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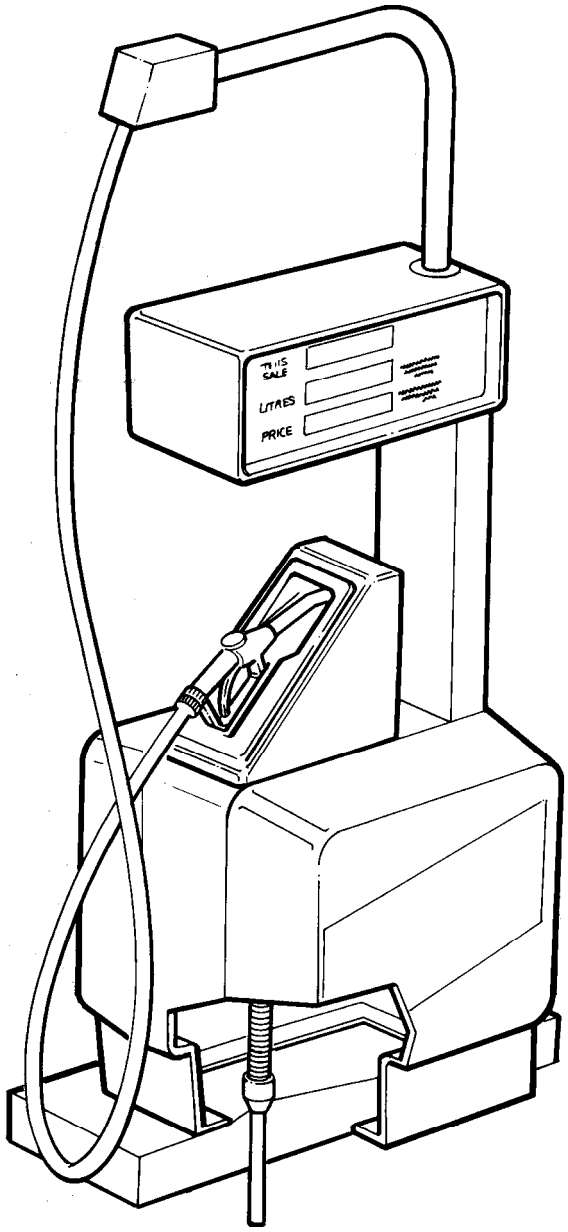

Petrol filling stations: Construction and operatibn

Health and Safety series booklet HS(G)41

Contents

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This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

Foreword

This booklet was prepared by a working party which met under the auspices of the Health and Safety Executive. Membership of the working party included representatives from the Institute of Petroleum, the Petrol Pump Manufacturers Association, the Motor Agents Association, the Local Authorities Coordinating Body on Trading Standards, the Association of County Councils, the National Inspection Council for Electrical Installation Contracting, Insurance Associations and HSE.

The booklet supersedes the Model Code of Principles of Construction and Licensing Conditions (Part I): Petrol Filling Stations which was prepared in 1968 under the auspices of the Home Office.

Introduction

1 This publication gives guidance on the planning, design, construction, operation and maintenance of petrol filling stations. It describes standards and methods of work aimed at:

(a) minimising risks to operators and members of the public at or near petrol filling stations of fires and explosions from petrol;

(b) guiding persons involved in the planning, design, construction and alteration of petrol filling stations on the standards necessary for the grant by a licensing authority under the Petroleum (Consolidation) Act 1928 of a licence to keep petrol;

(c) informing persons involved in the operation and maintenance of petrol filling stations of , the conditions necessary for the safe keeping of petrol.

2 The guidance is divided into three parts: Part 1 on general design and constructional matters; Part 2 on operational and maintenance activities; and Part 3 on the specialised design, constructional and testing features for electrical installations at petrol filling stations. All three Parts set safety standards and practices for consistent application throughout the country with effect from the date of publication. They do not preclude the use of alternative designs, materials or methods where that use provides equivalent or higher standards of safety. Each case should be considered on its merits. Any variations which appear to be necessary because of special circumstances or developments in technology should be agreed with the licensing authority.

3 The guidance on design and constructional matters in Parts 1 and 3 should not be applied rigidly to existing petrol filling stations unless redevelopment is taking place or new plant or equipment is being installed. Generally, only alterations which are reasonably practicable should be made, taking into account the risks presented at the filling station and the cost and feasibility of additional precautions. Nevertheless, the guidance on operational, maintenance and testing activities in Parts 2 and 3 should be applied at all petrol filling stations with effect from the date of publication.

4 Legal requirements, guidance literature and standards referred to in the guidance are listed in Appendix 6. They are subject to amendment or revision from time to time; references to them should be read as references to the latest editions.

Scope

5 The guidance deals with installations where petrol is kept and dispensed as fuel for motor vehicles on forecourt areas to which members of the public have access, It is also relevant to installations where petrol is kept and dispensed for commercial vehicles only and to which members of the public do not have access, but only to the extent that it is appropriate taking into account the particular circumstances at an individual installation. It does not deal with installations at harbours and airports used primarily for fuelling boats and aircraft.

6 The guidance is directed at the safe keeping of petrol. It covers other activities (eg unloading of petrol from road tankers, retail shops etc) and other substances (eg diesel fuel, LPG) only to the extent that the presence of those activities and substances might increase risks of fires or explosions involving petrol. It does not deal in detail with the toxic risks of petrol.

Glossary

7 Explanations of particular terms used in this guidance are as follows:

BASEEFA. British Approvals Service for Electrical Equipment in Flammable Atmospheres.

Class I and Class II electrical equipment. Equipment constructed in particular ways to protect against electric shock.

Competent person. A person with enough practical and theoretical knowledge and actual experience to carry out a particular task safely and effectively. The person should have the necessary ability in the particular operation of the type of plant and equipment with which he or she is concerned, an understanding of relevant statutory requirements and an appreciation of the hazards involved. That person should also be able to recognise the need for specialist advice or assistance when necessary and to assess the importance of the results of examinations and tests in the light of their purpose. A ‘person’ can be taken to mean more than one, or a body corporate or incorporate. It is therefore possible to appoint appropriate organisations (eg insurance companies or inspection bodies) to carry out tasks designated for competent persons.

Controlpoint. A position in a kiosk or other building at an attended self- service filling station from which an attendant can adequately view and

supervise activities at the dispensing equipment, activate the equipment and shut it off in an emergency.

Dispenser. A measuring system similar to a metering pump (see below) except that it does not incorporate its own pumping system.

Filling station. Premises at which petrol is dispensed into the fuel tanks of motor vehicles or into containers and which may be operated in one of the following modes:

Attendant operated. A filling station where an attendant directly operates and controls the dispensing equipment and the discharge nozzle;

Attended se/f-service. A filling station where customers operate the dispensing equipment which is activated, supervised and may be shut off in an emergency by an attendant in a control point;

Unattended self-service. A filling station where dispensing equipment is activated and operated by customers without supervision by an attendant.

F/ash point. The temperature for a flammable liquid at which sufficient vapour is released from the liquid to ignite when a naked light is applied to it under standard test conditions.

GRP. Glass reinforced plastic.

Hazardous area. An area where flammable or explosive gas or vapour-air mixtures (often referred to as explosive gas-air mixtures) are, or may be expected to be, present in quantities which require special precautions to be taken against the risk of ignition.

Hydrostatic testing. The testing of a vessel by means of a pneumatic test in which the explosive energy which would be released on failure is reduced by almost filling the vessel with water.

IEE Wiring Regulations. Recommendations by the Institution of Electrical Engineers which are non-statutory but are widely recognised and accepted as guides to good practice for the design, selection, erection, inspection and testing of certain electrical installations. Generally they apply to two defined voltage ranges. They are not relevant to methods of dealing with the fire and explosion hazards of electrical installations and equipment in hazardous areas (such methods are covered by BS 5345). New editions are issued from time to time (eg a 14th Edition was issued in 1966, a 15th Edition in 1981) and are amended between editions. References in this guidance to the IEE Wiring Regulations make clear which editions should be followed.

Impact check valve. An impact and/or heat activated device which closes to prevent flow from a pressure source and remains closed after activation.

Interceptor. A device installed in a surface water drainage system to separate out any petrol and thus prevent it reaching public drains, sewers or water courses.

Leak detector system. A system designed to close down a pump which will remain closed when a leak occurs in the pressurised pipework which it protects.

Licensing authority. The body described in para 10 for the place in which a filling station is situated.

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

Noncombustible material. Material which can be classified as noncombustible when tested for noncombustibility in accordance with BS 476 Part 4. Alternatively, material which when tested in accordance with BS 476 Part II does not flame and gives no rise in temperature on either the centre (specimen) or furnace thermocouples.

Nozzle. A device for controlling the flow of fuel during a dispensing operation.

Off-set filling pipe. A filling pipe for a tank or tank compartment which leads from a tank to a connection point for a road tanker delivery hose at some distance from the tank.

Petrol or petroleum-spirit. Petroleum which, when tested in accordance with the Petroleum (Consolidation) Act 1928, gives off a flammable vapour at a temperature of less than 23°C (73°F).

Remote pump. An electrically driven suction pump assembly mounted above or adjacent to a supply tank and remote from a dispensing facility. The inter- connection is made by a pressurised delivery pipe protected by a leak detector valve or by other means.

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

Vapour balancing system. A system which allows vapour displaced from storage tanks during delivery of petrol from a road tanker to be directed to that

tanker via a vapour return hose. It ensures there is minimal discharge of vapour to atmosphere during tanker delivery.

Zone. The classified part of a hazardous area representing the degree of likelihood of explosive gas-air mixtures being present.

Legal requirements: the Petroleum (Regulation) Acts 1928 and 1936 - arrangements for licensing, enforcement and appeals

The Petroleum (Regulation) Acts 1928 and 1936

8 Under the Petroleum (Consolidation) Act 1928, the keeping of petrol must be authorised by a licence and must accord with any conditions attached to that licence. The Petroleum (Mixtures) Order 1929, the Petroleum (Carbide of Calcium) Order 1929 and the Petroleum (Liquid Methane) Order 1957 extend the requirements of the Act to the keeping of other substances. A notice of any conditions of licence which are to be observed by persons employed must be displayed in an easily readable form and position at the filling station. Contravention of the requirements, including the pulling down of a notice, are offences under the Act.

9 The Petroleum (Transfer of Licences) Act 1936 enables a licensing authority to transfer a licence from one occupier to another. Fees for the grant, renewal and transfer of licences are chargeable by licensing authorities according to the rates set out in Regulations which are revised annually on or about the beginning of each financial year.

Arrangements for licensing and enforcement

10 In general, licensing authorities for filling stations are the fire and civil defence authorities in Greater London, Greater Manchester, Merseyside, West Midlands, Tyne and Wear, South Yorkshire and West Yorkshire; county councils elsewhere in England and Wales; and regional and islands councils in Scotland. However, the responsibilities for licensing fall to harbour authorities for filling stations in harbour areas and to the Health and Safety Executive for filling stations at any site which is subject to the Notification of Installations Handling Hazardous Substances Regulations 1982.

11 The functions of licensing authorities include the assessment of individual filling stations with a view to deciding whether or not the first grant or subsequent renewal of a licence is appropriate and what conditions should be attached to that licence. Licensing authorities will be guided by the standards and practices set out in this guidance, taking into account the objectives described in paras 1 to 3.

12 All licensing authorities have powers under the Health and Safety at Work etc Act 1974 (HSW Act) to enforce the requirements of the Petroleum (Consolidation) Act 1928. When an inspector appointed by a licensing authority visits a filling station his aim is to ensure the observance, maintenance and, where necessary, improvement of safety standards. In so doing, he seeks to secure compliance with the law, including any conditions attached to a licence. If any action is required, a wide variety of options are open to him. They range from informal procedures such as oral or written advice to formal procedures such as refusal to renew a licence, variation of conditions attached to a licence, the issue of improvement or prohibition notices under the HSW Act, and/or prosecution.

Arrangements for appeals

13 Under Section 44 of the HSW Act, any person who is aggrieved by a decision of a licensing authority in connection with a licence has a right of appeal to the Secretary of State for Employment. Decisions on licences for filling stations which may give grounds for appeal include refusing to grant, renew or transfer a licence and setting, or varying or refusing to vary, any term, condition or restriction attached to a licence. Appeals should be addressed to the Secretary of State, Department of Employment, HS 1. Caxton House, Tothill Street, London SW1 H 9NF.

14 Section 44 of the HSW Act does not cover appeals against improvement and prohibition notices which an inspector may use for enforcement purposes (see para 12). Appeals against such notices are governed by Section 24 of the HSW Act and should be made to an industrial tribunal on form IT 19. In practice, an inspector normally issues form IT 19 and its accompanying explanatory leaflet when he issues a notice.

Other legal requirements

Legal requirements enforced by licensing authorities

15 Other legal requirements which are relevant to filling stations and which are enforced

by the licensing authorities described in para 10 include:

(a) *the Petroleum-Spirit (Motor Vehicles &c.) Regulations 1929 and the Petroleum-Spirit (Plastic Containers) Regulations 1982:* the Regulations set strict storage conditions on the keeping without a licence of small amounts of petrol in metal and plastic containers by any person intending to use the petrol for an internal combustion engine and not wholly or partly for sale. They allow up to two metal containers of a capacity not exceeding 2 gallons each and up to two plastic containers of a capacity not exceeding 5 litres each to be kept in a motor vehicle, provided that the containers meet the requirements in the Regulations for marking or labelling and standards of construction. Guidance on the requirements for testing and marking or labelling of plastic containers is available in Approved Code of Practice COP 6;

(b) *the Public Health Act 1961 (Section 73) and the Civic Government (Scotland) Act 1982 (Section* 94): both requirements place duties on the occupiers or owners of land or premises to take all reasonably necessary steps to prevent danger from disused or derelict fixed tanks or containers which have been used for storing petrol;

(c) the Dangerous Substances (Conveyance by Road in Road Tankers and Tank Containers) Regulations 1981 (Regulation 20 and Schedule 4): the detailed requirements cover the unloading of petrol from road tankers into storage tanks. They place specific duties on tanker drivers, licensees and persons in charge of storage tanks at the time of unloading. General guidance on unloading is available in the Approved Code of Practice on the operational provisions of the 1981 Regulations.

Legal requirements enforced by other authorities

16 In addition, a wide range of legal requirements enforced by other authorities under the HSW Act apply generally or in particular circumstances at filling stations. Such authorities are determined by the Health and Safety (Enforcing Authority) Regulations 1989 and are normally local district or borough authorities or HSE.

17 The most important of these requirements are the general duties of the HSW Act:

(a) *Section* 2, which places a duty on every employer to ensure, so far as is reasonably practicable, the health, safety and welfare of his employees. The duty includes, in particular, the provision and maintenance of safe plant and systems of work; arrangements for ensuring safety during the use, storage etc of articles and substances; the provision of adequate information, instruction, training and supervision; the maintenance of any place of work in a safe condition, with safe access and egress; and the provision of a working environment without risks to health and with adequate welfare arrangements;

(b) *Section* 3, which requires every employer and self-employed person to conduct his undertaking so as to ensure, so far as is reasonably practicable, that persons not in his employment are not exposed to risks to their health and safety;

(c) *Section* 4, which places a duty on every person who has, to any extent, control of premises used by persons who are not his employees but who use the premises made available to them as a place of work or as a place where they may use plant or substances provided for their use there. The duty includes the provision, so far as is reasonably practicable, of safe means of access and egress and safe plant and substances;

(d) *Section* 6, which places a duty on every designer, manufacturer, importer, supplier, installer or erector of an article for use at work. The duty includes the need to ensure, so far as is reasonably practicable, that articles are designed, constructed, installed or erected so as to be safe and without risks to health in reasonably foreseeable circumstances of use, setting, cleaning and maintenance and that adequate information is provided to the user to secure safety in such circumstances. Manufacturers, suppliers and importers are under a similar duty for the safety of substances, and the provision of information to secure safety during use, handling, processing, storage and transportation. The duty applies to all substances used at work or made available at premises to which Section 4 of the HSW Act applies;

(e) *Section* 7, which requires all employees to take reasonable care of themselves and of others who may be affected by what they do or fail to do at work; and to co-operate with

employers to enable legal requirements to be complied with;

(f) *Section* 8, which places a duty on all people not to interfere with or misuse anything provided for health, safety and welfare purposes.

18 Other relevant legal requirements include:

(a) *the Safety Signs Regulations 1980.* The requirements provide that a safety sign (ie a sign combining geometrical shape, colour and pictorial symbol to provide health or safety information or instruction, whether or not any text is also included) for persons at work should comply with BS 5378 Part I. Advice is available in HSE Guidance Booklet HS(R)7;

(b) *the Classification, Packaging and Labelling of Dangerous Substances Regulations 1984 and the Road Traffic (Carriage of Dangerous Substances in Packages etc) Regulations 1986.* The Regulations include requirements for container labels and vehicle markings which may be met during activities at filling stations. Advice is available in HSE Guidance Booklets HS(R)22 AND HS(R)24;

(c) *the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1985.* The Regulations set out the types of incidents which must be reported and how and to whom reports must be made. Advice is available in HSE Guidance Booklet HS(R)23;

(d) *the Control of Substances Hazardous to Health Regulations* 1988. The Regulations require employers to assess the risks arising from hazardous substances at work and the measures needed to protect employees' health, and to take appropriate action to prevent or adequately control exposure;

(e) *the Electricity at Work Regulations 1989.* The Regulations impose requirements about electrical systems and equipment, including work activities on or near electrical equipment. Advice is available in HSE Guidance Booklet HS(R)25;

(f) *the Factories Act 1961 and the Offices, Shops and Railway Premises Act 1963.* Both Acts include requirements which may be relevant to activities at or associated with petrol filling stations.

Hazardous characteristics of petrol

19 Petrol is a highly flammable liquid and gives off flammable vapour even at very low temperatures. Released vapour, when mixed with air in certain proportions, forms a flammable atmosphere which burns or explodes if a source of ignition is present, A flammable atmosphere exists when the proportion of vapour in the air is between approximately 1% (the lower flammable, or explosive, limit) and 8% (the upper flammable, or explosive, limit).

20 Petrol vapour is heavier than air and does not disperse easily in still air conditions. It tends to sink to the lowest possible level of its surroundings and may accumulate in tanks, cavities, drains, pits or other depressions. Petrol floats on the surface of water; it may therefore be carried long distances and create a hazard remote from its point of release.

21 Flammable atmospheres may be present in the vapour spaces of tanks containing petrol and in tanks after petrol has been removed. They may also exist where clothing and other absorbent material or substances are contaminated with petrol.

22 Petrol vapour, even when present in the atmosphere at levels below the lower explosive limit, can have acute and chronic effects if inhaled. The guidance does not deal with this in detail (see para 6) but the risks from inhaling petrol vapour should be considered in the assessment required under the Control of Substances Hazardous to Health Regulations 1988. Exposure to the vapour should be prevented and where possible this should be taken into account in the planning and design of a filling station and during all operations where vapour might be present.

Hazardous area classification

23 The safe development and operation of a filling station should be based primarily on an assessment of the likelihood of flammable or explosive atmospheres being present during operations; and the need to prevent, as far as possible, sources of ignition reaching such atmospheres. Therefore, the concept of hazardous area classification and zoning set out for fixed electrical equipment in BS 5345 Parts 1 and 2 should be followed throughout the activities covered by all three parts of this guidance. All sources of ignition, including those associated with sparks of any sort or hot surfaces of electrical equipment, should be excluded from hazardous

areas or, in the case of electrical equipment, should be specially protected. This includes both fixed and portable equipment.

24 BS 5345 defines the following hazard zones:

(a) Zone *0*: in which an explosive gas-air mixture is continuously present, or present for long periods;

(b) Zone I: in which an explosive gas-air mixture is likely to occur in normal operation;

(c) 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.

BS 5345 also defines the areas outside these zones as non-hazardous.

