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British Standard

Metering pumps and dispensers to be installed at filling stations and used to dispense liquid fuel

Part 1. Specification for construction

Pompes et distributeurs pour stations de distribution de combustibles liquides
Partie 1. Spécification de construction

Zapfsäulen und andere Einrichtungen zur Abgabe von Flüssigtreibstoff auf Tankstellen
Teil 1. Konstruktion

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Foreword

This Part of BS 7117 has been prepared under the direction of the Industrial-process Measurement and Control Standards Committee. It forms Part 1 of a standard on metering pumps and dispensers to be installed at filling stations and used to dispense liquid fuel into the tanks of motor vehicles, boats and light aircraft and into portable containers.

The other Parts to be published are:

Part 2. Guide for the installation of a pump to its connections

Part 3. Guide for maintenance

Attention is drawn to the existence of statutory requirements and by-laws which place responsibility for complying with specific safety requirements on the licensee and user. At the date of publication of this standard, these include the following:

The Health and Safety at Work etc, Act 1974

The Electricity (Factories Act) Special Regulations 1908 and 1944

Memorandum on the Electricity Regulations SHW 928

The Factories Act 1961

The Petroleum (Consolidation) Act 1928

The Weights and Measures Act 1985

and other relevant statutory requirements or by-laws.

For detailed guidance on construction and operation of petrol filling stations the reader is directed to the Health and Safety Executive publication HS(G)41*, part of which complements this British Standard.

The drawings given in this standard are not necessarily to scale and are intended only to supplement the text and to illustrate the general principles. They are not the only possible examples and they are not intended as design examples or as fully dimensioned working drawings.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

Requirements for the construction of electrical apparatus for use in hazardous atmospheres are specified, for example, in BS 5501 (EN 50014 to EN 50020, EN 50028 and EN 50039) and BS 4683. Compliance with accepted standards is demonstrated by the production of a certificate from a certification body, of which there are a number of competent ones, but not all of which have recognition by UK Petroleum Licensing Authorities.

The recognized authority in the United Kingdom for the certification and approval of electrical equipment for use in hazardous areas (non-mining) for the issuing of certificates of conformity with the EEC Directive 76/117/EEC is:

BASEEFA

Health and Safety Executive

Harpur Hill

Buxton, Derbyshire SK17 9JN

There are EEC-recognized national certification authorities in other countries.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

*In preparation.

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Specification

0 Introduction

The vapours given off by liquid fuels dispensed at filling stations are flammable. If ignited they may burn with considerable explosive force when mixed with air in appropriate proportions. Therefore sources of ignition should be excluded wherever possible from hazardous areas where vapour may be present. Electrical equipment used in such areas, e.g. in the vicinity of metering pumps, should be constructed so as not to be a source of ignition of flammable vapour. It is important that such equipment is correctly designed, selected, installed, used and maintained and shall not facilitate the perpetration of fraud.

1 Scope

This Part of BS 7117 specifies requirements for metering pumps and dispensers to be installed at filling stations and used to dispense liquid fuels into the tanks of motor vehicles, boats and light aircraft and into portable containers. It gives particular attention to electrical, mechanical and hydraulic equipment and electrical apparatus installed within, or mounted on, the housings of metering pumps or dispensers.

It does not include any requirements for metering performance such as those specified under the Weights and Measures Legislation.

Except where specifically mentioned, the requirements in this Part apply to apparatus suitable for use and storage at ambient temperatures between -20°C and $+40^{\circ}\text{C}$, inclusive, unless otherwise marked.

This Part applies to equipment for fuels which are flammable liquids having a flash point not exceeding 100°C , but does not include equipment for liquefied petroleum gas.

This Part does not deal with any hazards related to the dispensing of liquid fuel other than those arising from the ignition of flammable liquids/vapour.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 7117 the definitions given in BS 4727, BS 5501, BS 6941 and BS 5345 (published in a number of Parts) apply, together with the following. For convenience some definitions have been reproduced from those standards.

2.1 air and/or vapour separator. A device which allows air or vapour to escape to a vent pipe from the liquid stream before the liquid reaches the measuring unit (meter).

2.2 computer. A device which receives data from the measuring unit and processes it into volume (and if required, price) units.

