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FOREWORD

The guidance included in this publication has been prepared by the Service Station Panel of the Energy Institute in consultation with a wide range of industry stakeholders, with the encouragement and support of the UK Health and Safety Executive (HSE).

The guidance is intended to assist those in the UK comply with the statutory Electricity at Work Regulations (1989) and petroleum storage legislation, with regard to electrical design and installation relating to the storage and dispensing of LPG and/or CNG as an automotive fuel.

The guidance includes key features of the electrical provisions of APEA/IP Guidance for the design, construction, modification and maintenance of petrol filling stations.

The guidance in this publication has primarily been prepared for use within the UK. However, those installing such facilities elsewhere may benefit from considering the guidance included herein.

The Energy Institute cannot accept responsibility, of whatsoever kind, for damage or loss, arising or otherwise occurring as a result of the application of the information contained in this publication.

Suggested revisions are invited and should be submitted to the Technical Department, the Energy Institute, 61 New Cavendish Street, London W1G 7AR, UK.
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- Association of Petroleum and Explosives Administration (APEA)
- Association of UK Oil Independents (AUKOI)
- Berry & Co
- BP
- ChevronTexaco Ltd
- ConocoPhillips
- Electrical Contractors Association (ECA)
- Esso Petroleum Company Ltd
- J & R Gilbert
- Health & Safety Executive
- LP Gas Association (LPGA)
- National Inspection Council for Electrical Installation Contracting (NICELC)
- Petrol Retailers Association (PRA)
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The Association for Petroleum and Explosives Administration (APEA) is thanked for agreeing to the reproduction of certain sections of text taken directly from APEA/IP Guidance for the design, construction, modification and maintenance of petrol filling stations.
INTRODUCTION

Liquefied Petroleum Gas (LPG) for use in motor vehicles, generally known as Autogas, is being encouraged in the UK as an alternative fuel because of its cleaner burning characteristics and environmental benefits. Autogas may be sold alongside other motor fuels at vehicle refuelling stations or at dedicated Autogas stations.

Compressed Natural Gas (CNG) similarly is available in the UK.

In the UK all vehicle refuelling stations storing and dispensing LPG or CNG are covered by the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR), whether dedicated to those fuels alone or in combination with petroleum. Other Health and Safety legislation applies in any event. Where LPG or CNG is installed at a vehicle refuelling station that is presently subject to petroleum licensing, the Petroleum Enforcement Authority (PEA) can attach conditions which relate to LPG or CNG, since the storage and dispensing of those fuels may impact with the storage and dispensing of petroleum.
CONSULTATION

The facilities needed at the LPG/CNG/petroleum refuelling station should be ascertained as accurately as possible by consultation between the client and, as appropriate, the operator (if not the client), the architect, the consultant, the main contractor, the electrical contractor, the fuel storage and dispensing equipment manufacturer and installer, the cathodic protection contractor, the static protection contractor, the lightning protection contractor, the fire insurer, the electricity supplier, the enforcing authority and any other public authority concerned.

Documents should then be prepared and circulated for final written agreement, or comment, showing:

a) details of the installation proposed, related extraneous-conductive-parts (e.g. tanks, pipework and structures) and additional electrical bonding;

b) the accommodation and structural provisions required for the equipment (e.g. siting of switchgear and metering, central control point, emergency switching, etc.) and the provision of lighting and adequate access of all equipment;

c) chases, ducts, manholes, draw-chambers, conduits, channels, trunking and other provisions required for electrical wiring.
DESIGN STANDARDS

This guidance on electrical installations incorporates and, where appropriate, supersedes earlier recommendations contained in publications from IP, APEA, LPGA and other sources.

The design and installation should, in general, comply with the electrical provisions of APEA/IP Guidance for the design, construction, modification and maintenance of petrol filling stations. Key features of that publication and additional or alternative provisions for LPG and CNG installations are identified further in this publication, which should be used in conjunction with Guidance for the design, construction, modification and maintenance of petrol filling stations.

