HVAC R industry sector survey results

A co-design survey with HVAC R peak bodies, AIRAH, ARC and AMCA

Understanding the needs of the industry for HVAC R qualification updates.

Powering Skills Organisation Ltd

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Recognition is also given to the Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH), Australian Refrigeration Council (ARC) and the Air Conditioning and Mechanical Contractors Association of Australia Limited (AMCA) for their support in distributing the survey and facilitating sector-wide engagement. Their commitment to workforce development and qualification improvement has enabled this report to present a broad, representative view of industry needs and priorities. The contributions of all individuals and organisations involved have been fundamental in shaping the recommendations and conclusions, supporting the advancement of education and training standards within the HVAC R sector.

Executive Summary

Powering Skills Organisation (PSO) in conjunction with the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH), Australian Refrigeration Council (ARC) and the Air Conditioning and Mechanical Contractors Association of Australia Limited (AMCA) co-designed an industry specific survey for the Heating, Ventilation, Air Conditioning and Refrigeration (HVAC R) industry to ascertain what industry needed for future iteration of training products within the UEE Training Package.

Using a mixed method approach to assessing these needs, PSO, AIRAH, ARC and AMCA published a survey that was distributed by all parties between 8 July 2025 and 23 August 2025 and was available for seven weeks for public consultation. The survey yielded 526 responses from a cross sector of industry, including, small, medium and large employers, union organisations, industry associations, regulatory bodies and registered training organisations (RTOs).

Key insights reveal that most responses were provided by small business employers located in metropolitan regions. Most businesses operate across multiple HVAC R system types and applications including domestic, commercial, industrial refrigeration sectors, and included, mining, transport and defence, highlighting the technical diversity of the HVAC R workforce.

The survey identified strong dependence on hydrofluorocarbon refrigerants, increasing engagement with flammable and natural refrigerants, and widespread multi-licensing among technicians. Safety, testing, and diagnostic activities were dominated by work on electronic controls and commissioning tasks, reflecting a shift towards technologically complex systems.

Feedback from employers and RTOs highlights pervasive gaps in apprentice and graduate training, particularly in exposure to modern systems, practical competencies, advanced controls, and emerging technologies such as artificial intelligence (AI) and Internet of Things (IoT). It was further noted that gaps in training related to digital literacy, energy management, and workplace skills such as communication and customer service do not adequately support a graduate to work effectively within the HVAC R industry upon completion of their qualification.

Jurisdictional inconsistencies in licensing, regional access limitations, and variation in qualification recognition contribute to barriers for workforce mobility, productivity and business efficiency. Qualifications such as the Certificate III and Diploma level pathways are seen as outdated, lacking in specialisation and practical rigour, and misaligned with current industry needs. The Certificate II in Split Air Conditioning and Heat Pump Systems is broadly recognised as insufficient for safe and competent trade practice.

This report’s recommendations focus on reforming qualification structures, expanding electrical competencies, increasing work-based and practical training, improving regional access, harmonising licensing standards, strengthening soft skill integration, and investing in educator development. Collaboration between industry, regulators, and training organisations is vital to

ensure training programs meet expectations and set clear pathways for career progression and technical upskilling.

In conclusion, the findings and recommendations provided in this report form a clear guidance for industry-wide reforms. Recommendations aim to address identified gaps to ensure education, training, and training products in the HVAC R sector support the industry needs now and into the future.

Introduction

The Australian refrigeration and air conditioning (HVAC R) industry stands at a pivotal moment, where rapid advances in technology, evolving regulatory frameworks, and dynamic market demands are reshaping both the expectations and capabilities of its workforce. This report undertakes a comprehensive analysis of the critical risk, competency, and training gaps currently facing HVAC R technicians, drawing upon an extensive survey of 526 respondents. As the HVAC R landscape continues to transition towards greater use of natural and flammable refrigerants, such as ammonia, CO_2, and hydrocarbons, industry technicians must navigate a broad range of matters.

Against this backdrop, evidence from the survey highlights industry concern about how current training products develop and support qualified and job ready technicians, whilst also providing clear career pathway and progression opportunities. This situation is compounded by the introduction of new refrigerant technologies, advanced controls, and integrated commissioning modules, leaving many recent graduates and technicians underprepared to address both safety-critical and operational challenges within commercial, domestic, and specialty applications, including marine, automotive, and agricultural systems. Employers report persistent difficulties in recruiting and retaining talent with the necessary skillsets, while regulators are faced with ongoing enforcement issues. Field auditors are also repeatedly identifying non-compliant practices, misidentified hazards, and procedural gaps.

This report is structured to provide a thorough appraisal of stakeholder feedback by HVAC R industry participants. The report is structured to cover, the methodological approach taken by PSO and partners and a comprehensive results section for each question posed to the participants. It provides a discussion section summarising the findings of the results and presents key recommendations related to training package development for PSO to consider when reviewing HVAC R qualifications.

Each section is anchored in the lived experience and detailed feedback of technicians, trainers, regulatory bodies, and industry experts, with the discussion portion offering an in-depth and critical evaluation of the challenges facing the industry. A thematic analysis of quantitative, and qualitative data is presented in this report, and the report aims not only to diagnose current industry vulnerabilities but also to identify actionable pathways towards improved safety, professional credibility, and regulatory coherence. In doing so, the report highlights both the urgency of training product reform and the larger strategic need for industry-wide alignment. As Australia's HVAC R sector looks ahead to increasing technological complexity, higher efficiency

standards, and a global skills shortage, this analysis provides a timely foundation for targeted interventions and evidence-based policy recommendations, ensuring technicians are equipped, and supported to meet the industry's evolving challenges with competence and confidence.

Methodology

A nationwide survey with a mixed-methods approach was adopted due to the geographical reach of stakeholders. The survey was open from 8 July 2025 and closed on 23 August 2025, meaning that stakeholders had seven weeks to respond. A coordinated approach was taken by all parties, where PSO, AIRAH, ARC and AMCA advised their respective networks of the opportunity to engage with the survey throughout this time. As a result of this coordinated approach, the survey yielded 526 responses from stakeholders which includes, employers, unions, employees, Industry Training Advisory Bodies (ITABs), Peak Industry Bodies RTOs and Regulators. PSO has taken a three-step approach to analyse the data, which is outlined below.

Stage 1: Protocol development and data collection

A protocol plan guided data collection to obtain pertinent information to address the questions posed to our stakeholders. Using established networks of AIRAH, ARC and AMCA the distribution of the survey was sufficient. In addition, PSO used various methodologies to gain feedback from PSOs established networks, which primarily included the use of social media posts, email sends and an established PSO monthly newsletter notification. As this survey is primarily focused on gaining a lived experience of those that interact with HVAC R qualifications and those that graduate and enter the industry with these qualifications, a review of grey literature was not deemed necessary at this stage.

Stage 2: Data coding and organisation

The findings of this survey in stage 1 were manually collated by PSO and discussed with the team before being confirmed and included into the discussion section. Open-text questions were classified for themes. Subject Matter Experts (SME) input was used to validate thematic coding, integrating regulatory alignment and national/industry standards perspectives.

Stage 3: Data analysis

Content analysis was used to sort information, all survey responses were read, and similar content was summarised and discussed under each question that was posed to participants. Outside the demographic questions, 14 questions were posed to participants. They are discussed below in the results section.

Results

This report explicitly reviews the commentary provided by the 526 respondents to the survey that was shared via established networks of PSO, AIRAH, ARC and AMCA within a seven-week

period between July and August 2025. To gauge an understanding the demographics of respondents, the first section of the results will focus on ‘who’ the respondents are to establish context.

