



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

**Technical Reference
Electrical Engineering Safety
EES-012**

**NSW DPI Technical Reference
Assessment and Registration of
Cable Repair Signatory
For Reeling, Trailing and Flexible
Feeder Cables used in NSW
Underground Coal Mine
Hazardous Zones**

*Coal Mine Health and Safety Act 2002
Coal Mine Health and Safety Regulation 2006*

September 2007 (Version 2)



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PREFACE

Contemporary safety management requires fit for purpose equipment, competent personnel and appropriate procedures all within a managed work environment and supported by a systematic approach.

Underground coal mining presents engineering personnel with serious technical challenges, in this environment there often occurs potential for accumulation of explosive mixtures of methane and a further explosive dust hazard. A prime barrier to preventing explosions is the use of specially constructed mining cables and special (usually flameproof) plug attachments and glanding. These cables are used in a harsh environment and are regularly subject to abuse and damage. On average there are 600 cables damaged every month in NSW underground coal mine hazardous zones. This damage varies from minute pin holes in a cable sheath to the whole cable being pulled in half. To minimise the risk of fires, explosions, electric shock and burns it is essential that these damaged cables are returned to a condition that is as close to practical "as new". To do this requires competent people and proper facilities with specialist test and repair equipment. The licensed workshop and Cable Repair Signatory system approach provides a framework for the provision of suitable facilities for the repair of flexible reeling, trailing and feeder cables for use in NSW underground coal mines.

Original cable manufacturers are not considered to have the necessary facilities and competent people to repair such cables.

This Technical Reference is intended to provide a basis from which cables can be restored to a fit for purpose condition, after damage, for the safety of mine workers, as required by legislation and community expectations. The Technical Reference identifies the requirements for competent people repairing cables for use in coal mining environments in New South Wales.

Complementing the above are:

- Standards for the design and repair of cables
- Standards for the design, inspection, maintenance, overhaul and repair of cable accessories

This Technical Reference will be used by Mine Safety Operations to register persons as Competent in Cable Repairs as part of the requirements for licensing cable repair facilities.

John Francis Waudby

Senior Inspector of Electrical Engineering



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Chapter 1 Establishment

1.1 Title

This is the DPI Electrical Engineering Safety Technical Reference – Assessment and Registration of Cable Repair Signatories for Reeling, Trailing and Flexible Feeder Cables used in NSW Underground Coal Mine Hazardous Zones.

1.2 Purpose

This Technical Reference is intended as an aid to applicants who are seeking accreditation as a Cable Repair Signatory in the role of repair of cables for use in NSW underground coal mines.

The Technical Reference sets out the minimum criteria that would be used for assessment of Cable Repair Signatories is intended to provide a framework for to assess applications for registration as a Cable Repair Signatory and for assessing competency requirements as part of the cable repair licensing program.

The outcomes sought to be achieved by this Technical Reference are to protect people and property from the risks associated with the use of electrical cables in coal operation hazardous zones including:

- Electrocution
- Electric shock
- Electrical burn injuries
- Arc blast injuries
- Injuries sustained through operation of the equipment
- Unintended operation of the equipment
- Ignitions of flammable mixtures of gas or dust
- Fire

1.3 Scope

This Technical Reference is primarily for cable repair workshops located in NSW.

This Technical Reference is intended as an aid to applicants who are seeking registration as a Cable Repair Signatory working at a facility licensed in the role of repair of cables for use in NSW underground coal mines.

This Technical Reference supplements the following Technical Reference:

- EES007 NSW DPI Technical Reference – Licensing of Cable Repair Facilities for Reeling, Trailing, and Flexible Feeder Cables used in NSW Underground Coal Mine Hazardous Zones.

1.4 Authority

This is an Electrical Engineering Safety Technical Reference and is recommended by the Department of Primary Industries. This document replaces VERSION 1.



1.5 Definitions

Licensed Cable Repair Workshop - a quality accredited facility, with at least one Cable Repair Signatory in full-time employ and the necessary equipment and procedures deemed suitable to receive a license as a cable repair workshop. Licensed workshops are required by the Department and Australian Standards to keep historical records of all repairs made to cables used in NSW coal mines.

Cable Repair Signatory - a person who has been verified as competent for the inspection, repair and testing of electrical reeling, trailing and feeder cables as defined in AS/NZS1747. This also includes the inspection, testing, fitting and replacement of parts of restrained and bolted plugs. Applicants shall have adequate knowledge and expertise to ensure compliance with the applicable parts of:

- AS/NZS 3800 “Electrical equipment for explosive atmospheres - Repair and Overhaul”.
- AS/NZS 1747 “Reeling, trailing and feeder cables used for mining - Repair, testing and fitting of accessories”.

Cable Repair Signatories are required to work under the auspices of a licensed workshop, and shall maintain appropriate records of overhaul & repair of cables.

Department - means Mine Safety, Department of Primary Industries.