For guidance on non-electrical aspects relating to Autogas, reference may be made to the LPGA suite of Codes of Practice which cover most aspects of storage and transportation.
4

AREA CLASSIFICATION AND SEPARATION DISTANCES

4.1 GENERAL

Hazardous area zoning for LPG/CNG installations is based on the fundamental criteria given in BS EN 60079-10:2003 for Zones 0, 1 or 2 as applied to petroleum and other potentially explosive products.

Electrical equipment installed in a zoned area must be appropriately explosion-protected for installation in that area.

By implication, an area which is not classified as Zone 0, 1 or 2 is deemed to be non-hazardous with respect to the selection of electrical apparatus.

Descriptions of hazardous area zones are given in Annex A. Details of hazardous area zoning around LPG storage vessels, pumps and delivery vehicle connections are given in IP Model Code of Safe Practice Part 15 Area classification code for installations handling flammable fluids. LPGA Code of Practice Part 1, gives separation distances between LPG vessels and buildings and other items of equipment.

Where provisions for storage and dispensing LPG or CNG are to be added to a site dispensing petroleum, and the zoning for these fuels may overlap with zoning of petroleum-related equipment, care must be taken to satisfy the more extensive zoning requirements for the LPG or CNG.

4.2 DISPENSER ZONING

For consistency with other fuel dispensers (e.g. complying with BS 7117) LPG/CNG dispensers should be considered as petrol dispensers with stage 2 vapour recovery but without the vent air separator. General zoning requirements for petrol dispensers are given in Guidance for the design, construction, modification and maintenance of petrol filling stations.

As with petrol dispensers the zoning within and immediately above the housing of an LPG/CNG dispenser will depend on the internal construction (e.g. employing vapour barriers). Knowledge of the dispenser internal zoning is essential.

A manufacturer/importer or someone marketing a dispenser should supply with the unit a diagram showing the zoned areas in and around the unit. This should be available at the design stage.

An alternative is to apply the area classification for Autogas dispensers shown in LPGA Code of Practice 20.

4.3 SEPARATION DISTANCES

In order to ensure clearance from an item of LPG equipment to other items of equipment, buildings or potential sources of ignition, guidance on separation distances has been established.

Tables 1 and 2 in Annex A provide guidance on separation distances between a range of components and other objects.
Electrical supplies for the LPG/CNG installation should comply with the relevant provisions of Section 14.3 of 
Guidance for the design, construction, modification and 
maintenance of petrol filling stations.

Essential features to be considered include the following.

— A plan of the LPG/CNG installation should be appended to the existing site plan displayed within 
the premises.

— The LPG/CNG installation should not be installed below overhead conductors (electricity, telephone 
lines, etc.), except where protected overhead by an 
earthed metallic canopy as detailed in Guidance for 
the design, construction, modification and 
maintenance of petrol filling stations.

— At an existing vehicle refuelling station, an 
assessment should be made of the incoming 
electricity supply and main switchgear with regard 
to its ability to accommodate the proposed 
LPG/CNG installation.

— On a stand-alone LPG/CNG site, the specific 
recommendations of Section 14.3 of Guidance for 
the design, construction, modification and 
maintenance of petrol filling stations apply in full.

— A risk assessment should be carried out by the 
designer to determine the need for lightning 
protection of structures at the LPG/CNG location.

— Where protective multiple earthing (PME) exists as 
the means of earthing the site, particular attention 
should be given to the possible effect of diverted 
neutral currents passing into hazardous zones via 
metalwork and protective conductors.
SELECTION, INSTALLATION AND LOCATION OF EQUIPMENT

The following features relating to the selection, installation and location of equipment include a summary of the provisions of Sections 14.4 and 14.5 of Guidance for the design, construction, modification and maintenance of petrol filling stations, which should be applied to installations for dispensing LPG or CNG to road vehicles.

— Equipment should be certified to an explosion protection standard suitable for the zone in which it is to be used – only equipment constructed to comply with The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996, or an appropriate British, harmonised European, equivalent international standard and with ATEX should be used.

— Associated equipment installed in a non-hazardous area must not have an adverse effect on the explosion-protection concept of the equipment located in the hazardous area.

— Equipment, which when operating displaces or ingests air, (e.g. vacuum cleaning equipment with extended hose, car wash, warm air central heating or air compressors) should not be installed where it may affect, or be affected by, a potentially explosive atmosphere.

