Australian Government

Department of Education, Employment and Workplace Relations

UEENEEJ172A Recover, pressure test, evacuate, charge and leak test refrigerants - split systems

Release: 2

UEENEEJ172A Recover, pressure test, evacuate, charge and leak test refrigerants - split systems

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor **1**)

1.1) **Descriptor**

This competency standard unit covers the recovery of refrigerant, pressure and leak testing, evacuation and refrigerant charging in split air conditioning and heat pump systems. It encompasses working safely and to standards, following regulations and industry practices for handling refrigerants and completing the necessary documentation.
Note:
The Ozone Protection and Synthetic Greenhouse Gas Legislation Amendment Bill 2003 may apply to this competency standard unit. Prior to planning the delivery of any training and/or assessment activities all legislative and regulatory requirements shall be identified and included.

Application of the Unit

Application of the Unit **4**)

This unit is intended for competency development entry-level employment-based programs incorporated in approved contracts of training and may be used to augment other electrotechnology qualifications at AQF 2 level or higher.

Licensing/Regulatory Information

1.2) License to practice

The skills and knowledge described in this unit may, in some States/Territories, require a license to practice in the workplace subject to regulations for undertaking refrigeration and air conditioning work. Practice in workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.
Note:
1. The Ozone Protection and Synthetic Greenhouse Gas Legislation Amendment Bill 2003 may apply to this unit. Prior to planning the delivery of any training and/or assessment activities all legislative and regulatory requirements shall be identified and included.
2. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control, lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.
3. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures

Pre-Requisites

Prerequisite Unit(s) **2)**

2.1) Competencies

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.
UEENEEJ102A Prepare and connect refrigerant tubing and fittings
UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace
For the full prerequisite chain details for this unit please refer to Table 2 in Volume 1, Part 2

Employability Skills Information

Employability Skills	**3)** This unit contains Employability Skills The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a unit	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT		PERFORMANCE CRITERIA	
1	Prepare to recover refrigerants, pressure and leak test, evacuate and charge split systems.	1.1	OHS procedures for a given work area are identified, identified, obtained and understood
		1.2	Established OHS risk control measures and procedures are followed in preparation for the work.
		1.3	Safety hazards which have not previously been identified are noted and established risk control measures are implemented.
		1.4	The nature of the problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.
		1.5	The work is appropriately sequenced in accordance with job schedule.
		1.6	Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.

ELEMENT		PERFORMANCE CRITERIA	
		1.7	Refrigerants, lubricants and cleaning materials needed for the work are obtained in accordance with established procedures and checked against job requirements
		1.8	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety
		1.9	Preparatory work is checked to ensure no damage has occurred and complies with requirements.
2	Recover refrigerants, pressure and leak test, evacuate and charge split systems.	2.1	OHS risk control measures and procedures for carrying out the work are followed
		2.2	Checks are carried out to ensure the system or component parts are isolated, when necessary, in strict accordance with OHS requirements and procedures
		2.3	Machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures and circuits are isolated and confirmed by appropriately competent personnel
		2.4	Refrigerants are removed from a split system safely into suitably labelled containers in accordance with regulatory requirements and industry practices, and any electrical work is referred to an appropriate licensed person
		2.5	Precautions are taken to prevent damage to components while pressure testing the system
		2.6	Pressure testing is conducted using dry nitrogen at a pressure relative to the refrigerant to be used
		2.7	Leaks are located and rectified using testing methods appropriate to the system under test and in accordance with industry practices
		2.8	Split system is evacuated to the required level and cleaned the system of all moisture and other containments in accordance with industry practices
		2.9	A 'Drop test' is used to prove effectiveness of the evacuation in accordance with industry practice using

ELEMENT		PERFORMANCE CRITERIA	
			an appropriate electronic vacuum gauge
		2.10	Components lubricants are checked and maintained in accordance with manufacturer's requirements
		2.11	Split systems are charged with the appropriate refrigerant in accordance with manufacturer's requirements and industry practices
		2.12	Problematic situations that arise during the work are dealt with in an appropriate manner
		2.13	Split systems are pressure and leak tested, evacuated and charged efficiently without unnecessary waste of materials or damage to apparatus and the surrounding environment or services and using sustainable energy practices
3	Complete and report refrigerants recovery, pressure and leak test and evacuate and charge work	3.1	OHS risk control work completion measures and procedures are followed
		3.2	Work site is cleaned and made safe in accordance with established procedures
		3.3	Contaminated refrigerant is dealt with in accordance with legislative/regulatory requirements
		3.4	Completion of the work is documented and an appropriate person or persons notified in accordance with established procedures

