

<b>Title</b>	<b>Test reeling, trailing, and flexible electrical cables</b>		
<b>Level</b>	<b>4</b>	<b>Credits</b>	<b>1</b>

<b>Purpose</b>	<p>This unit standard covers the pre and post repair testing of reeling, trailing, and flexible cables. It requires the ability to work safely and to Standards, evaluate the condition of cables, conduct cable tests, write repair specifications, and document test results and cable repair history.</p> <p>This unit standard is intended for electricians or electrical service technicians who are responsible for electrical apparatus overhaul and repair.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> <li>– demonstrate knowledge of reeling, trailing, and flexible cable, and repair techniques;</li> <li>– demonstrate knowledge of electrical fundamentals and testing techniques;</li> <li>– prepare to test cables;</li> <li>– specify the extent of cable repair required;</li> <li>– test repaired cable; and</li> <li>– document cable tests.</li> </ul>
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<b>Classification</b>	Explosive Atmospheres > Electrical Apparatus in Explosive Atmospheres - Operations
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<b>Available grade</b>	Achieved
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<b>Entry information</b>	
<b>Critical health and safety prerequisites</b>	Unit 26739, <i>Demonstrate introductory underpinning knowledge of electrical apparatus in explosive atmospheres</i> , or demonstrate equivalent knowledge and skills.

**Explanatory notes**

- 1 This unit standard has been designed for training and assessment on-job or off-job in a simulated environment which includes explosion-protected apparatus and wiring systems similar to those encountered in a real workplace.

- 2 This unit standard is directly equivalent to Unit 2.24 *Test reeling, trailing and flexible cables* in the Australian/New Zealand Standard AS/NZS 4761.1:2008 *Competencies for working with electrical equipment in hazardous areas (EEHA) Part 1: Competency standards* and includes essential skills and knowledge as specified in the relevant clauses. It aligns with Australian Competency Standard *UEENEEM071A* from UEE07 Electrotechnology Training Package Version 3.1 (copyright Australian National Training Information Service).
- 3 This unit standard is intended to be assessed against in conjunction with other work skills related to general testing and inspection of general overhaul or repair work.
- 4 References  
AS/NZS 1768:2007, *Lightning protection*;  
AS/NZS 2802:2000, *Electric cables – Reeling and trailing for mining and general use (other than underground coal mining)*;  
AS/NZS 2802:2000/Amendment 1:2003, *Electric cables – Reeling and trailing for mining and general use (other than underground coal mining)*;  
AS/NZS 3000:2007, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*;  
AS/NZS 4761.1.2008, *Competencies for working with electrical equipment for hazardous areas (EEHA) Part 1 – Competency standards*;  
AS/NZS 4761.2.2008, *Competencies for working with electrical equipment in hazardous areas (EEHA) Part 2 – Guide to assessing competency*;  
AS/NZS 60079.10.1:2009, *Explosive atmospheres – Classification of areas – Explosive gas atmospheres*;  
AS/NZS 60079.14:2009, *Explosive atmospheres – Electrical installations design, selection and erection*;  
AS/NZS 60079.17:2009, *Explosive atmospheres – Electrical installations inspection and maintenance*;  
AS/NZS 60079.29.2.2008, *Explosive atmospheres – Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen*;  
AS/NZS 61241.0:2005, *Electrical apparatus for use in the presence of combustible dust – General requirements*;  
AS/NZS 61241.14:2005, *Electrical apparatus for use in the presence of combustible dust – Selection and installation*;  
AS/NZS 61241.2.1:2000, *Electrical apparatus for use in the presence of combustible dust – Test methods – Methods for determining the minimum ignition temperature of dust*;  
Electricity Act 1992;  
Electricity (Safety) Regulations 2010;  
Hazardous Substances and New Organisms Act 1996;  
Health and Safety in Employment Act 1992, and associated regulations;  
*Workplace Exposure Standards and Biological Exposure Indices*, available from the Department of Labour, <http://www.osh.govt.nz/order/catalogue/329.shtml>, and associated regulations;  
and their subsequent amendments and replacements.
- 5 Definitions  
*Appropriate personnel* – individuals with responsibilities for co-ordination, design, installation, maintenance, production, or servicing activities. This can include: site managers, project managers, engineers and technicians, technical experts, line

managers or supervisors, regulatory personnel, team leaders, other personnel designated by an organisation or enterprise.