25 The following general guide indicates how this might be applied to different parts of a filling station:

(a) Zone *0*: the interior of petrol tanks and of chambers containing tank filling connections;

(b) *Zone 1*: the interior of metering pump and dispenser housings, the vicinity of vent openings, and pits and other depressions below ground level partly or wholly within a zone 2 area;

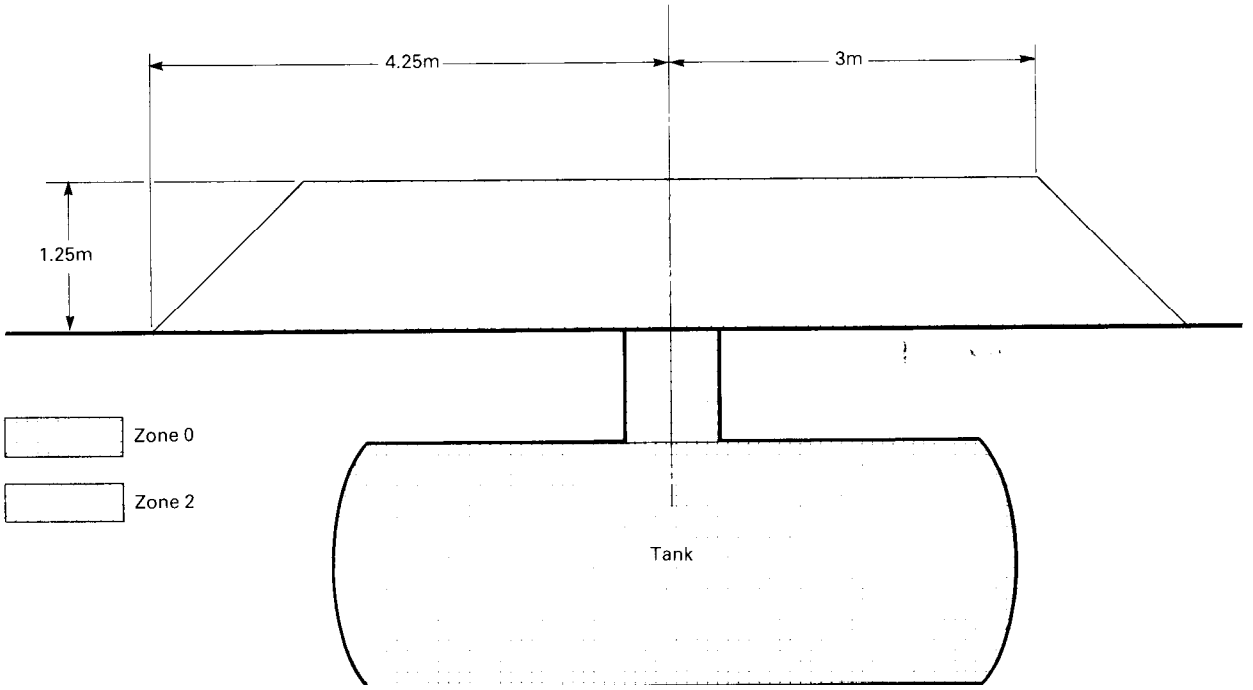
(c) *Zone* 2: other areas that may be affected by occasional spillage or release of vapour from plant and equipment handling petrol.

26 The guidance in Table 1, in conjunction with guidance obtained from suppliers of the equipment involved and of the petrol, should be applied to determine the extent of the various zones. In compiling Table 1, regard has been paid to operational factors peculiar to filling stations (eg free access of members of the public and their motor vehicles). Consequently, the extent of some of the zones may be different from those which would apply at a petroleum installation where operational factors (eg access limited to appropriately trained persons) are different. This is consistent with the approach recommended in BS 5345 Part 2, which describes a method of carrying out an area classification procedure. Local site conditions may mean that the extent of zones will vary in individual cases, and each site should be considered separately. In particular, the horizontal distances quoted for Zone 2 areas will depend on the likely wetted area of a liquid spillage, and this will vary with paving and drainage conditions and the degree of containment from walls and other obstructions. Also, if a location apparently falls within two zones, that location should be regarded as being in a zone with the higher risk.

Table 1 Hazardous area classification

			Area classification
Underground storage tanks	(a)	Within any tank and within any manhole chamber in which there are tanker delivery hose connection points.	Zone 0
	(b)	Within any manhole chamber not containing tanker delivery hose connection points.	Zone 1
	(c)	For tank filling connections, vertically for 1.25m above forecourt level, extending horizontally for 3m and coming down to forecourt level at a radius of 4.25m from the connections (see Fig 1).	Zone 2
Vent pipes for underground	(a)	Within a radius of 3m in all directions of the open end of any vent pipe.	Zone 1
	(b)	The area below the Zone 1 area of the vent pipe, for a radius of 3m around the discharge point and down to ground level (see Fig 2).	Zone 2

		Area classification
Metering pumps and dispensers	(a) Within the metering pump/dispenser housing and any enclosed spaces directly connected thereto.	Zone 1
	(b) Within approximately 3m horizontally, coning downwards to 4.25m at forecourt level, of the centre line of the metering pump/dispenser, and vertically to the top of the hydraulic housing with a minimum height of 1.25m (see Figs 3-5 and zoning diagrams in BS 7117: Part 1 for exceptions to this rule).	Zone 2
	(c) For metering pumps/dispensers (or radial arms attached thereto) incorporating a sight-glass, within 0.75m horizontally from 0.15m above the sight-glass down to ground level.	Zone 2
	(d) Any canopy fitted to a low-hose metering pump/dispenser, provided adequate precautions are taken to prevent vapour from the dispenser body reaching the canopy This is subject to the bottom of the canopy being at least 1.25m above the forecourt level.	Non-hazardous (safe) area
Remote pumps	(a) Within any enclosure around the pump.	Zone 1
	(b) Within 3m horizontally coning downwards to 4.25m at forecourt level of the centre line of the remote pump housing and vertically to the top of the hydraulic housing with a minimum height of 1.25m.	Zone 2
Screwed or flanged joints in above ground pipework	A cylinder 1 m in diameter centred on the joint extending from 1 m above the joint to ground, unless the pipe is in an enclosed or essentially enclosed space in which case it is the entire space.	Zone 2
Road tankers parked for unloading	(a) Within 1 m in all directions of the centre of any tanker top openings, extending 2m above the tanker shell and within 300mm of the shell extending vertically down to ground level.	Zone 1
	(b) Within 4.25m horizontally of the tank discharge connections 1 m in all directions from the connections extending down to ground level.	Zone 2
	(c) Where the road tanker is parked under a canopy or similar structure, within a radius of 2.5m of any opening on the tank top.	Zone 2
Forecourts	The forecourt area within a 4.25m radius of dispensers and filling points up to a height of 0.25m above ground level.	Zone 1
Buildings	Kiosks and other small buildings with openings in a hazard zone.	The appropriate zone at the same height throughout the building
Pits, trenches etc. Zone 1	Any pit, trench or depression below ground wholly or partly in a Zone 1 or Zone 2 area.	



NOTE. The manhole chamber is classified as zone 0 only when it contains points to which tanker delivery hoses can be connected (see table 1).

Fig 1 Hazardous area surrounding underground storage tank (section)

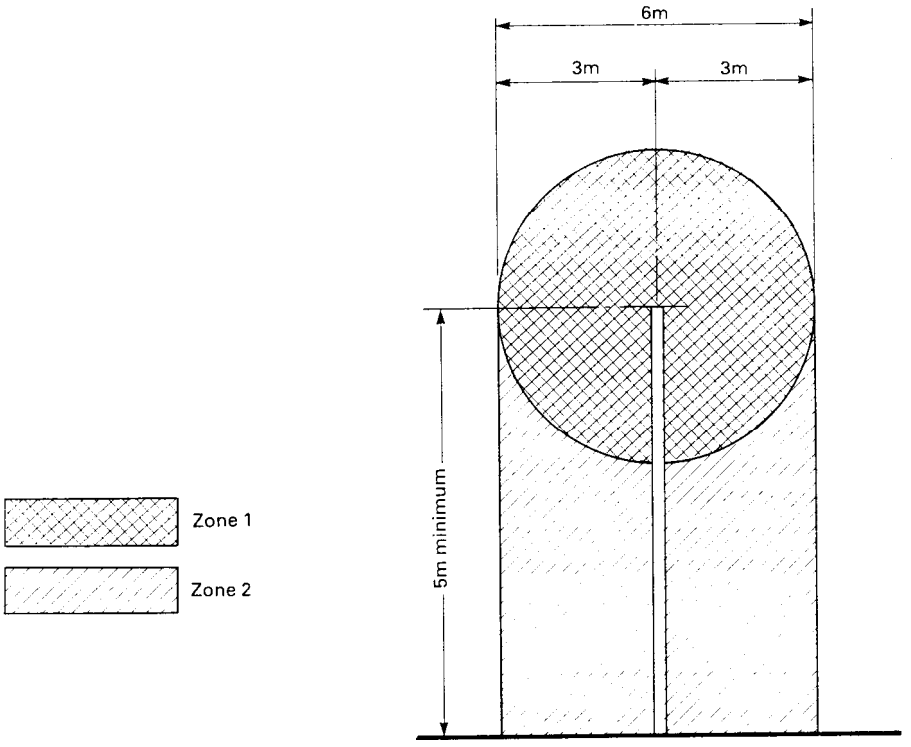


Fig 2 Hazardous area surrounding vent pipe

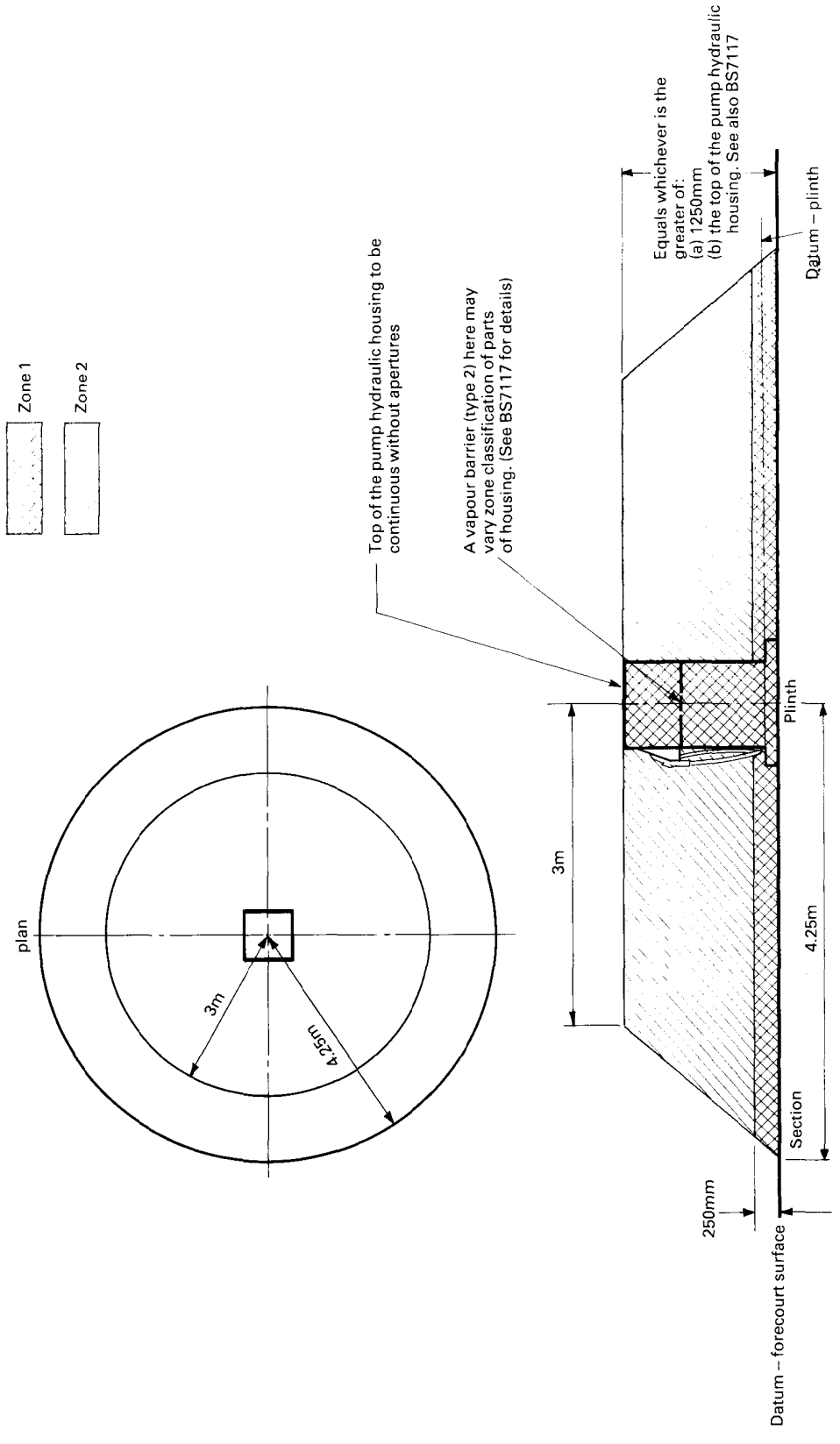


Fig 3 *Hazardous area at a low hose metering pump/dispenser - see also BS 7117*

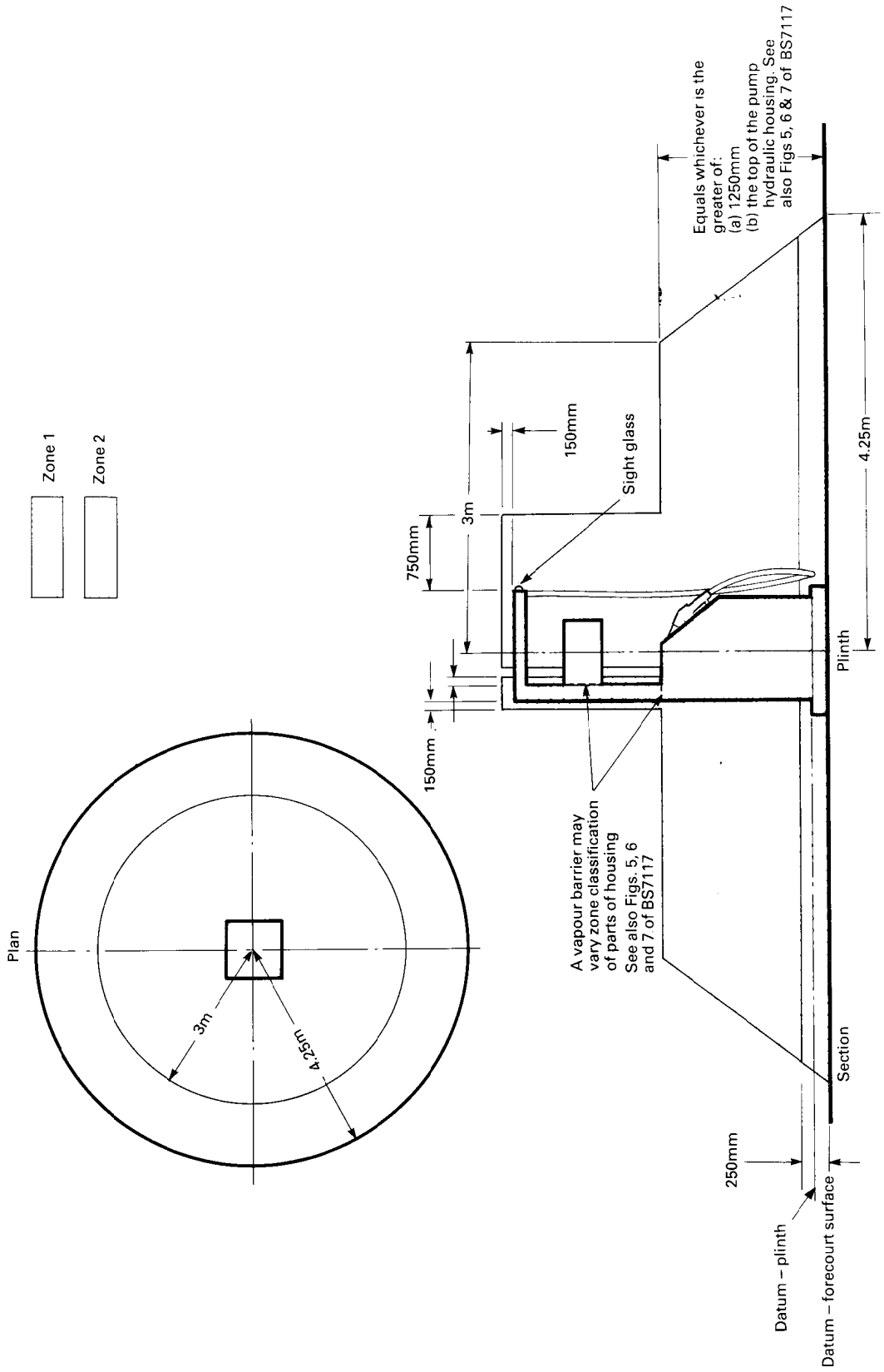


Fig 4 Hazardous area for a high hose metering pump/dispenser fitted with eight glass and without barriers see also BS 7117

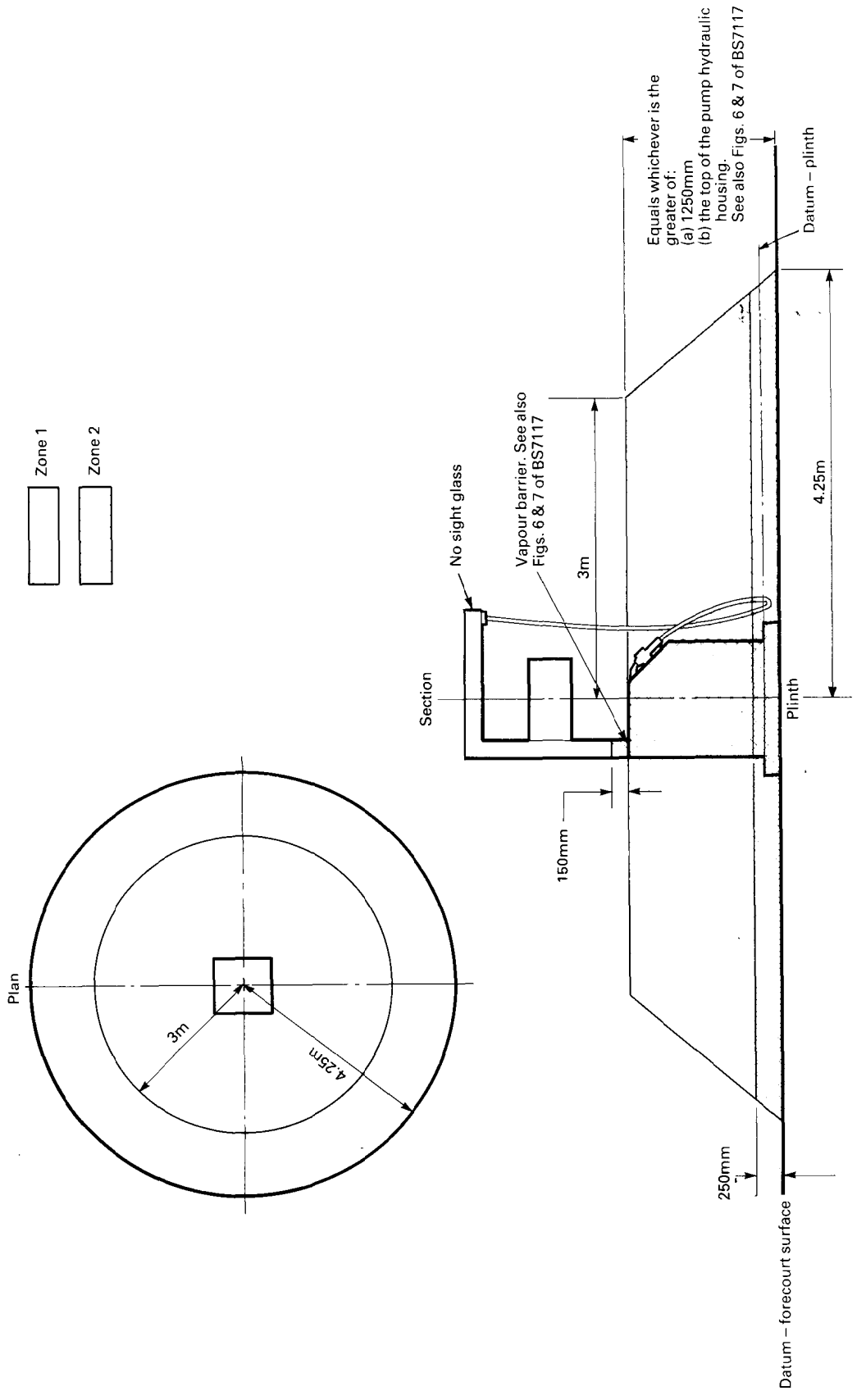


Fig 5 Hazardous area for a high hose metering pump/dispenser - no sight glass - with barrier - see also BS 7117

Part 1 Planning, construction and installation

Planning and design

Initial planning

27 Any site chosen for a filling station should be sufficiently spacious for it to be designed to minimise the risks from petrol to any person likely to be at or near the filling station. The locations of tanks, filling and vent pipes, metering pumps, dispensers, road tanker delivery stands and buildings should be designed to provide for adequate means of escape for persons in the event of a fire or other incident; for hazardous areas to be protected from sources of ignition; and for safe access, routing, parking and exit of customers' vehicles, service vehicles and road tankers.

28 Hazardous processes being carried out or hazardous materials being stored on land or in buildings or other structures close to the boundaries of the filling station should be taken into account. The locations of tanks and other equipment and services at the filling station should be chosen to minimise the effects of fire or explosion at adjacent premises and to avoid jeopardising the adequate means of escape of persons at the filling station or at adjacent premises. Consultation with the occupiers of adjacent premises may be necessary.

29 The nature, location and depth of any waste disposal (landfill), any subterranean water courses, culverts, pipelines or mine workings and any cuttings or tunnels for road or rail vehicles or pedestrians directly beneath or adjacent to the filling station should be identified and assessed for any effects on the safe keeping of petrol. Where the licensing authority assesses that the risks involved with such features justify it, a form of secondary containment for, and contents or leak monitoring of, the petrol storage should be provided. The nature of the original use of land being redeveloped should also be identified and assessed. Consultation with responsible public authorities or other organisations will usually be necessary.

30 Initial planning should also take into account the guidance on planning for electricity supplies and electrical equipment in Part 3; and the need for coordination between all persons involved in the development of the filling station, eg the developer, contractors, operator, suppliers of equipment and petrol, installers, etc.

