



Australian Government

**UEENEEP014A Disconnect - reconnect
water heaters connected to low voltage
installation wiring**

Release 2

UEENEEP014A Disconnect - reconnect water heaters connected to low voltage installation wiring

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit covers disconnecting and reconnecting water heaters connected to low voltage installation wiring. This may be incidental to or a primary and regular function of work related to a principle work function. It encompasses working safely, identifying supply arrangements, following isolation procedures, selecting and using testing and measuring devices, terminating and connecting cables and conductors, safely testing and reporting.

The unit coverage excludes disconnecting or reconnecting circuits at a switchboard or to general electrical accessories (including switches, socket outlets, circuit protective devices etc.); or installation of or alteration to any part of the fixed electrical wiring system (defined as electrical installing work).

Application of the Unit

Application of the Unit 2)

This unit applies to any formal recognition for this standard at the aligned AQF 3 level or higher.

Licensing/Regulatory Information

License to practice 3)

The skills and knowledge described in this unit requires a

License to practice

3)

license to practice in the workplace where plant and equipment operate at voltage above 50 V a.c. or 120 V d.c. However 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 regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

Note:

Candidates are to meet regulator eligibility requirements by providing formal confirmation from the relevant state/territory regulator for the respective work class and scope of work prior to developing and being conferred competent.

Pre-Requisites

Prerequisite Unit(s)

4)

Competencies

4.1)

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

UEENEEE1 Apply Occupational Health and Safety
01A regulations, codes and practices in the
workplace

Competencies needed for emergency services and equipment repair.

Literacy and numeracy skills

4.2)

Participants are best equipped to achieve 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

Employability Skills Information

Employability Skills 5)

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.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit	Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.
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Elements and Performance Criteria

ELEMENT

PERFORMANCE CRITERIA

1 Prepare to disconnect water heaters	1.1	Disconnection is planned to ensure OHS policies and procedures are followed.
	1.2	Appropriate persons are consulted to ensure work is coordinated effectively with others involved in the work site.
	1.3	Safety hazards which have not previously been electrical characteristics of water heaters and electrical supply are determined and recorded in accordance with established procedures.
	1.4	The point of isolation of water heaters to be disconnected is determined.
	1.5	Tools, equipment and testing devices needed to carry out the work are obtained in accordance with established procedures and checked for

ELEMENT	PERFORMANCE CRITERIA
	correct operation and safety.
2 Disconnect water heaters	2.1 OHS policies and procedures are followed.
	2.2 Water heaters are isolated in accordance with AS/NZS 4836:2001 and established procedures (see Range Statement).
	2.3 Conductor connection sequence is recorded and labelled in accordance with established procedures.
	2.4 Visual checks of the water heaters and associated wiring are carried out in accordance with established procedures to detect any abnormal or obvious damage or fault.
	2.5 Isolated equipment is confirmed as de-energised.
	2.6 Water heaters are disconnected from fixed wiring without damage to other components.
	2.7 Approval is obtained in accordance with established procedures from appropriate personnel, before any contingencies are implemented.
	2.8 Disconnected conductors/cables are terminated in accordance with requirements to ensure they are safe and present no potential hazard.
3 Prepare to reconnect water heaters	3.1 Reconnection is planned to ensure OHS policies and procedures are followed.
	3.2 Appropriate personnel are consulted to ensure work is coordinated effectively with others involved in the work site.
	3.3 The point of isolation of the circuit to which the water heaters is to be connected is determined.
	3.4 Replacement water heaters are selected on the basis of rating and characteristics being the same as that of the original water heaters.
	3.5 Appropriate personnel are consulted in the event that replacement water heaters are not available.

ELEMENT

PERFORMANCE CRITERIA

- | | | |
|---|-------------------------|---|
| | 3.6 | Original and/or replacement water heaters are tested to ensure it is safe to connect to the electrical supply and use. |
| | 3.7 | Tools, equipment and testing devices needed to carry out the work are obtained in accordance with established procedures and checked for correct operation and safety. |
| 4 | Reconnect water heaters | |
| | 4.1 | OHS policies and procedures are followed. |
| | 4.2 | Measures are taken to ensure circuit to which water heaters is to be connected remains isolated and de-energised in accordance with AS/NZS 4836:2001. |
| | 4.3 | The continuity of the protective earthing conductor is tested to determine whether it is sufficiently low. |
| | 4.4 | The resistance between the protective earthing conductor and the neutral conductor is tested to determine whether it is sufficiently low, i.e. not greater than 2 Ohms. |
| | 4.5 | The insulation resistance of active conductors is tested to confirm that it is greater than 1 Megohm. |
| | 4.6 | An appropriate qualified person is engaged to rectify any non-compliance condition revealed by the testing under item 4.3 to 4.5. |
| | 4.7 | Continuity between exposed conductive parts of the appliance and the main earth or metal switchboard enclosure is confirmed. |
| | 4.8 | Water heaters are connected to comply with requirements. |
| | 4.9 | Connections to the appliance are checked to confirm they are correct. |

