



Australian Government

UEERA0051 Install, commission, service and maintain air conditioning systems

Release: 1

UEERA0051 Install, commission, service and maintain air conditioning systems

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Application

This unit involves the skills and knowledge required to safely and effectively install, commission, service and maintain air conditioning systems.

It includes the ability to source relevant data and schematics; install components, pipe work, accessories and controls to create a functional air conditioning system. It covers selecting, installing and terminating interconnecting and controller cables between the sensor/s, controller/s, indoor and outdoor units of residential and small commercial systems; replacing damaged cables on equipment operating at voltages up to 500 volt (V) alternating current (a.c.) after its main switch with like-for-like cables; commissioning the system to ensure it operates at the specified design conditions, locating and rectifying faults and carrying out routine maintenance procedures.

The skills and knowledge of this unit of competency will be applied by refrigeration and air conditioning technicians during the installation, commissioning and servicing of air conditioning systems.

To undertake this unit, the learner must have a current Trainee Refrigerant Handling Licence as it includes work on refrigeration and air conditioning equipment that carries the risk of a fluorocarbon refrigerant being emitted.

The skills and knowledge described in this unit require a national Refrigerant Handling Licence as it includes work on refrigeration and air conditioning equipment that carries the risk of a fluorocarbon refrigerant being emitted while decanting the refrigerant or manufacturing, installing, commissioning, servicing, maintaining or decommissioning refrigeration and air conditioning equipment.

The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations which are designed to operate at voltages greater than 50 V alternating current (a.c.) or 120 V direct current (d.c.).

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, skills and knowledge described in this unit require a relevant contract of training, such as an Australian Apprenticeship.

Additional and/or other conditions may apply in some jurisdictions subject to regulations related to refrigeration, air conditioning and electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

Permits may also be required for some work environments, such as confined spaces, working

aloft, near live electrical apparatus and site rehabilitation.

Pre-requisite Unit

UEECD0007 Apply work health and safety regulations, codes and practices in the workplace

Competency Field

Refrigeration and air-conditioning

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to install air conditioning systems

2 Select, install and terminate low voltage (LV) and extra-low voltage (ELV) cables for refrigeration or air conditioning installations

PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

- 1.1** WHS/OHS risk control measures and procedures for carrying out the work are obtained and implemented in accordance with workplace procedures
- 1.2** Work details are determined from documentation and/or supervisor to establish scope of work to be completed in accordance with workplace procedures
- 1.3** Components, piping, accessories, controls and consumables for the installation work are obtained and checked against job requirements in accordance with industry standards and codes of practice
- 1.4** Tools, equipment and testing devices to complete work are obtained in accordance with workplace procedures and checked for operational safety in accordance with workplace procedures
- 2.1** Cable conductor sizes are selected to meet the equipment manufacturer specifications, current-carrying capacity requirements and voltage-drop

- 2.2 Reasons for selections made, including calculations, are documented in accordance with established procedures
 - 2.3 Cables are installed to comply with technical standards and job specifications and requirements with sufficient access to affect terminations
 - 2.4 Cables and conductors are terminated at accessories in accordance with manufacturer specifications and regulatory requirements
 - 2.5 Safety inspection of installed cables and testing of installed circuits are undertaken and any defects are rectified
 - 2.6 'As-installed' cables/wiring are documented and appropriate person/s notified in accordance with established procedures
- 3 Install non-ducted split air conditioning systems**
- 3.1 All required major components are securely mounted in the locations identified by the documentation or the supervisor in accordance with workplace procedures
 - 3.2 Refrigerant pipe work and associated components are installed according to specifications ensuring all connections and tube cleanliness are in accordance with requirements and workplace procedures
 - 3.3 Pressure testing of the installed components and pipe work is conducted to the required level for the type of refrigerant being used in accordance relevant codes of practice and industry standards
 - 3.4 Leaks are located and rectified employing appropriate methods in accordance with relevant codes of practice and industry standards
 - 3.5 Air conditioning system is evacuated to remove moisture and other contaminants in accordance with relevant codes of practice and industry standards
 - 3.6 Vacuum drop test is carried out to verify all moisture and other contaminants have been removed from the system in accordance with relevant codes of practice and industry standards
 - 3.7 Power and control circuit wiring is checked to ensure it conforms to circuit diagram specifications and system is electrically safe to energise in accordance with relevant