Organisation type

Organisations that responded to the survey cover primary stakeholder groups that PSO engages with; this includes, employers, regulatory bodies, industry associations, RTOs (public, private and enterprise) and union representatives. By far most responses came from employers (73%) who have small businesses consisting of up to 10 employees (43%). The highest represented jurisdiction within the responses came from Queensland (25%) with most stakeholders stating they primarily service the metropolitan region (53%). When employers were asked how many apprentices, they employed 43% of the respondents stated that they do not employ apprentices whilst 37% of employers stated they employ 1-5 apprentices. This aligns with and reflects the response showing that most employers who responded to this survey were small businesses.

Most respondents indicated that their organisation works across the sector on all air conditioning applications, split systems, commercial, central plant, industry and other areas, such as underground mining ventilation and air conditioning, data centres, beverage, automotive, marine and transport air conditioning and refrigeration and mobile systems, hazardous areas HVAC R maintenance and cleaning of these systems. One participant noted they worked on air conditioning systems for Defence industry ships and submarines.

A further question was posed to respondents to identify the types of refrigeration applications their organisation works across. Again, most respondents stated that they worked across all areas of the sector, being domestic, commercial, supermarket and industrial. Others indicated that they also worked on refrigeration applications in the mining, oil and gas sectors, automotive and transportation, farm cold storage, hazardous areas, defence, specifically marine vessels, Cryogenics (medical) and hotel refrigeration.

Figure 1: Stakeholder group category

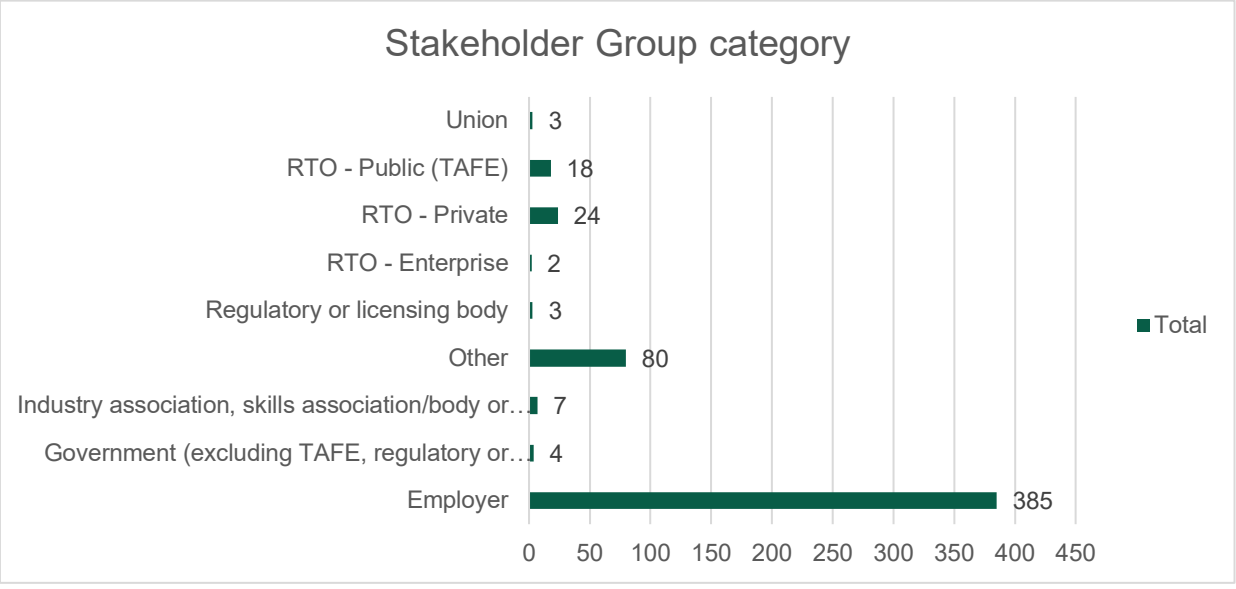

Figure 2: Business size (employee numbers)

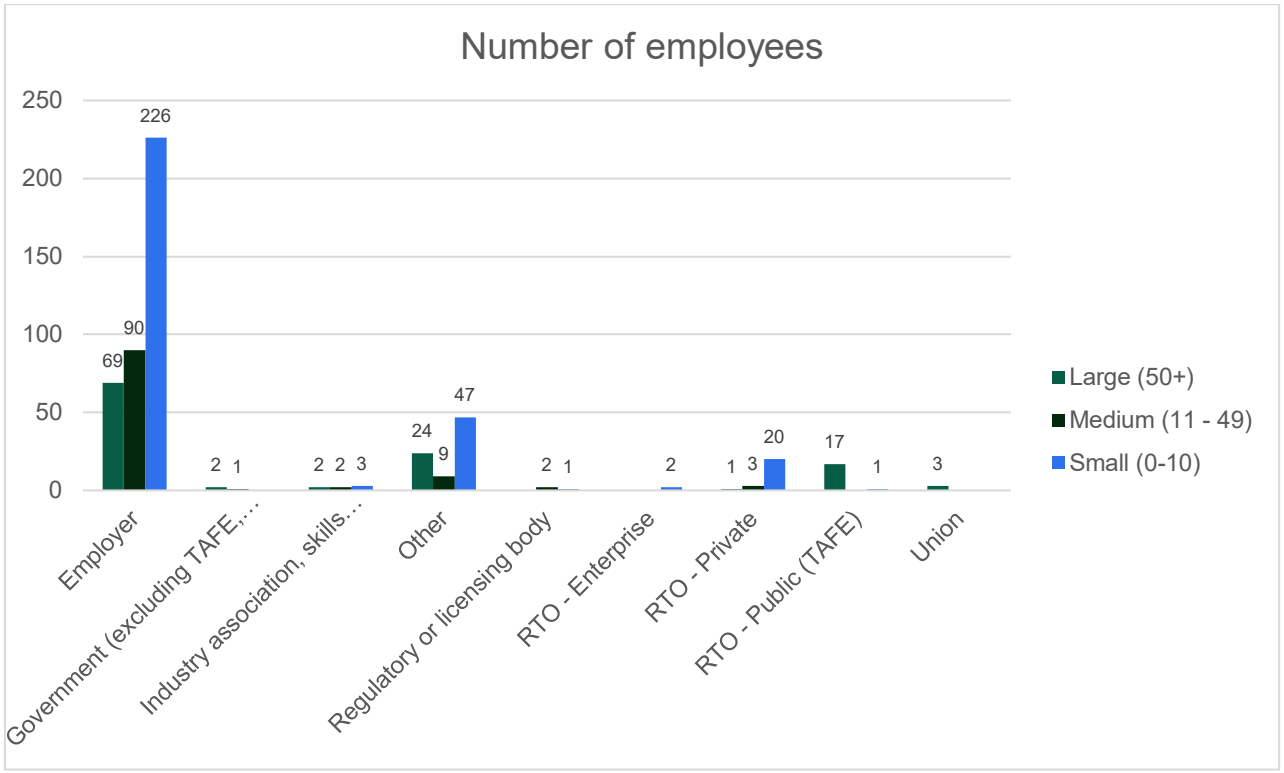

Figure 3: Apprentice currently employed.

