LCHT - training pack covering phase 1-3 Practical


IHallEdu 2023

Unit 9

Overview

To be used for all phases of the Low Carbon Heating Technician practical training period. KSB's are highlighted matching where they occur within each Duty.

Student Name:_____

Duties in order for 36 month PTP

Year 1

Duty 1 Plan low carbon heating and hot water systems to meet customers' needs and in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.K1 K2 K5 K6 K8 K9 K10 K12 K24 K25 S1 S2 S3 S4 S13 S14 S15 B1 B2 B3 B4 B5 B6

Duty 2 Select and size low carbon heating and hot water systems to meet customers' needs and in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures.K1 K2 K5 K6 K8 K9 K10 K21 K25 S1 S2 S13 S14 S15 B1 B2 B3 B4 B5 B6

Duty 3 Carry out preparatory work for the Installation of low carbon heating and hot water systems. K1 K2 K3 K5 K6 K8 K9 K10 K12 K24 S1 S2 S3 S4 S14 B1 B2 B3 B4 B5 B6

Duties in order for 36 month PTP

Year 2

Duty 4 Install low carbon heating and hot water systems in accordance with design criteria, manufacturers guidance, regulatory requirements and industry recognised standards and procedures. K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K12 K25 S1 S2 S5 S7 S14 B1 B2 B3 B4 B5 B6

Duty 5 Test and commission low carbon heating and hot water system installations in accordance with manufacturers guidance, regulatory requirements and industry recognised standards and procedures. K1 K2 K4 K5 K6 K7 K8 K9 K10 K11 K13 S1 S2 S6 S8 S14 B1 B2 B3 B4 B5 B6

Duty 6 Carry out appropriate handover procedures for low carbon heating and hot water systems to customers and or end users including the provision of written information, diagrammatic information, verbal information and demonstration regarding the systems operation and use. K1 K2 K5 K6 K7 K8 K9 K10 K25 S1 S2 S6 S8 S14 S15 B1 B2 B3 B4 B5 B6

Duties in order for 36 month PTP

Year 3

Duty 7 Carry out routine service and maintenance procedures on low carbon heating and hot water systems. K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K16 K17 K18 K19 K20 K25 K26 S1 S2 S9 S10 S14 S15 B1 B2 B3 B4 B5 B6

Duty 8 Perform fault finding, diagnosis and rectification procedures on low carbon heating and hot water systems. K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K17 K19 K20 K26 S1 S2 S9 S10 S14 S15 B1 B2 B3 B4 B5 B6

Duty 9 Decommission heating and hot water systems. K1 K2 K5 K6 K7 K8 K9 K10 K14 K15 K17 S1 S2 S11 S12 S14 B1 B2 B3 B4 B5 B6

Duty 10 Conform to all health, safety and welfare in the workplace requirements. K1 K3 K4 K5 K6 K7 K8 K9 K10 K11 K14 K15 K16 K17 K18 K19 K20 K21 K22 K23 K24 K25 K26 S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 B1 B2 B3 B4 B5 B6

Phase #001-Safety

Hazard spotting;

● Create a room that has various hazards, candidates to record a number of hazards and what issues they may lead to and how to remove or reduce the hazards recorded in the training manual.

K1 & S1 & B1

Hazard	Issues	Remove or Reduce

Risk Assessment

S4 & K24 & B1

All employers must conduct a risk assessment. If you have fewer than five employees you don't have to write anything down.

We have started off the risk assessment for you by including a sample entry for a common hazard to illustrate what is expected (the sample entry is taken from an office-based business). Look at how this might apply to your business, continue by identifying the hazards that are the real priorities in your case and complete the table to suit. You can print and save this template so you can easily review and update the information as and when required. You may find our example risk assessments a useful guide (http://www.hse.gov.uk/risk/casestudies). Simply choose the example closest to your business.

Company name: **Date of risk assessment:**

What are the hazards?	Who might be harmed and how?	What are you already doing?	Do you need to do anything else to control this risk?	Action by who?	Action by when?	Done
Slips and trips	Staff and visitors may be injured if they trip over objects or slip on spillages.	General good housekeeping is carried out. All areas are well lit, including stairs. No trailing leads or cables. Staff keep work areas clear, eg no boxes left in walkways, deliveries stored immediately.	Better housekeeping in staff kitchen needed, eg on spills. Arrange for loose carpet tile on the second floor to be repaired/replaced.	All staff, supervisor to monitor Manager	From now on **19/06/202**	**19/06/202**

Feedback on hazard spotting and things to work on

Manual handling;

● Candidate to use centre risk assessments to assist them in carrying out three manual handling exercises, one man lift, two person lift and mechanical aid.

Evidence will be supplied by the candidate, recording the methods used to safely move the three objects via a write up.

K1 & S1 & S14 & B1

Candidate evidence on how they carried out the above activities;

PPE kit;

Candidate will be shown a range of PPE kit, they will then be asked to identify the items and record them on the sheet below;

K1 & S1 & B1

Name of Item	Use	Protection Offered

Access equipment; K1 & S1 & B1

All candidates will erect a step ladder and extension ladder. Before which they will identify and record the visual checks to be carried out on the access equipment before use;

Step ladders

Visual checks to be carried out on step ladders before use

Extension ladders

Visual checks to be carried out on an extension ladder before use

Additional activity

All will be aware of how to safely ingress and egress from a mobile tower scaffold, with an awareness of how to inspect for safe use.

Candidates to record their findings from the tower scaffold below;

Findings -
Safe to use -

Fire fighting

K1 & S1 & B1

Item	Complete the tasks below	Check
1	Identified the source of a small fire as Class A material near a main electrical fuse box.	
2	From a range of different types of extinguisher within the fire location area, select the correct type to extinguish the fire.	
3	Directed the extinguisher to the base of the fire.	

Working with hazardous materials K1 & S1 & B1

Demonstrate safe practice when using solvent-based products

Item	Complete the tasks below	Check
1	Referred to the centre's COSHH assessment for this task and applied it in conjunction with the following activities.	
2	Confirmed the health and safety risk of the solvent being used by referring to the COSHH assessment sheet.	
3	Using the COSHH assessment sheet, identified the safe method of working with the solvent including any equipment to be used.	
4	Applied the solvent in a safe manner.	

Working safely with electrical items/tools

Electric Drill

Item	Complete the tasks below	Check
1	Referred to the centre's risk assessment for this task and applied it in conjunction with the following activities.	
2	Selected the item to be used and undertook the following actions: (a) the item had been the subject of a PAT test within recommended timescales (b) the item was visually inspected.	
3	Using the risk assessment sheet identified the safe method of working with the power tool including any personal protective equipment to be used.	
4	Used the item in a safe manner.	

Working safely with electrical items/tools

Electric welding machine (plastic pipe)

Item	Complete the tasks below	Check
1	Referred to the centre's risk assessment for this task and applied it in conjunction with the following activities.	
2	Selected the item to be used and undertook the following actions: (a) the item had been the subject of a PAT test within recommended timescales (b) the item was visually inspected.	
3	Using the risk assessment sheet identified the safe method of working with the power tool including any personal protective equipment to be used.	
4	Used the item in a safe manner.	

Feedback on safety and things to work on

Identification of fittings

K3

Task introduction

This task requires you to identify each of the fittings provided or located within the workshop area and describe their use.

Equipment

Your tutor/trainer will provide you with reference material and a selection of gas and water fittings for you to correctly identify to perform this task.

Item	Complete the task below	Check
1	Using the fittings provided, complete the table below to identify each of the fittings provided or located within the workshop area and describe their use.	

Fitting identification and description	How is it used?

Soldering

Task introduction

In the workshop, select, assemble and operate a blowtorch to solder a joint on copper pipework.

Equipment

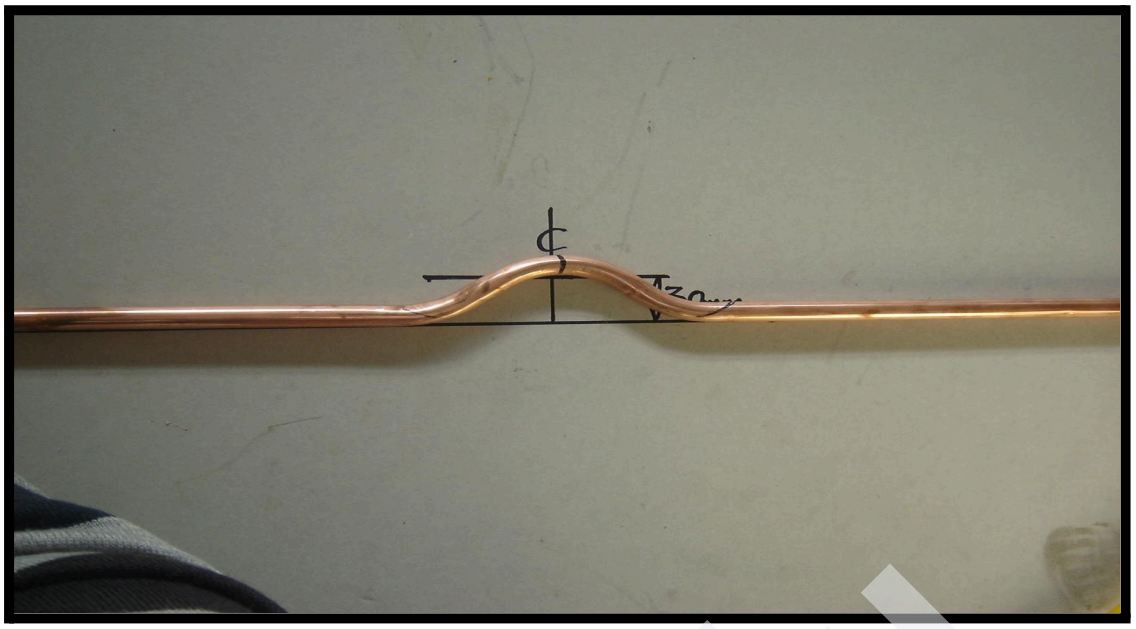
Your tutor/trainer will provide you with the tools and material required to perform this task.

Item	Complete all the tasks below	Check
1	Wear the correct PPE for the task.	
2	Select appropriate tools for the task and inspect them for safety.	
3	Identify and select the components of a gas blowtorch.	
4	Assemble the components of a gas blowtorch in a safe manner.	
5	Assemble two pieces of copper pipe with an end feed coupling.	
6	Clean and prepare fitting and pipework for assembly.	
7	Apply flux to pipework prior to jointing.	
8	Holding the blowtorch in the upright position, solder the fitting, applying solder wire to the heated joint.	
9	Disassemble the blowtorch in a safe manner.	
10	Tidy work area.	

