Australian Government

MEM23130A Coordinate servicing and fault-finding of HVACR control systems

Release: 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

MEM23130A Coordinate servicing and fault-finding of HVACR control systems

Modification History

Release 1 (MEM05v9)

Unit Descriptor

This unit of competency covers the coordination of servicing and fault-finding of heating, ventilation, air conditioning and refrigeration (HVAC/R) environment control systems. The control system may be a part of a building management system. It includes work health and safety (WHS) and related safety compliance requirements, performance analysis software and validation, and related thermodynamic concepts and laws.

Application of the Unit

This unit applies to technicians who are required to coordinate the servicing and fault-finding of HVAC/R control systems. This includes undertaking required technical analyses and coordinating and supervising tradespersons or other technicians. The extent of individual and joint work may vary according to the size of the HVAC/R system. The unit may also apply to system managers, designers and draftspersons, and others who are required to evaluate the performance of HVAC/R control systems.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

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

Elements and Performance Criteria

1	Prepare for HVAC/R analysis and service task	1.1	Establish type, location and scope of control systems for HVAC/R plant
		1.2	Identify stakeholders to be consulted during analysis and service
		1.3	Lead review of functions and features of HVAC/R system
		1.4	Establish software and software techniques required for evaluation
		1.5	Identify relevant WHS, regulatory and environmental requirements
		1.6	Investigate sustainability implications of HVAC/R control and energy management systems
2	Coordinate review and analysis of HVAC/R control system	2.1	Review passive characteristics, heat loads and energy requirements for the HVAC/R system
		2.2	Review energy options, tariffs, system and component consumption against benchmarks and comparative tariffs
		2.3	Confirm scope of control system hardware, including controllers, analog and digital Input/Output (I/O), interfaces and actuators, including electrical, electronic, pneumatic and hydraulic devices
		2.4	Review, map and monitor HVAC/R control system, protocols and topology, system function, control settings, I/O, and major system hardware components

			and energy requirements
		2.5	Identify building management system control system software and programming techniques
		2.6	Supervise selection of tools, equipment, testing devices and materials required for service and fault-finding
		2.7	Determine required measurements and measurement techniques
		2.8	Supervise calibrate, set up, and test measurement equipment and procedures
		2.9	Identify appropriate analysis techniques, analysis and simulation software and software validation techniques
3	Coordinate servicing, fault-finding and optimising of HVAC/R control systems	3.1	Supervise measuring of the performance of the control system in maintaining specified environmental conditions
		3.2	Adjusted HVAC/R system to specification according to specifications and enterprise procedures
		3.3	Ensure isolation, repair or replacement of components not performing to specification
		3.4	Validate control programs and software for system performance and simulation
		3.5	Supervise testing or measuring on an electrically live system
		3.6	Ensure compliance with WHS, regulatory, environmental and risk management requirements
		3.7	Optimise the control system for economic and efficient operation through daily, seasonal and annual cycles
		3.8	Develop control diagram and record settings for optimal system performance
4	Report results	4.1	Record results, including rectification or improvement recommendations
		4.2	Provide report and supporting documentation, such as building thermal and control system audits, energy

costing, and efficiency evaluations, control system map and signal diagrams, control programs, system analysis and simulation files

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- interpreting drawings, diagrams, manuals and design information to determine HVAC/R control system layout, components and functions
- identifying WHS and other regulatory requirements
- coordinating the work of others in HVAC/R servicing and fault-finding, including allocating tasks and confirming results
- communicating with clients, stakeholders and technical experts
- identifying sustainability implications of HVAC/R control systems
- selecting appropriate HVAC/R analysis and simulation software and validation techniques
- reviewing control systems techniques, hardware and software taking into account thermal loads, energy options, tariffs, consumption, benchmarks and comparative tariffs
- mapping and monitoring control system, function, settings, I/O, and hardware and energy requirements
- optimising the energy management system
- measuring control system performance and developing optimal control diagram and settings
- documenting and reporting evaluation results, including efficiency evaluations, maps and diagrams, programs, analysis and simulation files and conclusions

Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- sources of professional and technical assistance
- trends in HVAC/R system design, installation, operation and maintenance, including integration with energy management systems
- current options and trends in performance analysis software, including underpinning program techniques
- sustainability implications of HVAC/R systems control and energy management systems
- building management systems features and functions related to HVAC/R and integration with other features, such as:
  - lighting, alarms and security
  - multi-zone operation
  - operating modes, such as occupied, unoccupied, morning warm-up, and night-time setback
- features, components, functions, protocols and topology of HVAC/R control systems, including:
  - protocols and topology