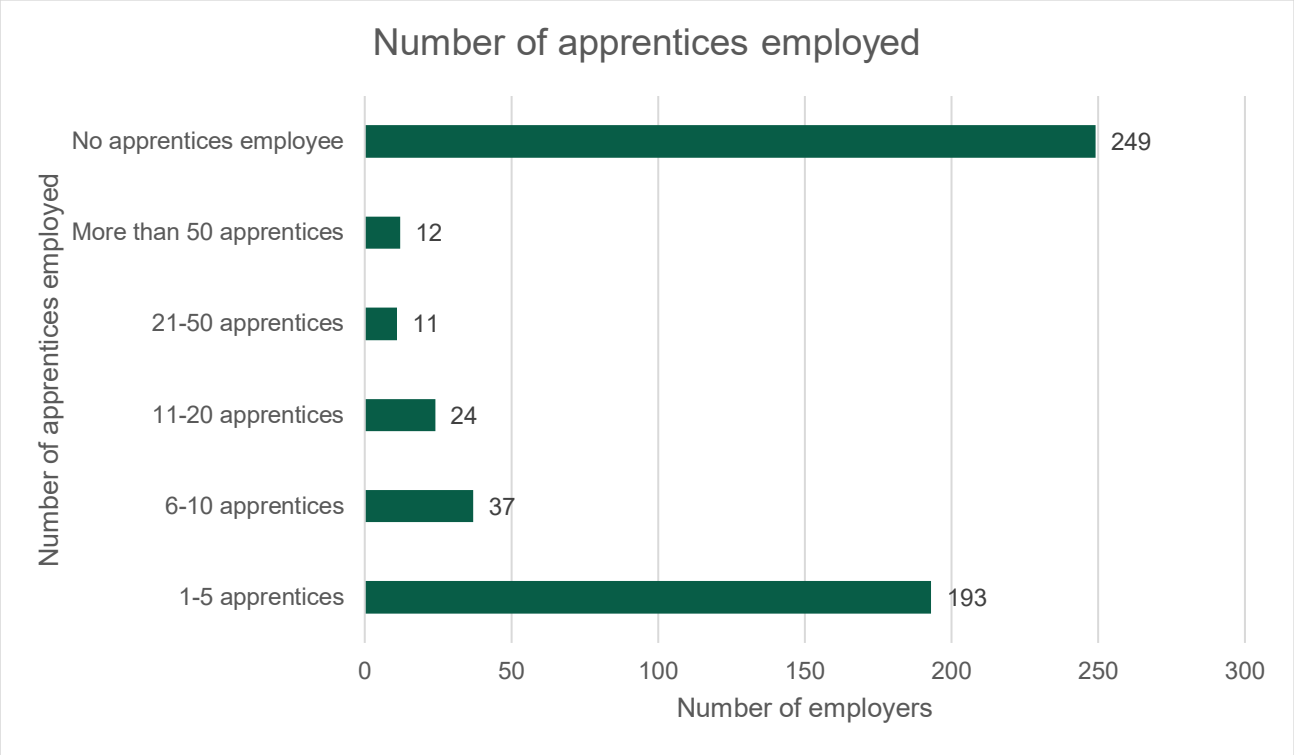

Figure 4: Geographical location HVAC R stakeholders

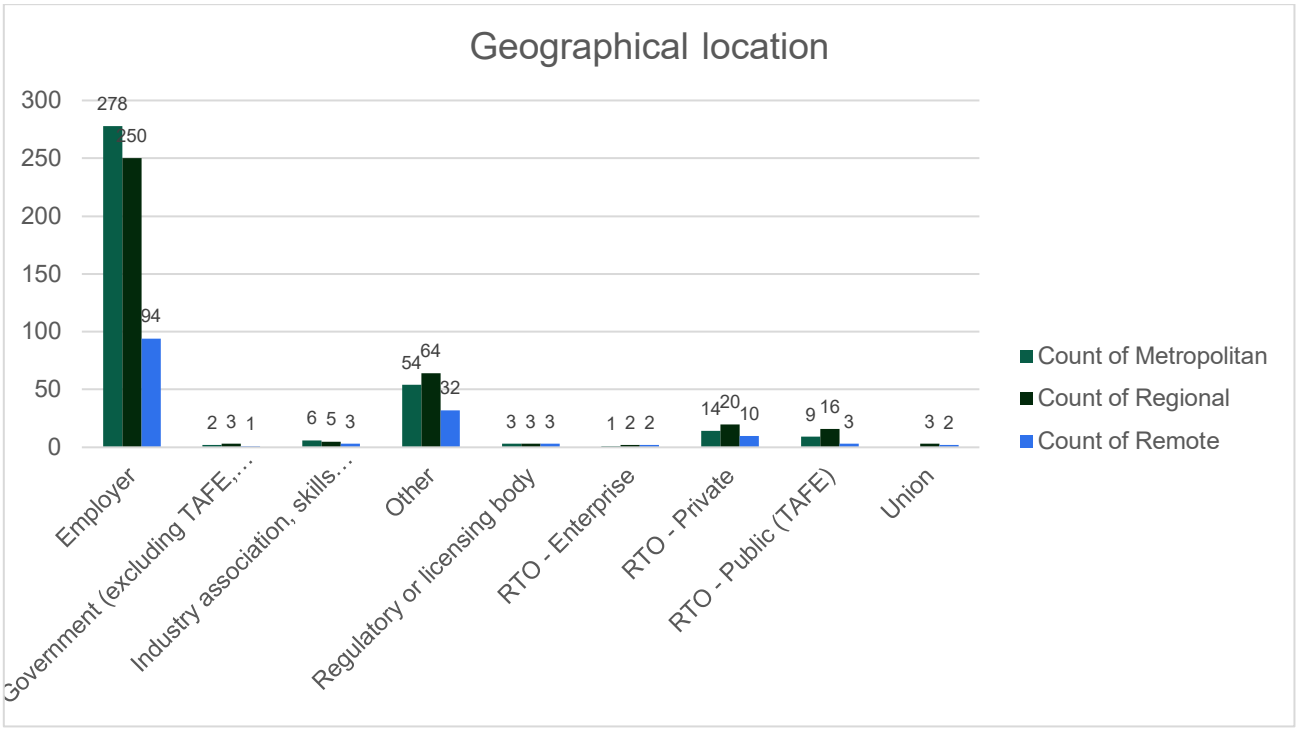

Figure 5: Jurisdictional location

Refrigerant type used by organisations.

Respondents were asked to identify the type of refrigerants their organisation works with on a regular basis. 96% of respondents identified that Hydrofluorocarbon (HFCs) was the refrigerant most handled and used, which includes Difluoromethane, R32 at 65.7%, followed by Hydrocarbons (HCs) at 38.7%.

Table1: Refrigerant types

Refrigerant Type	Count	Percentage value
Hydrofluorocarbon (HFCs)	507	96%
Difluoromethane, R32	346	65.7%
Hydrofluoro-olefins (HFOs)	91	17%
Hydrocarbons (HCs)	204	38.7%
Ammonia, R717	58	11%
Carbon Dioxide, R744	69	13%
Other	1	<1%

Refrigerant handling skills required.

Following on from the refrigerant types being used by respondents, respondents were asked to identify skills requiring further development for refrigerant handling based on the types that are generally handled within industry. Most respondents stated that further skill development was needed for handling flammable refrigerants (38.7%), followed by Carbon Dioxide (27.2%). A significant number of respondents handle multiple refrigerant types as part of their regular work.

Table 2: Further Skill development required for Refrigerant Handling

Skill development related to Refrigerant Handling	Count	Percentage
Flammable refrigerant	204	38.7%
Carbon Dioxide	143	27.2%
Fluorocarbon refrigerants	135	25.7%
Ammonia	104	19.8%

Safety, testing and fault finding activities primarily conducted.

Respondents stated that refrigeration and/or air conditioning mechanics/ technicians, who completed their apprenticeship in the last five years, lack and need additional safety, testing and fault-finding training in Electronic controls (24.3%), followed by Variable speed controls (23%), Commissioning (21.5), Energy Efficiency (19.5%) and Electrical (18.6%).

Table 3: Primary activities conducted requiring further skill acquisition.

Further Skill acquisition required areas	Count	Percentage
Electrical	98	18.6%
Electronic controls	128	24.3%
Variable speed controls	121	23%
Energy Efficiency	103	19.5%
Commissioning	113	21.5%

Natural Refrigerant systems

Respondents stated that refrigeration and/or air conditioning mechanics/ technicians, who completed their apprenticeship in the last five years, lack and need additional natural refrigerant systems training in Ammonia (20.90%) followed by Carbon Dioxide systems (17.70%) and Hydrocarbon systems 12.90%. Note that 48.5% did not respond.

