

Title	Demonstrate knowledge of the principles of refrigeration and air conditioning		
Level	3	Credits	15

Purpose	<p>This unit standard is for people who work or intend to work in the refrigeration and air conditioning sector of the engineering industry. It covers the basic principles of refrigeration and air conditioning and their application, and is intended for use in the training of installers and technicians of refrigeration and air conditioning equipment.</p> <p>People credited with this unit standard are able to demonstrate knowledge of: physics related to refrigeration and air conditioning; the refrigeration cycle; refrigeration systems; air conditioning systems; the basic principles of cold food storage; and establish operating parameters of a small refrigeration system and a heat pump.</p>
----------------	--

Classification	Mechanical Engineering > Refrigeration and Air Conditioning
-----------------------	---

Available grade	Achieved
------------------------	----------

Explanatory notes

- 1 References
Althouse, Turnquist, Bracciano. *Modern Refrigeration and Air Conditioning*. 19th edition. Tinley Park, Illinois: The Goodhouse-Willcox Company Inc. ISBN 1-59070-280-8.
- 2 Definitions
SI – Systeme International d’unites.
- 3 Assessment
Assessment of Outcome 6 may be made on commercially manufactured systems, or on working models built for the purpose of instruction.

Outcomes and evidence requirements

Outcome 1

Demonstrate knowledge of physics related to refrigeration and air conditioning.

Evidence requirements

- 1.1 The terms *saturation*, *latent heat of fusion*, *latent heat of evaporation*, *specific heat*, *relative humidity*, and *dry and wet bulb temperature* are defined as used in refrigeration and air conditioning.
- 1.2 The three methods of heat transfer are explained with reference to their application in refrigeration and air conditioning.
- 1.3 The first and second laws of thermodynamics are described in terms of energy, heat, work, and enthalpy.
- 1.4 The SI units for temperature and pressure are stated together with symbols.
- 1.5 The terms *specific volume*, *specific density*, and *specific gravity* are explained, and their SI units are stated together with symbols.

Outcome 2

Demonstrate knowledge of the refrigeration cycle.

Evidence requirements

- 2.1 A simple pressure/enthalpy skeleton chart is sketched.
- Range constant pressure, temperature lines, saturated vapour/liquid lines, specific volume lines, constant entropy lines, critical point, constant enthalpy lines.
- 2.2 *Glide point*, *bubble point*, and *dew point* are explained with the aid of a Mollier chart.
- 2.3 A refrigeration cycle is superimposed on a Mollier chart, and the terms *coefficient of performance* and *refrigeration effect* are explained.
- 2.4 The refrigeration cycle is explained with the aid of a diagram, and with reference to changes in volume, temperature, pressure, and state of the refrigerant.
- 2.5 The effects of pressure on a refrigerant are described.
- Range compression and expansion, refrigeration laws, pressure-volume-saturated temperature relationships.
- 2.6 The effects of humidity in a refrigerated space on comfort cooling and refrigerated food are stated.
- 2.7 The difference between critical and non-critical refrigeration systems is explained.

Outcome 3

Demonstrate knowledge of refrigeration systems.

Evidence requirements

- 3.1 The major components of a typical refrigeration system are identified and their functions described.
- 3.2 Commonly used types of refrigeration compressors are identified and their differences explained.
- 3.3 Basic electrical components and controls are identified and their functions described.
- 3.4 Materials required for insulation and sealing of refrigerated space are identified and their properties described.
- 3.5 The use of copper pipework in some refrigeration systems and aluminium pipework in others is explained.
- 3.6 Air and fluid paths through the components of a typical refrigeration system are outlined with reference to purpose and input versus output states.
- Range components – evaporator, condenser, heat exchanger, refrigerated product.
- 3.7 The types of defrost cycles used in modern refrigeration systems are described.

Outcome 4

Demonstrate knowledge of air conditioning systems.

Evidence requirements

- 4.1 The requirements for personal comfort are stated.
- 4.2 The application of air conditioning to achieve personal comfort is outlined with reference to heating, cooling, and humidity.
- 4.3 The major components of a small split air conditioning system are identified and their functions and interconnections described.
- 4.4 The major components of a typical air conditioning system, for use in a commercial building, are identified and their functions and interconnections described.

Outcome 5

Demonstrate knowledge of the basic principles of cold food storage.

Evidence requirements

- 5.1 The effects of storage temperature on food are described with reference to food quality, food safety, and growth of microorganisms.

- 5.2 The safe temperature ranges for storing food in refrigerators and freezers are stated.
- 5.3 The maximum safe periods refrigerated and frozen foods may be left out of a chiller or freezer in the event of a breakdown are stated.
- 5.4 The effects of high and low humidity on food in cold storage are stated.

Outcome 6

Establish operating parameters of a small refrigeration system and a heat pump.

Range parameters – pressure, temperature, airflow, humidity.

- 6.1 Measurements of parameters are made at input and output of key components of the systems, and recorded with SI units.
- 6.2 Temperature and pressure measurements are plotted on pressure/enthalpy diagrams.

Replacement information	This unit standard and unit standard 28952 replaced unit standard 22701.
--------------------------------	--

Planned review date	31 December 2020
----------------------------	------------------

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	18 June 2015	N/A

Consent and Moderation Requirements (CMR) reference	0013
--	------

This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMRs). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz at qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.