Australian Government

MEM Manufacturing and Engineering

Release: 1.0

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

CONTENTS

MEM Manufacturing and Engineering

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Links

MEM Manufacturing and Engineering Training Package - http://www.mskills.org.au/training-packages/

MEM31215 Certificate III in Engineering - Industrial Electrician

Modification History

Release 1. New qualification

Qualification Description

This qualification provides competencies in the ability to select, set up and install, test, fault-find, repair and maintain electrical systems and equipment in buildings and industrial environments, including oil/gas installations, mine sites, processing plants and the like. The qualification covers the Essential Performance Capabilities as required by electrical regulators and includes a capstone assessment.

Persons engaged in training towards this qualification must provide evidence of workplace experience to assist assessment against the units of competency and for any license application.

This qualification is designed to support an application in each state and territory for a license to practise as an electrician. Other supporting documentation may be required. Local regulations should be checked for details.

Entry Requirements

There are no entry requirements for this qualification.

Packaging Rules

To be awarded the MEM31215 Certificate III in Engineering – Industrial Electrician between 33 and 38 units of competency to a minimum value of 96 points must be achieved, chosen as outlined below:

- all 32 core units of competency listed below (totalling 90 points) and
- elective units of competency to the value of 6 points, to bring the total value to at least 96 points.

Points associated with prerequisites count towards the total. Units with prerequisite requirements are marked with an asterisk (refer to individual units for details). All prerequisites have been included in the units listed.

Core units of competency

Select all of the units from this list.

Unit code	Unit title	Points	*P
MEM10016	Terminate and test electrical wiring and accessories	4	*
MEM10018	Select cable types and sizes to suit loads and electrical installation environment	4	
MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing	2	*
MEM10020	Install low voltage cabling and fit-off accessories, appliances and equipment	4	*
MEM10021	Inspect, test and verify electrical installations	4	*
MEM10022	Commission and decommission high and low voltage equipment or installations	2	
MEM10023	Design and connect control switching of circuits for building services and industrial equipment	4	*
MEM10024	Install and troubleshoot luminaires and ancillary equipment	2	*
MEM10025	Undertake a capstone assessment	1	*
MEM12023A	Perform engineering measurements	5	

MEM12024A	Perform computations	3	
MEM13014A	Apply principles of occupational health and safety in the work environment	0	
MEM13017	Apply safety practices, procedures and compliance standards associated with licensed electrical work	2	*
MEM14004A	Plan to undertake a routine task	0	
MEM14005A	Plan a complete activity	4	
MEM15002A	Apply quality systems	2	
MEM15024A	Apply quality procedures	0	
MEM16006A	Organise and communicate information	2	
MEM16007A	Work with others in a manufacturing, engineering or related environment	0	
MEM16008A	Interact with computing technology	2	
MEM17003A	Assist in the provision of on the job training	2	
MEM18001C	Use hand tools	2	
MEM18100	Fault-find, test and rectify AC machines and circuits	4	*
MEM18102	Fault-find, test and rectify single and three-phase transformers	4	*
MEM18103	Fault-find, test and rectify electrical circuits and equipment	4	*
MEM18104	Dismantle, replace and assemble electrical components and equipment	3	*
MSAENV272B	Participate in environmentally sustainable work practices	3	
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace	2	
UEENEEE104A	Solve problems in d.c. circuits	5	*
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications	4	*

UEENEEG101A	Solve problems in electromagnetic devices and related circuits	5	*
UEENEEG102A	Solve problems in low voltage a.c. circuits	5	*
	Total for core		

Elective units of competency

Select units to the value of at least 6 points from the list below or from any MEM Certificate III qualification.

Unit code	Unit title	Points	P*
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4	
MEM05012C	Perform routine manual metal arc welding	2	
MEM05050B	Perform routine gas metal arc welding	2	
MEM07032B	Use workshop machines for basic operations	2	*
MEM13016	Work in hazardous areas	2	*
MEM18105	Disconnect and reconnect high voltage fixed wired equipment	3	*
MEM18106	Terminate communication and data cables	4	*
MEM18108	Troubleshoot analog and digital electronic equipment	4	*
MEM18109	Troubleshoot instrumentation systems and equipment	4	*

Qualification Mapping Information

New qualification

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM05001B Perform manual soldering/desoldering - electrical/electronic components

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers performing manual soldering/desoldering for the installation and fabrication of electrical/electronic components.

Application of the Unit

Application of the unit	Work is undertaken in a production or maintenance environment using predetermined standards of quality, safety and work procedures. Component protection procedures are predetermined. Depending on the actual soldering job, hand and power tools and measuring skills may be required. These are covered by other units such as Unit MEM18001C (Use hand tools), Unit MEM18002B (Use power tools/hand held operations) and appropriate measurement units. This unit does not include skills in silver soldering or brazing skills. These skills are covered in Unit MEM05006B (Perform brazing and/or silver soldering). Where soldering and desoldering is limited to the straightforward termination, disconnection or reconnection of electrical wiring then see Unit MEM10002B (Terminate and connect electrical wiring). Advanced specification and high reliability soldering associated with the installation of electrical/electronic components, in areas where reliability of connections is critical, is covered by Unit MEM05002B (Perform high reliability soldering and desoldering). **Band**: **A** **Unit Weight**: **4**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Prepare materials for soldering	1.1. Materials preparation instructions are followed. 1.2. Materials are prepared using correct tools, equipment, materials and procedures. 1.3. Materials are prepared to specifications using instruction or standard operating procedures.
2. Solder materials	2.1. Correct soldering techniques, procedures, materials and soldering tools are selected. 2.2. Materials to be jointed, mounted, shaped are to specification using standard operating procedures. 2.3. Solder is applied using correct and appropriate techniques. 2.4. Where appropriate, excess material is removed using correct tools and techniques. 2.5. Procedures for the protection of components are observed according to standard operating procedures.
3. Inspect solder joints	3.1. Inspection procedure is undertaken to standard operating procedures. 3.2. Inspection results are reported/recorded to standard operating procedures as required.
4. Undertake desoldering	4.1. Correct and appropriate techniques, procedures, desoldering tools and equipment are selected for given task. 4.2. Materials/components are desoldered using correct procedure and minimising damage to materials/ components. 4.3. Material/components are removed and cleaned to specifications using 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: • performing routine soldering

REQUIRED SKILLS AND KNOWLEDGE
• performing desoldering • undertaking material preparation • reading and interpreting routine information on written job instructions, specifications and standard operating procedures • following oral instruction
Required knowledge
Look for evidence that confirms knowledge of: • cleaning solutions and properties and cleaning procedures • use and application of personal protective equipment for manual soldering/desoldering • safe work practices and procedures • methods of joint preparation • properties of fluxes and their uses • heat and damage protection procedures • procedures for preventing electrostatic discharge damage • soldered joint testing and inspection procedures • reworking procedures and precautions

Evidence Guide

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 perform manual soldering/desoldering of electrical/electronic components.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with manual soldering/desoldering for the installation and fabrication of electrical/ electronic components 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, standards, manuals and reference materials.

EVIDENCE GUIDE	
Guidance information for assessment	

Range Statement

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. 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.	
Materials	Solder (solid, resin core and paste), flux (resin or powder) etc.
Instructions	Verbal or written job sheet
Tools	Soldering irons, cutters, brushes, files, soldering tips, solder syringes, holding devices etc.
Inspection procedures	Visual, mechanical or electric techniques with pre-setup equipment

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Fabrication

MEM05012C Perform routine manual metal arc welding

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers preparing the materials and carrying out routine manual metal arc welding (MMAW).

Application of the Unit

Application of the unit	This unit applies in a maintenance or manufacturing environment where the welding is not required to meet an Australian standard or equivalent. Fillet and butt welds would typically be performed on low carbon/mild steels. Where welding is required to AS 1554 General Purpose or equivalent codes, occupational health and safety regulations and/or licensing requirements, Unit MEM05015D (Weld using manual metal arc welding process) should be selected. **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Refer to Application of the Unit

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Identify weld requirements	1.1. Weld requirements are identified from job instructions. 1.2. Location of welds is identified in accordance with standard operating procedures and job specifications.
2. Prepare materials for welding	2.1. Materials are cleaned and prepared ready for welding.
3. Prepare equipment for welding	3.1. Welding equipment is set up correctly. 3.2. Correct electrodes are selected to suit application and settings.
4. Perform routine welding using MMAW	4.1. Safe welding practices are applied. 4.2. Materials are welded to job requirements. 4.3. Welds are cleaned 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:

- preparing materials and electrodes
- setting up welding equipment
- welding with MMAW
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- performing measurements for joint preparation and routine MMAW

Required knowledge

Look for evidence that confirms knowledge of:

- material and equipment preparation
- properties and characteristics of materials and consumables
- weld characteristics
- equipment set-up and settings
- MMAW processes and properties

REQUIRED SKILLS AND KNOWLEDGE
• post-welding treatments • safe welding practices • use and application of personal protective equipment

Evidence Guide

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 prepare materials and carry out routine manual metal arc welding (MMAW).
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. Where assessment occurs off the job, i.e. the candidate is not in productive work, then appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing routine manual metal arc welding 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 should not require language, literacy and numeracy skills beyond those required in this unit. 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, standards, manuals and reference materials.
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Range Statement

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. 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.	
Materials	Low and mild carbon steel or similar
Prepared	Cleaning, setting up jigs, fixtures, clamps, joint preparation
Welding equipment	Welding leads, welding machines, electrode holder etc.
Cleaned	Slag and spatter, cleaning, using files and grinders

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Fabrication

MEM05050B Perform routine gas metal arc welding

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers preparing materials and routine gas metal arc welding (GMAW).

Application of the Unit

Application of the unit	This unit applies in a maintenance or manufacturing environment where the weld quality is not required to meet an Australian Standard or equivalent. Fillet and butt welds would typically be performed on low carbon/mild steels. Where welding is required to meet Australian Standard 1554 General Purpose or equivalent codes, occupational health and safety regulations and/or licensing requirements, Unit MEM05017D (Weld using gas metal arc welding process) should be selected. **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Refer to Application of the Unit

Pre-Requisites

Prerequisite units		

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Identify weld requirements	1.1. Weld requirements are identified from job instructions. 1.2. Locations of welds are identified in according to standard operating procedures and job specifications.
2. Prepare materials for welding	2.1. Materials are cleaned and prepared ready for welding.
3. Prepare equipment for welding	3.1. Welding equipment is set up correctly. 3.2. Settings and consumables are selected to suit application.
4. Perform routine welding using GMAW	4.1. Safe welding practices are applied. 4.2. Materials are welded to job requirements. 4.3. Welds are cleaned to 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:

- preparing materials
- setting up welding equipment
- welding with GMAW
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instruction
- using measurement skills relating to joint preparation and routine GMAW

Required knowledge

Look for evidence that confirms knowledge of:

- different current and voltage settings, gas flow rates wire diameters, wire feed speed and other variables to suit typical situations.
- material and equipment preparation
- properties and characteristics of materials and consumables
- equipment and equipment settings

REQUIRED SKILLS AND KNOWLEDGE
• fuel gas properties and applications • post-welding treatments • weld characteristics • safe welding practices • use and application of personal protective equipment for routine GMAW

Evidence Guide

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 perform routine gas metal arc welding (GMAW).
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing the materials and carrying out routine gas metal arc welding 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, standards, manuals and reference materials.
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assessment	

Range Statement

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. 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.	
Materials	Mild and low carbon steel
Prepared	Preheating, setting up jigs, fixtures, clamps, joint preparation
Equipment	Hoses, welding leads, gas shrouds, gas regulators, liners, contact tips
Consumables	Filler wire, shielding gas
Cleaned	Slag and spatter

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Fabrication

MEM07032B Use workshop machines for basic operations

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers basic machining in a maintenance or jobbing environment.

Application of the Unit

Application of the unit	The unit applies to machines that include but are not limited to lathe, radial arm drill, mills etc., and covers the sharpening of tools as required. This unit should not be selected when Unit MEM07005C (Perform general machining) or Unit MEM07024B (Operate and monitor machine/process) have already been selected. For hand held/power tools use Unit MEM18002B (Use power tools/hand held operations). **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools

Employability Skills Information

Employability skills	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. 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. Identify job requirements.	1.1. Job requirements are interpreted from work instructions and standard operating procedures. 1.2. Appropriate machine is selected to meet requirements.
2. Set up machine	2.1. Tools are selected appropriate to the work requirements. 2.2. Cutting tools are sharpened as required. 2.3. Tools are correctly installed using standard operating procedures. 2.4. Guards are set and adjusted as required.
3. Operate machine	3.1. Material to be machined is mounted and secured using clamping device appropriate to the material and work requirements. 3.2. Machine is operated correctly to suit work and material requirements.
4. Check finished component	4.1. Machined component is checked against work requirements and predetermined finish.

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: • reading, interpreting and following routine and familiar information on written job instructions, standard operating procedures and other applicable reference documents • selecting the appropriate machine for the given task • setting up machines and tooling within the scope of this unit, including speeds and feeds • sharpening tools within the scope of this unit • operating machines within the scope of this unit • checking finished components • checking and clarifying task-related information

REQUIRED SKILLS AND KNOWLEDGE
• measuring components to specification within the scope of this unit
Required knowledge
Look for evidence that confirms knowledge of: • cutting tool sharpening methods and techniques • tool geometry within the scope of this unit • units of measurement, tool geometry and numerical operations within the scope of this unit • safe operation of tool sharpening equipment • consequences of incorrect sharpening • machine set-up • consequences of incorrect speeds and feeds • procedures for operating workshop machines • reasons for poor surface finish. • hazards and control measures • use and application of personal protective equipment • safe work practices and procedures

Evidence Guide

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 use workshop machines for basic operations. 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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using workshop machines for basic operations 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, standards, manuals and reference materials.

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Range Statement

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. 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.	
Machines	Lathe, radial arm drill, mill etc.
Cutting tools	Lathe tools, milling cutters, drills etc.
Materials	Ferrous and non ferrous
Clamping device	Chucks, vices, clamps, bars and packing etc.

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Machine and process operations

MEM10016 Terminate and test electrical wiring and accessories

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson - industrial electrician apprenticeship training and the recognition of trade-level skills in the termination and testing of electrical cables, cords and accessories using appropriate fixing devices and methods.

It covers the installation requirements for a wide range of typically used electrical cables in a variety of situations and separation from other services, including fire wall penetrations.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capabilities (EPCs):

- EPC 41 – Describe the construction, specifications, colour coding and applications of various types of cables and cords.
- EPC 42 – Demonstrate the skills to prepare and terminate cords and cables.
- EPC 43 – Demonstrate the selection and attachment of electrical accessories, using appropriate fixing devices and methods.
- EPC 49 – Determine and apply AS/NZS 3000:2000 and AS/NZS 3008 requirements for the installing, terminating and testing of MIMS and Armoured cables. This is to include the cable type selection to AS2381 (or other standards) requirements.

And

Essential Performance Capability (EPC) classified as ‘critical’:

- EPC 44 – Demonstrate the knowledge and skill to install and terminate a variety of electrical cables in a wide range of applications (including final subcircuits) to AS/NZS 3000:2000.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM18001C	Use hand tools

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
		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.	Prepare to terminate electrical cables and cords	2.1.	Inspect accessories to determine the appropriate type and size of cable/cord and termination connectors/lugs, as required
		2.2.	Obtain specialised tools, equipment and test instruments needed for terminating electrical cables and cords
3.	Terminate electrical cables and cords	3.1.	Isolate and tag circuits and equipment in accordance with procedures, where required
		3.2.	Prepare cable/cord end to suit connector/lug without

		causing any damage to insulation or conductor
	3.3.	Fit and secure specialist cable glands and retaining devices
	3.4.	Ensure terminations/connections are made to specifications, manufacturer requirements, and regulatory and legislative requirements
	3.5.	Ensure all entry points are sealed using appropriate compounds, including resins, where required
	3.6.	Mark/tag and label all cables, wires, conductors and connections to specifications
4. Test electrical cables and cords	4.1.	Test terminated cables to ensure continuity and insulation resistance readings comply with requirements
	4.2.	Complete all reports and documentation to the required specifications and 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.

Electrical cable and cord types include five or more of the following:	• thermoplastic insulated cable (TPI) • flat thermoplastic sheathed (TPS) • circular thermoplastic sheathed (TPS) • steel wired armoured (SWA) • fire rated cable (high tension (HT) or high frequency (HF) or mineral insulated metal sheath (MIMS)) • flexible cords and cables • aluminium conductor/cable
Termination of cables and cords include two or more of the following connectors and lugs:	connectors: • screw • stud • tunnel lugs: • crimp and compression • soldering • solderless
Regulatory requirements include:	• AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules) • AS/NZS 3008.1.1:2009 Electrical installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV – typical Australian installation conditions
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10016 Terminate and test electrical wiring and accessories

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- identifying the cables and cords by conductor size, type and rating
- preparing and terminating cable and cords to accessories using appropriate hardware, tools and equipment, including soldering without undue damage to insulation or conductor
- preparing and terminating at least five (5) or more of the following cable and cord types at a device terminal enclosure:
  - thermoplastic insulated cable (TPI)
  - flat thermoplastic sheathed (TPS)
  - circular thermoplastic sheathed (TPS)
  - steel wired armoured (SWA)
  - fire rated cable (HT or HF or MIMS)
  - flexible cords and cables
  - aluminium conductor/cable
- terminating the above selected cable and cord types into two (2) or more of the following connectors and lugs:
  - connectors:
    - screw
    - stud
    - tunnel
  - lugs:
    - crimp and compression
    - soldering
    - solderless
- inspecting and testing terminated cables to ensure they comply with continuity and insulation resistance requirements and are safely intended for use
- using test equipment to locate faults, completing remedial action and retesting to ensure compliance
- documenting termination and testing of electrical cables, cords and accessories 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 PPE
- different types of electrical cables and cords and their applications
- structural components of cables and their purpose (conductor material, stranding, insulation type, voltage rating, screening, sheathing, armour and serving)
- Australian and International colour standards for cables and cords
- factors affecting cable current-carrying capacity:
  - current requirements for the circuit
  - cable installation method to be used
  - environmental conditions in the vicinity of cable installation
- support, fixing and protection methods
- Australian/New Zealand Wiring Rules requirements for flexible cords, cables and plugs
- Australian Standards and manufacture requirements for the termination of:
  - TPS and TPI cables
  - fire protection and mineral insulated metal sheathed cables
  - SWA
  - trailing cable and catenary wire systems
- soft soldering process, including the use of liquid petroleum (LP) gases and precautions to be observed
- fire rated cable types, including HT, HF and MIMS
- test requirements to ensure compliant continuity and insulation resistance and documentation to be completed.

Assessment Conditions

Assessors must:

- have vocational competency in terminating and testing electrical wiring and accessories 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM10018 Select cable types and sizes to suit loads and electrical installation environment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in selecting cables for electrical installation work and equipment in areas including consumer mains, submains and final subcircuits for operating voltages up to 1000 V alternating current (AC) or 1500 V direct current (DC).

It covers a comprehensive understanding of the cable selection process of the Australian/New Zealand Wiring Rules and cable selection standards in determining maximum demand, voltage drop limitations, current-carrying capacity and short circuit capability.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capability (EPC):

- EPC 49 – Determine and apply AS/NZS 3000:2000 and AS/NZS 3008 requirements for the installing, terminating and testing of MIMS and Armoured cables. This is to include the cable type selection to AS2381 (or other standards) requirements.

And

Essential Performance Capabilities (EPCs) classified as ‘critical’:

- EPC 29 – Demonstrate the ability to select cables for mains and submains using AS/NZS 3000:2000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capability, maximum demand and voltage drop, for single phase and three phase installations including multiple installations.
- EPC 30 – Demonstrate the ability to select cables for final subcircuits using AS/NZS 3000:2000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capability, maximum demand, earth loop impedance and voltage drop.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Nil

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
	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. Select wiring systems and cables for electrical installation work and equipment	2.1. Select wiring systems to suit loads and electrical installation work environment
	2.2. Select cable conductor sizes based on current-carrying capacity, short circuit capacity, maximum demand, voltage drop and earth fault-loop impedance in accordance with regulatory requirements
	2.3. Select circuit protective devices based on current-carrying capacity requirements of the selected cables
	2.4. Select earthing system parts to meet the multiple earth neutral (MEN) system
	2.5. Document selection of cable types and sizes and installation requirements 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.

Electrical installations include:

At least one general electrical installations comprising a main switchboard, supplying more than one circuit each for, lighting, socket outlets and fixed appliances

At least one industrial electrical installation comprising a distribution board separate from the main switchboard and at least one circuit supplying a three-phase load and safety system in one of the following industrial environments:

- factory
- building
- off shore platform
- mine site processing
- oil and gas installation
- processing plant
- workshop
- underground installation

Three-phase loads include at least one or more of the following:

- motors – for pumps, conveyors, mills, agitators, crushers and screening plants
- heaters
- compressor packages
- heating, ventilation and air conditioning (HVAC) units
- facility accommodation units, sea container workshops and storage units, and laboratories
- workshop equipment, including lathes, milling machines and welders
- underground dewatering systems and ‘gate end’ boxes for drilling equipment

Regulatory requirements include:

- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- AS/NZS 3008.1.1:2009 Electrical Installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV – typical Australian installation conditions

Safe working practices include:

Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10018 Select cable types and sizes to suit loads and electrical installation environment

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- determining the cable routes, length and conditions in which the wiring system is to operate
- complying with relevant Australian/New Zealand Wiring Rules, and Cable Selection and Service Rules when selecting cables ensuring coordination between protective devices and conductors in regard to the following aspects:
  - design of the circuit taking into account the safety considerations
  - determining the final subcircuit arrangements
  - determining the factors affecting suitability of wiring systems
  - calculating the maximum demand on consumer mains/submains
  - calculating the current-carrying capacity requirements
  - calculating the voltage drop requirements
  - calculating the expected fault loop impedance
  - selecting cables to satisfy voltage drop, current-carrying capacity and fault loop impedance requirements
  - selecting the appropriate protection devices
  - selecting the appropriate isolation devices and switching arrangements
- selecting earthing system parts to meet the MEN system
- documenting reasons for selection and installation requirements 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 PPE
- Australian/New Zealand Wiring Rules, AS/NZS 3008.1.1:2009 Electrical Installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV – typical Australian installation conditions and other related standards in regards to the following:
  - design and safety performance requirements, including:
    - protection of persons, livestock and property from harmful effects
    - correct functioning of the electrical installation for intended use
    - compatibility with the electricity distribution system, or other source of supply, to which the electrical installation is to be connected
    - type of insulation required:
      - thermoplastic
      - elastomer
      - cross linked polyethylene (XLPE)
      - mineral insulated metal sheath (MIMS)
      - high temperature
    - supply characteristics
    - reasons for dividing installations into circuits and factors that determine their number and type
    - external influences that may damage installation and be considered in the design, including applying derating factors caused by the effect of:
      - grouping of cables
      - ambient temperature
      - depth of laying
      - thermal resistivity of soil
      - varying of loads
      - thermal insulation
      - direct sunlight
    - acceptable methods of protection against risks of ignition of flammable materials
    - likely sources of unwanted voltages and methods of dealing with this potential hazard
    - requirements for protection against fault current
    - protection against harmful effects of faults between live parts of circuits supplied at different voltages
    - mechanical movement protection
    - fire rated construction and how integrity of fire rating can be maintained
  - final subcircuit arrangements, including:
    - factors to consider when determining the number and type of circuits required
    - daily and seasonal demand for lighting, power, heating and other loads in a given installation
    - factors affecting current-carrying capacity of cables
    - layout/schedule of circuits
  - factors affecting suitability of wiring systems

- acceptable methods of determining maximum demand on an installation's consumer's mains and submains up to 400 A per phase
- external factors that require the use of a derating factor when determining current-carrying capacity
- requirements for maximum voltage drop in an installation and relevant tables for unit values of voltage drop
- requirements for maximum fault loop impedance in an installation and the relevant tables to determine cable impedances
- accepted methods used against indirect contact when selecting protection devices to protect against overload and short circuit current situations
- provision of isolation of every circuit for a range of installations and conditions
- earthing system parts, including the selection of earth electrode, main earthing conductor, main earthing terminal/connection or bar, MEN link, protective earthing conductors and equipotential bonding.

Assessment Conditions

Assessors must:

- have vocational competency in selecting cable types and sizes to suit loads and electrical installation environment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM10019 Select circuit protection devices by type and rating, fit to switchboards and install earthing

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson - industrial electrician apprenticeship training and the recognition of trade level skills in selecting and installing circuit protection devices to protect against electric shock, over current and over voltage for operating voltages up to 1000 V alternating current (AC) or 1500 V direct current (DC) and install earthing in accordance with multiple earth neutral (MEN) system.

It covers a comprehensive understanding of earthing arrangements, the MEN system (including sub-installations), the calculation and selection of protective devices, alternative arrangement against electric shock and the requirements for use of residual current devices (RCDs).

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capability (EPC):

- EPC 32 – Demonstrate an understanding of the AS/NZS 3000:2000 and regulatory requirements for the location of switchboards and the arrangement of switchboard equipment in installations.

And

Essential Performance Capabilities (EPCs) classified as ‘critical’:

- EPC 21 – Describe and apply in practice the requirements of AS/NZS 3000:2000 in relation to earthing arrangements and fault loop impedance calculations.
- EPC 22 – Demonstrate a comprehensive knowledge and understanding of the MEN system and its application, including on sub-installations.
- EPC 27 – Describe and apply in practice the requirements for circuit protection using AS/NZS 3000:2000 and other relevant Australian Standards. E.g. AS/NZS 3018.1.
- EPC 28 – Demonstrate knowledge of the SELV, PELV and earth leakage current protection systems and their application in accordance with AS/NZS 3000:2000.
- EPC 31 – Describe the control and protection requirements for installations and equipment. Demonstrate the ability to select suitable equipment and switchgear for a particular installation or part of an installation.
- EPC 34 – Demonstrate the appropriate methods for the installation, modification and testing of electrical installations and equipment for construction and demolition sites, complying with AS/NZS 3012 and applicable workplace safety legislation.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **2**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical cables, cords and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM18001C	Use hand tools

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
	1.3. Use appropriate personal protective equipment (PPE) in accordance with SOPs
	1.4. Identify job and load requirements from specifications, drawings, job sheets or work instructions
2. Prepare and select circuit protection controls and devices for electrical installations	2.1. Organise circuits and switchboard equipment to comply with layout drawings, specifications and regulatory requirements
	2.2. Select suitable circuit protective devices to meet specifications
	2.3. Select RCDs to meet required circuit requirements and specifications
	2.4. Select switchgear/control gear by type, rating and purpose for a particular installation or part of an

		installation
3.	Install circuit protection controls and devices for electrical installations	3.1. Isolate and tag circuits and equipment in accordance with procedures, where required
		3.2. Install circuit protection devices in compliance with job specifications and requirements
		3.3. Install RCDs, where required, to protect all lighting and socket outlets in final subcircuits in domestic electrical installations
		3.4. Install switchgear (including main switch/s) and control gear according to manufacturer and regulatory requirements
		3.5. Check installed components are straight and square in the required locations and within acceptable tolerances
		3.6. Terminate earthing to meet with the MEN system requirements
		3.7. Inspect installed components and earthing system visually to ensure compliance
		3.8. Test the earthing system for continuity and insulation resistance to ensure compliance
		3.9. Mark all switches, circuit-breakers, RCDs and other electrical equipment on or adjacent to the switchboard
		3.10. Document selection of circuit protection devices and electrical installation arrangement 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.