31 As early as possible during the planning stage, the advice of the licensing authority should be sought. Before any work on site is started, an application should be made to the licensing authority. The application should be accompanied by a site plan (approx 1:100 scale) showing the locations of tanks, pipework, metering pumps, dispensers, drainage systems, buildings and other structures. Work should not be started until the licensing authority has agreed the proposed arrangements in writing.

Locations of tanks, off-set filling points and pipelines

32 Petrol storage tanks should be located underground, clear of the foundations of buildings and not within buildings or in or within approximately 6m of basements. The centre lines of any tank openings or off-set filling points should be not less than 4.25m from the public thoroughfare or any other boundary of the filling station; but where there is an imperforate wall at the boundary extending sideways not less than 6m from any filling point and not less than 3m in height, filling points may be located close to the boundary. The locations chosen should allow for tank openings or off-set filling points to be in the open air to ensure adequate ventilation for dispersing accumulations of vapour; and to be separated from occupied buildings by a distance sufficient to minimise the effect of radiant heat on buildings (eg 12m from living accommodation, 6m from other types of occupied buildings) unless the openings to such buildings are themselves adequately protected (ie to a minimum standard of half-hour fire resistance). The locations of offset filling points should also allow for some form of protective construction (see para 73).

33 Pipelines from tanks to off-set filling points, metering pumps, dispensers and vent pipes should be routed below the ground surface. The routes chosen should not be under buildings or other obstructions so that access to the pipelines can be gained if a need arises after installation. In the event of alterations to the agreed pipeline routes shown on the original plan a final diagram should be submitted to the licensing authority.

34 Tanks for flammable liquids with flash points of 32°C and above (eg diesel fuel, paraffin) should be located in a safe place in relation to the petrol installation. Above-ground tanks should be separated from petrol storage tanks and other petrol equipment by at least the distances specified in Table 2. In addition, guidance in HSE Guidance Booklet HS(G)50 about, for example, minimum separation distances from buildings, boundaries etc, and the provision of bunds for all aboveground tanks, should be followed.

Table 2 Minimum distances between petrol equipment and the storage of high flash point liquids (32" and above) in above-ground storage tanks

Tank capacity (litres)		*Minimum separation distances from any part of a tank to filling points of petrol tanks, vent discharge points and metering pumps and dispensers (metres)*
Single tanks	*Total for a group (maximum)*	
up to 1000	3000	*4*
1000- 5000	15000	*4*
5000- 33000	100000	6
33000- 100000	300000	8
Above 100000	750000	10

Table 3 Minimum distances between LPG facilities and petrol equipment

LPG facilities	*Distance*	*Petrol facilities*
LPG tanks and filling connections.	7.5m	Metering pumps/dispensers, tank vents, underground tank manholes and fill points
LPG dispensers	7.5m	Tank vents and fill points

Although the flammable liquids and LPG referred to in paras 34 to 36 are not of themselves subject to licensing under the Petroleum (Consolidation) Act 1928, the licensing authority's powers extend to them if, in the authority's view, the presence of such substances at a filling station affects the safe keeping of petrol.

35 At commercial filling stations (ie filling stations where the public have no access), the guidance in para 34 may also be applied to the aboveground storage of liquids with flash points below 32°C other than petrol (eg some types of anti-freeze).

36 Underground, mounded or above-ground tanks for LPG should also be located where they will not increase the risks of fires or explosions from petrol. Minimum separation distances between LPG facilities and petrol storage tanks and other petrol equipment are set out in Table 3. The delivery stand for the LPG tanker should be positioned so that these distances are not seriously reduced when LPG is being delivered. The separation distances should be used in conjunction with the more detailed advice in HSE Guidance Booklet HS(G)34 (for bulk installations). In addition, detailed guidance in LPGITA Code of Practice No 20 (for LPG vehicle refuelling facilities), LPGITA Code of Practice No 22 (for pipework) and HSE Guidance Note CS4 (for LPG cylinders and similar containers) should be followed where appropriate.

Locations of vent pipes for underground storage tanks

37 The extensions of vent piping above ground should be located where vented vapour will be dispersed safely into the atmosphere. Locations should be chosen taking into account conditions at or near the filling station which could adversely affect safe dispersal of any discharge and cause a flammable atmosphere to reach a source of ignition (eg the nature, height and location of surrounding developments; the direction of prevailing winds and the possibility of unusual air currents caused by high buildings; and the proximity of possible ducts for vapour, such as roof gutters, down pipes, chimney stacks, ventilation shafts, trees, narrow passages and gaps between buildings).

38 Vent pipes should extend to a height greater than the maximum liquid level in any road tanker likely to deliver petrol to associated tanks and, in any case, not less than 5m above ground level. The vent discharge point should not be within 3m, in any direction, of opening windows or any other opening to a building. Vent pipes should be not less than 3m from a boundary; but where there is an imperforate wall at the boundary extending from ground level and for at least 3m in any direction from the vent discharge point, they may be located close to the boundary.

Locations of metering pumps and dispensers

39 Metering pumps and dispensers should be located in the open air where they will be adequately ventilated. The centre lines of their housings should be not less than 4.25m from the

public thoroughfare or other boundary of the filling station. They should be separated from occupied buildings by a distance adequate for protection against the entry of fire (eg 9m from living accommodation, 6m from other types of occupied buildings) unless the openings to such buildings are themselves adequately protected. They should be positioned so that vehicles can be parked easily in a convenient position alongside each dispenser without restricting the movement of other vehicles; and so that hoses do not have to be extended unduly and are not likely to be damaged by contact with stanchions or other obstructions. At attended self-service stations, metering pumps and dispensers should also be located where vehicles etc being filled from them can be adequately viewed and supervised from the control point.

Locations of road tanker delivery stands

40 The road tanker stand for delivering petrol into storage tanks should be in the open away from buildings (excluding canopies), dispensing activities and emergency escape routes. It should be large enough to allow a road tanker to be positioned wholly within it during delivery (ie not less than 15m long and 5m wide at any point). The location chosen should allow for the road tanker to be positioned so that it has a clear and unobstructed escape route in a forward direction. The stand should be level with sufficient clearance above the tanker from any overhanging obstruction to permit dipping (see also para 44) and access to foot valve controls.

Locations of buildings and other features

41 Any building intended for use as a control point at an attended selfservice filling station should be located where an attendant at the control point can exercise adequate supervision over dispensing activities. The view from the control point necessary to ensure adequate supervision of dispensing activities should therefore not be obscured by other buildings or structures or by a road tanker properly positioned for delivery of petrol into storage tanks (see also paras 126 and 127).

42 A building intended for use as a shop for consumer goods and other services (including shops known as convenience stores) may attract to the filling station large numbers of customers not associated with petrol sales. As far as possible, the location of the building, together with any associated design features, should avoid the possibility of such customers affecting the safe operation of petrol dispensing or road tanker delivery. Ideally, there should be two entrances to the shop, one from the forecourt for customers for petrol sales and one remote from the forecourt for other customers; and parking facilities with entrances and exits away from the petrol operations. Where this is not possible, adequate separation between the petrol operations and pedestrians and vehicles visiting only the shop should be achieved by the provision of clearly marked routes and parking areas.

43 Vending machines and other facilities not related to the dispensing of petrol should be located so that customers' use of them and access to them do not adversely affect the safe operation of petrol dispensing or road tanker delivery.

44 The need for the openings to storage tanks, off-set filling points, pipelines, metering pumps and dispensers to be in the open air (see paras 32, 33 and 39) does not prevent the location of a canopy over a filling station forecourt provided that the dimensions of the canopy do not adversely affect the ventilation of or access to the equipment. Any canopy should not prevent the dipping of a road tanker properly positioned for delivery of petrol into storage tanks.

45 Petrol interceptors should always be installed and should be located where they will prevent the drainage of any petrol spillages or water contaminated with petrol from entering any water courses, public drains or sewers or from otherwise escaping from the filling station. Locations should be chosen taking into account that water draining from car wash facilities should not pass through the petrol interceptors; that by-pass interceptors will not cope with large spillages and are therefore not suitable for filling stations; that the capacity of interceptors should be adequate to contain at least the maximum contents of a compartment of a road tanker likely to deliver petrol at the filling station; and that each chamber should be vented. Vent pipes should extend to not less than 2.4m above ground level, should be not less than 75mm diameter and of robust construction, and should be manifolded above ground.

Construction and installation

Construction of tanks and connections

46 Underground mild steel storage tanks should be designed, manufactured, inspected and tested in accordance with BS 2594 or other appropriate recognised standard. Each tank or, in the case of multi-compartment tanks, each compartment, should be fitted with a manhole of the dimensions described in BS 2594 and fitted with adequate

protection against damage to the bottom of the tank from any dipstick (eg a steel plate of 6mm thickness and adequate area welded inside the bottom of the tank beneath each dip pipe during manufacture).

47 Alternatively, underground GRP tanks may be used provided that they are manufactured, inspected and tested according to BS 4994 (Category I) and that, until a recognised standard specific to GRP tanks for underground use is developed, the special considerations set out in this guidance are followed. Chemical resistance testing of the resin to be used for the tanks (see BS 4994, clause 6.5) and prototype tank testing (see BS 4994, clause 38.3) should be performed as set out in Table 4; and prototype tank testing should be witnessed by an independent assessor (see BS 4994, clause 38.1). Each tank or compartment should be fitted with a bolted steel neck or a neck of flame retardant material (ie it should achieve a class 1 rating under BS 476 Part 7) and with adequate protection against damage to the bottom of the tank or compartment from any dipstick. It should also be fitted with a metal plate which is electrically bonded to the steel tank lid; is in such a position in the base of the tank or compartment that any liquid contents will be in contact with it; and is of such a size that any liquid contents will be no more than 2m from it (see BS 5958 Part 2).

Table 4 Chemical resistance and prototype testing for underground GRP tanks

Item	*Test*	*Method*
Resin	Chemical resistance	Representative specimens of resin laminate should be immersed in an appropriate reference fuel for 28 days at 38°C. After 28 days, the tensile strength, flexural strength and Izod impact resistance (as determined by the appropriate method in BS 2782) must be not less than 80% of that of identical control specimens stored in air at 22°C (± 2°C) for the same period.
Prototype tank	Earth load	The tank should be installed in a pit and supported on appropriate granular bedding material (see paragraph 56). The pit should be backfilled with similar material to a depth of 900mm (± 75mm) above the tank. The tank should not leak, fail or show a deflection of more than 2% of the vertical diameter of the unloaded tank when measured at a fitting near the centre of the tank (see ASTM D.4021-86, item 6.4.1).
Prototype tank	Concentrated load	The tank should be installed as described for the earth load test. A concentrated load should be applied at the mid-span of the tank (by hydraulic or other means) to a load bearing plate 500mm square on the top of the covering backfilling material equivalent to 500kg in excess of the current maximum permitted axle loading for a road tanker. The tank should perform as required by the earth load test (see ASTM D.4021-86, item 6.4.2).
Prototype tank	External pressure	The tank (empty) should be installed as described for the earth load test. The pit should be backfilled to the level described for the earth load test and filled with water to the same level. The water level should be maintained for 24 hours. During this period, the tank should perform as described for the earth load test.
Prototype tank	Water load	The tank should first be subjected to an air pressure test to 0.35 barg and wiped with a soap solution to test for soundness (see guidance on safety in pressure testing in HSE Guidance Note GS4 and BS 4994, clause 39.7). The sound tank should then be installed in a pit. The pit should be backfilled to the level of the top of the tank and the tank filled with water. The tank should be subjected to an air pressure test to 0.7 barg for at least 1 hour and should maintain that pressure during that period.

48 Each tank or compartment should be fitted with connections for filling, discharging and venting. Openings should be limited to those necessary for fitting those connections and, if appropriate, for automatic contents measuring equipment. The filling pipe should be carried down inside the tank to not less than 40mm from the bottom of the tank or as near the bottom as possible; the discharging pipe should terminate not less than 35mm above the bottom of the filling pipe to maintain a liquid seal. The delivery end of each filling pipe, whether the pipe is fitted for filling at the tank or compartment or at an offset filling point, should be fitted with a screw-on or snap-on lockable cap, provided with a suitable washer, incorporating, where appropriate, a separate capped aperture for a dipstick. Any opening associated with automatic contents measuring equipment should be capable of closure in a way which will prevent unauthorised access.

49 Each tank or compartment should be fitted with accurately calibrated means for measuring its contents. If a dipstick is to be used as the means, that dipstick should be made of brass, wood (with a protected end), GRP or other material which will not cause a spark when in contact with the tank, tank connections or tank surroundings. A dipstick may only be used in a direct filling connection; in the case of filling through off-set filling points, automatic means of measuring contents should be fitted. In order to avoid spillage resulting from a build up of back pressure, contents gauges should not be installed in a filling pipe or vent pipe.

50 Each tank or compartment should also be fitted with means for removal of accumulations of water. The means should be either through a direct filling pipe or, where an off-set filling point is used, by the insertion of a T-piece in the filling pipe with the unconnected end securely plugged. Any plug arrangements should be removable only by the use of tools.

51 Before each steel tank is lowered into its excavation ready for installation, it should be cleaned of all exterior rust and scale and adequately protected against corrosion, eg by the application of one coat of red lead (BS 2523, composition Type B) followed by one coat of bitumen, or by the application of two coats of bituminous paint (BS 3416 or BS 6949). Any other form of protection which might be proposed should be the subject of specialist advice.

52 Any above-ground tanks for flammable liquids (see paras 34 and 35) should be designed, manufactured, inspected and tested in accordance with BS 2594, BS 2654 or other appropriate standard of good practice. Tanks should be protected from corrosion according to, for example, BS 5493. Further guidance about above-ground tanks is in HSE Guidance Booklet HS(G)50. Any storage tanks for LPG (see paragraph 36) should be in accordance with the standards in LPGITA COP No 20 and HSE Guidance Booklet HS(G)34.

Installation of tanks

53 Each underground steel tank should be installed in an excavation and, with the exception of the tank or compartment manhole lid, should be surrounded by concrete not less than 150mm in thickness unless effective secondary containment (eg double skinned tank, specialised excavation liner) and contents monitoring are provided. Where secondary containment is provided, the excavation may be backfilled as described in paragraph 56. Any concrete or infilling above the tank should be reinforced to withstand vehicular traffic. Each tank should be supported by a reinforced concrete base slab not less than 150 mm in thickness with suitable fixing points for tank anchoring straps.

54 Each manhole lid for a steel tank and any opening within the manhole, other than the upper termination of any off-set filling pipe and vent pipe, should be enclosed in a chamber of concrete with walls of not less than 150mm in thickness or of other impermeable material capable of retaining any petrol spillage. Brickwork is not suitable. Each chamber should be fitted with a cover which is strong enough to withstand vehicular traffic and which is watertight or raised sufficiently above ground level to prevent the entry of surface water. Diagrams of typical steel tank installations are at Figs 6 and 8.

55 Concrete for the tank surround and manhole chambers should be made of one of the prescribed mixes for ordinary structural concrete in Section 6 of BS 8110 to the standard set out in Table 5.

Table 5 Concrete for tanks etc

Grade designation	*C3OP*
Type of cement	Sulphate resisting Portland cement (BS 4027) or other sulphate resisting cement (BS 146, BS 4246)
Nominal maximum size of aggregate	20mm
Workability	Medium
Method of compaction	Needle or surface vibration
Minimum cement content	350kg per cubic metre

