# Defining HVAC R competence

## Job Functional Analysis for Qualification Development

Training Product – UEE32225
Certificate III Air Conditioning and Refrigeration

Powering Skills Organisation Ltd

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# Executive Summary

As part of Air Conditioning and Refrigeration qualification review project, a '*functional analysis'* was conducted to systematically define the roles, tasks, and skill requirements within this profession. This structured approach breaks down the occupation into core and supporting functions, identifying the knowledge and performance outcomes required across different job roles. This analysis was grounded in desktop research of job advertisements and industry data, supplemented by stakeholder interviews ensuring that the *Certificate III in Air Conditioning and Refrigeration (UEE32225)* is aligned with real occupational outcomes rather than legacy training product requirements.

**Grounding qualifications in functional analysis strengthens their credibility, providing a defensible, evidence-based foundation for decisions on content, structure, and industry relevance.**

The purpose of this activity was to ensure that future updates to the Certificate III in Air Conditioning and Refrigeration are driven by real occupational outcomes of the technician rather than being shaped solely by curriculum content. This proactive, industry-informed approach supports the development of robust qualifications and units of competency that reflect the skills, tasks and responsibilities required in contemporary air conditioning and refrigeration environments. It also ensures alignment with current and emerging workforce demands while supporting compliance with national training package policies, which mandate that qualifications are anchored in clearly defined job roles and consistent occupational outcomes.

This research explores the current state and outlook of the air conditioning and refrigeration sector in Australia. The research aims to provide evidence on current workforce requirements, skill gaps, and future training needs to inform updates to the Certificate III in Air Conditioning and Refrigeration. The findings support the alignment of training products with industry practice, emerging technologies, and changing consumer and safety needs. A mixed methods approach was used, incorporating desktop research, employer, RTO and apprentice interviews and workforce data analysis.

The functional analysis findings reveal the following:

- **Modernising the qualification is imperative.** The analysis confirms that UEE32225 covers fundamental trade skills well, but important updates are needed to address significant industry shifts. New and emerging competencies, for example, working with low-GWP and natural refrigerants ($CO_2$, ammonia, hydrocarbons, including A3-class hydrocarbon refrigerants that are increasingly prevalent in low-charge self-contained equipment and heat-pump applications, handling mildly flammable (A2L) refrigerants, servicing variable refrigerant flow (VRF) and advanced heat-pump systems, and troubleshooting digital control/BMS technologies – are not adequately covered in the current core training. These areas should be given much greater emphasis in the qualification, rather than left as optional or learned post-qualification. One regulator interviewed warned that *"$CO_2$ and natural refrigerants are becoming mainstream but current training barely covers their installation and commissioning."* Industry stakeholders strongly concur that the training package must be updated to keep pace with technology and environmental regulations.
- **Strengthen safety, compliance, and licensing alignment.** The qualification must reinforce training on safe handling of new refrigerants and high-pressure systems and ensure full coverage of evolving safety standards and codes of practice (e.g. AS/NZS 5149 for refrigeration safety, AS 1851 for fire system maintenance, AS/NZS 3000 wiring rules). Apprentices often graduate without enough familiarity with such standards or clarity about their legal licensing scope, leading to confusion and skills gaps. Interviewees stressed that graduates should leave the apprenticeship with a *clear understanding of what tasks their licence entitles them to do*, to avoid scenarios where

newly qualified mechanics find they must obtain additional licenses, as seen in some jurisdictions. Regulators and employers alike urge that the qualification be explicitly linked to licensing requirements, so graduates are job-ready and compliant on day one.

- **Greater focus on maintenance, fault-finding, and advanced diagnostics.** The occupational analysis and employer feedback underscored that maintenance, troubleshooting, and repairs form the bulk of a qualified technician's work, far more than new installations. Yet many employers report that newly qualified technicians lack sufficient fault-finding experience and confidence – they can assemble systems but often struggle with systematic diagnosis of complex faults. As one stakeholder noted, *"Post-trade there are more service calls than there are installations – servicing is the real work"* (Employer). The training package should therefore strengthen practical diagnostics training for example through capstone assessments or simulated faults to ensure graduates can hit the ground running in maintenance roles and meet the high employer demand for troubleshooting skills.
- **Integrate electrical, electronics and digital skills.** Modern HVAC R systems are highly integrated with electrical and control technologies. The analysis found a rising need for skills in electronics, automation, and digital control systems, such as programming of building management systems and variable-speed drives. Employers stress that today's "fridgie" must be part electrician and part IT technician – *"Without digital skills… you won't be able to do anything. It's really, really important"* (Industry Association Representative). While the current Certificate III includes basic electrical units, supporting a Restricted Electrical Licence, it lacks dedicated content on advanced controls or networked HVAC systems. Updates should incorporate digital literacy and advanced control competencies as core knowledge to produce technicians who are comfortable with laptops, smart devices, and software-based diagnostics, not just with gauges and wrenches.
- **Address structural issues in career pathways and post-trade development.** Stakeholders identified broader workforce challenges that impact how the qualification functions in practice. A notable concern is the gap between completing the apprenticeship and meeting industry's "experienced" expectations. Many job ads seek 3–5 years of experience beyond the trade certificate, effectively sidelining newly qualified graduates from certain roles. Employers reported that fresh graduates often require considerable on-the-job mentoring before they can handle complex tasks independently, reflecting a mismatch between training outcomes and real-world demands. This suggests a need for bridging programs or post-trade support for example structured "graduate year" mentoring, additional skill sets or a staged qualification model to accelerate early-career development. Additionally, interviewees expressed that the current training pathway could be extended or restructured by integrating a Certificate IV, Diploma or Advanced Diploma as a standard progression so that apprentices attain higher technical competencies. *"Cert III is not sufficient anymore,"* argued one industry leader, calling for a more robust two-stage qualification that leads to a fully qualified, licensed technician (Industry Association Leader). These structural reforms, along with better support for ongoing upskilling and lifelong learning, are seen as crucial to meeting the evolving needs of the industry and improving workforce retention.
- **Bolster "workplace skills" and customer engagement abilities.** In the service-oriented HVAC R field, technical prowess must be paired with effective communication, client service, teamwork, and self-management skills. Job advertisements frequently list these attributes, and employers confirm their importance. However, such skills are not given enough emphasis in the current training – for instance, customer relations is only an optional unit, which many apprentices do not undertake. The analysis recommends weaving these competencies into the core curriculum. As a result, graduates will be better prepared to manage client interactions, document their work clearly, and operate professionally, all of which are essential for career success. One employer explained that *"our best technicians are those who communicate well – they build trust with clients and that keeps business coming"* (Service Business Owner). In a focus group, an apprentice admitted *"I hated talking to customers; I didn't know how to do it"* initially (Apprentice) highlighting

the need for guidance in developing these skills early in training. By incorporating more role-plays, team projects, and customer service scenarios into the apprenticeship, the industry can produce well-rounded tradespeople who not only fix systems but also excel in service quality and teamwork.

In summary, this functional analysis provides an evidence-based foundation for updating the UEE32225 Certificate III and related training strategies. The HVAC R trade is at the nexus of technological innovation, heightened safety and environmental expectations, and workforce supply challenges. The findings and stakeholder input converge on a clear message: the qualification and its surrounding support systems must adapt boldly to prepare the next generation of refrigeration and air conditioning mechanics.

The recommendations in this report call for modernising training content, strengthening licensing and safety alignment, enhancing workplace skills and post-trade development, and exploring structural reforms to the apprenticeship pathway. These changes will help ensure that HVAC R technicians are equipped for contemporary industry needs and future demands, supporting Australia's goals in energy efficiency.

# Introduction

## Purpose of the functional analysis

The purpose of a functional analysis is to pinpoint the precise skills, knowledge and capabilities required to perform job tasks effectively within the HVAC R trade roles and ensure the UEE32225 Certificate III in Air Conditioning and Refrigeration reflects those requirements. It establishes a robust foundation for the design of training products and targeted workforce development. By breaking down the occupation into its core functions and tasks, the analysis provides a robust foundation to align training products with real-world job outcomes. This approach makes it possible to identify any gaps or misalignments in the current qualification and to inform evidence-based updates. Key objectives of the functional analysis include:

- **Identifying workforce requirements and skill gaps:** Determining the practical skills and knowledge that HVAC R technicians need on the job, so that training can target these areas. This ensures graduates are ready for *installing, servicing, fault-finding,* and other critical tasks in modern air conditioning and refrigeration roles.
- **Highlighting deficiencies in current training products:** Using evidence from industry, including job advertisements, employer input, and regulatory changes to spot where UEE32225 may not fully address emerging industry demands or employer expectations.
- **Mapping career progression pathways:** Understanding how an HVAC R apprentice progresses to a qualified tradesperson and beyond, including common *specialisations or higher-level roles* such as leading hand, systems technician, supervisor, technical specialist. This ensures the qualification supports long-term career development and the evolving needs of the industry.
- **Reviewing and refining training design principles:** Ensuring the Certificate III and associated units remain adaptable and future focused. The qualification must keep pace with evolving technology, such as IoT-enabled HVAC systems, changing safety and environmental standards, and industry best practices.

Grounding the qualification in functional analysis helps achieve these aims, so that any updates to UEE32225 are driven by actual job functions and critical competencies rather than by legacy content. This aligns with national training package policy, which mandates that qualifications be anchored in clearly defined job roles and consistent occupational outcomes.

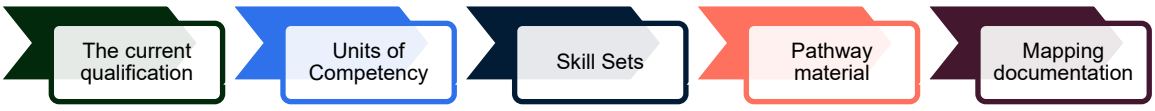
Overall, this functional analysis is a critical step in ensuring that the Certificate III in HVAC R continues to produce graduates who meet the contemporary requirements of the trade.

By linking the qualification's content to verified occupational functions, the analysis supports the development of training that is relevant, credible, and beneficial to both industry and workers.

**Figure 1: The functional analysis process**

To ensure that training and assessment in the field of air conditioning and refrigeration align with industry requirements, this analysis will form the basis for reviewing the following:

**Figure 2: Training Product development aligned to the Job Functional Analysis process.**



# Intended audience

This report is designed to inform a broad range of industry stakeholders of the current and emerging skills requirements within the HVAC R sector. It delivers evidence-based insights to support strategic training development, workforce planning, and policy formulation, ensuring the sector remains responsive, competitive, and future-ready. The intended audience includes, but is not limited to:

• **Powering Skills Organisation:** to provide an evidence base for the current training package review and ensure alignment with broader workforce strategy initiatives in the electrotechnology and refrigeration and heating sectors.

• **Industry associations and peak bodies**: to support industry advocacy and professional standards by highlighting skills gaps and training needs identified through this analysis, so they can champion necessary changes.

• **Employers and HVAC R businesses:** to help align their in-house training, recruitment, and upskilling efforts with the identified core functions and emerging competencies of the trade. Employers can better understand the capabilities of new graduates and where additional on-the-job training may be required.

• **Registered Training Organisations (RTOs) and VET practitioners:** to guide training product development and delivery, ensuring training is up-to-date, industry-relevant, and produces work-ready graduates. The analysis points RTOs to areas of the training product that may need enhancement, such as digital controls, advanced refrigerants, and workplace skills training.

• **Policy Managers and regulators:** to inform decisions on skills priorities, apprenticeship funding, and licensing policies by providing current evidence of industry needs. This can help in shaping supportive policies, such as funding for updated training resources or streamlined licensing frameworks that match training outcomes.

By engaging this diverse audience, the functional analysis aims to foster a shared understanding of the workforce challenges and opportunities in HVAC R. It ensures that training solutions, qualification updates, and broader workforce initiatives are practical, evidence-based, and aligned with real-world occupational demands and future industry direction.

# Methodology applied

This functional analysis employed a mixed-methods approach, drawing on multiple data sources and stakeholder inputs to capture a comprehensive picture of the HVAC R occupation. Major components of the methodology included:

- **Desktop research – job advertisement analysis:** Over several months in 2025 and 2026, we systematically collected and reviewed HVAC R job postings across major online job boards. This provided quantitative data on *in-demand qualifications, licenses, technical skills, experience levels,* and employment conditions in current job markets. In total, several hundred job ads for roles such as “HVAC technician,” “refrigeration mechanic,” and “air conditioning installer” were analysed across all Australian states and territories, including metropolitan and regional contexts. We also examined position descriptions from employer websites and industry publications to validate and enrich the picture of role requirements. This job ads intelligence revealed common expectations, and recurring skill sets that employers seek in HVAC R roles, forming key evidence base for the functional mapping.
- **Stakeholder interviews:** Semi-structured interviews and focus groups were conducted with a diverse range of industry stakeholders in early 2026 to capture qualitative insights beyond what could be gleaned from advertisements. Over a dozen interviews were completed with participants from key stakeholder groups: industry regulators, private sector employers, ranging from small business owners to large contracting firms, industry associations, group training organisations,

equipment manufacturers and suppliers, TAFE and RTO instructors, and current apprentices**.** All interviewees were assured anonymity; therefore, quotes are attributed only by stakeholder role. The interview discussions explored day-to-day job functions, emerging skill needs, gaps in the current training, and workforce challenges. A thematic analysis of more than 150 distinct comments was performed: evidence from transcripts was coded into themes aligned with the major job functions and skills, and recurring topics were clustered into high-level themes with supporting sub-themes. These were then cross-referenced with the desktop research findings to determine where interview feedback reinforced those findings or introduced new perspectives not evident in the job ads. (see Appendix A for interview questions)

- **Surveys and industry reports:** The analysis also considered data from a sector-wide HVAC R industry survey conducted by the PSO in 2025, as well as relevant industry research and governmental reports. For instance, we reviewed Jobs and Skills Australia (JSA) reports on trade shortages and vacancy rates to understand the broader labour market context. Key industry publications and policy documents including those from the Australian Refrigeration Council (ARC) and the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH), Jobs and Skills Australia, Department of Climate Change, Energy, the Environment and Water (DCCEEW), Department of Employment and Workplace Relations (DEWR), National Skills Commission (NSC) and Queensland Building and Construction Commission (QBCC) were examined to capture information on regulatory changes, licensing developments, and technology trends impacting the trade. These sources provided context on issues like the national phase-down of high Global Warming Potential refrigerants, energy efficiency initiatives, and workforce development programs.

