



Australian Government

UEERA0017 Design complex air conditioning systems and select equipment

Release: 1

UEERA0017 Design complex air conditioning systems and select equipment

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 design complex air conditioning systems and select equipment.

It includes applying processes and methods of complex air conditioning systems, safety and relevant industry standards; developing alternative design schemes based on a design brief and customer requirements; and documenting system designs.

The skills and knowledge described in this unit may, in some jurisdictions, require a licence or permit to practice in the workplace subject to regulations for undertaking refrigeration and air conditioning work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

No other licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

UEERA0022 Design heating, ventilation and air conditioning (HVAC) systems and select components

UEERA0004 Analyse vibration and noise in refrigeration and air conditioning systems

UEERA0042 Evaluate thermodynamic and fluid parameters of refrigeration systems

UEERA0001 Analyse the operation of HVAC air and hydronic systems

UEERA0002 Analyse the psychrometric performance of HVAC/R systems
and

UEERA0003 Analyse the thermodynamic performance of HVAC/R systems
or

UEERA0094 Verify functionality and compliance of refrigeration and air conditioning installations

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

UEECD0019 Fabricate, assemble and dismantle utilities industry components

UEECD0020 Fix and secure electrotechnology equipment

UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications

UEECD0016 Document and apply measures to control WHS risks associated with electrotechnology work

UEERA0059 Prepare and connect refrigerant tubing and fittings

UEERA0036 Establish the basic operating conditions of vapour compression systems

UEERA0035 Establish the basic operating conditions of air conditioning systems

UEERA0050 Install refrigerant pipe work, flow controls and accessories

UEERA0081 Select refrigerant piping, accessories and associated controls

UEERA0031 Diagnose and rectify faults in air conditioning and refrigeration control systems

UEERA0092 Solve problems in low voltage refrigeration and air conditioning circuits

UEERL0005 Locate and rectify faults in low voltage (LV) electrical equipment using set procedures

UEERL0004 Disconnect - reconnect electrical equipment connected to low voltage (LV) installation wiring

UEERL0001 Attach cords and plugs to electrical equipment for connection to a single phase 230 Volt supply

UEERL0002 Attach cords, cables and plugs to electrical equipment for connection to 1000 V a.c. or 1500 V d.c.

Competency Field

Refrigeration and air-conditioning

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to design complex air conditioning systems

PERFORMANCE CRITERIA

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

- 1.1** WHS/OHS requirements and workplace procedures for a given work area are identified, obtained and applied
- 1.2** WHS/OHS risk control measures and workplace procedures are followed in preparation for the work

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| | 1.3 | Scope of the refrigeration system is determined from the design brief and/or consultations with relevant person/s |
| | 1.4 | Design development work is planned in accordance with workplace procedure for timelines in consultation with others involved |
| 2 | Design complex air conditioning systems | |
| | 2.1 | Relevant complex air conditioning processes and methods are applied to the design |
| | 2.2 | Alternative concepts for design are evaluated in accordance with the design brief |
| | 2.3 | Safety, functionality and budgetary considerations are incorporated in the design specifications |
| | 2.4 | System design draft is checked for compliance in accordance with the design brief and relevant industry standards |
| | 2.5 | System design is documented for submission to relevant person/s for approval |
| | 2.6 | Unplanned events are dealt with in accordance with problem solving techniques and workplace procedures |
| 3 | Obtain approval for complex air conditioning systems design | |
| | 3.1 | System design is presented to customer and/or relevant person/s |
| | 3.2 | Requests for alterations to the design are negotiated with relevant person/s in accordance with workplace procedures |
| | 3.3 | Final design is documented and approval obtained from relevant person/s in accordance with workplace procedures |
| | 3.4 | Quality of work is monitored in accordance with workplace procedures and relevant industry standards |

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.

- Designing a complex air conditioning system must include at least the following:
- one major component, including:
 - air handling plant
 - compressors
 - condenser
 - evaporators
 - circuits and/or systems
 - associated components and controls

Unit Mapping Information

This unit replaces and is equivalent to UEENEEJ143A Design complex air conditioning systems and select equipment.