— In addition to an electrical enclosure being suitably explosion-protected, protection against adverse environmental conditions, particularly the ingress of moisture or water, must be provided by an enclosure having an appropriate 'Index of Protection' (IP number).

— Where a tank and pipework system incorporate plastics components with isolated metal parts, protection against static electricity may be required. Detailed provisions for this form of protection are given in 14.4.6 of Guidance for the design, construction, modification and maintenance of petrol filling stations.

— Where cathodic protection of LPG/CNG tanks and pipework is required, comprehensive guidance on the subject is given in IP Guidance on cathodic protection of underground steel storage tanks and steel pipework at petrol filling stations.

— Any LPG/CNG dispenser should be covered by the site loudspeaker warning system. The loudspeaker warning system should be separate from the dispensers and not controlled by the emergency switching system.

— Lighting of the LPG/CNG compound and associated road tanker delivery area should be designed to ensure an illuminance of 100 lux at ground level in these areas, allowing for a delivery vehicle to be in position.
The following features relating to isolation and switching include a summary of the provisions of Section 14.6 of *Guidance for the design, construction, modification and maintenance of petrol filling stations*.

— Means of isolation and switching must comply with Regulation 12 of the Electricity at Work Regulations 1989 (as amended).

— For stand-alone LPG/CNG installations, the provisions of Section 14.6 of *Guidance for the design, construction, modification and maintenance of petrol filling stations* apply in general.

— Devices for the isolation and control of LPG electrical equipment should interrupt simultaneously all live poles, including the neutral. Other than isolating devices adjacent to pumps, which must be suitably explosion- and ingress-protected, devices for isolation and control should be located in a non-hazardous area.

— Devices for isolation for electrical maintenance purposes must have locking-off facilities. Fuse carriers are not acceptable.

— An emergency switching device should be provided at each entrance/exit of the LPG/CNG compound.

— Where a tank and fill point are installed underground, an emergency switching device must be provided in a non-hazardous area adjacent to the tanker stand. This device may be within a driver controlled delivery (DCD) facility.

— The electrical circuits, other than any incorporating certified intrinsically safe equipment, to the LPG/CNG pump(s) and dispenser(s) should be arranged such that, on the operation of an emergency switch on the refuelling station, the LPG/CNG pump(s) and dispenser(s) and also the petrol pumps and dispensers are ALL electrically de-energised – the supply should be capable of being reset only from inside the console area.
OVERCURRENT PROTECTION
AND DISCRIMINATION

The following features of overcurrent protection and discrimination include a summary of the provisions of Section 14.7 of *Guidance for the design, construction, modification and maintenance of petrol filling stations*, which should be applied to installations for dispensing LPG or CNG to road vehicles.

— Discrimination of operation of series devices must be ensured for both fault current and overload protection.

— For residual current devices in series the supply side device should be time-delayed to ensure discrimination of operation.

— Every fault current device and residual current device should have fault breaking capacity not less than the prospective fault level at its point of installation.

— If separate devices are employed for fault current and overload protection, their characteristics should be co-ordinated and each device labelled to show its function.

— Each dispenser circuit (including integral lighting and ancillary circuits other than data and signalling circuits not liable to overload or fault currents) should be individually protected against overload and fault currents by a suitably rated multi-pole circuit breaker arranged to break all live conductors including the neutral.

— If the circuit breaker is suitable for, and is provided as, a means of isolation it must have locking-off facilities.
PROTECTION AGAINST ELECTRIC SHOCK

The following features of protection against electric shock include a summary of the provisions of Section 14.8 of Guidance for the design, construction, modification and maintenance of petrol filling stations, which should be applied to installations for dispensing LPG or CNG to road vehicles.

— Protection against indirect contact should be provided by earthed equipotential bonding and automatic disconnection of supply or by use of equipment of Class II construction (double insulated) where it is under effective supervision in normal use.

— Where bonding is required, it must be provided locally across the gap between the items to be bonded, regardless of bonding elsewhere.

— The automatic disconnection of supply to forecourt circuits must not exceed 100 ms in the event of an earth fault.

— Where a single device provides protection against overload, fault current and indirect contact it must break phase and neutral conductors, i.e. a multi-pole circuit breaker (CB) or residual current circuit breaker with overcurrent protection (RCBO) is required - fuses must not be used.