By triangulating these data sources, quantitative job market analytics, qualitative employer/apprentice interviews, and supplementary industry reports, the functional analysis is both broad and deep. All research inputs were gathered and reviewed between October 2025 and April 2026, ensuring the findings are up to date. The resulting insights form the basis of the following sections, which cover an overview of the industry, detailed functional mapping of the trade's tasks, and evidence-driven recommendations for updating the training package.

# Functional analysis outcomes: Key findings

The desktop research provided valuable insights into the evolving skills requirements of the workforce, the configuration of job roles, and how these roles are positioned within organisational structures. By systematically analysing position descriptions and company frameworks, the research identified recurring qualifications and core competencies in demand across the sector. It also uncovered emerging trends in job responsibilities and structural models, offering critical evidence to inform strategic workforce planning, role design, and future training development.

## Overview of the HVAC R industry

The HVAC R industry in Australia is a vital skilled trade sector responsible for the installation, commissioning, maintenance, and repair of heating, ventilation, air conditioning, and refrigeration systems across residential, commercial, industrial, and institutional settings. The occupation of *Air Conditioning and Refrigeration Technician* (OSCA 382131) forms the core of this workforce, comprising tradespeople who ensure indoor environments are comfortable, safe, and operating efficiently. These technicians are trained to work on a wide array of equipment, from small split-system air conditioners and refrigerators to large commercial *chillers, cool rooms, commercial freezers, ventilation and extraction systems*, and complex industrial cooling plants.

They handle refrigerants in accordance with environmental regulations, requiring a national ARCtick Refrigerant Handling Licence and typically must hold a Restricted Electrical Licence (REL) to work on associated electrical controls and circuits. The occupation usually requires completion of a four-year apprenticeship and the UEE32225 Certificate III qualification, which is the

nationally recognised trade certificate for this field and is linked to licensing in most jurisdictions. In some jurisdictions, the technician is also required to hold an occupational licence, but this is not the case in all jurisdictions.

**Workforce characteristics:** The HVAC R technician workforce in Australia is large, growing, yet facing some challenges. According to the Australian Refrigeration Council, there are over 12,618 licensed refrigeration and air conditioning technicians nationwide, 90,996 individuals Refrigerant Handling Licences (RHLs) and 22,357 business related Refrigerant Trading Authorisations (RTAs) for 2024-2025 a growth of 14,181 licence issuance within one year. Tables 1 and 2 below indicates RHLs and RTAs numbers per jurisdiction compared to the population according to the Australian Refrigeration Council. New talent is developed primarily through apprenticeships, with more than 7,300 apprentices currently in training, but this pipeline is not keeping up with demand. While ARC issued an additional 3,498 trainee licences in 2024-2025, increasing the total of trainee licence holder to a total of 8.051 overall, this is across the both stationary and automotive sectors, not just for the Certificate III in Air Conditioning and Refrigeration industry sector. Jobs and Skills Australia have identified the occupation as *in national shortage*, with employers across all states reporting chronic difficulties filling vacancies for qualified HVAC R technicians. The trade remains overwhelmingly male, with female participation estimated at well under 5% and many current workers are mid-career or nearing retirement age, leading to a net outflow of experienced talent each year. In fact, industry analysis indicates the sector loses 5% of its workers annually due to retirements and attrition, exacerbating the replacement demand. As a result of these factors, competition for skilled “fridgies” is intense.

**Table 1 : Number of RHLs by state and territory**

| State/ Territory | Number of RHLs | Population | RHLs per 1,000 persons |
|---|---|---|---|
| New South Wales | 20,867 | 8,545,100 | 2.44 |
| Victoria | 15,409 | 7,011,100 | 2.20 |
| Queensland | 25,996 | 5,618,800 | 4.63 |
| Western Australia | 17,114 | 3.008,700 | 5.69 |
| South Australia | 7,014 | 1,891,700 | 3.71 |
| Tasmania | 1,857 | 575,800 | 3.23 |
| Australian Capital Territory | 964 | 481,700 | 2.00 |
| Northern Territory | 1,729 | 262,200 | 6.60 |
| International | 16 | N/A | N/A |
| National | 90,966 | 27,400,000 | 3.32 |

(Source: ARC, Annual Report 2024-2025 OPSGG Management Permit Scheme)

**Table 2 : Number of RTAs by state and territory**

| State/ Territory | Number of RTAs | Active Businesses | RHLs per 1,000 businesses |
|---|---|---|---|
| New South Wales | 6,015 | 896,461 | 6.71 |
| Victoria | 4,373 | 737,877 | 5.93 |
| Queensland | 6,194 | 510,440 | 12.13 |
| Western Australia | 3,239 | 255,384 | 12.68 |
| South Australia | 1,585 | 164,512 | 9.63 |
| Tasmania | 305 | 44,033 | 6.93 |
| Australian Capital Territory | 211 | 36,313 | 5.81 |
| Northern Territory | 435 | 16,369 | 26.57 |
| National | 22,357 | 2,661,389 | 8.40 |

(Source: ARC, Annual Report 2024-2025 OPSGG Management Permit Scheme)

The nature of employment is predominantly full-time and often based in small-to-medium enterprises (SMEs). Over 85% of advertised technician roles are in full-time positions. A notable niche in this sector is the prevalence of Fly-In/Fly-Out (FIFO) or Drive-In/Drive-Out (DIDO) roles in remote mining and industrial sites, roughly 10% of job listings, where experienced technicians are flown to remote locations on rotation and compensated with higher wages. By contrast, most HVAC R technicians work in metropolitan and regional centres, serving urban development, commercial facilities, and residential customers.

Salaries reflect these patterns and demand levels: the national average salary for a qualified HVAC R technician is around $90,000 – $110,000 per year but pay can range widely with Jobs and Skills Australia stating the median weekly wage is $2100. However, wage premiums in certain segments underline the acute skill shortages and the need for improved training and workforce supply.

## Occupational description and workforce characteristics

*Air Conditioning and Refrigeration Mechanics* are typically trained trades workers (OSCA Skill Level 3) who install and maintain the systems that regulate air temperature, humidity, and air quality in buildings, as well as commercial and industrial refrigeration units. The work is physically demanding and requires technical problem-solving, strict adherence to safety practices, and often customer interaction. Technicians usually operate in the construction and building services industry or in maintenance/service companies, and many eventually become self-employed contractors running their own small businesses.

Apprenticeship is the main entry pathway into the occupation, combining paid on-the-job training with formal study. Most apprenticeships last around four years. Upon completion, apprentices attain the Certificate III qualification and typically become trade qualified HVAC R technicians, though, notably, in some jurisdictions additional experience or assessments are needed for certain licenses – an evolving issue discussed later.

As noted, the workforce is dealing with supply pressures, high demand and not enough new entrants leading to a competitive job market. The occupation’s gender imbalance is conspicuous, with women making up only a small fraction of the field; increasing diversity is a longer-term opportunity to alleviate shortages. Many HVAC R businesses report an aging workforce and difficulties attracting young people into the trade. The apprenticeship completion rate in this field hovers around 55 to 60%, meaning nearly half of those who start an air-conditioning and refrigeration apprenticeship do not finish, which is a concern for industry sustainability. The combined effect of these factors is that employers are struggling to find and retain qualified technicians, and they often seek experienced workers, which can leave newly qualified technicians at a disadvantage. These trends underscore the importance of updating training to

both improve outcomes, so more apprentices become fully competent and stay in the trade, and to market the trade as a modern, technology-driven career to appeal to a broader talent pool.

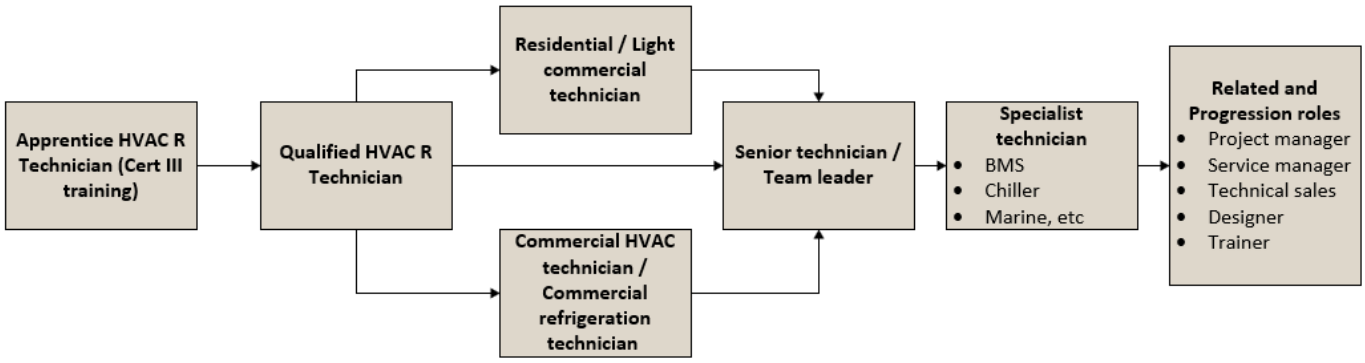
## Key job roles in the HVAC industry

The HVAC R industry comprises a **r**ange of interrelated job roles that together deliver cooling and heating services across various sectors. At the core is the Air Conditioning and Refrigeration technician, the fully qualified tradesperson who performs installations, maintenance, fault diagnosis, and repairs on HVAC R systems. Surrounding this core role are several others that support or extend the work of the technician:

- **Apprentice HVAC R technician:** An entry-level role, usually involving a 3.5 to 4-year apprenticeship. Apprentices work under the supervision of qualified tradespeople while completing the Certificate III. They assist with basic tasks and gradually take on more complex duties as their skills increase. Over the course of the apprenticeship, they move from observer to independent worker in training.
- **Qualified HVAC R Service Technician:** Upon completing the apprenticeship and obtaining necessary licenses, a tradesperson works independently on installing, commissioning, servicing, and repairing HVAC R systems. Service technicians may **specialise by sector or equipment type**:
    - *Residential/Light-Commercial Technician:* Focuses on domestic and light-commercial systems such as split-system air conditioners, ducted home air conditioning, heat-pump water heaters, and small commercial refrigeration, such as small cool rooms.
    - *Commercial HVAC Technician:* Handles larger and more complex air conditioning systems in offices, retail centres, hospitals, schools, and other commercial or institutional facilities for example, packaged rooftop units, multi-split or VRF systems, chillers and cooling towers, and interfacing with building management systems.
    - *Commercial Refrigeration Mechanic:* Specialises in refrigeration systems for supermarkets, cold storage, food processing plants, and industrial settings. This can include working with large-scale commercial freezers, display cases, refrigerated warehouses, and specialised equipment using natural refrigerants like ammonia or $CO_2$. In practice, many qualified tradespeople work across both air conditioning and refrigeration domains, given the overlapping skill set and licensing.
- **Senior Technician / Team Leader:** An experienced tradesperson who, in addition to hands-on work, coordinates jobs and other staff. A senior technician may lead a small team of techs and apprentices, plan and assign daily jobs, handle the more complex troubleshooting or commissioning tasks, and act as the on-site liaison with clients. They often mentor apprentices and ensure quality control. This role is typically attained after several years post-qualification.
- **Specialist Technician:** In larger organisations or niche areas, some technicians develop expertise in particular sub-fields. Examples include a Controls/BMS Technician focused on the programming and maintenance of building automation and control systems for HVAC, a Chiller Technician specialising in large central chilled-water plants and industrial refrigeration, often requiring knowledge of ammonia or $CO_2$ systems, or a Marine/Transport Refrigeration Specialist working on refrigeration in ships, trucks, or other mobile applications. These specialists usually hold the base Certificate III and often additional training specific to their specialty.
- **Related and progression roles:** HVAC R technicians often work alongside other trades and may move into related roles as their careers progress. Some become project managers or estimators, using their technical background to scope and quote HVAC installations. Others advance to service managers or operations managers in contracting firms. A number transition into technical sales or support roles for equipment manufacturers and suppliers,

where they leverage their hands-on experience to advise customers. A few pursue further education such as a Diploma, Advanced Diploma, or engineering degree to become design engineers, refrigeration consultants, or technical instructors. These roles typically involve stepping away from regular field work into design, consulting, training, or management, but the foundational trade knowledge remains essential.

**Figure 3: Job roles functions pathway within the HVAC R sector**




Each of these roles contributes to the HVAC R sector's capacity to deliver safe, effective climate control solutions. The functional analysis primarily focuses on the trade-level roles apprentice through to experienced technician and their functions, as these form the scope of the Certificate III qualification. However, understanding the broader role context is vital, as it informs how the Certificate III can provide a platform for career progression and the additional skills that might be needed for advanced roles.

## Core skill categories

Analysis of HVAC R job advertisements and role descriptions reveals five broad categories of skills and knowledge that employers consistently seek in this field. These categories reflect the multifaceted nature of the job, combining hands-on technical competencies with safety compliance, digital know-how, and workplace skills. The key skill domains are:

1. **Technical HVAC R systems:** Fundamental trade skills related to working on cooling and heating equipment. This includes the ability to install, commission, maintain, and repair a wide variety of systems, from common residential split-system air conditioners and ducted units to commercial multi-split and VRF air conditioning systems, to refrigeration equipment like cool rooms, freezer rooms, and display cases. Proficiency across different system types such as packaged rooftop units, chilled water plants, evaporative coolers, transport refrigeration units is highly valued, as many technicians service diverse client needs. A competent technician can interpret technical drawings and wiring diagrams, assemble and install components, braze and pipe refrigerant circuits, perform correct evacuation and charging of systems, and test system performance against specifications.
2. **Refrigerants and emerging technologies:** Knowledge of refrigerant types and new HVAC R technologies is also highly desirable. With the industry's transition to more sustainable practices, employers look for familiarity with both legacy fluorocarbon refrigerants (R-410A, R-134a) and newer alternatives. These include mildly flammable A2L refrigerants (like R-32, now common in new AC units), natural refrigerants such as carbon dioxide, and ammonia in commercial plants, and hydrocarbon refrigerants in certain systems, particularly low-charge self-contained equipment and some heat-pump applications where additional ignition-risk controls and safe-work procedures apply.

Technicians are expected to understand the properties, safe handling, and performance characteristics of these refrigerants. Similarly, emerging system types like high-efficiency heat pumps for space heating and hot water, and even renewable or solar-assisted HVAC systems, are becoming more prevalent. Technicians should be adaptable and willing to learn these modern technologies as they are adopted by industry. Job ads increasingly mention these skills for example experience with $CO_2$ systems or VRF setups as desirable, indicating that the market values technicians who stay current with technological advancements.

