key
2 non hazardous area
3 continuous fabrication
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure A.5 — Nozzle boot area – side view

Dimensions in millimetres



Key
2 non hazardous area
3 continuous
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure A.6 — Nozzle boot area – top view

Annex B
(normative)

Vapour barriers

B.1 Classification

B.1.1 General

Within this annex, all references to IP54 shall be taken as references to IP54 Category 2 of EN 60529.

In Figure B.1, Figure B.2, Figure B.3, Figure B.4, Figure B.5 and Figure B.6, the IP ratings shown are those necessary for limiting the extent of hazardous areas.

B.1.2 Vapour barrier - Type 1

A vapour barrier shall be classified as Type 1, if it consists of one wall with a protection level IP67 in accordance with EN 60529 (see Figure B.1 and Figure B.2).

B.1.3 Vapour barrier - Type 2

A vapour barrier shall be classified as Type 2, if it consists of two walls, each with protection to IP54 in accordance with EN 60529 and with an air gap greater than 20 mm (see Figure B.3, Figure B.4, Figure B.5 and Figure B.6).

B.1.4 Air gaps

Air gaps shall be designed so that no vapour is trapped.

Where the air flow through the air gap is restricted by cables, screens or other objects, the effective width of the air gap shall be greater than 20 mm. Where there are obstructions to the air gap, the effective minimum cross ventilation section shall be at least (L x 20) mm.

For defining the actual gap d (in mm) in case of obstructions, the following equation shall be used:

$$d = 20 \frac{L}{L - s} A_{\mathrm{F}}$$

where

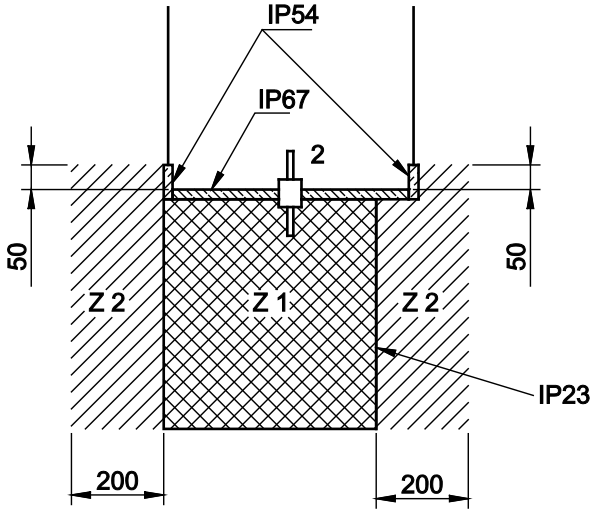
- d is the defining gap in mm
- s is the mean total width of the obstruction (cables, studs, etc.) seen in the cross ventilation section
- L is the longest length of the vapour barrier over the cross ventilation section
- A_{F} is the screen factor, which is the total surface of the screen covering one face of the space divided by total area of the holes in the same face of the screen

B.1.5 Screens

Where a screen is used the diameter of screen holes or width of screen apertures shall be at least 5 mm. See Figure B.3, Figure B.4, Figure B.5 and Figure B.6.

