REGULATED QUALIFICATION FRAMEWORK (RQF)

QUALIFICATION SPECIFICATION

Foundation Course in Heat Pump Technology (Non-Refrigerant Circuit)

Objective:

The heat pump course is specifically aimed at existing fossil fuel plumbing and heating engineers and giving them the necessary training to upskill their existing skills to install heat pumps.
The qualification allows learners to continue to learn, develop and practise the skills required for employment within the Building Engineering Services (BES) Renewable sector.
The objective of this qualification is for learners to demonstrate they know and understand the requirements for installing heat pump systems. The learner will know the different operational characteristics of each type of heat pump, namely air, ground and exhaust air heat pumps, their components, the principles of heat pump selection, system design, emitter selection, hydraulics, the preparatory work required for heat pumps installations and the requirements to install, commission and hand over heat pump systems. The learner will know the health and safety risks and regulations and standards relating to the installation, testing, and commissioning of heat pump systems.
The objective of this qualification is for learners to demonstrate they are competent in accordance with legislation, regulations, and industry standards.
The learner is only fully qualified to install, commission and handover heat pump systems for each particular heat pump technology after completing their individual technology qualification which can be run as a full course or separate modules.

The target groups for the qualification are those learners who are:

a. Updating occupational competence, continuous professional development and/or obtaining a licence to practice

b. Preparing for further learning or training and/or developing knowledge and/or skills in a subject area and are existing workers in the occupation seeking to extend their range of work

Prior qualifications, knowledge, skill or understanding which the learner is required to have before taking this qualification. (Pre-requisites)

- N/SVQ Level 2/3 in Plumbing or equivalent earlier certification that provides evidence of competence;
  or
- N/SVQ Level 2/3 in Heating and Ventilating (Domestic Installation) or equivalent earlier certification that provides evidence of competence;
  or
- N/SVQ Level 2/3 in Heating and Ventilating (Industrial and Commercial Installation) or equivalent earlier certification that provides evidence of competence;
  or
- N/SVQ Level 2/3 in Oil-Fired Technical Services or equivalent earlier certification that provides evidence of competence;
  or

- N/SVQ Level 2/3 in Gas Installation and Maintenance or equivalent earlier certification that provides evidence of competence.
  or
- heating installers with minimum 3 years of experience installing wet central heating systems, evidenced either by manufacturer courses certification or Gas Safe Register, OFTEC, MCS or HETAS registration

In addition, if not included in the above current certification in relation to:

- Low Temperature Heating and Hot water Systems in Dwellings
- WRAS Water Regulations/Water Byelaws or equivalent
- Domestic Hot Water Storage Systems (G3)

Qualification Framework:

The qualification comprises of four mandatory units and will be covered in two days with exams and workshop assessment. The learner is required to successfully achieve a pass in each unit for this qualification to be awarded.

Unit Specification A: Know the requirements to size, select, install, commission and handover heat pump systems (non-refrigerant circuits).

Learning Outcome 1. The learner will know what a heat pump is, the principle of the vapour compression system and system components.

The learner will demonstrate knowledge of:

1.1 Confirm the purpose and operational characteristics of the following components:

- evaporator
- low pressure switch
- compressor
- high pressure switch
- condenser
- dryer/receiver
- expansion valve
- expansion valve phial
- refrigerant four-way valve

1.2 Confirm how the vapour compression refrigerant circuit within a heat pump unit operates.

Learning Outcome 2. The learner will know the different operational characteristics of each type of heat pump unit and system arrangement.

The learner will demonstrate knowledge of:

2.1 Identify the different type of heat pump within their categories and recognise their individual heat source:

- Air Source heat pump
  - Monoblock, fixed speed, invertor driven
  - Split
  - Air to air
- Ground source heat pump
  - Fixed speed, invertor driven
  - Closed loop
  - Open loop
- Exhaust air heat pump
  - Fixed speed, invertor driven
  - Heating and hot water
  - Hot water only
  - Air to air

2.2 State the requirements of the current fluorinated greenhouse gases regulations in relation to:

- the competence of personnel installing heat pumps where the refrigerant circuit has been assembled and tested by the product manufacturer
- the competence of personnel installing heat pumps where the refrigerant circuit is to be assembled and tested in the location where the heat pump is to be installed and operated
- the competence of personnel undertaking leakage checking on heat pump refrigerant circuits
- the competence of personnel undertaking recovery of fluorinated greenhouse gases from heat pump refrigerant circuits
- flammability of certain refrigerants

Learning Outcome 3. The learner will know the fundamental principles of heat pump efficiency and design selection that are common for heat pumps.

The learner will demonstrate knowledge of:

3.1 Confirm the meaning of the term ‘Coefficient of Performance’.

3.2 Confirm the relationship between Coefficient of Performance and the:

- heat pump input temperature
- heat pump emitter temperature.

3.3 Confirm the effect that ambient temperature can have on:

- coefficient of performance
- heat pump output.

