Australian Government

Department of Education, Employment and Workplace Relations

# MEM18062B Install, maintain and calibrate instrumentation sensors, transmitters and final control elements

**Release: 2**

INDUSTRY SKILLS COUNCILS

Creating Australia's Future

# MEM18062B Install, maintain and calibrate instrumentation sensors, transmitters and final control elements

## Modification History

Single band identifier removed to clarify dual status

# Unit Descriptor

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| **Unit descriptor** | This unit covers selecting and installing appropriate sensors and signal transmitters, maintaining and diagnosing correct operation of sensors and signal transmitters, and completing fault documentation. |

# Application of the Unit

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| **Application of the unit** | This unit applies to planning corrective action; repairing, replacing and overhauling sensors and signal transmitters; and calibrating, testing, re-installing and recommissioning instrumentation sensors and signal transmitters.<br>Tasks relate to the use of mechanical, electrical, electronic (analog and digital) and associated sensing indications and signal transmitting instrumentation, representing measurement of pressure, temperature, level, flow rate, weight, density and other process variables.<br>It also applies to the maintenance of control valves (including changing and reseating valve plugs); adjustment of valve actuators (pneumatic, electrical and hydraulic); and maintenance and adjustment of pneumatic, electro-pneumatic and electronic valve positioners and signal converters.<br>Tasks are undertaken in workshop, laboratory or on-site environments.<br>Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered.<br>If diagnosis and repair of electronic equipment is undertaken to component level, Unit MEM18056B (Diagnose and repair analog equipment and components) and/or Unit MEM18065B (Diagnose and repair digital equipment and components) should be selected.<br>**Band:**<br>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).<br><br>**Unit Weight**: **8** |

# Licensing/Regulatory Information

Not Applicable

# Pre-Requisites

| **Prerequisite units** | | |
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| **Path 1** | MEM05001B | Perform manual soldering/desoldering - electrical/electronic components |
| | MEM09002B | Interpret technical drawing |
| | MEM12004B | Perform precision electrical/electronic measurement |
| | MEM12023A | Perform engineering measurements |
| | MEM18001C | Use hand tools |
| | MEM18002B | Use power tools/hand held operations |
| | MEM18054B | Fault find, test and calibrate instrumentation systems and equipment |
| | MEM18055B | Dismantle, replace and assemble engineering components |
| | MEM18057B | Maintain/service analog/digital electronic equipment |
| **Path 2** | MEM09002B | Interpret technical drawing |
| | MEM12002B | Perform electrical/electronic measurement |
| | MEM12023A | Perform engineering measurements |
| | MEM18001C | Use hand tools |
| | MEM18002B | Use power tools/hand held operations |
| | MEM18054B | Fault find, test and calibrate instrumentation systems and |

| | | |
|---|---|---|
| **Prerequisite units** | | |
| | | equipment |
| | MEM18055B | Dismantle, replace and assemble engineering components |
| | MEM18064B | Maintain instrumentation system components |

# Employability Skills Information

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| **Employability skills** | This unit contains employability skills. |

# Elements and Performance Criteria Pre-Content

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| Elements describe the essential outcomes of a unit of competency. | Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide. |

# Elements and Performance Criteria

| ELEMENT | PERFORMANCE CRITERIA |
|---|---|
| 1. Select for installation appropriate sensors, transmitters and final control elements | 1.1. Specification requirements are determined from data sheets, circuit diagrams, engineering drawings.<br>1.2. Using knowledge of device characteristics and principles of operation, specification requirements are interpreted, defined and understood.<br>1.3. Having regard for measurement range, processes and environment, sensors, transmitters and final control elements are selected according to their device characteristics, principles of operation and measurement capabilities, in conformance to specifications. |
| 2. Install instrumentation sensors, transmitters and final control elements | 2.1. Sensors, transmitters and final control elements are installed using sound working knowledge of installation principles, procedures, techniques, tools and test equipment, according to appropriate codes of practice, standards, safety and legislative requirements.<br>2.2. During installation access for maintenance and mounting connections for power, signal, and process are planned and catered for.<br>2.3. Installed sensors, transmitters and final control elements are diagnosed for correct operation using appropriate test equipment and procedures. Results are assessed against specifications or manufacturers' technical data sheets. |
| 3. Maintain, diagnose correct operation of sensors, transmitters and final control elements | 3.1. Using knowledge of device characteristics and principles of operation, preventative maintenance schedules and procedures are applied to maintain sensors, transmitters and final control elements in optimum condition.<br>3.2. Using knowledge of device characteristics and principles of operation, sensing elements are cleaned and serviced to maintain optimum operating condition particularly at the process interface, using correct principles, tools, test equipment, techniques and procedures.<br>3.3. Using appropriate test equipment and procedures, sensors, transmitters and final control elements are diagnosed, within the system or as individual devices, to determine correct operation or malfunction.<br>3.4. Operation of sensors, transmitters and final control elements is monitored and assessed against |

