Qualification Specification

ETS-008

BPEC Level 3 Award in Heat Pump Systems (Non-refrigerant Circuits)

Qualification Number – **610/0821/7**

Contents

1. About BPEC

BPEC Certification Ltd was initially established in February 1997 to act as an autonomous, accredited certification company following the announcement of the establishment by the Health and Safety Executive (HSE) of the Nationally Accredited Certification Scheme for Individual Gas Fitting Operatives (ACS). BPEC Certification Ltd now provides services in the field of assessment and certification of competence of operatives working in the Building Services Engineering sector.

In September 2010 BPEC established a recognised Awarding Organisation, offering a suite of regulated qualifications. These have been developed with the input of industry and learning providers to meet the demands of the Building Services Engineering sector.

The company is committed to high levels of customer service and providing support to organisations who deliver our qualifications. We are also committed to offering qualifications which meet the needs of industry, learners, and providers on an ongoing basis.

BPEC Certification is a not-for-profit company, and any surplus funds are gift aided to the BPEC Charity. The focus of the Charity is to raise the knowledge and skills of those who work in the UK plumbing and heating industry and support associated projects.

Should you wish to learn more about BPEC (including our charity work) please contact:

BPEC Certification Ltd
1-2 Mallard Way
Pride Park
Derby
DE24 8GX

Tel: 01332 376000 or 0845 6446558

Or visit our website at:

www.bpec.org.uk

2. Introduction to the qualification

2.1. Qualification overview

Qualification title	BPEC Level 3 Award in Heat Pump Systems (non-refrigerant Circuits)				
Qualification Number (QN)	610/0821/7				
Qualification type	Vocationally Related Qualification				
BPEC qualification code	ETS-008				
Assessment method(s)	Practical assessments, Multiple choice questions				
Entry requirements	Learners must be 16 years old or over				
Registration Duration	12 Months				
GLH	30	**TQT**	40	**Credits**	4
Mandatory units	2				
Optional units	N/A				
Pathways	N/A				
Last registration date	31/06/2027				
Last certification date	30/06/2028				

2.2. Registration Duration

The registration duration for the qualification detailed within this document is detailed in the table above. All learners must complete the qualification within the registration duration, should they fail to complete the qualification within this period, the centre must register the learner again and pay for a new registration, fees are detailed in the BPEC Awarding Organisation Fees List.

Learners must be made aware that they will be required to complete the qualification within the registration duration, for the relevant qualification as detailed in the table above.

BPEC will only consider extending a learner registration in exceptional circumstances such as e.g. long-term illness, bereavement, psychological conditions, caring for family members etc. Please note this list is not exhaustive. Each request will be reviewed by BPEC on an individual basis, please contact AOadmin@bpec.org.uk , giving details of the learner, qualification, and the rationale for the request.

2.3. Who this qualification is for?

This qualification is for those learners currently employed in the plumbing and domestic heating industry, providing them with the necessary training to develop their existing skills. Learners will be required to demonstrate the necessary abilities, skills, and knowledge to be able to plan, select, install and commission heat pump systems. In addition to this, learners will also demonstrate a knowledge of service, maintenance and fault diagnosis and fault rectification of heat pump systems.

2.4. The Purpose of the qualification

The purpose of this qualification is for learners to be able to develop the skills and knowledge necessary to plan, select, install, commission, maintain, service and repair heat pump systems within the Building Services Engineering (BSE) renewable sector. The target groups for the qualification are those learners who are:

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

2. 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.

2.5. Support and accreditation

This qualification is supported by industry and regulated by Ofqual.

2.6. Relationship to other qualifications

This qualification, the BPEC Level 3 Award in Heat Pump Systems (Non-refrigerant Circuits) ETS-008 is one of three qualifications for the installation of heat pumps. These qualifications are deemed the minimum requirement for MCS recognition for an operative wishing to install, commission, service, maintain and fault diagnose heat pumps.

This qualification replaces all previous BPEC heat pump qualifications.

2.7. Qualification limitations

This qualification is the minimum requirement for the installation, commissioning, maintenance, and fault-finding diagnostics for heat pumps. Those operatives wishing to specialise in either air source heat pumps or ground source heat pumps will require either of the following:

- BPEC Level 3 Award in Air Source Heat Pump Systems (Non-refrigerant Circuits)
- BPEC Level 3 Award in Ground Source Heat Pump Systems (Non-refrigerant Circuits)

The learner should be aware that this qualification only allows the installation of the 'wet' side of the heat pump and does not allow any work on the refrigerant aspects of heat pumps. The knowledge and competencies required to work on/maintain refrigerant circuits is covered separate ***refrigerant handling*** qualifications. Operatives wishing to install split heat pump systems, and the relevant refrigerant circuits, must undergo further training and F-GAS Regulation registration.

3. Qualification structure

3.1. Overview

This qualification consists of 2 mandatory units.