ELEMENT	PERFORMANCE CRITERIA
5 Test the reconnected water heaters for safe operation	5.1 OHS policies and procedures, and established procedures for the reinstatement of isolated circuits and water heaters are followed.
	5.2 Arrangements are made with appropriate personnel to test the operation of the water heaters in accordance with established procedures.
	5.3 Operational non-conformances are identified and reported in accordance with established procedures.
6 Identify and report faults	6.1 Water heaters are isolated in accordance with established procedures.
	6.2 Other OHS policies and procedures are followed.
	6.3 Visual checks of the appliance to be disconnected and/or reconnected are carried out in accordance with established procedures to detect any abnormal or obvious damage or fault.
	6.4 Fault(s) at point of disconnection and/or reconnection are identified and reported in accordance with established procedures.
	6.5 Approval is obtained in accordance with established procedures from appropriate personnel, before any contingencies are implemented.
7 Provide status report(s)	7.1 Status report(s) are completed and notified in accordance with established procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) 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 disconnecting and reconnecting fixed wired water heaters connected to a Low Voltage supply.

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

KS01-EP014A Electrical Safety Principles

Evidence shall show an understanding of electrical safety principles to an extent indicated by the following aspects

T1 The basic electrical circuit encompassing:

- elements of a simple electric circuit (supply, control switch, protection device and load).
- definition, the symbol and the abbreviation of the unit for electromotive force, potential difference, current, resistance
- types of electrical load
- need for devices to afford electrical protection and the mechanisms used in protection devices including resetting
- symbols for the components of a basic electrical circuit
- connection of the circuit from the schematic diagram
- a.c supply (both single and three phase) and d.c. supply
- correct connection and use of voltmeters and ammeters, including the selection of correct range in terms of magnitude and whether the supply is a.c. or d.c.
- need for isolating, testing and tagging electrical circuits
- isolation, testing and tagging accessories in a simulated environment
- connecting a simple electrical circuit including supply, control switch and load.
- measuring voltage and current within a simple circuit

T2 Relationships in an electrical circuit encompassing:

- relationship between Voltage, Current and Resistance
- connection of meters to determine resistance from voltmeter and ammeter readings using a variation of the Ohm's Law relationship
- predicting changes in circuit parameters for altered values of voltage, current and resistance
- definition of 'power' in electrical terms (for d.c. or resistive a.c. circuits)
- using circuit readings determine power using the appropriate equations, symbols and unit abbreviations including the use of multiples and sub multiples

T3 Electrical diagrams encompassing:

- symbols used for fuse, circuit breaker, isolator, normally open contacts, normally

REQUIRED SKILLS AND KNOWLEDGE

closed contacts, coil, energy meter, a.c. motor, transformer.

- using a 'block diagram' as means of developing concepts and understanding
- producing a block diagram of a simple circuit
- function of single line diagrams including their application in three phase systems
- definition of a 'circuit' or 'schematic' diagrams
- wiring diagrams
- connecting a simple circuit using a schematic diagram noting the wide degree of variety in the way the conductors may be run
- producing the wiring diagram of the connections used in following the schematic diagram
- connecting a simple circuit following a wiring diagram
- producing a schematic diagram from the wiring diagram

T4 Test equipment – selection and care encompassing:

- fault currents and the implications of incorrectly connecting a meter to a high fault current source
- category ratings of multimeters in terms of their breaking capacity (fault current interruption) and identification of the appropriate category of instrument for typical domestic work and for typical commercial work.
- regulatory requirements in regard to the maintenance and testing of test instrumentation.
- steps and procedures for the safe use, care and storage of electrical instruments.
- selecting test equipment for given situations

T5 Test equipment - Voltage measurement encompassing:

- voltage measurement -meters connected in parallel
- operation of series test lamps
- construction of a set of series test lamps with emphasis on safety requirements
- using a set of series test lamps
- operation of neon test pencils and test screwdrivers with emphasis on the limitations of their safe use
- operation and limitations of voltage probes including their limitations
- using an analog multimeter for voltage measurement ensuring the following - setting zero, correct scale; ac or dc, polarity and magnitude, avoiding parallax error and estimating between division readings
- using a digital multimeter for voltage measurement ensuring the following - correct range and no active conductors are connected to any meter earth

T6 Test equipment - Resistance measurement encompassing:

- voltmeter-ammeter method of resistance measurement
- measuring resistance in a simple circuit using the voltmeter-ammeter method with emphasis on the correct choice of long or short shunt
- measuring resistance in a simple circuit using an analog multimeter ensuring the following - setting zero, selecting correct range, estimating of between division

