



Trade &  
Investment  
Mine Safety

# **GUIDELINE**

## **MDG 3608**

### **Non-metallic materials for use in underground coal mines**

**August 2012**

**Produced by Mine Safety Operations Branch**

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MDG 3608 has been revised and replaced with a technical reference guide:  
TRG Non-metallic materials for use in underground coal mines and reclaim tunnels in coal  
mines  
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## Disclaimer

The compilation of information contained in this document relies upon material and data derived from a number of third party sources and is intended as a guide only in devising risk and safety management systems for the working of mines and is not designed to replace or be used instead of an appropriately designed safety management plan for each individual mine. Users should rely on their own advice, skills and experience in applying risk and safety management systems in individual workplaces.

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In the event of inconsistency with a provision of any relevant Act or Regulation the provision prevails over the guideline.

This publication may refer to NSW legislation that has been amended or repealed. When reading this publication you should always refer to the latest laws. Information on the latest laws can be checked at: [www.legislation.nsw.gov.au](http://www.legislation.nsw.gov.au),

Alternatively, phone (02) 4931 6666.

NOTE: Notwithstanding the above, at the time of publication this guideline is mandatory<sup>1</sup> for ventilation appliances and accessories (including ventilating sheet and non-metallic ventilating ducting), conveyor belt and conveyor accessories in any underground coal mine and reclaim tunnel.

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<sup>1</sup> Specified in the Gazette to clauses 70 and 124 of the Coal Mine Health and Safety Regulation 2006, see Appendix B

## Publication History

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## Foreword

This is *MDG 3608 Non-metallic materials for use in underground coal mines*.

The use of non-metallic materials in an underground coal mine has potential to initiate a fire or explosion, propagate a fire and emit toxic products into the confined environment if the risks are not adequately controlled.

This guideline has been compiled to assist in assessing the risks from the use of such materials and in formulating appropriate testing standards. It can be considered good industry practice for mitigating the risks associated with the use of non-metallic materials in an underground coal mine at this time.

This guideline provides guidance on testing methods which can be used for non-metallic materials in underground coal mines.

NOTE: Compliance with the specified testing methods does not relieve other general obligations imposed under the Workplace Health and Safety Act.

At the time of publication, the previous version of this guideline is referenced in the gazette to Clause 70 of the Coal Mine Health and Safety Regulation 2006, refer Appendix B.

This is a 'Published Guideline'. It provides an industry benchmark for engineering standards and fit-for-purpose equipment. It represents acceptable industry practice for reducing the risks associated with the use of this equipment.

Users of this Guideline should rely on their own advice, skills and experience in applying risk and safety management systems in individual workplaces.

A feedback sheet is provided in the appendices. Constructive comment is essential to help the department improve this Guideline.

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# 1. Purpose and Scope

## 1.1 Purpose

The purpose of the guideline is to minimise risks to health and safety of people from the use of non-metallic materials in an underground coal mine by providing appropriate testing requirements where there is a risk of;

- (a) a static electric charge,
- (b) fire initiation,
- (c) fire propagation, or
- (d) toxic products of combustion.

NOTE: At the time of publication this guideline is mandatory<sup>2</sup> for ventilation appliances and accessories (including ventilating sheet and non-metallic ventilating ducting), conveyor belt and conveyor accessories in any underground coal mine and reclaim tunnel.

## 1.2 Scope

This guideline covers the general risk controls and testing of non-metallic materials intended for use in underground coal mines.

The outcome sought by this guideline is to provide testing requirements for non-metallic materials where use or application of the material may create a risk to the health, safety and welfare of people working in underground coal mines.

NOTE: This guideline is intended to assist in the evaluation of risk and may not comprehensively cover all safety-related aspects of the use of non-metallic materials.

## 1.3 Application

The guideline applies to all coal mines where non-metallic materials are being supplied, used or being considered for use underground.

It should be used by designers, manufacturers, suppliers and users when undertaking risk assessments and ascertaining minimum testing requirements.

## 1.4 References

A list of documents referenced in this guideline is included in Appendix A.

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<sup>2</sup> Specified in the Gazette to clauses 70 and 124 of the Coal Mine Health and Safety Regulation 2006, see Appendix B

## 1.5 Abbreviations

For the purpose of this document the abbreviations below apply:

AS	Australian Standards
FRAS	Fire resistant anti-static
PCBU	Person conducting a business or undertaking

## 1.6 Definitions

For the purpose of this document the definitions below apply.

### 1.6.1 Chief Inspector

The person appointed as Chief Inspector under Section 145 of the Coal Mine Health and Safety Act 2002.

### 1.6.2 Minor conveyor Accessories

Non-metallic conveyor accessories typically in contact with the conveyor belt which are in small quantities. For example: scraper blades, ploughs, skirt rubbers, pulley lagging, belt splicing kits and belt repair kits.

Notes:

1. It is necessary to ensure an acceptable risk with regard non-metallic conveyor accessories which are in contact with the conveyor belting. Such risks are associated with combustibility (initiation and propagation of fire), static electricity and toxicity of the products of combustion.
2. Non-metallic materials in large quantities such as non-metallic conveyor idlers and structure are not considered "minor conveyor accessories".

### 1.6.3 The department

Refers to NSW Department of Trade and Investment, Regional Infrastructure and Services.

NOTES:

1. also referred to as NSW Trade and Investment
2. Previously the NSW Department of Industry and Investment
3. Previously the NSW Department of Primary Industries

### 1.6.4 Must

Indicates that legal requirements exist, which must be complied with.

### 1.6.5 Shall

Indicates strongly recommended and is a requirement for compliance where compliance with this guideline is sought.

### 1.6.6 Should

Indicates a recommended course of action.



### **1.6.7 Type testing**

Initial and periodic independent testing of a type of product to ensure the product conforms to the specified testing requirements.

NOTE: Type testing is analogous to conformance testing.

### **1.6.8 Ventilation Products and Accessories**

Includes ventilation appliances and accessories, ventilating sheet, non-metallic flexible ventilating ducting, non-metallic rigid ventilating ducting.

## 2. General Requirements

### 2.1 Workplace Health and Safety

#### 2.1.1 Legislative Framework

The Workplace Health and Safety Act 2011 (WHS Act) imposes a general obligation to ensure the health and safety of workers through a process of identifying hazards, assessing risks and eliminating or controlling risks.

In addition to the general duty of care, the NSW Coal Mines Health and Safety regulations require ventilation appliances and accessories, ventilating sheet and non-metallic ventilating ducting, conveyor belt and conveyor accessories in any underground coal mine and reclaim tunnels be flame resistant and antistatic (FRAS) as gazetted.

The WHS legislative framework for engineering safety on mine sites is represented by the diagram in Appendix B2 - Legislative Framework. This diagram highlights the hierarchy of legislation and the legislative considerations when managing engineering safety on a mine.

NOTE:

1. Appendix B provides a summary of referenced legislation
2. Legislation can be found at [www.legislation.nsw.gov.au](http://www.legislation.nsw.gov.au)

#### 2.1.2 WHS Act 2011 and WHS Regulation 2011

The WHS Act and Regulations requires –

**Persons conducting a business or undertaking (PCBU)** must ensure, so far as is reasonably practicable, the health and safety of workers.

Without limitation, that duty extends to, so far as reasonably practicable:

- a) the provision and maintenance of safe plant and structures that are without risks to the health and safety of any person
- b) the provision and maintenance of safe systems of work,
- c) the provision of any information, training, instruction or supervision that is necessary to protect all persons from risks to their health and safety arising from work carried out
- d) that the health of workers and the conditions at the workplace are monitored for the purpose of preventing illness or injury of workers.

PCBUs who are designers, manufacturers, importers and suppliers of plant must ensure, so far as is reasonably practicable,

- i). the plant, substance or structure is designed, manufactured and supplied to be without risks to the health and safety of persons
- ii). they carry out, or arrange the carrying out of, any calculations, analysis, testing or examination that may be necessary to ensure the plant is without risks to the health and safety of persons

- iii). they give adequate information to each person who is provided with the design and give adequate information to each person who is supplied with the plant concerning:
- the purpose for which the plant designed, manufactured, supplied.
  - the results of any calculations, analysis, testing or examination.
  - any conditions necessary to ensure that the plant is without risks to health and safety when used for the purpose for which it was designed.
- iv). on request, so far as reasonably practicable, give current relevant information to a person who manufacturers, supplies or uses the plant.

NOTE: PCBUs are advised to consult the *WHS Act 2011* and the *WHS Regulation 2011*, particularly Chapter 5 Plant and Structure, for details of these requirements.

NOTE: To effectively consider this guideline, designers, manufacturers, suppliers of plant and employers need to be aware of these requirements and have systems and procedures in place to apply them.

### 2.1.3 Hierarchy of Control Measures

The WHS legislation requires that risks (that are not reasonably practicable to eliminate) must be controlled, so far as is reasonably practicable, in the following order:

- a) Substitute the hazard for a hazard of lesser risk;
- b) Isolate the hazard from people; then
- c) Implement engineering controls.
- d) If a risk still remains, then, so far as is reasonably practicable, by
- e) implementing administrative controls, e.g. Safe Work Procedures; then
- f) ensuring the provision and use of suitable personal protective equipment (PPE)

NOTE: A combination of the controls set should be used to minimise risks, so far as is reasonably practicable, if a single control is not sufficient for the purpose.

### 2.1.4 Consultation

The PCBU must, so far as is reasonably practicable, consult with workers who carry out work for the business or undertaking who are, or are likely to be, directly affected by a matter relating to work health or safety.

NOTE: Further guidance can be obtained in the 'OHS Consultation' Code of Practice by WorkCover NSW, see [www.workcover.nsw.gov.au](http://www.workcover.nsw.gov.au)

### 2.1.5 Information

The WHS Regulation requires that all available information must be provided to users with respect to:

- a) identifying the hazards for the use of non-metallic materials
- b) assessing the risks from these hazards
- c) eliminating or controlling those risks
- d) providing other relevant information

## 2.2 Risk Management

### 2.2.1 Hazard Identification

All hazards must be identified and dealt with so that they are eliminated or controls established to minimise the risk to the lowest level reasonably practicable (ALARP). Guidance on the hazard identification and risk management process can be found in AS/NZS ISO 31000.

Specific hazards associated with use of non-metallic materials in underground coal mines which may lead to a risk to the health and safety of persons or personal injury may include but not be limited to:

- a) The initiation of fire due to:
  - (i) Friction between the non-metallic material and another surface.
  - (ii) A static electrical charge being discharged
  - (iii) Heating or melting of the non-metallic material

NOTE: Coal dust may ignite at 150°C

- (b) Propagation fire due to:
  - (i) The quantity of non-metallic materials
  - (ii) The properties of the non-metallic material supporting and / or propagating combustion
- (c) Sparking a potentially gaseous environment due to a static electrical charge being discharged.

NOTE: A static charge may build up with air movement over the non-metallic material and / or rubbing of the material against other materials. Risk varies with velocity, exposed surface area, humidity, temperature, etc.

NOTE: Non-metallic materials that rely on low electrical resistance to dissipate accumulated charge need to be effectively earthed.

- (d) Products of combustion
  - (i) Producing toxic emissions.
  - (ii) Smoke obscuration

### 2.2.2 Risk Assessment

Legislation not only requires that risks to health and safety be managed (covering hazard identification, risk assessment, risk review, risk control, information, auditing, monitoring and review) it also outlines the hierarchy of risk controls.

Designers, manufacturers and suppliers must carry out a design risk assessment to identify all risks and implement appropriate risk controls prior to the supply of any non-metallic materials into an underground coal mine.

This risk assessment should<sup>3</sup> be reassessed whenever variations in design, use, conditions or environment could change the risk.

Risk assessments shall be in accordance with AS 4024.1301 or ISO 3010 and ISO Guide 73, or equivalent recognised standards such as the 'National Minerals Industry Safety and Health Risk Assessment Guideline'.

In the context of non-metallic materials it is preferable to:

- (a) Use a metallic material where reasonably practicable;
- (b) Remove the non-metallic material from potential heat sources or air movements;
- (c) Use a fire resistant and anti-static material where there is a risk;
- (d) Minimise the quantities of non-metallic material;
- (e) Use materials with products of combustion of lower toxicity;
- (f) Implement appropriate emergency plans;

## 2.3 Documentation

Accurate records should be kept and maintained on the risk assessment, testing and purpose of the non-metallic material.

## 2.4 Quality Plan

Non-metallic materials should be manufactured in accordance to a recognised quality system.

NOTE: This is required to ensure consistence of the tested material to that being supplied.

## 2.5 Alternative Equivalent Tests

Alternative equivalent tests to those specified in this guideline may be used provided the alternative provides an equivalent level of safety and is acceptable to the Chief Inspector.

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<sup>3</sup> See also clause 38 WHS Regulation

## 3. Conveyor Belting and Accessories

### 3.1 General

All conveyor belting and accessories must comply with AS4606:2012 and the requirements specified in this section.

NOTE: At the time of the publication this section of the guideline is mandatory<sup>4</sup>

NOTE: Conveyor belts used in underground coal mines must be design registered by the department before use, see [www.resources.nsw.gov.au/safety](http://www.resources.nsw.gov.au/safety).<sup>5</sup>

#### 3.1.1 Test Facility

The test facility used for type testing must;

- (a) be unrelated to the organisation manufacturing the conveyor belt or conveyor accessory; and
- (b) be unrelated to the organisation supplying the conveyor belt or conveyor accessory; and
- (c) be accredited for conducting the tests specified in this Standard and for the issue of reports for these tests by the National Association of Testing Authorities (NATA); or
- (d) be acceptable to the Chief Inspector

#### 3.1.2 Type Testing

All conveyor belting (Grade S) and conveyor accessories being supplied for use must be initially and periodically type tested to independently confirm the conveyor belting or conveyor accessory complies and remains in compliance with this guideline.

NOTE: For non-conventional belts, the Chief Inspector may vary the tests stipulated.

As a minimum, but not limited to, type testing must be carried out:

- (a) Before any belting construction or accessory is supplied for use on the first occasion in an underground coal mine.
- (b) At least every 5 years.
- (c) Where the conveyor belt or conveyor accessory is to be manufactured at an alternative factory.

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<sup>4</sup> See gazette to clauses 70 and 124 of the CMHS Regulation 2006,

see [www.resources.nsw.gov.au/safety/legislation/gazettals](http://www.resources.nsw.gov.au/safety/legislation/gazettals) and Appendix B

<sup>5</sup> Pursuant to clause 53 of Schedule 18B of the *Work Health and Safety Regulation 2011*; Division 3 of Part 5.2 and subclauses 136(5) and (6) of the *Occupational Health and Safety Regulation 2001* continue to apply as if it had not been repealed.

- (d) Where there is a change in supply of raw materials that may affect the performance.
- (e) Where there is a change or difference in the manufacturing process, which may affect the performance.
- (f) Where the manufacturer/supplier becomes aware of circumstances where product has been supplied and subsequently found to be non-compliant to this Guideline.

### **3.1.3 Information to be given to the test facility**

The following information must be given to the test facility prior to the commencement of any type tests, as applicable:

- (a) Applicant's legal name and trading name.
- (b) Applicant's contact details and authorized representative.
- (c) Manufacturer's legal name.
- (d) Location of plant (factory) where conveyor belting was manufactured.
- (e) Purpose of test (i.e. initial type testing, 5 yearly type testing or prototype testing).
- (f) Belt construction i.e. solid woven, ply, steel cord.
- (g) Belt designation.
- (h) Carcass material, including warp and weft (where applicable) and thickness.
- (i) Carcass weave (where applicable).
- (j) Carcass impregnation or polymer impregnation material (skim material), material identification number and thickness.
- (k) Top cover compound(s)/material(s), identification number(s) and thicknesses.
- (l) Bottom cover compound(s)/material(s), identification number(s) and thicknesses.
- (m) Steel cord diameter and construction (where applicable).
- (n) Manufacturer's reference number for the sample supplied (e.g. roll number).
- (o) Colour.
- (p) Confirmation that samples have been produced on manufacturing equipment using manufacturing processes and from the same roll.

### **3.1.4 Records to be kept**

The manufacturer/supplier shall retain records of the following for the life of the particular conveyor belt or conveyor accessory or 7 years whichever is the greater:

- (a) The detailed test results from type testing.
- (b) The detailed results of production acceptance testing.

