



Australian Government

**UEENEEP022A Disconnect and reconnect
3.3 kV electric propulsion components of
self-propelled earth moving vehicles**

Release: 2

UEENEEP022A Disconnect and reconnect 3.3 kV electric propulsion components of self-propelled earth moving vehicles

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers isolating, disconnecting and reconnecting HV electric propulsion components on engine driven, self-propelled earth moving vehicles under the restrictions of designated electrical equipment and conditions specified, operating at 3,300 volts. It encompasses working safely, identifying circuit and isolation arrangements, following isolation procedures, selecting and using HV testing and measuring devices, terminating and connecting HV cables and conductors, safety testing and reporting.

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 may require a license to practice in the workplace subject to regulations for undertaking of electrical work. Practice in workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as

License to practice 3)
apprenticeships.

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 mechanical maintenance of HV electric propulsion components off-road earth moving trucks.

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.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare for disconnection or reconnection	1.1 Designated HV electric propulsion components to be replaced is identified and purpose of the work to be carried out is verified with the authorised personnel.
	1.2 Occupational health and safety and other statutory requirements and established procedures are followed.
	1.3 Work clearances are obtained; isolation and disconnection procedures are followed in accordance with established procedures.
2 Disconnect designated HV electric propulsion components	2.1 Relevant electrical characteristics and protection specifications are identified.
	2.2 Where appropriate on –board cables are identified and marked and connection sequence recorded.
	2.3 Designated HV electric propulsion components are inspected for damage to components, and conclusions verified with authorised personnel.
	2.4 Visual checks of the designated HV electric propulsion components and associated wiring are carried out in accordance with established procedures to detect any abnormal or obvious damage or fault.

ELEMENT	PERFORMANCE CRITERIA
	2.5 Isolated equipment is confirmed as de-energised.
	2.6 Approval is obtained in accordance with established procedures from appropriate personnel, before any contingencies are implemented.
	2.7 On –board cables are, where appropriate, disconnected without unnecessary damage to terminals or components.
	2.8 Designated HV electric propulsion components is dismantled, removed and/or replaced in accordance with requirements to the extent necessary for disconnection, and without unnecessary damage.
	2.9 Designated HV electric propulsion components parts and/or associated components are stored appropriately to protect them against damage.
	2.10 Repairs, where appropriate, to the removed equipment are carried out in accordance with requirements and established procedures.
3 Reconnect designated HV electric propulsion components	3.1 Cables, where appropriate, are re-connected without damage to terminals or components.
	3.2 Connections are checked and tested to confirm correct polarity and continuity.
	3.3 Designated HV electric propulsion components is assembled and checked to comply with the relevant Standards for the given technique.
	3.4 Designated HV electric propulsion components is tested for safety and correct operation.
4 Prepare designated HV electric propulsion components for return to service	4.1 Isolation devices are removed and work clearance is released in accordance with established procedures.
	4.2 Documentation is completed in accordance with

ELEMENT

PERFORMANCE CRITERIA

established procedures.

- 4.3 Operational personnel are notified when designated HV electric propulsion components are ready for return to service 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 3.3 kV electric propulsion components of self-propelled earth moving vehicles.

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

KS01-EP022A 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-EP022A Disconnect and Reconnect HV Electric Propulsion Components

Evidence shall show an understanding of disconnect and reconnect HV electric propulsion components on off-road earth moving trucks 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:

REQUIRED SKILLS AND KNOWLEDGE

- faulty earth-fault current paths
- using safe working practices when carrying out fault finding work.
- 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 an components 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 appliance
- 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 components is turned off and why the empty wedge is replaced once the fusible link has been removed
- tests to determine if an components 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 3.3 kV electric propulsion components encompassing:

- identification of the type and arrangement of circuits supplying electric propulsion components that is to be disconnected from a 3.3 kV supply.
- procedures that ensure the safe isolation of the supply to electric propulsion components which is to be disconnected
- disconnection of isolated electric propulsion components 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 3.3 kV electric propulsion components encompassing:

- importance of checking the new electric propulsion components nameplate details against those of the electric propulsion components being replaced
- need to visually inspect and test the electric propulsion components electrical characteristics using suitable test equipment to ensure electric propulsion

REQUIRED SKILLS AND KNOWLEDGE

components 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 electric propulsion components, ie insulation resistance and continuity
- testing the disconnected electric propulsion components for faults (open circuits, partial open circuits, short circuits, partial short circuits and earth faults), and recognise any unsatisfactory test results obtained
- procedures for electric propulsion components with unsatisfactory results - unsuitability for reconnection
- identification of the type and arrangement of circuits supplying electric propulsion components that is to be reconnected to a 3.3 kV supply
- procedures ensuring isolation of supply
- process to establish the integrity of the circuit to which the disconnected electric propulsion components 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
 - 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 electric propulsion components to fixed wiring with minimal damage to wiring system
- continuity between exposed conductive parts of the electric propulsion components 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 electric propulsion components
- restoring all mechanical protection eg terminal covers
- checking operation of reconnected electric propulsion components

T7 Produce documentation and reports

- 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 3.3 kV 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.

T8 Enterprise reporting and recording system

- purpose and extent of maintaining work activities records in an enterprise

REQUIRED SKILLS AND KNOWLEDGE

- 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/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 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:
 - Disconnect and reconnect 3.3 kV electric propulsion components of self-propelled earth moving vehicles as described in 8) and including:
 - a. Preparing to disconnect or reconnect of HV electric propulsion components of off-road self-propelled earth moving vehicles operating at 3,300 volts
 - b. Disconnecting of HV electric propulsion components of off-road HV electric propulsion components on engine driven, self-propelled earth moving vehicles operating at 3,300 volts
 - c. Repairing in accordance with established procedures HV electric propulsion components of off-road HV electric propulsion components on engine driven, self-propelled earth moving vehicles operating at 3,300 volts
 - d. Reconnecting of HV electric propulsion components of off-road self-propelled earth moving vehicles operating at 3,300 volts
 - e. Preparing of HV electric propulsion components of off-road HV electric propulsion components on engine driven, self-propelled earth moving vehicles operating at 3,300 volts for return to service
 - f. Providing status report(s);
 - g. 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 3.3 kV electric propulsion components of self-propelled earth moving vehicles.

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.

This unit shall be demonstrated in relation to disconnecting and reconnecting of HV electric propulsion components of HV electric propulsion components on engine driven, self-propelled earth moving vehicles operating at 3,300 volts.

Note:

Limitations of this unit. This unit does not cover the knowledge and skills necessary for work:

- a) Where high fault currents are possible,
- b) On complex electrical work;
- c) Associated with other than to disconnect and reconnect of HV electric propulsion components of off-road HV electric propulsion components on engine driven, self-propelled earth moving vehicles earth moving vehicles operating at 3,300 volts
- d) Nor competencies associated with fixed wiring

Safe Working. Safe procedures for working within in the scope of this unit shall be in accordance with AS/NZS 4836 '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