

# User Information Sheet 008

Formerly LPGA Technical Memorandum NO.76 – January 2003

## Electrical Installations Associated with Bulk LPG Installations

### 1. Introduction

It has become increasingly common for electrical equipment to be associated with LPG bulk supplies. This Technical Memorandum describes the principles and practices which should be used where electrical equipment is installed within the hazardous area associated with LPG installations such as: Autogas installations which are not associated with licensed petroleum retailing sites; electrically heated vaporisers.

The guidance is intended to assist installers and operators to comply with the electrical requirements relevant to LPG installations and the duties imposed under the dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). It is based on BS 60079 (particularly Parts 10 & 14) together with BS7671 and associated documents.

- Detailed guidance on electrical installation standards is given in EEMUA Publication No. 186; "A practitioner's handbook – Electrical installations in potentially explosive atmospheres."
- Detailed guidance on electrical installations at licensed petrol filling stations is given in the IP/APEA publication "Guidance for the design, construction and modification of petrol filling stations" (often referred to as the "Blue Book").

This Technical Memorandum only applies when low voltage (less than 1000 V AC) equipment is being used.

Under DSEAR all bulk LPG installations require assessment to establish their hazardous area zones and to confirm the equipment is appropriate for the relevant zone.

- LPGA Codes of Practice 1 part 1 and 25 give further guidance.

**Note:** Installations using cathodic protection systems for corrosion protection of vessels or pipework require special consideration and expert advice should be sought.

## 2. *Competence*

Electrical work, installation, testing and maintenance, in a zoned or hazardous area should only be carried out by suitably trained electricians who can prove competence in the type of work being undertaken.

This would normally require the Company/Organisation to be a member of an organisation providing accreditation under a third party assessment system and, when implemented, to be on the hazardous area approval register. Individual electricians should have completed suitable training. (e.g. COMP 'Ex'.) Consideration should be given to using individual electricians holding an appropriately endorsed "Joint Industries Board" (JIB) card.

- A JIB card includes a summary of training on the back of the card.
- The Provision and Use of Work Equipment Regulations (issued under The Health & Safety at Work Act) requires every employer to ensure that where work equipment is likely to involve a specific risk, the use of that equipment is restricted to those persons given the task of using it and repairs, modifications maintenance or servicing that work equipment is restricted to specifically designated persons whom the employer must ensure have received adequate related training.

## 3. *Positioning of Installation*

### a) *General*

LPG installations differ from other fuel installations in several respects. The most important difference is that the LPG installation a pressurised system with no venting system releasing flammable vapours during storage or filling. There is only a limited release on release of the filling coupling.

b) *Electrical Power Cables*

LPG vessels, pumps and dispensers etc. should not be located directly below overhead electrical power cables.

As conductors may swing out or drag lower than their observed position of rest under adverse weather conditions vessels should not be positioned less than 1.5 m from a vertical line drawn from cables operating at voltages of less than 1 kV.

- This includes telephone cables.

For cables operating at voltages of 1 kV and above, the distance needs to be increased to not less than 10 metres

These distances may need to be increased further when the overhead cable could constitute a danger to the users of the facility, LPG tankers or personnel. Further advice may need to be obtained from the electricity line owner.

To avoid risk of damage to underground electrical power cables during installation and disruption to the LPG installation in the event of subsequent work on such power cables, LPG vessels, pumps and dispensers etc. should not be located directly above electrical power cables not associated with the installation.

4. *Electrical Supply*

a) *Provision of supply*

The supply into a hazardous area should be directly from a main switch disconnector and not from a ring main feeding other parts of the site. The switch disconnector must isolate all live and neutral conductors.

b) *Type of Supply*

Electrical supplies into a hazardous area should be **TN-S, TT or IT**. For all other types of supply a competent electrician should carry out a risk assessment before the installation is undertaken.

- **Note:** The form of earthing defines the types of electrical supply used.
  - **TN system**, a system having one or more points of the source of energy directly earthed, the exposed-conductive-parts of the

installation being connected to that point by protective conductors;

- **TN-C system**, a system in which neutral and protective functions are combined in a single conductor throughout the system;
- **TN-S system**, a system having separate neutral and protective conductors throughout the system;
- **TN-C-S system**, a system in which neutral and protective functions are combined in a single conductor in part of the system;
- **TT system**, a system having one point of the source of energy directly earthed, the exposed-conductive-parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the source;
- **IT system**, a system having no direct connection between live parts and Earth, the exposed-conductive-parts of the electrical installation being earthed.

(Also see the layout on Page 151 of the APEA "Guidance for the design, construction and modification of petrol filling stations".)

c) *Generators*

Special precautions may be necessary when the use of a generator to provide the electrical supply it is planned or is needed for use in emergencies.

d) *Voltage*

Tests should be carried out to confirm there are no excessive voltage drops e.g. due to length of cable and/or the relatively high power absorbed by many LPG pump motors on start up.