3.4 Confirm the meaning of the term ‘Seasonal Performance Factor’.

3.5 Identify the factors that can affect the Seasonal Performance Factor.

3.6 Demonstrate understanding of a products ErP label and product Fiche

3.7 Confirm the meaning of the term ‘System Efficiency’.

3.8 Identify the factors that can affect the ‘System Efficiency’.

3.9 Demonstrate understanding of a products package label

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

3.11 State the effect that oversizing of a heat pump has on:
- system performance/efficiency
- heat pump operation.

3.12 State the effect that under-sizing of a heat pump has on:
- system performance/efficiency
- heat pump operation.

3.13 Confirm the meaning of the terms:
- monovalent system
- bivalent system
- hybrid system.

3.14 Confirm how to use manufacturer’s data to select heat pump units:
- output charts
- other data.

3.15 Confirm the meaning of the term ‘bivalent points’ in relation to heat pump output charts.

3.16 Confirm how ‘bivalent points’ are used to determine auxiliary heat requirements.

3.17 Confirm how heat pump output capacity is affected by:
- heat pump input temperature
- heat pump output temperature.

3.18 State the typical mean water temperature recommended when designing a hydraulic emitter circuit that incorporates:
- standard panel radiators.
- underfloor heating
- fan assisted convector heaters
- fan coils

3.19 State the typical annual operating hours for a heat pump that is being used for:
- heating only
- heating and domestic hot water.

3.20 State how heat pump annual operating hours may vary in relation to the:

- type of building
- geographical location of the installation.

Learning Outcome 4. The learner will know the fundamental principles of domestic hot water cylinder selection and system design that are common for heat pumps.

The learner will demonstrate knowledge of:

4.1 Identify the different type of heat pump hot water cylinders:

- heat pump, hot water packaged unit
- coiled cylinder
- tank in tank cylinder
- thermal store
- solar cylinder

4.2 Identify volume of hot water cylinder required for the building.

4.3 Identify output required from heat pump to heat the hot water cylinder.

4.4 Identify correct selection of hot water cylinder for the heat pump.

4.5 Identify correct zone valve selection for heat pump and hot water cylinder.

4.6 Requirements for secondary hot water circulation.

4.7 Confirm safe system design in relation to regulations for:

- Legionella protection
- Hot water temperature protection and prevention of scalding.

Learning Outcome 5. The learner will know the fundamental principles of hydraulic system design that are common for heat pumps.

The learner will demonstrate knowledge of:

5.1 Identify the suitability of the following types of hydraulic heating system emitter for heat pump systems:

- Standard panel radiators.
- Underfloor heating
- Fan assisted convector heaters
- Combined systems (radiators, underfloor heating)
- Multiple zones

5.2 Confirm how to identify heat pump hydraulic flow rate requirements and circulation pump selection.

5.3 Confirm how to identify heat pump pipe size requirements in relation to designed flow temperature.

5.4 Identify why a buffer vessel maybe required in the system design.

5.5 Confirm how to size a buffer vessel in the system design.

5.6 Identify correct piping alternatives for buffer vessels in the system design.

Learning Outcome 6. The learner will know the fundamental principles of heat pump controls.

The learner will demonstrate knowledge of:

6.1 Confirm the common control systems for heat pump units in relation to:

- weather compensation
- indoor and outdoor sensors
- heat curves
- scheduling
- optimisation
- accessories
- internet connections and Apps

Learning Outcome 7. The learner will know the preparatory work required for heat pump installation work.

The learner will demonstrate knowledge of:

7.1 Confirm the common requirements of pre-installation checks for heat pump unit installations connected to hydraulic emitters circuits in relation to:

- authorisation for the work to proceed
- the availability and collation of all relevant information
- verification of the suitability of the hydraulic emitter circuit for connection to the heat pump unit
- verification that the heat output capacity of the heat pump unit is matched to the required proportional contribution of the total building heat load
- verification that the buffer tank sizing is correct
- the availability of appropriate access to all required work areas
- the availability and condition of a suitable electrical input service
- verify the correct fuse rating for heat pump
- adequate provision for the siting of key internal system components
- the suitability of the building structure in relation to the proposed installation.
- DNO notification
- Building Regulation and assignment of rights

Learning Outcome 8. The learner will know the requirements to install and test heat pump systems (non-refrigerant circuits).

The learner will demonstrate knowledge of:

8.1 Confirm the requirements for moving and handling heat pump units to avoid damage to the unit.

8.2 Confirm the requirements to avoid undue noise and/or vibration transmission from the heat pump unit to the building structure during the operation of the heat pump.

8.3 Identify the requirements where brine circuit pipework passes through the external building fabric in relation to:

- provision for movement
- protection against freezing
- prevention of water ingress

8.4 Confirm the charging and flushing requirements for hydraulic system in relation to:

- correct filling and venting
- purging of air and installation debris
- addition of antifreeze protection and suitable cleansers and or inhibitors.
- checking for leaks
- check filters for debris

8.5 State what equipment is needed for system charging and flushing.

8.6 Confirm the hydraulic test requirements.

Learning Outcome 9. The learner will understand the requirements to commission heat pump system installations (non-refrigerant circuits).