Installations include:

At least one general electrical installations comprising a main switchboard, supplying more than one circuit each for, lighting, socket outlets, and fixed appliances

At least one industrial electrical installation comprising a distribution board separate from the main switchboard and at least one circuit supplying a three-phase load and safety system in one of the following industrial environments:

- factory
- building
- off shore platform
- mine site processing
- oil and gas installation
- processing plant
- workshop
- underground installation

Three-phase loads include at least one or more of the following:

- motors – for pumps, conveyors, mills, agitators, crushers and screening plants
- heaters
- compressor packages
- heating, ventilation and air conditioning (HVAC) units
- facility accommodation units, sea container workshops and storage units, and laboratories
- workshop equipment, including lathes, milling machines and welders
- underground dewatering systems and ‘gate end’ boxes for drilling equipment

Regulatory requirements include:

- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- AS/NZS 3012:2010 Electrical installations – Construction and demolition sites

Safe working practices include:

Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10019 Select circuit protection devices by type and rating, fit to switchboards and install earthing

Modification History

Release 1. New unit

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 occasions and include:

- following work instructions, SOPs and safe work practices
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- determining the individual load requirements of the installation
- selecting the appropriate switchboard and layout arrangements
- complying with Australian/New Zealand Wiring Rules, other Australian Standards e.g. AS/NZS 3008.1.1:2009 Electrical Installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV – typical Australian installation conditions, Service Rules and other relevant standards when selecting circuit protection controls and devices in regard to the following aspects:
  - protection against indirect contact, overcurrent or excess earth leakage current conditions and over and under voltage by selecting and installing using safe working practices:
    - fuses for fault current-limiting protection
    - appropriate circuit breakers with a current rating not less than the maximum demand of the portion of the electrical installation they control
    - RCDs with a maximum rated residual current of 30 mA
  - control of the electrical installation (or parts thereof) by suitable switching arrangements by selecting and installing using safe working practices:
    - main switches to control the whole of the electrical installation
    - switches for isolation, emergency, mechanical maintenance and functional (control) with appropriate Ingress Protection (IP) rating
  - installing and terminating the compliant earthing system components for the MEN system and other earthing arrangements
  - terminating all circuit protection controls and devices
  - inspecting visually all components and earthing system to ensure compliance
  - testing earthing system for continuity and insulation resistance
  - identifying with marking all switches, circuit breakers and RCDs and other electrical equipment on or adjacent to the switchboard
- using test equipment to locate faults, completing remedial action and retesting to ensure compliance
- documenting reasons for selection and installation arrangement requirements 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 PPE
- Australian/New Zealand Wiring Rules and other related standards in regards to the following:
  - requirements for the selection and installation of switchgear and controlgear, including:
    - protection against indirect contact
    - protection against overcurrent or excess earth leakage current conditions
    - protection against over voltage and under voltage
    - control of the electrical installation (or parts thereof) by suitable switching arrangements
    - design, selection and installation of switchboards
  - design of an electrical installation
  - application and segregation requirements of separated extra-low voltage (SELV) and protected extra-low voltage (PELV) circuits
  - application and arrangement of an isolated supply
  - hazards and risks in an electrical installation
  - protection against indirect contact, including:
    - methods of protection
    - protection by automatic disconnection of supply
    - touch-voltage limits
    - earthing system impedance
    - disconnection times
    - supplementary equipotential bonding
    - protection by the use of Class II equipment or by equivalent insulation
    - protection by electrical separation
  - protection by the use of RCDs
  - protection against thermal effects in normal service
  - protection against unwanted voltages
  - protection against over current and fault currents
  - protection against over voltage
  - protection against injury from mechanical movement
  - devices for isolation
  - fire integrity
  - protection form damp situations
  - earthing system terms, parts and arrangement
  - devices and operating principles for automatic disconnection of supply, including circuit breakers, fuse and RCDs
  - devices for isolation and switching, including for the following functions:
    - isolation
    - emergency
    - mechanical maintenance
    - functional (control)

    - switchboards and distribution boards purpose, types, application, layout and compliance requirements
- construction and demolition requirements in accordance with AS/NZS 3012:2010 Electrical Installations – Construction and demolition sites.

Assessment Conditions

Assessors must:

- have vocational competency in selecting circuit protection devices by type and rating, fit to switchboards and install earthing 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 and comply with the National Vocational Education and Training Regulator Act 2011 or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM10020 Install low voltage cabling and fit-off accessories, appliances and equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in installing low voltage (LV) cabling/wiring, and fitting-off of accessories, appliances and equipment to an electrical switchboard in a variety of situations.

It covers a comprehensive understanding of the Australian/New Zealand Wiring Rules and regulatory requirements and knowledge of other standards that apply to particular situations and installations for selecting and fixing of accessories; the location of switchboards; arrangement and identification of switchboard equipment; and access requirements, including the separation and minimisation of the spread of fire.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capabilities (EPCs):

- EPC 32 – Demonstrate an understanding of the AS/NZS 3000:2000 and regulatory requirements for the location of switchboards and the arrangement of switchboard equipment in installations.
- EPC 37 – Demonstrate knowledge of the AS/NZS 3000:2000 requirements and the standards referenced for special installations including emergency systems, and construction/demolition sites.
- EPC 45 – Demonstrate the knowledge and skills for the installation of wiring support systems.
- EPC 49 – Determine and apply AS/NZS 3000:2000 and AS/NZS 3008 requirements for the installing, terminating and testing of MIMS and Armoured cables. This is to include the cable type selection to AS2381 (or other standards) requirements.
- EPC 50 – Determine and apply AS/NZS 3000:2000 requirements for the installing, terminating and testing of catenary supported cables, pendant-type socket outlets and trailing cables.

And

Essential Performance Capabilities (EPCs) classified as ‘critical’:

- EPC 33 – Demonstrate an understanding of the AS/NZS 3000:2000 and regulatory requirements for the installation of electrical equipment in given damp situations and wet areas.
- EPC 34 – Demonstrate the appropriate methods for the installation, modification and testing of electrical installations and equipment for construction and demolition sites, complying with AS/NZS 3012 and applicable workplace safety legislation.
- EPC 35 – Demonstrate knowledge of AS/NZS 3000:2000 requirements for the installation of aerial conductors and underground wiring.
- EPC 36 – Demonstrate a knowledge of AS/NZS 3000:2000 requirements for electrical installations in hazardous areas and an awareness of the standards to which it refers (e.g. AS 2430, AS 2381.1).

- EPC 44 – Demonstrate the knowledge and skill to install and terminate a variety of electrical cables in a wide range of applications (including final subcircuits) to AS/NZS 3000:2000.
- EPC 47 – Install final subcircuit wiring into switchboards and connect switchboard equipment in accordance with AS/NZS 3000:2000 and local supply authority requirements.
- EPC 48 – Connect consumer mains to an installation, in accordance with AS/NZS 3000:2000 and local supply authority requirements.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection controls devices by type and rating, fit to switchboards and install earthing
	MEM10023	Design and connect control switching of circuits for building services and industrial equipment
	MEM10024	Install and troubleshoot luminaires and ancillary equipment
	MEM18001C	Use hand tools

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
	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. Plan installation of electrical wiring, accessories and appliances	2.1. Plan cable routes in accordance with requirements contained in the job instructions/specifications
	2.2. Obtain necessary cables, appropriate cable support systems and enclosures, accessories and appliances needed for the installation work in accordance with established procedures and check against job requirements
	2.3. Obtain necessary tools, equipment and testing instruments needed for the installation work
3. Install and fit-off electrical wiring, accessories and appliances	3.1. Isolate and tag circuits and equipment in accordance with procedures, where required
	3.2. Install and fix cable support system in position ensuring components are square and plumb, securely attached using fastenings appropriate to the weight of the components and the material of the mounting
	3.3. Install electrical cables and wiring, accessories and appliances in compliance with specifications and regulatory requirements
	3.4. Maintain fire integrity when installing electrical cables and wiring

3.5. Terminate cables and conductors at switchboards, accessories and appliances in accordance with manufacturer specifications and regulatory requirements

3.6. Test and inspect installed circuits to ensure compliance in accordance with legislative and regulatory requirements

3.7. Rectify any defects and re-test to ensure compliance

3.8. Document installation of wiring, accessories and appliances 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.

Electrical installations include:

At least one general electrical installations comprising a main switchboard, supplying more than one circuit each for, lighting, socket outlets and fixed appliances

At least one industrial electrical installation comprising a distribution board separate from the main switchboard and at least one circuit supplying a three-phase load and safety system in one of the following industrial environments:

- factory
- building
- off shore platform
- mine site processing
- oil and gas installation
- processing plant
- workshop
- underground installation

Three-phase loads include at least one or more of the following:

- motors – for pumps, conveyors, mills, agitators, crushers and screening plants
- heaters
- compressor packages
- heating, ventilation and air conditioning (HVAC) units
- facility accommodation units, sea container workshops and storage units, and laboratories
- workshop equipment, including lathes, milling machines and welders
- underground dewatering systems and ‘gate end’ boxes for drilling equipment

Cable routes include one or more of the following:

- internal to buildings
- underground
- aerial

Electrical cable and wiring types include five or more of the following:

- thermoplastic insulated cable (TPI)
- flat thermoplastic sheathed (TPS)
- circular thermoplastic sheathed (TPS)
- steel wired armoured (SWA)

	• fire rated cable (high tension (HT) or high frequency (HF) or mineral insulated metal sheath (MIMS)) • flexible cables • aluminium conductor/cable • underground cables • aerial conductors
Termination of cables and cords include two or more of the following connectors and lugs:	connectors: • screw • stud • tunnel lugs: • crimp and compression • soldering • solderless
Cable support systems include four or more of the following:	• metallic conduit • non-metallic conduit • trunking • duct • cable tray/ladder • catenary • posts/poles/struts
Regulatory requirements include:	• AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules) • AS/NZS 3018.1 Electrical installations – Domestic installations (or its equivalent updated version) • local supply authority requirements
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10020 Install low voltage cabling and fit-off accessories, appliances and equipment

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- planning the cable routes in accordance with legislative and customer requirements
- installing cable support systems
- complying with the following cable support system requirements:
  - bending steel conduits (where applicable) such that the internal diameter is not significantly reduced
  - preparing entry joints and joints to ensure cable insulation is not damaged
  - joining steel conduits together using appropriate accessories or, if required, through a welding process
  - ensuring joints are adequately sealed against entry of water or rain
- installing wiring systems using applicable cable support systems according to the electrical installation requirements and standards paying particular attention to factors effecting cable current-carrying capacity
- maintaining fire integrity
- terminating cables and conductors to switchboard protective devices
- terminating cables and conductors at switchboards, accessories and appliances according to legislative, regulatory and manufacturers requirements
- installing all accessories, appliances and equipment square and straight and in the required location using appropriate hand and power tools
- inspecting and testing installed and terminated cables to ensure they comply with continuity and insulation resistance and are safe to connect to the supply
- rectifying any defects and retesting to ensure compliance
- completing appropriate documentation 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 PPE
- Australian Standards, codes and requirements applicable to the installation for:
  - TPS (flat and circular) and TPI cables
  - fire protection and MIMS cables
  - SWA
  - flexible cords used as fixed wiring
  - trailing cable and catenary wire systems
  - cables support systems
  - protection against mechanical damage
  - wiring systems likely to be disturbed
  - wiring systems installed vertically
  - change of direction
  - prohibited cable locations
  - selection and installation to minimize the spread of fire
  - limitation of circulating and eddy currents
- Australian/New Zealand Wiring Rules requirements for enclosure of cables, including:
  - types of wiring enclosures – change of wiring enclosures, entry of water and support of cables
  - installation of wiring enclosures – support, continuity, bending, passage of conductors, terminations, in direct sunlight, and provision for expansion and cable trunking
  - factors effecting cable current-carrying capacity
- dissimilar metals in a corrosive environment
- application of protective coatings, for example, paint, galvanizing and powder coatings
- techniques, tools and equipment required to install conduit (metallic and non-metallic), enclosures and support systems
- Australian Standards, codes and requirements applicable to the installation of electrical equipment, including:
  - appliances
  - switchgear, controlgear and accessories
  - switchboards – location and access, physical and circuit arrangements
  - socket outlets
  - lighting equipment and accessories, lamps and luminaires
  - smoke and fire detectors
  - cooking appliances
  - appliances producing hot water or steam
  - room, space and duct heaters
  - electric heating cables for floors and ceilings
  - electricity converters
  - motors, transformers, capacitors and batteries
  - control, switching and over current and residual current device (RCD) protection
  - required and permitted locations for current-using equipment and accessories
- terminal configuration of phase, neutral and protective earthing conductors for each type of equipment

- installation standards identified by the Australian/New Zealand Wiring Rules for special situations, including:
  - movable premises and caravan parks
  - shows and carnivals
  - boating marinas
  - electromedical treatment areas
  - outdoor sites under heavy conditions
  - cranes and hoists
  - lifts
  - cold cathode illumination systems
  - electric fences
  - construction and demolition sites
  - film, video and television sites
  - telecommunications networks power supplies
  - hazardous areas e.g. AS/NZS 2430, AS/NZS 2381 (or their equivalent updated versions)
- Australian/New Zealand Wiring Rules requirements for special electrical installations or locations, including:
  - baths, showers or other fixed water containers
  - swimming pools, paddling pools and spa pools or tubs
  - sauna heaters
  - refrigeration rooms
  - locations where water general hosing down operations are carried out
  - fountains and water features
  - extra-low voltage electrical installations
  - high voltage electrical installations
  - hazardous areas
  - emergency systems
- underground wiring systems, including:
  - arrangements and installation requirements
  - spacing from other underground services
  - consumer mains
- aerial wiring systems, including:
  - types of conductor
  - arrangements, clearances, distance between supports (spans), aerial conductor supports, poles and posts, and joints and connections
  - Australian/New Zealand Wiring Rules and local supply authority requirements
  - testing of installed cables in compliance with Australian Standards
- cables supported by catenary, including:
  - types of cables
  - catenary supports
- tools, techniques and procedures for installing cables and wiring systems
- testing and verification of installed and terminated cables to ensure they comply with a visual inspection, all mandatory and optional tests and are safe to connect to the supply.

Assessment Conditions

Assessors must:

- have vocational competency in installing low voltage cabling and fit-off accessories, appliances and equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM10021 Inspect, test and verify electrical installations

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in inspecting, testing and verifying electrical installations in accordance with the Australian/New Zealand Wiring Rules and regulatory requirements.

It covers all aspects inspection and testing, including visual, application of mandatory testing, interpreting test results and recording reporting requirements.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capability (EPC):

- EPC 39 – Demonstrate the reporting of test results for an electrical installation as typically required to satisfy regulatory requirements.

And

Essential Performance Capabilities (EPCs) classified as 'critical':

- EPC 34 – Demonstrate the appropriate methods for the installation, modification and testing of electrical installations and equipment for construction and demolition sites, complying with AS/NZS 3012 and applicable workplace safety legislation.
- EPC 38 – Describe and perform to AS/NZS 3000:2000 and AS 3017 standards the electrical checks and tests required to ensure electrical installations are safe.
- EPC 46 – Describe and perform the circuit tests required for electrical cables in a range of installations, with attention to the final subcircuit tests.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
	MEM10020	Install low voltage cabling and fit-off accessories, appliances and equipment
	MEM10022	Commission and decommission high and low voltage equipment or installations
	MEM10023	Design and connect control switching of circuits for building services and industrial equipment
	MEM10024	Install and troubleshoot luminaires and ancillary equipment
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18100	Fault-find, test and rectify AC machines and circuits
	MEM18102	Fault-find, test and rectify single and three-phase transformers
	MEM18103	Fault-find, test and rectify electrical circuits and equipment
	MEM18104	Dismantle, replace and assemble electrical components and equipment

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
		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.	Prepare to inspect, test and verify electrical installations	2.1.	Review all relevant documentation pertaining to the electrical installation in preparedness for testing and verification
		2.2.	Consult with relevant personnel in readiness for inspection, verification and testing of the electrical installation
		2.3.	Obtain all necessary tools, equipment and testing instruments needed to verify compliance
3.	Inspect, test and verify electrical installations	3.1.	Isolate and tag circuits and equipment in accordance with procedures, where required
		3.2.	Carry out a visual inspection of the electrical installation in accordance with the Testing and Verification – Visual Inspection Check List described in the Australian/New Zealand Wiring Rules
		3.3.	Conduct all mandatory tests to verify that the earthing conductor resistance, insulation resistance, all polarities and circuit connections meet the requirements in accordance with the Australian/New Zealand the Wiring Rules
		3.4.	Conduct optional testing to verify that the fault-loop

			impedance and the operation of residual current devices meet the requirements in accordance with the Australian/New Zealand the Wiring Rules
4.	Report inspection and test results	4.1.	Identify and report all defects and make recommendations for rectification in accordance with SOPs
		4.2.	Complete all mandatory documentation in accordance with regulatory and local supply authority requirements

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.

Electrical installations include:

At least one general electrical installations comprising a main switchboard, supplying more than one circuit each for, lighting, socket outlets and fixed appliances

At least one industrial electrical installation comprising a distribution board separate from the main switchboard and at least one circuit supplying a three-phase load and safety system in one of the following industrial environments:

- factory
- building
- off shore platform
- mine site processing
- oil and gas installation
- processing plant
- workshop
- underground installation

Three-phase loads include at least one or more of the following:

- motors – for pumps, conveyors, mills, agitators, crushers and screening plants
- heaters
- compressor packages
- heating, ventilation and air conditioning (HVAC) units
- facility accommodation units, sea container workshops and storage units, and laboratories
- workshop equipment, including lathes, milling machines and welders
- underground dewatering systems and ‘gate end’ boxes for drilling equipment

Regulatory requirements include:

- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- AS/NZS 3017:2007 Electrical installations – Verification guidelines
- AS/NZS 3018.1 Electrical installations – Domestic installations (or its equivalent updated version)
- AS/NZS 3760:2010 In-service safety inspection and testing of electrical equipment

	• AS/NZS 3012:2010 Electrical installations – Construction and demolition sites
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10021 Inspect, test and verify electrical installations

Modification History

Release 1. New unit

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, SOPs and safe work practices
- obtaining the relevant work permits and implementing appropriate risk control measures
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- preparing and following work plans in accordance with legislative and regulatory requirements and hazard and safety requirements
- reviewing all relevant documentation pertaining to the electrical installation to be inspected and tested
- consulting with all relevant personnel affected by this process
- obtaining the necessary tools, equipment and testing instruments
- preparing a safety work method statement (SWMS) or job safety analysis (JSA) in the absence of established procedures for effective isolation
- performing a visual inspection ensuring that it meets the requirements of the Australian/New Zealand Wiring Rules – Testing and Verification Visual Inspection Check List
- performing the mandatory and optional circuit tests required for electrical cables in a range of installations and final subcircuits, including:
  - following safe testing procedures
  - testing to show if the earth continuity is sufficiently low
  - testing to show if the insulation resistance is sufficiently high
  - testing to show if the polarity and circuit connections are correct
  - testing to show earth fault-loop impedance is sufficiently low
  - performing testing to verify that residual current devices (RCDs) operate as intended
- identifying and reporting of any non-compliance defects and making necessary recommendations in accordance with appropriate procedures
- completing all mandatory documentation in accordance with regulatory and local supply authority requirements.

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 PPE
- isolation and lockout procedures and the purpose and use of SWMS or JSA
- tools, equipment and test instruments needed to conduct electrical installation inspection, testing and verification process
- testing procedures, requirements and considerations
- visual inspection of installations for compliance with the Australian/New Zealand Wiring Rules, including:
    - general – protection against direct and indirect contact, hazardous parts, spread of fire and general condition
    - consumers mains
    - switchboards
    - wiring systems
    - electrical equipment
    - earthing
- mandatory tests, including:
    - continuity of the earthing system
    - insulation resistance
    - polarity
    - correct circuit connections
- optional tests, including:
    - fault-loop impedance
    - verification of operation of RCDs
- mandatory documentation and records as required by local supply authority, legislative and regulatory requirements
- documentation for periodic testing and tagging of electrical equipment
- inspection and testing of construction and demolition sites complying with AS/NZS 3012:2010 Electrical installations – Construction and demolition sites, and recording of tests.

Assessment Conditions

Assessors must:

- have vocational competency inspecting, testing and verifying electrical installations 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM10022 Commission and decommission high and low voltage equipment or installations

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade level skills in switching, isolating, commissioning and decommissioning high voltage (HV) and low voltage (LV) electrical equipment or installations and seeking appropriate assistance.

It covers the knowledge of isolating and earthing arrangements, permit requirements for switching HV, appropriate assistance where required; commissioning and decommissioning procedures and safety measures.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capabilities (EPCs):

- EPC 60 – Describe the types of potential operational situations that may be encountered in various areas of industry that will require assistance from more experienced industry personnel.
- EPC 61 – Describe the type of assistance that may be needed for operational situations that could be encountered in various areas of industry.

And

Essential Performance Capability (EPC) classified as ‘critical’:

- EPC 62 – Describe the methods of commissioning and/or decommissioning electrical equipment or an installation, using a systems approach.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **2**

Pre-requisite Unit

Nil

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
	1.3. Use appropriate personal protective equipment (PPE) in accordance with SOPs
	1.4. Consult and obtain approval from authorised personnel the need to commission or decommission electrical equipment or installation
	1.5. Analyse and confirm commissioning, switching and work schedules, including drawings, plans and regulatory requirements
2. Prepare to commission or decommission electrical equipment or installation	2.1. Inspect or confirm suitability and safety of electrical equipment or installation site for required commissioning or decommissioning
	2.2. Identify and obtain WHS policies and procedures related to the requirements for commissioning or decommissioning electrical equipment or installation
	2.3. Obtain necessary tools, equipment and testing devices needed for commission or decommission electrical equipment or installation
	2.4. Brief others participating in or affected by the work on commissioning or decommissioning of electrical equipment or installation
	2.5. Prepare the site according to the work schedule to minimise risk, disruption and damage to property,

		operations and individuals
3.	Commission or decommission electrical equipment or installation	3.1. Commission electrical equipment or installation using a systems approach, including the use of appropriate test equipment, in accordance with the approved commissioning schedule
		3.2. Verify that the performance of the installed equipment/installation through a series of tests is consistent with the customer requirements/specified design intent
		3.3. Capture and record performance data of the whole installation as the baseline for future operation and maintenance
		3.4. Decommission electrical equipment or installation using an approved decommissioning schedule, including the use of appropriate test equipment, according to requirements and established procedures
		3.5. Shut down and isolate electrical equipment or installation sequentially in preparation for repair or maintenance work using safe working practices
		3.6. Deal safely with unexpected situations during the isolation process, including, where required, the approval of an authorised person
4.	Complete commission or decommission electrical equipment or installation	4.1. Check work undertaken against work schedules for conformance with requirements and report anomalies in accordance with established procedures
		4.2. Document completion of commissioning or decommissioning of electrical equipment or installation in accordance with established procedures

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.

Electrical equipment and installations include:	New, replaced, or extensively modified equipment or installation in one or more of the following industrial environments: • factory • building • off shore platform • mine site processing • oil and gas installation • processing plant • workshop • underground installation
Test equipment includes one or more of the following:	• multimeters • ammeters • tong testers • voltmeters • continuity testers • insulation resistance testers • appropriate proving dead meters • high potential testers
Regulatory requirements include:	AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules)
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10022 Commission and decommission high and low voltage equipment or installations

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings, specifications, commissioning, decommissioning switching schedules and instructions relevant to the work to be undertaken
- preparing and following work plans associated with commissioning and decommissioning electrical equipment or installation in accordance with legislative and regulatory requirements, hazard and safety requirements
- complying with the Australian/New Zealand Wiring Rules and regulatory requirements for HV and LV electrical equipment and installations
- selecting the appropriate measuring and testing devices
- conducting briefing sessions to all personnel participating in or affected by the work
- preparing the site, including signage, barriers and warning devices
- commissioning electrical equipment or installation using a systems approach
- verifying the performance of the installed equipment/system to meet the design requirements through a series of tests/measurements
- making adjustments, where necessary, to ensure conformance with the specified design intent
- capturing and recording performance data of the whole installation as the baseline for future operation and maintenance
- decommissioning electrical equipment or installation
- shutting down and isolating electrical equipment sequentially in preparation for maintenance or repair using lock out and tag procedures and safe working practices
- seeking assistance from authorised personnel for site specific commissioning and decommissioning of electrical equipment and installations, including the need for HV switching
- documenting completion of commissioning/decommissioning process 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 PPE
- Australian/New Zealand Wiring Rules and regulatory requirements for HV and LV electrical installations
- industry personnel to be consulted for advice on commissioning or decommissioning procedures
- test and commissioning, including:
  - procedures required for a particular electrical equipment or installation
  - objectives to be achieved, including:
    - to verify proper functioning of the equipment/system after installation
    - to verify that the performance of the installed equipment/systems meet with the specified design intent through a series of tests and adjustments
    - to capture and record performance data of the whole installation as a baseline for future operation and maintenance
  - using a systems approach, including:
    - performance tests appropriate to equipment/installation to be commissioned
    - measurements required to ensure conformance to specifications
    - adjustments to be made to meet specified design and operational requirements
    - the use of appropriate test equipment
- decommissioning of electrical equipment or installation, including:
  - procedures required for a particular electrical equipment or installation
  - a working knowledge of the electrical equipment or installation in order to sequentially shut down and isolate for the purposes of repair and maintenance, including using lock out and tag procedures, to enable safe removal of equipment/conductors
  - types of operational forms, access authorities, permits and requirements associated with HV switching
- reporting requirements relevant to the electrical equipment or installation being commissioned.

Assessment Conditions

Assessors must:

- have vocational competency in commissioning and decommissioning high and low voltage equipment or installations 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM10023 Design and connect control switching of circuits for building services and industrial equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in designing and connecting control switching of circuits.

It covers basic switching and control arrangements and hazards and safety requirements associated with static electricity discharge from components.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capabilities (EPCs):

- EPC 52 – Design and connect switching circuits, including via electronic logic controls, as per AS/NZS 3000:2000.
- EPC 63 – Describe the functioning of basic electronic circuits used in common electrical power circuit applications including related hazards and safety requirements.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
	MEM18001C	Use hand tools

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
		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.	Design control switching of circuits	2.1. Design agreed control switching of circuits to comply with specifications and regulatory requirements
		2.2. Document agreed design of control circuits in accordance with procedures
		2.3. Obtain the necessary tools, equipment, test instruments and materials needed to connect the control circuits
3.	Connect control switching of circuits	3.1. Isolate and tag circuits and equipment in accordance with procedures, where required
		3.2. Terminate and connect control circuit components to comply with the design and regulatory requirements
		3.3. Functional test control circuit operation to ensure compliance with agreed design
		3.4. Rectify any non-compliances and re-test to meet requirements

3.5. Terminate and connect control circuits

3.6. Test control circuits to ensure functionality

3.7. Document control circuits 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.

Control switching of circuits include five or more of the following:	• multiple light switching circuit • master control circuit • local start-stop control and with electrical interlocking • connecting a timer in a controlled circuit • a multiple motor starting circuit which incorporates start, stop and jog control • machine safety circuit • line conditioners • inverters • uninterrupted power supplies (UPS) • energy management systems

Control circuit components include five or more of the following:	• multi-way switches
	• switches with more than two positions and off
	• push buttons
	• electromechanical relays
	• programmable relays
	• contactors
	• motor reversing contactors
	• three-phase starters
	• reduced voltage starters
	• transducers/sensors, including:
	  • limit, proximity, float and pressure switches
	  • photoelectric cells
	  • light and temperature sensors

Regulatory requirements include:	AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10023 Design and connect control switching of circuits for building services and industrial equipment

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- determining the electrical and non-electrical isolation requirements to prevent the creation of hazards linked from the loss of machine/system/process control according to established procedures
- using lock out tag procedures with appropriate tags/signs
- proving electrical isolation and following established safety rules prior to working on electrical equipment or wiring
- ensuring all electrical equipment and tools are tested and tagged and are up to date
- developing according to specifications at least five (5) or more of the following control circuit designs:
    - multiple light switching circuit
    - master control circuit
    - local start-stop control and with electrical interlocking
    - connecting a timer in a controlled circuit
    - a multiple motor starting circuit which incorporates start, stop and jog control
    - machine safety circuit
    - line conditioners
    - inverters
    - UPS
    - energy management systems
- terminating and connecting to comply with the above selected control circuit scenarios and regulatory requirements at least five (5) or more of the following control circuit devices:
    - multi-way switches
    - switches with more than two positions and Off
    - push buttons
    - electromechanical relays
    - programmable relays
    - contactors
    - motor reversing contactors
    - three-phase starters
    - reduced voltage starters
    - transducers/sensors, including:
        - limit, proximity, float and pressure switches
        - photoelectric cells
        - light and temperature sensors
- programming timers and using the monitoring facility of the programmable relay to verify the values of the timer
- testing connected control circuit devices as against agreed design and rectifying any non-compliant functions

- complying with the Australian/New Zealand Wiring Rules and local supply requirements for three-phase motor installations and starters
- testing control circuits to ensure functionality
- using test equipment to locate faults, completing remedial action and re-testing to ensure compliance
- documenting connected control circuits 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 PPE
- electrical drawings – conventions in linework, symbols used in electrical circuit diagrams, placement and arrangement of circuit components
- drawing schematic circuit diagrams complying with Australian Drawing Standard AS/NZS 1102.101-1989 Graphical symbols for electrotechnical documentation - General information and general index, and converting to wiring diagrams
- construction and operation of contactors and relays with various types of contacts, including:
  - normally open
  - normally closed
  - timed on closing
  - timed in opening
  - timed in both closing and opening
- drawing contactors in circuits and drawing conventions applied
- control diagrams drawn as ladder diagrams where the ladder stiles are the supply lines and the ladder rungs are the various circuit lines
- control circuit variations, including:
  - two-position control
  - local or remote operation
  - two-wire control
  - two-wire and push button control where extra start push-buttons are all placed in parallel and where extra stop push-buttons are placed in series
  - reversing circuits – use of mechanical and electrical interlocks
  - jogging control
- common control devices used in circuits, including:
  - multi-way switches
  - switches with more than two positions and Off
  - push buttons
  - electromechanical relays
  - programmable relays
  - contactors
  - motor reversing contactors
  - three-phase starters
  - reduced voltage starters
  - transducers/sensors, including:
    - limit, proximity, float and pressure switches
    - photoelectric cells
    - light and temperature sensors
- programmable timers, including specifications to be met and functions to be controlled, including machine operation or process output
- line conditioners and the purpose they provide
- inverters and the purpose they provide

- energy management systems and the purpose they provide
- static electricity discharge or electrostatic discharge, the hazards associated and the precautions to be taken.

