MRA LPG

Code of Practice D3:2008

Ancillary Equipment

Valves for Transportable LPG Cylinders

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 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.

The MRA

LPG Code of Practice D3

Valves for Transportable LPG containers

Foreword

Codes of Practice D2 and D3 cover the technical requirements for valves and fittings specifically designed for LPG service.

A number of relevant European Standards have been published (although it should be noted that some of these are being progressed as International Standards where amendment may take place). Such standards should be used in preference to this Code of Practice for new valves in areas where they overlap. It is intended that MRA LPG Code of Practice D3 be fully reviewed when CEN and ISO work programmes are completed and their standards published.

At the time of the preparation such standards were:

MSA EN 12864 – Low-pressure, non adjustable regulators having a maximum outlet pressure of less than or equal to 200 mbar, with a capacity of less than or equal to 4Kg/h, and their associated safety devices for butane, propane of their mixture

> Note: Regulator connections are described in this standard. These are compatible with Code of Practice D3. Work is in progress within CEN to develop the matching specification for cylinder valve outlet threads.

MSA EN 13152 – Specification and testing of LPG cylinder valves. Self closing.

MSA EN 13153 – Specification and testing of LPG cylinder valves. Manually operated.

Section 1: Introduction, Objective, Scope and Definitions

1.1 Introduction

Code of Practice D3 is not intended to be retrospective and shall not apply to existing service valve designs and materials with compatible connections which have proved satisfactory in service.

Continued manufacture of these valves shall however be subjected to the quality control procedures laid down in this Code of Practice.

1.2 Objective

1.2.1 This Code of Practice is intended to set standards for the key technical requirements for service valves for LPG cylinders and their connectors.

1.3 Scope

1.3.1 This Code of Practice covers the materials of construction, design, manufacture, testing and maintenance of valves with tapered stem threads in accordance with the relevant parts of BS EN 13322-1:2003 or other accepted designs suitable for the conveyance, storage and use of LPG as defined in BS 4250:1997or equivalent within a service temperature range of minus 20 degrees C to 50 degrees C.

1.3.2 Requirements include details of cylinder neck threads, valve stem threads, service valve connectors and associated equipment for vapour and/or liquid service

1.3.3 Valve Dimensions

Critical dimensions are given for

(i) the inlet and outlet connections that provide for interchange ability of equipment and
(ii) stem threads. It does not provide dimensions for general valve design.

Valve body stem threads are specified to be compatible with refillable cylinders that
comply with relevant specifications issued by MRA

1.3.1.1 Appendix A gives details of 'valving' of cylinders.

1.3.1.2 The scope does not include:-

- Self closing connections for vapour service which are opened automatically as the equipment mating piece is assembled, and closes on disconnection.

- Valve bodies made by processes involving brazing, soldering, or welding of attachments considered to be part of the valve body except for dip/eduction tubes.

Section 2: General

2.1 Definitions

For the purposes of this Code of Practice the following definitions apply.

2.1.1 **Service Valve**
A shut -off valve designed to isolate the cylinder from the service application.

2.1.2 **Valve Body**
The major valve component including a cylinder connection and service connection and, where applicable, provision for pressure relief, fixed liquid level, etc.

2.1.3 **Spindle**
The element of the valve which when operated causes the sealing member to open or close.

2.1.4 **Seating Face**
The fixed contact face for completing the seal against LPG flow.

2.1.5 **Valve Stem**
The male threaded connection to fit the cylinder neck.

2.1.6 **Valve Outlet Inlet**
The valve service connection.

2.1.7 **Eduction Tube**
A tube fitted to the valve to allow withdrawal of LPG, either in the liquid or vapour phase, with the cylinder in its normal operating position.

2.1.8 **Fixed Liquid Level Gauge**
A bleed valve used in conjunction with a dip tube to determine the maximum permitted liquid level in a cylinder when being filled.

2.1.9 **Dip Tube**
A tube of predetermined length positioned to indicate liquid level when a bleed valve is opened. (Used in conjunction with 2.1.8).

2.1.10 **Vent Valve**
A control valve designed to vent LPG to atmosphere through an outlet orifice not greater than 1.4mm diameter.

2.1.11 **Excess Flow Valve**
A device designed to close when the liquid or vapour passing through it exceeds a predetermined flow rate/pressure drop and which reopens when the pressure is restored.

2.1.12 **Back Pressure Check Valve**

A non return valve designed to close automatically and prevent the reverse flow of vapour or liquid.

2.1.13 **Liquid Filler Valve**

A valve designed for liquid fill service only.

2.1.14 **Self Closing Valve**

A valve designed to open automatically as the equipment is connected and closes automatically on disconnection.

2.1.15 **Vapour Liquid Valve**

A valve designed so that either vapour or liquid may be obtained without inverting the cylinder. The valve shall have separate vapour and liquid service connections.

2.1.16 **Thread Sealant**

A material applied to a taper thread to effect a gas tight joint.

2.1.17 **Pressure Relief Valve (Safety Valve)**

A device which is in direct contact with the vapour space, and designed to open and close within predetermined pressure limits.

2.1.18 **Nominal Set Pressure**

The nominal pressure marked on the valve body at which the pressure relief valve is set and specified to start to discharge.

2.1.19 **Flow Rating Pressure**

The pressure at the inlet of a pressure relief valve which is used for establishing its rated flow capacity.

2.1.20 **Certified Discharge Capacity**

The discharge capacity permitted to be used as a basis for the application of the pressure relief valve quoted in cubic metres of free air at standard temperature and pressure.

2.1.21 **Leak**

An unintended flow of gas or liquid.

During testing this means:

- *Pneumatic Test.* In excess of 15 cm^3/h of air or nitrogen when corrected to 1 013 mbar absolute and 15℃.
- *Hydraulic Test.* No visible leakage, or pressure drop during the stated period.

2.1.22 **Prototype Test**

A test or series of tests directed towards approval of a new design.

2.1.23 **Cylinder Neck**
The part of the cylinder that has the female threaded connection for the cylinder valve stem.