- codes of practice and industry standards
- 4 Install ducted split air conditioning systems**
- 4.1** Major components are securely mounted in the locations identified by the documentation or the supervisor in accordance with workplace procedures
- 4.2** Flexible ductwork, associated fittings and flow control devices are installed according to specifications ensuring all connections are in accordance with workplace procedures and industry standards
- 4.3** Refrigerant pipework and associated components are installed ensuring all connections and tube cleanliness is maintained at all times in accordance with workplace procedures and manufacturer specifications
- 4.4** Pressure testing of the installed components and pipe work is conducted to the required level for the type of refrigerant being used in accordance with relevant industry standards and workplace procedures
- 4.5** Leaks are located and rectified employing appropriate methods in accordance with industry standards and codes of practices
- 4.6** Air conditioning system is evacuated to remove moisture and other contaminants in accordance with industry standards, relevant codes of practices and workplace procedures
- 4.7** Vacuum drop test is carried out to verify all moisture and other contaminants have been removed from the system in accordance with industry standards, relevant codes of practices and workplace procedures
- 4.8** Power and control circuit wiring is checked to ensure it conforms to circuit diagram specifications and system is electrically safe to energise in accordance with industry standards, relevant codes of practices and workplace procedures
- 5 Commission air conditioning systems**
- 5.1** Air conditioning system is charged with the appropriate type and quantity of refrigerant in accordance with industry standards, relevant codes of practices and workplace procedures
- 5.2** Measurements are obtained and recorded to confirm that the refrigerant charge is optimal in accordance with the system's design and manufacturer specifications

- | | | |
|--|------------|--|
| | 5.3 | Control devices installed in the air stream for air flow quantity and distribution control are adjusted in accordance with the system's design and manufacturer specifications |
| | 5.4 | Measurements are obtained and recorded to confirm that air flow quantities and distribution is optimal in accordance with the system's design and manufacturer specifications |
| 6 Locate and rectify faults and carry out maintenance on air conditioning systems | 6.1 | Fault diagnosis is carried out in accordance with industry standards, relevant codes of practices and workplace procedures |
| | 6.2 | Fault-finding and rectification processes are carried out effectively without damage to the system and components in accordance with relevant codes of practice, industry standards and workplace procedures |
| | 6.3 | System is returned to an operational state in accordance with workplace procedures and manufacturer specifications |
| | 6.4 | Components that require routine maintenance are identified and regularly maintained in accordance with relevant timeframes, industry standards and workplace procedures |
| 7 Complete work and report activities | 7.1 | WHS/OHS risk control measures continue to be applied in accordance with workplace procedures |
| | 7.2 | Worksite and equipment are cleaned and made safe in accordance with workplace procedures |
| | 7.3 | Refrigerant usage is recorded in accordance with relevant industry regulations and codes of practice |
| | 7.4 | Supervisor is notified of task completion in accordance with workplace procedures |

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Selecting, installing and terminating LV and ELV cables for air conditioning installations must include the following applications:

- interconnecting and controller cables between the sensor/s, controller/s, indoor and outdoor units of residential and small commercial air conditioning systems
- replacing damaged cables on air conditioning equipment operating at voltages up to 500 V a.c. after its main switch with like-for-like cables

Selecting, installing and terminating LV and ELV cables for air conditioning installations must include the following cable types:

- circular thermoplastic sheathed (TPS)
- data cables
- flat TPS
- flexible cables
- shielded cables
- thermoplastic insulated (TPI) cable
- high wall split air conditioning system
- ceiling cassette split air conditioning system
- ceiling suspended split air conditioning system

Installing, commissioning, servicing and maintaining split air conditioning systems must include at least one of the following:

- ducted split air conditioning system
- ducted package air conditioning system

Installing, commissioning, servicing and maintaining ducted air conditioning systems must include at least one of the following:

- single phase 240 V
- three phase 415 V

Electrical supply to the installed air conditioning system must include one of the following:

Fault finding and rectification of an air conditioning system must include at least two of the following mechanical faults:

- incorrect refrigerant charge
- restriction within refrigerant circuit, including filter drier and refrigerant metering device (RMD)
- non-condensables
- incorrect low side superheat
- incorrect high side sub-cooling
- component failure, including compressor not pumping

Fault finding and rectification of an air conditioning system must include at least two of the following electrical faults:

- open circuit, including load, conductor and/or control
- incorrect circuit wiring

Carrying out maintenance on air conditioning systems must include all of the following

- earthing short, including load circuit has connected with casing and/or frame
- shunted short, including load is internally shorted causing lower resistance
- incorrect phase rotation
- high wall split air conditioning system
- ducted split air conditioning system
- ducted package unit air conditioning system

Unit Mapping Information

No equivalent unit.