Assessment Conditions

Assessors must:

- have vocational competency in designing and connecting control switching of circuits for building services and industrial equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide -
http://www.mskills.org.au/training-packages/info/

MEM10024 Install and troubleshoot luminaires and ancillary equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in installing and troubleshooting luminaires and ancillary equipment in accordance with the relevant standards.

It covers a basic understanding of the various types of faults, luminaires and the purpose components and ancillary equipment for operating voltages up to 1000 V alternating current (AC) or 1500 V direct current (DC) and related hazard and safety requirements.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC)

Essential Performance Capability (EPC):

- EPC 65 – Demonstrate an understanding of the basic operation of the various types of luminaires and the purpose of components and ancillary equipment including related hazards and their safety requirements.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **2**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
	MEM10023	Design and connect control switching of circuits for building services and industrial equipment

MEM18001C Use hand tools

Competency Field

Installation and commissioning

Unit Sector

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, including appropriate risk control measures
	1.3. Use appropriate personal protective equipment (PPE) in accordance with SOPs
	1.4. Determine through the interpretation of electrical diagrams, drawings, lighting standards and/or from consultation the luminaire and ancillary equipment requirements for the electrical installation
2. Install luminaires and ancillary equipment	2.1. Obtain the number and type of luminaires and associated ancillary equipment through established procedures
	2.2. Obtain necessary tools, equipment and testing instruments needed for installing luminaires and ancillary equipment
	2.3. Isolate and tag circuits and equipment in accordance with procedures, where required
	2.4. Install luminaires and accessories complying with job specifications, and regulatory and legislative requirements
	2.5. Check installed accessories are straight and square in the required locations and within acceptable tolerances

		2.6. Terminate lighting circuits to luminaires, switches and other control devices in accordance with manufacturer specifications and regulatory requirements
		2.7. Test luminaires and ancillary equipment to ensure compliance
3.	Troubleshoot luminaires and ancillary equipment	3.1. Identify the fault and resulting safety hazards and implement risk control measures in consultation with appropriate personnel
		3.2. Apply diagnostic techniques to troubleshoot luminaires, ancillary equipment and associated lighting circuits using appropriate test equipment
		3.3. Repair/replace faulty circuits/components according to manufacturer specifications and regulatory requirements
		3.4. Test repaired/replaced circuit/component for functionality in accordance with regulatory requirements
		3.5. Dispose of discharge lamps in accordance with environmental guidelines and procedures
		3.6. Document installation and troubleshooting of luminaires, ancillary equipment and associated circuits 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.

Lighting standard includes:	AS/NZS 1680.1:2006 Interior and workplace lighting general principles and recommendations
Regulatory requirements include:	AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules
Faults include:	• fluorescent light circuits, including lamp, ballast and starter • metal Halide and high-pressure sodium (HPS) lighting and circuits, including capacitor, poor connection, igniter, ballast • extra-low voltage (ELV) lighting devices, including transformer (iron core or electronic), voltage drop, heat, over voltage, poor connections, incompatible dimmers • lighting control circuits, including manual control, passive infra-red (PIR),dimmers, photo electric or day-light switches and time clocks • lighting management systems

Lighting circuits include two or more of the following:	• single light controlled by a single switch
	• multiple lights controlled by a single switch
	• two and three-way switching using:
	  • loop at the light method
	  • loop at the switch method

Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10024 Install and troubleshoot luminaires and ancillary equipment

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings, specifications and plans relevant to the work to be undertaken
- determining the electrical and non-electrical isolation requirements to prevent the creation of hazards linked from the loss of machine/system/process control according to established procedures
- using lock out tag procedures with appropriate tags/signs
- proving electrical isolation and following established safety rules prior to working on electrical equipment or wiring
- ensuring all electrical equipment and tools are tested and tagged and up to date
- installing accessories ensuring that they are straight and square in the required location
- using safe working practices and take additional care when working with lights that operate at high voltage or contain capacitors
- terminating two (2) or more of the following lighting circuits:
  - single light controlled by a single switch
  - multiple lights controlled by a single switch
  - two and three-way switching using:
    - loop at the light method
    - loop at the switch method
- complying with the Australian/New Zealand Wiring Rules requirements for the installation and termination of lighting equipment and accessories, including related hazards and safety requirements, and maintaining fire integrity
- measuring and recording illumination for comparison against lighting standard AS/NZS 1680.1:2006 Interior and workplace lighting - General principles and recommendations, using a suitable light meter
- locating and repairing faults in luminaires and ancillary equipment
- troubleshooting and repairing faults in common lighting circuits
- replacing lamps with ‘like for like’
- performing periodic servicing of emergency lighting and smoke detector systems and recording intervals of servicing, including remedial action taken
- disposing of discharge lamps according to environmental guidelines and established procedures
- documenting installation and troubleshooting, including remedial action taken 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 PPE
- lighting applications, including:
  - basic principles, terminology and units in describing process and concepts of illumination
  - the major design requirements of luminaires regarding reflection or diffusion of light and direct the light onto the working place
  - functional category types of luminaires:
    - direct with 90-100% downward light component
    - indirect with 90-100% upward light component
    - general diffusing with approximately equal upward and downward components
    - semi direct with 10-40% upward and 60-90% downward
    - semi direct with 60-90% upward and 10-40% downward
  - maintenance of luminaires, including lamp replacement and cleaning
  - common faults in luminaires
  - disposal of discharge lamps in accordance with environmental guidelines and established procedures
  - elementary lighting design, including:
    - requirements to clearly show up the task or work area
    - recommended maintenance luminance
    - the advantages of the use of reflectors and diffusers
    - determining illuminance on a working plane using the point by point method and lumen method
    - the use of a lux meter to determine lighting and illumination requirements
  - emergency evacuation lighting in buildings, including:
    - escape and standby lighting
    - installation requirements of emergency lighting luminaires
    - installation of smoke detection in domestic and residential premises
    - inspection and maintenance of emergency lighting and smoke detectors
    - recording requirements
- light sources, including:
  - lamp type and their characteristics
  - operating principles of various types of lamps and luminaries and the purpose of their auxiliary control equipment
  - the cause of low power factor and the measures used to improve power factor in discharge lighting
- Australian/New Zealand Wiring Rules requirements for the installation of lighting equipment and accessories, including related hazards and safety requirements
- application of various types of lamps and luminaires
- 'stroboscopic effect' and the methods used to overcome, including:
  - 'non-stroboscopic' circuit (inclusion of a capacitor in one fluorescent lamp circuit to provide phase shift in relation to the other lamp circuit)
  - connecting adjacent lamps to different phases in large installations

  - electronic lamp circuits operating at high frequencies
- lighting circuits, including:
  - including single light controlled by a single switch
  - multiple lights controlled by a single switch
  - two and three way switching using the loop at the light method and the loop at the switch method
- lighting control, including:
  - manual control involving the use of two-way and intermediate switches
  - time switches both analogue and digital for programmed control
  - time delay switches that are adjustable and may be air-valve or electronic type
  - photo-sensitive electronic control used to control outdoor and street lighting
  - PIR technology used in scanning devices to detect movement of a hot or cold body and automatically switch on security or convenience lighting
  - various types of light dimmers, including electronic
  - lighting management systems for example C-Bus.

Assessment Conditions

Assessors must:

- have vocational competency in installing and troubleshooting luminaires and ancillary equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM10025 Undertake a capstone assessment

Modification History

Release 1. New unit

Application

This assessment is to be carried out after the completion of all other assessment requirements of the units of competency that make up MEM31214 Certificate III in Engineering – Industrial Electrician and prior to application for an Electrical Licence.

This assessment is to be carried out at the premises of the Registered Training Organisation (RTO) and is expected to be conducted by an assessor other than the one who has been a regular instructor to the apprentice.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capabilities (EPCs) classified as 'critical':

- EPC 2 – Demonstrate a knowledge of the various effects of electric current.
- EPC 5 – Explain the operation of a simple practical circuit.
- EPC 6 – Determine the resistance, voltage, current and power in any part of a DC circuit using theory and actual measurement methods.
- EPC 11 – Demonstrate a knowledge of alternating voltage & current generation, phase relationships, energy in an AC circuit, and actual measurement methods.
- EPC 13 – Demonstrate an understanding of the fundamental principles of the AS/NZS 3000:2000 Section 1.
- EPC 16 – Describe methods of electric motor selection, starting, connection and protection.
- EPC 21 – Describe and apply in practice the requirements of AS/NZS 3000:2000 in relation to earthing arrangements and fault loop impedance calculations.
- EPC 22 – Demonstrate a comprehensive knowledge and understanding of the MEN system and its application, including on sub-installations.
- EPC 26 – List typical applications of various types of transformers and key safety issues.
- EPC 27 – Describe and apply in practice the requirements for circuit protection using AS/NZS 3000:2000 and other relevant Australian Standards. E.g. AS/NZS 3018.
- EPC 28 – Demonstrate a knowledge of the SELV, PELV and earth leakage current protection systems and their application in accordance with AS/NZS 3000:2000.
- EPC 29 – Demonstrate the ability to select cables for mains and submains using AS/NZS 3000:2000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capacity, maximum demand and voltage drop, for single phase and three phase installations including multiple installations.
- EPC 30 – Demonstrate the ability to select cables for final subcircuits using AS/NZS 3000:2000 and AS/NZS 3008.1 based on current carrying capacity, short circuit capacity, maximum demand, earth loop impedance and voltage drop.
- EPC 31 – Describe the control and protection requirements for installations and equipment. Demonstrate the ability to select suitable equipment and switchgear for a particular installation or part of an installation.
- EPC 33 – Demonstrate an understanding of the AS/NZS 3000:2000 and regulatory requirements for the installation of electrical equipment in given damp situations and wet areas.

- EPC 34 – Demonstrate the appropriate methods for the installation, modification and testing of electrical installations and equipment for construction and demolition sites, complying with AS/NZS 3012 and applicable workplace safety legislation.
- EPC 35 – Demonstrate knowledge of AS/NZS 3000:2000 requirements for the installation of aerial conductors and underground wiring.
- EPC 36 – Demonstrate a knowledge of the AS/NZS 3000:2000 requirements for electrical installations in hazardous areas and an awareness of the standards to which it refers (e.g. AS 2430, AS 2381.1).
- EPC 38 – Describe and perform to AS/NZS 3000:2000 and AS 3017 standards the electrical checks and tests required to ensure electrical installations are safe.
- EPC 40 – Demonstrate the knowledge and skill to perform effective safe isolation of any equipment, including switch and lock off, circuit isolation, equipment testing and tagging procedures.
- EPC 44 – Demonstrate the knowledge and skill to install and terminate a variety of electrical cables in a wide range of applications (including final subcircuits) to AS/NZS 3000:2000.
- EPC 46 – Describe and perform the circuit tests required for electrical cables in a range of installations, with attention to the final subcircuit tests.
- EPC 47 – Install final subcircuit wiring into switchboards and connect to switchboard equipment in accordance with AS/NZS 3000:2000 and local supply authority requirements.
- EPC 48 – Connect consumers mains to an installation, in accordance with AS/NZS 3000:2000 and local supply authority requirements.
- EPC 51 – Demonstrate ability to read, sketch and interpret electrical diagrams.
- EPC 53 – Describe basic statutory occupational safety and health responsibilities for employers and employees, including supervisory requirements and employees' own "duty of care".
- EPC 54 – Demonstrate understanding of the requirements for personal safety in the workplace including safe isolation and application of safety practices.
- EPC 57 – Describe the method of rescuing a person in contact with live electrical conductors or equipment.
- EPC 58 – Describe the emergency first aid requirements for an electric shock victim and demonstrate the knowledge and application skill of EAR and CPR.
- EPC 59 – Demonstrate knowledge and understanding of the significant dangers of High Voltage equipment and distribution systems.
- EPC 62 – Describe methods of commissioning and/or decommissioning electrical equipment or an installation, using a systems approach.
- EPC 66 – Demonstrate the knowledge and skills for diagnosing and rectifying faults in electrical apparatus and associated circuits.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **1**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
	MEM10020	Install low voltage cabling and fit-off accessories, appliances and equipment
	MEM10021	Inspect, test and verify electrical installations
	MEM10022	Commission and decommission high and low voltage equipment or installations
	MEM10023	Design and connect control switching of circuits for building services and industrial equipment
	MEM10024	Install and troubleshoot luminaires and ancillary equipment
	MEM12023A	Perform engineering measurements
	MEM13014A	Apply principles of occupational health and safety in the work environment
	MEM13017	Apply safety practices, procedures and compliance standards associated with licensed electrical work
	MEM18001C	Use hand tools
	MEM18100	Fault-find, test and rectify AC machines and circuits
	MEM18102	Fault-find, test and rectify single and three-phase transformers
	MEM18103	Fault-find, test and rectify electrical circuits and equipment
	MEM18104	Dismantle, replace and assemble electrical components and equipment

Competency Field

Installation and commissioning

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
1.	Prepare to undertake a capstone assessment	1.1.	Follow standard operating procedures (SOPs)
		1.2.	Comply with work health and safety (WHS) requirements at all times, including appropriate risk control measures
		1.3.	Use appropriate personal protective equipment (PPE) in accordance with SOPs
		1.4.	Identify practical assessment requirements from specifications, drawings, job sheets or work instructions
2.	Carry out practical assessment	2.1.	Obtain necessary tools, equipment and testing devices needed for completing the practical assessment and check for correct operation and safety
		2.2.	Select cable types and sizes to suit loads and electrical installation environment
		2.3.	Select circuit protection devices by type and rating
		2.4.	Install and terminate low voltage (LV) cabling and wiring, fit-off accessories, appliances and equipment in accordance with specifications and regulatory requirements
		2.5.	Inspect, test and verify electrical installation to ensure compliance with regulatory requirements
		2.6.	Rectify all non-compliance defects and re-test to ensure compliance
3.	Carry out a theory assessment	3.1.	Obtain all applicable standards and other approved reference books relevant to the test being undertaken
		3.2.	Complete the written component of the capstone assessment within the allocated timeframe

4.	Complete the capstone assessment	4.1. Demonstrate fundamental knowledge and comprehension of electrical concepts and safety principles, using (where possible) problems that test a combination of practical and theoretical skills
		4.2. Satisfy the minimum requirements of both the written and practical component of the capstone assessment
		4.3. Demonstrate fundamental knowledge and comprehension of electrical concepts and safety principles, using (where possible) problems that test a combination of practical and theoretical skills
		4.4. Satisfy the minimum requirements of both the written and practical component of the capstone assessment

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.

Assessment requirements include:	As described by the National Uniform Electrical Licensing Advisory Council or its successor – Capstone assessment requirements for prospective electricians include the following: • all 'critical items' of the EPCs list • may be an 'open book' style, with the permitted use of standards and published reference books (programmable calculators, computers and personal notes are to be excluded)
Capstone assessment includes:	• written component – objective assessment methods to be used, including a sensible proportion of multiple choice questions ('essay style' to be avoided) and some written answers to the objective questions, aimed at demonstrating a trainee's understanding of the 'critical' aspects as specified in the EPC list • practical component – required demonstration of fundamental knowledge and comprehension of electrical concepts and safety principles, as specified in the 'critical' items of the EPC list, using (where possible) problems that test a combination of practical and theoretical knowledge and skills
Duration of capstone assessment includes:	One full working day to complete, with the practical component representing about 70% of the whole test, e.g. written test 2-3 hours and practical test 4-6 hours
Minimum requirements of the capstone assessment include:	• written – the apprentice is required to demonstrate satisfactory performance in every 'critical' item tested • practical – the apprentice is required to have demonstrated *****competence for the 'critical' items tested ***Note:** Competence in this setting means that it is evident that the person comprehends the key safety issues and the practical work performed does not suffer from any defects of the kind categorised as 'serious' by Electrical Regulators
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM10025 Undertake a capstone assessment

Modification History

Release 1. New unit

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:

- demonstrating fundamental knowledge and comprehension of electrical concepts and safety principles, using (where possible) problems that test a combination of practical and theoretical skills
- following work instructions, SOPs and safe work practices
- identifying and interpreting circuits, drawings, plans and specifications relevant to the work to be undertaken
- obtaining the necessary tools, equipment and testing devices ensuring that they are checked for safety and operation
- undertaking the necessary calculations in determining current-carrying capacity, short circuit capacity, maximum demand and voltage drop, and earth-loop impedance for the given installation
- selecting cables ensuring coordination between protective devices and conductors in accordance with specifications and regulatory requirements
- selecting and installing suitable switch gear and circuit protection devices complying with specifications and regulatory requirements
- installing and terminating LV cabling and wiring, fitting-off accessories, appliances and equipment in accordance with specifications and regulatory requirements
- performing a visual inspection ensuring that it meets the requirements of the Australian/New Zealand Wiring Rules – Testing and Verification Visual Inspection Check List
- performing the mandatory and optional circuit tests required for electrical cables in a range of installations and final subcircuits, including:
  - following safe testing procedures
  - testing to show if the earth continuity is sufficiently low
  - testing to show if the insulation resistance is sufficiently high
  - testing to show if the polarity and circuit connections are correct
  - testing to show earth fault-loop impedance is sufficiently low
  - performing testing to verify that residual current devices (RCDs) operate as intended
- identifying and rectifying of any non-compliance defects and re-testing to ensure compliance
- completing all mandatory documentation in accordance with regulatory and local supply authority requirements
- completing the written component of the capstone assessment in the allocated timeframe
- satisfying the minimum requirements of both the written and practical components of the capstone assessment.

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 PPE
- various effects of electric current
- operation of a simple practical circuit
- determination of resistance, voltage, current and power in any part of a direct current (DC) circuit using theory and actual measurements
- alternating voltage and current generation, phase relationships, energy in an alternating current (AC) circuit and actual measurement methods
- understanding of the fundamental principles of AS/NZS 3000: 2007 Electrical installations (known as the Australian/New Zealand Wiring Rules) Section 1
- methods of electric motor selection, starting, connection and protection
- requirements and its application of the Australian/New Zealand Wiring Rules in relation to earthing arrangements and fault-loop impedance calculations
- understanding of the multiple earth neutral (MEN) system and its application, including on sub-installations
- applications of transformers and key safety issues
- requirements and application of the Australian/New Zealand Wiring Rules in relation to circuit protection and other relevant Australian Standards e.g. AS/NZS 3018 (or its equivalent updated version)
- requirements and application of the Australian/New Zealand Wiring Rules in relation to separated extra-low voltage (SELV), protected extra-low voltage (PELV) and earth leakage current protection systems
- cable selection for mains and submains using the Australian/New Zealand Wiring Rules and AS/NZS 3008.1.1:2009 Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions based on current-carrying capacity, short circuit capacity, maximum demand and voltage drop for single-phase and three-phase installations, including multiple installations
- cable selection for final subcircuits using the Australian/New Zealand Wiring Rules and AS/NZS 3008.1.1:2009 Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions based on current-carrying capacity, short circuit capacity, earth-loop impedance and voltage drop
- control and protection requirements for installations and equipment and the ability to select suitable equipment and switchgear for a particular installation or part of an installation
- installation of electrical equipment in given damp situations and wet areas in accordance with the Australian/New Zealand Wiring Rules and regulatory requirements
- installation, modification and testing of electrical installations and equipment for construction and demolition sites complying with AS/NZS 3012:2010 Electrical installations - Construction and demolition sites, and applicable workplace safety legislation
- requirements of the Australian/New Zealand Wiring Rules in relation to the installation of aerial conductors and underground wiring

- requirements of the Australian/New Zealand Wiring Rules in relation to electrical installations in hazardous areas and awareness of the standards to which it refers (e.g. AS 2430, AS 2381.1 or their equivalent updated versions)
- electrical tests and checks to be performed as required by the Australian/New Zealand Wiring Rules and AS/NZS 3017:2007 Electrical installations - Verification guidelines to ensure electrical installations are safe
- effective safe isolation of any equipment, including switch and lock off, circuit isolation, equipment testing and tagging procedures
- installation and termination requirements for a variety of cables in a wide range of applications (including final subcircuits) to the Australian/New Zealand Wiring Rules
- circuit tests requirements for electrical cables in a range of installations, with attention to final subcircuits
- installation requirements of final subcircuit wiring into switchboards and connection to switchboard equipment in accordance with the Australian/New Zealand Wiring Rules and local supply authority requirements
- connection requirements of consumer mains to an installation in accordance with the Australian/New Zealand Wiring Rules and local supply authority requirements
- reading, sketching and interpretation of electrical diagrams
- basic statutory WHS responsibilities for employers and employees, including supervisory requirements and employees' own 'duty of care'
- requirements for personal safety in the workplace, including safe isolation and application of safety practices
- method of rescuing a person in contact with live electrical conductors or equipment
- emergency first aid requirements for an electric shock victim and demonstrate the knowledge and application skill of expired air resuscitation (EAR) and cardiopulmonary resuscitation (CPR)
- understanding of the significant dangers of HV equipment and distribution systems
- methods of commissioning and/or decommissioning electrical installation using a systems approach
- diagnosing and rectifying faults in electrical apparatus and associated circuits.

Assessment Conditions

Assessors must:

- hold a current electrical licence and be an assessor other than the one who has been a regular instructor to the apprentice.
- satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State as the case requires.

The capstone assessment is an entirely RTO conducted assessment at the RTO's chosen location where the entire assessment needs to be carried out in one day.

Conditions for assessment must include access to all tools, equipment, materials and documentation required, including relevant workplace procedures, product and manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM12023A Perform engineering measurements

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers performing measurement skills requiring straightforward use of mechanical measuring devices and associated calculations.

Application of the Unit

Application of the unit	This unit covers straightforward measurement using devices which incorporate visual indications representing units of measurement. It applies to the use of measuring devices in a range of manufacturing, engineering and related environments. It includes, where required, adjustment of measuring devices through simple means and typically includes zeroing or scale adjustment. Measurements may be expressed in metric or imperial units. All measurements are undertaken to standard operating procedures. Electrical/electronic devices used are those not requiring the connection or disconnection of circuitry. Work is undertaken autonomously or part of team environment, in the field, work station or workshops. For straightforward use of comparison or pre-set measuring devices, Unit MEM12001B (Use comparison and basic measuring devices) should be accessed. **Band**: **A** **Unit Weight**: **5**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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 appropriate device or equipment	1.1. Measurement requirements are determined from specifications. 1.2. Appropriate device or equipment is selected according to standard operating procedures, to achieve required outcome.
2. Obtain measurements using a range of measuring devices	2.1. Correct and appropriate measuring technique is used. 2.2. Measurements are accurately obtained . 2.3. Dimensions are determined or verified using basic calculations, where required.
3. Maintain measuring devices	3.1. Routine care and storage of devices is undertaken to manufacturers' specifications or standard operating procedures. 3.2. Routine adjustments to devices are made and checked.
4. Communicate measurements as required	4.1. Measurements are accurately recorded, where required. 4.2. Freehand sketch which depicts required information is prepared, as required.

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: • selecting the appropriate measuring device for given measuring tasks • using appropriate measuring technique • reading all measurements taken accurately to the finest graduation of the selected measuring device • handling and storing measuring devices in accordance with manufacturers' specifications or standard operating procedures • verifying all measuring devices before use • making, where appropriate, routine adjustments to measuring devices • reading, interpreting and following information on written job instructions,

REQUIRED SKILLS AND KNOWLEDGE
specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents • planning and sequencing operations • checking and clarifying task related information • checking for conformance to specifications • undertaking numerical operations involving addition, subtraction, multiplication, division, fractions and decimals within the scope of this unit • preparing drawings as required
Required knowledge
Look for evidence that confirms knowledge of: • correct application of a range of measuring devices • correct and appropriate measuring technique for a range of measuring devices • addition, subtraction, multiplication, division, fractions, decimals to the scope required by this unit • procedures for handling and storing a range of measuring devices • procedures for adjusting and zeroing a range of measuring devices • methods of communicating measurements by drawings, as required • safe work practices and procedures

Evidence Guide

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 perform engineering measurements.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing engineering measurements 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	
Specifications	Drawings, sketches, job instructions, schematics, diagrams, technical manuals
Range of measuring devices	Protractors, combination squares, set squares, dial indicators, thermometers, tapes, rules, micrometers, vernier-scaled measuring equipment
Basic calculations	Calculations needed to assist in determining measurements where a reading of the graduated device is not sufficient, for example subtracting one measurement from another to give a third measurement. Examples of calculations needed are addition, subtraction, multiplication, division, fractions and decimals. Calculations may be made using a calculator
Routine adjustments	Validating the device using simple zeroing or scale adjustment
Measurements	Measuring length, squareness, flatness, angle, roundness, clearances or any other measurements that can be read off analog, digital or other measuring device
Information	Dimensions, instructions, base line or datum points

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Measurement

MEM12024A Perform computations

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers estimating approximate answers to arithmetical problems, carrying out basic calculations involving percentages and proportions, and determining simple ratios and averages. The unit includes producing and interpreting simple charts and graphs.

Application of the Unit

Application of the unit	This unit applies in manufacturing, engineering or related environments. It includes the application of the four rules of algebraic expressions, extracting information from drawings, diagrams, graphs and charts and producing simple charts and graphs. Data may be derived from readings taken or may be computer generated. Applications can include computations associated with pressure, volume, temperature, heat, speed, power, elasticity, density, mass, force etc. Calculations may be performed using pen and paper or on a calculator. **Band**: **A** **Unit Weight**: **3**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Determine work requirement	1.1. Required outcomes are established from job instructions. 1.2. Data is obtained from relevant sources and interpreted correctly. 1.3. Required calculation method is determined to suit the application, including selection of relevant arithmetic operations and/or formulae. 1.4. Expected results are estimated, including rounding off, as appropriate.
2. Perform calculations	2.1. Calculation method is applied correctly. 2.2. Correct answer is obtained. 2.3. Answer is checked against estimation.
3. Produce charts and graphs from given information	3.1. Data is transposed accurately to produce charts or graphs. 3.2. Charts or graphs accurately reflect data on which they are based.

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:

- performing calculations involving whole numbers using all four basic rules
- performing calculations involving length, perimeter, area and volume
- checking calculated answers for accuracy
- rounding off estimated answers
- expressing information presented in fractional or decimal format as a percentage
- selecting appropriate formulae for the given application
- substituting the correct values for each term in the relevant formulae
- using appropriate mathematical operations
- performing calculations involving ratios or proportions
- determining required information from appropriate charts or graphs
- producing simple charts or graphs from given information or observations made

REQUIRED SKILLS AND KNOWLEDGE

- selecting appropriate scales and using them in the production of charts and graphs
- marking appropriate limits clearly on the graph or chart
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

Required knowledge

Look for evidence that confirms knowledge of:

- formula applicable to the determination of perimeter, area and volume of simple geometric shapes
- techniques for estimating approximate answers
- reasons for using dimensions with the same units when calculating length, perimeter, area and volume
- concepts of perimeter, area and volume
- procedures for rounding off figures when estimating approximate answers
- mixed numbers, decimals, fractions and whole numbers
- concept of percentage
- procedures to be followed in converting a decimal to a percentage
- procedures for carrying out calculations involving fractions and using each of the four basic rules
- procedures to be followed on converting a fraction to a percentage
- sources of appropriate formulae
- reasons for ensuring that the units of each term are consistent with the formulae selected
- procedures for converting given units to those required for use in formulae
- concepts of ratio and proportion
- given ratios and proportions can be expressed in terms of whole numbers, fractions and decimal fractions
- scales applicable to the axes of the graphs or charts
- three types of charts and/or graphs used in the individual's field of work
- where appropriate, upper and lower limits of acceptability applicable to data entered on a graph or chart
- where appropriate, the trends indicated by the slope or gradient of a graph
- where appropriate, the action to be taken when given trends occur or set limits are approached on graphs or charts
- procedures for drawing 'lines of best fit'

REQUIRED SKILLS AND KNOWLEDGE
• the trends indicated by the graphs or charts drawn • hazards and control measures associated with performing computations, including housekeeping • safe work practices and procedures

Evidence Guide

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 perform computations.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing computations 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	
Relevant sources	Charts, graphs, diagrams, measurement data, reference manuals and specifications
Application	Applications can include computations associated with pressure, volume, temperature, heat, speed, power, elasticity, density, mass, force etc.
Arithmetic operations	• Application of subtraction, addition, multiplication and division • Manipulation of decimals, fractions and mixed numbers and whole numbers • Determining of percentages • Performing of algebraic expressions • Calculation of proportions and ratios
Charts and graphs	Simple histograms, control charts, pie charts etc.

