

EXAMINATION PAPER | CERTIFICATE OF COMPETENCE

# Mechanical engineering manager of underground coal mines

July 2017

## CME1 – Mechanical engineering practices applicable to underground coal mines

### Instructions to candidates

Unless otherwise stated all references to Act and Regulations are to:

*Work Health and Safety Act 2011*

Work Health and Safety Regulation 2011

*Work Health and Safety (Mines and Petroleum Sites) Act 2013*

Work Health and Safety (Mines and Petroleum Sites) Regulation 2014

It is expected that candidates will present their answers in an engineering manner making full use of diagrams, tables and relevant circuits where applicable and showing full workings in calculations. Credit marks will be given for such work in assessing marks for these questions. Neatness in diagrams and hand writing is essential and will be considered in the allocation of marks.

Provide answers in point form wherever appropriate. If you are unable to fit your answers in the available space, you may use the space on the opposing page. Two (2) blank pages have also been included at the end of the paper.

Electronic aids may not be used, apart from a non-programmable calculator.

**Questions 1, 2, 3 and 4** are compulsory and candidates must attempt each of these questions.

**Questions 5, 6, 7 and 8** are elective – candidates must attempt only one (1) of these questions. If more than one elective question is attempted, only the mark from one of the attempted elective questions will contribute to the candidate's total.

All questions are of equal value, but parts of questions may vary in value. The marks applicable to each part of a question will be indicated adjacent to the question.

Place your identification number only, NOT your name, on your paper.

10 minutes reading time is allowed prior to the start of the examination. Candidates can use a highlighter to mark points of importance during the reading time, but may not begin answering the questions.

This examination is a closed book examination.

## Question 1 (Compulsory - total 60 marks)

SA17-04 dated 10th May 2017

### Synthetic fibre sling fails

#### INCIDENT

A crane was lifting a leg assembly into position on a skyline conveyor. One of the synthetic fibre slings that were attached to the leg assembly failed. This allowed the leg assembly to move and come into contact with a boom-type elevated work platform (EWP). The EWP had two workers on board. The workers in the EWP anchored their harnesses to the conveyor walkway and exited via that walkway. The incident occurred at a mine near Lithgow on 4 April 2017.

Figure 1: Leg assembly resting on elevated work platform



#### CIRCUMSTANCES

The mine operator had identified that several sets of the conveyor's legs were deformed by both the weight of coal on the legs and the passing of stockpile dozers on the coal. The legs still had sufficient structural integrity for the required load but it was decided to replace them.

New legs were designed and a change-out method using cranes was developed. A 220 tonne crane was used to support the skyline conveyor during the change out process. A 110 tonne crane was used to remove the existing leg assembly and to install the new assembly.

The legs were attached to the crane using synthetic fibre slings in a choked hitch under a bolted flange. The leg assembly was lifted from a horizontal position and was nearly in the final vertical position when the sling failed. The EWP was positioned adjacent to the top of the leg assembly. This provided final guidance for positioning and then to bolt the leg assembly into position. Two men were in the basket.

Figure 2: The failed sling



As the Mechanical Engineering Manager at the site, answer the following questions:

- a) When notifying of this incident to the NSW Resources Regulator what process would you go through, and what clause(s) would be referred to? (15 marks)
- b) Identify three (3) probable contributing factors to this incident? (15 marks)
- c) For each of the three (3) contributing factors identified above, provide three (3) control measures you would implement. (20 marks)
- d) What recommendations would you make to industry to prevent a similar occurrence? (10 marks)

## Question 2 (Compulsory - total 60 marks)

In the mining industry, people have been injured while working on pressurised fluid power systems such as compressed air, hydraulics, greasing, fire, water and pump lines.

- a) As the Mechanical Engineering Manager of a new mine, describe the process of developing a Fluid Power Management Standard at your mine including consultation requirements/ references/inputs. (15 marks)
- b) When considering what needs to be managed in fluid power systems, list fifteen (15) key hazards of Fluid Power? (15 marks)
- c) As the Mechanical Engineering Manager responsible for managing Fluid Power risks, list the key controls required to manage Fluid Power in the following areas:
  - i. Design (10 marks)
  - ii. Competence (10 marks)
  - iii. Safe systems of work (10 marks)

## Question 3 (Compulsory - total 60 marks)

### Multiple choice

Questions are each worth 4 marks each – please circle the correct answers.