1.6 Applicable legislation

The Occupational Health and Safety Act 2000

The Occupational Health and Safety Regulation 2001

The Coal Mine Health and Safety Act 2002

The Coal Mine Health and Safety Regulation 2006

1.7 Referenced Gazette Notices

Gazette Notice - *Types of Plant that can be used in a Hazardous Zone*

1.8 Referenced Standards and applicable guidance documents

AS 1299	Electrical equipment for coal mines – Flameproof restrained plugs and receptacles
AS 1300	Electrical equipment for coal mines – Bolted flameproof cable coupling devices
AS/NZS 1747	Reeling, trailing and feeder cables used for mining – Repair, testing and fitting of accessories
AS/NZS 1802	Electric cables – Reeling and trailing – For underground coal mining purposes
AS/NZS 1972	Electric cables – Underground coal mines – Other than reeling and trailing



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AS/NZS 2290.1	Electrical equipment for coal mines – Introduction and maintenance – For hazardous areas
AS/NZS 2802	Electric cables – Reeling and trailing for mining and general use (other than underground coal mining)
AS/NZS 3800	Electrical equipment for explosive atmospheres – Repair and Overhaul
AS/NZS ISO 9001	Quality management system – Requirements
AS/NZS 4871 series	Electrical equipment for coal mines, for use underground
GNC – 010	NSW DPI Guidance Note - Licensing
GNC – 010 Attachment 3	Licensing Application Form – Licensing of Cable Repair Facilities for Reeling, Trailing and Flexible Feeder Cables used in NSW Underground Coal Mines Hazardous Zones.
EES - 007	Technical Reference – Licensing of Cable Repair Facilities for Reeling, Trailing and Flexible Feeder Cables used in NSW Underground Coal Mines Hazardous Zones

Note: Documents published by, or on behalf of the Department are available, generally free of charge at www.dpi.nsw.gov.au/minerals/safety/publications. Australian Standards may be purchased from online at <http://www.saiglobal.com/shop/script/search.asp>.

1.9 Acronyms

AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
Ex	Explosion protected
DPI	Department of Primary Industries
SCCB	Secretary of the Coal Competency Board



Chapter 2 Licensed Cable Repair Facilities

2.1 Selection & repair of flexible reeling, trailing & flexible feeder cables used in hazardous zones



Coal Mine Health and Safety Regulation 2006 Clause 19(1)

Requires that only specified plant be used in a hazardous zone, that this plant be maintained in an explosion-protected condition and that overhaul and repair of explosion-protected plant and flexible reeling, trailing and feeder cables is only to be done at licensed facilities.

Therefore, flexible reeling, trailing and feeder cables must be shown to comply with specified (gazetted) requirement and only be repaired at licensed facilities.

- Refer to DPI publication - Technical Reference EES-007 - Licensing of Cable Repair Facilities for Reeling, Trailing and Flexible Feeder Cables used in NSW Underground Coal Mine Hazardous Zones
- Refer to DPI publication - Guidance Note GNC-010 - Licensing

2.2 General requirements - Licensing



Coal Mine Health and Safety Regulation 2006 Clause 149(1)(b)

Defines a particular licensable activity as “repair of flexible reeling, feeder and trailing cables used in a hazardous zone.”

Good engineering practice is a primary goal of the cable repair workshop licensing scheme and satisfying the associated Cable Repair Signatory scheme is a prerequisite to the granting of any cable repair workshop license.

Workshops licensed for the purposes of repair of cables shall comply with the requirements of AS/NZS1747. The scope of work will typically encompass the overhaul, repair and testing of flexible mining cables and accessories such as restrained plugs, flit plugs, glands and stuffing boxes. Occupational health and safety responsibilities embrace both the end-user and the workshop to ensure that all repaired cables are returned to service in a fit for purpose condition.

Assessment for licensing purposes will be conducted by the Inspectors of Electrical Engineering and/or Mine Safety Officer – Electrical Engineering from the Mine Safety Division, Department of Primary Industries.

Prior to implementation of any changes to workshop practices, processes or materials, the licensed workshop shall assess such changes for on-going compliance with their license and advise the licensing authority where such changes may impact on the license, in particular where the practices impact on the control of the repair/overhaul processes for cables and fittings.



Chapter 3 Cable Repair Signatory

3.1 General

A Cable Repair Signatory shall be a person who has been verified as competent in the repair of cables and the inspection and replacement of parts of cable fittings. That person shall have adequate knowledge and expertise to ensure compliance with the applicable parts of AS/NZS 3800, AS/NZS 1747 and with other standards relevant to the apparatus or cables.

3.2 Responsibilities

A Cable Repair Signatory is responsible for:

- The identification of cables submitted for repair
- The identification of correct documents for cables under repair
- The identification of repair work to be undertaken to return the cable to a compliant condition
- The verification/evaluation of the results of repairs and testing of cables
- The verification/evaluation of the fitting of flameproof plugs and replacement parts of plugs and inspection of completed work (refer Section 4.5, AS/NZS1747)
- The issuing and authorisation of documentation, certifying compliance with the relevant procedures, certification or approval documentation and Standards for repair and overhaul work

The Cable Repair Signatory assumes the responsibility for the technical validity and accuracy of all information contained in inspection, report and statement of compliance documents

3.3 Accreditation

Competency assessment will be conducted in accordance with Chapter 4.

Signatory accreditation cannot be transferred or delegated. The Department reserves the right to suspend and/or withdraw signatory accreditation where the defined responsibilities have not been met.



Chapter 4 Criteria for competency assessment for accreditation as a Cable Repair Signatory

4.1 Demonstration of competency

Before accreditation as a Cable Repair Signatory, an applicant must be able to demonstrate competency in three technical areas and sit a formal assessment, as follows:

Module 1	Repair of Electric Reeling and Trailing Cables
Module 2	Testing and fault location - Reeling and Trailing Cables
Module 3	Inspection, fitting and replacement of parts of explosion protected restrained and bolted couplers, and
Module 4	Successfully complete an oral examination encompassing the above.