*Established procedures* – formal documented arrangements of an organisation, enterprise or statutory authority in regard to how work is to be done and by whom and may include but are not limited to – quality management systems, safety management systems, work clearance systems, work instructions, reporting systems, and arrangements for dealing with emergencies.

*Explosion-protection techniques* – techniques applied to the design of electrical apparatus, components, and systems to prevent the electrical energy from becoming an ignition source in the presence of flammable vapours and gases or combustible dusts in explosive atmospheres. See *explosion-protected apparatus*.

*Explosion-protected apparatus* – electrical apparatus to which specific measures are applied to avoid ignition of a surrounding explosive atmosphere. Such apparatus employs one or more of the following explosion-protection techniques:

For gas and vapour atmospheres

Ex d – flameproof;

Ex e – increased safety;

Ex i – intrinsic safety; with levels of protection Ex ia, Ex ib and Ex ic;

Ex n – non-sparking;

For dusts

Ex iD – intrinsic safety (dusts);

Ex tD – enclosed;

Others, less common

Ex p – pressurisation; Ex pD (dust);

Ex m – encapsulation, with levels of protection Ex ma, Ex mb, Ex mc (gases and vapours), and Ex mD (dusts);

Ex s – special protection; categorised by Zone of application; e.g. 'Ex s (Zone 0);

Ex o – oil immersion;

Ex q – sand filled;

Ex v – ventilation.

## 6 Range

- a Assessment is to take account of variations between the industry sectors and enterprises. For example, apparatus used in underground coal mining will be different in some respects from that used in a petrochemical plant.
- b Occupational Safety and Health (OSH) policies and procedures may include but are not limited to – work permits and clearances, hazard monitoring, evacuation procedures, plant and electrical isolation.
- c The application of contingency management skills must be demonstrated for all outcomes and evidence requirements.
- d Established maintenance procedures must be followed.
- e All activities and evidence presented for all outcomes and evidence requirements in this unit standard must be in accordance with safe working principles and practices, legislation, policies, procedures, ethical codes and Standards, safe and sound practice, and industry practice; and, where appropriate, manufacturers' instructions, specifications, and data sheets.
- f Evidence is required for repair to at least four separate cables, which have all of the following features and associated AS/NZS designated cable type:
  - Standard conductor construction:
    - 209; 210; 240; 241; 260; 275; 409; 412.1; 440; 441.1; 441; 450; 455.
  - Super flexible:

245.  
 HV-EP-90 insulated:  
 441; 450; 455.  
 Semi conductive extruded screens:  
 241; 245; 441.1; 441; 450; 455.  
 Metal braided screens:  
 209; 210; 240; 260; 409; 440; 450.  
 Interstitial earths:  
 241; 245; 275; 412.1; 441.1; 441; 450; 455.  
 Interstitial pilots:  
 240; 260; 440; 450; 455.  
 Central pilot:  
 209; 210; 241; 245; 275; 409; 441.1; 441.  
 Pliable armour:  
 260; 412.1.

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## Outcomes and evidence requirements

### Outcome 1

Demonstrate knowledge of reeling, trailing, and flexible cable, and repair techniques.