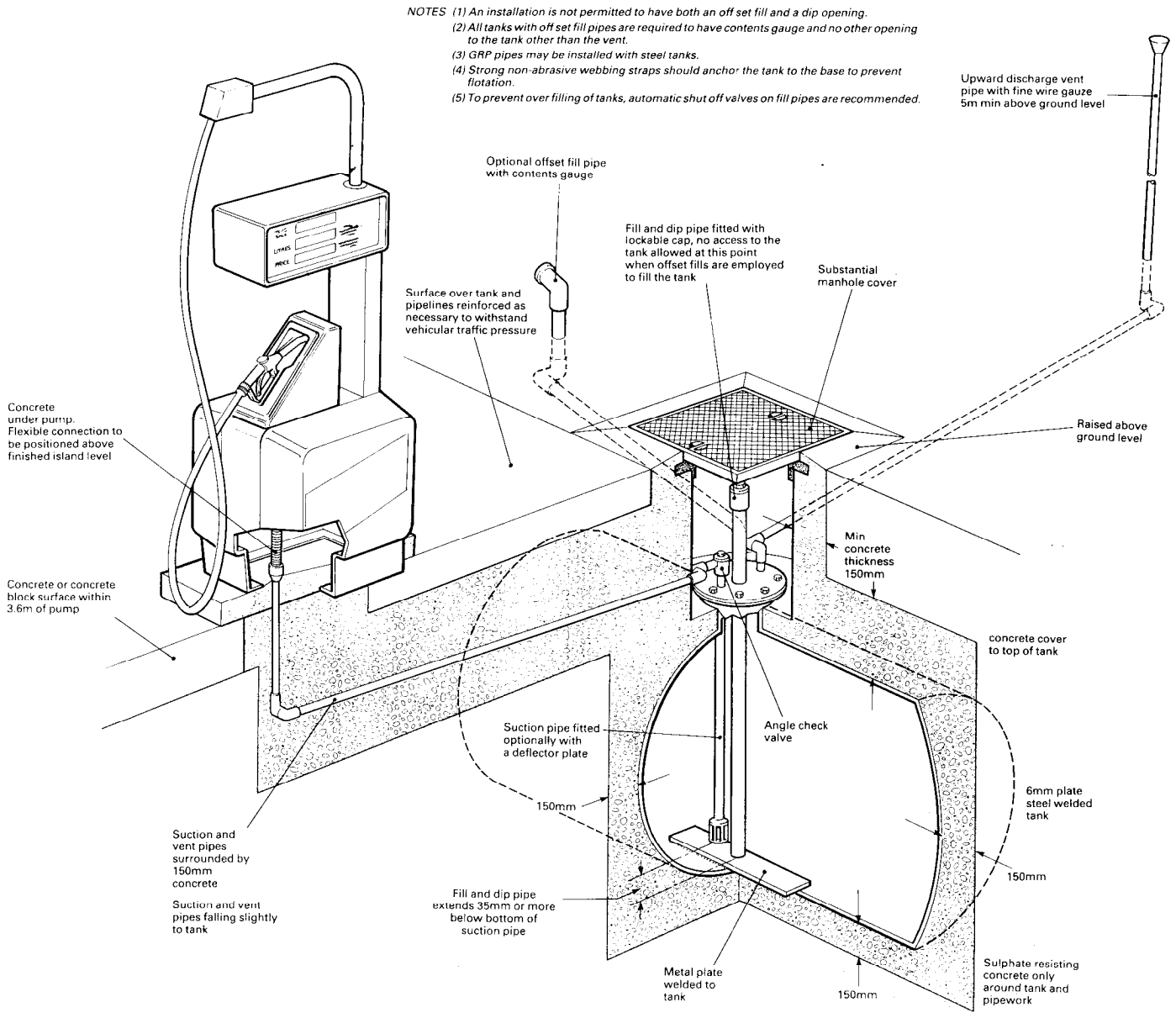


Fig 6 Typical layout of a steel petrol tank installation

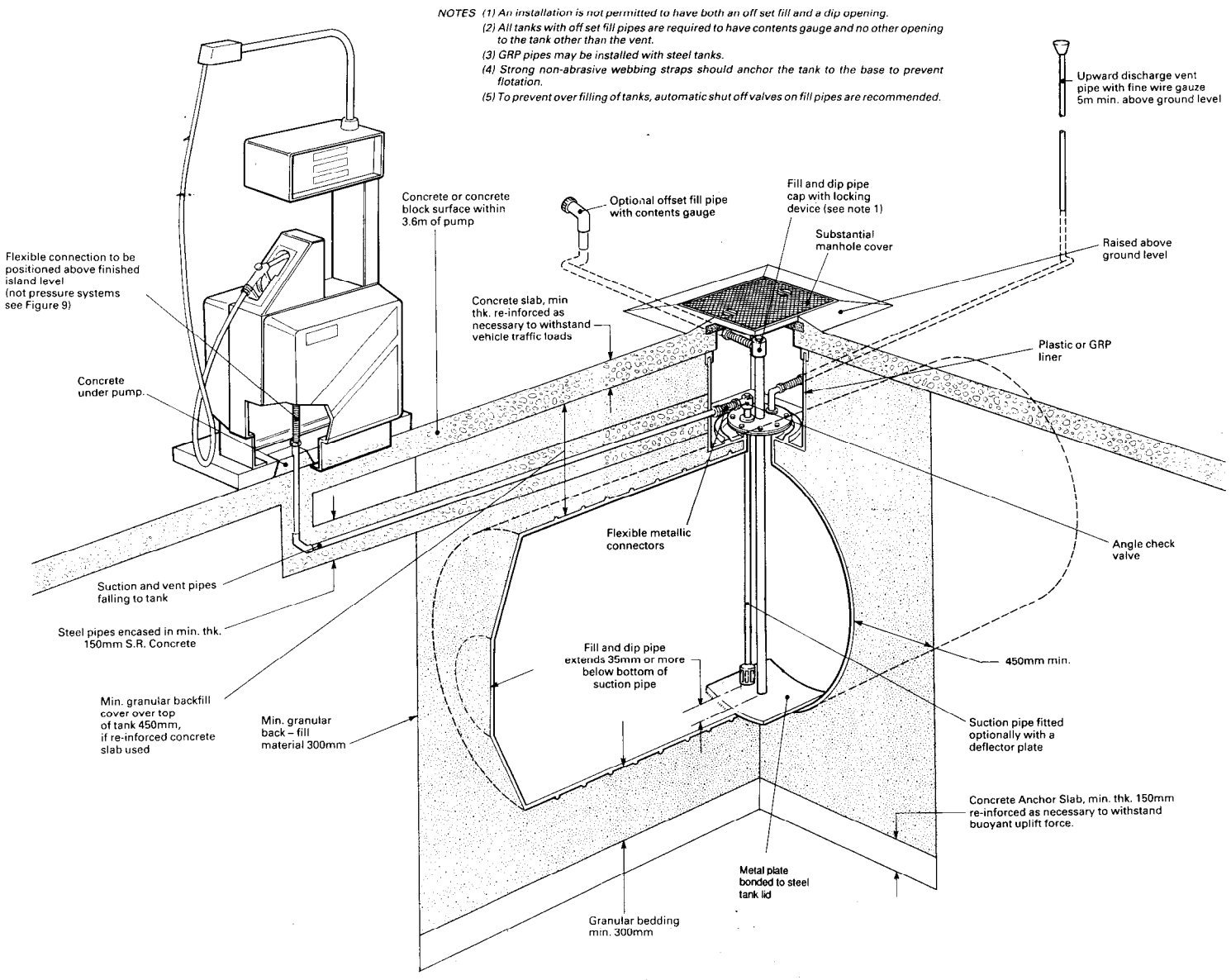


Fig 7 Typical layout of a GRP petrol tank installation

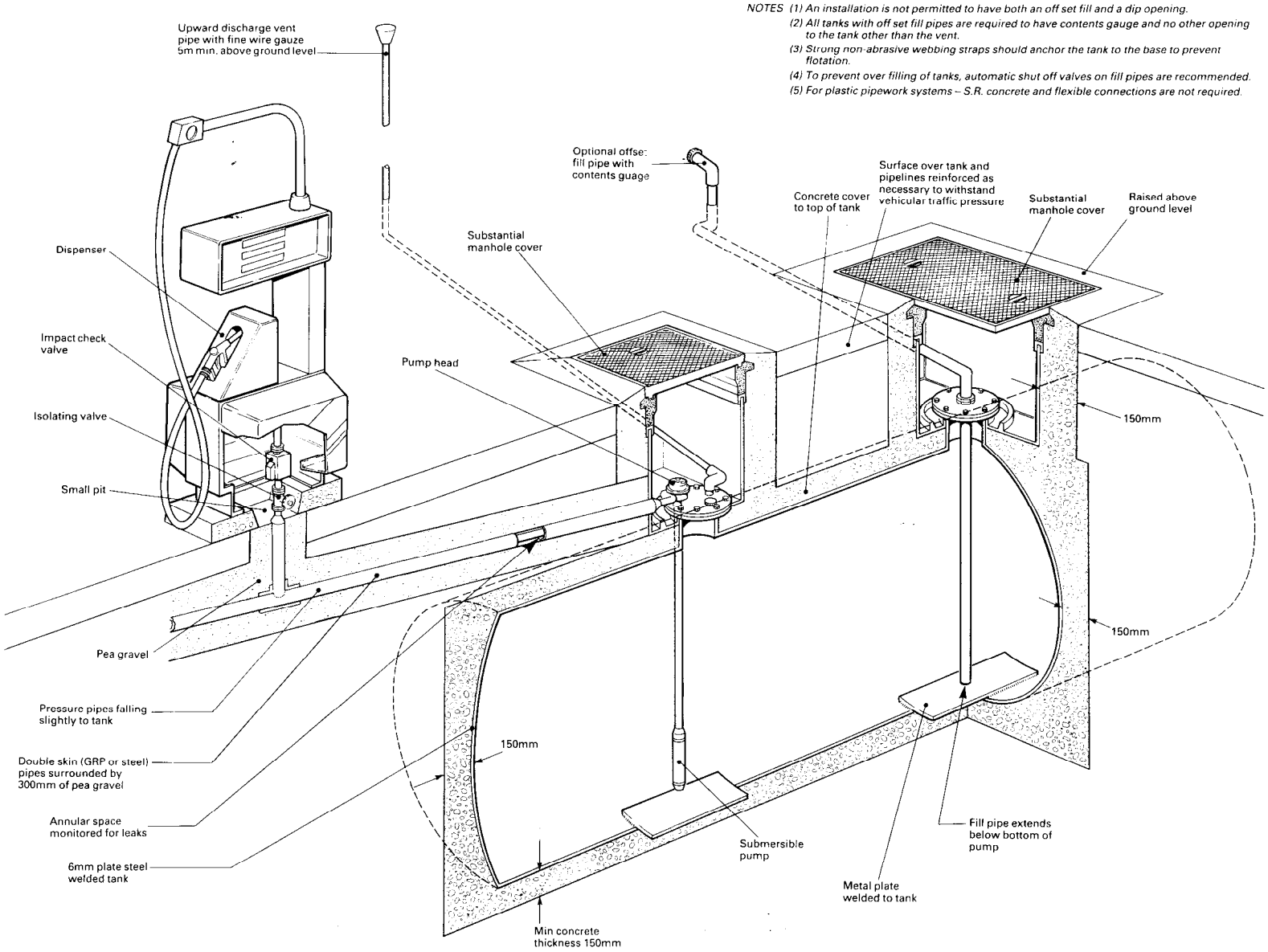


Fig 8 Typical layout of a submersible pump with pressure lines

56 A GRP underground tank should be installed with the top at least 900mm below ground level or, where a concrete reinforced slab of not less than 150mm thickness is installed above it as protection from vehicular traffic, at least 450mm below ground level. It should be above a reinforced concrete base-slab of not less than 150mm in thickness and surrounded by suitable granular backfill material of not less than 300mm. The concrete should be provided with suitable fixing points for tank anchoring straps. Suitable backfill material would be free flowing rounded pea gravel (ie with no particle larger than 10mm and no more than 8% by weight capable of passing a no 200 sieve or with a mix of particle sizes between 3mm and 20mm and no more than 3% capable of passing a No 8 sieve); stone or crushed rock (ie with an angular particle size between 3mm and 12mm and no more than 3% capable of passing a No 8 sieve); or dry washed sand. In some circumstances, the material may need to be contained in a filter fabric to prevent migration in the backfilled excavation.

57 The manhole lid for a GRP tank should be enclosed in a chamber which should be capable of retaining any spillage of petrol. The walls of the chamber should not transmit any surface loading to the tank shell; and any part of the tank shell exposed within the chamber should be flame retardant (ie it should achieve a Class 1 rating under BS 476 Part 7). The chamber should be fitted with a cover as described in para 54. All metal tank lids, metal pipework etc should be electrically bonded. A diagram of a typical GRP tank installation is at Fig 7.

58 Each excavation for a steel or GRP tank should be made with particular care if it is in the vicinity of existing buildings or structures. It should provide a firm level base for the tank; and ledges or high spots which might stress the tank should be avoided. The sides of the excavation should be adequately shored to prevent soil or other material from falling into the hole. Guidance in the HSE leaflet Safety *in excavations* should be followed.

59 Each tank should be lowered into the excavation with sufficient care to avoid damage to the tank or its protective coating. Where there is a possibility of flotation, it should be anchored effectively. Where metal or wire rope anchoring straps are used with a steel tank, a layer of damp proof membrane should be placed between the straps and the tank. Anchoring straps for a GRP tank should be of nylon or similar material to avoid abrasion or distortion of the tank shell. Before any concreting or complete infilling takes place, the tank should be tested (see paras 98 to 102). Any chocks should be removed at the time of concreting. Any removable shoring used in an excavation for a GRP tank should be removed by stages as the gravel is compacted to ensure that no voids are left.

60 Any above ground tanks for flammable liquids (see paras 34 and 35) should be installed in accordance with HSE Guidance Booklet HS(G)50. Any storage tanks for LPG (see para 36) should be installed in accordance with LPGITA COP20 and HSE Guidance Booklet HS(G)34.

Construction of pipelines and fittings

61 Tubes for pipework should be manufactured in accordance with BS 1387 to the thickness specified for medium tubes and, if intended for use with petrol, should be galvanised. Pipework should be constructed in accordance with a suitable standard (eg ANSI B31.3 (with EEMUA supplement 153) or, if welded construction is adopted, BS 2971). Joints should be kept to a minimum; those installed below ground should be welded or screwed with a corrosion allowance built in to design. To minimise leakage, welded joints are to be preferred and should always be used in non-hazardous areas. Adequate protection against corrosion should be provided with particular attention to vulnerable areas (eg screwed joints). Aboveground pipework may have welded, screwed or flanged joints although it should be recognised that any screwed or flanged joint will create a Zone 2 area (see Table1). It should be adequately protected against corrosion. Any valves should be constructed of materials which are sparkproof and corrosion resistant. Any jointing compound should be resistant to petrol.

62 Where pipework using other material such as plastic or GRP is planned, specialist advice should be sought and the plan should be discussed with the licensing authority.

63 Where a GRP underground tank is being used, all pipeline connections within the tank manhole chamber should incorporate flexible sections manufactured of material appropriate to their exposed nature within the manhole chamber (eg stainless steel). Such sections should prevent damage to pipework or connections in the event of differential movement between the tank and any concrete-encased steel pipework. This is not necessary if plastic or GRP pipework is used.

64 A check valve should be fitted in each suction pipeline to restrain the fallback of petrol to the tank or compartment between delivery operations or during prolonged shut down of the system (eg overnight). It may be fitted in the

suction pipeline immediately above the tank lid (see Fig 6) or at the metering pump.

65 A leak detector system should be fitted with each underground pressure delivery line from a remote or submerged pumping unit, unless the delivery line is down stream of the meter (eg a double walled pipe with a suitable monitoring device in the void). For ease of maintenance, an isolating valve should be fitted in the pressure line at each dispenser. Fig 8 illustrates examples of these features.

66 An impact check valve to cut off fuel in the event of impact should be provided in the pressure delivery line riser at the base of each dispenser (see Fig 8 and BS 7117 Part 2). Alternatively, adequate protection from damage for the dispenser and its associated pipework (eg by placing a riser pipe within the web of a substantial H section beam) should be provided.

Construction of vent pipes, including vapour balancing systems

67 A separate vent pipe should extend from each tank or compartment, should not be less than 40mm diameter and should have no dips which might trap small amounts of petrol. Subject to the particular conditions at the filling station (see paras 37 and 38), each open end should be constructed to discharge upwards. Except in the case of vapour balancing arrangements where special considerations apply (see

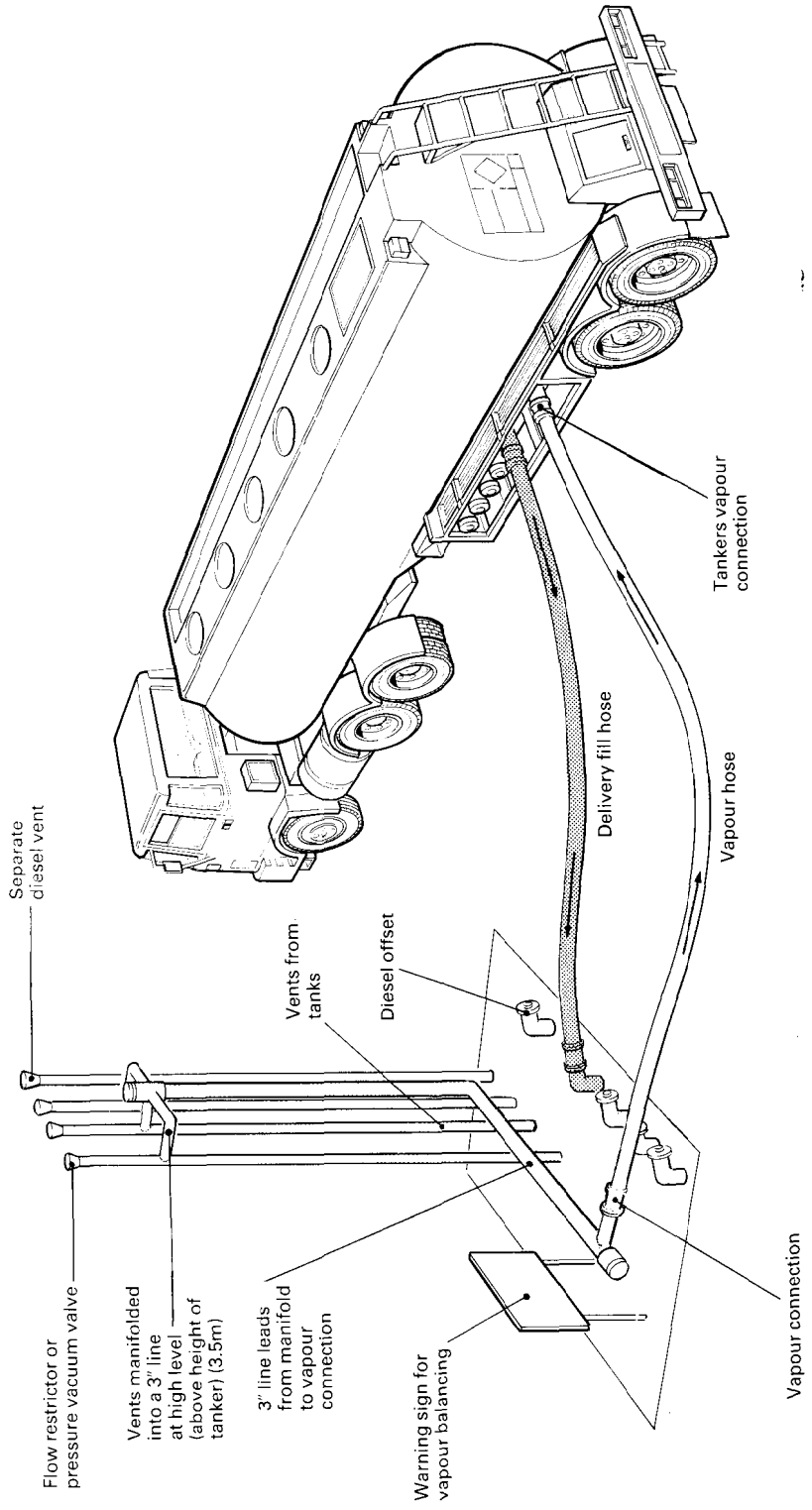


Fig 9 Typical vapour balancing installation with a manifold at high level

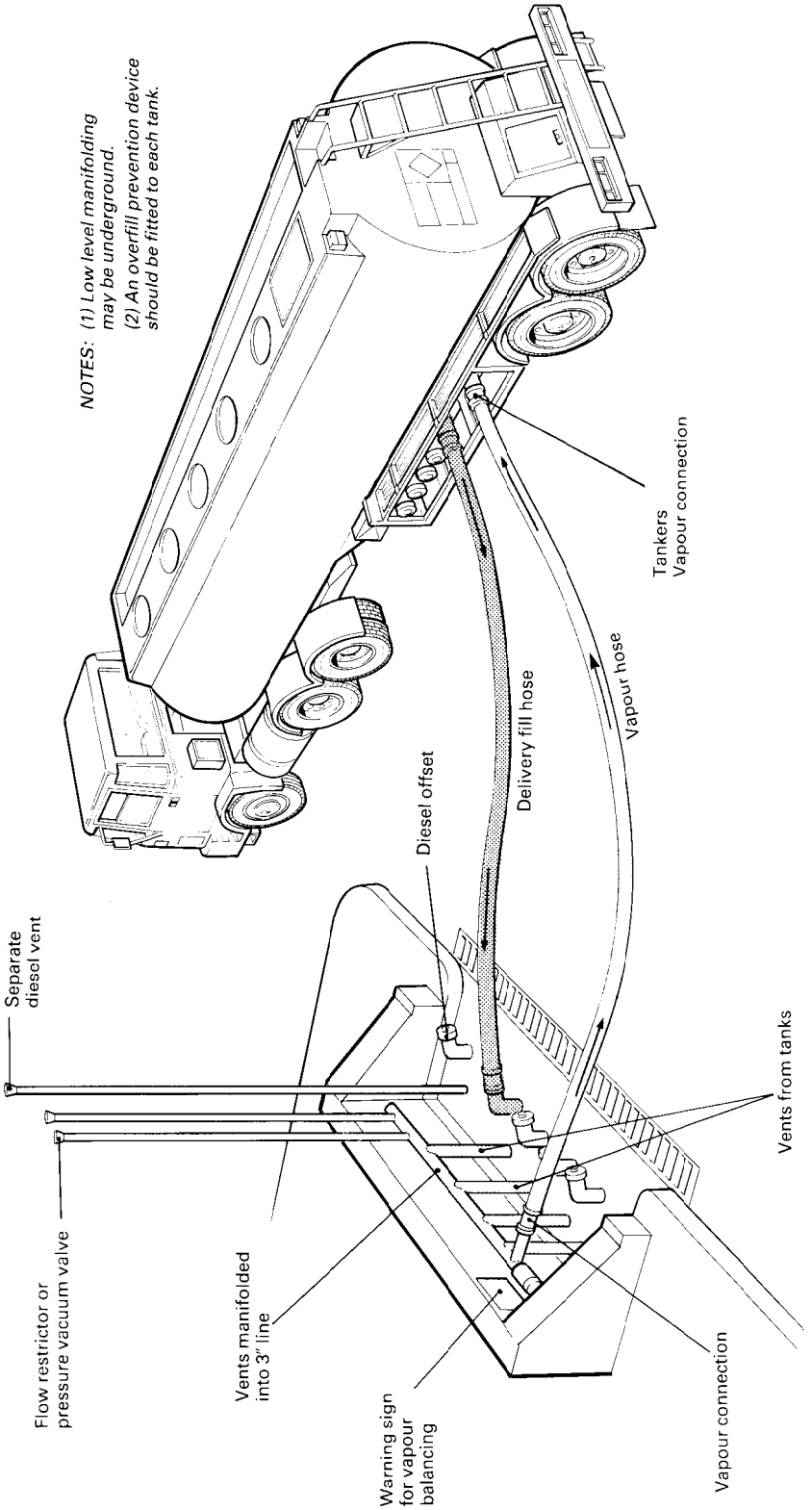


Fig 10 Typical vapour balancing installation with manifold at low level

concrete base. In the case of an impact check valve or isolating valve, the pressure line may terminate in a shallow, liquidtight pit. The pit should be constructed with walls and floor of concrete of the standard in Table 5 and of not less than 150mm in thickness. The pit should be as shallow as possible and should in no case be deeper than is necessary to accommodate the valve (see Fig 8).

73 Where possible, each off-set filling pipe should be installed so that the filling connection is about 0.3m above ground, with the termination angled to assist connection with the road tanker delivery hose. Each off-set filling point should be adequately protected against impact (eg by installing kerbs, bollards, barriers or boxing, or by insetting into surrounding or overhanging walls).

74 Where it is necessary to terminate an off-set filling point below ground, it should be installed in a chamber made of concrete to the standard in Table 5 with walls of not less than 150mm in thickness. The chamber should be fitted with a cover as described in para 54 above. Any change-over or isolating valves should be installed and fitted in the same way.

75 Before any concreting or infilling of underground pipe runs takes place, all fillings, suction, syphon and vent pipes should be separately identified and tested (see paragraphs 103 to 105).

Construction and installation of metering pumps and dispensers

76 All metering pumps and dispensers should be constructed, certified and installed in accordance with BS 7117 Parts 1 and 2 or other equivalent standard (see also para 182). Any metering pumps or dispensers intended for liquids other than petrol should, if located within 6m of equipment for petrol, conform to the same standard.

77 In addition to the construction standards in BS 7117 Part 1, metering pumps and dispensers at unattended self-service filling stations should include a limiting device designed to prevent a continuous outflow of petrol of more than 50 litres (the limiting device should be additional to any money, token or credit card pre-set device). An independent timing device to prevent continuous operation of the pump for a period of more than 3 minutes should also be included. Such devices are not necessary at filling stations where dispensing equipment is controlled or may be shut off in an emergency by an attendant. At unattended commercial filling stations to which the public do not have access, limiting devices of 100 litres may be installed but no independent timing devices are necessary.

78 Metering pumps and dispensers should be securely mounted on islands or plinths raised above the surface of the surrounding forecourt or otherwise securely fixed with adequate protection against damage from vehicles. Any island should be constructed of concrete with an impact-resistant kerb.

Construction of forecourts and road tanker delivery stands

79 Areas subject to vehicular traffic should be constructed of materials capable of supporting the anticipated weight and intensity of traffic without excessive settlement, cracking or erosion. Areas above underground tanks and pipe runs should be adequately reinforced (see paras 53 and 71).

80 The surface of any area within a radius of 3.6m of metering pumps and dispensers should be paved with non-slip concrete, or concrete blocks manufactured in accordance with BS 6717 Part 1. Blocks should be a minimum of 80mm thickness and should be secure against lateral movement. Any area intended as a road tanker delivery stand should be paved with non-slip concrete.