- a) What is the maximum distance a fire extinguisher should be located away from the hot works area:
  - i. 5m

- ii. 10m
  - iii. 15m
  - iv. 20m
- a) Storage of gas cylinders must be in accordance with what Australian Standard?
- i. AS4332
  - ii. AS1940
  - iii. AS1596
  - iv. All of the above
- b) The minimum distance gas fuel cylinders should be stored away from fuel bays, fuel outlets and/or mobile equipment under repair:
- i. 5m
  - ii. 10m
  - iii. 15m
  - iv. 20m
- c) LPG bulk storage tanks require inspection:
- i. Monthly
  - ii. Annually
  - iii. Every four (4) years
  - iv. At time of manufacture
- d) Hydraulic intensification can occur in:
- i. Single acting hydraulic cylinders
  - ii. Air driven hydraulic intensifiers
  - iii. Automated greasing systems
  - iv. All of the above
- e) Which Australian Standard would you consult for fixed platforms, walkways, stairways and ladders:
- i. AS4024
  - ii. AS4100
  - iii. AS1657
  - iv. AS1418
- f) The minimum width of a walkway should be equal to or greater than:
- i. 500mm
  - ii. 550mm
  - iii. 600mm
  - iv. 750mm
- g) Rung type ladders operate between:
- i. 45 to 60 degrees
  - ii. 60 to 70 degrees
  - iii. 70 to 90 degrees
  - iv. None of the above
- h) The hand rail of a walkway should be a vertical height of:
- i. Not less than 600mm, not more than 750mm
  - ii. Not less than 600mm, not more than 900mm
  - iii. Not less than 750mm, not more than 1100mm

- iv. Not less than 900mm, not more than 1100mm
- i) The gap between the toeboard and the floor of a walkway should not exceed:
  - i. 10mm
  - ii. 15mm
  - iii. 20mm
  - iv. None of the above
- j) Which Australian Standard would you refer to when you undertake a design risk assessment of a safety critical component:
  - i. AS4240
  - ii. AS4024
  - iii. AS4100
  - iv. None of the above
- k) When considering operational design of reclaim tunnels what standards and/or guidelines would you refer to:
  - i. AS4024 Safety of machinery series of standards
  - ii. MDG1032 – Prevention and early detection and suppression of fires
  - iii. MDG25 – Safe cutting and welding operations at mines
  - iv. MDG29 – Guideline for the management of diesel engine pollutants in underground environments
  - v. All of the above
- l) According to MDG28 what are the recommended methane (CH<sub>4</sub>) detector set points for alarm and trip in reclaim tunnels
  - i. 0.25% alarm and stop coal feed, 1% trip power to non-explosion protected equipment
  - ii. 0.5% alarm and stop coal feed, 1% trip power to non-explosion protected equipment
  - iii. 0.5% alarm and stop coal feed, 1.25% trip power to non-explosion protected equipment
  - iv. 0.5% alarm and stop coal feed, 1.5% trip power to non-explosion protected equipment
- m) Which of the following may be considered a risk control measure for the safe operation of reclaim tunnels?
  - i. A system to control the entry of people to the reclaim tunnel and indicate when the tunnel is occupied
  - ii. Use of FRAS conveyor belting and accessories
  - iii. Emergency lighting and communications rated for safe operation in explosive atmospheres
  - iv. Ventilation of all parts of the reclaim tunnel to control airborne dust and prevent accumulation of gas or other airborne contaminants
- n) Which of the following risk control measures would not be considered appropriate to prevent potential dozer engulfment in the reclaim draw point?
  - i. GPS in dozer cab with proximity alarm
  - ii. Flashing light on conveyor gantry indicating active draw point
  - iii. Spotter on conveyor gantry with two way radio to dozer operator
  - iv. Heavy duty grizzly cage over the coal valve

## Question 4 (Compulsory - total 60 marks)

### PART A - Short answer questions.

- a) According to AS3584.2 clause 2.15.8.1, what are the undiluted diesel exhaust gas emission limit quantities, and units of measurement, for explosion protected DES?
  - i. CO (3 marks)
  - ii. CO, while 1% CH<sub>4</sub> is injected into intake (3 marks)
  - iii. NO (3 marks)

- iv. NO<sub>2</sub> (3 marks)
- b) According to MDG29, what is the diesel exhaust particulate limit quantity, and unit of measurement, for Elemental Carbon (EC) in explosion protected DES? (3 marks)
- c) What is the maximum permissible surface temperature for explosion protected DES? (3 marks)
- d) What is the ventilation quantity required to operate a 100kW DES emitting 0.8 mg/m<sup>3</sup>/s EC unfiltered:
  - i. With DPF (4 marks)
  - ii. Without DPF (4 marks)
- e) According to AS3584, what is the acceptable flame path gap in millimeters on an open joint for explosion protected diesel engine systems? (3 marks)
- f) On a wet scrubbed DES where would you position temperature safety switches and why? (5 marks)
- g) Describe the difference between an open joint and a fixed connection in terms of explosion protected diesel engine systems. You may use labelled diagrams if required. (2 marks)
- h) An increase in CO in diesel exhaust gas emissions generally indicates what other condition with the engine exhaust emissions? (2 marks)
- i) The following tinge/colour in exhaust smoke generally indicates what condition with the engine?
  - i. Black (2 marks)
  - ii. White (2 marks)
  - iii. Blue (2 marks)

## PART B

What are the approximate converted values for the following? (14 marks total - 2 marks each)

Starting unit	Target unit	Value
100psi	kPa	
1 inch	mm	
1 foot	m	
1 micron	mm	
1 thou	mm	
1 ft lb force	Nm	
100 kPa	Bar	

## Question 5 (Elective - total 60 marks)

You are the Mechanical Engineering Manager at a mine which includes a Coal Handling and Preparation Plant.

