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Introduction

All operatives are required to prove their competence in Gas Safety, Installation, Service and Maintenance.

Since 1st August 1998 that proof of competence has been carried out through the Nationally Accredited Certification Scheme (ACS) for Individual Gas Fitting Operatives. Each operative is required to have successfully completed the assessment requirements laid down by an accredited UKAS certification body and then be re-assessed at periods of no more than five years.

The BPEC Services Ltd – CCN1 Initial/Re-assessment Domestic Gas course is intended to provide the training required to support proving competence in this area of work.

Training Objectives

The aim of this open learning/tutor taught training package is to furnish you with the information to enable the **Nationally Accredited Certification Scheme (ACS) assessments for core gas safety CCN1 Initial/ Re-assessment** and any appropriate appliance assessments to be completed.

The objective of this training material is to allow you to practise general skill/knowledge of the Gas Safety Regulations, procedures and British Standards, which must be applied when carrying out work on gas installations. Throughout your course of study emphasis is placed on **relevant** legislation, so that the significance of the legislation is **defined in familiar context**.

You should firstly read the individual modules and then attempt the associated questions in the question booklet. This will give experience in the area of multi-choice questions that will be encountered in the ACS assessments, and also represents a source of reference for later use. If studying at a training centre practical tasks can be undertaken to reaffirm the knowledge gained from the manuals. Sample practical tasks are contained within the task manual, however, training centre developed scenarios may also be used.

Course Structure

Core Domestic Gas Safety Modules

Introduction and Practical Task

- Module 1 Gas Safety Legislation
- Module 2 Gas Emergency Actions and Procedures
- Module 3 Characteristics of Combustion
- Module 4 Ventilation
- Module 5 Installation of Pipework and Fittings
- Module 6 Testing for Tightness
- Module 7 Checking and/or Setting Meter Regulators
- Module 8 Identification of Unsafe Situations, Emergency Notices and Warning Labels
- Module 9 The Operation and Positioning of Emergency Isolation Controls and Valves
- Module 10 Checking and Setting Appliance Burner Pressures and Gas Rates
- Module 11 The Operation and Checking of Appliance Gas Safety Devices and Controls
- Module 12 Chimney Standards
- Module 13 Chimney Flue Testing
- Module 14 Installation of Open, Balanced and Fan Assisted Chimney Configurations
- Module 15 Re-establishing Gas Supplies and Re-lighting Appliances
- Module 16 Knowledge Questions and Model Answers

Contents

Introduction

The purpose of this module is to furnish you with the knowledge and develop your understanding of the gas safety aspects of Safety and Legislation. This will enable you to successfully complete the relevant area within the Core Gas Safety assessment CCN1 Initial/Re-assessment of the Nationally Accredited Certification Scheme (ACS) for Individual Gas Fitting Operatives.

By the end of Module 1 Safety and Legislation, you should be able to show understanding in the following areas:

- The Gas Safety (Installation and Use) Regulations 1998.
- Use of the current Regulations to identify and rectify any contravention of the Regulations.

Standards

Read carefully the following pages of text and when you feel confident that you have a good knowledge of the Gas Safety (Installation and Use) Regulations 1998, you will be able to tackle the associated questions contained within the knowledge manual. Additionally if you are studying at a training centre you may attempt the tasks in the practical task manual.

Then you will

Upon completion of the associated question paper you should check your answers against those given in the model answers section in the Knowledge Manual. If your score is less than 100% it is important to understand where you have gone wrong and if necessary repeat the questions.

Regulations and Standards

It is common knowledge that gas installations may be connected to electricity and water supplies along with the gas supply. Some gas appliances require to be connected to all of these services in order to function correctly, such as some Central Heating boilers. It is therefore important that the installer complies with all appropriate statutory requirements (including any local bye-laws) when undertaking gas work.

The following list should act as a guide to the principal statutory and other requirements that must be observed by the installer:

- Gas Safety (Installation and Use) Regulations 1998.
- Water Bye-laws and Water Regulations.
- Electricity at Work Regulations 1989.
- IET Wiring Regulations (Current Edition).
- Building Regulations and Standards.
- Health and Safety at Work etc. Act 1974.
- The Gas Safety (Management) Regulations 1996.

Note: Appropriate requirements, especially those relating to water and building legislation, vary depending on which area of the UK you are working in, for example England, Wales, Scotland, Northern Ireland, Guernsey, Jersey or the Isle of Man. Due care must be given to ensure the appropriate legislation is applied and adhered to.

The Gas Safety (Installation and Use) Regulations 1998, Guidance and Approved Code of Practice, have been reproduced in this publication by the kind permission of the Controller of Her Majesty's Stationery Office.

Regulations

PART A – General

Citation and commencement

1. These Regulations may be cited as the Gas Safety (Installation and Use) Regulations 1998 and came into force on 31st October 1998.

General interpretation and application

2. **(1)** In these Regulations, unless the context otherwise requires "appropriate fitting" means a fitting which:

a has been designed for the purpose of effecting a gas tight seal in a pipe or other gasway;

b achieves that purpose when fitted; and

c is secure, so far as is reasonably practicable, against unauthorised opening or removal;

"distribution main" means any main through which a transporter is for the time being distributing gas and which is not being used only for the purpose of conveying gas in bulk;

"emergency control" means a valve for shutting off the supply of gas in an emergency, being a valve intended for use by a consumer of gas;

"flue" means a passage for conveying the products of combustion from a gas appliance to the external air and includes any part of the passage in a gas appliance duct which serves the purpose of a flue;

"gas" means any substance which is or (if it were in a gaseous state) would be gas within the meaning of the Gas Act 1986ⓐ except that it does not include gas consisting wholly or mainly of hydrogen when used in non-domestic premises;

"gas appliance" means an appliance designed for use by a consumer of gas for heating, lighting, cooking or other purposes for which gas can be used, but it does not include a portable or mobile appliance supplied with gas from a cylinder, or the cylinder, pipes and other fittings used for supplying gas to that appliance, save that, for the purposes of regulations 3, 35 and 36 of these Regulations, it does include a portable or mobile space heater supplied with gas from a cylinder, and the cylinder, pipes and other fittings used for supplying gas to that heater;

"gas fittings" means gas pipework, valves (other than emergency controls), regulators and meters, and fittings, apparatus and appliances designed for use by consumers of gas for heating, lighting, cooking or other purposes for which gas can be used (other than the purpose of an industrial process carried out on industrial premises), but it does not mean:

a any part of a service pipe;

b any part of a distribution main or other pipe upstream of the service pipe;

c a gas storage vessel; or

d a gas cylinder or cartridge designed to be disposed of when empty;

"gas storage vessel" means a storage container designed to be filled or re-filled with gas at the place where it is connected for use or a refillable cylinder designed to store gas, and includes the vapour valve, but it does not include a cylinder or cartridge designed to be disposed of when empty;

"gas water heater" includes a gas fired central heating boiler;

ⓐ 1986 c.44.