81 Surface drainage of any area surrounding metering pumps, dispensers and road tanker delivery points should be arranged to carry any spills or leaks of petrol, through trapped gullies or by channels, to petrol interceptors before draining from the filling station (see para 45). Water from car wash facilities should not be channelled through the interceptors. Interceptors should be fitted with outlet pipes which are larger than the inlet pipes, vent pipes (which should interconnect above ground) and manholes with covers; and should be installed in concrete of the standard in Table 5. If necessary, manhole chamber covers and the ground surface above the interceptors should be strong enough to withstand vehicular traffic.

Construction of buildings

82 Buildings should be constructed generally of non-combustible materials and should conform to national and local building regulations and practices where applicable. They should have adequate means of escape in case of fire and should be adequately ventilated. Floor finishes should be non-absorbent, resistant to oil and water, and non-slip. All doors forming part of the means of escape from any part of a building should be

capable of being opened from inside at times when the filling station is open for business.

83 Doorways or other openings to buildings likely to be affected by any spills or leaks of petrol should be raised above the level of the surrounding ground surface or protected by sills.

84 Any space heating equipment of a standard appropriate to and installed in a building in an area classified as non-hazardous should not be connected to a hazardous area by means of ducts or ventilators. An exception is indirectfired heaters provided that all incoming air is fresh and the ducts into the area are sited at least 1.8m above floor level (see BS 6230 for indirectfired gas heaters). Any equipment installed in an area classified as hazardous should be constructed to an explosion-protected standard suitable for the zone in which it is installed. Consideration should also be given to installing heating at a high level (ie at or close to the ceiling) so that the equipment is not likely to act as a source of ignition for petrol contaminated clothing.

Construction of canopies and other features

85 Canopy structures should also be constructed of non-combustible materials and should conform to national and local building regulations and practices. Subject to the provisos in subparagraphs (a) and (b), canopy cladding should have a surface spread of flame characteristic not inferior to Class 1 of BS 476 Part 7.

(a) Canopy facias should have a surface spread of flame characteristic not inferior to Class 3 of BS 476 Part 7. The edges of all plastic/acrylic materials should be protected by steel or aluminium;

(b) Lighting units may be installed under canopies provided that they do not exceed 10% of the canopy area and are placed to prevent flame spread from one to another. Diffusers for the units should have a surface spread of flame characteristic not inferior to Class 3 of BS 476 Part 7.

86 Where canopy stanchions are part of or close to metering pumps and dispensers, any cladding should have a surface spread of flame characteristic not inferior to Class 2 of BS 476 Part 7. Pole and price signs should stand apart from the canopy and, unless their proximity to a road tanker delivery stand makes a higher standard necessary, should have a minimum of Class 3 surface spread of flame.

87 Lighting boxes installed over metering pumps and dispensers should be small, isolated from the metering pumps/dispensers and positioned to prevent flame spread from one to another. They should have a surface spread of flame characteristic not inferior to Class 3 of BS 476 Part 7 and any exposed edges should be protected by steel or aluminium.

Marking and identification of tanks and associated equipment

88 The purpose of marking and identification is to avoid confusion or errors which might lead to an incident. All markings and identifications should be clear, durable, not readily altered or obliterated (taking into account chemical corrosion), and in positions where they can be easily read. Paper or cardboard labels should not be used.

89 Each tank should be marked with an identifying number to distinguish it from any other tank. In the case of multi-compartment tanks, each compartment should be marked with a separate number and type of fuel. Each dipstick or other measuring device should be marked to be identifiable with its associated tank or compartment.

90 Each direct filling or off-set filling pipe should also be marked to be identifiable with its associated tank or compartment and to show the type of fuel which its associated tank or compartment is used for. The marking should be as close as possible to the connection for the delivery hose from a road tanker. All valves in pipework should be marked similarly and any above-ground pipework should be colour-coded.

Fire and emergency equipment

91 The possibility of fires or other incidents at filling stations is minimised by careful site planning and design, sound construction and installation of tanks and other equipment, and good operating practices. Nevertheless, fires and petrol spills or leaks may occur. Adequate means for summoning the local fire brigade and suitable equipment for controlling minor incidents and for limiting the escalation of incidents should be installed.

92 At attended self-service and attendant operated filling stations, a telephone should be installed close to any control point or attendant's kiosk. In addition, the following devices should be installed.

(a) At a location readily accessible for quick operation by an attendant at the control point - an emergency switch for switching off all metering pump/dispensing equipment and integral lighting with an adjacent warning notice (eg PETROL PUMPS. SWITCH OFF HERE);

(b) On the forecourt readily accessible to firefighters and members of the public - an emergency switch which will isolate all metering pumps/dispensing equipment and integral lighting with an adjacent warning notice as above;

(c) At a location accessible to firefighters called to deal with an emergency - a switch for disconnecting neon and/or high voltage signs with an adjacent warning notice (ie HIGH VOLTAGE SIGN. FIREMAN'S SWITCH);

(d) At attended self-service filling stations - a loudspeaker system for communicating with customers.

Further guidance on isolation and switching is given in paras 201 to 212; and on loudspeaker systems in para 194.

93 At unattended self-service filling stations, an emergency cabinet should be installed on the forecourt to be readily accessible to customers. The cabinet should be conspicuous and should house a telephone, fire extinguishers and an emergency switch interlocked with the door of the cabinet to isolate the metering pumps when the door is opened (see also para 210). A switch should also be installed as described in paragraph 92(c). In addition, the following emergency warning notices should be installed at or close to:

(a) the telephone - a notice displaying the name and address of the filling station and of the person to be contacted in case of emergency;

(b) dispensing points - notices displaying the actions to be taken in the event of a fire or other emergency.

All notices should be conspicuous, should be illuminated where necessary and may be pictorial or may include pictorial symbols, if appropriate. Guidance on specifications for notices is given in para 95.

94 At all filling stations a supply of dry sand or similar absorbent material should be kept in a container with a close fitting lid and should be installed in an accessible place. The means for applying the material should also be provided. The supply should be sufficient to clean up small spills or leaks of petrol (eg 1 full bucket for each fire extinguisher installed). Other fire and emergency equipment, including any fire extinguishers which may be necessary for kiosks and other small buildings associated with the forecourt, should be installed in accordance with advice from the local fire brigade. As a general guide, the minimum equipment necessary for the forecourt consists of foam fire extinguishers of not less than 9 litres capacity each or dry powder extinguishers of not less than 4.5kg capacity each according to the scale in, and notes below, Table 6.

Table 6 Fire extinguishers

Metering pumps or dispensers	*Extinguishers (see Notes below)*
Up to 4	*2*
For up to each additional 2	1 more

Notes

1 Extinguishers should not have fire ratings of less than 34B in tests shown in BS 5423.

2 All extinguishers at a filling station should be compatible and of the same method of operation. BS 5423 and BS 5306 Part 3 are appropriate.

Warning and information notices

General

95 The use of conspicuous and easily understood notices can help the safety of operations at filling stations and the effective action necessary in the event of a fire or other emergency. There are therefore clear advantages in following the BS safety signs and colours system for all notices, whether or not they are or they include pictorial symbols. For certain types of signs in some circumstances, the Safety Signs Regulations 1980 require that system to be followed (see para 18(a)). In all other circumstances, the system (including the fire safety signs system) in BS 5378 and BS 5499 should be followed when selecting signs to carry the information in paras 69, 92, 93 and 96.

Notices for customers and other visitors

96 At all filling stations, in addition to the notices described in paras 69, 92 and 93, notices

displaying the words PETROL (or PETROLEUM SPIRIT), HIGHLY FLAMMABLE, NO SMOKING and SWITCH OFF ENGINE should be installed in the vicinity of metering pumps or dispensers. They should be positioned so that the warnings and instructions are brought to the attention of customers immediately on their arrival at the dispensing equipment. Similar notices should also be installed close to tank filling points.

Notices for filling station employees

97 The Petroleum (Consolidation) Act 1928, Section 2(4), requires an occupier of a filling station to display a notice setting out any conditions of licence to be observed by persons employed at the filling station (see para 8). The notice should be installed where it is readily accessible and easily readable by all employees likely to be at the filling station at any time.

Testing, commissioning and record keeping

Testing of all tanks

98 Each underground tank should be examined visually before installation and tested for soundness by a competent person after lowering into the excavation but before concreting or infilling takes place. The purpose of the visual examination is to check that any corrosion protection applied to the exterior of a tank is undamaged and that the tank is securely settled on a level base. The purpose of the test is to ensure that the tank or any compartments remain sound under pressures at least as great as those they must sustain during normal service. The competent person should certify his satisfaction with the examination and test. Notice of the examination and test should be given to the licensing authority so that an officer may agree a time and date for visiting, if necessary.

99 Generally, hydrostatic testing according to the following method should be used for steel tanks. Each tank or compartment should be filled with water to just below the neck of the manhole collar. Additional pressure of 0.5 barg should be applied by means of air and the pressure maintained for one hour. There should be no observable leaks.

100 Alternatively, in exceptional circumstances where the possibility of hydrostatic testing as described above is excluded, a pneumatic test without water may be used, as follows. The tank or compartment should be pressurised up to 0.5 barg and sealed, temperature and atmospheric readings should be taken and the tank or compartment left for the period of test as set out in Table 7. There should be no pressure loss during the period of test.

Table 7 Period of pressure test

Nominal capacity of tank or compartment not exceeding	Period of test
15,000 litres	*24* hours
30,000 litres	*48* hours
45,000 litres	*72* hours
60,000 litres	96 hours

(Note: When a multi-compartment tank is *tested, pressure should be applied so that the maximum differential pressure between adjacent compartments does not exceed 0.14 barg. Care should be taken to ensure there is no overpressurisation of compartment plates).*

101 In the case of GRP tanks, the guidance in paras 99 and 100 should be followed. Precautions should be taken to ensure that any tanks left uncovered after testing are not damaged by vehicles or other work activities. In cases of doubt about the integrity of tanks left uncovered for a period, retesting should be undertaken before the tanks are finally covered.

102 Guidance on safety in pressure testing in HSE Guidance Note GS4 should be followed. The guidance stresses the dangers of all pressure testing and sets out specific safety precautions.

Testing of pipelines and fittings

103 All joints in pipelines should be tested for soundness and checked for signs of leaks by a competent person before underground pipe runs are encased in concrete or otherwise buried. Prior notice to the licensing authority and certification of satisfaction should be given (see para 98).

104 All non-pressure lines (ie suction, off-set filling and vent pipes) should be subjected to air pressure of 0.7 barg. While under that pressure, each joint should be wiped with soapy water and checked for signs of leaks. The soapy water should be applied over the surfaces of all elbows and similar fittings.

105 All pressure lines (ie pipelines between remote or submerged pumps and dispensing equipment) should be hydrostatically pressure tested at $1\frac{1}{2}$ times their normal working pressures

and examined for leaks. Alternatively, provided that guidance on safety in pressure testing in HSE Guidance Note GS4 is followed, an air pressure test may be used over a period based on 2 minutes for every 5 litres capacity of the line, subject to a minimum of 15 minutes. During the test, soapy water should be used to detect leaks (see para 104).

Metering pumps, dispensers and associated pumping equipment

106 All metering pumps, dispensers and pumping units, together with associated valves, should be checked for leaks after installation by a competent person. Hoses and nozzles and their connections should also be checked. Further guidance is included in BS 7117 Parts 1 and 2.

Commissioning

107 Before the filling station is brought into operation, it should be inspected by the licensee or other competent person to ensure that its condition is safe for public access and use. In particular, the inspection should ensure that:

(a) all initial tests of tanks, pipelines and fittings have been carried out and certified;

(b) the initial inspection and tests of the electrical installation have been carried out and certified (see Part 3);

(c) the site is clear of combustible material, including weeds and long grass, contractors' plant and equipment;

(d) all emergency equipment has been installed and is in working order;

(e) all warnings and information notices are in place;

(f) all necessary means of escape are provided;

(g) all marking and identification of tanks and associated equipment have been carried out accurately;

(h) all drainage and interceptors are installed and connected.

Appropriate records should be completed (see para 109 and Appendix 1).

108 Before petrol is brought onto the filling station, its keeping should be authorised by a licence issued by the licensing authority (see para 10). The licensing authority is unlikely to grant a licence until items (a)-(h) of para 107 have been satisfied.

Record keeping

109 Paragraph 166 points out that the management of safety at a filling station will benefit from the maintenance of clear records of various activities which affect safety. A specimen register for keeping the records sequentially is included at Appendix 1. Such records are best started with the agreed site plan including final pipeline routes (see paras 31 and 33), the results of initial tests and inspections of tanks, pipelines, metering pumps and dispensers (see paras 98, 103 and 106) and the results of the commissioning inspection (see para 107).

Part 2 Operations and maintenance

General operations

Responsibility for safety

110 Overall responsibility for the safety of operations at any filling station rests with the licensee. Arrangements for keeping and dispensing petrol authorised by the licensing authority at the time of the issue of the licence should be adhered to; conditions attached to the licence should be met; all reasonable steps to prevent fires, explosions and leaks or spills of petrol should be taken; clearly defined operating and emergency procedures should be brought to the attention of all persons involved; and adequate training for persons employed should be provided. A responsibility for the safety of operations also rests with persons employed during the times they are involved with the running of the filling station.

Relationship with the licensing authority

111 Arrangements authorised by the licensing authority when the licence is issued commonly cover matters such as the total quantity of petrol which may be kept, the locations and sizes of tanks, the configuration and number of metering pumps or dispensers, the mode of operation of the filling station (eg attended self-service operation), the locations of road tanker delivery stands and the natures and locations of buildings or other structures. Any proposals to vary the authorised arrangements should be submitted to the licensing authority; work should not start until the licensing authority has agreed to it in writing. Any information about developments adjacent to the filling station which might affect the safety of operations should be passed to the licensing authority.

112 The licensing authority should also be given notice of:

(a) any fire, explosion, spillage or other incident involving petrol and any leak or suspected leak of petrol, as soon as possible after the event;

(b) any proposal to discontinue the use of any storage tank or compartment;

(c) any proposal to repair, modify or remove a storage tank or compartment or pipeline;

(d) any intention to transfer the occupancy of the filling station to another person.

Precautions against fires, explosions, leaks and spills

113 As far as possible, all sources of ignition should be excluded from hazardous areas (see paras 23 to 26). Likely sources of ignition include smoking, smoking materials and other naked flames; any tools or other equipment which may cause sparks if rubbed, knocked or chipped against metal, concrete or brick; hot surfaces; and fixed or portable electrical equipment not specifically designed for use in hazardous areas (see Part 3).

114 Appropriate steps should be taken to prevent leaks and spills of petrol and to detect the sources of any leaks, including leaks suspected because of, for example, evidence from monitoring petrol stocks and use (see paras 135 to 138) or excessive petrol odours at or in the vicinity of the filling station. Any leaks or spills should be prevented from escaping from the filling station. Small leaks or spills should be cleared up promptly by the application of dry sand or other absorbent material.

115 All sand or other material used for clearing or containing leaks or spills should not be exposed to a source of ignition and should be disposed of safely (eg by removal from the filling station by a hazardous waste disposal specialist). If it is retained for any length of time pending disposal, it should be kept in a safe place (eg in a closed bin or other container). Any other material contaminated with petrol (eg clothing, rags, soil) should be treated in a similar way.

116 Any leaks or spills should be removed promptly from petrol interceptors and drainage channels, if necessary by a waste disposal specialist (see also guidance on regular maintenance in para 148).

117 All emergency equipment should be kept readily available and in a condition ready for immediate use (see paras 91 to 94). All warning and information notices or signs should be on unobscured display. Levels of lighting appropriate to safe operations at tank filling points and dispensing equipment should be provided during the hours of darkness or in other dark conditions (see para 195).

118 All means of escape from areas of the filling station likely to be affected by a fire or other incident should be free from obstruction at all times. All areas of the filling station, including in particular vent pipes, manhole and other chambers and off-set filling points, should be kept clear of

combustible material and rubbish (eg oily rags, oil, grease, cartons, long grass and other vegetation). Any material removed during cleaning operations should be disposed of safely.

119 Goods incompatible with the need to avoid fires and explosions from petrol (eg fireworks and other explosive substances) should not be offered for sale at filling stations.

120 Except when the filling station is open for business and an attendant is directly supervising operations (or, in the case of an unattended selfservice station, someone is on call), all electrical power to dispensing equipment should be switched off and the equipment securely locked to prevent nozzles being removed from housings. Except when they are needed for immediate use, all tank filling and dipping pipes and access to them should also be securely locked. Means to switch on power and to release locking devices should be inaccessible to the general public.

Dispensing activities

General

121 Petrol should be dispensed only by means of dispensing equipment of an appropriate standard (see para 76) into the fuel tanks of motor vehicles or into appropriately marked or labelled portable containers suitable for keeping petrol (see paras 15(a) and 18(b)). As far as possible, persons under the age of 16 years should be denied access to petrol; and all radio transmitting equipment (eg CB radios, mobile telephones) should be restricted from operating at a filling station (nb radio transmitting equipment could present a potential source of ignition if operated within the vicinity of dispensing equipment).

122 Engines of vehicles should be switched off before dispensing starts. Dispensing equipment should be operated in accordance with the manufacturer's instructions (eg equipment designed to be operated by an attendant should be operated only by an attendant). Nozzles should be fully inserted into the filling pipes of vehicle fuel tanks. Delivery hoses should not be kinked or stretched. After dispensing, nozzles should be firmly stowed in their housings to switch off metering pumps and dispensers or, in the case of centralised pump systems, to isolate hoses from sources of pressure. If appropriate, hoses should be draped to avoid damage by moving vehicles.

123 Suitable portable containers (see para 15(a)) should be filled with the nozzle operating levers held open manually. Containers should be securely closed as soon as dispensing finishes and should be removed from the dispensing area promptly.

124 If any equipment faults arise or spills, leaks or other emergencies occur during dispensing operations, those operations should stop and nozzles should be returned to their housings. The electrical supply should be isolated from faulty equipment. Dispensing should not restart until any faults affecting safety have been corrected or any incidents have been dealt with.

Attendant operated filling stations

125 Whenever an attendant operated filling station is open for business, a trained attendant should be available to operate the dispensing equipment in the manner described in paras 121 to 124. The attendant should not allow customers to operate the equipment with or without supervision. No operating attendant should be under the age of 16 years and no one under the age of 18 years should be left in sole charge of a filling station.

Attended self-service filling stations

126 Adequate supervision of all dispensing activities at an attended selfservice filling station should be exercised by a trained attendant or attendants at a suitably located and equipped control point or points (see paras 41 and 92). The age restrictions referred to in para 125 above apply. Pump control equipment should not allow any activation of dispensing equipment unless the attendant, only on demand, releases a specific pump identified by its pump number (ie there should be no facility for dispensing equipment to be activated automatically).

127 An attendant should not activate any dispensing point unless satisfied that no smoking or other sources of ignition are present; that the engine of the vehicle to be filled is switched off; that adequate supervision can be continued; and that any necessary action in the event of an emergency or deviation from dispensing in the manner described in paras 122 to 124 can be taken. Irrespective of the configuration and number of dispensing points at the filling station, an attendant should not activate any more dispensing points than can be adequately supervised at any one time.

Unattended self-service filling stations

128 Operating procedures for any unattended self-service station should be as simple as

possible. Notices giving clear instructions for safe dispensing, against misuse and in case of emergency, together with adequate emergency equipment, should be kept in place (see paras 93 to 96). The licensee or a representative should be on call to customers whenever the filling station is open for business.

Commercial filling stations

129 Dispensing activities at commercial filling stations to which the public do not have access generally take place with the individual dispensing the petrol acting as the attendant. In these circumstances, the guidance in para 128 should be followed.

Storage activities

Road tanker deliveries

130 Detailed requirements for road tanker operators and drivers, licensees and persons in charge of storage tanks during road tanker deliveries to filling stations are set out in Regulation 20 and Schedule 4 of the Dangerous Substances (Conveyance by Road in Road Tanker and Tank Containers) Regulations 1981. General guidance on unloading is included in the Approved Code of Practice associated with the 1981 Regulations (see para 15(c)). All delivery activities must be carried out in accordance with those provisions (Note: At certain *filling* stations where *HSE, in conjunction with the licensing authority, has exercised its statutory powers in the 198 1 Regulations to allow driver-only deliveries, the delivery activities must follow the special conditions imposed under those statutory powers).*

131 At any filling station with a vapour balancing system (see para 68), care should be taken to prevent release of petrol vapour at ground level. Consequently, when connecting hoses prior to delivery of petrol, the vapour hose should be connected before the delivery hose. On completion of the delivery operation, the vapour hose should not be disconnected until the delivery hose has been discharged and disconnected.

132 Adequate warning notices should be in place during deliveries (see para 96). At certain existing filling stations where road tanker delivery stands located to the standards set out in para 40 are not available, the road tanker should be parked for delivery at a safe distance off any public thoroughfare or according to specific arrangements agreed by the licensing authority. Delivery of petrol and LPG simultaneously should not be made.

Storage of diesel fuel in multi-compartment petrol tanks

133 Where diesel fuel intended for use in motor vehicles is stored in a compartment of a multi-compartment petrol tank, all the precautions and standards necessary for the storage of petrol should be followed. Distinctive marking and identification should be in place (see paras 88 to 90), adequate steps to detect leaks should be taken (see paras 135 to 138) and regular monitoring to detect any contamination should be carried out. In the event of failure of a compartment, the whole tank should be regarded as failed.