3.2. Mandatory units

Unit Code	Unit type	Unit title	Level	GLH	TQT	Credit
M/650/2406	**K**	Know the requirements to size, select, install, commission and handover heat pump systems (non-refrigerant circuits)	3	18	20	2
R/650/2407	**P**	Plan, prepare, install, commission, and maintain air source and ground source heat pumps (non-refrigerant circuits)	3	12	20	2
			Totals	30	40	4

Key	Unit type
K	**Knowledge**
P	**Performance**

3.3. Optional units

There are no optional units for this qualification. All units are mandatory.

3.4. Rule of combination

The Learner must complete all mandatory units.

4. Learners

4.1. Qualifications which a learner must have completed before taking the qualification

- 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.

Important Note:

Standalone technical certification and/or vocational related qualifications are not acceptable.

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

- WRAS Water Regulations/Water Byelaws or equivalent.

Please note, it is the centres responsibility to ensure that learners meet the pre-requisite requirements detailed above prior to undertaking this qualification. Centre's must ensure that all pre-requisite evidence is provided to BPEC when submitting certification requests, for each individual learner.

4.2. Recommended learning prior to taking the qualification

Although not a pre-requisite for this heat pump course, it is recommended that learners complete the **BPEC Low Temperature Hot Water Heating Systems** qualification **LTH-001** to enhance their knowledge of the design of low temperature hot water heating systems that utilise a heat pump as the heat source.

4.3. Knowledge, skills or understanding which the learner is required to have before taking the qualification

Specific:

- The learner should have knowledge, skills and understanding of the building services engineering industry before taking the qualification. Knowledge, skills, and understanding would be demonstrated by the learner meeting the requirements of section 4.1.

General:

The centre should:

- Undertake an initial assessment of each learner to ensure they have the minimum levels of numeracy and literacy to comply with the health and safety aspects of the qualification and the completion of the learning outcomes and assessments
- Establish if the learner has any specific training needs
- Identify any support and guidance the learner may require when working towards the qualification.

4.4. The units which a learner must have completed before the qualification will be awarded and any optional routes

Learners will need to complete the 4 mandatory units.

4.5. Any other requirements which a learner must have satisfied before the learner will be assessed or before the qualification will be awarded

None identified.

4.6. Qualification achievement

- The qualification will be achieved when all necessary units have been completed
- If a learner does not complete all the units necessary to complete the full qualification, no certificate will be issued.

5. Delivery requirements

5.1. Centre recognition

Centres wishing to deliver this qualification will need to gain centre recognition and qualification approval (see 5.2). For full details of the recognition process please contact:

BPEC Certification Ltd
1-2 Mallard Way
Pride Park
Derby
DE24 8GX

Tel: 01332 376000

5.2. Qualification approval

- Centres wishing to deliver this qualification who are already recognised (see 5.1) should complete and submit a Qualification Approval Form to BPEC Certification Ltd.
- Before to submission centres should ensure they can meet the delivery requirements
- Centres who are approved to deliver this qualification and wish to extend delivery to satellite sites must seek approval for each additional site.

5.3. Physical Resources

- General – centres must provide a safe environment for learners and staff with appropriate policies and procedures in place which are adhered to
- Teaching provision – centres must provide adequate facilities and equipment to allow the effective teaching of the qualification including any practical provision
- Assessment/exam provision – centres must provide facilities and equipment which allow assessments and/or exams to be conducted in accordance with assessment criteria/guidance and exam procedures.

5.4. Facilities and equipment

Centres will need to provide the following equipment for demonstration and practical training and assessment purposes. The provision must represent the type of equipment currently available in the Domestic Heat Pump market. The simulation installation shall represent a realistic working environment for the Learners when undertaking training and assessment. These must include:

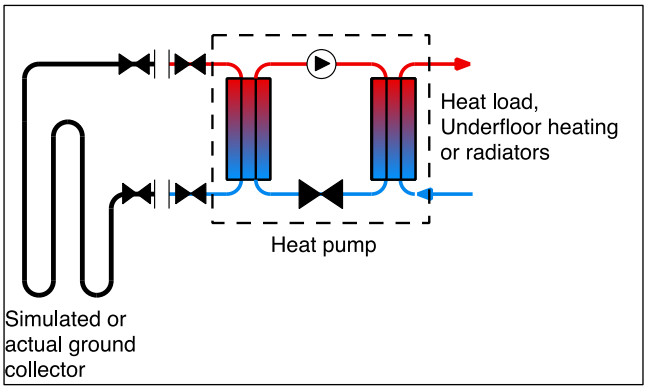
- A working ground source heat Pump and air source heat pump with a real or simulated heat distribution system (either radiators and/or underfloor heating)
- Appropriate tools and test instrumentation, including refractometers, thermometers, purging and filling pumps
- Suitable faulty and replacement parts to suit the faults/defects utilised within the assessments (See specification for recommended faults).

