

Title	Demonstrate knowledge of refrigerants and their management		
Level	3	Credits	5

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 foundation knowledge of refrigerants to underpin their safe handling and the safety of operators.</p> <p>People credited with this unit standard are able to demonstrate knowledge of: the physical properties of commonly used refrigerants; refrigerant classifications; the hazards associated with refrigerants, and their management; gas cylinders and their safety features for use with refrigerants; standard industry practices for handling refrigerants; and legislation and codes of practice for the use and management of refrigerants. They are also able to describe safe methods of identifying refrigerants.</p>
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Classification	Mechanical Engineering > Refrigeration and Air Conditioning
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Available grade	Achieved
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Guidance Information

- 1 Legislation and standards
 - Health and Safety at Work Act 2015;
 - Hazardous Substances and New Organisms Amendment Act 2015;
 - Hazardous Substances (Compressed Gases) Regulations 2004;
 - Land Transport Rule (Dangerous Goods) 2016;
 - Ozone Layer Protection Act 1996;
 - Climate Change Response Act 2002;
 - AS/NZS 5149:2016 *Refrigerating systems and heat pumps parts 1:5 Refrigerating systems and heat pumps – Safety and environmental requirements*;
 - AS/NZS 817:2016 *Refrigerants – Designation and safety classification*;
 - Australia and New Zealand Refrigerant Handling Code of Practice 2007;
 - and any subsequent amendments.

- 2 References
 - Environmental Protection Authority. *Guide to Gas Cylinders*;
 - Environmental Protection Authority. *List of HSNO classification codes*;
 - The Institute of Refrigeration Heating & Air Conditioning Engineers of New Zealand, Inc. and Climate Control Companies Association New Zealand. *Code of Practice for the reduction of emissions of fluorocarbon refrigerants in refrigeration and air conditioning application 2001*. Available from <http://www.irhace.org.nz>; *Dangerous Goods Emergency Action Code List 2019*. National Chemical Emergency Centre, London;

Safety Data Sheets (for refrigerants). Available from refrigerant suppliers and must be available on the work site.

3 Definitions

ASHRAE – the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

CH₃Cl – Methyl chloride.

Code of Practice – the *Australia and New Zealand Refrigerant Handling Code of Practice 2007*.

EPA – Environmental Protection Authority.

F-gas – a fluorinated gas.

GWP – Global Warming Potential.

HAZCHEM – Hazardous Chemicals. A system of codes used to alert emergency services to the presence of hazardous substances and how to deal with them.

HC – Hydrocarbon.

HCFC – Hydrochlorofluorocarbon.

HFC – Hydrofluorocarbon.

HSNO – Hazardous Substances and New Organisms.

Industry practices refer to approved codes of practice and standardised procedures accepted by the wider refrigeration and air conditioning industry sectors as examples of best practice.

IRHACE – Institute of Refrigeration, Heating and Air Conditioning Engineers New Zealand.

ODP – Ozone Depleting Potential.

SDS – Safety Data Sheet.

4 Assessment information

Appropriate tables of refrigerant properties must be available for the assessment for all activities in performance criterion 1.5.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the physical properties of commonly used refrigerants.

Performance criteria

- 1.1 The term *refrigerant* is explained in terms of heat transfer.
- 1.2 Terminology relating to physical properties of refrigerants is explained.
- Range critical point, toxicity, lower explosive limit, azeotrope, zeotrope, ODP, GWP.
- 1.3 The meaning of the term *F-gas* is explained, and the chemical compositions of three F-gases are stated.
- 1.4 The meaning of the term *natural refrigerants* is explained, and five examples are given.

1.5 Properties of commonly used refrigerants are compared.

Range refrigerants – HFC–R404a, HFC–R410a, HFO–1234yf, HFC–R134a, Propane–R290, Isobutane–R600a, ammonia–R717, carbon dioxide–R744;
properties – critical temperature, toxicity, flammability, ODP, GWP.

Outcome 2

Demonstrate knowledge of refrigerant classifications.

Performance criteria

2.1 The ASHRAE system of refrigerant designation is outlined in accordance with AS/NZS 817:2016.

2.2 The chemical compositions of refrigerants are identified from ASHRAE “R” number, cylinder colour code, and pressure temperature chart.

Range refrigerants – unitary, zeotrope, azeotrope; non-organic, organic, hydrocarbon, ammonia.

2.3 The flammability (Groups 1, 2, and 3) and toxicity (Groups A and B) classifications of refrigerants are explained, and examples interpreted in accordance with AS/NZS 817:2016.