Table 4: Natural Refrigerant system type being used and further skill acquisition required by apprentices.

Natural Refrigerant system type training needed	Count	Percentage
Ammonia systems	110	20.90%
Carbon dioxide systems	93	17.70%
Hydrocarbon systems	68	12.90%
Did not respond	255	48.5%

Gaps identified in training of apprentices in the last five years.

Respondents were asked to identify gaps in apprentice training in the last five years, including gaps related to new or emerging technological gaps. These gaps require further training to be undertaken either through non-accredited training or further on the job training by the employer for recent graduates. Areas of concerns that was noted included:

- Hot water heat pump system training especially with new technologies related to these systems.
- Exposure to complex supermarket refrigeration (carbon dioxide systems)
- Central Plant, chilled water and cooling tower systems

- Industrial and process refrigeration
- VRV/ VRF systems and controls related to installation, commissioning, diagnostics, and repair of these complex systems.
- Flammable and natural refrigerants, noting the correct identification, handling, installation and commissioning and safety procedures for these types of gases.
- Energy Efficiency and indoor air quality was noted as limited understanding related to energy recovery, demand-based optimisation, energy management interface programming and air quality monitoring as well as system upgrades for improved sustainability practices.
- Use of modern diagnostic and electronic tools and equipment such as digital gauges, commissioning tools, and diagnostic and commissioning software especially for understanding, diagnosing and repairing electronic components such as printed circuit boards (PCBs), electronically communicated (EC) fans and electronic expansion Valves (EEVs) and inverters.
- Artificial Intelligence (Ai) and Internet of Things (IoT) integration was noted by respondents especially with the rapid increase and adoption of Ai in predictive maintenance, fault diagnostics and remote monitoring and with IoT enabled controls for chilled water, variable refrigerant flow/ variable refrigerant volume systems (VRF/VRV) and integrated systems this was a significant gap in graduate skills and knowledge.

In addition to the gaps identified above, respondents noted that skill improvement was required in the following areas:

- Electrical competency, in terms of fault finding, safe disconnection practices, reading wiring diagrams, relays, contactors and electronic diagnostics. Digital literacy was further noted as an area of concern considering that the industry uses job management software and electronic diagnostics tools and digital reporting platforms to convey job outcomes.
- Newer technologies related to advanced control systems such as variable speed drives (VSDs), EC motors, electronic expansion valves (EEVs) modern building management systems (BMS), programmable logic controllers (PLC), SCADA controls as well as digital controllers, noting a deeper understanding of the diagnostics, software updates, system integration, programming and fault finding was needed.
- Basic refrigeration principles such as cycle operation, pressure and temperature relationships, superheat/subcooling and understanding flow/air distribution.
- Commissioning and advanced diagnostics
- Brazing and leak testing that is compliant with the Australian Standards
- Safety knowledge and installation rules for natural refrigerant and relevant risk management practices like fire damper certification.
- The application of the Australian Standards and compliance for the industry, including building, fire safety and environmental compliance standards for installation of equipment

was noted as a gap in knowledge. This was specifically related to hygiene and infection control and maintenance of systems to ensure safe use.

- Customer service, communication and work ethics was also noted as an area of concern, noting that professional communication, reporting, time management, self-motivation, empathy and understanding of the workplace role and planning responsibilities were missing within current training outcomes.

Noting the above, training and apprenticeship programs have been described by respondents as being too heavily focused on domestic split-system installations which has led to a lack of training for more complex refrigeration systems as well as a significant gap in training relating to new and emerging technologies. Furthermore, feedback suggests that recent air conditioning and refrigeration graduates lack substantial training in hydrocarbon and CO_2 systems, supermarket and large commercial refrigeration, central plant HVAC, advanced controls, transport refrigeration, electrical competencies, commissioning, and foundational theory and diagnostics. These comments and views have obvious implications for current and future training package review work.

It is also clear that respondents need graduates to have not only the technical skills but also what is commonly referred to as the generic workplace skills such as effective communication, being able to manage time effectively and provide good customer service. Overall, there was consistent concern about the quality and standard of work being produced by recent graduates and the need for employers to upskill recent graduates and a misalignment with the expectations of employers.

Recent graduates training gaps

Respondents were further asked to assess the outcomes of current and recent graduates (those that have graduated within the last 12 to 24 months). Key themes noted by respondents indicate the following concerns for the industry:

- Access to training opportunities within regional and remote communities – regional employers may not have access to appropriate training facilities, requiring them to send apprentices to the metropolitan area or larger regional centres for their training. This could add additional cost to the business due to transport and accommodation costs related to attendance for training to be completed.

- Inconsistency licensing requirements across jurisdictions and therefore limits the ability workforce mobility especially for those employers whose business may be on the border between jurisdictions. There is an extra compliance burden or an additional cost to the individual and or business to ensure technicians have the required licences and required understanding of licence requirements for every jurisdiction they operate within. It was noted that restricted electrical licences may restrict HVAC R technicians' ability to fully work on controls and wiring adding additional costs or delays associated with the engagement of electricians to complete part of the work required.

- Technical gaps noted including training is still skewed towards traditional refrigeration work and systems, meaning that recent graduates are not getting trained sufficiently on modern systems and technology.

- Emerging refrigerants, like flammable, hydrocarbons, natural refrigeration like ammonia and the specific handling and safety training requirements were noted as a gap.
- Practical skills like welding, pipework, brazing in complex environments, ductwork installation and mechanical troubleshooting on large commercial HVAC systems were noted as being underdeveloped.
- Commercial refrigeration cycles, superheat/ subcooling, pressure testing, oil logging and refrigerant best handling practices for large system maintenances activity.
- Fire systems and HVAC interconnection knowledge and compliance with building codes was noted as needing improvement.
- In terms of training and industry experience, it was noted that more hands on training with less theoretical classroom training would be beneficial and would reflect real on-the-job application.
- It was further noted that with on-the-job training, having access to and ensuring the apprentices can get access to all facets of the industry while training would ensure recent graduates could complete their studies with the required knowledge and skills necessary for both aspects of the industry, that being air conditioning and refrigeration. It was noted that hosting apprentices across employers may help improve this issue.
- It was noted that employers also had a part to play in ensuring graduates were adequately trained given that an apprenticeship is shared costs and responsibility between the individual, the RTOs and the employer, noting a considerable amount of training is on the job with the employer and not within an RTO setting.
- It was noted that there are no continuous professional development (CPD) requirements to maintain and keep skills current, leaving the onus of currency regarding technological change and other facets of industry practice to the individual. It was stated that if there was CPD there would be a need for individuals to maintain and gain skills with emerging technologies and therefore improve industry standards.
- Lack of electives and original equipment manufacturer brand specific training was noted as a limiting factor on graduates' knowledge and skills standards upon graduation.
- Like the graduates within the last five years, recent graduates also lack generic workplace skills such as communication, safety culture, motivation and customer service skills to interact with customers and each other professionally.

These results point to a need to undertake a holistic review of not only the training product but how the industry works together to ensure the apprentice gains the necessary skills and experience throughout their apprenticeship for both air conditioning and refrigeration.

Furthermore, it must be noted that jurisdictional licensing add a level of complexity for those who work across and in different jurisdictions and more broadly training of these courses need to be available not just in the metropolitan regions but should be made more available in regional and remote communities to support the uptake of the trade more readily.

UEE32220/5 – Certificate III in Air Conditioning and Refrigeration specific concerns

Respondents were asked to clearly identify any issues and concerns that they may have in relation to the current and previous Certificate III in Air Conditioning and Refrigeration. Considering this qualification is the benchmark for entry into the industry it is imperative that this qualification meets the needs of industry moving forward. Noting the above concerns already, outlined, further comments provided are summarised below.