The reclaim tunnel is of concrete arch construction and is fed by six (6) coal valves from the clean coal stockpile. It delivers coal via conveyor to a train loading bin. Details of some key characteristics are in the table below.

Characteristics	Reclaim Tunnel	Secondary Egress
Length	200m	80m
Date Commissioned	1970	2000
Gas Monitoring	CH <sub>4</sub> , CO, CO <sub>2</sub>	None



Tunnel Ventilation	Natural & Forced	Natural & Forced
Forced Ventilation Source	965mm dia Axial flow fan 5.5 KW (975rpm) 415V	965mm dia Axial flow fan 5.5 KW (975rpm) 415V
Ventilation Electric Motor Location	Outside the Reclaim Tunnel (Secondary Egress)	Outside the Reclaim Tunnel (Secondary Egress)

The Coal Handling and Preparation Plant Manager has asked you to formulate a Reclaim Tunnel Management Plan, addressing the requirements of MDG28 and the associated hazards in the tunnel.

- Outline your understanding of reclaim tunnels by identifying and describing eight (8) typical hazards likely to be encountered and dealt with in your Reclaim Tunnel Management Plan. (24 marks)
- List appropriate controls for the safe management of the hazards you have identified above. (36 marks)

## Question 6 (Elective - total 60 marks)

Black Stump coal operation, at which you are the Mechanical Engineering Manager, is proposing to open up a new rejects emplacement area located 7kms further from the existing operating areas. This area is expected to be utilised for at least two (2) years.

You suspect that your earthmoving truck tyres, which have traditionally only worked short hauls, may not be fit for purpose for this additional haul distance. Further to this, the access road to the new reject emplacement area is over an old reject/tailings emplacement that is known to have issues with spontaneous combustion and hot ground conditions.

- Detail your specific knowledge of "TKPH" in relation to tyre selection. (15 marks)
- What steps will you need to undertake to check whether your existing fleet's tyres are able to successfully deliver the reject to the emplacement area? (10 marks)
- With regards to the tyre and equipment related hazards posed by spontaneous combustion and hot ground conditions, identify the hazard and outline suitable controls. (10 marks)
- Explain what "Pyrolysis" is and how this can lead to a tyre explosion. (10 marks)
- Identify three (3) potential causes of a tyre explosion and suggest suitable controls, in line with the WHS Regulation 2011 (clause 35 and 36), to manage the risk. (15 marks)

## Question 7 (Elective - total 60 marks)

As the Mechanical Engineering Manager at Black Stump coal mine you are reviewing the existing Mechanical Engineering Control Plan. You start to update the Welding Management Plan (WMP), as required under MDG25 – Guideline for Safe Cutting and Welding at Mines.

- What would you consider are the main risks that need to be addressed by the WMP? (20 marks)
- For the risks identified above, what would you consider are the effective controls that would be identified in the WMP? (40 marks)

## Question 8 (Elective - total 60 marks)

Black Stump Coal Preparation Plant uses froth floatation to assist in fine coal recovery. One of the chemicals used in the froth floatation process is Methyl Isobutyl Carbinol (MIBC). Refer to the attached Safety Data Sheet for MIBC.

Maintenance of the MIBC storage and dosing plant is managed by your Coal Preparation Plant maintenance team. The maintenance plan for the next month includes the installation of a backup dosing pump onto the MIBC storage tank. This will require the use of gas cutting equipment, electric welding equipment, electrical hand tools (including grinders), a telehandler and lifting equipment.

It should not be necessary to enter the tank, and this work will be carried out by a contracting company.