2.3 degree of protection by enclosures. The measures applied to the enclosures of electrical apparatus to ensure:

- (a) the protection of persons against contact with live or moving parts inside the enclosure and protection of the apparatus against ingress of solid foreign bodies;
- (b) the protection of the apparatus against ingress of liquids.

(Reproduced from BS 5501 : Part 1 : 1977. (EN 50014))

2.4 delivery hose. A flexible delivery pipe.

2.5 delivery unit/equipment. The delivery pipework from the outlet of the measuring unit, the dispensing hose and the delivery control nozzle.

NOTE. It may also incorporate arrangements for supporting the dispensing hose, nozzle, nozzle housing and dispensing controls.

2.6 dispenser. A measuring system similar to a metering pump except that it does not incorporate its own pumping system.

2.7 dispersed unit delivery system. A measuring system similar to a metering pump except that the units may be separated and located in individual protective housings.

2.8 electrical system. All the electrical and electronic apparatus (including cables and wiring) contained within or mounted on the housing or housings.

2.9 explosive atmosphere. A mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour or mist, in such proportions that it can be exploded by excessive temperature, arcs or sparks. (Reproduced from BS 5501 : Part 1 : 1977. (EN 50014))

2.10 filling station. An establishment providing the dispensing of liquid fuels into the fuel tanks of motor vehicles, boats and light aircraft and into portable containers.

2.11 hazardous area. An area in which explosive gas/air mixtures are, or may be expected to be, present in quantities such as to require special precautions for the construction, and use of, electrical apparatus.

(Reproduced from BS 5345 : Part 1 : 1976.)

NOTE. See clause 4.

2.12 indicator unit. A unit which displays the results of measurement transferred to it from the computer.

2.13 measuring unit (meter). A device for measuring the amount of fuel dispensed.

NOTE. The unit can be coupled directly to a mechanical computer and/or an indicating unit, or the measurement data can be transmitted to a computer (remotely mounted or otherwise).

2.14 non-hazardous area. An area in which explosive gas-air mixtures are not expected to be present so that special precautions for the construction and use of electrical apparatus are not required.

NOTE. Special considerations may be required for a non-hazardous area apparatus that is associated with hazardous area apparatus (see in particular BS 5345 : Part 4).

(Reproduced from BS 5345 : Part 1 : 1976.)

2.15 type of protection. The measures applied in the construction of electrical apparatus to prevent ignition of the surrounding explosive atmosphere by such apparatus. (Reproduced from BS 5501 : Part 1 : 1977. (EN 50014))

2.16 flameproof enclosure 'd'. A type of protection in which the parts which can ignite an explosive atmosphere are placed in an enclosure which can withstand the pressure developed during an internal explosion of an explosive mixture and which prevents the transmission of the explosion to the explosive atmosphere surrounding the enclosure.

(Reproduced from BS 5501 : Part 5 : 1977. (EN 50018))

NOTE. This type of protection is indicated by the letter 'd'.

2.17 increased safety 'e'. A type of protection by which measures are applied so as to prevent with a higher degree of security the possibility of excessive temperatures and of the occurrence of arcs or sparks in the interior and on the external parts of electrical apparatus which does not produce them in normal service.

(Reproduced from BS 5501 : Part 6 : 1977. (EN 50019))

NOTE. This type of protection is indicated by the letter 'e'.

2.18 intrinsically safe circuit. A circuit in which no spark or any thermal effect produced in the test conditions prescribed in BS 5501 : Part 7 (which include normal operation and specified fault conditions) is capable of causing ignition of a given explosive atmosphere.

(Reproduced from BS 5501 : Part 7 : 1977. (EN 50020))

2.19 intrinsically safe electrical apparatus. Electrical apparatus in which all the circuits are intrinsically safe. (Reproduced from BS 5501 : Part 7 : 1977. (EN 50020))

NOTE. This type of protection is indicated by the letter 'i'.

2.20 pressurized apparatus 'p'. A type of protection by which the entry of a surrounding atmosphere into the enclosure of the electrical apparatus is prevented by maintaining, inside the said enclosure, a protective gas at a higher pressure than that of the surrounding atmosphere. The overpressure is maintained either with or without a continuous flow of the protective gas.