- (c) Other supporting documents as required by quality assurance accreditation including all process control documents.

The owner/user of conveyor belts and minor conveyor accessories shall retain testing records for the life of the particular belting or accessories

## 3.2 Underground Conveyor Belting

### 3.2.1 General

All conveyor belting used in underground parts of a coal operation must meet the requirements of AS 4606:2000 and the following.

Note: Conveyor belting must<sup>6</sup> be design registered with Trade & Investment before it is used in an underground coal mine.

### 3.2.2 Type Testing Requirements

The following tests must be carried out at intervals as specified in Clause 3.1.2

#### 3.2.2.1 Combustion Propagation Characteristics (Gallery Test)

When tested in accordance with AS 1334.12, meets the requirements of AS 4606:2000, Clause 7.1.

#### 3.2.2.2 Ignition and Maximum Surface Temperature Of Belting Subject To Friction (Drum Friction Test)

When tested in accordance with AS 1334.11, meets the requirements of AS 4606:2000, Clause 7.2.

#### 3.2.2.3 Ignition and Flame Propagation Characteristics (Finger Burn Test)

When tested in accordance with AS 1334.10, meets the requirements of AS 4606:2000, Clause 7.3.

#### 3.2.2.4 Oxygen Index

When tested in accordance with ISO 4589-2, meets the requirements of AS 4606:2000, Clause 7.4.

When the material is tested or retested at a later stage, the results must be within  $\pm 3$  points of that originally obtained but in no case shall be less than 28%.

#### 3.2.2.5 Electrical Resistivity

Surface resistance – When tested in accordance with AS 1334.9 meets the requirements of AS 4606:2000, Clause 7.5.

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<sup>6</sup> Pursuant to clause 53 of Schedule 18B of the *Workplace Health and Safety Regulation 2011*; Division 3 of Part 5.2 and subclauses 136(5) of the *Occupational Health and Safety Regulation 2001* continue to apply as if it had not been repealed. Pursuant to clause 107 of the OHS regulation 2001, conveyor belts used in underground coal mines must be design registered before use.

Refer to [www.resources.nsw.gov.au/safety](http://www.resources.nsw.gov.au/safety) for more information.



### **3.2.3 Manufacture and Supply**

#### **3.2.3.1 Quality Assurance**

All conveyor belting must be manufactured in a factory that operates under a quality system certified to AS/NZS ISO 9001. The quality management system shall—

- (a) be certified by a JAS-ANZ accredited body or a signatory to the IAF MLA for Quality Management Systems (QMS);
- (b) incorporate the entire manufacturing process; and
- (c) be current at the time of manufacture.

Where conveyor belting is manufactured overseas, the supplier must ensure the belting is type tested and manufactured in a quality process in compliance with this guideline.

#### **3.2.3.2 Production acceptance testing**

Production acceptance testing must be conducted on every production run or at intervals of 800 m of manufactured belt, whichever is the lesser.

For all conveyor belting constructions, the following tests shall be carried out in accordance with Clause 3.2.2 :

- (a) Ignitability maximum surface temperature of belting subjected to friction (Drum friction test).
- (b) Electrical resistance.
- (c) Oxygen index.
- (d) Ignitability and flame propagation characteristics (Finger burn test).

The manufacturer's production acceptance test certificates must be labelled with a pass/fail in accordance with for each test conducted.

Production acceptance testing must be carried out at a testing laboratory which is operating under a quality assurance testing regime under a certified (AS/NZS) ISO 9001 system, which includes periodic technical audits.

#### **3.2.3.3 Supply of new belt**

The manufacturer/supplier must not supply conveyor belting manufactured after the stated expiry date for type testing.

#### **3.2.3.4 Supply of used conveyor belt (2nd hand)**

Where the records of used Grade S belting are available, a competent person shall validate that the records apply to the conveyor belt being supplied and the following tests shall be conducted on each 800 m intervals of belting:

- (a) Electrical resistance.
- (b) Oxygen index.

NOTE: The oxygen index test may be used as a measure of its continued fire resistance.

- (c) Ignitability and flame propagation characteristics (Finger burn test).

In addition, a risk assessment shall be carried out on the re-installation of the conveyor belting. The risk assessment shall consider the need to carry out the following tests:

- (i) Combustion propagation characteristics (Gallery test).
- (ii) Ignitability maximum surface temperature of belting subjected to friction (Drum friction test).

Where there are no records available on used Grade S belting, the tests specified in Item (i) and Item (ii) above shall be carried out.

### **3.2.4 Splicing and belting repair materials**

All splicing materials and belting repair material used in underground parts of a coal operation must meet the following requirements:

NOTE: Testing should be performed on samples with the product applied to a FRAS conveyor belt. The belt should have covers on and cut from one direction of belt only.

#### **3.2.4.1 Ignition and Flame Propagation Characteristics (Finger Burn Test)**

When tested in accordance with AS 1334.10, meets the requirements of AS 4606:2000, Clause 7.3.

#### **3.2.4.2 Oxygen Index**

When tested in accordance with ISO 4589-2, meets the requirements of AS 4606:2000, Clause 7.4. The result shall be not less than 28%.

When the material is tested or retested at a later stage, the results shall be within  $\pm 3$  points of that originally obtained but in no case shall be less than 28%.

Testing should be performed on samples with the product applied to a FRAS conveyor belt.

#### **3.2.4.3 Electrical Resistivity**

When tested in accordance with AS 1334.9 meets the requirements of AS 4606:2000, Clause 7.5.

## **3.3 Minor Conveyor Accessories**

### **3.3.1 Testing Requirements**

All non-metallic minor conveyor accessories such as scraper blades, ploughs, skirt rubbers, and pulley lagging must meet the following.

#### **3.3.1.1 Ignitability and Flame Propagation Characteristics (Finger Burn Test)**

When tested in accordance with AS 1334.10, meets the following requirements:

- (a) the average duration of the visible flame shall not exceed 30 s and the average duration of the visible after glow shall not exceed 120 s.
- (b) The duration of the visible flame of any test piece shall not exceed 45 s and the duration of the visible afterglow of any test piece shall not exceed 180 s.

The persistence time of the flame shall include any flame from any molten material that drips from the test piece.

Where no more than two individual sample tests fail due to re-ignition from molten material hitting the gauze under the burner, the test may be redone on a full set of samples by moving the gauze from 6 mm to 12 mm, provided the test

facility has the sufficient samples from the same batch. This must be noted on the test report.

If the sample fails with the gauze at 12 mm, the test may be redone with the gauze at 18 mm; however this is not considered a pass unless otherwise approved by the Chief Inspector.

NOTE: For polymers that drip under this test, the burner may be rotated 45 degrees about the longitudinal axis of the finger in order to prevent molten material falling into the burner

### **3.3.1.2 Oxygen Index**

When tested in accordance with ISO 4589-2, meets the requirements of Clause 7.4 of AS 4606:2000. The result shall be not less than 28%.

When the material is tested or retested at a later stage the results shall be within  $\pm 3$  points of that originally obtained but in no case must be less than 28%.

### **3.3.1.3 Electrical Resistivity**

Surface resistance – When tested in accordance with AS 1334.9 meets the requirements of AS 4606:2000, Clause 7.5.

Through resistance – Where the normal electrical discharge path is between two surfaces, the average of two resistance measurements shall not exceed 300 M $\Omega$  when tested to Clause 7.2 or 7.3 of ISO 2878:2005.

Non-metallic conveyor accessories must be effectively earthed, when installed, to ensure there is no potential for a static charge build-up.

## **3.3.2 Manufacture and Supply**

### **3.3.2.1 Quality Assurance**

All conveyor accessories shall be manufactured under a quality management system that is consistent with the relevant requirements in AS/NZS ISO 9001. The quality management system shall be periodically reviewed.

### **3.3.2.2 Production acceptance testing**

A sample of minor conveyor accessories shall be tested periodically. The manufacturer's quality management system shall stipulate the sampling and testing periods, which shall not exceed 12 months.

When sampled, the following tests shall be carried out in accordance with Clause 3.3.1

- (a) Electrical resistance.
- (b) Oxygen index.
- (c) Ignitability and flame propagation characteristics (Finger burn test).

## **3.4 Non-metallic Conveyor Idlers or Idler lagging**

### **3.4.1 General**

Where large quantities of non-metallic conveyor accessories are used in underground coal mines, (such as in non-metallic conveyor idlers, lagged conveyor idlers and non-metallic conveyor structure) the risks for each particular installation must be identified and controlled to the lowest level reasonably practicable.

Underground coal mines are confined environments and typically have potential to contain methane in an explosive condition. As such a fire or spark in an underground coal mine is considered an event with potentially catastrophic consequences. Any fire or spark, has the potential to ignite methane or ignite coal dust creating an explosion or large scale fire. In addition, the products of combustion may be in the atmospheric environment which people in by or downwind breathe. Some mines do not have oxygen generated self-rescuers, in this case the products of combustion may also block up the filter type self-rescuers.

### **3.4.2 Hazards Identification**

Hazards must be identified and dealt with so that they are eliminated or controls established to minimize the risk to the lowest level reasonably practicable (ALARP). For hazards associated with use of non-metallic materials, see Clause 2.2 Risk Management.

### **3.4.3 Risk Assessment**

#### **3.4.3.1 Design, manufacture, import, supply – Risk assessment**

A design risk assessment for each particular brand, type and model of non-metallic idlers or non-metallic conveyor structure must be carried out by the designer, manufacturer, importer and/or supplier.

A copy of this risk assessment together with the results of all calculations, analysis, testing and other information, as required by Section 22, 23, 24, 25 of the WHS Act and this guideline must be provided to the Chief Inspector at least three months prior to the on-metallic idlers or non-metallic structure being installed on a conveyor system in underground parts of the coal mine.

#### **3.4.3.2 Application site specific – Risk assessment**

An application specific risk assessment on the risks associated with the use of non-metallic idlers must be carried out at each location before any non-metallic idlers or non-metallic structure is used in underground parts of the coal mine.

A copy of this risk assessment must be provided to the Chief Inspector at least one month prior to the on-metallic idlers or non-metallic structure being used in underground parts of the coal mine.

The risk assessment must be carried out in the context of the mine environment and must consider —

- (a) All hazards, risk and means to eliminate or control those risks, as far as reasonably practicable.
- (b) minimum ventilation quantities to dilute the products of combustion to below safe exposure limits;
- (c) methods for automatic detection and suppression of fires; and
- (d) emergency procedures in the event of a fire to ensure people working downwind or in an affected area have no increase in risk to health and safety from the use of non-metallic idlers.
- (e) means to effectively earth the conveyor belt to ensure there is no potential for a static charge build-up.

### **3.4.3.3 *Manufacture and Supply***

The manufacture and supply of non-metallic conveyor idlers must comply with Clause 3.3.2 Manufacture and Supply.

### **3.4.3.4 *Documentation to User***

In addition to the WHS information requirements, a copy of all test results must be provided with the supply of the non-metallic idler or structure to the end user along with identification of the type and quantum of each non-metallic material. These documents must be maintained in a plant safety file for non-metallic idlers at the mine.

## **3.4.4 Minimum Testing Requirements – Conveyor Idlers**

All non-metallic conveyor idlers or metallic idlers with non-metallic lagging must meet the following requirements:

### **3.4.4.1 *Combustion Propagation Characteristics (Gallery Test)***

Where idlers are installed they must undergo a modified gallery test meeting the requirements of Clause 7.1 of AS 4606:2000 in accordance with a modified procedure, to AS 1334.12:1996.

NOTE: The purpose of this test is to check whether the materials used prevent a full scale fire from self propagating along the conveyor structure or between idlers. The test may also be used to measure toxicity of products of combustion in a large scale test and the relative change imposed by the additional non-metallic materials.

The modified procedure must be acceptable to the Chief Inspector.

A draft test procedure is included in Appendix F.

### **3.4.4.2 *Ignitability and Maximum Surface Temperature of Idler Subject To Friction***

A test must be carried out to determine whether a seized idler can initiate a fire by friction between the seized or partially seized idler and the moving conveyor belting due to self-ignition, melting of the non-metallic material or excessive surface temperatures.

NOTE: The purpose of this test is to determine whether a seized idler can initiate a fire by friction between the seized idler and the moving conveyor belting due to; self ignition, melting of the non-metallic material or excessive surface temperatures.

A seized idler must be tested under the following conditions:

- (a) Conveyor belting must run continuously over the idler at a speed of not less than the designed belt speed or 3.0 m/s, whichever is the greater.
- (b) The idler must be loaded with a normal (perpendicular) load of at least 125% of the maximum design dynamic load applied to the idler from the conveyor.
- (c) At least one metal belt clip joint shall be included in the conveyor belt.
- (d) The type of conveyor belting intended for use on the idler in the mine environment that provides the worst results shall be used in the test.
- (e) The conveyor belting shall be run dry during the test.

- (f) The conveyor shall run continuously over a period of at least 2 hours past the point where temperature stabilisation has occurred or for a period of 8 hours, whichever is the lesser.

The idler must meet these requirements at the completion of or during the test;

- (i) The surface temperature of the idler must not exceed 325°C,
- (ii) There must be no visible flaming or visible glowing, and
- (iii) The material shall not melt at a temperature above 150°C.

The procedure must be the acceptable the Chief Inspector.

NOTE: A sample test procedure is included in F2.

#### **3.4.4.3 Ignitability and Flame Propagation Characteristics (Finger Burn Test)**

All non-metallic materials used in the construction of the idler, excluding bearing weather shields must have the following properties.

When tested in accordance with AS 1334.10, meets the following requirements:

- (a) The average duration of the visible flame shall not exceed 30 s and the average duration of the visible after glow shall not exceed 120 s.
- (b) The duration of the visible flame of any test piece shall not exceed 45 s and the duration of the visible afterglow of any test piece shall not exceed 180 s.

NOTE: The persistence time of the flame shall include any flame from any molten material that drips from the test piece.

#### **3.4.4.4 Oxygen Index**

All non-metallic materials used in the construction of the idler, excluding bearing weather shields must have the following properties.

When tested in accordance with ISO 4589-2, meets the requirements of AS 4606:2000, Clause 7.4. The result shall be not less than 28%.

When the material is tested or retested at a later stage, the results shall be within  $\pm 3$  points of that originally obtained but in no case shall be less than 28%.

#### **3.4.4.5 Electrical Resistivity**

Non-metallic conveyor idlers must have a means to ensure the conveyor belt is effectively earthed or otherwise tested to ensure there is no potential for a static charge build-up. This means must be acceptable to the Chief Inspector.

NOTE: For further guidance, see AS/NZS 1020.

NOTE: The non-metallic conveyor idler and structure needs to be effectively and positively earthed to the conveyor belt, otherwise the charge may be held within the conveyor belt i.e. analogous to a car on rubber tyres.

One means includes testing the idler such that there is no more than 1 M $\Omega$  (mega ohm) electrical resistance between any two points on the non-metallic idler and between the non-metallic idlers and ground (or any electrically connected earthing system). Where the idler support structure is made of a conducting material, insulation tests to ground are not required.

The procedure must be consistent with a recognised standard or otherwise acceptable the Chief Inspector.

Where the idler does not have a metallic shaft, at least one bay of conveyor structure must be erected, complete with idlers. The idler must be tested to ensure that there is no more than 1 MΩ (mega ohm) electrical resistance between any point on the structure to any point on the non-metallic idler, to prove effective earth to prove effective grounding of static charges.

Each conveyor system must be tested under the worst conditions for static charge build-up.

#### **3.4.4.6 Toxicity of Products of Combustion**

A toxicity test(s) must be carried out to determine the increase in risk to health or safety from the toxicity or obscurity of the products of combustion from the use of the non-metallic materials.

The designer, manufacturer, importer and supplier must be able to quantitatively demonstrate that the products of the combustion (in the event of a large fire) from the use of the non-metallic idlers in the underground environment will not provide an unacceptable health risk to workers in the mine.

For small scale testing, each type of non-metallic material used in the conveyor idler construction must be tested to and meet the requirements of Appendix C8 Toxicity testing.

For larger scale testing, the products of combustion, as per the table to Appendix C8, and smoke obscurity must be measured, where possible.

NOTE: The results of the test should be used in the risk analysis.

