

MRA LPG

Code of Practice B2:2008

Small Cylinders Storage and Filling

Recommendations for the Safe Filling of
LPG Cylinders at Depots

The information in this Code of Practice is given in good faith and belief in its accuracy at the time of its publication, but does not imply any legal liability or responsibility by the Malta Resources Authority.

Users of this Code of Practice must give regard to any relevant legislation or authoritative recommendations, especially to those which may have evolved subsequent to the date of publication.

This guidance is not an authoritative interpretation of the Law, but if you do follow the Guidance, you will normally be doing enough to comply with the Law.

Malta Resources Authority Officials may refer to this Guidance as illustrating good practice.

This document is heavily based on UKLPG's suite of Codes of Practice (for further information see www.uklpg.org). Their permission to use these within Malta is gratefully acknowledged.

Copyright subsists in all UKLPG publications as reproduced herein. Text based on UKLPG's Codes of Practice remains subject to their copyright.

The MRA reserves any right of exploitation in any form and by any means of this publication. No part may be photocopied or otherwise reproduced without prior permission in writing of the Malta Resources Authority © MRA 2009.

Copyright ©2009

This Code has been prepared by the Malta Resources Authority in consultation with the Malta Environment and Planning Authority (MEPA), the Malta Standards Authority (MSA), the Occupational Health and Safety Authority (OHSA), the Civil Protection Department (CPD) and Enemalta Corporation (EMC).

Before publication, the contents of this document were sent out for wide consultation to all stakeholders with an interest in the transportation, storage or use of L P Gas. Many of the comments received have been incorporated in the document.

The aforementioned Authorities believe that the contents of this Code demonstrate good practice in the L P Gas Industry and commend its use.

This page is left intentionally blank

DRAFT

The MRA**LPG Code of Practice B2****Recommendations for the safe filling of LPG Cylinders at
Depots**

Section 1: Introduction, Scope, Definitions and	
References	1
1.1 Introduction.....	1
1.2 Scope.....	1
1.3 References.....	1
1.4 Definitions.....	2
Section 2: Operational Procedures	3
3.1 Cylinder Design and Construction.....	4
3.2 Cylinder Labelling	4
3.3 Valve Design	4
Section 4: Plant and Equipment	5
4.1 Site Layout and Security	5
4.2 Bulk Storage and Security.....	5
4.3 LPG Transfer Pumps and Compressors.....	5
4.4 Pipework and Fittings.....	6
4.5 Filling Buildings	6
4.6 Hoses.....	7
4.7 Cylinder Filling Equipment	7
4.8 Electrical Installation and Electrostatic Hazard Precautions	8
4.9 Other Services	10
Section 5: Cylinder Filling Operations	13
5.1 Inspection and Segregation of Cylinders.....	13
5.2 Before Commencing Filling Operations	13
5.3 While Filling Cylinders.....	14
5.4 Post Fill Operations	14
5.5 Fill Plant Shut Down.....	15
Section 6: Gas Charging of Cylinders	16
Section 7: Bulk Transfer	17
7.1 General.....	17
7.2 Before Commencing Off-Loading	17
7.3 Product Transfer.....	17
Section 8: Plant Maintenance	18
8.1 General.....	18
8.2 Permits to Work.....	19
Section 9: Fire Protection Equipment	20
9.1 Water Supply and Distribution	20
9.2 First Aid Fire Extinguishers	21
9.3 Alarm Systems.....	21

9.4	Detection Systems.....	22
Section 10: Emergency Procedures		23
10.1	General.....	23
10.2	On-Site Emergency Procedure	23
10.3	Emergency Actions	24
Section 11: Training.....		25
11.1	General.....	25
11.2	Special Requirements	25
11.3	Special Training	25
11.4	Operating Procedures.....	26
11.5	Personnel Training Record	26
Appendix A: Safe Handling and Properties of LPG		27
A.1	Safe Handling of LPG.....	27
A.2	Typical properties of LPG.....	29
Appendix B: Precautions against Caustic Soda in LPG.....		30
Appendix C: Recommended Area Classification		31
Appendix D: Flow Diagram for Cylinder Filling.....		32
Appendix E: Recommended Personal Protective Equipment		34
Appendix F: Cylinder Maintenance Operations		35
F.1	Periodic Examination and Testing	35
F.2	Treatment of Defective Cylinders.....	35
F.3	Surface Treatment, Cleaning and Painting of Cylinders.....	35
Appendix G: Sample calculations of maximum permissible fill		37
Appendix H: References		38

This page is left intentionally blank

DRAFT

Section 1: Introduction, Scope, Definitions and References

1.1 Introduction

- 1.1.1 New fill plants should comply with this Code from the date of publication. Operational procedures contained in the Code should be adopted for all filling plants as soon as reasonably practicable after the date of publication.

1.2 Scope

- 1.2.1 This Code applies to permanent filling plants where cylinders are filled and stored. Recommendations on cylinder maintenance and re-qualification, which may be carried out on the same site, are given in Appendix F. The bulk LPG storage required to supply the cylinder filling is covered in the MRA LPG Code of Practice A1.

- 1.2.2 This Code does not apply to the following activities:

- (a) the filling of cylinders at consumers' premises;
- (b) automotive LPG refuelling facilities which are the subject of MRA LPG Code of Practice C3;
- (c) the filling of aerosols and cartridges;
- (d) mobile cylinder filling systems;
- (e) the transport of cylinders outside the filling plant and the stowage of cylinders on road vehicles.

- 1.2.3 The storage of full and empty cylinders is the subject of MRA LPG Code of Practice B1.

- 1.2.4 This Code of Practice adopts the recommendations of MSA, BSI, CEN and ISO for the presentation of numeric values. The thousand separator is therefore a space (e.g. one million is represented as 1 000 000) and the decimal separator a comma (e.g. one point five is represented as 1.5).

1.3 References

This Code of Practice incorporates by dated or undated reference, provisions from other Codes of Practice. These references are cited at the appropriate places in the text and the publications are listed in Appendix H. For dated references, subsequent amendments to or revisions of any of their publications apply to this Code of Practice only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

1.4 Definitions

- 1.4.1 **LPG:** Liquefied Petroleum Gas with properties in accordance with Appendix A.
- 1.4.2 **Filling Plant:** An establishment for the filling and maintenance of LPG cylinders, including bulk storage vessels, buildings and service areas.
- 1.4.3 **Cylinder:** A transportable, refillable container suitable for use with LPG.
- 1.4.4 **Aerosols and Cartridges:** Non-refillable transportable containers up to 2 litres capacity which may contain LPG only, or LPG in mixtures with other components.
- 1.4.5 **Hazardous Areas:** Areas, defined as in MSA EN 60079-10:2003 and described in 4.8 and Appendix C to this Code of Practice, in which flammable atmospheres may be present.
- 1.4.6 **Weight Filling:** The filling of a cylinder with LPG, controlled by weight.
- 1.4.7 **Volumetric Filling:** The filling of a cylinder with a fixed volume of LPG. For cylinders with a fixed liquid level gauge, the principles of MRA LPG Code of Practice C3 apply.
- 1.4.8 **Safety Valve:** A pressure relief device which will open and relieve pressure when a predetermined pressure is attained in a vessel or piping.

Section 2: Operational Procedures

2.1 The LPG filling plant operator is to prepare written operating procedures clearly defining the actions or functions of personnel involved.

2.2 Procedures should include:

- (a) bulk transfer of LPG (see Section 7);
- (b) cylinder filling requirements (see Section 5);
- (c) cylinder maintenance (see Appendix F);
- (d) permit to work system (see Section 8);
- (e) emergency procedures (see Section 10).

2.3 All procedures for the filling of cylinders or associated operations shall aim at achieving the lowest practical level of LPG release into the filling area or other relevant area.

Section 3: Cylinder Design and Construction, Labelling and Valve Design.

3.1 Cylinder Design and Construction

Cylinders shall be designed and constructed to an approved standard (for example MSA EN 13322-1:2003) in accordance with the Pressure Equipment Regulations (L.N. 248 of 2002) and the Transportable Pressure Equipment Regulations (L.N. 331 of 2002)

3.2 Cylinder Labelling

LPG cylinders shall be labelled in accordance with the Motor Vehicles (Carriage of Dangerous Goods by Road) Regulations (L.N. 211 of 2003) and the Transportable Pressure Equipment Regulations (L.N. 331 of 2002).