2.1.24 **Proving Tests**
Tests carried out on representative samples of the first production run of valves to verify the operating characteristics.

2.1.25 **Associated Equipment**
Any item connected to the valve to enable the valve to function.

2.1.26 **Back Sealing**
The facility to create a gland seal by fully opening the valve.

2.1.27 **'Quick-Coupling'**
A coupling which enables a non threaded union between a cylinder valve and regulator etc. to be easily effected without the use of tools.

2.1.28 **Sealing Cap Plug**
A secondary means of closure for sealing the service connection of the valve during transit and storage.

2.1.29 **Fixed Automotive Installation**
A non demountable cylinder which forms a permanent part of the vehicle equipment installation.

2.1.30 **Customer Seal**
A non metallic seal in quick-coupling valves which ensures a leak-tight joint between the cylinder valve and the regulator attachment.

2.2 Information to be supplied by the Purchaser and Manufacturer

2.2.1 Information to be supplied by the Purchaser.

The Purchaser shall inform the manufacturer of the following:

(a) Name(s) of gas(es) for containment i.e. Propane/Butane or a mixture thereof.
(b) Service application including any adverse condition.
(c) Service connection number in accordance with this Code of Practice.
(d) Stem thread size.
(e) Pressure relief valve requirements.
(f) Details of optional markings required.
(g) Excess flow valve requirements (See 4.1.13 and 5.2.4).
(h) Length and orientation of eduction and/or dip tube (where relevant).

2.2.2 Information to be supplied by the Manufacturer

The manufacturer shall, on request, supply to the Purchaser:

(a) A drawing showing the operative dimensions of the valve.
(b) Materials of construction.
(c) Valve body hydraulic test pressure.
(d) Drawing showing layout of stamped marking.
(e) Test certificates.
(f) Flow characteristics of the valve.
(g) Impact test if required (See 4.1. 16).

Section 3: Material Requirements

3.1 General

Materials, components and associated equipment, shall be compatible with LPG and be suitable for the service life of the valve, which shall be a minimum of 10 years.

3.2 Valve Components

In selecting an appropriate material for valve components, it is important to design not only for adequate strength in service but consideration should be given to other modes of possible metallic failure, such as atmospheric corrosion, brass dezincification, stress and electrolytic corrosion, shock loads, fatigue, etc.

3.3 Valve Bodies

Valve bodies in copper alloys shall be machined from leaded brass to grade CZ 122 or CZ 128 of MSA EN 12165:1998 or MSA EN 12163:1998.

The manufacturer may, with the agreement of the purchaser, supply an alternative grade of brass. Mechanical properties of such an alloy shall not be less than those specified for the materials above.

3.4 Non-metallic Materials

3.4.1 All non-metallic materials shall be compatible with LPG.

3.4.2 Rubber type materials shall meet the requirements of MSA EN 549 and the following:

- Temperature class A2.
- Nominal hardness class H3 unless otherwise agreed between manufacturer and purchaser to meet specified functional tests.
- Shall be ozone resistant.
- Shall have a unique material reference.
- The material shall satisfy the tests set out in MSA EN 549 including:
  - Hardness
  - Tensile strength
  - Elongation at break
  - Compression set
  - Resistance to ageing
  - Resistance to LPG
  - Resistance to ozone
- Manufacturers shall declare their method of quality control of production components. See normative references A and B in MSA EN 549.

Their declared data shall include at least that required by MSA EN 549 and shall be documented.

SECTION 4: SERVICE VALVE DESIGN AND CONSTRUCTION

4.1 Service Valve Design Criteria

4.1.1 Valves shall be suitable for a service life to suit the re-qualification period of the cylinder of less than 10 years and be capable of operating satisfactorily under the extreme conditions of an environment which could cause a pressure rise in the cylinder contents up to the discharge pressure of the relief valve.

4.1.2 Valve bodies shall be capable of withstanding the hydraulic test pressure of any cylinder to which they are fitted.

4.1.3 Gland assemblies shall be secured by a method that will prevent loosening during conveyance or use. When a gland assembly is not locked, its security in service shall be satisfactorily demonstrated (See Appendix B).

4.1.4 Design and manufacture of valves shall be such that they will not leak during transit as a result of vibration (See Appendix B).

4.1.5 It shall not be possible to withdraw the spindle under normal operating conditions.

4.1.6 Pressure relief valves when fitted shall comply with MRA LPG Code of Practice D2 and shall have uninterrupted contact with the vapour space.

4.1.7 Hand wheel dosing torques shall not exceed those which are compatible with the materials of construction and valve design.

4.1.8 Dip/eduction tubes shall be secured in a manner that shall prevent them from becoming loose or detached during conveyance or use.

4.1.9 The valve body stem shall be of sufficient strength to withstand the maximum valving torque specified in Table 4, Appendix A, without overstressing.

4.1.10 Manufacturing tolerances of component parts shall be established to enable interchange ability between units of the same design.

4.1.11 All pressure containing parts, excluding sealing caps and plugs fitted to the valve body, shall withstand the hydraulic test pressure specified for the valve.

4.1.12 Diameters of main gas passages in valve stems shall not be larger than the values shown in Table 1. In selecting a suitable diameter

consideration shall be given to the strength required to withstand the valving torque and general handling.

In the case of vapour/liquid valves with two passages through the stem, the sum of the hole area shall not exceed 80% of the area of the maximum hole against the relevant stem thread size shown in Table 1.

There shall be a minimum thickness of 1 mm between passages and/or external surfaces.

TABLE 1

Maximum diameter of holes through Valve Stem and Seating Face

Valve Stem Type	Maximum Diameter of Hole Through Valve Body Stem (mm)	Maximum Orifice Through Valve Seating Face	
		Vapour (mm)	Liquid (mm)
M 26 x 2	-	-	-
¾" NGT	17.0	8	3

4.1.13 The passageways (with the exception of those for relief valves) through the stem of the valve, or the cylinder if this is smaller, shall not exceed 3 mm (1/8 ") diameter for liquid and 8mm diameter for vapour unless protected by an excess flow valve (see Section 7).