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Co-requisite units		

Competency field

Competency field	Measurement

MEM13014A Apply principles of occupational health and safety in the work environment

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers following occupational health and safety procedures in an engineering or similar work environment.

Application of the Unit

Application of the unit	This unit covers essential skills and knowledge that underpin all units within the Metal and Engineering Training Package. The unit applies to working in the engineering, manufacturing or similar industries. Competencies demonstrated would be associated with performance of duties and use of specialist skills. This unit and these standards do not cover the skills of emergency teams such as fire fighting, first aid officer etc. **Band**: **A** **Unit Weight**: There is no unit weighting for this unit.

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Follow safe work practices	1.1. Work is carried out safely and in accordance with company policy and procedures and legislative requirements. 1.2. Housekeeping is undertaken in accordance with company procedures. 1.3. Responsibilities and duties of employees are understood and demonstrated in day-to-day actions. 1.4. Personal protective equipment is worn and stored according to company procedures. 1.5. All safety equipment and devices are used according to legislative requirements and company/manufacturers' procedures. 1.6. Safety signs/symbols are identified and followed as per instruction. 1.7. All manual handling is carried out in accordance with legal requirements, company procedures and National Occupational Health&Safety Commission guidelines. 1.8. Emergency equipment is identified and appropriate use is demonstrated.
2. Report workplace hazards and accidents	2.1. Actual and foreseeable workplace hazards are identified during course of work and reported to appropriate person according to standard operating procedures. 2.2. Accidents and incidents are reported according to workplace procedures
3. Follow emergency procedures	3.1. Appropriate personnel and emergency services and means of contacting them in the event of an incident can be identified. 3.2. Emergency and evacuation procedures are understood and carried out where required. 3.3. Company evacuation procedures are followed in case of an emergency.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE
This section describes the skills and knowledge required for this unit.

REQUIRED SKILLS AND KNOWLEDGE

Required skills

Look for evidence that confirms skills in:

- following safe working practices
- maintaining a safe and clean condition workplace
- carrying out workplace activities such as working safely, not endangering others, following company and legislative requirements, following procedures
- selecting, wearing and storing appropriate personal protective equipment
- using appropriate safety equipment and devices
- carrying out work with the information given by safety signs and symbols
- carrying out manual handling principles
- using emergency equipment correctly
- noting workplace hazards
- contacting appropriate personnel and emergency services in the event of an accident
- following emergency and evacuation procedures
- communicating and interpreting information appropriate to OH&S within the scope of this unit
- checking and clarifying task-related information
- communicating with emergency personnel
- checking for conformance to specifications

Required knowledge

Look for evidence that confirms knowledge of:

- rights, responsibilities and duties of employees and employers
- use of personal protective equipment
- appropriate equipment and safety devices for particular workplace tasks
- reasons for using safety equipment and devices
- meaning and application of safety signs and symbols
- procedures and limits for manual handling
- location and use of emergency equipment
- reasons for selecting a particular type of equipment
- procedures for identifying and reporting hazards
- persons or services to be contacted in the event of a range of accidents
- reasons for use of standard procedures
- standard procedures including those for emergencies and evacuation
- hazards and housekeeping requirements associated with the work environment
- safe work practices and procedures

Evidence Guide

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 apply principles of occupational health and safety in the work environment.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying principles of occupational health and safety in the work environment 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, standards, manuals and reference materials.

EVIDENCE GUIDE	
Guidance information for assessment	

Range Statement

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. 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.	
Personal protective equipment	• Safety glasses • Face and head protection • Hard hats • Protective footwear • Protective clothing • Breathing apparatus • Ear protection • Gloves
Safety equipment and devices	• Safety harness • Screens, barriers and shielding • Extraction fans • Machine guards • Isolation devices

Safety signs/symbols	• Standard signage/symbols conforming to AS 1319-1994
	• Safety signs for the occupational environment, and any other applicable Australian Standards
	• Workplace-specific signage
	• Typical classes of relevant signs/symbols are:
	  • mandatory
	  • prohibition
	  • danger
	  • caution
	  • general safety
	  • safety information

RANGE STATEMENT	
	• fire safety equipment
Manual handling	Posture, weight limits, bending, twisting

Hazards	For the purposes of this unit a hazard is defined as anything with the potential for injury or damage. Hazards may be:
	• physical:
	  • machinery
	  • hot metal
	  • electricity
	  • fire
	• poor housekeeping:
	  • spills
	  • trip hazards such as congestion, clutter, waste build-up
	  • cleanliness
	• noise and vibration
	• extremes of temperature and humidity
	• condition/design of equipment
	• individual (behavioural):
	  • skylarking and foolishness
	  • substance abuse
	  • failure to follow procedures
	  • lack of training or experience
	  • carelessness
	  • poor personal health/hygiene
	  • using the wrong techniques/procedures
	  • ignoring safety rules and signs
	  • taking short cuts
	  • knowingly using unsafe equipment
	• environmental hazards:
	  • explosive materials
	  • flammable materials
	  • poor ventilation
	  • poor lighting
	  • dust
	  • fumes
	  • vapours

RANGE STATEMENT	
	• gases • liquids • mineral fibres • chemical spills • pollutants • other toxic or dangerous materials
Accidents and incidents	For the purposes of this unit an accident is defined as 'an unplanned and unexpected event which interrupts the normal course of activity. It may or may not result in damage or injury'. This definition includes near misses. An incident is defined here as any other unexpected or extraordinary event not classed as an accident. Examples include: • burns • poisoning • broken limbs • eye accidents • other injuries • spills • explosions • falls • electrical accidents • breakdowns • damage to equipment or materials/product • incidents involving physical, individual or environmental hazards
Appropriate personnel	• Safety representative • Occupational health and safety officer • OHS committee member • First aid officer • Supervisor • Union representative
Emergency and evacuation procedures	Documented workplace emergency procedures

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Occupational health and safety

MEM13016 Work in hazardous areas

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in working in hazardous areas.

It covers the basic requirements for performing installation and maintenance work on electrical equipment in hazardous areas. It provides a fundamental understanding of hazardous areas with regard to Electrical Equipment for Hazardous Areas (EEHA) principles, hazardous area classification definitions and factors affecting this aspect, protection techniques, ex-certification, competency requirements for personnel affecting hazardous areas, relevant standards and restrictions to repair work.

If more extensive skills are required for hazardous areas then the appropriate national accredited unit/s should be selected.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **2**

Pre-requisite Unit

Path 1	MEM13014A	Apply principles of occupational health and safety in the work environment

Competency Field

Work health and safety

Unit Sector

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, including appropriate risk control measures
		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.	Prepare to work in hazardous areas	2.1.	Ascertain and interpret the area classification regarding zoning, gas group and temperature class from hazardous area layout drawings
		2.2.	Identify factors that may affect the classification of an area
		2.3.	Identify relevant hazards specific to hazardous areas and implement appropriate risk control measures
		2.4.	Obtain specialist tools, equipment and testing devices needed to carry out maintenance work
3.	Work in hazardous areas	3.1.	Carry out maintenance work in accordance with specifications and procedures
		3.2.	Check and test equipment to ensure functionality and complies with appropriate documentation
		3.3.	Identify hazardous area defective and unsuitable equipment and components for the application and source replacement items with the appropriate equipment certification
		3.4.	Carry out adjustment and/or permitted repairs to equipment using appropriate tools, equipment and

		techniques to specifications
4.	Complete work in hazardous areas	4.1. Ensure all completed work and testing complies with the relevant EEHA Standards
		4.2. Record all inspection and maintenance activities according to established procedures and regulatory requirements

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.

Compliance with relevant EEHA Standards includes:

- hazardous area classification of the area regarding zone, gas group and temperature class
- factors affecting the zoning of an area
- protection technique of the equipment
- ex-certification
- competency requirements for personnel working on the equipment and the required supervision
- which repairs to the equipment may be restricted
- unauthorised modifications
- manufacturer specifications

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM13016 Work in hazardous areas

Modification History

Release 1. New unit

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, SOPs and safe work practices
- obtaining the relevant work permits and informing appropriate personnel prior to commencing work
- identifying and interpreting hazardous layout drawings and interpreting markings of hazardous areas classifications relevant to the work to be undertaken
- identifying hazards specific to hazardous areas and implementing appropriate risk control measures
- checking and testing equipment to ensure functionality of equipment
- identifying defective or unsuitable equipment and sourcing replacement items with the correct equipment certification
- carrying out adjustments or permitted repairs using appropriate tools, equipment and techniques in accordance with procedures and specifications
- ensuring all completed work and testing complies with the relevant EEHA standard along with equipment conformity certificate requirements and special conditions
- documenting all inspection and maintenance work in accordance regulatory requirements and 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 PPE
- history and reasoning behind the EEHA Standards and accreditation creation
- aspects of hazardous area classification regarding zoning, gas group and temperature class
- markings of classifications on technical drawings
- situations which may alter the source of release conditions, thereby affecting the classification of an area
- hazards specific to hazardous areas
- different methods of protection, including:
  - Ex-d
  - Ex-e
  - Ex-n
  - Ex-l
  - Ex-p
  - Ex-m
- relationship between the classification ratings of the equipment to the classification ratings of the area
- importance of earthing
- testing and certifying bodies, including International Electrotechnical Commission (IEC), Ex, ATEX, AUSEx, CSA and Fm
- documentation required for inspections.

Assessment Conditions

Assessors must:

- have vocational competency in working in hazardous areas 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM13017 Apply safety practices, procedures and compliance standards associated with licensed electrical work

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in working safely with electrical installations and equipment, following work health and safety (WHS) systems and procedures and the scope, application and fundamental principles of the Australian/New Zealand Wiring Rules.

It covers knowledge of the application of WHS regulations; procedures for identifying and mitigating electrical hazards; supervision requirements applying to apprentices and trainees; following documented safe work methods, including safe isolation procedures; and application of compliance standards to ensure electrical installations and equipment are safe to use.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capability (EPC):

- EPC 56 – Demonstrate the knowledge and practices that are essential for working safely with electrical equipment and tools and knowledge of testing and tagging procedures to AS 3760.

And

Essential Performance Capabilities classified as ‘critical’:

- EPC 13 – Demonstrate an understanding of the fundamental safety principles of AS/NZS 3000:2000 Section 1.
- EPC 40 – Demonstrate the knowledge and skill to perform effective isolation of any equipment, including switch and lock off, circuit isolation, equipment testing and tagging procedures.
- EPC 54 – Demonstrate understanding of the requirements for personal safety in the workplace including safe isolation and application of safety practices.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **2**

Pre-requisite Unit

Path 1	MEM13014A	Apply principles of occupational health and safety in the work environment

Competency Field

Work health and safety

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1. Follow WHS systems and procedures	1.1. Follow standard operating procedures (SOPs)
	1.2. Comply with WHS requirements at all times, including appropriate risk control measures
	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
	1.5. Isolate and tag circuits and equipment in accordance with procedures, where required
	1.6. Ensure all tools and equipment are checked for safety in accordance with procedures and regulatory requirements
	1.7. Follow established safety rules before beginning work on electrical wiring and equipment
	1.8. Determine and implement the level of supervision required appropriate to the type of electrical work and the level of the apprentice's and/or trainee's training
2. Perform emergency first aid	2.1. Assess situation to identify points of danger to the injured person and potential rescuer
	2.2. Rescue/recover injured person or provide assistance to injured person in accordance with recognised standards/procedures
	2.3. Make contact with the appropriate medical and rescue authorities
	2.4. Record details of first aid given

3.	Identify codes of practice, standards and organisations that have an impact on the work of licensed electricians	3.1. Identify the codes of practice that apply to work carried out by licensed electricians
		3.2. Apply the fundamental safety procedures as outlined in AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules) Section 1
		3.3. Identify the other relevant standards that apply to work carried out by licensed electricians
		3.4. Identify other regulatory requirements that apply to work carried by licensed electricians
		3.5. Identify organisations that have an impact on the roles and responsibilities of licensed electricians

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.

Regulatory requirements include:	• AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules) • AS/NZS 3008.1.1:2009 Electrical Installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1 kV – typical Australian installation conditions • AS/NZS 3017:2007 Electrical installations – Verification guidelines • AS/NZS 3760:2010 In-service safety inspection and testing of electrical equipment • Electrical Safety Act (various states/territories) • electrical regulations (various states/territories) • local service rules • the Building Code of Australia
Organisations include:	• Electrical Regulatory Authorities Council (ERAC) • Electrical Safety Office or equivalent (various states/territories) • Electrical Contractor Association or equivalent (various states/territories) • energy supply authorities • local TAFE
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM13017 Apply safety practices, procedures and compliance standards associated with licensed electrical work

Modification History

Release 1. New unit

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, SOPs and safe work practices
- determining the electrical and non-electrical isolation requirements to prevent the creation of hazards linked from the loss of machine/system/process control according to established procedures
- using lock out tag procedures with appropriate tags/signs
- preparing a safe work method statement (SWMS) or job safety analysis (JSA) in the absence of established procedures for effective isolation
- proving electrical isolation and following established safety rules prior to working on electrical equipment or wiring
- ensuring all electrical equipment and tools are tested and tagged and up to date
- supervising all electrical apprentices and trainees to the level determined by their training and competence
- applying procedures for movement/treatment of injured, including:
  - safe rescue of victim from a live situation
  - clearing of airways
  - cardiopulmonary resuscitation (CPR)
  - care of spinal injuries
  - treatment of cuts/lesions
  - treatment of burns/scalds
  - treatment of shock
- accessing and using other relevant standards associated with electrical installation work
- accessing and abiding by codes of practice and other regulatory requirements
- contacting (when appropriate) organisations for guidance and assistance.

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 PPE
- typical hazards and risks in an electrical installation, including:
  - effects on the human body of various levels of alternating current (AC) and direct current (DC) and duration of current flow for various current paths
  - risk of ignition of flammable materials due to the thermal effects of current or electric arcs in normal service of an electrical installation
  - risk of injury from mechanical movement of electrical actuated equipment
  - protection from direct contact (basic protection)
  - acceptable methods
  - use of extra-low voltage (ELV)
- procedures and principles used to control risks associated with these hazards, including:
  - the development of an WHS policy
  - consultation with everyone involved in the workplace
  - providing information training
  - identifying and assessing hazards
  - implementing and following risk control measures
  - maintaining and improving the WHS program
- approved lock out and tag procedures, including:
  - purpose and use of SWMS or JSA
  - reasons for isolation
  - lock-off equipment and signage
  - tools and equipment to prove electrical isolation of circuit/installation/system is dead
- testing and tagging guidelines for electrical equipment and tools in accordance with AS/NZS 3760:2010 In-service safety inspection and testing of electrical equipment
- level of supervision required by electrical apprentices and trainees
- workplace emergency procedures, including appropriate methods of rescue:
  - removal of the victim of electric shock, including live switchboard rescue from live low voltage (LV) conductors
  - release from contact with live high voltage (HV) conductors (no attempt should be made until circuit has been switched off)
  - risks associated with fallen distribution lines and the associated voltage gradients
  - other points of danger, including:
    - fire
    - traffic
    - risks, including chemicals
    - possibility of falls
  - life support – CPR procedures, including ‘Duty of Care’
  - appropriate use of fire-extinguishers for given types of fires
  - using carbon dioxide or dry chemical powder to fight electrical fires
  - appropriate local medical and rescue services
  - recording of first aid delivered
- codes of practice and regulatory requirements, including:

- Electrical Safety Act or equivalent
- Electrical Regulations or equivalent
- Service Rules provided by local electricity distributors
- Building Code of Australia

- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules) Section 1 – Scope and Fundamental Safety Principles in regards to the following:
  - scope and application
  - referenced documents
  - definitions
  - alterations, additions and repairs
  - alternative arrangements
  - protection for safety, including:
    - against both direct and indirect contact by use of ELV
    - against direct and indirect contact
    - use of residual current devices (RCDs)
    - thermal effects in normal service
    - unwanted voltages
    - over-current and fault currents
    - over-voltage
    - injury from mechanical movement
    - devices for isolation
    - fire integrity
  - design of an electrical installation, including:
    - protection, functioning and compatibility
    - supply characteristics
    - maximum demand
    - voltage drop
    - electrical installation circuit arrangements
    - external influences
  - selection of electrical equipment, including:
    - safety requirements
    - external influences
    - adverse effects and interference
    - evidence of compliance
  - installation of electrical equipment, including:
    - safe and sound practice
    - accessibility
    - information and identification
    - segregation
  - inspection and testing, including:
    - visual inspection
    - continuity of earthing system
    - insulation resistance
    - polarity
    - correct circuit connections

- other relevant standards associated with electrical installation work and testing and tagging of electrical equipment and tools
- organisations that can have an impact of the role of the licensed electrician.

Assessment Conditions

Assessors must:

- have vocational competency applying safety practices, procedures and compliance standards associated with licensed electrical work 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM14004A Plan to undertake a routine task

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers a person planning their own work where tasks involve one or more steps or functions and are carried out routinely on a regular basis. It includes the concepts of following routine instructions, specifications and requirements.

Application of the Unit

Application of the unit	This unit covers essential skill and knowledge that underpin all units within the Metal and Engineering Training Package. Instructions, such as standard operation sheets, are provided. Clear specifications and requirements, including quality and time allowances are also provided. The task and associated planning activity are carried out under supervision. The plan may or may not be documented. The task involves one or more steps or functions carried out routinely on a regular basis. The planning activity does not require judgment to be made in relation to priorities or time limitations. **Band**: **A** **Unit Weight**: There is no unit weighting for this unit.

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Identify task requirements	1.1. Instructions and procedures are obtained, understood and where necessary clarified. 1.2. Relevant specifications for task outcomes are obtained, understood and where necessary clarified. 1.3. Task outcomes are identified. 1.4. Task requirements such as completion time and quality measures are identified.
2. Plan steps required to complete task	2.1. Based on instructions and specifications provided, the individual steps or activities required to undertake the task are understood and where necessary clarified. 2.2. Sequence of activities is identified. 2.3. Plan is checked to ensure it complies with specifications and task requirements.
3. Review plan	3.1. Effectiveness of plan is reviewed against specifications and task requirements. 3.2. If necessary, plan is revised to better meet specifications and task requirements.

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:

- obtaining instructions for tasks from correct source of information (job card, supervisor, work colleagues and others)
- clarifying tasks and required outcomes with appropriate personnel where necessary
- identifying relevant specifications from documentation, job cards, or other information source
- preparing plans for tasks
- sequencing activities
- comparing planned steps against specifications and task requirements
- communicating and interpreting information appropriate to the scope of this unit

REQUIRED SKILLS AND KNOWLEDGE

Required knowledge

Look for evidence that confirms knowledge of:

- correct sources of information for a particular task
- procedures for obtaining instructions and clarification
- specifications for the task
- hazards and established control measures associated with the routine task, including housekeeping
- safe work practices and procedures

Evidence Guide

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 plan to undertake a routine task.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with planning to undertake a routine task 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	

Specifications	• Specific product or process information, such as:
	  • outcome and performance requirements
	  • quality requirements and checks
	  • quantity
	• Specifications are conveyed verbally or on familiar standard forms, such as on job sheets

Requirements	• General requirements necessary to carry out routine tasks, such as:
	  • dedicated tools and equipment
	  • materials and parts
	  • work procedures
	  • completion time
	  • safety measures and equipment
	• Requirements and instructions are supplied verbally or on familiar standard forms, such as on job sheets. Instructions are carried out under supervision and in accordance with established procedures

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Planning

MEM14005A Plan a complete activity

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers planning activities which, whilst following established procedures, may require a response and modification of procedures or choice of different procedures to deal with unforeseen developments.

Application of the Unit

Application of the unit	The unit covers the development of plans for individual complete activities and may include the use of planning techniques and tools. The activity may require prioritising of the individual plan components to facilitate the meeting of the objectives. Examples of activities to be planned may include: fault diagnosis and repair of an item of equipment, a modification of an established sequence of assembly tasks. However the activities may require a response and modification of procedures or a choice of different procedures to deal with unforeseen developments. Activities are normally performed by the individual undertaking the planned activity, and associated reports are completed as required. Planning will be related to familiar work tasks and environments and be performed to standard operating procedures. Where more extensive reporting requiring research and forming conclusions is required, refer to Unit 16.14 (Report technical information). **Band**: **A** **Unit Weight**: **4**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Identify activity requirements	1.1. Activity outcomes and objectives are identified and clarified with appropriate persons. 1.2. Activity requirements, including resources, overall timeframe, quality requirements and criteria for acceptable completion are identified and clarified. 1.3. Relevant specifications and procedures are obtained and clarified.
2. Plan process to complete activity	2.1. The individual components of the activity are identified and prioritised. 2.2. Planning tools and techniques are selected and used according to the needs of the activity. 2.3. The plan is checked for accuracy and conformance to instructions and requirements.
3. Modify plan	3.1. The plan is referred to and modified as necessary to overcome unforeseen difficulties or developments that occur as work progresses. 3.2. The results of the activity are reviewed against the plan, and possible future improvements to plan are identified.

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:

- obtaining, reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawing and other applicable reference documents
- preparing a plan including sequential steps that will enable the activity to be completed
- modifying the plan where appropriate, to take account of difficulties or developments that occur while following the prepared plan
- planning and sequencing activities
- checking and clarifying task-related information

REQUIRED SKILLS AND KNOWLEDGE
• checking for conformance to specifications • using numerical operations, geometry and calculations/formulae within the scope of this unit • using planning techniques such as scheduling, time management, brainstorming, setting of goals and defined outcomes, prioritising, review and evaluation strategies
Required knowledge
Look for evidence that confirms knowledge of: • tasks to be performed • person/s who can clarify the objectives, requirements and specifications • specifications relevant to the tasks to be performed • outcomes to be achieved • timeframe for activity completion • quality requirements of the product or service • priority of each step in the plan • reasons for the relative priority of each step • modifications to the plan to overcome a range of unforeseen situations • hazards and control measures associated with planning the complete activity, including housekeeping • safe work practices and procedures

Evidence Guide

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 plan a complete activity.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with planning a complete activity 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	

Requirements	• Formal or informal information about the task required, such as:
	  • timeframe
	  • quality requirements
	  • outcome and performance requirements
	  • job history
	  • checks and tests
	  • special reporting requirements
	  • tools and equipment
	  • materials and parts
	  • reference documents
	• Requirements and instructions are supplied verbally or in written form such as on job sheets. Instructions are carried out in accordance with established procedures

Specifications	Technical task related information conveyed verbally or as found in: • task lists • instructions • manufacturer manuals • diagrams and schematics • technical drawings and sketches • parts lists • computer records
Planning techniques and tools	Scheduling, time management, brainstorming, setting goals and defined outcomes, prioritising, review and evaluation strategies

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Planning

MEM15002A Apply quality systems

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers working within a quality improvement system, either individually or in a team situation.

Application of the Unit

Application of the unit	This unit is applicable for any work within a quality improvement system in a manufacturing, engineering or related environment. The definition of customer is wide and applies to the next person or organisation receiving the product or service. Application may include quality inspection of own or other employee's work up to the level of the employee's technical competence. **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Work within a quality system	1.1. Instructions and procedures are followed and duties are performed in accordance with requirements of quality improvement system. 1.2. Conformance to specifications is ensured. 1.3. Defects are detected and reported according to standard operating procedures. 1.4. Performance of operation or quality of product or service is monitored to ensure customer satisfaction.
2. Engage in quality improvement	2.1. Current performance is assessed. 2.2. Established performance measures are identified. 2.3. Specifications and standard operating procedures are identified. 2.4. Defects are detected and reported according to standard operating procedures. 2.5. Process improvement procedures are participated in. 2.6. The improvement of internal/external customer/supplier relationships is participated in. 2.7. Performance of operation or quality of product or service is monitored to ensure customer satisfaction.

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: • reading, interpreting and following information on written job sheets, instructions, standard operating procedures and drawings • checking and clarifying task-related information • entering information onto workplace documents • checking for conformance to specifications • identifying duties of the individual within the quality improvement system • identifying customers' requirements with respect to the operation or quality of the product or service • reporting where appropriate, defects detected

REQUIRED SKILLS AND KNOWLEDGE

- carrying out work in accordance with the process improvement procedures
- carrying out work in a manner consistent with the improvement of customer/supplier relationships
- performing numerical operations, geometry and calculations/formulae within the scope of this unit

Required knowledge

Look for evidence that confirms knowledge of:

- quality system terminology and concepts, e.g.
  - quality assurance - planning to meet customers' requirements
  - quality control - checks and procedures to ensure customer requirements are met
  - quality inspection - inspecting and testing products and services
  - total quality control - a company-wide approach that combines both quality assurance and quality control so that the customer is always satisfied
- commonly accepted meaning/s of the terms quality and quality system
- the reasons for following the requirements of the quality improvement system
- strategies and approaches for working within a quality system
- procedures to be followed in undertaking the work
- specifications to which the individual's work is to comply
- reasons for ensuring work conforms to specification
- benefits of good quality:
  - quality products
  - reduced costs
  - customer confidence, satisfaction and loyalty
  - good reputation
  - job satisfaction
  - solving problems
  - increased competitiveness
  - keeping up with technology
- costs and consequences of poor quality e.g.
  - lost customers
  - accidents
  - wastage
  - lost time
  - low morale
  - conflict
- procedures for reporting defects
- examples of common defects

REQUIRED SKILLS AND KNOWLEDGE
• quality improvement procedures • four steps of the quality cycle: plan, do, check, act • reasons for following process improvement procedures • examples of ways in which customer/supplier relationships can be improved • benefits of good customer/supplier relationship • hazards and control measures associated with applying quality procedures, including housekeeping • safe work practices and procedures

Evidence Guide

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 apply quality systems.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying quality systems 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 should not require language, literacy and numeracy skills beyond those required in this unit. 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	
Quality improvement system	A system comprising some or all of the following elements: • quality assurance • quality control • quality inspection • quality improvement • total quality control
Customer	The next person or organisation receiving the production or service

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Quality

MEM15024A Apply quality procedures

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers applying established quality procedures to an employee's own work within a manufacturing, engineering or related environment.

Application of the Unit

Application of the unit	This unit covers essential skill and knowledge that underpins all units within the Metal and Engineering Training Package. This competency is applied to an individual's own work. It includes concepts of meeting customer needs to achieve outcomes that are 'fit for purpose'. This includes following quality procedures to conform to specifications and requirements. **Band**: **A** **Unit Weight**: There is no unit weighting for this unit.

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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. Take responsibility for own quality	1.1. Concept of supplying product or service to meet the customer requirements (internal and external) is understood and applied. 1.2. Responsibility is taken for quality of own work.
2. Apply standard procedures of workplace quality to own job	2.1. Quality system procedures are followed. 2.2. Conformance to specifications is ensured.

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:

- identifying and communicating instances of non-compliance to work specifications
- following quality procedures including work instructions
- conforming to product and process specifications
- checking and clarifying task-related information

Required knowledge

Look for evidence that confirms knowledge of:

- concepts of quality and the benefits of using specifications and standard operating procedures
- quality procedures applying to own work
- standard operating procedures
- safe work practices and procedures

Evidence Guide

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 apply quality procedures.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying quality procedures 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	
Quality	Consistently meeting customer requirements

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Quality

MEM16006A Organise and communicate information

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers accessing, organising and communicating information related to processes or tasks.

Application of the Unit

Application of the unit	This unit applies in manufacturing, engineering or related environments. It may include information related to production, maintenance or associated processes. Information may be drawn from a variety of sources. This unit includes the ability to communicate using common workplace terminology. For access and recording of data requiring system knowledge and judgement, see Unit MEM16008A (Interact with computing technology). **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	

Prerequisite units	

Employability Skills Information

Employability skills	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. 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. Access information and/or records	1.1. Information requirements of tasks are determined and relevant information is accessed from a range of sources. 1.2. Workplace terminology is correctly recognised.
2. Organise and analyse information	2.1. Information is interpreted and organised in accordance with enterprise and work requirements. 2.2. Information is analysed according to enterprise and work requirements.
3. Communicate organised information using established workplace methods	3.1. Information is communicated using established workplace methods.