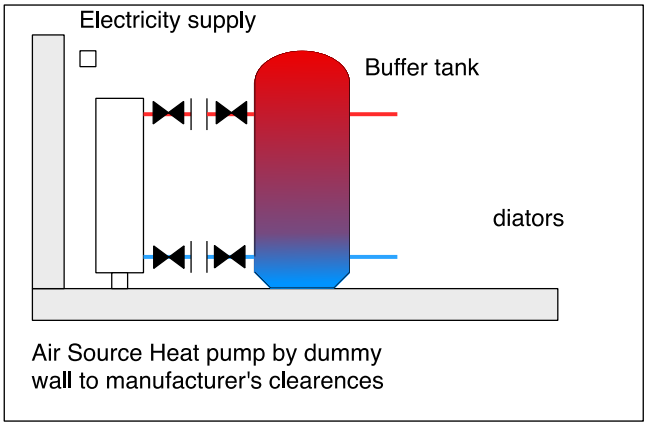
The equipment provided for assessment MUST enable Learners as a minimum to:

- Connect the Ground Source Heat Pump and Air Source Heat Pump to the heat distribution system
- Commission the Ground Source and Air Source Heat Pump
- Maintain and service Ground Source and Air Source Heat Pumps
- Diagnose and rectify faults on Ground Source and Air Source Heat Pumps.

By 'working' it is not necessarily meant that the system is a permanent installation but will need to be a system that will produce a realistic output when assembled.

Suggested pipework arrangements:





5.5. Staff conducting tuition, teaching, or instruction

Staff must:

- Have knowledge and understanding of the occupation covered by this qualification
- Have knowledge and understanding of the structure and content of this qualification
- Be technically competent in the occupation covered by this qualification

It is recommended that staff:

- Have 2 years verifiable experience in teaching/tuition/training; or
- Are working towards an appropriate teaching qualification; or
- Hold an appropriate teaching qualification.

5.6. Staff conducting assessments

Technical/occupational competency. The assessor must:

- Have knowledge and understanding of the occupation covered by this qualification
- Have knowledge and understanding of the structure and content of this qualification
- Be technically competent in the occupation covered by this qualification.

Assessor competency. The assessor must hold:

- Level 3 Award in Assessing Vocationally Related Achievement ***or***
- Level 3 Award in Assessing Competence in the Work Environment ***or***
- Level 3 Certificate in Assessing Vocationally Related Achievement ***or***
- A1 or D32 /D33 with an Upgrade to A1 as a minimum.

Assessor CPD:

- The occupational competence of assessors must be updated on a regular basis through CPD and/or requalification if required.
- Records of assessor CPD should be maintained for verification by the external quality assurer.

Assessor approval:

- Assessors must be approved by BPEC Certification Ltd before undertaking any assessments.

Candidate assessors:

- Must be registered on a programme to attain their assessor qualification and have a clear action plan for achieving the qualification within 18 months (candidate assessor approval may be withdrawn if the assessor qualification has not been attained in this period)
- Must be supervised and their assessment decisions countersigned by a qualified assessor who is approved by BPEC Certification Ltd.

5.7. Staff conducting Internal Quality Assurance (IQA)

Technical/occupational competence:

- Have knowledge and understanding of the occupation covered by this qualification
- Have knowledge and understanding of the structure and content of this qualification
- Be technically competent in the occupation covered by this qualification.

IQA competence. The IQA must hold:

- Level 3 Certificate in Assessing Vocationally Related Achievement or A1; or
- D32 /D33 with an Upgrade to A1 as a minimum; and
- Level 4 Award in Internal Quality Assurance of Assessment Processes and Practice; or
- Level 4 Certificate in Leading the Internal Quality Assurance of Assessment Processes and Practice; or
- V1 or D34 with an upgrade to V1 as a minimum.

IQA CPD:

- The occupational competence of IQA's must be updated through CPD and/or requalification if required on a regular basis
- Records of an IQA's CPD should be maintained for verification by the external quality assurer.

IQA approval:

- IQA must be approved by BPEC Certification Ltd before undertaking any IQA activity.

Candidate IQA's:

- Must meet the technical/occupational competences detailed above.
- Must hold Level 3 Certificate in Assessing Vocationally Related Achievement or A1 or D32/33 with an upgrade to A1
- Must be registered on a programme to attain their IQA qualification and have a clear action plan for achieving the qualification within 18 months (candidate IQA approval may be withdrawn if the qualification has not been attained in this period)
- Must be supervised and their decisions countersigned by a qualified IQA who is approved by BPEC Certification Ltd.

