

Refrigeration Air Conditioning and Heat Pump Engineering Technician (Level 3)

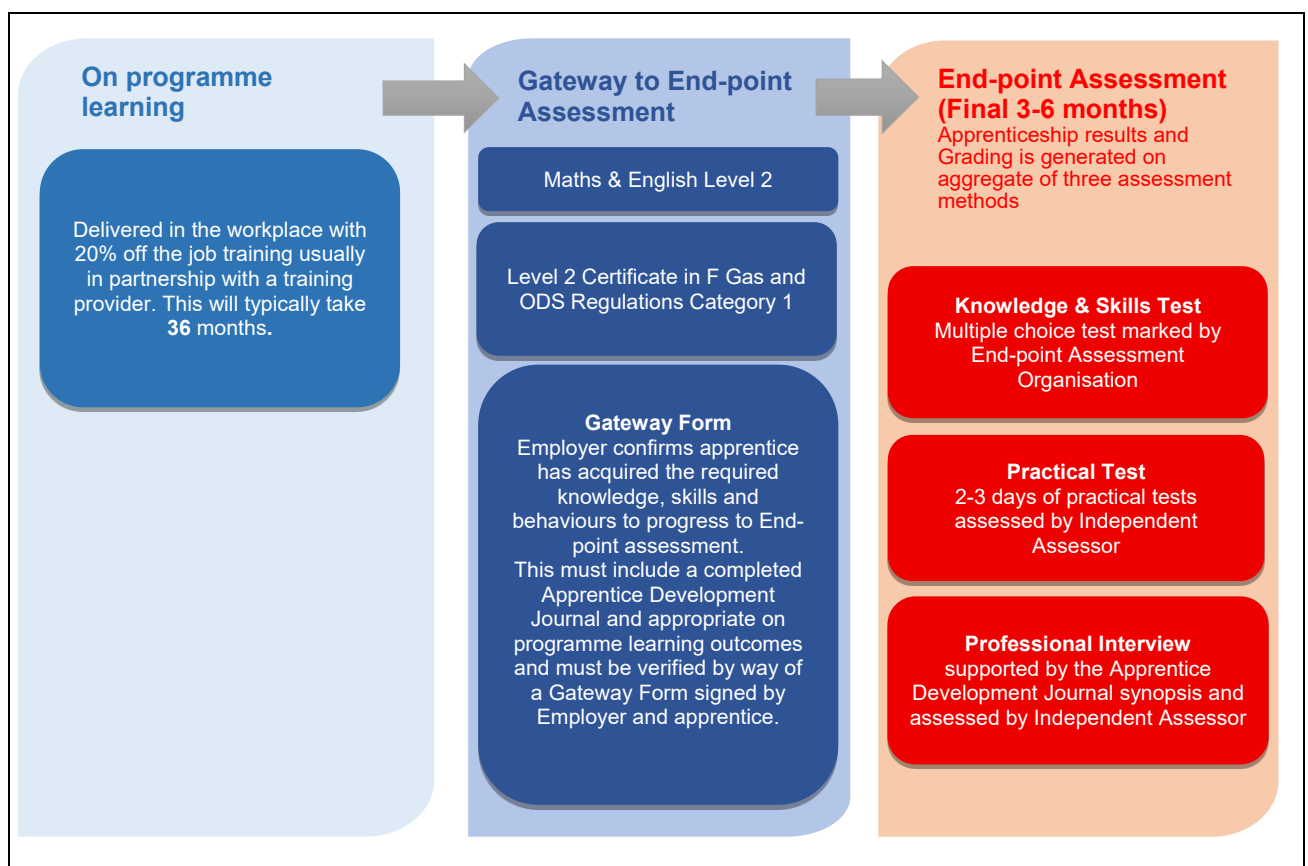
End-point Assessment Plan

1 – INTRODUCTION

This assessment plan provides details of the requirements for the Gateway and End-point assessment for this apprenticeship. It has been developed to support employers, apprentices, training providers and End-point Assessment Organisations (EPAO) with the delivery and assessment requirements. It reflects the needs of employers of apprentices who carry out work in a variety of roles in installation, commissioning, service and maintenance of systems in a variety of business applications.

Apprentices are expected to acquire the required transferrable knowledge, skills and behaviours identified in the Refrigeration Air Conditioning and Heat Pump (RACHP) Engineering Technician Standard and to provide evidence of their application in their specific work environment. This apprenticeship has been designed by industry representing a wide range of employers diverse in terms of size, location and type of work and supported by Professional Institutes and Trade associations.

2 - SUMMARY OF ASSESSMENT



The End-point Assessment (EPA) will provide summative synoptic assessments to test apprentices against the full apprenticeship standard. Before accessing EPA there will be a Gateway stage at which evidence will have to be provided for each apprentice to confirm their readiness to progress to EPA.

3 - APPRENTICESHIP GRADING

The overall apprenticeship grade is aggregated at pass, merit or distinction from the three assessment methods:

- I. **Knowledge & Skills Test** – an online multiple choice exam assessing across the knowledge requirements of the Standard. This is written, delivered and marked by the End-point Assessment Organisation (EPAO).
- II. **Practical Test** – takes between 14- 18 hours to complete and can be carried out over a maximum of 3 days. It is anticipated that a minimum of 14 hours should be allowed in order to carry out all of the test tasks specified adequately. Practical tests must be written by the EPAO in line with the specification in this End-point Assessment Plan. The assessment will be observed, documented, recorded, marked and graded by an Independent Assessor appointed by the EPAO.
- III. **Professional Interview supported by an Apprentice Development Journal synopsis** – a focused interview with an Independent Assessor appointed by the EPAO enabling the apprentice to give evidence verbally of how they have applied the required knowledge, skills and behaviours through their work experience, drawing on examples from their Apprentice Development Journal synopsis. The synopsis itself will not be assessed as part of the Interview and will not contribute to the grading of the apprenticeship.

Each element of the End-point Assessment will be graded and will carry equal weighting towards the aggregation of the overall apprenticeship grade.

4 - ON-PROGRAMME

During on-programme training apprentices must achieve the mandatory qualification “Level 2 Certificate in F Gas and ODS Regulations Category 1” as defined in the apprenticeship standard. This is a legal requirement under Statutory Instrument No 2015 No. 310, Environmental Protection, “The Fluorinated Greenhouse Gases Regulations 2015” for all operatives working on RACHP equipment containing F Gas refrigerants. The F Gas Certificate must be submitted as part of the Gateway.