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 information from a range of sources
- recording, where appropriate, the accessed information
- recognising and using workplace terms
- reading, interpreting and following information in workplace documentation
- checking and clarifying information
- organising, categorising and sequencing information

Required knowledge

Look for evidence that confirms knowledge of:

- types of information
- available sources of information
- information analysis techniques
- methods of categorising and organising information
- methods of recording and communicating information

Evidence Guide

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 organise, analyse and communicate information.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with organising, analysing and communicating information 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, standards, manuals and reference materials.
Guidance information for	

EVIDENCE GUIDE	
assessment	

Range Statement

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. 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.	
Range of sources	Job instructions, specifications, standard operating procedures, charts, lists, documents, computer data, drawings, sketches, tables, technical manuals and/or charts and other applicable reference material
Workplace terminology	Terminology - referring to equipment, processes, workplace areas, staff and procedures - specific to the processes and equipment used in the workplace
Analyse	Analysis for this unit involves simple determinations of relevance and implication for the employee's immediate work requirements
Established workplace methods	• Proforma reports • Data entry e.g. bar coding and simple keyboard operations • Verbal • Drawings

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Communication

MEM16007A Work with others in a manufacturing, engineering or related environment

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers operating in an interactive work environment. It covers contribution to a group effort in order to plan and carry out work. This includes identification of work roles, communication and cooperation with others.

Application of the Unit

Application of the unit	This unit applies to work-related group activities that typically occur in and between sections or departments of an enterprise. Employees would normally be working together to achieve a common purpose e.g. manufacture of a product, maintenance of plant and equipment. Individuals are not responsible for the overall group effort but would be required to contribute to activities and objectives using their own existing technical competencies. **Band**: **A** **Unit Weight**: **0**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	

Employability Skills Information

Employability skills	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. 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. Identify roles and responsibilities	1.1. Own role and responsibilities are identified. 1.2. Relationships within immediate group and with employees performing related/interdependent activities are identified.
2. Plan activities	2.1. Common goals, objectives and task requirements are identified and clarified with appropriate persons. 2.2. Individual tasks are determined and agreed on according to workplace procedures.
3. Work with others	3.1. Effective interpersonal skills are applied to interact with others and to contribute to activities and objectives. 3.2. Assigned or agreed tasks are performed in accordance with agreed requirements, specifications and workplace procedures. 3.3. Work progress is reviewed and modified as agreed to complement the work of others. 3.4. Agreed reporting lines are followed using 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:

- contributing to planning and allocation of work
- performing assigned tasks
- coordinating work effort with others
- following agreed reporting lines
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- applying effective interpersonal skills

Required knowledge

REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- effective interpersonal strategies and skills:
  - effective listening
  - basic speaking skills
  - use of terminology and jargon
  - giving and receiving feedback
  - checking and clarifying task-related information
  - interpreting instructions
  - basic conflict resolution
  - selecting modes and methods of communication
  - identifying and resolving communication breakdowns and barriers
  - principles of effective communication
- relationships and roles within immediate group and with interdependent others
- reporting relationships and procedures
- own responsibilities with respect to products/services to be provided
- skills and competencies of the individual and other employees performing interdependent activities
- common goals, objectives and task requirements
- sources of technical expertise/assistance
- appropriate forms of communication
- hazards and control measures associated with workplace activities, including housekeeping
- safe work practices and procedures

Evidence Guide

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 operate in a work-based team environment.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating in a work-based team environment 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	
Effective interpersonal skills	Basic listening and speaking skills, use of terminology and jargon, giving and receiving feedback, interpreting instructions, verbal and non-verbal modes and methods of communication, communication breakdowns and barriers, basic principles of effective communication

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Communication

MEM16008A Interact with computing technology

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers accessing, inputting and storing information used in manufacturing, engineering or related environments, using computing technology.

Application of the Unit

Application of the unit	This unit applies in manufacturing, engineering or related environments. It involves identifying the type and source of information required, and using the technology to access, input and store information. The equipment may include computers and a range of other equipment based on computing technology. **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	

Employability Skills Information

Employability skills	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. 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. Determine job requirements	1.1. Nature and scope of task requirement are identified. 1.2. Information/data required to be accessed, input or stored is identified. 1.3. Source of information/data is identified.
2. Access information/data	2.1. Access procedures are followed. 2.2. Technology is navigated to find the required information/data. 2.3. Relevant software application menus, functions and commands are used to locate required information/data. 2.4. Information/data is retrieved using organisational procedures. 2.5. Information/data is checked for relevance to job requirements.
3. Input information/data	3.1. Relevant software menus, functions and commands are used to manipulate information/data. 3.2. Information/data is entered, changed, or removed as required.
4. Store information/data	4.1. Data/files are saved following standard procedures prior to exiting the application. 4.2. Data output is produced as required. 4.3. Procedures for shutting down/logging off/exiting computing technology are followed.
5. Access assistance as required	5.1. Appropriate personnel are identified and consulted as required. 5.2. Manuals, online help and other reference materials are identified and used as required.

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:

REQUIRED SKILLS AND KNOWLEDGE
• ability to enter or retrieve data using appropriate software applications • reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents • planning and sequencing operations • checking and clarifying task-related information • using numerical operations within the scope of this unit
Required knowledge
Look for evidence that confirms knowledge of: • functions and capabilities of various types of computing technology used in the workplace • functions of software applications • hazards and control measures associated with using computing technology, including housekeeping • safe work practices and procedures

Evidence Guide

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 interact with computing technology to achieve workplace outcomes.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with interacting with computing technology 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 should not require language, literacy and numeracy skills beyond those required in this unit. 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, standards, manuals and reference materials.
Guidance information for	

EVIDENCE GUIDE	
assessment	

Range Statement

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. 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.	
Access procedures	Logging on and security procedures, virus checks, start-up routines, application start-up
Technology	Hand held data recording devices, screen based equipment, personal computers, bar coders
Applications	• Word processing spreadsheets and databases • Customised engineering and manufacturing applications • Material Resource Planning (MRP) • Warehousing inventory applications • Predictive reliability and maintenance applications • Production data management applications
Data output	Report, email, chart, graph, printout, data transfer, labels

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Communication

MEM17003A Assist in the provision of on the job training

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers assisting in the provision of on the job training to others while undertaking normal duties.

Application of the Unit

Application of the unit	This unit may involve the replacement of normal duties with training duties for limited periods of time. The individual would not be expected to be solely responsible for the assessment or reporting of a trainee's progress. Typical applications could include the provision of on the job guidance by a tradesperson to apprentices/trainees or by a production worker to other production workers/trainees. Where development of training programs is involved see Unit MEM17001B (Assist in development and deliver training in the workplace). **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	

Employability Skills Information

Employability skills	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. 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. Determine role of on the job training	1.1. Objectives of training and role of on the job training are identified in consultation with team leaders or other appropriate personnel.
2. Provide on the job training	2.1. Training is conducted using learning methods appropriate to the training objectives and learner. 2.2. Trainee progress is monitored and feedback is provided appropriate to the learning outcomes.
3. Report on trainee performance	3.1. Trainee's progress is reported according to standard operating procedure.

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:

- obtaining all relevant information with respect to the training to be provided
- applying suitable training methods
- providing feedback to the trainee throughout the training process
- reporting on the trainee's progress
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information

Required knowledge

Look for evidence that confirms knowledge of:

- training to be delivered
- personnel to be consulted with respect to the training to be provided
- the individual's role in the provision of training
- objectives of the training
- the person(s) to be trained
- procedures to be followed when training individuals

REQUIRED SKILLS AND KNOWLEDGE
• training location(s) • tools, equipment, procedures, materials and resources • training delivery methods, their applications, advantages and disadvantages • feedback techniques • reasons for monitoring trainee progress • reporting procedures • hazards and control measures associated with assisting in the provision of on the job training, including housekeeping • safe work practices and procedures

Evidence Guide

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 assist in the provision of on the job training.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assisting in the provision of on the job training 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	
Learning methods	Explanation, demonstration, simulation
Report	Should include information about the skills satisfactorily achieved and those where further practice is required

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Training

MEM18001C Use hand tools

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers using a range of hand tools for a variety of general engineering applications.

Application of the Unit

Application of the unit	Applications may include hand tools used for adjusting, dismantling, assembling and finishing of items or components, and the finishing, cutting, scraping of metallic and non-metallic material to size and shape. This includes simple tapping and threading and routine maintenance of hand tools. This unit should not be selected if the hand tool is dedicated to a single operation or machine and if only a machine specific/customised tool is used. When using hand held power tools or power tools used for hand held operations, refer to Unit MEM18002B (Use power tools/hand held operations). **Band**: **A** **Unit Weight**: **2**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	

Employability Skills Information

Employability skills	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. 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. Use hand tools	1.1. Hand tools are selected appropriate to the task requirements. 1.2. Hand tools are used to produce desired outcomes to job specifications which may include finish, tension, size or shape. 1.3. All safety requirements are adhered to before, during and after use. 1.4. Unsafe or faulty tools are identified and marked for repair according to designated procedures before, during and after use. 1.5. Routine maintenance of tools, including hand sharpening is undertaken according to standard operational procedures, principles and techniques. 1.6. Hand tools are stored safely in appropriate location according to standard operational procedures and manufacturers' recommendations.

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:

- reading and following information on standard operating procedures
- following verbal instructions
- selecting hand tools appropriate to the task
- using hand tools safely
- identifying hand tool defects and marking for repair
- maintaining/sharpening hand tools using appropriate techniques
- storing hand tools in accordance with manufacturers'/standard operating procedures

Required knowledge

Look for evidence that confirms knowledge of:

- applications of different hand tools in a general engineering context
- common faults and/or defects in hand tools

REQUIRED SKILLS AND KNOWLEDGE
• procedures for marking unsafe or faulty tools for repair • routine maintenance requirements for a range of hand tools • storage location and procedures for a range of hand tools • hazards and control measures associated with using hand tools • use and application of personal protective equipment • safe work practices and procedures

Evidence Guide

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 use hand tools for a range of general engineering applications.
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. This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using hand tools 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, standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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. 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.	
Hand tools	Hacksaws, hammers, punches, screwdrivers, sockets, wrenches, scrapers, chisels, gouges, wood planes and files of all cross-sectional shapes and types
Job specifications	Finish, tension, size or shape etc.
Routine maintenance	Cleaning, lubricating, tightening, simple tool repairs, hand sharpening and adjustments using engineering principles, tools, equipment and procedures

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Maintenance and diagnostics

MEM18100 Fault-find, test and rectify AC machines and circuits

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in locating and rectifying faults in alternating current (AC) machines and circuits.

It covers characteristics, including their construction and operating principles. It also includes their application, control and protection methods, reversal of rotation and the requirements to limit starting current as well as skills in testing and fault-finding, including abnormal operating conditions.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC)

Essential Performance Capabilities (EPCs):

- EPC 15 – Describe the rationale and operating principles and characteristics of three phase induction motors and generators.
- EPC 17 – Describe the ASA/NZS 3000:2000 and local supply authority requirements for three phase motor installations and starters.
- EPC 18 – Describe the possible causes of malfunction of three phase induction motors and demonstrate the tests required for diagnosing faults.
- EPC 19 – Describe the operating principles, typical control methods and characteristics of single phase motors and their key components.
- EPC 20 – Describe the suitability of various types of single phase motors for particular applications and describe the fault finding methods.

And

Essential Performance Capability (EPC) classified as ‘critical’:

- EPC 16 – Describe methods of electric motor selection, starting, connection and protection.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
	MEM10023	Design and connect control switching of circuits for building services and industrial equipment
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18104	Dismantle, replace and assemble electrical components and equipment

Competency Field

Maintenance and diagnostics

Unit Sector

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, including appropriate risk control measures
	1.3. Use appropriate personal protective equipment (PPE) in accordance with SOPs
	1.4. Research the nature of the fault through checking of documentation and/or consultation with appropriate person

2.	Prepare to fault-find on AC machines and associated control circuits	2.1.	Obtain all necessary tools, equipment and testing instruments needed to conduct fault diagnosis of AC machines and circuits
		2.2.	Isolate and tag circuits and equipment in accordance with procedures
3.	Fault-find AC machines and associated control circuits	3.1.	Apply diagnostic techniques to solve problems in AC machines and their associated control circuits, including the use of specialised test equipment
		3.2.	Test single and three-phase windings for continuity and insulation resistance between windings and to earth with appropriate test equipment
		3.3.	Dismantle and reassemble AC machine using appropriate fitting techniques, equipment and tools in accordance with specifications and procedures, if required
		3.4.	Remove/repair/replace faulty components/circuits in accordance with manufacturer specifications and regulatory requirements
		3.5.	Test AC machine/circuit to ensure functionality in accordance with specifications
		3.6.	Document all necessary repairs 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.

AC machines include three or more of the following:	• single-phase motors • three-phase motors • variable speed drives (VFDs) • synchronous machines • non-rotating AC equipment and components
Control starter circuits include one or more of the following:	• direct-on-line (DOL) • star-delta • autotransformer • primary resistance • secondary resistance
Split phase induction motors include:	• split-phase motor • capacitor-start motor • capacitor-start, capacitor-run motor • permanently-split capacitor motor • shaded-pole motor
Environmental protection and general enclosure types include:	• open motors • protected motors • drip-proof motors • duct ventilated • totally enclosed • flameproof
Specialised test equipment includes one or more of the following:	• built-in systems (software and site displays) • vibration monitors • infra-red temperature sensing device
Rotating electrical machines in general requirements include:	AS 1359.106-1996 Rotating electrical machines – General requirements – Methods of cooling (IC Code)
Regulatory requirements include:	AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18100 Fault-find, test and rectify AC machines and circuits

Modification History

Release 1. New unit

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 occasions and include:

- following work instructions, SOPs and safe work practices
- identifying and interpreting circuits, drawings and specifications relevant to the work to be undertaken
- determining the electrical and non-electrical isolation requirements to prevent the creation of hazards linked from the loss of machine/system/process control according to established procedures
- using lock out tag procedures with appropriate tags/signs
- proving electrical isolation and following established safety rules prior to working on electrical equipment or wiring
- ensuring all electrical equipment and tools are tested and tagged and up to date
- using specialised test equipment, including condition monitoring equipment, to conduct online analysis
- carrying out online functional tests for voltage and current using a voltmeter or multimeter and a clip on ammeter
- applying fault-finding and diagnostic techniques on at least three (3) or more of the following AC machines and circuits:
  - single-phase motors
  - three-phase motors
  - VFDs
  - synchronous machines
  - non-rotating AC equipment and components
- carrying out electrical tests for continuity and insulation resistance tests; between windings and to earth of single and three-phase motors
- dismantling, replacing and assembling single and three-phase AC machines using appropriate hand and power tools in accordance with manufacturer specifications, if required
- complying with the Australian/New Zealand Wiring Rules and local supply requirements for three-phase motor installations and starters
- using a synchroscope for paralleling of alternators
- documenting all necessary repairs 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 PPE
- three-phase induction motors, including:
  - basic component parts of a three-phase induction motor i.e. stator and rotor (squirrel-cage and wound rotor)
  - motor enclosures
  - terminal block arrangements – connecting a three-phase motor in both star and delta
  - operating principles, including:
    - rotating magnetic fields
    - rate of rotation and factors affecting it
    - direction of rotation and reversal
  - induction and its effects, including:
    - torque
    - slip
    - rotor frequency
  - operating characteristics, including:
    - squirrel-cage rotors
    - special purpose squirrel-cage rotors
    - wound-rotor motors
  - operating parameters for induction motors
- single-phase induction motors, characteristics and operating principles of the following:
  - split-phase motor
  - capacitor-start motor
  - capacitor-start, capacitor-run motor
  - permanently-split capacitor motor
  - shaded-pole motor
- series motor – operating characteristics and reversing the direction of rotation
- comparison of single-phase and three-phase motors and advantages and disadvantages of three-phase motors
- abnormal operating conditions for three-phase motors, including:
  - phase reversal, single phasing and overloading
  - voltage fluctuation, higher operating temperatures, frequency variation, overloading and frequent starting
  - other factors, including exposure to corrosive fumes, explosive vapours, dust, steam, salt air, high humidity, operation in ambient temperature of below approximately 100C or above 400C, or operation at altitudes in excess of 1000 metres
- abnormal operating conditions for single-phase motors, including centrifugal switch failure
- diagnostic techniques including the use of specialised test equipment, including growlers
- electrical tests for continuity and insulation resistance tests, between windings and to earth of single and three-phase motors
- testing, including the following:

  - DC test – to determine the stator resistance
  - no-load test – to determine the rotational losses and magnetisation current
  - locked rotor test – to determine the rotor and stator impedances
  - thermography and condition monitoring
- dismantling three-phase motors, including application of ‘witness marks’
- operation of a ’growler’ to perform voltage drop testing of armatures of the series or universal motor
- electric motor control and protection, including:
  - reasons why motor protection is required
  - Australian/New Zealand Wiring Rules and local supply requirements for three-phase motor installations and starters, including:
    - isolation and switching
    - automatic starting
    - emergency stopping
    - starting methods for limitation of starting currents
- three-phase motor starters and their operating principles and characteristics, including:
  - DOL
  - star-delta
  - autotransformer
  - primary resistance
  - secondary resistance
- various types of motor overload protection, including high rupture capacity (HRC) fuses
- operating principles of magnetically activated over-current relays, thermally activated over-current relays and combined thermal-magnetic over-current relays
- temperature-dependent resistor protection
- under-voltage and over-voltage protection
- single-phasing and reverse-phase sequence protection and the protection methods
- types of enclosures to give environmental protection, including:
  - open - ends of machine are open allowing free ventilation with fan attached to the motor shaft to draw air through the motor
  - protected - protection obtained by fastening steel wire mesh or perforated metal over enclosures with fan attached to the motor shaft to draw air through the motor
  - drip proof - an advance on the protected motors with openings further protected by a hood to prevent foreign materials or moisture from falling vertically into motor
  - duct ventilated - air is drawn from outside through a duct or air is forced via a blower through a duct to the motor
  - totally enclosed - no contact between the air outside and inside the machine can be classified as waterproof, weatherproof or submersible
  - flameproof - totally enclosed motor with additional precautions including to seal bearings and used where there are flammable gases and risk of explosion if spark enters the atmosphere
- AS 1359.106-1996 Rotating electrical machines – General requirements – Methods of cooling (IC Code)
- three-phase motor braking and the principles of operation of the major types, including mechanical, eddy current, dynamic, regenerative and plug
- altering the speed of AC induction motors by varying the number of poles or frequency

- variable speed drives, including:
  - methods and operating principles
  - installation requirements
  - shielding and filtering
  - harmonics and power factor
  - performance characteristics
  - set up and commissioning
  - common faults – their symptoms and causes
- three-phase synchronous machines – alternators:
  - construction and operating principles
  - excitation and generated voltage
  - effect of load on alternator voltage
  - effect of power factor on output voltage of an alternator
  - voltage regulation
  - alternator ratings expressed in kVA
  - parallel operation of alternators – synchronising and the methods used to achieve synchronisation, including the use of a synchroscope
  - effects of a change in excitation when connecting two alternators in parallel
- three-phase synchronous machines – motors:
  - construction and operating principles
  - effect of a load on a synchronous motor
  - effect on varying the field (DC) excitation, including changes in power factor
- hunting in three-phase synchronous machines and the methods used to reduce this effect, including the use of amortisseur windings in the pole faces of the rotor
- starting methods and applications of three-phase synchronous motors
- single-phase synchronous motors:
  - the primary purpose and the major types: reluctance and hysteresis motors
  - applications of single-phase synchronous motors
- standby power supplies, including uninterruptable power supplies (UPS) and the purpose they provide i.e. mains power at a specified voltage and frequency
- standby engine driven alternators starting methods and sequence of operation
- non-rotating AC equipment and components, including construction, operation and application of:
  - linear motors and actuators
  - solenoids, relays and contactors
  - welders and other non-rotating AC machines.

Assessment Conditions

Assessors must:

- have vocational competency in fault-finding, testing and rectifying AC machines and circuits 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM18102 Fault-find, test and rectify single and three-phase transformers

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in fault-finding and rectifying single and three-phase transformers.

It includes the operating principles of transformers; their construction and open circuit and full load characteristics; types of transformers used in transmission and distribution systems, appliances and welding machines; hazards associated with step and touch voltages, induced voltages and stored energy particularly with high voltages; earthing requirements to limit the rise of touch voltage; and safe working procedures for connecting, testing and fault-finding transformers.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capabilities (EPCs):

- EPC 23 – Describe the basic construction of transformers.
- EPC 24 – Demonstrate understanding of the principle of operation of transformers.
- EPC 25 – List the main types of transformers.

And

Essential Performance Capabilities (EPCs) classified as ‘critical’:

- EPC 26 – List typical applications of various types of transformers and key safety issues.
- EPC 59 – Demonstrate knowledge and understanding of the significant dangers of High Voltage equipment and distribution systems.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18104	Dismantle, replace and assemble electrical components and equipment

Competency Field

Maintenance and diagnostics

Unit Sector

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, including appropriate risk control measures
	1.3. Use appropriate personal protective equipment (PPE) in accordance with SOPs
	1.4. Research the nature of the fault through checking of documentation and/or consultation with appropriate person

2.	Prepare to fault-find single and three-phase transformers and associated circuits	2.1.	Obtain all necessary tools, equipment and testing instruments needed to conduct fault diagnosis of single and three-phase transformers and circuits
		2.2.	Isolate and tag circuits and equipment in accordance with procedures
3.	Fault-find single and three-phase transformers and associated circuits	3.1.	Apply diagnostic techniques to fault-find single and three-phase transformers and associated circuits using appropriate test equipment
		3.2.	Remove/repair/replace faulty components/circuits in accordance with manufacturer specifications and regulatory requirements
		3.3.	Test single and three-phase transformers associated circuits to ensure functionality in accordance with specifications
		3.4.	Carry out routine maintenance on transformers, including oil testing, silica gel change and bushing repairs, where applicable
		3.5.	Document all necessary repairs 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.

Transformers include two or more of the following:	• instrument
	• current
	• voltage
	• oil filled transformers
	• high voltage (HV) power transformers
	• low voltage (LV) power transformers
	• neutral
	• distribution:
	  • step up
	  • step down

Regulatory requirements include:	AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18102 Fault-find, test and rectify single and three-phase transformers

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings and specifications relevant to the work to be undertaken
- determining the electrical and non-electrical isolation requirements to prevent the creation of hazards linked from the loss of machine/system/process control according to established procedures
- using lock out tag procedures with appropriate tags/signs
- proving electrical isolation and following established safety rules prior to working on electrical equipment or wiring
- ensuring all electrical equipment and tools are tested and tagged and up to date
- observing WHS precautions and considerations when dealing with instrument transformers especially current transformers and HV equipment
- applying fault-finding and diagnostic techniques on at least two (2) or more of the following single and three-phase transformers and their associated control circuits:
  - instrument
  - current
  - voltage
  - oil filled transformers
  - HV power transformers
  - LV power transformers
  - neutral
  - distribution:
    - step up
    - step down
- complying with the Australian/New Zealand Wiring Rules for the installation and safety requirements of transformers, including limiting the rise of touch voltages
- performing the following tests in accordance with specifications and regulatory requirements:
  - basic insulation resistance, continuity and winding identification tests
  - open and short circuit tests
- carrying out routine maintenance on transformers
- documenting all necessary repairs 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 PPE
- operating principles of transformers, including:
  - principles of mutual induction and how it relates to a transformer
  - phasor diagram for a transformer on no-load and the voltage and current components
  - factors that determine the value of induced voltage in a transformer winding
  - transformers ratios both voltage and current
  - calculate the value of output voltage given the input voltage and turns ratio of a transformer
- transformer losses, including:
  - eddy current losses and the use of laminations to reduce this effect
  - hysteresis losses and core materials to reduce this effect
  - copper losses also referred to as primary/secondary losses or I^2R losses
- transformer efficiency and the effect flux leakage has on it and its related formula i.e.

transformer efficiency =

- voltage regulation as applicable to a transformer and its related formula i.e. voltage

  regulation =
- power in a transformer i.e. power in = power out
- impedance ratio and reflected impedance
- percentage impedance as applied to transformers and how its value affects the value of the available short circuit current
- calculating the percentage impedance of a transformer and determine the percentage impedance of a transformer from test results
- transformer construction, including:
  - single and three-phase transformer cores and winding arrangements
  - transformer ratings i.e. in kVA
  - relationship between transformer cooling and rating
  - methods used for natural and forced cooling of transformers
  - properties and tests that are conducted on transformer oil
  - winding polarities and polarity identification of single and three-phase transformers
  - four common methods of connecting the primary and secondary windings of a three-phase transformer i.e. star-star, delta-delta, delta-star and star-delta
  - three-phase tertiary windings and the purpose they perform
  - changing transformer ratios i.e. off-load and on-load changing
  - transformer auxiliary equipment and their function (bushings, surge-diverters, tap-changers, hot oil and winding indicators, breather, Buchholz relay and conservator)
  - application of transformers, including welders
- paralleling of single-phase transformers, including:
  - ensuring their voltages are equal
  - instantaneous polarities are identical
  - consequences of incorrectly phased transformers
- paralleling of three-phase transformers, including:
  - the need for paralleling
  - ensuring they are of equal voltages, same phase sequence and phase voltages are in step and the consequences if they are not
- testing of transformers, including:

  - performing basic insulation resistance, continuity and winding identification tests
  - testing of final connections i.e. in star, delta and open-delta configurations and transformer ratio
  - safe working procedures when connecting and testing transformers
  - open and short circuit tests
  - dielectric tests
- special transformers, including:
  - potential and current transformers and the reason why they are used
  - construction and application of potential and current transformers
  - WHS hazards associated with instrument transformers especially current transformers where the secondary must never be open-circuited under any circumstances as it will cause a potentially dangerous voltage to be present at the secondary terminals
  - instrument transformer load or burden ratings
  - safe working procedures of potential and current transformers
  - commissioning and testing instrument transformers
  - transformers with multiple secondaries and tapped windings
  - advantages and disadvantages of auto-transformers
  - calculate the voltage and current in the windings of an auto-transformer
  - high-reactance or leakage transformers
  - applications of auto-transformers and instrument transformers
- Australian/New Zealand Wiring Rules installation and safety requirements for transformers
- dangers of high voltage equipment and distribution systems, including:
  - step and induced voltages
  - sources of induced voltage and stored energy
  - creepage and clearance requirements
  - application of safe working procedures in the vicinity of HV equipment.

Assessment Conditions

Assessors must:

- have vocational competency in fault-finding, testing and rectifying single and three-phase transformers 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM18103 Fault-find, test and rectify electrical circuits and equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in finding and rectifying faults in electrical circuits and equipment.

It covers safe fault-finding testing and procedures in a range of electrical circuits and equipment as well as the rectification of those faults in accordance with the relevant standards.

This unit covers the skills and knowledge required to meet the Electrical Regulatory Authorities Council (ERAC).