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and recovering, pressure and leak testing, evacuating and charging refrigerants split systems.
All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EJ172A Split system basic operating principles, refrigerants and lubricants

Evidence shall show an understanding of refrigerants and lubricants used in split air conditioning and heat pump systems, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated

T1 The Residential Air Conditioning and Heat Pump Industry and Licensing Requirements

- Brief overview and history of the Australian residential air conditioning/heat pump industry
- Typical applications and equipment
- Overview of the State and federal agencies (environment and heritage, greenhouse office, ARC, OFT etc)
- State and federal licensing requirements
- The ozone protection act
- The ozone layer (function, ozone depleting substances)
- Overview of the Australia and New Zealand refrigerant handling code of practice 2007, Part 2, Systems other than Self-contained low charge systems

T2 Heat

- Matter (atoms, molecules, energy and its different forms)
- Heat energy (definition, unit of measurement)
- Enthalpy (definition, unit of measurement)
- Heat flow (hot to cold)
- Heat transfer
  - methods (conduction, convection, radiation)
  - requirements
  - effects

T3 Temperature and Relative Humidity

- Temperature
- Scale types (imperial, metric, absolute) and their units of measurement

REQUIRED SKILLS AND KNOWLEDGE

- Conversion to/from absolute values
- Temperature difference/change (td, Δt, unit of measurement)
- Relative humidity

T4 Sensible and Latent Heat

- Definition of specific heat capacity, latent heat and sensible heat (including units of measurement)
- Types of latent heat
- Heat calculations

T5 Pressure

- Define
- Scale types (imperial, metric, absolute) and their units of measurement
- Vacuum scales (Pascals, microns)
- Conversion to/from absolute values
- The basic Gas Laws – Boyles, Charles and Daltons (excl combined or general gas law)
- Pressure gauge types and applications (pressure, compound, vacuum, manometer, magnehelic, barometer)
- Hazards and related safe working practices (dangerous system pressures)
- Care and maintenance (ingress of oil and contaminants (dirt), avoiding needle bounce (especially HP) etc)
- Calibration (atmospheric pressure, send to a specialist etc)
- Appropriate and safe methods of use
- Typical locations

T6 Refrigerant conditions

- Saturation temperature
- Saturated liquid / saturated vapour
- Superheated vapour
- Sub-cooled liquid
- Pressure temperature relationships
- P/T charts
- Enthalpy

T7 The Vapour Compression Cycle

- Major system components
- High and low pressure sides
- Basic system operation

T8 Thermometers and relative humidity devices

- Thermometer types and applications (digital, stem, dial, max/min, non-contact, data loggers)
- Relative Humidity measurement devices and applications (dry bulb/wet bulb, sling,

REQUIRED SKILLS AND KNOWLEDGE

digital)
- Hazards and related safe working practices (working near rotating machinery - fans, pulleys, belts etc)
- Care and maintenance (bending stems, overheating, removing batteries after use, uncoiling capillary)
- Calibration (boiling water, iced water, send to a specialist etc)
- Appropriate and safe methods of use
- Typical locations on a system
- Fitting temperature and relative humidity instruments

T9 Leak Detectors

- Detector types and applications (electronic, halide, bubble, ultra violet)
- Hazards and related safe working practices (working around rotating machinery, open flame, ultra violet light etc)
- Care and maintenance (delicate electronic equipment, changing sensor tip filters, changing gas cartridges etc)
- Calibration (auto calibrating , send to a specialist etc)
- Leak detection procedures

T10 Service Gauges

Manifold Gauges

- Types (dial gauges or electronic, manifolds with additional vacuum and charging ports & sight glasses)
- Typical uses for service gauges (high & low side pressure readings, charging, evacuating)
- Care and maintenance (oil and contaminants (dirt) in hoses, avoiding needle bounce, changing hose seals)
- Calibration (hoses open to atmosphere, adjusting screw etc)
- Hose shut-off valves and adaptors (access control valves, kwik couplers, etc)