4.1.14 Seats and seals shall be capable of withstanding the effects of such repeated operations as are agreed between the manufacturer and purchaser. Where a soft seat is employed, a metal to metal seal shall be achievable if the soft seat is missing.

4.1.15 Outlet sealing caps/plugs (where fitted) shall meet the requirements of Section 9.

4.1.16 Where the valve will not be protected by a shroud or cover, the valve bodies shall be capable of withstanding an impact test. Impact energies shall be agreed between manufacturer and purchaser. A typical impact test rig is illustrated by Fig. 4.

4.1.17 Where connections include a non-metal joint seal, the material shall be compatible with the gas service and shall not creep or flow beyond limits allowed by design.

4.2 Service Connections

4.2.1 Threaded valve service connections shall be as follows:-

Table 2a

LPG	Connection No.	Figure
Both LPG Mix and Propane Vapour	G.1 Threaded Connection 20 x 1.814 L.H.	1

Note: Connection is included in MSA EN 15202

4.2.2 'Quick-coupling' valve service connections shall be as follows:-

Table 2b

.LPG	Connection No	Figure
LPG Mix	G.54 – Quick Coupling Diameter 22	2

4.2.3 Liquid Service Connections for Propane or Butane shall be as follows:-

Table 2c

Connection No.	Figure
G.29 1/1/4 x 5 ACME liquid service	3

Section 14 of this Code of Practice specifies the marking of the service connections.

4.2.4 Valve Dimensions

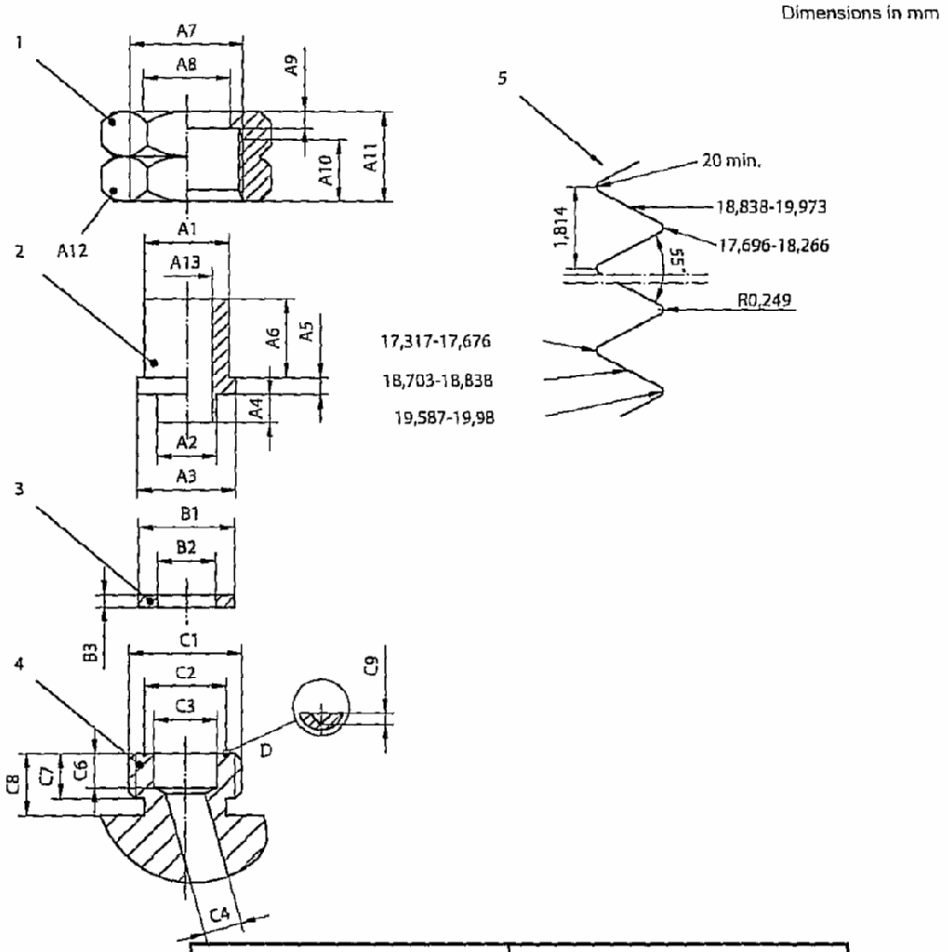
Unspecified dimensions and machined finishes shall be agreed by the Purchaser and Manufacturer.

Selection of valve body and connector bore diameters shall be determined by the application for the gas, the rate of flow required, the gas service pressure, and the required mechanical strength of the connection. The ability of the connection and valve to withstand all mechanical, pressure and thermal stresses under all anticipated service condition is paramount.

4.3 Gauging

Gauging of 3/4" NGT is contained in Federal Standard H28/12 and ANSI/ASME B1.20.1

For gauging of all other dimensions and threads standard engineering gauges, as appropriate, shall be used.



