Introduction

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About the Training Package

This training material is designed to provide you with learning support material that will help you to prepare for the Nationally Accredited Certification Scheme (ACS) changeover assessments from Domestic Natural Gas to Liquefied Petroleum Gas. You may want to attend a BPEC training course in order to gain a better understanding of the course content prior to sitting the assessments. There are many Bpec approved centres throughout the UK, where you can complete your training and assessment. If you choose to attend a training course, you will work in a classroom and workshop environment with the support of a tutor, working through this material. This training material contains six generic core Liquefied Petroleum Gas ACS modules (1 to 6) and four Liquefied Petroleum Gas appliance type modules (7 to 10). When you have completed the training you should be ready to sit the Domestic Natural Gas to Liquefied Petroleum Gas changeover ACS assessment. If you are attending a BPEC training course your tutor will give you further guidance at this point.

Nationally Accredited Certification Scheme Assessment Criteria, Domestic Natural Gas to Liquefied Petroleum Gas

The Nationally Accredited Certification Scheme (ACS) requires that individual gas fitting operatives are assessed on their competence to carry out safe gas work and are certified to that effect by a certification body (such as BPEC Certification Ltd). The certification body has demonstrated conformity with the International Standard ISO IEC 17024 through assessment and accreditation by an approved body, which is a signatory to the European Accreditation of Certification multilateral agreement. It is important that you are fully aware of what the ACS requirements for each module are, so we have included details of the assessment criteria here.

Domestic Natural Gas to Liquefied Petroleum Gas Changeover (CoNGLP1) Pre-requisites

Before any of the Domestic Natural Gas to Liquefied Petroleum Gas changeover assessments can be undertaken, you must hold a Certificate of Competence in:

- Any Core Gas Safety Assessment.
- A valid ACS aligned Gas Services S/NVQ.

Assessment introduction

Generic Domestic Natural Gas to Liquefied Petroleum Gas Changeover Assessment Criteria Modules 1-6

Module 1 Characteristics of Liquefied Petroleum Gas (LPG)

Module 2 Cylinder storage/location, safety requirements and sizing

Module 3 LPG Supply Pressures – operation of and positioning of emergency isolation, flow controls and valves for cylinders

Module 4 Gas emergency actions and procedures

Module 5 Installation of pipework and fittings for LPG (range of pipe sizes: 6mm to 28mm)

Module 6a Tightness testing LPG service and installation pipework in accordance with IGEM/UP/1B edition 3

And/or

Module 6b Tightness testing LPG installations in boats, yachts and other vessels (B)

Specific Assessment Criteria Units 7-11

Candidates must successfully complete generic competencies 1 to 6 and one or more of the domestic LPG sectors (PD), (RPH), (LAV) and (B)

Module 7 Permanent Dwellings (PD)

Module 8 Residential Park Homes (RPH)

Module 9 Leisure Accommodation Vehicles (LAV)

Module 10 Boats, yachts and other vessels (B)

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Liquefied Petroleum Gas Initial Changeover Assessment NG-LPG (Part A)

Module 1 Characteristics of Liquefied Petroleum Gas (LPG)

Satisfactory completion of the assessment in this Core Competency will provide evidence of competence in the characteristics of LPG.

The candidate must be able to answer correctly gas safety questions in the following topics relating to characteristics of LPG:

1. Types of commercial LPG (propane, butane)
2. Storage pressures for both gas types in cylinders and vessels
3. Specific gravity of LPG vapour and its effect in relation to air and natural gas
4. Vaporisation of LPG liquid and off-take – effects of temperature
5. Limits of flammability
6. Calorific value of LPG and its relationship to natural gas

Module 2 Cylinder storage/location, safety requirements and sizing

Satisfactory completion of the assessment in this Core Competency will provide evidence of competence in cylinder locations, safety requirements and sizing.

The candidate must be able to correctly answer gas safety questions in the following topics relating to cylinder locations, safety requirements and sizing:

1. Safety requirements, sizing of cylinders:
   (i) Sizes and marking of common Propane and Butane cylinders commercially available and recommended off-take to match appliance demand
   (ii) Requirements for linking cylinders through manifolds
   (iii) Areas where cylinders must not be located
   (iv) safety and security for single supply gas storage vessels and controls (not boats)
2. Gas Safety (Installation and Use) Regulations – HSC Approved Code of Practice and Guidance:
   (i) Regulation 6 General Safety Precautions 6(7)
   (ii) Regulation 6 General Safety Precautions 6(8). These can be cross-referenced if required
   (iii) Regulation 6 General Safety Precautions 6(9)

Module 3 LPG Supply Pressures – operation of and positioning of emergency isolation, flow controls and valves for cylinders

Satisfactory completion of the assessment in this Core Competency will provide evidence of competence in LPG supply pressures – operation and positioning of emergency isolation, flow controls and valves for cylinders.

The candidate must be able to answer correctly questions in the following topics relating to checking system pressure regulators, under and over pressure cut off and limited relief valves.