REQUIRED SKILLS AND KNOWLEDGE

readings

- measuring resistance using a digital multimeter
- insulation resistance, and list the required minimum values for insulation resistance for low voltage wiring and low voltage equipment (insulation resistance between active and earth the value for appliances incorporating heating elements)
- insulation resistance needs to be measured at higher than supply voltage and list the voltages to be used
- conducting insulation resistance tests using a hand held tester after checking for zero and meter calibration
- continuity and what a continuity tester does
- checking the polarity of a three core extension cord using a continuity tester

T7 Test equipment - Current measurement encompassing:

- advantage(s) of the clip-on method of current measurement
- measuring current in a simple circuit using a multimeter on the correct current range and explain why a series connection must be used
- measuring current using a clip-on (tong tester) taking each circuit conductor in turn.

KS02-EP014A Disconnect and Reconnect Water Heaters

Evidence shall show an understanding of disconnect and reconnect water heaters to an extent indicated by the following aspects

T1 Cable connections encompassing:

- construction of typical power cables.
- principle of operation of the following types of terminals stud, screw, tunnel, faston and soldered
- cable preparation and terminating methods appropriate to each type of terminal, including any special requirements which apply
- terminating cables using all of the above terminal types employing the correct preparation and the relevant terminating tools including the correct size soldering equipment

T2 Protection for Safety encompassing:

- dangers associated with earth-faults.
- protection of persons against electric shock from earth-faults.
- maintaining a low earth-fault current path resistance.
- components in an earth-fault current path.
- testing the resistance of a fault-current path.
- regulatory issues/requirements/limitations in regards to working live

T3 Safety testing preparation and procedures encompassing:

- faulty earth-fault current paths
- using safe working practices when carrying out fault finding work.

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- Identification of earthing system components.
- unsatisfactory resistance of a fault-current path.
- actions to rectify unsatisfactory resistance of an earth-fault current path or insulation.

T4 Isolating supplies encompassing:

- regulatory requirements in regards to working de-energised, and ensuring and maintaining isolation
- reasons for advising all personnel likely to be affected:
- preventing others wanting to remake supply
- reason for isolation and approximate time of outage to allow planning of alternate activities
- identification the type and arrangement of circuits supplying equipment that is to be disconnected
- availability of supply is tested at a water heater about to be disconnected
- locating isolation device/s e.g. lockable adjacent isolating switch or fuse/circuit breaker at a distribution board usually identified at the water heater
- determining the method of isolation to be used; which available device
- isolating a supply at a fuse, the fuse wedge is removed only after the water heater is turned off and why the empty wedge is replaced once the fusible link has been removed
- tests to determine if a water heater is turned off when isolating at a fuse/circuit breaker
- use of and reason for danger tags at the point of isolation
- reason for the following steps: testing on a known live supply, testing for isolation, retesting on a known live supply after confirming isolation

T5 Disconnecting an water heater - ELV encompassing:

- identification of the type and arrangement of circuits supplying equipment that is to be disconnected from a ELV single phase and/or multiphase supply of voltages up to 50 V a.c. or 120 V d.c.
- procedures that ensure the safe isolation of the supply to water heater which is to be disconnected.
- disconnecting isolated electrical water heater from fixed wiring with minimal damage to wiring system. after ensuring no visible faults or damage, and the recording of conductor connection sequence
- termination practices in regard to disconnected wiring

T6 Reconnecting an water heater - ELV encompassing:

- importance of checking the new electrical water heater nameplate details against those of the water heater being replaced
- need for high insulation resistance and the need to test insulation of 400 volt water heater at 1000 volts and identify the minimum acceptable value of insulation resistance between active.

REQUIRED SKILLS AND KNOWLEDGE

- testing procedures: testing on a known live supply, testing for isolation and retesting on a known live supply after confirming isolation
- need to disconnect circuit cables before undertaking insulation resistance testing
- compliance testing the water heater: insulation resistance test and continuity test
- need to ensure the following steps are taken when terminating cables: stranded conductors are twisted tightly together, appropriate lugs are used rather than simple loops under a nut e.g. soldered lugs or Ross Courtney, Stanco or other solderless variety, shake proof washers are used, cables are not left under physical stress, cables are protected when passing through metal openings, conductors are doubled in tunnel connectors

T7 Disconnecting an water heaters - LV encompassing:

- identification of the type and arrangement of circuits supplying equipment that is to be disconnected from a single phase and/or multiphase supply of voltages up to 1000 V a.c. or 1500 V d.c.
- procedures that ensure the safe isolation of the supply to equipment which is to be disconnected
- disconnection of isolated equipment from fixed wiring with minimal damage to wiring system after ensuring no visible faults or damage, and the recording of conductor connection sequence
- termination practices in regard to disconnected wiring