MIBC is classified as a Hazardous Chemical according to Safe Work Australia. Hazards associated with this chemical include;

- Flammable liquid and vapour,

- Serious eye irritation, and
  - Respiratory irritation.
- a) Identify five (5) hazards associated with the proposed work. (15 marks)
  - b) List your safety management system controls for each of the five (5) hazards identified in a). (10 marks)
  - c) List five (5) signs you would expect to see on the storage vessel and in the dosing plant area. (10 marks)
  - d) One of the tools available to assist your team in managing the hazards associated with chemicals is the SDS (Safety Data Sheet). The Work Health and Safety Regulation 2011, Schedule 7 - Safety Data Sheets, lists the required contents of an SDS. List fifteen (15) sections you would expect to see in an SDS. (15 marks)
  - e) You have identified that the MIBC storage tank will need to be emptied and cleaned before any hot work can occur. Based on the information available to you in the SDS, list five (5) preventative measures you would take to ensure the contractors performing the work do not come in contact with the chemical, or cause an ignition source for fire and/or explosion. (10 marks)



# CME2 – Legislation and standards applicable to underground coal mines

## Instructions to candidates

Unless otherwise stated all references to Act and Regulations are to:

*Work Health and Safety Act 2011*

Work Health and Safety Regulation 2011

*Work Health and Safety (Mines and Petroleum Sites) Act 2013*

Work Health and Safety (Mines and Petroleum Sites) Regulation 2014

It is expected that candidates will present their answers in an engineering manner making full use of diagrams, tables and relevant circuits where applicable and showing full workings in calculations. Credit marks will be given for such work in assessing marks for these questions. Neatness in diagrams and hand writing is essential and will be considered in the allocation of marks.

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Place your identification number only, NOT your name, on your paper.

10 minutes reading time is allowed prior to the start of the examination. Candidates can use a highlighter to mark points of importance during the reading time, but may not begin answering the questions.

This examination is an open book examination.

## Question 1 (total 20 marks)

Please read the scenario below and answer the questions.

The coal handling and preparation plant at your mine site is part of your statutory responsibility. During a maintenance day inspection you notice the access door to the primary crusher under the ROM hopper is open and a contractor is standing outside.

You note a second contractor inside the chute, standing on the washery feed conveyor belt, weld repairing the hardfacing on the crusher rotating element. Sitting on top of the crusher frame is a partly completed confined space access permit, with no escape plan, and no gas detector at the work location.

- What controls need to be addressed by the PCBU in relation to confined spaces, and why? (5 marks)
- What specific controls have failed in this scenario? (5 marks)
- What legislative clause would prompt a review of control measures? (5 marks)
- To whom, and when, is a confined space entry not applicable? (5 marks)

## Question 2 (total 20 marks)

Your mine has recently taken delivery of a new piece of plant. During the site entry inspection it has been brought to your attention that the plant is emitting an excessive level of noise (above 85dBA weighted average).

- In the process of acquiring the plant, who has responsibility for ensuring noise emissions are as low as reasonably practical? (5 marks)
- How are you going to determine the level of noise being emitted by the plant when in use? (5 marks)
- Where and how can you source information on noise emission of the plant? (5 marks)
- With the information you have obtained regarding the noise emissions of the plant how can the site introduction process be progressed? (5 marks)

## Question 3 (total 20 marks)

As the Mechanical Engineering Manager for a new coal mine you must develop the Mechanical Engineering Control Plan for your site.

- List all the elements that the operator of a mine must take into account when developing the plan. (2 marks)
- List all the control measures that the Mechanical Engineering Control Plan must take into account for plant and structures at the mine. (4 marks)
- List all the matters that must be taken into account when developing the control measures identified above. (7 marks)
- List all the specific matters that must be taken into account when developing these control measures with respect to belt conveyors. (3 marks)
- Select two (2) control measures you identified above and describe how they could be practically implemented on your mine site. (4 marks)

## Question 4 (total 20 marks)

### Part A

List the mechanical items of plant that need to be item/design registered to operate in an underground mine. (3 marks)

### Part B

A mining firm has been awarded a contract to do Tail Gate Development at your site. As part of the contract they will be supplying the plant and personnel listed below. How you would manage the introduction of these plant and personnel to site referencing all legislative requirements associated with each?

- One LHD and two man transporters (6 marks)
- Jiffy Drive Conveyor and all required Conveyor belting and structure (6 marks)

c) Mechanical, Electrical Trades and Operators (5 marks)

## Question 5 (total 20 marks)

### Part 1

Please refer to attached **Gazette No.52 – 26th June 2015**

For each standard identified in 6.1 (2) of the attached gazette notice, describe the test method used to determine compliance for conveyor belting to be used in underground mines and/or reclaim tunnels:

- a) AS1334.12 (3 marks)
- b) AS1334.11 (3 marks)
- c) AS1334.10 (3 marks)
- d) ISO4589-2 (3 marks)
- e) ISO284 or AS1334.9 (3 marks)

### Part 2

You are tendering for new steel cord belt for your main drift conveyor. What document, required to be completed by the belting supplier and submitted to the NSW Resources Regulator for new conveyor belting in underground coal mines and/or reclaim tunnels, would you want to see, and what information needs to be included in the document? (5 marks)

## More information

NSW Department of Planning and Environment

Resources Regulator

Mining Competence Team

T: 02 4931 6625

Email: [minesafety.competence@industry.nsw.gov.au](mailto:minesafety.competence@industry.nsw.gov.au)

## Acknowledgments

Mechanical Engineering Manager Examination Panel

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (July 2017). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the NSW Department of Planning and Environment or the user's independent advisor.