### **3.5 Non-Metallic Conveyor Structure**

Non-metallic conveyor structure must comply with all requirements of Clause 3.4 Non-metallic Conveyor Idlers or Idler lagging with the following amendments.

- (a) An ignitability and maximum surface temperature subject to friction test must be carried out to determine whether conveyor belt rubbing on the non-metallic structure can initiate a fire by friction between the non-metallic structure and the moving conveyor belting due to self-ignition, melting of the non-metallic material or excessive surface temperature

A test method similar clause to 3.4.4.2 Ignitability and Maximum Surface Temperature of Idler Subject To Friction is to be used. The procedure must be the acceptable the Chief Inspector.

The following requirements must be meet at the completion of or during the test;

- 1) The surface temperature of the non-metallic conveyor structure must not exceed 325°C,
  - 2) There must be no visible flaming or visible glowing, and
  - 3) The material shall not melt at a temperature above 150°C.
- (b) The erected structure must be effectively earthed (effectively earthing the conveyor belt) such that there is no more than 1 MΩ

electrical resistance between any point on the non-metallic structure or non-metallic idler to a proven effective earth.

### **3.6 Slider Impact Bars**

If slider impact bars are used in small quantities only, then they may be considered a minor non-metallic material in which case they must comply with Clause 3.3 Minor Conveyor Accessories.

The electrical through resistance must be measured from the conveyor belt surface to the mounting surface, see Clause 3.3.1 Testing Requirements - Electrical Resistivity.

Where slider impact bars pose a larger risk and/or are used in quantities which may increase the risk to the health and safety of workers, then they must also be tested for the following:

- (a) Toxicity of products of combustion as specified in Clause 3.4.4 Minimum Testing Requirements – Conveyor Idlers - Toxicity of Products of Combustion
- (b) An ignitability and maximum surface temperature test similar to Clause 3.4.4 Minimum Testing Requirements – Conveyor Idlers - Ignitability and Maximum Surface Temperature of Idler Subject To Friction. The test method must be acceptable to the Chief Inspector.



## 4. Ventilation Products and Accessories

### 4.1 General

NOTE: At the time of publication this section of the guideline is mandatory<sup>7</sup>

#### 4.1.1 Test Facility

The test facility used for type testing must:

- (a) be unrelated to the organisation manufacturing the ventilation products or accessories; and
- (b) be unrelated to the organisation supplying the ventilation products or accessories; and
- (c) be accredited for conducting the tests specified in this Standard and for the issue of reports for these tests by the National Association of Testing Authorities (NATA); or
- (d) be acceptable to the Chief Inspector

#### 4.1.2 Type Testing

All ventilation products and accessories being supplied for use in underground coal mines must be type tested to independently confirm the product complies with this guideline.

The product must be periodically re-tested –

- (a) At least every 5 years prior continuing supply to confirm the product remains in compliance,
- (b) where there is a change in the raw materials or manufacturing process which may affect the products performance
- (c) where the designer, manufacturer, importer, supplier becomes aware of circumstances where product has been supplied and subsequently found to be non-compliant to this guideline.

#### 4.1.3 Information to be given to the test facility

The following information must be given to the test facility prior to the commencement of any type tests, as applicable:

- (a) Clear identification of the product being tested.
- (b) Applicant's legal name and trading name.
- (c) Applicant's contact details and authorised representative.

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<sup>7</sup> See gazette to clauses 70 and 124 of the CMHS Regulation 2006,

see [www.resources.nsw.gov.au/safety/legislation/gazettals](http://www.resources.nsw.gov.au/safety/legislation/gazettals) and Appendix B

- (d) Manufacturer's legal name.
- (e) Location of plant (factory) where product was manufactured.
- (f) Purpose of test (i.e. initial type testing, 5 yearly type testing or prototype testing).
- (g) Material(s) used in construction and relevant identification number(s).
- (h) Manufacturer's reference number for the sample supplied (e.g. batch or roll number).

#### **4.1.4 Records to be kept**

The designer, manufacturer, importer, supplier must retain records of the following for the life of the particular product or 7 years whichever is the greater:

- (a) The detailed test results from type testing.
- (b) The detailed results of production acceptance testing.
- (c) Other supporting documents as required by quality assurance accreditation including all process control documents.

A copy of the test report must be provided to all users of the product. The coal operator must maintain a record of the test certificate whenever the product is in use at the underground coal mine.

#### **4.1.5 Manufacture and Supply**

##### **4.1.5.1 Quality Assurance**

All ventilation products and accessories shall be manufactured under a quality management system that is consistent with the relevant requirements in AS/NZS ISO 9001. The quality management system shall be periodically reviewed.

##### **4.1.5.2 Production acceptance testing**

A sample of products shall be tested periodically. The manufacturer's quality management system shall stipulate the sampling and testing periods, which shall not exceed 12 months.

#### **4.1.6 Markings**

For traceability, products shall be permanently marked, where reasonably practicable. Markings should include:

- (a) An indication of being FRAS to this guideline
- (b) Year of manufacture.
- (c) Manufacturer's or supplier's identification or trademark
- (d) Manufacturer's serial number or product number

#### **4.1.7 Earthing of Low electrical resistivity materials**

Non-metallic ventilation products and accessories which comply with the following requirements due to their low electrical resistivity must be effectively earthed, when installed, to ensure there is no potential for a static charge build-up.

## 4.2 Ventilating Sheet

All ventilating sheet must be constructed of materials that meet the following requirements.

### 4.2.1 Fire resistance

#### 4.2.1.1 *One Kilowatt Burner Flame Test, Appendix C2*

When tested in accordance with the method in Clause C2.1 the ventilating sheet must meet the requirements specified in Clause C2.2.

#### 4.2.1.2 *Spirit Lamp Test, Appendix C3*

When tested in accordance with the method in Clause C3.1 the ventilating sheet must meet the requirements specified in Clause C3.2.

If during the spirit lamp test the material shrivels away such that the flame does not make contact with the material for the entire application time, then the ventilating sheet may be retested in accordance with the "Follow – Up" Flame Test as specified in Clause C4. When tested in accordance with the method in Clause C4.1 the ventilating sheet must meet the requirements specified in Clause C4.2

### 4.2.2 Electrical resistance

The ventilating sheet must be tested and must pass one of the following:

#### 4.2.2.1 *Electrical Resistance of Flat Surfaces Test, Appendix C5*

When tested in accordance with the method in Clause C5.1, the ventilating sheet must meet the requirements in Clause C5.2.

**OR**

#### 4.2.2.2 *Spark Incendivity, Appendix C9*

When tested in accordance with the method in Clause C9.1 there shall be no ignition, see Clause C9.2.

### 4.2.3 Air Permeability of Brattice Test, Appendix 1

When tested in accordance with the method in Clause C7.1 the ventilating sheet must meet the requirements specified in Clause C7.2

### 4.2.4 Oxygen index

The oxygen index of the ventilation sheeting must be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product must be within  $\pm 3$  points of that originally obtained.

## 4.3 Non-Metallic Flexible Ventilating Ducting

All non-metallic flexible ventilating ducting must be constructed of materials that meet the following requirements.

### 4.3.1 Fire resistance

#### 4.3.1.1 *One Kilowatt Burner Flame Test, Appendix C2*

When tested in accordance with the method in Clause C2.1 the non-metallic flexible ventilating ducting must meet the requirements specified in Clause C2.2.

#### **4.3.1.2 Spirit Lamp Test, Appendix C3**

When tested in accordance with the method in Clause C3.1 the non-metallic flexible ventilating ducting must meet the requirements specified in Clause C3.2.

If during the spirit lamp test the material shrivels away such that the flame does not make contact with the material for the entire application time, then the non-metallic flexible ventilating ducting may be retested in accordance with the "Follow – Up" Flame Test as specified in Clause C4. When tested in accordance with the method in Clause C4.1 the non-metallic flexible ventilating ducting must meet the requirements specified in Clause C4.2

#### **4.3.2 Electrical resistance**

##### **4.3.2.1 External Surface, Appendix C5**

When tested in accordance with the method in Clause C5.1, the non-metallic flexible ventilating ducting must meet the requirements in Clause C5.2.

##### **4.3.2.2 Internal Surface**

The internal surface of the non-metallic flexible ventilating ducting must be tested in accordance with the method in AS 1180.13A:1983.

The electrical resistance of the internal surface of the finished ducting (with supporting spiral, coupling band and any accessories) must not be greater than 1 M $\Omega$ /m.

#### **4.3.3 Oxygen index**

The oxygen index of the non-metallic flexible ducting must be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product must be within  $\pm 3$  points of that originally obtained.

### **4.4 Non-Metallic Rigid Ventilation Ducting**

All non-metallic rigid ventilating ducting must be constructed of materials that meet the following requirements.

#### **4.4.1 Fire resistance**

Non-metallic rigid ventilating ducting must be tested in accordance with the method in AS 1180.10B:1982.

The average duration of flaming and glowing shall not exceed 30 s.

#### **4.4.2 Electrical resistance**

##### **4.4.2.1 Ducting material**

Non-metallic rigid ventilating ducting material must be tested in accordance with the method in AS 1180.13A:1983.

The electrical resistance of the ducting shall not be greater than 1 M $\Omega$ /m.

##### **4.4.2.2 Joined Ducting**

The joined ducting must be tested in accordance with the method in AS 1180.13A:1983.

The electrical resistance of the finished ducting (with supporting spiral, coupling band and any accessories) shall not be greater than 1 M $\Omega$ /m.

#### **4.4.3 Oxygen index**

The oxygen index of Non-metallic rigid ventilating ducting must be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product must be within  $\pm 3$  points of that originally obtained.

### **4.5 Joining Bands for Non-Metallic Ventilating Ducting**

All joining bands for non-metallic ventilating ducting must be constructed of materials that meet the following requirements.

#### **4.5.1 Fire resistance**

The joining bands for non-metallic ventilating ducting must be tested in accordance with the method in AS 1180.10B:1982.

With a flame application time of 20 seconds only, the average duration of flaming and glowing shall not exceed 30s.

#### **4.5.2 Electrical resistance**

##### **4.5.2.1 External Surface, Appendix C5**

When tested in accordance with the method in Clause C5.1, the joining bands for non-metallic ventilating ducting must meet the requirements in Clause C5.2.

##### **4.5.2.2 Internal Surface**

The internal surface of the non-metallic ventilating ducting must be tested in accordance with the method in AS 1180.13A:1983.

The electrical resistance of the internal surface of the finished ventilating ducting (with supporting spiral, coupling band and any accessories) must not be greater than 1 M $\Omega$ /m.

#### **4.5.3 Oxygen index**

The oxygen index of the joining bands for non-metallic ventilating ducting must be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product must be within  $\pm 3$  points of that originally obtained.

## 5. Materials Polymerised Underground

A polymeric material is any material that is polymerised underground, including its constituent components but excluding polyester resin capsules for strata support or any material gazetted by the Chief Inspector as being excluded.

At the time of publication, polymeric materials must be applied by a licensed person. The requirements for licensing have been gazetted by the Chief Inspector.

Copies of the gazetted requirements are available from the department's website; see Appendix B3 for current version at time of publication. See also Appendix D – Polymeric Materials Test Manual – TM003 which sets out testing requirements and is referenced in the gazette.

## 6. Other Defined Applications

### 6.1 Air / Water Hose

Air/water hose used in underground coal mines shall be constructed of materials that meet the following requirements.

#### 6.1.1.1 *Fire resistance*

When tested in accordance with AS 1180.10B:1982, the average duration of flaming and glowing shall not exceed 30 s (AS 2660:1991 Clause 2.1).

#### 6.1.1.2 *Electrical resistance*

When tested in accordance with AS 1180.13A:1983, the electrical resistance shall not be greater than 1 M $\Omega$ /m (AS 2660:1991 Clause 2.2).

#### 6.1.1.3 *Oxygen index*

The oxygen index of air/water hose shall be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product shall be within  $\pm 3$  points of that originally obtained.

### 6.2 Hydraulic Hose

Hydraulic hose used in underground coal mines shall be constructed of materials that meet the following requirements.

#### 6.2.1.1 *Fire Resistance*

When tested in accordance with ISO 8030, meets the requirements of ISO 6805:1994 Clause 15.

#### 6.2.1.2 *Electrical Resistance*

When tested in accordance with ISO 8031, meets the requirements of ISO 6805:1994 Clause 14.

### 6.3 Grid Mesh

Any grid mesh sheet used in underground coal mines shall be constructed of materials that meet the following requirements.

#### 6.3.1 *Fire resistance*

##### 6.3.1.1 *One Kilowatt Burner Flame Test, Appendix C2*

When tested in accordance with the method in Clause C2.1 the grid mesh shall meet the requirements specified in Clause C2.2.

##### 6.3.1.2 *Spirit Lamp Test, Appendix C3*

When tested in accordance with the method in Clause C3.1 grid mesh shall meet the requirements specified in Clause C3.2.

If during the spirit lamp test the material shrivels away such that the flame does not make contact with the material for the entire application time, then the grid mesh may be retested in accordance with the "Follow – Up" Flame Test as

specified in Clause C4. When tested in accordance with the method in Clause C4.1 the grid mesh must meet the requirements specified in Clause C4.2

### **6.3.2 Electrical resistance**

When tested in accordance with I of this guideline, meets the requirements in Appendix C5.2.

When tested in accordance with the method in Clause C5.1, the grid mesh shall meet the requirements in Clause C5.2.

### **6.3.3 Oxygen index**

The oxygen index of grid mesh shall be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product shall be within  $\pm 3$  points of that originally obtained.

## **6.4 V–Belts and Wedge Belts**

Any v-belts or wedge belts used in underground coal mines shall meet the following requirements.

### **6.4.1.1 Fire Resistance**

When tested in accordance with AS 2784:2002 Appendix E, meets the requirements of AS 2784:2002 Clause 2.9.

### **6.4.1.2 Electrical Resistance**

When tested in accordance with AS 2784:2002 Appendix D, meets the requirements of AS 2784:2002 Clause 2.8.

### **6.4.1.3 Oxygen index**

The oxygen index of v-belts or wedge belts shall be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product shall be within  $\pm 3$  points of that originally obtained.

## **6.5 Rib / Roof Bolts**

Rib / roof bolts and supports incorporating fibreglass dowels and plastic rods, and any holding (fastening) nuts shall be constructed of materials that meet the following requirements.

### **6.5.1.1 Fire resistance**

When tested in accordance with AS 1180.10B:1982, the average duration of flaming and glowing shall not exceed 30s.

### **6.5.1.2 Electrical resistance**

When tested in accordance with the method in Clause C5.1, the rib / roof bolts shall the requirements in Clause C5.2.

### **6.5.1.3 Oxygen index**

The oxygen index of roof / rib bolts shall be determined in accordance with ISO 4589-2:1996 for characterisation of the material. Subsequent testing of the product shall be within  $\pm 3$  points of that originally obtained.



## 6.6 Encapsulants

Encapsulants and potting compounds are resins or adhesives which are used to encapsulate circuit boards and semiconductors, fill containers of electronic components and infiltrate electrical coils.

Any encapsulant material used in a mine underground shall meet the requirements of AS/NZS 60079:18:2011.

## 6.7 Flexible intermediate bulk containers (FIBC, stone dust bags)

Any FIBC used in underground coal mines shall be constructed of materials that meet the following requirements.

### 6.7.1 Fire resistance

#### 6.7.1.1 *One Kilowatt Burner Flame Test, Appendix C2*

When tested in accordance with the method in Clause C2.1 the FIBC shall meet the requirements specified in Clause C2.2.

#### 6.7.1.2 *Spirit Lamp Test, Appendix C3*

When tested in accordance with the method in Clause C3.1 FIBC shall meet the requirements specified in Clause C3.2.

If during the spirit lamp test the material shrivels away such that the flame does not make contact with the material for the entire application time, then the FIBC may be retested in accordance with the "Follow – Up" Flame Test as specified in Clause C4. When tested in accordance with the method in Clause C4.1 the FIBC must meet the requirements specified in Clause C4.2

### 6.7.2 Electrical resistance

When tested in accordance with the method in Clause C5.1, Electrical Resistance of Flat Surfaces Test, the FIBC shall meet the requirements in Clause C5.2.

**OR**

Meets the requirements in IEC 61340-4-4.