"installation pipework" means any pipework for conveying gas for a particular consumer and any associated valve or other gas fitting including any pipework used to connect a gas appliance to other installation pipework and any shut off device at the inlet to the appliance, but it does not mean:

a a service pipe;

b a pipe comprised in a gas appliance;

c any valve attached to a storage container or cylinder; or

d service pipework;

"meter by pass" means any pipe and other gas fittings used in connection with it through which gas can be conveyed from a service pipe or service pipework to installation pipework without passing through the meter;

"primary meter" means the meter nearest to and downstream of a service pipe or service pipework for ascertaining the quantity of gas supplied through that pipe or pipework by a supplier;

"refillable cylinder" means a cylinder which is filled other than at the place where it is connected for use;

"the responsible person", in relation to any premises, means the occupier of the premises or, where there is no occupier or the occupier is away, the owner of the premises or any person with authority for the time being to take appropriate action in relation to any gas fitting therein;

"room-sealed appliances" means an appliance whose combustion system is sealed from the room in which the appliance is located and which obtains air for combustion from a ventilated uninhabited space within the premises or directly from the open air outside the premises and which vents the products of combustion directly to open air outside the premises;

"service pipe" means a pipe for distributing gas to premises from a distribution main, being any pipe between the distribution main and the outlet of the first emergency control downstream from the distribution main;

"service pipework" means a pipe for supplying gas to premises from a gas storage vessel, being any pipe between the gas storage vessel and the outlet of the emergency control;

"service valve" means a valve (other than an emergency control) for controlling a supply of gas, being a valve:

a incorporated in a service pipe; and

b intended for use by a transporter of gas; and

c not situated inside a building;

"supplier" in relation to gas means:

a a person who supplies gas to any premises through a primary meter; or

b a person who provides a supply of gas to a consumer by means of the filling or re-filling of a storage container designed to be filled or re-filled with gas at the place where it is connected for use, whether or not such container is or remains the property of the supplier; or

c a person who provides gas in refillable cylinders for use by a consumer whether or not such cylinders are filled or re-filled directly by that person and whether or not such cylinders are or remain the property of that person, but a retailer shall not be deemed to be a supplier when he sells a brand of gas other than his own;

"transporter" in relation to gas means a person who conveys gas through a distribution main;

"work" in relation to a gas fitting includes any of the following activities carried out by any person, whether an employee or not, that is to say:

a installing or re-connecting the fitting;

b maintaining, servicing, permanently adjusting, disconnecting, repairing, altering or renewing the fitting or purging it of air or gas;

c where the fitting is not readily movable, changing its position; and

d removing the fitting;

but the expression does not include the connection or disconnection of a bayonet fitting or other self-sealing connector.

(2) For the purposes of these Regulations:

a any reference to installing a gas fitting includes a reference to converting any pipe, fitting, meter, apparatus or appliance to gas use; and

b a person to whom gas is supplied and who provides that gas for use in a flat or part of premises let by him shall not in so doing be deemed to be supplying gas.

(3) Subject to paragraphs (4) and (5) below, these Regulations shall apply to or in relation to gas fittings used in connection with:

a gas which has been conveyed to premises through a distribution main; or

b gas conveyed from a gas storage vessel.

(4) Save for regulations 37, 38 and 41 and subject to regulation 3(8), these Regulations shall not apply in relation to the supply of gas to, or anything done in respect of a gas fitting at, the following premises, that is to say:

a a mine or quarry within the meaning of the Mines and Quarries Act 1954ⓐ or any place deemed to form part of a mine or quarry for the purposes of that Act;

b a factory within the meaning of the Factories Act 1961ⓑ or any place to which any provisions of the said Act apply by virtue of sections 123 to 126 of that Act;

c agricultural premises, being agricultural land, including land being or forming part of a market garden, and any building thereon which is used in connection with agricultural operations;

d temporary installations used in connection with any construction work within the meaning assigned to that phrase by regulation 2(1) of the Construction (Design and Management) Regulations 1994;ⓒ

e premises used for the testing of gas fittings; or

f premises used for the treatment of sewage;

but they shall apply in relation to such premises or part thereof used for domestic or residential purposes or as sleeping accommodation.

ⓐ 1954 c.70.

ⓑ 1961 c.34.

ⓒ S.I. 1994/3140: regulation 2(1) was amended by S.I. 1996/1513.

(5) Nothing in these Regulations shall apply in relation to the supply of gas to, or anything done in respect of a gas fitting on:

- **a** a self-propelled vehicle except when such a vehicle is:
  - (i) hired out in the course of a business; or
  - (ii) made available to members of the public in the course of a business carried on from that vehicle;
- **b** a sea-going ship;
- **c** a vessel not requiring a national or international load line certificate except when such vessel is:
  - (i) hired out in the course of a business;
  - (ii) made available to members of the public in the course of a business carried out from that vessel; or
  - (iii) used primarily for domestic or residential purposes;
- **d** a hovercraft; or
- **e** a caravan used for touring otherwise than when hired out in the course of a business.

(6) Nothing in these Regulations shall apply in relation to:

- **a** the supply of gas to the propulsion system of any vehicle or to any gas fitting forming part of such propulsion system;
- **b** the supply of gas to, or anything done in respect of, a bunsen burner used in an educational establishment; or
- **c** work in relation to a control device on a gas appliance if:
  - (i) the device is intended primarily for use by a consumer of gas; and
  - (ii) the work does not involve breaking into a gasway.

(7) These Regulations shall not apply in relation to a gas fitting used for the purpose of training gas fitting operatives in a college or other training establishment, except that paragraphs (1) to (5) and (7) of regulation 3 shall apply to work in relation to a gas fitting carried out by a person providing such training.

(8) These Regulations shall not apply in relation to a gas fitting used for the purpose of assessing the competence of a gas fitting operative at an assessment centre where such assessment is carried out for the purposes of a nationally accredited certification scheme, except that regulation 3(1) and (2) shall apply to work in relation to a gas fitting carried out by a person carrying out such assessment.

Contents

Introduction

The purpose of Module 5 is to furnish you with the knowledge and develop your understanding of the gas safety aspects of Installation of Pipework and Fittings. This will enable you to successfully complete the relevant area within the Core Gas Safety Assessment CCN1 Initial/Re-assessment of the Nationally Accredited Certification Scheme (ACS) for Individual Gas Fitting Operatives.

By the end of Module 5, Installation of Pipework and Fittings, you should be able to show understanding in the following areas:

- Copper and mild steel pipe and fittings.
- Flexible and rigid connections and micropoints.
- Jointing and cleaning agents for copper and mild steel pipes.
- Pipe supports, clipping and fixing requirements for copper and mild steel pipework.
- Sleeving and protecting pipework under floors in walls and builders' openings etc.
- Installation of pipework externally and restrictions on use of compression fittings etc.
- Precautions to be taken when soldering pipework with gas meters installed.
- Equipotential and temporary continuity bonding.
- Siting and installation of gas controls and isolation valves.
- Making and breaking gas connections on appliances.
- Related areas of Gas Safety (Installation and Use) Regulations.