Modules 1, 2 and 3 may be completed “in-house” at an approved cable repair workshop. Module 4, which is an “external” oral assessment, is conducted by peer assessment to verify the candidate’s knowledge.

The candidate must have successfully demonstrated competency in Modules 1, 2 and 3 and have at least two years experience in repairing cables in accordance with AS/NZ 1747 before applying for Module 4 assessment.

4.2 Competency assessment for Modules 1, 2 and 3

It is expected that the skills, knowledge and experience to demonstrate competency in all aspects of cable repairs will be developed over a period of time whilst completing the actual tasks detailed in Modules 1, 2 and 3. The competency assessment for Modules 1 to 3 has been structured to permit timely assessment of individuals. The format of the modules also lends itself to timely review of the individual’s knowledge and skills so that a training/retraining and competency matrix can be maintained by the licensed cable repair facility.

It is recommended that each employee conducting safety critical tasks in respect cable repairs be assessed in accordance with the module criteria before they are given the individual responsibility for the task outcome.

The “in-house” assessment for modules 1, 2 and 3 must be done by a person or persons who satisfy the following criteria:

- Qualifications as a certificate IV assessor, and
- Qualifications as a Cable Repair Signatory (formerly Class B competent person - cable repairs) or a Class A competent person, with a minimum of two years experience managing a cable repair facility.



4.3 Competency assessment for Module 4

Module 4 assessment is managed by the NSW Department of Primary Industries, Mine Safety Secretary of the Coal Competency Board (SCCB) and is the final stage to achieving accreditation as a Cable Repair Signatory. In applying for accreditation the candidate must supply the following information:

1. A completed CABLE REPAIRS Competency Assessment Table and Assessment results form (Module 1)
2. A completed CABLE TESTING / FAULT FINDING Competency Assessment Table and Assessment results form (Module 2)
3. A completed PLUG / COUPLER INSPECTION, FITTING & COMPONENT REPLACEMENT Competency Assessment Table and Assessment results form (Module3)
4. A copy of assessors qualifications as a certificate IV assessor, and qualifications as a Cable Repair Signatory (formerly Class B competent person - cable repairs) or a Class A competent person, with a minimum of two years experience managing a cable repair facility

An individual wishing to be assessed as a cable repair signatory will need to complete and submit the Module 4 application form. Upon the receipt of an application the SCCB will liaise with suitable examiners to arrange the oral examination and notify the applicants of the time, date and place of the scheduled examination. The Secretary will attempt to schedule the oral examination promptly after receiving the application and within the region of the applicant's workplace. However the Department reserves the right to defer applications until there are sufficient applications for efficient utilisation of Department and examiners time, and to select an examination location for best efficiency of all involved.

Prior to the examination the Department will randomly generate a series of questions for each of the key competency technical areas and additional questions in respect the responsibilities of the position as a cable repair signatory.

The examination will consist of a variety of open and closed questions. It is envisaged that an oral examination of approximately one hour should be sufficient time for the applicant to demonstrate their overall competency to the examiners.

Applicable Australian Standards will be made available to the applicant at the examination for reference if required, however excessive time revising material may see the applicant not complete the examination and therefore not demonstrate the full breadth of competencies to the examiners.

The outcomes of the examination will be issued in writing to SCCB by the examiners. The Secretary will verify the qualifications and independence of examiners as per internal procedures and upon a successful outcome, prepare a report and certificate template for review and authorisation by the Senior Inspector of Electrical Engineering. The applicant will be notified the outcome of the examination by mail.



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The assessment for module 4 must be done by a team of at least two persons. The team qualifications shall satisfy the following criteria:

- Qualifications as a certificate IV assessor, and
- Qualifications as a Cable Repair Signatory (formerly Class B competent person - cable repairs) or a Class A competent person, with a minimum of two years experience managing a cable repair facility, and
- At least one person independent of the organisation for whom the candidate works.

An appeals process is available to unsuccessful applicants via the SCCB, otherwise unsuccessful applicants may resubmit for a further examination in three months.



CHAPTER 5 Competency Modules

MODULE 1 Cable Repair Competency Assessment Table

Demonstration of competency

This provides a summary of each of the essential elements of this competency module. The assessment for this module can be done “in-house”. The assessment must be done by a person or persons who satisfy the following criteria:

- Qualifications as a certificate IV assessor, and
- Qualifications as a Cable Repair Signatory (formerly Class B competent person - cable repairs) or a Class A competent person, with a minimum of two years experience managing a cable repair facility.

Note: Where the figures 1.1, 3.3 and 11 are used this relates to the voltage rating of the cable in kilovolts.