(Reproduced from BS 5501 : Part 3 : 1977. (EN 50016))

2.21 type of protection N. A type of protection applied to electrical apparatus such that, in normal operation, it is not capable of igniting a surrounding explosive atmosphere and a fault capable of causing ignition is not likely to occur.

(Reproduced from BS 6941 : 1988.)

NOTE. This type of protection is indicated by the letter 'N'.

2.22 type of protection powder filling 'q'. A type of protection in which the enclosure of electrical apparatus is filled with a material in a finely granulated state so that, in the intended conditions of service, any arc occurring within the enclosure of an electrical apparatus will not ignite the surrounding atmosphere. No ignition shall be caused either by flame or by excessive temperature of the surfaces of the enclosure.

(Reproduced from BS 5501 : Part 4 : 1977. (EN 50017))

NOTE. This type of protection is indicated by the letter 'q'.

2.23 type of protection oil immersion 'o'. A type of protection in which the electrical apparatus or parts of the electrical apparatus are immersed in oil in such a way that an explosive atmosphere which may be above the oil or outside the enclosure cannot be ignited.

(Reproduced from BS 5501 : Part 2 : 1977. (EN 50015))

2.24 type of protection special protection 's'. A concept that has been adopted to permit the certification of those types of electrical apparatus that, by their nature, do not comply with the constructional or other requirements specified for apparatus with established types of protection, but which, nevertheless, can be shown, where necessary by test, to be suitable for use in hazardous areas in prescribed zones.

(Reproduced from BS 5345 : Part 8 : 1980.)

NOTE. This type of protection is indicated by the letter 's'.

2.25 pump/dispenser canopy. A housing which contains displays and/or luminaires and/or associated circuitry.

2.26 pump/dispenser housing. The housing which provides mechanical protection for the equipment in a metering pump/dispenser.

NOTE. This housing may contain apparatus other than electrical equipment.

2.27 metering pump. A measuring system designed to dispense liquid fuel. It contains its own pumping system to draw fuel from a supply tank or tanks.

2.28 remote pump. An electrically driven suction pump assembly mounted above or adjacent to a supply tank and remote from a dispensing facility.

2.29 submersible pump. An electrically driven pump immersed in the liquid fuel in the storage tank.

2.30 restricted breathing enclosure. An enclosure that is designed to restrict the entry of gases.

2.31 safety nozzle. A device for controlling the flow of fuel during a dispensing operation.

2.32 suitable for Zone 0. Certified by the Certification Authority for use in Zone 0.

2.33 suitable for Zone 1. Certified by the Certification Authority for use in Zone 1.

2.34 suitable for Zone 2. Certified by the Certification Authority for use in Zone 2.

2.35 vapour barrier. A sealing system to prevent the flow of fuel vapour between adjacent zones.

3 Classification of fuels

Fuels are divided into three classes according to flash point.

Class I. Liquids which have a flash point below 21 °C, e.g. petroleum spirit (leaded and unleaded) and petroleum spirit mixtures.

Class II. Liquids which have a flash point from 21 °C to 55 °C inclusive, e.g. kerosene, diesel oil and paraffin.

Class III. Liquids which have a flash point above 55 °C up to and including 100 °C, e.g. diesel fuel.

4 Classification of hazardous areas

The concept of hazardous area classification recognizes the differing degrees of probability with which explosive (flammable) concentrations of flammable gas or vapour may arise in installations in terms of both frequency of occurrence and duration of existence on each occasion.

In a hazardous area three types of zone are recognized.

- Zone 0.** In which an explosive gas-air mixture is continuously present, or is present for long periods.
- Zone 1.** In which an explosive gas-air mixture is likely to occur in normal operation.
- Zone 2.** In which an explosive gas-air mixture is not likely to occur in normal operation, and if it occurs it will exist only for a short time.

All other areas are classed as non-hazardous.

NOTE 1. Further information on hazardous area classification is given in BS 5345 : Part 2.

NOTE 2. Examples of the hazardous areas for metering pumps and dispensers, subdivided into appropriate zones, are shown in figures 1 to 10.

5 Classification of modes of operation of dispensing equipment

The operation of dispensing equipment at filling stations is classified as follows.