Standards

The main Standards and Regulations applying to the Installation of Pipework and Fittings include:

- Regulations 10, 18, 19, 20, 21, 22, 23 and 35 of the Gas Safety (Installation and Use) Regulations.
- BS 6891:2015 – Specification for the installation of low pressure gas installation pipework up to 35mm (R1¼) on premises.

You should

Read carefully the following pages of text and when you feel confident, you will be able to tackle the associated questions contained within the question booklet. Additionally if you are studying at a training centre you may then attempt the tasks in the practical task manual.

Then you will

Upon completion of the associated question paper you should check your answers against those given in the answer booklet. If your score is less than 100% it is important to understand where you have gone wrong and if necessary repeat the questions.

Gas Pipework Materials

This section is concerned with the basic principles of pipe selection and jointing and with the identification of fittings and fixings associated with their installation.

Pipes, fittings and jointing materials are all subject to British Standard Specifications, which regulate their composition. Consideration should be given to the strength, appearance and cost of materials. The need for protection against corrosion must also be considered. The following list identifies the relevant British Standard (BS) for pipes, fittings and jointing materials used on gas supplies.

Mild steel pipes and fittings should comply with BS EN 10255, BS EN 10216-1 and 2, BS EN 10217-1 and 2 as appropriate. Medium grade steel is recommended for internal domestic gas low pressure installations.

The nominal size of the pipe is identified by the letters DN followed by a number loosely based on the metric dimension of the pipe. Thread size designations are based on the old imperial sizes e.g ½, ¾, 1 or 1¼. Because the metrication of steel pipes has resulted in a change of name but not a change of diameter or thread, no adaptors are necessary when extending existing supplies.

Rigid stainless steel tube should comply with BS 6362, BS EN 10217-7, BS EN 10216-5, BS 3605-2 (obsolete) or BS EN 10312 and have the same external diameter as BS EN 1057 copper tube.

Steel fittings shall comply with BS EN 10241 with malleable iron and cast copper alloy fittings with BS 143, BS 1256 and BS 10242 (all parts) as appropriate.

Pliable corrugated stainless steel tubing and self-flaring fittings should comply with BS 7838 or BS EN 15266 and must be installed and connected only in compliance with manufacturer's instructions.

Copper tube should comply with BS EN 1057; capillary and compression fittings with BS EN 1254-1 to 5 (formerly BS 864). Copper and copper alloy press end fitting must comply with BS 8537. Copper tube may be jointed without the use of fittings by forming the ends of the pipework using purpose made tools in accordance with BS EN 1254 Parts 1 and 2.

Compression fittings shall only be used where they will be readily accessible to allow the nuts to be tightened to make a sound joint and therefore, for example, must not be buried in the structure, below ground or beneath floorboards.

Push-fit fittings shall not be used with the exception of self-sealing sockets conforming to BS 669-1 and 2 or BS EN 15069 which are specifically designed for use with readily moveable flueless appliances such as freestanding cookers or tumble dryers installed to BS 6172 or BS 7624.

Polyethylene pipe (PE) conforming to BS 1555 Parts 1 and 2 is only designed for external use and should never be installed internally. PE fittings are more commonly of the electrofusion type, however compression fittings, specific for use with PE, can be used. Any fitting used for jointing PE must conform to BS 5114 or BS EN 1555-3 as appropriate.

Gas Pipework Jointing

Before jointing pipework the pipe ends must be cut square and deburred, especially where wheel type pipe cutters are used. Joints must be made in such a manner that they are mechanically strong, gas tight, free from internal obstruction to the flow of gas and exert no undue stresses on the fitting(s).

All jointing compounds and tapes must comply with BS 6956 or BS EN 751-1 to 3 as appropriate. Fibrous materials such as hemp must not be used with the exception of existing long screws where, in conjunction with jointing compounds, it seals the back nut of the fitting.

Copper Pipework

Capillary joints are the most popular joints used to joint copper pipework, however, it should be noted that there are some basic rules that should be followed. The correct fluxes and fittings must always be used.

Fittings must comply with BS EN1254-1 to 5 (formerly BS 864). Fittings may be end feed (Figure 1) which need solder to be applied to the joint, or solder ring (Figure 2) which has the correct quantity of solder contained within an annular ring inside the fitting.

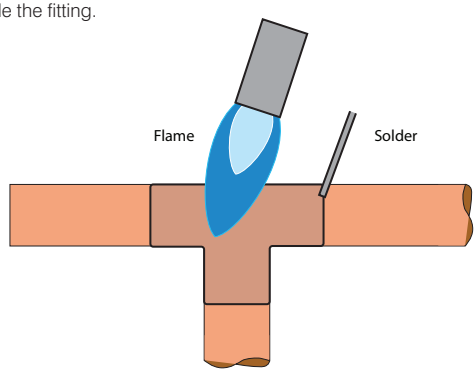

Figure 1: End feed fitting

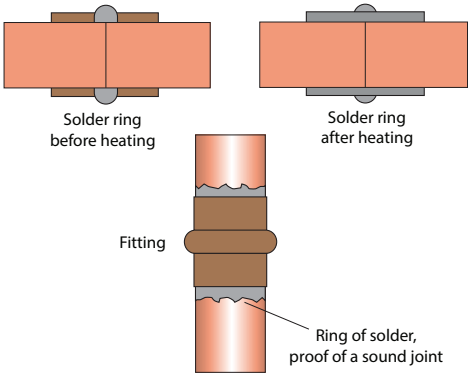

Figure 2: Solder ring fitting

Flux used to make capillary joints should only be active during the heating process. After the joint has been made any remaining flux shall be removed. Self-cleaning fluxes may fall into this category but must be checked.

It is known that fluxed, unsoldered joints may satisfy the tightness test, therefore, finished joints shall always be visually examined to confirm that the solder has run.

Procedure for Making a Soldered Joint

- Cut the end of the tube square and remove any burrs within the pipe. Do not file the surface of the tube.
- Clean the inside of the fitting and about 20mm of the tube with steel wool or pipe cleaner (if self cleaning flux is used only heavily soiled pipes need be cleaned).
- Flux male surface only (excessive flux may cause a blockage within the joint).
- Assemble the joint. It may be made in any plane but the tube must fit squarely and be fully inserted within the fitting.
- Protect any adjacent surface with a heat proof mat.
- Heat the fitting evenly, applying solder in the case of end feed fittings, until a complete ring of solder is seen at the mouth of the fitting. Do not add more solder to solder ring fittings.
- Wipe off any surplus flux from the joint to avoid corrosion in the future.
- Allow the joint to cool naturally. Quick cooling may cause the joint to crack and therefore leak gas.

If this procedure is followed the soldered joints will be sound. Excessive flux is the cause of many problems with soldered joints from partial blockages to solder running down a fitting.