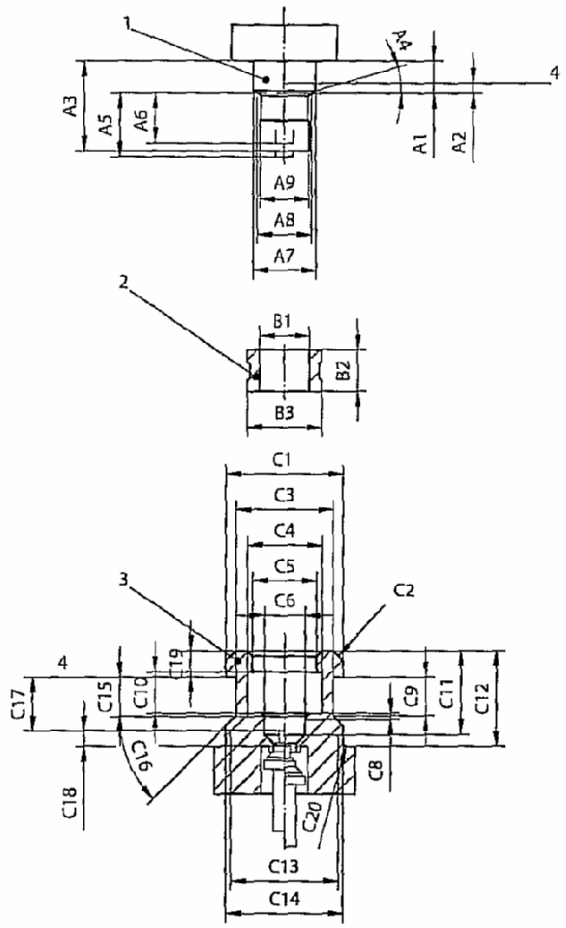
Key

1 Nut
2 Connector
3 Seal
4 Valve
5 Screw

Connector/Nut		Seal	
A1	Ø 14,80 - Ø 15	B1	Ø 16,8 - Ø 17
A2	Ø 10,5 - Ø 10,6	B2	Ø 10,2 - Ø 10,4
A3	Ø 17,4 - Ø17,5	B3	2,0 – 2,2
A4	4,8 – 5,2	NBR or equivalent	
A5	2,9 – 3,1	EN 549 A2/H3	
A6	14 min.	Valve	
A7	20 x 1,814 L.H. ISO 228-1	C1	20 x 1,814 L.H. ISO 228-1
A8	Ø 15,15 - Ø15,26	C2	Ø 14,3 – 14,7
A9	2,9 – 3,1	C3	Ø 11,1 – 11,3
A10	11 min.	C4	Ø 6,8 - Ø 7,2
A11	15,8 – 16,2	C5	R0,3 – R0,7
A12	25 A/F	C6	6,0 – 6,3
A13	8,4 max.	C7	7,0 – 10,0
		C8	11 min.
		C9	0,5 90°

Figure 1 – Type G.1 – Threaded connection 20 x 1,814 L.H.

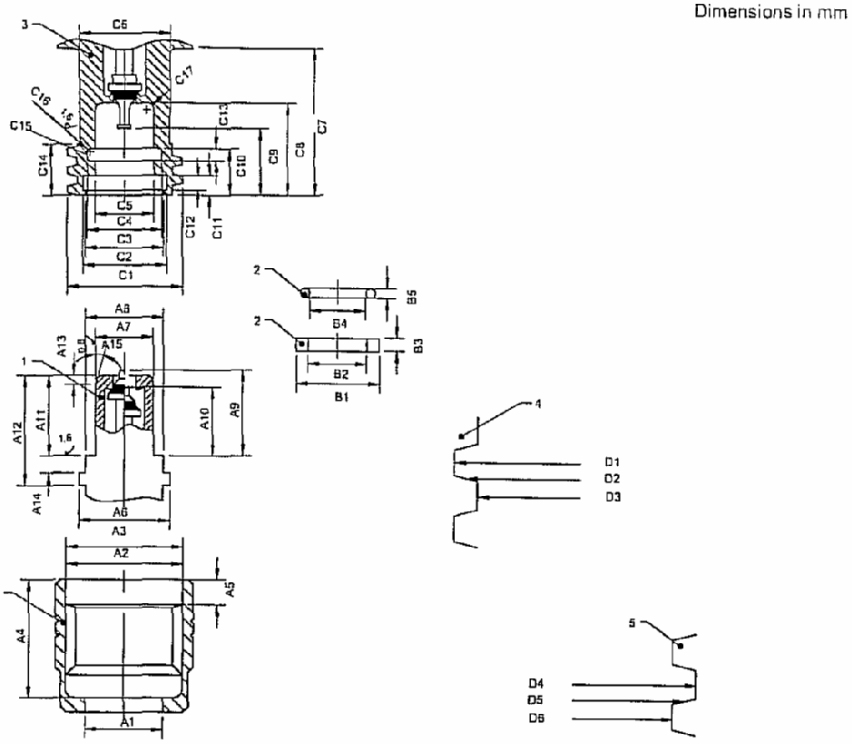
Dimensions in mm



Key		Connector		Seal		Valve			
1	Connector	A1	5,6 – 6,0	B1	Ø 9,65 - Ø 9,75	C1	Ø 21,9 - Ø 22,1	C11	15,1 min.
2	Seal	A2	1,8 – 2,2	B2	7,1 – 7,3	C2	Ø 18,7 - Ø 19,1 x 45°	C12	16,1 min
3	Valve	A3	13 – 15	B3	Ø 14,2 - Ø 14,35	C3	Ø 18,25- Ø 18,55	C13	Ø 20,0 ref. C15
4	Datum	A4	29° - 31°	NBR or equivalent		C4	Ø 14,1 - Ø 14,4	C14	Ø 22,0 - Ø 22,15
		A5	10,025 max.	EN 549 A2/H3		C5	Ø 12,45 - Ø 12,6	C15	6,9 – 7,2
		A6	6,25 max.			C6	Ø 9,05 - Ø 9,15	C16	44° - 46°
		A7	Ø 12,3 - Ø 12,4			C7	0,6 – 1,0 x 45°	C17	8,9 – 9,5
		A8	Ø 9,8 ref. A2			C8	0,3 – 0,6 x 45°	C18	2,65 min.
		A9	Ø 8,5 - Ø 9,0			C9	7,1 – 7,3	C19	3,4 – 3,6
						C10	7,1 – 7,4	C20	R0,5 – R0,8

Figure 2 – Type G.54 – Quick Coupling – Diameter 22

Dimensions in mm



Key	
1	Connector
2	Typical seal (non metallic) (Seal ref. 114 BS 1806)
3	Valve
4	External 1 ¼" x 5 ACME 2G ANSI/ASME/B1.5
5	Internal 1 ¼" x 5 ACME 2G ANSI/ASME/B1.5