## 6.8 Bags Used for Explosion Barriers ("Bat Bags")

Any bags used for explosion barriers ("bat bags") used in underground coal mines shall be constructed of materials that meet the following requirements.

### 6.8.1 Electrical resistance

Bat bags shall be tested and must pass one of the following:

#### 6.8.1.1 *Electrical Resistance of Flat Surfaces Test, Appendix C5*

When tested in accordance with the method in Clause C5.1, the ventilation sheeting must meet the requirements in Clause C5.2.

**OR**

#### 6.8.1.2 *Spark Incendivity, Appendix C9*

When tested in accordance with the method in Clause C9.1 there shall be no ignition, see C9.2.

## 6.8.2 Other requirements

Bat bags shall also meet any requirements in MDG 3006 MRT 5 Guideline for Coal Dust Explosion Prevention and Suppression.

## 6.9 Non-metallic Pipe

Where non-metallic pipe is used in the underground parts of a coal mine the risk associated with its use, must be assessed to ascertain the required fire resistant and antistatic properties. The risk of antistatic discharge increases with pipe conveying gases or air at velocity.

Non-metallic pipe shall not be used for conveying of fire hydrant water, see MDG 1032.

Note: The level of FRAS required will vary depending on the application, fluid being conveyed, the location of the pipe in the mine and the quantity of non-metallic material used.

Other considerations in the use of non-metallic pipe should also be given to the pipe products of combustion toxicity, strength, impact resistance, pressure rating and potential risk should the pipe fail.

Where it has been established that FRAS properties are required on non-metallic pipe then following should be considered.

### 6.9.1.1 Fire resistance

Non-metallic pipe shall be tested in accordance with the method in AS 1180.10B:1982.

The average duration of flaming and glowing shall not exceed 30 s.

### 6.9.1.2 Electrical resistance

Non-metallic pipe shall be tested and pass one of the following:

- (a) When tested in accordance with AS 1180.13A:1983, the electrical resistance shall not be greater than 1 MΩ/m (AS 2660:1991 Clause 2.2).

**OR**

- (b) When tested in accordance with Appendix C6, Electrical Resistance of Rigid Pipes and Rods Test against the method in Clause C6.1 meet the requirements in Clause C6.2.

**OR**

- (c) Pass a spark incendivity test (or similar) to a method and requirements acceptable to the Chief Inspector.

### 6.9.1.3 Oxygen Index

When tested in accordance with ISO 4589-2, meets the requirements of AS 4606:2000, Clause 7.4. The result should be not less than 28%.

When the material is tested or retested at a later stage, the results should be within  $\pm 3$  points of that originally obtained.

### 6.9.1.4 Toxicity

Meet the requirements of Appendix C8 Toxicity testing.

# 7. Non-Defined Applications

## 7.1 Risk Assessment

All other non-metallic materials (not specified in earlier Sections of this MDG) intended for use in underground parts of a coal mine must<sup>8</sup> be assessed for the risk of;

- (a) Combustibility,
- (b) Static electric discharge, and
- (c) Toxicity of products of combustion in the intended operating environment.

NOTE: This is not an exhaustive list; there may be other risks present, e.g. excessive temperature from surface friction.

Where there is a risk, the risk assessment shall be supplied to the end user.

Where the risk assessment identifies the need for fire resistant, antistatic or limited toxicity properties then the material should have (as far as reasonably practicable) the relevant properties as specified below or as specified in a relevant recognised standard for the material's application.

NOTE: Further advice should be sought from the department where the following tests are not applicable to the product or application.

## 7.2 Testing Requirements

### 7.2.1 Fire Resistance

Where there is a fire risk and sufficient quantity of material to sustain or propagate a fire, the material should contain the following fire resistant properties:

NOTE: These requirements are not required where it can be reasonably demonstrated that there is no fire risk from the application of the material.

#### 7.2.1.1 Ignitability and flame propagation characteristics (*Finger burn test*)

When tested in accordance with AS 1334.10:1994 the maximum allowable duration of the visible flame should be 10 seconds for the average of all tests and 15 seconds for any single test.

#### 7.2.1.2 Combustion Propagation Characteristics

As an alternative to the finger burn test, for hose or hose type products the average duration of the flame of glowing should not exceed 30 seconds when tested in accordance with AS 1180.10B:1982.

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<sup>8</sup> Mandatory as a generally WHS duty to identify hazards, assess risks and eliminate or if not reasonably practicable control risks

### **7.2.1.3 Oxygen Index**

When tested in accordance with ISO 4589-2:1996, the result should be not less than 28%.

Where the material is tested or retested at a later stage the results should be within  $\pm 3$  points of that originally obtained but in no case should be less than 28%.

## **7.2.2 Antistatic Properties (Electrical Resistivity)**

Where a non-metallic material is likely to hold an electrostatic charge, (refer AS/NZS 1020:1995) such as large surface areas, moving components, near or touching moving components, or in the path of a dust-laden air-stream the material should be verified for ignition risk of flammable gases expected in underground coal mines.

Verification of ignition risk should be in accordance with the following paragraphs or a recognised standard for the material's application.

NOTE: Anti-Static testing is not required where it can be shown that the application of the material prevents any likelihood of electrical charging.

### **7.2.2.1 General applications**

When tested in accordance with the method in Clause C5.1, Electrical Resistance of Flat Surfaces Test, the product shall meet the requirements in Clause C5.2.

**OR**

Meets the requirements of AS 60079.0:2012.

### **7.2.2.2 Higher risk applications**

Materials subject to high velocity air passing over them or requiring a lower level of electrical resistance should meet the requirements of Clause 2.2 of AS 2660:1991.

### **7.2.2.3 Discharge between two surfaces**

Where the normal electrical discharge path is between two surfaces, the average of two resistance measurements should not exceed 300 M $\Omega$  when tested to Clause 8.2 or 8.3 of ISO 2878:2011.

## **7.2.3 Toxicity of Products of Combustion**

Where there is a risk that the products of combustion of the material, in the event of a fire, is likely to affect the toxicity of the mine environment to a point above safe exposure levels to people, then the requirements of Appendix C8 Toxicity testing should be considered.

NOTE: Toxicity testing is not required where it can be reasonably demonstrated that there is no fire risk or risk from the products of combustion.

# Appendix A - Associated Documents

## A1 Australian Standards (including AS/NZS and AS/NZS ISO)

AS/NZS 1020:1995	The control of undesirable static electricity
AS 1180.10B:1982	Methods of test for hose made from elastomeric materials - Determination of combustion propagation characteristics of a horizontally oriented specimen of hose using surface ignition
AS 1180.13A:1983	Methods of test for hose made from elastomeric materials - Determination of electrical resistance of hose and hose components
AS 1334.9:1982	Methods of testing conveyor and elevator belting - Determination of electrical resistance of conveyor belting
AS 1334.10:1994	Methods of testing conveyor and elevator belting - Determination of ignitability and flame propagation characteristics of conveyor belting
AS 1334.11-1988	Methods of testing conveyor and elevator belting - Determination of ignitability and maximum surface temperature of belting subjected to friction
AS 1334.12:1996	Methods of testing conveyor and elevator belting - Determination of combustion propagation characteristics of conveyor belting
AS 2106.2:2005	Methods for the determination of the flash point of flammable liquids (closed cup)-Determination of flash point – Pensky Martens closed cup method
AS 2660:1991	Hose and hose assemblies - Air/water - For underground coal mines
AS 2784:2002	Endless wedge belt and V-belt drives
AS 4024.1301:2006	Risk assessment—Principles of risk assessment
AS 4606:2000 (or 2012 when published)	Fire resistant and antistatic requirements for conveyor belting used in underground coal mines
AS/NZS ISO 9001:2008	Quality management systems - Requirements
AS/NZS ISO 31000:2009	Risk management - Principles and guidelines
AS 60079.0:2012	Explosive atmospheres - Equipment - General requirements

AS 60079.18:2011	Explosive atmospheres - Equipment protection by encapsulation 'm'
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## **A2 Trade and Investment NSW Publications**

MDG 1032 : Jan 2010	Guideline for the prevention, early detection and suppression of fires in coal mines
MDG 3006 MRT 5 : Dec 2001	Guideline for Coal Dust Explosion Prevention and Suppression
MDG 3602 : May 2012	Guideline for material testing for hydraulic fluids, greases and aerosol products

## **A3 International Standards (ISO and IEC)**

ISO Guide 73:2009	Risk management - Vocabulary
ISO 2878:2011	Rubber - Antistatic and conductive products - Determination of electrical resistance
ISO 3010:2001	Basis for design of structures - Seismic actions on structures
ISO 4589-2:1996	Plastics - Determination of burning behaviour by oxygen index – Part 2: Ambient-temperature test
ISO 6805:1994	Rubber hoses and hose assemblies for underground mining - Wire-reinforced hydraulic types for coal mining - Specification
ISO 8030:1995	Rubber and plastics hoses - Method of test for flammability
ISO 8031:2009	Rubber and plastics hoses and hose assemblies - Determination of electrical resistance and conductivity
IEC 61340-4-4:2012	Electrostatics Part 4-4: Standard test methods for specific applications- Electrostatic classification of flexible intermediate bulk containers (FIBC)
IEC 60695-11-2:2003	Fire Hazard Testing Part 11-2: Test flames – 1 kW nominal premixed flame – Apparatus, confirmatory test arrangement and guidance.

## **A4 National Coal Board Standards – United Kingdom (NCB)**

NCB 245:1985	Fire and electrical resistance properties of supported and unsupported sheeting, issued by the National Coal Board of the United Kingdom
NCB 441:1964	Brattice sheeting made from textile supported plastics, issued by the National Coal Board of the United Kingdom

## **A5 Other Publications**

NOHSC: 2011 ( 2003)

National Code of Practice for the Preparation of  
Materials Safety Data Sheets - 2nd Edition

AFAP-3 Edition 3  
2010

NATO Reaction-to-fire-tests for Materials –  
Toxicity of Fire Effluents

# Appendix B - Current Legislation

## B1 General Legislation

Principle legislation for coal mines and mines includes:

- (a) The Workplace Health and Safety Act 2011
- (b) The Workplace Health and Safety Regulation 2011
- (c) The Coal Mine Health and Safety Act 2002
- (d) The Coal Mine Health and Safety Regulation 2006
- (e) The Mine Health and Safety Act 2004
- (f) The Mine Health and Safety Regulation 2007

NOTE: Copies of this legislation are available at [www.legislation.nsw.gov.au](http://www.legislation.nsw.gov.au)

### B1.1 Specific Legislation

#### **B1.1.1 FRAS Materials Ventilating sheet and non-metallic ventilating ducting**

Clauses 70 and 124 of the Coal Mine Health and Safety Regulation 2006 state:

70 FRAS materials

The operator of an underground mine must ensure that ventilation appliances and conveyor belt and accessories in the underground parts of the mine (including reclaim tunnels) are flame resistant and anti-static (FRAS) as Gazetted.

124 Ventilating sheet and non-metallic ventilating ducting

The operator of an underground mine must ensure that a ventilating sheet or non-metallic ventilating ducting is not used in the mine unless it is of material that:

- a) does not give rise to a risk of fire or static electricity, and
- b) meets any Gazetted requirements.

Gazette to Clause 70 FRAS materials and 124 Ventilating sheet and non-metallic ventilating ducting – prior to publication of this guideline



**COAL MINE HEALTH AND SAFETY ACT 2002**

Notice under Clauses 70 and 124(b) of Coal Mine Health and Safety Regulation 2006

**Flame Resistant and Anti-Static (FRAS) Materials**

I, ROBERT REGAN, Chief Inspector, pursuant to Clauses 70 and 124(b) of the Coal Mine Health and Safety Regulation 2006, by this notice, specify that all non-metallic ventilation appliances (including ventilation sheeting and non-metallic ventilation ducting), conveyor belt and non-metallic conveyor accessories in any underground mine must meet the requirements specified in MDG 3006 MTR 8, 'Testing of non-metallic solid materials for use in underground coal mines', December 2006.

Dated this 24th day of January 2007.

ROBERT REGAN,  
Chief Inspector,  
NSW Department of Primary Industries

Dated this 24th day of January 2007.

ROBERT REGAN,  
Chief Inspector,  
NSW Department of Primary Industries

**COAL MINE HEALTH AND SAFETY ACT 2002**

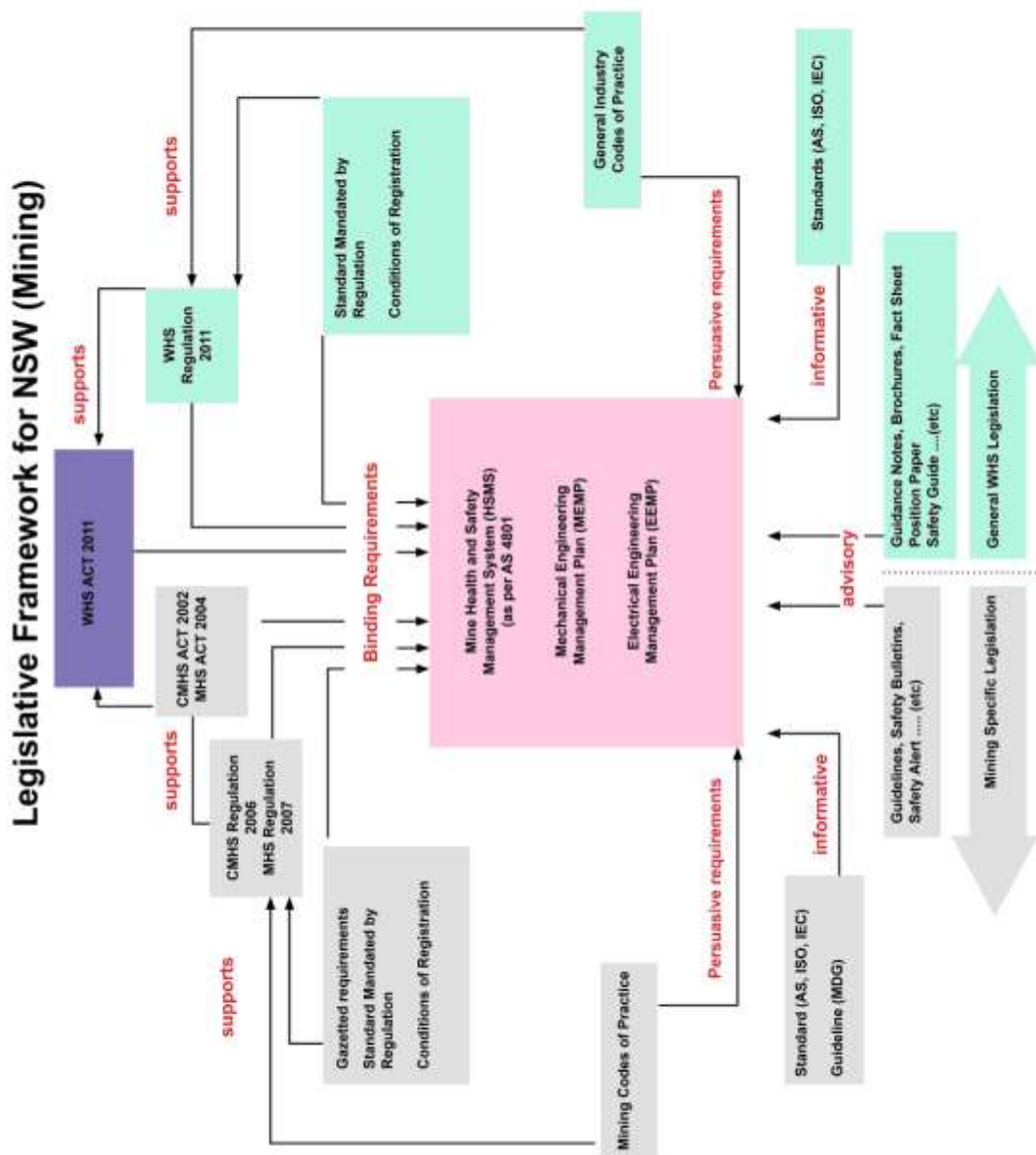
Notice under Clause 3(1) of Coal Mine Health and Safety Regulation 2006

**Powered Winding System**

I, ROBERT REGAN, Chief Inspector, pursuant to Clause 3(1) (definition of "powered winding system") of the Coal Mine Health and Safety Regulation 2006, by this notice, specify that a powered winding system includes:

- (i) any mechanical winch, hoist or other winding plant powered by air, electricity, internal combustion, water, hydraulic power or other means or operated by a force of gravity, designed for the purpose of lifting or lowering persons or heavy materials to or from different levels within an underground mine and/or to the surface of the strata, means of a cable mine

## B2 Legislative Framework



as of February, 2012

Workplace Health and Safety legislative framework for mines in NSW

## Department of Trade and Investment, Regional Infrastructure and Services

ANIMAL DISEASES (EMERGENCY OUTBREAKS)  
ACT 1991

Erratum

THE notice published in the *New South Wales Government Gazette* No. 127 of 16 December 2011, relating to Section 29 Notice, 2nd Further Extension of Importation Order Pigeons (No. 2), was gazetted incorrectly.

