Title	**Apply knowledge of electrics and electronics to the installation and maintenance of RAC systems under supervision**		
Level	**3**	**Credits**	**6**

Purpose	This unit standard is for people working in the refrigeration and air conditioning (RAC) industry under supervision. People credited with this unit standard are able to: assess the operating performance of electrical and electronic components in RAC systems; select electrical and electronic components to meet the operating requirements of RAC systems; identify the causes of electrical and electronic faults in RAC systems and components; and programme a programmable logic controller (PLC).

Classification	Mechanical Engineering > Refrigeration and Air Conditioning

Available grade	Achieved

Prerequisites	Unit 15852, *Isolate and test low-voltage electrical subcircuits;* Unit 6401, *Provide first aid;* and Unit 6402, *Provide basic life support;* or demonstrate equivalent knowledge and skills.

Guidance Information

1 Recommended skills and knowledge:
Unit 28961, *Demonstrate knowledge of electrical and electronic components used in commercial RAC systems,* or demonstrate equivalent knowledge and skills.

2 Legislation and standards
Health and Safety at Work Act 2015;
Building Act 2004;
Electricity (Safety) Regulations 2010;
Electricity Act 1992;
Hazardous Substances and New Organisms Amendment Act 2015;
Ozone Layer Protection Act 1996;
AS/NZS 5149:2016 *Parts 1:5 Refrigerating Systems and Heat pumps – Safety and environment requirements;*
AS/NZS 817:2016 *Refrigerants – Designation and safety classification*;
AS/NZS 3000:2007 *Electrical installations (known as the Australian/New Zealand Wiring Rules)*;
and any subsequent amendments.

3 References

Althouse, Turnquist, Bracciano. *Modern Refrigeration and Air Conditioning*. 19th edition. Tinley Park, Illinois: The Goodhouse-Willcox Company Inc. ISBN 1-59070-280-8.
Institute of Refrigeration, Heating and Air Conditioning Engineers of New Zealand (IRHACE New Zealand). 2001 *Code of Practice for the reduction of emissions of fluorocarbon refrigerants in refrigeration and air conditioning applications*. Available from IRHACE, http://www.irhace.org.nz/.

4 Definitions

EST refers to electrical service technician.
Standard industry practices refer to standard and proven industry practices accepted by the refrigeration and air conditioning industry.
Under supervision means under the oversight and guidance of an experienced and authorised person holding an Electrical Service Technician licence who takes overall responsibility for the work carried out.
Worksite procedures refer to documented procedures used by the organisation carrying out the work and applicable to the tasks being carried out. They may include but are not limited to – standard operating procedures, site safety procedures, equipment operating procedures, codes of practice, quality assurance procedures, housekeeping standards, procedures to comply with legislative and local body requirements.

5 Assessment information

This unit standard may be assessed in the workplace using naturally occurring evidence or in a simulated environment that demands performance equivalent to that required in the workplace.
All work must be carried out under supervision and in accordance with worksite procedures.

Outcomes and performance criteria

Outcome 1

Assess the operating performance of electrical and electronic components in RAC systems.

Performance criteria

1.1 The properties of electrical and electronic components and circuits are checked to ensure they meet system specifications.

Range components – motors, relays, switches, protection devices, circuit boards, temperature probes, pressure transmitters; properties – voltage, current, resistance, power.

1.2 The performance of electrical and electronic components in RAC systems is assessed in terms of electrical principles and properties.

Range components – motors, relays, protective devices; protective devices – fuses, circuit breakers, contactors, overloads;

principles and properties – current flow, resistance, voltage, power, temperature rise, capacitance, earthing.

Outcome 2

Select electrical and electronic components to meet the operating requirements of RAC systems.

Range electric motors, relays, contactors, switches, wiring, protection devices.

Performance criteria

2.1 Analysis of system output and operating requirements establishes the operating parameters of electrical components.

Range parameters may include but are not limited to – speed, torque, voltage, current, power.

2.2 Components selected match plant and regulatory requirements, and the operating environment.

Range plant requirements may include but are not limited to – starting requirements, speed, load, cycling times, duty cycle; operating environment – moisture, vibration, hazardous gases, hygiene, temperature.

2.3 Components are identified using accepted industry terminology.

Outcome 3

Identify the causes of electrical and electronic faults in RAC systems and components.

Range electric motors, stepper motors, relays, contactors, protection devices, variable speed drives, solenoids.

Performance criteria

3.1 Electrical measuring instruments are selected to match the testing requirements and system and/or component parameters.

3.2 Measuring instruments are used in accordance with standard industry practices and manufacturer’s specifications.

3.3 Analysis of measurement data establishes that faults are electrical in origin.

3.4 Probable causes of faults are identified in electrical and/or electronic terms.

Range causes may include – power supply faults and/or failures, component faults and/or failure, inappropriate selection and/or use of components, overload from mechanical failure.

Outcome 4

Programme a PLC.

Performance criteria

4.1 A PLC is programmed to perform a simple task.

Range simple task relating to one of – time setting, temperature setting, an event.

Replacement information	This unit standard, and unit standard 28959 replaced unit standard 22703.

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
Revision	2	22 October 2020	N/A

Consent and Moderation Requirements (CMR) reference	0013

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.