

**SQA/SNIJIB**



# **Training and Assessment Programme for SVQ 3 Domestic Plumbing and Heating**

**Installation Practice**

## Learning and delivery guidance

Heating, gas installation and electrical work are fully integrated within the plumbing sector. For example, hot and cold water systems, sanitation and drainage, central heating and electrical and gas installation are combined to provide a functional service for domestic and non-domestic customers.

The SVQ programme attempts to emulate this integration within the learning environment. As part of achieving the SVQ, the National Occupational Standards (NOS) attached to the Units require the learners to:

H98F 04/SUMPH04	Install and test domestic plumbing and heating systems
H98G 04/SUMPH05	Service and maintain domestic plumbing and heating systems
H98H/SUMPH06	Inspect and pre-commission domestic plumbing and heating systems
H98J/SUMPH07	Commission domestic plumbing and heating systems
H98K 04/SUMPH08	Decommission domestic plumbing and heating systems

These Units/Standards are for people who install and test domestic plumbing and heating systems.

The person performing this work must be able to comply with the correct procedures and practices for installing and testing domestic plumbing and heating systems. This work must be in accordance with the current versions of the appropriate industry standards and regulations; the specification; industry recognised working practices; the working environment and the natural environment. They must know and understand:

- ◆ direct and indirect cold water systems
- ◆ direct and indirect hot water systems
- ◆ hot water heating systems
- ◆ unvented domestic hot water storage systems
- ◆ above ground sanitary pipework systems
- ◆ rainwater systems
- ◆ site services and system supplies
- ◆ methods and techniques for connecting appliances, components and accessories

Other Units within the SVQ, eg the Electrical Unit and the optional Units of Stage 3 can be integrated, but have their own criteria to satisfy.

### The National Occupational Standards Units — Performance Criteria

Each of the above SVQ Units has the following NOS (National Occupational Standards) attached to them. The NOS titles and their performance objectives/criteria are shown below.

The performance criteria for each of the occupational standards is shown below.

**SUMPH04 — Install and test domestic plumbing and heating systems**

To carry out work in accordance with the current versions of the appropriate industry standards and regulations, the specification, working practices, the working environment and the natural environment.

- P1 Verify that the job information and documentation are current and relevant and that the plant, instruments, access equipment and tools are fit for purpose.
- P2 Confirm before work starts that the work location and work area can be accessed safely and has been checked for the risk to other personnel on the site, and take appropriate action if a risk is present.
- P3 Select appliances, components and accessories and confirm that they are:
  - P3.1 of the right type and size
  - P3.2 fit for purpose in accordance with the domestic plumbing and heating system's design
  - P3.3 suitable for the working environment in which they are to be installed
- P4 Confirm that the site services and system supply are compatible with the domestic plumbing and heating system's design.
- P5 Produce a risk assessment and method statement for the work to be carried out, including the identification and use of personal protective equipment, in accordance with the working environment.
- P6 Determine at the outset, that the plans for positioning and fixing the appliances, components and accessories are in accordance with:
  - P6.1 the domestic plumbing and heating system's design
  - P6.2 the working environment
  - P6.3 manufacturer instructions
- P7 Comply with industry practices and organisational procedures to ensure the co-ordination of site services and system supply and the activities of other trades.
- P8 measure and mark out the locations for fitting and fixing the selected appliances, components and accessories in accordance with:
  - P8.1 the domestic plumbing and heating system's design
  - P8.2 manufacturer instructions
- P9 Fit, fix and connect the selected appliances, components and accessories in accordance with:
  - P9.1 the domestic plumbing and heating system's design
  - P9.2 the working environment
  - P9.3 manufacturer instructions
- P10 Confirm the integrity of the installed system using soundness testing procedures.
- P11 Confirm with the relevant people:
  - P11.1 those variations to the planned programme of work
  - P11.2 the actions to be taken to ensure that any variations to the planned programme of work will minimise the potential for hazard and risk
- P12 Implement organisational procedures for the safe transport and/or disposal of waste material, substances and liquids in accordance with suppliers' and manufacturers' instructions.