#### Evidence requirements

- 1.1 Cable types are described in terms of construction, materials, and design features.
- Range function of each design feature, cable storage conditions, Standards to which cables are manufactured, applications.
- 1.2 Cable repair preparation and conductor splicing methods are explained.
- Range criteria for determining the section of cable suitable to be joined; cable preparation methods; splicing methods; application for power, pilot, and earthing conductors.
- 1.3 Replacement of cable insulation is explained.
- Range preparation of a power conductors before the application of insulation, types of insulation repair tapes and their application, techniques for applying insulation repair tape.
- 1.4 Techniques for joining pliable wire armour are described.
- 1.5 Techniques for replacing and repairing cable sheath are described.
- Range setting up a vulcanizer to vulcanize a repair, vulcanizing techniques and issues.

### Outcome 2

Demonstrate knowledge of electrical fundamentals and testing techniques.

**Evidence requirements**

- 2.1 Nature of electrical current and charge is explained.
- 2.2 Sources of electricity are identified.
- 2.3 Effects of current are described.
- 2.4 Single-source single-load circuits in terms of components that make up the circuit and the relationship between voltage and current.
- 2.5 Consequences of a short circuit and an open circuit are explained.
- 2.6 Insulation materials are described in terms of insulating properties and types and applications in cable technology.
- 2.7 Conducting materials are described in terms of conducting properties, factor affecting resistance and types and applications in cable technology.
- 2.8 Semiconducting materials are described in terms of properties, types, and applications in cable technology.
- 2.9 Electrical parameters of cables and their measurement are described.
- 2.10 Care and handling of testing devices and requirement for measuring instruments to have current calibration certification are explained.
- 2.11 Types of devices used for testing cables are identified.
- 2.12 Testing design parameters of cables and cable assemblies are explained.

Range cable tests – continuity, phase rotation, insulation resistance, high-voltage proof, partial break, symmetrical load, sheath hardness tests;  
test outcomes – causes of inaccuracies and methods to overcoming them, test device set up and safety procedures, interpretation of test readings, expected test results that show a cable complies with the Standards requirements.

**Outcome 3**

Prepare to test cables.

**Evidence requirements**

- 3.1 Cable to be repaired is confirmed with appropriate personnel and the cable type is identified.
- 3.2 Cable history test records are reviewed to identify potential issues and ascertain the viability of repair.

- 3.3 Materials required for the repair are obtained in accordance with established procedures.
- 3.4 Special tools, apparatus and testing devices needed to carry out the tests are obtained and checked for correct operation, safety, and currency of calibration certification.

#### **Outcome 4**

Specify the extent of cable repair required.

#### **Evidence requirements**

- 4.1 Cables are inspected and tested to ascertain the viability of repairs and extent of repairs required.
- 4.2 Viability or extent of the cable repair is determined from inspection/test results and cable repair history records.
- 4.3 Specifications and instructions for the cable repair are documented in accordance with established procedures.
- 4.4 Appropriate personnel are notified of the cable repair work required in accordance with established procedures.

#### **Outcome 5**

Test repaired cable.

#### **Evidence requirements**

- 5.1 Cables are tested in accordance with design parameters and relevant testing methods.
- Range cable tests include – continuity, phase rotation, insulation resistance, high-voltage proof test, partial break test, symmetrical load test, sheath test.
- 5.2 Cable testing devices are handled carefully and set up correctly before each test.
- 5.3 Each test reading is confirmed for accuracy and recorded in accordance with established procedures.
- 5.4 Actions are taken to have any non-compliance identified by measurements, tests, and inspections rectified in accordance with established procedures.

#### **Outcome 6**

Document cable tests.

## Evidence requirements

- 6.1 Cable history test records are updated in accordance with established procedures.
- 6.2 Appropriate personnel are notified of the completion of the work and provided with copies of the documents in accordance with established procedures.

<b>Planned review date</b>	31 December 2016
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### Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	20 May 2011	N/A

<b>Consent and Moderation Requirements (CMR) reference</b>	0003
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

### Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMRs). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

### Comments on this unit standard

Please contact the ElectroTechnology Industry Training Organisation (ETITO) [reviewcomments@etito.co.nz](mailto:reviewcomments@etito.co.nz) if you wish to suggest changes to the content of this unit standard.