Bending tube (copper and LCS)

Item	Complete all tasks below	Check
1	Measure and prepare templates for bends	
2	Use the tools in a safe manner	
3	Bend all pipes to required angles	
4	90° bend to set measurements agreed with trainer/tutor	
5	Passover bend to set measurements agreed with trainer/tutor	
6	Offset bend to set measurements agreed with trainer/tutor	
7	Complete all bends in both materials	
8	Tidy work area	

90° bend Size set by tutor



Double passover bend size set by tutor

Offset bends size to be set by tutor

Combination frame

Task introduction

Test your enhanced pipework skills by designing a frame in a group or on your own. Once the agreed design is achieved, fabricate a frame comprising copper, LCS and plastic push-fit pipework.

Equipment

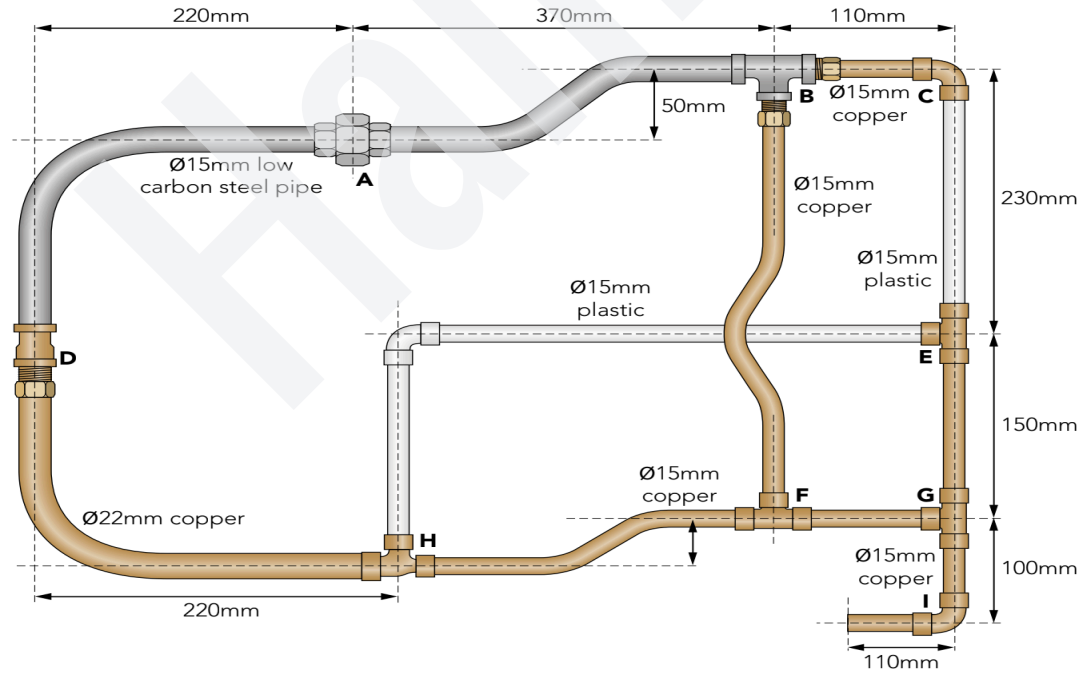
Your tutor/trainer will provide you with the tools and materials required to perform this task.

Item	Complete all tasks below	Check
1	Review the diagram on the following page for a frame that comprises copper, LCS and plastic push-fit pipework.	
2	Identify the fittings required.	
3	Calculate the pipe lengths required.	
4	Wear the correct PPE for the task.	
5	Select appropriate tools for the task and inspect them for safety.	
6	Cut the pipe lengths required and deburr pipe ends.	
7	Set up the bending machine (where required) and bend the tubes to your requirements.	
8	Set out the assembled components on the workbench and check final dimensions.	
9	Join all fittings using an appropriate jointing method for each material.	
10	Soundness test your frame using hydraulic test equipment.	
11	Tidy work area.	

List of fittings

A
B
C
D
E
F
G
H
I

Design for a frame comprising copper, LCS and plastic push-fit pipework:



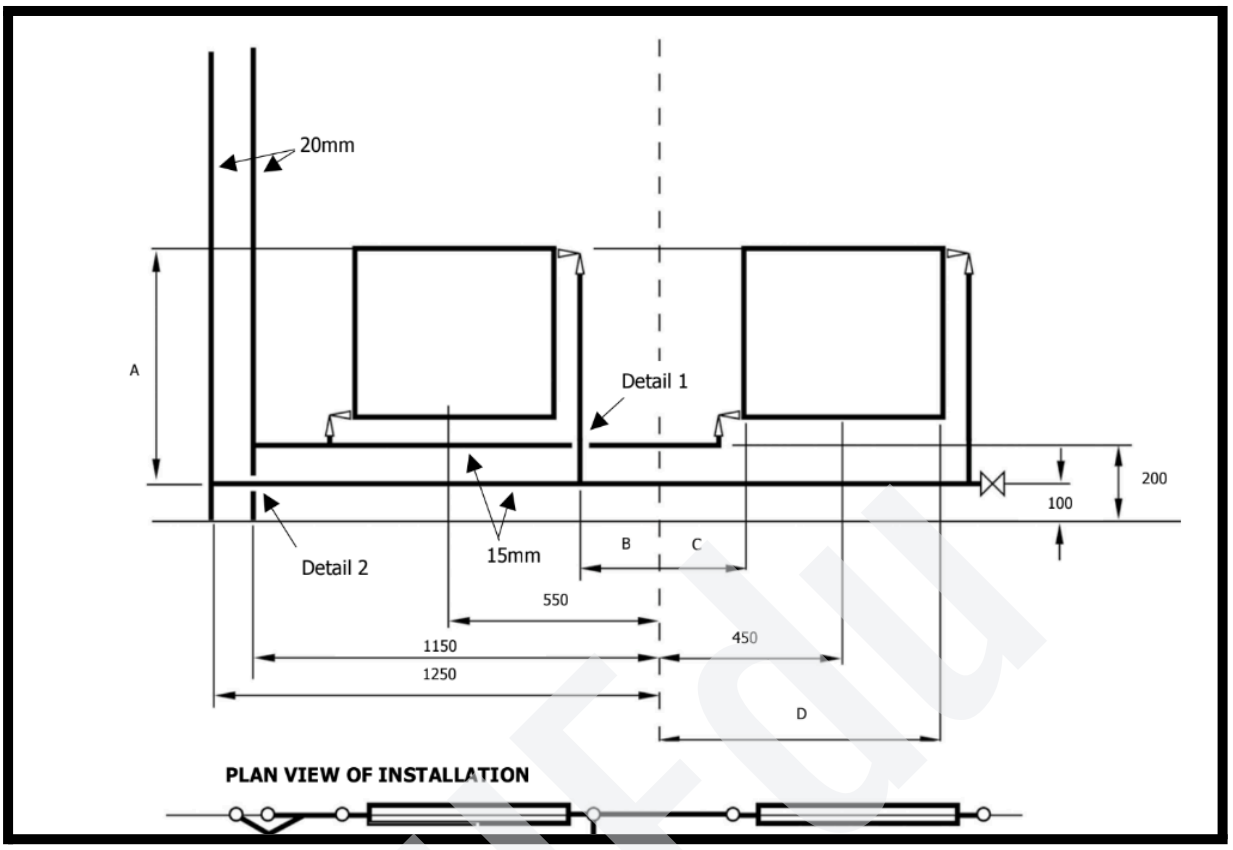
Materials for frame

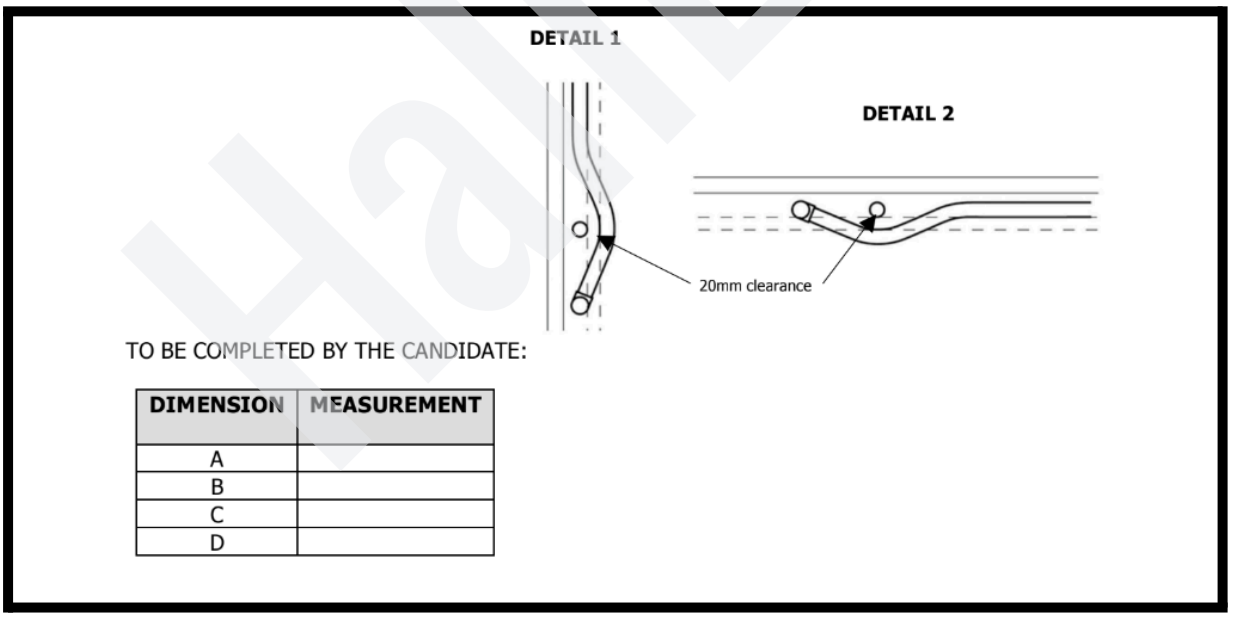
Materials/fittings	Quantity

Pipe lengths

Pipework	Total pipe length required
Copper	
LCS	
Plastic	

Installation task-Copper and Plastic Pipe (LH-copper RH-plastic)





TO BE COMPLETED BY THE CANDIDATE:

DIMENSION	MEASUREMENT
A	
B	
C	
D	

Item	Complete all tasks below	Check
1	Transfer data from drawing and transfer to wall	
2	Use the tools in a safe manner	
3	Dress and install radiators	
4	Fix clips to wall	
5	Install pipework, fittings and components	
6	Record data from install onto table	
7	Check and fill system to 2 bar	
8	Tidy work area	

Phase #001-Electrical

Electrical component identification;

Candidates will be offered the images and required to identify them in the table provided.

1

2

3

4

Name of component	Use of component
1	
2	
3	
4	

Safe electrical isolation;

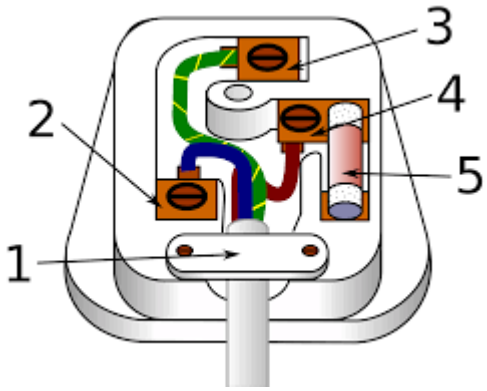
All candidates will be required to safely isolate an electrical circuit. After which they will record the process in the table provided.

