



Australian Government

UEEEL0005 Develop and connect electrical control circuits

Release: 2

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Modification History

Release 2. This is the second release of this unit of competency in the UEE Electrotechnology Training Package.

Workplace evidence requirements updated in Performance Evidence and Assessment Conditions.

Assessor requirements updated in Assessment Conditions.

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Application

This unit involves the skills and knowledge required to develop, connect and functionally test electrical power and control circuits that perform specific control functions.

It includes working safely, developing schematic diagrams and converting them to wiring diagrams, selecting and connecting contactors and control devices to perform a specific function. It also includes testing electrical control circuits and completing circuit development activities documentation.

The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c.).

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, may be required.

Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

Pre-requisite Unit

UEECD0007 Apply work health and safety regulations, codes and practices in the workplace

UEECD0019 Fabricate, assemble and dismantle utilities industry components

UEECD0020 Fix and secure electrotechnology equipment

UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications

UEEEL0003 Arrange circuits, control and protection for electrical installations

UEEEL0020 Solve problems in low voltage a.c. circuits

UEEEL0023 Terminate cables, cords and accessories for low voltage circuits

UEEEL0019 Solve problems in direct current (d.c.) machines

UEEEL0021 Solve problems in magnetic and electromagnetic devices

UEEEL0024 Test and connect alternating current (a.c.) rotating machines

UEEEL0025 Test and connect transformers

and

UEECD0043 Solve problems in direct current circuits

or

UEECD0044 Solve problems in multiple path circuits

UEECD0046 Solve problems in single path circuits

Competency Field

Electrical

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Develop electrical control circuits

PERFORMANCE CRITERIA

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

- 1.1** WHS/OHS requirements and workplace procedures for a given work area are identified obtained and applied
- 1.2** Control circuit/s requirements are determined from discussions with relevant person/s and documented in accordance with workplace procedures
- 1.3** Agreement for the control circuit/s requirement is sought from appropriate person/s and documented in accordance with workplace procedures
- 1.4** Schematic arrangement of control circuits that complies with agreed requirement is documented in accordance with workplace procedures
- 1.5** Wiring diagram of control circuits is developed from schematic diagram in accordance with workplace

procedures

- 1.6** Materials needed to connect control circuit/s are obtained in accordance with workplace procedures and checked against job requirements
- 1.7** Tools, equipment and testing devices needed to connect control circuit/s are obtained in accordance with workplace procedures and checked for correct operation and safety
- 1.8** Preparatory work is checked to ensure no damage has occurred and complies with control circuit/s application requirements

2 Connect and test electrical control circuits

- 2.1** WHS/OHS risk control measures and workplace procedures for carrying out work are followed
- 2.2** Need to test or measure live electrical work is determined in accordance with WHS/OHS requirements and conducted within established safety workplace procedures
- 2.3** Circuits/machines/plant are checked and isolated as required in accordance with WHS/OHS requirements and workplace procedures
- 2.4** Control circuit component/s are connected to comply with the agreed control requirements
- 2.5** Control circuit operation is tested for functionality and in accordance with WHS/OHS requirements and workplace safety procedures
- 2.6** Non-compliant control functions are rectified
- 2.7** Unplanned situations are dealt with safely and with the approval of an authorised person in accordance with workplace procedures in a manner that minimises risk to personnel and equipment
- 2.8** Control circuits are connected, inspected and tested without unnecessary waste of materials or damage to apparatus, circuits, the surrounding environment or services using sustainable energy practice

3 Complete and document circuit development activities

- 3.1** WHS/OHS work completion risk control measures and workplace procedures are followed

- 3.2** Worksite is cleaned and made safe in accordance with workplace procedures
- 3.3** 'As-connected' control circuits are documented using standard drawing conventions and appropriate person/s notified in accordance with workplace procedures

Foundation Skills

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

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Developing, connecting and functional testing must include at least four of the following electrical control circuits:

- machine interlocked circuit
- machine safety circuit
- motor jogging circuit
- multiple stop-start circuit
- single stop-start circuit
- time controlled circuit

Developing, connecting and functional testing must include at least three of the following components and electrical devices:

- contactors
- electromechanical relays
- programmable relays
- push buttons
- reduced voltage starters
- soft starters
- three phase starters
- variable speed drives

Developing, connecting and functional testing must include at least two of the following transducers/sensors:

- float switches
- light sensors
- limit switches
- photoelectric cells
- pressure switches
- proximity switches
- temperature sensors
- timers

Unit Mapping Information

This unit replaces and is equivalent to UEENEEG109A Develop and connect electrical control circuits.