All apprentices must complete an Apprentice Development Journal on-programme. This must be completed before the apprentice can pass through to the End-point Assessment at Gateway stage, and will be used to inform the Apprentice Development Journal synopsis which the apprentice will write during the EPA period. Guidance on the required contents of the Apprentice Development Journal and Apprentice Development Journal synopsis is provided in Appendix 6.

5 - GATEWAY

The EPA should only start once the employer is satisfied that the apprentice is consistently working at or above the level set out in the standard, the pre-requisite gateway requirements for EPA have been met and that they can be evidenced to an End Point Assessment Organisation. Employers may wish to take advice from their apprentice’s training provider(s).

Gateway requirements:

- English and mathematics at level 2
- Completed work-based Apprentice Development Journal
- F Gas Certificate

The Apprentice Development Journal contents will have been mapped to the Knowledge, Skills and Behaviours assessed in the Professional Interview as shown in Appendix 1 by the apprentice. The End Point Assessment Organisation (EPAO) will provide a checklist of task evidence that must be included.

When the employer is satisfied that the apprentice has attained the knowledge, skills and behaviours to the level required in the Standard and is ready for EPA, it is recommended that a Gateway Form shall be completed and signed by all parties as a declaration of this. If used, the Gateway Form should include evidence of:

- I. Achievement of mandatory F Gas Certificate.
- II. Meeting the relevant English and Maths requirements*
- III. A completed Apprentice Development Journal which provides sufficient evidence of the apprentice's ability to apply knowledge, skills and behaviours specified in the standard in their work place, to allow them to prepare for the Professional Interview element of the EPA.
- IV. A record of the results and decisions of the Gateway meeting with space for comment by Employer and apprentice.
- V. Signatures of Employer and apprentice.

If used, the completed Gateway form and evidence must be submitted to the EPAO.

* For those with an education, health and care plan or a legacy statement the apprenticeships English and maths minimum requirement is Entry Level 3 and British Sign Language qualification are an alternative to English qualifications for whom this is their primary language.

6 - END-POINT ASSESSMENT

EPAOs must be approved to be on the Register of End-point Assessment Organisations to deliver this EPA. This register is held by the Education and Skills Funding Agency (ESFA).

Appendix 1 shows what areas of the standard will be assessed in each assessment method.

i. Knowledge & Skills test (see Appendix 3)

What is it?

Online multiple choice tests that must include 50 questions from a question bank of questions developed by EPAOs. The recommended Test Specification in Appendix 3 gives guidance on the spread of questions across the Knowledge and Skills criteria from the Standard. The EPAO is responsible for ensuring that the Knowledge and Skills test adequately covers the KSBs outlined in this appendix and is responsible for implementing continuous improvements.

Test versions must be organized so that apprentices can re-take or resit a version of the test they have not previously sat after a period of further study. The question bank must be of sufficient size to prevent predictability and will be reviewed regularly (at least once a year) by the EPAO to ensure the test specification and the questions are fit-for-purpose.

Each question will present the apprentice with four answer options with only one correct answer.

The duration of the test will be (75 minutes), which is based on an average duration of 1.5 minutes per question. This length of time and scope of the test is commensurate with the complexity and range of mathematical calculations required for this occupation.

This is a closed book test i.e. the apprentice cannot refer to reference books or other materials.

Tests can also be made available in a paper based format should this be required for accessibility to the assessment.

Where does it take place? Assessments must take place in a controlled environment accessible to the apprentice which is quiet and free from distractions. The test shall be invigilated by a nominated non-technical person. The maximum invigilator to apprentice ratio must be 1 to 15 if face-to-face; or 1 to 5 if

remote. The invigilator's role is to authenticate the apprentice's identification and ensure apprentices do not have access to technical literature or external assistance online that may aid their performance in the test. If the test is invigilated remotely or an on-line platform is used, e.g. video-conferencing, EPAOs must ensure appropriate methods to prevent misrepresentation are in place. For example, screen share and 360-degree camera function with an invigilator when taking the test on-line.

How is it marked and graded? The test will be marked by the EPAO. Apprentices will receive an overall mark for the test and a grade for that mark. The test will be graded fail, pass, merit, distinction.

Grade boundaries for this assessment are			
Fail Less than 30 correct answers Or more than 30 correct answers where these are not spread across a range of at least 4 or more of the 6 Criteria from the Standard shown in Appendix 3	Pass 30-39 correct answers (With marks spread across at least 4 of the 6 Criteria from the Standard shown in Appendix 3)	Merit 40-44 correct answers (With a minimum of 1 mark achieved against each of the 6 Criteria from the Standard shown in Appendix 3)	Distinction 45-50 correct answers (With a minimum of 1 mark achieved against each of the 6 Criteria of the Standard shown in Appendix 3)

How does this contribute to the overall Apprenticeship? The results of the test will contribute towards one third of the weighting for the final apprenticeship grading.

ii. Practical Test (see Appendix 4)

What is it? Practical tasks which are synoptic in nature and which are sufficiently complex to demand the use of a wide range of skills, knowledge and behaviours. The Practical Test will take between 14-18 hours to complete and can be carried out over a maximum of 3 days. The standardised equipment specification and test descriptors in Appendix 4 shall be used to prepare the necessary equipment and layout for the practical test.

Where will it take place? The practical tests must be carried out under controlled conditions on standardised test equipment to ensure consistency of assessment. It is recommended that they be carried out at a location which provides access to the necessary test equipment and materials in a safe and controlled environment for observed assessment. There may be breaks during the assessment to allow for lunch and refreshments and to enable the apprentice to move from one location to another. An Independent Assessor (IA) appointed by the EPAO will carry out the assessment, recording and collecting evidence for grading.

How will it be marked and graded? Apprentices must be provided with both written and verbal instructions on the tests they must complete including timescales before they start their Assessment. The IA will observe the apprentice as they carry out test activities and will use observation and evidence generated by the apprentice to support their assessment decisions. Independent assessors may observe up to a maximum of 3 apprentices at any one time, to allow for cost effective use of resources while maintaining quality and rigour. The IA will record the marks given to each activity, based on observation of the activity and the supporting evidence provided by the apprentice to the IA during the Practical Test as specified in Appendix 4. If the candidate does not achieve a pass in the performing of any of the tasks specified in the Practical Test they will have deemed to have failed the Test. The Practical Test will be graded pass or fail only.

For the practical assessment, only those components failed will need to be resat or retaken.

EPAOs will provide Independent Assessors with assessment guidance and recording forms to ensure consistency. These forms will include a list of test activities that require direct observation and list of evidence to be collected regarding the apprentices' justification for how they have carried out the activities specified. This evidence may take the form of photographs/videos taken at various critical stages of the assessment as

well as all charts, calculations, datasheets, commissioning / performance data, F Gas logs, design schematics and risk assessments. Appendix 4 details of evidence to be collected.