- The qualification is too broad in nature and does not allow for in depth experience or practical knowledge acquisition for specialised areas such as split systems, ducted systems and commercial refrigeration.
- There is insufficient separation between domestic, small and commercial air conditioning and other sectors of the trade with some respondents noting that the qualification should be split into distinct qualifications such as Air Conditioning AND Refrigeration. It is believed that with this approach, more in depth understanding and specialisation would occur mitigating some of the concerns raised in this report.
- It was noted again that a restricted electrical license scope is seen as too narrow, especially compared to electricians who can cross-skill quickly and perform a wider range of work following completion of shorter courses. It was noted that there should be broader electrical scope to better align with industry realities.
- It was noted that the course is outdated, overly theoretical and not sufficiently updated for new technologies such as advanced controls, sensors, BMS, energy management and compliance in the healthcare environment. Respondents stated that training does not provide sufficient practical experience and hands-on work on up-to-date training equipment.
- As noted previously, lack of adequate training in fault finding, diagnosis, controls and automation training results in insufficient preparation for modern systems and industry requirements.
- There is an overemphasis on design and mechanical engineering components which detracts from relevant practical workplace skills for apprentices especially in the early years of their apprenticeship.
- Some respondents noted that the apprenticeship structure and qualification duration of four years is too long for some sectors, with suggestions of shorter, more targeted specialisation.
- Pathways and guidance for apprentices' post apprenticeship is lacking. It was noted this has resulted in a lack of understanding of how an apprentice can transition into supervisory, mentoring or management roles post trade.
- It was further noted that with pathways, it was difficult for technicians to upskill or gain credentials for electrical work or hazardous areas with a restricted licence holders being excluded from certain qualifications despite relevant experience.

- It was noted that it was difficult for RTOs to provide Recognition of Prior Learning (RPL) for visa holders making it harder for skilled migrant workers to achieve trade recognition in Australia.

- It was noted that there is frustration where there is a variation in qualifications being used between jurisdictions. For example, Western Australian RTOs deliver the MEM qualification whilst the rest of the nation utilise the UEE training package. Credit Transfers cannot occur between the two packages.

- It was further noted that the trade feels undermined by the use of the Certificate II in Split Air Conditioning and Heat Pump Systems which allows plumbers and electricians to perform air conditioning installation work with minimal training. The industry considers this dilutes complexities related to refrigerant handling and diagnostics. It was noted that residential work for an air conditioning technician was being reduced due to those entering the market with the Certificate II.

- It was noted that there is a chronic shortage of educators in RTOs. In addition, the lack of investment in teacher knowledge and upskilling has led to learning resources and assessments being outdated and not keeping pace with the emerging technologies within the industry.

As a result, the general feedback from respondents indicate that there is widespread concern that the current UEE32220/5 Certificate III in Air Conditioning and Refrigeration is not sufficiently fit-for-purpose, needs more robust and industry-aligned electrical training pathways, reduced regulatory barriers to genuine competency, and a major rethink of course content, delivery, and assessment to meet industry standards and ensure trade sustainability.

UEE51225 Diploma of Air Conditioning and Refrigeration Engineering concerns

Once an apprentice completes their apprenticeship (Certificate III qualification), a pathway exists towards a Diploma of Air Conditioning and Refrigeration Engineering. This qualification is currently underutilised by the industry and therefore, a question was posed to respondents about the relevancy of this qualification. A summary of respondent feedback is provided below.

- Access to training in the higher-level qualifications such at the Diploma and Advanced Diploma level in each jurisdiction is poor, making it difficult for technicians to upskill for the industry. Furthermore, it was noted that the Diploma qualification was primarily delivered online, meaning limited hands-on, face to face training.

- It was noted that course delivery is limited and not clearly promoted or advertised resulting in a general lack of awareness of the qualification. When individuals can locate a provider, the enrolment process is confusing leading to disengagement.

- There is a perception that the qualification is skewed towards air conditioning with some respondents calling for the qualification to be split into two separate qualifications in a similar way to call for Certificate III to be split into two separate qualifications.

- It was noted that the qualification does not reflect the complexity of the operational requirements within the industry, and the program is generally outdated and not aligning to current industry standards.
- Theoretical focus outweighs the practical skill development. It was noted that participants wanted more practical face-to-face training.
- Respondents noted that the qualification rarely results in increased employability, pay or expanded duties, questioning the value industry places on the Diploma. As a result, there is no structured pathway into higher compliance or supervisory roles.
- The Diploma does not lead to registration with professional engineering bodies in any state with some respondents noting that in Victoria the qualification is perceived as offering no benefit to the individual.
- There are limited licensing outcomes from obtaining the Diploma.
- Due to lack of funding for the Diploma, course expense compared to the value of the training and outcomes (career progression) is seen as a deterrent to engaging in further education.
- It was suggested that shorter skill sets would be preferred to upskill post trade workers in this industry.

Overall, there is broad dissatisfaction with availability, content, industry recognition, pathway options, and integrity of delivery for post trade air conditioning and refrigeration qualifications and that this should be addressed to ensure career progression is available and seen as a value to the industry and individual.

UEE20120 Certificate II in Split Air Conditioning and Heat Pump Systems scope of works

Respondents were asked to identify whether the UEE20120 Certificate II in Split Air Conditioning and Heat Pump Systems provided the scope of work required to install, commission and decommission single head, split air conditioning and heat pump systems. Overall, respondents noted that the above-mentioned qualification does not sufficiently cover the scope of work required to install, commission, and decommission single head, split air conditioning and heat pumps systems to a prescribed routine (18.25%) whilst 4.23% stated that it did cover the scope sufficiently. However, it must be noted that of the 526 respondents only 185 respondents answered this question represents 35.17% of the surveyed respondent. Of those that responded, 66 (35.67%) noted that they did not know the current coverage or scope of the qualification to answer this question.

Further investigation into this question is needed to understand why respondents do not sufficiently feel that the qualification supports the scope of work required as a job outcome by completing this qualification.

Table 5: Responses to Certificate II in Split Air Conditioning and Heat Pumps Systems

Response	Count	Percentage
Yes	23	4.23%
No	96	18.25%
Not aware of its current coverage/scope	66	12.54%
Did not answer	341	64.82%

Final words from respondents

The last two questions of the survey asked respondents to provide an overview of what is not sufficiently covered by current training products and if there was any further information that respondents would like PSO, AIRAH, ARC and AMCA to consider. Below is a summary of these comments.

- There was a consensus from respondents that the Certificate II in Split Air Conditioning and Heat Pump Systems is significantly inadequate in preparing an individual to work within the HVAC R industry, with respondents citing basic skills being delivered within this course did not prepare individuals to safely or competently install air conditioning systems.
- It was noted that those holding a Certificate II have not gained the necessary skills to safety handle refrigerants, pressure test to the required standards and to best practice, with some respondents noting that there are reports of underqualified technicians causing leaks, unsafe installations and safety risks that could impact customers and consequently requiring remedial work by a fully qualified HVAC R tradesperson.
- As a result, several respondents called for the qualification to be substantially reviewed by PSO and relevant stakeholders.
- There was strong sentiment from respondents for an improvement in regulations by creating a clear, nationally consistent licensing and enforcement framework that aligns licensing with skills and training rather than trade type or minimal coursework.
- It was suggested that incentivising apprenticeships and raising the Certificate III training standards, to incorporate new refrigerants, controls and technological advancements is needed.
- There is a strong sentiment for the HVAC R qualification suite to be completely reviewed ensuring it aligns to current and future trade requirements and standards.

Overall, there is a strong desire from respondents for the HVAC R industry qualifications to be reviewed and updated.

Discussion

This section interprets the findings from the survey of 526 stakeholders conducted by PSO, AIRAH, ARC, and AMCA over a seven-week period between July and August 2025. By analysing responses across diverse demographic groups, organisational types, and jurisdictions, implications for current practices, training gaps, and qualification frameworks within the air conditioning and refrigeration (HVAC R) industry can be determined. The analysis draws connections between respondent commentary, prevailing industry trends, and systemic challenges to inform recommendations for program and policy improvement.