— Extra-low voltage data and other systems not intrinsically safe should be provided by the installation of SELV circuits (separated extra-low voltage) supplied via a BS 3535 (BS EN 60742) safety isolating transformer or equivalent safety source - neither the live parts nor the exposed metalwork of the SELV circuit should be earthed.

— Where a vehicle refuelling station installation is part of a TT system, or where earthing arrangements are such that disconnection times cannot be achieved with overcurrent protective devices, residual current devices (RCDs) will be required to facilitate automatic disconnection of supply.

— It is inappropriate to provide a single 'front end' RCD at the main switch position as the sole means of earth fault disconnection for the installation.

— Circuits will usually be RCD protected individually in order to satisfy site operational requirements - in any event an RCD incorporated in a circuit serving a hazardous area should be independent of RCDs protecting non-hazardous area circuits.

— If RCDs are connected in series, discrimination of operation of a load side device must be ensured by incorporating a supply side device having a suitable time-delay.

— For each RCD the leakage current of the associated circuit must not exceed 25 % of the rated residual current of the RCD.

— Where mineral insulated cable having circuit conductors of 2,5 mm² or less cross-sectional area
(csa), installed to meet specified conditions, is protected by a circuit breaker complying with BS 3871 or BS EN 60898 and having a rating of 32A or less, the automatic disconnection requirements for indirect contact shock protection are deemed to be met.
The general guidance on earthing and bonding in Section 14.8 of *Guidance for the design, construction, modification and maintenance of petrol filling stations* should be applied to LPG/CNG installations.

Particular attention should be given to the following.

— Where the site earthing system is connected to a PME terminal, a risk assessment should be carried out to determine any possible adverse effects on the LPG/CNG installation – where the metalwork of the LPG/CNG installation is cathodically protected and employs isolating joints, the effects of diverted neutral currents should be obviated.

— An earthing bar or terminal should be provided in every enclosure of electrical equipment, other than equipment specified as having Class 2 construction.

— Care should be taken to ensure that the earthing arrangements for data cable screening do not introduce potentially dangerous levels of ignition energy into a hazardous area - generally screening should be earthed at one point only.

— Provision should be made for the electrical connection of LPG/CNG road tankers to the metalwork of the LPG/CNG system. The terminal or other provision, which must not be located in a manhole or other hazardous area location, should be suitable for making a bond to the tanker prior to the commencement of, and until completion of, the final transfer operation. Where the LPG/CNG tank and pipe metalwork are cathodically protected, care should be taken to ensure that provision of the tanker bonding point, when in use, does not bridge the cathodic protection arrangements.

— Where an LPG or CNG electrical installation does not share a site with facilities for dispensing of petroleum or other fuels, an all-insulated test socket for measuring earth loop impedance and prospective fault current should be installed at the origin of the installation in conjunction with the main earth terminal test link - a suitably labelled insulated protective conductor which is segregated from the earthing arrangements within the installation should connect the earth terminal of the test socket to the earthing conductor side of the main earth terminal test link.

— The test socket and its related all-insulated device incorporating isolation and overcurrent protection should comply with 14.4.4 of *Guidance for the design, construction, modification and maintenance of petrol filling stations*. The means of isolation should be capable of being locked and should be provided with a label identifying its purpose (see Section 14 for label details).
The following features of wiring systems include a summary of the provisions of Section 14.9 of Guidance for the design, construction, modification and maintenance of petrol filling stations, which should be applied to installations for dispensing LPG or CNG to road vehicles.

— All conductors (other than prescribed bonding bridges) having a CSA of 16 mm² or less should be copper.

— Every protective conductor not forming part of a cable or cable enclosure should be identified throughout by green/yellow insulating covering.

— Contact between cables of intrinsically safe (IS) circuits and those which are non-intrinsically safe should be prevented - preferably running the IS cables in a non-conducting duct or pipe reserved solely for that purpose.

— IS conductors must not be run in the same multicore cable with non-IS circuit conductors - nor in the same enclosure or duct with non-IS circuits unless segregated by an earthed metallic screen or sheath.