System Access Fittings

- Types (Schrader, service valve, post valve, quick couplers etc)
- Typical applications for each
- Hazards and related safe working practices (oil or liquid spray, keeping clean, leaks etc)
- Care and maintenance (gland nuts loosened/tightened, seal caps fitted, regulations on piercing valves)

Using Service Gauges

- Service gauge manifold hose fitting
- Purging
- Pressure readings
- Service gauge manifold hose removal
- Pressure to temperature conversion

REQUIRED SKILLS AND KNOWLEDGE

T11 Properties of Split Heat Pump Refrigerants

- Types (R22, R407C, R410a, R12 (old units) Hydrocarbons)
- Terms (blend, azeotrope, zeotrope, glide, CFC, HCFC, HFC, HC, bubble point, dew point, critical point, ODP, GWP etc)
- Typical properties of the current refrigerants used in split systems (boiling point, glide, composition (components), comparative latent heat performance etc)

T12 Properties of Split Heat Pump Refrigerant Oils

- Types (mineral, POE, AB) and their applications
- Basic properties (miscibility, dielectric strength and viscosity)
- Typical issues regarding compatibility (neoprene and POE, POE and mineral etc)
- Safe handling (MSDS - POE's, Mineral, AB's - Residual acid's in used oil)

T13 Procedures for Working with Refrigerants

- Contaminants (Non-condensables, moisture, carbon, copper etc), effects of contamination (Acid, motor burnout, oil contamination, seizing, RMD blockage etc) and methods of contamination prevention
- Reclaiming/recovering refrigerants (using recovery pumps)
- Recovery cylinders (suitable types, markings and precautions – Code of Practice)
- Disposing of recovered refrigerants (Code of Practice)
- Pressure testing systems (suitable gases (nitrogen), test pressure etc)
- Purging pipework (illegal in Australia)
- Evacuation of newly installed split systems (vacuum pumps, correct use, 'drop testing')
- Charging refrigerant into a newly installed split system (pre-charged, charging cylinders, electronic scales)
- Detecting refrigerant leaks (electronic, bubbles, halide for R22)
- De-commissioning a split system (recovering refrigerant, isolating in outdoor unit)
- The practice of retrofitting (overview)
- Working with high pressure refrigerants (R410A) and Hydrocarbons (special precautions, tools etc)

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package. .
The Evidence Guide forms an integral part of this Unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines

EVIDENCE GUIDE

of this Training Package.

Overview of Assessment	**9.1**) Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. In some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy. Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed. The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment. Activities associated with normal everyday work influence decisions about how/how much the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.
Critical aspects of evidence required to demonstrate competency in this unit	**9.2**) Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: • A representative body of work performance demonstrated within the timeframes typically expected of the discipline,

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work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

- Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range statement
- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Determine the basic operating conditions, recover, pressure and leak test, evacuate and charge refrigerants split systems as described in 8) and including:

A Selecting and using appropriate measuring devices, materials and equipment correctly

B Recording measurements

C Using calculation methods accurately

D Identifying the conditions of a refrigerant at various locations in the vapour compression system

E Documenting operating conditions correctly

F Removing and storing refrigerant correctly

G Conducting pressure testing at the appropriate pressure level and without damaging components

H Locating and rectifying leaks

I Evacuating the system to the required standard and

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using appropriate vacuum measuring instruments

J Charging the system with the appropriate refrigerant

K Completing the necessary documentation

L Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

Evidence should show demonstrated competency in recovering, pressure and leak testing, evacuating and charging refrigerants split systems.

Method of assessment

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires assessment in a structured environment which is intended primarily for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units

9.5)

There are no concurrent assessment recommendations for this unit.

Range Statement

RANGE STATEMENT

8) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit must be demonstrated in relation to testing and charging split systems encompassing the following:

- Determining operating conditions using measurement and basic calculation methods of vapour compression split systems whether used for refrigeration or air conditioning. These conditions include suction and discharge pressures, ambient, evaporator and condensing temperatures, evaporator, and condenser temperature difference.
- Recovering refrigerant from an existing split system including split single head air conditioning and hot water heat pump systems
- Pressure and leak testing a newly installed systems
- Evacuating newly installed systems in preparation for charging with refrigerant
- Charging newly installed systems with refrigerant

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not Applicable

Competency Field

2.2) Literacy and numeracy skills

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	3	Writing	3	Numeracy	3

Custom Content Section

Competency Field **5)**

Refrigeration and Air Conditioning