If the apprentice carrying out the tests fails to adhere to the necessary safety, legal or environmental requirements at any time during the assessment, the IA may intervene, stopping the assessment and the apprentice will have failed the assessment.

Grade boundaries for this assessment are	
Fail Apprentice fails any of the criteria or fails to adhere to the necessary safety, legal and environmental requirements.	Pass Apprentice passes all of the criteria and adheres to the necessary safety, legal and environmental requirements.

How does this contribute to the overall Apprenticeship? The results of the test will contribute towards one third of the weighting for the final apprenticeship grading.

iii. Professional Interview supported by Apprentice Development Journal synopsis (see Appendix 5)

What is it? An Independent Assessor (IA) will conduct a one-to-one interview with the apprentice to allow the apprentice to demonstrate verbally their attainment of the knowledge, skills and behaviours criteria from the Standard specified in Appendix 1. The discussion will be based upon evidence detailed in a synopsis of their Apprentice Development Journal which must have been submitted to the EPAO at least four weeks before the interview takes place, for this to be prepared for submission to an IA at least two weeks before the interview. The apprentice may bring a copy of the Apprentice Development Journal synopsis to the interview and refer to it. The interview will include 12 core questions which are scoped in Appendix 5 and these may be followed up by supplementary questions to seek clarification. The Apprentice Development Journal synopsis itself will not be assessed as it contains evidence completed on-programme.

The interview will last between 45 and 55 minutes. It will be structured to ensure consistency of assessment by IAs. It should be scheduled allowing sufficient time for the apprentice to have time to prepare, which means that they must be notified of the interview date at least two weeks in advance of it taking place. It may take place on the same day that the Practical Test is completed.

The EPAO having received the Apprentice Development Journal synopsis four weeks in advance of the assessment will ensure that this is provided to the allocated IA at least two weeks in advance of the Professional Interview in order for them to contextualise the examples of work evidence the apprentice will be discussing, as the job roles within this occupation are very diverse.

The IA will record the responses of the apprentice either in writing or by recording device and their assessment decision and marking in a proforma which includes the headings shown in Appendix 5 to ensure consistency of assessment and grading.

The IA conducting the Professional Interview may be the same individual who has carried out the Practical Test Assessment. The Professional Interview would usually take place as the final assessment, after the apprentice has successfully completed the Knowledge & Skills Test and the Practical Test.

Where will it take place? As the interview will be a formal documented conversation it must be conducted in a 'controlled environment' i.e. a quiet room. The interview may be scheduled take place on the same or following day of the Practical Test assessment to aid manageability and reduce cost of assessment. There should be provision for the interview to take place remotely if needed utilising video conferencing. If video conferencing is used the Independent Assessors should take additional steps to authenticate the apprentice's identity and responses to ensure a fair and accurate assessment take place.

How will it be marked and graded? The Independent Assessor will conduct the interview and make a record either in writing or using a recording device. The IA will make a note of the marks and reasoning for those marks against each of the outcomes as advised by the EPAO as shown in Appendix 5. The marks will be

aggregated to achieve a final mark and grading for the assessment. The interview will be graded fail/pass/merit/distinction as below.

Professional Interview Grading			
Fail Does not demonstrate pass criteria	Pass Must pass all 12 criteria	Merit Must achieve at least a pass in all 12 criteria and distinction in at least 6	Distinction Must achieve a distinction in all 12 criteria

Grading Descriptors are shown in Appendix 5.

7 – DEFINITIONS OF RETAKES AND RESITS

A *retake* involves the apprentice requiring further learning or preparation before a second attempt of the failed assessment method(s). If the apprentice fails the Professional Interview, their retake will involve a further review of the content of their Apprentice Development Journal and Apprentice Development Journal synopsis by the apprentice along with a resubmission of these documents to the EPAO.

A *resit* involves another attempt of the failed assessment method(s) without a further period of study.

If an apprentice fails any elements of the EPA at the first attempt the maximum grade they can achieve for the apprenticeship, after resitting/retaking that element is a pass, except for exceptional circumstances as outlined below.

If the apprentice fails or does not complete the assessment as a result of exceptional circumstances i.e for reasons outside their control, e.g. illness, equipment failure, emergency circumstances occurred, the resit(s)/retake should be rescheduled at a mutually convenient time for the apprentice, employer and EPAO. The assessment and final apprenticeship may then be graded fail, pass, merit or distinction.

For the practical assessment, only those components failed will need to be resat or retaken.

The apprentice's employer determines whether a resit or retake is an appropriate course of action. Resits are typically taken with three months of the previous EPA outcome notification and retakes are dependent on how much additional learning is required and are typically taken within six months of the previous EPA outcome notification. Resits/retakes must not be offered to apprentices who pass and wish to achieve a higher grade.

8 - INDEPENDENT ASSESSORS (IA), INVIGILATORS AND MARKERS

Independent Assessors will be contracted by EPAOs to conduct the Practical Test and Professional Interview assessments. The EPAO will be responsible for their recruitment, training, standardisation and monitoring of performance. IAs must be independent of the apprentice, the training provider who delivered the on-programme training, the venue where the assessment is being conducted and the apprentice's employer. The EPAO must have in place sufficient quality assurance systems to ensure on-going monitoring and moderation of the IAs they contract. EPAO's with multiple IAs should appoint a Lead IA to oversee the activities of IAs and to ensure consistency of decision-making.

All Independent Assessors must meet these minimum requirements;

- Hold a nationally recognised qualification in assessment such as Level 3 Certificate in Assessing Vocational Achievement (earlier qualifications are accepted provided they are supported with evidence of CPD to the current standard)
- Evidence of technical knowledge in RACHP to Level 3 or above
- Evidence of having worked in a RACHP technical occupation within the past 10 years (e.g. refrigeration, air conditioning or heat pump technician, service/maintenance engineer, installer)

- Membership at any level of a relevant professional engineering institute. This is required because this standard is aligned to Engineering Council Engineering Technician grade level and Independent Assessors are therefore required to demonstrate that they understand professional engineering standards and associated CPD, conduct and ethics requirements.

EPAO's must appoint administrators/invigilators and markers to administer/invigilate and mark the Knowledge & Skills test. They must have no direct connection with the apprentice, their employer or training provider i.e. there must be no conflict of interest. There are no specific qualification or experience requirements for administrators/invigilators/markers. They must be trained in the task(s) by their EPAO and operate according to their guidance.