Range may include but not limited to – A1, A3, B1, B2.

2.4 The purpose of HSNO codes for hazardous substances is explained, and the meanings of Classes 2.1.1A and 2.1.1B interpreted.

2.5 The purpose of an SDS is explained, and relevant information retrieved from a given SDS.

2.6 The purpose of HAZCHEM or Emergency Action Codes is explained, and the meaning of HAZCHEM code 2RE identified. The HAZCHEM code for a given refrigerant is identified.

Outcome 3

Describe safe methods of identifying refrigerants.

Performance criteria

3.1 Safe methods to identify common refrigerants in containers or vessels, and in systems are described in accordance with standard industry practice.

Range HCFCs (R0XX) – for example R22;
HFCs (R1XX) – for example R134a;
Zeotropes (R4XX) – for example R404A;
HC (R2XX) – for example R290.
Identification of one refrigerant from each group is required.

- 3.2 Safe methods to identify a harmful gas which is not commonly used as refrigerant are described with reference to SDS and manufacturer's or supplier's recommendations, and in accordance with standard industry practice.

Range may include but not limited to – CH₃Cl.

Outcome 4

Demonstrate knowledge of the hazards associated with refrigerants, and their management.

Performance criteria

- 4.1 Hazards associated with refrigerants are described.

Range hazards – flammability, toxicity, asphyxiation, ozone depletion effects, global warming; hazards associated with pressure vessels; refrigerants – F-gases, hydrocarbons, ammonia.

- 4.2 Methods of managing refrigerant hazards are described.

Range avoidance of leakage, ventilation, use of personal protective equipment, first aid measures, labelling of cylinders and equipment, warning signs, training and certification of fillers and handlers.

- 4.3 Minimum requirements for personal protective equipment when working with refrigerants are stated, and additional requirements for some refrigerants are identified from an SDS.

- 4.4 The danger of counterfeit refrigerants is explained, and measures to minimise their use are stated.

Outcome 5

Demonstrate knowledge of gas cylinders and their safety features for use with refrigerants.

Performance criteria

- 5.1 Types of compressed gases are distinguished with reference to critical temperature and liquid or gas phase.

Range types of compressed gases – permanent, low pressure liquefied, cryogenic, liquefied, high pressure liquefied, refrigerated liquefied.

- 5.2 The use of different types of cylinders used for refrigerants are distinguished in accordance with standard industry practice.

Range storage cylinders, returnable service cylinders, disposable cylinders.

- 5.3 The EPA approval status of a given cylinder for the recovery of a given refrigerant is identified.
- 5.4 The time interval between periodic inspection and test for refrigerant cylinders is stated, and the inspection and testing procedure is described.
- 5.5 The purpose and operation of over-pressure safety devices is explained.
- 5.6 The purpose of clockwise and anticlockwise valve outlet threads is explained.
- 5.7 The markings and labelling of a given cylinder and valve are interpreted.

Outcome 6

Describe standard industry practices for handling refrigerants.

Performance criteria

- 6.1 Procedures for evacuation and pressurisation of a system are described.
- Range connection of equipment, setting of valves, running of equipment.
- 6.2 Procedures for recovering refrigerant from a system are described.
- Range vapour recovery method, liquid recovery method, push/pull recovery method;
connection of equipment, setting of valves, running of equipment.
- 6.3 Service procedures for detecting the loss of refrigerant from a system are described.
- 6.4 Procedures for the labelling of a refrigeration system are described.
- Range refrigerant type, lubricant type, date of service, name of service organisation.
- 6.5 Methods for safe handling and storing of refrigerants are described.
- Range approved cylinders, recovery bags.

Outcome 7

Demonstrate knowledge of legislation and codes of practice for the use and management of refrigerants.

Performance criteria

7.1 Legislation, code of practice, and technical guide, for the safe use and management of refrigerants, are briefly outlined.

Range Compressed Gas Regulations 2017;
Environmental Protection Authority – Guide to Gas Cylinders;
Health and Safety at Work Act 2015;
Land Transport Rule (Dangerous Goods) 2005;
Ozone Layer Protection Act 1996;
Australia and New Zealand Refrigerant handling code of practice 2007.

7.2 The purpose and scope of Approved Filler certification explained.

Replacement information	This unit standard and unit standard 28970 replaced unit standard 22701.
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Planned review date	31 December 2020
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	18 June 2015	N/A
Revision	2	22 October 2020	N/A

Consent and Moderation Requirements (CMR) reference	0013
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Comments on this unit standard

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