Essential Performance Capability (EPC) classified as 'critical'

- EPC 66 – Demonstrate the knowledge and skills for diagnosing and rectifying faults in electrical apparatus and associated circuits.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM10019	Select circuit protection devices by type and rating, fit to switchboards and install earthing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18100	Fault-find, test and rectify AC machines and circuits

MEM18102	Fault-find, test and rectify single and three-phase transformers
MEM18104	Dismantle, replace and assemble electrical components and equipment

Competency Field

Maintenance and diagnostics

Unit Sector

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, including appropriate risk control measures
		1.3.	Use appropriate personal protective equipment (PPE) in accordance with SOPs
		1.4.	Research the nature of the fault through checking of documentation and/or consultation with appropriate person/s
2.	Prepare to fault-find and rectify electrical circuits and equipment	2.1.	Obtain all necessary tools, equipment and testing instruments needed to conduct fault diagnosis and repair of electrical circuits and equipment
		2.2.	Isolate and tag circuits and equipment in accordance with procedures
3.	Fault-find and rectify electrical circuits and equipment	3.1.	Apply diagnostic techniques to locate faults in electrical circuits and equipment, including the use of specialised test equipment
		3.2.	Dismantle equipment, where necessary, and repair/replace faulty items and reassemble using

appropriate tools and equipment in accordance with manufacturer specifications and regulatory requirements

3.3. Test repaired electrical circuits and equipment to ensure functionality and compliance

3.4. Document reasons and all necessary repairs 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.

Circuits include two or more of the following:	• power distribution • lighting control • distributed control system (DCS) instrument loop control • motor control • package unit control • single circuit may be controlled by one or more devices and the output may control one or more devices • complex circuit is defined as interdependent circuits and applies to interconnected electrical circuits where electrical equipment and/or components are connected electrically, that is there are multiple electrical power supplies or sources, voltages or circuits which are found in the control or switching of the circuit
Equipment includes three or more of the following single and three-phase appliances:	• single-phase appliances – handheld power tools, fridges, microwaves, TV's, lighting, motors, air conditioning units, air compressors, portable pumps, pedestal drills, lathes, bench grinders, motors, fans and fan motors • three phase appliances – variable speed drives (VSDs), fan and pump motors, welding machines, freezer units, heaters, general commercial kitchen equipment, generators, air conditioning units, air compressors and air blowers
Diagnostic techniques include:	Testing for voltage, current, frequency, polarity, phase, circuit continuity, insulation resistance and earth continuity
Test equipment includes one or more of the following:	• continuity testers • ammeters • voltmeters • multimeters • tong testers • wattmeters • cathode ray oscilloscopes (CROs)
Regulatory requirements include:	AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules
Safe working practices include:	Demonstration of safe working practices and installation in accordance with industry established safe and sound practices

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18103 Fault-find, test and rectify electrical circuits and equipment

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuits, drawings and specifications relevant to the work to be undertaken
- determining the electrical and non-electrical isolation requirements to prevent the creation of hazards linked from the loss of machine/system/process control according to established procedures
- using lock out tag procedures with appropriate tags/signs
- proving electrical isolation and following established safety rules prior to working on electrical equipment or wiring
- ensuring all electrical equipment and tools are tested and tagged and up to date
- applying methodical diagnostic techniques and using safe working practices to fault-find electrical circuits and equipment
- using test equipment, including the use of multimeters, CROs, signal/function generators and power supplies, in diagnosing faults in electrical circuits and equipment
- taking measurements and comparing the results to the calculated value
- dismantling, repairing and replacing faulty components and equipment using appropriate hand and power tools and engineering techniques
- carrying out electrical tests for continuity and insulation resistance tests on single and three-phase appliances and equipment
- repairing faulty electrical installation circuits, components and wiring to comply with relevant standards
- re-testing according to regulatory and legislative requirements
- documenting all reasons and remedial action taken 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 PPE
- fault finding techniques, including:
  - visual inspection
  - signal injection and measurement
  - half split rule and component isolation
  - interpreting wiring and equipment circuits, drawings and specifications
- test equipment for diagnosing faults, including multimeters, ammeters, voltmeters, continuity testers, wattmeters and tong testers
- specialised AC test equipment, including:
  - CRO and its operating features, interpreting a CRO screen, dual trace CROs and its advantage over a single trace CRO and CRO applications
  - signal, function generators and power supplies and their operating features and applications when fault-finding alternating current (AC) circuits
- diagnostic techniques include testing for voltage, current, frequency, polarity, phase, circuit continuity, insulation resistance and earth continuity
- wiring faults, including short circuit, open-circuit, high resistance, breakdown in insulation resistance, residual current device (RCD) tripping, transposition of conductors, earthing, loose connections and corrosion
- power distribution, lighting control, signal and data, motor control and package unit control circuits
- lighting faults, including switching, lamp holders, ballast, starter, capacitor, igniter, transformer, loose connections, poor contact, corrosion and lighting management systems
- equipment faults in the following single-phase appliances:
  - handheld power tools, fridges, microwaves, hot water systems, TV's, motors, air conditioning units, air compressors, portable pumps, pedestal drills, lathes, bench grinders, motors, fans and fan motors
- equipment faults in the following three-phase appliances:
  - VSDs, fan and pump motors, freezer units, welding machines, heaters, general commercial kitchen equipment, generators, air conditioning units, air compressors and air blowers
- mechanical faults in motors, including bearings, fans, bent shaft, locked rotor, blocked air vents, centrifugal switches, slipping belts and environmental factors.

Assessment Conditions

Assessors must:

- have vocational competency in fault-finding, testing and rectifying electrical circuits and equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM18104 Dismantle, replace and assemble electrical components and equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson - industrial electrician apprenticeship training and the recognition of trade-level skills in dismantling, replacing and assembling electrical components and equipment which are designed to operate at voltages greater than 50 V alternating current (AC) or 120 V direct current (DC).

It covers dismantling and identifying faulty components, selecting replacements, and assembling electrical components into assemblies or sub-assemblies, including the safe use of hand and power tools and interpretation of mechanical drawings/diagrams.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **3**

Pre-requisite Unit

Path 1	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

Competency Field

Maintenance and diagnostics

Unit Sector

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, including appropriate risk control measures
		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.	Dismantle electrical components and equipment	2.1.	Obtain all necessary tools, equipment and measuring devices needed to dismantle electrical components and equipment
		2.2.	Isolate and tag circuits and equipment in accordance with procedures
		2.3.	Inspect electrical component/equipment and analyse task requirements
		2.4.	Select the appropriate tools and equipment
		2.5.	Ensure all applicable handheld power tools are tested and tagged and are checked for correct operation and safety
		2.6.	Dismantle the item according to engineering drawings, manufacturer requirements and SOPs
		2.7.	Mark electrical components to aid in reassembly
3.	Identify faulty components and select replacement	3.1.	Obtain and interpret specifications for components from appropriate source
		3.2.	Assess damaged or faulty components against specifications in accordance with procedures and

		manufacturer requirements
	3.3.	Identify faulty components and arrange for repair, replacement or adjustment in accordance with procedures and manufacturer requirements
	3.4.	Select replacement and/or repaired parts for reassembly in accordance with specifications and procedures
4. Assemble electrical components and equipment	4.1.	Apply appropriate techniques to assemble electrical components/equipment using fastening equipment and methods which ensure conformance to specifications and operational performance
	4.2.	Select, where appropriate, correct lubrication, packing and sealing materials and apply them in accordance with job specifications
	4.3.	Inspect, test and adjust assembled electrical component/equipment as necessary for compliance with operational specifications and return to use in accordance with procedures
	4.4.	Complete documentation, including all necessary remedial action and reasons why they were carried out, 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.

Electrical components and equipment include one or more of each of the following:	• single-phase appliances – hand held power tools, fridges, microwaves, TV's, lighting motors, air conditioning units, air compressors, portable pumps, pedestal drills, lathes, bench grinders, motors, fans and fan motors • three phase appliances – freezer units, welding machines, fan and pump motors, heaters, general commercial kitchen equipment, generators, air conditioning units, air compressors and air blowers • DC machines • non-rotating AC and DC equipment and components
Appropriate tools and equipment include one or more of the following:	• a range of hand and power tools • bearing pullers • special purpose dismantling and assembly tools
Testing and tagging requirements of portable tools include:	Those identified in AS/NZS 3760:2010 In-service safety inspection and testing of electrical equipment

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18104 Dismantle, replace and assemble electrical components and equipment

Modification History

Release 1. New unit

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 occasions and include:

- Following work instructions, SOPs and safe work practices
- identifying and interpreting circuits, drawings and specifications relevant to the work to be undertaken
- preparing component/equipment for dismantling
- ensuring all handheld power tools are tested and tagged to the requirements of AS/NZS 3760:2010 In-service safety inspection and testing of electrical equipment
- dismantling component/equipment using appropriate techniques, tools and equipment
- marking component/equipment parts appropriately to aid in reassembly
- checking components visually and dimensionally for conformance to specifications
- selecting and confirming replacement parts to specifications from supplier catalogues
- preparing and assembling component/equipment using appropriate techniques and procedures
- undertaking shaft and coupling alignment, where appropriate
- applying lubricants, packing and/or sealing materials, where appropriate, in accordance with the job specifications
- inspecting and checking the final assembly for conformance with operational specifications and returning to use
- documenting all necessary remedial action and reasons why they were carried out 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 PPE
- mechanical drawing interpretation, including:
  - application of AS 1100.101-1992 Technical drawing – General principles, in accordance with SOPs
  - conventions used in technical drawings, including relationship between the views contained in the drawing, objects represented, units of measurement, and dimensions of the key features and symbols used
  - correct interpretation of instructions contained in drawings
  - materials from which drawing objects are made and their features and manufacturing/assembly requirements
- power tools, including:
  - application of different power tools, including electric or pneumatic/hydraulic drills, grinders, jigsaws, nibblers, cutting saws, sanders, planers, routers, pedestal drills and grinders
  - clamping/securing methods, including multigrips, vices, jigs, fixtures and clamps
  - adjustments/alignments to a range of power tools
  - common faults and/or defects in power tools
  - procedures for marking unsafe or faulty power tools for repair
  - routine maintenance requirements and cleaning of a range of power tools, including lubricating, tightening, simple tool repairs and adjustments using engineering principles, tools, equipment and procedures to statutory and regulatory requirements
  - tool sharpening techniques for a range of power tools
  - storage location and procedures of a range of power tools
  - safety precautions when using power tools
- precautions to be observed when drilling materials containing asbestos, including the following:
  - undertaking a risk assessment prior to commencement of work
  - a non-powered hand drill or low speed battery-powered drill or drilling equipment fitted with local exhaust ventilation (LEV) dust control hood wherever possible
  - safe working procedures, including applicable PPE
- portable tool safety and tagging system in accordance with the requirements of AS/NZS 3760:2010 In-service safety inspection and testing of electrical equipment
- correct procedures for storage of hand and power tools
- types of seals, bearings, fans and pulleys commonly found in electrical equipment
- non-rotating DC equipment and components, including construction, operation and application of:
  - solenoids, relays and contactors
  - linear actuators
  - Hall effect devices
  - magnetic sensing devices
  - magnetostriction equipment
- dismantling and assembly techniques, including:

- marking component/equipment parts to aid in reassemble
- selecting appropriate hand and power tools used in dismantling and assembling electrical components
- procedures for safe handling and storage of dismantled components.

Assessment Conditions

Assessors must:

- have vocational competency in dismantling, replacing and assembling electrical components and equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM18105 Disconnect and reconnect high voltage fixed wired equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in disconnecting and reconnecting high voltage (HV) fixed wired equipment using appropriate techniques and procedures.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band:
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).

Unit Weight: **3**

Pre-requisite Unit

Path 1	MEM10016	Terminate and test electrical wiring and accessories
	MEM10018	Select cable types and sizes to suit loads and electrical installation environment
	MEM18001C	Use hand tools

Competency Field

Maintenance and diagnostics

Unit Sector

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, including appropriate risk control measures
	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. Disconnect equipment	2.1. Determine function of electrical of equipment by reference to circuit drawings, schematics, reference manuals, equipment specifications, identification plate and/or consultation with technical adviser
	2.2. Determine and record equipment characteristics, including direction of rotation, where appropriate
	2.3. Identify points of isolation and isolate equipment in accordance with procedures
	2.4. Check that circuits/equipment are isolated and tagged using all appropriate lock-off equipment and signage
	2.5. Note, record and label conductor layout
	2.6. Disconnect conductors and terminate and make safe disconnected cables/connections using appropriate tools, equipment and techniques
3. Prepare to reconnect equipment	3.1. Plan reconnection ensuring WHS policies and procedures are followed
	3.2. Identify characteristics, including rating of the equipment to be connected, and determine connection requirements

		3.3.	Test original and/or replacement item to ensure it is safe to be connected
4.	Connect equipment	4.1.	Isolate and tag circuits and equipment in accordance with procedures
		4.2.	Check connections and prepare conductors for termination
		4.3.	Test the conductors for continuity and insulation resistance readings ensuring they comply with regulatory and legislative requirements
		4.4.	Confirm continuity between exposed conductive parts of the equipment and the main earth or metal switchboard enclosure
		4.5.	Connect conductors to equipment in accordance with specifications and regulatory requirements
		4.6.	Fasten/seal all cables/wires/conduit to specifications
		4.7.	Remove all lock-off equipment and signage
5.	Perform emergency first aid	5.1.	Assess situation to identify points of danger to the injured person and potential rescuer
		5.2.	Rescue/recover injured person or provide assistance to injured person in accordance with recognised standards/procedures
		5.3.	Make contact with the appropriate medical and rescue authorities
		5.4.	Record details of first aid given

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.

Appropriate techniques and procedures include:	Clearances for safe approach as mandated by statutory authorities
Isolation includes:	Isolating supply for safe disconnection of all electrical power to equipment supply circuit with switch circuit breaker or fuses on circuits/equipment at voltage levels above 1000 V alternating current (AC) and 1500 V direct current (DC)
Test equipment and tools includes one or more of the following:	In accordance with voltage and fault-limiting requirements: • appropriate proving dead meters • high potential testers • voltmeters • insulation resistance testers • handheld tools, including pliers, screwdrivers, sockets, spanners, keys, earthing links and operating sticks
Signage includes one or more of the following:	• tags • access permit holders • restricted access signs

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18105 Disconnect and reconnect high voltage fixed wired equipment

Modification History

Release 1. New unit

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 occasions and include:

- following work instructions, SOPs and safe work practices
- identifying and interpreting specifications, charts, lists, circuit drawings, schematics, regulatory and legislative requirements to disconnect/reconnect HV fixed wired equipment
- checking that the electrical equipment is isolated and tagged where necessary in strict accordance with WHS requirements and procedures using appropriate lock-off equipment and tags/signs
- disconnecting equipment by labelling and recording conductors and making safe disconnected cables/connections using appropriate tools, test equipment, procedures and techniques
- confirming isolation prior to reconnecting fixed wired equipment and checking connections and preparing conductors for termination in accordance with manufacturer specifications and regulatory requirements
- testing conductors prior to connection to ensure continuity, and insulation resistance readings comply with following requirements:
    - checking continuity of the protective earth conductor to determine whether it is sufficiently low
    - testing the resistance between the protective earth conductor and the neutral conductor to determine whether it is sufficiently low – not greater than 2 Ohms
    - testing the insulation resistance of active conductors to confirm that it is greater than 1 Megohm
- testing to ensure continuity is confirmed between the exposed conductive parts of the equipment and the main earth or metal switchboard enclosure
- connecting conductors to equipment and fasten/seal cables/wires/conduits using appropriate procedures and tools to relevant specifications and regulatory requirements
- removing all lock-off devices and signage and checking/testing equipment and circuits for compliance to specifications
- rescuing/recovering of injured person in accordance with appropriate standards/procedures and provide first aid, including cardiopulmonary resuscitation (CPR) where appropriate, and contacting the appropriate medical and rescue authorities
- recording details of first aid given.

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 PPE
- any applicable industry standards, national/Australian Standards, NOHSC guides, state/territory regulatory codes of practice/standards and relevant regulatory requirements
- characteristics of the circuit and the equipment, including rating and rotation
- points of isolation for the fixed wired equipment and reasons for selecting the particular isolation point) and reasons for using earthing, lock-off equipment and signs
- clearances from live parts
- safe isolation
- operational specifications of the fixed wired equipment and connections to be made
- procedures for confirming electrical isolation of fixed wired equipment and circuits
- procedures, techniques, tools and equipment to be used for disconnecting/reconnecting conductors
- test requirements to ensure compliant continuity and insulation resistance of conductors
- test requirements to ensure continuity between exposed conductive parts of the equipment and the main earth or metal switchboard enclosure
- potential dangers/risks associated with work
- recognised procedures for the movement and treatment of the injured person, including HV rescue, clearing of airways, CPR, care of spinal injuries, treatment of cuts/lesions, burns/scalds and treatment of shock
- appropriate local medical and rescue services
- procedures for incident reporting.

Assessment Conditions

Assessors must:

- have vocational competency in disconnecting and reconnecting HV fixed wired equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM18106 Terminate communication and data cables

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in terminating all types of communication and data cables in accordance with the relevant legislative requirements and statutory regulations.

Some jurisdictions require the holder of this unit to be licensed or certified and users should check with the relevant authorities.

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM05001B	Manual soldering/desoldering - electrical/electronic components
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

Competency Field

Maintenance and diagnostics

Unit Sector

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, including appropriate risk control measures
		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.	Identify and mark conductors/cables	2.1. Identify cables and conductors using appropriate test equipment and techniques
		2.2. Label cables and conductors in accordance with procedures, legislative requirements and statutory regulations to specifications
3.	Prepare and terminate cable	3.1. Obtain termination requirements and specifications
		3.2. Maintain the minimum bend radius of the cable in accordance with specifications when cutting cable to required length
		3.3. Prepare cable ends to specifications, legislative requirements and statutory regulations utilising appropriate tools and techniques
		3.4. Terminate cables according to specifications using appropriate tools and techniques
		3.5. Test/examine terminations for compliance with specifications
4.	Fix/secure cables	4.1. Fix/secure cables utilising appropriate fixing/securing techniques
		4.2. Use the proper cable management hardware to support the in-place cables and relieve tension

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.

Legislative requirements and statutory regulations include one or more of the following:

- ACA Technical Standards AS/ACIF008, AS/ACIF009
- SAA Communications Cabling Manual (Open)
- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- Telecommunications Act 1997

Types of cables include one or more of the following:

- thermocouple/compensator cables, including mineral-insulated metal sheath (MIMS)
- transmission cables
- thermoplastic/elastomer insulated/sheathed
- compensating cables
- coaxial
- telephone
- category 5
- optical fibre
- extra-low voltage (ELV) control cables

Minimum bend radius includes:

Bend radius according to manufacturer specifications, including:

- 4 times the cable diameter for unshielded twisted pair (UTP) and screened twisted pair (ScTP) cables
- 10 times the cable diameter for optical fibre cable

Tools include one or more of the following:

- krone tool
- cable strippers
- crimping tools, e.g. RJ45 crimping tool
- slitter tool
- pliers

Terminations include one or more of the following:

- crimp
- wire wrap (non-insulated and pre-insulated)
- solder
- connectors
- multi-terminal plugs and sockets
- fibre optics
- coaxial
- terminal blocks
- punch-down connections

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18106 Terminate communication and data cables

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting specifications, data sheets, legislative requirements and statutory regulations and obtaining relevant data with respect to terminating signal and data cables
- identifying cables and conductors and label in accordance with requirements, procedures and regulations
- maintaining the minimum bend radius of the cable according to manufacturer specifications
- preparing and terminating cables using appropriate tools and techniques to specifications
- testing terminations for compliance with specifications
- using the proper cable management hardware to support the in-place cables and relieve tension
- fixing/securing cables in accordance with procedures.

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 PPE
- legislative requirements and statutory regulations, including ACA Technical Standards AS/ACIF008, AS/ACIF009, SAA Communications Cabling Manual (Open), AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules) and Telecommunications Act 1997
- test equipment, techniques and procedures to be used to identify cables and conductors
- labelling requirements and procedures for labelling cables and conductors
- minimum bend radius for communication and data cables
- termination requirements, specifications and procedures, tools and techniques for preparing and terminating cables
- procedures for testing cables and terminations
- factors that influence selection of fixing/securing techniques, including cable management hardware.

Assessment Conditions

Assessors must:

- have vocational competency in terminating communication and data cables 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM18108 Troubleshoot analog and digital electronic equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in troubleshooting analog/digital electronic equipment down to sub-assembly and/or card level where a series of checks and pre-determined tests is applied in accordance with workshop manuals and testing procedures.

It applies to a wide range of electronic systems and sub-assemblies used in an industrial environment.

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

Band: **A**
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18104	Dismantle, replace and assemble electrical components and equipment

Competency Field

Maintenance and diagnostics

Unit Sector

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. Troubleshoot electronic equipment	2.1. Determine the function of electronic equipment by reference to circuit diagrams, equipment manuals and/or consultation with equipment operator, where appropriate
	2.2. Run equipment built-in test functions and record results, where appropriate
	2.3. Note and record built-in faults/status display
	2.4. Apply diagnostic techniques to locate faults in electronic equipment, including the use of specialist test equipment
	2.5. Isolate and remove faulty card or sub-assembly from electronic system using appropriate tools and techniques
	2.6. Source replacement item and replace in accordance with manufacturer specifications
3. Return electronic equipment to service	3.1. Adjust/tune or calibrate electronic equipment for conformance to specifications, where appropriate
	3.2. Test repaired equipment/sub-assemblies for compliance to specifications and/or manufacturer requirements
	3.3. Complete all documentation requirements according to 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.

Electronic equipment includes one or more of the following:	• amplifiers • analog/digital hardware • telecommunication • consumer audio/video • electronic appliances • process control • computer systems • security monitoring and alarm systems • scanning systems • fire systems • power supplies • test equipment
Fault-finding techniques include one or more of the following:	• signal injection • substitution • monitoring • measurement • visual
Test equipment includes one or more of the following:	• continuity testers • ammeters • voltmeters • cathode ray oscilloscopes (CROs) • frequency counters • signal generators • digital probes

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18108 Troubleshoot analog and digital electronic equipment

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting circuit diagrams, specifications, schematics, maintenance records, drawings, supplier catalogues and obtaining relevant data with respect to troubleshooting analog/digital electronic equipment
- locating, reading/recording and diagnosing built-in fault indicators and obtaining error code interpretation documents and run test functions and recording faults and/or equipment status indicated by built-in functions/display
- applying diagnostic techniques in fault-finding electronic equipment down to sub-assembly and/or plug-in card level
- isolating and removing faulty item and selecting replacement item from appropriate sources
- adjusting/tuning and calibrating in accordance with specifications
- verifying repaired electronic equipment for compliance to specifications
- completing all documentation 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 PPE
- function(s) and operational specifications of the electronic equipment/sub-assembly and electrical principles associated with electronic sub-assemblies
- implications of electro-static discharge (ESD) upon the electronic equipment
- procedures for running built-in test functions and recording identified faults
- equipment and techniques to be used to test the electronic equipment, including the use of specialised test equipment
- diagnostic techniques, including:
  - visual inspection
  - signal injection
  - half-split rule and component isolation
- procedures for running built-in test functions and recording faults identified
- errors indicated by built-in devices
- procedures for isolating electronic equipment/sub-assemblies
- tools and techniques to be used to remove/replace components from/into electronic equipment
- procedures and techniques for adjusting/tuning and calibrating electronic equipment/sub-assemblies
- test procedures and specifications for returning repaired equipment/sub-assemblies to service.

Assessment Conditions

Assessors must:

- have vocational competency in troubleshooting analog and digital electronic equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MEM18109 Troubleshoot instrumentation systems and equipment

Modification History

Release 1. New unit

Application

This unit has been developed for Engineering Tradesperson – industrial electrician apprenticeship training and the recognition of trade-level skills in fault-finding and troubleshooting techniques that are instrumental in reducing instrumentation down-time.

It covers performing functional tests under normal, extreme, overload and environmental conditions using hardware and software techniques across a wide range of instrumentation systems used in an industrial environment.

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

Band: A
Unit Weight: **4**

Pre-requisite Unit

Path 1	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18104	Dismantle, replace and assemble electrical components and equipment
	MEM18108	Troubleshoot analog and digital electronic equipment

Competency Field

Maintenance and diagnostics

Unit Sector

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.	Prepare to troubleshoot systems and equipment	2.1.	Observe and localise device isolation methods/requirements
		2.2.	Apply appropriate test procedures and application principles in assessing operation of instrumentation systems and equipment
		2.3.	Apply normal operating characteristics of instrumentation systems and equipment to the level necessary to identify and localise faults
		2.4.	Apply characteristics/operational function assessment procedures according to safety and regulatory/site specifications
		2.5.	Check and verify characteristics and operational function
3.	Troubleshoot systems and equipment and localise fault conditions	3.1.	Utilise manufacturer manuals, history files and maintenance and repair records as a source of information when troubleshooting
		3.2.	Utilise drawings/diagrams and operational specifications in identifying and localising fault conditions
		3.3.	Examine and interpret built-in fault indicators and error codes and record results, where appropriate

		3.4.	Conduct appropriate tests to establish fault condition to major component level using appropriate test equipment, procedures and techniques
4.	Repair/replace faulty condition/component	4.1.	Repair faulty condition using appropriate tools, equipment and techniques to meet specifications, where applicable
		4.2.	Source replacement item and replace in accordance with manufacturer specifications
5.	Functionally test instrumentation equipment/components	5.1.	Undertake tests on equipment/components using appropriate test equipment, procedures and techniques
		5.2.	Verify system/equipment to meet specifications and operational requirements
		5.3.	Document all repairs, including results of tests carried out 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.

Tests include one or more of the following:

- determining the correct operational function of electrical, electronic, mechanical, fluid power systems, equipment, components and associated items
- tests conducted under:
  - normal
  - extreme
  - overload
  - environmental conditions using hardware and software techniques

Equipment includes one or more of the following:

- process machines
- temperature control systems
- sterilisation units
- water cooling/filtration systems
- equipment utilising mechanical, pneumatic/electro-pneumatic or electronic (analog/digital) principles
- associated instruments measuring variables, including level, pressure, light, flow, current, resistance, voltage, density and temperature

Components include one or more of the following:

- sensors
- transmitters
- converters
- indicators
- analysers
- controllers
- transducers
- power supplies
- removable circuit boards
- sensor units associated with determining/controlling density, level, flow, temperature and composition of a range of materials

Test equipment includes one or more of the following:

- system calibrators
- manometers
- dead weight testers
- wheatstone bridge
- potentiometers
- frequency/signal generators

- logic probes
- multimeters (analog/digital)
- test gauges
- cathode ray oscilloscopes (CROs)
- other associated equipment

Unit Mapping Information

No equivalent unit

Links

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

Assessment Requirements for MEM18109 Troubleshoot instrumentation systems and equipment

Modification History

Release 1. New unit

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, SOPs and safe work practices
- identifying and interpreting specifications, drawings, manufacturer manuals, history files and maintenance and repair records, and other applicable reference documents and obtaining relevant data with respect to troubleshooting instrumentation systems/equipment
- isolating instrumentation system/equipment in accordance with procedures
- checking and verifying the operational functions of the instrumentation system/equipment, including reading/recording and interpreting built-in fault indicators and error codes
- conducting appropriate tests to establish fault condition using applicable test equipment using hardware and software techniques
- repairing fault condition to meet specification requirements
- isolating and removing faulty major component and selecting replacement item from appropriate sources
- undertaking appropriate tests on instrumentation system/equipment in accordance with SOPs
- verifying system to meet operational requirements
- completing all documentation 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 PPE
- instrumentation principles controlling density, level, flow, temperature and composition of a range of materials
- effects of resistance, capacitance, inductance and impedance (R,L,C) upon electrical circuit
- interpretation requirements of schematic, wiring and block diagrams and circuits
- principles of hydraulic, pneumatic and electrical flow
- purpose/operational function of instrumentation system
- equipment and techniques to be used to test instrumentation systems and equipment, including the use of specialised test equipment
- procedures for running built-in test functions and recording identified faults
- functional tests to be carried out under normal, extreme, overload and environmental conditions
- specifications of each instrumentation system and acceptable deviations from specifications
- correct operation of the instrumentation system, including the procedures for isolating instrumentation systems
- range of faults in instrumentation system/equipment components
- variations between test results and operational specifications
- probable causes of faults in instrumentation system/equipment components and action to be taken to rectify the causes of faults
- sequence of events to be undertaken to correct faults in the instrumentation system/equipment components
- difference between real and potential faults
- function and procedural checks on instrumentation systems/equipment.

Assessment Conditions

Assessors must:

- have vocational competency in troubleshooting instrumentation systems and equipment 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* and comply with the *National Vocational Education and Training Regulator Act 2011* or equivalent legislation covering VET regulation in a non-referring State 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 manufacturer 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

MEM Companion Volume Implementation Guide - http://www.mskills.org.au/training-packages/info/

MSAENV272B Participate in environmentally sustainable work practices

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This competency covers the outcomes required to effectively measure current resource use and carry out improvements including those reducing negative environmental impacts of work practices. This unit is based on the sustainability guideline standard GCSSUS01A Participate in environmentally sustainable work practices.

Application of the Unit

Application of the unit	This competency applies to operators/team members who are required to follow procedures so as to work in an environmentally sustainable manner. This ensures regulatory compliance and also aims at minimising environmental risks and maximises the environmental performance of the process and the organisation. It includes: • Resources used • Potential environmental hazards • Improving environmental performance (within scope of competency and authority). This competency applies to all sectors of the manufacturing industry and members of its value chain. It may also be applied to all sections of an organisation, including office, warehouse etc. This unit will need to be appropriately contextualised as it is applied across an organisation and across different industry sectors.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units	This unit has **no** prerequisites	

Employability Skills Information

Employability skills	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. 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. Identify current resource use and environmental issues.	1.1. Identify workplace ***environmental and resource efficiency issues***. 1.2. Identify resources used in own work role. 1.3. ***Measure*** and record current usage of resources using ***appropriate techniques***. 1.4. Identify and report workplace environmental hazards to appropriate personnel.
2. Comply with environmental regulations.	2.1. Follow ***procedures*** to ensure ***compliance***. 2.2. Report environmental **incidents** to appropriate personnel.
3. Seek opportunities to improve environmental practices and resource efficiency.	3.1. Follow ***enterprise plans*** to improve environmental practices and resource efficiency. 3.2. Make ***suggestions*** for improvements to workplace practices in own work area.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills include the ability to:

- report as required by procedures
- follow procedures and instructions and respond to change
- ask questions and seek clarifications relating to work requirements

Reading and writing is required in order to interpretrequired procedures and complete required workplace forms/reports.