Quality assurance staff must hold or be working towards quality assurance qualifications. They must be independent of the apprentice, their employer and training provider i.e. there must be no conflict of interest.

9 – FINAL JUDGEMENT ON END-POINT ASSESSMENT MARKING AND GRADING

The overall grade of the apprenticeship will be aggregated from the three assessment methods by the EPAO and may be graded Pass, Merit or Distinction. Apprentices must achieve a minimum of a pass in all three assessment methods in order to pass the EPA and achieve their apprenticeship.

EPAOs must have processes in place to ensure that all assessments carried out within the EPA are fair, consistent and based on valid judgement. Appeals and Enquiry processes for assessments and grading decisions must be provided by the EPAOs. Apprentices shall have the right to appeal against decisions on assessment or grading based on stages of escalation.

10 - INDEPENDENCE OF DECISION MAKING

This assessment plan achieves independence by:

- End-point Assessment delivery by End-point Assessment Organisations registered on the Education and Skills Funding Agency's (ESFA) Register of End-point Assessment Organisations (RoEPAO).
- Using knowledge assessments based on multiple choice tests developed by EPAOs.
- Assessing of Practical Tests and Professional Interview by Independent Assessors appointed by EPAOs with requirements for Independent Assessors to be independent of the apprentice, the apprentice's employer, the apprentice's training provider and the organisation whose venue is being used to host the assessment.
- Requiring the development of assessment instruments and recording documentation for the Practical Tests and Professional Interview by EPAOs.

11 – END-POINT GRADING

The overall End-point Assessment grade will be determined by the EPAO using the conditional aggregation model below. Each assessment has equal weighting towards the overall apprenticeship grade.

Independent assessors must individually grade each assessment method according to the requirements set out in this plan. Restrictions on grading apply where apprentices resit or retake an assessment except in exceptional circumstances (see Section 7).

An independent assessor must combine the grades of all the assessment methods to determine the EPA grade. A fail in any element of the end-point assessment results in an overall fail. Where more than one independent assessor is involved, the independent assessor responsible for the assessment method completed last will be responsible for combining the grades. Independent assessors' decisions must be subject to moderation by the EPAO – see internal quality assurance section. Decisions must not be confirmed until after moderation.

Table 1 - Apprenticeship Grade Aggregation

Final grading of the apprenticeship	Grade achieved in Practical Test	Grades achieved in other two elements of the assessment
PASS	Pass	Pass/Pass
PASS	Pass	Pass/Merit
MERIT	Pass	Pass/Distinction
MERIT	Pass	Merit/Merit
MERIT	Pass	Merit/Distinction
DISTINCTION	Pass	Distinction/Distinction

12 - PROFESSIONAL BODY RECOGNITION

This standard is designed to meet the professional standards of the Engineering Council for registration as an Engineering Technician (EngTech) which can be awarded by relevant licensed Professional Engineering. Institutions should successful apprentices wish to apply.

13 - SUMMARY OF ROLES AND RESPONSIBILITIES AT END-POINT

Role	Responsibilities
Employer	<p>In order for apprentices to meet the Gateway requirement of a completed Apprentice Development Journal, the employer must supervise workplace activity of the apprentice to allow them to demonstrate that they have achieved the required knowledge, skills and behaviours at work for the Gateway. Employers must also arrange sufficient off-the-job learning whilst the apprentice is on-programme.</p> <p>Employers will confirm whether the apprentice is ready to be entered for the End-point Assessment at Gateway stage and complete the Gateway Form.</p>
Training Provider	<p>At Gateway stage Training providers may be involved in advising whether the apprentice is considered ready to be entered for the End-point Assessment and confirm the apprentice has achieved on-programme learning outcomes.</p> <p>Conduct the mandatory qualification Level 2 Certificate in F Gas and ODS Regulations Category 1.</p> <p>Support the apprentice in the completion of their Apprentice Development Journal with evidence from the workplace so that this can be used at the Gateway interview and for preparation by the apprentice of the Apprentice Development Journal synopsis.</p>
Invigilator	<p>The invigilator's role is to administer on line and/or paper knowledge examinations, authenticate the apprentice's identification and ensure apprentices do not have access to technical literature or external assistance e.g. online that may aid their performance in the test. Invigilators must have no direct connection with the apprentice or their employer, and must have taken no part in training the apprentice i.e. there must be no conflict of interest. There are no specific qualification or experience requirements for invigilators.</p>
End-point Assessment	<p>Knowledge & Skills test – develop secure on line multiple choice tests, mark, grade and provide feedback for the apprentice. Approve appointment of trained invigilators to invigilate the Knowledge & Skills test, ensuring they operate according to EPAO</p>

Organisation (EPAO)	<p>guidance.</p> <p>Practical test – develop practical assessments and recording documentation in line with the Assessment Plan.</p> <p>Professional interview – develop proforma for recording of interview answers and assessment decisions by IAs.</p> <p>Aggregation of grading for each element of the EPA and for the overall apprenticeship grade by collect the results of all marking and allocate final grading in line with Table 1 - Apprenticeship Grade Aggregation (section 11).</p> <p>Manage internal verification, quality assurance, appeals processes. Recruitment, training of IAs and Lead Independent Assessors. Conducting standardisation activities with IAs and Lead Independent Assessors. Managing Appeals.</p>
Independent Assessor (IA)	<p>Observe, collect evidence, mark, record decisions and grade the Practical Test.</p> <p>Conduct, mark, record decisions and grade the Professional Interview.</p> <p>Participate in EPAO moderation and standardisation activities.</p>
Lead Independent Assessor	<p>Monitor and support a team of Independent Assessors to ensure standardised and consistent approach to quality assurance. Support development and delivery of End-point Assessor briefings, updates, training, recruitment, induction, reporting.</p>

14 - INTERNAL QUALITY ASSURANCE (IQA)

End-point Assessment Organisations will be responsible for internal quality assurance measures and must meet the requirements set out below:

- Provision of standardised assessment materials for each assessment method which map to the Standard as in Appendix 1 and incorporate grading descriptors as shown in Appendix 2 and Appendix 5.
- Documenting procedures for decision-making, moderation, appeals, managing conflicts and record keeping.
- Documenting benchmarking of decisions, moderation of assessments and reviewing of standards over time across Independent Assessors (IAs).
- Processes for recruiting, training and monitoring of IAs to ensure independence and competence levels in line with the requirements of this Assessment Plan.
- Monitoring and moderation processes so that the results of End-point Assessments are reviewed by a Lead Assessor to ensure consistency in decision making, including an Independent Assessors meeting being held at regular intervals (at least annually) for standardization and review purposes.
- Review and moderate a minimum of 15% of each independent assessors' assessments annually.
- Carrying out standardisation activities at least annually, i.e. review of processes, procedures, implementing continuous improvements

15 - EXTERNAL QUALITY ASSURANCE (EQA)

EQA for this plan will be provided by OFQUAL.