Assessment	Description	Section Tasks	Training Completed / Competent	Date	Assessors Initials
1.1 Basic OH&S Training.	Foundation knowledge of workplace health and safety.	- Lifting, manual handling - Isolation practices - Sharps, burns, first aid including CPR, electric shock reporting - Toxicology (heavy metals, pcbs, fumes from heavy metals and insulation materials)	<input type="checkbox"/>		
1.2 Risk Assessment.	To be able to identify and control risk.	Perform a risk assessment on a selected section within this Module	<input type="checkbox"/>		



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Assessment	Description	Section Tasks	Training Completed / Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
1.3 Cable Identification.	To be able to identify the construction of different cables to ensure that the correct materials are used in the repair process.	Type 275	<input type="checkbox"/>				
		Type 209	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Type 240	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Type 241	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Type 245	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Type 260	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Type 409		<input type="checkbox"/>	<input type="checkbox"/>		
		Type 440		<input type="checkbox"/>	<input type="checkbox"/>		
		Type 441		<input type="checkbox"/>	<input type="checkbox"/>		
		Type 450		<input type="checkbox"/>	<input type="checkbox"/>		
			Review certificate/report of new cable compliance to standards		<input type="checkbox"/>		
1.4 Repair Materials.	To be able to identify the different repair materials used in the repair process and the storage requirements of repair tapes.	Semi-conductive repair tape		<input type="checkbox"/>			
		CSP repair tape		<input type="checkbox"/>			
		PCP repair tape		<input type="checkbox"/>			
		Dielectric repair tape		<input type="checkbox"/>			
		Storage of repair tape		<input type="checkbox"/>			



Assessment	Description	Section Tasks	Training Completed / Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
1.5 Cable preparation.	Removal of damaged materials and preparation of cores for repair.	Sheath	<input type="checkbox"/>				
		Power Cores	<input type="checkbox"/>				
		Earth Cores	<input type="checkbox"/>				
		Pilot cores	<input type="checkbox"/>				
1.6 Splicing of conductors.	To be able to join all types of conductors found in mining cables.	Power cores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Earth cores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Pilot cores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Screens	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Pliable Armour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
1.7 Splicing methods.	To be able to demonstrate the ability to join cables and/or conductors using different methods.	Single ferrule	<input type="checkbox"/>				
		Multi ferrule	<input type="checkbox"/>				
		Hot shot	<input type="checkbox"/>				



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Assessment	Description	Section Tasks	Training Completed / Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
1.8 Soldering.	To be able to identify different types of solder and flux. Correct soldering methods.	Correct soldering techniques		<input type="checkbox"/>			
		Minimise solder migration		<input type="checkbox"/>			
		Flux and solder requirements		<input type="checkbox"/>			
		Correct use of PPE		<input type="checkbox"/>			
1.9 Replacement of insulation or covering.	To understand the requirements and application of different types of repair materials.	Power cores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Pilot cores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Earth cores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Outer sheath	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
1.10 Joining pliable armour.	To return mechanical protection back to a suitable condition.	Join armour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Alternate methods					



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Assessment	Description	Section Tasks	Training Completed / Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
1.11 Replacement of sheath.	To return a sheath back to an as new condition to retain its electrical and mechanical properties.	Sheath construction – semi-con screened	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Sheath construction – metallic screened	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Sheath tapers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Application of sheath repair tapes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
1.12 Vulcanising.	To identify when a repair has cured and how to test for hardness. How to identify completed repairs.	Vulcanising times	<input type="checkbox"/>				
		Temperature requirements	<input type="checkbox"/>				
		Hardness testing	<input type="checkbox"/>				
		ID tag requirements	<input type="checkbox"/>				
		Measurement/test instrument calibration	<input type="checkbox"/>				
1.13 Compliance reporting	Cable repair compliance and non-compliance reporting	Reject non-compliance	<input type="checkbox"/>				
		Report compliance	<input type="checkbox"/>				



Typical questions

Typical questions and / or observations that may be asked / made to demonstrate competency in the majority of the essential elements of the cable repair module:

Cable Identification	1. Identify the following cable types -275, 209.1, 241.1, 241.3, 260 (for open cut cables identify types 409, 441, 450).
Repair Materials	1. What materials are used in the construction of the cable you are repairing? 2. Under what conditions are they stored? 3. Identify the following repair tapes - Semi Conductive, CSP repair tape, REP 90 repair tape.
Splicing of Conductors - Joining Power Conductors	1. What criteria would you use to determine that sections of cable were suitable to be joined? 2. Demonstrate how you would prepare a cable to be spliced. 3. What are the other acceptable methods of splicing /joining cables? 4. Where / when is it permissible to use these alternate methods? 5. How would you set the lengths of the remaining conductors to coincide with the first conductor length? 6. What type of solder would you use for multi ferrule and single ferrule splices? 7. Where would you find the requirements for splicing cables?
Splicing of conductors - Joining Pilot Conductors	1. Demonstrate the methods used to join pilot conductors. 2. Where is solder used when joining pilots? 3. Are there any circumstances where a ferrule may be used to join a pilot?
Splicing of conductors - Joining Earth Conductors	1. Describe the types of earths used in the construction of cables. 2. Describe the methods that are acceptable when joining these earths (demonstrate if possible) 3. With metallic earths how do you restore tension after repairs have been completed?
Splicing Methods	1. Demonstrate a single ferrule splice on a conductor 2. Demonstrate a multi ferrule splice on a conductor 3. Demonstrate a Hot / Shot splice on a conductor