Respondent demographics and organisational context

Responses were received from key stakeholder groups within the HVACR industry, encompassing employers, regulatory bodies, industry associations, Registered Training Organisations (RTOs), and union representatives. Most respondents (73%) were employers, primarily representing small businesses with up to 10 employees (43%). This indicates that small businesses form the dominant employer base in the industry, highlighting the significance of small enterprise perspectives in shaping training and workforce development policy.

Geographically, Queensland recorded the highest representation (25%), with over half of the respondents (53%) servicing metropolitan areas. This distribution reflects the concentration of HVAC R workforces in densely populated regions, although a substantive stakeholder component indicated operational coverage extending to industrial and specialist applications. When queried about apprenticeships, 43% of employers reported employing no apprentices, while 37% reported employing 1–5 apprentices. This correlation mirrors the predominance of small business operations, implying that apprenticeship opportunities are limited in smaller enterprises, thereby constraining training exposure across the full range of industry specialisations.

Scope of sectoral work

Respondents reported extensive engagement across all major sub-sectors of air conditioning applications, from split systems to large-scale commercial, industrial, and specialised systems. Specific niche applications included underground mining ventilation, marine and defence systems, industrial refrigeration, data centre cooling, and hazardous area HVAC maintenance. Such diversity underscores the sector’s complexity and the need for qualifications flexible enough to accommodate distinct contexts of practice.

A similar pattern was identified in refrigeration work, where respondents indicated multi-sector involvement across domestic, commercial, supermarket, and industrial refrigeration. Additional work areas included mining, oil and gas, transport refrigeration, cryogenics, farm cold storage, and pub refrigeration. Collectively, this demonstrates the highly multidisciplinary nature of the HVAC R trade, suggesting that qualifications must encompass both breadth across system types and depth in specialised applications.

Refrigerant and Handling practices

Analysis of refrigerant use indicates that Hydrofluorocarbons (HFCs) remain the dominant refrigerant, handled by 96% of respondents, with R32 (Difluoromethane) used by 65.7%. Hydrocarbons were handled by 38.7%, reflecting growing exposure to flammable refrigerants, while 11% worked with ammonia (R717) and 13% with carbon dioxide (R744).

These figures suggest that while traditional refrigerants continue to dominate, there is significant industry engagement with low-GWP (Global Warming Potential), and natural refrigerants driven by environmental regulations and market transition.

Refrigerant handling data affirms this diversification. Most respondents indicated that they handled multiple refrigerant types and that apprentices needed further skill development in this area, in particular training related to flammable refrigerant handling (38.7%), followed by Carbon Dioxide (27.2%), Fluorocarbon (25.7%), and Ammonia (19.8%). The overlap of handling different refrigerant types for apprentices indicates workforce exposure to multiple refrigerant types requiring differentiated safety and technical competencies needs to be embedded in future apprenticeship training. This reinforces the necessity for training that reflects both legacy and emerging refrigerant technologies in practice.

Safety, testing, and fault-finding activity types

Survey data shows that refrigeration and/or air conditioning mechanics/ technicians, who completed their apprenticeship in the last five years, lack and need additional safety, testing and fault-finding training in Electronic controls (24.3%), followed by Variable speed controls (23%), Commissioning (21.5), Energy Efficiency (19.5%) and Electrical (18.6%). This trend illustrates an increasing convergence of electrical and mechanical competencies within the trade, as industry adoption of control-based and energy-efficient systems broadens. The prevalence of commissioning work also suggests employer demand for higher diagnostic and commissioning proficiency among graduates and therefore this should be reviewed and included in future development of apprenticeships training.

Natural Refrigerant system engagement

When asked about natural refrigerant systems, respondents reported that refrigeration and/or air conditioning mechanics/ technicians, who completed their apprenticeship in the last five years, lack and need additional natural refrigerant systems training in Ammonia (20.90%) followed by Carbon Dioxide systems (17.70%) and Hydrocarbon systems 12.90%. Note that 48.5% did not respond.

This shows that there is significant capability development required within the apprenticeship for new technicians to graduate with the necessary skills and knowledge to handle natural refrigerant type systems. Therefore, the training in this area needs development and incorporation to ensure skill development is adequate for the future industry use and handling of these types of refrigerants.

Training gaps in apprenticeship delivery

Respondents identified multiple areas of concern regarding apprentice training within the past five years. Critical deficiencies were consistently reported in technical, technological, and professional skill domains.

Specific technical gaps include inadequate training in heat pump systems, carbon dioxide based supermarket refrigeration, central plant and chilled water systems, VRF/VRV installations, and industrial refrigeration processes. These deficiencies collectively indicate that apprenticeship programs do not sufficiently deliver training aligned to complex and emerging technologies.

Respondents also expressed concern about limited training for flammable and natural refrigerants, including correct handling, commissioning, and safety compliance procedures. Lack of energy efficiency knowledge and indoor air quality diagnostics imply minimal integration of sustainability and environmental management competencies into current qualifications.

Further gaps identified relate to insufficient training in the use of digital diagnostic tools, commissioning software, and modern electronic components such as PCBs, EC fans, and inverters. This corresponds with industry digitalisation trends where technical proficiency increasingly depends on interpretation of electronic data and programmable controls. Respondents also cited emerging technologies such as AI and IoT systems integration as major areas where current qualifications lack relevance and coverage.

Limited skill development in electrical competency and digital literacy further compound these technical gaps. In practical terms, this limits technicians' capabilities in diagnostics, safe disconnection, reading diagrams, and using job management software systems. Limited understanding of the Australian Standards, fire safety, and environmental compliance were also noted as significant knowledge gaps impacting overall workmanship quality and safety.

Respondents further emphasised generic workplace skill shortcomings, including communication, time management, customer service, and work ethic. Employers attributed these gaps to a lack of structured emphasis within training programs on employability skills, contributing to overall concerns about graduate readiness.

Recent graduate skill gaps and structural barriers

For graduates within the past 24 months, responses highlight compounded challenges. Access to training across regional and remote areas was a recurring issue, where limited RTO availability/ capability increases cost and restricts participation. Licensing inconsistency between jurisdictions was identified as another major concern, complicating workforce mobility and imposing additional cost burdens on employers and employees operating across borders.

Technical training for recent graduates remains skewed toward traditional systems, failing to cover emerging technologies such as modern refrigerants, automation, and advanced controls. The lack of practical exposure to current industry standard systems, including brazing, ductwork, and complex mechanical systems, indicates training heavily weighted towards classroom theory and traditional skill development that may reflect current industry trends. It was noted that more practical training was needed where students could apply their theoretical knowledge to practical tasks in support of a more skilled graduate outcome.

The absence of structured CPD and uneven exposure to all industry facets were also identified as barriers to skill progression. Respondents suggested that shared apprenticeships across different employers (GTO model) could broaden skills exposure but recognised the shared responsibility of RTOs and employers in ensuring holistic skills development. It must also be noted there was complexity with this approach that was noted by the respondents.

Qualification-specific concerns: Certificate II (UEE20120)

A minority (4.23%) of respondents believed that the Certificate II in Split Air Conditioning and Heat Pump Systems adequately covers the required occupational scope. A larger proportion (18.25%) stated that it does not, and 12.54% were unaware of its scope or coverage, while 64.82% chose not to answer. This low response indicates uncertainty or lack of engagement with the qualification. Those who did provide comment described it as insufficient for safe, competent installation work with numerous reports of underqualified technicians performing work beyond their competency level. Respondents urged either the removal of the qualification or tighter regulation, including longer supervision for those working under it.

Qualification-specific concerns: Certificate III (UEE32220/5)

The Certificate III in Air Conditioning and Refrigeration, considered the industry's trade entry qualification, was widely criticised for its inadequacy and misalignment with industry requirements. Respondents perceived the qualification as too broad, resulting in insufficient depth of knowledge in specialised fields such as commercial refrigeration and ducted systems.