- BS7671 requires that the voltage drop at the extremity of the circuit does not exceed 4%.

The available voltage at any motor contactor should remain within the stated tolerances both on start up and during running. For a single-phase AC motor intended to operate at nominal voltage of 230 V AC the voltage should not fall below 220 V AC on start up.

e) *Protection against Indirect Contact*

When a different type of supply is used for the hazardous area compared with the main supply there must be a suitable separation, typically in excess of 2.5m, between components to prevent inadvertent contact between the two.

In this case a disconnectable earth bar and test socket should be installed for each installation in accordance with the IP/APEA "Guidance for the design, construction and modification of petrol filling stations".

f) *Site Earthing*

Site earthing is required for all sizes of storage vessel when fitted with electrical equipment, with the primary requirement being protection against electric shock. This is not the same as the earthing required for the dissipation of static electricity.

An earth-bonding conductor should be run back to a primary earthing point at the source of energy. This is typical of a TN-S system where all metallic parts will ultimately be bonded to this point. (Typical earth figures for bonding should comply with BS 7671 Table 54H or Regulation 547-02-01.)

The electrical supply must have a suitable effective earth, usually TN-S, TT or IT. TNC-S (PME) may be considered providing a competent electrician has carried out an appropriate, documented, risk assessment.

Details of the types of protection to be installed are given in section 14.8 of the IP/APEA "Guidance for the design, construction and modification of petrol filling stations".

Should the type of supply not be established or the site has a different type of earth then the unit supplier must be contacted before any electrical connections are made.

Mains circuit breakers (MCB's) should disconnect all poles of the supply (i.e. phase(s) and neutral). Consideration should be given, when sizing MCB's, to the current rating of the type, its short circuit capability and earthing impedance values, which need to be evaluated on site to ensure compliance with BS7671.

Bonding to other services must comply with BS7671.

**Note:** Installations using cathodic protection systems for corrosion protection of vessels or pipework require special consideration and expert advice should be sought.

5. *Installation of Equipment*

a) *Motor overload/low voltage protection*

BS 7671 requires that every electric motor having a rating exceeding 0.37 kW be provided with control equipment incorporating means of protection against overload of the motor.

Every motor needs to be provided with means to prevent automatic restarting after a stoppage due to a drop in voltage or failure of supply.

b) *Cable sizing*

Care should be taken in the design of cable sizing taking into account the length of the cable and the maximum load current. (Note that many LPG pump motors have a particularly high starting load current.)

Unless individual site calculations are carried out the size of any earth cable should not be less than 25 mm<sup>2</sup>.

c) *Glands*

Cable glands should be suitable for the area and connection zone and for the cable employed.

d) *Auxiliary equipment*

Any auxiliary equipment (e.g. solenoid valves) should be suitably protected in the event of electrical failure. This protection should not be incorporated into hazardous area enclosures unless written approval is received from the manufacturer.

e) *Enclosures of equipment for use in Hazardous Areas*

Any modification to enclosures after dispatch from the manufacturer may invalidate the electrical certification for use in hazardous areas and should not be carried out.

f) *Isolation/Emergency Switch*

A suitable switch disconnecter for emergency use, which will isolate all live and neutral conductors, should be fitted outside the hazardous areas.

Where required by BS7671 and BSEN60079–14 a means to secure the isolation shall be provided.

g) *Switching off for mechanical maintenance*

A means of switching off the power supply for mechanical maintenance should be provided for any electrical equipment in accordance with BS7671 and BSEN60079-14.

h) *Earthing*

Metallic sections of an installation should be designed, constructed and installed to be effectively electrically connected together. For equipment not mounted on common steelwork each component may need to be electrically connected, using an appropriately sized conductor, back to a single point. Consideration should be given as to whether earthing of metallic items within a distance of 4 metres is required. e.g. adjacent metallic fencing. Care should be taken to ensure that surface features (e.g. powder coating) do not render surfaces insulating.

i) *Static earthing*

Before connecting a vessel to a local earth rod an assessment is required to see if this would affect the protection of the total installation.

A “clean” earth may need to be made available for connection to a delivery tanker earth connection.

j) *Sodium lamps*

Due to the potential hazardous if a lamp is dropped or falls, sodium lamps should not be installed within or above zoned areas.

6. *Testing*

a) *Construction Test*

A suitable certificate should be provided on satisfactory completion and testing of the installation. An example of the information required is given in Appendix 1.

b) *Periodic Inspection*

Periodic inspection is required in accordance with BS EN 60079. An assessment should be made (and recorded) at the time of issuing the completion certificate of:

- the type of inspections required;
- the period between inspections (which should not exceed 12 months).