Avoid excessive heat as the joint will oxidise, solder will not 'run' within the joint and the result will be an obtrusive joint that is likely to be unsound.

Compression – Fittings must comply with BS EN1254-2 (this replaces BS 864-2).

Unions shall be of the ground face or compression type. Union joints and compression fittings shall only be used where they will be readily accessible to allow the nut to be tightened for a sound joint. Pipes under the floor or in ducts are not considered to be readily accessible.

Problems are encountered when compression joints are incorrectly assembled. When making a compression joint the end of the joint must be clean and not scratched or distorted. It must be squarely cut and all burrs removed. The cap must be tightened sufficiently to form a sound joint, but not over-tightened, as this would cause the olive to distort the pipework and cause an unsound joint. The pipework should not be strained when the joint is made.

Some people prefer to smear the joint lightly with jointing compound before assembling it. This is not necessary but it does, perhaps, act as a lubricant between the surfaces as the joint is tightened. The joint seals using the olive, not the thread, so no treatment is required on the threads, e.g. jointing paste or tape.

Pressed end connections must be suitable for use with gas, normally the body of the fitting is marked with a tan or yellow sealing ring, and be installed as per the manufacturer's instruction. The customer must be instructed not to paint the joint with oil or solvent based paints, unless stated otherwise by the manufacturer, as this can affect the integrity of the elastomeric seal.

Mild Steel Pipework

Screwed fittings used for threaded joints shall comply with BS 143, BS 1256, BS EN 10241 and BS EN 10242 (all parts). With the exception of a long screw, male threads on steel pipework and fittings must be tapered and conform to BS 21, BS 846-2, BS EN 1254-4, BS EN 10226-1, BS EN ISO 228-1 or ISO 7-1.

Pipe fittings screwed to BS 21 have internal taper threads. The coupler or sockets supplied to protect the ends of threaded pipe are normally screwed with internal parallel threads. The steel pipe may be supplied with either external taper threads or plain unthreaded ends.

When making pipe threads a few simple rules will ensure sound joints. It is important to ensure that joints are assembled correctly, as it is difficult to tighten or reseal a joint that is within a pipework installation. Remember these points:

- The pipe threads must be cleaned before use.
- Hemp must not be used on a threaded joint except when in conjunction with thread sealing compounds for longscrew back-nut seals.
- Tape shall be wound with a 50% overlap starting from the thread runout in a direction counter to the thread form (see Figure 3).
- When jointing paste is used, it should only be applied to the external thread. Excess paste should be removed on completion of the joint.
- Where PTFE tape is used it should be of the 'thicker' one wrap type.
- Jointing paste and PTFE tape should not be combined on a thread

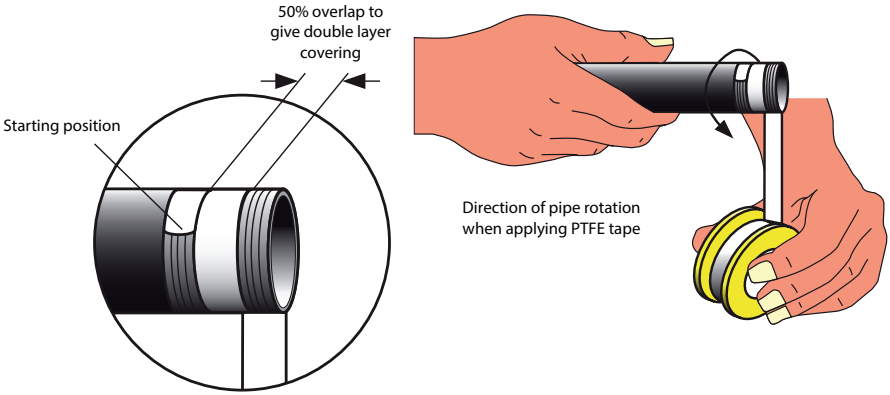

Figure 3: Thread wrapping method for PTFE tape

Contents

Introduction

The purpose of Module 15 is to furnish you with the knowledge and develop your understanding of the gas safety aspects of re-establishing existing gas supplies and relighting appliances. This will enable you to successfully complete the relevant area within the Core Gas Safety Assessment CCN 1 Initial/Re-assessment of the Nationally Accredited Certification Scheme (ACS) for Individual Gas Fitting Operatives.

By the end of Module 15 Re-establishing Existing Gas Supplies and Relighting Appliances, you should be able to show understanding in the following areas:

- Re-establishing existing supplies after temporary isolation.
- Relighting a customer's existing appliance after the gas supply has been temporarily isolated.
- Describe the correct action to be taken when uncommissioned appliances are identified.
- Confirm the actions to be taken should pipework and appliances not be tested when supply is re-established.
- Gas Safety (Installation and Use) Regulations – HSE Code of Practice and Guidance:
  - Regulation 26.
  - Regulation 33(1) to (3) inclusive.
  - Regulation 34.

Standards

The main Regulations and Standards applying to Re-establishing Gas Supplies and Re-lighting Appliances include:

- Regulations 26, 33 and 34 of the Gas Safety (Installation and Use) Regulations.
- BS 6891: 2005+A2: 2008 – Installation of Low Pressure Gas Pipework up to 28mm in Domestic Premises.
- IGE/UP/1B 3rd Edition Tightness testing and purging of domestic sized Natural Gas Installations.

You should

Read carefully the following pages of text and when you feel confident, you will be able to tackle the associated questions contained within the question booklet. Additionally, if you are studying at a training centre you may then attempt the tasks in the practical task manual.

Then you will

Upon completion of the associated question paper you should check your answers against those given in the answer booklet. If your score is less than 100% it is important to understand where you have gone wrong and if necessary repeat the questions.

Regulations

As you should be well aware of by this stage of your studies, the Gas Safety (Installation and Use) Regulations place responsibility on the last operative to carry out work on an installation and appliances to ensure their continued safe operation.

When an appliance is not directly worked on by the operative, the requirements are less exhaustive. The Gas Safety (Installation and Use) Regulation 34(3) says that:

> 'Any person engaged in carrying out any work in relation to a …….. gas fitting who knows or has reason to suspect that any gas appliance cannot be used without constituting a danger to any person shall forthwith take all reasonably practicable steps to inform the responsible person for the premises in which the appliance is situated and, where different, the owner of the appliance or, where neither is reasonably practicable, ……, the Transporter'.

The consequence of this is that an operative should make a brief check as to the safe operation of any appliances fitted on an installation, even if all appliances are not being worked on. An example of this is where an operative carries out routine maintenance upon a central heating boiler, he/she should:

- Maintain the boiler as per the manufacturer's instructions.
- If the customer has noticed any smell of gas, test for installation tightness.
- Check that the supply of ventilation air for **all appliances** is adequate.
- Check there are no signs of incomplete combustion or signs of spillage from any appliances.
- Check that no **appliances** appear in a dangerous condition.