16 - IMPLEMENTATION

Affordability has been built into the design of the EPA in the following ways:

- The End-point Assessments have been designed to ensure that Apprentices are not disadvantaged to access End-point Assessments on the basis of geography, employer size or numbers of apprentices taking up of training.
- Practical Tests - There are substantial costs associated with the delivery of End-point Practical Test Assessments which must be taken into account to ensure the deliverability of the End-point Assessment. RACHP equipment is complex, expensive, must be in a fixed location and requires a large specialist working environment in which to carry out Practical Test assessments safely with adequate levels of supervision and a large number of consumables e.g. refrigerant gas options which must be stored safely. The Practical Tests will require a maximum of 3 day time scale due to the complexity of processes involved in the test i.e. installation of components, fabrication of pipework and commissioning procedures which require sufficient time (i.e. several hours) to carry out a pressure test ensuring that a system is leak-tight.
- A standardised End-point Practical Test assessment rig specification is provided in Appendix 4 to ensure expenditure on equipment and components represents best value and items are reusable and that damage to the environment is limited from release of refrigerant to atmosphere. Where suitable facilities exist to ensure that candidates are not able to observe other candidates, a ratio of 1 assessor to 3 candidates is acceptable, and the list of critical tasks to be observed during the Practical Test assessment must be adhered to in Appendix 4.
- Professional Interview – could be scheduled to take place immediately after the Practical Test assessment to minimise costs of Independent Assessor time and travel. If required this may be conducted as a video conference provided that the conditions specified are met.
- Knowledge & Skills Tests – can be administered in any suitable invigilated and controlled environment that meets the requirements of this Assessment Plan. There is no affordability advantage in holding the Knowledge & Skills test immediately after the Professional Interview or Practical tests, as the Knowledge & Skills test requires invigilation but do not require presence of an IA.
- Consistency - EPAOs will be responsible for ensuring consistency of marking and evaluation by providing standardised materials (e.g. Apprentice Development Journals, Knowledge & Skills tests, Assessment proforma) in accordance with the Appendices to this plan. Procedures for training and induction of the Independent Assessors, management of process of decision making, appeals procedures, managing conflicts and record keeping will be managed by the EPAO.
- Volume: It is estimated that approximately 500 apprentices will register annually.

17 - MANAGEABILITY AND FEASIBILITY

- Flexibility - flexibility has been built into this Assessment Plan to allow apprentices from a range of specialisms, business size or geographical location to undertake the End-point Assessment. For example, templates for the Apprentice Development Journal evidence tasks provide flexibility for apprentices to record evidence to reflect the unique scope of their work (job sheets, photos, written descriptions).
- End-point Assessments can be delivered at existing specialist training facilities or using in-house or workplace assessment facilities. The assessment methods for knowledge, skills and behaviours will be applicable in any refrigeration, air conditioning or heat pump engineering technician work context.
- Recruitment of Independent Assessors - The sector has ready access to a pool of subject competent persons from whom the EPAOs can recruit and train to become qualified as Independent Assessors.

APPENDICES

1. Mapping of Assessments to the Standard
2. Practical Assessment Grading Descriptors
3. Knowledge & Skills Test Specification
4. Practical Assessment Tests
5. Professional Interview Marking and Grading Descriptors
6. Apprentice Development Journal Synopsis and Apprentice Development Journal Contents Guidance

APPENDIX 1 - MAPPING OF ASSESSMENTS TO STANDARD

RACHP Occupation Apprenticeship Standard	Knowledge & Skills Test (On line multiple choice)	Practical Test	Professional interview
I. KNOWLEDGE			
1.1 Legislation	X		
1.2 Regulations	X		
1.3 Standards	X		
1.4 Underpinning Principles	X		X
1.5 Data Analysis	X		
1.6 System fundamentals	X		
1.7 Sustainability	X		X
II. SKILLS			
2.1 Safe working practices		X	X
2.2 Control circuit application		X	
2.3 Mechanical operations		X	
2.4 Application of mathematical principles	X	X	
2.5 Sustainable system operation		X	X
III. BEHAVIOURS			
3.1 Safety Approach			X
3.2 Strong Work Ethic			X
3.3 Logical problem solver			X
3.4 Focus on quality			X
3.5 Personal Responsibility			X
3.6 Communicates well			X
3.7 Adaptable			X
3.8 Self motivated			X

APPENDIX 2 - GRADING INDICATORS FOR PRACTICAL TEST

All SKILLS are assessed through the Practical Test will be graded pass/fail only

RACHP Occupation Apprenticeship Standard	Fail criteria An apprentice who...	Pass Criteria An apprentice who..
Safe Working Practices Evaluating and mitigating risk associated with refrigerant use, installation, commissioning, service (including testing, fault diagnosis rectification and selecting suitable components/refrigerant), maintenance and decommissioning procedures on a live system.	If the apprentice carrying out the Practical Test during EPA fails to adhere to safety, legal or environmental requirements at any time during the assessment, the IA will intervene, stopping the assessment and the apprentice will have failed the assessment	Develops and works to risk assessments and safe working procedures.
Control circuit application Electrical and electronic control systems setting, testing and fault finding; and their integration with system-associated communication networks	Fails to demonstrate pass criteria to set controls accurately and to carry out effective controls fault finding.	Sets, tests and fault finds in electrical control circuits Positioning, installing, testing and fault finding electrical controls to ensure effective control of the system operation including system-associated communication networks, in line with current standards
Mechanical operations Positioning, fixing, jointing and testing of pipework, electrical circuits and water circuits where relevant.	Fails to demonstrate pass criteria in carrying out mechanical operations Is unable to install, test and set to work a system operating in line with the test specification within the time scale provided. (app4)	Carries out mechanical operations for pipework, electrical and other circuits to a system design and setting system to work including the ability to identify and rectify faults.
Application of mathematical principles Determining heating and cooling loads and selecting and balancing appropriate components and systems for maximum performance and efficiency.	Fails to demonstrate pass criteria in applying mathematical principles related to load determining, component selecting and system balancing activities	Produces evidence of mathematical principles applied, formulae used and calculations carried out to evaluate the choice and balancing of components and selecting refrigerants, for maximising efficiency and effective and environmental operation of the installation This includes: select, apply and manipulate mathematic formulae Plot and interpret graphical information.
Sustainable system operation To achieve measurable and sustained reductions in direct and indirect system carbon emissions through optimising system operation and use of low GWP refrigerants	Fails to demonstrate pass criteria to reduce system emissions by measuring system performance and use of low GWP refrigerants.	Uses data to ascertain system performance and implement modifications to reduce direct and indirect system emissions and takes into account overall environment impact.