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 UEERA0017 Design complex air conditioning systems and select equipment

Modification History

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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 one occasion and include:

- developing outlines of alternative designs
- developing the design within the safety, regulatory, functional requirements and budget limitations
- documenting and presenting design effectively
- successfully negotiating design alteration requests
- obtaining approval for final design
- dealing with unplanned events
- applying relevant work health and safety (WHS)/occupational health and safety (WHS/OHS) requirements, including using risk control measures
- designing complex commercial refrigeration system
- preparing to design complex air conditioning system.

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:

- complex heating, ventilation and air conditioning (HVAC) system design, safe working practices and relevant standards, codes and regulations, including:
 - HVAC load estimating of multiple zone and multi-storey buildings:
 - system design parameters:
 - human comfort
 - system requirements in accordance with AS 1668 The use of ventilation and air conditioning in buildings SAA refrigeration code
 - heat transfer calculations for complex structures and building components
 - heat and radiation transfer calculations through complex glass structures including various internal and external shading devices
 - indoor air quality

- olfs and decipols
- complex shading:
 - solar data, azimuth and altitude angles
 - shading from adjacent structures
- computer software:
 - heat load estimating
 - building thermal performance analysis and simulation software
- advanced psychrometrics:
 - complex psychrometric processes:
 - revise sensible cooling and heating and evaporative (adiabatic) cooling
 - cooling and dehumidification
 - cooling and dehumidification with high latent load
 - cooling and dehumidification all outdoor air
 - cooling and dehumidification all outdoor air with dehumidified air requirements less than supply air
 - cooling with evaporative humidification
 - cooling with near isothermal humidification
 - spray process to include cooling and dehumidification, cooling and humidification with heated spray water, heating and humidification
 - partial load processes
 - reheat
 - bypass of, RA only and mix of RA and OA
 - variable air volume
 - variable coil effective surface temperature
 - split coil, horizontal, vertical and intertwined
 - system performance:
 - saturation efficiency of sprayers
 - system capacity calculated from air quantity and enthalpy change
 - required plant capacity and airflow rates:
 - effects of coil bypass factor and ADP
 - calculation of dehumidified air quantity, using both TSH and ERSR methods
 - recap on psychrometrics formulae and charts:
 - properties of air
 - gas constants
 - derivation of air constants
 - combined gas laws
 - Dalton's law of partial pressures
 - carrier's equation
 - psychrometric property tables
 - psychrometric charts

- air mixing equations
- air quantity equations
- indirect evaporative coolers
- analysis of cooling coil selection and performance
- psychrometric analysis of:
 - air conditioning in tropics
 - all outdoor air
 - LCV/HWF systems
 - psychrometric analysis using equations and tables
- air conditioning system design:
 - design parameters for multi-storey building:
 - customer and objective
 - customer concept of environment desired
 - economic
 - client brief
 - relevant design criteria:
 - building purpose, location, orientation and shape
 - external environment ambient conditions
 - internal load diversity
 - thermal capacity behaviour
 - thermal load (full and partial)
 - zoning and building usage:
 - space and building
 - occupancies, single purpose and multi-purpose
 - system selection criteria:
 - economics
 - environment
 - control requirements
 - existing structures
 - new structures
 - system components
 - space for equipment and system
 - selection of appropriate system
 - system and applications:
 - design features, engineering procedures and controls
 - direct expansion - self-contained room/zone, heat pump, multi-zone fan-coils and central station
 - all water - room fan-coil
 - all-air - constant volume variable temperature, face and bypass, reheat, constant temperature variable volume, constant volume induction, dual-duct and

- dual-conduit
- air water - induction unit and primary air fan-coil
- HVAC energy conservation techniques:
 - heat recovery systems
 - night cycle
 - optimum stop/start
 - purge cycles
 - chiller/boiler/cooling tower sequencing
 - economy cycles (based on temperature or enthalpy)
 - supply air reset
 - supply water reset
 - condenser water temperature reset
 - power demand control
 - load limiting
 - load shedding
 - set point relaxation
 - ventilation cycles
 - plant - fixed OA to economy, boiler to electric reheat and constant volume to variable air volume (VAV)
 - cost-benefit (payback)
- problem-solving techniques
- relevant job safety assessments or risk mitigation processes
- relevant manufacturer specifications
- relevant WHS/OHS legislated requirements
- relevant workplace budget, quality, policies and procedures
- relevant workplace documentation.

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 suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated suitable 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 simulations
- relevant and appropriate materials, tools, facilities and equipment currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

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