3. **Electrical and controls competence:** Cross-disciplinary skills in electrical work and control systems are crucial. Modern HVAC R equipment integrates sophisticated electrical components, from variable-speed motors and electronically commutated fans to sensors and microprocessor-based controllers. As a result, technicians must be able to read and interpret electrical wiring diagrams, perform basic Restricted Electrical Licence (REL) work and testing, and diagnose electrical faults in HVAC R systems. Additionally, experience with digital control platforms is a growing asset: for instance, understanding building management system (BMS) interfaces, common control protocols, and basic programming or adjustment of control settings and programmable logic controllers (PLCs). As buildings become “smarter” and more interconnected, the ability to interface HVAC R systems with computerised controls or use software-based diagnostic tools is increasingly important. Many employers now seek candidates who are comfortable with digital gauges, mobile apps for system monitoring, and remote control/monitoring systems in HVAC units.

4. **Process, safety and compliance:** A significant part of the job is following proper procedures, safety practices, and regulatory requirements, including the additional risk controls required when working with flammable refrigerants (particularly A3 hydrocarbon refrigerants) such as managing ignition sources, ventilation, charge limits, and incident response procedures. HVAC R technicians must conduct work in compliance with Work Health and Safety (WHS) regulations, managing risks such as electrical hazards, working at heights or in confined spaces, handling hazardous refrigerants, and implementing lock-out/tag-out procedures. They must also be well-versed in environmental regulations related to ozone-depleting substances and greenhouse gases for example not venting refrigerants, properly recording usage for the ARC licence.

   Technicians frequently handle documentation and compliance tasks: filling out service reports and maintenance logs, completing pressure test certificates, and commissioning sheets, and ensuring work meets Australian Standards and codes (such as AS/NZS 5149 for refrigeration safety, AS/NZS 1668 for ventilation and air quality, and relevant building code requirements for mechanical services). Employers value diligence in these areas, a technician who works safely and keeps accurate records protects both the business and the customer.

5. **Non-technical (workplace) skills:** Successful HVAC R tradespeople combine technical prowess with strong interpersonal and organisational skills. Employers frequently request effective communication and customer service abilities, since technicians often interact directly with clients to explain issues, provide recommendations, and leave a positive impression of the company. Problem-solving skill is another universally cited requirement: technicians must think critically to troubleshoot complex mechanical or control faults under time pressure. Being self-motivated and able to work independently is important, especially for field service roles where a technician might be dispatched alone to various sites without direct supervision. Time management and reliability are key – a technician needs to efficiently handle multiple jobs and meet deadlines. Teamwork is also essential for larger projects, where coordination with colleagues and other trades is required. Finally, basic digital literacy is increasingly needed for tasks like using service software, writing emails/reports, or accessing digital manuals and online resources.

These five skill categories formed the basis for coding and analysing the job advertisement data. They illustrate that a competent HVAC R technician must be multi-skilled, mastering the hands-on technical elements of the trade while also embracing modern technologies, rigorously following safety, and compliance processes, and demonstrating professional workplace skills. The subsequent findings from

both the job ads and employer interviews show that these skill demands are evolving with industry changes, and that some areas are not sufficiently addressed by the current training.

## Major sectoral consideration and emerging needs

The desktop analysis of job advertisements and employer websites identified several broader trends influencing the HVAC R workforce. These trends point to a sector that is evolving in response to technological, demographic, regulatory, and consumer changes. Each of these emerging factors has implications for training, recruitment, and professional development.

- **Technological advancements***:* Rapid innovation is redefining HVAC R work. Modern air conditioning systems are more complex and efficient – for example, Variable Refrigerant Flow (VRF) multi-split systems allow precise climate control across multiple zones and are now common in large commercial fit outs. Technicians increasingly encounter digitally controlled and "smart" systems with connected thermostats, IoT-based monitoring, and advanced diagnostics. Tools like wireless sensor kits and smartphone apps are becoming routine for commissioning and troubleshooting. As technology raises performance standards, technicians must engage in continual learning to keep pace. One outcome is that customer expectations are higher: clients assume technicians can utilise the latest diagnostic tools and provide quick, data-driven service. An industry association expert summarised this shift: *"Without digital skills… you won't be able to do anything"* (Industry Association Representative), underscoring that ICT literacy and ability to work with automated controls are now fundamental requirements in the trade.

- **Environmental & energy policy drivers:** Climate change mitigation policies and energy efficiency objectives are having a significant and direct impact on the HVAC R occupation. International and domestic commitments to reduce greenhouse gas emissions, including the phase-down of high global-warming-potential (GWP) refrigerants under international agreements, are accelerating the adoption of alternative refrigerants and associated technologies. As a result, HVAC R technicians must increasingly work with a wider range of refrigerants and systems, each presenting different safety, design, and servicing considerations.

  In addition to the growing use of lower-GWP synthetic refrigerants such as A2L-class refrigerants (for example R-32 and R-454B), there is a pronounced shift towards A3-class hydrocarbon refrigerants, particularly in very low-charge, self-contained equipment. Industry data indicates that, as of January 2024, approximately 84 per cent of GEMS-registered portable air-conditioner models operated using hydrocarbon refrigerant HC-290, with only 11 per cent using HFC-32 and 3 per cent using HFC-410A. This trend reflects a broader move towards hydrocarbons where low refrigerant charges and system design can mitigate flammability risks. A similar transition is projected in the domestic hot-water heat-pump market, where HC-290 is expected to become the dominant refrigerant, accounting for around 80 per cent of installations by 2030 (Cold Hard Facts, 2024).

  These shifts place greater emphasis on technician competence in managing flammable refrigerants, including understanding charge limits, ventilation requirements, ignition risk controls, and emergency response procedures associated with A3 refrigerants. At the same time, a broader policy push toward electrification and energy efficiency is increasing the uptake of heat-pump technologies for space heating, water heating, and certain industrial and process-heating applications, displacing gas-fired equipment. HVAC R mechanics are therefore increasingly required to install, commission, maintain, and optimise high-efficiency heat-pump systems.

  Rising building-energy-performance requirements, including Section J of the National Construction Code and rating schemes such as the National Australian Built Environment Rating System (NABERS), are also placing greater emphasis on system optimisation rather than basic installation alone. This elevates the importance of skills in retro-commissioning, control tuning, performance verification, and minimising refrigerant leakage, not only to meet client cost and sustainability objectives, but also to comply with increasingly stringent environmental and safety regulations.

- **Geographic distribution and remote work***:* Australia's geography presents unique service delivery challenges. HVAC R services are required everywhere from dense cities to remote outposts, but the workforce is unevenly distributed. Regional and remote areas often face acute skill shortages where critical facilities in those areas, such as mines, hospitals, indigenous community infrastructure rely on refrigeration and air conditioning, yet attracting and retaining qualified technicians in remote locations is difficult. This has expanded the use of FIFO/DIDO work arrangements for refrigeration technicians. While FIFO roles offer higher pay success in these environments requires resilience and versatility: technicians may have to work solo with limited support, handle a wider array of more complex systems, and improvise solutions when spare parts or specialist help are far away. Limited local access to training and modern technology in remote areas can cause skill stagnation, highlighting the need for innovative training delivery, such as mobile training units, virtual learning modules, or intensive "block" courses to support upskilling of regional technicians. Even in smaller jurisdictions or less populated regions, large-scale projects while not as pronounced still often require expert technicians to commission systems, which can deprive local apprentices of exposure to complex systems. In one focus group, a Tasmanian apprentice commented that if a major new system is being installed, *"guaranteed, it's going to be an engineer from the mainland who comes to commission it"* (Apprentice), illustrating how local technicians may miss out on hands-on experience with advanced systems. Bridging the urban-regional skills divide is an ongoing concern for the industry.
- **Regulatory and licensing complexity***:* The HVAC R trade operates under a complex national regulatory framework with a combination of national regulatory and licensing to variation between state and territory frameworks. Australia does not have a single uniform HVAC R mechanic licence; instead, technicians often need multiple credentials. A typical tradesperson must hold the national ARC Refrigerant Handling Licence and a Restricted Electrical Licence, and in some states also obtain additional occupational licences or registrations for example *Mechanical Services* registration for certain plumbing or medical gas-related aspects of HVAC work in Victoria and Queensland, or a contractor's licence to run a business. The regulatory environment is evolving (for example, some states have recently tightened the requirements for mechanical services work, impacting HVAC workers). Industry bodies like ARC have advocated for more uniform national licensing to reduce cross-border barriers. From a training perspective, this complexity means the qualification must cover the core competencies demanded by these licences such as, sufficient electrical training for the REL, and knowledge of relevant plumbing and ventilation standards for mechanical services registration so that graduates can seamlessly move into the workforce and meet compliance requirements. It also means technicians need to develop strong knowledge of codes and standards to navigate their obligations; however, employers report that new graduates' awareness of specific Australian Standards is often lacking. Without clearer guidance during training, apprentices may finish with uncertainty about what tasks they are legally allowed to perform, especially with differing rules across jurisdictions.

**Table 3: Jurisdictional regulatory and licensing requirements**

| State / Territory | Mandatory national licence | Additional state / territory occupational licence | Electrical licensing relevant to HVAC R work | Regulatory notes (JFA context) |
|---|---|---|---|---|
| ACT | ARC Refrigerant Handling Licence | None | Restricted electrical licence required for fixed wiring work | ACT relies on national refrigerant licensing; electrical licensing applies where electrical work is undertaken. |
| NSW | ARC Refrigerant Handling Licence | Yes<br>Air Conditioning and Refrigeration contractor / specialist work licence | Restricted electrical work included within ACR scope | Air-conditioning and refrigeration work classified as specialist work. |
| VIC | ARC Refrigerant Handling Licence | Yes<br>VPC / ESV mechanical services licensing | Restricted electrical licence required where wiring is undertaken | State licensing required in addition to ARC for RAC work. |
| QLD | ARC Refrigerant Handling Licence | Yes<br>QBCC Mechanical Services (A/C & Refrigeration) | Restricted electrical licence required for associated electrical work | Occupational licence applies to building-related mechanical services. |
| SA | ARC Refrigerant Handling Licence | Yes<br>Consumer and Business Services (installation-focused) | Restricted electrical licence may apply | State licence applies to defined air-conditioning installation work. |
| WA | ARC Refrigerant Handling Licence | None | Electrical licence required where electrical work is undertaken | Rely on national refrigerant licensing and electrical regulation. |
| TAS | ARC Refrigerant Handling Licence | None | Electrical licence required where electrical work is undertaken | No separate RAC occupational licence beyond ARC. |
| NT | ARC Refrigerant Handling Licence | None | Restricted electrical work licence applies | National ARC scheme supported by electrical regulation. |

- **Workforce supply and development challenges***:* As noted, the HVAC R sector is experiencing a skills shortage, with more job openings than there are qualified tradespeople. Low apprenticeship completion rates indicate many trainees either do not finish or do not remain in the occupation. This attrition, combined with an aging workforce, means the gap between supply and demand for experienced technicians is widening. Another factor is the "experience paradox": many job postings request several years of post-qualification experience, effectively making it hard for newly qualified Certificate III holders to secure those roles and gain that very experience. Employers express that freshly qualified tradespeople often require additional mentoring and time to handle complex jobs independently meaning that there is a mismatch between employer expectations and apprenticeship outcomes. This suggests that the qualification alone isn't seen as proof of full job readiness for higher-stakes work. In addition, the trade remains male-dominated and could benefit from improved diversity; women and other under-represented groups are an untapped source of talent and attracting them may require cultural changes and outreach. Finally, the industry's structure being predominately small businesses means varying capacity to support professional development within the sector as there are fewer resources for formal training or diverse job experiences for apprentices. These workforce challenges point to a need for strategies beyond just training package content, such as mentorship programs, better support for apprentices to help improve completion and retention and potentially new models of post-trade skill development to bridge the gap between a novice and an expert technician.

In summary, the HVAC R industry sits at the intersection of technological change, environmental mandates, and workforce dynamics. The following sections discuss how these trends inform the core functions of the trade and what they mean for training and workforce development.

## Implications for training and workforce development

The findings from the desktop research have several implications for the design, delivery, and future development of training in the HVAC R sector. These insights should inform design of the Air Conditioning and Refrigeration training products. Key implications are outlined below:

- **Modernise and broaden technical content:** The Certificate III Air Conditioning and Refrigeration requires updating to include emerging technologies as mainstream competencies. The current qualification covers many traditional core skills, but topics such as advanced VRF multi-split air conditioning systems, contemporary heat pump applications, low-GWP refrigerants, and building automation controls are underrepresented. For example, VRF systems, prevalent in commercial practice, are only addressed in an elective unit rather than in core training. Similarly, there is no explicit core unit on heat pump technology despite its growing use in diverse climates for heating and hot water. Heat pumps are expressly covered by the Certificate II in Split-Air Conditioning and Heat Pump Systems.

  Refrigerants like $CO_2$ or A2L-class gases and advanced controls, BMS and IoT integration are optional topics or absent altogether, meaning many apprentices can qualify without ever working with these technologies. To prepare graduates for the future, the qualification must be re-balanced to incorporate these areas by potentially elevating certain electives to core status or by creating new units so that every apprentice gains fundamental experience with new refrigerants, smart controls, and high-efficiency systems during their training.

- **Strengthen safety, standards, and compliance training:** As equipment and refrigerants evolve, comprehensive safety training is more critical than ever. The qualification should ensure thorough coverage of safely handling flammable refrigerants and high-pressure systems like $CO_2$, as well as electrical safety for modern electronically controlled equipment. Both the content and assessment should align with what is needed to obtain and retain mandatory licences that being the ARC

refrigerant licence, Restricted Electrical Licence, and any new state-based licences to ensure graduates are fully prepared for regulatory requirements. The functional analysis indicates that topics like working at heights, use of access equipment, confined-space procedures, and even basic first aid  which many job sites now require should be reinforced, either through core units or through prerequisite certifications integrated into the apprenticeship. Additionally, applying Australian Standards and codes of practice should be a deliberate focus in training.

Employers note that new technicians must be familiar with standards such as AS/NZS 5149, AS/NZS 1668, AS/NZS 1851, and others that govern their work. Yet currently, apprentices may only encounter these in passing. As one service manager pointed out, *"None of our apprentices get shown AS 1851… once you know how systems operate, you need to know the rules around building them, putting them in and maintaining them"* (HVAC Service Manager).
The training package should embed reference to such standards in relevant units and tasks so that awareness of Standards and codes becomes second nature. Emphasising compliance documentation such as refrigerant handling records, pressure-test and commissioning sheets and risk assessments in training is also important, given the growing emphasis on documentation and accountability in the field.