3.3 Valve Design

3.3.1 Cylinder valves should be in accordance with MRA LPG Code of Practice D3.

Section 4: Plant and Equipment

4.1 Site Layout and Security

- 4.1.1 Access to Filling Plants should be strictly controlled to ensure that the discipline of hazardous areas is observed and that casual access by members of the public is prevented.
- 4.1.2 Filling Plants should be enclosed by an industrial security fence at least 1,8 m high. This may include radiation or building walls without windows for part of its length.
- 4.1.3 The fence should have at least two means of exit not adjacent to each other, and these should be kept clear at all times.
- 4.1.4 Within the boundary fence, areas should be designated as safe, or hazardous in accordance with MSA EN 60079-10:2003. Details of this, and the effects of the area classification, are given in 4.8 and Appendix C.
- 4.1.5 The site layout shall be such that hazardous areas can be kept free of all sources of ignition. This includes matches, lighters, all naked flames, mobile phones, spark producing processes, spark ignition engines and unsuitable electrical equipment.
- 4.1.6 Elements of the Filling Plant, which shall be outside the hazardous areas include all sources of ignition, such as flame fired boilers, welding and grinding units, smoking areas and car parks for spark ignition vehicles. The speed limit of all vehicles entering the Filling Plant should not exceed 10km/h. Additionally a spark arrestor should be attached to all spark ignition vehicles entering the depot. Ideally no spark ignition engines should be allowed inside the depot.
- 4.1.7 Adequate warning signs shall be displayed to indicate 'hazardous' areas, prohibition of smoking or naked lights, prohibition of any mobile phone use, no unauthorised entry, etc. All warning and other signs shall comply with the Work Place (Provision of Health and, or Safety Signs) Regulations. (L.N. 45 of 2002).
- 4.1.8 A wind direction indicator should be provided, see also 10.2.2.

4.2 Bulk Storage and Security

References should be made to MRA LPG Codes of Practice A1 and A3.

4.3 LPG Transfer Pumps and Compressors

- 4.3.1 Reference should be made to MRA LPG Code of Practice A1.
- 4.3.2 Consideration should be given to the provision of stop/start controls at the cylinder filling point. Where such remote controls are installed a means of isolating the system electrics with lock-off should be fitted to facilitate maintenance.
- 4.3.3 Isolating valves and a safe system of venting should be provided at the inlet and outlet connections of pumps and compressors to facilitate maintenance.
- 4.3.4 All transfer pumps and compressors should be installed and regularly maintained in accordance with the manufacturer's instructions.
- 4.3.5 Any electrical equipment shall be suitable for use in areas as classified in 4.8.

4.4 Pipework and Fittings

- 4.4.1 All pipework and fittings should be in accordance with MRA LPG Code of Practice D6.
- 4.4.2 Remotely operated isolation valves should be installed at the point where LPG pipework enters filling buildings.

4.5 Filling Buildings

4.5.1 General

- 4.5.1.1 The ground level area surrounding the filling building shall be free of pits or depressions.
- 4.5.1.2 Reference should be made to MRA LPG Code of Practice A1 for separation distances.
- 4.5.1.3 The area occupied by the buildings which house filling equipment are classified as hazardous Zone 1. All electrical equipment shall be suitable for use in Zone 1 areas. There shall be no sources of ignition within the area. (See 4.8).
- 4.5.1.4 All parts of the building structure shall have two hour fire resistance to BS 476 Part 20: 1987 or equivalent.
- 4.5.1.5 The floor of the filling building may be at or above ground level, but not below. If the floor is raised above ground level, any spaces beneath the floor shall be open, unobstructed and without depressions below ground level to ensure adequate natural ventilation.
- 4.5.1.6 Any chambers or pits in the floor shall be adequately ventilated to prevent accumulation of LPG vapour.

4.5.2 Ventilation

- 4.5.2.1 If buildings have two or more sides permanently open, no additional ventilation is required.
- 4.5.2.2 If buildings have one side open, then the wall opposite the opening shall have low level ventilation spaces amounting to not less than 1,5 % of that wall.
- 4.5.2.3 Where shutters or their equivalent are provided for weather protection on otherwise open sides, they shall be kept fully open whilst cylinder filling is in operation. Consideration should be given to electrical interlocks with the LPG supply so that filling cannot take place if the shutters are moved from the fully open position.
- 4.5.2.4 If the building is constructed with no openable sides, then forced ventilation should be provided together with floor level vents in the walls to the outside of the building, amounting to not less than 1,5 % of the total wall area. Natural ventilation alone may only be used provided it will ensure that any LPG vapour in the atmosphere inside the building resulting from the filling operation does not exceed safe limits. Forced ventilation for this purpose means a ducted extractor fan system drawing from around the filling points to control the level of LPG in the atmosphere inside the building resulting from the filling operation, to acceptable safe limits. [The fan extracting capacity should be in excess of that required to dilute the possible LPG release during full production, so that it never exceeds 25 % of the LFL within the ducting under any foreseeable conditions].
- 4.5.2.5 Extractor fan systems shall discharge at a safe height to the outside atmosphere via suitable ducting. The fan motor should be suitable for operating in a zone 1 area (See 4.8). Ventilation fans should be interlocked with the LPG supply in such a way that filling cannot take place unless the fans are running.

4.6 Hoses

All hoses for the transfer of LPG in the liquid phase, including those used on cylinder filling shall be made to BS 4089: 1999 or equivalent. They shall have electrical continuity.

Hoses shall be used, maintained and tested in accordance with MRA LPG Code of Practice D1. Hoses with wire braiding shall have the braiding in stainless steel.

4.7 Cylinder Filling Equipment

- 4.7.1 The location of cylinder filling equipment should take account of:
 - (a) the need for good ventilation;
 - (b) adequate separation between adjacent weighing platforms;
 - (c) clear access for empty and full cylinders moving to and from the filling equipment.

- 4.7.2 The design and selection of cylinder filling equipment shall take account of the range of cylinder sizes it is intended to fill and check.
- 4.7.3 Equipment should be designed to operate such that cylinders are filled in accordance with the required contents and tolerances.
- 4.7.4 Cylinders may be filled on equipment designed to fill by weight or by volume. Cylinder filling by weight is the most widely adopted method. Filling by volume tends to be employed on small cylinder sizes.
- 4.7.5 When filling by weight, only the scales compliant with the Measuring Instruments Directive (2004/22/EC which has been transposed as L.N. 221 of 2006) or the Non-Automatic Weighing Instruments Directive (90/384/EEC which has been transposed into Maltese legislation as L.N. 396 of 20002) shall be used for checking. Such instruments bear the M mark. They may be separate from the filling scales that only have to satisfy the requirements of 4.7.3 above.
- 4.7.6 The scales mentioned in sub-paragraph 4.7.5 shall be subject to a periodic inspection scheme and criteria which are acceptable to the Malta Resources Authority.
- 4.7.7 When filling by volume, the first stage equipment shall remove residual liquid from the cylinder, usually by connection to a vacuum line, see section 4.9.5. The second stage will dispense a measured volume of LPG, adjusted for temperature compensation.
- 4.7.8 The filling head shall be correctly designed to couple with the cylinder valve, with the amount of LPG released on disconnection kept to a minimum. If the same line is used to fill both butane and propane, then procedures shall be in place and followed to ensure the correct grade is filled and prevent the mixing of grades.
- 4.7.9 Equipment shall be available to remove excess LPG in a safe manner immediately from any overfilled cylinders found at checking. The preferred method is by connecting the cylinder to a vacuum installation, see 4.9.5

4.8 Electrical Installation and Electrostatic Hazard Precautions

- 4.8.1 The selection, installation and use of electrical apparatus in hazardous areas should be in accordance with the recommendations of MSA EN 60079-14:2003.
- 4.8.2 The areas detailed in Appendix C of this Code are classified according to the degree of probability that flammable concentrations of gas (or vapour) may arise. The hazardous area definitions are as follows:
- Zone 0** - an area in which an explosive gas-air mixture is continuously present, or present for long periods;
- Zone 1** - an area in which an explosive gas-air mixture is likely to occur in normal operation;