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Replacement of Insulation	<ol style="list-style-type: none"> 1. Demonstrate & describe the steps in the preparation of a power conductor prior to the application of insulation. 2. Describe the differences present if the cable were: <ul style="list-style-type: none"> • Semi-conductive screened. • High Voltage. 2. Why is it important to ensure the cleanliness of the insulation? 3. What length would you cut the tapers on the insulation?
Joining Pliable Armour	<ol style="list-style-type: none"> 1. Describe how you would join a pliable wire armoured cable. 2. Are there any alternatives & where may they be applied?
Replacement of Sheath	<ol style="list-style-type: none"> 1. Explain the construction of the sheath component. 2. What is the essential difference in the construction of sheath for semi-conductive & metallic screened cables? 3. Demonstrate & explain how tapers are achieved on cable sheath. 4. Demonstrate how cable sheath is applied. 5. Explain any considerations you deem to be important when applying sheath.
Vulcanising	<ol style="list-style-type: none"> 1. Demonstrate how you would set up a vulcaniser to vulcanise a repair. 2. What are common problems when vulcanising cables. 3. How would you determine that a cable was vulcanised. 4. Demonstrate the use of a Shore "A" Durometer. 5. What effect does an increase in cable CSA or voltage have on the vulcanising times?
Desirable Criteria	<ol style="list-style-type: none"> 1. Task Methodology. 2. Housekeeping. 3. Safety & the application of safe working practices.



Competency assessment results form

MODULE 1 – Cable Repair	
Assessors 1 Name: _____ Qualification Ref: _____	Assessors 2 Name: _____ Qualification Ref: _____
Comments from Assessor(s)	
Comments from Assessee	
I (Assessee) _____ have received a copy of, and agree with, the Assessment Criteria for 'Cable Repair' Cable repair workshop experience commenced (Month/Year): _____ Signed _____ Date _____	
Assessment Result	
Competency achieved -YES / NO	Signature Assessor _____ Date _____
Competency achieved -YES / NO	Signature Assessor _____ Date _____
	Signature Candidate _____ Date _____
Appeal Required	YES / NO If YES, record # _____
Are any changes required to the Assessment process	YES / NO If YES, record # _____
Assessment agreed to by all parties	YES / NO



MODULE 2 Cable Testing & Fault Finding Competency Assessment Table

Demonstration of competency

This provides a summary of each of the essential elements of this competency module. The assessment for this module can be done “in-house”. The assessment must be done by a person or persons that satisfy the following criteria:

- Qualifications as a certificate IV assessor, and
- Qualifications as a Cable Repair Signatory (formerly Class B competent person - cable repairs) or a Class A competent person, with a minimum of two years experience managing a cable repair facility.

Note: Where the figures 1.1, 3.3 and 11 are used this relates to the voltage rating of the cable in kilovolts.

Assessment	Description	Section Tasks	Training Completed / Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
2.1 Basic OH&S Training	Foundation knowledge of workplace health and safety.	Precautions for setup, operating and discharging of high voltage test circuits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2.2 Risk Assessment	To be able to identify and control risk.	Perform a risk assessment on a selected section within this Module	<input type="checkbox"/>				
2.3 Cable History	Access the historical records, identify potential issues and provide information to update records.	Access records	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Interpret records	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Update records	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		



Assessment	Description	Section Tasks	Training Completed / Competent	Date	Assessors Initials
2.4 Electrical Terms	To be able to understand the electrical terms used when reading instruments and recording test results.	Open circuit	<input type="checkbox"/>		
		Short circuit	<input type="checkbox"/>		
		Meg, Gig ohms	<input type="checkbox"/>		
		Resistance	<input type="checkbox"/>		
		Voltage	<input type="checkbox"/>		
		Current	<input type="checkbox"/>		
2.5 Test Equipment	To understand how to read and safely operate test equipment. The correct application of test equipment when testing cables.	Ohm meter	<input type="checkbox"/>		
		Megger	<input type="checkbox"/>		
		Hi pot	<input type="checkbox"/>		
		Sym load	<input type="checkbox"/>		
		Discharge Stick	<input type="checkbox"/>		
		Partial Break	<input type="checkbox"/>		
		Measurement/test Instrument calibration	<input type="checkbox"/>		
2.6 Continuity and Phase Rotation	To be able to demonstrate the method of test and to understand and record the results of the test.	Purpose of phase rotation	<input type="checkbox"/>		
		Circuit connections	<input type="checkbox"/>		
		Power core resistance	<input type="checkbox"/>		
		Earth core resistance	<input type="checkbox"/>		
		Pilot core resistance	<input type="checkbox"/>		



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Assessment	Description	Section Tasks	Training Completed / Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
2.7 Insulation Resistance	To be able to demonstrate the method of test and to understand and record the results of the test.	Purpose of Insulation Test	<input type="checkbox"/>				
		Circuit connections	<input type="checkbox"/>				
		Power core insulation	<input type="checkbox"/>				
		Pilot core insulation	<input type="checkbox"/>				
		Test Voltages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Fault finding	<input type="checkbox"/>				
2.8 High Voltage Proof Test	To be able to demonstrate the method of test and to understand and record the results of the test.	Purpose of Proof test	<input type="checkbox"/>				
		Circuit connections	<input type="checkbox"/>				
		Test Voltages and Times	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Discharging	<input type="checkbox"/>				
		Fault finding	<input type="checkbox"/>				
2.9 Partial Break Test	To be able to demonstrate the method of test and to understand the purpose of the test.	Purpose of Partial Break Test	<input type="checkbox"/>				
		Circuit connections	<input type="checkbox"/>				
		Fault Finding	<input type="checkbox"/>				
		Test requirements	<input type="checkbox"/>				