Screw	
D1	Major Ø 31,75 - Ø 31,49
D2	Pitch Ø 28,98 - Ø 28,47
D3	Minor Ø 26,16 - Ø 25,39
D4	Major Ø 32,26 - Ø 32,77
D5	Pitch Ø 29,21 - Ø 29,72
D6	Minor Ø 26,67 - Ø 26,92

Connector	
A1	Ø 21,3 - Ø 21,5
A2	1 ¼" x 5 ACME 2G
A3	Ø32,8 - Ø33,0
A4	32,8 – 33,2
A5	6,8 – 7,2
A6	Ø 24,9 - Ø 25,1
A7	Ø 15,8 - Ø 15,85
A8	Ø 21,2 - Ø 21,4
A9	23,15 – 23,95 (Fully closed)
A10	17,85 – 19,85 (Fully open)
A11	21,9 – 22,1
A12	30,00 – 30,15
A13	2,37 – 2,63
A14	4,6 – 4,8
A15	15

Seal	
B1	Ø 23,00 - Ø 23,35
B2	Ø 15,82 - Ø 16,48
B3	3,3 – 3,7
B4	Ø 15,41 - Ø 15,67
B5	2,54 – 2,7

Valve	
C1	1 ¼" x 5 ACME 2G
C2	Ø 22,96 - Ø 23,11
C3	Ø 21,46 - Ø 21,59
C4	Ø 20,19 - Ø 20,44
C5	Ø 16,00 - Ø 16,13
C6	Ø 24,75 - Ø 25,25
C7	30 min.
C8	24,7 – 25,3
C9	18,00 – 18,54
C10	12,45 – 12,95
C11	5,33 – 5,46
C12	3,93 – 4,07
C13	3,23 – 3,37
C14	13,75 – 14,25
C15	Radii and surface finish to BS 1806
C16	R0,8
C17	R2 max.

Figure 3 – Type G.22 – 1 ¼ "x 5 ACME liquid service connection

Section 5: Liquid Service Valves

5.1 General

Valves for use in liquid service shall meet the requirements of this Code of Practice and shall take account of Section 4 and the additional requirements specified in clause 5.2.

5.2 Design and manufacturing requirements

5.2.1 Outlet connections and adaptors shall be 1 1/4" x 5 TPI ACME in accordance with Fig. 3.

5.2.2 The male and female parts of the connections shall incorporate a self closing valve which opens when coupled and closes on disconnection, the dimensions of which shall comply with Fig. 3 as appropriate.

5.2.3 All liquid service valves shall incorporate a manual shut off between the self closing valve and the cylinder.

5.2.4 Liquid service valves shall where appropriate incorporate an excess flow valve meeting the requirements of Section 7 (See also Table 1 and 4.1.13).

5.2.5 Eduction tubes shall be so designed that the filling and discharge capacities meet the requirements specified by the purchaser.

5.2.6 Eduction tubes and any other internal device shall be secured in a manner that will prevent them from becoming loose or detached during transport and use.

5.2.7 Consideration shall be given to the prevention of possible entrapment of liquid between manual shut off valves and self closing check valves.

Section 6; Liquid Filler Valves Which Do Not Form Part of Another Valve

6.1 General

Valves specifically designed for liquid fill service shall not be used for any other purpose.

They shall be designed in accordance with this Code of Practice, and shall take account of Section 4 and meet the additional requirements specified in paragraph 6.2.

6.2 Design and manufacturing requirements

6.2.1 Liquid filler valves shall incorporate either:

(a) two back pressure check valves, the outer one of which shall have a resilient seat; or
(b) a positive shut off valve and a back pressure check valve.

6.2.2 Back pressure check valves with resilient seats shall not leak within the definition of this Code of Practice.

6.2.3 Back pressure check valves with non-resilient seats shall be designed so that when closed the flow past the seat shall not exceed that of a 1.4mm diameter orifice.

Section 7: Excess Flow Valves Which Form Part of a Service Valve

7.1 General

Excess flow valves shall be designed in accordance with this Code of Practice and shall take account of Section 4 and meet the additional requirements specified in clause 7.2.

7.2 Design and manufacturing requirements

7.2.1 Excess flow valves shall be designed to close automatically at the rated flows of vapour or liquid specified by the purchaser, and shall re-open automatically when the differential pressure across the valve is equalised.

7.2.2 Excess flow valves shall be designed with a bypass, not to exceed 1.4mm diameter (or equivalent area) to allow equalisation of pressure.

Section 8: Fixed Liquid Level Gauges

8.1 General

Fixed liquid level gauges specifically designed for liquid level indication shall not be used for any other purpose.

They shall generally be designed in accordance with this Code of Practice, and shall take account of Section 4 and meet the following additional requirements specified in clause 8.2.

8.2 Design and manufacturing requirements

8.2.1 The bleed hole from a fixed liquid level gauge shall not be larger than 1.4mm diameter.

8.2.2 If the fixed liquid level gauge valve is removable from the main valve body, the vent hole in the main body shall not be larger than 1.4mm diameter.

8.2.3 The operating spindle of the fixed liquid level gauge valve shall be captive and shall not be removable from its valve body.

8.2.4 The length of the dip tube shall satisfy the requirements of the filling ratios as specified in the Motor Vehicles (Carriage of Dangerous Good by Road) Regulations (L.N. 211 of 2003 as amended by L.N. 349 of 2005).

8.2.5 Where the fixed liquid level gauge is connected to the main valve or directly into the cylinder by means of a thread, this will be 1/4" NPT to ANSI/ASME B1.20.1.

Section 9: Outlet Sealing Caps/Plugs

9.1 General

All service valves shall have a secondary means of closure for use during transit and storage. Hand wheel valves without secondary closure and self closing single seal valves shall be fitted with suitable sealing caps/plugs which shall meet the following requirements.

9.1.1 They shall be designed to withstand the service pressure and other conditions as defined in 4.1.1. Leakage shall not exceed the rate defined in 2.1.21.