- **Enhance workplace skills and customer engagement:** Evidence from industry underscores that communication, customer service, and teamwork skills are essential for a technician's effectiveness and career progression, not just "bonus" traits. The current qualification only offers a customer service unit as an elective - BSBOPS203 *Deliver a service to customers*, which many apprentices might not take if it is not required or offered by the Registered Training Organisation (RTO). Incorporating key workplace skills into the core of the training, or at least strongly encouraging them, would better reflect actual job requirements. For example, apprentices could receive training on how to explain technical findings and options to clients in clear, non-technical language, how to write concise service reports and emails, and how to manage their time across multiple service calls. Role-playing common customer scenarios, like an unhappy client with a breakdown on a hot day, can build apprentices' confidence in handling real-world pressures. Similarly, fostering teamwork and leadership, through group projects or having senior apprentices' mentor junior ones in class, can prepare them for taking on supervisory responsibilities later. Developing these workplace skills will improve graduates' professionalism and make them more immediately valuable to employers.

- **Improve flexibility and accessibility of training delivery:** Given the wide geographic spread of HVAC R work, the training system should adopt more flexible delivery modes to reach apprentices in distant or underserved areas. This could include greater use of online learning for theoretical components, virtual simulations for certain practical skills, and intensive block-release scheduling to accommodate apprentices from remote regions or those on non-traditional rosters, like FIFO workers. Some RTOs have already trialled creative solutions; for instance, one Queensland training provider brings students from regional towns to a well-equipped city campus for intensive practical workshops, ensuring they get experience with complex systems not available locally. The industry could further explore mobile training units or regional training hubs in partnership with major employers to bring equipment and trainers to where apprentices are. Embracing technology such as virtual reality training modules for complex plant or online troubleshooting simulators could further help standardise exposure to advanced systems for all apprentices, regardless of location.

The goal is to ensure no apprentice is disadvantaged by their location, and that all can gain the full complement of skills required by the trade.

- **Bridge the gap between training and workforce expectations:** The analysis highlights a need to help new graduates transition from classroom to competent independent practice in a high stakes work environment. While some learning can only come with time on the job, there are opportunities for the training package and industry to facilitate a smoother handover. One strategy, beyond the qualification itself, is for industry stakeholders to implement post-trade development programs, for instance, a structured "graduate year" where newly qualified technicians receive mentoring, attend advanced workshops, and rotate through different types of jobs to broaden their experience. Several employers and registered training organisations indicated interest in such models; a group training representative noted the *"huge difficulties… in post-trade training"* (GTO Representative) currently, due to the lack of formal avenues for continued skill development. Establishing voluntary "graduate" skill sets or mentorship programs could accelerate the attainment of expertise, helping bridge the 3–5 year experience gap that many employers expect and improving retention of new tradespeople in the industry.

Considering these implications, the next section provides details on current training and education for HVAC R technicians, setting the context for the recommendations that follow.

## Training and education

The UEE32225 Certificate III in Air Conditioning and Refrigeration is the foundational qualification for HVAC R technicians in Australia. It is traditionally delivered through a four-year apprenticeship program, combining off-the-job learning with on-the-job experience. Apprentices typically undertake training at Registered Training Organisations (RTOs) either via block release or day-release, while spending the rest of their time employed in industry under a qualified technician. Successful completion of the Certificate III, along with meeting any additional state requirements, qualifies an individual to become a fully qualified Air Conditioning and Refrigeration tradesperson. Currently, there are 28 RTOs that have the qualification on scope with enrolments for 2024 at 7330 across all state and territories.

**Table 4: NCVER 2024 enrolment data UEE32220 Certificate III in Air Conditioning and Refrigeration**

| Location | 2024 |
|---|---|
| New South Wales | 2540 |
| Victoria | 1295 |
| Queensland | 2110 |
| South Australia | 675 |
| Western Australia<br>**Note:** WA preferred qualification to meet industry needs is MEM31322 Certificate III in Refrigeration and Air Conditioning reflecting low UEE enrolment numbers. | 30 |
| Tasmania | 115 |
| Northern Territory | 195 |
| Australian Capital Territory | 165 |
| Offshore | 190 |
| Not known | 15 |

*Source: NCVER 2025, Total VET students and courses 2024: program enrolments DataBuilder, Total, State/territory of residence, Training package, Program name by Year.*

The UEE32225 qualification comprises a set of 27 core units, covering fundamental knowledge and skills and a selection of electives to tailor the training jurisdiction and industry stakeholder needs. The core units span key areas: refrigeration and air conditioning principles, electrical fundamentals and circuits, installing and servicing refrigeration and air conditioning equipment, fault diagnosis and repair, electrical and electronic controls, plumbing and pipe joining techniques, performing routine maintenance, equipment commissioning and decommissioning, safe handling of refrigerants and oils, and essential safety practices such as work safety, environmental protection, and testing for safe isolation of equipment. In total, the core units amount to 1070 points (nominal hours) and ensure that every apprentice is taught the basic competencies of the trade.

In addition, to complete the qualification, apprentices must attain at least 140 points from elective units, divided into groups that encourage either broadening or deepening of skills. Electives allow for some specialisation or emphasis based on regional needs or employer focus. For example, there are elective units on working with natural refrigerants ($CO_2$, ammonia, hydrocarbons), on advanced control (a PLC programming unit), on solar and sustainable energy aspects, customer service, and other topics. In practice, the choice of electives may be constrained by what the RTO offers and the nature of the apprentice's workplace. Some electives with low demand may not be offered by local training providers.

Because HVAC R work is a licensed trade, the Certificate III is integrated with certain licensing outcomes. Completion of core units is designed to satisfy the requirements for obtaining a full Refrigerant Handling Licence from the Australian Refrigeration Council (ARC). Apprentices usually also complete their construction site induction, White Card, and other safety certifications during the apprenticeship if not already held, though these may be separate from the UEE32225 course itself. A Restricted Electrical Licence (REL) is obtained during or at the end of the apprenticeship; the core electrical units in UEE32225 are intended to cover the necessary competencies for the REL, and apprentices are required

to apply to their jurisdictional electrical regulator to obtain the REL outcome. In some jurisdictions, recent changes have introduced additional occupational licensing requirements under relevant building regulators, but this varies between jurisdictions.

Higher-level qualifications in refrigeration and air conditioning are available in the training package, such as a Certificate IV in Refrigeration and Air Conditioning Systems, and Diploma and/ or Advanced Diploma programs oriented towards engineering design or supervisory roles. However, uptake of these beyond the trade certificate has historically been limited with stakeholders noting that there is no benefit to them in undertaking further education as it does not provide career progression pathways or increased wages. In practice, many technicians rely on years of field experience, manufacturer courses, and short workshops for their post-trade development rather than enrolling in formal higher VET qualifications. Part of the industry feedback suggests that this model may need to change: if the complexity of the job is increasing, the training pathway could evolve to include more formal post-trade learning opportunities or even an extended qualification. Indeed, some industry leaders have suggested a two-stage qualification where apprentices gain the base knowledge and skill requirement to be a technician and then post-trade training that supports skill development in more complex systems.

Overall, the Certificate III remains the primary qualification and entry point for the occupation, and virtually all employers use it as the benchmark for hiring a qualified HVAC R technician. It is recognised nationwide and underpins the professional identity and standards of the trade. This functional analysis will directly inform the ongoing review of the UEE Training Package being overseen by the PSO and industry committees, ensuring that the qualification can be updated in line with the evidence presented here. In the next section, we translate the research findings into a detailed mapping of the HVAC R trade's functions, followed by the key themes from employer interviews, before presenting recommendations for the way forward.

# Findings of interviews with employers

To complement the desktop research, targeted stakeholder interviews were conducted with HVAC R industry participants. These conversations provided real-world perspectives on the daily functions, required skills, and pain points of the trade. The qualitative evidence from employers and other stakeholders reinforced the findings of the job advertisement analysis – but also added depth and new insights, particularly regarding training quality, emerging skill gaps, and workforce challenges. This section synthesises the key themes from the interviews, illustrated with representative quotes. It must be stated upfront that caution must be noted feedback due to a low interview rate, which was constrained by time and availability of participants. However, whilst caution is advised, the themes provided were consistent across the surveyed population that allow confidence in reporting the outcomes.

## Key roles and functions in the HVAC R sector

Employers and practitioners confirmed the range of roles and core functions identified in the research. In a typical HVAC R contracting business, a qualified refrigeration and/or air conditioning technician leads the technical work, often supported by one or more apprentices or trade assistants. Larger organisations may have teams of technicians with a field service manager or senior technician coordinating multiple jobs. Across these contexts, interviewees consistently described a set of fundamental job functions that an HVAC R technician is expected to perform:

- **Installation of systems:** Technicians install and upgrade air conditioning and refrigeration systems, from small split-system air conditioners in homes to complex multi-component systems in commercial buildings. This includes surveying sites, reading plans, mounting compressors and evaporators, running refrigerant pipework and electrical wiring, connecting ductwork, and integrating controls. Successful installation requires not only technical skill but also coordination with other trades such as electricians, plumbers, and builders on site to ensure everything is fitted correctly and safely.

- **Commissioning and testing:** After installation, bringing new systems into operation is a crucial function. Technicians charge systems with refrigerant, test for leaks, adjust pressures and airflow, set up control parameters, and verify that equipment meets performance specifications. Proper commissioning can be a detailed, methodical process especially for larger or more sensitive systems and is vital for energy efficiency and reliability. Some employers noted that only their most experienced staff handle complex commissioning and air balancing tasks. *"Commissioning and air balancing is kind of its own specialty… could be a post-trade thing,"* explained one employer, highlighting that these high-level tasks often require additional training or experience beyond the basic qualification.

- **Scheduled maintenance:** A significant portion of most businesses is routine maintenance which may include cleaning filters and coils, checking refrigerant levels, tightening electrical connections, testing, and replacing wear-and-tear parts on a regular schedule. Proper preventive maintenance is critical in commercial settings to avoid breakdowns and ensure warranty compliance. Technicians in interviews emphasised that being organised and thorough in carrying out maintenance across multiple sites is a key part of their job, even if it does not always get the same attention as installation work.

- **Troubleshooting and repairs:** The most valued function is diagnosing and repairing faults when systems malfunction. Every experienced interviewee stressed that fault-finding ability is what truly defines a high-performing technician. Technicians must rapidly determine why a system is not performing, whether the cause is electrical, refrigeration-related or control-system related and then implement the fix. *"The real value of a good fridgie is keeping things running when they break,"* one employer noted. This function often entails working under pressure and applying deep knowledge to solve problems that may not have been encountered during training. As one RTO representative observed, *"fault-finding skills [are] scarcely taught"* during formal training, so employers find they must mentor new graduates extensively in this area.

- **Regulatory compliance and documentation:** Technicians devote time to safety checks and paperwork to meet regulatory and quality requirements. This involves recovering refrigerant during servicing to prevent emissions, keeping accurate logs of refrigerant usage and leak tests, as required by the environmental legislation, completing commissioning sheets, service reports, and risk assessments, and ensuring all work is done to the relevant standards and codes. A diligent focus on compliance was seen as a hallmark of professionalism. Several employers noted that a good technician is *"diligent with the paperwork"* – for example, documenting all test results and services – because these records are legally required and demonstrate the quality of work to clients.

- **Customer and stakeholder communication:** Particularly in service and maintenance roles, technicians are often the face of the company to customers. They need to communicate clearly and courteously, explaining technical issues in simple terms, advising customers on usage or further work needed, and generally providing good service. On project sites, they must liaise with engineers, project managers, or facility managers, coordinating work and sometimes negotiating around operational constraints. Employers highlighted that technicians who excel in communication and build rapport with clients enhance the business's reputation. *"Every technician is an ambassador for our company's reputation,"* one manager said, underlining how much weight is put on interpersonal skills alongside technical duties.

These core functions align closely with those identified via the job ads and functional mapping, reinforcing their central importance. In practice, an HVAC R tradesperson's day can see them wearing many hats, installer, electrician, pipefitter, diagnostician, safety officer, and customer service agent. A seasoned employer summed it up best: a truly competent technician is *"someone who can walk into a plant room and handle whatever they find."* The interviews confirmed that versatility across the above functions is what industry values most, and it is where training and experience must produce results.

## Workforce 'skills' requirements

When asked about the essential skills and attributes for HVAC R technicians today, employers and other stakeholders echoed the broad skill categories identified in the desktop research, but with some additional nuances and priorities. The consensus on critical skills from the interviews were:

- **Technical troubleshooting and diagnostics:** Almost every interviewee placed the ability to effectively fault-find at the top of the list. Employers provided anecdotes of how valuable a technician is if they can "figure out why a system isn't cooling properly" or "isolate a fault quickly and safely." This skill is strongly linked to having solid fundamental knowledge of refrigeration cycles, electrical circuits, and control logic – and knowing how to apply that knowledge logically in the field. Many felt this is the area that distinguishes an average technician from a high performer. However, as noted earlier, several stakeholders felt that apprentices do not get enough live experience in this during training, meaning new tradespeople often need considerable guidance to build diagnostics skills.

- **Safety consciousness and regulatory knowledge:** Employers expect technicians to demonstrate vigilant safety habits and knowledge of regulations from day one. The *best technicians treat safety as paramount*, performing all required checks such as lockout/tagout, test-for-dead, ventilation when brazing, using PPE for refrigerants as second nature. They are also aware of the current codes and regulations, for example, knowing if a particular installation needs a secondary refrigerant relief valve per code, or understanding the requirements for handling A2L flammable refrigerants. This mindset of doing the job "by the book" was highlighted as something that needs to be instilled early. Technicians who cut corners, even out of expediency, were seen as liabilities in the long run.

- **Customer service and communication:** The ability to interact professionally with clients and colleagues was repeatedly stressed. Traits like reliability, clear communication, honesty, and a presentable, courteous demeanour were frequently mentioned. Because many HVAC R businesses rely on word-of-mouth and repeat maintenance contracts, a technician's workplace skills can directly impact customer satisfaction and the company's reputation. As one service business owner put it, *"Our best technicians are those who communicate well – they build trust with clients and that keeps business coming."* Conversely, some apprentices noted these interactions can be challenging initially, *"I hated talking to customers; didn't know how to do it"* confessed one interviewee (Apprentice) about their early experience, indicating the need for training to better prepare apprentices for customer-facing scenarios.