Zone 2 - an area in which an explosive gas-air mixture is not likely to occur in normal operation, and if it occurs it will only exist for a short time;

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

- 4.8.3 The boundary of the hazardous area should be clearly marked. There shall be no source of ignition within any hazardous area including prohibition of smoking, any spark or flame producing process, mobile phone use or spark ignition vehicles.
- 4.8.4 All electrical apparatus for use in classified zones shall have certification for the appropriate zone, gas group and temperature classification as detailed in MSA EN 60079-14:2003 and MSA EN 60079-10:2003.
- 4.8.5 All wiring and cable shall be in accordance with MSA EN 60079-14:2003
- 4.8.6 Maintenance shall be in accordance with MSA EN 60079-14:2003.
- 4.8.7 The main electrical switchgear should be installed outside any hazardous areas.
- 4.8.8 Consideration should be given to including the following: -
- (a) residual current circuit breakers (RCCBs);
 - (b) high quality earthing for the electrical circuits. This should be separate from earth connections on the storage vessels and pipework;
 - (c) complete circuit breaks, i.e. isolation of all phases and the neutral for each item of equipment with the facility for locking in the 'off position;
 - (d) local start/stop switches suitable for the zones in which they operate;
 - (e) emergency stop buttons, clearly identified, capable of shutting down all or part of the electrical circuits;
 - (f) back-up generators with automatic start and circuit selection;
 - (g) forced ventilation of the switchgear room.
- 4.8.9 Consideration should be given to electrostatic hazard precautions including: -
- (a) pipelines, fittings and hoses conveying liquid LPG should have electrical continuity and be effectively connected to earth. Detailed information on the generation of static electricity and advice on earthing and bonding is given in PD CLC/TR 50404:2003 Part 2 gives specific guidance for LPG filling plants;
 - (b) all earthing points for the dissipation of static electricity shall have an electrical resistance to ground of not greater than 1×10^6 ohms.

4.9 Other Services

4.9.1 Compressed Air

This can be used for the operation of valves, filling equipment, air tools and emergency shutdown systems. Any shutdown device operating on air should be a fail safe device, i.e. in the event of air failure it moves to the safe position. The compressor should be positioned in a non-hazardous area.

When designing the system consideration should be given to including: -

- (a) equipment to remove moisture and compressor oil;
- (b) regulators and/or filters before individual control equipment;
- (c) lubricators at points where valves or air tools are operated;
- (d) sufficient isolating valves and pipework to enable parts to be isolated without closing all the plant;
- (e) a back up compressor or inert gas supply connections for use in event of a compressor failure to enable the plant to be shut down or maintain a safe state;
- (f) pressure sustaining valves to maintain air supply to essential equipment in the event of excessive consumption elsewhere.

On completion of the pipework installation it should be blown through and pressure tested.

Pipework should be identified in accordance with BS 1710:1984 or equivalent.

4.9.2 Water

This covers all water supplies from the mains but does not include all water supplied for fire fighting purposes.

All installation work should comply with the requirements of the Water Directorate of the Malta Resources Authority.

The provision of toilets, washing and showering areas should comply with the requirements of the Work Place (Minimum Health and Safety Requirements) Regulations LN 44 of 2002 and any other regulations issued by the Occupational Health and Safety Authority.

Suitable personnel wash areas should be provided adjacent to messing areas. In the event of corrosive chemicals being used, e.g. for cylinder maintenance, eye baths and safety sprays should be provided.

4.9.3 Process Water

Any water used in plant processes should be properly treated. Consideration should be given to adding antifreeze and/or inhibitors to closed circuit systems.

Closed circuit systems should be provided with suitable filters where necessary. When water is used to purge cylinders, it should come via a header tank and go into a separate draining system to allow any gas to separate out safely.

4.9.4 Drains

Drains that are installed in the hazardous areas should be fitted with water traps and consideration should be given to installing a full size interceptor at the property boundary. The design shall minimise the chance of any leakage of gas getting into the mains sewer system.

4.9.5 Vacuum/Venting Installation

Vacuum systems may be installed to evacuate cylinders containing air prior to gas charging. They can also be used to remove product from cylinders requiring maintenance, or from overfilled cylinders.

There are two types of vacuum system to be considered:

- (a) that which deals with LPG vapours only;
- (b) that which deals with both liquid and vapour.

Type (a) can be relatively simple with the air or vapour being passed through the pump and vented via a vent stack. (See Appendix C for separation distances).

For type (b) the design of the system shall consider:

- (i) selection of suitable vacuum pump capable of withstanding maximum vapour pressure and with suitable motor and drive arrangement;
- (ii) installing a catch-pot to prevent liquid being drawn into the pump;
- (iii) use of hoses and fittings suitable for maximum vapour pressure created by any liquid left in the system if the pump is turned off;
- (iv) installation of hydrostatic relief valves where liquid may be trapped between shut-off valves;
- (iv) installing suitable pressure/vacuum gauges to monitor the pump performance.

For vapour only, an alternative system to vacuum is a free discharge into the inlet of an exhaust fan system, discharging into a suitable vent stack. (See Appendix C for separation distances).

A suitable vent stack should be fitted with a flame arrestor and be designed to ensure that any vapour is diluted to less than 25 % of the LEL before reaching ground level or any source of ignition.

If vapour is to be flared, specialist advice should be sought.

4.9.6 Inert Gas Supplies

These may be provided as nitrogen in cylinders under pressure as a back up for the pneumatic control equipment, or for purging.

The cylinders may be supplied singly or in banks or pallets. The cylinder pressure is up to 200 bar and suitable pressure regulators and associated equipment shall be used.

Where the cylinders are used as a back up, a low pressure alarm shall be included.

4.9.7 *Steam Heating*

Steam heating may be used as a safe means of heating within hazardous areas. Live steam may be used for gas freeing of cylinder.

Where steam boilers are flame fired, they shall be sited outside hazardous areas.

DRAFT

Section 5: Cylinder Filling Operations

5.1 Inspection and Segregation of Cylinders

All cylinders that are received into the Filling Plant shall be inspected and segregated into categories. This is laid out as a flow diagram in Appendix D, and below.

- 5.1.1 Cylinders without authority for filling/maintenance. These should be referred to appropriate owner/filler.
- 5.1.2 Cylinders due for re-qualification. See Appendix F.
- 5.1.3 Faulty or defective cylinders including those with damaged valves, shrouds, carrying handles, foot rings, dented or tire damaged cylinders. See Appendix F.

Note: Leaking cylinders should be immediately emptied in a safe manner by evacuation of the contents as specified in 4.9.5.
- 5.1.4 Cylinders with incomplete marking or labelling as defined in Section 3, or cylinders with unacceptable surface finish. See Appendix F.
- 5.1.5 Cylinders with air content, i.e. new cylinders or maintained cylinders which have air content. See Section 6.
- 5.1.6 Cylinders suitable for filling as defined in MSA EN 1439:2005.

5.2 Before Commencing Filling Operations

- 5.2.1 All personnel carrying out the filling operation shall have received the level of training required to allow them to carry out all duties expected of them competently and safely, including a complete understanding of the plant operating procedures and site evacuation plan.
- 5.2.2 A visual check of the filling plant, storage area and compound shall be carried out, looking for any unusual or potentially dangerous situations, and operations shall not be started until it is safe to do so.
- 5.2.3 The correct product shall be connected to the filling machine for the cylinders to be filled.
- 5.2.4 The scales shall be kept in good working order and scales referred to in sub-paragraph 4.7.5 shall follow the periodic scheme and fulfil the criteria mentioned in sub-paragraph 4.7.6 throughout their service life.
- 5.2.5 If ventilation fans are fitted, it should be verified that such fans have started before commencing filling.
- 5.2.6 Appropriate personal protective equipment shall be available and worn by all operatives before work starts. A list of the recommended clothing is given in Appendix E.