The correct notice relating to Section 29 Notice, 2nd Further Extension of Importation Order Pigeons (No. 2) was published in the *New South Wales Government Gazette* No. 126 of 14 December 2011, this date will remain as the date of gazetta].

### COAL MINE HEALTH AND SAFETY REGULATION 2006

Notice under Clauses 149 and 152 Specifying Polymer  
Injection etc. as Licensable and Contents of Licence  
Applications

I, ROBERT REGAN, Chief Inspector, pursuant to Clauses 149 (1) (e) and 152 (1) (b) of the Coal Mine Health and Safety Regulation 2006 (the Regulation), by this notice:

- (a) Revoke the notice titled "Notice under Clauses 149 and 152 specifying polymer injection etc as licensable and contents of licence applications" published in *New South Wales Government Gazette* No. 41 of 19 March 2009, at pages 1289-1290, and
- (b) Specify that:
  - i. the injection or application of polymeric material for the purpose of ventilation or strata control is a licensable activity; and
  - ii. an application for a licence under Part 5 of the Regulation for that activity must contain:
    - the information and particulars specified in the Schedule below; and
    - any other information and particulars required by any applicable form that may be published from time to time on the website of NSW Trade and Investment.

Note: Licences for this activity may be granted for trial and/or ongoing use application.

In this notice, *polymeric material* means any material (including its constituent components) that is polymerised underground, but excludes polyester resin capsules for strata support and any other material that the Chief Inspector may from time to time determine and notify in the *New South Wales Government Gazette*.

Dated this 19th day of December 2011.

ROBERT REGAN,  
Chief Inspector,  
Department of Trade and Investment,  
Regional Infrastructure and Services

SCHEDULE

#### 1. Definitions

In this Schedule:

**equipment** means equipment that an applicant for a licence under Part 5 of the Regulation proposes to use in the injection or application of polymeric material as referred to in paragraph (a) of this notice.

**German permit** means the permit, approval or authorisation (however described) issued by the District Government Arnsberg, Department of Mining and Energy, North Rhine-Westphalia, Federal Republic of Germany demonstrating suitability and covering requirements for safe use of the relevant polymer material in German underground coal mines.

#### 2. Information and particulars on the polymeric material

##### 2.1 Use and nature of polymeric material

Particulars of the nature of the polymeric material and details of its intended uses.

Evidence of the suitability of the polymeric material for its intended uses, including (but not limited to) adhesion properties, strength and flexibility.

##### 2.2 Certification of polymeric material

2.2.1 Subject to Clause 2.2.3, a copy of the complete German permit (that is, of the original in German), including all conditions, signed by the relevant Arnsberg authority, and a certified English translation of all that documentation.

2.2.2 The test report for the relevant polymeric material from the Mine Safety Technology Centre (MSTC), Thornton NSW stating the material has passed all applicable tests in Mine Safety Test Method TM 003.

2.2.3 The German permit requirement under Clause 2.2.1 may be waived, if the applicant provides alternative test reports acceptable to the Chief Inspector.

#### 3. Information on the equipment

A detailed description of the equipment, including schematics, photographs and engineering general arrangement drawings.

#### 4. Risk assessment of equipment and injection or application process

4.1 The report of a risk assessment (that complies with Clause 4.2) conducted on the equipment and the injection or application process.

4.2 The risk assessment must:

- be conducted by a professional independent third party provider;
- include a team member who is an occupational hygienist or chemist with knowledge of the product and component hazards, and other team members acceptable to the Chief Inspector;
- consider any requirements of the German permit where applicable, and

NEW SOUTH WALES GOVERNMENT GAZETTE No. 132

- be in accordance with MDG 1010 – Risk Management Handbook for the Mining Industry, and MDG1014 Guide to Reviewing a Risk Assessment of Mine Equipment and Operators.

#### 5. Information on the licence applicant's operations

##### 5.1 Applicants must provide evidence they have:

- competent people who remain competent by frequently injecting or applying the polymeric material;
- safe work methods for injection or application of the polymeric material that comply with the findings of the risk assessment and conditions of the German permit;
- a documented risk management system that is consistent with AN/NZS ISO 31000:2009 Risk Management – Principles and Guidelines or a health and safety management system consistent with Australian/New Zealand Standard AS/NZS 4804:2001 Occupational health and safety management systems – General guidelines on principles, systems and supporting techniques.
- a quality system that is certified under AS/NZS ISO 9001 for the applicant's operations, with scope to include, as appropriate, the injection or application of polymeric material for ventilation or strata control in the mine;
- conducted a surface trial of the polymeric material and the relevant system; and

Note: The Chief Inspector or the Chief Inspector's representative must be given at least one week's notice before such trials are undertaken.

- 5.2 For materials that are applied directly from pre-packaged syringes or pressurised containers less than 40 kg total weight, the applicant is not required to have a quality system certified to AS/NZS ISO 9001 or to conduct a surface trial as required in 5.1. The applicant may only obtain material from a supplier who has a quality system that is certified under AS/NZS ISO 9001.

#### MINING ACT 1992

##### Instrument of Appointment of Inspector

I, BRAD MULLARD, Executive Director Mineral Resources, Department of Trade and Investment, Regional Infrastructure and Services, pursuant to section 361 of the Mining Act 1992, appoint Gavin Dale Hoskins as an inspector for the purpose of that Act.

Dated this 21st day of December, 2011.

BRAD MULLARD,  
Executive Director Mineral Resources  
Department of Trade and Investment  
Regional Infrastructure and Services  
(Under delegation)

#### MINE HEALTH AND SAFETY ACT 2004

##### Instrument of Appointment

I, BRAD MULLARD, Executive Director Mineral Resources, Department of Trade and Investment, Regional Infrastructure and Services, pursuant to section 127 (1) (c) of the Mine Health and Safety Act 2004, hereby appoint John George LEAN as a Mine Safety Officer.

Dated this 20th day of December 2011.

BRAD MULLARD,  
Executive Director,  
Mineral Resources,  
Department of Trade and Investment,  
Regional Infrastructure and Services  
(in exercise of the Minister's function under  
section 127 (1) (c) of the Act, delegated with  
authority to sub-delegate to the Director-General  
under section 182, and sub-delegated  
under section 184 (2))

#### MINE HEALTH AND SAFETY ACT 2004

##### Instrument of Appointment

I, BRAD MULLARD, Executive Director Mineral Resources, Department of Trade and Investment, Regional Infrastructure and Services, pursuant to section 127 (1) (c) of the Mine Health and Safety Act 2004, hereby appoint Gavin Dale Hoskins as a Mine Safety Officer.

Dated this 21st day of December, 2011.

BRAD MULLARD,  
Executive Director Mineral Resources  
Department of Trade and Investment,  
Regional Infrastructure and Services  
(in exercise of the Minister's function under  
section 127 (1) (c) of the Act,  
delegated with authority to sub-delegate to the  
Director-General under section 182,  
and sub-delegated under section 184 (2))

#### MINERAL RESOURCES

NOTICE is given that the following applications have been received:

##### EXPLORATION LICENCE APPLICATIONS

(T11-0381)

No. 4456, MOBILA PTY LTD (ACN 002 069 258), area of 84 units, for Group 1, dated 16 December 2011. (Orange Mining Division)

(T11-0382)

No. 4457, STBARBARALIMITED (ACN 009 165 066), area of 10 units, for Group 1, dated 20 December 2011. (Orange Mining Division)

##### MINING LEASE APPLICATION

(11-6538)

No. 416, DONALDSON COAL PTY LTD (ACN 073 088 945) and NEWCASTLE COAL COMPANY PTY LTD (ACN 074 900 208), area of about 1085.1 hectares, to mine for coal, dated 12 December 2011. (Singleton Mining Division)

CHRIS HARTCHER, M.P.  
Minister for Resources and Energy

# Appendix C - Mine Safety Technology Centre - Test Methods

## C1 General

NOTE: Note: These following tests can be carried out at the NSW Mine Safety Technology Centre at Thornton, see [www.resources.nsw.gov.au/safety](http://www.resources.nsw.gov.au/safety).  
Telephone: 02 4924 4000

## C2 One Kilowatt Burner Flame Test

### C2.1 Method

This method has been adapted from the National Coal Board Specification NCB 245:1985 Fire and Electrical Resistance Properties of Supported and Unsupported Sheeting, Appendix 2 – 1 Spirit burner flame test procedure

#### C2.1.1 Test Pieces

##### C2.1.1.1 Selection of test pieces

Samples of not less than 3 m<sup>2</sup> shall be selected for test from material in sheet or roll form.

NOTE: Note: Samples can be cut from the same 3 m<sup>2</sup> sheet as supplied for tests C3 Spirit Lamp Test and C4 "Follow – Up" Flame Test

Six test pieces, 75 mm wide x 360 mm long shall be cut cleanly from the sample. Three test pieces shall be cut parallel to the length of the sheeting and three at right-angles to it. The test pieces shall be cut from places widely spaced from each other so that they are representative of the whole area of the sample of sheeting.

##### C2.1.1.2 Conditioning

The test pieces shall be conditioned by free suspension at normal room temperature and humidity with both sides freely exposed to the atmosphere for at least 12 hours.

#### C2.1.2 Apparatus

##### C2.1.2.1 Spirit burner

A spirit burner complying with the requirements of BS 5865 'Specification for construction and burner for small-scale laboratory tests'. The supply of fuel to be from a reservoir having a graduated arm.

The burner shall be supplied with IMS 95 methylated spirit at a rate of 2.55 ± 0.15 ml/min. The fuel level reservoir shall be maintained within the range 760 ± 20 mm above the base of the burner.

##### C2.1.2.2 Alternative burner and fuel

As an alternative to the above, a 1 kW burner that meets the requirements of IEC 60695-11-2 may be used.

### **C2.1.2.3 Cabinet**

The test shall be carried out in a cabinet generally to the design and dimensions in *Figure 1 Schematic diagram of cabinet*. The inside of the cabinet shall be black.

A fume hood, with an extraction fan, may be positioned above the cabinet; the fan may be run during the test provided that it does not induce air movement through the cabinet additional to that required for the operation of the burner. Where this condition is not satisfied the fan shall be switched off during the test.

If required, additional close fitting holes may be made in the cabinet to permit the entry of a remote handling device for the burner and the fuel pipe.

### **C2.1.2.4 Stand for flame test**

The purpose of the stand, which is shown in *Figure 2 Typical experimental set up for the spirit burner test*, is to hold both the test piece and the spirit burner in the required positions for carrying out the test.

The stand consists of a fabricated light steel frame and the test piece is suspended from the top crossbar of the stand by means of a spring-clip. The lower corner of the test piece is slipped into a simple fork formed by a longitudinal saw cut in the end of a steel strip. The steel strip shall be not larger than 10 mm wide and 3 mm thick.

The fork serves to hold the test piece steady during the test and shall be fixed to the stand such that the distance from the bottom edge of the fork to the bottom end of the test piece is 12 mm and the distance from the end of the fork to the side edge of the test piece is 25 mm.

A rotating bracket or similar device is attached to the side of the stand opposite the fork with arrangements for clamping the burner at an angle of 45° to the vertical. By this means the burner may be moved so that the flame either plays on the test piece or is well clear of it.

A small metal tray is fixed to the stand approximately 15 mm below the bottom edge of the test piece when in the test position. This tray serves to catch any portion of the test piece which may fall and allows it to continue burning. A marker is stretched horizontally across the stand in front of the test piece. This consists of a length of 20 SWG wire and is set 280 mm above the bottom edge of the test piece.

Alternative stand and burner support designs are acceptable provided that they are dimensionally equivalent.

### **C2.1.3 Procedure**

- a) Tests shall be carried out in the test cabinet in subdued light.
- b) Light the burner and check for correct operation.
- c) The position of the burner in its clamp shall be adjusted so that, when in the test position, the centre of the burner mouth is 50 mm below and 50 mm to one side of the nearer lower corner of the test piece with the in the plane of the test piece.
- d) Each test piece shall be in the burner flame for 20 seconds and the burner and flame shall then be swung clear of the test piece.

- e) The behaviour of each test piece shall be observed from the time the flame is applied until at least 30 seconds after any flame or glow on the test piece is extinguished.

### C2.1.4 Expression of Results

The following results shall be stated in the test report:

- a) the time for all visible flame and glow to disappear on each of the six individual test pieces;
- b) the time for all visible flame and glow to disappear of the six test pieces

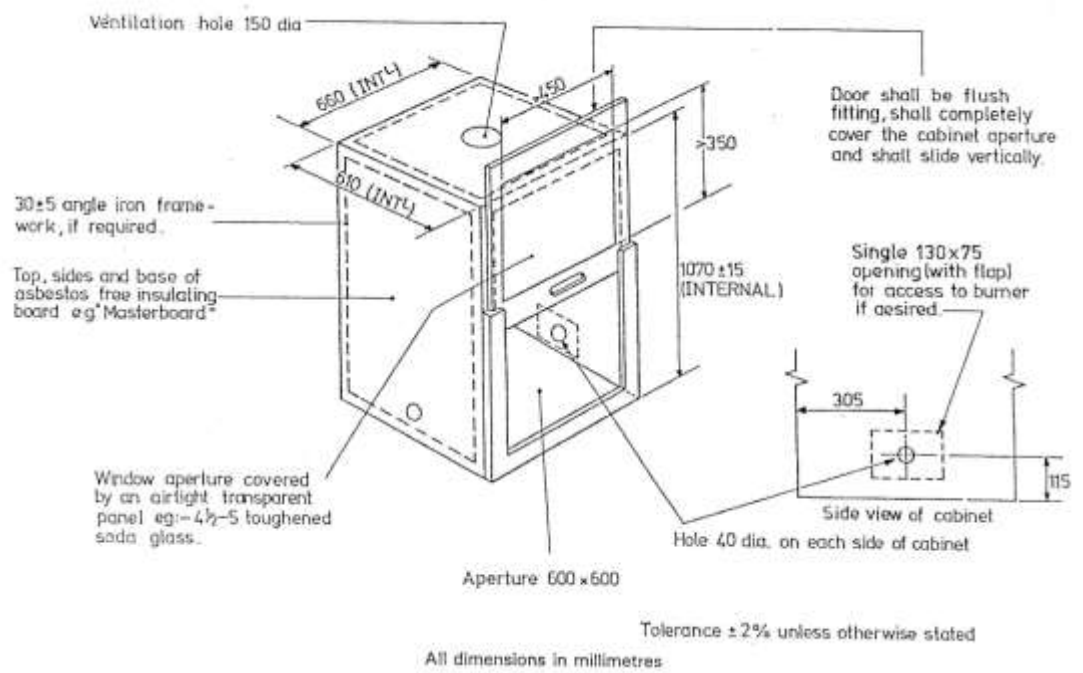


Figure 1 Schematic diagram of cabinet

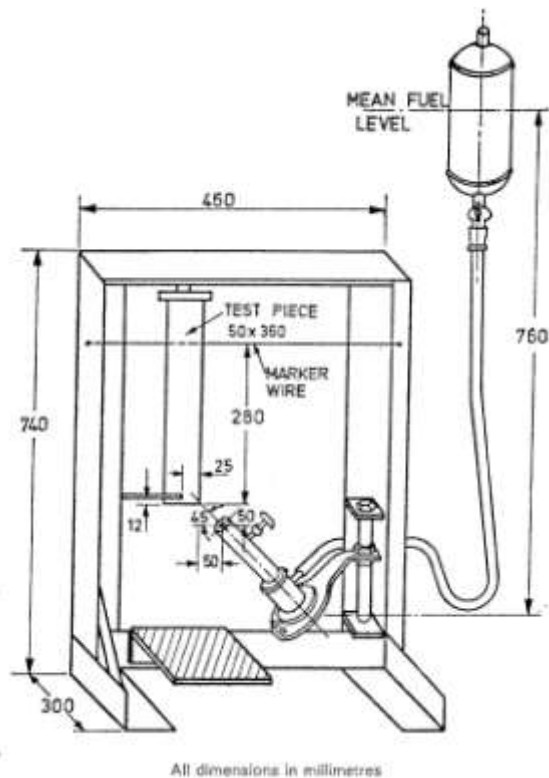


Figure 2 Typical experimental set up for the spirit burner test

## C2.2 Requirements

The material shall fail the test if any of the following occur:

- a) If at any time:
  - (i) a flame on two or more test pieces extends above the marker wire; or
  - (ii) a glow on two or more test pieces extends above the marker wire.

