



Australian Government

MEM23130 Coordinate servicing and fault-finding of HVACR control systems

Release: 1

MEM23130 Coordinate servicing and fault-finding of HVACR control systems

Modification History

Release 1. Supersedes and is equivalent to MEM23130A Coordinate servicing and fault finding of HVACR control systems.

Application

This unit of competency defines the skills and knowledge required to coordinate servicing and fault-finding of heating, ventilation, air conditioning and refrigeration (HVACR) environment control systems. It includes content about work health and safety (WHS) and related safety compliance requirements, performance analysis software and validation, and related thermodynamic concepts and laws. The control system can be a part of a building management system and may be a control system in industrial or commercial refrigeration, a hydronic system or food storage technology.

This unit applies to technicians, system managers, designers and draftspersons, and others who are required to coordinate the servicing and fault-finding of HVACR control systems, including undertaking required technical analyses and coordinating and supervising tradespersons or other technicians.

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

Pre-requisite Unit

MEM23004 Apply technical mathematics

MEM23006 Apply fluid and thermodynamics principles in engineering

Competency Field

Engineering science

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Prepare for HVACR analysis and service task	1.1 Establish type, location and scope of control systems for HVACR plant 1.2 Identify stakeholders to be consulted during analysis and service 1.3 Lead review of functions and features of HVACR system

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	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 HVACR control and energy management systems
2. Coordinate review and analysis of HVACR control system	2.1 Review passive characteristics, heat loads and energy requirements for the HVACR 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 HVACR 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 calibration, set up, and test measurement equipment procedures 2.9 Identify appropriate analysis techniques, analysis and simulation software and software validation techniques
3. Coordinate servicing, fault-finding and optimising of HVACR control systems	3.1 Supervise measuring of the performance of the control system in maintaining specified environmental conditions 3.2 Adjust HVACR system to specifications and in accordance with organisational 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

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	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 including thermal and control system audits, energy costing, efficiency evaluations, control system map and signal diagrams, control programs, system analysis and simulation files

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

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

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Building management system HVACR control systems include:	- human-machine interfaces (HMIs) - web servers, network topology and bus systems - protocols - system or network controllers - programmable logic controllers (PLCs) - terminal unit controllers for major plant components including boilers and HVACR 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 including fire, security, and lighting.
---	--

Analog or digital I/O includes:	- inputs including 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 including 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 including: - alarms for limiting condition or status indication including the monitoring of carbon monoxide levels or low motor current - pneumatic and hydraulic sensor and actuator interfaces.
Sustainability includes:	- 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 includes:	- technical support and advice relating to elements which have intrinsic dangers - professional support for technologies.
WHS, regulatory requirements and organisational procedures includes:	- WHS acts, regulations and 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.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23130A Coordinate servicing and fault finding of HVACR control systems.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM23130 Coordinate servicing and fault-finding of HVACR control systems

Modification History

Release 1. Supersedes and is equivalent to MEM23130A Coordinate servicing and fault finding of HVACR control systems.

Performance Evidence

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

- interpreting drawings, diagrams, manuals and design information to determine heating, ventilation, air conditioning and refrigeration (HVACR) control system layout, components and functions
- communicating HVACR servicing and fault-finding tasks and requirements on at least two occasions
- identifying relevant work health and safety (WHS), other regulatory requirements, standards and codes
- investigating sustainability implications of HVACR control systems
- assessing HVACR control system and hardware on at least two occasions, including building management system control systems
- selecting and using appropriate analysis and simulation software and validation techniques
- reviewing thermal loads, hardware, energy options, tariffs, consumption, benchmarks and comparative tariffs
- mapping and monitoring control system, input/output (I/O), hardware and energy use on at least two occasions
- optimising HVACR control system for seasonal and load cycles
- measuring control system performance
- developing optimal control diagram and settings
- reporting and documenting results including efficiency evaluations, maps and diagrams, programs, analysis and simulation files and conclusions.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- sources of professional and technical assistance
- trends in HVACR system design, installation, operation and maintenance including integration with energy management systems

- current options and trends in performance analysis software including underpinning program techniques
- HVACR control systems applications
- sustainability implications of HVACR systems control and energy management systems
- analog and digital inputs and outputs
- building management systems features and functions related to HVACR and integration with other features including:
 - lighting, alarms and security
 - multi-zone operation
 - operating modes including occupied, unoccupied, morning warm-up, and night-time setback
- features, components, functions, protocols and topology of HVACR control systems including:
 - protocols and topology
 - control settings
 - I/O devices and techniques
 - software and programming techniques
 - proportional-integral-derivative (PID) controller functions in HVACR control systems
- interface principles and techniques for electrical, electronic, pneumatic and hydraulic sensors and actuators
- HVACR principles and techniques related to energy distribution and consumption
- passive characteristics and heat load on the system under control
- daily, seasonal and annual HVACR load cycles
- sources of technical and professional assistance for engineering specialisations
- energy options, unit tariffs, system and component consumption and 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.
-

Assessment Conditions

- Assessors must:
 - have vocational competency in coordinating servicing and fault finding of HVACR control systems at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015 or its replacement* and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.

- Where possible assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- 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.
-

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>