



Australian Government

UEERA0027 Design secondary refrigerant systems

Release: 1

UEERA0027 Design secondary refrigerant 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 design secondary refrigerant systems.

It includes designing secondary refrigerant systems based on a design brief and customer requirements, applying relevant industry standards, selecting components and documenting system design.

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

UEERA0016 Design commercial refrigeration systems and select components

UEERA0034 Establish heat loads for commercial refrigeration and/or air conditioning applications

UEERA0042 Evaluate thermodynamic and fluid parameters of refrigeration systems

UEERA0038 Establish the thermodynamic parameters of refrigeration and air conditioning 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

UEECD0042 Solve problems in ELV single path circuits

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 secondary refrigerant system

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** Scope of the refrigeration system is determined from

- design specifications and/or in consultation with relevant person/s
- 1.3 Safety and system are identified, obtained and applied in accordance with relevant industry standards
 - 1.4 Work supervisor and/or customer/s are consulted to determine functions and parameters of the system required in accordance with design specifications and workplace documentation
 - 1.5 Design development work is planned in accordance with workplace procedures for timelines in consultation with others involved
- 2 Design secondary refrigerant systems**
- 2.1 WHS/OHS risk control measures and workplace procedures for carrying out the work are followed
 - 2.2 Relevant secondary refrigeration system analysis, components and piping are applied to developing the system design in accordance with workplace procedures and relevant industry standards
 - 2.3 Safety, functionality and budgetary considerations are incorporated in the installation specifications
 - 2.4 Equipment is selected in accordance with the design specifications and workplace procedures
 - 2.5 Location of components is documented in accordance workplace procedures and operation of system functions
 - 2.6 System design draft is checked in accordance with the design brief and relevant industry standards
 - 2.7 System design is documented for submission to relevant person/s for approval
 - 2.8 Unplanned events are dealt with in accordance with problem-solving techniques and workplace procedures
- 3 Obtain approval for engineering computer applications design**
- 3.1 System design is presented to customer and/or relevant person/s in accordance with workplace procedures
 - 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 secondary refrigeration systems must include at least the following:

- two of the following:
 - two multi-stage cascade, or
 - two liquid recirculation, or
 - one multi-stage and one liquid recirculation
- major components, including:
 - heat exchanger
 - condenser
 - compressor
 - accumulator
 - pump
- associated components and controls

Unit Mapping Information

This unit replaces and is equivalent to UEENEEJ183A Design secondary refrigerant systems.

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 UEERA0027 Design secondary refrigerant systems

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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:

- understanding required operating functions and parameters from the design specification
- developing the design within the safety, regulatory and functional requirements and budget limitations
- documenting and presenting design effectively
- negotiating design alteration requests successfully
- obtaining approval for final design
- dealing with unplanned events
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk controls
- designing secondary refrigeration systems
- preparing to design secondary refrigeration systems.

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:

- secondary refrigeration system design, components and piping design, safe working practices and relevant standards, codes and regulations, including:
 - technical standards, regulations and codes for secondary refrigeration systems:
 - environmental and safety considerations in the use and disposal of secondary refrigerants:
 - toxicity and food compatibility
 - flammability
 - environmental effects
 - safe disposal
 - safety data sheets (SDS)/material safety data sheet (MSDS) samples
 - registration requirements for transport and on-site use

- secondary refrigeration systems design requirements:
 - applications of secondary refrigeration systems in refrigeration
 - introduction to secondary refrigeration
 - applications in industrial refrigeration: cold storage, food processing and climatic test chamber
 - application in commercial refrigeration: supermarkets and small commercial systems
 - advantages and disadvantages of secondary refrigerants over the direct use of primary refrigerants
- properties, application and limitations of available secondary refrigerants:
 - general classification of secondary refrigerant types – single phase, volatile and phase change
 - general types of single phase secondary refrigerants available: glycols, alcohols, brines, hydrocarbons, silicone oils and water
 - common types of volatile and phase change secondary refrigerants available: CO₂ and ice slurries
 - thermal and transport properties of most widely used single phase secondary refrigerants (MEG, PG, ethyl alcohol, CaCl₂, potassium brines)
 - pump selection for viscous fluids
- application concepts and principles:
 - main and loop circuits, use of variable speed pumps and overflow valves
 - buffer and storage tanks, benefits and disadvantages
 - loop temperature control and loop pump selection
 - control valve options: regulating and on/off, two-way and three-way, mixing and diverting
 - expansion and contraction of components, compensation for pipe expansion and effect of pipe pre-insulation
 - expansion and contraction of secondary refrigerant, use of membrane expansion tanks versus open expansion tank
 - air purging
- secondary refrigeration system components and piping:
 - corrosion and material selection:
 - materials compatibility table
 - thermal and other properties of materials in use
 - pipe material and jointing methods/materials
 - pumps, impellers and seals
 - isolation and control valves
 - heat exchangers
 - pipe and insulation materials:
 - metal pipe
 - plastic pipe

- post-installation insulation (in situ foaming, formed insulation and closed cell flexible insulation)
- pre-insulated pipe material
- vapour barrier – importance and maintenance
- heat exchangers:
 - plate heat exchangers, brazed, welded, semi-welded and gasketed; design considerations in conjunction with primary refrigerant, flooded, direct expansion, and pump circulated primary refrigerant
 - shell and tube and plate and shell heat exchangers
 - fan coil units
- system control:
 - primary pump speed and staging control
 - maintenance of minimum flow and control valve pressure head
 - overflow valves
 - secondary loop temperature control
 - room humidity and temperature control with fan-coil units
- 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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