- **Continuous learning and adaptability:** Given the rapid changes in technology and regulations, employers value technicians who have a mindset of ongoing learning. Many described their best employees as those who *"stay curious and keep up with new tech."* Some companies offer in-house training or send technicians to manufacturers' courses for example, ARC's $CO_2$ handling course or a controls workshop by a BMS vendor, and they appreciate technicians who embrace

these opportunities. Conversely, resistance to learning new methods or technologies was seen as a career limiter. Interview participants also mentioned adaptability, the willingness to take on unfamiliar tasks or systems as a key trait, especially in smaller companies or remote areas where a day's work could range widely.

- **Basic IT and administrative skills:** As more of the workflow becomes digitised, today's technicians need to be comfortable with digital tools for scheduling, reporting, and diagnostics. Employers noted that tasks like filling out electronic service reports on a tablet, using mobile apps to calculate superheat or read a smart gauge, or even just emailing a quote to a client, are now routine. Some older technicians have had to catch up on these skills, whereas younger technicians are often more digitally native. Nevertheless, all new entrants are expected to be computer-literate at a basic level, able to learn a service software platform, search online for technical manuals, or connect a laptop to a controller to pull error logs. This also ties into documentation: being thorough and prompt with administrative tasks was highlighted as part of professional reliability.

It is noteworthy that these priorities align with what was found in job ads analysis, but the interviews emphasised their interdependence. For example, troubleshooting skill is not just a technical ability but also relies on continuous learning and on communication with colleagues when needed. Similarly, safety consciousness ties into regulatory knowledge and into professional attitude. Table 2 below provides a summary of several in-demand skill areas and how well the current Certificate III training covers them, based on the functional mapping:

**Table 5: In-Demand Skills in HVAC R vs. Coverage in Current UEE32225 Training**

| Skill Area | Demand in Industry | Coverage in Current Cert III |
|---|---|---|
| **Preventive maintenance & basic repairs** | **Very High** – Core expectation for all technicians; frequently listed in job ads for service roles. | **Strong** – Multiple core units cover routine servicing, common repairs, and safe work practices (e.g. fault-finding, replacing components, WHS). |
| **Diagnostics & complex fault-finding** | **Very High** – Critical for independent field work; employers seek experienced troubleshooters. | **Partial** – Fundamental principles are taught but limited real-fault simulation. New graduates often need further on-job experience to build confidence in systematic troubleshooting. |
| **Customer service & communication** | **Very High** – Consistently requested in job ads (effective communication, client focus). | **Weak** – Only addressed via an optional elective. No guaranteed training in customer relations or communication unless chosen; many apprentices miss this. |
| **Advanced controls & BMS** | **Medium (and growing)** – Becoming more important with smart buildings and integrated systems, but still a specialist area in many ads. | **Minimal** – Basic electrical control covered in core, but no specific unit on digital controls or BMS (except an elective on PLCs rarely taken). Many apprentices graduate without exposure to real BMS or advanced control systems. |
| **New refrigerants** | **Emerging** – Increasing demand in industrial/commercial refrigeration ads; expected to grow with regulatory changes. | **Minimal** – Addressed only in elective units which are not widely taken. It is possible to complete the qualification without any hands-on training on natural or low-GWP refrigerants. |
| **Compliance & Standards knowledge** | **High** – Understanding of codes and Australian Standards (electrical, mechanical, building standards) and licence conditions is expected by employers. | **Partial** – Core units include safety and some regulatory content (e.g. ODS & SGG rules, basic electrical regulations). However, specific Australian Standards and detailed licensing knowledge could be enhanced through training. |
| **IT literacy & documentation** | **High** – Use of digital tools and accurate reporting valued by employers (appears in many job criteria). | **Partial** – Some core units involve documentation, but training on digital tools is ad hoc (depends on RTO). Not a formal focus area in training products, often learned on the job. |

This comparison shows that while traditional technical skills and safety are strongly covered by UEE32225, there are notable gaps in areas like advanced technology (controls, new refrigerants) and workplace skills. The employer interviews reinforced that all the skills listed as “very high” demand should be non-negotiable outcomes of the training and that every graduate should possess them upon completion of their training and apprenticeship. Whereas the skills of “medium” or “emerging” demand are exactly the areas where the qualification needs to keep evolving. The recommendations section will directly address how the training product can be adjusted to cover these gaps, for example suggesting customer service training become compulsory, or integrating natural refrigerant handling into core

competency. Interviewees stressed that if industry needs it, then the training should teach it. Aligning those two is the goal of this review.

## Workplace settings

HVAC R technicians find employment across a range of workplace settings, each with distinct demands and work patterns. The interviews underscored how the context in which a technician works can shape the skills they use and the challenges they face:

- **Domestic and light commercial work:** A significant number of technicians, especially in small businesses, service homes, shops, and small offices. In this setting, a technician might spend a morning installing a split-system air conditioner in a house, then the afternoon responding to a call about a café's cool-room not holding temperature. These jobs involve mostly smaller-scale equipment and usually a high level of direct customer interaction which often the technician is working in someone's home or business. Communication and customer service skills are critical: the technician must explain the work, advise the client on usage or maintenance, and leave the work site clean and presentable. Technicians in this segment often work independently or with one apprentice, so they need to be self-sufficient and resourceful. The pace can be unpredictable, especially during summer when breakdown calls spike, requiring flexibility and good personal organisation. Employers noted that domestic jobs also demand a broad skill set because "you don't know what you'll be working on next" – one day it could be a ducted air conditioning install, the next a pool heat pump repair.

- **Large commercial and institutional facilities:** These include multi-storey office buildings, shopping centres, hospitals, hotels, universities, and government buildings. Technicians in these environments may be part of a dedicated in-house maintenance team or work for service contractors who manage HVAC systems for clients. The systems are typically centralised and complex for example large chiller and boiler plants, cooling towers, extensive ducted ventilation systems with air handling units, building management systems (BMS) controlling multiple zones, and backup redundancy. Maintenance in these settings is often scheduled after hours, to avoid disrupting building occupants, and technicians might handle detailed tasks like air-balancing, calibration of sensors, cleaning cooling towers, and optimizing control setpoints for energy efficiency. Teamwork is more prominent, a team of technicians might work together to overhaul a big chiller or replace a cooling tower fan, often coordinating with other professionals such as mechanical engineers or controls specialists. Communication skills are vital for interacting with facility managers or clients' engineering staff; technicians need to provide clear reports on system status and sometimes follow stringent permit-to-work and safety procedures especially in hospitals or data centres). Employers mentioned that technicians in these roles benefit from deeper knowledge of controls, hydraulics, and airflow measurement than a typical residential technician might have.

- **Industrial and heavy refrigeration environments:** This category encompasses factories, food processing plants, cold storage warehouses, breweries, and other industrial sites. Here, refrigeration systems can be very large-scale for example, multi-compressor ammonia refrigeration plants, $CO_2$ cascade systems, blast freezers and often mission-critical for operations. Technicians in these roles usually undergo additional specialised training for instance, ammonia safety or in operating sophisticated control systems unique to industrial refrigeration. The work often involves *shift work or on-call rosters* since these facilities may run 24/7 and a failure could be costly like loss of product. Maintenance is heavily preventive and according to strict Standard

Operating Procedures. On such sites, HVAC R techs might work alongside or under engineers, and need to integrate with process control systems or industrial maintenance teams. Safety standards are paramount as technicians must handle toxic or flammable refrigerants with care and observe process safety management protocols. Interviewees noted that these positions are usually filled by very experienced tradespeople; a newly qualified technician would typically start in commercial work and progress into industrial roles after further training and proving themselves capable.

- **Remote and mining sites:** A unique subset of HVAC R work occurs in extremely remote locations, such as mining camps, oil & gas facilities, outback communities, and large agricultural stations. In these settings, a technician often becomes a jack-of-all-trades for climate control systems on site. They may be responsible for everything from the air conditioning in workers' accommodation and offices, to refrigeration in kitchens and medical facilities, even to cooling systems in heavy machinery or processing plants. Interviews with technicians who had worked FIFO/DIDO described the environment: you typically operate on a rotational schedule for example 2 weeks on site, 1 week off, extreme climate conditions very hot, dusty environments or in one interviewees case extreme cold locations in the Antarctic and long hours. Support resources are limited, if a critical component fails, you may have to improvise repairs or find a temporary solution until a replacement part can be flown in. Because of this, remote-site technicians develop a broad skill set and high autonomy. They also often carry additional certifications to handle the isolation. Not everyone is suited to this lifestyle, and retention can be a challenge despite the attractive salaries; those who do thrive tend to enjoy the independence and unique challenges. As discussed, the reliance on FIFO is one way industry tries to fill regional skill gaps, but it is not a complete solution and therefore improving local training and incentives for technicians to live in regional areas is also important.

In all these settings, a common theme from employers was the need for adaptability. Many technicians will move between sectors over their career for example, an apprentice might train with a domestic air conditioning installer, then later take a job maintaining large commercial HVAC systems, or an industrial refrigeration technician might transition to a metropolitan service company. Thus, the Certificate III needs to provide a solid foundation that is relevant across all these contexts. At the same time, specialised electives or on-the-job training can cater to the differences. The variety of workplaces also reinforces why skills like communication, planning, and self-learning are as important as technical knowledge as a technician might be on a quiet solo job one day and on a large, coordinated project the next, and they must perform effectively in both scenarios.

## Career pathways

Career progression in the HVAC R industry can follow in multiple directions. The interviews highlight that while completing the Certificate III apprenticeship makes one a qualified "technician" continuous development and diversification of skills are key to advancement. Some typical career pathways include:

- **Apprentice → Qualified technician:** After four years, an apprentice obtains the Certificate III and required licences and becomes a fully qualified Air conditioning and Refrigeration technician. Initially, newly qualified technicians focus on solidifying their skills, gaining speed and efficiency in standard tasks, and building confidence in tackling jobs without close supervision. Many remain with the same employer for a period post-qualification to continue learning under mentors, gradually taking on more responsibility.

- **Experienced technician → Senior/Lead technician:** With around 5–8 years of experience, a technician often moves into a senior role. This might involve mentoring junior staff and apprentices, leading larger jobs, and being the go-to person for complex troubleshooting. At this stage, some tradespeople pursue additional credentials such as the Diploma of Air Conditioning and Refrigeration Engineering or specific short courses related to the industry such as energy efficiency, advanced controls, contractor management, which can prepare them for supervisory or specialist responsibilities. Those who build a reputation for excellence in diagnostics and project leadership may become service managers or field supervisors, overseeing a team of technicians.

- **Specialisation or cross-skilling:** At various points, technicians may choose to specialise or broaden their credentials:
    - Some become Controls or BMS Specialists, focusing on the programming and maintenance of building automation systems for HVAC. They might take extra training in control technologies sometimes offered by manufacturers or through formal accredited training.

    - Others pursue a dual trade or additional licence - a common example is acquiring an electrician's licence via the Certificate III in Electrotechnology Electrician after or in conjunction with the refrigeration trade. These dual-qualified individuals are in high demand because they can sign off on a wider range or scope of work. Employers noted that having both qualifications can lead to roles in facilities maintenance or contracting where both electrical and HVAC skills are utilised daily. Several interviewees advocated making it easier to attain a dual qualification, noting that the refrigeration trade has significant overlaps with the electrical trade. *"We should integrate an electrical and refrigeration pathway – they're so intertwined,"* one industry representative suggested. In fact, an imbalance was pointed out: under current licensing, a full electrician can legally do certain HVAC installations if they hold the ARC licence associated with the Certificate II in Heat Pump and Split Systems and often command higher pay, whereas a refrigeration technician has a narrower licence scope. This is motivating some in the trade to add an electrical licence or support the idea of a combined apprenticeship stream.

    - Technicians in the commercial refrigeration sector might take up a natural refrigerant handling course, if not already covered in their training, to specialise in $CO_2$ or ammonia systems, which can open opportunities in the supermarket or industrial sectors.

    - Some tradespeople move laterally into roles like estimating, project management, or technical sales after developing a solid technical base. These moves often require learning new skills in business, management, or sales techniques but benefit from the credibility of hands-on experience.

- **Business ownership or management:** A common pathway for experienced technicians is to start their own contracting business or move into management within a larger company. Those who pursue becoming a contractor/business owner need to obtain any necessary contractor licences which requires obtaining business competencies. Running a business brings new challenges: building client networks, ensuring regulatory compliance for the company, managing finances and staff. Some interviewees mentioned that technicians often need support in

developing leadership and business skills when they make this transition – something the industry could facilitate through short courses or mentoring programs.

- **Higher technical or engineering roles:** A smaller number of individuals use the trade as a springboard into higher technical education. For example, a technician with a strong academic inclination might complete an Advanced Diploma or an Engineering degree to become a design engineer or consultant. Others might become technical trainers/RTO instructors, which typically requires a combination of industry experience and a training qualification in Certificate IV in Training & Assessment. The trade background is highly valued in these roles, though additional qualifications are required. Notably, some stakeholders pointed out a gap in formal education pathways: *"It's disappointing there's no degree beyond Cert III…,"* one employer said (Private Contractor), referring to the absence of a dedicated refrigeration engineering degree or a higher apprenticeship that could attract those wanting a clear path to an engineering career within the field.

Overall, the consensus in the interviews was that the HVAC R trade offers robust career opportunities, but that clearer pathways and additional training options would help more people advance. Employers noted that encouraging technicians to pursue further qualifications or endorsements can be challenging due to work pressures, but those who do upskill tend to progress faster. The functional analysis suggests that the Certificate III can better prepare apprentices by giving them a broader awareness of these pathways by exposing them to basic control concepts might inspire a future controls specialist, or discussing higher qualifications might motivate continued learning. This way, each graduate not only enters the trade job-ready, but also with a vision of how they can continue to grow in their profession.

## Industry preference for qualifications

The consultations reaffirmed that UEE32225 Certificate III in Air Conditioning and Refrigeration is firmly regarded as the base qualification for working in this industry. Most employers require this trade certificate as a minimum for hiring an air conditioning and/or refrigeration technician, typically stated in job ads as *"must have a Cert III in Refrigeration and/or Air Conditioning."* This is both a market expectation and a regulatory necessity: one cannot obtain the full national Refrigerant Handling Licence without the qualification and in most states, it is effectively mandatory for any kind of independent trade contracting or registration.