Numeracy is required to interpret numeric workplace information, readings and measurements, handle data as required and complete numeric components of workplace forms/reports.

Required knowledge

Competency includes sufficient knowledge to:

- have a basic understanding of sustainability
- know the environmental hazards/risks, resource use and inefficiencies associated with own workplace (at an appropriate level)
- know the relevant environmental and resource efficiency systems and procedures for own work area
- know the impact of laws and regulations to a level relevant to the work context

Evidence Guide

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 competence in this unit must be able to provide evidence of the ability to follow workplace procedures according to instructions given and to participate in the improvement of environmental and resource efficient work practices at own level of responsibility. Evidence must be strictly relevant to the particular workplace role.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to: • identify and measure resources used in their job • identify situations likely to lead to an environmental incident • follow procedures related to environmental performance. Consistent performance should be demonstrated. For example, look to see that: • work is routinely to procedures • the minimum of resources is used consistent with the job requirements, good practice and the procedures.
Context of and specific resources for assessment	Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge. Depending on the selected methods of assessment access may be required to: • workplace procedures and plans • documentation in relation to production, waste, overheads, hazard control/management • reports from supervisors/managers • case study/scenarios
Method of assessment	A holistic approach should be taken to the assessment. Competence in this unit may be assessed: • by demonstration in the workplace

EVIDENCE GUIDE	
	• using targeted questioning for appropriate portions • by use of a suitable simulation and/or a range of case studies/scenarios • by a combination of these techniques. In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment.
Guidance information for assessment	Assessors need to be aware of any cultural issues that may affect responses to questions. Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

Range Statement

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. 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.	
Procedures	All operations are performed in accordance with procedures including all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.
Environmental and resource efficiency issues	Environmental and resource efficiency issues include minimisation of environmental risks and maximisation of opportunities to improve business environmental performance and to promote more efficient production and consumption of natural resources, for example by: • minimisation of waste, through implementation of the waste management hierarchy • efficient and effective use of energy and other resources • seeking alternative sources of energy • efficient use of materials and appropriate disposal of waste • use of controls to minimise the risk of environmental damage from hazardous substances • efficient water use • reducing emissions • life cycle analysis applied to issues such as energy supply, materials, transport, production
Measure	Measure should be interpreted in a manner consistent with the scope of the job and may include things like: • counting the number of items entering/leaving a work area • reading indicators in the work area • obtaining relevant information from support

RANGE STATEMENT	
	personnel • other simple means
Appropriate techniques	Appropriate techniques include: • material fed to/consumed by plant/equipment • plant meters and gauges • job cards including kanbans • examination of invoices from suppliers • measurements made under different conditions • examination of relevant information and data.
Compliance	Compliance includes meeting relevant federal, state and local government laws, by-laws, regulations and mandated codes of practice. It also includes any codes and standards that the enterprise applies voluntarily.
Incidents	Incidents include: • breaches or potential breaches of regulations • occurrences outside of standard procedure which may lead to lower environmental performance.
Enterprise plans	Enterprise plans include: • documented policies and procedures • work plans to minimise waste, increase efficiency of water/energy use, minimise environmental hazards
Suggestions	Suggestions include ideas that help to: • prevent and minimise environmental risks and maximise opportunities • reduce emissions of greenhouse gases • reduce use of non-renewable resources • improve energy efficiency • increase use of renewable, recyclable, reusable and recoverable resources • reduce waste • increasing the reusability/recyclability of wastes/products • reduce water usage and/or water wastage.

Unit Sector(s)

Unit sector	

Competency field

Competency field	Competitive manufacturing tools

Co-requisite units

Co-requisite units		

UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor **1**)

1.1) Descriptor

This unit specifies the mandatory requirements of occupational health and safety and how they apply to the various electrotechnology work functions. It encompasses responsibilities for health and safety, risk management processes at all operative levels and adherence to safety practices as part of the normal way of doing work.

Application of the Unit

Not Applicable

Licensing/Regulatory Information

1.2) License to practice

During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships.

In the workplace: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c.

Other conditions may apply under State and Territory legislative and regulatory requirements.

Pre-Requisites

Prerequisite Unit(s) **2)**

2.1) Competencies

There are no prerequisite competencies for this unit.

Employability Skills Information

Employability Skills **3)**

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Application of the Unit **4)**

This unit addresses information, processes and techniques for the application of general occupational health and safety requirements in workplaces and is essential for employees without managerial or supervisory responsibilities

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a unit of competency

Elements and Performance Criteria

ELEMENT		PERFORMANCE CRITERIA	
1	Prepare to enter a work area	1.1	Work area access permits are obtained from appropriate personnel according to established procedures
		1.2	Safe work methods for controlling risk obtained, read and understood prior to undertaking a work activity.
		1.3.	Preparations for electrical and non-electrical isolation are carried out to prevent creation of hazards from loss of machine/system/process control according to established procedures.
		1.4	Tools and equipment needed for the work are checked for safety and correct functionality according to established procedures and regulatory requirements.
2	Apply safe working practices.	2.1	Safe work methods for controlling risk are followed accurately.
		2.2	Workplace procedures for dealing with accidents, fires and emergencies are followed according to work procedures and scope of responsibility and competencies.

ELEMENT	PERFORMANCE CRITERIA	
3. Follow workplace procedures for hazard identification and risk control	3.1	Hazards are identified and control measures implemented and monitored through active participation in the consultation process with employer and other employees.
	3.2	Hazards in the work area are recognised and reported to appropriate personnel according to established procedures.
	3.3	OHS records of incidents are completed in accordance with regulatory requirements and established procedures.
	3.4	Workplace instructions and training are followed accurately within established procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and applying OHS practices in the workplace.

The knowledge and skills shall be contextualised to current industry standards, technologies and practices.

KS01-EE101A Occupational Health and Safety principles

Evidence shall show an understanding of Occupational Health and Safety to an extent indicated by the following aspects

T1 The basic legal requirements covering occupational health and safety in the workplace encompassing:

- underlying principles of OH&S
- general aims and objectives of the relevant state or territory legislation relating to OH&S.
- employer and employee responsibilities, rights and obligations.
- major functions of safety committees and representatives.
- powers given to Occupational Health and Safety Inspectors
- housekeeping and potential hazards in relation to improper housekeeping
- selecting appropriate personal protective equipment (PPE) given hazardous situations

T2 The work environment encompassing:

- typical hazards associated with a range of work environments
- procedures used to control the risks associated with these hazards
- principles of risk assessment / management and state the purpose of each.
- hierarchy of OH&S hazard control measures.
- required documentation for risk assessment.
- commonly used workplace safety signs.
- workplace emergencies that pose a threat to health and safety and suitable procedure for an emergency workplace evacuation.
- appropriate fire extinguisher for a given type of fire.
- requirements for the location, mounting and maintenance of portable fire extinguishers.
- basic process of fighting a fire.
- Importance of safe premises, buildings and security in an industrial setting and the consequences of non- compliance.

REQUIRED SKILLS AND KNOWLEDGE

- standard work procedure.

T3 Manual Handling encompassing:

- typical manual handling injuries and the effect they can have on lifestyle
- situations that may cause manual handling injuries
- correct procedures for lifting and carrying to prevent manual handling injuries

T4 Chemicals in the workplace encompassing:

- hazardous substances and dangerous goods.
- classification of chemicals as hazardous substances and/or dangerous goods
- requirements for labelling of chemicals in the workplace
- safe storage procedures for chemicals
- purpose and interpretation of material safety data sheet (MSDS)

T5 Working at heights encompassing:

- dangers associated with working on ladders and scaffolds
- identification of work area as a height risk and use appropriate safety equipment to prevent a fall
- selecting an appropriate ladder for a given situation and perform a safety check before use
- precautions that should be taken when ascending and working off a ladder
- precautions that should be taken when working on and around a scaffold and elevated platforms.

T6 Confined spaces encompassing:

- hazards associated with working in a confined space
- identifying workplace situations that could be classified as a confined space
- control measures for working in a designated confined space

T7 Physical and psychological hazards encompassing:

- short and long term effects of excessive noise and techniques to avoid damage to hearing due to excessive noise
- effects of vibration on the human body and work practices to protect against vibration
- effects of thermal stress on the human body and work practices to protect against thermal stress
- effects of ultraviolet (UV) radiation on the human body and work practices to protect against UV radiation.
- dangers associated with laser operated equipment and tools and suitable protective measures to overcome the danger.
- occupational overuse syndrome, how it occurs and means to overcome it
- factors that cause stress in the workplace, symptoms of a person suffering from stress and personal stress management techniques
- detrimental effects and dangers of drug and alcohol use in the workplace

REQUIRED SKILLS AND KNOWLEDGE

T8 Working safely with electricity encompassing:

- effects of electric shock on the human body
- common causes of electrical accidents
- precautions that can minimise the chance of electric shock (earthing, extra low voltage, fuses, circuit breakers and residual current devices – RCDs)
- protection offered by a residual current device (RCD)
- need for ensuring the (safe) isolation of an electrical supply
- appropriate method of removing an electric shock victim from a live electrical situation

T9 Life support - CPR in the workplace encompassing:

- First Aid.
- responsibilities of the First Aider.
- priorities of first aid management for any accident or injury.
- procedures required at an accident scene.
- legal and ethical issues, which may impact on the management of care.
- 'Duty of Care'.
- examination of a casualty for injuries.
- effect of cardio pulmonary arrest on the body.
- Managing simulated conditions of: airway obstruction; respiratory arrest and cardio pulmonary arrest,
- single and two-person cardio pulmonary resuscitation (CPR).
- signs and symptoms of an altered level of consciousness
- management of simulation of a casualty with an altered level of consciousness.
- signs and symptoms of shock.
- management of simulation of a casualty in shock

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of the unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment	**9.1**) Longitudinal competency development approaches to

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assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline,

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work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

- Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement encompassing:
- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Applying OHS practices in the workplace as described in 8) and including:

A Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.

B Understanding and following risk control safe work methods.

C Applying work procedures and instructions as they apply to risk control measures.

D Dealing with accidents and emergencies within the scope of responsibility.

E Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

F Dealing with unplanned events

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Note:
Ability to implement these Occupation Health and Safety measures shall be demonstrated on all occasions safety issues arise.

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed in this unit.

These should be used in the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to applying OHS practices in the workplace.

Method of assessment

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:
Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units

9.5)

This unit shall be assessed concurrently, as it relates to other units undertaken in a possible skill clusters or qualification.

Components of this unit are included in the critical aspects of

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evidence of all units to help ensure the appropriate level of responsibility for safety has been acquired

Range Statement

RANGE STATEMENT

8) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to each of the following

- Relevant Occupational Health and Safety legislation, regulations and codes of practice related to hazards present in the industry and particular workplace
- Accepted industry work procedures and the specific safety procedures and work instructions for particular workplace.

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not Applicable

Competency Field

2.2) Literacy and numeracy skills

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	3	Writing	3	Numeracy	3

Custom Content Section

Competency Field **5**)

Electrotechnology

UEENEEE104A Solve problems in d.c. circuits

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor **1**)

1.1) Descriptor

This unit covers determining correct operation of single source d.c. series, parallel and series-parallel circuits and providing solutions as they apply to various electrotechnology work functions. It encompasses working safely, problem solving procedures, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in single and multiple path circuits.

Application of the Unit

Not Applicable

Licensing/Regulatory Information

1.2) License to practice

During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships.

In the workplace: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c.

Other conditions may apply under State and Territory legislative and regulatory requirements.

Pre-Requisites

Prerequisite Unit(s) **2)**

2.1) Competencies

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace

Employability Skills Information

Employability Skills **3**)

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Application of the Unit **4**)

4.1) **General Application**

This unit applies to competency development entry-level employment based programs incorporated in approved contracts of training.

4.2) **Importation**

RTOs wishing to import this unit into any qualification under the flexibility provisions of NQC Training Package Policy

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a unit of competency

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to work on d.c. electrical circuits.	1.1 OHS procedures for a given work area are identified, obtained and understood.
	1.2 OHS risk control work preparation measures and procedures are followed.

ELEMENT		PERFORMANCE CRITERIA	
		1.3	The nature of the circuit problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.
		1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.
		1.5	Sources of materials that may be required for the work are identified and accessed in accordance with established procedures.
		1.6	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.
2	Solve d.c. circuit problems.	2.1	OHS risk control work measures and procedures are followed.
		2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.
		2.3	Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures.
		2.4	Established methodological techniques are used to solve d.c. circuit problems from measure and calculated values as they apply to electrical circuit.
		2.5	Unexpected situations are dealt with safely and with the approval of an authorised person.
		2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.
3	Complete work and document problem solving activities.	3.1	OHS work completion risk control measures and procedures are followed.
		3.2	Work site is cleaned and made safe in accordance with established procedures.
		3.3	Justification for solutions used to solve circuit problems is documented.

ELEMENT	PERFORMANCE CRITERIA
	3.4 Work completion is documented and appropriate person(s) notified in accordance with established procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and solving problems in d.c. circuits.

The knowledge and skills shall be contextualised to current industry standards, technologies and practices.

KS01-EE104A Direct current circuits

Evidence shall show an understanding of electrical fundamentals and direct current multiple path circuits to an extent indicated by the following aspects:

T1 Basic electrical concepts encompassing:

- electrotechnology industry
- static and current electricity
- production of electricity by renewable and non renewable energy sources
- transportation of electricity from the source to the load via the transmission and distribution systems
- utilisation of electricity by the various loads
- basic calculations involving quantity of electricity, velocity and speed with relationship to the generation and transportation of electricity.

T2 Basic electrical circuit encompassing:

- symbols used to represent an electrical energy source, a load, a switch and a circuit protection device in a circuit diagram
- purpose of each component in the circuit
- effects of an open-circuit, a closed-circuit and a short-circuit
- multiple and sub-multiple units

T3 Ohm's Law encompassing:

- basic d.c. single path circuit.
- voltage and currents levels in a basic d.c. single path circuit.
- effects of an open-circuit, a closed-circuit and a short-circuit on a basic d.c. single path relationship between voltage and current from measured values in a simple circuit
- determining voltage, current and resistance in a circuit given any two of these quantities
- graphical relationships of voltage, current and resistance
- relationship between voltage, current and resistance

REQUIRED SKILLS AND KNOWLEDGE

T4 Electrical power encompassing:

- relationship between force, power, work and energy
- power dissipated in circuit from voltage, current and resistance values
- power ratings of devices
- measurement electrical power in a d.c. circuit
- effects of power rating of various resistors

T5 Effects of electrical current encompassing:

- physiological effects of current and the fundamental principles (listed in AS/NZS 3000) for protection against the this effect
- basic principles by which electric current can result in the production of heat; the production of magnetic fields; a chemical reaction
- typical uses of the effects of current
- mechanisms by which metals corrode
- fundamental principles (listed in AS/NZS3000) for protection against the damaging effects of current

T6 EMF sources energy sources and conversion electrical energy encompassing:

- basic principles of producing a emf from the interaction of a moving conductor in a magnetic field.
- basic principles of producing an emf from the heating of one junction of a thermocouple.
- basic principles of producing a emf by the application of sun light falling on the surface of photovoltaic cells
- basic principles of generating a emf when a mechanical force is applied to a crystal (piezo electric effect)
- principles of producing a electrical current from primary, secondary and fuel cells
- input, output, efficiency or losses of electrical systems and machines
- effect of losses in electrical wiring and machines
- principle of conservation of energy

T7 Resistors encompassing:

- features of fixed and variable resistor types and typical applications
- identification of fixed and variable resistors
- various types of fixed resistors used in the Electro technology Industry. e.g. wire-wound, carbon film, tapped resistors.
- various types of variable resistors used in the Electro technology Industry e.g. adjustable resistors: potentiometer and rheostat; light dependent resistor (LDR); voltage dependent resistor (VDR) and temperature dependent resistor (NTC, PTC).
- characteristics of temperature, voltage and light dependent resistors and typical applications of each
- power ratings of a resistor.
- power loss (heat) occurring in a conductor.

REQUIRED SKILLS AND KNOWLEDGE

- resistance of a colour coded resistor from colour code tables and confirm the value by measurement.
- measurement of resistance of a range of variable' resistors under varying conditions of light, voltage, temperature conditions.
- specifying a resistor for a particular application.

T8 Series circuits encompassing:

- circuit diagram of a single-source d.c. 'series' circuit.
- Identification of the major components of a 'series' circuit: power supply; loads; connecting leads and switch
- applications where 'series' circuits are used in the Electro technology industry.
- characteristics of a 'series' circuit - connection of loads, current path, voltage drops, power dissipation and affects of an open circuit in a 'series' circuit.
- the voltage, current, resistances or power dissipated from measured or given values of any two of these quantities
- relationship between voltage drops and resistance in a simple voltage divider network.
- setting up and connecting a single-source series dc circuit
- measurement of resistance, voltage and current values in a single source series circuit
- effect of an open-circuit on a series connected circuit

T9 Parallel circuits encompassing:

- schematic diagram of a single-source d.c. 'parallel' circuit.
- major components of a 'parallel' circuit (power supply, loads, connecting leads and switch)
- applications where 'parallel' circuits are used in the Electrotechnology industry.
- characteristics of a 'parallel' circuit. (load connection, current paths, voltage drops, power dissipation, affects of an open circuit in a 'parallel' circuit).
- relationship between currents entering a junction and currents leaving a junction
- relationship between branch currents and resistances in a two branch current divider network.
- calculation of the total resistance of a 'parallel' circuit.
- calculation of the total current of a 'parallel' circuit.
- Calculation of the total voltage and the individual voltage drops of a 'parallel' circuit.
- setting up and connecting a single-source d.c. parallel circuit
- resistance, voltage and current measurements in a single-source parallel circuit
- voltage, current, resistance or power dissipated from measured values of any of these quantities
- output current and voltage levels of connecting cells in parallel.

T10 Series/parallel circuits encompassing:

REQUIRED SKILLS AND KNOWLEDGE

- schematic diagram of a single-source d.c. 'series/parallel' circuit.
- major components of a 'series/parallel' circuit (power supply, loads, connecting leads and switch)
- applications where 'series/parallel' circuits are used in the Electrotechnology industry.
- characteristics of a 'series/parallel' circuit. (load connection, current paths, voltage drops, power dissipation, affects of an open circuit in a 'series/parallel' circuit).
- relationship between voltages, currents and resistances in a bridge network.
- calculation of the total resistance of a 'series/parallel' circuit.
- calculation of the total current of a 'series/parallel' circuit.
- calculation of the total voltage and the individual voltage drops of a 'series/parallel' circuit.
- setting up and connecting a single-source d.c. series/ parallel circuit
- resistance, voltage and current measurements in a single-source d.c. series / parallel circuit
- the voltage, current, resistances or power dissipated from measured values of any two of these quantities

T11 Factors affecting resistance encompassing:

- four factors that affect the resistance of a conductor (type of material, length, cross-sectional area and temperature)
- affect the change in the type of material (resistivity) has on the resistance of a conductor.
- affect the change in 'length' has on the resistance of a conductor.
- affect the change in 'cross-sectional area' has on the resistance of a conductor.
- effects of temperature change on the resistance of various conducting materials
- effects of resistance on the current-carrying capacity and voltage drop in cables.
- calculation of the resistance of a conductor from factors such as conductor length, cross-sectional area, resistivity and changes in temperature
- using digital and analogue ohmmeter to measure the change in resistance of different types of conductive materials (copper, aluminium, nichrome, tungsten) when those materials undergo a change in type of material length, cross-sectional area and temperature.

T12 Effects of meters in a circuit encompassing:

- selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application.
- measuring resistance using direct, volt-ammeter and bridge methods.
- instruments used in the field to measure voltage, current, resistance and insulation resistance and the typical circumstances in which they are used.
- hazards involved in using electrical instruments and the safety control measures that should be taken.
- operating characteristics of analogue and digital meters.

REQUIRED SKILLS AND KNOWLEDGE

- correct techniques to read the scale of an analogue meters and how to reduce the 'parallax' error.
- types of voltmeters used in the Electrotechnology industry – bench type, clamp meter, Multimeter, etc.
- purpose and characteristics (internal resistance, range, loading effect and accuracy) of a voltmeter.
- types of voltage indicator testers. e.g. LED, neon, solenoid, volt-stick, series tester, etc. and explain the purpose of each voltage indicator tester.
- operation of various voltage indicator testers.
- advantages and disadvantages of each voltage indicator tester.
- various types of ammeters used in the Electrotechnology industry – bench, clamp meter, multimeter, etc.
- purpose of an ammeter and the correct connection (series) of an ammeter into a circuit.
- reasons why the internal resistance of an ammeter must be extremely low and the dangers and consequences of connecting an ammeter in parallel and/or wrong polarity.
- selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application
- connecting an analogue/digital voltmeter into a circuit ensuring the polarities are correct and take various voltage readings.
- loading effect of various voltmeters when measuring voltage across various loads.
- using voltage indicator testers to detect the presence of various voltage levels.
- connecting analogue/digital ammeter into a circuit ensuring the polarities are correct and take various current readings.

T13 Resistance measurement encompassing:

- Identification of instruments used in the field to measure resistance (including insulation resistance) and the typical circumstances in which they are used.
- the purpose of an Insulation Resistance (IR) Tester.
- the parts and functions of various analogue and digital IR Tester (selector range switch, zero ohms adjustment, battery check function, scale and connecting leads).
- reasons why the supply must be isolated prior to using the IR tester.
- where and why the continuity test would be used in an electrical installation.
- where and why the insulation resistance test would be used in an electrical installation.
- the voltage ranges of an IR tester and where each range may be used. e.g. 250 V d.c, 500 V d.c and 1000 V d.c
- AS/NZS3000 Wiring Rules requirements – continuity test and insulation resistance (IR) test.
- purpose of regular IR tester calibration.
- the correct methods of storing the IR tester after use
- carry out a calibration check on a IR Tester

REQUIRED SKILLS AND KNOWLEDGE

- measurement of low values of resistance using an IR tester continuity functions.
- measurement of high values of resistance using an IR tester insulation resistance function.
- volt-ammeter (short shunt and long shunt) methods of measuring resistance.
- calculation of resistance values using voltmeter and ammeter reading (long and short shunt connections)
- measurement of resistance using volt-ammeter methods

T14 Capacitors and Capacitance encompassing:

- basic construction of standard capacitor, highlighting the: plates, dielectric and connecting leads
- different types of dielectric material and each dielectric's relative permittivity.
- identification of various types of capacitors commonly used in the Electrotechnology industry (fixed value capacitors -stacked plate, rolled, electrolytic, ceramic, mica and Variable value capacitors – tuning and trimmer)
- circuit symbol of various types of capacitors: standard; variable, trimmer and polarised
- terms: Capacitance (C), Electric charge (Q) and Energy (W)
- unit of: Capacitance (Farad), Electric charge (Coulomb) and Energy (Joule)
- factors affecting capacitance (the effective area of the plates, the distance between the plates and the type of dielectric) and explain how these factors are present in all circuits to some extent.
- how a capacitor is charged in a d.c. circuit.
- behaviour of a series d.c. circuit containing resistance and capacitance components. - charge and discharge curves
- the term 'Time Constant' and its relationship to the charging and discharging of a capacitor.
- calculation of quantities from given information: Capacitance (Q = VC); Energy (W =½CV2); Voltage (V = Q/C)
- calculation one time constant as well as the time taken to fully charge and discharge a given capacitor. ($\tau = RC$)
- connection of a series d.c. circuit containing capacitance and resistor to determine the time constant of the circuit

T15 Capacitors in Series and Parallel encompassing:

- hazards involved in working with capacitance effects and the safety control measures that should be taken.
- safe handling and the correct methods of discharging various size capacitors
- dangers of a charged capacitor and the consequences of discharging a capacitor through a person
- factors which determine the capacitance of a capacitor and explain how these factors are present in all circuits to some extent.
- effects of capacitors connected in parallel by calculating their equivalent capacitance.

REQUIRED SKILLS AND KNOWLEDGE

- effects on the total capacitance of capacitors connected in series by calculating their equivalent capacitance.
- Connecting capacitors in series and/or parallel configurations to achieve various capacitance values.
- common faults in capacitors.
- testing of capacitors to determine serviceability.
- application of capacitors in the Electrotechnology industry.

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of the unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment

9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to

EVIDENCE GUIDE

be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

EVIDENCE GUIDE

- Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Solving problems in d.c. circuits as described in 8) and including:

    A Using methodological techniques to solve d.c. circuit problems from measure and calculated values

    B Determining the operating parameters of an existing circuit.

    C Altering an existing circuit to comply with specified operating parameters.

    D Developing circuits to comply with a specified function and operating parameters.

    E Dealing with unplanned events

EVIDENCE GUIDE

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed in this unit.

These should be used in the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to solving problems in d.c. circuits.

Method of assessment

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:
Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units

9.5)

There are no concurrent assessment recommendations for this unit.

Range Statement

RANGE STATEMENT

8) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to single source series, parallel and series-parallel d.c. circuits as they apply to problems related to installation, fault finding, maintenance or development work functions and at least two of the following types of circuit problems and on more than one occasions:

- Determining the operating parameters of an existing circuit
- Altering an existing circuit to comply with specified operating parameters
- Developing circuits to comply with a specified function and operating parameters

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not Applicable

Competency Field

2.2) Literacy and numeracy skills

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	3	Writing	3	Numeracy	3

2.2) Literacy and numeracy skills

Competency Field **5**)

Electrotechnology

UEENEEE107A Use drawings, diagrams, schedules, standards, codes and specifications

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor **1**)

1.1) **Descriptor**

This unit covers the use of drawings, diagrams, cable schedules, standards, codes and specifications as they apply to the various electrotechnology work functions. It encompasses the rudiments for communicating with schematic, wiring and mechanical diagrams and equipment and cable/connection schedules, manuals, site and architectural drawings and plans showing the location of services, apparatus, plant and machinery and understanding the use and format of compliance standards and job specifications.

Application of the Unit

Not Applicable

Licensing/Regulatory Information

1.2) License to practice

During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships.

In the workplace: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c.

Other conditions may apply under State and Territory legislative and regulatory requirements.

Pre-Requisites

Prerequisite Unit(s)

2)

2.1) Competencies

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace

Employability Skills Information

Employability Skills **3**)

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Application of the Unit **4**)

4.1) **General Application**

This unit applies to competency development entry-level employment based programs incorporated in approved contracts of training.

4.2) **Importation**

RTOs wishing to import this unit into any qualification under the flexibility provisions of NQC Training Package Policy

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a unit of competency

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA	
1 Prepare to use drawings, diagrams, schedules and manuals.	1.1	Established OHS risk control measures and procedures are followed.
	1.2	The need for drawings, diagrams, schedules or manuals is determined from the nature of the work to be undertaken.

ELEMENT	PERFORMANCE CRITERIA	
	1.3	Established routines and procedures are followed to obtain drawings, diagrams, schedules or manuals required for the work to be undertaken.
2 Use drawings, diagrams, schedules and manuals to obtain job information.	2.1	Drawings, diagrams, schedules and/or manuals are selected, appropriate to the work being undertaken.
	2.2	Drawings, diagrams and schedules are interpreted using knowledge of drawing layouts, conventions and symbols.
	2.3	Dimensions are extracted from drawings and diagrams for application to work undertaken.
	2.4	Location of equipment is determined from equipment schedules and location diagrams.
	2.5	Manuals are reviewed to ascertain their format and where information relevant to the work to be undertaken is located.
	2.6	Information given in manuals is interpreted in relation to the work to be undertaken.
3 Use drawings, diagrams, schedules and manuals to convey information and ideas.	3.1	Drawing conventions are used in neat freehand drawings to convey information and ideas to others involved in the work to be undertaken.
	3.2	Drawing conventions are used to neatly correct freehand original job drawing to show final 'as-installed' arrangement.
	3.3	Corrected drawings are forwarded to appropriate person(s) in accordance with established procedures.
4 Prepare to use compliance standards, codes and specifications.	4.1	Compliance Standards and Codes that apply to particular disciplines are sought and obtained.
	4.2	The format of compliance Standards and Codes that apply to particular disciplines are reviewed and understood.
	4.3	The purpose and format and typical content of job specifications are reviewed and understood.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and using drawings, diagrams, cable schedules, standards, codes and specifications.

The knowledge and skills shall be contextualised to current industry standards, technologies and practices.