— Particular attention should be given to the construction of cables for IS circuits so as to ensure that they are not damaged by the installation of other cables sharing a common duct.

— Care should be taken to ensure that metallic screening or sheaths of IS circuit cables are earthed at one point only and do not constitute an earth path for electrical fault current or currents which could adversely affect transmitted data.

— Where extra-low voltage circuits (ELV = not more than 50 Va.c., 120 Vd.c.) are contained in the same trunking, duct or multicore cable as higher voltage circuits, the latter must be provided with an earthed metallic screen or sheath with a current carrying capacity equivalent to that of the higher voltage cores. Alternatively, the conductors of an ELV system should be insulated individually or collectively for the highest voltage present on other conductors in the same enclosure. The higher voltage grade insulation should be applied throughout the ELV system.

— All cables installed underground or in site-formed ducts should be laid at a depth of not less than 500 mm or be otherwise protected against mechanical damage.

— Cables laid directly in the ground should be protected by cable covers or identified by suitable marking tape.

— Cables laid or drawn into ducts should be of such construction that they are not liable to be damaged by the drawing in or withdrawal of other cables.

— In any location available for vehicular access,
cables, trunking or other electrical enclosures should be positioned or additionally protected to a height of 1.5 m so that they are unlikely to be damaged by moving vehicles.

— The protective conductor for every circuit supplying low voltage equipment (e.g. 230 V power) in a hazardous area should be provided by means of an integral cable core in addition to any protective function provided by a cable sheath or armour.

— Types of cable are specified, mineral insulated cable terminated with earth tail pots and glands approved for Zone 1 or Zone 2, as appropriate, being preferred.

— Steel wire armoured cables terminated with glands approved for Zone 1 or Zone 2, as appropriate, in hazardous areas may be employed subject to the installation of earth tag washers at the cable glands in non-hazardous areas - a lugged cable connection (cable same csa as related phase conductor, minimum 2.5 mm²) being provided between the earth tag washer and enclosure earthing bar or terminal.

— Alternatively, steel wire braided cable having hydrocarbon resistant outer covering may be employed if it is terminated in shrouded glands which provide mechanically and electrically sound anchorage for the steel wire braid and which are suited to the zoning of the hazardous area to maintain the integrity of the explosion protection concept.

— Other cable is acceptable only if it forms part of an intrinsically safe (IS) circuit and, if multicore, contains only IS circuits and is not run with other circuits in a common duct unless the other circuits are separated from the IS circuit(s) by a suitable earthed metallic screen or barrier.

— Within Zone 0 hazardous areas the previously described cables are acceptable providing they form part of a system certified as intrinsically safe for Zone 0, or pass unbroken through the Zone.
The following are general features applicable to ducts and manholes of LPG/CNG installations.

— Duct systems for underground cables in hazardous areas must be designed and constructed to minimise the possibility of fuel or vapour entering other areas or accumulating within the duct system.

— Electric cables should not be enclosed in the same duct as LPG/CNG pipelines.

— Ducts must be impervious to water and fuel products.

— Manholes, cable chambers and draw boxes should be water and fuel tight, constructed of GRP, polythene or engineering brick.

— Comprehensive guidance on the provision of underground cable duct systems is given in Guidance for the design, construction, modification and maintenance of petrol filling stations.

— Other than for duct systems which are suction fan vented, it is of the utmost importance that, before any fuel is brought on site, duct terminations are adequately sealed in underground chambers, at dispensing equipment, the central control point and particularly where ducts pass from hazardous to non-hazardous areas.

— Sealing should be achieved with suitable compound or other material resistant to hydrocarbon products and their vapours, all spare and unused ducts first being fitted with tapered hardwood plugs - cable pits, trenches and manholes should not be sand filled and/or screeded.
FORCE VENTILATED DUCTS AND MANHOLES

Where a force ventilated system is employed to avoid a build-up of vapour in ducts and manholes associated with the LPG/CNG system, the following points should be noted.

— Guidance for the design, construction, modification and maintenance of petrol filling stations does not contain guidance on this subject.

— The ventilation unit should not be controlled by the emergency switching arrangements for the pump systems.

— The ventilation unit must be certified for use in Zone 1.