**SUMPH05 — Service and maintain domestic plumbing and heating systems**

To carry out work in accordance with the current versions of the appropriate industry standards and regulations, the specification, working practices, the working environment and the natural environment

- P1 Verify that the job information and documentation are current and relevant and that the plant, instruments, access equipment and tools are fit for purpose.
- P2 confirm before work starts that the work location and work area can be accessed safely and has been checked for the risk to other personnel on the site, and take appropriate action if a risk is present.
- P3 Select appliances, components and accessories and confirm that they are:
  - P3.1 of the right type and size
  - P3.2 fit for purpose in accordance with the domestic plumbing and heating system's design
  - P3.3 suitable for the working environment in which they are to be installed
- P4 Confirm that the site services and system supply are compatible with the domestic plumbing and heating system's design.
- P5 Produce a risk assessment and method statement for the work to be carried out, including the identification and use of personal protective equipment, in accordance with the working environment.
- P6 Determine at the outset, that the plans for servicing and maintaining the appliances, components and accessories are in accordance with:
  - P6.1 the domestic plumbing and heating system's design
  - P6.2 the working environment
  - P6.3 manufacturer instructions
- P7 Comply with industry practices and organisational procedures to ensure the co-ordination of site services and system supply and the activities of other trades.
- P8 Complete soundness testing procedures in line with industry practices.
- P9 Carry out service and maintenance activities and procedures in accordance with:
  - P9.1 the domestic plumbing and heating system's design
  - P9.2 the working environment
  - P9.3 manufacturer instructions
- P10 Complete repairs/replacements as necessary.
- P11 Confirm with the relevant people:
  - P11.1 those necessary variations to the planned programme of work
  - P11.2 the actions to be taken to ensure that any variations to the planned programme of work will minimise the potential for hazard and risk
- P12 Implement organisational procedures for the safe transport and/or disposal of waste material, substances and liquids in accordance with suppliers' and manufacturers' instructions.
- P13 Complete relevant documentation in accordance with organisational procedures.

**SUMPH06 — Inspect and pre-commission domestic plumbing and heating systems**

To carry out work in accordance with the current versions of the appropriate industry standards and regulations, the specification, working practices, the working environment and the natural environment.

- P1 Verify that the job information and documentation are current and relevant and that the plant, instruments, access equipment and tools are fit for purpose.
- P2 Confirm before work starts that the work location and work area can be accessed safely and has been checked for the risk to other personnel on the site, and take appropriate action if a risk is present.
- P3 Confirm appliances, components and accessories installed are:
  - P3.1 of the right type and size
  - P3.2 fit for purpose in accordance with the domestic plumbing and heating system's design
  - P3.3 suitable for the working environment in which they are installed
- P4 Confirm that the site services and system supply are compatible with the domestic plumbing and heating system's design.
- P5 Produce a risk assessment and method statement for the work to be carried out, including the identification and use of personal protective equipment, in accordance with the working environment.
- P6 Determine that the appliances, components and accessories have been fitted in accordance with:
  - P6.1 the domestic plumbing and heating system's design
  - P6.2 the working environment
  - P6.3 manufacturer instructions
- P7 Comply with industry practices and organisational procedures to ensure the co-ordination of site services and system supply and the activities of other trades.
- P8 Inspect and pre-commission appliances, components and accessories in accordance with:
  - P8.1 the domestic plumbing and heating system's design
  - P8.2 manufacturer instructions
- P9 Confirm with the relevant people:
  - P9.1 those necessary variations to the planned programme of work
  - P9.2 the actions to be taken to ensure that any variations to the planned programme of work will minimise the potential for hazard and risk
- P10 Implement organisational procedures for the safe transport and/or disposal of waste material, substances and liquids in accordance with suppliers' and manufacturers' instructions.
- P11 Complete relevant documentation in accordance with organisational procedures.