1. Recognition of supply pressures from gas storage cylinders:
   (i) High pressure stage
   (ii) Low pressure stage
2. Operation and positioning of gas storage cylinder fittings:
   (i) Pressure relief valve
   (ii) Cylinder valve
3. Operation and positioning of automatic changeover valves for cylinders
4. Types and sizing of gas regulators
5. Operation and positioning of emergency isolation valves
6. Gas Safety (Installation and Use) Regulations – HSC Approved Code of Practice and Guidance: Regulation 14 Regulators 14(2) and 14(4)
7. Minimum and maximum outlet pressures for BS 3016, EN 12864 and EN 13785 regulators
8. Lock-up pressure for BS 3016, EN 12864 and EN 13785 regulators
9. Identification of causes of over pressure conditions
10. Visible indicators (where applicable) of OPSO
11. Procedures when OPSO has operated
12. Identification of causes of under pressure conditions
13. Visible indicators (where applicable) of UPSO
14. Procedures for re-setting under pressure valves
15. Operation and positioning of the limited relief valve

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Module 4 Gas emergency actions and procedures

Satisfactory completion of the assessment in this Core Competency will provide evidence of competence in LPG emergency actions and procedures.

The candidate must be able to answer correctly gas safety questions in the following topics relating to LPG emergency actions and procedures:

Priorities of actions and responsibilities:

1. The action to take to deal with gas leakage with fire
   (i) Safety/fire precautions to be observed with cylinders

2. The action to take to deal with gas leakage without fire
   (i) Specific gravity and its effect in relation to air e.g. search techniques
   (ii) Effective methods of preventing/reducing dangerous concentrations of gas in atmosphere and at low level

3. Advice to occupants

4. Gas Safety (Installation and Use) Regulations – HSC Approved Code of Practice and Guidance:
   (i) Regulation 9 (5) Emergency controls.

Module 5 Installation of pipework and fittings for LPG (range of pipe sizes: 6mm to 28mm)

Satisfactory completion of the assessment in this Core Competency will provide evidence of competence in the installation of pipework and fittings for LPG, to make the connection between an appliance/equipment isolation valve and the appliance/equipment.

The candidate must be able to answer correctly gas safety questions in the following topics relating to domestic installation of pipework and fittings for LPG:

1. Flexible hoses (e.g. coloured band on cooker hose) and rigid connections standards suitability and use

2. High and low pressure hoses and connections – identification of types, condition and date of manufacture

3. Restrictions to length of hoses from regulator to low pressure nozzle and pigtails from cylinders to regulator/ change over valves – procedures for replacing pigtails

4. Pipe sizing to appliance requirements – including theoretical exercise

5. Jointing and cleaning agents for copper pipework used for LPG

6. The precautions and protection required when installing pipework for LPG

7. MP and LP meter locations which do not comply with BS 6400-3

8. Location and sizing for vent pipes on MP meter installations

9. Gas meters supplying mobile dwellings and boats

10. Where primary meters for a multi-occupancy building are grouped together

11. Notices fitted to meter installations and meter housings

Module 6a Tightness testing LPG service and installation pipework in accordance with IGEM/UP/1B edition 3

Satisfactory completion of the assessment in this core competency will provide evidence in testing for gas tightness for LPG as above. N.B. this performance criteria for testing for gas tightness is suitable for domestic, small commercial, residential park homes (RPH), and leisure accommodation vehicles (LAV) but NOT boats

1. Correct reading of pressure gauges

2. Air test pressure requirements where a regulator is fitted in section to be tested

3. Test pressures for installations with an operating pressure (OP) of 28mbar, 30mbar (LAV only) and 37mbar

4. Locating escapes

5. Actions for dealing with cylinder valves letting by

6. Effects of flexible connections used to connect cylinders on let-by tests

7. Use of electronic pressure gauge (calibration requirements)

8. Calculating permissible pressure drops for existing LPG installations with appliances (IGEM/UP/1B Edition 3 (Appendix 8))

Module 6b Tightness testing LPG installations in boats, yachts and other vessels (B)

Satisfactory completion of the assessment in this Core Competency will provide evidence of competence in testing for tightness for LPG on the low-pressure stage of the installation.

The candidate must be able to answer correctly gas safety questions in the following topics relating to LPG testing for tightness on installation pipework:

1. Correct reading of pressure gauges

2. Use of electronic pressure gauge (calibration requirements)

3. Procedures for locating escapes

4. Procedures for dealing with valves letting by

5. Determining permissible pressure loss as per BS 5482-3

6. Tightness testing principles

Additional specific competencies required to support generic fuel changeover CoNGLP1 – Natural Gas to LPG

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Module 7 Permanent Dwellings (PD)

This section contains the specific sector competencies required for Permanent Dwellings. However, it does not stand alone and must be used in conjunction with the Generic fuel changeover competencies (1 to 6).

The candidate must be able to answer correctly questions in the following topics relating to checking system pressure regulators, under and over-pressure shut-off and limited relief valves:

Range: All LPG fittings in Permanent Dwellings.