5.3 While Filling Cylinders

- 5.3.1 The necessary protective clothing should continue to be worn throughout the filling operation.
- 5.3.2 For each batch of cylinders segregated fit for filling it shall be ensured that:
 - (a) all the cylinders in the batch are for the same grade of LPG;
 - (b) the filling weight or volume for the size of cylinder is known (see Appendix G.
- 5.3.3 The number of full and nominally empty cylinders within the filling building should be kept to a minimum.
- 5.3.4 When filling by weight, care shall be taken that the tare weight of each individual cylinder is correctly set on the filling scale, and that the correct net fill weight is set.
- 5.3.5 Where cylinders are to be filled by volume they shall be completely emptied of liquid before being sent for filling, see 4.9.5.
- 5.3.6 Each time a cylinder is connected for filling care shall be taken to ensure that the connection between the fill connector and the cylinder is made correctly.
- 5.3.7 Any fault developing or becoming apparent while filling is in progress, shall be attended to immediately, and the filling operation stopped if the fault is judged by the operator to be a possible hazard.
- 5.3.8 Reported faults shall be inspected promptly by supervisory staff. It is recommended that a written log is maintained of reported faults and the subsequent action taken.

5.4 Post Fill Operations

- 5.4.1 After filling, and before other finishing operations, cylinders should be check weighed for correct fill. Checks should be in place to ensure that all cylinders are being correctly filled within the appropriate tolerance, (i.e. according to the requirements as established by the Metrology Directorate of the Malta Standards Authority) and according to MSA EN 1439: 2008.
- 5.4.2 Under-filled cylinders should be returned for correct filling. Over-filled cylinders should be made safe immediately by the removal of the excess product in a safe manner. This means removal of the excess LPG into a closed system, or through a vent stack. After fill correction, cylinders shall be rechecked for correct fill (80% for cylinders).
- 5.4.3 If there is reason to suspect air in the cylinder it should be checked, e.g. by noting the vapour pressure. If air is indicated it shall be removed through a suitable venting system. (See 4.9.5).
- 5.4.4 Cylinders should be checked for absence of leakage from any source including valves and fittings. Leaking cylinders should be made safe immediately. For

clip-on valves, a leak test should be included to test the seal between the valve and the regulator/connector. Faulty seals shall be replaced.

- 5.4.5 All appropriate labels, valve sealing caps or plugs and any valve protection caps should be fitted prior to despatch.

5.5 Fill Plant Shut Down

At the conclusion of filling operations the operating procedure shall be carefully followed when shutting down at the end of the day, giving special attention to the closure of the valves, etc.

DRAFT

Section 6: Gas Charging of Cylinders

6.1 All cylinders known to contain, or suspected of containing air (i.e. new, reconditioned or re-valved cylinders) shall have the air removed and replaced with LPG vapour before being filled with LPG. Failure to properly gas charge cylinders in vapour or liquid off-take duty can give rise to safety problems due to instability of combustion in user equipment.

6.2 The method used shall not create flammable atmospheres in uncontrolled situations. Two methods are described which are satisfactory.

6.2.1 Using a vacuum pump suitable for handling LPG/air mixtures, which discharges through a vent stack, evacuate the cylinder and then charge with LPG vapour to a positive pressure. Repeat the evacuation/gas charge cycle if necessary. An example of a suitable cycle of operations is as follows: -

- evacuate to 0.32 bar absolute (680 mbar or 20" of mercury vacuum);
- gas charge to 0.35 bar;
- repeat the evacuation and gas charge.

6.2.2 Inject a quantity of liquid LPG into the cylinder. Vent the cylinder into an extraction system with sufficient volume of air to dilute the LPG vapour to below the lower explosive limit at the high level discharge point. No electrical equipment should be installed in the extraction system. An example of a suitable cycle of operations is as follows: -

- *inject 0,5 kg of propane per 30 litres of cylinder capacity and vent for 2 minutes. If butane is used, note shall be taken of its vapour pressure to ensure that gas charging is adequate.*

The operator shall monitor the process to ensure that the quantity of liquid and the time of venting gives adequate gas charging.

The system should be designed to ensure adequate air flow for dilution of the contents of the maximum number of cylinders being vented at anyone time.

Venting systems are defined in 4.9.5.

Section 7: Bulk Transfer

7.1 General

- 7.1.1 The information in this section is specific to road tanker transfer into storage operations. The general principles apply to rail and ship deliveries and pipeline supplies, but specialist advice should be obtained in these areas.
- 7.1.2 Appropriate personal protective equipment shall be worn by all persons involved in the transfer operation as recommended in Appendix D.
- 7.1.3 All site personnel involved in bulk transfer operations shall have received the level of training required to allow them to carry out all duties expected of them competently and safely, including a complete understanding of the plant operating and emergency procedures.
- 7.1.4 The off-loading operation shall be under the control of a competent person over the age of 18 years.
- 7.1.5 Deliveries outside daylight hours shall only be accepted where adequate, safe, artificial lighting is provided.
- 7.1.6 The tanker escape route and/or emergency vehicle access shall be kept clear of parked vehicles or other obstacles.
- 7.1.7 Note should be taken of the Motor Vehicles (Carriage of Dangerous Goods by Road) Regulations. (L.N. 211 of 2003 as amended by L.N. 349 of 2005).

7.2 Before Commencing Off-Loading

The competent person should know the location of emergency pump isolators, shut-off valves, alarm buttons or other safety devices likely to be used in the event of an emergency occurring and is familiar with the site emergency procedures.

7.3 Product Transfer

Product transfer shall be carried out in accordance with the appropriate Section of MRA LPG COP A1.

Section 8: Plant Maintenance

8.1 General

A full schedule of inspection and maintenance should be produced covering the complete installation. This should take account of the requirements for a written scheme of examination under the MRA LPG Code of Practice A2, MRA LPG Code of Practice D1 and manufacturers' instructions. It should include preventative maintenance as well as routine work.

8.1.1 Schedules

Schedules can be informal as well as formal. Some points to be considered are listed below:

8.1.1.1 Daily

Walk round plant when off and when running and check:

- (a) all gauges give the expected readings;
- (b) no leaks are visible or audible;
- (c) Pipe supports look satisfactory.

8.1.1.2 Weekly

Check:

- (a) water/liquid separators;
- (b) oil levels in compressors, vacuum pumps, lubricators etc;
- (c) circulating water system;
- (d) operation of emergency generators and stand-by equipment;
- (e) operation of scales with check-weights;
- (f) operation of emergency shut down system;
- (g) pressure of inert gas blanket equipment;
- (h) security fences and emergency exits;
- (i) hoses and couplings;
- (j) drain water from bulk storage vessels.

8.1.1.3 Routine Work - up to annual frequency

Check:

- (a) motor and pump bearings. Consider change if suspect;
- (b) alignment of motors with pumps, compressors, etc;
- (c) operation of all valves;
- (d) operation of air dryers and lubricators;
- (e) earthing efficiency;
- (f) operation of Residual Current Circuit Breakers and isolators;
- (g) pumps, compressors etc. to manufacturers' instructions;
- (h) filters;
- (i) inspections of bulk storage facilities;

- (j) statutory inspections;
- (k) water drench system.

8.2 Permits to Work

Where maintenance or any other work includes vessel entry, or any spark or flame producing processes in hazardous areas, a Permit to Work shall be obtained from the authorised responsible person. This shall lay down the precautions to be followed for the work to be carried out safely.

DRAFT

Section 9: Fire Protection Equipment

9.1 Water Supply and Distribution

Provision should be made for adequate supplies of water for fire protection.

- 9.1.1 Consultation should take place with the Civil Protection Department and Occupational Health and Safety Authority, with regard to the overall water requirement and the minimum duration of any on site emergency water storage and pumping facility. (Usually 60 minutes).

Further discussion is recommended with regard to the necessity or otherwise to observe the requirement of the CPD notes for drenching systems with particular regard to:

- (a) minimum pump delivery capacities;
- (b) duration of emergency water supplies;
- (c) system operating pressures;
- (d) sprinkler nozzle design;
- (e) hazard area classification;
- (f) standby diesel driven pump sets.

- 9.1.2 Consideration should be given at the plant design stage to the means of application of water to the following areas: -

- (a) bulk storage vessels (fixed drenching). See MRA LPG Code of Practice A1.;
- (b) road tanker off-loading (fixed drenching recommended where frequent bulk deliveries occur). See MRA LPG Code of Practice A1.;
- (c) cylinder filling points (fixed drenching recommended);
- (d) cylinder storage areas (hoses and/or monitors).