B.2 Typical vapour barrier arrangements

Dimensions in millimetres

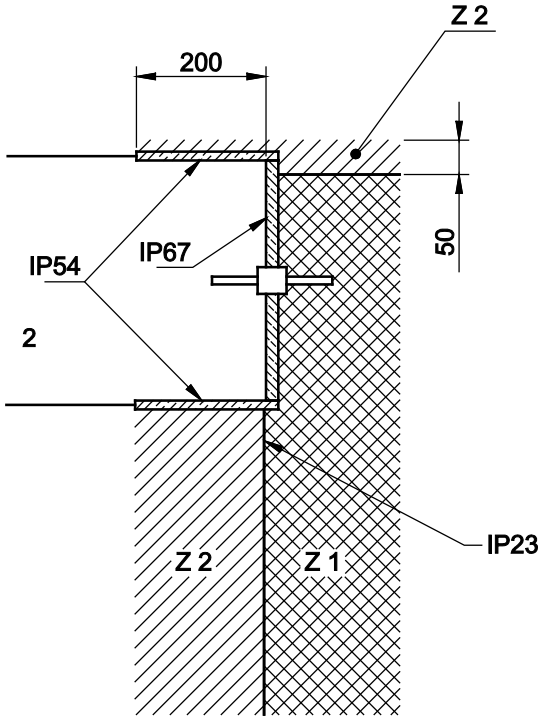


Key

2 non hazardous area
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure B.1 — Horizontal vapour barrier – Type 1

Dimensions in millimetres

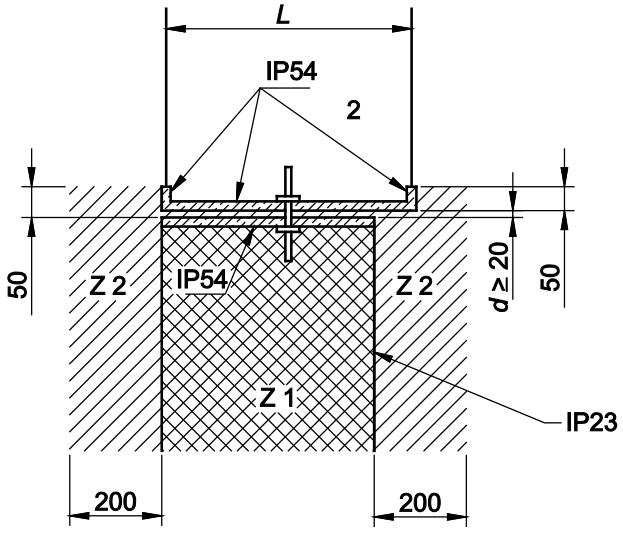


Key

2 non hazardous area
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure B.2 — Vertical vapour barrier – Type 1

Dimensions in millimetres

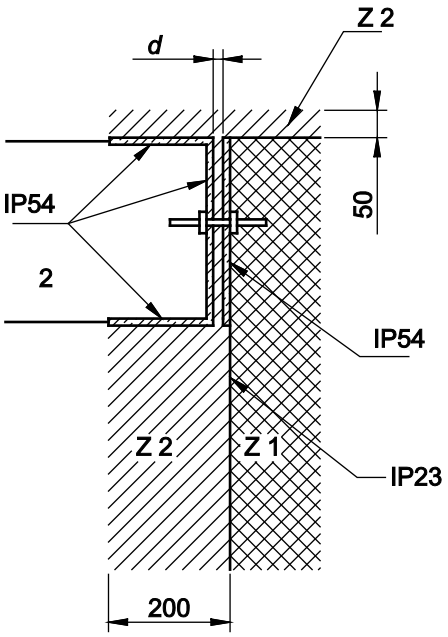


Key

2 non hazardous area
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure B.3 — Horizontal vapour barrier – Type 2

Dimensions in millimetres

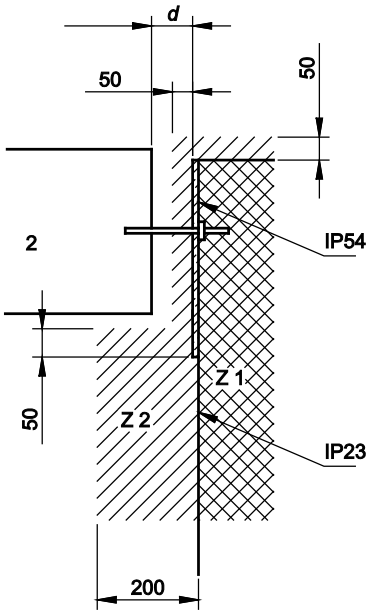


Key

2 non hazardous area
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure B.4 — Vertical vapour barrier – Type 2 – (50 mm > d ≥ 20 mm)

