Title	**Install and start-up pre-commission of air conditioning systems**		
Level	**4**	**Credits**	**30**

Purpose	People credited with this unit standard are able to: prepare for installation of air conditioning systems; install air conditioning systems; prepare for start-up pre-commissioning procedures; perform start-up pre-commissioning procedures; provide quality assurance information and complete as-built documentation to stakeholders.

Classification	Mechanical Engineering > Refrigeration and Air Conditioning

Available grade	Achieved

Prerequisites	Unit 28950, *Meet requirements for Approved Filler Test Certificate for refrigerants,* or demonstrate equivalent knowledge and skills.

Guidance Information

1 Recommended skills and knowledge:
Unit 32754, *Demonstrate knowledge of air conditioning systems principles, applications and hazards*.

2 Legislation and standards relevant to this unit standard:
Building Act 2004;
Climate Change Response Act 2002;
Electricity Act 1992;
Electricity Amendment Act 1997;
Electricity (Safety) Regulations 2010;
Hazardous Substances and New Organisms Amendment Act 2015;
Health and Safety at Work Act 2015;
Ozone Layer Protection Act 1996;
AS/NZS 5149:2016, Refrigerating systems and heat pumps parts 1:5 *Refrigerating systems and heat pumps – Safety and environmental requirements*;
AS/NZS ISO 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*. 21st edition. Tinley Park, Illinois: The Goodhouse-Willcox Company Inc.
ISBN 1-63563-877-1.

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 All worksite practices must meet recognised codes of practice and documented safety procedures and safety plans (where these exceed the code) for personal and worksite safety, and obligations required under current legislation.

5 Definitions

Air conditioning systems refer to systems that provide heating, cooling and suitable indoor air quality for use in residential or light commercial applications.

Specifications typically includes drawings, performance specification, parts list, installation instructions, commissioning tests and procedures, and operating instructions.

Work permit in this unit standard refers to the documented procedures associated with controlling potentially hazardous work activities.

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.

6 Range

a. Air conditioning systems types include – roof top packaged unit, ducted indoor unit, high-wall indoor unit, air cooled outdoor condenser, air cooled outdoor multi system condenser, under-ceiling indoor unit, cassette indoor unit, floor console indoor unit, extract air systems, outdoor air supply system, heat recovery ventilator.
b. Specifications may include but are not limited to – drawings, performance specification, parts list, installation instructions, commissioning tests and procedures, and operating instructions.

7 Assessment information

a. Competence is to be demonstrated on at least six occasions of installing and pre-commissioning, one of which must be a ducted system in different circumstances.
b. All activities and evidence must be in accordance with worksite procedures, approved industry practices and specifications.
c. Competence must be demonstrated in a workplace under the commercial environment.

Outcomes and performance criteria

Outcome 1

Prepare for installation of air conditioning systems.

Performance criteria

1.1 Quality and quantity related non-conformance are identified and rectified.

Range quality and quantity may include but are not limited to – missing components from bill of materials, damaged components and materials, incorrect components and materials.

1.2 Timeframes are established with stakeholders.

Range stakeholders may include but are not limited to – manager, supervisor, contract manager, main contractor, sub-contractors, building owner, internal staff.

1.3 Drawings and manufacturers specifications are checked for suitability of installation.

1.4 Materials and components are checked for suitability of installation.

Range materials and components may include but are not limited to – valves, controls, filters, driers, condensate drains, solid ducting, flexible ducting, fans;
installation materials may include but are not limited to – supports and bracketing to secure pipework, piping, tubing, capping, thermal insulation, duct work, fans;
installation considerations – seismic restraint, passive fire.

1.5 Tools and access equipment are selected for suitability of installation.

1.6 The ability to meet building code requirements for the installation is confirmed and, where required, permits and/or consents are identified and confirmed as to their suitability.

1.7 Different types of work permit, attachments, certificates and associated procedures are identified in relation to the work to be carried out.

Range includes but is not limited to – cold, hot, confined space entry, isolation, working at height, lifting/cranage.

Outcome 2

Install air conditioning systems.

Performance criteria

2.1 Air conditioning plant and equipment are positioned and installed in accordance with specifications, site conditions, plans, and instructions.

Range may include but are not limited to – indoor unit, outdoor unit, packaged unit, fans;
installation considerations may include but are not limited to – sufficient support, vibration elimination, seismic restraint, retaining building's structural integrity, water-tightness, passive fire.

2.2 Ancillary components and installation materials are installed.

Range ancillary components may include but are not limited to – valves, controls, filters, driers, condensate drains, solid ducting, flexible ducting;
installation materials may include but are not limited to – supports and bracketing to secure pipework, piping, tubing, capping, thermal insulation;
installation considerations – seismic restraint, nitrogen purging, internal cleanliness.

2.3 The work of associated trades personnel is identified and scheduled.

2.4 Installation is completed on time and to the specifications.

Outcome 3

Prepare for start-up pre-commissioning procedures.

Performance criteria

3.1 Quality related non-conformance is identified, reported and rectified.

3.2 Electrical requirements are confirmed with licenced personnel.

3.3 Integrity of the installation is confirmed by appropriate visual and tactile checks against plans and specifications.

Range may include but is not limited to – terminations, building penetrations, connections, condensate drains.

3.4 Start-up pre-commissioning timeframes are established with stakeholders.

Range stakeholders may include but are not limited to – manager, supervisor, contract manager, main contractor, sub-contractors, building owner, internal staff.

3.5 Identify the type and quantities of testing equipment required to test the system.

Range may include but is not limited to – refrigeration gauges, vacuum pump, nitrogen regulator, anemometer, leak detector, vacuum gauge.

Outcome 4

Perform start-up pre-commissioning procedures.

Performance criteria

4.1 Refrigeration system, pipework and components are verified as safe to be exposed to test pressures.

Range may include but is not limited to –flared nuts, brazed joints, compression fittings, access ports;
considerations – passive fire, seismic restraint

4.2 Refrigeration system, pipework and components are pressure tested to confirm system integrity.

4.3 Refrigeration system is evacuated according to manufactures recommendations to ensure that moisture, oxygen, and non-condensables are removed.

Range evacuation tools include but are not limited to – Schraeder core removal tool, vacuum analyser, vacuum pump, short large-bore vacuum hose, solenoid valve, isolating valves.

4.4 Vacuum is broken with appropriate refrigerant charge after evacuation.

Range charging scales, gauge manifold.

4.5 Condensate drain is tested to ensure water flows from the outlet.

4.6 Ventilation system components and system integrity is checked and verified.

Range may include but is not limited to – fans, flexible ducting, solid ducting, dampers, grilles, louvers, cowls, filters, mechanical joints, flanges, canvas joints;
considerations – passive fire, seismic restraint.

4.7 Pre-commissioning is completed in accordance with agreed timeframe.

Outcome 5

Provide quality assurance information and complete as-built documentation to stakeholders.

Performance criteria

5.1 Quality assurance and as-built documentation is completed and provided to stakeholders.

Range quality assurance and as-built documentation may include but not limited to – manuals, operating instructions, system schematics, Pressure test reports, warranty cards.

Replacement information	This unit standard replaced unit standard 22443.

Planned review date	31 December 2026

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	26 August 2021	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.