134 Fuel intended for use in heaters should be stored in tanks separate from petrol.

Monitoring and testing for leaks

Continuous inventory checking

135 Consistent, accurate monitoring of petrol delivered, stored and dispensed should be carried out at any filling station to detect leaks from each underground tank and connected pipeline system. At least once during each working day an inventory check and record should be made as follows:-

(a) measure the contents of each tank or compartment;

(b) before more petrol is delivered or dispensed, take a reading of the meter totalisator of each connected metering pump or dispenser;

(c) maintain a running record of the measurements and readings for each separate tank or compartment and connected system, together with a record of associated deliveries.

136 The daily record should be maintained in a form which shows clearly all gains and losses for each tank or compartment and connected pipeline system. It should be retained at the filling station for at least 12 months and should be available for examination by the licensing authority at all reasonable times.

137 Inventory checking should be supported by regular checks for the presence of.water in each tank or compartment. The presence of water in

quantities greater than might reasonably be expected from the effects of condensation could result from leakage through the manhole cover gasket, pipeline connections, or fractures or corrosion in the tank shell.

138 The effectiveness of inventory checking as a method for detecting leaks depends upon the consistent accuracy of the checks, the reliability of the methods of measurement and a competent assessment of the trends indicated by the results. Competent assessment requires a progressive comparison of recorded results, taking into account the possible effects of significant temperature variations or volumetric measurement, possible loss of petrol through vapour release (eg during tank or compartment filling) and results of checks for the presence of water. Small daily discrepancies which, over a period, tend to vary around a norm, are likely to arise from the factors mentioned above rather than from direct leakage. But significant leaks should soon be apparent and smaller leaks should be identifiable from a trend established over a period of days rather than months.

Leak testing

139 When any leaks are suspected, either as a result of inventory checking or for any other reason, the licensing authority should be informed. Tests on tanks or compartments and connected pipelines should be carried out and any defective storage and dispensing system taken out of service. Any suspected tank or compartment should be subjected to an ullage test using water or a pressure test on water (ie hydrostatic testing). For safety reasons a pressure test using air or gas on an empty tank is unsuitable for testing the integrity of an underground tank after installation.

140 A suitable ullage test is as follows.

(a) Remove any petrol from the tank or compartment.

(b) Blank off all pipeline connections (other than vent pipes) to the tank or compartment to be tested.

(c) Fill the tank or compartment with water to within approximately 25mm of the manhole neck.

(d) Determine the ullage (eg by dipping with a short ullage rod to penetrate the surface of the water for a few centimetres only).

(e) Seal the tank or compartment (other than vent pipes) for at least 24hours.

(f) Redetermine the ullage using the method in subparagraph (d).

(g) If in doubt about the result, repeat subparagraphs (e) and (f).

141 Any hydrostatic testing used should be in accordance with the method described in para 99.

142 Any connected blanked-off pipeline normally subject to pressure should be tested by inert gas at a pressure equivalent to $1^1/_2$ times the normal working pressure of the pipeline. The period of test should be sufficient for any leak to be identified. Any non-pressure lines should be tested in accordance with the method set out in para 104 except that inert gas should be used as the test medium.

143 Water used for the tests referred to in paras 140 and 141 will be contaminated with petrol. Therefore it should be either removed from the filling station by a hazardous waste disposal specialist or disposed of through the petrol interceptor at the filling station provided that:

(a) the capacity of the interceptor is adequate for the purpose;

(b) the interceptor is cleared of any petrol by a disposal specialist before the contaminated water is discharged into it;

(c) the discharge of contaminated water through the interceptor is monitored to ensure that undue turbulence does not occur;

(d) the pumping rate of the contaminated water from the tank is controlled as necessary;

(e) on completion, any petrol in the interceptor is removed by a disposal specialist.

Maintenance, repairs and modifications

General

144 A maintenance scheme to ensure the integrity of plant and equipment, the presence and effectiveness of safety and emergency provisions and the maintenance of the site in a condition free from fire hazards should be in operation at any filling station. Records should be kept to monitor the various elements of the scheme, to show any significant faults detected and to reflect significant repairs and modifications (see para 166 and Appendix 1).

145 Periodic examination and servicing of plant and equipment should be carried out by a competent person. The periods between servicing should depend on the recommendations of the manufacturer, supplier or installer of each piece of plant or equipment and the advice of the competent person who last carried out an examination. In the case of underground storage tanks a scheme for examination, including the scope and frequency of thorough examination, should be agreed between the licensee and the competent person. Options for thorough examinations include ultrasonic thickness testing and the leak tests described in parasl39 to 141. As a general guide, an interval between examinations of 10 years may be considered reasonable. However, the competent person's assessment may result in such an interval being extended if the type of installation, the presence of leak detection measures or the geographical location warrants it; or in the interval being reduced, particularly where a tank is more than 20 years old.

146 Specific guidance on servicing metering pumps, dispensers and associated equipment is given in BS 7117 Part 3.

147 Any modifications, repairs, removals or abandonments of tanks, tank compartments, pipelines, metering pumps, dispensers and associated equipment should be under the control of a competent person. Any modifications or repairs to tanks which affect tank integrity should be carried out in accordance with the design standard. Adequate precautions should be taken to ensure that all plant or equipment on which work is to be undertaken and any area of the filling station in which work is to take place are free from the risk of ignition of a flammable atmosphere. Guidance about the cleaning and gas freeing of tanks containing flammable residues in HSE Guidance Note CS 15 should be followed.

148 On a regular basis, all parts of the filling station should be cleaned to keep them free from combustible rubbish and other material likely to cause a hazard (see also para 118). All emergency equipment, warning and information notices and safety devices should be checked for effectiveness; and all petrol interceptors and drainage channels should be cleared to prevent restriction of surface drainage at least twice a year.

Cleaning of tanks

149 Cleaning (ie the removal of solid and liquid residues) of underground tanks or compartments may be necessary for a variety of reasons. It should be carried out only after the surrounding area has been cleared of all possible sources of ignition, the tank has been emptied and gas-freed (ie the removal of all flammable vapour from the tank) and all pipeline connections have been isolated from the tank. In some circumstances, the filling station may need to be closed during operations. With all gas freeing and cleaning operations, the detailed guidance on appropriate procedures, equipment, precautions and methods in HSE Guidance Note CS 15 should be followed. When entry into a tank is necessary, HSE Guidance Note GS5 should also be followed.

Repair of tanks

150 As a general rule, any corroded tank or any other defective tank which has been installed underground for more than 10 years should be taken out of use permanently rather than repaired. In other cases (eg weld or metal failures in any tank less than 10 years old), repairs may be possible but should be carried out without the application of heat or flame which could affect the external surface of the tank. The tank should be gas-freed and cleaned as described in para149, or inerted as described in HSE Guidance Note CS 15. The repairs should be carried out by plugging the failed area of the tank and lining the whole interior of the tank with suitable material. They should be regarded as strictly temporary and subject to a finite extended life as recommended by the competent person.

Modification of tanks

151 Where it is necessary to modify a tank manhole lid (eg to adapt or add equipment incorporated in a manhole lid) the tank should be rendered safe by the method described in para 153. The manhole lid should be removed for modification and a blank lid put in its place meantime. Cold cutting or drilling methods suitable for use in hazardous areas may be considered.

152 Where other modifications are necessary (eg to pierce the compartment divisions in a multi-compartment tank), the tank should be prepared as described in para 149 or inerted in accordance with HSE Guidance Note CS 15.

Tanks taken out of use temporarily

153 Where any underground tank or compartment is taken out of use pending cleaning or modifications, or during redevelopment of the filling station, it should be rendered safe. A suitable method is:

(a) remove all residual petrol;

(b) fill the tank or compartment with water to ensure a liquid seal;

(c) disconnect and drain all pipelines (except vent pipes) and add water to the tank or compartment until clear water appears at the vent pipe opening;

(d) cap or blank off all openings to the tank or compartment;

(e) flush through and cap at each end all pipelines previously connected to the tank or compartment.

Provided that frequent, regular examinations are carried out and appropriate steps taken to ensure the maintenance of water filling, to detect the presence of petrol on the surface of the water and to remove such petrol, the tank or compartment may remain in this condition for a period of up to 1 year. Other suitable inerting techniques are available and may be used where appropriate to the particular circumstances of a tank being taken out of use temporarily.

154 Any tank temporarily made safe for a period should be leak tested according to para 139 before being brought back into use. Contaminated water resulting from temporary making safe and any subsequent testing should be disposed of according to para 143.

Tanks taken out of use permanently

155 Where any tank or compartment is defective and cannot be repaired or is to be taken out of use permanently for any other reason, the tank should be removed from its excavation and disposed of safely or, in cases where removal is not possible or necessary, rendered safe and abandoned in place.

156 Any tank to be removed should be rendered safe before excavation work starts. For a tank without leaks, the procedure described in para 153(a) to (e) should be followed or the tank filled with nitrogen. Excavation work should be carried out with the tank in filled condition and with suitable precautions to avoid sparks. When the tank is ready for lifting, any water used should be emptied and all openings immediately closed. Water should be disposed of according to para 143. For a tank with leaks, all residual petrol should be removed and the atmosphere in the tank inerted by means of carbon dioxide, nitrogen or nitrogen foam (see guidance on these inerting methods in HSE Guidance Note CS 15). Inerting should be maintained during the excavation process; any fault in the tank shell should be sealed as soon as it is exposed; and the atmosphere in the excavation should be monitored throughout the process in case of leakage of inert gas or of the presence of a flammable atmosphere arising from petrol leakage. Any excavated tank should be indelibly marked on two sides with the words PETROL - HIGHLY FLAMMABLE in letters not less than 50mm high; and should be water filled or remain inerted, as appropdate, pending disposal.

157 Any tank without leaks which is to be abandoned in place should be dealt with according to the procedure described in para 153(a) to (e). Immediately on completion of flushing, the water, except that necessary to retain a liquid seal of any residues, should be pumped out and disposed of according to para 143. If the tank is not to be filled with concrete or sand immediately, it should be filled with nitrogen foam so as to prevent the ingress of air and the formation of a flammable atmosphere within the tank. If this is not done then all sources of ignition should be removed for a distance of 3m in all directions around tank openings (eg manholes) while concrete is being added. Lean-mix concrete should be added to fill the tank completely. The concrete should be vibrated to remove air pockets. Sand or other adequate alternative, appropriately vibrated or puddled with small amounts of water to ensure complete filling and remove air pockets, may be used instead of lean-mix concrete. Any leaking tank or compartment to be abandoned in place should be inerted by means of carbon dioxide, nitrogen or nitrogen foam (see HSE Guidance Note CS 15) prior to filling with lean-mix concrete, sand or adequate alternative.

158 The location of any abandoned tank should be recorded and brought to the attention of any person who subsequently becomes responsible for the site.

Disposal of tanks

159 Any tank which has been removed from its excavation should be disposed of safely as soon as possible. Preparation for and removal by road should be in accordance with the provisions of Certificate of Exemption No 8 of 1984 of the Dangerous Substances (Conveyance by Road in Road Tankers and Tank Containers) Regulations 1981. The person responsible for removal of a tank from a filling station should ensure that the recipient of the tank is made aware of the tank's previous use and of the need to take adequate precautions against fires and explosions when dealing with it.

160 Cleaning or demolition of any tank on site should not take place without the agreement of the appropriate authority. Preparation for cleaning or demolition should be in accordance with HSE Guidance Note CS 15 and the guidance on safety in tank demolition in HSE Guidance Note GS 2912.

Modification, repair and removal of pipelines

161 The modification, repair or removal of any pipeline should not be carried out until the affected pipeline has been drained, isolated from fuel sources and, in the case of vent pipes, blanked off. The surrounding area of the filling station should be rendered free of flammable vapour. Any excavated pipeline should be removed from the filling station as soon as possible and disposed of safely.

Operating and emergency procedures

162 Written procedures for normal and emergency operations should be available to persons working at any filling station. The procedures should set out clearly the actions necessary for compliance with the licence and other legal requirements, safe operation, effective maintenance and appropriate emergency response at the filling station. Where appropriate, the procedures should be issued in whole or in part to individuals so that there can be no doubt about the actions necessary and where various responsibilities lie.

163 All operational and emergency procedures should be reviewed regularly. They should be amended to take into account any changes in local circumstances, any alterations or modifications to the plant or equipment at the filling station and any practical experience arising from suspected or actual leaks, spills or other incidents.

Training

164 All persons working at any filling station should be given adequate theoretical training and practical instruction to ensure that they fully understand the hazardous characteristics of petrol, the operational and emergency procedures at the filling station and relevant licensing and other legal requirements. Examples of subjects which should be included in training programmes for various functions are set out in Appendix 2.

165 Records of training should be maintained (see Appendix 1). They should be kept under review to ensure that refresher training, and any training in new techniques or for new equipment, is provided when necessary.

Record keeping

166 The management of safety at a filling station will benefit from the maintenance of clear, readily available records of various activities which affect safety. Such records will ensure that a licensee and any person employed at a filling station can monitor safety performance effectively and identify servicing and maintenance needs adequately. They will also ensure that visiting maintenance and inspecting contractors and licensing authority inspectors can obtain information essential to the effective performance of their functions. Consequently, a specimen register for keeping records is set out in Appendix1 ; the suggested format can be adapted to suit particular circumstances, types of plant and equipment, and company policies and practices. In any event, records should be kept sequentially; should be based on the items referred to in para 109 if they are available; and should include the results of inventory checking (see para 136), maintenance records (see paras 144 to 146), written procedures for normal and emergency operations (see paras 162 to 163) and details of training given (see paras 164 to 165).

Part 3 The electrical installation, equipment and testing

Hazardous area classification

167 Paragraphs 23 to 26 and Table 1 above give guidance on the concept of hazardous area classification or zoning in relation to petrol filling stations. All references to hazardous areas and zones in this Part should be interpreted in the light of that guidance. Diagrams of typical zoning applications for tanks, vent pipes and metering pumps/dispensers are in Figs 1 to 5.

168 All areas of a filling station outside the hazardous areas classified in accordance with paras 23 to 26 can be classified as non-hazardous unless they are affected by processes or events which create their own hazardous areas (eg handling, storage, spills or leaks of petrol).

Planning and design of site electrical supplies

Siting of premises

169 Generally the site should be arranged so that there are no overhead conductors (eg power or telephone lines) at their maximum horizontal swing passing over an area within 3m of the hazardous area, and over or within a radius of 3m of the tank vent pipes and a line extending vertically upwards from the vent pipes.

170 Exceptionally, where all relevant authorities are in agreement, the site may be located beneath overhead lines provided that precautions are taken to avoid the dangers from falling cables, the possibility of stray currents in the metalwork and the possibility of direct contact of delivery personnel using dip sticks on tops of tankers. A method for achieving this is as follows.

(a) The hazardous area associated with the metering pumps/dispensers should be protected by the creation of an equipotentially bonded metallic cover over the area.

(b) Where an overhead line passes over an area within 3m of the hazardous area associated with the metering pumps/dispensers an equipotentially bonded metallic cover should be created over the hazardous area and extended for a further 3m beneath the overhead line.

(c) The supports for the metallic cover should be located outside the hazardous area associated with the metering pumps/dispensers.

(d) The metallic cover should be electrically bonded to a ring of driven earth rods surrounding all buried metalwork and tanks of the site to a depth not less than the bottom of the deepest tank.

(e) In any event, the vent pipes and road tanker delivery stands should be located away from the area beneath the overhead lines as described in para 169.

Site electrical supplies

171 The filling station site should be supplied via underground cables suitably protected against mechanical and environmental damage and routed outside the hazardous areas. Where the filling station site is supplied via an overhead system, the conductors should be terminated outside the hazardous areas and the supply continued by means of underground cables, suitably protected against mechanical and environmental damage and routed outside the hazardous areas (see also paras 235 to 237).

172 If the filling station forms part of and adjoins premises on the site (eg a garage'or service area), the supplies to the filling station portion of the site may be routed above ground from the other premises but within the confines of or fixed to the buildings. The intake position should be located in an easily accessible low fire risk position and kept unobstructed.

Lightning

173 Where the site is located in an area susceptible to lightning discharges and an overhead line provides the electricity supply, the local area electricity board should be consulted about surge divertors to protect the installation against the effect of lightning surges on the supplies (see also para 188).

Protective multiple earthing

174 The filling station area should be treated as a separate system and not be supplied by means of an electrical system in which neutral and protective functions are combined in a single conductor in part of the system (ie a TN-C-S system). Where the filling station is part of a larger site and the main supplies to the site are provided from a TN-C-S system, the filling station should be segregated to minimise the possibility of uncontrolled currents to earth. If the supply authority are unable to

provide a supply from a TN-S system to the filling station site, it should be provided with its own earth electrode to which the exposed conductive parts of the installation are connected (ie a TT system) and protected by its own independent residual current device(s). As an alternative, consideration could be given to the installation of a TT system using an isolation transformer for the filling station.

175 To minimise the inadvertent interruption of power to hazardous area circuits, any residual current device(s) incorporated in circuits serving a hazardous area should be independent of the operation of devices protecting nonhazardous area circuits.

Back up power supplies

176 When back up power supplies are provided external to the petrol dispenser computer equipment, they should be connected to the equipment located in the hazardous area either by a changeover device located outside the hazardous area or, if the equipment contains its own changeover facilities, by direct independent wiring into the equipment. Adequate isolation facilities should be provided. Where high levels of electrical interference from other equipment or external sources are likely, care should be taken in the design and erection of the installation to reduce the possibility of interference signals affecting the normal operation of the installation.

The electrical installation: planning and design

Exchange of information

177 The facilities needed at the filling 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 dispensing equipment manufacturer and installer, the fire insurer, the licensing authority and any other public authority concerned. Documents should then be prepared showing:

(a) details of the installation proposed and related external conductive parts (eg pipework and structures) and additional bonding whether or not it forms part of the electrical installation:

(b) the accommodation and structural provisions required for the equipment (eg siting of central control point, location of kiosk etc);

(c) chases, ducts, conduits, channels, trunking and other provisions required for electrical wiring.

178 The documents prepared should be retained at the filling station for future use in initial and periodic inspections and tests. During the course of the installation work, they should be amended to reflect any changes since the design stage. Appendix 1 sets out a specimen of a site register with which the documents 'should be kept.

The electrical installation: selection and installation of equipment

General

179 The electrical installation should comply with the edition of the IEE Wiring Regulations, including any amendments, current at the time the work is carried out. Any proposal to use alternative electrical equipment or wiring should give a degree of protection equivalent to that in this guidance and should be the subject of discussion with the licensing authority.

Equipment in hazardous areas

180 Equipment should be constructed to an explosion-protected standard suitable for the zone in which it is to be installed and used. In designing the electrical installation in hazardous areas and in selecting and installing the equipment, reference may be made to BS 5345. HSE Guidance Booklet HS(G)22 also gives guidance on the types of electrical equipment available for use in potentially explosive atmospheres and on the selection, installation and use of such equipment.

181 Preferably the equipment used should be of a type certified as suitably explosion-protected by an accredited or otherwise recognised testing and certifying body (eg BASEEFA or one of the other bodies listed in Appendix 1 of HSE Guidance Booklet HS(G)22). The equipment should bear the mark and certification number issued by the body and, in the case of equipment marketed under the EEC Explosive Atmospheres Directives (see HSE Guidance Booklet HS(R)15 (revised)), the distinctive European Community mark of an Ex bordered by a hexagon. Where the certification number on the equipment is followed by an X, special installation conditions apply and the certification documents should be studied before the equipment is installed. Suitably explosion-protected equipment which has not been certified may also be used provided that it has been

assessed as providing a level of safety equivalent to certified equipment; and that adequate information is available to demonstrate that the equipment is considered to be acceptable for use in potentially explosive atmospheres and about any conditions necessary for safe use.

182 Metering pumps and dispensers should comply with the standards in BS 7117 Part 1 or BASEEFA Certification Standard SFA 3002 (Note: *When BS 77 7 7 Part 1 is fully operative, SFA 3002 will be withdrawn except to the extent necessary for recertification of metering pumps/dispensers originally certified to that standard).* Any equipment intended for on site modifications of metering pumps/dispensers should be the subject of an assessment report by the relevant certifying body (ie a report attesting that a combination of the modifying equipment and the particular type of metering pump/dispenser for which the equipment is intended will comply with the standard to which Yhe metering pump/dispenser was originally manufactured and certified).

Equipment in non-hazardous areas

183 Where equipment is installed in a non-hazardous area but is associated with, controls or supplies equipment located in a hazardous area, then in addition to the normal requirements for this equipment, it should be selected and installed so as not to have an adverse effect on the explosion protection concept of the equipment located in the hazardous area. Equipment which ingests air for use (eg vacuum cleaning equipment, car wash, warm air central heating systems or air compressor etc) should not be installed where the effect of its operation will extend a hazardous area.

Environmental conditions

184 Each item of electrical equipment should either have a degree of ingress protection appropriate to the environmental conditions in which it is installed or be contained in an enclosure giving this level of protection. Particular attention should be given to the prevention of ingress of water and moisture into equipment installed on the forecourt or in other external locations. Guidance on the 'Index of Protection' indicated by the relevant 'IP number' is given in BS 5490.