- (a) **Attendant-operated.** Attendant-operated stations are those where fuel is supplied by an attendant who directly operates the equipment and the discharge nozzle.
- (b) **Attended self-service.** Attended self-service comprises dispensing equipment which is operated by the customer but which is activated by an attendant from a control point from which the attendant is able to authorize and, in an emergency, to shut off the dispensing equipment.
- (c) **Unattended self-service.** Unattended self-service comprises dispensing equipment which is operated by the customer and not supervised by an attendant.

6 Classification of pump facilities

The hydraulic and electrical facilities of multiple product pumps (mpd) are classified as follows.

Category A. Shared electrical facilities. Multiple pumps with common electrical facilities which, if left energized in a fault condition, could cause a hazard in any of the other units.

Category B. Separate electrical facilities. Multiple pumps in which the electrical facilities are either independent

of each other, or in which a fault condition in one unit does not cause a hazard in any of the other units.

Category C. Shared hydraulic facilities. Multiple pumps with common hydraulic facilities which if left energized in a fault condition could cause a hazard in any of the other units.

Category D. Separate hydraulic facilities. Multiple pumps in which the hydraulic facilities are either independent of each other, or in which a fault condition in one unit does not cause a hazard in any of the other units.

NOTE. The facilities referred to are those which make up one self-contained unit such as a single pump through to a multi-product metering pump/dispenser.

7 Classification of vapour barriers

7.1 Type 1 vapour barrier

A vapour barrier shall be classified as type 1 if it complies with the following.

- (a) The barrier is continuous or allows the passage of rigidly located cables and pipes.
- (b) When a pressure difference of not less than 1.5 bar* is maintained across the barrier for not less than 60 s, there is no discernible leakage.

7.2 Type 2 vapour barrier

A vapour barrier shall be classified as type 2 if it complies with the following.

- (a) The barrier allows the passage of rigidly located cables, pipes and shafts.
- (b) The barrier passes the type test for restricted breathing described in appendix G of BS 6941 : 1988.

8 Construction and performance

8.1 Electrical apparatus

NOTE. Metering pumps and dispensers that have been repaired, refurbished or re-worked in any way should conform strictly to the requirements of the certificates issued to the original manufacturers by the certification bodies, e.g. National Weights and Measures Laboratory†, and should be marked accordingly. (See BS 7117 : Part 3‡.)

Users of this British Standard should ensure that any certification body employed has recognition from UK Petroleum Licensing Authorities.

8.1.1 The voltage and wattage of lamps and small illuminated equipment shall be permanently marked on, or adjacent to, the equipment.

8.1.2 All electrical apparatus within the dispenser shall be capable of withstanding an insulation resistance test at 500 V d.c. or shall be provided with facilities for convenient and safe disconnection, without dismantling, so that the test may be conducted up to and including the connections within the hazardous area. Such facilities shall be identified and clearly labelled.

*1 bar = 10⁵ N/m² = 100 kPa

†The address of the National Weights and Measures Laboratory is Department of Trade and Industry, National Weights and Measures Laboratory, Stanton Avenue, Teddington, Middlesex TW11 0JZ.

‡In preparation.

8.2 Materials

8.2.1 All materials used in construction shall be resistant to attack by liquid fuel and its vapours and shall be chemically and dimensionally stable under service conditions.

8.2.2 Electrical and mechanical components used in metering pumps/dispensers when made from light alloys shall contain no more than 6 % by mass of magnesium.

NOTE. Light alloys may be used in the construction of electrical equipment which is protected from mechanical damage by being enclosed in a housing, but attention is drawn to the frictional sparking hazard arising from impact between rusty iron or steel with aluminium, magnesium and titanium and alloys of these metals (see annex B of BS 5345 : Part 1 : 1976).

8.3 Location and safety

8.3.1 Power-driven delivery equipment shall be fitted with a safety nozzle which is provided with an automatic cut-off to prevent overfilling. The minimum flow rate to operate the cut-off shall not be more than 10 L/min. For latch-open nozzles and those for self-service see also 8.13.

8.3.2 Metering pumps, dispensers, remote pumps and/or dispersed unit delivery systems shall be provided with a means for mounting on a plinth or other foundation and shall be enclosed by a protective housing which may incorporate transparent apertures to display the delivery particulars.