Beyond the Certificate III, however, employers had varying views on additional qualifications:

- **Post-trade HVAC R:** Some employers see value in the UEE Certificate IV and above air conditioning and refrigeration qualifications where these qualifications focus on advanced technical and supervisory skills, especially for those moving into lead roles or more complex work. But it was noted that few tradespeople currently undertake the post-trade training unless it was required for a specific reason. On the job experience often substitutes for formal higher qualifications in the eyes of many employers. For instance, a technician with 10+ years of varied field experience might be considered equally or more valuable than someone who took time off for a post-trade qualification. That said, the content of these post-trade qualifications which can include advanced controls, thermo-fluid theory, and management units was viewed as beneficial, and some larger companies encourage their staff to pursue it part-time.

- **Other skill sets and endorsements:** Interviewees noted that certain industry certifications or short courses are highly regarded even if they are not full qualifications. These include the previously mentioned natural refrigerant courses which are often offered by industry bodies or TAFEs, and manufacturer-specific training for example training on brand specific control systems,

chiller products, or HVAC design software). If a candidate has these, it can be a “bonus” signalling initiative and specific expertise. Many employers themselves sponsor their technicians to attend such training to broaden the company’s service capabilities.

- **Dual trades:** Contexts, having multiple trade qualifications is a significant advantage. For example, a refrigeration mechanic who is also a licensed electrician can perform both mechanical and electrical aspects of HVAC R installations, making them extremely versatile for service or project work, eliminating the need to call in separate trades. Some employers, especially those in facilities maintenance or remote work, actively encourage dual-trade upskilling. Another example is combining the refrigeration trade with the plumbing/gas fitting trade; while rare, this could allow a technician to work on gas-fired heating or extensive piping associated with HVAC R systems in states where that overlap exists. These dual qualifications can enhance career prospects and earning potential. Several stakeholders advocated for exploring integrated training pathways that would allow an apprentice to achieve dual competencies more efficiently, given the substantial overlap in the skills.

Importantly, many stakeholders emphasised not just the need to maintain the rigour of the Certificate III, but also to consider expanding the training pathway. There is a growing sentiment, particularly among industry leaders and training professionals, that the traditional 4-year Certificate III may no longer suffice on its own. They suggest developing more post-trade skill sets that support specialisations for more complex work with progression into Certificate IV or Advanced Diploma as part of skill development of the industry. This would effectively lengthen and deepen the training to cover more advanced competencies. *“Cert III is not sufficient anymore,”* one industry association leader stated, advocating a higher qualification as the new standard. While most employers are not yet requiring such higher qualifications, they are broadly supportive of raising the skill ceiling for the trade, if it is done in consultation with industry. They want the Certificate III to remain the respected foundation, but with clear options for those who wish to continue to Certificate IV and beyond.

In summary, the Certificate III remains the cornerstone of employment and practice in HVAC R. The focus of industry feedback was not to replace it, but to strengthen and supplement it. A strengthened Certificate III, with clear progression pathways post-trade to Certificate IV, Diploma and Advanced Diploma with additional skill sets, was seen as the way to ensure that newly qualified technicians meet the demands of modern industry without needing extensive additional ad hoc training. The recommendations later in this report reflect this by suggesting specific enhancements to the qualification and consideration of formalised post-trade development options.

## On the job training

Every employer and stakeholder highlighted that practical on-the-job training is indispensable in the HVAC R trade. The apprenticeship model inherently relies on the workplace to provide real-world experience and practice to complement formal learning. Key points from the interviews include:

- **Mentorship during apprenticeship:** The quality of supervision and mentoring that an apprentice receives on the job can make or break their development. *“How well an apprentice does comes down to who their supervisor or mentor is,”* noted one service business owner (Employer), a sentiment echoed by many. A supportive and knowledgeable mentor reinforces what is taught in trade school, demonstrates proper techniques and takes the time to explain why they are done the job that way, and ensures they gradually expose the apprentice to more complex tasks was key. Some businesses have structured approaches by rotating apprentices through different types of jobs or pairing them intentionally with senior technicians, while others leave it more to chance. A challenge identified is that not all workplaces have the capacity or commitment to provide a broad training experience, for example, if an apprentice spends four years only doing installation work for

a small company, they may qualify with little exposure to maintenance or fault repair. Group Training Organisations (GTOs) help mitigate this by rotating apprentices among host employers to gain diverse experience. The industry recognises the need to support and encourage good mentoring, however, it was noted that additional training, such as short courses for tradespeople on how to coach apprentices was needed, given that an excellent technician is not automatically an excellent teacher. Improved on-job training practices would likely raise apprenticeship completion rates and skill outcomes.

- **Post-trade skill development:** The learning does not stop at qualification. Many companies provide ongoing in-house training or send technicians to external workshops regularly. Commonly, equipment manufacturers or suppliers will run free training days on new products or techniques, interviewees cited examples like refrigerant suppliers teaching best practices in leak detection and reclamation, or air conditioning manufacturers training technicians on commissioning their latest VRF systems. Technicians who take advantage of these tend to become the go-to experts in their company for those systems. Larger organisations may formalise this by creating annual training plans for staff. However, smaller businesses sometimes struggle to release staff for training due to workload. This highlights the importance of making short courses and updates accessible through online modules that can be done after hours. The concept of lifelong learning is very much part of the HVAC R profession due to the constant evolution of technology and regulations.

- **Preparing for additional licences and roles:** Much of the learning needed for advanced licences or roles happens informally on the job. A tradesperson aiming to become a contractor might learn about business management by observing how their boss runs things, before taking the leap to get a contractor licence. Stakeholders suggested it would be beneficial to have more formalised recognition of on-job learning through the Recognition of Prior Learning (RPL) to streamline ways to get an accredited unit of competency or skill set added to their record without having to attend lengthy off-site training. This would encourage upskilling and provide recognition that can be portable across jobs.

- **Industry support and collaboration:** Several interviewees mentioned that better collaboration between training providers and employers could enhance on-the-job learning. For instance, RTOs could provide employers with a simple training plan guide highlighting what tasks or competencies an apprentice needs exposure to at each stage, helping employers ensure they cover those. Some RTOs already do informal check-ins. Additionally, industry associations could facilitate peer-to-peer learning where one idea raised by an apprentice was creating an apprentice “community of practice” or network where apprentices from different companies can share experiences and tips, possibly mentored by a retired expert. These community and support structures can supplement what an individual employer provides and help apprentices feel more supported, especially if their workplace mentor is very busy or less proactive.

In conclusion, workplace training is where apprentices truly turn knowledge into skill, and it complements the formal training. The functional analysis supports continued on the job training with skills being logged during the apprenticeship. Moreover, strengthening the overall ecosystem through mentor training, resource sharing, and possibly funding incentives for employers who provide broad training was seen as critical to improving outcomes. The recommendations later touch on how the industry might bolster this aspect, in tandem with updating the qualification itself.

## Challenges identified

Through the stakeholder consultations, several critical challenges were identified that impact the HVAC R workforce and the effectiveness of training. These challenges validate many of the issues raised in the desktop research and provide direct insight into the pain points that need to be addressed. The key challenges and their implications are summarised below and outlined in Table 6 below.

**Table 6: Identified challenges.**

| Challenge Area | Description of Issue | Implications for Industry and Training |
|---|---|---|
| **Technological gap in current training** | Training content is lagging rapid technological change. Areas such as natural and flammable refrigerants, smart controls and BMS, and high-efficiency system types are not adequately covered in standard training. Many technicians therefore learn these skills informally after qualification, or not at all. | Limits uptake of cleaner and more efficient technologies; creates safety risks when technicians encounter unfamiliar systems; risks Australia's HVAC R workforce falling behind global best practice. Stakeholders emphasised the need for new or updated units and practical exposure to emerging technologies during apprenticeships. |
| **Workforce shortages and retention issues** | The industry faces ongoing shortages driven by apprenticeship non-completion, an ageing workforce, and competition from other industries. Long hours, physically demanding work, and high pressure affect job satisfaction, while limited diversity restricts the talent pool. | Results in unfilled vacancies, heavier workloads, reliance on overtime and FIFO arrangements, and reduced workforce sustainability. Training must remain relevant and attractive, with clearer career pathways and stronger apprentice support to improve completion and retention. |
| **Inconsistent training quality and skill variance** | Employers report wide variation in graduate capability. Some apprentices complete training with limited exposure to complex systems or core tasks (e.g. wiring control circuits), often due to uneven RTO capability or narrow workplace experience. | Employers must invest additional time in post-trade training. Stakeholders identified the need for minimum practical skill benchmarks, broader exposure through rotations or placements, stronger capstone assessments, and ongoing professional development for trainers to ensure consistency and currency. |
| **Licensing and regulatory complexity** | Licensing arrangements vary by jurisdiction and do not always align clearly with qualification outcomes. Some graduates are not authorised to perform all expected work tasks upon completion, leading to confusion for both employers and apprentices. | Creates frustration, misaligned expectations, and administrative burden—particularly for small businesses. Training should provide clear guidance on licensing pathways, regulatory scope, and compliance requirements, supported by ongoing collaboration between regulators and training bodies. |
| **Workplace skills gaps and variable mentoring** | Communication, customer service, self-management, and teamwork skills are often learned informally. Mentoring quality varies widely, with some apprentices receiving strong support and others experiencing limited development or being used primarily as labour. | Poor workplace support contributes to disengagement and attrition. Stakeholders supported formal inclusion of workplace skills in training, improved mentoring practices, and initiatives such as mentor guidance materials or mentor training to strengthen apprentice outcomes and professionalism. |

These challenges underscore the urgency of modernising the training and support for HVAC R tradespeople. They highlight the need to clearly map the functions performed in the occupation to ensure training aligns with real work. The next step is to translate these findings into a structured functional mapping of the HVAC R trade, breaking down the occupation into its core functions and tasks. This functional mapping will form the basis for aligning the qualification's content with actual job requirements in the subsequent section.

# Functional mapping

Functional mapping is a structured process used to identify and categorise the core functions (major areas of work) and sub-functions (specific tasks or duties) performed by individuals in key job roles within the HVAC R sector. By defining what technicians do in the workplace with an evidence-based foundation ensures qualifications and units of competency are aligned with real-world job demands. In this analysis, functional mapping distils the HVAC R technician's role into its essential functions, ensuring that any training package updates target the competencies truly needed on the job.

## Functions and sub-functions

To support this functional analysis, we first outline the primary roles within the HVAC R trade, including apprentices, qualified air conditioning, and/or refrigeration technician, senior or specialist technicians, and service/operations managers and describe each in terms of its main purpose and associated tasks. Following the role descriptions, we present the key functions and sub-functions that comprise the work of a qualified HVAC R technician. These functions encapsulate the principal activities identified through the job data review and employer consultations and they illustrate how tasks are distributed across different roles. A visual functional map of the occupation is provided in **Figure 4** to depict these roles and their interrelated functions and sub-functions.

- **Apprentice HVAC R Mechanic:** Entry-level trainee – Typically enrolled in a 3–4 year apprenticeship, an apprentice works under the supervision of licensed tradespeople while learning the trade. The primary purpose of an apprentice is to develop practical skills and knowledge through hands-on experience and formal training. Key tasks include assisting senior technicians with installations and repairs, performing basic servicing tasks, and gradually taking on more complex duties as their competence grows. Apprentices often rotate through various job functions to build a broad skill base, one day they might help install a split-system air conditioner, and another day shadow a technician on a preventative maintenance visit or a breakdown call. They also attend off-the-job training through RTO classes to learn theory and foundational principles. Under close supervision, apprentices progressively gain independence; by their later years, they should be performing many of the same tasks as a qualified mechanic, albeit with guidance readily available. An apprentice's role is crucial in supporting experienced technicians by handling preparatory work and routine tasks while developing into the next generation of qualified tradespeople.
- **Qualified Air Conditioning/Refrigeration Technician:** *Fully qualified tradesperson* – After completing the Certificate III and obtaining necessary licenses, a person can work independently as an HVAC R technician. The primary purpose of this role is to carry out the full range of installation, commissioning, maintenance, and repair tasks to ensure HVAC R systems are safe, compliant, and functioning effectively. Key tasks include installing air conditioning and refrigeration equipment, commissioning new installations, conducting routine maintenance, and diagnosing and repairing faults in equipment. A qualified technician is expected to work autonomously, solving problems on the job and making decisions about repairs or adjustments. They must also manage compliance aspects such as recovering refrigerant, filling service reports, and logbooks, adhering to safety protocols and electrical codes – and often handle significant customer interaction, like explaining work to clients or advising on system use. Depending on the employer or industry niche, a qualified HVAC R technicians may service a broad variety of systems (e.g. domestic air conditioners in homes one day, commercial walk-in freezers the next) or

may specialise in a particular segment. In all cases, this role demands a well-rounded skill set covering practical trade skills, technical knowledge, safety and environmental responsibility, and communication.

- **Senior / Specialist HVAC R technician:** Advanced tradesperson or subject-matter expert, with extensive experience often 5–10 years or more post-qualification, a technician may progress into a senior role or develop a specialty. The primary purpose at this level is to either lead and oversee technical work or to provide expertise in a specialised area, or sometimes both. A senior technician (or *team leader*) takes on leadership within a service team. Key tasks include coordinating and scheduling work for other technicians and apprentices, performing the most complex installations or repairs, mentoring junior staff, and acting as a site supervisor and safety leader on larger jobs. Senior technicians often handle critical troubleshooting that less experienced staff cannot resolve and ensure quality control on projects. They may also liaise with clients more directly on technical matters and assist management with scoping jobs or training initiatives. On the other hand, a Specialist technician focuses deeply on a particular sub-field of HVAC R. For example, one might become a *Controls/BMS Specialist*, concentrating on building management systems and advanced control logic – programming controllers, integrating HVAC equipment with automation networks, and optimising system performance. Another might be a *Chiller or Industrial Refrigeration Specialist*, working on large ammonia or $CO_2$ refrigeration plants, which involves tasks like calibrating complex pressure controls, managing ammonia safety procedures, and overseeing major overhauls in cold storage facilities. Others might specialise in niche areas like marine refrigeration, transport refrigeration, or specific product lines by a manufacturer. These specialists typically acquire additional training or endorsements through manufacturer courses or post-trade qualifications beyond the Certificate III. In practice, many senior tradespeople wear both hats – they are team leaders and are specialised. Whether as a supervisor or a technical expert, the senior/specialist role is characterised by a high degree of skill, autonomous decision-making, and often a responsibility for guiding the technical direction of a team or company in their domain of expertise.
- **Service Manager / HVAC R Business Owner:** Operations and people manager is a role that represents those experienced tradespeople who transition into managing roles, either as the service/operations manager in a larger firm or by starting their own contracting business. The primary purpose here shifts from hands-on tools work to overseeing service delivery, business operations, and client relationships. A service manager or owner ensures that the field team runs efficiently and that the business aspects are handled properly. Key tasks include planning and scheduling jobs, providing technical support and decision-making for challenging jobs, managing customer accounts and quotations, and maintaining compliance from a business perspective. Additionally, this role involves staff management duties such as recruiting and training new technicians or apprentices, conducting performance checks, and sometimes handling billing and financial tracking if it is a small business. People in these positions often hold their Certificate III and trade licences but have pursue further qualifications in business management or project management. While not all service managers remain actively involved in daily technical work, their solid grounding in the trade is crucial as it earns the respect of the team and credibility with clients, and it informs sound decision-making on technical and safety matters. This role is included in the functional mapping because it is a common career progression for senior technicians and it influences how technical functions are carried out through leadership and resource allocation.