- 9.1.3 Fixed drenching systems may be manually or automatically operated.

Manually operated valves, positioned in safe locations, should be included in automatic systems to ensure that water can be directed to those areas of obvious risk.

Galvanised piping should be employed throughout, with underground pipework further protected with protective wrapping.

Above ground pipelines should be provided with self draining devices or if not normally drained, should be protected against freezing.

The entire fire protection system should be tested at one-month intervals to ensure correct operation.

- 9.1.4 Connection points for fire brigade appliances should be provided at safe locations in the water supply pipeline to fixed drenching systems.

- 9.1.5 Systems used for protection of LPG bulk storage vessels, road tankers and cylinder storage areas should be capable of discharging water at a rate

sufficient to maintain an adequate film of water over the entire surface of the vessel and supports or to stored cylinders under fire conditions.

The recommended minimum drenching density is 7 litres per minute for each square metre of vessel surface area. To achieve this application of density fixed spray systems should be designed to discharge 9,8 litres/m²/minute. Fixed drenching systems on storage vessels shall include the ends of the vessel. See MRA LPG COP A1.

The recommended drenching rate for application on cylinder filling points should not be less than 7,5 litres/m²/minute over the required floor area.

Depot Area	Recommended drenching density in litres/m²/minute
Over Valves Assemblies and Bottles	3
Over trucks, the LPG Dispensing Equipment and Carousel	10

- 9.1.6 Hydrants, where provided, should be readily accessible at all times and so spaced as to provide adequate protection to areas not otherwise protected. Sufficient lengths of fire hose fitted with standard couplings should be provided to equip the outlet of each hose line with a combination jet and spray nozzle. Underground fire hydrants should be installed in accordance with BS 750:2006 or equivalent and a sufficient number of standpipes, hydrant keys and cover removal bars provided. For details of hydrants, standard fire hose couplings and ancillary equipment refer to BS 5306-0:1986 and BS 5306-1:2006 or equivalent.

9.2 First Aid Fire Extinguishers

A sufficient number of first aid transportable fire extinguishers of adequate size and suitable for LPG fires should be provided at strategic locations. The use of dry powder fire extinguishers conforming to MSA EN 3 and BS 7863:1996 or equivalent is recommended. For guidance on siting, inspection, testing and maintenance of portable fire extinguishers references should be made to BS 5306 Part 3:2003 or equivalent.

9.3 Alarm Systems

- 9.3.1 An alarm system should be installed.
- 9.3.2 An alarm system can be initiated manually, electrically, pneumatically or hydraulically and the comments made under the appropriate sections in 'Services' will generally apply (see 4.9).
- 9.3.3 The purpose of an alarm is two fold; firstly to indicate to those responsible for the plant at the earliest possible moment that a fault may exist, and secondly to

give those working in the plant or storage area the maximum amount of time to evacuate.

- 9.3.4 The alarm should be clearly audible over the area to be evacuated and every employee shall be familiar with the sound and understand the action to be taken if the alarm is activated. Visitors should be notified of the sound of the alarm and the action to be taken.
- 9.3.5 Alarms can be activated automatically by sensing devices and/or manually. The manual initiation points shall be carefully positioned so that a point can be easily reached from all areas of the plant or storage area. At least one point should be positioned outside the plant and storage areas.
- 9.3.6 Consideration should be given to interlocking the alarm used to evacuate the plant and storage area so that on initiation the water drenching sprays are brought into operation, automatic valves fitted on the LPG supply lines immediately close, and all LPG pumps shut down.
- 9.3.7 The manual activation points shall be clearly marked and the method of operation simple and obvious.
- 9.3.8 Audible alarms should be subject to a weekly check, each being recorded and witnessed in a log book.

9.4 Detection Systems

- 9.4.1 When deciding if a detection system is required and which type to use the following points shall be considered: -
 - (a) the manning level on the site;
 - (b) the period of time the site is unattended;
 - (c) the location of the site.
- 9.4.2 Maximum advantage will be gained from a detection system if when activated it will both sound the site alarm and initiate operation of water drench systems.
- 9.4.3 The design of a detection system is a highly specialised activity and expert guidance and advice should be obtained.

Section 10: Emergency Procedures

10.1 General

- 10.1.1 LPG Filling Plants holding an LPG inventory of above 50 tonnes are subject to the Control of Major Accident Hazard (COMAH) Regulations (LN 37 of 2003 as Amended by LN 6 of 2005) and shall have adequate emergency procedures.
- 10.1.2 Irrespective of the total LPG inventory, an on-site emergency procedure is required and where the declared inventory is 200 tonnes or more, an off-site emergency plan is also required.
- 10.1.3 The off-site plan is the responsibility of the COMAH Competent Authority and should be prepared in conjunction with the site operator
- 10.1.4 The depot operators must participate to practical exercises and application of the emergency plan. They must execute at least two practices a year with the required participation of the CPD. The date and the duration of the practices must be recorded on an appropriate register and this should upon request, be shown to the officials of the CPD.

10.2 On-Site Emergency Procedure

- 10.2.1 The procedure shall identify the hazards and risks applicable to the site and shall detail actions deemed necessary to ensure the safety of personnel, the minimising of damage to plant and property and minimising effects on third parties.
- 10.2.2 Consideration should be given to the types of emergency that could occur and account shall be taken of the areas likely to be affected. Particular attention should be paid to the effect of wind direction and strength and the effect these may have on the spread of vapour or fire.
- 10.2.3 Emergency alarms, as defined in 9.3 shall be the means of alerting all personnel on site when an emergency situation arises.
- 10.2.4 A member of staff with a thorough knowledge of the site processes and associated hazards should be nominated as Emergency Controller. A deputy should also be appointed to take charge in the absence of the Emergency Controller. Out of normal working hours, the most senior member of staff available should assume control until relieved by the Emergency Controller.
- 10.2.5 The Emergency Controller should be readily identifiable, e.g. wear a bright coloured luminous jacket and helmet.
- 10.2.6 The duties of the Emergency Controller should include the following: -
 - (a) locate the incident and assess situation;
 - (b) ensure that the Civil Protection Department or other services are contacted if necessary;
 - (c) observe wind direction and condition;

- (d) initiate local response where possible using authorised personnel;
- (e) hand over control to Civil Protection on arrival;
- (f) provide technical advice to Civil Protection including details of site layout.

10.2.7 All other personnel should evacuate to a predetermined assembly point in a safe area.

A person should be appointed to supervise evacuation and ensure that all persons on site are accounted for.

10.2.8 An Emergency Control Centre should be set up from which operations can be safely directed. It is essential for communications on and off site, to have the Control Centre in a safe zone and equipped with telephones, site plans and copies of the Emergency Procedures.

10.3 Emergency Actions

10.3.1 Anyone discovering a fire that cannot be immediately put out, or a major release of LPG, an explosion or other serious emergency, should operate the nearest alarm.

If there is a plant emergency stop button adjacent, this should be actuated.

10.3.2 On arrival of the Emergency Controller, give details of the incident and render assistance as directed.

10.3.3 All naked flames, cutting or welding torches etc. shall be extinguished and all persons other than those with specific emergency duties proceed to the assembly point.

10.3.4 The emergency alarm invalidates all Work Permits. These may only be reauthorized after the All Clear and Return to Work has been established.

10.3.5 Any tanker drivers shall stop filling or discharging operation. If considered safe to do so, disconnect the tanker and remove it to a safe place. Otherwise, switch off engine and emergency valves and proceed to assembly point.

10.3.6 Where necessary, key personnel not on site should be contacted.

10.3.7 No return to work shall be permitted until authorised by the Emergency Controller.

Section 11: Training

11.1 General

- 11.1.1 All persons involved with LPG and the associated handling equipment should be given appropriate instruction. Personnel involved in cylinder filling, handling and distributing should be trained to a level commensurate with their involvement with the products and should have a clear understanding of the following: -
- 11.1.2 Emergency procedures relevant to situations that may arise in the course of their work (see Section 10).
- 11.1.3 Product identification, properties and hazards (see Appendix A). Basic knowledge of cylinders including handling and operation of container valves, safety devices and the purpose of valve protection guards and caps.