1. Recognition of supply pressures from gas storage vessels:
   (i) Medium pressure stage
2. Operation and positioning of first and second stage regulators
3. Identification of causes of under pressure conditions
4. Operation, positioning and visible indicators of under-pressure shut-off valves
5. Procedures for re-setting under-pressure shut-off valves
6. Operation and positioning of the limited relief valve
7. Advice to the customer on re-setting the under-pressure shut-off valve
8. Recognition of supply pressures to individual flats in multi-storey buildings
9. Recognition of additional final stage regulator controlling low pressure supplies in multi-storey buildings
10. Labelling requirements for intermediate and low pressure supplies in multi-storey buildings
11. Operation and positioning of vapour service shut-off valve

12a. Cylinders
   (i) Installation, location and protection
   (ii) Construction (including ventilation) of compartments, lockers and internal housings
   (iii) Safety precautions for storage and use

12b. Vessels
   (i) Installation
   (ii) Marking of common vessels commercially available for single supply
   (iii) Location

13. Jointing and cleaning agents for stainless and galvanised steel pipework
14. Ventilation requirements for pipework installed within ducts
15. Locations where LPG pipework should not be installed
16. Galvanised steel pipe and fittings, standards, suitability and use

Module 8 Residential Park Homes (RPH)

Satisfactory completion of the assessment in this Core Competency will provide evidence of competence in operation of and positioning of emergency isolation, flow controls. However, it does not stand alone and must be used in conjunction with the Generic fuel changeover competencies (1 to 6).

The candidate must be able to correctly answer questions in the following topics relating to checking system pressure regulators, under and over-pressure shut-off and limited relief valves:

Range: All LPG fittings in Residential Park Homes.

1. Recognition of supply pressures from gas storage vessels:
   (i) Medium pressure stage
2. Operation and positioning of first and second stage regulators
3. Identification of causes of under pressure conditions
4. Operation, positioning and visible indicators of under-pressure shut-off valves
5. Procedures for re-setting under-pressure shut-off valves
6. Operation and positioning of the limited relief valve
7. Advice to the customer on re-setting the under-pressure shut-off valve
8. Operation and positioning of vapour service shut-off valve

9a. Cylinders
   (i) Installation, location and protection
   (ii) Construction (including ventilation) of compartments, lockers and internal housings
   (iii) Safety precautions for storage and use

9b. Vessels
   (i) Installation
   (ii) Marking of common vessels commercially available for single supply location

10. Calculating ventilation (BS 3632 2005)
11. Calculating ventilation (BS 3632 1995)
12. Restrictions for use of screens to prevent entry of vermin
13. Jointing and cleaning agents for stainless and galvanised steel pipework
14. Ventilation for pipework installed within ducts
15. Locations where LPG pipework is not to be installed
16. Galvanised steel pipe and fittings, standards, suitability and use
17. Commissioning notices

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Module 9 Leisure Accommodation Vehicles (LAV)

This section contains the specific sector competencies required for Leisure Accommodation Vehicles.

However, it does not stand alone and must be used in conjunction with the Generic fuel changeover competencies (1 to 6).

The candidate must be able to answer correctly questions in the following topics relating to checking system pressure regulators, under and over-pressure shut-off and limited relief valves:

Range: All LPG fittings in Leisure Accommodation Vehicles.

1. Recognition of supply pressures from gas storage vessels:
   (i) Medium pressure stage
2. Operation and positioning of first and second stage regulators
3. Identification of causes of under pressure conditions
4. Operation, positioning and visible indicators of under-pressure shut-off valves
5. Procedures for re-setting under-pressure shut-off valves
6. Operation and positioning of the limited relief valve
7. Advice to the customer on re-setting the under-pressure shut-off valve
8. Operation and positioning of vapour service shut-off valve

9a. Cylinders
   (i) Installation, location and protection
   (ii) Construction (including ventilation) of compartments, lockers and internal housings
   (iii) Safety precautions for storage and use

9b. Vessels
   (i) Installation
   (ii) Marking of common vessels commercially available for single supply location

10. Restrictions for electrical equipment in cylinder compartments
   (i) Only Extra Low Voltage (ELV) equipment and cables not connecting within compartment allowed
   (ii) Not a potential source of ignition
   (iii) Protection against mechanical damage
11. Siting of ventilation (wall, window, floor, ceiling and ducted) direct to outside air, or via series air vents
12. Calculating ventilation for combustion

13. Calculating ventilation for enclosed spaces – cupboards, compartments for open, balanced and fan assisted flued appliances

14. Calculating ventilation for combustion for multi-appliance installations

15. Flueless appliances

16. Restrictions for use of screens to prevent entry of vermin

17. Positioning of trunked ventilation into a space containing a gas appliance(s)

18. Ventilation safety precautions for storage of cylinders

19. Gas dispersal drains (drop holes)

20. Copper pipe and fittings – hard soldering

21. Locations where LPG pipework is not to be installed

22. Installing fuel cells

23. Installing LPG power generators
    (i) Sealing and ventilating and fire protecting generator compartment
    (ii) Accessibility of controls