185 The 'IP number' system relates to protection against contact with live parts and the prevention of the ingress of solid particles, water and moisture. It is not related to, and should not be confused with, types of protection against the explosion hazard. In hazardous areas in exterior environments, both forms of protection should be provided.

Maintenance considerations

186 When selecting electrical equipment, the quality and frequency of maintenance that the installation can reasonably be expected to receive during its intended life should be taken into account. The reliability of the equipment should be appropriate to the intended life. All equipment should be designed and arranged to allow for operation, inspection, testing, maintenance and access to connections.

187 A test point for measuring the earth loop impedance should be provided at the origin of the supply. This could be done by the provision of a switch fuse connected as shown in Fig 11 (see also Appendix 5). The switch fuse should be marked "For testing purposes only" and should be lockable.

Lightning protection of buildings and structures

188 Where protection against lightning is required, the installation should comply with BS 6651. The main earthing terminal of the electrical installation should be electrically connected to the lightning conductor by a bonding conductor of cross sectional area not less than that required for compliance with the IEE Wiring Regulations current at the time (see, for example, Regulation 5472 of the 15th edition of the Regulations). The connection of the bonding conductor to the lightning protection system should be made in the vicinity of the lightning conductor test clamp and to the down conductor side thereof (ie to the side of the clamp opposite the earth electrode connection). It should not pass through the hazardous area.

Radio and electrical interference

189 The installation should be designed and installed so that it does not cause radio interference in excess of the limits specified in BS 800.

The electrical installation: location of equipment

Dispensers for paraffin oil and diesel fuel

190 Where paraffin oil and diesel fuel dispensers are installed within a hazardous area, their electrical equipment should meet the requirements for the appropriate zone.

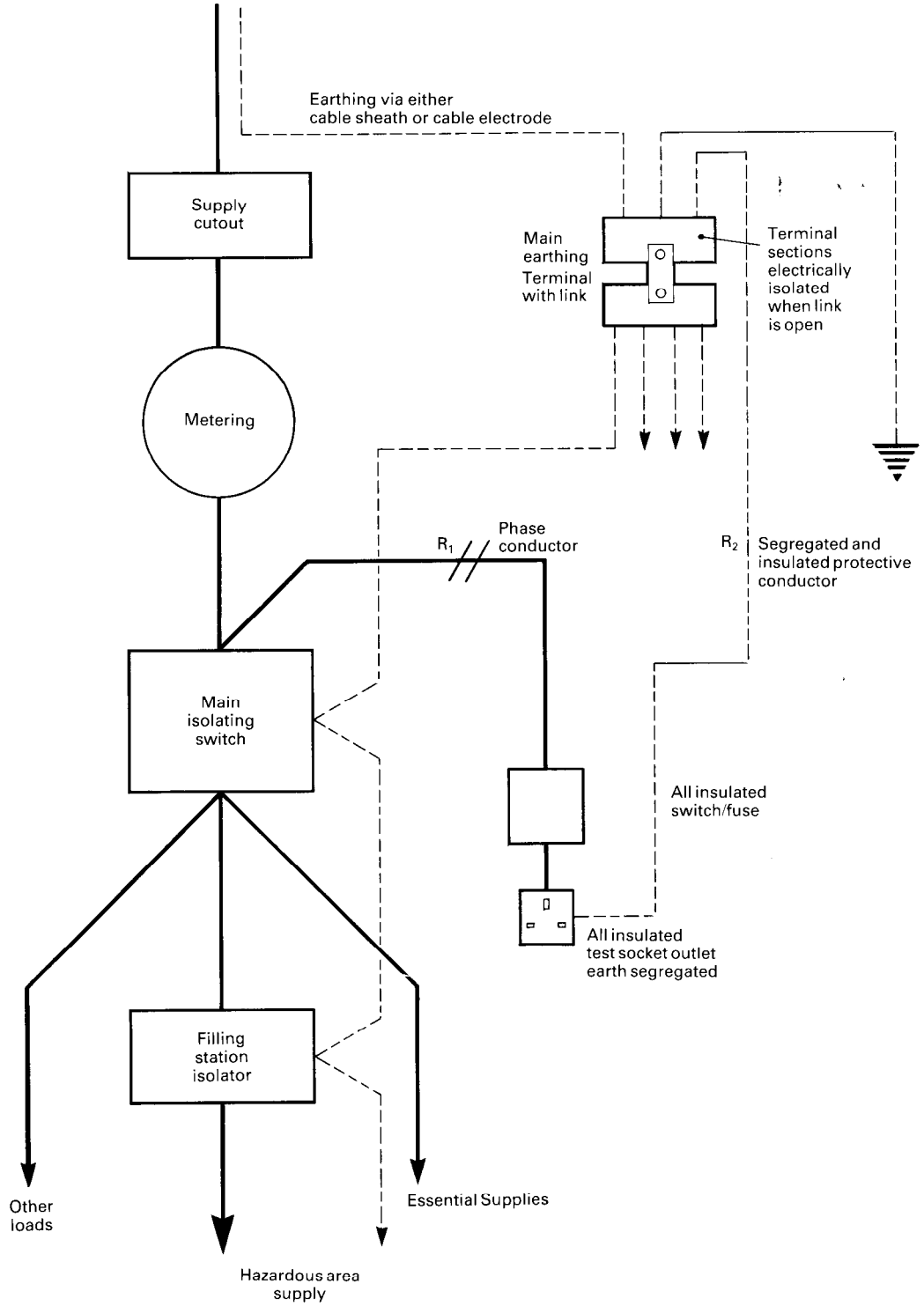


Fig 11 **Test point** for **measuring** earth loop impedance

Battery charging equipment

191 Battery charging equipment, other than that integral with the metering pump/dispenser should be installed outside any hazardous area of the filling station.

Vent pipes

192 Vent pipes should not be used for mounting or securing luminaires or other electrical apparatus. This does not preclude the use of clamps or other means of securing conductors for electrical bonding purposes, where required.

Canopies

193 Canopies are generally constructed above and clear of hazardous areas related to metering pumps/dispensers, etc. Therefore, luminaires mounted beneath or within the underside of a canopy should not normally require explosion protection. However, care should be taken when siting such luminaires to anticipate hazardous areas which may be introduced by the use of tanker dip sticks or other portable equipment; which may arise from nearby vent pipes; or which may exist because pressurised jointed pipework has been or will be located in a canopy (Note: *A Zone 2 hazardous area may exist in the vicinity of screwed or flanged joints - see Table 7).*

Loudspeaker systems

194 Where dispensing equipment at an attended self-service filling station is likely to be supervised at any time by a single attendant from a control point, a loudspeaker system should be installed (see Part 2). Any loudspeaker should either be installed in a non-hazardous area or be suitably explosion-protected for the zone of installation in a hazardous area.

Luminaires

195 Any dispensing areas of the forecourt and any road tanker delivery areas should be adequately lit for safety purposes at all times of use. The illuminance at ground level in the above areas and the read out level of any dispensing equipment should be not less than 100 lux. Further guidance on illuminance is available in HSE Guidance Booklet HS(G)38.

196 Any luminaire installed in a hazardous area should be suitably explosion-protected for the zone of its location. In the case of canopy luminaires, the guidance in para 193 should also be followed. Luminaires containing lamps with free metallic sodium should not be located in or above hazardous areas because of the fire hazards if such lamps fall or are dropped. On all luminaires, the maximum permissible lamp wattage should be clearly indicated by a durable or permanent label securely fixed inside or on the outside of the luminaire. On small illuminated components, the lamp voltage and wattage should be indicated.

Radio-frequency transmitting equipment

197 Where any device capable of emitting electromagnetic waves is installed, care should be taken to ensure that it cannot induce a current or charge which could ignite a flammable atmosphere (see BS 6656).

Socket outlets

198 Any socket outlet should either be installed in a non-hazardous area or be suitably explosion-protected for the zone of installation in a hazardous area. It should also have ingress protection suitable for the environment in which it is located.

Portable and transportable equipment

199 Portable and transportable equipment intended for use in hazardous areas should be suitably explosion-protected for Zone 1 use. Portable handlamps should be of an explosion-protected design certified by BASEEFA or equivalent international body and should operate at extra low voltage (not exceeding 50 volts AC) to reduce the electric shock risk.

200 Portable equipment (other than handlamps) and transportable equipment should be supplied via a thermoplastic or elastomer insulated flexible cable or cord with a continuous flexible metallic screen or armour and with a PVC, PCP or similar sheath overall. The metallic screen or armour should be connected to the supply protective conductor and should not be used as the sole means of earthing Class I equipment. The equipment should be supplied at a reduced voltage (eg 110 centre tapped earth supply) or, if supplied at a higher voltage, should preferably be provided with either earth proving or monitoring protection or a residual current device having a rated residual operating current of not more than 30mA. For further advice, see HSE Guidance Note PM 32.

Isolation and switching

General

201 Where necessary to prevent danger, suitable means should be available for cutting off the supply of electrical energy from any electrical equipment and for the secure isolation of any electrical equipment from every source of supply of electrical energy. Where standby supplies are installed, they should be subjected to the same isolation and switching requirements as a main supply, except as defined in para 208.

202 Means of isolation and switching should comply with the IEE Wiring Regulations current at the time (see, for example, Chapter 46, section 476 and section 537 of the 15th edition of the Regulations) and with paras 203 to 212.

203 Devices for isolation and control of a metering pump/dispenser unit circuit should interrupt simultaneously all live poles, including neutral, and be located in a non-hazardous area. Devices for isolation for maintenance purposes must have locking off facilities. Isolating devices should comply with BS 5419, except as defined in para 208. Fuse carriers are not acceptable as a means of isolation for metering pump/dispenser circuits.

204 A common device may serve more than one function provided that it satisfies all the requirements for each function (eg the requirements for isolation and for emergency switching may be satisfied by using a 'no-volt release' circuit breaker operated by emergency trip buttons and incorporating the required characteristics of an isolator).

Main switch

205 Main switchgear should be located in a non-hazardous area and should incorporate the main switch and the means of isolation required by the IEE Wiring Regulations current at the time of installation (see, for example, Regulations 476-l 5 and 476-l of the 15th edition of the Regulations). The functions may be achieved by installation of a suitable isolating switch or an isolator linked with a switch or circuit breaker in the required manner. The switches should interrupt simultaneously all live conductors of the installation, including the neutral.

Pump motors, integral lighting and ancillary circuits

206 Every metering pump/dispenser circuit not intrinsically safe should be provided with an isolating switch or isolating circuit breaker for disconnection from the source of electrical energy. Where the equipment is supplied from more than one source of electrical energy (which may include a central control point or pump based battery support) suitable warning notices should be affixed within the housing and adjacent to any external isolating devices (nb an intrinsically safe circuit is one 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).

207 For extra low voltage circuits where electric shock protection is not the prime consideration, a suitably explosion protected device (relay or switch) capable of withstanding 500 volts dc across open contacts may be considered as providing equivalent isolating facilities.

208 Where a time delay is required for legal metrology purposes or for the discharge of energy storage devices before working on equipment, a suitable warning notice should be affixed.

Central control point

209 In addition to the means of isolation required for individual metering pumps/dispensers, attended self-service filling stations controlled from a central control point or points should have at each point a means of disconnecting all other forecourt circuits.

Emergency switching

210 In addition to the main switch controlling the installation, a separate emergency switching device should be provided to disconnect the supply to all metering pumps/dispensers and their integral lighting. The means of operation of the emergency switching device should be readily visible and identifiable to the public and within easy reach for quick operation in cases of emergency. The means of resetting the switch should be manual and be located where it is inaccessible to unauthorised persons.

211 A conspicuous notice should be fitted adjacent to each means of operation of the emergency switching device bearing the words PETROL PUMPS SWITCH OFF HERE. The means of operation of the switch should be coloured red against a yellow background.

High voltage or neon signs

212 High voltage or neon signs should not be located in the hazardous area. Where they are installed elsewhere on site, they should comply with BS 559. An isolating switch should be provided to disconnect all live conductors of the supply to such signs and associated control equipment. A conspicuous notice bearing the words HIGH VOLTAGE SIGN. FIREMAN'S SWITCH should be affixed adjacent to it. The switch should be installed in accordance with the IEE Wiring Regulations current at the time of installation (see, for example, Regulations 476-l 2, 476-l 3 and 537-l 7 of the 15th edition of the Regulations). The enclosure for the switch should have ingress protection not less than IP 55.

Short circuit and overload protection

"General

213 For circuits supplying dispensing equipment, a single device for short circuit and overload protection should preferably be used. If separate devices are used for short circuit and overload protection, each device should be labelled to show its function and its characteristics should be coordinated in accordance with the IEE Wiring Regulations current at the time of installation (see, for example, Regulation 435-l of the 15th edition of the Regulations).

214 Every short circuit protection device should have a rated breaking capacity not less than the prospective short circuit current at the point of installation of the device. Discrimination of operation between series devices should be ensured for both short circuit and overload protection.

Pump motors, integral lighting and ancillary circuits

215 Each circuit should be protected against short circuit and overload by a suitably rated multiple pole circuit breaker arranged to break all live conductors including the neutral (see para 206 for isolation of dispenser circuits).

Protection against electric shock

General

216 Protection against indirect contact should be provided by means of earthed equipotential bonding and automatic disconnection of supply, or by use of equipment of Class II construction where such equipment is under effective supervision in normal use. All circuits feeding equipment on the forecourt must be disconnected in a time not exceeding 400ms in the event of the occurrence of an earth fault.

Earthing

217 The earthing arrangements for the installation should provide for connection of the main earthing terminal to the supply authority's cable sheath (TN-S system) or an electrode independent of the incoming supply (TT system).

218 A supply authority's Protective Multiple Earthing Facility (TN-C-S system) should not be used for earthing electrical apparatus in a filling station. Where the filling station supply is derived from such a system, and the supply authority is unable to provide a supply from a TN-S system, the earthing facility for the installation should provide for connection to an electrode arrangement not connected to the supply authority's earthing facility. The installation should be treated as part of a TT system. See also paras 174 to 175.

219 The electrode arrangement may be provided by suitably driven earth rods, earth mats, tapes etc located outside the hazardous area and should comply with BS CP 1013. Individual electrodes should be located and interlinked to provide a common electrode resistance area for the filling station site. Provision should be made for the separate testing of individual electrodes.

220 Prior to the installation of any earth electrode, a prospecting test should be carried out in accordance with the recommendations in BS CP 1013. It may be necessary to install an independent electrode for test purposes, depending on the electrode arrangement.

Main earthing bar or terminal

221 A main earthing bar or terminal for an installation should be provided at the junction of the earthing conductor and the main bonding conductors connected to main metallic service pipes, structural metal-work etc. The bar or terminal should be in an accessible position located near to point of supply and should afford disconnection of the earthing conductor from the main bonding conductors and protective conductor(s) of the installation to facilitate testing of the earthing arrangements. This joint should preferably be in the form of a mechanically strong and electrically reliable link so that it can be disconnected only be means of a tool.

Earthing of dispenser circuits in hazardous areas

222 A protective conductor for a dispenser circuit should be provided by means of a cable core which should be connected to an earthing terminal located in the dispenser junction box or motor.

Earthing bars or terminals in equipment enclosures

223 An earthing bar or terminal should be provided in every enclosure of electrical equipment other than equipment specified as having Class II construction. Protective conductors of related incoming and outgoing circuits should terminate at the earthing bar or terminal in the enclosure. When more than two protective conductors are involved, an earthing bar having an appropriate number of terminal ways should be provided.

'Metallic conduit, ducting and trunking

224 Where metallic conduit, ducting or trunking enters or passes through a hazardous area, a separate protective conductor should be provided within the conduit etc. The protective conductor may serve more than one circuit, subject to satisfying the IEE Wiring Regulations current at the time (see, for example, Regulation 543-l (a) of the 15th edition of the Regulations). In any event, it should have a cross-sectional area of not less than $2.5mm^2$.

Bonding

225 Electrical bonding of extraneous conductive parts and other metallic parts such as pipes, rails, steel framework etc., which do not form part of the electrical installation, should be installed to provide:

(a) protection against the potential explosion hazard from sparks caused by contact between metal parts having different potentials; and

(b) protection against electric shock by avoiding the presence of potentially dangerous voltages between simultaneously accessible conductive parts under fault conditions.

Care should be taken to ensure that both aspects of bonding are taken into account and that incompatibilities between the two forms of protection do not arise.

226 All exposed metal work within a hazardous area which requires bonding should be bonded within the hazardous area, regardless of any bonding connections outside the hazardous area.

Interconnection of earthing systems

227 The electrical installation, lightning protection and any static earthing systems, together with the metal work of any LPG or other installation, should be bonded together to ensure, as far as is possible, that all metal work in a particular area is at or about the same potential.

Continuity of bonding connections

228 In general, an electrical bond between two metallic parts may be achieved by a permanent and reliable metal-to-metal joint of negligible impedance. Flanged joints in pipework should be fitted with metal bridges to ensure good electrical continuity. Where sound metal-to-metal joints cannot be achieved, connection should be by means of a supplementary bonding conductor having a cross-sectional area of not less than $2.5mm^2$, positioned or protected so as not to be subject to mechanical damage or $4mm^2$ if protection against mechanical damage is not provided. Bonded metal work should have an electrical continuity of not greater than 0.01 ohm per metre at 20^oC.

LPG installations at petrol filling stations

229 All storage tanks, filling lines, couplings and other pipes carrying liquefied gas should be electrically bonded and earthed. Any flanged joints in liquefied gas pipelines should be fitted with metal bridges to ensure good electrical continuity. It is insufficient to rely on coupling bolts in this case, notwithstanding the guidance in paragraph 228 about permanent and reliable metal-to-metal joints.

230 Provision should be made for the electrical connection of LPG road tankers to the earthed bonding system provided for any LPG storage tank and associated pipelines. The terminal or other provision should be capable of retaining the tanker bond in place until the fuel transfer operation has been completed.

Wiring systems

General

231 This guidance applies to the electrical installation of a filling station located within the hazardous areas and not to the internal wiring of

the factory assembled units. Particular attention should be given to the advice in BS 5345 Part 1 about particular concepts of explosion protection. For areas other than hazardous areas, the relevant parts of the IEE Wiring Regulations current at the time of installation should be followed. These Regulations also apply to aspects of the installation in hazardous areas not related to the explosion hazard (eg cable sizes, volt drops etc).

Conductor material

232 Any conductor having a cross-sectional area of 1 6mm^2 or less should be of copper. Protective conductors should not be of aluminium. Every protective conductor not forming part of a cable or cable enclosure should be protected throughout by insulation at least equivalent to that provided for singlecore, nonsheathed cables of appropriate size complying with BS 6004.

Cables for intrinsically safe circuits

233 Adequate precautions should be taken to prevent contact between the conductors of intrinsically-safe circuits and those of any nonintrinsically safe system. The wiring should not form part of a multi-core cable or be run in the same enclosure or duct unless separated by an earthed metal screen or shield. For further information see BS 5345 Parts 1 and 4.

Cables for extra low voltage circuits

234 Where cables of extra low voltage circuits are contained in enclosures also containing cables of higher voltage circuits, their insulation must be rated for the highest voltage present.

Cables installed underground

235 All cables installed underground or in site-formed ducts etc, should be laid at a depth of not less than 0.5m or be otherwise protected against mechanical damage. Cables laid direct in the ground must be covered by cable covers or suitable marking tape. Where ducting, ducts, pipes, trunking, manholes or similar enclosures are used to accommodate cables, precautions should be taken to prevent the passage of flammable vapour or liquid from one zone to another zone or to a non-hazardous area and to prevent the collection of flammable vapour or liquid in such enclosures. Such precautions will involve sealing the enclosures with suitable compound or other material resistant to hydrocarbon products and their vapours.

Protection against mechanical damage

236 In any location available for vehicular access, any cables, trunking or other enclosures should be positioned or protected so that they cannot be damaged by moving vehicles.

Types of cable

237 Generally, types of cable and the methods of their installation should comply with the IEE Wiring Regulations current at the time (see, for example, Chapter 52 of the 15th edition of the Regulations). Within Zone 1 and Zone 2 areas the following types are acceptable, with mineral insulated cable being preferred:

(a) mineral insulated sheathed cable. The cable should be terminated into accessories or enclosures with an approved gland appropriate to a Zone 1 or Zone 2 location employing an earth tailed pot. The cable should be served overall with a PVC sheath or equivalent and glands should be protected by a suitable shroud. This type of cable may be damaged by transient voltages: particular care should be taken to ensure that associated equipment complies with the cable manufacturer's requirements for voltage surge suppression. Where surge suppression devices are located in hazardous areas, they should be suitably explosion-protected. Earth tail pots should be used to provide reliable earthing connection to the sheath of mineral insulated cable.

(b) armoured cable, ie PVC or equivalent, steel wire armoured and PVC or equivalent sheath cable. The cable should be terminated in a gland suited to the zoning of the hazardous area to maintain the integrity of the enclosure of the explosion protection concept. An earth tag washer should be fitted between the cable gland and enclosure to provide a means of connecting a separate protective conductor to the earthing bar or terminal within the enclosure.