Step 1	
Step 2	
Step 3	
Step 4	
Step 5	
Step 6	

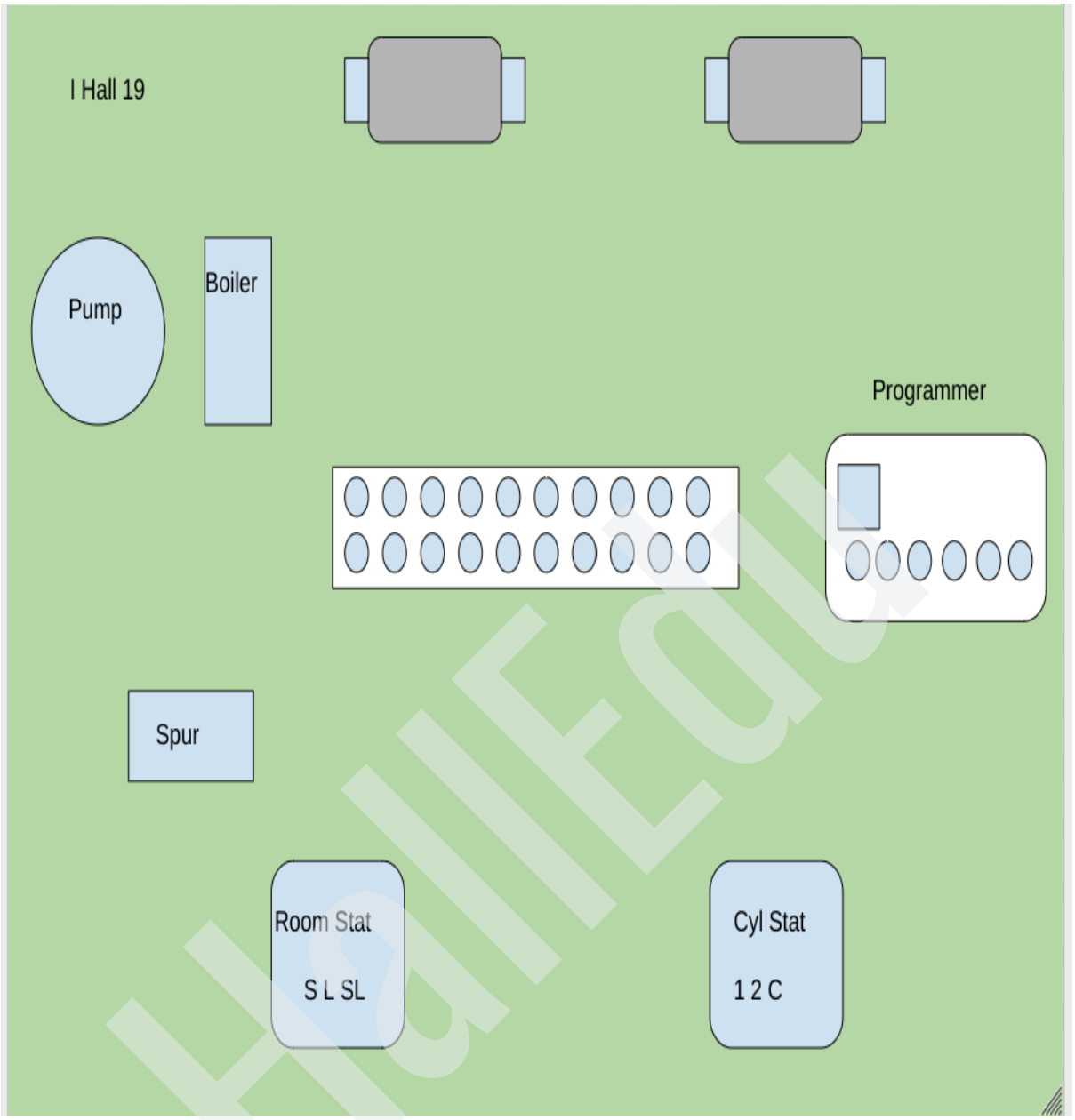
Electrical wiring;

Candidates will be required to wire a circulating pump and a plug via a flex. Wire a junction box via cable and carry out basic tests.

Evidence will be practical observation and labelling of the plug and a summary of the testing procedure.



1	
2	
3	
4	
5	



Before commencing with a practice wiring task for an S plan heating system, students are to add the wiring to the drawing above. A separate drawing can be added to this as a stretching activity featuring an S plan +.

Testing procedure
Short circuit; Earth Continuity; Polarity;

Fault finding on electrical circuits- Faults to be given by tutor- list of faults dependant on centre

	Fault 1	Fault 2	Fault 3
ASHP			
GSHP			
Solar Thermal			
Unvented			

Feedback on electrical section and things to work on

Phase #001- Safe use of LPG

Candidate Brief:

After a practical demonstration and under the supervision of your tutor, you are required to carry out the following tasks prior to using a propane blowtorch.

- **Produce a safety checklist for the assembly and use of the equipment**
- **Select suitable components**
- **Connect up the gas equipment in the correct order**
- **Purge the installation and test for leakage**
- **Light up blowtorch**
- **Shut down and make safe using correct procedures**
- **Demonstrate the need for a heat mat when soldering close to combustible materials**

NOTE

In the interest of safety this must only be carried out in the presence of your tutor who will provide feedback on completion of the exercise.

Grade	Unsatisfactory	Satisfactory	Good	Very Good

Phase #001- Measuring and recording dimensions

Pipe Lengths

No.	Material	Diameter	Length
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Areas

No.	Object / room	Length	Width	Area
1	Bay 1			
2	Bay 2			
3	Hot water Cylinder Bay			
4 Bench top				

Volume

No.	Object / room	Length	Width	Height	Area
1	Bay 1				
2	Bay 2				

Working with a level

Time Allocation: 1.5 hours

Candidate Brief:

Following a demonstration by your tutor, you are required to complete the

following: ***With reference to the drawing on the following page:***

SPIRIT LEVEL
Working from a fixed datum point selected by your tutor –
• Select the tools and equipment you will require to complete the task
• Using a spirit level, ruler / tape measure and marker pen indicate the fixing points on the wall • Make screw fixings to mount copper tube fixings to the wall surface

PLUMB-LINE
Working from a fixed datum point selected by your tutor –
• Select the tools and equipment you will require to complete the task
• Using a plumb-line, ruler / tape measure and marker pen indicate the fixing points on the wall • Make screw fixings to mount copper tube fixings to the wall surface

Grade	Unsatisfactory	Satisfactory	Good	Very Good

Input from employer group on ground loop jointing methods for training

Task introduction

As a plumber/heating technician, you will regularly encounter scenarios where you will need knowledge of the Building Regulations. Complete the table below, identifying what the different parts of the Building Regulations relate to.

Part	Relates to
A	
B	
C	
D	
E	
F	
G	
H	
J	
K	
L	
M	
P	

Task introduction

As a plumber/heating technician, you will regularly encounter scenarios where you will need knowledge of the British Standards. Complete the table below, identifying the titles of the British Standards and explaining how they apply to the plumbing/heating sector.

British Standard	Title/Application
BS 1212	
BS EN 442	
BS 6798	
BS 1010	
BS 6340	
BS 7206	
BS EN 1057	
BS EN 1401	
BS EN 200	

Pipe sizing – heating

Task introduction

In order to ensure that the required heat output is delivered to the heat emitters, heating pipe sizes must be accurately calculated. Using reference material, determine

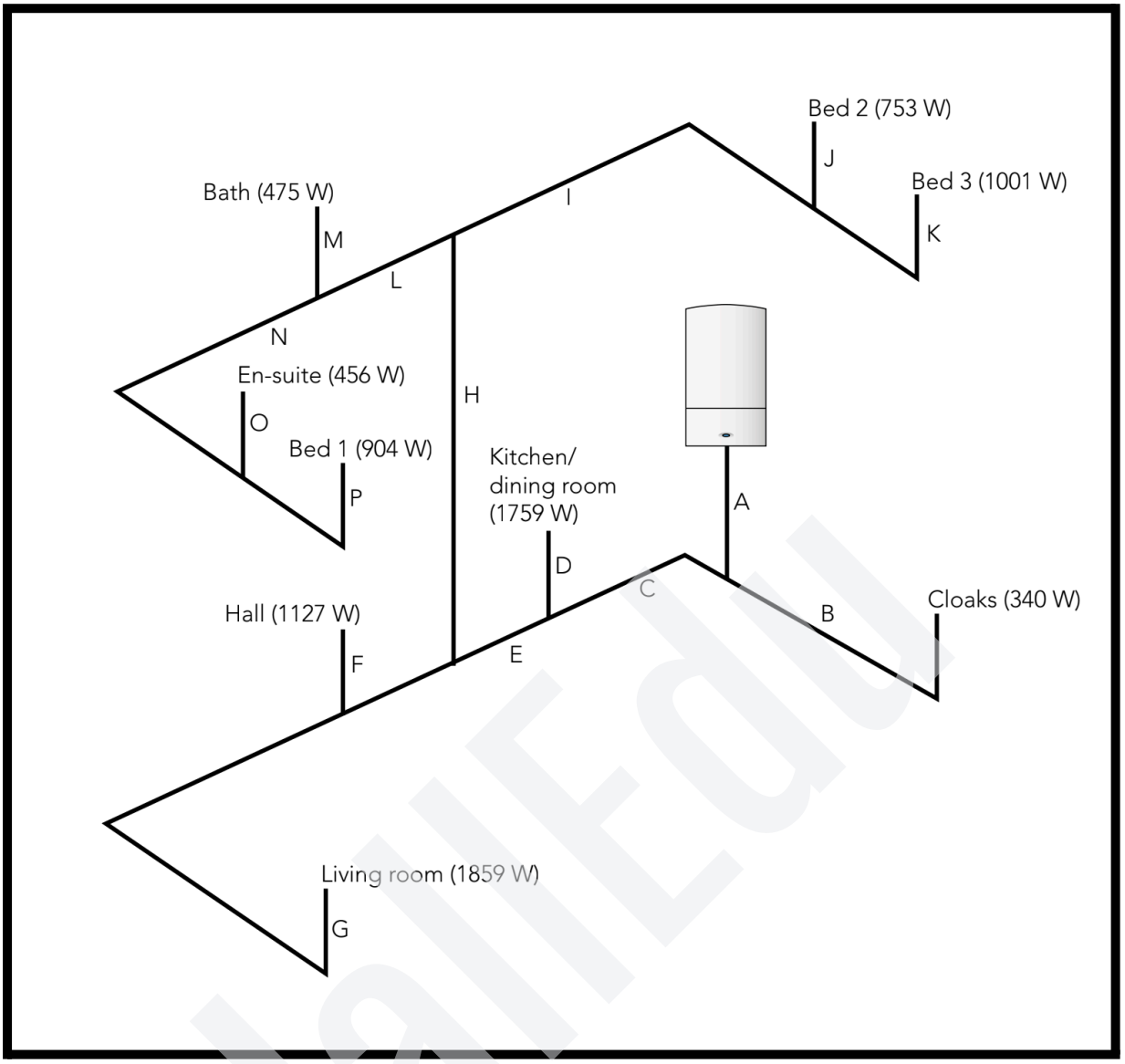
the correct pipe diameters to the installation provided in the diagram on the next page. Record these in the table.

