



Australian Government

Department of Education, Employment and Workplace Relations

UEENEEJ103A Establish the basic operating conditions of vapour compression systems

Release: 2

UEENEEJ103A Establish the basic operating conditions of vapour compression systems

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers the determination of the operating conditions of vapour compression systems. It encompasses working safely, determining refrigerant pressures and temperatures and relevant air and water temperatures using measurement and basic calculation methods.

Application of the Unit

Application of the Unit 4)

This competency standard is suitable for employment-based programs under an approved contract of training at the AQF level of the qualification in which the unit is first packaged or higher.

The unit may be selected as an elective from the relevant schedule (see qualification packaging rules) provided that all prerequisite units are undertaken or addressed through recognition processes.

This unit may be included in a skill set provided that it is listed in the schedule of electives (see Qualification Framework) and all prerequisite units are undertaken or addressed through recognition processes.

Delivery and assessment of this unit should be undertaken within regard to the requirements of License to Practice (1.2 above), Prerequisite Competencies and Literacy and Numeracy skills (2 above) and the recommendations for concurrent assessment and relationship with other units (9.5 below).

Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of

Application of the Unit 4)

training such as apprenticeships.

Note:

1. 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 and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.

2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting, risk safety measures etc.

Licensing/Regulatory Information

1.2) License to practice

The skills and knowledge described in this unit may, in some jurisdictions, 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. 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.

2. 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

Prerequisite Unit(s) 2)

confirmed.

UEENEEJ101A 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 determine the basic operating conditions of vapour compression systems

1.1 OHS procedures for a given work area are identified, obtained and understood through established routines and procedures

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 reported and advice on risk control measures is sought from the work supervisor

ELEMENT

PERFORMANCE CRITERIA

- | | | |
|---|--|---|
| | 1.4 | Expected operating conditions are obtained from documentation or from work supervisor to establish the scope of work to be undertaken |
| | 1.5 | Advice is sought from the work supervisor to ensure the work is coordinated effectively with others |
| | 1.6 | Sources of materials that may be required for the work are identified and accessed in accordance with established routines and procedures |
| | 1.7 | Tools, equipment and testing devices needed to determine the basic operating conditions are obtained and checked for correct operation and safety |
| 2 | Determine the basic operating conditions of vapour compression systems | |
| | 2.1 | Established OHS risk control measures and procedures for carrying out the work are followed |
| | 2.2 | Measuring system operating parameters is conducted in strict accordance with OHS requirements and established safety procedures |
| | 2.3 | System is checked and isolated where necessary, in strict accordance OHS requirements and procedures |
| | 2.4 | Established procedures are used to determine actual and specified range of operating conditions from measured and calculated values as they apply to particular vapour compression systems. |
| | 2.5 | Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented. |
| | 2.6 | Unexpected situations are dealt with safely and with the approval of an authorised person |
| | 2.7 | Operating conditions are determined without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices |

ELEMENT	PERFORMANCE CRITERIA
3 Complete work and report	3.1 OHS work completion risk control measures and procedures are followed
	3.2 Work site and equipment is cleaned and made safe in accordance with established procedures
	3.3 Operation conditions are documented, including identification of any parameter that is not within the specified range for the system
	3.4 Work supervisor is notified of the completion of the work 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 determining the basic operating conditions of vapour compression systems. All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EJ103A Basic operating conditions of vapour compression systems

Evidence shall show an understanding of basic operating conditions of vapour compression systems, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1 Refrigeration Industry

- The history of the refrigeration industry (note that A/C is covered in another unit)
- Applications, classifications and equipment used in the refrigeration industry

T2 Introduction to the Vapour Compression System

- Basic Operation
- Major Components

T3 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

T4 Temperature and relative humidity

- Temperature
- Scale types (imperial, metric, absolute) and their units of measurement
- Conversion to/from absolute values
- Temperature difference/change (td, Δt , unit of measurement)
- Relative humidity
- Thermometer types and applications (digital, stem, dial, max/min, non-contact, data loggers)
- Relative Humidity measurement devices and applications (dry bulb/wet bulb,

REQUIRED SKILLS AND KNOWLEDGE

sling, 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

T5 Sensible and Latent Heat

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

T6 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 (esp. HP) etc)
- Calibration (atmospheric pressure, send to a specialist etc)
- Appropriate and safe methods of use
- Typical locations

T7 Refrigerant conditions

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

T8 The vapour compression cycle

- Primary system components

REQUIRED SKILLS AND KNOWLEDGE

- High and low pressure sides
- Basic system operation

T9 Working safely with refrigeration vapour compression systems

- Risk management principles and processes
- Hazards and risk control measures associated with:
 - refrigeration vapour compression systems and components
 - refrigerants
 - measuring and testing equipment

T10 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

T11 Service gauges

- Service 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, Hansen lines etc)
- System Access Fittings
 - Types (Schrader, piercing, 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

REQUIRED SKILLS AND KNOWLEDGE

- Pressure to temperature conversion

T12 Refrigeration Compressors

- Function of the compressor
- Compressor styles (open drive, semi-hermetic, hermetic)
- Types, construction and their applications (reciprocating, rotary, centrifugal, screw, scroll)
- Basic types of compressor oil (Mineral, Polyolester (POE), Alkyl Benzene, Polyalkylene Glycols (PAG)) (brief overview - covered in more detail in J8)
- Methods of lubrication (splash, forced)
- Safe handling (MSDS - POE's, PAG's, Mineral, AB's - Residual acid's in used oil)

T13 Condensers and related components

- Function of the condenser
- Types, construction and their applications (static, forced draught, water cooled)
- Function of a cooling tower
- Types, construction and their applications (natural, induced, forced, evaporative)
- Function of water pumps
- Basic Types and their applications
- Function of liquid receivers
- Types, construction and their applications (horizontal, vertical, combined condenser/receivers)

T14 Evaporators and related components

- Function of the evaporator
- Evaporator styles (direct expansion, flooded)
- Types, construction and their applications (static, forced draught, water cooling)
- Refrigerant/air/water flow paths (forced/induced draft, parallel/counter flow)
- Need for water treatment in water systems
- Methods used to provide water treatment (brief overview)
- Regulations governing water treatment (brief overview)
- Secondary refrigerants (brief overview)
- Properties & applications of secondary refrigerants (water, sodium/calcium chloride, ethylene/propylene glycol)
- Hazards associated with their use (MSDS)

T15 Common Refrigerant Metering Devices

- Function of a refrigerant metering device
- Overview of common types and their applications (capillary tube and TX Valve)

T16 Basic Operating Conditions

- Ambient conditions
- Common climate values (highest max temp, lowest min temp, mean daily temp,

REQUIRED SKILLS AND KNOWLEDGE

mean highest/lowest)

- Typical climates for various common localities
- Evaporator Td
- Effect of changes in Evap. Td and typical industry reference values for water cooled, forced draught and static coils
- Condenser Td
- Effect of changes in Cond. Td and typical industry reference values for water cooled, forced draught and static coils
- Typical storage conditions (temp & RH) for common products (dairy, produce, meat and frozen food rooms)
- Typical high and low side system operating values (pressures and temperatures allowing 1K equivalent PD)

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 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.

EVIDENCE GUIDE

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

EVIDENCE GUIDE

- 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 of vapour compression systems as described in 8) and including:
 - A Selecting and using appropriate measuring devices 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 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

EVIDENCE GUIDE

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 determining the basic operating conditions of vapour compression 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 determining operating conditions using measurement and basic calculation methods of vapour compression 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.

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
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Custom Content Section

Competency Field 5)

Refrigeration and Air Conditioning