APPENDIX 3 – RECOMMENDED KNOWLEDGE & SKILLS TEST SPECIFICATION

This is the employer recommended test specification. The EPAO may adjust this, but this must fully meet the requirements of the standard and ensure occupational competence is fully tested.

Standard Criteria	Standard Criteria Breakdown	Knowledge Questions	Scenario-based Questions	Total	%
K 1.1-1.3 Legislation, Regulations and Standards	Understanding of relevant UK and international standards, technical and environmental legislation including:			8	16
	health & safety	1			
	environmental protection	1			
	working with pressure systems,	1	1		
	electrical circuits	1	1		
	flammable substances.	1			
	Familiarity with industry Codes of Practice and other sources of up to date information and advice on technical safety and legislative aspects of their work	1			
K 1.4 Underpinning principles	Sound understanding of principles of:			15	30
	Thermodynamics	1	2		
	gas laws	1	1		
	Psychrometrics	1	2		
	fluid flow	1	1		
	Electricity	1	2		
	properties of refrigerant fluids and lubricants	1	1		
K 1.5 Data analysis	Ability to understand relevant:			6	12
	diagrams / calculations	1	1		
	tools / charts	1	1		
	tables and				
	formulae and apply them as appropriate	1	1		
K 1.6 System fundamentals	Understanding of the function and operation of system components and how they interact in a range of different systems and applications.	2	3	5	10
K1.7 Sustainability	Understanding of environmental impact of:			12	24
	refrigerants	1	1		
	maximising efficient system performance	1	1		
	mitigation of direct and indirect carbon emissions	1	1		
	Understanding of environmental technologies employed in the sector such as				
	Heat recovery	1	1		
	low GWP refrigerants	1	1		
	other equipment that can be used to reduce heat gain, cooling load or energy use.	1	1		
S 2.4 Application of mathematical principles	Determining heating and cooling loads	1	1	4	8
	Selecting and balancing appropriate components and systems for maximum performance and efficiency.	1	1		
Total		25	25	50	100

APPENDIX 4 - PRACTICAL TEST SPECIFICATION

The tests specified below reflect the regular day to day activities that must be carried out by all RACHP Engineering Technicians in all roles as a key element of their work. They are designed as synoptic tests that will assess skills on a complete operating test system. Therefore the tests will be the same for all apprentices undergoing the assessment. This will also aid consistency of assessment. This Assessment will be graded pass or fail only.

Grade boundaries for this assessment are	
Fail Apprentice fails any of the criteria or fails to adhere to the necessary safety, legal and environmental requirements.	Pass Apprentice passes all of the criteria and adheres to the necessary safety, legal and environmental requirements.

TEST1 – RETROFIT (Changing of refrigerant in a working system)

Description – To perform a change of refrigerant on a single refrigeration systems which operates two different evaporators in two separate spaces, operating at different temperatures (one above 0 degrees C and one below 0 degrees C). Tests involves selecting the replacement refrigerant from a choice of available fluids, recovering waste refrigerant, charging with new refrigerant, setting the system parameters so that it is working correctly and carrying out commissioning. Apprentices will be assessed on their ability to collect and record technical evidence in a way that demonstrates competence in the activities below and therefore the EPAO will not be required to provide templates for this evidence. **Duration** 10-12 hours which must be carried out over two days.

Test 1 – Retrofill activities assessed	Direct observation notes	Documentation and evidence generated	Pass or Fail
1. Written Risk Assessment		x	
2. Running Log/commissioning check and recording of data		x	
3. Evaluation of performance efficiency – provide written copies of mathematical calculations carried out which compare performance and selection of suitable replacement refrigerant from choice of four at least one of which should be flammable or more available and provide written justification for choice charted on a pressure enthalpy diagrams		x	
4. Isolate and lock off	x		
5. Recovery of refrigerant and labelling of cylinder	x	x	
6. Install components/pipework		x	
7. Pressure testing (strength and tightness) and recording of results	x	x	
8. System Evacuation and dehydration	x		
9. Charging and recording of weight and type of refrigerant added	x	x	
10. Re-commissioning Running log book	x	x	
11. Evaluation of performance using a suitable chart or table		x	
12. Optimisation and recording of impact of any changes made on system performance parameters		x	
13. Completion of Documentation & Handover materials to client		x	

TESTS 2- FAULT FINDING

Description – To identify and rectify faults on an existing refrigeration, air conditioning or heat pump system so that the system is operational. **Duration** – 4-6 hours

Tests to be carried out and assessed:	Direct observation notes	Documentation and evidence generated	Pass or Fail
1- Inspect system for correct operation	x		
2- Recording operating parameters using charts if necessary		x	
3- Identification of faults (2 electrical and 2 mechanical to be identified on a safely isolated system)	x		
4- Rectification of each fault in turn and perform function test. Test processes and values recorded before electrical isolation is removed and function test performed.		x	
5- Ensuring correct operation and functioning of system	x		
6- Recording results of their activity in system log as necessary		x	

Test System and Equipment

Tests must be carried out on operational systems . The system for Test 1 Retrofill should contain a high GWP refrigerant to be recovered. Apprentices will have access to a two chamber cold room with different temperature requirements set for each room. The system must contain as a minimum:

- 1 high pressure condensing unit
- 2 evaporators (one with electric defrost, one needs an electronic expansion valve the other needs a thermostatic expansion valve)
- evaporator pressure regulator
- single semi hermetic compressor with crank case heaters
- Oil separator
- control panel (including electronic thermostat/temperature control PLC)
- suction line accumulator
- mechanical safety (HP/LP switch)
- 2 liquid line solenoid valves
- Liquid line driers and sight glass
- High and low side pressure relief valves

Apprentices must have access to the following:

- Electrical diagrams
- F Gas Log books
- Choice of 4 different types of refrigerants for retrofill at least one of which should be flammable
- Recovery machine and hoses
- Suitable recovery cylinder(s)
- Equipment manuals if relevant

Personal equipment required for each apprentice

- Appropriate gauge manifold set
- Air temperature probe
- Refrigerant comparator
- Electronic leak detector
- Scales
- PPE
- Surface temperature probe