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Assessment	Description	Section Tasks	Training Completed / Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
2.10 Symmetrical Load Test	To be able to demonstrate the method of test and to understand the purpose of the test.	Purpose of test	<input type="checkbox"/>				
		Circuit connections	<input type="checkbox"/>				
		Test requirements	<input type="checkbox"/>				
2.11 Sheath Test	To be able to demonstrate the method of test and to understand the purpose of the test.	Purpose of test	<input type="checkbox"/>				
		Circuit connections	<input type="checkbox"/>				
		Test Voltages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		Test requirements	<input type="checkbox"/>				
2.12 Compliance reporting	Cable testing compliance and non-compliance reporting	Reject non-compliance	<input type="checkbox"/>				
		Report compliance	<input type="checkbox"/>				



Typical questions

Typical questions and / or observations that may be asked / made to demonstrate competency in the majority of the essential elements of the cable testing and fault finding module:

Risk Assessment	Review a risk assessment completed by the applicant
Review of Cable History	Why should prior history test records be reviewed?
Electrical Terms	<ol style="list-style-type: none"> The applicant should be able to describe the following electrical terms. <ul style="list-style-type: none"> Open circuit Short circuit Resistance Voltage Current Demonstrate how you would take a reading from a Ohm meter Demonstrate how you would take a reading from a Megger
Continuity & Phase Rotation	<ol style="list-style-type: none"> Why do you perform these tests? How do you know that: <ul style="list-style-type: none"> Power conductor is acceptable. Pilot conductor is acceptable. Earth conductor is acceptable. How would you perform this test if you only had access to one termination? Demonstrate how you would carry out this test. Apart from conductors what other components are tested for continuity?
Insulation Resistance Test	<ol style="list-style-type: none"> Why are insulation tests performed? When would you determine that a cable had failed this test? Demonstrate how you would carry out this test. What are the minimum allowable readings for the cable you are testing? Do these readings vary with different voltages, cable constructions or lengths?
High Voltage Equipment	<ol style="list-style-type: none"> Where would you find requirements for electrical equipment used for tests? How does a capacitor discharge unit (surge generator) locate a fault?



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	<ol style="list-style-type: none"> 3. Demonstrate how you test/locate a cable/fault using this equipment. 4. Where would you find the information relating to the maximum pulse voltages for the cable you are testing? 5. Demonstrate the correct use of a discharge stick. 6. How would you apply the test voltage? 7. What are the requirements if you need to exceed the maximum voltage?
High Voltage Proof Test	<ol style="list-style-type: none"> 1. What component part of a cable is tested by the High Voltage proof test? 2. Describe what happens during the test. 3. What are the test connections for the proof test? 4. Why are the connections made in this manner? 5. What type of voltage (AC/DC) does the test unit you are using utilise to perform the test? 6. Where are the selected test voltages listed? 7. 7 Demonstrate how you would carry out this test.
Partial Break Test	<ol style="list-style-type: none"> 1. Explain how the equipment locates a fault. 2. Demonstrate how the connections are made to the cable. 3. How do you determine where a fault is located? 4. What are the requirements if partial break testing armoured cables? 5. Could you test conductors in parallel? Explain your answer.
Symmetrical Load Test	<ol style="list-style-type: none"> 1. What is the purpose of this test? 2. Demonstrate the test connections. 3. Explain how you would determine that the cable was faulty. 4. What would you do if the instrument indicated a fault?
Sheath Test	<ol style="list-style-type: none"> 1. What voltage would you use for the cable under test? 2. How did you determine that the voltage was appropriate? 3. Do test voltages vary with cable construction? 4. Demonstrate how you would use this machine. 5. Why do we earth the earth and power conductors on the cable under test? 6. Explain why & how we rate the electrical cables condition.
Desirable Criteria	<ol style="list-style-type: none"> 1. Task Methodology. 2. Housekeeping. 3. Safety & the application of safe working practices.



Competency assessment results form

MODULE 2 – Cable Testing and Fault Finding	
Assessors 1 Name: _____ Qualification Ref: _____	Assessors 2 Name: _____ Qualification Ref: _____
Comments from Assessor(s)	
Comments from Assessee	
I (Assessee)_____ have received a copy of, and agree with, the Assessment Criteria for 'Cable Testing and Fault Finding' Cable repair workshop experience commenced (Month/Year): _____ Signed _____ Date _____	
Assessment Result	
Competency achieved -YES / NO	Signature Assessor _____ Date _____
Competency achieved -YES / NO	Signature Assessor _____ Date _____ Signature Candidate _____ Date _____
Appeal Required	YES / NO If YES, record # _____
Are any changes required to the Assessment process	YES / NO If YES, record # _____
Assessment agreed to by all parties	YES / NO



MODULE 3 Plug & Coupler Inspection, Fitting & Component Replacement Competency Assessment Table

Demonstration of competency

This provides a summary of each of the essential elements of this competency module. The assessment for this module can be done “in-house”. The assessment must be done by a person or persons that satisfy the following criteria:

- Qualifications as a certificate IV assessor, and
- Qualifications as a Cable Repair Signatory (formerly Class B competent person - cable repairs) or a Class A competent person, with a minimum of two years experience managing a cable repair facility.

Note: Where the figures 1.1, 3.3 and 11 are used this relates to the voltage rating of the cable in kilovolts.