If any of the tests, when maintaining the boiler fail, or the subsequent checks on other appliances are unsatisfactory, the appropriate action must be taken (see Module 8).

The checks that should be made when appliances are not directly worked upon are far less comprehensive than, for example, when appliances are worked on or a supply is re-established. The Gas Safety (Installation and Use) Regulations 26(9) says that:

'Where a person performs work on a gas appliance, he shall immediately thereafter examine:

- The effectiveness of any flue,
- The supply of combustion air,
- Its operating pressure or heat input or where necessary both,
- Its operation so as to ensure its safe functioning.'

These checks need only be carried out when the appliance is worked on. Following these checks, action where required should be taken. These checks do not constitute appliance commissioning; reference should be made to manufacturer's instructions.

Re-establishing Existing Systems

When gas operatives re-establish the gas supply to an installation which has been temporarily isolated, it is necessary to ensure that the installation and appliances are safe to be used. The following is a procedure that may be used under these circumstances:

- **A visual check of the installation should be made.** This will allow the operative to make the customer aware of any problems and potential problems prior to work commencing. The checks should include pipe runs, pipe clipping, pipe sleeving, flues etc.
- **A visual check of the appliances should be made.** This will also allow the operative to make the customer aware of any problems and potential problems prior to work commencing. The checks should include signs of spillage, overheating, incorrect installation and insecure siting.
- **Check ventilation available for appliances fitted.** The customer can be informed of further work to bring installations up to standard prior to re-establishing system (appliance should not be re-established if no permanent ventilation is provided where it is required).
- When removal and refitting of the gas meter or pipework takes place, **ensure a temporary continuity bond is used**. The temporary continuity bond reduces the danger from stray electrical currents.
- **Test installation for tightness.** Ensure all appliance isolation valves are turned on and cooker lids open prior to testing (see Module 6).
- **Purge meter and installation from furthest practical position (using a cooker hotplate, where fitted, is probably the easiest).** This ensures that any air entrained at the meter is fully purged.
- **Purge remaining sections of the installation.** The remaining sections may contain a gas/air mixture, therefore, do not attempt to light appliances until completely purged.
- **Re-light each appliance in turn, ensuring that the user controls are operating satisfactorily.** The user can therefore use the appliance safely.
- **Check all open flued appliances for spillage.** Spillage testing is not mandatory under these circumstances, but it would be foolish to allow an appliance to be used without checking the operation of the flue.
- **Finally,** check that the customer knows how to operate controls satisfactorily.

These checks will ensure, as far as practicable, that appliances brought into commission will represent no danger to the user.

These checks are only relevant when appliances are existing and were in use prior to the supply being temporarily disconnected. When an appliance is discovered within an installation that has not been used and, therefore, not been commissioned, the actions required of the operative are quite different. The operative therefore, must either commission or permanently disconnect the uncommissioned appliance from the supply (see the section on Supplying Gas for the First Time later in this module).

If the user will not allow the operative to disconnect or commission the appliance, the supply must not be reconnected.

The operative should also establish the reason for the disconnection of the supply. The reason may be one of risk to the user from an installation containing faulty components or incorrectly installed appliances. In these circumstances, the operative must be cautious of re-establishing the installation and appliances.

Purging of Installations

For purging procedures see Module 6, page 18.

Supplying Gas for the First Time

When an operative supplies gas to a new installation by the fitting of a meter, be it primary or secondary, the requirements for testing the appliances installed are more comprehensive. All the checks that must be made when re-establishing a supply are required, but with additional tests.

The Gas Safety (Installation and Use) Regulations 33(1) is concerned with testing of appliances following their installation and connection to the gas supply. The Regulation states:

"When gas is being supplied to the premises in which the appliance is installed, the operative shall immediately thereafter test its connection to the installation pipework and check to verify that it is gastight and examine the appliance and the gas fittings and other works for the supply of gas and any flue or means of ventilation to be used in connection with the appliance for the purpose of ascertaining whether:

a. The appliance has been installed in accordance with these Regulations.

b. The operating pressure is as recommended by the manufacturer.

c. The appliance has been installed with due regard to any manufacturer's instructions provided to accompany the appliance; and

d. All gas safety controls are in proper working order."

With this in mind, a modified procedure should be followed as shown below:

- **A visual check of the installation should be made.** The checks should include pipe runs, pipe clipping, pipe sleeving, flues etc.
- **A visual check of the appliances should be made.** The checks should ascertain that the appliance is installed in accordance with the manufacturer's instructions and with due regard to The Gas Safety (Installation and Use) Regulations, and the appliance is securely sited.
- **Check the appliance and other fittings are suitable for use with the gas to be supplied.**
- **Where necessary, calculate ventilation requirements for appliances fitted.** Gas should not be supplied to appliances with inadequate ventilation.
- **Check the suitability and operation of the chimney/flue.** Carry out a visual inspection of the entire flue and undertake a chimney/flue flowtest (see Modules 12-14) as required.
- **Test Installation for Tightness.** Ensure all appliance isolation valves are turned on and cooker lids open prior to testing.
- **Purge meter and installation from furthest practical position.** This ensures that any air entrained in the system is fully purged.
- **Purge remaining sections of the installation.** This ensures remaining sections will not contain a gas/air mixture.
- **Begin a full commissioning procedure on each uncommissioned appliance in turn.** Check the operation of all gas safety and user controls.

- **When a quantity of gas has been passed turn off the purge point and, if necessary, test for tightness using leak detection fluid.**
- **Ensure the operating pressure and gas rate are as recommended by the manufacturer.** Confirm input is correct for appliance.
- **Check all open flued appliances for spillage.**
- **Finally, check the customer knows how to operate controls satisfactorily and, where appropriate, issue a landlord's record.**

When gas is being supplied to premises for the first time, the installation must be tested for tightness and the pipework purged. Any appliances installed must then be fully commissioned. However, if this is not possible, Regulation 33(2) states that the appliance must be disconnected from the supply and the pipework sealed with an appropriate fitting and the appliance labelled correctly. Any person then reconnecting the appliance must carry out the tests highlighted in Regulation 33(1) and in the text above.

When commissioning or testing an appliance, the manufacturer's instructions must always be followed.

You have now completed Module 15 of this course and it is time for you to attempt the related questions in Module 16 Knowledge Questions and Model Answers.

If you are studying at a training centre you may also like to enquire about related tasks.

Contents

Question Booklet Instructions

The candidate is advised to read the modules within the Core Domestic Gas Safety CCN1 and Domestic Appliance Initial/Re-assessment Training Manual.

The recommended procedure is to read each module individually and when complete, the corresponding questions should be attempted.

The first attempt should be made without the aid of the manual. The answers should then be checked using the appropriate module. Following this, answers should be marked using the rationale at the end of the question booklet.

If the answers are not 100% correct, wrong answers should be cross checked with the corresponding module. This cross checking will clarify and ensure that you understand the correct answer.

Alternatively, the complete manual could be read and all the questions answered in one attempt. This would, however, be more difficult.