**SUMPH07 — Commission domestic plumbing and heating systems**

- P1 Verify that the job information and documentation are current and relevant and that the plant, instruments, *access equipment* and tools are fit for purpose.
- P2 Confirm before work starts that the work location and work area can be accessed safely and has been checked for the risk to other personnel on the site, and take appropriate action if a risk is present.
- P3 Confirm appliances, components and accessories installed are:
  - P3.1 of the right type and size
  - P3.2 fit for purpose in accordance with the domestic plumbing and heating system's design
  - P3.3 suitable for the working environment in which they are installed
- P4 Confirm that the site services and system supply are compatible with the domestic plumbing and heating system's design.
- P5 Produce a risk assessment and method statement for the work to be carried out, including the identification and use of personal protective equipment, in accordance with the working environment.
- P6 Perform visual and manual checks to ensure that the appliances, components and accessories have been fixed, fitted and connected in accordance with:
  - P6.1 the domestic plumbing and heating system's design
  - P6.2 the working environment
  - P6.3 manufacturers' instructions
- P7 Comply with industry practices and organisational procedures to ensure the co-ordination of site services and system supply and the activities of other trades.
- P8 Commission appliances, components and accessories, adjusting safely and effectively the control features in accordance with:
  - P8.1 the domestic plumbing and heating system's design
  - P8.2 the working environment
  - P8.3 manufacturers' instructions
- P9 Confirm with the relevant people:
  - P9.1 those necessary variations to the planned programme of work
  - P9.2 the actions to be taken to ensure that any variations to the planned programme of work will minimise the potential for hazard and risk
- P10 Implement organisational procedures for the safe transport and/or disposal of waste material, substances and liquids in accordance with suppliers' and manufacturers' instructions.
- P11 Complete relevant documentation in accordance with organisational procedures.

**SUMPH08 — Decommission domestic plumbing and heating systems**

To carry out work in accordance with the current versions of the appropriate industry standards and regulations, the specification, working practices, the working environment and the natural environment.

- P1 Verify that the job information and documentation are current and relevant and that the plant, instruments, access equipment and tools are fit for purpose.
- P2 Confirm before work starts that the work location and work area can be accessed safely and has been checked for the risk to other personnel on the site, and take appropriate action if a risk is present.
- P3 Decommission appliances, components and accessories in accordance with industry practices and organisational procedures.
- P4 Ensure that the domestic plumbing and heating system cannot be accidentally reactivated or become dangerous.
- P5 Produce a risk assessment and method statement for the work to be carried out, including the identification and use of personal protective equipment, in accordance with the working environment.
- P6 Comply with industry practices and organisational procedures to ensure the co-ordination of site services and system supply and the activities of other trades.
- P7 Confirm with the relevant people:
  - P7.1 those necessary variations to the planned programme of work
  - P7.2 the actions to be taken to ensure that any variations to the planned programme of work will minimise the potential for hazard and risk
- P8 Implement organisational procedures for the safe transport and/or disposal of waste material, substances and liquids in accordance with suppliers' and manufacturers' instructions.
- P9 Complete relevant documentation in accordance with organisational procedures.

## Summative assessment system design

A simulated system should create a realistic installation environment. The resource to create this will vary between centres, however the same standard has to be demonstrated and achieved across the sector. It is **not** the case that the learner activities stated in the NOS have to be incorporated into one large installation. Learner achievement can be demonstrated while working on different installations.

A portfolio of assessment evidence should be generated by the learner as he/she progresses through the installation process. This should include the:

- ◆ drawings and guidelines of the system
- ◆ summative appendix documents
- ◆ marking schedules and learner feedback documents

Using headings that are derived from the Units, the following guidelines and indicators show how a portfolio of evidence might be achieved.

## Health and safety

Strict adherence to relevant safety procedures must be observed throughout the installation exercise and all its associated areas. For example:

- ◆ use of PPE (personal protective equipment)
- ◆ observance of procedures when using power tools, mechanical devices (eg pipe bending machines), scaffolds, ladders and hand tools
- ◆ adoption of proper procedures when manual handling

None of the above areas is summatively assessed. They should be viewed as formative learning — the summative part of health and safety being undertaken within the Health and Safety Unit.

## Risk assessment

The learner should be encouraged throughout the practical exercises to assess the potential for accidents. A formal risk assessment for one area should be undertaken and recorded. This could take the form of assessing the risk when working at height or using power tools or similar scenarios. Appendix 6 gives an example of a risk assessment sheet that could be used.

## Marking schedules, Performance Criteria and learner feedback

Throughout these practical exercises the learner's performance has to be monitored and recorded. Appendices 7A to 7D give an example of a combined marking schedule and learner feedback sheet. The learner may have several of these in his/her portfolio of assessment evidence. The centre should generate the appropriate number of sheets, which will depend on the practical activities that have been devised.



## H98F 04/SUMPH04 — Install and test domestic plumbing and heating systems

The design of the system is at the discretion of the centre. However, the centre is encouraged to incorporate current installation designs, methods and practices within its systems. The suggestions below outline the central part of the system which should also include the appliances, components, controls, fittings and materials described. The centre should provide clear and precise drawings of the intended system (one system) with installation guidelines.

The following suggestions are for the design of cold water, hot water, and central heating systems.