24. Open gas flue systems: natural draught:
    (i) Termination positions for open flues – 1 pre-December 2000
    (ii) Termination positions for open flues after December 2000
    (iii) Termination positions for open flues after February 2003

25. Closed flue systems: natural draught: specific flue heights and termination positions for closed flues

26. Balanced flue: natural draught:
    (i) Restrictions for balanced flue termination positions pre-December 2000
    (ii) Restrictions for balanced flue termination positions after December 2000 – IGE/UP/8 and MIs
    (iii) Restrictions for balanced flue terminal positions after February 2003

27. Inspect flue visually to UKLPG COP21: identify closed flue defects

28. Carry out closed flue spillage test

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Module 10 Boats, yachts and other vessels (B)

This section contains the specific sector competencies required for Boats, Yachts and Other Vessels. However, it does not stand alone and must be used in conjunction with the Generic fuel changeover competencies (1 to 6).

The candidate must be able correctly to answer gas safety questions in the following topics relating to ventilation requirements for LPG appliances:

Range: All LPG fittings in boats, yachts and other vessels.

1. Cylinder location and safety requirements
   (i) Installation, location and protection
   (ii) Construction including ventilation, of compartments, lockers and internal housings
   (iii) Safety precautions for storage and use
2. Siting of ventilation (hull, windows, decks and ducted) direct to outside air, or via series air vents
3. Installation of ventilation grilles and vents in boats
4. Types of grilles and vents used in boats
5. Calculating ventilation requirements for combustion in boats
6. Calculating ventilation requirements for enclosed spaces – cupboards, compartments for open, balanced and fan assisted flued appliances
7. Calculating ventilation combustion requirements for multi-appliance installations
8. Requirements for flueless appliances
9. The positioning of trunked ventilation into a space containing a gas appliance(s)
10. Location and ventilation requirements for gas cylinder housings in boats (BS 5482 Part 3 1999 and BS EN ISO 10239: 2000)
11. Protection for low level appliances (gas detection and interlocks)
12. Copper pipe and fittings standards suitability and use – hard soldering
13. Sleeving pipework through bulkheads
14. Galvanised steel pipe and fittings, standards, suitability and use

15. Jointing and cleaning agents for copper, stainless and galvanised steel pipework

16. Installation of pipework passing through engine compartments

17. Precautions and protection when installing pipework

18. Open gas flue systems: natural draught:
    (i) Flue requirements, termination positions for open flues BS 5482-3 and appropriate MIs pre-November 2000
    (ii) Flue requirements, termination positions for open flues after November 2000 BS EN ISO 10239, IGEM/G/6 and Manufactures Instructions (MIs)
    (iii) Flueing for appliances installed in boats after May 1999
    (iv) Specific flue heights and termination positions for open and closed flues
    (v) Risk assessments when replacing existing open flue water heaters

19. Room sealed
    (i) Restrictions for room sealed termination positions
    (ii) Requirements and restrictions for room sealed appliances – BS EN ISO 10239, IGEM/G/6 and MIs

20. Open flue testing procedures for boats

21. Procedures if flues show signs of spillage

22. Re-establish existing supply and relight appliances
    (i) Adjacent structures in contact with any gas appliance
    (ii) Combustible materials adjacent to appliances that may be subject to a temperature rise of 50^{o}C
    (iii) Minimum separation distances for cooking appliances from Class 1 combustible surfaces
    (iv) Information for users

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Module 1 Characteristics of Liquefied Petroleum Gas

Introduction

The purpose of this training module is to provide you with the knowledge and understanding of the characteristics of Liquefied Petroleum Gas (LPG). Satisfactory completion in this Core Competency will support the completion of the Nationally Accredited Certification Scheme (ACS) generic fuel changeover from Natural Gas to Liquefied Petroleum Gas (CoNGLP1).

By the end of this module you must be able to correctly answer gas safety questions in the following topics relating to characteristics of LPG:

1. Types of commercial LPG (propane and butane)
2. Storage pressures for both gas types in cylinders and vessels
3. Specific gravity of LPG vapour and its effect in relation to air and natural gas
4. Vaporisation of LPG liquid and off-take – effects of temperature
5. Limits of flammability
6. Calorific value of LPG and its relationship to natural gas

Liquefied Petroleum Gas as its name suggests is a by-product of the petroleum industry that is supplied in a liquid form. LPG is obtained during the refining process of crude oil. LPG is unique among the commonly used fuels in that it can be stored in a liquid form under moderate pressure and at normal ambient temperatures. When released at relatively low ambient temperatures, at atmospheric pressure, it vaporises and can be used and handled as a gas. In its gaseous state LPG can be utilised in the same way as natural gas albeit operating under different operating parameters and using slightly different control systems. In its liquid state LPG is similar to petrol in the way it is stored, transported and measured. There is, however, one essential difference, the liquid state is only maintained, at normal ambient temperatures, under pressure. It is a requirement of the many codes of practice covering LPG and its utilisation that all persons concerned, including customers should be familiar with the properties of and potential hazards that can arise from the improper use of LPG.