The learner will demonstrate knowledge of:

9.1 Confirm the conditions that are required to implement commissioning activities for heat pump systems.

9.2 Confirm the commissioning requirements for heat pump systems in relation to:

- setting of mechanical controls
- setting of electrical controls and temperature sensors
- functional tests
- hydraulic balancing
- checking flow rates.
- checking the designed delta T
- checking start and stop temperatures

Learning Outcome 10. The learner will understand the requirements to handover heat pump system installations.

The learner will demonstrate knowledge of:

10.1 Confirm the pre-handover checks that need to be carried out for a heat pump system installation.

10.2 Confirm the industry handover procedures for a heat pump system installation in relation to the:

- provision of completed commissioning sheet
- provision of diagrammatic information
- provision of verbal information/demonstration relating to system operation and use.

Unit Specification B: Plan, prepare and Install heat pumps (Non-Refrigerant Circuits)

Learning Outcome 1. The learner will plan and prepare for the installation of heat pumps (non-refrigerant).

The learner will demonstrate knowledge of:

1.1 Undertake pre-installation checks for a heat pump installation to include checks relating to:

- authorisation for the work to proceed
- client/end user requirements
- statutory regulations and/or industry recognised procedures
- manufacturers requirements
- the availability of appropriate access to all required work areas
- the availability and collation of all relevant information
- verification that the heat pump rating is suitable for the emitter circuit load (heating and/or heating and hot water)
- verification of the suitability of the proposed location of the heat pump unit
- verification that the emitter circuit design or existing installation is compatible with the proposed heat pump installation.
- verification that the buffer tank size (where relevant) is appropriate
- verification of the suitability of the availability of a suitable electrical input service
- the proposed siting of key internal system components
- the suitability of the building structure in relation to the
- proposed installation.

Learning Outcome 2. The learner will install heat pump units (non-refrigeration units).

The learner will demonstrate knowledge of:

2.1 Install a heat pump in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures, to include as a minimum the connection of the heat pump unit to the hydraulic emitter circuit.

Unit Specification C: Commission and handover heat pumps (Non-Refrigerant Circuits)

Learning Outcome 1. The learner will test and commission a heat pump system (non-refrigerant circuits).

The learner will demonstrate knowledge of:

1.1 Prepare a heat pump system for testing and commissioning to include checks/actions to confirm:

- compliance with the system design and specification
- compliance with system/component manufacturer requirements
- the suitability of electrical supply circuit arrangements
- correct flushing the system of installation debris
- correct filling and venting the hydraulic circuits
- protection of the system against freezing.

1.2 Identify the commissioning requirements for the installation in relation to:

- the system/component manufacturer(s) requirements
- system design/specification requirements
- the client/end user requirements
- statutory regulations and/or industry recognised procedures.

1.3 Commission the installation in accordance with manufacturer's guidance, design requirements, client's requirements and statutory requirements and/or industry recognised procedures.

1.3 Complete relevant documentation to record the commissioning activities.

Learning Outcome 2. The learner will know the requirements for the handover of a heat pump installation (non-refrigerant circuits).

The learner will demonstrate knowledge of:

2.1 Undertake relevant checks to ensure that the system is ready for handover and compliant with manufacturer's guidance, the system design/specification, client's requirements, regulatory requirements and/or industry recognised requirements.

2.2 Explain and demonstrate to the end user the operation and use of the system using manufacturer's guidance and industry agreed handover procedures.

2.3 Identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements.

2.4 Obtain acceptance by the end user of the system according to the industry agreed handover procedures.

2.5 Ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer's guidance and industry recognised procedures.

Unit Specification D: Know the requirements to inspect, service and maintain heat pump systems (Non-Refrigerant Circuits)

Learning Outcome 1. The learner will know the requirements for non-refrigerant circuit routine service and maintenance of a heat pump system installation (non-refrigerant circuits).

The learner will demonstrate knowledge of:

1.1 Confirm which documentation needs to be available to enable routine service and maintenance work on heat pump system installations.

1.2 Confirm typical routine service and maintenance requirements for an air source heat pump installation in relation to:

- visual inspection requirements
- cleaning of components
- checking of system water content
- functional tests.

1.2 Confirm typical routine service and maintenance requirements for a ground source heat pump installation in relation to:

- visual inspection requirements
- cleaning of components
- checking of system water content
- functional tests.

1.3 Confirm the industry requirements for the recording and reporting of routine service and maintenance work on heat pump system installations.

1.4 State the action(s) to take in the event of a failure or suspected failure of the refrigerant circuit and/or a suspected refrigerant circuit defect.

Learning Outcome 2. The learner will undertake non-refrigerant circuit fault diagnosis work on a heat pump system installation.

The learner will demonstrate knowledge of:

2.1 The learner will be able to demonstrate knowledge of the cause of a minimum of FOUR separate faults from the following list.

- heat pump low pressure trip/alarm activated by a collector circuit malfunction
- heat pump high pressure trip/alarm activated by an emitter circuit malfunction
- poor or no collector circuit performance
- insufficient heat output to emitter circuit
- domestic hot water heat up is satisfactory but space heating is not operating
- system noise and/or vibration.

2.2 Agree with the relevant person(s) fault rectification procedures for the faults identified.