Finally, the more confident operative may wish to attempt the question booklet prior to reading the manual. Again, this is acceptable.

A method that is not productive is to attempt the questions by referring to the manual. This will only equip you with the knowledge to answer questions in the booklet and not the ACS assessments.

Course Structure

Appliance Specific Gas Safety Modules

- **Module 17 Domestic Central Heating and Water Heaters (CENWAT)**
- **Module 18 Domestic Cookers (CKR1)**
- **Module 19 Domestic Space Heaters, Gas Fires and Wall Heaters (HTR1)**
- **Module 20 Domestic Warm Air (DAH1)**

Introduction

All operatives are required to prove their competence in Gas Safety, Installation, Service and Maintenance.

Since 1st August 1998 that proof of competence has been carried out through the Nationally Accredited Certification Scheme (ACS) for Individual Gas Fitting Operatives. Each operative is required to have successfully completed the assessment requirements laid down by an accredited UKAS certification body and then be re-assessed at periods of no more than five years.

The BPEC Services Ltd – CCN1 Initial/Re-assessment Domestic Gas course is intended to provide the training required to support proving competence in this area of work.

Training Objectives

The aim of this open learning/tutor taught training package is to furnish you with the information to enable the **Nationally Accredited Certification Scheme (ACS)** assessments for appropriate appliances to be completed.

Method of Study

You can undertake the study by either self learning:

In which case you are required to study through the manuals at your own time and pace undertaking the questions highlighted in the knowledge question manual when prompted at the end of each module. You will then attend an approved assessment centre to undertake assessment.

NOTE: To undertake assessment you must:

a) Feel that you can completely meet all the knowledge objective requirements, and

b) Feel that you can competently carry out practical tasks covering the full range of modules discussed.

Or alternatively you can attend a training course at a BPEC training centre. You will progress through the course manuals in a structured learning environment. In addition, you will also work through a course practical task manual which links directly to the practical performance requirements identified previously.

If in doubt about completing the practical or knowledge requirements, it is always advisable to go for the BPEC training course option.

Contents

Introduction

The objective of this module is to enable you to successfully complete assessment across the following range of gas fired central heating boilers and instantaneous water heaters:

- Open flued.
- Room sealed (natural and fanned draught).
- Condensing.
- Back boiler units.
- Combination boilers.
- Combination units.
- Flueless – single point (under 12kW heat input).
- Large multipoint heaters – open flued, room sealed natural draught and fan assisted.

You will be required to prove that you can install, disconnect, service, repair, breakdown and commission domestic gas fired central heating/hot water boilers and circulators up to 70kW and domestic gas fired instantaneous water heaters.

Practically, you should be able to ensure the following:

- The appliance assembly is complete and is fit for purpose.
- The gas supply is isolated prior to work commencing.
- The appliance is correctly sealed to the balanced flue set.
- The appliance is correctly sealed to the open flue set.
- The gas supply is re-established.
- The work carried out is gas tight.
- The appliance is correctly located, level and stable.
- The appliance operational gas safety components are dismantled and cleaned, using appropriate cleaning methods and agents (e.g. burners, primary air ports, combustion chambers, ignition devices, thermostat, limit stats, pressure switches and flame supervision).
- The appliance is commissioned as follows:
  - The appliance is purged of air.
  - The working pressure at the appliance is correct.
  - The burner flame pictures, stability and ignition are correct.
  - The user controls are operating correctly.
  - The safety control devices are operating correctly.
  - The temperature controls are operating correctly.
- The flue connections are sound and flues are operating correctly.
- Defects on gas safety components are identified.
- The safe operation and use of the appliance is explained.

Additionally, you should know the following:

- Identification of unsafe conditions.
- Diagnosis of gas safety faults.
- The effects of unsatisfactory appliance case seals.
- Recognition of suitable and unsuitable appliance room/space locations.
- Clearance requirements (proximity of combustible materials) and fire proofing of compartments.
- The operation of mechanical and electrical controls.

Section 1 – Types of Appliances and their Operating Principles

Introduction

In sections 1 to 3 you shall be taking a look at the various types of appliances and the key operating principles of:

- Wet central heating/hot water boilers.
- Circulators.

Part 1 – Wet Central Heating/Hot Water Boilers

For the purposes of this module wet central heating/hot water boilers shall be defined as gas appliances designed to provide heat to wet space heating systems or combined wet space heating and hot water systems.

What types of appliance are available?

Boilers generally fall into one of three categories, related to possible positions where they may be sited:

- Floor standing.
- Wall mounted.
- Back boilers (behind a fire) GFBB (gas fired back boilers).

These categories can be manufactured as open flued room sealed or fanned draught models with the exception of back boilers, which are only available as open flued appliances.

Boilers can, however, be categorised further:

- Open flued or fanned draught.
- Room sealed – natural draught or fanned draught.
- System boilers.
- Combination boilers.
- Combination units.
- Condensing boilers.

By understanding the operating principles of these six appliance types, you should be able to describe how the mechanical and electrical controls operate within the majority of appliances which you may have to install or maintain.

Natural draught room sealed

Figure 1 is an exploded diagram of a typical room sealed natural draught gas boiler. The casing and control panel (including the boiler thermostat) have been omitted from the diagram for the purposes of clarity.

Legend

1. Heat exchanger
2. Flue baffles
3. Hook bolt kit assembly
4.1 Pipe – RH flow
4.2 Pipe – LH flow
4.3 Pipe – Return
5. Pipe – Return assembly
6. Collector hood
7. Combustion chamber
12. Main burner
18.1 Detection electrode
22. Thermostat pocket
25. Boiler thermostat
26. Control thermostat knob
34. Balanced flue terminal
47. Gasket, grommet and bush kit
53. Wall mounting plate

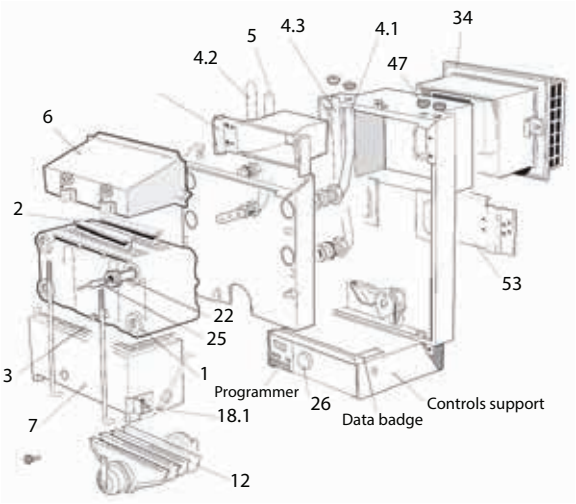

Figure 1: Typical room sealed natural draught floor standing boiler

Legend

10. Burner manifold
11. Air box and pilot assembly
12. Main burner
13. Main burner injector
16. Pilot shield
17. Gas control valve
42. Gas service cock

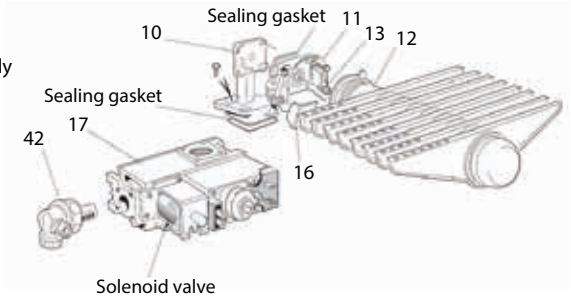

Figure 2: Burner and controls

How does the appliance work?