NOTE 1. A metering pump usually includes an electric motor, a pump, an air and/or vapour separator, a measuring unit (meter), a computer, indicator units, delivery equipment (including a control nozzle) and optional lighting.

NOTE 2. A remote pumping system usually comprises the following inter-connected units: an electric motor, a pumping unit, an air and/or vapour separator, an interlock valve, and input and output piping. A measuring unit (meter) may also be included in the remote pumping system. The complete mechanism is surrounded by a protective housing.

8.3.3 Where the dimension from the base of a metering pump/dispenser to a notional horizontal line across the pump designating the height of the Zone 2 area generated by the pump outside the pump casing (dimension x on figure 7) is less than 1250 mm then a warning plate shall be fitted stating 'WARNING: THIS PUMP SHALL BE MOUNTED ON A PLINTH OF MINIMUM HEIGHT z mm'.

NOTE 1. The value of z mm will be determined from information given on the manufacturer's drawings. (See also figure 7.)

NOTE 2. As the warning plate is required only when the dimension x is less than 1250 mm, it may be separate from the pump certification label but should be fixed adjacent to that label when it is required.

8.3.4 The notional horizontal line across the pump shall be identified by a mark $\ominus$ at a height defining the interface of the hazardous and non-hazardous areas for the pump.

NOTE. This interface mark takes into account the metering pump/dispenser only and not other forecourt influences.

8.3.5 Items within a hazardous area shall be physically positioned or mechanically protected to prevent the possibility of the degradation of one item by another. The layout and design of the electrical apparatus shall take into account the possibility of drips occurring from seals of rotating shafts.

8.4 Sight glass

Any sight glass shall be capable of withstanding an internal hydraulic pressure of 5 bar for at least 60 s following a test of resistance to impact according to BS 5501 : Part 1 with an energy of 7 J, but performed at normal ambient temperature in all cases.

8.5 Maximum pressure

The maximum pressure of both class I and class II fuels dispensed through metering pump systems shall not exceed 2.5 bar and that of class III fuels dispensed through pump systems shall not exceed 3 bar.

8.6 Piping

8.6.1 Except for the sight glass and delivery hose when they are entirely external to the housing, the piping and other components of metering pumps or dispensers through which liquid fuel passes shall be constructed of materials that, when so formed into piping or other components, comply with the following.

- (a) The material is not degraded by the liquid fuel.
- (b) Within the temperature range -20°C to 310°C , the mechanical strength of the material does not decrease by more than 25 % of its value at 15°C .
- (c) Within the temperature range -20°C to 310°C , the piping or other component does not leak when subjected to one and a half times its maximum working pressure for a period of not less than 60 s.
- (d) Within the temperature range -20°C to 310°C , the piping or other component does not fail when subjected to four times its maximum working pressure for a period of not less than 60 s.

NOTE. The materials should have ageing properties acceptable to the Certification Authority.

8.6.2 Piping assemblies and components through which liquid fuel passes and the associated seals and gaskets shall not leak when subjected to one and a half times maximum working pressure for a period of not less than 60 s and shall not fail when subjected to 4 times maximum working pressure for a period of not less than 60 s. Joints in the delivery pipe shall be of high integrity and resistant to vibration, and where these joints are located in a non-hazardous area they shall be either welded or brazed. Soft solder shall not be used (see figure 11).

8.6.3 Piping and components through which liquid may pass shall not form a part of the constructional framework of any type of dispensing equipment.

NOTE. Such piping and components may support lightweight cladding.

8.6.4 A flexible connection used to connect the pump/dispenser to the delivery pipe from the storage tank shall be positioned wholly within the pump/dispenser housing.

8.7 Air and/or vapour separator

8.7.1 Flame arrestor. Any air and/or vapour separated by the air and/or vapour separator shall be exhausted to the atmosphere through a flame arrestor comprising a fine wire gauze of copper, brass or other non-corroding material having a mesh width of approximately 500 μm and a wire diameter of approximately 400 μm . A device shall be provided to prevent the ejection of liquid fuel from the vent pipe.

8.7.2 Float. Any hollow float provided in the air/vapour separator of the metering pump shall be capable of withstanding, without distortion, an external pressure of not less than 5 bar for at least 60 s.