If on only one test piece a flame or glow extends above the marker wire, then a further six test pieces shall be prepared and tested. In this circumstance the material shall fail the test if flame or glow extends above the marker wire from any single test piece.

- b) If after the burner flame has been removed:
  - (iii) the mean persistence time of the flame of each of the six test pieces exceeds 3 seconds, or if the persistence time of the flame on any one test piece exceeds 10 seconds;
  - (iv) the mean persistence time of the glow of each of the six test pieces exceeds 10 seconds or if the persistence time of the glow on any one test piece exceeds 30 seconds.

Glow time shall be measured from the instant of removal of the burner flame from the test piece. The requirements of (i) and (ii) refer both to the suspended test pieces and any portions that may have fallen from the test pieces.



## C3 Spirit Lamp Test

### C3.1 Method

This method has been adapted from the National Coal Board Specification NCB 245:1985 Fire and Electrical Resistance Properties of Supported and Unsupported Sheeting, Appendix 3 – Spirit lamp test

#### C3.1.1 Test Pieces

##### C3.1.1.1 Selection of test pieces

Samples of not less than 3 m<sup>2</sup> shall be selected for test from material in sheet or roll form.

Note: Samples can be cut from the same 3 m<sup>2</sup> sheet as supplied for tests C2 One Kilowatt Burner Flame Test and C4 "Follow – Up" Flame Test

Six test pieces, 75 mm wide × 360 mm long shall be cut cleanly from the sample. Three test pieces shall be cut parallel to the length of the sheeting and three at right-angles to it. The test pieces shall be cut from places widely spaced from each other so that they are representative of the whole area of the sample of sheeting.

##### C3.1.1.2 Conditioning test pieces

The test pieces shall be conditioned by free suspension at normal room temperature and humidity with both sides freely exposed to the atmosphere for at least 12 hours.

#### C3.1.2 Apparatus

##### C3.1.2.1 Spirit lamp

A methylated spirit lamp of minimum capacity 60 millilitres. The visible flame shall be between 30 and 35 mm high measured from the top of the wick holder to the top of the flame.

The burner be supplied with IMS 95 methylated spirit.

##### C3.1.2.2 Test stand

A suitable test stand shall be used (*Figure 3 Experimental set up for the spirit lamp and follow up flame tests*) consisting of a framework and clamps to hold the test piece in the required position during the test.

##### C3.1.2.3 Cabinet

The test shall be carried out in a cabinet generally to the design and dimensions in *Figure 1 Schematic diagram of cabinet*. The inside of the cabinet shall be black.

A fume hood, with an extraction fan, may be positioned above the cabinet; the fan may be run during the test provided that it does not induce air movement through the cabinet additional to that required for the operation of the burner. Where this condition is not satisfied the fan shall be switched off during the test.

If required, additional close fitting holes may be made in the cabinet to permit the entry of a remote handling device for the burner and the fuel pipe.

### C3.1.3 Procedure

- a) Tests shall be carried out in the test cabinet in subdued light.
- b) The test piece shall be suspended from the clamps so that it hangs vertically with its lower end held by horizontal clamps, one each side in such a way as to prevent movement of the test piece during the application of the flame (Figure 3). The lower edge of the clamps shall coincide with the lower edge of the test piece and overlap the sides by 13 mm.
- c) The flame is positioned so that the top of the wick holder is 20 mm below the middle of the lower edge of the test piece.
- d) Each test piece shall be held in the flame for 10 seconds and the lamp and flame shall then be withdrawn clear of the test piece.

### C3.1.4 Expression of Results

The following results shall be stated in the test report:

- a) the time for all visible flame and glow to disappear from each of the six individual test pieces: and
- b) the mean time for all visible flame and glow to disappear on the six test pieces.

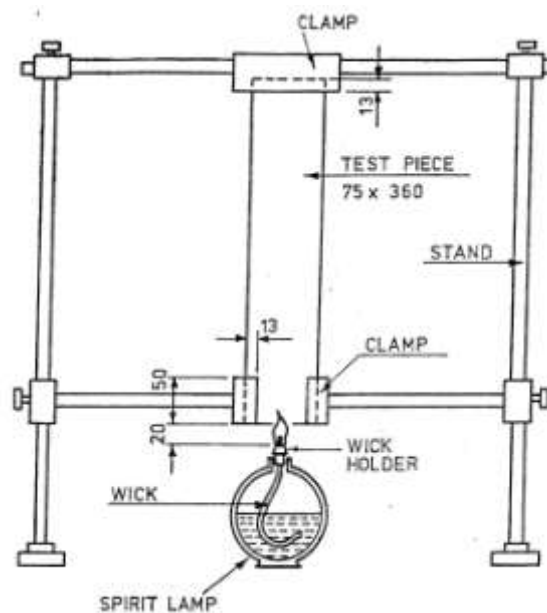


Figure 3 Experimental set up for the spirit lamp and follow up flame tests

### C3.2 Requirements

The material shall fail the test where any of the following occur:

- a) mean persistence time of the flame of the six test pieces exceeds 6 seconds or if the persistence time of the flame of any one test piece exceeds 12 seconds;
- b) mean persistence time of the glow of the six test pieces exceeds 10 seconds or if the persistence time of the glow on any one test piece exceeds 30 seconds.

Should the material shrivel away such that the flame does not make contact with the material for the entire application time, the test shall be deemed invalid and the follow-up flame test shall be performed.

## **C4 "Follow – Up" Flame Test**

### **C4.1 Method**

This method has been adapted from the National Coal Board Specification NCB 245:1985 Fire and Electrical Resistance Properties of Supported and Unsupported Sheeting, Appendix 4 – Follow up flame test

NOTE: This test should only be performed where, during the spirit lamp test, the material shrivels away such that the flame does not make contact with the material for the entire application time and the test is deemed invalid.

The concept behind the test is to see whether, following simple low energy ignition, the sheeting will sustain combustion.

The reason for altering the "Follow-Up" Flame test in NCB 245:1985 Appendix 4 is because the method was biased against materials that shrivelled away from a flame. Using that method resulted in test samples not complying with the "completely consumed" criteria of the "Follow-Up" Flame test requirements. Since this characteristic of shrivelling away from a flame needed to be encouraged and not discouraged, the method was altered.

Therefore instead of using six different exposure times, a single exposure time is selected prior to testing, and this is used for the six samples that are tested. Selection of the exposure time is detailed in the revised method.

To protect against approving materials that burn very rapidly, then the "completely consumed" criteria still remains part of the "Follow-Up" Flame test requirements.

#### **C4.1.1 Test Pieces**

##### **C4.1.1.1 Selection of test pieces**

Samples of not less than 3 m<sup>2</sup> shall be selected for test from material in sheet or roll form.

Note: Samples can be cut from the same 3 m<sup>2</sup> sheet as supplied for tests C2 One Kilowatt Burner Flame Test and C3 Spirit Lamp Test

Six test pieces, 75 mm wide × 360 mm long shall be cut cleanly from the sample. Three test pieces shall be cut parallel to the length of the sheeting and three at right-angles to it. The test pieces shall be cut from places widely spaced from each other so that they are representative of the whole area of the sample of sheeting.

##### **C4.1.1.2 Conditioning test pieces**

The test pieces shall be conditioned by free suspension at normal room temperature and humidity with both sides freely exposed to the atmosphere for at least 12 hours.

## **C4.1.2 Apparatus**

### **C4.1.2.1 Spirit lamp**

A methylated spirit lamp of minimum capacity 60 millilitres. The visible flame shall be between 30 and 35 mm high measured from the top of the wick holder to the top of the flame.

The burner be supplied with IMS 95 methylated spirit

### **C4.1.2.2 Test stand**

A suitable test stand shall be used (Figure 3) consisting of a framework and clamps to hold the test piece in the required position during the test.

### **C4.1.2.3 Cabinet**

The test shall be carried out in a cabinet generally to the design and dimensions in *Figure 1 Schematic diagram of cabinet*. The inside of the cabinet shall be black.

A fume hood, with an extraction fan, may be positioned above the cabinet; the fan may be run during the test provided that it does not induce air movement through the cabinet additional to that required for the operation of the burner. Where this condition is not satisfied the fan shall be switched off during the test.

If required, additional close fitting holes may be made in the cabinet to permit the entry of a remote handling device for the burner and the fuel pipe.

## **C4.1.3 Procedure**

The procedure shall be as follows:

1. Suspend the test piece in accordance with Appendix C3.1.3 and open the door of the cabinet up to 180 mm.
2. Insert a sample in the test stand and position the flame so that the top of the wick holder is 20 mm below the middle of the lower edge of the test piece.
3. Hold the lamp in a stationary position and record the time taken for the sample to shrivel away from the flame.
4. Repeat the above and record the mean time.
5. Select a test exposure time of either 15, 20, 25, 30, 45, and 60 seconds based on the next highest increment to the value recorded in step 4. (e.g. if the value recorded in step 4 was 22 seconds then the test exposure time would be 25 sec.)
6. Insert a new sample in the test stand.
7. Hold and steadily raise the spirit lamp by hand so that the flame remains in contact with the test piece including char or slag (i.e. the material is not allowed to shrivel away from the flame).
8. Any char or slag shall not be removed during the test.
9. The lamp shall be removed after the exposure time (i.e. determined above). The persistence time of the flame and glow shall be measured.
10. Repeat the steps 6 to 9 for another five samples.

#### **C4.1.4 Expression of Results**

The following results shall be stated in the test report:

- a) the time for all visible flame and glow to disappear from the test piece at each of the six exposure times;
- b) the mean time for all visible flame and glow to disappear from the six test pieces, and
- c) whether the test piece is completely consumed at each of the six exposure times.

#### **C4.2 Requirements**

The material shall fail the test where any of the following occur:

- a) the mean persistence time of the of the six test pieces exceeds 60 seconds or where the persistence time of the flame of any one test piece exceeds 80 seconds;
- b) mean persistence time of the glow of the six test pieces exceeds 60 seconds or where the persistence time of the glow on any one test piece exceeds 80 seconds; or
- c) the material is completely consumed.

### **C5 Electrical Resistance of Flat Surfaces Test**

#### **C5.1 Method**

This method has been adapted from the National Coal Board Specification NCB 245:1985 Fire and Electrical Resistance Properties of Supported and Unsupported Sheeting, Appendix 5 – Electrical resistance of flat surfaces test

##### **C5.1.1 Test Pieces**

Two test areas shall be prepared on the upper surface of the sample of sheeting and two on the lower surface. Each test area shall be not less than 300 mm x 300 mm.

##### **C5.1.2 Preparation of Test Pieces**

###### **C5.1.2.1 Surface cleaning**

The surfaces of the test areas shall be cleaned by dusting and rubbing with Fullers' earth (Technical Grade) using a clean pad of cloth or wool. After all traces of powder have been cleaned away, the surfaces shall be wiped over with a clean pad moistened with distilled water and then rubbed dry with a clean cloth.

###### **C5.1.2.2 Application of electrodes**

An electrode system shall be applied to each of the test areas. Each electrode system shall comprise two electrodes of soft, thin metal foil consisting of a circular disc 25 mm in diameter with a concentric annulus having internal and external diameters of 125 mm and 150 mm respectively as shown in Figure 4. Great care shall be taken to ensure accuracy of the dimensions of the electrodes, however the symmetry of the annulus about the centre disc is not critical.

The electrode system shall be applied centrally on the test area.

The electrode shall be attached to the test areas by a conducting liquid contact agent of:

- (a) anhydrous polyethylene glycol of molecular weight 600: 4 parts by mass;
- (b) soft soap: 1/200 parts by mass; and
- (c) water: 1 part by mass.

Liquid coatings of the same dimensions as the foil electrodes shall be formed on the surface. This may be conveniently accomplished with two felt pads of the same dimensions as the electrodes, moistened with the contact agent. The electrodes shall be rubbed on to the test surface with a finger or small soft pad. If the surface is indented, the foil electrodes shall, after rubbing, clearly follow the indentation. The contact agent shall not be smeared on the surface between the central disc and the annulus, however any small excess may be wiped away with a clean wool pad.

The foil electrodes may be omitted if the sheeting surface is sufficiently smooth and flat to enable the liquid contact agent to maintain continuous contact between the sheeting and the brass contact pieces, however with other surfaces such an omission can result in the indicated resistance being higher than the true resistance.

### **C5.1.3 Apparatus**

#### **C5.1.3.1 Measuring instrument**

The resistance measuring instrument shall cover the range  $10^6 \Omega$  (1 M $\Omega$ ) to  $10^{10} \Omega$  (10,000 M $\Omega$ ) and shall be accurate to within  $\pm 5\%$  of the true value over this range. The potential applied to the electrodes under test shall be between 40 and 1000V dc and shall be chosen so not more than 1 W is dissipated in the test piece.

#### **C5.1.3.2 Brass contact pieces**

The brass contact pieces shall consist of a cylinder and a ring as dimensioned in Figure 4. The lower surface of each contact piece shall be machined flat and shall be polished and clean. Each contact piece shall be provided with a flexible insulated lead

#### **C5.1.3.3 Polythene base**

A clean sheet of polythene (or other material with resistivity not less than that of polythene) not less than 2 mm thick and 300 mm  $\times$  300 mm shall be used.

### **C5.1.4 Test Procedure**

The sample of sheeting shall be prepared and cleaned and without delay shall have the electrodes applied as described above. It shall immediately be placed for two hours in the following ambient conditions:

- a) temperature  $20 \pm 2^\circ\text{C}$  and
- b) relative humidity  $65 \pm 5\%$ .

It shall then be tested without delay in the same ambient conditions.

NOTE: Non-compliance with the limit of resistivity specified can be proved only under the above conditions, however compliance can be proved under any condition less than the upper limits of a) and b)

The polythene sheet shall be placed underneath the sample of sheeting immediately below the test areas and the brass contact pieces shall be mounted in position on the electrodes.

The leads from these contact pieces shall be taken direct to the measuring instrument so that the outer ring electrode is always connected to the earthed or low potential terminal and the inner cylinder to the higher potential terminal. These leads shall not touch each other, the sample of sheeting, or any part of the apparatus except the terminals to which each is connected. All terminals shall be connected to the same point.

The test potential from the measuring instrument shall be applied to the test area and the resistance shall be measured when a steady indication is obtained. The test potential shall be applied for not more than five minutes. Care shall be taken to avoid breathing on the test areas as any condensation of moisture on to these surfaces may lead to gross inaccuracies in the resistance measured.

The test shall be repeated in turn on the remaining three test areas.

Where a high degree of accuracy and reproducibility is required, for example in development work and laboratory calibration tests, the following requirements are recommended:

- i) The test area should be conditioned prior to the test for two hours at a temperature of  $20 \pm 2^{\circ}\text{C}$  and relative humidity  $65 \pm 5\%$ . Care should thereafter be taken not to stress the test area during handling.
- ii) The temperature and humidity at which the tests are made should be controlled as closely as possible.
- iii) When working with an instrument for measuring a very high resistance range, an earthed metal base sheet covered with insulating material should be placed under the instrument and polythene base sheet.

It is not intended that these refinements should be used for routine production control and acceptance tests.

#### **C5.1.5 Expression of Results**

The following results shall be stated in the test report:

- a) the resistance measurement obtained for each test area:
- b) the average value of the two resistance measurements on the upper surface; and
- c) the average value of the two resistance measurements on the lower surface.