System design/Installation	Content of system
1 Indirect hot water and indirect cold water with central heating.	Cold water storage cistern (possible feed and expansion cistern) Hot store vessel (indirect cylinder) Boiler (open vent or systems), radiators, motorised valves, etc Radiators
2 Mains-fed hot water and direct cold water with central heating.	Mains-fed hot water cylinder/thermal store Boiler, radiators, motorised valves, etc Radiators
3 Instantaneous hot water and direct cold water with central heating.	Combination boiler; radiators

Within the hot, cold and central heating system designs, it would be acceptable for one boiler to service several systems provided separate flow and return pipes to the different installations are installed and the learner has access to the boiler. Suggestion 3 would not be included in this arrangement.

### Above-ground sanitary pipework system

In addition to the suggested systems above, the appropriate above-ground sanitary pipework system should be installed which would include the range of soil and waste materials and fittings listed below. It should observe design principles in accordance with British and EN Standards and appropriate design guides as these relate to:

- ◆ diameters of waste pipes
- ◆ diameters of stacks
- ◆ lengths and gradients of waste pipes
- ◆ connections between different materials
- ◆ connection of waste pipes to stack
- ◆ access to pipework
- ◆ system performance
- ◆ support and fixing of pipework

Although the modern practice is for waste and soil pipes and fittings to usually be made of plastic, it is expected that an element of cast iron will be used with modern installation and jointing techniques.

## Guttering and downpipes

A system of guttering and downpipes should be installed. This system should be designed to give sufficient installation practice and to enable the learner to work at height. Materials are described in the list below.

### Materials and components required

In this integrated summative assessment the above systems should include the following as appropriate:

<b>Appliances</b>	Sink, wash-hand basin, shower tray or bath, WC pan and cistern
<b>Components</b>	At least two central heating radiators, boiler, hot store vessel, cold water storage cistern
<b>Pipework controls</b>	Motorised valves, screw-down stop cock, gate valve, spherical valve, float-operated valve, mixing valves and thermostatic shower valves
<b>Pipe fittings</b>	Selection of water fittings to include: metallic compression, capillary, push-fit plastic, metallic press-fit Selection of soil and waste fittings to include: compression, push-fit, solvent weld and cast iron 'time saver' Selection of rainwater fittings to include: gutters: stop ends, centre drops, unions, brackets Downpipe: bends, offsets
<b>Pipe materials</b>	Water: copper, plastic Waste: plastic compression, plastic solvent Soil: plastic, cast iron Gutters: plastic guttering and downpipes
<b>Fixings</b>	Fixings should be appropriate to the appliances, components and pipe

The centre should ensure that it has the necessary tools and equipment to allow the learner the best opportunity to carry out the tasks asked of him/her.

## H98H 04/SUMPH06 — Inspect and pre-commission domestic plumbing and heating systems

Prior to commissioning the installed system, the learner should carry out a series of checks to ensure compliance with industry standards and requirements:

- ◆ Fittings and components satisfactorily installed
- ◆ Pipework properly supported and clipped
- ◆ Insulation applied where appropriate

The scenarios below have been observed on a completed installation. The learner should describe a remedial action that is needed before the system is commissioned. He/she should also state possible outcomes should the scenarios not be rectified. Five of the scenarios should be on an actual system for the learner to view.

Installation scenario	Possible outcome	Remedial action	Evidence
As the hot distribution pipe leaves the cylinder it dips below the horizontal line.	Air becoming trapped causing poor hot water flow or no hot water.	Re-install pipe to ensure slight upward gradient from cylinder.	WR/LO
The diameter of the cold-feed pipe is 15 mm.	Insufficient to hot taps with possible air ingress through vent pipe.	Increase diameter of cold-feed pipe in line with BS6700 guidelines.	WR/LO
One end of a green and yellow cable is lying loose under the radiator.	Earthing problem which could lead to health and safety issue.	Connect cable to radiator with appropriate fitting.	WR/LO
The waste pipe is connected directly to the appliance outlet grating.	Waste trap fitting has been omitted; foul smells entering property.	Install appropriate trap.	WR/LO
A two metre length of pipework is sagging below the floor.	Mechanical damage to pipe at a later date.	Clip pipe in accordance with BS6700.	WR/LO
A section of under-floor pipework has no insulation material.	Water in pipes freezing during winter sub-zero temperatures.	Insulate pipes using appropriate materials.	WR/LO
The end of a five-core cable from a three-port motorised valve is lying loose on the floor and the valve has no cover.	Hot water/heating system malfunction due to electrical parts of valve not being connected.	Valve to be electrically connected.	WR/LO
Taps installed on a wash-hand basin are not symmetrical in appearance.	Bad appearance; customer dissatisfaction.	May be installation or manufacturing problem —investigate both.	WR/LO
Central heating radiator is not level.	Bad appearance; partially due to air being trapped if air valve is at low side.	Re-fit radiator level	WR/LO

