



Australian Government

Department of Education, Employment and Workplace Relations

UEENEEJ193A Analyse the thermodynamic performance of HVAC/R systems

Release: 2

UEENEEJ193A Analyse the thermodynamic performance of HVAC/R systems

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This unit covers the analysis of heating, ventilating, air conditioning and refrigeration (HVAC/R) systems to provide solution to thermodynamic performance issues. It encompasses working safely, apply extensive knowledge of thermodynamic parameters, gathering and analysing data, applying problem solving techniques, developing and documenting results and solutions for use in design work.

Application of the Unit

Application of the Unit

4)

This unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training or institutional based delivery. It applies to any formal recognition for this standard at the aligned AQF 6 level.

Licensing/Regulatory Information

1.2) License to practice

The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety, codes of work practice and standard work procedures related to the operation of automated machinery.

Pre-Requisites

Prerequisite Unit(s) 2)

2.1) Competencies

There are no prerequisite competencies for this unit.

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.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to analyse the thermodynamic performance of HVAC/R systems	<p>1.1 OHS processes and procedures for a given work area are identified, identified, obtained and understood</p> <p>1.2 Established OHS risk control measures and procedures are followed in preparation for the work.</p> <p>1.3 The extent of the thermodynamic issues are determined from performance specifications and situation reports and in consultations with relevant persons</p> <p>1.4 Activities are planned to meet scheduled timelines in consultation with others involved in the work.</p> <p>1.5 Effective strategies are formed to ensure solution development and implementation is carried out efficiently.</p>
2 Analyse the thermodynamic performance of HVAC/R systems	<p>2.1 OHS risk control measures and procedures for carrying out the work are followed.</p> <p>2.2 Knowledge of thermodynamic principles are applied to analytical solutions to refrigeration and air conditioning systems.</p> <p>2.3 Parameters, specifications and performance requirements in relation to refrigeration and air conditioning systems are obtained in accordance with established procedures.</p> <p>2.4 Approaches to analysing thermodynamic parameters are carried out to provide the most effective solution.</p> <p>2.5 Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.</p> <p>2.6 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards</p>

ELEMENT	PERFORMANCE CRITERIA
3 Document and report on the results of the thermodynamic performance analysis and actions taken.	<p>3.1 Solutions to thermodynamic issues are evaluated to determine their effectiveness and modified where necessary.</p> <p>3.2 Analysis is documented including details of all findings, calculations and assumptions.</p> <p>3.3 Analysis is reported to appropriately personnel to establish appropriate action to be taken based on findings.</p> <p>3.4 Justification for findings and any actions to be undertaken in relation to the equipment is documented for inclusion in work/project or development records in accordance with professional standards.</p>

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 analysing the thermodynamic performance of HVAC/R systems.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EJ193A Refrigeration systems

Evidence shall show an understanding of introduction to refrigeration systems, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1. Major components, type and functions:

- evaporators
- compressors
- expansion devices
- ancillary components
- refrigerants

T2. System operation and performance:

- thermodynamic properties of refrigerants
- pressure enthalpy charts
- refrigerant cycle
- refrigerant cycle represented on pH charts
- introduction to refrigerating effect, heat of compression, heat rejected on high side, co-efficient of performance, liquid sub-cooling suction superheating
- effects on performance of changing operating pressures, liquid sub-cooling, suction superheating

T3. Application of refrigeration:

- introduction to industrial refrigeration, specific system component types and refrigerants applied.
- scope of commercial refrigeration, specific system component types and refrigerants applied

T4. Refrigerated enclosures and cabinets:

- merchandising and display cabinets:
- deep freeze meat

REQUIRED SKILLS AND KNOWLEDGE

- dairy
- fruit and vegetable
- multi-deck display
- single deck
- well type
- island cases
- glass door
- reach door
- reach in merchandisers
- defrosting methods
- cold rooms and freezer rooms
- types and construction
- insulation
- vapour barrier
- frost heave
- interior fittings
- location of equipment
- defrosting methods
- cold tracking
- trace heating
- storage conditions
- temperature
- relative humidity
- air velocity
- air patterns
- load limits

KS02-EJ193A

Air conditioning systems

Evidence shall show an understanding of introduction to air conditioning systems, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1. Occupational health requirements:

- WH&S requirements
- BCA requirements
- AS1668 parts 1 & 2
- AS3666
- noise and vibration
- air quality
- sick building syndrome

T2. Operating requirements:

REQUIRED SKILLS AND KNOWLEDGE

- ventilation
- air distribution
- terminal velocity
- temperature
- relative humidity
- air quality
- noise
- basic psychometrics

T3. Operating modes

- ventilation
- evaporative cooling
- ventilation and cooling
- ventilation and heating
- dehumidification
- dehumidification
- dehumidification and reheat
- humidification

T4. Operating terminology/characteristics:

- throw, drop
- primary and secondary air
- coanda effect

T5. HVAC system components and functions:

- fans
- ducting
- registers
- dampers
- filters
- cooling coils
- heating coils
- induction units
- fan coil units
- terminal units
- humidifiers, pumps and sprayers
- hydronic systems and components

T6. Applications and construction of air conditioning systems:

- applications
- residential, commercial, low and high rise, industrial ventilation and air conditioning

REQUIRED SKILLS AND KNOWLEDGE

- packaged plant
- RACs, split systems (wall and floor console, ceiling fan coil), wall facia, roof top, reverse cycle option central station plant
- all air systems, constant volume variable temperature, constant temperature variable volume, air/water systems
- all water system, multi-zoning, thermal storage systems
- basic air conditioning system diagrams
- duct layout
- hydronic layout
- unit/conditioner drawings

T7. HVAC control systems:

- basic principles
- terminology
- symbols and diagrams
- basic applications

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

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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, 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:
 - Analyse the thermodynamic performance of HVAC/R systems as described in 8) and including:
 - A Understanding the thermodynamic performance issues
 - B Forming effective strategies for analysing refrigeration and air conditioning systems performance
 - C Obtaining thermodynamic performance parameters, specifications and performance requirements appropriate to each situation.
 - D Evaluating the results of the analysis
 - E Documenting analysis details of all findings, calculations and assumptions.
 - F Documenting justification of actions to be implemented in accordance with professional standards.
 - G Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with

EVIDENCE GUIDE

the above listed items

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified

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 analysing the psychrometric and thermodynamic performance of HVAC/R 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

9.5)

There are no concurrent assessment recommendations for this

EVIDENCE GUIDE

other units 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 analysing thermodynamic parameters in at least two different refrigeration and air conditioning systems.

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	5	Writing	5	Numeracy	5
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Custom Content Section

Competency Field 5)

Refrigeration and Air Conditioning