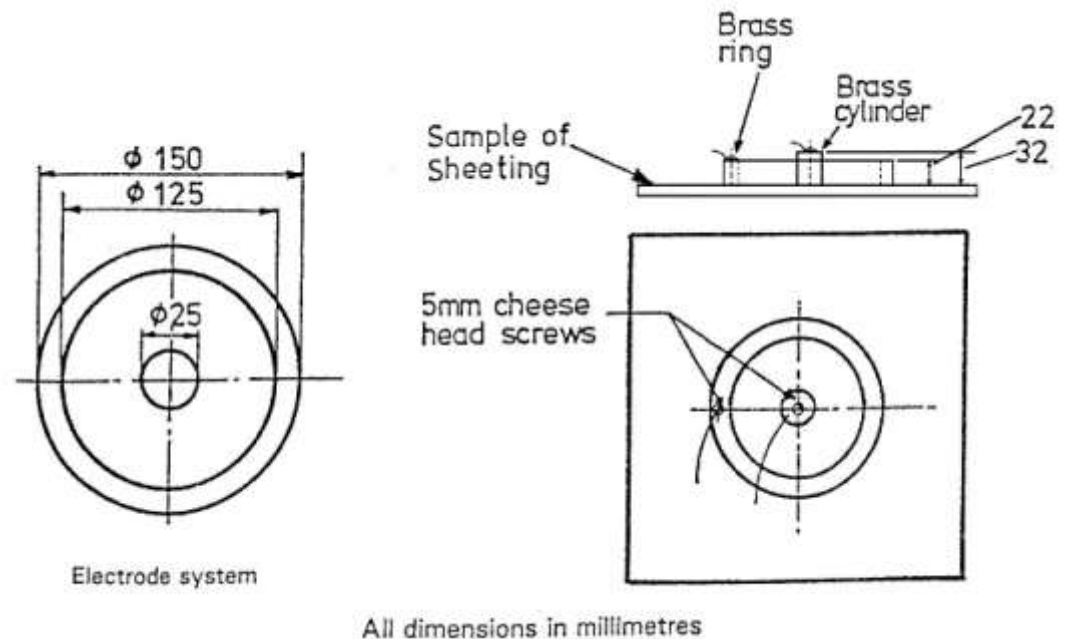


Figure 4 Dimensions of electrodes

## C5.2 Requirements

The average value of the electrical resistance on both the upper and lower surfaces of the sheeting shall be not greater than 300 M $\Omega$  (megohms) and shall remain so in use.

## C6 Electrical Resistance of Rigid Pipes and Rods Test

### C6.1 Method

This method has been adapted from the National Coal Board Technical Memorandum No. RD/NMMB (84) 3 Anti-Static Requirement for Rigid Plastics Pipe for Underground Use

#### C6.1.1 Principle of Test

The electrical resistance of the pipe is measured between circumferential electrodes 100 mm apart.

#### C6.1.2 Measuring Instrument

The measuring instrument shall cover the range  $10^5$  to  $10^{10}$   $\Omega$  and shall be accurate to within  $\pm 5\%$  of the true value over this range. The instrument shall supply to the electrodes under test a potential difference of between 40 and 1000 V d.c. The potential difference shall be such that not more than 1 watt is dissipated in the test piece.

#### C6.1.3 Sampling

A representative sample of the pipe 2 m long shall be supplied for test.

#### C6.1.4 Test Pieces

Five test pieces each consisting of a 300 mm length of pipe shall be cut from the sample supplied for test.



## **C6.1.5 Preparation of Test Pieces**

### **C6.1.5.1 Surface Cleaning**

The surface of each test piece shall be cleaned by rubbing with Fullers earth (Technical Grade) using a clean pad of cotton wool or cloth. After all traces of the powder have been cleaned away the surface shall be wiped with a clean pad of cotton wool moistened with distilled water and then rubbed dry with a clean cloth.

### **C6.1.5.2 Application of Electrodes**

The electrodes shall be applied to each of the test pieces after surface cleaning treatment.

The electrodes shall be formed by two parallel circumferential bands of colloidal graphite (i.e. a colloidal solution of graphite in alcohol) or other conducting material painted on to the outside surface of the test piece. The resistance of the electrodes shall be such as to make no significant contribution to the measured resistance of the test piece. The electrodes shall be 25 mm wide and shall be positioned with their inner edges 100 mm apart and with their outer edges at equal distances from the ends of the test piece.

### **C6.1.5.3 Contact Pieces**

The contact pieces shall be made from 25 mm wide strips of conducting metal foil. These shall be wrapped round the test piece in the same position as the electrodes. The free ends of the foil strip shall be held together and the strip lightly tensioned by means of a bulldog clip so that contact between the foil strip and the electrode is maintained round the complete circumference.

## **C6.1.6 Test Procedure**

The test piece shall be prepared and cleaned and the electrodes and contact pieces applied as described above. The test piece shall then be placed for two hours in the following ambient conditions;

- (a) temperature  $20 \pm 2^\circ\text{C}$
- (b) relative humidity  $65 \pm 5\%$

and shall then be tested without undue delay under the same conditions.

NOTE: Non-compliance with the requirements of this document can only be proved when the conditioning and testing are carried out at the temperature and humidity specified above. For routine purposes however compliance may be proved when the conditioning and testing are carried out at temperatures and humidities lower than those specified above.

The test piece shall be supported at each end on blocks of insulating material resting on a working surface of insulating material e.g. Polythene. The insulating blocks shall provide resistance of at least  $10^{11}$  ohms between the test piece and the working surface. The resistance of the blocks and working surface may be maintained by periodic cleaning with Fuller's earth as described above.

The leads from the testing instrument shall be connected to the contact pieces and shall not touch each other or any part of the test piece. The test potential shall be applied to the test piece and the resistance measured as soon as a steady indication is obtained. The test potential shall be applied for not more than five minutes. Care shall be taken to avoid breathing on the test piece while the test potential is applied.

One observation of resistance shall be made on each of the five test pieces.

### C6.1.7 Expression of Results

The following shall be reported:

- The measured outside diameter of the pipe  $D$  in millimetres.
- The observed resistance in ohms of each of the five test pieces.
- The upper limit of resistance,  $R_{Max}$ , required by this document calculated from

$$R_{Max} = \frac{7.5 \times 10^9}{D} \quad (\text{in } \Omega)$$

where  $D$  is the measured outside diameter in millimetres.

### C6.2 Requirements

Each of the five observations of electrical resistance shall not exceed  $7.5 \times 10^9/D \Omega$ , where  $D$  is the measured outside diameter of the pipe in millimetres.

No external conductive coating or external metallic conductor shall be permitted.

## C7 Air Permeability of Brattice Test

### C7.1 Method

This method has been adapted from the National Coal Board Specification NCB 441:1964 Brattice sheeting made from textile supported plastics Appendix 4.

#### C7.1.1 Test Pieces

Five test pieces,  $300 \times 300$  mm, shall be cut from the sample supplied for test.

#### C7.1.2 Apparatus

A schematic diagram of the experimental apparatus is shown in Figure 5.

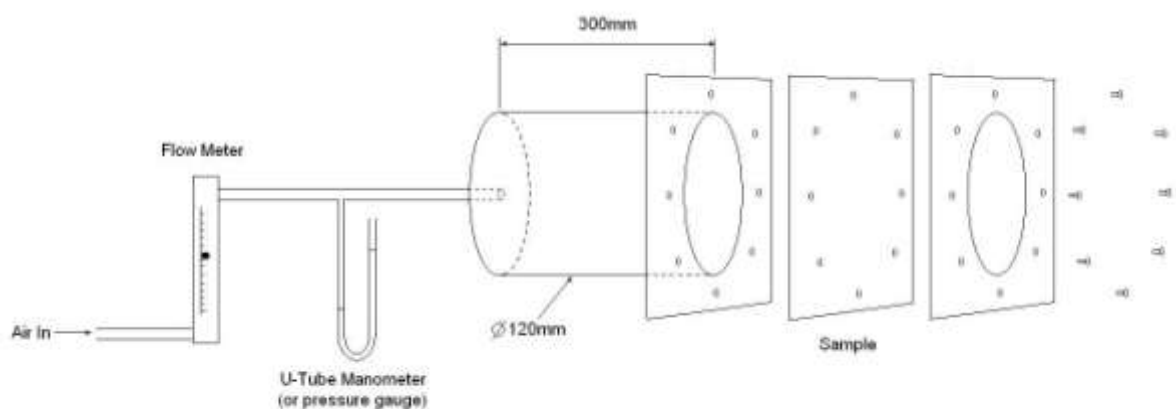


Figure 5 Experimental apparatus for air permeability test

### C7.1.3 Procedure

- a) Secure the sample between the two faceplates and secure with screws. A suitable sealant material may be used between the faceplates to ensure no leakage.
- b) Adjust the air supply to provide a pressure of 1.24 kPa (127 mm H<sub>2</sub>O).
- c) Read flow rate from the flowmeter.
- d) Calculate the air flow from the following equation and convert units to Ls<sup>-1</sup>m<sup>-2</sup>.

$$F = \frac{F_{Measured}}{Area}$$

### C7.2 Requirement

The air flow shall not be greater than 25.4 Ls<sup>-1</sup>m<sup>-2</sup>.

## C8 Toxicity testing

### C8.1 Method

Products shall be tested to ISO/TS 19700 Controlled equivalence ratio method for the determination of hazardous components of fire effluents.

Note: This test shall be carried out before any gallery or friction testing is undertaken, as applicable.

Fire effluent shall be tested for the following types of fire (from ISO/TS 19706:2004, Table1):

- Stage 1. Non flaming
- Stage 2. Well ventilated flaming
- Stage 3. Less well-ventilated flaming

Results from the testing shall be scaled to represent the concentrations that 100 g of material would emit into a 1 m<sup>3</sup> volume. The Toxicity Index for each fire type as calculated using the 30 minute fatal exposure concentrations per Allied Fire Assessment Publication 3 (AFAP-3) shall be less than or equal to ten (≤10).

The toxicity index *TI* is calculated as follows;

$$TI = \sum \frac{C_1}{Cf_1} + \frac{C_2}{Cf_2} + \frac{C_3}{Cf_3} + \dots \dots \dots \frac{C_n}{Cf_n}$$

Where

C<sub>n</sub> = the concentration of gas n

C<sub>f<sub>n</sub></sub> = the concentration of the gas considered fatal to a person for a 30 minute exposure (Critical factor)

Critical Factors are in the table below.

Gas	Formula	Cf (ppm)
Carbon Dioxide	CO <sub>2</sub>	100000
Carbon Monoxide	CO	4000
Oxides of Nitrogen	NO <sub>x</sub>	100
Sulphur Dioxide	SO <sub>2</sub>	400
Hydrogen Fluoride	HF	50
Hydrogen Bromide	HBr	150
Hydrogen Chloride	HCl	500
Hydrogen Cyanide	HCN	90
Phenol	C <sub>6</sub> H <sub>5</sub> OH	250
Formaldehyde	HCHO	500
Acrolein	CH <sub>2</sub> CHCHO	5

NOTE: Phenol, Formaldehyde and Acrolein need only be determined where the Toxicity Index for the other components is greater than 7.

## C8.2 Requirements

For each of the fire types, the toxicity indices shall be less than 10.

Where the toxicity index is greater than ten, the data from ISO/TS 19700 assessment may be used in ISO 13444 Estimation of lethal toxicity of fire effluents and ISO 13571 Life threatening components of fire – Guidelines for the estimation of time available for escape using fire data as part of a fire safety risk analysis. The risk analysis would also have to consider models for the analysis of the initiation and development of fire, fire spread and smoke formation. The risk analysis results may influence design of the mine and its ventilation.

## C9 Spark Incendivity

### C9.1 Method

NOTE: This test is adapted from IEC 61340-4-4 for materials that do not comply with surface resistivity testing.

Samples with earthing points can be tested with or without the point connected. These items are only required to pass testing with the earth connected.

#### C9.1.1 Test Piece

A sample between 0.1 to 0.5 m<sup>2</sup>.

#### C9.1.2 Apparatus

- An ignition probe and gas control equipment that meets Clause 7.2 of IEC 61340-4-4.
- Supplies of air and ethylene.
- Equipment to apply a static charge to the sample in excess of 30 kV (e.g. van de Graff Generator)

- d) Test stand to support the sample. Metal components shall be over 100 mm away from sample.

### **C9.1.3 Procedure**

The procedure shall be as follows:

- a) Hang the test piece from the support stand. Items that are designed to be earthed in normal use shall be earthed. Items that are designed not to be earthed in normal use shall not be earthed.
- b) Apply an electric charge to the sample.
- c) Apply gas to the probe for 30 secs and move the probe to approach the sample at a rate of approximately 0.75 m/s until it touches the sample.
- d) Where the gas ignites, the test is recorded as an ignition and failure.
- e) Repeat the test:
  - (i) 50 times each side of flat samples, or
  - (ii) a total of 100 times for other samples, or
  - (iii) until ignition occurs.

### **C9.2 Requirements**

There shall be no ignition.

# Appendix D – Polymeric Materials Test Manual – TM003

## D1 Maximum Exothermic Temperature

### D1.1 Method

#### D1.1.1 Principle

To measure the heat evolved when the supplied components of a grouting resin are mixed together. The temperature rise of a 200 ml (millilitre) mixture of the components is monitored in a plastic container with a digital thermometer.

#### D1.1.2 Apparatus

- a) A plastic or paper container of 170 mm high x 95 mm top diameter x 65 mm bottom diameter that can be readily cut away from the cured resin.
- b) Stirring rod.
- c) Digital thermometer with thermocouple attachment.
- d) Stopwatch/timer

#### D1.1.3 Test Specimens

Prepare a 200 ml (millilitre) mixture using the recommended mix ratio of the individual components.

#### D1.1.4 Procedure

1. The supplied components are mixed together in the plastic container, with vigorous stirring, using the recommended mix ratio.
2. The temperature rise is monitored by a digital thermometer via a thermocouple or probe placed midway in the reaction mixture.
3. Observe any temperature over the setting/curing time and in particular any sharp rise during the initial reaction.
4. Observe by touch (carefully) the heat on the exterior of the container.
5. Repeat 1 to 4 at least once if sufficient samples are available.
6. Average the maximum temperature for each duplicate and note, with emphasis, any sharp temperature rises.

### D1.2 Requirement

The heat evolved from any from any mixing process which is undertaken to form grouts, sealants, foams etc. in a N.S.W. underground coal mine shall result in a maximum temperature no greater than 150°C.

## D2 Electrical resistance

### D2.1 Method

#### D2.1.1 Principle

To measure the surface electrical resistance of samples of the cured resin in accordance with *NCB 245:1985 Appendix 5*.

#### D2.1.2 Apparatus

A Megohmmeter with a nominal open voltage of 500 V d.c. and a resistance range from 50 kΩ to 20GΩ is required to measure the surface resistance in this procedure.

#### D2.1.3 Test Specimens

Two sheets of cured resin, with dimensions not less than 300 mm × 300 mm.

#### D2.1.4 Procedure

[Refer AppendixC5.]

The Electrical Resistance test is conducted on both sample sheets of cured resin positioned on a clean base sheet of polythene (- or other material with resistivity not less than polythene). Testing is performed on:

- a) supplied sample; and
- b) conditioned sample after 2 hours in a humidity oven.

Measurements shall be taken from both the upper and lower surface of each sheet.

### D2.2 Requirement

The mean value for the Electrical Resistance on both the upper and lower surfaces of the (cured) material shall not be greater than 300 Megohms (i.e. 300 MΩ;  $300 \times 10^6 \Omega$ ).

## D3 Fire Resistance

### D3.1 Method

#### D3.1.1 Principle

Blocks of cured resin are positioned on a piece of cement sheeting with a circular hole 50 mm in diameter. Each block is tested by the direct application, through the hole, of the flame from a standard LPG burner, which has been adjusted to  $1000^\circ\text{C} \pm 50^\circ\text{C}$ . A series of increasing flame application times is used.

#### D3.1.2 Apparatus

- (a) LPG of at least 95% purity.
- (b) LPG burner of diameter 11 mm
- (c) Stand for supporting the cement sheet
- (d) Stopwatch/timer

### D3.1.3 Test Specimens

The cured resin samples are in the form of 50 mm × 50 mm × 50 mm blocks.