9.1.2 They shall be designed to facilitate customer replacement.

9.1.3 Where the cap/plug is of the screw type, the direction of tightening and/or untightening shall be indicated. The method of operation for its removal shall be marked on the assembly.

9.1.4 It is recommended that sealing plugs put in service are chosen with a design catering minimise damage to the sealing face.

Section 10: Manufacture and Workmanship

10.1 Machining

All components shall be free from burrs and unnecessary sharp edges. Particular attention shall be paid to:

(a) sealing faces to ensure that there are no surface imperfections to impair sealing.
(b) concentricity of related features and components to ensure correct operation.
(c) thickness limits between passageways of gas/liquid valves to avoid cracking or drilling through. (See clause 4.1.12).

10.2 Screw Threads

Screw threads on metal components shall be formed by cutting or rolling and shall conform to the appropriate standard.

10.3 Cleaning

All components, sub-assemblies and assemblies shall be free from foreign matter.

10.4 Lubricants, Sealants and Adhesives

Where used on operating threads and seals, lubricants, sealants and adhesives shall be compatible with LPG and shall be to a specification agreed between manufacturer and purchaser.

10.5 Assembly and Assembly Torques

All components shall be assembled, with particular attention being given to the application of the assembly torques, to ensure the correct and proper operation of the valve in service.

Section 11: Prototype Testing

11.1 General

A new design of service valve shall be tested to ensure, as far as is possible, that the valve and its associated equipment are suitable for a service life at least 10 years.

11.2 Type Approval Tests

11.2.1 Prototype Sample Test

A representative sample of each new valve design shall be tested to ensure compliance with the design specification including rated flow capacities.

11.2.1.1 Hydraulic Pressure Test

One prototype valve body shall undergo a hydraulic pressure test at 45 bars. During this test, the pressure relief valve shall be blanked off when appropriate.

The test pressure shall be held for a period of not less than 2 minutes during which the valve shall not leak or fail.

11.2.1.2 It is recommended that valves, unless they can be regarded as proven from results of previous tests or experience, should be subjected to a conveyance test, such a test is given in Appendix B.

11.2.1.3 Gland/Seal Leakage Test

(a) Samples of hand wheel valve assemblies shall be set in the open position without back sealing and with the outlet sealed.

A gland pneumatic leakage test shall be carried out at a pressure not less than 7 bars.

(b) Samples of 'quick-coupling' valves shall be tested pneumatically for leakage passed the' customer seal' using a device which simulates a regulator connection. A pressure test at a pressure not exceeding 1 bar gauge shall be followed by a high pressure test at not less than 7 bar gauge applied with the main valve open, and applied to simulate the valve in service. The test device shall take account of the most adverse dimensional tolerances of connectors.

11.2.1.4 Valve Seat Leakage Test -Vapour

(a) Samples of hand wheel valve assemblies shall be set in the closed position at the design closing torque and with the outlet open to atmosphere. A seat pneumatic leakage test shall be carried out at a test pressure not less than 7 bars.

(b) Samples of 'quick-coupling' valve assemblies shall be tested pneumatically at a test pressure not less than 7 bars.

11.1.2.5 Valve Seat Leakage Test-Liquid

(a) Hand wheel valves shall be tested as 11.2.1.4 (a) above.

(b) Self closing valves, both male and female parts of the half coupling shall be tested pneumatically at a pressure of not less than 7 bars.

11.1.2.6 Fixed Liquid Level Gauges

Fixed liquid level gauges shall be tested pneumatically at a pressure of not less than 7 bars.

11.1.2.7 Excess Flow Valves

Three valves shall be tested to determine the closing flow. Each valve shall close within ± 10% of the nominal value.

11.1.2.8 Pressure Relief Valves

Pressure relief valves shall be tested in accordance with the relevant parts of the MRA LPG Code of Practice D2.

11.2.1.9 Endurance test for quick coupling valves

Tests shall be carried out to ensure compliance with the endurance tests for “Clip-on connections" in MSA EN 12864:2001 including connection and disconnection (5 000 cycles), and valve opening/closing tests (10 000 cycles). The valves shall show no .sign of excessive wear resulting from these tests.

11.2.1.10 Test Results

Those valves which fail any of the tests shall be examined to determine the cause of failure. If the failure was due to breakdown

of the test equipment, or suspected inaccurate readings, or faulty materials and/or workmanship, the tests shall be repeated.

If failures were due to a design fault, the design shall be rejected.