KS01-EE107A Drawings, diagrams and schedules

Evidence shall show an understanding of drawings, diagrams and schedules used in electrotechnology work to an extent indicated by the following aspects:

T1 Architectural drawings encompassing:

- site plans, floor plans detailed drawings and standard drawings
- architectural floor plan to determine the power and lighting or communications / audio/ video layouts required in a domestic installation
- site plan to locate the service point, consumers mains, communication services, main switchboard, distribution boards and/or builders supplies.
- standard drawing scales to determine the actual lengths represented by dimensions on an architectural drawing.
- reading and interpretation of floor plans to determine the location of the electrical/ communication/audio accessories and appliances.
- Australian standard symbols used on floor plans to show the location of the accessories and appliances as detailed in an electrical schedule.

T2 Electrical drawings encompassing:

- types of electrical drawings: block, circuit, wiring and ladder diagrams
- purpose and application of block, circuit, wiring diagrams and ladder diagrams
- Australian standard symbols used to represent components on electrical diagrams.
- conventions used in and the features of circuit diagrams
- converting a circuit diagram to a wiring diagram
- identification of cable type, origin and route from a cable schedule.
- developing a cable schedule for a given installation.

T3 Circuit diagrams encompassing:

- purpose of circuit diagrams in the electrotechnology industry
- conventions used in and the features of circuit diagrams
- sketching basic circuit diagrams
- common symbols used in circuit diagram (Australian Drawing Standard AS/NZS 1102)

REQUIRED SKILLS AND KNOWLEDGE

- developing switching charts to identify the terminals of various types of switches
- connecting equipment using circuit diagrams.

T4 Wiring diagrams encompassing:

- purpose of wiring diagrams in the electrotechnology industry
- conventions used in and the features of wiring diagrams
- sketching basic wiring diagrams
- common symbols used in wiring diagram (Australian Drawing Standard AS/NZS 1102)
- connecting equipment using wiring diagrams.

T5 Building construction drawings and diagrams encompassing:

- building types: timber frame, brick veneer, double brick and metal frame.
- identification of different types of: footings, floors, external walls, roofs, interior walls
- typical cable routes through buildings, structures and premises
- sequence of each constructional stage for brick, brick veneer and timber cottages
- identification of the stages at which the electrical/communications - first and second fixing occurs in the constructional sequence
- areas of cooperation between electrical/communications and other building trades

KS02-EE107A Introduction to regulations, compliance standards and codes

Evidence shall show an understanding of regulations, compliance standards and codes that apply to electrical work to an extent indicated by the following aspects:

T1 Regulation for undertaking electrical work encompassing:

- scope of work covered by licensing in the electrotechnology industry (Electrical licensing)
- legislative requirements for ensuring electrical or electronic equipment is safe i.e. compliance requirements of electrical installations

T2 Standards philosophy and format encompassing:

- performance verses prescriptive requirements
- purpose of technical standards and their development
- role of standards Australia/New Zealand, International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC)
- how standards are used in compulsory and accreditation compliance schemes.
- arrangement and use of technical standards in relation to electrical and electronic work
- how to read and apply a standard.
- Standards and codes that apply to all types of electrical installations
- Standards include Standards mandated under regulation (e.g. Wiring Rules) or by an authority, deemed-to-comply standard and local service requirements (e.g. Service rules).
- Codes include those applicable to electrical safe working practices and some aspects of

REQUIRED SKILLS AND KNOWLEDGE

the Building Code of Australia.

T3 Purpose, format and content of typical job specifications encompassing:

- NATSPEC specification system - provide the most common templates on which job specification are written.

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of the unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment

9.**1**)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and

EVIDENCE GUIDE

operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
  - Demonstrate an appropriate level of skills enabling employment
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Use drawings, diagrams, schedules, standards, codes and specifications as described in 8) Range and including:

    A Identifying drawings, diagrams, schedules and manuals relevant to the work to be undertaken.

    B Interpreting drawings, diagrams, schedules and manuals correctly.

EVIDENCE GUIDE

	C	Using correct conventions in freehand drawings.
	D	Giving correct information in freehand drawings.
	E	Obtaining compliance Standards and Codes applicable to particular disciplines
	F	Reviewing and understanding the format of compliance Standards and Codes that apply to particular disciplines
	G	Reviewing the format and content of typical job specifications.
	H	Dealing with unplanned events

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed in this unit.

These should be used in the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to using drawings, diagrams, schedules and manuals.

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Method of assessment	**9.4**) This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'. Note: Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.
Concurrent assessment and relationship with other units	**9.5**) For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with units covering the use of drawings, diagrams, schedules, standards, codes or specifications is required.

Range Statement

RANGE STATEMENT

8) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to assembly, installation, fault finding, maintenance or development work functions in any of the following disciplines:

- Appliances
- Business equipment
- Computers
- Data Communications
- Electrical
- Electrical Machines
- Electronics
- Fire protection
- Instrumentation
- Refrigeration and Air Conditioning
- Renewable / sustainable energy, and
- Security technology

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not Applicable

Competency Field

2.2) Literacy and numeracy skills

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	3	Writing	3	Numeracy	3

Custom Content Section

Competency Field **5**)

Electrotechnology

UEENEEG101A Solve problems in electromagnetic devices and related circuits

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor **1**)

1.1) **Descriptor**

This unit covers determining correct operation of electromagnetic devices and related circuits and providing solutions as they apply to electrical installations and equipment. It encompasses working safely, power circuit problems solving processes, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in electromagnetic devices and related circuits.

Application of the Unit

Not Applicable

Licensing/Regulatory Information

1.2) License to practice

During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships.

In the workplace: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c.

Other conditions may apply under State and Territory legislative and regulatory requirements.

Pre-Requisites

Prerequisite Unit(s) **2)**

2.1) Competencies

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE104A	Solve problems in d.c circuits

Employability Skills Information

Employability Skills **3)**

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Application of the Unit **4)**

4.1) General Application

This unit applies to all qualifications, competencies and/or Skill Sets which require an electrical licence.

4.2) Importation

RTOs wishing to import this unit into any qualification under the flexibility provisions of NQC Training Package Policy

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a unit of competency

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to work on electromagnetic devices and circuits.	1.1 OHS procedures for a given work area are identified, obtained and understood.
	1.2 OHS risk control work preparation measures and procedures are followed.
	1.3 The nature of the device(s)/circuit(s) problem is obtained from documentation or from work supervisor

ELEMENT	PERFORMANCE CRITERIA	
		to establish the scope of work to be undertaken.
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.
	1.5	Sources of materials that may be required for the work are established in accordance with established procedures.
	1.6	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.
2 Solve electromagnetic devices/circuit problems.	2.1	OHS risk control work measures and procedures are followed.
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.
	2.3	Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures.
	2.4	Established methods are used to solving circuit problems from measure and calculated values as they apply to electromagnetic devices/circuits.
	2.5	Unexpected situations are dealt with safely and with the approval of an authorised person.
	2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.
3 Complete work and document problem solving activities.	3.1	OHS work completion risk control measures and procedures are followed.
	3.2	Work site is cleaned and made safe in accordance with established procedures.
	3.3	Justification for solutions used to solve circuit problems is documented.
	3.4	Work completion is documented and an appropriate person or persons notified in accordance with established procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and solving problems in electromagnetic devices and related circuits.

The knowledge and skills shall be contextualised to current industry standards, technologies and practices.

KS01-EG101A Electromagnetic devices and circuits

Evidence shall show an understanding of electromagnetic devices and circuits to an extent indicated by the following aspects:

T1 Magnetism encompassing:

- magnetic field pattern of bar and horse-shoe magnets.
- magnets attraction and repulsion when brought in contact with each other.
- common magnetic and non-magnetic materials and groupings (diamagnetic, paramagnetic and ferromagnetic materials).
- principle of magnetic screening (shielding) and its applications.
- practical applications of magnets
- construction, operation and applications of reed switches.

T2 Electromagnetism encompassing:

- conventions representing direction of current flow in a conductor.
- magnetic field pattern around a single conductor and two adjacent conductors carrying current.
- Using the “right hand rule” to determine the direction of magnetic field around a current carrying conductor.
- direction of force between adjacent current carrying conductors.
- effect of current, length and distance apart on the force between conductors (including forces on bus bars during fault conditions).
- magnetic field around an electromagnet.
- Using the “right hand rule” to determine the direction of magnetic field around a current carrying coil.
- magnetomotive force (m.m.f.) and its relationship to the number of turns in a coil and the current flowing in the coil.
- practical applications of electromagnets.

T3 Magnetic circuits encompassing:

- magnetic characteristic curve for various materials and identify the various regions.
- Identify the various conditions of a magnetic material from its Hysteresis loop.

REQUIRED SKILLS AND KNOWLEDGE

- factors which determine losses in magnetic material.
- methods used to reduce electrical losses in a magnetic circuit.
- magnetic flux (definition, unit and symbol).
- reluctance as the opposition to the establishment of magnetic flux.
- permeability (definition, symbol and unit).
- difference for magnetic and non-magnetic materials in regards to reluctance and permeability.
- calculation of m.m.f., flux or reluctance given any two values.
- flux density (definition, symbol, unit and calculation).
- magnetising force (definition, symbol, unit and calculation).
- common magnetic circuit types.
- effect of an air gap in a magnetic circuit.
- terms “magnetic leakage” and “magnetic fringing”.

T4 Electromagnetic induction encompassing:

- principle of electromagnetic induction (Faraday’s law of electromagnetic induction).
- applying “Fleming’s right hand rule” to a current a carrying conductor under the influence of a magnetic field.
- calculation of induced e.m.f. in a conductor given the conductor length, flux density and velocity of the conductor.
- calculation of induced e.m.f. in a coil given the number of turns in a coil and the rate of change of flux.
- calculation of force on a conductor given the flux density of the magnetic field, length of the conductor and the current being carried by the conductor.
- Lenz’s law
- applications of electromagnetic induction

T5 Inductance encompassing:

- construction of an inductor, including a bifilar winding inductor.
- Australian Standard circuit diagram symbol for the four types of inductor.
- effect of physical parameters on the inductance of an inductor.
- common types of inductor cores.
- applications of the different types of inductors.
- definition of terms self induction, inductance and mutual inductance.
- calculation of value of self induced e.m.f. in a coil.
- mutual induction occurs between two coils.
- graphical relationship between load voltage, current and self induced e.m.f. in a single d.c. circuit having inductance.
- practical applications for the effects of self and mutual induction.
- undesirable effects of self and mutual induction.
- definition of term “time constant” and draw the characteristic curve as applied to a series circuit containing an inductor and a resistor. (LR circuit)Calculation of value

REQUIRED SKILLS AND KNOWLEDGE

of the time constant for an LR circuit given the values of the components.

- time constants required for the current in an LR circuit to reach its final value.
- determining of instantaneous values of voltage and current in an LR circuit using a universal time constant chart.

T6 Measurement Instruments encompassing:

- moving coil, moving iron, dynamometer meter movements and clamp testers.
- practical applications for moving coil, moving iron and dynamometer meter movements.
- Calculation of resistance of shunts and multipliers to extend the range of ammeters and voltmeters.
- factors to be considered in selecting meters for a particular application.
- safety category of meters and their associated applications.
- steps and procedures for the safe use, care and storage of electrical instruments.

T7 Magnetic devices encompassing:

- construction, operation and applications of relays.
- construction, operation and applications of contactors.
- magnetic methods used to extinguish the arc between opening contacts.
- construction, operation and applications of Hall Effect devices.
- operation and applications of magnetostriction equipment.
- construction, operation and application of magnetic sensing devices.

T8 Machine principles encompassing:

- basic operating principle of a generator.
- applying Fleming's right hand rule for generators.
- basic operating principle of a motor.
- applying Fleming's left hand rule for motors.
- calculation of force and torque developed by a motor.

T9 Rotating machine construction, testing and maintenance encompassing:

- components of a d.c. machine.
- difference between a generator and a motor in terms of energy conversion.
- nameplate of a machine.
- using electrical equipment to make electrical measurements and comparison of readings with nameplate ratings.
- Identification of faults in a machine from electrical measurements.
- care and maintenance processes for rotating machines
- safety risks associated with using rotating machinery.

T10 Generators encompassing:

- basic operation of a d.c generator.
- calculation of generated and terminal voltage of a d.c. shunt generator

REQUIRED SKILLS AND KNOWLEDGE

- prime movers, energy sources and energy flow used to generate electricity.
- types of d.c. generators and their applications.
- methods of excitation used for d.c generators.
- equivalent circuit for a d.c. generator.
- importance of residual magnetism for a self excited generator.
- open circuit characteristics of d.c. generators.
- load characteristics of a d.c generator.
- reversing the polarity of a d.c. generator
- Connect and test a d.c generator on no-load and load
- Identify safety risks associated with using generators.

T11 Motors encompassing:

- operation of a motor and its energy flow.
- effect of back e.m.f. in d.c. motors
- torque as the product of the force on the conductors and the radius of the armature/rotor.
- types of d.c. motors and their applications.
- circuit diagrams for the types of d.c. motors.
- equivalent circuit for the types of d.c. motors.
- calculation of power output of a motor.
- characteristics of the different types of d.c. motors.
- connection and testing a d.c. shunt motor on no-load and load
- reversing the direction of rotation of a d.c. motor.
- safety risks associated with using motors (include risks of series d.c. motors).

T12 Machine efficiency encompassing:

- losses that occur in a d.c machine.
- methods used to determine the losses in a d.c. machine.
- calculation of losses and efficiency of a d.c machine.
- efficiency characteristic of a d.c. machine and the conditions for maximum efficiency.
- application of Minimum Energy Performance standards (MEPS).
- methods used to maintain high efficiency.

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

EVIDENCE GUIDE

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment

9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also

EVIDENCE GUIDE

comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
  - Demonstrate an appropriate level of skills enabling employment
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Solve problems in electromagnetic circuits as described as described in 8) and including:

    A Using methodological techniques to solve problems in circuits with an electromagnetic device from measure and calculated values

    B Determining the operating parameters of an existing circuit with an electromagnetic device.

    C Alternating an existing circuit with an electromagnetic device to comply with specified operating parameters.

    D Developing circuits with electromagnetic devices to comply with a specified function and operating parameters.

    E Dealing with unplanned events

EVIDENCE GUIDE

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to solving problems in electromagnetic devices and related circuits.

Method of assessment

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:
Competent performance with inherent safe working practices is expected in the industry to which this unit applies. This requires assessment in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units

9.5)

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

Range Statement

RANGE STATEMENT

8) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to solving problems in electromagnetic devices and related circuits by:

- Determining the operating parameters of an existing circuits with electromagnetic devices
- Altering an existing circuit with an electromagnetic device to comply with specified operating parameters
- Developing circuit with an electromagnetic device to comply with a specified function and operating parameters

AND

In relation to the following on more than one occasions:

Solving problems

- Connecting circuits,
- Using methodological problem solving techniques,
- Solving electromagnetic device problems,
- Demonstrate an understanding of the behaviour of current and voltage in circuits with electromagnetic devices
- Calculating circuit parameters accurately,

Circuit and device testing

- Choose correct instruments and ranges for testing,
- Connect meters to measure parameters in circuits with electromagnetic devices,

and

At least four of the following electromagnetic devices

- Reed switches
- Solenoids
- Relays
- Contactors
- Inductive limit switches
- Bells

RANGE STATEMENT

- Lifting magnets
- Core balance devices
- Magnetic overloads
- Motors
- Generators
- Magnetic brakes
- Magnetic circuit breakers

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not Applicable

Competency Field

2.2) Literacy and numeracy skills

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	4	Writing	4	Numeracy	4

2.2) Literacy and numeracy skills

Competency Field **5)**

Electrical

UEENEEG102A Solve problems in low voltage a.c. circuits

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor **1**)

1.1) **Descriptor**

This unit covers ascertaining correct operation of single and three phase a.c. circuits and solving circuit problems as they apply to servicing, fault finding, installation and compliance work functions. It encompasses safe working practices, multiphase circuit arrangements, issues related to protection, power factor and MEN systems and solutions to circuit problems derived from calculated and measured parameters.

Application of the Unit

Not Applicable

Licensing/Regulatory Information

1.2) License to practice

During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships.

In the workplace: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c.

Other conditions may apply under State and Territory legislative and regulatory requirements.

Pre-Requisites

Prerequisite Unit(s) **2)**

2.1) Competencies

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE104A	Solve problems in d.c circuits
UEENEEG101A	Solve problems in electromagnetic devices and related circuits

Employability Skills Information

Employability Skills **3)**

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Application of the Unit **4)**

4.1) General Application

This unit applies to all qualifications, competencies and/or Skill Sets which require an electrical licence.

4.2) Importation

RTOs wishing to import this unit into any qualification under the flexibility provisions of NQC Training Package Policy

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a unit of competency

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to solve low voltage a.c. circuit problems.	1.1 OHS procedures for a given work area are identified, obtained and understood.
	1.2 Established OHS risk control measures and procedures in preparation for the work are followed.
	1.3 Safety hazards, which have not previously been identified, are noted and established risk control

ELEMENT	PERFORMANCE CRITERIA	
		measures are implemented.
	1.4	The nature of the circuit(s) problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.
	1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.
	1.6	Sources of materials that may be required for the work are established in accordance with established procedures.
	1.7	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.
2 Solve low voltage a.c. circuit problems.	2.1	OHS risk control measures and procedures for carrying out the work are followed.
\	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.
	2.4	Established methods are used to solve circuit problems from measure and calculated values as they apply to single and three-phase low voltage circuit.
	2.5	Unexpected situations are dealt with safely and with the approval of an authorised person.
	2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.
3 Complete work and document problem solving activities.	3.1	OHS work completion risk control measures and procedures are followed.
	3.2	Work site is cleaned and made safe in accordance with established procedures.
	3.3	Justification for solutions used to solve circuit problems is documented.

ELEMENT	PERFORMANCE CRITERIA
	3.4 Work completion is documented and an appropriate person or persons notified in accordance with established procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

7) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and Solving single and three phase low voltage circuit problems.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EG102A Alternating current power circuits

Evidence shall show an understanding of alternating currents power circuits to an extent indicated by the following aspects:

T1 Alternating Current Quantities encompassing:

- sine, cosine and tangent ratios of a right angle triangle
- Pythagoras Theorem to a right angle triangle.
- use of the CRO to measure d.c. and a.c. voltage levels
- sinusoidal voltage generated by a single turn coil rotated in a uniform magnetic fields
- terms 'period', 'maximum value', 'peak-to-peak value', 'instantaneous value', 'average value', 'root-mean-square (r.m.s.) value', in relation to a sinusoidal waveform.
- calculation of the instantaneous value of induced voltage of a generated sinusoidal waveform.
- measurement of instantaneous, peak, peak-to-peak values and the period of a sinusoidal waveform.
- calculation of root-mean-square (r.m.s.) value and frequency of a sinusoidal waveform from values of peak voltage and period.

T2 Phasors Diagrams encompassing:

- purpose of phasor diagrams
- 'in-phase', 'out-of-phase', 'phase angle" lead' and 'lag'.
- phase angle between two or more alternating quantities from a given sinusoidal waveform diagram.
- convention for representing voltage, current and the reference quantity in a phasor diagram.
- drawing phasor diagrams to show the relationship between two or more a.c. values of voltage and/or current.
- determination of phase relationship between two or more sinusoidal waveforms from a given diagram and measurements.

T3 Single Element a.c. circuits encompassing:

- setting up and connect a single-source resistive a.c. circuit and take voltage and current

REQUIRED SKILLS AND KNOWLEDGE

measurements to determine the resistance

- determining the voltage, current resistances from measure of given values of any tow of these qualities.
- relationship between voltage drops and current in resistive a.c. circuit
- applications of resistive a.c. circuits
- defining 'inductive reactance'.
- calculation of inductive reactance for a given inductor and the relationship between inductive reactance and frequency.
- applying Ohm's Law to determine voltage, current of inductive reactance in a purely inductive a.c. circuit given any two to these quantities.
- applications of inductive a.c circuits.
- calculation of capacitive reactance
- applying Ohm's Law to determine voltage, current or capacitive reactance in a purely capacitive a.c circuit given any two of the quantities.
- applications of capacitive a.c circuits

T4 RC and RL Series a.c. circuits encompassing:

- impedance and impedance triangle.
- determining the impedance, current and voltages for a series RC circuit given the resistance, capacitance and supply voltage.
- drawing and labelling the impedance triangle for a series RC circuit
- drawing phasor diagrams for a series RC circuit
- AS/NZS 3000 requirements for the installation of capacitors.
- examples of capacitive components in power circuits and systems and the effect on the phase relationship between voltage and current.
- determining the impedance, current and voltages for a series RL circuit given the resistance, inductance and supply voltage.
- drawing and labelling the impedance triangle for a series RL circuit
- drawing the equivalent circuit of a practical inductor
- Draw phasor diagrams for a series RL circuit.
- examples of inductive components in power circuits and systems and describe their effect on the phase relationship between voltage and current

T5 RLC Series a.c. circuits encompassing:

- measuring component voltages in a series RLC circuit and using a phasor diagram to determine the supply voltage and phase angle between circuit voltage and circuit current.
- determining the impedance, current and voltages for a series RLC circuit given resistance, inductance, capacitance and supply voltage.
- drawing and labelling the impedance triangle for a series RLC circuit.
- calculation of total impedance for a series RLC circuit.
- calculation of voltage drop for cables using the values for reactance and a.c. resistance from AS/NZS 3008.

REQUIRED SKILLS AND KNOWLEDGE

- comparison of current limiting characteristics of inductors and resistors.
- practical examples of RLC series circuits

T6 Parallel a.c. Circuits encompassing:

- determining the branch currents of a parallel circuit that contain RL, RC or LC in two branches.
- using a phasor diagram to determine the total circuit current and phase angle in parallel RL, RC or LC circuits.
- determining the total circuit impedance of parallel RL, RC or LC circuits.
- measuring the branch currents in a parallel RLC circuit and use a phasor diagram to determine the total current and phase angle between circuit voltage and circuit current.
- determining the branch impedances, branch currents and phase angles voltages for a parallel RLC circuit given resistance, inductance, capacitance and supply voltage.
- calculation of impedance for a parallel RLC circuit.
- practical examples of parallel circuits.

T7 Power in an a.c. circuit encompassing:

- difference between true power, apparent power and reactive power and the units in which these quantities are measured.
- drawing the power triangle to show the relationships between true power, apparent power and reactive power
- defining the term "power factor" and phase angle.
- methods used to measure single phase power, energy and demand.

T8 Power Factor Improvement encompassing:

- effects of low power factor.
- requirements for power factor improvement.
- methods used to improve low power factor of an installation.
- local supply authority and AS/NZS 3000 wiring rules requirements regarding the power factor of an installation and power factor improvement equipment.
- methods used to measure single phase power factor.
- using manufacturers catalogues to select power factor equipment for a particular installation

T9 Harmonics and Resonance Effect in a.c. Systems encompassing:

- term "harmonic" in relation to the sinusoidal waveform of an a.c. power system.
- sources in a.c. systems that produce harmonics.
- problems that may arise in a.c. circuits as a result of harmonics and how these are overcome.
- methods and test equipment used to test for harmonics
- methods used to reduce harmonics in a.c. power system
- conditions in a series a.c. circuit that produce resonance.
- dangers of series resonance circuits

REQUIRED SKILLS AND KNOWLEDGE

- conditions in a parallel a.c. circuit that produce resonance.
- dangers of parallel resonance circuits
- AS/NZS3000 and the local supply authority requirements concerning harmonics and resonance effect in a.c. power systems.

T10 Three Phase Systems encompassing:

- features of a multiphase system.
- comparison of voltages generated by single and multiphase alternators.
- reasons for the adoption of three phases for power systems.
- how three phases is generated in a single alternator.
- Calculation of r.m.s. value of voltage generated in each phase given the maximum value.
- relationship between the phase voltages generated in a three phase alternator and the conventions for identifying each.
- term "phase sequence" (also, referred to as "phase rotation").
- determining the phase sequence of a three phase supply

T11 Three phase star-connections encompassing:

- connecting a three phase star-connection load.
- phase relationship between line and phase voltages and line and phase currents of a star-connected system.
- determining the r.m.s. value of line and phase voltage given any one of these quantities.
- determining the r.m.s. value of line and phase current given any one of these quantities.
- terms "balanced load" and "unbalanced load".
- effect of a reversed phase winding of a star connected alternator.
- example of balanced and unbalanced loads in typical power systems.

T12 Three phase four wire systems encompassing:

- purpose of the neutral conductor in a three phase four wire systems.
- determining the effects of an high impedance in the neutral conductor of a three phase four wire system supplying an unbalanced load where MEN earthing is employed.
- determining the value and phase relationship of neutral current in an unbalanced three phase four wire systems given line currents and power factors.
- AS/NZS 3000 requirements regarding neutral conductors.
- AS/NZS 3008.1.1 method for determining voltage drop in unbalanced three phase circuits

T13 Three phase delta-connections and Interconnected systems encompassing:

- connecting three phase delta loads.
- phase relationship between line and phase voltages and line and phase currents of a delta-connected system.
- determining the r.m.s. value of line and phase voltage given any one of these quantities.
- determining the r.m.s. value of line and phase current given any one of these quantities.

REQUIRED SKILLS AND KNOWLEDGE

- limitations and uses of open delta connections
- effect of a reversed phase winding of a delta connected transformer
- example of loads in typical power systems.
- drawing the typical combinations of three phase interconnected systems using star-connections and a delta-connection.
- relationship between line and phase voltages and line and phase currents in the typical interconnected systems using star-connections and delta-connections.

T14 Energy and power requirements of a.c. systems encompassing:

- purposes for measuring power, energy, power factor and maximum demand of a.c. power systems and loads.
- difference between true power, apparent power and reactive power and the units in which these quantities are measured in a three phase system.
- drawing the power triangle to show the relationships between true power, apparent power and reactive power in a three phase system.
- methods used to measure three phase power , energy, power factor and demand.
- determining how the power factor of a three phase installation can be improved.
- using manufacturers catalogues to select measurement equipment for a particular installation

T15 Fault Loop Impedance encompassing:

- term fault loop impedance of a a.c. power system
- determining fault loop impedance using resistance and reactance values from AS/NZS 3008.1.1
- measuring fault loop impedance of typical circuits
- procedures for testing fault loop impedance

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment	**9.1**) Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that

EVIDENCE GUIDE

can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit

9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

EVIDENCE GUIDE

- Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range statement
- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Solve problems in single and three phase circuits as described as described in 8) and including:

    A Using methodological techniques to solve problems in circuits in a.c. circuits from measure and calculated values

    B Determining the operating parameters of existing circuits

    C Altering an existing circuit to comply with specified operating parameters.

    D Developing circuits to comply with a specified function and operating parameters.

    E Determining the cause of low power factor in an existing circuit.

    F Determining conditions causing an existing circuit to be unsafe.

    G Dealing with unplanned events

EVIDENCE GUIDE

Context of and specific resources for assessment

9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to solving single and three phase low voltage circuit problems.

Method of assessment

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note: Competent performance with inherent safe working practices is expected in the industry to which this unit applies. This requires assessment in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

Concurrent assessment and relationship with other units

9.5)

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

Range Statement

RANGE STATEMENT

8) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to solving problems in a.c. circuit by:

- Determining the operating parameters of existing circuits
- Altering an existing circuit to comply with specified operating parameters
- Developing circuits to comply with a specified function and operating parameters of voltage, current, impedance, power and power factor
- Determining the cause of low power factor in an existing circuit.
- Determining conditions causing an existing circuit to be unsafe includes electric shock hazard from indirect contract with conductive parts, insufficiently low impedance of a fault current path and inadequate fault protection.

In relation to the following on more than one occasions:

Single phase circuits

- Connecting single-phase circuits
- Choosing correct instruments
- Taking measurements correctly and accurately.

Three-phase circuits

- Connecting three-phase circuits
- Choosing correct instruments
- Taking measurements correctly and accurately.

AND

At least four of the following applications

- Series a.c. circuits
- Parallel a.c. circuits
- Series / parallel a.c. circuits
- Single phase motors / controls
- Three phase motors / controls
- Synchronous machines
- Transformers / Auxiliary components

RANGE STATEMENT

- Star connected circuits
- Delta connected circuits
- Star-Delta interconnected circuits
- Open Delta circuits

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not Applicable

Competency Field

2.2) Literacy and numeracy skills

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	4	Writing	4	Numeracy	4

Custom Content Section

Competency Field **5)**

Electrical

MEM Manufacturing and Engineering

Modification History

Release 1. Primary release

Credit Arrangements

Links

MEM Manufacturing and Engineering Training Package - http://www.mskills.org.au/training-packages/