PUB17/443

**WORK HEALTH AND SAFETY (MINES)  
REGULATION 2014**

Registration of Conveyor Belting Design Order 2015

I, Douglas Revette, Executive Director Governance, with the delegated authority of the Secretary, Department of Trade and Investment, Regional Infrastructure and Services in pursuance of clause 177 (5) of the *Work Health and Safety (Mines) Regulation 2014* (“the Regulation”) make the following Order.

Dated this 25th day of June 2015.

DOUGLAS REVETTE  
Executive Director Governance  
Department of Trade and Investment, Regional  
Infrastructure and Services

**Explanatory note**

From 1 July 2015, any reference to the Department of Trade and Investment, Regional Infrastructure and Service is a reference to the Department of Industry, Skills and Regional Development in accordance with the *Administrative Arrangements (Administrative Changes—Public Service Agencies) Order (No 2) 2015*.

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**REGISTRATION OF CONVEYOR BELTING  
DESIGN ORDER 2015**

under the

WORK HEALTH AND SAFETY (MINES)  
REGULATION 2014

**1 Name of Order**

This Order is the *Registration of Conveyor Belting Design Order 2015*.

**2 Commencement**

This Order commences on 1 July 2015.

### 3 Interpretation

In this Order:

*AS* is a reference to Australian Standards.

*Chief Inspector* is a person appointed under the *Work Health and Safety (Mines) Act 2013*.

*ISO* is a reference to International Organisation for Standardisation.

*Regulation* means the *Work Health and Safety (Mines) Regulation 2014*.

### 4 Revocation of Requirements for Design Registration of Conveyor Belts used in Underground Mines

Pursuant to clause 177 (5) and clause 34 (5) of Schedule 12 of the Regulation, the *Requirements for Design Registration of Conveyor Belts used in Underground Mines* published in *NSW Government Gazette* No 24 of 2 February 2007 at page 666 is revoked, as is any Notice revived as a result of their revocation.

### 5 Design requirements

- (1) All conveyor belting used in underground coal mines must be designed in accordance with AS 4606-2012 *Grade S fire resistant and antistatic requirements for conveyor belting and conveyor accessories*.
- (2) In this Order, all references to AS 4606-2012 is a reference to such standard, as amended from time to time.

### 6 Testing requirements

#### 6.1 General

- (1) Conveyor belts must be type tested and retested in accordance with the requirements of clause 5 ‘*Type testing*’ of AS 4606-2012 (as amended from time to time).
- (2) Conveyor belts must be tested in accordance with all of the following test standards (as amended from time to time), as altered by clause 6.1 of AS 4606-2012:
  - (a) AS 1334.12-1996 *Methods of testing conveyor and elevator belting – Determination of combustion propagation characteristics of conveyor belting*;
  - (b) AS 1334.11-1988 *Methods of testing conveyor and elevator belting – Determination of ignitability and maximum surface temperature of belting subjected to friction*;
  - (c) AS 1334.10-1994 *Methods of testing conveyor and elevator belting – Determination of ignitability and flame propagation characteristics of conveyor belting*;
  - (d) ISO 4589-2:1996 *Plastics – Determination of burning behaviour by oxygen index – Part 2: Ambient-temperature test*;
  - (e) ISO 284:2012 *Conveyor belts – Electrical conductivity – Specification and test method*, or AS 1334.9-1982 *Methods of testing conveyor and elevator belting – Determination of electrical resistance of conveyor belting*.

- (3) Retesting of conveyor belt samples may be carried out in accordance with clause 6.3 ‘*Retesting for type tests*’ of AS 4606-2012.

#### 6.2 Test Facility

- (1) Despite the requirements of clause 5.5 ‘*Test facility*’ of AS 4606-2012, the test facility used for type testing must be a test facility which is unrelated to the organisation manufacturing or supplying the conveyor belt.
- (2) The test facility must either be:
  - (a) a test facility in Australia and be accredited by the National Association of Testing Authorities (NATA) for conducting the tests and issuing reports for those tests; or
  - (b) a facility acceptable to the Chief Inspector having regard to test equipment, equipment calibration, quality processes, work methods, past test experience and independent technical verification.

### 7 Performance standards

- (1) Conveyor belts must comply with the requirements of Grade S conveyor belting as set out in AS 4606-2012.
- (2) Despite the performance requirements of clause 6.1.3 of AS 4606-2012, ‘*Ignitability and maximum surface temperature of belting subjected to friction (Drum friction test)*’, conveyor belts for special applications need not comply with those requirements, provided:
  - (a) it can be demonstrated that it is not reasonably practicable to comply; and
  - (b) a risk assessment is carried out to identify all engineering control measures that will be in place to protect from the risk of heating of the conveyor belt due to belt slip and/or friction between the conveyor belt and a metal object.