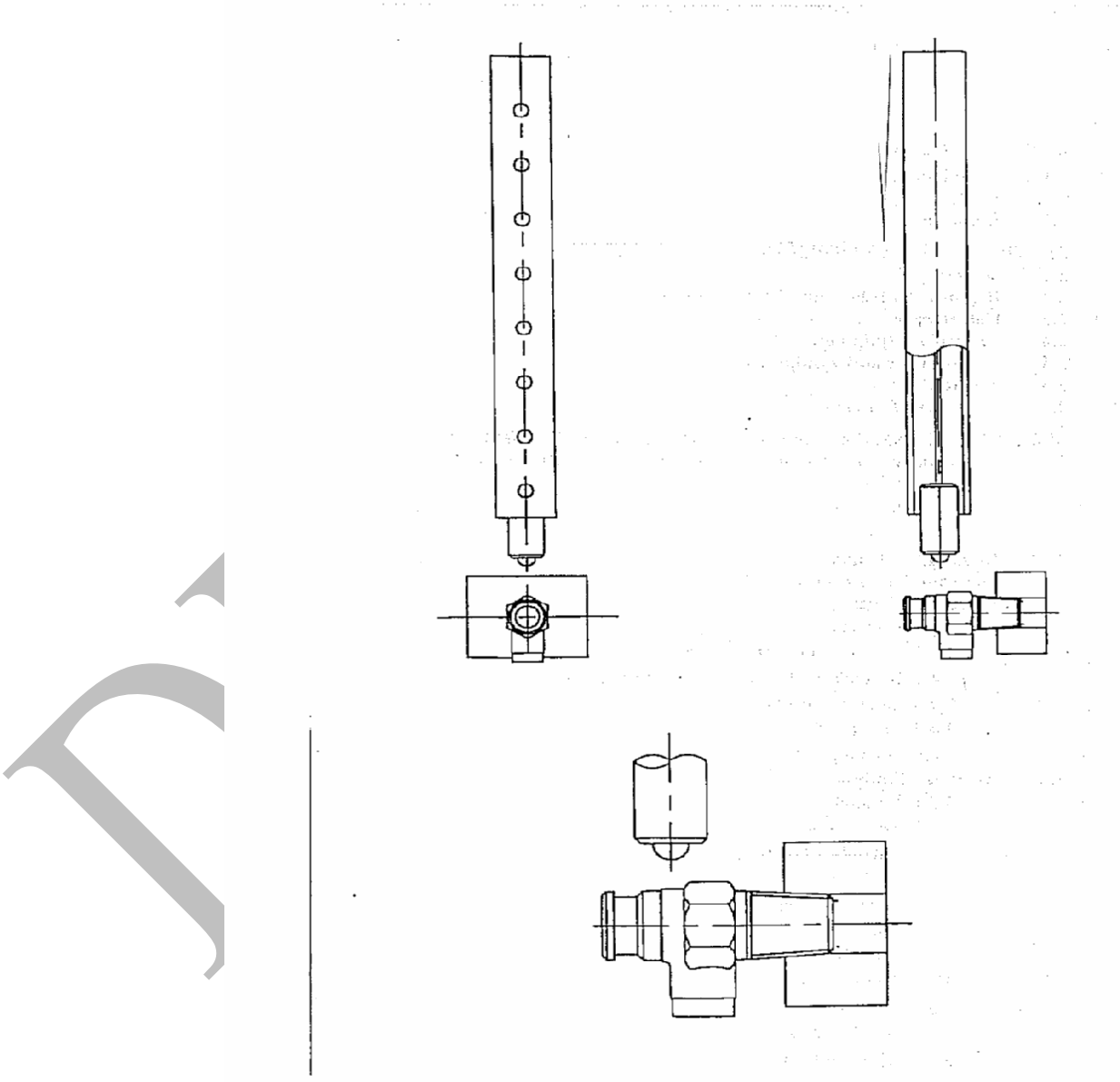


Figure 4. Typical Test Rig For Valve Impact Test.

Section 12: Pre-Production Testing and Inspection

12.1 Pre-production Tests

12.1.1 Hydraulic Test

On the first production batch of a new valve design one in 1000 machined valve bodies with a minimum of 3 sample bodies shall be subjected to an hydraulic test of 3 5 bar. The test pressure shall be held for a period of not less than 2 minutes during which the valve shall not leak or fail.

12.1.2 Proving Test

Representative samples of the first production batch of valve assemblies of each design shall be tested to prove that the rated flow capacities and other characteristics comply with the design specification.

Section 13: Production Inspection and Testing

13.1 Production Inspection

13.1.1 Materials and components shall be visually examined for freedom from surface flaws, laps (folds), inclusions and other imperfections.

Quality levels shall be agreed between the purchaser and manufacturer.

13.1.2 After assembly, each valve shall be inspected to ensure that it has been correctly assembled and that threads, etc. have not been damaged during manufacture. Hand wheel valves shall be opened hilly and closed to check ease and smoothness of operation and effectiveness of spindle retention, where appropriate.

13.1.3 There shall be random sampling of assembled valves in accordance with BS 6001-2:1993 or ISO 2859-2:1985. The valves shall be dismantled and all parts inspected to ensure compliance with this Code of Practice.

13.2 Production Testing

13.2.1 Gland Leakage Test

An agreed sample of hand wheel valve assemblies shall be set in the open position without back sealing and with the outlet sealed. A gland pneumatic leakage test shall be carried out at a pressure of not less than 7 bar gauge. Leaking valves shall be rejected.

13.2.2 Valve Seat Leakage Test - Vapour

13.2.2.1 Every hand wheel valve shall be set in the closed position at the design closing torque and with the outlet open to atmosphere. A seat pneumatic leakage test shall be carried out at a test pressure not less than 7 bars. Leaking valves shall be rejected.

13.2.2.2 All 'quick-coupling' valves shall be tested pneumatically at a test pressure not less than 7 bars. Leaking valves shall be rejected.

13.2.3 Valve Seat Leakage Test-Liquid

13.2.3.1 All hand wheel valve assemblies shall be tested as in 11.2.1.4 (a).

13.2.3.1 Self closing valves -both male and female parts of half coupling shall be tested pneumatically at a pressure of not less than 7 bars. Leaking valves shall be rejected.

13.2.4 "Customer Seal" Leakage Tests

An agreed sample of "quick coupling" valves shall be tested pneumatically for leakage past the "customer seal" at high and low pressure as set out for prototype testing in 11.2.1.3.

13.3 Final Inspection

On satisfactory completion of tests, each valve shall be dried and stamped with the date of test (care should be taken not to distort valve bodies) together with any other valve marking requirement specified in Section 14. Each valve shall then be visually examined for any signs of external damage, particularly to threads before being packed for despatch.

Section 14: Marking. Packing and Certification

14.1 Marking

14.1.1 Each valve shall be marked with the following information.

(a) Valve type number
(b) The nominal set pressure in bar of relief valve, where fitted.
(c) Date mark indicating the month and year of manufacture.
(d) An indication of the direction for opening and/or closing the valve, where applicable.
(e) Valve manufacturer's mark.

14.2 Packing

Valves shall be prepared for despatch in such a way as to minimise the possibility of damage to internal or external parts during storage and transit.

14.3 Certification

The manufacturer shall, on request, certify that the valves comply with this Code of Practice.

Section 15: Periodic In-Service Inspection, Testing and Maintenance of Valves

15.1 General

Valves should be subjected to periodic inspection, testing and maintenance at periods not less frequent than that of the cylinder to which they are fitted.

The service life of the valve must be satisfactory for the inspection periods being adopted.