5.8. Equivalent assessor/IQA qualifications

Assessors:

- The Teaching Qualification for Secondary Education (TQSE) or the Teaching Qualification for Further Education (TQFE) (which is recognised in Scotland) these awards are acceptable providing they are the versions that are recognised as equivalents to the (A1) assessors award plus appropriate CPD
- SQA Accredited Learning and Development Unit L&D 9D Assess workplace competence using direct methods.

IQA:

- SQA Accredited Learning and Development Unit L&D 11 “Internally monitor and maintain the quality of workplace assessment”.

5.9. Staff conducting external assessments (exams)

This relates to staff that are conducting and controlling exam sessions only.

These must:

- Be experienced - Staff should be experienced in the supervision of assessments or be under the supervision of an experienced person
- Knowledgeable - Staff should be knowledgeable of the assessment procedure
- Be Independent - Staff conducting exams should not be related to any learner sitting the assessment exam nor be involved in teaching or quality assuring the subject.

6. Support materials

6.1. Qualification specification

This qualification specification provides details of all units, Learning Outcomes and Assessment Criteria and specific advice regarding the assessment process.

6.2. Learner Result Submission Form (LRSF)

A learner result submission form is available for this qualification. This should be completed for each learner and submitted when certification is required.

Centres are reminded that they should retain a copy of the learner result submission form in centre for a period of 3 years.

Centre's must ensure that all pre-requisite evidence is provided to BPEC when submitting certification requests, for each individual learner.

6.3. Learner assessment packs

Learner assessment packs for this qualification are available.

6.4. Learner assessment pack rationale

A learner assessment pack rationale for the practical aspects of this qualification has been produced and is available.

6.5. Course Textbook

BPEC have produced a textbook that accompanies both ground and air source heat pumps. It is available from the BPEC website.

Follow the link:

https://bpec.org.uk/product/heat-pump-installer/

7. Unit details

The tables below identify the 4 units which compose the qualification and details the title, UAN, GLH, aim, learning outcomes, assessment criteria and range for each unit.

Unit Ref: M/650/2406

Unit Title - Know the requirements to size, select, install, commission and handover heat pump systems (non-refrigerant circuits).
UAN – M/650/2406
GLH - 18
AIM The unit focuses upon the underpinning knowledge required to plan and prepare for, install (including testing and commissioning) and handover heat pump system installations. The unit covers fundamental heat pump system design awareness and component selection but does not include detailed system design.

Learning Outcome 1. Know what a heat pump is, the principle of the vapour compression system and system components.

Learning Outcome 2. Know the different operational characteristics of each type of heat pump unit and system arrangement.

Learning Outcome 3. Know the fundamental principles of heat pump efficiency and design selection that are common for heat pumps.

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

Learning Outcome 5. Know the fundamental design considerations that are generic to air and ground source heat pumps.

Learning Outcome 6. Know the fundamental principles of hydraulic system design that are common for heat pumps.

Learning Outcome 7. Know the common requirements for the installation of a heat pump connected to hydraulic emitter circuits.

Learning Outcome 8. Know the fundamental principles of heat pump controls.

Learning Outcome 9. Know the fundamental design principles for ground source heat pump collector circuits, design, component sizing and installation.

Learning Outcome 10. Know the preparatory work required for heat pump installation work.

Learning Outcome 11. Know the preparatory work required for the installation of an air source heat pump.

Learning Outcome 12. Know the requirements to install and test heat pump systems (non-refrigerant circuits).

Learning Outcome 13. Understand the requirements to commission heat pump system installations (non-refrigerant circuits).

Learning Outcome 14. Understand the requirements to handover heat pump system installations.

Learning Outcome 1	
Know what a heat pump is, the principle of the vapour compression system and system components.	
Assessment Criteria	
1.1	Confirm the purpose and operational characteristics of the following components: **Generic components:** a) Evaporator b) Low pressure switch c) Compressor d) High pressure switch e) Condenser f) Dryer/receiver g) Expansion valve h) Expansion valve phial i) Refrigerant four-way valve. **GSHP components:** a) Ground source b) Brine pump. **ASHP components:** a) De-frost cycle b) Fan.
1.2	Confirm how the vapour compression refrigerant circuit within a heat pump unit operates.

Learning Outcome 2	
Know the different operational characteristics of each type of heat pump unit and system arrangement	
Assessment Criteria	
2.1	Identify the different type of heat pump within their categories and recognise their individual heat source: a) Air Source heat pump - Monoblock, fixed speed, invertor driven - Split - Air to air. b) Ground source heat pump - Fixed speed, invertor driven - Closed loop - Open loop. c) Exhaust air heat pump - Fixed speed, invertor driven - Heating and hot water - Hot water only - Air to air.

Learning Outcome 2	
Know the different operational characteristics of each type of heat pump unit and system arrangement	
Assessment Criteria (continued)	
2.2	State the requirements of the current fluorinated greenhouse gases regulations in relation to: a) The competence of personnel installing heat pumps where the refrigerant circuit has been assembled and tested by the product manufacturer b) 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 c) The competence of personnel undertaking leakage checking on heat pump refrigerant circuits d) The competence of personnel undertaking recovery of fluorinated greenhouse gases from heat pump refrigerant circuits e) Flammability of certain refrigerants.