# Safety Data Sheet



## 1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

**Product Name:** METHYL ISOBUTYL CARBINOL

**Other name(s):** Methyl amyl alcohol; 4-Methyl-2-pentanol; Isobutyl methyl carbinol; MIBC; Metilisobutilcarbinol

**Recommended Use of the Chemical and Restrictions on Use** Solvent; mineral floatation agent.

**Supplier:** Ixom Operations Pty Ltd  
**ABN:** 51 600 546 512  
**Street Address:** Level 8, 1 Nicholson Street  
East Melbourne Victoria 3002  
Australia

**Telephone Number:** +61 3 9906 3000  
**Emergency Telephone:** 1 800 033 111 (ALL HOURS)

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

## 2. HAZARDS IDENTIFICATION

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.

This material is hazardous according to Safe Work Australia; HAZARDOUS CHEMICAL.

### Classification of the chemical:

Flammable liquids - Category 3  
Eye Irritation - Category 2A  
Specific target organ toxicity (single exposure) - Category 3

**SIGNAL WORD:** WARNING



### Hazard Statement(s):

H226 Flammable liquid and vapour.  
H319 Causes serious eye irritation.  
H335 May cause respiratory irritation.

### Precautionary Statement(s):

#### Prevention:

P210 Keep away from heat, sparks, open flames, hot surfaces. No smoking.  
P233 Keep container tightly closed.  
P240 Ground or bond container and receiving equipment.  
P241 Use explosion-proof electrical, ventilating, lighting equipment.  
P242 Use only non-sparking tools.  
P243 Take precautionary measures against static discharge.  
P261 Avoid breathing mist, vapours, spray.  
P264 Wash hands thoroughly after handling.  
P271 Use only outdoors or in a well-ventilated area.  
P280 Wear protective gloves / protective clothing / eye protection / face protection.

*Product Name:* METHYL ISOBUTYL CARBINOL  
*Substance No:* 000031314201

*Issued:* 13/02/2017  
*Version:* 6



# Safety Data Sheet



## Response:

P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P312 Call a POISON CENTER or doctor/physician if you feel unwell.

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337+P313 If eye irritation persists: Get medical advice/attention.

P370+P378 In case of fire: Use extinguishing media as outlined in Section 5 of this Safety Data Sheet to extinguish.

## Storage:

P403+P233 Store in a well-ventilated place. Keep container tightly closed.

P403+P235 Store in a well-ventilated place. Keep cool.

P405 Store locked up.

## Disposal:

P501 Dispose of contents and container in accordance with local, regional, national, international regulations.

**Poisons Schedule (SUSMP):** None allocated.

## 3. COMPOSITION AND INFORMATION ON INGREDIENTS

Components	CAS Number	Proportion	Hazard Codes
Methyl isobutyl carbinol	108-11-2	>98.0%	H226 H335
Diisobutyl ketone	108-83-8	<2.0%	H226 H335
Methyl isobutyl ketone	108-10-1	<1.0%	H225 H332 H319 H335

## 4. FIRST AID MEASURES

For advice, contact a Poisons Information Centre (e.g. phone Australia 131 126; New Zealand 0800 764 766) or a doctor.

### Inhalation:

Remove victim from area of exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. If patient finds breathing difficult and develops a bluish discolouration of the skin (which suggests a lack of oxygen in the blood - cyanosis), ensure airways are clear of any obstruction and have a qualified person give oxygen through a face mask. Apply artificial respiration if patient is not breathing. Seek immediate medical advice.

### Skin Contact:

If skin contact occurs, remove contaminated clothing and wash skin with running water. If irritation occurs seek medical advice.

### Eye Contact:

If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre or a doctor, or for at least 15 minutes.

### Ingestion:

Rinse mouth with water. If swallowed, do NOT induce vomiting. Give a glass of water. Seek immediate medical assistance.

### Indication of immediate medical attention and special treatment needed:

Treat symptomatically. No known specific antidote.

## 5. FIRE FIGHTING MEASURES

Product Name: METHYL ISOBUTYL CARBINOL  
Substance No: 000031314201

Issued: 13/02/2017  
Version: 6

# Safety Data Sheet



## **Suitable Extinguishing Media:**

Alcohol resistant foam is the preferred firefighting medium but, if it is not available, normal protein foam can be used.

## **Unsuitable Extinguishing Media:**

Water jet. Solid water jet/stream may scatter and spread the fire.

## **Hazchem or Emergency Action Code:** - 3Y

## **Specific hazards arising from the chemical:**

Flammable liquid. May form flammable vapour mixtures with air. Vapour may travel a considerable distance to source of ignition and flash back.