15.2 Inspection at Filling

15.2.1 The valve shall be visually examined for defects including the following:

(a) Bent, deformed, contaminated, corroded, badly marked and scored bodies or those with cracks.
(b) Cross-threaded, damaged or stripped valve outlet threads/connections.
(c) Indication of having been subjected to excessive heat or having been in a fire.

Any valve exhibiting any of the above defects shall be destroyed. Contaminated valves may be cleaned as appropriate.

15.2.2 All service connection seals shall be tested and their integrity confirmed.

15.2.3 Seals and detachable components which are defective shall be replaced. It is essential that replacement seals meet the requirements of this Code and are approved by the original valve manufacturer.

Section 16: Reconditioning

16.1 General

No valve shall be re-used after removal from service unless it has been satisfactorily reconditioned in accordance with the design/manufacturer's recommendations. All components used must comply with the original design specification.

When reconditioning valves, all non metallic components, springs, pins, screws and nuts shall be scrapped and replaced with new components.

Valves which are reconditioned shall be proved, by appropriate tests, to be satisfactory for service and to meet the original design specification. Reconditioned valves shall be marked to indicate the reconditioner and the date of reconditioning.

All other requirements shall be in accordance with this Code of Practice. Replacement seals shall meet the same requirements as specified for 15.2.3.

APPENDIX A: Valving

A.1 General

A.1.1 Before a cylinder is 'valved,' it shall be visually inspected to ensure it is fit for service and not contaminated with foreign matter. The cylinder valve shall be visually inspected to ensure it is fit for service.

A.1.2 Cylinder neck and valve stem threads shall be inspected to ensure compliance with clause 10.1 and that they are compatible with each other.

A.1.3 An LPG compatible thread sealant shall be used.

A.2 Torque Values

A.2.1 Either a torque spanner or valving machine shall be used to ensure that a valve is satisfactorily tightened into the cylinder neck.

A.2.2 Table 4 gives a range of recommended valving torques for valves with tapered stems. The actual value selected for any valve and cylinder is dependent upon factors such as the thread tolerance, thread sealant used and orientation.

A.2.3 After the valve has been fitted to the cylinder, a check shall be made to confirm that thread engagement is correct.

A.2.4 Torque spanners and valving machines shall be calibrated in accordance with their manufacturer's recommendations.

TABLE 4

Recommended valving torques for copper alloy valves with tapered stem threads fitted to steel cylinders

Valve Stem Type	Minimum Nm	Maximum Nm
¾" NGT	110	240
M26 x 2	-	-

Note 1 - The torque values quoted are for use with PTFE tape thread sealant.

Note 2 - The table serves as a guide for the conditions stated in Note 1. If different sealants are introduced the torque values shown in the table may have to be changed to ensure:

(a) A gas-tight joint.

(b) The correct valve thread engagement.

Note 3 - The maximum valving torque allows for orientation of the valve and should not be exceeded.

Appendix B: Conveyance Test for Hand wheel Valve Assemblies

B.1 General

Security of gland assemblies during conveyance or use will be deemed to be satisfactorily demonstrated by use of the following test.

B.1.1 Test Procedure

B.1.1.1 Fit three prototype valves to LPG cylinders and charge the cylinders to normal operating pressure with the service gas or an inert gas.

B.1.1.2 Close each service valve by applying a normal closing torque in accordance with manufacturer's specifications.

B.1.1.3 Check the valve outlet connections, the screwed connections between the valve body stems and cylinder necks, and all other screwed connections that are subject to gas pressure for leakage with soap and water or other suitable solution.

B.1.1.4 Mark the relative position of each valve spindle to the valve body and the valve body as applicable to the cylinder neck, so that any movement can be detected.

B.1.1.5 Load the cylinders on a delivery vehicle in normal service and subject them to a journey period of 5 days or 500 miles whichever is the longer. At the end of the test period, check the points of leakage again with the above solution. Check the relationship of the spindle to the valve and the valve body to the cylinder neck as applicable. There shall have been no movement.

Appendix C: References

C.1 Standards

BS 341	Transportable gas container valves
MSA EN 12864:2001	Low-pressure, non adjustable regulators having a maximum outlet pressure of less than or equal to 200 mbar, with a capacity of less than or equal to 4kg/h, and their associated safety devices for butane, propane or t heir mixtures
MSA EN 12165:1998	Copper and copper alloys. Wrought and unwrought forging stock
MSA EN 12163:1998	Copper and copper alloys. Rod for general purposes
BS 3643-1:1981	ISO metric screw threads. Principles and basic data
BS 4250:1997	Specification for commercial butane and commercial propane
MSA EN 13322-1:2003	Transportable gas cylinders. Refillable welded steel gas cylinders. Design and construction. Carbon steel
MSA EN 13096:2003	Transportable gas cylinders. Conditions for filling gases into receptacles. Single component gases
MSA EN 1803:2002	Transportable gas cylinders. Periodic inspection and testing of welded carbon steel gas cylinders
MSA EN 6001-2:1993, ISO 2859-2:1985	Sampling procedures for inspection by attributes. Specification for sampling plans indexed by limiting quality (LQ) of isolated lot inspection
MSA EN 549:1995	Specification for rubber materials for seals and diaphragms for gas appliances and gas equipment
MSA EN 15202	LPG equipment and accessories. Essential operational dimensions for LPG cylinder valve outlet and associated equipment connections

C.2 STATUTORY INSTRUMENTS

Motor Vehicles (Carriage of Dangerous Good by Road) Regulations (LN 211 of 2003 as amended by L.N. 349 of 2005).

MRA LPG CODES OF PRACTICE

Number	DESCRIPTION
	GROUP A - BULK VESSELS
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
	GROUP B - SMALL CYLINDERS STORAGE AND FILLING
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
	GROUP C - LPG DRIVEN MACHINERY
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
	GROUP D - ANCILLARY EQUIPMENT
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
	GROUP E - LPG CYLINDER USAGE AT DIFFERENT PREMISES
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