— Ventilated ducts and manholes should be totally segregated from all other ducts and manholes.

— The ventilated ducts must not be sealed or obstructed in any way.

— Where the ventilation system incorporates a vent pipe, the pipe should be treated as a petroleum vent pipe without vapour recovery for the purposes of zoning.

— Electrical equipment, including cable, must not be mounted on the vent pipe.
The following features of wiring systems include a summary of the provisions of Section 14.9.8 of Guidance for the design, construction, modification and maintenance of petrol filling stations, which should be applied to installations for dispensing LPG or CNG to road vehicles.

— Labels should be of a permanent nature, e.g. 'sandwich' plastics material resistant to adverse effects of weather and hydrocarbons, so that paint filling of engraved characters is not required - use should be made of contrasting colours, e.g. black against white background, white against red background, etc. as appropriate.

— Labels and their lettering should be sized in proportion to equipment on which they are to be mounted and should be securely fixed.

— Where equipment must not be drilled, e.g. explosion-protected or watertight apparatus, a suitable adhesive should be used, the maker's recommendations on preparation of surfaces, etc. being fully observed.

— Where adjacent equipment has interchangeable removable covers, labels should not be fitted to covers but should be in fixed positions.

— If any labels are provided to warn of a significant risk to health and safety, or are required under any other relevant law, they must comply with the Health and Safety (Safety Signs and Signals) Regulations 1996.

— A conspicuous, durable and legible notice must be fitted adjacent to the main isolating switch for the refuelling station electrical installation and at any equipment at which cathodically protected metalwork is simultaneously accessible with other earthing arrangements, bearing the words: "ALL OR PART OF THE TANKS AND PIPEWORK AT THIS SITE HAS CATHODIC PROTECTION".

— The isolating device for the test socket at the origin of the installation should be labelled "THIS DEVICE IS NOT ISOLATED BY THE MAIN ISOLATING SWITCH AND MUST REMAIN LOCKED IN THE OFF POSITION WHEN NOT BEING USED FOR TEST PURPOSES".

— On all luminaires within a hazardous area, the maximum permissible lamp wattage should be clearly indicated by a permanent label securely fixed and readily visible when re-lamping the luminaire - on small illuminated components, the lamp voltage and wattage should be indicated.

— Where electrical equipment cannot be isolated by a single device, unless suitable interlocking is provided, a suitable warning notice, clearly identifying all the isolation devices, should be permanently fixed in a prominent position, visible before access to live parts can be gained.

— A conspicuous, durable and legible notice must be fitted adjacent to the operating means of each emergency switching device (the operating means
being coloured red against a yellow background) within the LPG/CNG storage compound, bearing the words "EMERGENCY. LPG PUMP - SWITCH OFF HERE" (or CNG where relevant).

— Each other emergency switch accessible to staff and the general public must have fitted adjacent to it a conspicuous, durable and legible notice bearing the words "LPG (or CNG where relevant) AND PETROL PUMPS SWITCH OFF HERE".

— Where high voltage lighting or signs are associated with an LPG or CNG installation the associated external electrical switch provided for emergency use should have displayed adjacent to it the notice "HIGH VOLTAGE SIGN. FIREMAN'S SWITCH".

— Where electrical apparatus within a dispenser cannot withstand a 500 Vd.c. insulation test, the means of safe disconnection for test purposes must be identified and clearly labelled.

— Labels warning where to isolate equipment electrically before removing electrical enclosure covers must be mounted within a dispenser housing and be clearly visible when the inside of the dispenser housing is exposed.

— A conspicuous, durable and legible notice must be fitted adjacent to the terminal or other provision for earth bonding of road tankers during fuel transfer, bearing the words: "TANKER EARTH BONDING POINT".
The inspection and testing of electrical installations associated with the dispensing of LPG or CNG to road vehicles should, in general comply with the comprehensive guidance given in Guidance for the design, construction, modification and maintenance of petrol filling stations.

Dispensers for LPG and CNG, including refurbished units, should be certified by an accredited testing and certifying body as complying with BS 7117 Part 1, an equivalent harmonised European or international standard and with ATEX.