Installation scenario	Possible outcome	Remedial action	Evidence
Supply pipe to flushing cistern has no control valve on supply pipe prior to entering the cistern.	Contravention of water byelaws; whole installation has to be closed down if the cistern requires attention.	Install appropriate service valve on supply pipe as it enters the cistern.	WR/LO

The lecturer should choose the five scenarios to be included in a system for LO (lecturer observation) or WR (written response).

Statements in red are model answers and should be removed prior to the learner attempting scenarios (they are for guidance only).

Refer to Appendix 1 for blank template.

## H98J 04/SUMPH07 — Commission domestic plumbing and heating systems

On completion of the installation, emphasis should be placed on commissioning the system. The learner should be made aware of the guidelines set out in the relevant British Standards (ie BS6700 and BS EN14336:2004). The commissioning should follow a procedural format, ie the learner should check for faults, put the system into use, ensure that it operates safely and efficiently, and that it would be to the customer's satisfaction. This should be formalised and recorded under the following headings:

- ◆ Making a visual inspection of the installation
- ◆ Soundness testing (testing for leaks)
- ◆ Flushing and disinfection (where appropriate)
- ◆ Inclusion of inhibitors (where appropriate)
- ◆ Performance testing
- ◆ Final checks/hand over

**NOTE:** Commissioning does not include the fuel and combustion part of the heat source used — this would be undertaken within the appropriate Unit. However, the heat source used should have been commissioned and be appropriate for use in this installation.

Activity	Description of work	Evidence
Making a visual inspection of the installation HC; CH; D	Check system components and controls for correct installation, fixing and operation prior to undertaking the commissioning procedures.	WR and LO
Soundness testing (testing for leaks) HC; CH; D	Isolate system into sections and fill gradually with water observing pipework for leaks. The appropriate BS and EN documents for commissioning systems should be referred to.	WR and LO
Flushing and disinfection. HC	Inspect system for debris and remove. Fill system with water and drain down. Identify if installation is for a single family where no disinfection would be necessary. Oral discussion with learner on disinfection of hot and cold systems.	WR and LO
Inclusion of inhibitors. CH	Fill heating system with water and drain down. Refill, releasing air from the system. Ensure water level in cistern is satisfactory or system pressure is achieved. Oral discussion with learner on inclusion of corrosion inhibitors in heating systems.	WR
Performance testing HC; CH; D	Adjust the system controls to give the required performance in line with manufacturer's instructions and customer requirements.	WR and LO
Final checks/hand over HC; CH; D	Provide the customer or system user with verbal information and written instructions on the operation and use of the system and its components.	WR

HC	hot and cold water systems
CH	central heating systems
D	sanitary pipework systems
WR	written response
LO	lecturer observation

Statements in red are model answers and should be removed prior to the learner attempting scenarios (they are for guidance only).

Refer to Appendix 2 for blank template.

## H98K 04/SUMPH08 — Decommission domestic plumbing and heating systems

The learner should decommission a system. It should be emphasised to the learner that they should:

- ◆ work in a logical manner to ensure minimal disruption to a property
- ◆ dispose of water and contaminated liquids carefully
- ◆ salvage and/or recycle materials and components whenever feasible

Decommissioning should be formalised and recorded under the following headings:

- ◆ Isolate and drain down previously installed plumbing and heating systems
- ◆ Take all necessary precautions in the disposal of contaminated liquids
- ◆ Cap-off all services which have been disconnected
- ◆ Store all dismantled materials and equipment for re-use
- ◆ Recycle any materials which cannot be re-used and dispose of the remainder in a responsible manner