Dimensions in millimetres

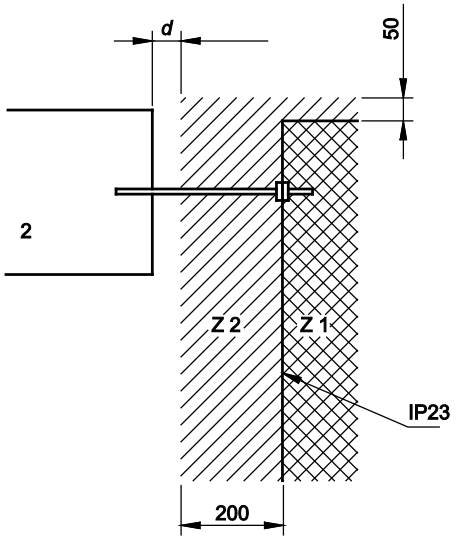


Key

2 non hazardous area
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure B.5 — Vertical vapour barrier – Type 2 – (200 mm > d ≥ 50 mm)

Dimensions in millimetres



Key

2 non hazardous area
Z 1 zone 1 – category 2 equipment
Z 2 zone 2 – category 3 equipment

Figure B.6 — Vertical vapour barrier – Type 2 – (d > 200 mm)

Annex C
(informative)

Information on explosion protected equipment

EN 1127-1 specifies methods for the identification of hazardous situations that can lead to an explosion. It details the design and construction measures to achieve the required safety. It includes the relationship between categories and zones and the applicable equipment in the different zones.

Information on the control and classification of hazardous places for gases and vapours by the use of ventilation is given in EN 60079-10-1.

Category 1: Equipment for this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases or mists (or by air/dust mixtures) are present continuously, for long periods or frequently.

NOTE 1 In general, this applies for Zone 0 (see EN 60079-10-1).

Category 2: Equipment of this category is intended for use in areas in which explosive atmospheres caused by gases, vapours or mists (or air/dust mixtures) are likely to occur.

NOTE 2 In general, this applies for Zone 1 (see EN 60079-10-1).

Category 3: Equipment of this category is intended for use in areas in which explosive atmospheres caused by gases, vapours or mists (or air/dust mixtures) are unlikely to occur or if they do occur, are likely to do so infrequently and for a short period only.

NOTE 3 In general, this applies for Zone 2 (see EN 60079-10-1).

Table C.1 — Standard protection concepts applicable

Protection technique (Ex)	**Symbol**	**Standard**	**Zone**		
			0	**1**	**2**
Intrinsic safety	ia	EN 60079-11	**A**	**A**	**A**
Intrinsic safety	ib	EN 60079-11	**-**	**A**	**A**
Flameproof	d	EN 60079-1	**-**	**A**	**A**
Increased safety	e	EN 60079-7	**-**	**A**	**A**
Oil immersion	o	EN 60079-6	**-**	**A**	**A**
Pressurised apparatus	p	EN 60079-2	**-**	**A**	**A**
Powder filling	q	EN 60079-5	**-**	**A**	**A**
Encapsulation	m	EN 60079-18	**-**	**A**	**A**
Non sparking	n	EN 60079-15	**-**	**-**	**A**
Intrinsically safe electrical systems	i	EN 60079-25	**A**	**A**	**A**
General requirements for Category 1 equipment	–	EN 60079-26	**A**	**-**	**-**
General requirements	–	EN 60079-0	**A**	**A**	**A**
A = applicable					

Annex D
(informative)