With regard to the installation status and selection of verification programme it will be necessary to ascertain that the LPG or CNG dispensers are appropriately certified as explosion-protected and incorporate the features of BS 7117 (for metering pump and dispensers) which are relevant to safe inspection and testing of the associated electrical installation.

BS 7117 relates only to metering pump/dispensers; it does not contain requirements for other aspects of refuelling station installations.

Electrical requirements in BS 7117 include:

— Zoning for electrical apparatus within a dispenser, dependent on the presence of prescribed vapour barriers.

— All electrical apparatus within a dispenser must be able to withstand a 500V dc insulation test or have a means of safe disconnection without dismantling. Such facilities must be identified and clearly labelled.

— Extra-low-voltage circuits in hazardous areas (ELV = not more than 50V a.c., 120V ripple-free d.c.) must be terminated in an explosion-protected terminal box separate from that for the supply cables.

— All internal metal enclosures of electrical apparatus must be connected to a main earth connecting facility in or on the metering pump or dispenser.

— A bonding terminal (for testing) must be provided within the housing.

— All cables and cable terminations must be labelled and easily identified from manufacturers’ drawings.

— Labels warning to isolate equipment electrically before removing electrical enclosure covers must be mounted within a dispenser housing and be clearly visible when the inside of the housing is exposed.

— Instructions must be provided for the safe installation and operation of the dispensing equipment, for retention with site records.

Items additional to those detailed in Guidance for the design, construction, modification and maintenance of petrol filling stations to be inspected and or tested include the following:

— The condition and continuity of the earth bonding
terminal or other provision for bonding a tanker
during fuel transfer.

— The condition and continuity of metal bridges
bonding across flanges or other couplings in
accessible fuel lines.

— The condition and adequacy of insulation materials
around and adjacent to isolating joints separating
cathodically protected parts from other metal work.

Final inspection of the electrical installation should
include checking that cathodic protection isolating
joints in pipework have not been by-passed by
protective conductors or other means such as
tanker earthing facilities.

Particular attention is drawn to checking that the
integrity of 'Ex' terminations and enclosures within
dispensers is maintained.
ANNEX A

A.1 HAZARDOUS AREA ZONING

Any equipment containing a flammable liquid or vapour requires to be assessed to determine the potential for forming a flammable atmosphere. This is usually called zoning and the zones are divided into:

Zone 0  An area in which flammable gas-air mixture is continuously present or is present for long periods.

Zone 1  An area in which a flammable gas-air mixture is likely to occur in normal operations.

Zone 2  An area in which a flammable gas-mixture is not likely to occur in normal operations and if it occurs it will only exist for a short time.

By implication an area which is not classified Zone 0, 1 or 2 is deemed to be non-hazardous with respect to the selection of electrical apparatus.

The final responsibility for establishing zoned areas is with the end user. It is the responsibility of the designer/installer to provide the information to allow the areas to be determined. A variety of published information may be used to assist competent persons with this work.

Electrical equipment installed in a zoned area must be of suitable design for installation in that area and must be correctly installed and maintained by competent persons.

IP Model Code of Practice, Part 15 Area classification code for installations handling flammable fluids gives details of hazardous area zoning around LPG tanks, vent pipes, dispensers, etc.

A.2 SEPARATION DISTANCES

Separation distances are established to ensure clearance from a vessel and/or associated equipment, buildings or potential sources of ignition which, if these caught fire, would pose a risk to the vessel or the associated equipment.

LPGA Code of Practice Part 1, gives separation distances between LPG vessels and buildings and other items of equipment.

Table 1 - Distances from buildings, boundaries and fixed sources of ignition

<table>
<thead>
<tr>
<th>LPG tank size (tonnes)</th>
<th>Buildings, boundary or fixed ignition source (metres)</th>
<th>With fire wall* (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,25 to 1,1</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>1,1 to 4</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>4 to 10</td>
<td>15,0 a/g</td>
<td>7,5 a/g</td>
</tr>
<tr>
<td></td>
<td>7,5 u/g</td>
<td>4,0 u/g</td>
</tr>
</tbody>
</table>

* Dispersion wall for underground vessels

Notes:

i) Separation distances are to valve assemblies and flanges for underground or mounded vessel systems and to the vessel surface for above ground systems. For below ground or mounded vessels a separation distance to the vessel surface of 1,0 m for tanks up to 1,1 tonnes and 3,0 m for vessels over this size should be maintained.