### D3.1.4 Procedure

1. The test block of cured resin is positioned across the hole on the cement sheet.
2. The LPG burner is lit and the flame is checked by a digital thermometer and adjusted to ensure the flame temperature is  $1000^{\circ}\text{C} \pm 50^{\circ}\text{C}$ .
3. The burner is positioned perpendicularly underneath the test block.
4. The burner flame is allowed to impinge on the test block for an initial period of 20 s and then withdrawn.
5. Observe any flame and/or glowing after the burner has been removed.
6. Observe any smoke, particularly the colour.
7. Determine the persistence time of flame, glow and smoke.
8. Repeat, using a burner flame application time of 60 s.
9. Repeat steps 1 to 8 for another 5 test blocks.
10. Average the persistence of flame, glow and smoke after the burner is removed.

### Note of Caution

The products of combustion may be highly toxic and extreme care must be taken to prevent the inhalation of any fumes.

A prime area of concern is the testing of polyurethane resins containing isocyanates, usually in the form MDI (diphenylmethane-4,-4-diisocyanate). **No testing will be undertaken on resins containing TDI (toluene diisocyanate)** because the extreme toxicity of this component prohibits its use in NSW underground coal mines.

In any case, fire testing should be conducted in a fume cupboard with sufficient draught and ventilation to quickly remove any vapours.

### D3.1.5 Report

The following information shall be reported:

- a) Whether burning occurred and, if extensive, emphasise.
- b) The colour of smoke, if any.
- c) The average persistence time for flame, glow and smoke.

## D3.2 Requirements

The material shall fail if any of the following occurs:

- a) After an exposure of 20 s, the mean persistence time of the flame or glow > 10 s.
- b) After an exposure of 60 s, the mean persistence time of the flame or glow > 30 s.



## D4 Fire Propagation

### D4.1 Method

#### D4.1.1 Principle

A test strip of cured resin is held vertically and tested by the application of the flame from an LPG burner. The burner is adjusted to  $1000^{\circ}\text{C} \pm 50^{\circ}\text{C}$ .

#### D4.1.2 Apparatus

- a) LPG burner of diameter 11 mm
- b) Stand for supporting the test strips
- c) Stopwatch/timer
- d) LPG Gas of at least 95% purity

#### D4.1.3 Test Specimens

The cured resin samples are in the form of 150 mm × 13 mm × 13 mm strips.

#### D4.1.4 Procedure

1. The test strip is held vertically at one end by a clamp.
2. The LPG burner is lit. The flame temperature is checked with a digital thermometer and adjusted to  $1000^{\circ}\text{C} \pm 50^{\circ}\text{C}$ .
3. Position the burner perpendicularly underneath the vertical test strip.
4. The burner flame is allowed to impinge on the test strip for a minimum period of 10 s and then withdrawn.
5. Observe any flame or glowing and the extent of melting of the material.
6. Determine the persistence time of flame and glow after burner removal.
7. Repeat steps 1 to 6 using a burner flame application time of 20 s.
8. Repeat steps 1 to 7 for another 5 test strips.
9. Average the persistence time of flame, glow and the amount melted by the flame, after the removal of the burner.

#### Note of Caution

As with the Fire Resistance test, extreme care must be taken to prevent the inhalation of any fumes.

#### D4.1.5 Report

The following information shall be reported:

- (a) Whether burning occurred and, if extensive, emphasise.
- (b) The average persistence time of flame and glow after removal.
- (c) The average amount (%) of material consumed/melted.

#### D4.1.6 Requirements

The material shall fail if any of the following occur:

- a) After a 20 s exposure, the mean persistence time of the flame or glow > 10 s.
- b) After an exposure time of 20 s, the material has been completely consumed.

## D5 Flashpoint (of each component of resin mixture)

### D5.1.1 Principle

The Flashpoint of each component of the resin mixture is determined in accordance with *AS 2106.2-2005*, using the Pensky-Martens closed-cup method apparatus.

### D5.1.2 Procedure

Each component of the resin is tested in duplicate.

### D5.2 Requirements

Each component of the resin shall have a flashpoint > 38°C.

## D6 Oxygen Index

### D6.1 Method

The test method followed is *ISO 4589-2:1996(E)*.

From Page 2 of the method, the following definition applies:

**Oxygen Index:** The minimum concentration of oxygen, by volume percentage, in a mixture of oxygen and nitrogen introduced at  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  that will just support combustion of a material under specified test conditions.

### D6.1.1 Test Specimens

At least 20 strips of cured resin of dimensions 150 mm × 13 mm × 13 mm.

### D6.2 Requirements

The Oxygen Index of any polymeric material proposed for use in NSW underground coal mines shall be at least 28%.

## D7 Chemical Characterisation of Components

### D7.1.1 Principle

The chemical nature of the components is examined by FTIR to:

- a) detect the presence of toluene diisocyanate (TDI), or any other substance prohibited for use/storage in NSW underground coal mines
- b) establish a reference library of any liquids proposed for said mines.

### D7.1.2 Equipment

Fourier Transform Infrared Spectrometer FT-IR

### **D7.1.3 Procedure**

As per equipment manual.

### **D7.2 Requirements**

Typical example: Any substance used/stored in NSW underground coal mines shall contain no isocyanate in the form of toluene diisocyanate (TDI).

# Appendix E- Material Safety Data Sheets

## E1 Assessment of Materials Safety Data Sheets (MSDS)

This applies to all cases where chemicals proposed for underground use are submitted for testing or evaluation.

The Materials Safety Data Sheets (MSDS) and any accompanying information are examined to determine the sufficiency of the information supplied to enable persons in coal mines to safely handle and use the materials submitted. Any issues particular to the use in a coal mine environment shall be specified, notwithstanding the application of the material in other industries. The MSDS shall comply with the following requirements:

- a) As the MSDS is a compulsory and integral component of the testing regime it shall be readily available to the department, and should be at the submission of the sample(s) for testing,
- b) The applicant is required to supply a MSDS for each separate chemical formulation submitted. The MSDS shall be in a form acceptable to the department and the applicant may be required to provide further information and / or samples on request.
- c) The adequacy of the MSDS submitted is evaluated with the preferred format as documented in the National Code of Practice for the Preparation of Materials Safety Data Sheets 2nd Edition – NOHSC: 2011 (2003) However, other formats may be acceptable, provided that all the following information is included :
  - i). Company Details
  - ii). Identification of Materials
  - iii). Chemical Reactions
  - iv). Use of Materials
  - v). Physical Description / Properties
  - vi). Composition – all ingredients and shall total 100%
  - vii). Health Hazard Information:
  - viii). Toxicity and Health effects,
  - ix). Acute (Swallowed, Eye, Skin, Inhaled)
  - x). Chronic
  - xi). First Aid :
    - xii). Swallowed, Eye, Skin, Inhaled
    - xiii). Advice to Doctor
  - xiv). Precautions for Use :
  - xv). Personal Protection,
  - xvi). Flammability
  - xvii). Safe Handling Information:

- xviii). Storage and Transport
- xix). Spills and Disposal:
- xx). Fire/ Explosion Hazards
- xxi). Emergency Contact: Name, Address, Phone Numbers
- xxii). Name, Address, Phone Numbers
- xxiii). Date and by whom MSDS has been issued.

# Appendix F - Non-Metallic Conveyor Idler Tests

## F1 Flame Propagation of Non-Metallic Conveyor Idlers Test

### F1.1 Method

#### F1.1.1 Scope

This draft test protocol sets out a method for testing the flame propagation characteristics of non-metallic idlers.

#### F1.1.2 Principle

Non-metallic idlers are installed on a trestle and placed in a test gallery subjected to a controlled airflow. A piece of conveyor belting is placed on top of the idlers and the idler/belting assembly is exposed to a flame (from underneath) from a propane burner for a specified time. After the burner is removed the idler/belting assembly is left on the trestle until all visible flame and glow have disappeared and a measurement of the undamaged length is made.

#### F1.1.3 Application to Fire Hazard

These test results on their own are not sufficient to indicate the fire hazard of the idler/conveyor combination under actual fire conditions and consequently should not be applied to the assessment of fire hazard without taking into account additional supportive information.

#### F1.1.4 Apparatus

The apparatus is the same as used in AS 1334.12-1996, with the following exceptions:

The trestle shall be designed in such a way as to allow the installation of the idlers being tested. The idlers shall be mounted on the trestle so that the lowest point of the idler surface is 350 mm from the floor of the test gallery. The distance from the underside of the idler to the burner is to be 100 mm. Note: This is normally 130 mm.

There is to be two idlers end to end in the centre so there is a gap between each idler as would normally occur in conventional structure. Note: This is to simulate a potential tracking path.

Longitudinal location of the idlers is given in Figure 6.

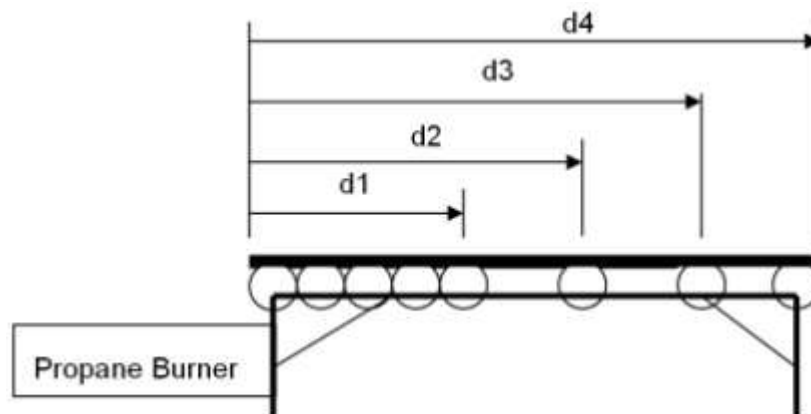


Figure 6 Idler flame propagation test apparatus

$d1 = 950$  to  $1050$  mm (skin to skin, measured to idler centre)

$d2 = (d1 + d3) \div 2$  (measured to idler centre)

$d3 = 1750$  mm (measured to idler centre)

$d4 = 2000$  (total length to outside diameter)

### F1.1.5 Test Pieces

#### F1.1.5.1 Samples

Full width idler samples shall be supplied for testing. A 4 m length (minimum) of conveyor belting shall also be supplied (width 1050 to 1200 mm).

#### F1.1.5.2 Conditioning

Samples shall be conditioned at atmospheric temperature and humidity for 24hr prior to testing

### F1.1.6 Procedure

The test procedure shall be the same as given in AS 1334.12-1996, with the following exceptions:

- (a) The sample of conveyor belting shall be cut into three separate 2 m long test pieces. The belt shall not be of steel cord construction.
- (b) A test to AS 1334.12 shall be performed one of the test pieces to determine its propagation characteristics without the influence of the idlers. Steel idlers shall be used. The undamaged length on the underside of this test piece shall be a maximum of 500 mm.
- (c) A second test shall then be performed with the conveyor belting resting on top of the non-metallic idlers skin to skin as per the figure above.
- (d) A third test shall be performed idlers set at approximately 300 mm between centres.

NOTE: Other tests may be required, subject to the results of the results these tests.

### F1.1.7 Report

The report shall include all results and the test procedure.

## **F1.2 Requirements**

Acceptance criteria are given in AS4606-2000. The idler at the 1750 mm mark shall not be damaged. If it is damaged the test shall be repeated so the edge of the idler is set at 1750 mm

When tested to this test method, the conveyor belt shall have an undamaged length greater than 250 mm.

## **F2 Ignitability and Surface Temperature - Idler Subject to Friction Test**

### **F2.1 Method**

#### **F2.1.1 Scope**

This draft test protocol sets out a method for testing the ignition and wear properties of a stalled non-metallic conveyor idler subjected to friction from a moving conveyor belt.

#### **F2.1.2 Principle**

A friction test apparatus may be used to simulate the scenario of a stalled idler with conveyor belting rubbing on it under a normal loading of coal. A stationary idler is made to contact an endless loop of conveyor belting driven around a set of pulleys and idlers with a specified minimum force until:

- a) the idler breaks or deforms in such a way as to remove the fire hazard due to friction
- b) the maximum allowable temperature is exceeded
- c) the idler ignites
- d) the specified time elapses

#### **F2.1.3 Application to Fire Hazard**

These test results on their own are not sufficient to indicate the fire hazard of the idler under actual fire conditions and consequently should not be applied to the assessment of fire hazard without taking into account additional supportive information.

#### **F2.1.4 Apparatus**

The following is required:

- a. A dynamic test rig consisting of an endless loop of belting being driven around a set of pulleys and idlers at a speed of  $3.0 \pm 0.5$  m/s. The idler being tested is installed at the end of a hinged arm over the belting, loaded to simulate a typical full conveyor load (see Figure 7). The arm shall be designed in such a way as to allow it to be periodically raised during a test to facilitate temperature measurement of the contacting surface of the idler.



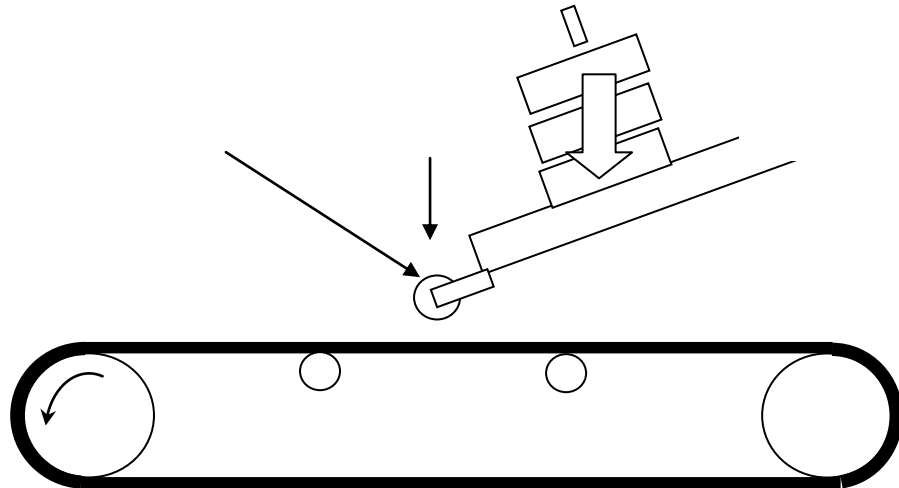


Figure 7 Idler friction test apparatus

- b. A suitable non-invasive temperature measuring device
- c. A suitable timing device

## F2.1.5 Test Pieces

### F2.1.5.1 Samples

Full width samples shall be supplied for testing. Where the idler is constructed from more than one layer of non-metallic compound, one test sample per layer shall be supplied.

### F2.1.5.2 Conditioning

Samples shall be conditioned at atmospheric temperature and humidity for 24hr prior to testing

## F2.1.6 Procedure

- a) Install the idler on the hinged arm. The test mass on the arm shall ensure the idler contacts the belt with a force of 104 kg per 900 mm width throughout the test.
- b) Measure the initial temperature of the surface of the idler to be in contact with the conveyor belt.
- c) Start the dynamic rig and set a conveyor speed of 3.0 (+0.5/-0) m/s. Lower the hinged arm so that the test idler contacts the conveyor under full test load.
- d) Raise the arm and record the temperature of the contacting surface of the idler at 15 minute intervals.
- e) Record the time at which breakage or other deformation that removes the fire hazard of the idler occurs (if any)
- f) Record the time at which a visible flame is observed (if any)
- g) Record the time at which a temperature  $>300^{\circ}\text{C}$  at the contacting surface of the idler is recorded (if any)
- h) Stop the test after 8 hrs of continuous running

### **F2.1.7 Report**

The report shall include all results and the test procedure.

### **F2.2 Requirements**

When tested to this test method, the idler shall not:

- a) Ignite;
- b) Have a surface temperature greater than 300°C.

# Appendix G - Feedback Sheet

Your comment on this guideline will be very helpful in reviewing and improving the document.

Please copy and complete the feedback sheet and return it to:

The Senior Inspector of Mechanical Engineering  
NSW Trade & Investment, Mine Safety  
PO Box 344, Hunter Region Mail Centre NSW, 2310  
Fax: 02 4931 6790

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

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What do you find most useful about the Guideline?

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What do you find least useful?

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Do you have any suggested changes to the Guideline?

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Thank you for completing and returning this feedback sheet.

END OF GUIDELINE