## **Special protective equipment and precautions for fire-fighters:**

On burning will emit toxic fumes, including those of oxides of carbon. Heating can cause expansion or decomposition of the material, which can lead to the containers exploding. If safe to do so, remove containers from the path of fire. Keep containers cool with water spray. Fire fighters to wear self-contained breathing apparatus and suitable protective clothing if risk of exposure to vapour or products of combustion.

## **6. ACCIDENTAL RELEASE MEASURES**

### **Emergency procedures/Environmental precautions:**

Shut off all possible sources of ignition. Clear area of all unprotected personnel. If contamination of sewers or waterways has occurred advise local emergency services.

### **Personal precautions/Protective equipment/Methods and materials for containment and cleaning up:**

Slippery when spilt. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contact and breathing in vapours. Work up wind or increase ventilation. Contain - prevent run off into drains and waterways. Use absorbent (soil, sand or other inert material). Collect and seal in properly labelled containers or drums for disposal. Use non-sparking tools.

## **7. HANDLING AND STORAGE**

### **Precautions for safe handling:**

Avoid skin and eye contact and breathing in vapour. All potential sources of ignition (open flames, pilot lights, furnaces, spark producing switches and electrical equipment etc) must be eliminated both in and near the work area. Do NOT smoke. Take precautionary measures against static discharges. Wash hands thoroughly after handling.

### **Conditions for safe storage, including any incompatibilities:**

Store in a cool, dry, well ventilated place. Store away from sources of heat or ignition. Store away from incompatible materials described in Section 10. Keep containers closed when not in use - check regularly for leaks.

## **8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

Methyl isobutyl carbinol: 8hr TWA = 104 mg/m<sup>3</sup> (25 ppm), 15 min STEL = 167 mg/m<sup>3</sup> (40 ppm), Sk

Diisobutyl ketone: 8hr TWA = 145 mg/m<sup>3</sup> (25 ppm)

Methyl isobutyl ketone: 8hr TWA = 205 mg/m<sup>3</sup> (50 ppm), 15 min STEL = 307 mg/m<sup>3</sup> (75 ppm)

# Safety Data Sheet



As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

STEL (Short Term Exposure Limit) - the airborne concentration of a particular substance calculated as a time-weighted average over 15 minutes, which should not be exceeded at any time during a normal eight hour work day. According to current knowledge this concentration should neither impair the health of, nor cause undue discomfort to, nearly all workers.

'Sk' (skin) Notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

## Appropriate engineering controls:

Ensure ventilation is adequate to maintain air concentrations below Workplace Exposure Standards. Vapour heavier than air - prevent concentration in hollows or sumps. DO NOT enter confined spaces where vapour may have collected. Keep containers closed when not in use.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

## Individual protection measures, such as Personal Protective Equipment (PPE):

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, CHEMICAL GOGGLES, GLOVES, RESPIRATOR.



Wear overalls, chemical goggles and impervious gloves. Use with adequate ventilation. If determined by a risk assessment an inhalation risk exists, wear an organic vapour respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716. Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use.

When handling this product in bulk quantities, and/or in Intermediate Bulk Containers (IBC's), wear overalls, safety shoes, impervious gloves, chemical goggles, and a face shield. If determined by a risk assessment an inhalation risk exists, wear appropriate respiratory protection as mentioned above.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**Physical state:** Liquid

Product Name: METHYL ISOBUTYL CARBINOL  
Substance No: 000031314201

Issued: 13/02/2017  
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<b>Colour:</b>	Colourless
<b>Odour:</b>	Mild
<b>Molecular Formula:</b>	(CH <sub>3</sub> ) <sub>2</sub> CHCH <sub>2</sub> CH(OH)CH <sub>3</sub>
<b>Specific Gravity:</b>	0.807 @20°C
<b>Relative Vapour Density (air=1):</b>	3.5
<b>Vapour Pressure (20 °C):</b>	Not available
<b>Flash Point (°C):</b>	40.56 (Open Cup)
<b>Flammability Limits (%):</b>	1.0 - 5.5 vol
<b>Autoignition Temperature (°C):</b>	355 @1013 hPa
<b>Solubility in water (g/L):</b>	17 @20°C
<b>Boiling Point/Range (°C):</b>	132
<b>pH:</b>	Not available
<b>Viscosity:</b>	5.2 mPa.s @20°C
<b>Evaporation Rate:</b>	0.43 (Butyl acetate = 1)
<b>Partition Coefficient:</b>	log Pow = 1.57 (estimated)
<b>Freezing Point/Range (°C):</b>	-90

## 10. STABILITY AND REACTIVITY

<b>Reactivity:</b>	No information available.
<b>Chemical stability:</b>	Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
<b>Possibility of hazardous reactions:</b>	Hazardous polymerisation will not occur.
<b>Conditions to avoid:</b>	Avoid exposure to heat, sources of ignition, and open flame.
<b>Incompatible materials:</b>	Incompatible with acids , oxidising agents , acid chlorides .
<b>Hazardous decomposition products:</b>	Oxides of carbon.