Activity	Description of work	Evidence
Isolate and drain down previously installed plumbing and heating systems.	HC — close main stop valve; connect drain hose to drain valve suitably positioned to discharge water. Open terminal fittings. CH — electrically isolate system; close appropriate service valve; connect drain hose to drain valve suitably positioned to discharge water. Open air valves on radiators. Ensure other components are open.	WR and LO
Take all necessary precautions in the disposal of contaminated liquids.	Dispose of contaminated liquids (CH inhibitor) in accordance with British Standards.	WR
Cap-off all services which have been disconnected.	Dismantle pipework and components in a logical and efficient manner and cap-off live pipework.	WR and LO
Recycle any materials which cannot be re-used and dispose of the remainder in a responsible manner.	Select materials for re-use; cut pipework into suitable lengths; re-assemble fittings; dispose remainder into appropriate scrap bins.	WR and LO
Store all dismantled materials and equipment for re-use.	Return salvaged materials, components and tools to store.	WR and LO

HC hot and cold water systems

CH central heating systems

D sanitary pipework systems

WR written response

LO lecturer observation

Statements in red are model answers and should be removed prior to the learner attempting scenarios (they are for guidance only).

Refer to Appendix 3 for blank template.

## H98G 04/SUMPH05 — Service and maintain domestic plumbing and heating systems (part 1)

The learner should service and maintain a number of components and pipework on existing systems (can be more than one). This should be across a range of plumbing, heating and sanitary pipework components and installations. The learner should be presented with the six situations below (or similar chosen by the centre) to service and maintain. He/she should carry out the work and record the action taken.

Component	Service maintenance action	Evidence
Float-operated valve in a storage cistern.	Check float and valve are in good working order and closing of water at predetermined level, ie 25 mm below invert level of overflow pipe.	WR and LO
Cylinder thermostat	Visual inspection of component to ensure securely fixed and safe. Operational checks to ensure component performance. Observance of manufacturer's guidelines.	WR and LO
Motorised (zone) valve	Visual inspection of component to ensure securely fixed and safe. Operational checks to ensure component performance. Observance of manufacturer's guidelines.	WR and LO
Hot and cold terminal fittings	Visual inspection of component to ensure securely fitted. Operational checks observing performance — ie closes water supply off satisfactorily with no water leaking from fitting.	WR and LO
Discharge flow from a basin or sink	Fill appliance with water and discharge observing flow rate and any potential leaks from waste pipe.	WR and LO
Discharge flow from a WC cistern	With water level correctly adjusted, flush the cistern observing performance of flushing action.	WR and LO

WR written response

LO lecturer observation

Statements in red are model answers and should be removed prior to the learner attempting scenarios (they are for guidance only).

Refer to Appendix 4 for blank template.



## H98G 04/SUMPH05 — Service and maintain domestic plumbing and heating systems (part 2)

Plumbing and heating system faults can range from a dripping tap to a major component malfunction. The approach to this area should be to encourage the learner to be sequential and logical in his/her diagnosis of the symptoms and subsequent course of action to rectify the fault. In order to ensure coverage in this area, two different methods can be used to determine learner competence — faults on actual systems and faults outlined in scenarios.

The learner should be shown a working system for at least five of the ten scenarios listed below. In each case, they need to identify a possible cause of the fault and either outline remedial action or rectify the fault.

Symptom	Possible cause	Remedial action	Evidence
Waste water in the shower tray is very slow to drain away.	Waste pipe has insufficient gradient.	Re-grade waste pipe to ensure sufficient flow.	WR/LO
The basin tap is closed but water is dripping from the spout.	Washer has deteriorated allowing water to pass.	Replace tap washer.	WR/LO
When the basin is discharged some of the water enters the shower tray through its waste outlet.	Partially choked waste pipe after the branch where the basin waste meets the bath waste pipe.	Clear choke and consider different pipe configuration.	WR/LO
When the cold tap is in operation a small amount of water discharges from where the spindle leaves the body of the tap.	Packing material has become worn.	Packing gland needs tightened or repacked.	WR/LO
The water at the hot taps is cold. The boiler is functioning correctly.	Faulty cylinder thermostat or motorised (zone) valve.	Replace cylinder thermostat or motorised (zone) valve.	WR/LO
A hot water heating system has a combination boiler but is failing to heat the radiators.	Diverter valve failing to open to heating circuit.	Replace diverter valve.	WR/LO
Water pressure is low at cold terminal fittings.	Lack of head, cistern has to be raised vertically.	Raise cistern vertically.	WR/LO
The bath and basin share a common waste pipe. When the bath is discharged a gurgling noise is heard from the basin resulting in a smell.	The bath discharging causes the trap seal from the basin to be induced out.	Connect basin waste separately to the stack or fit the basin waste with an anti-siphon trap.	WR/LO
A small amount of water is discharging from the flushing cistern overflow pipe.	Washer in float-operated valve (FOV) needs replaced.	Replace washer or FOV.	WR/LO