Learning Outcome 3	
Know the fundamental principles of heat pump efficiency and design selection that are common for heat pumps.	
Assessment Criteria	
3.1	Confirm the meaning of the term 'Coefficient of Performance'.
3.2	Confirm the relationship between Coefficient of Performance and the: a) Heat pump input temperature b) Heat pump emitter temperature.
3.3	Confirm the effect that ambient temperature can have on: a) Coefficient of performance b) Heat pump output.
3.4	Confirm the meaning of the term 'Seasonal Coefficient of Performance'.
3.5	Identify the factors that can affect the Seasonal Coefficient of Performance'
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: a) System performance/efficiency b) Heat pump operation.
3.12	State the effect that under-sizing of a heat pump has on: a) System performance/efficiency b) Heat pump operation.

Learning Outcome 3	
Know the fundamental principles of heat pump efficiency and design selection that are common for heat pumps.	
Assessment Criteria (continued)	
3.13	Confirm the meaning of the terms: a) Monovalent system b) Bivalent system c) Hybrid system.
3.14	Confirm how to use manufacturer's data to select heat pump units: a) Output charts b) 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: a) Heat pump input temperature b) Heat pump output temperature.
3.18	State the typical mean water temperature recommended when designing a hydraulic emitter circuit that incorporates: a) Standard panel radiators. b) Underfloor heating c) Fan assisted convector heaters d) Fan coils.
3.19	State the typical annual operating hours for a heat pump that is being used for: a) Heating only b) Heating and domestic hot water.
3.20	State how heat pump annual operating hours may vary in relation to the: a) Type of building b) Geographical location of the installation.

Learning Outcome 4	
Know the fundamental principles of domestic hot water cylinder selection and system design that are common for heat pumps.	
Assessment Criteria	
4.1	Identify the different type of heat pump hot water cylinders: a) Heat pump, hot water packaged unit b) Coiled cylinder c) Tank in tank cylinder d) Thermal store e) 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.

Learning Outcome 4	
Know the fundamental principles of domestic hot water cylinder selection and system design that are common for heat pumps.	
Assessment Criteria (continued)	
4.7	Confirm safe system design in relation to regulations for: a) Legionella protection b) Hot water temperature protection and prevention of scalding.

Learning Outcome 5	
Know the fundamental design considerations that are generic to air and ground source heat pumps	
Assessment Criteria	
5.1	Identify the factors that need to be considered when selecting an air source or ground source heat pump in Relation to: a) Heat load based on a heat loss calculation, based on worst case outside temperature b) Flow temperature c) Emitter type d) Hot water requirements e) Monovalent, bivalent or hybrid systems.
5.2	Identify suitable electrical supply in relation to: a) District Network Operator (DNO) connection b) Isolation switches c) Fuse rating.

Learning Outcome 6	
Know the fundamental principles of hydraulic system design that are common for heat pumps.	
Assessment Criteria	
6.1	Identify the suitability of the following types of hydraulic heating system emitter for heat pump systems: a) Standard panel radiators. b) Underfloor heating c) Fan assisted convector heaters d) Combined systems (radiators, underfloor heating) e) Multiple zones.
6.2	Confirm how to identify heat pump hydraulic flow rate requirements and circulation pump selection.
6.3	Confirm how to identify heat pump pipe size requirements in relation to designed flow temperature.
6.4	Identify why a buffer vessel maybe required in the system design.
6.5	Confirm how to size a buffer vessel in the system design.
6.6	Identify correct piping alternatives for buffer vessels in the system design.

Learning Outcome 7	
Know the common requirements for the installation of a heat pump connected to hydraulic emitter circuits.	
Assessment Criteria	
7.1	Identify the installation requirements where flow and return pipework passes through the external building fabric in relation to: a) Provision for movement b) Prevention of water ingress.
7.2	Identify the installation requirements for the connection to the following types of hydraulic Heating system emitter: a) Standard panel radiators. b) Underfloor heating c) Fan assisted convector heaters d) Fan coils e) Combined systems (radiators, underfloor heating) f) Multiple zones.
7.3	Identify if a buffer vessel is required in the system design and correctly size.
7.4	Identify the correct pipe size requirements in relation to designed flow temperature.
7.5	Identify heat pump hydraulic flow rate requirements and circulation pump selection.
7.6	Identify the installation requirements for suitable insulation of external pipework in relation to: a) Thermal loss b) Protection against freezing c) UV protection d) Animal protection.

Learning Outcome 8	
Know the fundamental principles of heat pump controls.	
Assessment Criteria	
8.1	Confirm the common control systems for heat pump units in relation to: a) Weather compensation b) Indoor and outdoor sensors c) Heat curves d) Scheduling e) Optimisation f) Accessories g) Internet connections and apps.