Environmental checklist

Environmental Aspect	Stages of the life cycle										All stages
	Acquisition		Production		Use			End-of-Life			
	Raw materials and energy	Pre-manufactured materials and components	Production	Packaging	Use	Maintenance and repair	Use of additional products	Reuse / Material and Energy Recovery	Incineration without energy recovery	Deposition	Transportation
Inputs											
Materials	4.1 4.3.3.6 4.3.3.7	4.1 4.3.3.6 4.3.3.7	4.1	9.2				4.1 4.3.3.7 8.2.3 9.2	4.1 4.3.3.7 8.2.3 9.2	4.1 4.3.3.7 8.2.3 9.2	
Water											
Energy				9.2	4.2.1						9.3
Land											
Outputs											
Emissions to air			5.1.3 6.1								
Discharges to water			5.1.3 5.3.3 6.1								
Discharges to soil			5.1.3 6.1								
Waste			4.1 5.1.3 6.1	9.1						4.1 4.3.3.7 8.2 9	
Noise, vibration, radiation, heat losses			4.1		4.1.5						
Other relevant aspects											
Risk to the environment from accidents or unintended use											
Customer information				7	7	7		7		7 8.2.3	
Comments:											

Annex E
(informative)

Significant technical changes between this document and the previous edition of this European Standard

The significant changes with respect to EN 14678-1:2006+A1:2009 are as listed in Table E.1.

Table E.1 — Significant technical changes between this document and EN 14678-1:2006+A1:2009

		Type		
Significant changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
The normative references have been updated throughout the document	2	X		
The terms and definitions have been updated to align with CEN/TC 286 EN standards.	3	X		
Environmental aspects have been added	4.1		X	
Requirements for chemical cells deleted	4.2.6			X
Requirements for low temperature service have been added	4.3.2		X	
Recommendations for cost reduction have been added	4.3.3.6		X	
Environmental aspects have been added	4.3.3.7		X	
Additional solutions added	4.5.1.2		X	
Requirements for unattended filling station have been added	4.5.6			X
Environmental aspects have been added	5.3.3		X	
Test requirements have been added	5.7.1			X
Test requirements have been added	5.8.1			X
Environmental aspects have been added	7		X	
Environmental aspects have been added	9		X	
Explanatory guidance has been added	A.1	X		
Summary of environmental aspects listed	Annex C	X		

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 94/9/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 94/9/EC of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA — Correspondence between this European Standard and Directive 94/9/EC

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 94/9/EC	Qualifying remarks/Notes
4.4	1.0.1	Principles of integrated explosion safety Equipment
4.2.4 4.4.1	1.0.2	Design for misuse
4	1.0.4	Surrounding area conditions
8	1.0.5	Marking
7	1.0.6 (a)	All equipment must be accompanied by instructions
8.1	1.0.6 (b)	The instructions must be drawn up in one of the Community languages
7 8.1	1.0.6 (c)	The instructions must contain the drawings and diagrams for the putting into service
4.4.1	1.1.1	Materials must not trigger off an explosion
4.4.1 4.3.3	1.1.3	Material characteristics
4	1.2.1	Regard to technological knowledge
4	1.2.3	Prevention of leaks giving rise to explosive atmospheres
4.5	1.2.5	Additional means of protection
4.4	1.2.7 (d)	Overloads
4.4	1.3.1	Hazards arising from different ignition sources
4.2.5 4.4.1	1.3.2	Hazards arising from static electricity

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 94/9/EC	Qualifying remarks/Notes
4.2	1.3.3	Hazards arising from stray electric and leakage currents
4.4.1	1.3.4	Hazards arising from overheating
4	1.4.1	Presence of humidity and contamination
4.3	1.4.2	Mechanical & thermal stress, aggressive substances
4.5.1.1 4.5.1.2	1.5.2	System security in the event of safety device failure
4.2.4	1.6.1	Manual override of process
4.2.1 4.5.1.1 4.5.1.2	1.6.2	Actuation of emergency shutdown
4.2.1 4.4.1	2.2.1.1	No sources of ignition in event of operating faults
4.2 4.4	2.3.1.1	Preventing ignition sources

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

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