A consistent call emerged for the qualification to be split into two separate specialisations or streams, being Air Conditioning and Refrigeration, to allow specialisation. Respondents further argued that the restricted electrical licence scope allocated to technicians under this qualification is too narrow and poorly aligned with contemporary industry practice.

The course's theoretical emphasis was perceived as disproportionate to practical requirements with respondents reporting limited training on modern systems and technologies such as advanced controls, energy management systems, and compliance requirements in complex environments such as healthcare. Variations in RTO delivery quality were also raised, with accelerated completion options, reduced face-to-face contact, and overly theoretical online assessments undermining graduate competency.

Some respondents reported frustration that assessment of apprentices in a simulated environment relies excessively on multiple-choice testing. The perception of declining rigour was coupled with concern about inconsistent delivery of the qualification. Some suggested reducing the qualification duration for targeted specialisations while improving defined career pathways post-trade, including supervisory and management routes could address some of these concerns.

A related issue was the lack of accessible pathways for restricted licence holders, migrants, and those seeking recognition of prior learning. It was further noted that the Certificate II in Split Air Conditioning and Heat Pump Systems enabling limited installation work by non-HVAC R trade persons was seen as directly undermining trade credibility. These findings collectively reinforce

respondents' sentiments that the Certificate III qualification is outdated, inconsistent, and insufficiently aligned to industry needs.

Qualification-specific concerns: Diploma (UEE51225)

The Diploma of Air Conditioning and Refrigeration Engineering received similarly negative feedback. Respondents characterised it as underutilised, unavailable in some jurisdictions, and overly theoretical with minimal practical value. Accessibility issues included limited course promotion, confusing enrolment processes, and a dominant online delivery mode that restricts hands-on practice all contributing to the ineffectiveness of the qualification.

Content was viewed as outdated and more aligned with air conditioning than refrigeration, echoing feedback about the need to split this qualification, echoing respondents feedback provided for the Certificate III qualification. Overall, respondents perceived limited industry recognition and inadequate career progression outcomes, as completion does not lead to registration or licensing advancement or recognition by engineering peak bodies. The cost-benefit ratio was considered poor, with limited funding and negligible employability improvement all leading to a lack of interest by individuals and the industry in enrolling in the qualification. Many respondents stated that they would find, and favoured skill sets, as more practical post-trade upskilling options for those looking for career advancement.

Systemic themes and industry expectations

Across all qualifications, the survey presents consistent themes of inadequate practical training; outdated course content; inconsistent delivery quality; regulatory misalignment; and insufficient emphasis on emerging technologies and generic workplace skills. Respondents repeatedly identified a need for qualifications that better reflect actual work practices.

Respondents strongly supported a national review of HVAC R qualifications underpinned by clear, consistent licensing and enforcement frameworks. They also recommended aligning training standards with current refrigerant technologies, advanced control systems, and digital fault diagnostics to sustain industry capability. Incentivising apprenticeships and strengthening CPD pathways were viewed as critical components of workforce sustainability.

Overall, there is industry consensus that HVAC R training products require substantial redevelopment. Employers dominating the respondent group express persistent dissatisfaction with overall graduate readiness, the balance between theory and practice, and the lack of standardisation in qualification assessment and delivery. Respondents further emphasised that qualifications, licensing frameworks, and training delivery must adapt to technological and environmental changes already transforming the industry should the industry meet the challenges presented by the transition to a net-zero economy.

Recommendations

The recommendations presented in this section directly address the challenges and gaps identified through analysis of feedback from 526 industry stakeholders. Grounded exclusively in respondent commentary and the survey data, these recommendations aim to guide targeted reforms to qualifications, training delivery, regulatory standards, and workforce practices across the industry. Each recommendation is designed to ensure that training products and industry

systems effectively meet current demands, adapt to emerging technologies, and support the development of a skilled and competent workforce.

Qualification structure reform

It is strongly recommended that the UEE32220/5 Certificate III in Air Conditioning and Refrigeration be reviewed and redeveloped to better reflect modern industry requirements. Respondent feedback consistently noted that the Certificate III is too broad in nature, with insufficient scope for specialisation. The HAVC R Subject Matter Expert group (SME) and Technical Committee should therefore consider whether the qualification should be split into distinct streams, such as separate qualifications for Air Conditioning and Refrigeration, to enable depth in knowledge acquisition and applied skill development within each discipline. This change would promote specialised training and support the attainment of competencies aligned to real-world operational roles, particularly for sectors such as split systems, ducted systems, commercial refrigeration, and hazardous area work.

Efforts should be made to update all core units of competency and electives to ensure robust coverage of advanced controls, digital diagnostics, energy management systems, indoor air quality, and emerging refrigerant handling techniques. Specific gaps identified, including exposure to heat pump technology, VRV/VRF systems, supermarket and central plant refrigeration, and commissioning practices, should be explicitly embedded within the revised structure.

It is further recommended that the current HVAC R SME group for the UEE full training product review, take these reports finding into account during their work and deliberations.

Enhancement of electrical competencies

Survey evidence highlights limitations related to the restricted electrical licensing scope embedded within current qualification frameworks. Respondents recommended broadening electrical content to support industry requirements, reflecting the shift toward integrated electronic controls and advanced diagnostic systems. Certificate III and associated training programs should be updated to cover fault-finding, safe disconnection, wiring diagrams, contactors, relays, programmable logic controllers (PLC), and building management systems (BMS).

Efforts to facilitate pathways for apprentices and technicians to upskill or gain recognised electrical credentials should be established, allowing for mobility and full scope of practice within the sector.

Increase practical and work-based training.

The survey results demonstrated a clear need for more hands-on, workplace-integrated training. Respondents indicated that recent graduates lacked practical competencies in areas such as brazing, leak testing, mechanical troubleshooting, installation of ductwork, commissioning, and fault-finding on complex commercial HVAC R systems. Training delivery should prioritise extensive practical, work-based learning, onsite equipment exposure, and real-world application rather than excessive classroom-based theoretical instruction.

Consideration should be given to industry–RTO partnerships where apprentices are rotated through diverse employers or industry placements. This would facilitate exposure to a range of air conditioning and refrigeration environments, ensuring graduates receive comprehensive skill development across installation, maintenance, and diagnostic activities.

Expansion and improvement of regional access

Respondents in regional and remote areas reported barriers to training participation due to limited provider capability/access and higher costs for travel and accommodation. Investments in regional training infrastructure and flexible delivery models, including mobile training facilities or block-release programs, would improve equity and allow businesses in isolated communities to train apprentices without excessive disruption or cost. This could promote local economic development and support workforce uptake in under-served areas.

Consistency and integration of licensing standards

The survey identified widespread concern related to the inconsistency of licensing requirements between jurisdictions, which limits technician mobility and increases compliance costs. A nationally consistent licensing and enforcement framework could address these concerns. This would facilitate cross-jurisdictional practice, reduce regulatory burdens for border businesses, and deliver clearer guidance to technicians and employers about required training, experience, and compliance for each licence type.

It is further recommended that HVAC R peak bodies work with trades recognition Australia to streamline recognition of prior learning for skilled migrants to ensure skill migrants can enter and work in the industry with minimal barriers to trade recognition.

It is further recommended that peak bodies support an introduction to a structured CPD system implementation to ensure technicians maintain workforce currency with emerging technologies, changing standards, and evolving safety procedures.

Strengthen generic workplace skills and professional practices.

It is recommended that technical proficiency alone is inadequate for successful performance in the HVAC R sector. Therefore, it is highly recommended that embedding generic workplace skills, such as customer service, professional communication, time management, self-motivation, work ethics, empathy, and planning, within all qualification levels and training products would be an advantage to the HVAC R industry. RTOs and employers should collaborate to ensure soft skill development is integrated into practical tasks, workplace simulation and assessment.