This module investigates the main characteristics of LPG, in particular when it is in its vapour stage, i.e. when utilised as a gas. It is intended to give the gas operative sufficient knowledge and understanding to work safely with LPG.

1. Types of commercial LPG (propane and butane)

There are two types of LPG, propane and butane. Butane is only sold in cylinders and is rarely sold as a bulk supply. Propane and butane are stored in purpose designed cylinders or in larger bulk storage vessels, these are generally coloured red for propane cylinders and blue for butane cylinders.

2. Storage pressures for both gas types in cylinders and vessels

LPG is always stored in a liquid form, the vessels are filled to only 85% of their liquid capacity, this allows for expansion of the liquefied gas due to the ranges of ambient temperature (weather changes). The range of expansion pressures are:

Propane	minimum pressure 2.7bar	approx maximum pressure 10bar
Butane	minimum pressure 0bar	approx maximum pressure 3 to 4bar

As gas is removed from the vessel, the liquid remaining boils, replacing the gas removed, and thereby maintaining a continuous gas flow. The normal storage pressures for LPG vessels at an ambient temperature of 15°C are:

Propane cylinders and bulk storage vessels	100psi (6.9bar)
Butane cylinders	28psi (1.93bar)

3. Specific gravity of LPG vapour and its effect in relation to air and natural gas

Every substance including gases have weight and mass. It is sometimes necessary to compare the weights of gases, and in order to do this a comparison is made between the density of a gas and that of air. This is known as the specific gravity (SG) which is also often referred to as the relative density (RD). The density of a substance is the weight of a given volume, the SI unit (International System) of density is kg/m^3. Specific gravity is a comparison of two substances measured in kg/m^3, it therefore has no units and is just a number. The specific gravity of air is 1. The specific gravity of LPG is 1.5, therefore LPG is 1.5 times heavier than air. LPG has an SG of 1.5 for propane and 2.0 for butane, therefore both of these gases if released into the atmosphere would fall to the ground – again this is an important point to remember.

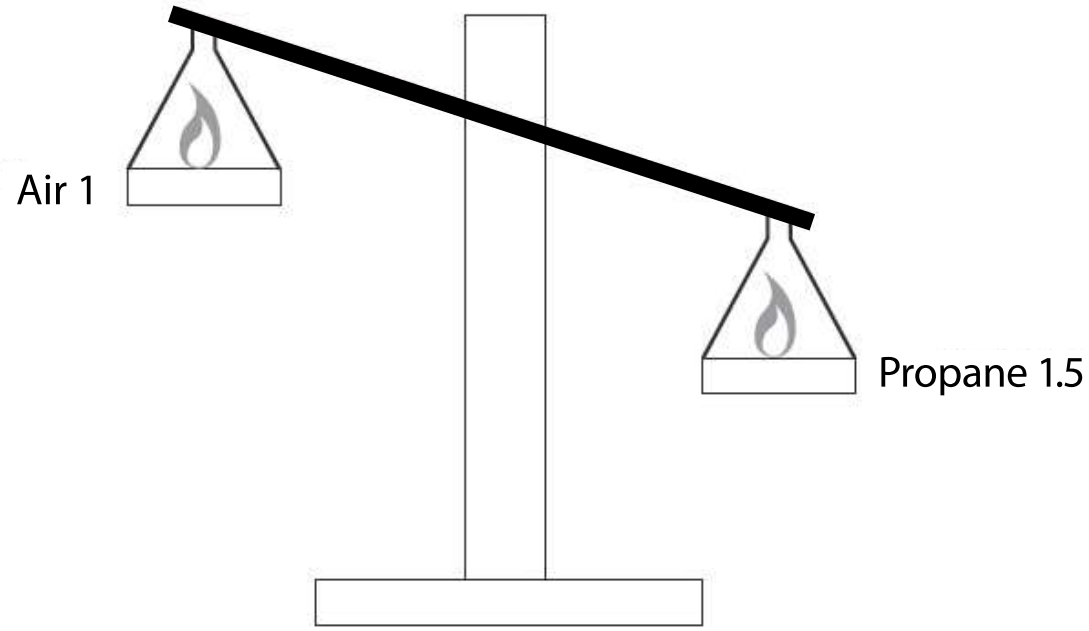

Figure 1: Specific gravity of propane

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4. Vaporisation of LPG liquid and off-take – effects of temperature

As gas is drawn off from a LPG vessel, the boiling process draws heat into the liquid from its surroundings through the vessel wall, hence the amount of heat available is controlled by the surface area of the vessel in contact with the liquid. As a result the amount of gas that can be drawn off is limited by the vessel size the typical storage vessel sizes and off-take rates are:

Recommended off-take rates (Cylinders)			
Butane		Propane	
Cylinder size (kg)	Off-take Kg/hr	Cylinder size (kg)	Off-take Kg/hr
7	0.487	6	0.777
15	0.696	13	1.054
-	-	19	1.319
-	-	47	2.373

Typical storage vessel sizes and off-take rates (Bulk Storage)				
Propane vessel capacity	380 Litres	1200 Litres	2000 Litres	3400 Litres
Vapour off-take capacity	2.3m^3/hr	5.7m^3/hr	7.1m^3/hr	10.2m^3/hr
Heat input	60kW	105kW	187kW	264kW

Bulk tanks and cylinders incorporate a safety valve which is designed to protect the vessel against over pressurisation which could be caused for example, exposure to heat. In the case of cylinders, the safety valve is part of the outlet valve and is designed to release over pressure at:

21bar for butane and 26bar for propane

Cylinders for both propane and butane are designed with a burst pressure of 96bar and are tested to one third of the burst pressure (32bar).