11.2 Special Requirements

11.2.1 *General*

In addition to 11.1 above, personnel involved in inspecting and testing LPG cylinders should have been trained to have a good practical knowledge of the operations they are required to perform and an understanding of all equipment and products they are handling.

11.2.2 *Product Properties and Special Handling Precautions*

All personnel should have access to appropriate and detailed data and safety information on all the products they are handling.

11.2.3 *Pressure*

Understanding is required of the potential hazards of pressurised systems, the need to check pressure suitability of equipment before use (including periodic inspection and hydraulic testing of containers and other pressure vessels) and the potential hazard of hydraulic pressure build-up in containers and systems if over-filled with LPG.

11.2.4 *Safety Equipment*

The importance of the use of the correct safety equipment in the event of an emergency shall be fully understood. These should include basic first aid action, as appropriate.

11.3 Special Training

Personnel responsible for specifying and issuing instructions on mixing/processing and filling LPG into cylinders should have a good technical understanding of all items listed on 11.1 and 11.2 above. They should preferably have had a good technical education and practical experience

enabling them to carry out the necessary checks and calculations to ensure the safety of the instructions they specify and issue.

11.4 Operating Procedures

All processes and operations relating to the handling and processing of LPG should be properly documented and written procedures available to relevant personnel.

11.5 Personnel Training Record

A formal training record should be maintained for each employee detailing the training and information they have received. Fire Drills / evacuation trials should be carried out by each individual once every six months.

Appendix A: Safe Handling and Properties of LPG

A.1 Safe Handling of LPG

The liquid petroleum gas which is generally available in Malta consists of a mixture of Butane and Propane (70-80% and 30-20% respectively) satisfying MSA EN 589 depending on the season. These component gases of the present LPG mixture may be made available for sale and use as separate products in accordance with BS 4250:1997 or equivalent.

The mixture is normally supplied in cylinders up to 25 kg capacity and has a much lower vapour (or cylinder) pressure than propane.

The combustion of LPG produces harmless carbon-dioxide (CO₂) and water vapour, but sufficient air must be available. Inadequate appliance flueing and/or ventilation, or poor air gas mixing, e.g. due to lack of servicing, can result in the production of toxic carbon monoxide.

Everyone concerned with the storage and handling of LPG should be familiar with the following characteristics and potential hazards: -

- (a) LPG is stored as a liquid under pressure. It is almost colourless and its weight is approximately half that of an equivalent volume of water.
- (b) LPG vapour is denser than air, butane is about twice as heavy as air and propane about one and a half times as heavy as air. Consequently, the vapour may flow along the ground and into drains, sinking to the lowest level of the surroundings and be ignited at a considerable distance from the source of leakage. In still air vapour will disperse slowly.
- (c) LPG can form a flammable mixture when mixed with air. The flammable range at ambient temperature and pressure extends between approximately 2 % of the vapour in air at its lower limit and approximately 10 % of the vapour in air at its upper limit. Within this range there is a risk of ignition. Outside this range any mixture is either too weak or too rich to propagate flame. However, over-rich mixtures can become hazardous when diluted with air. At pressures greater than atmospheric, the upper limit of flammability is increased but this increase with pressure is not linear.
- (d) Escape of even small quantities of the liquefied gas can give rise to large volumes of vapour/air mixture and thus cause considerable hazard. A suitably calibrated explosimeter may be used for testing the concentration of LPG in air.

A NAKED FLAME SHOULD NEVER BE USED TO SEARCH FOR A LEAK.

- (e) At very high concentrations in air, LPG vapour is anaesthetic and subsequently an asphyxiant by diluting or decreasing the available oxygen.
- (f) Commercial LPG is normally odourised before distribution by the additional of an odourant such as *ethyl mercaptan* or *dimethyl sulphide*, to enable detection by smell of the gas at concentrations down to one-fifth of the lower limit of flammability (i.e. approximately 0,4% of the gas in air). However in certain cases where the odourant may be detrimental to a process (for example in aerosol applications) the LPG is not odourised.

(g) Escape of LPG may be noticeable other than by smell. When the liquid evaporates, the cooling effect on the surrounding air causes condensation and even freezing of water vapour in the air. This effect may show itself as frost at the point of escape and thus make it easier to detect an escape of LPG. Because the refractive index of LPG differs from air, leaks can sometimes be seen as a 'shimmering'.

(h) Owing to its rapid vaporisation and consequent lowering of temperature, LPG, particularly liquid, can cause severe frost burns if brought into contact with the skin. Personal protective equipment (e.g. hand and eye protection) should be worn if this hazard is likely to occur.

(i) A container, which has held LPG and is 'empty' may still contain LPG in vapour form and is thus potentially dangerous. In this state the internal pressure is approximately atmospheric and if a valve is leaking or is left open, air can diffuse into the container forming a flammable mixture and creating a risk of explosion; alternatively, LPG can diffuse to the atmosphere.

Note: These properties are general characteristics of LPG and items such as (h) should not occur in normal cylinder usage.

A.2 Typical properties of LPG

	Commercial Butane	Commercial Propane
Relative density of liquid at 15°C	0,57 to 0,58	0,50 to 0,51
Imperial gallons/ton at 15°C	385 to 393	439 to 448
Litre/tonne at 15°C	1 723 to 1 760	1 965 to 2 019
Relative density of gas compared with air at 15°C and 1 013,25 mbar	1,90 to 2,10	1,40 to 1,55
Volume of gas (litres) per kg of liquid at 15°C and 1013,25 mbar	406 to 431	537 to 543
Volume of gas (ft ³) per lb of liquid at 60 °F and 30 in Hg	6,5 to 6,9 -2	8,5 to 8,7 -45
Boiling point at atmospheric pressure °C approx.		
Vapour pressure for products at their maximum specified vapour pressure (gauge)	bar	bar
Temp. °C	-	0,5
-40	*	2,3
-18	0,9	4,5
0	1,93	6,9
15	4,83	14,5
38	5,86	17,6
45	372,2	358,2
Latent heat of vaporisation (kJ/kg) at 15°C	160	154
Latent heat of vaporisation (Btu/lb) at 60 °F	2,386	2,512
Specific heat of liquid at 15°C (kJ/kg deg C)	Negligible	Negligible
Sulphur content per cent weight	0,02	0,02
Limits of flammability (percentage by volume of gas in a gas air mixture to form a combustible mixture)	Upper 9,0 Lower 1,8	Upper 10,0 Lower 2,2
Calorific Values:		
<i>Gross</i>		
(MJ/m ³) dry	121,8	93,1
(Btu/ft ³) dry	3270	2500
(MJ/kg)	49,3	50,0
(Btu/lb)	21200	21 500
<i>Nett</i>	112,9	86,1
(MJ/m ³) dry	3030	2310
(Btu/ft ³) dry	45,8	46,3
(MJ/kg)	19700	19900
(Btu/lb)		
Air required for combustion (m ³ to burn 1m ³ of gas)	30	24

*Minimum Commercial Butane vapour pressure at -18 DC is minus 524 mbar g

Appendix B: Precautions against Caustic Soda in LPG

- B.1 Aluminium and its alloys in general are susceptible to corrosion by strong alkalis. Caustic soda washing is employed in LPG production and consequently a corrosion problem can exist if the caustic soda contamination is not eliminated prior to filling LPG into aluminium alloy cylinders.
- B.2 Caustic soda is present in LPG only in entrained water which will accumulate at the lowest point in the storage system and can be removed by draining. A typical method is as follows:
- (a) Prior to bulk delivery of LPG for subsequent filling into aluminium cylinders, isolate the receiving bulk storage vessel from the filling point.
 - (b) After delivery, allow a settling period equal to 3 hours for every metre depth of product with a minimum period of 12 hours.
 - (c) Drain all free water from a suitable connection at the lowest point of the storage vessel.
- B.3 Following draining a sample of liquid LPG should be taken from a point adjacent to the vessel outlet connection and analysed to ensure that the total alkalinity is below 5 ppm before the product is released for filling.
- B.4 It is recommended that a coalescer type of filter be installed between the storage vessel and cylinder filling point as an additional precaution to the routine settling and sampling procedures.