Learning Outcome 9	
Know the fundamental design principles for ground source heat pump collector circuits, design, component sizing and installation.	
Assessment Criteria	
9.1	Identify the different types of ground source collectors in relation to: a) Horizontal ground loop b) Compact collector c) Slinky collector d) Vertical bore hole e) Lake collector f) Ground water g) Closed loop h) Open loop.
9.2	Confirm the principles of ground collector design in relation to: a) Collector type used b) Ground conditions and type c) Specific heat capacity W/m² of the ground d) Annual heat pump operating hours.
9.3	Confirm ground collector installation in relation to: a) Collector type used b) Suitable pipework materials c) Below ground jointing d) Protection of mechanical damage e) Separation distances to avoid thermal transfer f) Separation distances from other services and adjacent buildings g) Type of backfill material h) Achieving balanced collector circuits.
9.4	Confirm requirements where ground collector pipework passes through the external building Fabric in relation to: a) Provision for movement b) Protection against freezing c) Prevention of water ingress d) Prevention of condensation.
9.5	Confirm the requirements of charging and flushing of closed loop ground collectors relation to: a) Purging air and installation debris b) Addition antifreeze protection and suitable biocides c) Checking flow rates d) State equipment needed for system charging and flushing e) Pressure testing.

Learning Outcome 10	
Know the preparatory work required for heat pump installation work.	
Assessment Criteria	
10.1	Confirm the common requirements of pre-installation checks for heat pump unit installations connected to hydraulic emitters circuits in relation to: a) Authorisation for the work to proceed b) The availability and collation of all relevant information c) Verification of the suitability of the hydraulic emitter circuit for connection to the heat pump unit d) Verification that the heat output capacity of the heat pump unit is matched to the required proportional contribution of the total building heat load e) Verification that the buffer tank sizing is correct f) The availability of appropriate access to all required work areas g) The availability and condition of a suitable electrical input service h) Verify the correct fuse rating for heat pump i) Adequate provision for the siting of key internal system components j) The suitability of the building structure in relation to the proposed installation. k) DNO notification l) Building regulation and assignment of rights m) Internet connections and apps.

Learning Outcome 11	
Know the preparatory work required for the installation of an air source heat pump.	
Assessment Criteria	
11.1	Identify the factors that need to be considered when positioning an air source heat pump in relation to: a) Operating noise and proximity to habitable rooms and neighbouring properties. b) Planning considerations and permitted development c) Ensuring adequate airflow and clearances.
11.2	Identify the factors that need to be considered when wall or floor mounting an air source heat pump.
11.3	Identify the options to deal with the condensate produced from normal and defrost cycle Operation of an air source heat pump.
11.4	Identify suitable electrical supply in relation to: a) District Network Operator (DNO) connection b) Isolation switches c) Fuse rating.

Learning Outcome 12	
Know the requirements to install and test heat pump systems (non-refrigerant circuits).	
Assessment Criteria	
12.1	Confirm the requirements for moving and handling heat pump units to avoid damage to the unit.

Learning Outcome 12	
Know the requirements to install and test heat pump systems (non-refrigerant circuits).	
Assessment Criteria (continued)	
12.2	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.
12.3	Identify the requirements where brine circuit pipework passes through the external building fabric in relation to: a) Provision for movement b) Protection against freezing c) Prevention of water ingress.
12.4	Confirm the charging and flushing requirements for hydraulic system in relation to: a) Correct filling and venting b) Purging of air and installation debris c) Addition of antifreeze protection and suitable cleansers and or inhibitors. d) Checking for leaks e) Check filters for debris.
12.5	State what equipment is needed for system charging and flushing.
12.6	Confirm the hydraulic test requirements.

Learning Outcome 13	
Understand the requirements to commission heat pump system installations (non-refrigerant circuits).	
Assessment Criteria	
13.1	Confirm the conditions that are required to implement commissioning activities for heat pump systems.
13.2	Confirm the commissioning requirements for heat pump systems in relation to: a) Setting of mechanical controls b) Setting of electrical controls and temperature sensors c) Functional tests d) Hydraulic balancing e) Checking flow rates. f) Checking the designed delta T g) Checking start and stop temperatures.

Learning Outcome 14	
Understand the requirements to handover heat pump system installations.	
Assessment Criteria	
14.1	Confirm the pre-handover checks that need to be carried out for a heat pump system installation.
14.2	Confirm the industry handover procedures for a heat pump system installation in relation to the: a) Provision of completed commissioning sheet b) Provision of diagrammatic information

	c) Provision of verbal information/demonstration relating to system operation and use.