Bulk vessels have a separate pressure release valve (See Figure 2)

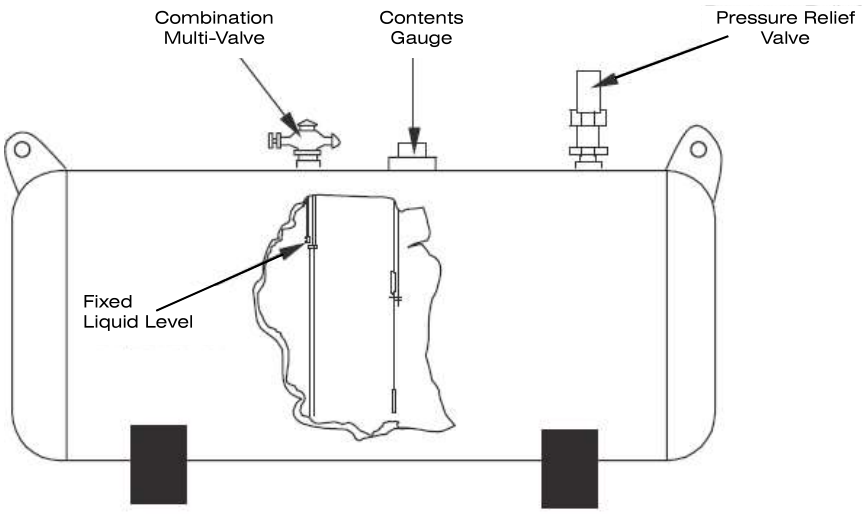

Figure 2: Bulk vessels

Module 4

Gas emergency actions and procedures

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Module 4 Gas emergency actions and procedures

Introduction

The purpose of this training module is to provide you with the knowledge and understanding of the correct actions and procedures for LPG emergencies. Satisfactory completion in this Core Competency will support the completion of the Nationally Accredited Certification Scheme (ACS) generic fuel changeover from Natural Gas to LPG (CoNGLP1).

By the end of this module you must be able to correctly answer gas safety questions in the following topics relating to LPG Emergency Actions and Procedures.

Priorities of actions and responsibilities:

1. The actions to take to deal with gas leakage with fire
   (i) safety/fire precautions to be observed with cylinders
2. The actions to take to deal with gas leakage without fire
   (i) specific gravity and its effect in relation to air e.g. search techniques
   (ii) effective methods of preventing/reducing dangerous concentrations of gas in atmosphere and at low level
3. Advice to LPG users
4. Gas Safety (Installation and Use) Regulations – HSC Approved Code of Practice and Guidance:
   Regulation 9(5) Emergency controls.
   Regulation 37(2), (3) and (4) Escape of gas

Gas emergency actions and procedures

Attention to gas escapes must take priority at all times over all other work

Escapes and incidents involving LPG

If an escape is detected or an incident occurs, the gas operative must immediately assess the situation and determine the best course of action to take. The gas operative needs to prioritise actions and procedures to ensure any escapes or incidents are dealt with safely and effectively.

The priorities in order of importance are:

1. *Safeguard life
2. *Safeguard property
3. *Find and secure escape
4. *Carry out final check

*** Only if it is safe to do so, under no circumstances should you place yourself in danger.**

Escapes of LPG as a vapour can normally be identified by a distinctive smell that enables it to be detected at very low concentrations, well below the lower flammability limit. Escapes of gas may also be detected by noise or frosting at the source of the leak. The latter of these is more probable at higher pressures, i.e. those found upstream of the final stage regulator. Under certain conditions the escape can be seen as a haze in a similar way as heat can be seen to be rising from a hot object.

Leak detection fluid or a suitable gas detector may be used to detect and pinpoint suspected leaks.

NEVER SEARCH FOR LEAKS WITH A NAKED FLAME.

If a liquid leak occurs it is readily visible. Minor liquid leaks develop ice on the vessel at the point of the leak, however, major leaks, possibly caused by a cracked cylinder, can be seen as a light mist. This is caused by the moisture in the air freezing as the liquid vapourises and expands lowering the ambient temperature at the source of the escape. This vapour cloud is highly flammable, even beyond the outer white fringe, the gas simply warms and becomes invisible at this point. A suitable gas detector is the only way of ensuring that the air/gas mixture in the atmosphere is below the lower flammability limit.

Avoid coming into contact with the LPG as it can cause severe cold burns, particularly in its liquid form, and saturated clothing that may subsequently be ignited.