Initial inspection and testing

General

238 On completion but before being energised, the installation should be inspected and tested by a competent person. In the case of an extension or modification of an existing installation, the area in

which testing is to be carried out should be certified gas-free by a competent person and the licensee or his competent representative should authorise work to start. Where it is not reasonably practicable to gas free the area, see para 244.

239 Inspection and testing should be carried out in accordance with the IEE Wiring Regulations current at the time of the initial installation or subsequent extension or modification, as appropriate. The following should also be carried out:

(a) visual examination;

(b) testing for effectiveness of earthing;

(c) insulation resistance test;

(d) other examinations; and

(e) recording and certification of the inspection and testing in a standard format (see Appendices 1, 4 and 5).

Visual examination

240 Appendix 3 lists the principle features to be examined visually. The examination should verify that the electrical equipment and installation:

(a) comply with the guidance in this booklet;

(b) comply with the applicable British Standard or equivalent international standard (this may be ascertained by mark or certification furnished by the installer or manufacturer);

(c) are correctly selected and erected in accordance with the edition of the IEE Wiring Regulations current at the time of installation, extension or modification;

(d) are, in hazardous areas, correctly selected and erected, for example, in accordance with BS 5345;

(e) are not damaged so as to impair safety.

Electrical testing

241 Initial testing of insulation and continuity from within the hazardous area should be carried out with instruments of the same type as used for periodic testing (see below) and certified intrinsically safe. Where practicable, testing should be carried out from non-hazardous areas following similar procedures to those required for the periodic testing after the petrol tanks have been filled. This will enable comparison to be made between the initial testing and subsequent periodic testing.

242 Earth testing procedures are carried out in the following sequence.

(a) After all protective conductors are connected, low current continuity tests should be made from the main earth terminal to all terminal points of all exposed and extraneous conductive parts. Test positions and resistance readings should be logged for comparison with future periodic tests (nb this test should be carried out both with the substantial current according to Appendix 15 of the IEE Wiring Regulations to test the integrity of the bonding, followed by a test with a low current tester for comparison with subsequent periodic testing).

(b) Earth electrode resistance tests should be carried out separately to each of the earth electrodes. The actual measurements should be recorded for future comparison.

(c) Earth fault loop impedance measurements should be made at the origin of the installation (using the facilities provided under para187) with only the earth electrodes, or other means of earthing via the earthing conductor and earth terminal, connected (see also Appendix 5). Other installation bonding and protective conductors should be temporarily disconnected. The results of ZE should be recorded for future comparison (see Appendix 1).

(d) After ensuring that all bonding and protective conductors are reconnected to the earthing terminal, earth fault loop impedance tests (ZS) should be carried out at all terminal points of the installation. The fault loop should include the circuit phase conductor. Measurements should be recorded.

243 Insulation resistance testing of metering pumps and dispensers, including the supply cables, should be carried out in accordance with the IEE Wiring Regulations current at the time (see, for example, Regulation 613-7 of the 15th Edition of the Regulations). The manufacturer should make provision for such testing, together with appropriate instructions. Metering pumps/dispensers not constructed in accordance with BS 7117 may contain electronic components which may be damaged when carrying out an insulation test. To avoid damage, the instructions

should be followed even if they do not allow for tests to be carried out in all modes (eg Earth/Phase, Earth/Neutral and Neutral/Phase).

Periodic inspection and testing

General

244 An annual inspection and test programme should be carried out by a competent person to ensure that the electrical equipment and installation in hazardous areas and associated equipment in non-hazardous areas continues to be in a satisfactory condition. The programme of testing should be carried out as the minimum necessary where the electrical installation has undergone additions or alterations and where it is not reasonably practicable to gas free the area. The instruments used should be certified as intrinsically safe.

245 The inspection and testing should be carried out in accordance with the IEE Wiring Regulations. Account should be taken of the requirements of these Regulations current at the time of original installation or of subsequent extensions or modifications to the original installation. The programme should comprise:

(a) visual examination (see Appendix 3);

(b) earth fault loop impedance measurements made at the origin of the filling station installation (see para 242(c) and Appendix 5);

(c) earth electrode(s) testing;

(d) continuity testing of protective conductors and equipotential bonding;

(e) operation of residual current devices, both time and current;

(f) insulation testing:

(g) recording and certification of the inspection and testing in a standard format (see Appendices 1 and 4).

Visual examination

246 The visual examination should be carried out as described in para 240.

Electrical testing

247 Earth fault loop impedance (ZE) measurements should be made at the origin of the installation in the way described in paragraph 242(c). The earth fault loop impedance (ZE) should be measured and compared with the initial result; significant increases should be highlighted for investigation and remedial action. All bonding and protective conductors should be reconnected.

248 The continuity of protective conductors and equipotential bonding should be tested between the main earth terminal and all terminal points of all exposed and extraneous conductive parts. The low current continuity testing instrument to be used should be intrinsically safe. If the instrument is not intrinsically safe it should be sited in a non-hazardous area. A wander lead of known resistance should be used to reliably connect the instrument between the point under test and the main earth terminal and should be connected to the point under test prior to any other connection being made. The results should be compared to those with the initial test and any significant increase in resistance should be highlighted for investigation and remedial action.

249 For the operation of residual current devices and testing of earth electrodes, all tests should be carried out from the non-hazardous areas and in accordance with the relevant edition of the IEE Wiring Regulations.

250 Insulation tests should be carried out as described in para 243, applied in non-hazardous areas.

251 All readings and measurements should be recorded (see Appendix 1).

Appendix 1 Suggested register for petrol filling stations

This Appendix sets out suggested pages (eg one page or group of pages per numbered section) for use in a loose-leaf register for retention at the filling station. The suggestions may be adapted to suit particular circumstances, equipment and methods of work.

1 Licensee ..... Licensing authority .....

Site address Address .....

Tel number Tel number

2 Record of underground storage tanks: installation and maintenance

Tank no..... Compartment No

Item	*Date*	*Type of test, examination, service or repair*	*Result*	*Competent person*	*Recommendation for periodic exam (see para 145)*	*Any other comments or action*
Installation and test (paras 53 to 59, 98 to 102)						
Periodic examination (para 145)						
Leak testing (para 139)						
Repairs or modifications (paras 147 to 160)						

3 **Record of pipelines: installation and maintenance**

Pipeline identification Material (eg steel, plastic)

Item	*Date*	*Type of test, examination, service or repair*	*Result*	*Competent person*	*Recommendation for periodic exam (see para 145)*	*Any other comments or action*
Installation and test (paras 71 to 75, 103 to 105)						
Periodic examination (para 145)						
Leak testing (para 142)						
Repairs or modifications (paras 147 to 161)						

4 **Record of metering pumps/dispensers and pump controllers: installation and maintenance**

(a) Pump/dispenser make and model serial no BASEEFA approval no . .

(b) Pump controller make and model serial no

Item	*Date*	*Type of test, examination, service or repair*	*Result*	*Competent person*	*Recommendation for periodic exam or servicing (see para 145 and BS 7117)*	*Any other comments or action*
Installation and test (paras 76 and 106, and BS 7117)						
Periodic examination or servicing (para 145 and BS 7117)						
Repairs or modifications (paras 147)						

5 **Record of continuous inventory checking (see paras 135 to 138)**

Daily record, week commencing

Tank No ..... C a p a c i t y Pump N o

(nb. Variations of format will be needed where more than one pump and/or one tank are interconnected)

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
A	Dip from previous day							
B	Delivery into tank							
C	Stock (add A and B)							
D	Today's dip							
E	Gone from tank (Take D from C)							
F	Pump Reading today							
G	Previous pump reading							
H	Delivery by pump (Take G from F)							
Difference between E and H)	) LOSS) GAIN							

Note: If E is greater than H show as loss: if H greater than E show as gain.

6 Record of general maintenance and repairs (see paras 144 and 148)

Item	*Date and person responsible*	*Action taken*	*Date and person responsible*	*Action taken*	*Date and person responsible*	*Action taken*
Firefighting equipment (para 94)						
Other emergency equipment, warning and information notices (paras 148 and 91 to 97)						
Interceptors and drainage channels (para 148)						
Manhole chambers, off-set filling points, vent pipes (paras 148 and 118)						
General site maintenance (para 118)						

7 Record of information and training for staff

Name of member of staff

Date	*Issue of written procedures for normal and emergency operations (para 162)*	*Type of training given (paras 164 and 165 and Appendix 2)*	*Type of additional or refresher training given (para 165)*

8 Record of electrical installation and contractor
(to be completed by electrical contractor)

(a) Electrical supply:

Voltage Phase(s) Frequency

Prospective short circuit current at origin of the installation KA

Type of earthing arrangement (TN-S or TT)

Type(s) of protective devices (overcurrent protective or residual current devices) .....!

Earth fault loop impedance at the origin

(b) Name and address of electrical contractor

(c) Name of person completing above information

9 **Schedule of electrical circuits** (to be completed by electrical contractor/engineer)

(a)

Circuit number	*Fusing rating 01 circuit breaker tripping current (A)*	*Description of circuit*

(b)

Date	*19__*			*19__*			*19__*		
Circuit number	*Insulation resistance (megohms)*		*Protective conductor resistance (ohms)*	*Insulation resistance (megohms)*		*Protective conductor resistance (ohms)*	*Insulation resistance (megohms)*		*Protective conductor resistance (ohms)*
	To earth	*Between conductors*		*To earth*	*Between conductors*		*To earth*	*Between conductors*	

10 **Schedule of fixed electrical equipment** (to be completed by electrical contractor, engineer)

(a)

Rating							Fuse rating or circuit breaker tripping current (amperes)	19
Item number	Position and/or usage	Type of plant	Serial number	Marker name	Enclosure	hp/kw volts kvs r.p.m.		Insulation resistance (megohms)

Date	19__	19__	19__	19__	19__	19__	19__	19__
Item Number	Insulation Resistance (megohms)	Insulation Resistance (megohms)	Insulation Resistance (megohms)	Insulation Resistance (megohms)	Insulation Resistance (megohms)	Insulation Resistance (megohms)	Insulation Resistance (megohms)	Insulation Resistance (megohms)

11 **Schedule of alterations to electrical installation or equipment**
(to be completed by electrical contractor or engineer)

(a)

Nature of alteration	Name of service company	Name of engineer/electrician

(b)

Item Number	*Circuit/Equipment*	*Location*	*Date of alteration*	*Name of engineer/electrician*

12 **Schedule of earth electrodes** (to be completed by electrical contractor or engineer)

Date	*19__*	*19__*	*19__*	*19__*	*19__*	*19__*	*19__*	*19__*
Circuit Number	*Earth path Resistance (ohms)*	*Earth path Resistance (ohms)*	*Earth path Resistance (ohms)*	*Earth path Resistance (ohms)*	*Earth path Resistance (ohms)*	*Earth path Resistance (ohms)*	*Earth path Resistance (ohms)*	*Earth path Resistance (ohms)*

13 Record of visits to filling station (to be completed by persons carrying out activities relating to the filling station installation, eg licensing officers, maintenance, repair, inspecting and testing staff)

Date	*Reason for visit*	*Company etc and signature*

Appendix 2 Elements of training for persons employed at petrol filling stations

1 Equipment operation (self-service and manual)

Sound knowledge and understanding of:

(a) operation of fuel dispensing and other forecourt equipment, including equipment specific to the site (eg off-site filling points, valve pits, storage and dispensing systems for fuels other than petrol);

(b) fuel grades and types;

(c) imperial/metric conversion.

Ability to:

(d) operate fuel dispensing equipment safely and correctly in accordance with company safety policy and legislation;

(e) recognise faults in fuel equipment, take appropriate action and follow reporting procedure;

(f) record tank contents and meter readings correctly;

(g) operate other forecourt equipment and recognise associated faults;

(h) deal with customer queries regarding safety and fuel grades, types and measures.

2 Control point operation

Sound knowledge and understanding of:

(a) control point and emergency procedures;

(b) correct operation and fault reporting;

(c) procedures for activating and controlling dispensers;

(d) appropriate emergency procedures;

(e) correct use of customer communication system.

3 Forecourt safety procedures

Sound knowledge and understanding of:

(a) legal requirements affecting forecourt operations;

(b) location, selection and use of firefighting equipment;

(c) policies and procedures covering accident and injury, safety, emergencies and emergency service contacts.

Ability to:

(d) follow correct procedures for use of firefighting equipmeht, dealing with leakages and spillages, enforcing “no smoking” requirements and recording accident damage;

(e) comply with accident, injury and safety policy procedure;

(f) contact emergency services when required.

4 Receipt of fuel products

Sound knowledge and understanding of:

(a) dangers associated with the delivery of fuel, including manholes, cap removal, spillage and vapour;

(b) arrangements for receipt and storage of fuel;

(c) driver’s and receiver’s responsibilities on delivery of fuel;

(d) dispensers, tank layout, grades and capacities, and any vapour balancing system.

Ability to:

(e) follow correct procedures for pump switch-off, tanker parking, tank and tanker dip checks or gauge readings, petroleum certification completion, grade checking, signing for delivery and completion of fuel stock control documentation;

(f) appreciate safety standards on receipt of goods.

5 Site housekeeping

Sound knowledge and understanding of:

(a) the importance of a clean, safe and tidy forecourt and stock displays;

(b) forecourt opening and closing procedures.

6 Site security

Sound knowledge and understanding of security practices and the ability to follow them.

7 Personal safety and hygiene

Sound knowledge and understanding of the value of protective clothing, footwear, gloves and goggles when required; the need to wash properly with plenty of soap and water after finish of work; and correct methods of handling and lifting.

Appendix 3 Check list for visual examination of electrical installations

This list should not be considered as exhaustive and may vary from installation to installation.

Visual examination should involve checking the following items relevant to the installation and may also involve use of tools to check tightness and gaps.

(a) Presence of register, diagrams and schedule information.

Hazardous area equipment and components

(b) Metering pumps/dispensers are in accordance with BS 7117;

(c) other electrical equipment in hazardous areas:

(i) equipment appropriate for the area classification;

(ii) correct temperature classification;

(iii) appropriate equipment group or sub-group;

(iv) correct circuit identification:

(v) maintenance of integrity of enclosure;

(vi) cable entries and stoppers etc complete and appropriate to the enclosure;

(vii) electrical connections tight;

(viii) satisfactory earthing;

(ix) correct rating of apparatus and components;

(x) damage to apparatus or wiring systems;

(xi) adequate environmental protection (eg against weather, mechanical damage);

(xii) no unauthorised modifications;

(xiii) all cables, conduit and accessories in accordance with the appropriate British Standards or other equivalent standards.

Note
Items are not listed in any order of priority. Where integrity of type of protection is dependent on electrical protection, this should be verified initially.

Associated electrical installations in non-hazardous areas

(d) Selection of equipment and protective measures appropriate to external influences.

(e) Presence of appropriate devices for isolation and switching.

(f) Choice and setting of protective and monitoring devices.

(g) Selection of wiring systems.

(h) Ancillary equipment - luminaires, socket outlets, portable and transportable equipment.

(j) Presence of lightning protection.

(k) Method of protection against direct and indirect contact.

(l) Earthing and bonding.

(m) Connection of conductors.

(n) Identification of conductors.

(o) Selection of conductors for current carrying capacity and volt drop.

(P) Connection of single pole devices for protection or switching in phase conductors only.

(q) Correct connection of socket outlets and lamp holders.

(r) Presence of fire barriers and protection against thermal effects.

(s) Labelling of circuits, fuses, switches and terminals.

(t) Presence of danger notices and other warning notices.

(u) Integrity of petrol and petrol vapour barriers in ducts, etc where applicable.

Appendix 4 Guidance for annual inspections and testing of electrical installations

An annual inspection and test programme should be carried out to ensure that the electrical installation and equipment in hazardous areas continues to be in satisfactory condition.

The items scheduled below should be inspected and tested as a minimum and will assist in completing the certificate. A separate report detailing test results and observations should be produced and the relevant sections in the site register should be completed.

Instruments used should be suitable for the areas tested. On no account should earth loop impedance testers be used in hazardous areas or circuits associated with hazardous areas.

Inspection and testing

Visual inspection to ensure equipment is well constructed to relevant British Standards, suitable for the appropriate hazardous-zone and not damaged to impair safety. The inspection and testing should include:

(a) register and relevant installation information;

(b) supply intake;

(c) earthing connections and bonding;

(d) main switchboard and distribution boards/circuits labelling;

(e) pump console and controls;

(f) fireman's switch;

(g) hazardous zone barriers;

(h) pumps (eg enclosures, metal seals);

(j) lighting (eg glasses, seals);

(k) apparatus is suitable for environment and correctly labelled;

(l) isolation and switching, (main and emergency);

(m) no signs of unauthorised or unrecorded modifications;

(n) presence of warning notices;

(o) check suitability of circuit breaker rating (normal and fault rating);

(P) tests as follows:

(i) earth loop impedance at socket outlets adjacent to supply intake in non-hazardous areas;

(ii) continuity of protective conductors and equipotential bonding;

(iii) operation of residual circuit breakers for earth fault protection;

(iv) insulation resistance tests;

(q) connection of single pole devices for protection or switching in phase conductors only;

(r) correct connection of socket outlets and lamp holders;

(s) presence of fire barriers and protection against thermal effects;

(t) labelling of circuits, fuses, switches and terminals;

(u) presence of danger notices and other warning notices;

(v) integrity of petrol and petrol vapour barriers in ducts, etc where applicable.

Electrical Certificate

Storage of petroleum spirit and mixtures
Electrical certificate for new installations
Annual inspections of existing installations

Petroleum (Regulations) Acts 1928 and 1936
Health and Safety at Work etc. Act 1974

Name of Occupier
Trading As
Address of Premises

I hereby certify that the electrical installation associated with the licensed storage, use and dispensing of petroleum spirit has been tested in accordance with the inspection schedule ref no . . . . . attached and with the exception of the remarks in the "Observation" column was found to be in satisfactory condition.

Date of Test

Signature of person carrying out the inspection

Full name (Block capitals)

Qualifications

Company

Address

Position with company

Date

1 It is an offence under Section 33 of the Health and Safety at Work etc. Act 1974 for any person to make a false entry on the certificate.

2 The person carrying out the inspection must be competent, be fully conversant and have practical experience with BS 5345 (Selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres).

Electrical certificate inspection schedule

			Satisfactory Yes/No	See Observations
1	Type of earthing arrangements State type	TN-S TN-C TT		
2	Type of protective device fuse State type (time and current)	MCB RCD		
3	Earth loop impedance at socket outlet adjacent to supply intake (non-hazardous area) state value ohms)			
4	Loose electrical connections including those for earthing			
5	Insulation test state (value in Mohms)			
6	Damage to apparatus or wiring system			
7	Condition of enclosures, gaskets and fastenings			
8	Loose fixings, glands, conduit, stoppers, etc			
9	Leakage of compound or oil			
10	Conditions of bearings			
11	Apparatus is adequately protected against corrosion, the weather, vibration and other adverse factors			
12	Correct lamp ratings or type			
13	Integrity of guards			
14	Inadvertent contact between rotating and fixed parts			
15	Malfunction of relays and protective devices			
16	Unauthorised modification or adjustment			
17	Inappropriate maintenance, eg not in accordance with manufacturer's recommendations			
18	Undue accumulation of dust and dirt			
19	Sealing of ducts between non and hazardous areas			
20	Isolators capable of being locked in "OFF" position			
21	Site documentation in order			

Appendix 5 Notes on measuring earth fault loop impedance and test point provisions

Test point

A test point should be provided to allow testing of phase - earth fault loop impedence at the origin of the electrical installation (see paragraph1 87). The test circuit should be arranged so that the path of the test current and conductive parts energized is minimal. The arrangement shown in Figure1 1 allows the test to be made between a phase of the incoming supply and means of earthing with the remaining installation and bonding system completely isolated.

The arrangement requires provision of an all insulated switch fuse with its own PVC/PVC tails of known resistance (material, length and cross sectional area) with provision of an insulated protective conductor of known resistance connected on the earthing conductor side of the main earth terminal. The all insulated switch fuse should supply an all insulated socket outlet having its earth contact segregated from the earthing arrangement within the electrical installation.

The switch fuse should be permanently and indelibly marked “For test purposes only” and should be lockable.

Testing procedures utilizing test point

1 The main isolating switch should be locked in the off position.

2 The main earthing terminal link should be secured in the open position.

3 With the main isolating switch open and bonding isolated, a loop impedance test should be made from the test socket outlet.

4 Figure 11 shows the test circuit. Any range switch on the earth loop impedance tester should be set to the highest value. The instrument should be plugged into the socket outlet, ensuring that the polarity neons are correctly lit before depressing the operating button. The earth fault loop impedance (Z_S) in ohms will then be indicated directly on the instrument scale. If it is necessary to select a lower range, the instrument should be allowed a delay of a minute or two before any tests are repeated.

5 The earth fault loop impedance (Z_E) at the origin of the installation should be calculated from instrument reading (Z_S) minus resistance of phase tail (R_1) and resistance of circuit protective conductor (R2) (nb where these are copper conductors of not less than 2.5 mm^2 CSA and of length not exceeding 2m then the resistance can be ignored).

6 The instrument should be disconnected from the socket outlet and the test switch should be locked in the open position.

7 The main earth terminal link should be reconnected.

8 The main isolating switch should be unlocked and closed.

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