Equipment

Your tutor/trainer will provide you with the relevant reference materials required to

perform this task.

Item	Complete the tasks below	Check
1	Determine the pipe load for each section across the installation, add 10% pipe losses to each load and determine the total pipe load for each section.	
2	Use a flow and return temperature difference of 10°C and a specific heat capacity of 4.187 J/kg/°C to calculate the mass flow rate (kg/s).	
3	Use the relevant reference materials to select the appropriate pipe diameter.	



Example of how to get Kg/s

Stage 1
Look at the section **Boiler to A** the total boiler load is 17.98Kw (without the 15%) and so the pipe size from boiler to A will need to carry all of that heat. A 10% margin for heat loss from the pipe is being added and the length of the run is 12m.

(Remember to convert watts to Kilowatts) before carrying out the following calculation.

17.968 X 1.10 (10%) = 19.765Kw

If we look at the next slide you can see these figures have been added. As we discussed earlier, the heat required is converted from Kw to Kg/s. the method is as follows;

Flow rate = Kw / (SHC X Δt) = Kg/s

Where;
Kw = total heat carried by the pipe
SHC = specific heat capacity of water taken as 4.19 Kj/Kg °C
Δt = flow and return temperature difference

The boiler is to be a condensing boiler with a 20 °C temperature difference across the flow and return. Therefore, the calculation looks like this;

Flow rate = 19.765 / (4.19 X 20) = 0.235Kg/s BIDMAS 4.19 round up to 4.2, then multiply by the Δt either 10 or 20 so 4.2 x 20 = 84. Then 19.765/84 = 0.235 Kg/S
Continue this process for each section of pipework, then use the CIBSE guide (page 67) to ascertain the pipe size.

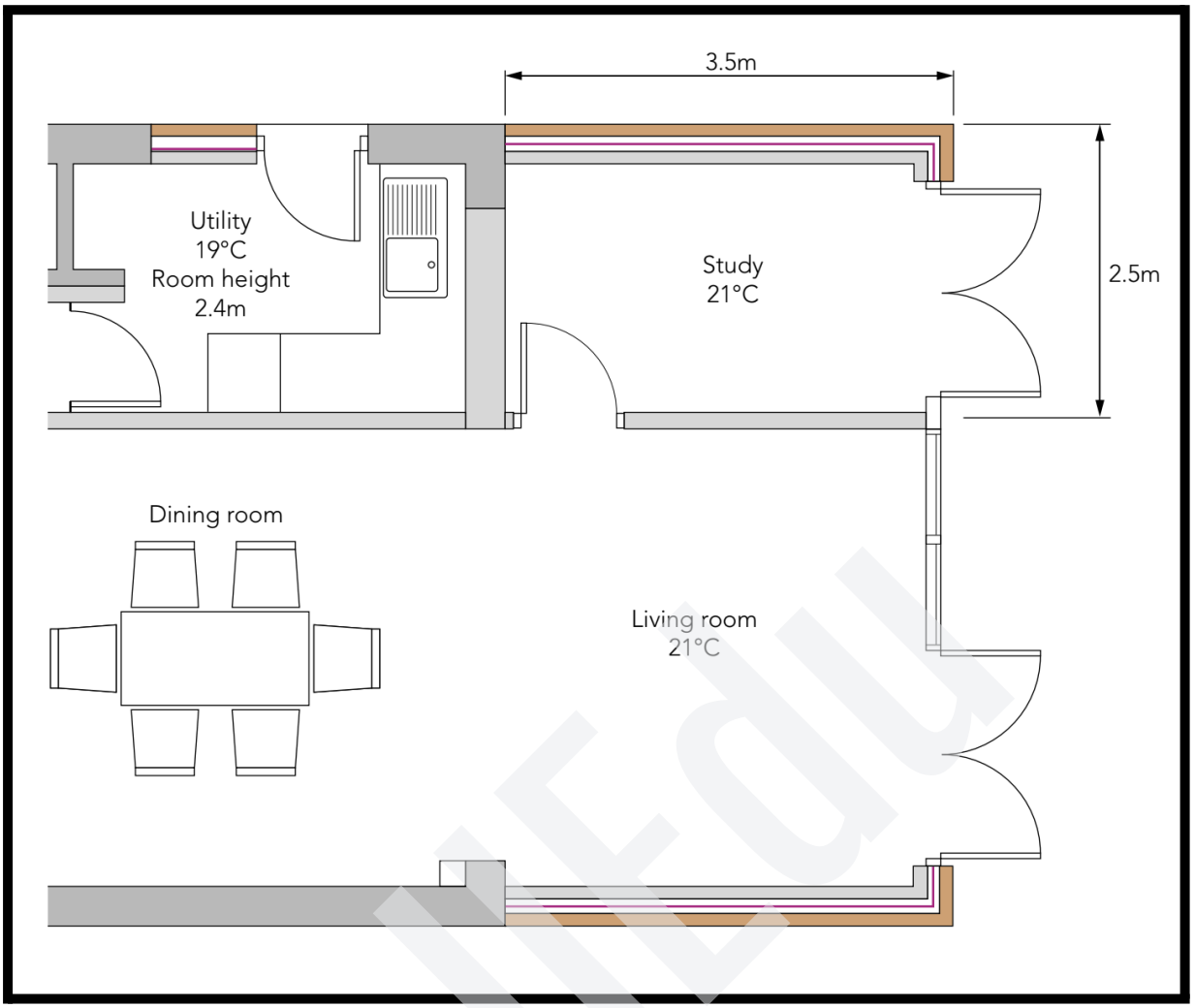
Pipe section	Pipe load (W)	10% heat loss from pipe (W)	Total pipe load (W)	Flow rate kg/s	Pipe diameter (mm)
A					
B					
C					
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					
N					
O					
P					

Heat loss calculation

Task introduction

When designing a heating system, you will have to accurately calculate the heat losses from a room in order to select a suitable radiator/heat emitter.

Item	Complete all tasks below	Check
1	Research and complete the table on the next page to calculate the fabric heat losses from the Study in the diagram below through each surface.	
2	Calculate the ventilation losses from the study in the diagram and provide the total heat loss from the room.	
3	Select a suitable heat emitter for the room, indicating on the drawing the position of the radiator.	


3.5m
Utility
19°C
Room height
2.4m
Study
21°C
2.5m
Dining room
Living room
21°C

Room	Study							
Design temperature	21°C	Outside temperature		-3°C	Design temperature difference			
	Room dimensions			Volume of room (m^3)	Air change factor (W/m^3K)	Temperature difference (°C)	Air changes per hour	Total heat loss Watts (-W)
	Height (m)	Length (m)	Width (m)					
Ventilation loss					0.33			
Fabric heat loss				Fabric area (m^2)	U-value (W/m^3K)	Temperature difference (°C)		Loss
Floor								
Ceiling								
Internal door								
Internal wall 1 minus internal door								
Internal wall 2								
Design heat loss (total Watts for all elements)								
		Additional factors				Yes	% add	
		Intermittent heating				Y	15%	
		Grand total heat loss from room (W)						

Design a system using a low loss header

Task introduction

As a plumber and domestic heating technician, you may be required to install a low loss header into a central heating system.

Equipment

Your tutor/trainer will supply you with the materials required for this task.

Item	Complete all tasks below	Check
1	Using your class notes and reference materials, research the installation and design of a low loss header.	
2	Draw a two-boiler system using a low loss header with connections to three circuits.	
3	Explain the reason for using a low loss header.	
4	Identify the various connections of a low loss header.	

Drawing

Details for item 3 & 4

3
4

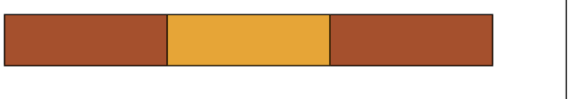
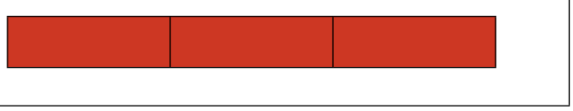
Identify different pipe labels

Task introduction

As a competent plumber/heating technician, you will need to be able to identify what is contained in pipework by the label.

Look at each colour-coded label and complete the second column with the relevant pipe contents.

- Grey water
- Heating water
- Natural gas
- Potable water
- Steam

Pipework label	Pipe contents
	
	
	
	
	