Links

Companion Volume Implementation Guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEEEL0005 Develop and connect electrical control circuits

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:

- # applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures and practices, including using risk control measures
- # applying sustainable energy principles and practices
- using manufacturers' catalogues to select:
 - circuit components for appropriate duty ratings
 - control devices for specified requirements
 - pushbuttons/pilot lamps for specific requirements
 - relays for specified requirements
 - the most suitable motor starter for a given situation
 - timers for specified functions
- # labelling wires and terminals
- converting circuit (schematic) diagrams to wiring diagrams
- # developing forward reverse circuit requiring interlocking from a description of the circuit operation, including jog and interlock functions
- developing:
 - electrical control circuit in accordance with a written description (specification) and listing the sequence of operation of the circuit
 - control circuit incorporating local and remote start and stop buttons and electrical interlocking
 - simple stop-start control circuit that incorporates pilot lights and latching circuit
 - timer controlled circuits from a written description and listing the sequence of circuit operation
- measuring starting current and torque of selected motor starters

- connecting and testing:
 - circuit with a braking feature to operate a three phase motor
 - control devices into control circuits
 - direct-on-line (DOL) motor starter and testing the operation of the power and control circuits
 - variable speed drive (VSD)
 - electronic (soft) starter
 - electrical circuits with local and remote start-stop control
 - input and output devices to a programmable relay using a diagram
 - motor starter power and control circuits for correct operation
 - multiple motor starting circuit which incorporates start, stop and jog control
 - simple electrical control circuit from circuit diagrams
 - timer controlled circuit using a circuit diagram as a guide
- completing and documenting circuit development activities.

Knowledge Evidence

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

- operating principles, basic contact configurations and identification and common applications of:
 - control relays
 - timers
 - contactors
 - thermal overloads
- control circuits, including:
 - converting circuit (schematic) diagrams to wiring diagrams
 - identification of circuit diagrams (schematic) symbols and explain the operation of components represented
 - switching configurations and common applications of push buttons
 - control circuit drawing conventions
- remote stop-start control and electrical interlocking, including:
 - operation of:
 - local and remote start-stop control of relays
 - operation of an electrically interlocked control circuit
 - applying circuit checking and testing techniques to an electrical control circuit
- time delay relays, including timer circuit checking and testing procedures
- circuits using contactors, including:
 - circuit diagram symbols

- circuit development using a contactor
- using contactors for motor control
- jogging and interlocking, including:
 - purpose and application of:
 - jogging control of motors
 - electrical/mechanical interlocking
 - operation of motor control using start, stop and jog buttons
- control devices, including:
 - common control devices used in automatic control circuits: limit switches, proximity switches, photoelectric cells, pressure switches, float switches, light sensors and temperature sensors
 - basic operating principles of common control devices
 - advantages and disadvantages of common control devices
 - applications for common control devices
- programmable relays, including:
 - advantages of programmable relays over electromagnetic control circuit control
 - typical applications of programmable relays
 - block diagram representation and basic operating principles
 - input and output parameters, listing, connections and output types
 - basic programming of ladder circuits consisting of inputs, outputs i.e. stop-start circuit
 - using the monitoring facility of the programmable relay to verify each ladder circuit operation
 - programming timers and using the monitoring facility of the programmable relay to check the values of the timer
 - external devices
 - implications of programming normally closed field devices
 - conversion of control circuits
 - common faults and their symptoms
- three phase induction motor starters, including:
 - reasons for limiting the starting current of large motors
 - requirements of AS/NZS 3000 and the local supply authority requirements, with regard to starting and control of motors
 - operating principles, applications and circuits for:
 - direct on line (DOL) starter
 - variable speed drive (VSD)
 - variable frequency drive (VFD)
 - electronic (soft) starter
- three phase induction motor starters - reduced voltage, including:
 - operating principles and circuits for reduced voltage starters
 - common applications for starter types

- comparison of motor starters basic characteristics
- three phase induction motor reversal and braking, including:
 - operating principles and control circuits for reversal and braking methods
 - comparison of the different braking methods used
 - typical applications for braking methods
- three phase induction motor speed control, including:
 - operating principles and circuits for motor speed control
- relevant manufacturer specifications

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessors must also hold the occupational licence for the jurisdiction the assessment is occurring where the activity being assessed requires a licence to practice.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in suitable workplace operational situations where it is appropriate to do so, where this is not appropriate, assessment must occur in suitable simulated workplace operational situations that replicate workplace conditions.

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.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, facilities, equipment and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, relevant industry standards, codes of practice and operation manuals.

In addition, evidence of Performance Evidence items of this unit marked with a hash (#) must be gathered in authentic workplace operational conditions (not simulated) before final determination of competence in this unit can be made.

Links

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