Assessment models should be reviewed and adjusted to place less emphasis on multiple-choice or online-only testing. Assessment should instead prioritise practical assessment tasks, reflective practices, and industry-contextual evaluations aligning with industry expectations for holistic performance.

Revise Certificate II qualification and oversight.

Respondents expressed significant concern that the UEE20120 Certificate II in Split Air Conditioning and Heat Pump Systems does not prepare graduates to undertake safe and competent work. Therefore, it is recommended that a considered review of this qualification is undertaken to ensure it supports the uplift of technical skills of those that are undertaking the qualification. Furthermore, noting the concerns, it is recommended that the Certificate II incorporate more in-depth skill development for working safely with refrigerants, commissioning, or pressure testing.

However, it must be noted that most respondents who engaged in this survey hold the Certificate III in Air Conditioning and Refrigeration and therefore, it is recommended that a specific survey for those who have completed or deliver UEE20120 Certificate II in Split Air Conditioning and Heat Pump Systems should be conducted to further gain clarity and feedback from this specific cohort.

Respond to technology and digital integration.

Rapid advances in automation, electronic controls, Ai, and IoT applications demand continual updates to training content. New units covering predictive maintenance, remote monitoring, diagnostic software, modern instrumentation, and electronic component repairs should be integrated at all certificate and diploma levels. It is recommended that further industry consultation should be undertaken to inform ongoing training product development to maintain alignment with innovation, environmental objectives, and compliance.

It is further recommended that digital literacy skills need to be embedded in all HVAC R qualifications as this will ensure graduates are work-ready to participate effectively in the HVAC R industry.

Revise post-trade qualification pathways.

The UEE51225 Diploma of Air Conditioning and Refrigeration Engineering is infrequently utilised due to poor access, perceived lack of value, and outdated content. Recommendations include reforming the qualification structure to split air conditioning and refrigeration, increasing practical delivery modes, and clarifying pathways for progression into supervisory, compliance, or engineering roles. Promotion and awareness should be improved to ensure industry recognition and uptake, and elective modules or shorter skill sets should be developed for post-trade upskilling.

Invest in trainer workforce development.

A chronic shortage of skilled trainers within the VET system was highlighted as undermining training quality. RTOs should invest in upskilling existing trainers and recruiting new educators with both industry experience and developing teaching comprehensive skills. Continuous professional development for trainers should be implemented to ensure teaching materials and assessments remain contemporary and technologically responsive. It is further recommended that RTOs support improved equipment to meet current industry standards and provide trainers with the required training to adequately deliver training on current equipment and tools being used in industry.

Strengthen industry and VET collaboration.

It is suggested that PSO continues to strengthen stakeholder engagement between industry, RTOs, employers, and regulatory bodies should be mandated for all major qualification reviews as the Jobs and Skills Councils for the industry. PSO should continue to hold regular forums for feedback, consultation, and training product input will ensure that emerging skills needs are rapidly addressed and training products remain relevant.

It is recommended that PSO conduct further qualitative research to clarify and provide a deeper understanding of the survey responds provided in this report. It is also recommended that PSO conducts a functional analysis assessment of the industry and report its comprehensive findings by mid-2026.

Western Australia case study.

A review of the survey data indicates that 85 respondents (16%) are from Western Australia, where the UEE32220/5 Certificate III in Air Conditioning and Refrigeration is not delivered due to specific Electrical Licensing requirements. To ensure more accurate and meaningful analysis, it is recommended that the survey data be reviewed and a separate report generated for Western Australia only. This approach will clarify any differences in outcomes between those who completed the MEM and UEE Certificate III in Air Conditioning and Refrigeration and will provide more valid results for the UEE qualification.

Conclusion

The survey findings present a substantive perspective on the current state and future directions of the Australia's air conditioning and refrigeration workforce. Respondent insights clearly point to a training and qualification system that must evolve to keep pace with technological change, regulatory demands, and diverse operational contexts. These have been broken into three key areas:

Gaps identified in training of apprentices in the last five years

The report lists a range of gaps in training listed on page11-13, some of which must be core and covered by all HVAC R apprentices, and some of which are specialised areas which only those apprentices working in that sector require, and some of which are higher level post-trade skills.

The listed gaps in training have been allocated into core, specialised and post-trade skills below for consideration by the SME group as part of the UEE full training product review.

Core Skills

- Flammable and Natural Refrigerants, noting the correct identification, handling and safety procedures for these types of gases.
- Use of modern diagnostic and electronic tools and equipment such as digital gauges, commissioning tools, and diagnostic and commissioning software especially for

understanding, diagnosing and replacing electronic components such as printed circuit boards (PCBs), electronically communicated (EC) fans and electronic expansion valves (EEVs) and inverters.

- Electrical competency, in terms of fault finding, safe disconnection practices, reading wiring diagrams, relays, contactors and electronic diagnostics.
- Digital literacy was further noted as an area of concern considering that the industry uses job management software and electronic diagnostics tools and digital reporting platforms to convey job outcomes.
- Newer technologies related to advanced control systems such as variable speed drives (VSDs), EC motors, electronic expansion valves (EEVs).
- Basic refrigeration principles such as cycle operation, pressure and temperature relationships, superheat/subcooling and understanding flow/air distribution.
- Brazing and leak testing that is compliant with the Australian Standards
- Safety knowledge and installation rules for natural refrigerant and relevant risk management practices like fire damper certification.
- The application of the Australian Standards and compliance for the industry, including building, fire safety and environmental compliance standards for installation of equipment. This was specifically related to hygiene and infection control and maintenance of systems to ensure safe use.
- Customer service, communication and work ethics was also noted as an area of concern, noting that professional communication, reporting, time management, self- motivation, empathy and understanding of the workplace role and planning responsibilities was missing within current training outcomes.
- Commercial refrigeration cycles, superheat/ subcooling, pressure testing, oil logging and refrigerant best handling practices for large system maintenances.
- Generic workplace skills like communication, safety culture, motivation and customer service skills to interact with customers and each other professionally.

Specialist Skills

- Hot water heat pump system training especially with new technologies related to these systems.
- Exposure to complex supermarket refrigeration (carbon dioxide systems)
- Central Plant, chilled water and cooling tower systems
- Industrial and process refrigeration
- VRV/VRF systems and controls related to installation, commissioning, diagnostics, and repair of these complex systems.

- Flammable and natural refrigerants, - installation, commissioning and servicing for these types of gases.
- Large commercial HVAC systems
- Fire systems and HVAC interconnection knowledge and compliance with building codes.

Post-trade Skills

- Energy efficiency and indoor air quality was noted as limited understanding related to energy recovery, demand-based optimisation, energy management interface programming and air quality monitoring as well as system upgrades for improved sustainability practices.
- Ai and IoT integration was noted by respondents especially with the rapid increase and adoption of Ai in predictive maintenance, fault diagnostics and remote monitoring and with IoT enabled controls for chilled water, variable refrigerant flow/ variable refrigerant volume systems (VRF/VRV) and integrated systems this was a significant gap in graduate skills and knowledge.
- Modern building management systems (BMS), programmable logic controllers (PLC), SCADA controls as well as digital controllers, noting a deeper understanding of the diagnostics, software updates, system integration, programming and fault finding was needed.
- Commissioning and advanced diagnostics

Overall, the survey validates the need for comprehensive, consultative, and ongoing reform in the HVAC R training and qualification system. Cross-sector collaboration must underpin all review, development, and implementation phases to ensure stakeholder needs are met, graduate capabilities are aligned, and the workforce is equipped to deliver safe, compliant, and technologically responsive services into the future.

Implementation of these recommendations will address current gaps, strengthen the professional pipeline, and support the industry as it adapts to changing systems, evolving technologies, and emerging regulatory requirements. Ensuring the right balance between practical skill, technical depth, workplace skills, and regulatory alignment will be essential for sustainable workforce development and sector advancement.