Install an unvented cylinder and all components

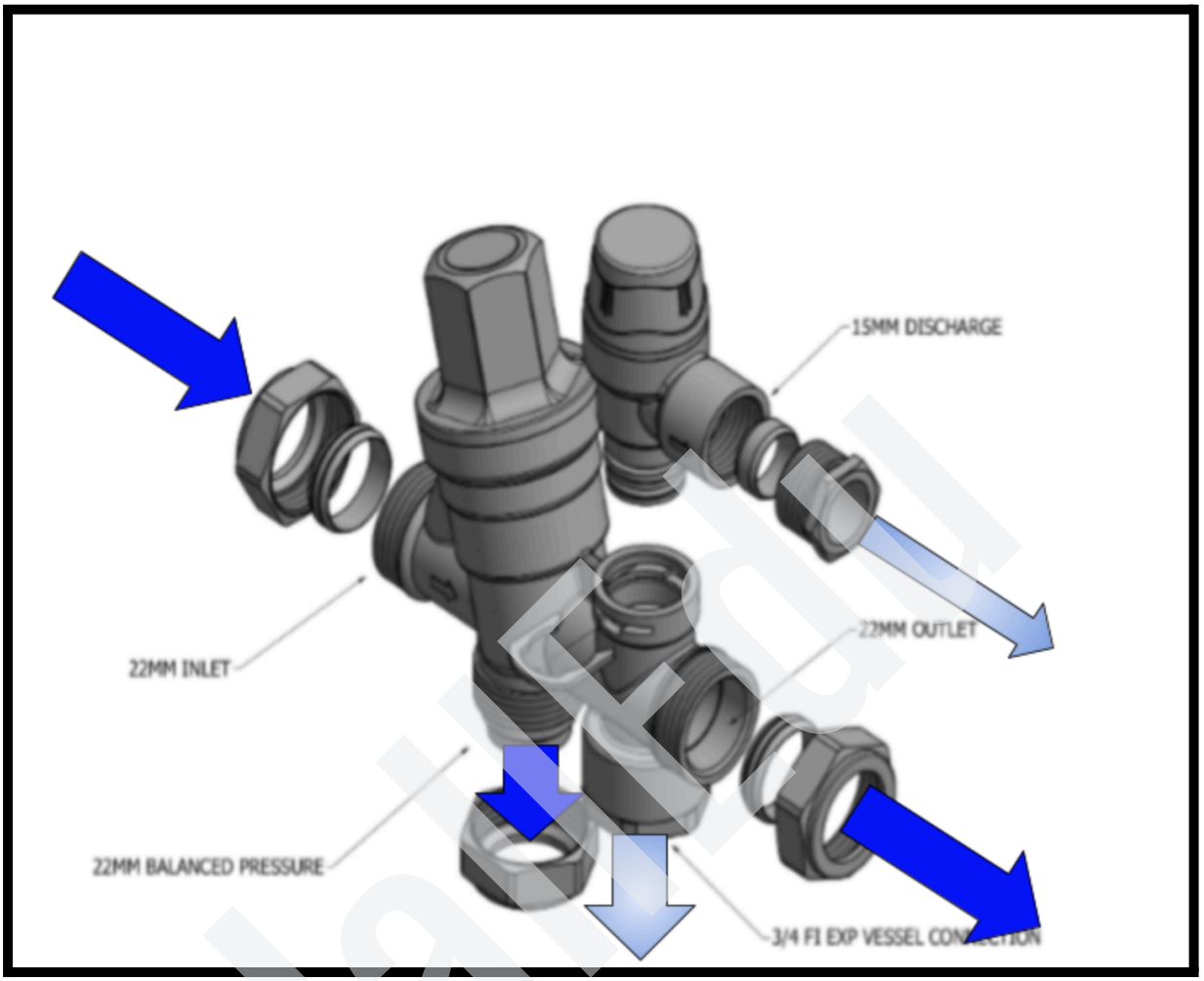
Task introduction

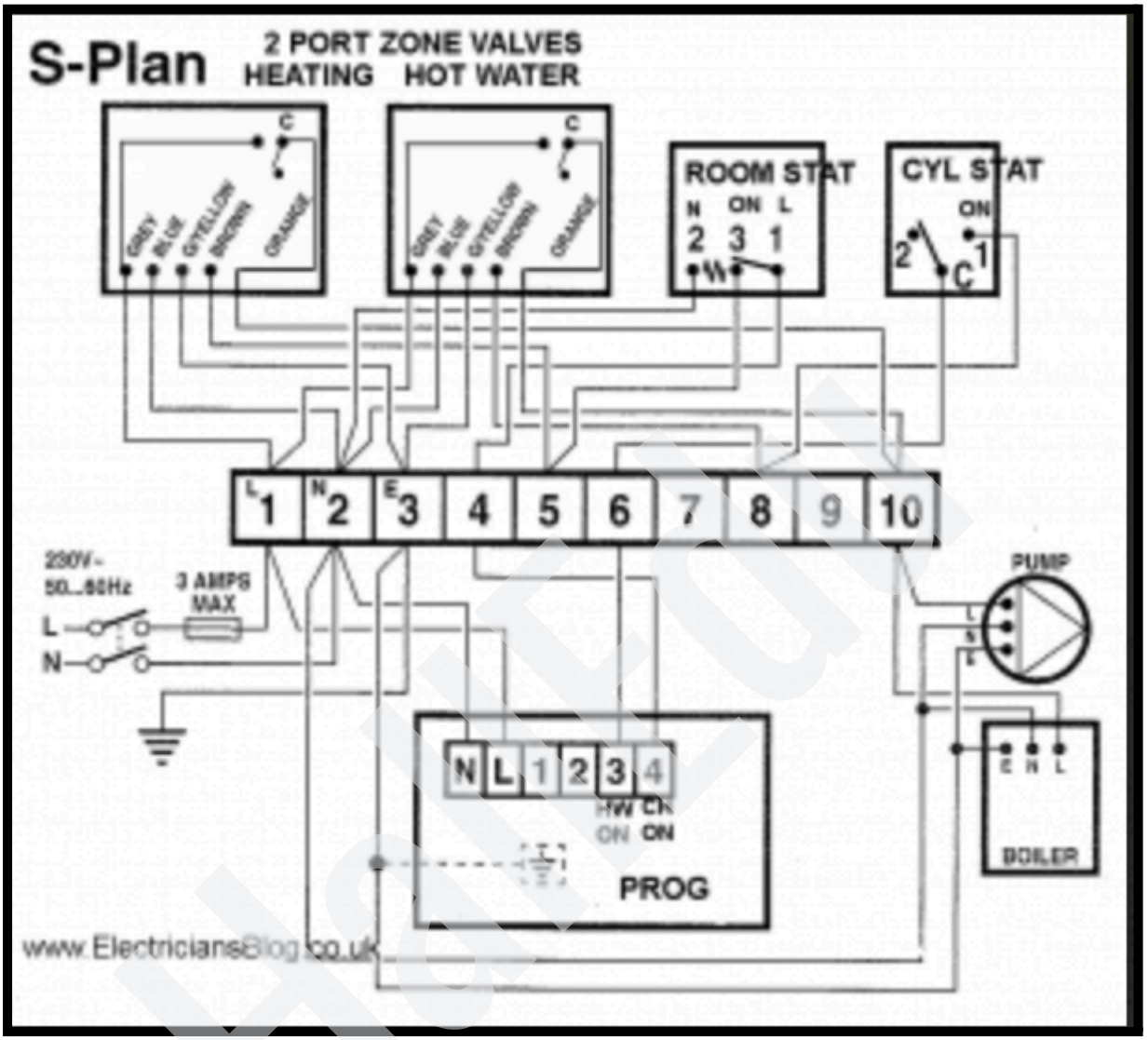
With the enhanced hot water flow rates associated with an unvented hot water system, as a plumber/heating technician you may be required to install one of these hot water cylinders and all of its controls.

Equipment

Your tutor/trainer will supply you with the tools and materials required for this task.

Item	Complete tasks below	Check
1	Ensure that the flow rate and water pressure are adequate for the system to be installed.	
2	Install the hot water cylinder and all associated components and controls following manufacturer instructions.	
3	Wire the S-plan controls following manufacturer instructions.	
4	Commission the unvented hot water system following manufacturer requirements, and ensure correct operation and flow rates/water pressure.	
5	Complete the commissioning checklist located	
6	Tidy the work area.	


15MM DISCHARGE
22MM OUTLET
22MM INLET
22MM BALANCED PRESSURE
3/4 FI EXP VESSEL CONNECTION


S-Plan
2 PORT ZONE VALVES
HEATING HOT WATER
C
GREY
BLUE
G/YELLOW
BROWN
ORANGE
ROOM STAT
N ON L
2 3 1
CYL STAT
ON
2
C
1
L 1
N 2
E 3
4
5
6
7
8
9
10
230V - 50...60Hz
3 AMPS MAX
L
N
PUMP
N L 1 2 3 4
ON ON
PROG
E N L
BOILER
www.ElectriciansBlog.co.uk

This Commissioning Checklist is to be completed in full by the competent person who commissioned the storage system as a means of demonstrating compliance with the appropriate Building Regulations and then handed to the customer to keep for future reference.

Failure to install and commission this equipment to the manufacturer's instructions may invalidate the warranty but does not affect statutory rights.

Customer name:	Telephone number:
Address:	
Cylinder Make and Model	
Cylinder Serial Number	
Commissioned by (PRINT NAME):	Registered Operative ID Number
Company name:	Telephone number:
Company address:	
	Commissioning date:
To be completed by the customer on receipt of a Building Regulations Compliance Certificate*:	
Building Regulations Notification Number (if applicable)	

ALL SYSTEMS PRIMARY SETTINGS (indirect heating only)					
Is the primary circuit a sealed or open vented system?	Sealed		Open		
What is the maximum primary flow temperature?					°C

ALL SYSTEMS					
What is the incoming static cold water pressure at the inlet to the system?					bar
Has a strainer been cleaned of installation debris (if fitted)?	Yes		No		
Is the installation in a hard water area (above 200ppm)?	Yes		No		
If yes, has a water scale reducer been fitted?	Yes		No		
What type of scale reducer has been fitted?					
What is the hot water thermostat set temperature?					°C
What is the maximum hot water flow rate at set thermostat temperature (measured at high flow outlet)?					l/min
Time and temperature controls have been fitted in compliance with Part L of the Building Regulations?				Yes	
Type of control system (if applicable)	Y Plan		S Plan	Other	
Is the cylinder solar (or other renewable) compatible?	Yes		No		
What is the hot water temperature at the nearest outlet?					°C
All appropriate pipes have been insulated up to 1 metre or the point where they become concealed				Yes	

UNVENTED SYSTEMS ONLY					
Where is the pressure reducing valve situated (if fitted)?					
What is the pressure reducing valve setting?					bar
Has a combined temperature and pressure relief valve and expansion valve been fitted and discharge tested?	Yes		No		
The tundish and discharge pipework have been connected and terminated to Part G of the Building Regulations				Yes	
Are all energy sources fitted with a cut out device?	Yes		No		
Has the expansion vessel or internal air space been checked?	Yes		No		

THERMAL STORES ONLY		
What store temperature is achievable?		°C
What is the maximum hot water temperature?		°C

ALL INSTALLATIONS		
The hot water system complies with the appropriate Building Regulations	Yes	
The system has been installed and commissioned in accordance with the manufacturer's instructions	Yes	
The system controls have been demonstrated to and understood by the customer	Yes	
The manufacturer's literature, including Benchmark Checklist and Service Record, has been explained and left with the customer	Yes	

Commissioning Engineer's Signature
Customer's Signature
(To confirm satisfactory demonstration and receipt of manufacturer's literature)

*All installations in England and Wales must be notified to Local Authority Building Control (LABC) either directly or through a Competent Persons Scheme. A Building Regulations Compliance Certificate will then be issued to the customer.

benchmark COLLECTIVE MARK
THE MARK OF QUALITY FOR THE INSTALLATION, COMMISSIONING AND SERVICING OF DOMESTIC HEATING AND HOT WATER SYSTEMS

www.centralheating.co.uk

Regulate the temperature on a blending valve

Task introduction

Carry out this task in pairs or groups.

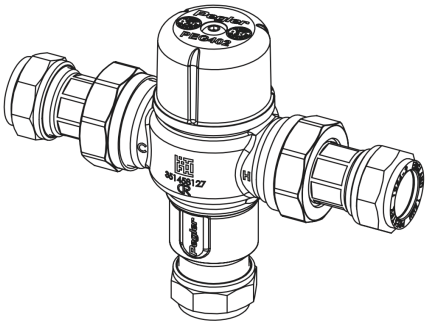
As a plumber/heating technician, you may be required to regulate the temperature on a blending valve.

Equipment

Your tutor/trainer will provide you with the materials required for the task.

Item	Complete tasks below	Check
1	Take the current temperature at the hot water tap.	
2	Remove the blending valve cap and alter the temperature to 48°C by checking the temperature at the outlet.	
3	Replace the cap.	
4	Tidy the work area.	