Unit Ref: R/650/2407

Unit Title - Plan, prepare, install, commission, and maintain air source and ground source heat pumps (non-refrigerant circuits)
UAN – R/650/2407
GLH - 12
AIM - The unit focuses upon the occupational competence required for planning, preparation, and installation, commissioning, and maintenance of a heat pump system. The unit covers a minimum requirement for a connection to the 'wet' central heating system to panel radiators or underfloor heating systems. The unit does not cover aspects of heat pump service and maintenance work that involves handling fluorinated greenhouse gases or working on the heat pump refrigerant circuit.

Learning Outcome 1. Plan and prepare for the installation of heat pumps (non-refrigerant circuits).

Learning Outcome 2. Install air and ground source heat pump units (non-refrigeration units).

Learning Outcome 3. Test and commission air and ground source heat pump systems (non-refrigerant circuits).

Learning Outcome 4. Know the requirements for the handover of air and ground source heat pump installations (non-refrigerant circuits).

Learning Outcome 5. Know the requirements for non-refrigerant circuit routine service and maintenance of a heat pump system installation (non-refrigerant circuits).

Learning Outcome 6. Undertake the non-refrigerant circuit routine service and maintenance of an air source and ground source heat pump system (non-refrigerant circuits).

Learning Outcome 7. Undertake non-refrigerant circuit fault diagnosis work on a heat pump system installation.

Learning Outcome 1	
Plan and prepare for the installation of heat pumps (non-refrigerant).	
Assessment Criteria	
1.1	Undertake pre-installation checks for a heat pump installation to include checks relating to: a) Authorisation for the work to proceed b) Client/end user requirements c) Statutory regulations and/or industry recognised procedures d) Manufacturer's requirements e) The availability of appropriate access to all required work areas f) The availability and collation of all relevant information g) Verification that the heat pump rating is suitable for the emitter circuit load (heating and/or heating and hot water) h) Verification of the suitability of the proposed location of the heat pump unit i) Verification that the emitter circuit design or existing installation is compatible with the proposed heat pump installation. j) Verification that the buffer tank size (where relevant) is appropriate k) Verification of the suitability of the availability of a suitable electrical input service l) The proposed siting of key internal system components m) The suitability of the building structure in relation to the proposed installation.

Learning Outcome 2	
Install air and ground source heat pump units (non-refrigeration units).	
Assessment Criteria	
2.1	Install an air and ground source 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.

Learning Outcome 3	
Test and commission air and ground source heat pump systems (non-refrigerant circuits)	
Assessment Criteria	
3.1	Prepare *air and ground* source heat pump systems for testing and commissioning to include checks/actions to confirm: a) Compliance with the system design and specification b) Compliance with system/component manufacturer requirements c) The suitability of electrical supply circuit arrangements d) Correct flushing the system of installation debris e) Correct filling and venting the hydraulic circuits f) Protection of the system against freezing.
3.2	Identify the commissioning requirements for the installation in relation to: a) The system/component manufacturer(s) requirements b) System design/specification requirements c) The client/end user requirements d) Statutory regulations and/or industry recognised procedures.
3.3	Commission the installation in accordance with manufacturer's guidance, design requirements, client's requirements, and statutory requirements and/or industry recognised procedures.

3.4	Complete relevant documentation to record the commissioning activities.

Learning Outcome 4	
Know the requirements for the handover of air and ground source heat pump installations (non-refrigerant circuits).	
Assessment Criteria	
4.1	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.
4.2	Explain and demonstrate to the end user the operation and use of the system using manufacturer's guidance and industry agreed handover procedures.
4.3	Identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements.
4.4	Obtain acceptance by the end user of the system according to the industry agreed handover procedures.

Learning Outcome 4	
Know the requirements for the handover of air and ground source heat pump installations (non-refrigerant circuits).	
Assessment Criteria (continued)	
4.5	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.

Learning Outcome 5	
Know the requirements for non-refrigerant circuit routine service and maintenance of a heat pump system installation (non-refrigerant circuits).	
Assessment Criteria	
5.1	Confirm which documentation needs to be available to enable routine service and maintenance work on heat pump system installations.
5.2	Confirm typical routine service and maintenance requirements for a heat pump installation in relation to: a) Visual inspection requirements b) Cleaning of components c) Checking of system water content d) Functional tests.
5.3	Confirm the industry requirements for the recording and reporting of routine service and maintenance work on heat pump system installations.
5.4	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 6	
Undertake the non-refrigerant circuit routine service and maintenance of an air source *and ground source* heat pump system (non-refrigerant circuits).	
Assessment Criteria	
6.1	Obtain relevant documentation required to be enable a routine service and maintenance work on an air source heat pump installation.
6.2	Undertake servicing of an air source *and ground source* heat pump in accordance with manufacturer's instructions.