Symptom	Possible cause	Remedial action	Evidence
When a radiator is working there is a cold section along the top.	Air is trapped in the radiator.	Release air from radiator; recharge system (if appropriate); investigate cause of air ingress to system.	WR/LO

WR written response

LO lecturer observation

Statements in red are model answers and should be removed prior to the learner attempting scenarios (they are for guidance only).

Refer to Appendix 5 for blank template.

## Appendix 1

### Inspect and test a system

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

Listed below are a number of scenarios that have been observed on a completed installation. You are required to describe a possible outcome for each scenario and recommend remedial action that is needed before the system is commissioned.

You should also state possible outcomes should the scenarios not be rectified. Five of the scenarios should be on an actual system for you to view.

<b>Installation scenario</b>	<b>Possible outcome</b>	<b>Remedial action</b>	<b>✓ or ✕</b>
As the hot distribution pipe leaves the cylinder it dips below the horizontal line.			
The diameter of the cold-feed pipe is 15mm.			
One end of a green and yellow cable is lying loose under the radiator.			
The waste pipe is connected directly to the appliance outlet grating.			
A two metre length of pipework is sagging below the floor.			
A section of under-floor pipework has no insulation material.			
The end of a five-core cable from a three-port motorised valve is lying loose on the floor and the valve has no cover.			
Taps installed on a wash-hand basin are not symmetrical in appearance.			
Central heating radiator is not level.			
Supply pipe to flushing cistern has no control valve on supply pipe prior to entering the cistern.			

✓ = Achieved

✕ = Not achieved

## Appendix 2

### Commission a system

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

You are required to commission a completed system by working through the activities below and by completing the column headed 'Description of work'.

You should follow a procedural format when commissioning the system — check for faults, put the system into use, ensure that it operates safely and efficiently, and ensure that the commissioned system will be to the customer's satisfaction.

<b>Activity</b>	<b>Description of work</b>	<b>Evidence ✓ or ✗</b>
Making a visual inspection of the installation HC; CH; D		WR and LO
Soundness testing (testing for leaks) HC; CH; D		WR and LO
Flushing and disinfection. HC		WR and LO
Inclusion of inhibitors. CH		WR
Performance testing HC; CH; D		WR and LO
Final checks/hand over HC; CH; D		WR

✓ = Achieved                  WR written response  
✗ = Not achieved          LO lecturer observation

## Appendix 3

### Decommission a system

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

You are required to decommission a completed system by working through the activities below and by completing the column headed 'Description of work'.

When decommissioning a system you should:

- ◆ work in a logical manner to ensure minimal disruption to a property
- ◆ dispose of water and contaminated liquids carefully
- ◆ salvage and/or recycle materials and components whenever feasible

<b>Activity</b>	<b>Description of work</b>	<b>Evidence ✓ or ✗</b>
Isolate and drain down previously installed plumbing and heating systems		WR and LO
Take all necessary precautions in the disposal of contaminated liquids		WR
Cap-off all services which have been disconnected		WR and LO
Recycle any materials which cannot be re-used and dispose of the remainder in a responsible manner		WR and LO
Store all dismantled materials and equipment for re-use		WR and LO

✓ = Achieved

✗ = Not achieved

## Appendix 4

### Service and maintain a system

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

The components and pipework of a working system are listed below. Your task is to service and maintain them and record the action that took place and any recommendations.

<b>Component/Pipe system</b>	<b>Service/maintenance action</b>	<b>✓ or ✗</b>
Float-operated valve in a storage cistern		
Cylinder thermostat		
Motorised (zone) valve		
Hot and cold terminal fittings		
Discharge flow from a basin or sink		
Discharge flow from a WC cistern		

✓ = Achieved

✗ = Not achieved

## Appendix 5

### Identify and rectify faults in a system

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

You will be shown a working system for at least five of the ten scenarios listed below.

In each case, identify a possible cause of the fault and either outline remedial action or rectify the fault.