**Table 7: Functional map of the HVAC R occupation.** *This diagram illustrates the key **job roles** (Apprentice, Qualified Technician, Senior/Specialist, Manager) and the **core functions** they perform.*

| Core function | Apprentice HVAC R mechanic | Qualified HVAC R technician | Senior / Specialist HVAC R technician | Service manager / HVAC R business owner |
|---|---|---|---|---|
| Install and commission HVAC R systems | Assists with installation and commissioning tasks under direct supervision. | Independently installs and commissions systems within scope of work. | Undertakes complex installations and oversees commissioning quality. | Oversees planning, resourcing, and delivery of installation and commissioning work. |
| Maintain and service HVAC R systems | Assists with routine servicing and maintenance under supervision. | Independently performs routine and non-routine maintenance and servicing. | Resolves complex maintenance issues and sets technical approaches. | Oversees service delivery models, performance standards, and client outcomes. |
| Diagnose and repair faults | Observes and assists with fault diagnosis; completes basic fault-finding with guidance. | Independently diagnoses faults and completes repairs across a range of systems. | Acts as technical escalation point for complex fault diagnosis and rectification. | Provides technical oversight and decision-making support for critical issues. |
| Ensure safety, regulatory, and environmental compliance | Follows safety, electrical, and environmental procedures under supervision. | Ensures compliance with refrigerant handling, safety, and regulatory requirements, including safe work practices for A2L and A3 refrigerants where present in equipment serviced. | Leads compliance on complex jobs and ensures team adherence to standards. | Maintains organisational compliance systems and licensing obligations. |
| Manage work documentation and customer interactions | Completes basic documentation and supports customer interactions with guidance. | Manages job documentation, service records, and routine customer communication. | Manages complex client interactions and supports technical scoping. | Manage contracts, quotations, client relationships, and service quality. |
| Coordinate, supervise, and direct HVAC R work | Not applicable. | May provide informal support to apprentices. | Coordinates work, supervises staff, mentors technicians, and ensures quality control. | Plans workforce capability, recruits staff and allocates resources. |

The functional mapping above provides a clear, role-by-role breakdown of what the HVAC R workforce does. It makes explicit the major functions that any updated training must cover for example, every qualified technician must be able to install and commission equipment, service and maintain systems, troubleshoot and repair faults, follow safety and regulatory procedures, and communicate effectively.

By visualising these functions and sub-tasks against each role, the analysis ensures that subsequent qualification development can be tightly aligned with actual job practice. In the next section, mapping to qualifications, we will examine how the current UEE32225 Certificate III units of competency correspond to these identified functions and sub-functions, identifying where the existing training supports the required skills and where gaps or misalignments may exist. This will lay the groundwork for targeted recommendations to realign the qualification with industry needs.

**Figure 4: Functional map of the HVAC R occupation.** *This diagram illustrates the key **job roles** (Apprentice, Qualified Technician, Senior/Specialist, Manager) and the **core functions** they perform.*

| Install and commission systems | Maintain and service systems | Diagnose and repair faults | Ensure safety, regulatory, and environmental compliance | Manage work documentation and customer interactions | Coordinate, supervise, and direct HVAC R work |
|---|---|---|---|---|---|
| • Install HVAC R equipment and components<br>• Commission systems to specifications<br>• Verify performance and operation | • Conduct routine servicing<br>• Inspect, test and adjust components<br>• Perform preventative maintenance | • Identify faults and isolate causes<br>• Rectify mechanical and electrical faults<br>• Recover and return systems to service | • Apply WHS and risk controls<br>• Comply with refrigerant handling requirements<br>• Meet regulatory and environmental obligations | • Complete job documentation and service records<br>• Communicate with clients and stakeholders<br>• Coordinator work, information and handovers | • Provide informal support to apprentices<br>• Coordinate work, supervise staff, mentor technicians and quality control<br>• Plan workforce capability and staff recruitment practices |

# Mapping to qualifications

Mapping the HVAC R functions and sub-functions to the *UEE32225 Certificate III in Air Conditioning and Refrigeration* was undertaken to highlight how well the current training product aligns with industry requirements, and to pinpoint areas needing improvement. By comparing the core job functions identified in the functional analysis with the units of competency in the qualification (both core and elective), this mapping ensures that foundational skills for essential tasks are addressed and that specialised or emerging capabilities for advanced roles are considered. The analysis confirms that while the qualification provides a strong grounding in traditional trade skills, there are notable gaps in coverage of modern technologies and workplace skills that have become important in the industry. Table 8 below summarises the alignment between key HVAC R job functions and the training package, indicating whether each function is well covered, partially covered, or weakly covered/not covered in the current qualification, and noting how that content is currently delivered.

**Table 8 : Mapping of HVAC R functions to UEE32225 Certificate III in Air Conditioning and Refrigeration**

| HVAC R Job Function | Coverage in UEE32225 (Core/Elective/Other) | Alignment & Observations |
|---|---|---|
| Installation & basic commissioning such as mounting equipment, connecting refrigeration pipework, basic electrical hook-up, initial system start-up, and testing. | **Well covered**<br><br>**(Core units)**<br>The qualification's core covers installation skills in-depth such as brazing and pipe fitting, electrical wiring basics, component placement. Basic system commissioning and decommissioning procedures are included in core competencies. | **Strong Alignment:**<br><br>Apprentices learn to install split systems, ducted units, and simple commercial systems under supervision and core units ensure they can properly evacuate and charge systems, test for leaks, and perform initial start-up checks. Evidence from job ads shows installation is a fundamental expectation, which the Certificate III addresses thoroughly. Advanced commissioning tasks like complex air-balancing or programming control setpoints are touched on only at a basic level; those high-level skills are typically acquired through experience or post-trade training. |
| Maintenance & routine servicing – scheduled inspections, cleaning, filter changes, performance tuning, minor adjustments, and part replacements. | **Well covered**<br><br>**(Core units)**<br><br>Multiple core units focus on performing routine maintenance and service procedures safely and effectively. These include checking system operation, cleaning components, | **Strong Alignment:**<br><br>The qualification reflects that preventive maintenance is core trade work. Every apprentice is trained in servicing common HVAC R equipment such as cleaning coils, lubricating motors, checking refrigerant levels and in following maintenance schedules. Job advertisements frequently list maintenance experience, and interviews confirm this skill set is well instilled by training. Newly |

| | | |
|---|---|---|
| | replacing consumables, and making standard adjustments. | qualified technicians are competent in routine servicing tasks, which form much of their early work. |
| Fault diagnosis & repair – troubleshooting malfunctions, systematic fault-finding, and repairing or replacing faulty components. | **Partially covered**<br><br>**(Core units + on-the-job)**<br><br>Core units introduce fault-finding principles and require demonstrating the ability to diagnose and rectify basic faults.<br>However, complex diagnostics integrating multi-fault scenarios and advanced control issues heavily rely on the on-the-job exposure and therefore there is limited structured practice of complex fault scenarios within the qualification. | **Moderate Alignment***:*<br><br>Basic fault diagnosis is taught for example how to use multimeters or gauges to identify issues, common fault symptoms, but employers report new graduates often lack depth in troubleshooting. As observed in interviews, many apprentices qualify without sufficient hands-on experience in diagnosing difficult or uncommon faults – *"fault-finding skills are still developing when they finish"* (RTO Training Representative). The mapping shows a gap which could be addressed through expanded fault simulation in training could strengthen this area, so graduates meet the high industry demand for independent diagnostic ability. |
| Refrigerant handling & management – safe handling of refrigerants, recovery, leak detection, charging systems, and understanding refrigerant properties/environmental rules. | **Well covered**<br><br>**(Core units)** for common refrigerants; **Weak coverage** for new refrigerants (Elective only).<br><br>Core units comprehensively cover safe handling of standard refrigerants and adherence to Ozone Depleting Substances (ODS) & Synthetic Greenhouse Gases (SGGs) regulations fulfilling requirements for the national Refrigerant Handling Licence. Emerging refrigerants are addressed only via optional elective units, which many | **Mixed Alignment:**<br><br>Foundational refrigerant practices are strongly taught where every graduate learns to handle, reclaim, charge and store refrigerants like R-410A or R-134a safely, and understands the environmental legislation. However, new refrigerants and systems are largely absent from core training. The functional analysis found increasing industry use of natural refrigerants and A2Ls, but an apprentice could qualify without ever working with or studying these substances. This gap is increasingly material given the rapid uptake of A3 hydrocarbon refrigerants in low-charge self-contained equipment and heat pump products, where servicing and recovery practices require additional flammability risk controls. Stakeholders flagged this as a concern: *"$CO_2$ and hydrocarbons are becoming mainstream, but training barely covers them"* (Industry Regulator). |

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| | apprentices do not undertake. | Mapping identifies this as a key gap to be closed for the qualification to remain current. |
| Electrical and control systems – integrating and wiring HVAC R controls, understanding control circuits, basic programming of thermostats or controllers, and interfacing with Building Management Systems (BMS). | **Partially covered**<br><br>**(Core units + Elective)**<br><br>Core units provide a solid grounding in electrical safety and basic control circuitry for example wiring motors, connecting thermostats, reading simple schematics sufficient for a Restricted Electrical Licence.<br><br>However, advanced controls and automation using digital controllers, BMS integration, PLC programming are only available in elective units that few apprentices choose, if offered at all by RTOs | **Moderate Alignment:**<br><br>The qualification ensures every technician has the essential electrical skills to install and troubleshoot standard control components such as contactors, relays, sensors and how to work safely on circuits. This aligns with the job need for electrical cross-skilling. Yet, the mapping shows a shortfall in digital control proficiency: modern skills like navigating BMS software or configuring variable-speed drives are not guaranteed learning outcomes. Industry feedback emphasises that “without digital skills, a tech will struggle with modern HVAC R” (Industry Association Representative).<br><br>Currently, apprentices gain those skills ad hoc or via post-trade learning, indicating an opportunity to integrate more control systems training into the core training. |
| Safety & regulatory compliance – work health and safety (WHS), electrical safety procedures, working at heights/confined spaces, adherence to standards, and completing compliance documentation. | **Well covered**<br><br>**(Core units)**<br><br>Core units embed fundamental safety practices, risk assessments, use of PPE, isolation procedures and cover the broad regulatory framework related to environmental laws and basic electrical regulations. | **Good Alignment** *(with gaps):*<br><br>The apprenticeship robustly instils a safety-first mindset and ensures legal compliance basics are second nature which aligns with employer expectations that graduates work safely. For instance, training covers safe refrigerant recovery and correct electrical isolation, which are mandatory competencies. Gaps emerge in the finer points of compliance: the functional analysis found that newly qualified technicians often lack familiarity with certain standards; one employer noted *“None of our apprentices get shown AS1851 fire damper maintenance standard in training”*, meaning they must teach it internally (HVAC Service Manager). The mapping suggests incorporating more explicit reference to standards and codes in |

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| | | training to ensure graduates are aware of the rules governing their work beyond the general WHS law. |
| Documentation, reporting & standards– reading technical drawings, writing service reports, completing logbooks, and following industry codes of practice. | **Partially covered**<br><br>**(Core units)**<br><br>The qualification includes some training in interpreting drawings and specifications, and apprentices practice writing basic service reports or job cards as part of their assessments. But formal training on detailed documentation such as commissioning sheets, compliance forms but deep familiarity with codes of practice are limited. These skills are often honed via workplace processes rather than explicit classroom focus. | **Moderate Alignment:**<br><br>Basic documentation skills are addressed through the apprentices learn to fill out simple job documentation and read manuals, aligning with the administrative aspect of the job. Yet, the mapping shows room for improvement: comprehensive professional documentation for compliance or handover to clients is crucial in industry but currently relies on mentorship and company templates to develop. Likewise, while core units implicitly require following manufacturers' specifications and standards, there is no dedicated unit on codes of practice. Strengthening this link in training requiring apprentices to use actual Australian Standards excerpts during assessments would reinforce document literacy and professional practice expected by employers. |
| Customer service & client communication – interacting with clients, understanding customer needs, explaining technical information in simple terms, and delivering professional service. | **Weakly covered**<br><br>**(Elective only)**<br><br>Customer service and communication skills are not a core part of UEE32225. The training package offers a customer service unit imported from the business training package as an elective, but it is not mandatory and many RTOs/employers opt for technical electives instead. Thus, most apprentices receive no formal training in customer relations or | **Poor Alignment:**<br><br>Despite being frequently listed in job ads and highlighted by employers as critical skills for technicians these workplace skills are largely left to chance in training. The functional analysis identified this as a shortfall: graduates can be technically sound yet underprepared for the customer-facing side of the role. Interviewees recounted that some new tradespeople struggle with client interaction initially indicating a gap in confidence-building within the qualification. Including customer service training as a core element or integrating such scenarios into technical units would better align the |

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| | communication, learning these skills informally on the job. | qualification with real job performance requirements. |
| Professional practice & industry knowledge – managing work tasks, teamwork, business fundamentals, ethical practice, and continuous learning. | **Partially covered**<br><br>**(Implicit in core + on-the-job)**<br><br>Elements of professional practice like working effectively in teams, time management, and awareness of the trade's scope are woven indirectly into the apprenticeship experience and some basic units. There is no explicit unit on business or professional ethics in the core; some electives for small business skills exist but are rarely chosen within this trade. Most apprentices gain professional habits of punctuality, workplace communication, learning culture through their employers' guidance rather than formal training. | **Moderate to Weak Alignment:**<br><br>The qualification's primary focus is technical; broader professional skills such as understanding how to run a small contracting business, or legal obligations as a contractor, or pursuing continuing professional development receive minimal formal coverage. Given that many technicians eventually become **c**ontractors or team leaders, this represents a forward-looking gap. The functional analysis suggests that topics like basic business management, leadership, or mentoring could be offered as post-trade or elective skill sets. While the core Certificate III is not expected to produce business managers, ensuring apprentices at least grasp the career pathway and professional responsibilities would round out their preparation. Currently, these insights are predominantly learned through on-the-job socialisation and experience. |

As shown in Table 8, the Certificate III provides strong foundational coverage for many of the day-to-day technical functions of an HVAC R technician. Core skills align well with what industry expects from an entry-level tradesperson and are consistently addressed by the mandatory units of competency. However, the mapping also reveals several critical gaps and weaknesses in the current qualification:

- **New and emerging technical skills:** Areas like advanced fault diagnostics, low-GWP refrigerants and digital control systems/BMS are insufficiently covered. They tend to be left to elective units or post-qualification learning, meaning many graduates do not acquire these competencies during their apprenticeship. Given the growing importance of these skills in the job market, this is a significant misalignment. The evidence from job ads and interviews supports the need to bring these topics into the core or otherwise ensure broader exposure during training.
- **Workplace skills and customer engagement:** The qualification currently makes little provision for workplace skills development. Communication, client service, and teamwork skills, though essential in practice, are not explicitly taught unless an employer selects the optional customer service unit. The functional analysis highlighted that this gap could impact on a graduate's effectiveness and employer satisfaction in early roles. The mapping underscores the opportunity to embed these professional skills into the training either by making the customer service unit core or by integrating workplace skill elements into technical units of competency.

