



Australian Government

MEM18060 Maintain, repair control instrumentation - single and multiple loop control systems

Release: 1

MEM18060 Maintain, repair control instrumentation - single and multiple loop control systems

Modification History

Release 1. Supersedes and is equivalent to MEM18060B Maintain, repair control instrumentation – single and multiple loop control systems

Application

This unit of competency defines the skills and knowledge required to determine control loop characteristics, monitor and record the operation of a control loop, localise the fault condition, and replace or repair the faulty condition.

It applies to split architecture single/multiple loop control instrumentation that includes programmable logic controllers (PLCs), distributed control systems (DCS) and computer-based systems.

Where fault-finding is required to electronic component level unit MEM18056 Diagnose and repair analog equipment and components and unit MEM18065 Diagnose and repair digital equipment and components, should also be selected as appropriate.

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

Band: B

Unit Weight: 8

Pre-requisite Unit

MEM05001	Perform manual soldering/desoldering - electrical/electronic components
MEM09002	Interpret technical drawing
MEM11011	Undertake manual handling
MEM12004	Perform precision electrical/electronic measurement
MEM12023	Perform engineering measurements
MEM13015	Work safely and effectively in manufacturing and engineering
MEM16006	Organise and communicate information
MEM18001	Use hand tools
MEM18002	Use power tools/hand held operations

MEM18054	Fault find, test and calibrate instrumentation systems and equipment
MEM18055	Dismantle, replace and assemble engineering components
MEM18062	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements

Plus, one or more of the following, including their prerequisites:

MEM18057	Maintain/service analog/digital electronic equipment
MEM18064	Maintain instrumentation system components

Competency Field

Maintenance and diagnostics

Elements and Performance Criteria

Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
1	Determine job requirements	1.1	Follow standard operating procedures (SOPs)
		1.2	Comply with work health and safety (WHS) requirements at all times
		1.3	Use appropriate personal protective equipment (PPE) in accordance with SOPs
		1.4	Identify job requirements from specifications, drawings, job sheets or work instructions
2	Determine control loop operating characteristics	2.1	Examine engineering specifications, technical information and historical trends for relevant data
		2.2	Examine, read and interpret system specifications, operational data and other relevant data sources and note relevant conclusions
		2.3	Consult with system operators and other relevant plant personnel and extract relevant data and document by appropriate means

Elements describe the essential outcomes.

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

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| | | 2.4 | Observe operation of the system by applying all control loop device characteristics, controller mode principles and adjustment methods |
| 3 | Monitor and record operation of a control loop | 3.1 | Interpret pneumatic, electrical and electronic circuit diagrams |
| | | 3.2 | Set point and manual output changes by applying all control loop device characteristics, controller mode principles and calibration/adjustment methods, and loop operation from the controller response using appropriate test equipment, principles and procedures |
| | | 3.3 | Interpret software configuration data for digital control systems |
| | | 3.4 | Monitor and record operational responses |
| | | 3.5 | Utilise fault-finding and diagnostic techniques throughout the checking and testing procedures including simple and multi-controller type control schemes |
| | | 3.6 | Analyse diagnostic results and conclusions against predetermined operational specifications |
| 4 | Localise fault condition | 4.1 | Test circuits to the level necessary to identify and localise faults using fault-finding, diagnostic techniques and appropriate test equipment |
| | | 4.2 | Utilise drawings/diagrams and operational testing data in identifying and localising fault conditions |
| | | 4.3 | Verify and localise fault condition to major component level using appropriate test equipment, procedures and techniques |
| 5 | Replace faulty items or repair | 5.1 | Dismantle components for repair or replacement using appropriate tools, equipment and techniques |

Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
	faulty condition	5.2	Select replaceable items from manufacturers' catalogues, spare parts lists or data sheets
		5.3	Repair faulty condition, where applicable
		5.4	Reassemble repaired and replaceable items
6	Calibrate and adjust control instrumentation	6.1	Calibrate and adjust panel mounted, split architecture single loop/multiple loop control instruments using appropriate calibration principles, equipment and methods for all devices according to manufacturers' instructions
		6.2	Adjust controller modes and actions are adjusted according to specifications
		6.3	Undertake zero span and range checks using appropriate configuration
		6.4	Make final adjustments to control instrumentation to meet specifications
7	Complete service reports and recommission	7.1	Complete service reports in accordance with SOPs
		7.2	Adopt appropriate follow-up procedures
		7.3	Recommission control instrumentation in accordance with SOPs

Foundation Skills

This section describes those required skills (reading, writing, oral communication and numeracy) that are essential to workplace performance in this unit of competency.