Assessment	Description	Section Tasks	Training Completed/Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
3.1 Risk Assessment	To be able to identify and control risk.	Perform a risk assessment on a selected section within this Module		<input type="checkbox"/>			
3.2 Plug / Coupler Identification	To be able to identify different types of plugs and couplers. Use of the correct Industry terms.	Restrained Plug	<input type="checkbox"/>	<input type="checkbox"/>			
		Restrained Receptacle	<input type="checkbox"/>	<input type="checkbox"/>			
		Bolted Coupler		<input type="checkbox"/>			
		Bolted Adaptor		<input type="checkbox"/>			



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Assessment	Description	Section Tasks	Training Completed/Competent			Date	Assessors Initials
			1.1KV	3.3/6.6KV	11KV		
3.3 Plug / Coupler Inspection	External mechanical checks and interior, socket and gland checks.	External Checks	<input type="checkbox"/>				
		Internal Checks	<input type="checkbox"/>				
3.4 Plug / Coupler Phasing	To be able to identify the correct phasing for voltage, current and pin configurations.	125amp 660V - 1.1kV 4 Pin	<input type="checkbox"/>				
		150amp 660V – 1.1kV 4 Pin	<input type="checkbox"/>				
		300amp 660V – 1.1kV 4 Pin	<input type="checkbox"/>				
		425amp 660V – 1.1kV 4 Pin	<input type="checkbox"/>				
		300 amp 3.3kV 6 pin		<input type="checkbox"/>			
		425 amp 3.3kV 6 pin		<input type="checkbox"/>			
3.5 Plug / Coupler Fitting	To be able to demonstrate the correct method of fitting plugs and couplers.	Preparation of cores	<input type="checkbox"/>				
		Correct Termination lengths	<input type="checkbox"/>				
		Soldering/Crimp Techniques	<input type="checkbox"/>				
		Sheath Protrusion	<input type="checkbox"/>				
		Sheath Clamping	<input type="checkbox"/>				
		Creepage & Clearance	<input type="checkbox"/>				



Assessment	Description	Section Tasks	Training Completed/Competent	Date	Assessors Initials
3.6 Cable Tails, Leads and Terminations	To be able to prepare, fit and inspect tails and Terminations.	Inspections	<input type="checkbox"/>		
		Tails to metallic screened cables and conductive cables	<input type="checkbox"/>		
		Terminate metallic screened and conductive cables	<input type="checkbox"/>		
3.7 Electrical explosion protection (Ex) requirements	To be able to demonstrate basic knowledge of flame proofing requirements.	Understanding Ex d e m	<input type="checkbox"/>		
		Verification against certification/approval documents	<input type="checkbox"/>		
		Requirements / conditions associated from manufacturers, certification and approval documents	<input type="checkbox"/>		
		Inspection of Flame paths, corrosion/indentation curves	<input type="checkbox"/>		
		How flame paths are measured 'L' and 'I'	<input type="checkbox"/>		
		Verification of measurement instrument calibration	<input type="checkbox"/>		
3.8 Compliance reporting	Compliance and non-compliance reporting	Reject non-compliance	<input type="checkbox"/>		
		Report compliance	<input type="checkbox"/>		



Typical questions

Typical questions and / or observations that may be asked / made to demonstrate competency in the majority of the essential elements of the Plug / Coupler Inspection, Fitting & Component Replacement module:

Risk Assessment	1. Review a risk assessment completed by the applicant
Plug / Coupler ID	1. Explain the difference between Restrained Plug, Restrained Receptacle, Bolted Adaptor and Bolted Coupler.
Plug / Coupler Inspection	<ol style="list-style-type: none"> 1. Demonstrate how you inspect a plug or coupler. 2. Why do you inspect the earth sleeves & flanges? 3. How would you determine that a plug or coupler is unfit for service? 4. Where would you obtain information regarding plugs and couplers? 5. Why is earth integrity important?
Plug / Coupler Fitting	<ol style="list-style-type: none"> 1. Demonstrate how you prepare a cable to fit a coupler. 2. How do you know what length to strip back the sheath & insulation? 3. If you did not have any information on strip back lengths how would you determine appropriate lengths? 4. Explain the terms clearance & creepage and where they apply to couplers. 5. What does a dull crystallised texture on a soldered connection indicate? 6. Demonstrate a soldered connection. 7. What are the requirements for solder & flux? 8. When is encapsulating compound used in a coupler? 9. How is earth integrity verified?
Plug / Coupler Phasing	<ol style="list-style-type: none"> 1. How would you identify plug and coupler voltages? 2. Where would you find the information to check if the plug / coupler phasing is correct?
Cable Tails, Leads and Terminations	<ol style="list-style-type: none"> 1. What inspections would you perform on cable tails and terminations? 2. Demonstrate the preparation of a set of tails. 3. Why is it important to include stress relief between the earth screens and power conductors on high voltage terminations? 4. Where would you find the strip back lengths for a termination?



Explosion Protection Requirements	<ol style="list-style-type: none">1. Explain the terms Exd, Exe, Exm.2. Why are the flameproof properties of plugs / couplers important?3. What is I.P. rating and how do you verify it is maintained?4. Where would you find information for flame paths on plugs and couplers?5. Why is verification against certification / approval document required?6. Why are the manufacturer's requirements important to understand?7. Is it necessary to verify certification and approval conditions for explosion protected apparatus?8. What should be considered when inspecting a flamepath?9. Describe how the AS/NZS 3800 corrosion/indentation curves should be interpreted?10. What is meant by the terms Zone 0, 1, 2?11. Why is verification of measurement/test instrument calibration important and how is it maintained at the workshop?
Desirable Criteria	<ol style="list-style-type: none">1. Task Methodology.2. Housekeeping.3. Safety & the application of safe working practices.