T8 Reconnecting an water heater – LV encompassing:

- importance of checking the new water heater nameplate details against those of the electrical water heater being replaced
- need to visually inspect and test the water heater electrical characteristics using suitable test equipment to ensure equipment is safe to connect in regard to sufficiently high insulation resistance, arrangements for protection against indirect contact are undamaged and in place, appropriate IP rating, and arrangements for protection against dangers of mechanical movement are undamaged and in place
- compliance testing of the fixed water heater, ie insulation resistance and continuity
- testing the disconnected water heater for faults (open circuits, partial open circuits, short circuits, partial short circuits and earth faults), and recognise any unsatisfactory test results obtained
- procedures for equipment with unsatisfactory results - unsuitability for reconnection
- identification of the type and arrangement of circuits supplying equipment that is to be reconnected to a single phase and/or multiphase supply of voltages up to 1000 V a.c. or 1500 V d.c.
- procedures ensuring isolation of supply
- process to establish the integrity of the circuit to which the disconnected equipment is to be connected, including:
- testing the resistance between the protective earthing conductor and neutral conductor as applicable is sufficiently low ie not greater than 2 ohms

REQUIRED SKILLS AND KNOWLEDGE

- insulation resistance of the active conductors is greater than 1 megohm
- engaging appropriately qualified person to rectify any noncompliance
- appropriate cable termination practices
- reconnection of water heater to fixed wiring with minimal damage to wiring system
- continuity between exposed conductive parts of the equipment and the main earth or metal switchboard enclosure
- restoring supply after ensuring correct connections, and all safety requirements have been met
- testing the supply at water heater
- restoring all mechanical protection eg terminal covers
- checking operation of reconnected equipment

T9 Produce documentation and reports encompassing:

- need to produce status reports and documents to locate and identify isolation mechanisms for a wide range of circuits and associated loads.
- production of reports and documents to use a suitable procedure to safely disconnect a component from a single phase supply and/or multiphase supply.
- content required in reports and documents used to safely determine the suitability of a component for reconnection to supply.
- producing reports and documents for the safe reconnection/commissioning of a component to the supply.

T10 Enterprise reporting and recording system encompassing:

- purpose and extent of maintaining work activities records in an enterprise
- types of records for maintaining work activities in an enterprise
- methods for recording and maintaining work records
- work records for regulation requirements
- producing enterprise records and documents for the safe reconnection/commissioning of a component to the supply.

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 and shall be used in conjunction with all components 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-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. 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 issues inherent in working with electricity, electrical equipment, gas or any other hazardous substance/material present a challenge for those determining competence. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work influence decisions about how/much 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 – UEE11'. Evidence shall also comprise:

- A representative body of performance criteria 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, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Disconnect and reconnect fixed wired water heaters connected to a Low Voltage supply as described in 8) for each endorsement and including:
 - a. OHS practice
 - b. Determining electrical characteristics of water heaters
 - c. Selecting tools, equipment, and testing devices
 - d. Identifying point of installation

- e. Identifying and isolating circuit (including testing for safe isolation)
- f. Preparing to disconnect water heaters
- g. Undertaking visual checks of the water heaters and associated wiring to detect and reporting any abnormal or obvious damage or fault
- h. Disconnecting of water heaters
- i. Preparing to reconnect water heaters
- j. Reconnection of water heaters
- k. Testing of the reconnected water heaters for safe operation including polarity and earth continuity
- l. Identifying fault(s) at point of disconnection and/or reconnection in accordance with established procedures
- m. Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a holistic assessment with the above listed items

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

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.
- Workplace evidence to be produced in an industry/regulator approved recording system (logbook) confirming skills development under appropriate supervision

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 disconnecting and reconnecting fixed wired water heaters connected to a Low Voltage supply.

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 intended primarily 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

10) 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.

Competency shall be demonstrated in relation to disconnecting and reconnecting water heaters connected to supplies up to 1,000V a.c or 1,500V d.c:

Note:

Limitations of this unit. This unit does not cover installations

- a. where high fault currents are possible,
- b. comprised of complex electrical apparatus and circuits,
- c. associated with fixed wiring including locating and rectifying faults of circuits at a switchboard or to general electrical accessories (including switches, socket outlets, circuit protective devices etc); or installation of or alteration to any part of the fixed electrical wiring system (defined as electrical installing work),
- d. which are luminaries,
- e. in hazardous areas or on electrical equipment that is part of an explosion-protection technique.

Safe Working. Safe procedures for working within in the scope of this unit shall be in accordance with AS/NZS 4836:2001 'Safe working on low-voltage electrical installations.'

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

Competency Field 11)

Restricted and Specialisations