| ELEMENT | PERFORMANCE CRITERIA |
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| | predetermined specification or manufacturers' technical data.<br>3.5. Using appropriate test equipment/procedures, correct operation of sensors, transmitters and final control elements is checked or fault condition identified, localised and monitored. |

| ELEMENT | PERFORMANCE CRITERIA |
|---|---|
| 4. Complete fault documentation and plan corrective action | 4.1. Faults and malfunctions are documented and/or reported according to standard operating procedures.<br>4.2. Corrective action is planned autonomously or in consultation with appropriate personnel and actioned. |
| 5. Analyse control loop and localise faults | 5.1. Engineering specifications and technical information, control device, signal transmission and final element specifications are obtained and interpreted. System specifications, including operational data, and historical records and trends are read and interpreted.<br>5.2. Consultation with system operators and other relevant plant personnel is carried out, relevant data is extracted and documented to standard operating procedures.<br>5.3. Operation of the system is observed using sound knowledge of all external control device characteristics, controller modes, signal transmission, final control devices.<br>5.4. Correct and appropriate signal transmission test equipment is set up and applied using appropriate technique.<br>5.5. Circuits and control lines are tested to the level necessary to detect and localise fault. |
| 6. Repair/replace, overhaul sensors, transmitters and final control elements | 6.1. Sensors, transmitters and final control elements are examined and verified for replacement, repair or overhaul using correct tools/test equipment and appropriate principles, techniques and procedures.<br>6.2. Replacement items are selected from manufacturers' parts lists or catalogues to meet specifications.<br>6.3. Replacement items are obtained.<br>6.4. Faulty items are repaired or overhauled using correct principles, techniques, tools, test equipment and procedures.<br>6.5. Repaired, overhauled and replacement items are prepared for refitting according to standard workshop procedures.<br>6.6. Sensors, transmitters and final control elements are refitted using correct principles, tools, test equipment and procedures.<br>6.7. Refitted sensors, transmitters and final control elements are prepared for testing and calibration. |
| 7. Calibrate and test instrumentation | 7.1. Sensors, transmitters and final control elements are calibrated against appropriate physical standards |

| ELEMENT | PERFORMANCE CRITERIA |
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| sensors, transmitters and final control elements | using correct calibration devices, test equipment, techniques and procedures.<br>7.2. Zero, span and range tests are performed using correct calibration devices, test equipment, principles, techniques and procedures.<br>7.3. Zero span and range results are assessed against manufacturers' instructions sheets.<br>7.4. Zero, span adjustments are applied to align sensors, transmitters and final control elements to manufacturers' instruction sheets using correct calibration equipment, principles, techniques and procedures. |

| ELEMENT | PERFORMANCE CRITERIA |
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| 8. Return sensors, transmitters and final control elements and control loops to service | 8.1. Sensors, transmitters and final control elements are put into service on conformance to specifications with due regard to process requirements, safety, installation/commissioning procedures and sequence of operation.<br>8.2. Controller modes and actions are adjusted according to specifications.<br>8.3. Electrical and pneumatic transmission lines are tested and appropriate action is taken including the use of signal conditioning devices.<br>8.4. Correct procedures are applied in returning instrumentation to service, including configuring, calibrating, adjusting, tuning and validating system performance.<br>8.5. System is returned to service in accordance with standard operating procedures. |