Competency assessment results form

MODULE 3 – Plug & Coupler Inspection, Fitting & Component Replacement	
Assessors 1 Name: _____ Qualification Ref: _____	Assessors 2 Name: _____ Qualification Ref: _____
Comments from Assessor(s)	
Comments from Assessee	
I (Assessee)_____ have received a copy of, and agree with, the Assessment Criteria for 'Plug & Coupler Inspection, Fitting & Component Replacement' Cable repair workshop experience commenced (Month/Year): _____ Signed _____ Date _____	
Assessment Result	
Competency achieved -YES / NO	Signature Assessor _____ Date _____
Competency achieved -YES / NO	Signature Assessor _____ Date _____
	Signature Candidate _____ Date _____
Appeal Required	YES / NO If YES, record # _____
Are any changes required to the Assessment process	YES / NO If YES, record # _____
Assessment agreed to by all parties	YES / NO



MODULE 4 Application for assessment as a Cable Repair Signatory

Applications are to be sent to:

Secretary
Coal Competence Board
Mine Safety
A branch of the NSW Department of Primary Industries
PO Box 344
Hunter Regional Mail Centre
MAITLAND, NSW 2310

Submission Requirements: (please complete and submit all 3 pages of the application form along with requested attachments).

PERSONAL DETAILS OF APPLICANT SEEKING ASSESSMENT

Name:
(SURNAME in block letters) (Other Names)

Date of Birth: Place of Birth:

Home Address:

Applicant's Address:

Suburb: State: Postcode:

Home Phone No: Email:

Employer's Details:

Name: ABN

Employers Address:

Suburb: State: Postcode:

Ph: Fax: Email:

Manager / Supervisor / Sponsor:

Position



APPLICANT'S EXPERIENCE:

(Your employer is to provide a statement of total practical cable repair related work experience below)

Employer	Dates		Category of Employment
	From	To	

SUBMISSION ATTACHMENTS: (the following items are essential submissions for the assessment to commence). Attach certified copies of documents and tick box for inclusion:

Applicant's Knowledge:

- A completed assessment for CABLE REPAIRS (see Module 1)
- A completed assessment CABLE TESTING / FAULT FINDING (see Module 2)
- A completed assessment for PLUG / COUPLER INSPECTION, FITTING & COMPONENT REPLACEMENT (see Module 3)

Assessors Details:

- A copy of assessors qualifications as a certificate IV assessor, and qualifications as a Cable Repair Signatory (formerly Class B competent person - cable repairs) or a Class A competent person, with a minimum of two years experience managing a cable repair facility.

APPLICANT FEE:

I enclose a (cheque / money order / other) for the sum of \$150 (GST exempt).

Note: Mine Safety, a branch of the NSW Department of Primary Industries-ABN 51 734 124 190



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DECLARATIONS:

I declare that the above information is a true record of work undertaken during the period specified.

Applicant Name: Signature:

I do solemnly and sincerely declare that the information contained in this application form is a true and faithful statement, and I make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of the Oaths Act, 1900.

Manager Name: Signature:

Made and signed before me at (place)

this day of

JP Name: Signature:



Amendments

EES-012 is to become a quality document. This will require amendments being carried out to facilitate this. When amendments are issued they will be numbered in sequence and dated with the subsequent reprint of the guide including the amendment in the text and the appendix.

The user of EES-012 should:

1. Advise the editor of changes, errors or omissions.
2. Keep the guide up to date with the latest amendment.
3. Send to:

The Editor, EES-012
Paul De Gruchy
Mine Safety Officer Electrical Engineering
PO Box 344
Hunter Regional Mail centre NSW 2320

AMENDMENT UP-DATE SHEET

No	AMENDMENT	Date of Amendment	Date entered	Entered by
0	Initial document based on MDG2006. MDG2006 was based on the 1999 regulations.	January 2007	22/01/2007	J F Waudby
1	Updated to align with legislation	February 2007	23/02/2007	J F Waudby
2	Competent Person – Cable Repairer re-termed to Cable Repair Signatory (The terminology is now aligned to nationally recognised schemes). Open cut requirements are advisory, and are to be used as guidance for workshops that repair open cut cables. References and web addresses have been updated. Reformatting and minor editorial changes made.	September 2007	18/09/2007	P de Gruchy



Feedback Sheet

Your comments will be very helpful in reviewing and improving this document.

Please copy and complete the Feedback Sheet and return it to:

Senior Inspector Electrical Engineering
Mine Safety Operations
NSW Department of Primary Industries
PO Box 344
MAITLAND NSW 2310
Fax: (02) 4931 6790
Phone: (02) 4931 6641

How did you use, or intend to use, this document?

What do you find most useful about this document?

What do you find least useful?

Do you have any suggested changes to the document?

Thank you for completing and returning this Feedback Sheet.



NSW DPI Contact Details

NSW DPI Mineral Resources offices located in coal mining regions

North East Area

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Hunter Regional Mail Centre NSW
2310
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Fax: (02) 4931 6790

Singleton

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Singleton NSW 2330
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Singleton NSW 2330
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