Symptom	Possible cause	Remedial action	✓ or ✗
Waste water in the shower tray is very slow to drain away.			
The basin tap is closed but water is dripping from the spout.			
When the basin is discharged some of the water enters the shower tray through its waste outlet.			
When the cold tap is in operation a small amount of water discharges from where the spindle leaves the body of the tap.			
The water at the hot taps is cold. The boiler is functioning correctly.			
A hot water heating system has a combination boiler but is failing to heat the radiators.			
Water pressure is low at cold terminal fittings.			
The bath and basin share a common waste pipe. When the bath is discharged a gurgling noise is heard from the basin resulting in a smell.			
A small amount of water is discharging from the flushing cistern overflow pipe.			
When a radiator is working there is a cold section along the top.			

✓ = Achieved

✗ = Not achieved

## Appendix 6

### Risk assessment

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

In the following table, produce a risk assessment for the situation agreed with your lecturer.

<b>Task</b>		
Application of equipment		Application of substance
Associated hazards		
Likelihood	Consequence	Risk factor
Risk exposure		Safeguards hardware
Control measures		



## Appendix 7A

### Marking schedule and learner feedback sheet — Hot and Cold Water Supply

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

<b>Performance Criteria</b>	<b>Yes</b>	<b>No</b>
Prepares the work area to prevent damage during installation		
Fixes components/appliances in place without damage to decor		
Protects the background from damage due to hot works		
Pipework securely fixed and supported		
Machine bends free from wrinkles and throating		
Fittings installed as per manufacturer's guidelines/instructions		
System has been tested for soundness		
System has been commissioned		
Work was completed in a safe and efficient manner		
<b>Learner feedback</b>		

**Assessor signature:** \_\_\_\_\_

**Learner:** I acknowledge that the above is all my own work: \_\_\_\_\_

**NOTE:** Learner feedback should relate to the points highlighted in the Performance Criteria/marketing schedule above.

## Appendix 7B

### Marking schedule and learner feedback sheet — Central Heating

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

<b>Performance Criteria</b>	<b>Yes</b>	<b>No</b>
Prepares the work area to prevent damage during installation		
Fixes components/appliances in place without damage to decor		
Protects the background from damage due to hot works		
Pipework securely fixed and supported		
Machine bends free from wrinkles and throating		
Fittings installed as per manufacturer's guidelines/instructions		
System has been tested for soundness		
System has been commissioned		
Work was completed in a safe and efficient manner		
<b>Learner feedback</b>		

**Assessor signature:** \_\_\_\_\_

**Learner:** I acknowledge that the above is all my own work: \_\_\_\_\_

**NOTE:** Learner feedback should relate to the points highlighted in the Performance Criteria/marketing schedule above.

## Appendix 7C

### Marking schedule and learner feedback sheet — Above-Ground Sanitary Pipework

<b>Name:</b>	<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>	<b>Date:</b>

<b>Performance Criteria</b>	<b>Yes</b>	<b>No</b>
Prepares the work area to prevent damage during installation		
Fixes components/appliances in place without damage to decor		
Components fixed to sanitary appliances as per manufacturer's instructions		
Protects the background from damage due to hot works		
Pipework securely fixed and supported		
Pipework gradients as per manufacturers and British Standards guidelines		
Fittings installed as per manufacturers guidelines/instructions		
System has been tested for soundness (air test/smoke test)		
System was tested for performance		
Work was completed in a safe and efficient manner		
<b>Learner feedback</b>		

**Assessor signature:** \_\_\_\_\_

**Learner:** I acknowledge that the above is all my own work: \_\_\_\_\_

**Note:** Learner feedback should relate to the points highlighted in the Performance Criteria/marketing schedule above.

## Appendix 7D

### Marking schedule and learner feedback sheet — Gutters and Downpipes

<b>Name:</b>		<b>Class:</b>	<b>Date:</b>
<b>Result:</b>	<b>Assessor:</b>		<b>Date:</b>

<b>Performance Criteria</b>	<b>Yes</b>	<b>No</b>
Gutters and downpipes securely fixed and supported		
Gradients as per manufacturers and British Standards guidelines		
Fittings installed as per manufacturer's guidelines/instructions		
System has been tested for soundness (water test)		
System was tested for performance		
Work was completed in a safe and efficient manner		
<b>Learner feedback</b>		

**Assessor signature:** \_\_\_\_\_

**Learner:** I acknowledge that the above is all my own work: \_\_\_\_\_

**NOTE:** Learner feedback should relate to the points highlighted in the Performance Criteria/marketing schedule above.