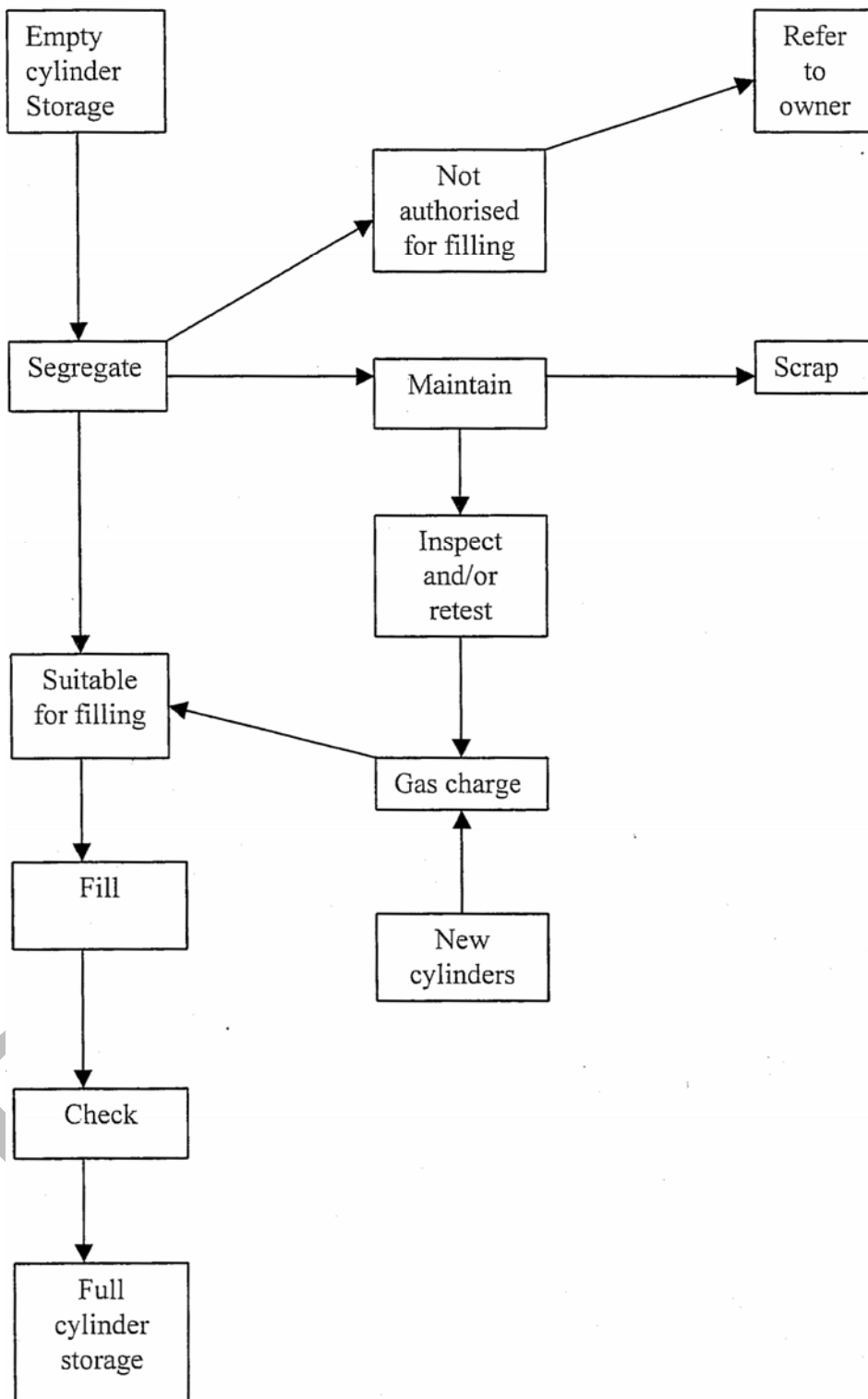
Appendix C: Recommended Area Classification

Area classification to the main elements of the Filling Plants

Elements of Plant	Extent of Classified Area	Area Classification
Cylinders in the open air	a. In the storage place up to a height of 1,5 m above the top of the stack or beneath any roof over the storage place.	Zone 2
	b. Outside the storage area or the space covered by any roof up to 1,5 m above ground level and decreasing uniformly to zero within the distance set out for a fixed source of ignition in MRA LPG Code of Practice B1	Zone 2
Cylinders within a building conforming to MRA LPG COP B1	a. Within the building.	Zone 2
	b. Outside any doorway, low level ventilators or any opening into the store up to 1,5 m above ground level and decreasing uniformly to zero within the distances set out for a fixed source of ignition in Table A of MRA LPG Code of Practice B1	Zone 2
Storage Tanks	a. Within 1,5 m from the discharge orifice of liquid level detection devices, e.g. fixed liquid level gauges or rotary or slip gauges.	Zone 1
	b. Up to 1,5 m above ground level and decreasing uniformly to zero within the distances set out for a fixed source of ignition in MRA LPG Code of practice A1	Zone 2
Relief Valve Discharge	a. Within direct path of discharge.	Fixed electrical equipment should not be installed.
	b. Within 1,5m in all other directions from pint of discharge.	Zone 1
	c. Beyond 1,5m but within 4,5m (3m in the case of tanks of water capacity not exceeding 2 500 litres) in all other directions from point of discharge.	Zone 2
Tank for Product Transfer Vehicle Connections	a. Within 1,5m in all directions from a point where connections are regularly made or disconnected or product transfer.	Zone 1

	b. Beyond 1,5m but within 4,5m from point of connection or disconnection	Zone 2
Pumps, compressors and Vaporisers other than Direct Fired	<p>(a) Outdoor in open air at or above ground level</p> <p>a. Within 1,5m in all directions b. Beyond 1,5m but within 4,5m in all directions</p> <p>Note: Where high standards of maintenance of pumps and pump seals obtain, the area within 1,5m in all directions from the pump may be classified as Zone 2.</p> <p>(b) Indoor location with adequate ventilation</p> <p>Entire room and any adjacent room not separated by a vapour-tight partition</p>	<p>Zone 1 Zone 2</p> <p>Zone1</p>
Vent Stack	<p>a. Within direct path of discharge</p> <p>b. Within 1,5m in all directions</p> <p>c. Beyond 1,5m but within 4,5 min all other directions from the point of discharge</p>	<p>Zone 0</p> <p>Zone 1</p> <p>Zone 2</p>
Cylinder Filling Points	<p>a. Indoor Location</p> <p>Entire Room Outside room to within 1,5m of filling room</p> <p>b. Outdoor Location</p> <p>Within 1,5m of filling point Within 16,5m of filling point</p> <p>Cylinder maintenance Room</p> <p>Entire Room Within 7,5m of maintenance room</p>	<p>Zone 1 Zone2 Zone1 Zone2 Zone1 Zone2</p>

Appendix D: Flow Diagram for Cylinder Filling



Appendix E: Recommended Personal Protective Equipment

- E.1 Personal protective equipment should be worn by personnel working in filling plants to minimise the risk of accident or injury.
- E.2 All clothing worn shall be antistatic to minimise the risk of inducing sparks. Fabrics such as nylon should not be worn as these can increase the severity of burns in a fire situation.
- E.3 Protective footwear with covered impact resistant toe-caps should be worn by all personnel. There should be no steel tips on sole or heels.
- E.4 Gloves to resist cold burns should be worn by all relevant personnel, e.g. those involved in bulk transfer or filling of LPG. Eye protection is also recommended for such operations.
- E.5 Other than these specific items, good industrial practice should be followed to reduce the risks of a normal place of work.

Appendix F: Cylinder Maintenance Operations

F.1 Periodic Examination and Testing

Periodic examinations/testing shall be carried out in accordance with the requirements of MSA EN 1440:2005, MSA EN 1803: 2002 or other written industry standard or scheme endorsed by a competent person who ensures adequate levels of safety.