  - control settings
  - I/O devices and techniques
  - software and programming techniques
  - proportional-integral-derivative (PID) controller functions in HVAC/R control systems
- interface principles and techniques for electrical, electronic, pneumatic and hydraulic sensors and actuators
- HVAC/R principles and techniques related to energy distribution and consumption
- passive characteristics and heat load on the system under control
- daily, seasonal and annual HVAC/R load cycles
- sources of technical and professional assistance for engineering specialisations
- energy options, unit tariffs, system and component consumption, benchmarks for energy costs and comparative tariffs
- testing and measuring devices and materials and their calibration, set-up, test and use
- analysis techniques, including use of analysis and simulation software and software validation techniques

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to coordinate the servicing, fault-finding and optimisation of HVAC/R control systems.This includes working individually or as part of a team on analysis and optimisation technical tasks.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • communicate HVAC/R servicing and fault-finding tasks and requirements to others • identify relevant WHS, other regulatory requirements, standards and codes • investigate sustainability implications of HVAC/R control systems • assess HVAC/R control system and hardware, including building management system control systems • use appropriate analysis and simulation software and validation techniques • review thermal loads, hardware, energy options, tariffs, consumption, benchmarks and comparative tariffs • map and monitor control system, I/O, hardware and energy use • optimise HVAC/R control system for seasonal and load cycles • measure control system performance • develop optimal control diagram and settings • report and document results.
Context of and specific resources for assessment	• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. • The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.

	• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application. • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. • Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

HVAC/R control system	HVAC/R control systems hardware and environmental requirements may include control systems in: • industrial refrigeration systems • commercial refrigeration systems • hydronic systems • automatic controls • food storage technology
Building management system HVAC/R control systems	Building management system HVAC/R control systems may include: • human-machine interfaces (HMI) • web servers, network topology and bus systems • protocols • system or network controllers • programmable logic controllers (PLCs) • terminal unit controllers for major plant components, such as boilers and HVAC/R central plant air handlers, chilled and hot water valves, air dampers, supply fans and lighting • analog and digital I/O, interfaces and actuators, including electrical, electronic, pneumatic and hydraulic devices • remote control systems, including ethernet options • interfaces with other controlled systems, such as fire, security, and lighting
Analog or digital I/O	Analog or digital I/O may include: • inputs, such as temperatures, humidity, pressure, current flow and air flow • analog inputs, including temperature, humidity and pressure sensors transmitting 4–20 mA or 1–10 V signals • digital inputs, such as volt-free switches or relays or 24 VDC/AC and pneumatic/electronic interfaces • analog outputs, including variable frequency speed drives, hot or chilled water proportional valves responding to a set-point difference or a damper setting • digital outputs to switch lights, valves or motor relays on or off, including alarms • special I/O include: • alarms for limiting condition or status indication, such as the monitoring of carbon monoxide levels or low motor current

	• pneumatic and hydraulic sensor and actuator interfaces
Sustainability	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: • meeting all regulatory requirements • conforming to all industry covenants, protocols and best practice guides • minimising ecological and environmental footprint of process, plant and product • maximising economic benefit of process plant and product to the organisation and the community • minimising the negative WHS impact on employees, community and customer

Appropriate technical and professional assistance	Appropriate technical and professional assistance may include:
	• technical support and advice relating to elements which have intrinsic dangers, such as:
	  • high pressure
	  • energised fluid vessels
	  • high temperatures and heat energy capacity
	  • switch boards, electric motors and wiring with high current and voltages above extra low voltage
	• professional support for technologies, such as:
	  • specialist electric motor drives and controllers
	  • specialist materials, plastics, metal alloys and nano materials
	  • special processes, alloy welding, heat treatment, sealing and fastening

WHS, regulatory requirements and enterprise procedures	WHS, regulatory requirements and enterprise procedures may include: • WHS Acts and regulations • relevant standards • codes of practice from Australian and overseas engineering and technical associations and societies • risk assessments • registration requirements • safe work practices • state and territory regulatory requirements
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular task

Unit Sector(s)

Competency field

Unit sector Engineering science

Custom Content Section

Not applicable.