ii) Separation distances should not be confused with hazardous area zoning (see following).

iii) Separation distances may be revised subject to the presentation of appropriate acceptable risk modelling data to the Competent Authority.
### Table 2 - Minimum separation distances
(Distances are as seen in plan view)

<table>
<thead>
<tr>
<th></th>
<th>Storage vessel</th>
<th>Storage vessel fill connection</th>
<th>LPG pump</th>
<th>LPG dispenser</th>
<th>Vehicle being filled</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LPG storage vessel</td>
<td>See CoP 1 Part 1</td>
<td>Nil</td>
<td>Nil but not beneath vessel</td>
<td>0,5 m</td>
</tr>
<tr>
<td>2</td>
<td>Storage vessel filling connection</td>
<td>Nil</td>
<td>Nil</td>
<td>1,0 m</td>
<td>3 m</td>
</tr>
<tr>
<td>3</td>
<td>LPG pump</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>1,5 m</td>
</tr>
<tr>
<td>4</td>
<td>LPG dispenser</td>
<td>0,5 m</td>
<td>1 m</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>5</td>
<td>Vehicle being filled</td>
<td>3 m</td>
<td>3 m</td>
<td>1,5 m</td>
<td>Nil</td>
</tr>
<tr>
<td>6</td>
<td>U/G petrol vessel manhole with fill connection</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
</tr>
<tr>
<td>7</td>
<td>U/G petrol vessel manhole without fill connection</td>
<td>3 m</td>
<td>3 m</td>
<td>3 m</td>
<td>Nil</td>
</tr>
<tr>
<td>8</td>
<td>Above ground vessel for liquids &lt; 65 °C flash point</td>
<td>As CoP Part 1 Table of safety distances for flammable liquids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Remote petrol vessel fill connections</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
</tr>
<tr>
<td>10</td>
<td>Petrol vessel vents</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
</tr>
<tr>
<td>11</td>
<td>Petrol dispensers - explosion-protected diesel dispensers - explosion-protected</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>Nil</td>
</tr>
<tr>
<td>12</td>
<td>Parked cars</td>
<td>6 m or separation distance in Table 1 if less</td>
<td>6 m or separation distance in Table 1 if less</td>
<td>1,5 m</td>
<td>Nil</td>
</tr>
<tr>
<td>13</td>
<td>Buildings, boundary or fixed source of ignition</td>
<td>As Table 1</td>
<td>4,0 m</td>
<td>4,0 m from vehicle fill point</td>
<td></td>
</tr>
</tbody>
</table>
ANNEX B

REFERENCES

British Standards Institution (BSI)¹


BS 7117 Part 1 Metering pumps and dispensers to be installed at filling stations and used to dispense liquid fuel - Specification for construction.

European Committee for Standardization (CEN)²

EN 60079-10 Electrical apparatus for explosive gas atmospheres - Classification of hazardous areas.

EN 60742 Isolating transformers and safety isolating transformers - Requirements.

EN 60898 Specification for circuit-breakers for overcurrent protection for household and similar installations.

IP publications from the Energy Institute³

Guidance on external cathodic protection of underground steel storage tanks and steel pipework at petrol filling stations.

Model Code of Safe Practice in the Petroleum Industry Part 15 Area classification code for installations handling flammable fluids.

Liquefied Petroleum Gas Association⁴

Code of Practice Part 1 Design, installation and operation of vessels located above ground.

Code of Practice Part 20 Automotive LPG refuelling facilities.

¹ Available from British Standards Institution, 389 Chiswick High Road, Chiswick, London, W4 4AL, UK. Tel: +44 (0)20 8996 9001, www.bsi-global.com

² Available from national standards organizations, e.g. BSI

³ Available from Portland Customer Services, Commerce Way, Whitehall Industrial Estate, Colchester, CO2 8HP. Tel: +44 (0)1206 796 351, email: sales@portland-services.com

⁴ Available from the LP Gas Association, Pavilion 16, Headlands Business Park, Salisbury Road, Ringwood, Hampshire BH24 3PB, UK. www.lpga.co.uk