- **Standards, regulatory knowledge, and licensing clarity:** While general safety and environmental compliance are covered, the **specific industry standards and licensing frameworks** that regulate HVAC R work are not explicitly addressed in the training product. New technicians may not fully understand the scope of work their licence allows or the details of standards they must follow. For example, awareness of standards for ventilation hygiene or fire dampers, or the nuances of differing state licence requirements, often comes only through workplace exposure. The mapping suggests that incorporating these topics as underpinning knowledge of relevant units would improve graduates' job readiness and confidence in compliance matters.
- **Reliance on electives and on-the-job training:** Several competencies that are becoming central to the trade are currently relegated to electives or assumed to be learned informally. This includes critical modern skills like working with cutting-edge refrigerants and complex control systems, as well as non-technical skills like customer communication. Because electives are not consistently delivered across RTOs and many apprentices complete only the minimum elective points focused on technical extensions like core skills, there is a risk that graduates emerge with gaps in these high-need areas. On-the-job training will always play a role in skill development, but the qualification should not leave systematic gaps that rely on chance workplace experience to fill. The findings reinforce that the training package should be updated to make these competencies more accessible to all apprentices by moving important electives into core or expanding core unit scope so that industry requirements are uniformly met.

In summary, the mapping exercise confirms that UEE32225 is a solid foundation for the HVAC R trade's traditional scope, but it also validates industry concerns that the qualification has not fully kept pace with change. The core units ensure that essential technical skills and safety practices are taught, which is reflected in graduates' ability to handle installations, basic servicing, and standard fault repairs, but they do not guarantee exposure to newer technologies, advanced diagnostic thinking, or client-facing skills. These gaps, identified through evidence-based functional analysis, present clear opportunities for improvement. The recommendations and next steps will propose targeted updates and enhancements to the training package to address these gaps, thereby improving the qualification's relevance, currency, and alignment with the evolving needs and practices of the HVAC R industry.

# Recommendations and next steps

## Recommendations for updates in qualifications and units

Based on the functional analysis findings and the mapping of job requirements to the current training, the following recommendations are proposed to update the *UEE32225 Certificate III in Air Conditioning and Refrigeration* and its associated units. These updates aim to ensure alignment with industry needs, address identified skill gaps, and incorporate stakeholder feedback:

- **Embed emerging refrigerant and sustainability skills in core training.** Update the qualification to include mandatory coverage of low-GWP and natural refrigerants, including A2L and A3 flammable refrigerant where relevant to current and emerging equipment and their safe handling. This may involve elevating existing elective content on natural refrigerants into core units or developing new core competencies focused on modern refrigerants and system sustainability. This change will support national safety and environmental goals by ensuring all new technicians are aware of and capable of working with alternative refrigerants from day one of trade qualification rather than encountering them for the first time post-qualification.

- **Enhance digital controls and building automation competencies.** Develop new training package content that focuses on HVAC control systems, Building Management System (BMS) integration, and IoT-enabled equipment. The current Certificate III includes a basic PLC programming unit, but it is not tailored to HVAC R applications and does not cover common industry control protocols such as BACnet/Modbus or modern energy management practices. Introducing one or more new units or a specialised “HVAC digital controls and automation” stream would ensure apprentices gain exposure to programming setpoints, interfacing with BMS, and using software-based diagnostic tools. This reflects the rise of smart building technologies and will equip graduates with the digital literacy now required in the trade.
- **Strengthen training in advanced diagnostics and commissioning.** To address the gap in complex fault-finding skills, incorporate a dedicated unit on advanced troubleshooting and system commissioning. This would require apprentices to diagnose multi-faceted faults and perform end-to-end system commissioning in a realistic scenario. By bolstering the systematic fault-finding and performance-optimisation training, graduates will be better prepared for the independent problem-solving demanded by employers. This could involve simulated fault scenarios during off-the-job training and an expectation of documented workplace evidence of diagnostics performed during the apprenticeship. Emphasising these high-order skills in the qualification will directly respond to employer concerns about new technicians’ confidence and ability to troubleshoot complex issues.
- **Mandate customer service and communication training.** Ensure that workplace skills development is a guaranteed outcome of the apprenticeship by incorporating formal training in customer relations, communication, and professional conduct. This could be achieved by making the existing elective unit on customer service a core requirement or by embedding customer-engagement elements into multiple core units. Every apprentice should practice skills such as explaining technical information in plain language, handling customer inquiries or complaints, and working effectively in teams. By requiring customer service competence, the qualification will produce more well-rounded tradespeople who can meet the industry’s client-service expectations and work smoothly in diverse workplace settings.
- **Align qualification content explicitly with licensing and standards.** Revise the Certificate III and its units to more explicitly link the skills to relevant licensing requirements and safety standards. In practice, this means updating units of competency to reference current Australian Standards more explicitly and to include knowledge of jurisdictional licensing frameworks for occupational licensing outcomes, where applicable. The qualification’s documentation should clearly delineate what licence outcomes or pre-requisites it provides, for instance, highlighting that completion of UEE32225 leads to the national Refrigerant Handling Licence and meets the Restricted Electrical Licence criteria. Emphasising compliance knowledge and licensing clarity within the training product will ensure graduates understand the regulatory context of their work and help them transition more smoothly into fully licensed roles without surprise gaps.
- **Reconfigure elective groups to cover high-priority skills.** Restructure the elective component of the qualification to better support industry-relevant specialisations and emerging skill areas. For example, create defined elective streams or mandatory elective groups that cover:
    - **Advanced refrigeration technologies:** including natural refrigerants and ultra-low GWP technologies, so that even if not all these units become core, every apprentice must complete at least one substantial unit in this area.
    - **Advanced controls and energy efficiency:** focusing on BMS, smart controls, and energy optimisation techniques, reflecting the specialisation needs of commercial HVAC controls technicians.
    - **Business and project fundamentals:** such as basic contracting, project planning, or supervisory skills, for those aiming to become leading hands or small business operators’ post-qualification. By guiding elective choices in this way, RTOs and employers can tailor the apprenticeship to the apprentice’s work context, while still covering critical new

competencies. It also ensures key topics are not entirely left out, for instance, an apprentice would not be able to complete the course without some exposure to either advanced refrigeration or advanced controls, as opposed to the status quo where they might inadvertently bypass both by taking only closely related basic electives.

- **Investigate a structured post-trade pathway or embedded higher-level skills.** Considering the growing complexity of the trade and the common requirement for post-qualification experience, consider strategies to extend and deepen the training pathway. One approach is developing a more seamless link from the Certificate III to a higher-level VET qualification. This approach would support career progression, enabling new tradespeople to more rapidly attain the expertise for senior or specialised roles.

By implementing these recommendations, the UEE32225 qualification and its units can be modernised and optimised to produce work-ready graduates who possess both the fundamental trade competencies and the new skills required in today's HVAC R field. These changes will help bridge the gap between training and employment expectations, support national objectives in safety and sustainability, and ensure the training package remains responsive to technological evolution in the industry.

# Next Steps

Following this functional analysis, the training package review process will move forward to turn these findings into concrete updates to the qualification:

- **Technical committee and Subject Matter Expert review and drafting:** Powering Skills Organisation (PSO), in collaboration with its Electrotechnology Industry Technical Committee and HVAC R subject matter experts, will examine the above recommendations and develop draft revisions to the *Certificate III in Air Conditioning and Refrigeration* and its component units. This will include drafting any new units or modifications and updating qualification documents to reflect improved licensing and standards alignment.
- **Public consultation on draft training products:** Once initial revisions are prepared, draft training products incorporating the proposed updates will be released for stakeholder feedback. A national consultation process will then be undertaken, engaging a wide range of stakeholders, including RTOs delivering HVAC R training, industry employers and small business owners, peak bodies like AIRAH and AMCA, ARC, jurisdictional electrical regulators and individual subject matter experts such as experienced technicians and trainers. Through workshops, webinars, and public feedback submissions, these stakeholders will review the draft qualification and units to ensure the changes are practical, industry-informed, and fit for purpose.
- **Refinement and endorsement:** Feedback from the consultation will be collected and analysed. The draft training products will be refined accordingly to address valid concerns or suggestions raised by stakeholders. PSO, technical committee and the HVAC R SME group will then finalise the revised qualification and units. The final step will be to submit the updated training package components for formal endorsement through the national training package governance process.

By following this structured development and consultation process, the updated HVAC R training products will reflect a broad consensus and expert validation. This approach ensures that the revised Certificate III qualification and its units are robust and relevant, meeting the current and emerging needs of the HVAC R sector. The outcome will be a training package that better prepares new technicians for the challenges of the trade, while also satisfying the expectations of employers, regulators, and the wider industry.

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# Appendix A – Interview questions

## Participant : Apprentice

**Questions included:**

1. The report says that many new workers feel unsure about working with electronic controls, speed controls, and setting up complicated systems like special air conditioners or refrigeration equipment in supermarkets.

   Question for you: When you think about your training and the work you've done so far, what parts of fixing or setting up equipment make you feel the least ready?

   Follow-up question: What kinds of jobs make you most worried to do by yourself, and why?

2. **Different Types of Systems You've Worked On**

   People in the industry said that trainees usually get to work a lot with home air conditioning units, but they don't get as much practice with bigger systems used in businesses, factories, and systems that use natural refrigerants.

   Question for you: What types of cooling and refrigeration systems have you actually worked on so far? What parts of the job do you feel like you're not getting enough practice with during your training?

3. **Using Computers and Following Rules**

   The survey found that many trainees need more help with using computers, working with diagnostic software (programs that help find problems), and understanding standards and safety requirements.

   Question for you: Can you tell us about a recent job where you had to use computer tools or follow Australian Standards (official rules)? What made it hard for you to feel fully confident doing that work?

4. **Communication and Work Skills**

   Employers said that workplace skills like talking with customers, managing your time, and having a good work attitude are often not well developed by the end of training.

   Question for you: Which of these everyday work skills have been hardest for you to learn? How has your training provider and workplace helped you (or not helped you) get better at them.

## Participant: Employer

**Questions included:**

1. Thinking about the apprentices you've had in the last five years, which specific technical tasks or system types (for example supermarket $CO_2$, central plant, VRV/VRF, natural or flammable refrigerants) do you most often find yourself having to 'teach from scratch' after they finish their formal training, and what impact does this have on your business?

2. The report highlights that many graduates are less confident in areas like electronic controls, variable speed drives, commissioning, and energy efficiency. In your day-to-day operations.

   Where do you see these capability gaps showing up most clearly, and how do you currently manage the associated risks, delays, or rework?

3. Employers and RTOs both identified digital literacy and use of job management software, diagnostic tools, and electronic reporting as weak points.

How well prepared are your current apprentices and recent graduates to work with the digital tools your business relies on?

Follow up question: What additional support or changes to training would make the biggest difference from your perspective?

4. There is strong feedback in the report about gaps in generic workplace skills such as communication, customer service, time management, and safety culture.

When you reflect on your apprentices and new tradespeople, which behaviours or 'soft skills' cause the most concern, and what approaches (either in your workplace or in formal training) have you seen work well to lift these?

5. The report notes structural issues such as regional access to training, inconsistent licensing requirements, and concerns about the Certificate II and current qualification pathways.

From your experience, what aspects of the current system (licensing, course structures, duration, delivery models, post-trade options) most limit your ability to grow and utilise your workforce effectively, and what changes would you prioritise if you could redesign the system?

# Participant: RTO educators

**Questions included:**

1. The report notes that recent apprentices often lack practical experience with complex systems such as supermarket CO2, central plant, industrial refrigeration, and advanced controls, while training is heavily skewed to domestic split systems.

How does your delivery model intentionally structure exposure and assessment, so apprentices get meaningful, repeated practice on these more complex and emerging system types, not just domestic work?

2. Industry feedback highlights gaps in digital literacy, use of diagnostic software and tools, and integration of AI/IoT-enabled controls into training.

In what ways are you currently embedding contemporary digital tools, smart controls, and data-driven diagnostics into your learning resources, assessments, and workshop equipment, and what changes are you planning over the next 1–3 years?

3. Respondents expressed concern that electrical competencies, safety and compliance knowledge, and application of Australian Standards are not at the depth needed for current practice, particularly around natural and flammable refrigerants.

How do you ensure that units covering electrical work, standards, and refrigerant safety are taught and assessed to a level that genuinely reflects contemporary field expectations and licensing requirements?

4. The report points to variability in training quality across regions, limited access for regional and remote apprentices, and a shortage of current, industry-experienced trainers.

What strategies does your RTO use to maintain consistency of quality across campuses or delivery sites, support regional access (e.g. block release, mobile trainers, partnerships), and keep trainers' technical skills and industry knowledge up to date?

5. Stakeholders described misalignment between qualification outcomes and employers' expectations, including weak development of workplace skills such as communication, customer service, time management, and professional conduct.

How do you systematically gather and act on employer feedback about graduate capability, and how are you deliberately designing learning and assessment to build these 'generic' workplace skills alongside the technical HVAC-R competencies?