# Required Skills and Knowledge

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required skills**

Look for evidence that confirms skills in:

- accessing relevant data sheets, circuit diagrams, engineering drawings, instructions, specifications, information and supplier catalogues and replacement components
- selecting sensors, transmitters and final control elements
- installing and testing sensors, transmitters and final control elements to specification
- obtaining and performing relevant scheduled/preventative maintenance schedules for sensors, transmitters and final control elements
- determining correct function of sensors, transmitters and final control elements
- recording test results
- identifying, localising, monitoring and reporting/recording faults in sensors, transmitters and final control elements
- preparing sequential action plan to correct faults in sensors, transmitters and final control elements
- applying procedures to sequential and loop testing
- checking sensors, transmitters and final control elements and marking for replacement, repair or overhaul

## REQUIRED SKILLS AND KNOWLEDGE

- repairing/overhauling faulty items for fitting and /or refitting
- fitting/ refitting sensors, transmitters and final control elements
- preparing fitted/refitted sensors, transmitters and final control elements for testing and calibration
- configuring, calibrating, testing, adjusting, tuning and validating system performance

### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics, specifications and principles of operation of the sensors, transmitters and final control elements to be installed
- criteria for selecting sensors, transmitters and final control elements
- procedures for testing, installing and maintaining sensors, transmitters and final control elements and for reporting/recording and monitoring faults and/or malfunctions in sensors, transmitters and final control elements
- factors that determine the type of test equipment required
- tools, equipment and techniques required to install sensors and transmitters
- relevant codes, standards, safety and legislative requirements
- connections to be made to sensors, transmitters and final control elements
- variations of test results from specifications and probable causes of variations between test results and specifications
- housekeeping requirements with respect to sensors.
- test equipment and techniques required to determine correct function or malfunction of sensors, transmitters and final control elements
- probable causes of variations between test results and specifications
- the need for systematic and/or sequential testing
- procedures for configuring, calibrating, testing, adjusting, tuning and validating system performance including sensors, transmitters and final control elements
- physical standards against which sensors, transmitters and final control elements are to be calibrated
- devices, equipment and techniques required to calibrate sensors, transmitters and final control elements
- zero, span and range tests to be applied to the sensors, transmitters and final control elements
- procedures for recommissioning sensors, transmitters and final control elements
- safety procedures to be taken when recommissioning sensors, transmitters and final control elements

# Evidence Guide

| EVIDENCE GUIDE | |
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| 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 install, maintain and calibrate instrumentation sensors, transmitters and final control elements. Competency in this unit cannot be claimed until all prerequisites have been satisfied. |
| **Critical aspects for assessment and evidence required to demonstrate competency in this unit** | Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts. |
| **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, that is the candidate is not in productive work, then an appropriate simulation 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. The assessment environment should not disadvantage the candidate.<br>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing, maintaining and calibrating instrumentation sensors, transmitters and final control elements, or other units requiring the exercise of the skills and knowledge covered by this unit. |
| **Method of assessment** | Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, |

| EVIDENCE GUIDE | |
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| | standards, manuals and reference materials. |
| **Guidance information for assessment** | |

# Range Statement

| RANGE STATEMENT | |
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| The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. 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. | |
| **Final control elements** | High level tolerances which include:<br>• proportional<br>• integrated differential (PID)<br>• supervisory control and data acquisition (SCADA)<br>• distributive control system (DCS) |
| **Test equipment** | Manometers, dead weight testers, vacuum system, power supplies, control valve test beds, pneumatic, analogue, digital, test and calibration equipment, utilised for maintenance, calibration and testing of process signal converters and final control elements |
| **Control loop** | A feedback system responding to analogue or digital configuration data via programmable logic controllers (PLCs), DCS, computer-based systems etc. from the controller response to set points and manual output changes |

# Unit Sector(s)

| Unit sector | |
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# Co-requisite units

| Co-requisite units | | |
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# Competency field

| Competency field | Maintenance and diagnostics |
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