- High pressure gauge and pressure test set
- Leak detection fluid
- Appropriate Regulator (nitrogen)
- Vacuum pump
- Vacuum gauge to record less than 2 Torr, 2000 microns/2.7 mb/270 Pa
- Oxygen free Nitrogen cylinder and trolley
- Voltage tester
- Multi-meter
- Electrical insulation tester
- Capacitor tester
- Electrical lock off kit – padlock, signage etc
- Ratchet Key
- Thermometer

APPENDIX 5 PROFESSIONAL INTERVIEW GUIDANCE AND GRADING

This apprenticeship is aligned to the professional engineering standard specified by the Engineering Council at Engineering Technician Level and must be carried out by an Independent Assessor (IA) who is also a member (at any grade) of a professional engineering body. The Interview is based on the application form for Engineering Council registration at Engineering Technician level. Achieving a pass in all areas scoped below is designed to allow candidates to demonstrate their competences at Engineering Technician level, should they wish to apply for registration with the Engineering Council.

The Professional Interview will be based on 12 core areas of questioning shown in the table below. Each question may then be followed up with supplementary questions. Apprentices must be prepared to discuss and refer to the three projects which demonstrate 21 tasks taken from their Apprentice Development Journal synopsis of their Apprentice Development Journal, which will be submitted by the Apprentice to the EPAO at least four weeks before the interview so that they can make this available to the IA at least two weeks in advance of the Interview in order to allow the IA to understand the context of the apprentice's work environment. Apprentices must draw evidence to be discussed from three different recent projects in detail in order to ensure they are able to demonstrate sufficient range of knowledge, skills and behaviour from across the standard.

The IA will record a summary of answers that the apprentice gives either in writing or using a recording device and will mark these according to the principles below and with reference to the Grading descriptors.

Professional Interview Grading			
Fail Does not demonstrate pass criteria	Pass Must pass all 12 criteria	Merit Must achieve at least a pass in all 12 criteria and distinction in at least 6	Distinction Must achieve a distinction in all criteria

Scope of Question (s)	Pass Criteria	Distinction Criteria
1. Apprentice solves technical problems, explains their role and how they select the appropriate techniques, procedures and/or methods.	Safety Approach BEHAVIOURS demonstrated Follows safe working practice behaviours related to the tasks carried out	Safety Approach BEHAVIOURS demonstrated Achieves the pass criteria and in addition: Applies safety behaviours proactively and flexibility to a range of work environments, demonstrating ability to respond to changing circumstances Influences safety policy for example by bringing to the attention of others changes required related to a task, or project or in their employers' policies.
2. Apprentice has taken action to prevent harm to people, equipment or data.	Safe working practices SKILLS demonstrated Develops and works to risk assessments and safe working procedures	Safe working practices SKILLS in demonstrated Achieves the pass criteria and in addition: Continually reassesses, monitors and communicates to others risks throughout the job being carried out and is able to contribute to the management of others in the work environment in order to mitigate risk and ensure the safe working practices of a variety of roles and tasks in a variety of work situations

3. Apprentice has taken action to evaluate and minimise environmental impacts.	Sustainable System Operation SKILLS criteria demonstrated Uses data to ascertain system performance and implement modifications to reduce direct and indirect system emissions and takes into account overall environment impact	Sustainable System Operation SKILLS criteria demonstrated Achieving the pass criteria and in addition: Works to reduce environmental impact across a range of new and existing systems consistently Evaluates the potential to implement sustainable technology changes into existing systems, contributes to developing new ways of apply such technologies and influences the behaviour of others Regularly applies a range of sustainable technologies
4. Apprentice can explain potential impact of systems on the environment, direct and indirect emissions.	Sustainability KNOWLEDGE criteria demonstrated Has awareness and understanding of sustainability issues for the RACHP sector and their personal responsibility for the environmental impact of systems they work with	Sustainability KNOWLEDGE criteria demonstrated Achieve the pass criteria and in addition: Can justify the use of a more sustainable technology and understands what actions they should be taking in the workplace to reduce environmental impact of systems Understands how to evaluate the impact of different technologies to achieve more sustainable systems and improve the sustainability of existing systems Provides a documented argument to justify adopting new more sustainable technologies to others
5. Apprentice can explain what equipment is used, why, how data is gathered and analysed and how they initiated the project to produce the desired outcome. Apprentice uses scientific, technical or engineering principles to complete their project.	Demonstrates criteria of KNOWLEDGE of underpinning principles Can discuss knowledge of underpinning principles relevant to their job role	Demonstrates criteria of KNOWLEDGE of underpinning principles Achieve the pass criteria and in addition: Demonstrates a greater depth of knowledge of a wider range of underpinning principles beyond their own job role Explains to advanced principles, and proactively seeks to deepen their knowledge of those principles
6. Apprentice uses data to make reports and support recommendations on work they have carried out to their employer or other people involved such as clients or suppliers.	Effective communication SKILLS demonstrated Gives examples of a wide range of communication methods used to communicate with peers and customers, e.g. verbal communication, written communication in the form of diagrams/charts etc.	Effective communication SKILLS demonstrated Achieve the pass criteria and in addition: Prepares their own communications to explain complex information effectively Persuades and influences stakeholders involved in projects by selecting and using the most suitable method of communication

7. Apprentice identifies, plans, and organises the resources needed to effectively complete a project, explaining how they took into consideration cost, quality, safety and environmental impact.	Focus on quality BEHAVIOURS demonstrated Follows instructions to support the importance of getting it right first time and assesses the potential implications if attention of detail is lacking Attention to detail in planning, documenting, preparing and checking	Focus on quality BEHAVIOURS demonstrated Achieve the pass criteria and in addition: Takes responsibility for ensuring a quality assurance system across a range of projects, for both their own work but also their team / project members
8. Apprentice can demonstrate their role and commitment to successful completion of a project	Strong work ethic BEHAVIOURS demonstrated Takes responsibility for completion of own projects, taking ownership for own actions and identifying and working with appropriate team members	Strong work ethic BEHAVIOURS demonstrated Achieves the pass criteria and in addition: Considers and adopts multiple solutions to challenges they are responsible for Consistently takes leadership in completion of projects by working proactively with all those involved in the project (team members management and clients) to provide range of solutions responding to problems which arise in a variety of situations
9. Apprentice exercises logical problem solving in a working environment relation to completion of a project	Logical problem solving BEHAVIOURS demonstrated Uses of logical problem solving and solution analysis	Logical problem solving BEHAVIOURS demonstrated Achieves the pass criteria and in addition: Anticipates and avoids potential problems for themselves and others in a range of projects or technical challenges
10. Apprentice exercises adaptability in a working environment relation to completion of a project	Adaptability BEHAVIOURS demonstrated Responds and adapts to changes to working practices within projects	Adaptability BEHAVIOURS demonstrated Achieves the pass criteria and in addition: Proactively implements changes to own working practice within projects Influences others to implement changes in a variety of projects
11. Apprentice complies with professional engineering Institutions' Code of Conduct and Ethics (see note below)	Personal responsibility BEHAVIOURS demonstrated Acts professionally at all times Maintains an awareness of impact of their own behaviour on their personal reputation and that of their employer, their customers and the engineering profession	Personal responsibility BEHAVIOURS demonstrated Achieves the pass criteria and in addition: Takes the initiative to influence the behaviour and professional standards of others in work situations
12. Apprentice ensures they keep up to date with developments in their technical area and continues to develop their professional competence.	Self motivated BEHAVIOURS demonstrated Is aware of factors that can influence performance Recognises how their own working style and team dynamics impact on a project's success	Self motivated BEHAVIOURS demonstrated Achieves the pass criteria and in addition: Plans own learning and identifies appropriate learning resources related to projects