Links

Companion Volume implementation guides are found in VETNet - -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEERA0051 Install, commission, service and maintain air conditioning systems

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:

- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements
- commissioning a ducted air conditioning system
- installing a ducted split air conditioning system
- installing a non-ducted split air conditioning system
- locating and rectifying mechanical faults and electrical faults on air conditioning systems
- maintaining air conditioning systems
- recording values and reporting completion of work
- selecting, installing and terminate low voltage (LV) and extra-low voltage (ELV) cables for refrigeration or air conditioning installations.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- air distribution, including:
 - air control damper types and applications
 - common fan types and applications
 - duct fitting types and applications
 - noise and vibration control methods
 - purpose of zoning, including advantages and disadvantages
 - relevant legislation, industry standards, codes of practice and regulations
 - rigid and flexible duct types and applications
 - supply and return air diffuser/grille types and applications
- basic ducted split system selection for a residential application, including:
 - application of industry recognised check figures watts per square metre (W/m²) and manufacturers data

- basic ductwork dimensioning employing a duct calculator
- drawing a basic ductwork layout map
- manufacturers design specifications and effects of operating the air conditioning system outside these conditions, including high/low ambient temperature and high relative humidity
- cable selection based on the existing cable, current-carrying capacity requirements, including:
 - *AS/NZS 3008 Electrical installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV* used to select conductor size based on the maximum current requirement for a given installation condition, including any applicable derating factors
 - types of cables and applications
- cable selection based on voltage-drop requirements, including:
 - *AS/NZS 3000* requirements for maximum voltage-drop in an installation
 - calculation of the expected voltage-drop in a given circuit
 - relevant tables in *AS/NZS 3008 Electrical installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV* for unit values of voltage-drop
 - selecting cables to satisfy voltage drop requirements in addition to current-carrying capacity requirements
- commissioning air conditioning systems requirements and procedures, including:
 - basic air balancing techniques
 - techniques to determine operating values for a reverse cycle high wall split air conditioning system
- common items identified on a preventative maintenance schedule, including the following air conditioning system types:
 - high wall splits
 - package units
 - split ducted
- defrost (de-ice) operation, including activation and termination conditions
- equipment installation requirements and procedures, including:
 - location considerations for outdoor and indoor units, including exposure, prevailing winds and noise regulations
 - maintaining structural integrity, including weight being applied and cutting of trusses/beams
 - maintenance of fire rating integrity
 - reading and interpreting manufacturer instructions
 - relevant legislation, industry standards, codes of practice and regulations
 - requirements for condensate removal and/or drainage
- fault finding and rectification of air conditioning systems requirements and procedures, including:
 - typical controller fault codes and use of manufacturer's data
 - symptoms and rectification of typical abnormal system conditions:
 - defrost initiation or termination failure

- earthing short, including load circuit has connected with casing and/or frame
- high side sub-cooling too low/too high
- incorrect phase rotation and scroll compressors
- inefficient compressor, including reduced pumping capacity
- inverter failure, including manufacturers recommended testing procedure
- low side superheat too low/too high
- non-condensables
- open circuit
- refrigerant overcharge and undercharge
- restricted filter drier
- shunted short, including load is internally shorted causing lower resistance
- package units, including construction, applications and installation
- reading and interpreting single phase wiring and pipe work schematics for a typical cooling only room air conditioner
- reading and interpreting single phase wiring and pipe work schematics for a typical reverse cycle high wall split air conditioner
- reading and interpreting three phase wiring and pipe work schematics for a typical reverse cycle package unit
- relevant standards, codes and requirements applicable to the installation of cables
- techniques for installing cables and wiring systems encompassing:
 - application of wiring accessories
 - cable and conductor terminations
 - drawing-in, placing and fixing of cables
 - inspecting and testing installed and terminated cables to ensure they comply with continuity and insulation resistance and are safe to connect to the supply
 - maintaining fire rating integrity
 - typical cable routes through buildings, structures and premises
- ventilation, including:
 - fresh air requirements in accordance with relevant industry standards
 - common methods, including natural, supply and exhaust
 - relevant legislation, industry standards, codes of practice and regulations.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational

situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, equipment and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, industry standards, equipment specifications, regulations, codes of practice and operation manuals

Links

Companion Volume implementation guides are found in VETNet - -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>