In all cases where an LPG escape is identified or an incident involving an LPG gas storage vessel occurs, the LPG supplier's gas emergency service provider should be immediately notified. This is particularly important where the escape is uncontrollable, i.e. cannot be stopped by isolating the supply of gas, or a fire exists. If anyone is to approach an LPG escape, incident or fire, they should approach from upwind.

It may also be beneficial, in certain circumstances, to notify the local Fire Service, even if the escape has not resulted in a fire. They can help deal with other emergencies, including cooling gas storage vessels and the dispersal of LPG.

Module 10

Boats, yachts and other vessels (B)

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Module 10 Boats, yachts and other vessels (B)

Introduction

The purpose of this training manual is to furnish you with the knowledge and develop your understanding of the gas safety aspects of LPG on boats, yachts and other vessels. This will enable you to successfully complete the relevant area within the Generic Fuel Changeover Gas Safety Assessment CoNGLP1 of the Nationally Accredited Certification Scheme (ACS) for Individual Gas Fitting Operatives.

By the end of this Module 10, you should be able to show understanding in the following areas:

1. Cylinder location and safety requirements (B)
2. Supply pressures – operation and positioning of emergency isolation, flow control and valves for cylinders (B)
3. Ventilation for LPG appliances (B)
4. Installation of pipework and fittings. Range of pipe sizes: 4mm to 22mm (B)
5. Chimney Standards (B)
6. Flue testing for LPG Appliances (B)
7. Re-establish existing supply and relight appliances (B)

Range: All LPG fittings in boats.

Pre-requisite to these assessments

Before this assessment may be undertaken the candidate must have completed the Generic fuel changeover Competencies in Part A (1-6).

Noted exclusions: The assessment will not assess any work that is not a matter of gas safety.

1. Cylinder location and safety requirements

The candidate must be able to correctly answer gas safety questions in the following topics relating to cylinder locations, safety requirements and sizing:

1. Location and safety requirements:
   - (i) Cylinder installation, location and protection requirements for propane and butane cylinders
   - (ii) Construction requirements (including ventilation) for compartments, lockers and internal housings
   - (iii) Safety precautions for the storage and use of cylinders
2. Requirements for installation of means to test the LPG system for leakage (e.g. bubble leak tester/pressure gauge) BS EN ISO 10239:2017
3. Supply pressures – operation and positioning of emergency isolation, flow control and valves for cylinders (B)
   1. Operation and positioning of pressure regulation devices for cylinders BS EN ISO 10239:2017
   2. Over pressure protection BS EN ISO 10239:2017

2. Installation of pipework and fittings. Range of pipe sizes: 4mm to 22mm

The candidate must be able to answer correctly gas safety questions in the following topics relating to domestic installation of pipework and fittings for LPG in boats, yachts and other vessels:

1. Copper pipe and fittings standards suitability and use-hard soldering
   a. Wall thickness requirements for solid drawn copper/stainless steel pipework
2. Sleeving pipework through bulkheads
3. Pliable corrugated stainless-steel tubing (PCT) and fittings, standards, suitability and use
4. Jointing copper and stainless-steel pipework
5. Installation of pipework passing through engine compartments
6. Precautions and protection when installing pipework
7. Requirements for pipework when in direct contact with metallic parts of the craft structure

3. Ventilation requirements for LPG appliances

The candidate must be able to correctly answer gas safety questions in the following topics relating to ventilation requirements for LPG appliances:

1. Siting of ventilation (hull, windows, decks and ducted) direct to outside air, or via series air vents
2. Installation of ventilation grilles and vents in boats
3. Types of grilles and vents used in boats
4. Calculating ventilation for combustion
5. Calculating ventilation requirements for enclosed spaces – cupboards, compartments for open, balanced and fan assisted flued appliances
6. Calculating ventilation combustion requirements for multi-appliance installations
7. Requirements for flueless appliances
8. The positioning of trunked ventilation into a space containing a gas appliance(s)
9. Location and ventilation requirements for gas cylinder housings in boats
10. Protection for low level appliances (gas detection and interlocks)

4. Chimney standards

The candidate must be able to correctly answer gas safety questions in the following topics relating to flueing standards:

1. open gas flue systems: natural draught:
   (i) flue requirements, termination positions for open flues after November 2000 PD 5482-3:2005 and manufacturer's instructions
   (ii) flueing for appliances installed in boats after May 1999
   (iii) specific flue heights and termination positions for open and closed flues in boats.
   (iv) risk assessments when replacing existing open flue water heaters
2. room sealed natural draught
   (i) restrictions for room sealed termination positions
   (ii) restrictions for room sealed appliances PD 5482-3:2005 and BS EN ISO 10239:2017

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5. Flue testing

The candidate must be able to correctly answer gas safety questions in the following topics relating to flueing standards:

1. Open flue testing procedures for boats
2. Procedures to be adopted if flues show signs of spillage

PD 5482-3:2005 Installations in boats, yachts and other vessels

Gas installations in boats, yachts and other vessels containing gas installations are supplied from either on-board LPG cylinders or through a shore-fed gas supply, the gas installation and appliances should be tested to either BS EN ISO 10239:2017 or PD 5482-3:2005, where appropriate.