	Undertakes clearly directed work independently Makes use of learning resources provided	Proactively seeks feedback on personal performance Influences and supports colleagues and the project team members by sharing learning resources with other project team members to improve working relationships
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Note – Summary of Professional Responsibility areas demonstrated by adherence to Professional Engineering Institutions Codes of Conduct / Ethics

The individual must behave in a way that

1. Upholds the dignity and reputation of the profession and safeguard the public interest in matters relevant to the advancement, science and practice of refrigeration.
2. Exercises skill and judgement to the best of their ability and discharge their professional duties and responsibilities with integrity.
3. Actively maintains and enhances, and where possible encourage others to do the same, an up to date knowledge and understanding of RACHP, in order to advance refrigeration for the public benefit.
4. Has due regard to the safety, health and welfare of themselves, colleagues, the general public and the environment. Assessing and managing relevant risks, liabilities and professional insurances and communicating these appropriately.
5. Acts in accordance with the principles of sustainability and prevent avoidable adverse impact on the environment and society.
6. In their professional conduct undertakes only professional tasks for which they are competent and disclose relevant limitations of their competence; avoid where possible real or perceived conflicts of interest and advise affected parties when such conflicts arise; observe the proper duties of confidentiality; Reject bribery, corruption and encourage others to do the same; raise a concern about a danger, risk, malpractice or wrongdoing with affects others and support colleagues or others to whom they have a duty of care in good faith; accept responsibility for work carried out under their supervision and treat all persons fairly and with respect.

APPENDIX 6 – APPRENTICE DEVELOPMENT JOURNAL SYNOPSIS

Apprentice Development Journal Synopsis contents

The purpose of the Apprentice Development Journal Synopsis is for the apprentice to identify the strongest examples of evidence against the Standard which they will use to support their Professional Interview assessment. Apprentices must submit the Apprentice Development Journal Synopsis to their EPAO at least 4 weeks before the scheduled date for the Professional Interview so that it can be provided to the IA at least 2 weeks prior to the interview for them to contextualise the interview discussion.

- The synopsis must cover three examples of projects carried out, the apprentice's actions (planning and execution) and responsibilities, and what they know about different aspects related to the tasks identified within that project. Note each project would normally cover a number of different tasks.
- The synopsis must include an annex containing a maximum of 21 pieces of evidence. Related to those three projects. It is not necessary for each Project to demonstrate seven tasks, provided that, in total there is evidence of 21 tasks carried across the projects.
- The task which must be evidenced are:
 - Task 1 – Jointing and System Testing
 - Task 2.1 - Evacuation and Dehydration /Commission and Charge (Critical Charge) and/or
 - Task 2.2 - Evacuation and Dehydration /Commission and Charge (Non Critical Charge)
 - Task 3 - Reactive Maintenance
 - Task 4 – Breakdown
 - Task 5 - Fault Finding + Rectification (Electrical)
 - Task 6 - Routine Maintenance
 - Task 7 - Refrigerant Recovery and Disposal – Decommissioning sheets
- The evidence must be attributable to the apprentice, in part or in full. Evidence must be accompanied by the declaration of authenticity by the witness and a statement outlining the apprentice's contribution, signed by the apprentice and their employer.
- Example evidence may include photographs, job sheets, system diagrams, performance charts, testing reports, commissioning, decommissioning and waste transfer notes. This list is not definitive and other evidence sources are permissible.
- The annex must include a mapping of the evidence to the Knowledge Skills and Behaviours assessed by this assessment method as shown in Appendix 5.

The Apprentice Development Journal

The Apprentice Development Journal should be completed throughout the apprenticeship by the apprentice in order to build up evidence of on the job learning. It is recommended that EPAO develops guidance and templates to support the apprentice in collecting a suitable range of task evidence across a sufficient number of different projects so that the apprentice will be able to prepare their Apprentice Development Journal Synopsis after the Gateway.

It is recommended that the following elements be included as Apprentice Development Journal templates

- 1- Title: RACHP Engineering Technician - Apprenticeship Apprentice Development Journal
- 2- List of tasks required and how the evidence generated maps to the standard

- 3- Templates for recording of task and project evidence
- 4- Templates for declaration of authenticity by witness and competent witness sample signatures
- 5- Templates for quarterly progress review meetings between employer, trainer and apprentice
- 6- Sample Job Sheets
- 7- As apprentices are likely to attend at least one service/maintenance or installation job a week over their 2.5 yrs work based learning, and each job carried out might be a suitable opportunity to collect 3 or more pieces of evidence, it is a minimum of three examples of each of the following be obtained:
 - Task 1 – Jointing and System Testing
 - Task 2 - Evacuation and Dehydration /Commission and Charge (Critical Charge)
 - and/or
 - Task 2 - Evacuation and Dehydration /Commission and Charge (Non Critical Charge)
 - Task 3 - Reactive Maintenance
 - Task 4– Breakdown
 - Task 5 - Fault Finding + Rectification (Electrical)
 - Task 6 - Routine Maintenance
 - Task 7 - Refrigerant Recovery and Disposal – Decommissioning sheets

The following elements are recommended for inclusion in the Journal template as guidance for apprentices:

- 1- Guidance on types and range of evidence, retention of evidence, how the evidence has been mapped to the standard, how the evidence should be recorded
- 2- List of essential Health and safety / Codes of practice considerations
- 3- Guidance on authenticating the apprentice's work