Application	Designation	Maximum Set Mixed Water Temperature
Bidet	HP-B LP-B	38°C
Shower	HP-S LP-S	41°C
Washbasin	HP-W LP-W	41°C
Bath*	HP-T44 LP-T44	44°C
Bath* (assisted)	HP-T46 LP-T46	46°C

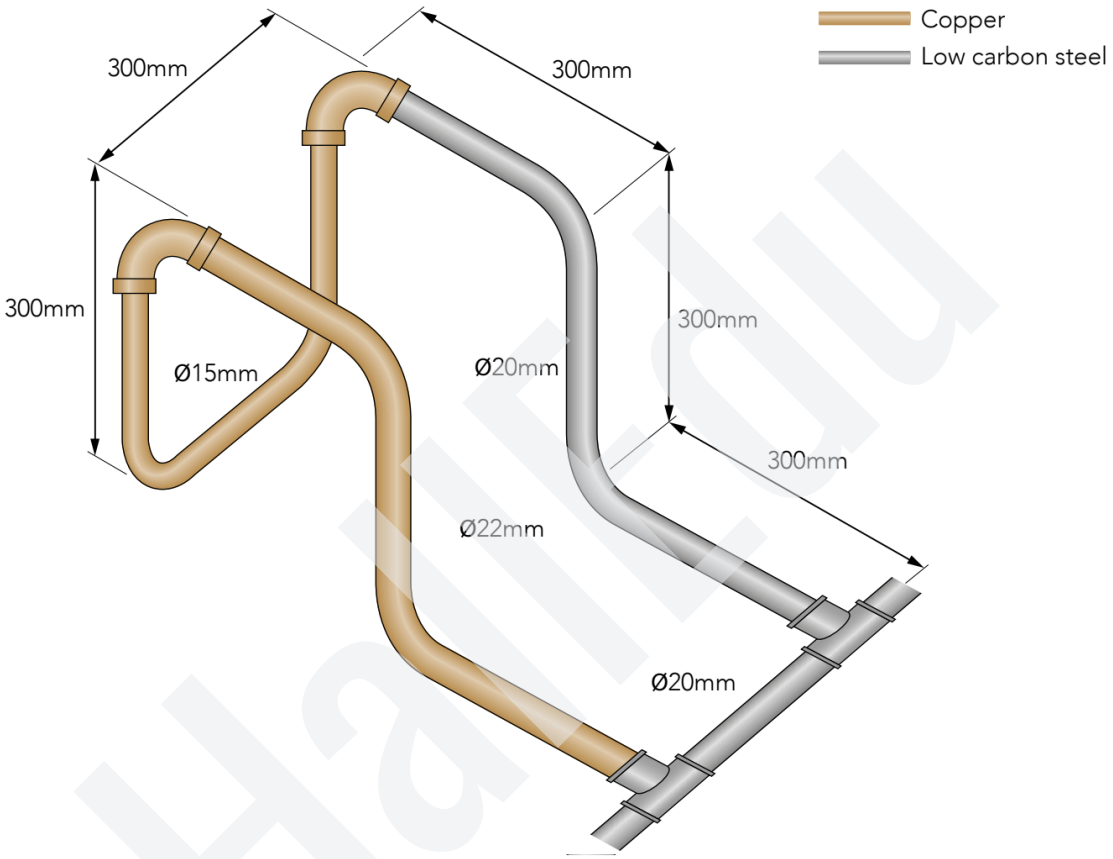


Additional pipework

Task introduction

In the table on the next page, list all the materials, lengths of pipework and fittings used to complete the frame in the diagram below.

On completion the frame should be pressure tested to 3 bar for 5 minutes.



Frame type		
Pipe material	Length of pipe	Fitting type

Install a primary filter on a central heating system

Task introduction

As a plumber/heating technician, you may have to install a primary filter on a central heating system.

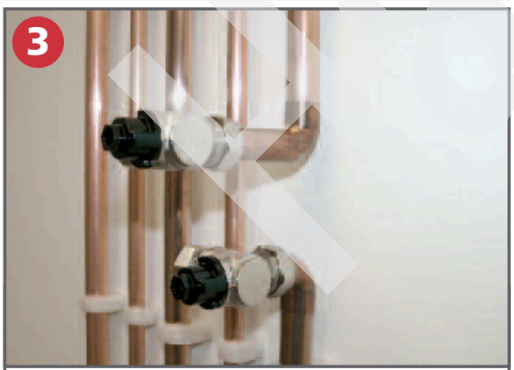
Equipment

Your tutor/trainer will provide you with the materials required for the task.

Item	Complete all tasks below	Check
1	Drain the central heating system.	
2	Install the primary filter into the central heating return.	
3	Place the correct amount of inhibitor into the central heating system.	
4	Refill and commission the central heating system.	
5	Tidy the work area.	

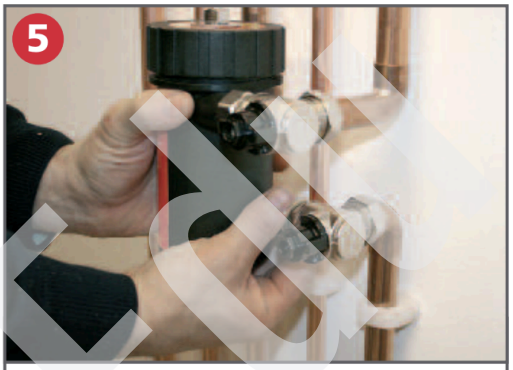
Drain the central heating system or plug-off feed and expansion tank and release the system pressure. Measure and mark a 110mm section for a 22mm unit and a 195mm section for a 28mm unit when making the connections with elbows supplied, as shown in **3** below. When installing below a boiler or other object, allow 250mm clearance from the top of the canister to beneath the object, to enable the lid assembly to be removed when servicing. This applies to both 22mm and 28mm *MagnaClean Professional* canisters.

Using a suitable cutter, carefully remove the marked section of pipework to create the correct opening.

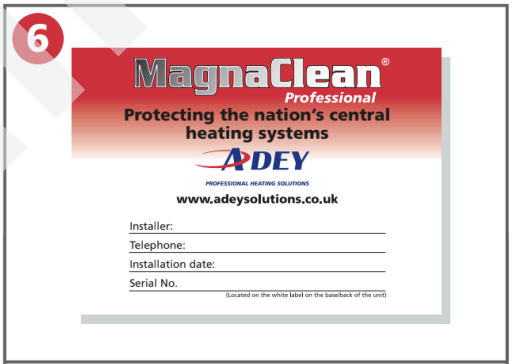


Prepare the pipe and fittings accordingly. Lubricate the olives and assemble the valves on the pipe. Hand tighten.

Loosely secure the *MagnaClean Professional* canister to the valves. Grip the *MagnaClean* canister and tighten the compression fittings being careful not to over tighten.



Loosen off the valve flange nuts and insert the rubber washers provided. Thoroughly tighten the flange nuts. Do not over tighten.
Refill the heating system.



Run the central heating system while checking for leaks. Attach the self-adhesive *MagnaClean Professional* label to the boiler, indicating your name, telephone number, date of installation and serial number. Always service the filter before leaving the premises. The lid and valve spanner can be left with the customer.

Your questions answered

Q. Where can I fit *MagnaClean® Professional*?

A. *MagnaClean Professional* is suitable for all central heating systems and can be fitted anywhere on the main heating circuit. In order to achieve the best protection for the boiler, it is recommended that *MagnaClean Professional* is fitted between the last radiator and the boiler (see diagram overleaf). In determining a suitable location for installation, it is important to ensure you allow adequate access for servicing.

Q. Which connection on the *MagnaClean Professional* canister is the flow and which is the return?

A. The inlet and outlet on *MagnaClean Professional* are reversible and there is no flow restriction.

Q. Can I fit *MagnaClean Professional* horizontally?

A. *MagnaClean Professional* can be fitted in any orientation. Each isolation valve can rotate through 360° making it possible to install in a vertical position on horizontal pipework.

Q. How often do I service *MagnaClean Professional*?

A. *MagnaClean Professional* has been designed to retain, on average, a year's build-up of sludge. Therefore, servicing is required once a year with the annual boiler service. If the system has a heavy sludge build-up, or a power-flush was not carried out, we recommend cleaning the filter at appropriate intervals during the first year of installation and annually thereafter. It is easy to check the filter periodically, following the instructions overleaf.

Q. Can I use chemicals with *MagnaClean Professional*?

A. Yes. You can use any chemical or acid agents on the market with *MagnaClean Professional*. The patented Pro-Fill air vent has been designed to allow installers to insert chemicals directly into the system as described overleaf. Chemical dosing kits for this purpose are available to purchase through your local plumbing merchant. Alternatively, remove the lid and use the canister as a dosing vessel.

Q. What is the lifespan of *MagnaClean Professional*?

A. *MagnaClean Professional* has been designed to last for the lifetime of the boiler, normally ten years. It provides continuous protection and comes with a two year warranty. Registering your warranty is straightforward and can be done online at **www.adeysolutions.co.uk**

Q. How do I isolate the valves?

A. Simply turn the valves to the marked OFF position using the spanner provided. The valves rotate 360° in either direction. Important: Remember to switch off the electrical supply to the boiler when servicing *MagnaClean Professional*.

Q. What can I install on 28mm pipework?

A. We recommend installing *MagnaClean Professional* 28mm which has been designed for this purpose. *MagnaClean Professional* 28mm can also be installed onto 22mm pipework where greater sludge capacity is required.

Q. I have a pacemaker, will *MagnaClean Professional* affect me?

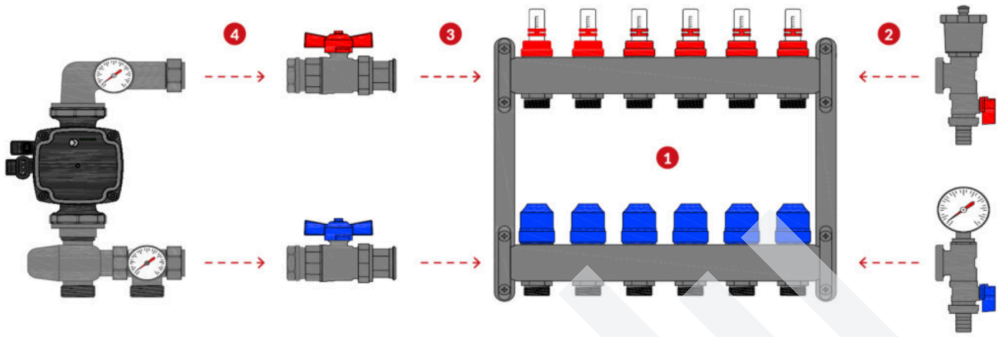
A. As with all magnetic products, if you have a pacemaker caution should be taken when handling *MagnaClean Professional* at all times. When *MagnaClean Professional* is installed, the magnetic field outside the canister is approximately one tenth of an average fridge magnet.