8.8 Vent pipe

The ventilating pipe from each air/vapour separator of a metering pump or remote pump shall discharge directly to the open air outside the unit housing. The vapour may vent through the metering pump/dispenser/hydraulic housing (casings) not less than 100 mm from any ventilation apertures (see figure 10), or may vent through the nozzle housing(s).

8.9 Housing

The pump/dispenser housing shall provide mechanical protection for the internal equipment. Any material used in its construction shall have a surface spread of flame characteristic not inferior to class 2 of BS 476 : Part 7. It shall provide a degree of protection not less than IP 23 in accordance with BS 5490.

8.10 Delivery hose

8.10.1 Flexible delivery hose and end fittings shall comply with BS 3395. The length of hose shall limit the movement of the nozzle to a maximum of 3.6 m from the metering pump/dispenser centre line unless any proposal for a longer hose has been agreed with the Petroleum Licensing Authority. In cases where petroleum delivery hose passes through a non-hazardous area the hose shall be continuous (i.e. without joints, etc.) for the purposes of hazardous area classification.

8.10.2 Where the area around the joint is to be considered as a non-hazardous area delivery hose and end fittings used on liquid fuel dispensing equipment of the high hose type shall comply with one of the hose type designations given in BS 3395.

8.10.3 The end fittings of the hose shall be of the non-reusable type. Taper threads shall not be used. The design of the end fittings shall be such that they will remain secure in use.

8.10.4 The seal between the end fitting and the delivery pipe shall be flat-faced and made of nylon, polyurethane

or similar hard, non-swelling material which is resistant to liquid fuel. The end fittings shall be designed to facilitate the use of such seals.

8.10.5 A warning label shall be attached adjacent to each hose inlet joint as specified in 9.4.

8.10.6 Once fitted to a dispenser, the hose and inlet joint assembly shall be tested by filling with liquid fuel and the delivery pump left running for 1 min. During this period the hose nozzle trip shall be operated several times.

NOTE. One method is to deliver liquid fuel into a container in such a way that at about 1 L increments the trip is operated by immersing the nozzle in the liquid fuel in the container.

The hose and end fitting shall then be inspected and shall not show signs of leakage.

8.10.7 All delivery hose and hose end joints entirely outside the metering pump/dispenser housing shall be visible without the removal of covers.

8.10.8 Where sections of the delivery hose and its joints are located inside the metering pump/dispenser housing, means shall be provided to relieve the hose and its joints of tension.

The hose shall not be bent through a radius of less than eight times the nominal bore and there shall be a straight section of delivery hose from the end fitting not less than eight times the nominal bore.

When finished the hose and joints shall comply with 8.6.1.

8.10.9 Where the delivery hose is within, or passes through, the metering pump/dispenser housing, protection shall be provided against abrasion and kinking.

8.11 Ventilation

8.11.1 General. Cross ventilation of the inside of a metering pump, dispenser, or remote pumping unit housing shall be provided and the total effective area of the ventilation openings shall be not less than the greater of 8000 mm^2 or 3.5 % of the horizontal internal cross-sectional area of the housing at the base of the pump, equally divided between the upper and lower casings of the housing.

8.11.2 Column extensions

8.11.2.1 Column extensions of the housings above a type 1 vapour barrier do not require ventilation.

8.11.2.2 Column extensions of the housings above a type 2 vapour barrier shall be ventilated at the top and bottom of the extension (see figure 6).

8.11.2.3 The top vent shall be not lower than 150 mm below the highest point of the extension. The minimum aperture area shall be 10 % of the horizontal cross-sectional area of the extension or 2500 mm^2 , whichever is the greater.

8.11.2.4 The lower ventilation shall be provided by vents on opposite sides of the extension to provide cross-ventilation. The vents shall be above the barrier but shall

be not higher than 150 mm above the barrier. The minimum aperture area shall be 10 % of the horizontal cross-sectional area of the extension or 2500 mm², whichever is the greater, and shall be equally divided between the vents. In circular housings the vents shall be diametrically opposed.

8.11.3 Fabrications (capable of enclosing a space) extending vertically from the top of a hydraulic housing (Zone 1 or 2) without a vapour barrier. If no vapour barrier is fitted, an enclosed fabrication will be considered as an extension of the zones unless:

- (a) 25 % or more of its surface area constitutes aperture/s open to free air; or
- (b) the ventilation extends completely to the junction of the Zone 1 or 2 enclosure so as to ensure that no vapour trap can remain below the lowest ventilation aperture.