F.2 Treatment of Defective Cylinders

- F.2.1 Reference should be made to MSA EN 1440:2005 and/or MSA EN 1803:2002 for rejection limits relating to physical and other faults on defective cylinders segregated in accordance with 6.1.3. Cylinders which are considered unsuitable for further service should be completely emptied, gas freed and destroyed as specified in MSA EN 1440:2005 and/or MSA EN 1803:2002
- F.2.2 For repairs involving welding and/or de-denting or any other hot work cylinders shall be depressurised to atmospheric pressure and gas freed. All such hot work repairs should be referred to cylinder reconditioning specialists. After satisfactory repair and hydrostatic test the cylinders shall have a new or reconditioned valve fitted in accordance with 3.3 and the valve-bung joints checked for absence of leaks.
- F.2.3 For other defects requiring the removal and/or replacement of valves or internal fittings, cylinders shall be depressurised to atmospheric pressure, the contents being discharged in a safe manner, see 4.9.5 This shall be carried out in a designated zone 1 area or otherwise the cylinders shall be fully gas freed.
- F.2.4 For minor defects not covered by A.6.2.2 or A.6.2.3 the necessary repairs shall be carried out in a safe manner.

F.3 Surface Treatment, Cleaning and Painting of Cylinders

- F.3.1 Cylinders which have surface rust, or deposits that cannot be removed by other cleaning methods, and which require complete surface treatment, should be devalved, gas freed and plugged prior to being shot-blasted, metal sprayed if required, painted and re-valved in accordance with A.6.2.
- F.3.2 It is not necessary to de-valve or gas free cylinders segregated in accordance with 5.1.5 requiring only cleaning or repainting provided that the valves are closed and suitably protected. Where heat is used during the washing or drying process care shall be taken to ensure that cylinders are not overheated, i.e. to the extent that excessive internal pressure is developed.
- F.3.3 Cylinders should preferably be painted in the following colours:

Propane,	Signal Red to BS 381C:1996
Butane,	Blue

LPG mix, Yellow

Note: Colours chosen should not conflict with MSA EN 1089-3:2004 or MSA EN ISO 407:2004.

DRAFT

Appendix G: Sample calculations of maximum permissible fill

Calculate the maximum possible fill taking account of fill tolerance for the filling/check weight scales to be used:

Maximum fill (kg) = (Actual Cylinder Water Capacity (litres) x Filling Ratio*) minus fill tolerance

* Filling ratios (0,95 x Density @ 40°C) need to be established by reference to MSA EN 1439:2005. Densities may be established by practical experience or by reference to MSA EN 13096:2003, MSA EN 13099:2003 and BS 4250:1997.

DRAFT

Appendix H: References

MSA EN 1089 3: 2004	Transportable gas cylinders. Gas cylinder identification (excluding LPG). Colour coding
BS 381C: 1996	Specification for colours for identification, coding and special purposes
BS 476-20: 1987	Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)
BS 750: 2006	Specification for underground fire hydrants and surface box frames and covers
MSA EN ISO 407: 2004	Small medical gas cylinders. Pin-index yoke-type valve connections
MSA EN 1440: 2005	LPG equipment and accessories. Transportable refillable welded and brazed steel liquefied petroleum gas (LPG) cylinders. Periodic inspection
BS 1710: 1984	Specification for identification of pipelines and services
BS 4089: 1999	Specification for metallic hose assemblies for liquid petroleum gases and liquefied natural gases
BS 4250:1997	Specification for commercial butane and commercial propane
MSA EN 13322-1: 2003	Transportable gas cylinders. Refillable welded steel gas cylinders. Design & construction. Carbon steel
BS 5306-0: 1986	Fire extinguishing installations and equipment on premises. Guide for the selection of installed systems and other fire equipment
BS 5306-1: 2006	Code of practice for fire extinguishing installations and equipment on premises. Hose reels and foam inlets
BS 5306-2:1990	Fire extinguishing installations and equipment on premises. Specification for sprinkler systems
BS 5306-3: 2003	Fire extinguishing installations and equipment on premises. Code of practice for the inspection and maintenance of portable fire extinguishers
BS 5306-4:2001	Fire extinguishing installations and equipment on premises. Specification for carbon dioxide systems

MRA DRAFT FOR CONSULTATION PURPOSES - NO LEGAL VALUE

MSA EN 60079-14: 2003	Electrical apparatus for explosive gas atmospheres. Electrical installations in hazardous areas (other than mines)
MSA EN ISO 17292: 2004	Metal ball valves for the petroleum, petrochemical and allied industries
MSA EN 13096: 2003	Transportable gas cylinders. Conditions for filling gases into receptacles. Single component gases
MSA EN 13099: 2003	Transportable gas cylinders. Conditions for filling gas mixtures into receptacles
BS 7863:1996	Recommendations for colour coding to indicate the extinguishing media contained in portable fire extinguishers
BS 7867: 1997	Specification for portable fire extinguishers for use in aircraft
MSA EN 3-3: 1996	Portable fire extinguishers. Construction, resistance to pressure, mechanical tests
MSA EN 3-6: 1996	Portable fire extinguishers. Provisions for the attestation of conformity of portable fire extinguishers in accordance with EN 3 Part 1 to Part 5. Amendment 1
MSA EN 3-7: 2004	Portable fire extinguishers. Characteristics, performance requirements and test methods
MSA EN 1803: 2002	Transportable gas cylinders. Periodic inspection and testing of welded carbon steel gas cylinders
PD CLC/TR 50404: 2003	Electrostatics. Code of practice for the avoidance of hazard due to static electricity
BS 7863:1996	Recommendations for colour coding to indicate the extinguishing media contained in portable fire extinguishers
MSA EN 3	Portable fire extinguishers
MSA EN 1439: 2005	LPG equipment & accessories. Transportable refillable welded and brazed steel liquefied petroleum gas (LPG) cylinders. Procedure for checking before, during and after filling.
MSA EN 60079-10:2003	Electrical apparatus for explosive gas atmospheres Classification of hazardous areas

LEGAL

Occupational Health and Safety Authority Act, Chapter 424 Laws of Malta

Work Place (Provision of Health and, or Safety Signs) Regulations. (L.N. 45 of 2002)

The Measuring Instruments Regulations, L.N. 221 of 2006

MRA DRAFT FOR CONSULTATION PURPOSES - NO LEGAL VALUE

Control of Major Accident Hazard (COMAH) Regulations (L.N. 37 of 2003 as Amended by L.N. 6 of 2005)

Transportable Pressure Equipment Regulations (L.N. 331 of 2002)

DRAFT

MRA LPG CODES OF PRACTICE	
<u>Number</u>	<u>DESCRIPTION</u>
<u>GROUP A - BULK VESSELS</u>	
A1	Design and Installation
A2	Examination and Inspection
A3	Buried/Mounded LPG Storage Vessels
A4	Purging LPG Vessels and Systems
A5	LPG Central Storage and Distribution Systems for Multiple Consumers
<u>GROUP B - SMALL CYLINDERS STORAGE AND FILLING</u>	
B1	Storage of Full and Empty Vessels
B2	Recommendations for the Safe Filling of LPG Cylinders at Depots
B3	Hazard Information and Packaging for Commercial LPG Cylinders
<u>GROUP C - LPG DRIVEN MACHINERY</u>	
C1	Autogas Installations
C2	The Safe Use of LPG as a Propulsion fuel for boats, yachts and other craft
C3	Automotive LPG Refuelling Facilities
C4	Gas Installations for Motive Power on Mechanical Handling and Maintenance Equipment
<u>GROUP D - ANCILLARY EQUIPMENT</u>	
D1	Hoses for the Transfer of LPG in Bulk: Installation, Inspection, Testing & Maintenance
D2	Safety Valves
D3	Valves for Transportable LPG Containers
D4	Flow rates up to 80 litres/min in Installations dispensing Road Vehicle Fuel
D5	Flow rates above 80 litres/min between Mobile Equipment and Fixed LPG Storage
D6	LPG Piping Systems: Design & Installation
<u>GROUP E - LPG CYLINDER USAGE AT DIFFERENT PREMISES</u>	
E1	The Use & Storage of LPG in Cylinders at Residential Premises
E2	The Storage and Use of LPG on Construction Sites
E3	Use of Propane in Cylinders at Commercial and Industrial Premises