The Gas Safety (Installation and Use) Regulations 1998 applies to boats that do not require a national or international load line certificate, but are made available to the public during the course of a business, hired out to the public or mainly used for domestic/residential purposes. Where boats containing sleeping accommodation are hired out to the general public then the vessel will be required to carry a "Landlord's Gas Safety Record".

Note: where the gas is supplied via a shore-fed natural gas supply then the individual appliances shall be tested in line with permanent dwellings, where the supply is by on-board LPG cylinders then additional requirements for flueing and ventilation will have to be taken into consideration (see manufacturer's installation instructions).

In addition the "Landlords Safety Record" where boats are used on inland waterways that come under the control of:

- National Rivers Authority
- Broads Authority
- British Waterways Board

They will require a "Boat Safety Certificate" which will be required to be renewed every four years.

New installations in boats, yachts and other vessels are required to comply with the essential safety requirements of the "European Recreational Craft Directive 94/25/EC". The following British Standards cover gas installation on small craft where the hull length does not exceed 24 metres.

- BS EN ISO 10239:2017 small craft LPG systems. This standard came into effect on 15 November 2000 for new gas installations.
- PD 5482-3:2005 Guidance for the design, commissioning and maintenance of LPG systems in small craft for domestic butane and propane gas-burning installations – part 3: installations in boats yachts and other vessels.

1. Cylinder location and safety requirements

Storage of LPG cylinders – below deck and above deck.

General storage rules:

- Cylinders should be stored in an upright position
- Cylinders should be firmly secured to prevent any damage to the cylinder, regulators, hoses or pipework
- Cylinders should be positioned away from engines, fuel tanks and battery spaces
- Cylinders should be positioned where any leakage drains away from the boat's interior
- Cylinder lockers/housings need to be clearly marked and accessible in the event of an emergency
- Cylinder lockers/housings must not cause any obstruction
- Care should be taken to ensure the following when the vessel is moving.
- Cylinders should be stowed at least 1m from any hatches or other opening into vessel or possible ignition source.

Below deck storage requirements

Below deck cylinder installations should be installed in purpose designed lockers which are separate from the living area, accessible from the outside and ventilated to the external atmosphere. The cylinder locker is required to:

- Allow access to valves/regulators and the changing of cylinders
- Have pipework/hose connections that maintain the lockers vapour seal
- Be vapour tight to the boat's interior
- Be accessed from the top via a lid that prevents damage to the cylinder installation.
- Be ventilated directly to the boat's exterior by a high level vent and have a 19mm diameter (minimum) low level drainage vent, which terminates at least 500mm from openings into the boat's interior. (See Figure 1)
- Have a low level drainage vent that does not contain a water retaining sump and is terminated at least 75mm above the loaded water line
- Have a minimum of 30 minutes fire resistance
- Be located away from heat sources
- Not be stored with engine fuel or within battery spaces
- Have a readily accessible and visible shut off valve, positioned outside of the accommodation areas and as close to the cylinder(s) as possible

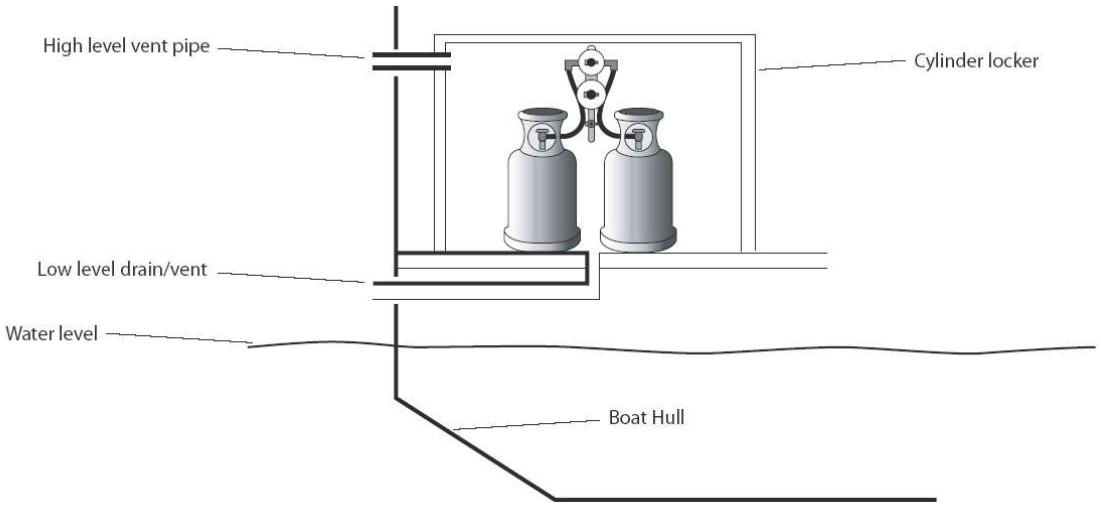

Figure 1: Typical view of a boat cylinder locker installation

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