8.12 Multiple outlet systems

Every dispenser connected to a single or multiple outlet pressure source, such as a remote pumping unit or a submersible pump, shall be fitted with a nozzle switch which on return of a nozzle into the nozzle housing:

- (a) initiates closure of a valve within the dispenser to prevent liquid flow; and
- (b) if no other dispenser connected to the pressure line system is operating, initiates disconnection of the electrical supply to the remote or submersible pump.

8.13 Safety nozzle

8.13.1 Safety nozzle valve. The nozzle shall incorporate a valve controlled by a lever for regulating the rate of flow. The inlet to the nozzle shall be connected to the delivery hose.

8.13.2 Safety nozzle: attendant operated. If the nozzle valve of a metering pump, or dispenser, is fitted with a latch-open device the following shall apply.

- (a) The minimum latch setting shall permit a flow of not less than 20 L/min.
- (b) In the event of the nozzle falling out of the filling pipe of a vehicle, the valve shall close and it shall not be possible to re-establish flow without first returning the nozzle control lever to the 'off' position.
- (c) The nozzle shall be fitted with an attitude device to prevent delivery unless the nozzle spout is pointing down; the device shall operate before 0.05 L of liquid fuel has passed the nozzle valve when the initial flow rate through the nozzle is in excess of 10 L/min. The flow of liquid shall stop in the event of the nozzle falling out of the filling pipe of a vehicle.
- (d) The nozzle shall be so designed that in a normal filling operation it will not be displaced from the filling pipe of the vehicle.
- (e) When the nozzle spout is in the filling pipe of a vehicle and a pulling force of 900 N is applied at any angle between the horizontal and 30° above the

horizontal, the nozzle shall be released from the filling pipe, or shall break off before damage to the control valve, coupling, delivery hose or pump occurs. The flow of liquid shall stop.

NOTE. This is to avoid damage to the control valve, coupling, delivery hose or pump in the event of a vehicle moving away with the nozzle in the filling pipe.

(f) The nozzle shall be fitted with a device to cut off the flow of petrol as soon as the nozzle end is covered.

(g) After the automatic cut-off has operated, it shall not be possible to re-establish flow without first returning the nozzle control lever to the 'off' position.

8.13.3 Safety nozzle: self service. The nozzle of a self-service pump shall comply with requirements (b) to (g) of 8.13.2. There shall be no latch-open device.

8.14 Submersible pump

NOTE. Pressure piping systems such as those supplied with liquid fuel by submersible or remote pumps are required to have a number of important safety features and on installation reference should be made to BS 7117 : Part 2*.

8.14.1 The stator winding of the submersible pump motor and any wiring to the motor which is to be within the storage tank (Zone 0) shall be totally sealed. The motor and associated wiring shall be of an approved type.

8.14.2 The submersible pump shall be cooled and lubricated by the product it pumps. In normal working conditions, completely dry operation of the pump and pump motor shall not be possible.

NOTE. Such an arrangement ensures that the pump and pump motor may be considered as operating in Zone 1.

8.14.3 A thermal switch shall be provided in the pump motor circuit to de-energize the motor in the event of the temperature in the motor winding exceeding 120 °C.

8.14.4 In the event of continuous dry operation the temperature of the bearings and moving parts of the pump and pump motor shall not increase by more than 60 K.

8.14.5 The pump head assembly shall be suitable for use in Zone 1 and shall have been designed to be installed either above ground in the open air or in a manhole chamber which has no other opening direct to the storage tank, i.e. no filling or dipping opening etc., is present.

8.15 Protection techniques

8.15.1 Within Zone 1 electrical equipment shall comprise electrical apparatus protected by one or more of the following types of protection:

- (a) flameproof enclosure 'd' (see BS 5501 : Part 5);
- (b) intrinsic safety 'i' (see BS 5501 : Parts 7 and 9);
- (c) increased safety 'e' (see BS 5501 : Part 6);
- (d) special protection 's' (recommendations given in BS 5345 : Part 8);
- (e) pressurization 'p' (see BS 5501 : Part 3).

*In preparation.