Learning Outcome 6	
Undertake the non-refrigerant circuit routine service and maintenance of an air source *and ground source* heat pump system (non-refrigerant circuits).	
Assessment Criteria (continued)	
6.3	Demonstrate knowledge of the routine servicing of relevant components of an air source *and ground source* heat pump installation, including checks in relation to: **Air Source:** a) External isolation is used b) Evaporator fins for any blockage c) Evaporator fins are cleaned d) Fan is not obstructed and moving freely e) Outer casing f) Condensate drain functioning and not blocked g) Condition of flexible hoses h) Condition and grade of pipe insulation i) Signs of system water leakage j) Oil leaks or deposits k) Condition and security of fixing system l) Anti-vibration mounts m) Fuse rating **Ground source (including ground collector):** a) Check system fluid levels b) Check the system pressure levels c) Signs of system fluid leakage d) Check anti-freeze with suitable refractometer e) Check particle filter f) Check pressure or filling vessel g) Condition and grade of pipe insulation h) Condition of casing i) Pipe connections j) Fuse rating.

6.4	Demonstrate knowledge of the routine servicing of a heat pump connected to hydraulic emitter circuits and controls, including checks in relation to: a) Signs of system water leakage b) Heating system water pressure c) Heating system water content and makeup d) Expansion vessel size and pressure e) Pressure relief valve (PRV) operation f) System filters g) System bypass h) Buffer vessel if installer i) Circulation pumps j) Mechanical valves k) Condition and grade of pipe insulation l) Control unit and alarm logs m) Heating settings n) Hot water settings o) Indoor and outdoor sensors or thermostats.
6.5	Undertake and maintenance functional tests on a heat pump to include: a) Safe operation b) Efficient operation c) The function of system components and controls d) Noise and vibration levels.
6.6	Complete service and maintenance records.

Learning Outcome 7	
Undertake non-refrigerant circuit fault diagnosis work on a heat pump system installation.	
Assessment Criteria	
7.1	Demonstrate knowledge of the cause of a minimum of FOUR separate Faults from the following list. a) Heat pump low pressure trip/alarm activated by a collector circuit malfunction b) Heat pump high pressure trip/alarm activated by an emitter circuit malfunction c) Poor or no collector circuit performance d) Insufficient heat output to emitter circuit e) Domestic hot water heat up is satisfactory, but space heating is not operating f) System noise and/or vibration.
7.2	Agree with the relevant person(s) fault rectification procedures for the faults identified.

8. Assessment methods and arrangements

8.1. Contribution to overall Qualification

This qualification will be assessed as identified below.

Unit Ref: M/650/2406 Know the requirements to size, select, install, commission and handover heat pump systems (non-refrigerant circuits).

To achieve the completion of this **knowledge unit** you must satisfactorily complete the **two online multiple-choice tests** for the knowledge learning outcomes within the unit.

Unit Ref: R/650/2407 Plan, prepare, install, commission, and maintain heat pumps (non-refrigerant circuits)

To achieve the completion of this **performance unit** learners must complete the appropriate **practical performance activities** in simulated conditions as per the requirements of the unit as specified in the BPEC practical assessment for this qualification.

9. Marking Strategies

9.1. On-line Multiple-Choice Tests

There are two (2) on-line exams that the learner must complete:

1. BPEC Level 3 Award in Heat Pump Systems (non-refrig. circuits) **HP-1**
2. BPEC Level 3 Award in Heat Pump Systems (non-refrig. circuits) **HP-2.**

The pass rate for all on-line exams is 60%. They are **OPEN BOOK** tests.

- **HP-1** is 36 Questions – 72 minutes duration
- **HP-2** is 30 Questions – 60 minutes duration.

If the pass rate of 60% if not achieved a full re-sit will be required. The centre should use the exams summary report to identify any areas that would need further training before offering any re-sits.

The centre should not enter any learner into any exams without first confirming they are ready.

9.2. Practical Assessments

The pass mark for the practical assessments is 100%.

First Attempt - Learners are given a first attempt in all areas of the performance assessment. Second Attempt – performance areas not satisfactorily completed will be re-attempted. At the assessor's discretion, the Learner is re-assessed by oral questioning and/or observing the performance to establish competence in all remaining areas. Learners who have not achieved the 100% pass mark at this stage will be deemed to have failed the performance assessment. Learners wishing to retake the assessment will be required to re-attempt the full performance assessment in its entirety.

9.3. Learner Result Submission Form

A Learner Result Submission Form has been produced for the BPEC Level 3 Award in Ground Source Heat Pump Technologies (Non-refrigerant Circuits). This document shall be used to record that the Learner has completed the whole qualification in a satisfactory manner. The document shall be completed and signed by the centre assessor and the internal quality assurer (IQA).

The completed Learner Result Submission Form shall be sent to BPEC Certification Ltd. for certification. Copies of the Learner Result Submission Form shall also be retained in the Learner Portfolio and the Centre Portfolio.

10. Additional Assessor Competency Requirements

No additional competency requirements have been identified.