The boiler shown incorporates a combination of both mechanical and electrical gas control devices. It uses a permanent pilot as its source of main burner ignition.

Gas is supplied via the service cock (the main point of appliance gas isolation) to the inlet of the multifunctional control valve, which incorporates:

- Constant pressure governor.
- Flame supervision device (in this case working on the thermo-electric principle, using a thermocouple).
- Solenoid valve.

A pilot pipe and thermocouple lead connect the multifunctional control valve to the pilot assembly, which is situated adjacent to the main burner. The function of the pilot is to light the main burner. The pilot assembly incorporates:

- Pilot burner (incorporating pilot injector).
- Thermocouple.
- Spark electrode.

The spark electrode is connected via a lead to the piezo unit; its function is to light the pilot burner.

The purpose of the flame supervision section of the multifunctional control valve and its associated thermocouple is to only permit a flow of gas to the main burner when the presence of a pilot flame has been detected. The gas governor section of the control valve allows for adjustment of gas flow through to the main burner. The electric solenoid valve section provides for on/off operation of the main burner.

A boiler (control) thermostat, which can usually be adjusted in terms of water temperature, is electrically connected to the solenoid section of the multifunctional valve. The thermostat, includes a thermostat phial and lead. The phial is placed inside the thermostat pocket, which projects into the heat exchanger waterways. The thermostat electrically activates the solenoid valve in response to water temperature fluctuations.

The outlet of the multifunctional control valve connects directly to the main burner via connecting pipework. The gas itself is discharged into the main burner through an injector.

In the case of room sealed appliances, the air supply is entrained from the outside of the building via the air duct assembly directly into the combustion chamber of the appliance.

Flue gases are discharged through the heat exchanger (which may include a series of flue baffles) into the collector hood, discharging to outside air via the flue duct assembly.

Contents

Introduction

The objective of this module is to enable you to successfully complete assessment across the following range of ducted air heaters:

- Open flue natural draught.
- Open flue fan draught.
- Up flow models.
- Down flow models.
- Horizontal flow models.

You will be required to prove that you can install, disconnect, service, repair, breakdown and commission domestic gas fired ducted air heaters up to 60kW.

Practically, you should be able to ensure the following:

- The compartment construction and ventilation meets current requirements.
- The appliance assembly is complete and is fit for use and purpose.
- The gas supply is isolated prior to work commencing.
- The existing heater is disconnected and removed.
- The replacement heater is positioned in the compartment.
- The plenum base is sized, located and adapted to fit replacement appliance.
- The return air duct is sized, located and adapted to fit replacement appliance.
- A suitable rigid connection is made between the gas point and the appliance.
- The open flue is connected to the appliance.
- The gas supply is re-established.
- The work carried out is gas tight.
- The appliance is correctly located, level and stable.
- The appliance operational gas safety components are dismantled and cleaned, using appropriate cleaning methods and agents (e.g. burners, primary air ports, combustion chambers, ignition devices, thermostats, limit switch and flame supervision).
- The appliance is commissioned as follows:
  - The appliance is purged of air.
  - The working pressure at the appliance is correct.
  - The burner flame picture, stability and ignition are correct.
  - The user controls are operating correctly.
  - The safety control devices are operating correctly.
  - The temperature controls are operating correctly.
  - The plenum/return air ducts are adequately sealed.
  - The flue is correctly clearing products of combustion.

- The connections are gas tight and flues are operating correctly.
- Defects on gas safety components are identified.
- The safe operation and use of the appliance is explained.

Additionally, you should know the following:

- Identification of unsafe conditions.
- Diagnosis of gas safety faults.
- The causes and effects of split heat exchangers.
- Suitable and unsuitable locations/compartments – fire proofing.
- Air filters and their effects on the appliance.
- Requirements where combustion air is supplied by the heaters circulating fan.
- Clearance requirements (proximity of combustible materials) and fire proofing of compartments.
- The operation of mechanical and electrical controls.

Section 1 – Types of Appliances and their Operating Principles: Ducted Air heaters

Introduction

In this module we shall be taking a look at the various types of appliances and the key operating principles of:

- Up flow models.
- Down flow models.
- Horizontal flow models.

Part 1 – Ducted Air Heaters

For the purposes of this training course we shall define ducted air heaters as gas appliances designed to provide heat for space heating.

What types of appliances are available?

Ducted air heaters fall into one of three categories:

- Up flow models.
- Down flow models.
- Horizontal flow models.

These categories can be manufactured as open flued, natural convection or open flued fitted with a flue boost.

However, ducted air heaters can be categorised further:

- Natural draught and fanned draught.
- Traditional control models.
- Modairflow models.

By understanding the operating principles of these appliance types, we should be able to describe how the mechanical and electrical controls operate within the majority of appliances that we may have to install or maintain.

The operation of a traditional control

When the room thermostat calls for heat, it will operate the gas valve, which in turn will switch on the burner.

Once the temperature in the heat exchanger has reached approximately 58°C, the fan thermostat will operate the fan unit, thus distributing warm air via the register. When the temperature in the heat exchanger falls to approximately 38°C, the fan thermostat will switch off the fan unit.

The problem with the simplistic control system is that the on-off switching of the fan unit creates a feeling of coldness to the room occupants during an off period.

The operation of a modairflow control

A time control in the air heater allows the user to pre-select times of heating system operation.

A thermista-stat on the wall allows selection of comfort level; it senses heat requirement and continuously informs the electronic controls in the air heater of the rate of warm air delivery required. The air heater controls automatically adjust the operation of both gas burner and air circulation fan. Figure 1 shows a typical operating sequence of a modairflow control.