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.

Historical trends include one (1) or more of the following:

- supervisory control and data acquisition (SCADA)
- charts
- chart recorders and data loggers
- equipment conditioning monitoring

An open and closed loop system includes:

- final control elements
- process measuring devices
- converters
- controllers
- process signals

Relevant data includes one (1) or more of the following:

- maintenance records
- fault indicators
- charts
- error codes
- operational symptoms
- observation monitoring
- consultation with appropriate personnel

Major components include one (1) or more of the following:

- transducers
- power supplies
- removable circuit boards
- sensor units
- other like components

Unit Mapping Information

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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 MEM18060 Maintain, repair control instrumentation - single and multiple loop control systems

Modification History

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria on at least two (2) occasions and include:

- following work instructions, standard operating procedures (SOPs) and safe work practices
- identifying and interpreting circuit diagrams, specifications, software data, diagrams and drawings, historical trends and documents and obtaining relevant data pertaining to the system components and operational data
- consulting with system operators and other relevant personnel with respect to the control loop and confirming function/ malfunction of the system and/or its components
- checking operational characteristics of the control devices, signal conversion instruments and final control elements for compliance to specifications
- locating, reading and interpreting in-built fault indicators and error codes and identifying faults/defects in control system
- obtaining relevant pneumatic, electrical and electronic circuit diagrams and testing and monitoring control loop for correct operation and recording the responses of the control system
- using fault-finding and diagnostic techniques and procedures throughout the monitoring and testing phase and comparing collected data with the operational specifications of the control system
- dismantling, repairing and reassembling faulty components, including selecting replacement parts from manufacturer/supplier catalogues
- calculating the control loop characteristics for the appropriate system in accordance with specifications
- setting and adjusting the controller modes using appropriate test and calibration equipment
- checking the control instrumentation for correct zero, span and range and making final adjustments, as required and recommissioning the control system
- completing all service reports in accordance with SOPs.

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:

- safe work practices and procedures and use of personal protective equipment (PPE)

- mathematical computations, including algebra, exponentials and logarithms, equations, graphs, charts, vectors, complex numbers and Boolean algebra
- relevant data, including information from in-built devices, on the control loop characteristics
- specifications of each system component
- control programming
- supervisory control and data acquisition (SCADA) systems, programmable logic controller (PLC) systems, distributive control systems (DCS) and computer-based systems
- procedures for:
 - documenting/reporting information and control system tests and analysis
 - isolating and testing the control system and its components
 - verifying apparent faults in circuits and/or control system components
 - marking components for repair or replacement
 - dismantling/disassembling components for repair or replacement
 - assembling repaired and/or replacement items
 - calibration of control system components and necessary equipment
 - checking control instruments for zero, span and range
 - making final adjustments to ensure all control system components conform to specification
 - commissioning the control system
- signal transmission, including the principles of operation of the final control element, procedures for calibrating and adjusting the control system
- correct function of the circuits and components within the control loop
- calibration and adjustment methods for the control loop devices
- configuration of the digital control system software
- operational responses and procedures for monitoring and recording test and operational data
- fault-finding and diagnostic techniques throughout the monitoring and testing process
- deviations/variations from specification
- correct maintenance procedures for serviceable item(s)
- adjustments which affect the calibration to control system components
- controller modes and actions
- reporting/recording requirements associated with the commissioning of the control system
- follow-up actions to be undertaken after maintaining/repairing control system instrumentation.

Assessment Conditions

- Assessors must:
 - have vocational competency in maintaining, repairing control instrumentation – single and multiple loop 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. This must 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.

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