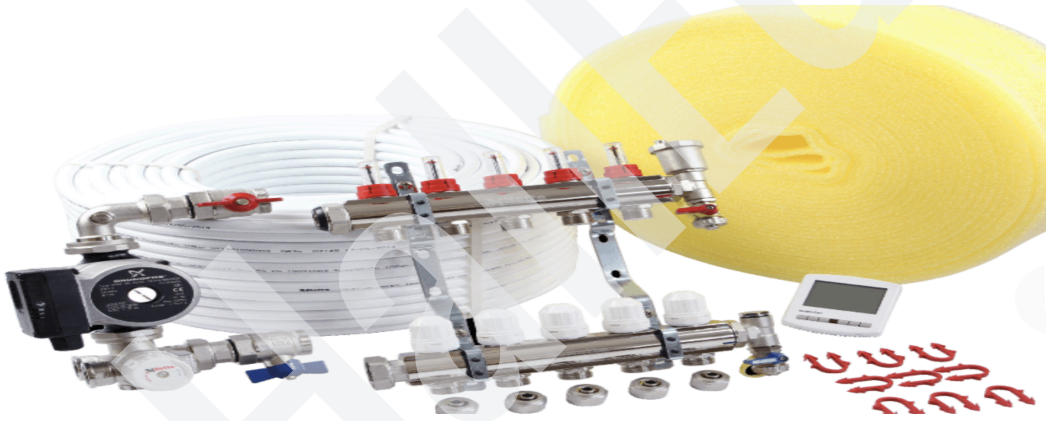
Q. What other size *MagnaClean* products do you provide?

A. When a *MagnaClean* product is required for larger pipework, up to 35mm, two *MagnaClean Professional* 28mm units can be fitted in parallel with no flow restriction. For pipework larger than 35mm we would recommend using *MagnaClean Industrial* from our commercial range. For more information call our sales team direct on **01242 546700** or visit our website, **www.adeysolutions.co.uk**

MagnaClean® Professional

Install an UFH manifold





Design an air source heat pump system

Suggested reference material for this task

MIS 3005 Requirements for MCS contractors undertaking the supply, design, installation, set to work, commissioning and handover of microgeneration heat pump systems
MCS Heat Pump Calculator
MCS Heat Emitter Guide MCS021
Domestic Building Services Compliance Guide
Manufacturer technical instructions

Before commencing the task of design, some background knowledge questions are to be completed below;

What does coefficient of performance (COP) mean and how is it calculated?

What effect can a decrease in ambient temperature have on a heat pump system?

Describe seasonal performance factor (SPF).

List two factors that affect seasonal performance factor (SPF)

Confirm the meaning of system efficiency and factors that affect it.

State why achieving minimum heat loss from the building is important when designing a heat pump system.

List four potential consequences of oversizing or under sizing a heat pump? Your answer should include at least one example of under sizing.

What document should be referenced when identifying heat pump hydraulic flow rate requirements?

State how to use manufacturers' data to select heat pump units.

What factors can affect heat pump output capacity?

Complete the table detailing heat emitter supply water temperatures.

Emitter type	**Supply water temperature**
Underfloor heating	
Radiators	
Fan coil units	

How are correction factors used to determine emitter output requirements?

List three advantages and disadvantages of including a buffer tank in the system design. Your answer should include at least one disadvantage.

Describe the method of determining the size of a heat pump.

State why heat pump annual operating hours vary.

List two factors to be considered when selecting and positioning air source heat pumps in relation to its fan coil unit.

Describe the defrost cycle and why it is required.

What is the guidance value for sizing buffer storage volume?

Checklist for questions pre design

The candidate has achieved the criteria detailed below	Assessor check
Described coefficient of performance (COP). Detailed coefficient of performance (COP) calculation.	
Described the effect that ambient temperature can has on coefficient of performance and heat pump output.	
Described seasonal performance factor (SPF) and listed factors that affect it.	
Confirmed the meaning of system efficiency and listed factors that affect it.	
Stated why achieving minimum heat loss from the building is important when designing a heat pump system.	
Listed four potential consequences of oversizing or under sizing a heat pump.	
Listed documents that should be referenced when identifying heat pump hydraulic flow rate requirements.	
Detailed how to use manufacturers' data to select heat pump units.	
Stated how heat pump output capacity is affected.	
Completed the table detailing heat emitter supply water temperatures.	
Stated how correction factors are used to determine emitter output requirements.	
Listed the advantages and disadvantages of including a buffer tank in the system design.	
Described the method of determining the size of a monovalent heat pump system.	
Stated why heat pump annual operating hours vary.	
Listed factors to be considered when selecting and positioning air source heat pumps.	
Describe the defrost cycle and why it's required. Stated guidance value for sizing a buffer tank.	

Install main components of an AHSP

The candidate is required to pre-inspect the work area and then install an air source heat

pump.

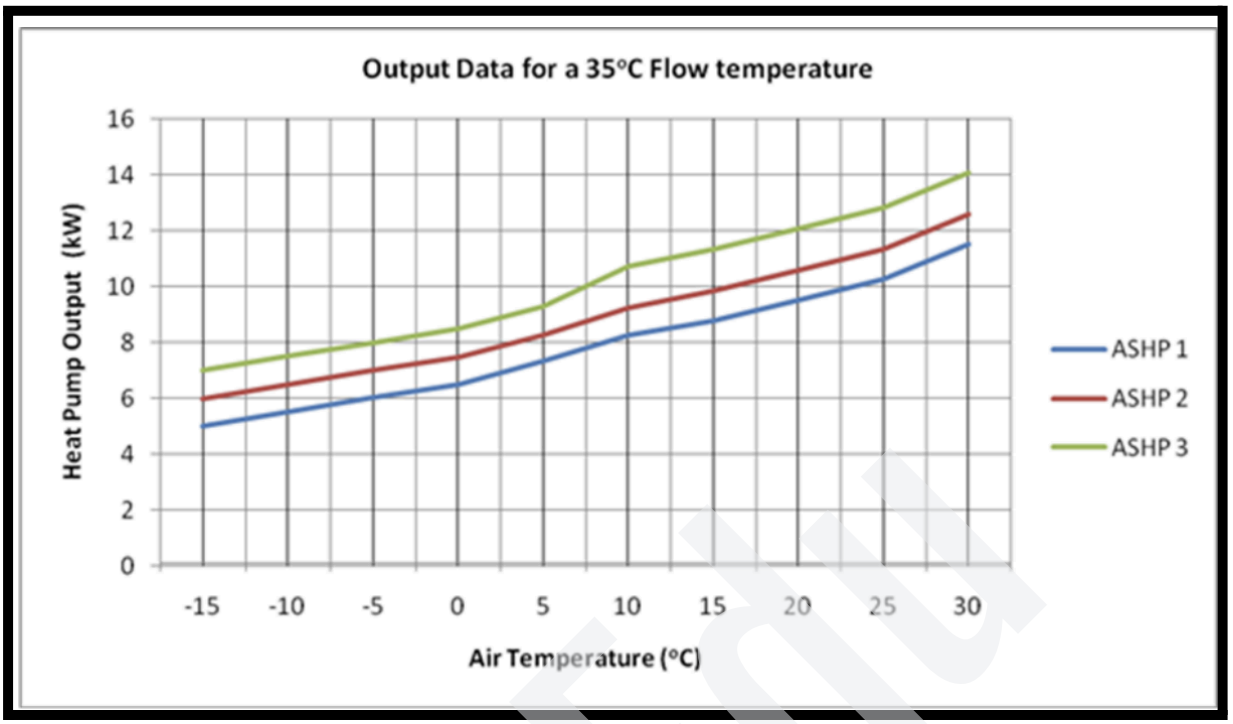
Using the components and manufacturers' instructions provided, the candidate must position, fix and connect the system components as specified.

Referring to the installation scenario below, complete the pre installation checklist :

System Design Data

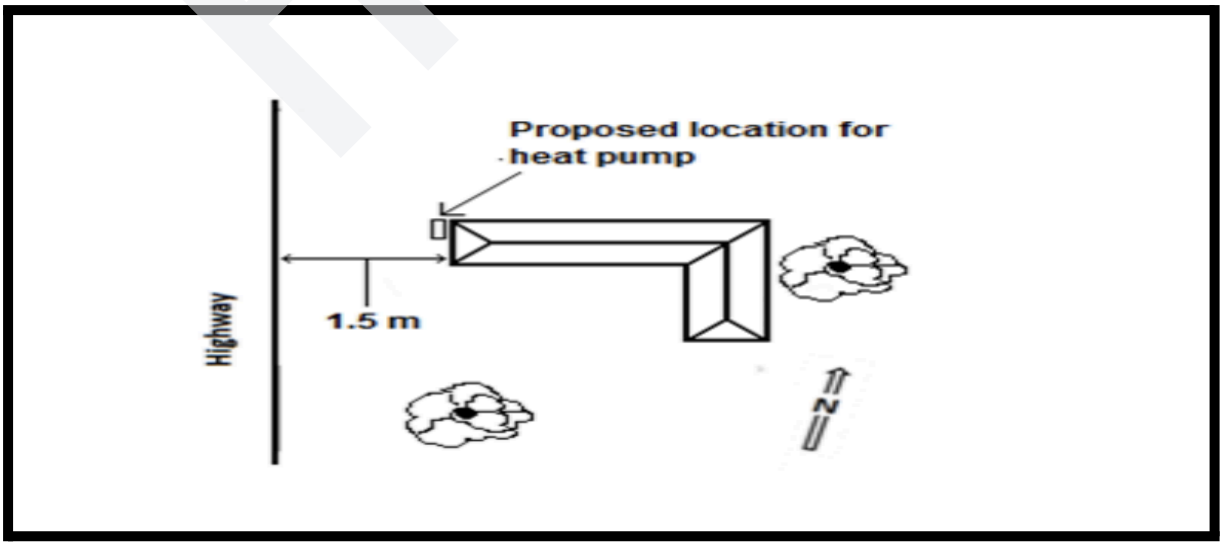
Building heat load	Space Heating 8kW Domestic Hot Water 0.8kW
External air temperature	-3 ℃
Room design temperature	21 ℃
Emitter circuit type	Bivalent (Bivalent Point to be 1℃)
Heat emitter type	Panel radiators (sized using a Temperature Difference Correction Factor of 0.304 (20℃)
Buffer tank included in emitter circuit	Yes
Purpose of buffer tank	To support the heat pump defrost cycle only
Buffer tank capacity	90 litres
Water flow temperature	50 ℃
Emitter circuit temperature drop	10 ℃

The system designer has selected ASHP 1 for the installation. The manufacturer's output data charts are given below:



Property description and location details

The property has one boundary to the public highway. It is a detached property; it is not a listed building and is not in a conservation area. Planning permission for the unit has been granted. The site plan is shown below:

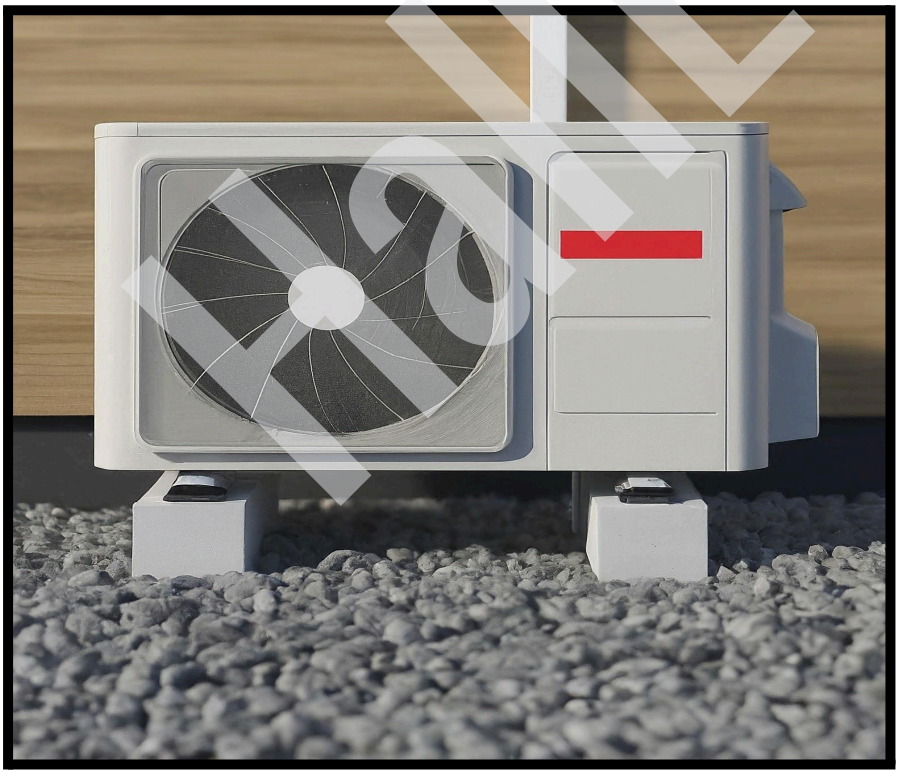


Pre installation checklist

CHECK REQUIREMENT	ITEMS CHECKED	APPROPRIATE FOR THE WORK TO PROCEED Yes	No	RECOMMENDED ACTIONS
Relevant authorisation for the work to proceed has been obtained				
The heat pump rating is suitable for the emitter circuit load (heating and/or heating and hot water)				
The suitability of the proposed location of the heat pump unit				
The emitter circuit design (new systems) or existing installation is compatible with the proposed heat pump installation				
The buffer tank size (where relevant) is appropriate				

Apprentice is now required to install an ASHP

Item	Check
Confirmed that the tools, materials and equipment required for the installation are available and in a safe, usable condition.	
Installed the air source heat pump to include, as a minimum, the connection of the heat pump unit to the hydraulic emitter circuit.	
Installed the air source heat pump in compliance with: ● the manufacturer's instructions (including clearances and mounting requirements) ● regulatory requirements	



Materials list for installation of ASHP

Basic Information			
Company Name			
Company Address			
Installation Engineer (Name)		Contact Phone No:	
Installer Ref. No. (MCS or equiv)		Installer Ref. No. (Fgas) (if applicable)	
Manufacturers Design Ref (if applicable)			
Installation Address			
DNO notified of installation	☐ Yes	* ☐ No	
Installation compliant with Building Regulations	☐ Yes	Time, temperature, and interlock provided	☐ Yes
Water Quality Check Completed	☐ Yes	☐ No	
Customer Handover & Explanation Complete	☐ Yes * ☐ No	Commissioning Date:	
System Design			
Property Heat Loss (kW)		Heat Loss Ambient Temp(°C):	
Outdoor Unit Information			
Outdoor Unit Manufacturer		Model No	
Outdoor Unit Type (Mono/Split)		Outdoor Unit Serial No	
Pipework Insulated	☐ Yes * ☐ No	De-frost/Condensate Provision: ☐ Yes * ☐ No	
Min Clearances Provided	☐ Yes	* ☐ No	
Anti-Vibration Installed	☐ Yes	☐ No	
Isolation Valves (Flow & Return) Installed	☐ Yes	* ☐ No	
MCB/RCBO Rating (Amps)			
Outdoor Isolator fitted	☐ Yes	* ☐ No	
Indoor Unit Information			
Indoor Unit Manufacturer		Model No:	
Indoor Unit Type (Hydro/Wiring Centre etc)		Indoor Unit Serial No	
DHW Cylinder Information			
Cylinder Manufacturer		Model No:	
Controller Information			
Flow Temperature Set-up (°C)		Stored DHW Temperature (°C)	
Heating Circuit Flow Rate (l/min)			
Weather/Load Compensation	☐ Yes	☐ No	
Legionella Protection Activated	☐ Yes	* ☐ No	
Heating System Information			
System Balanced	☐ Yes	* ☐ No	
Auto Bypass Fitted	☐ Yes * ☐ No	Hydraulic Separation	☐ Yes * ☐ No
Heating Expansion Vessel Fitted	☐ Yes	☐ No	
System Flushed & Cleansed	☐ Yes	* ☐ No	
System purged and inhibitor added as BS 7593	☐ Yes * ☐ No	System Filtration as BS 7593	☐ Yes * ☐ No
Heating System Frost Protected	☐ Yes	* ☐ No	
Primary Min Water Volume Met:	☐ Yes	* ☐ No	
Secondary Heat Source:	Gas Boiler ☐ Oil Boiler ☐ Electric Heater ☐ Solar Thermal ☐ * Other ☐		
Declaration			
Installer Signature:		**Print Name:**	
I confirm the installation complies with all relevant, current building, electrical, water and Fgas regulations, noise calculations and the relevant manufacturer's instructions			
Note: If answered No to any of the * highlighted questions, please add the reasons in the Additional Notes			
Additional Notes			

Supplementary Information (not mandatory)		
System Design		
Design flow temp at outdoor design temp (°C):		
Max & Min flow temperatures (°C):		
Max flow temp at ambient temp (°C):		
Min flow temp at ambient temp (°C):		
Have heat emitters been sized to meet the design heat loss (Y/N):	☐ Yes	☐ No
Refrigerant Information (if applicable)		
Refrigerant piping length (m):		
Additional refrigerant charge (kg):		
Pressure test (bar):	Vacuum test (mbar):	
Heating System:		
Filtration method (strainer/magnetic etc)		
Synchronised control for bi-valent:	☐ Yes	☐ No

Heat Pump Compliance Certificate on following page

Heat Pump Compliance Certificate

1. General information

1.1 Name of the owner	
1.2 Address of the owner	
1.3 Address at which the heating system is installed if different to above	
1.4 MCS certification number of installation company	
1.5 Name of MCS installation company	
1.6 Address of installation company Commissioning date of the installation	

2. Purpose of installation

2.1 Does the installation provide:	
i. Space heating	
ii. Domestic hot water	
iii. Other (please state)	
2.2 Is the installation designed for intermittent continuous heating?	
2.3 Are the heating services to the building bivalent/multivalent?	

3. Regulations and approval

3.1	
i. Have all regulations been met and approvals obtained (including planning approval as required)?	
ii. If installed in England, does the installation comply with MCS 020 where permitted development is required (ASHP only)?	

4. Heating calculations

4.1	
i. Has a heat loss calculation been carried out for every heated room?	
ii. Heat loss calculator used (name and version)	
iii. Design external temperature (°C)	
iv. Design ground temperature (°C)	
v. Design internal temperature (°C)	
vi. Total building heat loss in kW	
vii. Confirm that the system has been designed and installed to prevent the export of non-solar generated heat to the solar collectors	
4.2 If the installation has been designed for intermittent heating, what uplift factor has been applied to the building heat loss when sizing the:	
i. Heat source	
ii. Heat emitters	
4.3	
i. Has the Domestic Hot Water (DHW) system been designed by considering the number and types of points of use and anticipated consumption within the property?	
ii. Has the reheat time of the hot water storage vessel been estimated and agreed with the customer?	

5. Heat emitter design

5.1	
i. Lowest of the oversize factors or pip spacing (as appropriate) for the heat emitters that are to be used	
ii. What heat emitters are installed? (list all that apply using Heat Emitter Guide (HEG)	
iii. Floor covering (if underfloor heating)	
iv. All room heat losses in watts (W) (or w/m2 together with floor areas)	
v. Has a blending valve been installed to reduce the water temperature in the heat emitters?	
vi. Temperature (°C) of the water leaving the heat [pump when supplying space heating at the design external temperature	
vii. Has the customer been provided with a copy of the calculations carried out for the HEG	

6. Hot water system

6.1	
i. Is hot water provided by the heat pump?	
ii. Maximum flow temperature (°C) of the heat pump when providing hot water	
iii. Volume of the cylinder in litres and note evidence for the choice	
iv. Is the cylinder including the heat exchanger designed to operate with a heat pump?	

7. Heat pump selection

7.1	
i. Make and model of the installed heat pump	
ii. MC5 product certification number for the heat pump	
iii. Heat output from the heat pump in kW	

Service & Maintenance Record

Address	**ASHP model number**			
Maintenance	**Comment**	Yes	No	NA
Condition of casing		☐	☐	☐
Electrical connections		☐	☐	☐
Pipe connections		☐	☐	☐
Alarm log		☐	☐	☐
(Correct any fault before continuing)				
Mechanical Tasks	**Comment**	Yes	No	NA
Inspect and clean evaporator fins using fin comb if required		☐	☐	☐
Wet and dry clean evaporator and internally		☐	☐	☐
Check visually for signs of oil leaks which may indicate a refrigerant leak (check for leaks if necessary)		☐	☐	☐
Check integrity of water pipe work and lagging, (repair lagging if required)		☐	☐	☐
Check system operation		☐	☐	☐
Check the antifreeze and if necessary top up the concentration as per manufacturers recommendations		☐	☐	☐
Check and clean the magnetic particle filter		☐	☐	☐
Check system pressure		☐	☐	☐
Release any air from the primary/ heating systems		☐	☐	☐
Controller Tasks	**Comment**			
Check the correct operation and temperature setting of thermostats		☐	☐	☐
Check the operation of the zone valves				
Check the operation and the timing of the immersion heater				
	Engineer's Notes:			
Installer name				
Installer signature				
Date				
	IHallEdu 2023			

Fault Finding & Rectification

Candidates are required to identify and repair faults on a fully operational Air source heat pump installation.

Criteria

Confirmed documentation is available to complete fault identification and rectification.

Visually checked installation that it complies with current regulations and manufactures specifications.

Safely isolated system and electrical supplies and ensured the system could not be brought back into operation.

Carried out diagnostic tests and located faults on an Air source heat pump installation.

Carried out rectification of two faults.

Completed fault diagnosis and rectification and left installation in fully working condition.

The candidate must complete a fault identification checklist.

FAULT 1
Description of fault
Actions taken to rectify fault (if required)
FAULT 2
Description of fault
Actions taken to rectify fault (if required)

Install using skills and knowledge developed

UFH

Heat emitters

Install one of the following

Solar

ASHP

GSHP

Test commission and handover one of the following

Solar

ASHP

GSHP

Service one of the following

Solar

ASHP

GSHP

Find and rectify faults one of the following

Solar

ASHP

GSHP