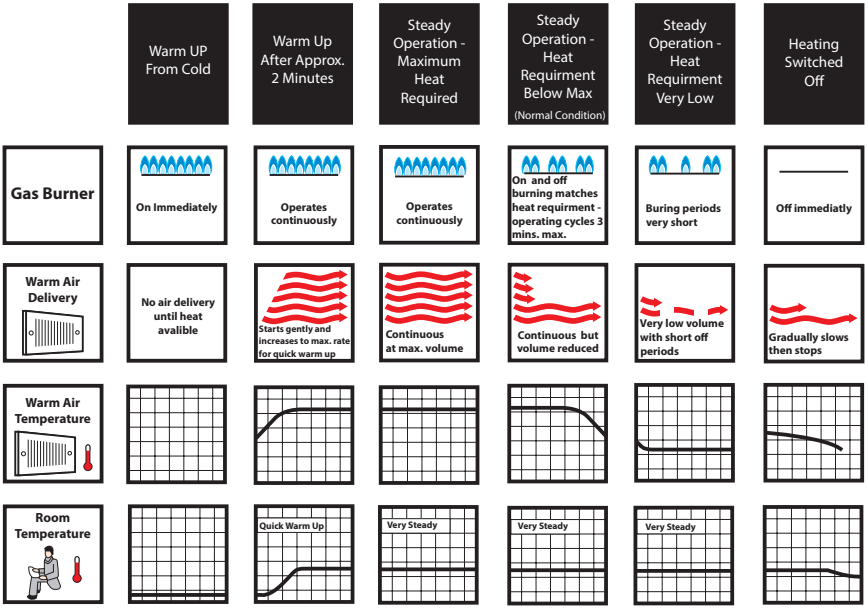

Figure 1: Operating sequence

How does the appliance work?

There are three variations in flow direction:

- **Downflow:**

Where the fan is positioned above the heat exchanger, directing the heat downwards through the unit, with the air distributed from the bottom (see Figure 2).

These are suitable for most dwellings.

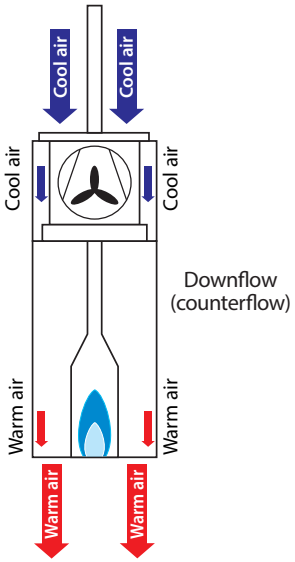

Figure 2: Downflow

- **Upflow:**

  Where the fan is positioned below the heat exchanger delivering air upwards for distribution (see Figure 3).

  These are suitable for installations in basement, but can be installed at other levels within a dwelling.

- **Horizontal flow:**

  Has the fan and heat exchanger located side by side and discharges air for distribution horizontally (see Figure 4).

  These are suitable for wall mounting.

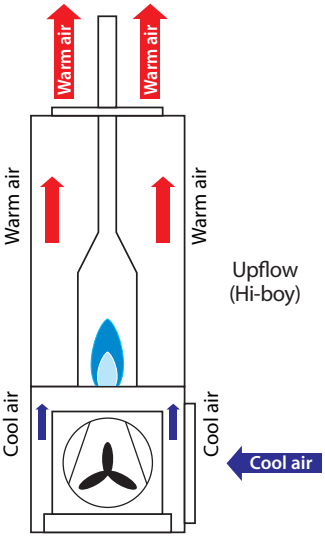

Figure 3: Upflow

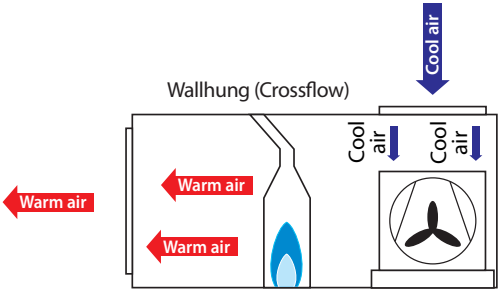

Figure 4: Horizontal flow

The working components

The centrifugal fan has an integral motor with sealed bearings designed to give trouble-free running.

With a basic heater, the fan switch (a bi-metal blade) controls the fan and ensures that it does not blow cold air on starting and that it dissipates warm air before stopping. The fan runs at a single speed.

With a modulating output heater, the airflow sensor (a thermistor) has a similar task to the fan switch, but the fan speed varies automatically. With the system ET (even temperature controls), the thermista stat controls the fan speed as well as the burner.

The heat exchanger – transfers heat from combustion chamber to circulation air without them mixing. It is shaped like a clam and made up of one or more sections. Most are constructed from stainless steel.

The burner – natural gas burners have a single injector, gas and air are mixed before burning. Each heat exchanger clam has its own burner bar.

The flue – takes combustion products from the heater to atmosphere and can be of different types. Mostly open flues are used, where combustion air is drawn in through the front of the heater. The flue products pass through a draught diverter and then to atmosphere via a flue pipe. Fan assisted open flues are also used.

Balanced flues – are used on individual heaters and the flue box induces combustion air and disposes of flue products.

The controls – All heaters use a multi functional gas valve. This allows gas to pass to the burner and is controlled by the limit switch.

The limit switch – performs the same function as a boiler stat and controls the temperature of air distributed to the grilles and registers.

Fan switch control (thermistor) – controls the speed of the fan according to the current temperature, or on basic models shuts the fan off.

Time control – allows the gas valve to open at pre-selected times.

Room stat – This will bring the burner into operation when calling for heat. The gas valve allows gas to permanent pilot, which will ignite the burner when the main gas is supplied.

The thermocouple – is a device to prevent gas being supplied to the burner when the pilot is not alight. Its probe is heated by the pilot, which produces a small electric current of 10-30 Mv, opening the gas valve.

The pilot – can be lit by pushing the gas valve button in (which allows gas to the pilot) and igniting the pilot by the piezo ignition. The button is held in long enough for the thermocouple to operate. Piezo means "pressure electric" and is a crystal which, when pressure is applied, becomes compressed and produces a spark.

Basic control ducted air heaters

These heaters are operated by a 24 volt thermostat which, when calling for heat, brings on the burner at a pre-selected rate via an electrical panel. The fan switch will consequently bring on the fan at a pre-selected speed. Warm air will then be delivered via the system until the thermostat is satisfied; the heater will then shut down.

On short ducted systems this can give fairly large temperature differences, both across rooms and from off and on. Draughts and noises can also be a problem.

Modairflow control ducted air heaters

These heaters are operated by a thermista-stat, which is a heat sensitive resistor sending a continuous signal to the heater. This brings on the burner, which cycles at approximately two minute intervals, with on periods always matching the heat requirement. The fan speed is then matched to the heat output.

This provides a heater with modulating output working almost continuously to match the heat requirement. Continuous output at lower fan speeds mean very stable temperatures, all round comfort and vastly reduced noises and draughts.

The filter contained within the heater can be a passive filter or with modern technology, an extremely efficient electronic air cleaner. Basic air heaters can also have electronic air cleaners fitted.

Task 2

Visually check the existing pipework system and note any defects below, and any remedial actions necessary, e.g. pipework fixings, pipe size, materials etc.

Task 3

Check to ensure that the gas supply has been effectively isolated prior to the work commencing.

Has the gas supply been effectively isolated? Yes No

If no, what remedial action is necessary?

Task 4

Carry out a gas tightness test of the existing pipework installation prior to the work commencing.

Does the tightness test indicate that the pipework system is leak free or within permissible tolerances?

Yes No

If no, what remedial actions are necessary?