## 11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms or effects that may arise if the product is mishandled and overexposure occurs are:

<b>Ingestion:</b>	Swallowing can result in nausea, vomiting and central nervous system depression. If the victim is showing signs of central system depression (like those of drunkenness) there is greater likelihood of the patient breathing in vomit and causing damage to the lungs.
<b>Eye contact:</b>	An eye irritant.
<b>Skin contact:</b>	Contact with skin may result in irritation. Will have a degreasing action on the skin. Repeated or prolonged skin contact may lead to irritant contact dermatitis. Can be absorbed through the skin with resultant adverse effects.
<b>Inhalation:</b>	Material is irritant to the mucous membranes of the respiratory tract (airways). Breathing in vapour can result in headaches, dizziness, drowsiness, and possible nausea. Breathing in high concentrations can produce central nervous system depression, which can lead to loss of co-ordination, impaired judgement and if exposure is prolonged, unconsciousness.

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## Acute toxicity:

Oral LD50 (rat): 2590 mg/kg  
Dermal LD50 (rabbit): 2870 mg/kg  
Inhalation LC50 (rat): >16000 mg/m<sup>3</sup>/4hr

**Respiratory or skin sensitisation:** Not a skin sensitiser (guinea pig).

**Chronic effects:** In vitro genetic toxicity studies were negative. For the minor component: The product has been found to cause cancer in laboratory animals.

**Specific Target Organ Toxicity (STOT) - single exposure:** May cause respiratory irritation.

**Specific Target Organ Toxicity (STOT) - repeated exposure:** In animals, effects have been reported on the following organs: kidney.

**Aspiration hazard:** May be harmful if swallowed and enters airways.

## 12. ECOLOGICAL INFORMATION

**Ecotoxicity:** Avoid contaminating waterways.

**Persistence/degradability:** The material is readily biodegradable.

48hr EC50 (Daphnia magna): 337 mg/L (semi-static test)  
96hr LC50 (rainbow trout): 359 mg/L (semi-static test)

## 13. DISPOSAL CONSIDERATIONS

### Disposal methods:

Refer to Waste Management Authority. Dispose of material through a licensed waste contractor. Advise flammable nature. Normally suitable for incineration by an approved agent.

## 14. TRANSPORT INFORMATION

### Road and Rail Transport

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.



**UN No:** 2053  
**Transport Hazard Class:** 3 Flammable Liquid  
**Packing Group:** III  
**Proper Shipping Name or Technical Name:** METHYL ISOBUTYL CARBINOL  
**Hazchem or Emergency Action Code:** · 3Y

### Marine Transport

Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; DANGEROUS GOODS.

Product Name: METHYL ISOBUTYL CARBINOL  
Substance No: 000031314201

Issued: 13/02/2017  
Version: 6

# Safety Data Sheet



**UN No:** 2053  
**Transport Hazard Class:** 3 Flammable Liquid  
**Packing Group:** III  
**Proper Shipping Name or Technical Name:** METHYL ISOBUTYL CARBINOL

**IMDG EMS Fire:** F-E  
**IMDG EMS Spill:** S-D

**Marine Pollutant** No

## Air Transport

Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; DANGEROUS GOODS.

**UN No:** 2053  
**Transport Hazard Class:** 3 Flammable Liquid  
**Packing Group:** III  
**Proper Shipping Name or Technical Name:** METHYL ISOBUTYL CARBINOL

## 15. REGULATORY INFORMATION

### **Classification:**

This material is hazardous according to Safe Work Australia; HAZARDOUS CHEMICAL.

### **Classification of the chemical:**

Flammable liquids - Category 3

Eye Irritation - Category 2A

Specific target organ toxicity (single exposure) - Category 3

### **Hazard Statement(s):**

H226 Flammable liquid and vapour.

H319 Causes serious eye irritation.

H335 May cause respiratory irritation.

**Poisons Schedule (SUSMP):** None allocated.

This material is listed on the Australian Inventory of Chemical Substances (AICS).

## 16. OTHER INFORMATION

Supplier Safety Data Sheet; 02/ 2017.

This safety data sheet has been prepared by Ixom Operations Pty Ltd Toxicology & SDS Services.

### **Reason(s) for Issue:**

5 Yearly Revised Primary SDS

Change in Hazardous Chemical Classification

Change in Personal Protection Requirements

Change in Physical Properties



# Safety Data Sheet



This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since Ixom Operations Pty Ltd cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Ixom representative or Ixom Operations Pty Ltd at the contact details on page 1.

Ixom Operations Pty Ltd's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.