NSW GOVERNMENT | Industry & Investment

GUIDELINES

MDG 16

Design guidelines for the construction of longwall shearers

Produced by Mine Safety Operations Branch

Industry and Investment NSW

November 1995

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FOREWORD

This guide-line has been revised to that originally issued in June 1992. The revisions incorporated in this issue have been shown in italics and summarised in Appendix 4 for ease of reference.

This document has been compiled to assist manufacturers, purchasers and the Department of Mineral Resources Coal Mining Inspectorate to identify the majority of safety related items that require consideration during the approval process.

The constructive comments and contributions from Manufacturers, Mine Mechanical Engineers(In Charge), Mining, Electrical and Mechanical Inspectors is gratefully acknowledged.

Bruce McKensey
24.11.95

Bruce McKensey
Chief Inspector of Coal Mines

CONTENTS

1. Scope

1.1 Clause 27(c) of the Coal Mines Regulation (Electrical - Underground Mines) Regulation 1984, requires that mobile apparatus to be operated at an underground coal mine shall be approved by the Chief Inspector.

Any Longwall Shearer is required to be approved.

1.2 The following guide-lines are intended to help longwall shearer designers by indicating those parameters which will be considered in the approval process assessment of mechanical features and operating control relating to safety.

The guide-lines do not generally give quantitative information as it is not intended to restrict innovative design. Where specific values or test procedures are required, advice should be sought from Inspectors of Mechanical Engineering, Coal Mining Inspectorate and Engineering Branch of the Department of Mineral Resources.

NOTE "shall" and "should"

(a) "shall" means that the requirement is mandatory if it is applicable to the equipment under consideration.

(b) "should" means that the requirements are not mandatory, but serious consideration should be given to adopting the recommendations.

1.3 Unless otherwise specified, the appropriate Australian Standards shall apply. For example AS.2595.1 Electrical Equipment for Coal Mines - Electrical Requirements for Underground Mining Machines and Accessories - Part 1 - Equipment for use in Explosive Atmospheres.

1.4 These guide-lines do not in any way negate or replace the requirements of the Coal Mines Regulation Act 67/1982 nor the Occupational Health and Safety Act, 1983, No 20.

Manufacturers/Suppliers shall take particular note of Section 18 Division 1 Part III of the above Act No 20.

1.5 Approval procedure.

1.5.1 Shearer approval applications should be supported by the following:-

(A) A brief statement of compliance, variation or reason for non compliance with each item mentioned in these guide-lines. A marked up and signed copy of these guide-lines shall be included with further explanation where required for clarity.

(B) Results of tests and a statement of compliance with all requirements in accordance with Australian or other relevant standards.

(C) Any further information requested within these guide-lines or as considered to be appropriate in supporting the application.

(D) Details of operation of all safety devices.

(E) Where radio control is used, the Manufacturer shall provide details of the proposed methodology for its safe use. This shall include the items listed in clause 2.6.

(F) A credible Risk Assessment report which effectively identifies, assesses and controls hazards relating to the safety of persons associated with the operation, maintenance and testing of the shearer.

NOTE:- This document may be used as an aid to assist in identification of hazards but should not be solely relied on for that purpose. Sources of other relevant information such as that referred to in section 4 of this guide-line should be utilised as should details of accidents or dangerous incidents which have occurred with other shearers.

(G) Relevant drawings including:-

- General arrangement.
- electrical "generic" or "Philosophy, block diagram/flowchart"
- brake schematic with description of operation.
- hydraulic schematic.
- location of controls.
- location of all safety devices and their function.
- cross section showing clearances from chocks, face conveyor and associated furnishings including effects of snaking of the face conveyor.

(H) Transport Schedule - including dimensions and weight of major components and any special lifting or support arrangements.

2. General Controls

2.1 The control and operation of the shearer in conjunction with the system of operation of the longwall is to be such that the driver can safely operate the shearer at all times and that there is no danger to other personnel during longwall face operations.

2.2 Various forms of shearer control may be provided including fully automatic, radio, umbilical cord, remote, manual and any other form of control that is effective.

2.3 All electrical equipment including components cables and glands shall comply with Australian Standard AS.2595.1 unless otherwise stated in these guide-lines.

2.4 The deadman feature required by section 5.1 of Australian Standard AS.2595.1 is not mandatory provided all possible hazards are identified by the manufacturer and user. Effective barriers to reduce risk of injury to an acceptable level shall be provided.

2.5 If the shearer is controlled remotely then the system of control shall comply with Australian Standard "AS4240 Remote Control for Mining Equipment", unless otherwise stated in this guideline.

Automatic and/or remote control of the shearer will be considered for approval provided all possible hazards are identified by the manufacturer and user of the shearer and effective alternative barriers to reduce risk and injury to an acceptable level are provided.

2.6 For radio control or other forms of remote control the following shall be specified by the Manufacturer:-

2.6.1 The maximum distance between the controller and shearer at which control is possible.

2.6.2 A safe system of operation including use of a spare transmitting unit, charging of the batteries, changeover procedure and location of the spare unit.

2.7 Systems for control of the operation of shearers which are duplicated ie. have local manual controls and radio remote control should be provided with the following features:-

2.7.1 The selection of either mode of control shall be designed with an effective interlock to prevent the inadvertent operation of any controls associated with the unselected mode.

2.7.2 Visual indication shall be provided at each mode of control to indicate which mode has been selected.

2.7.3 A single means of isolating both modes of control shall be provided.

2.8 Controls shall be so located that they are within comfortable reach of the driver and conform to recognised ergonomic requirements.

2.9 An emergency stop switch shall be provided to cut the power from all functions of the shearer accessible:-

2.9.1 at least from either end of the shearer, but preferably along the full length of the shearer,

2.9.2 from any remote control device.

NOTE 1 Any emergency control device should be capable of being operated at all times regardless of which form of shearer control has been selected.

NOTE 2 If radio remote control is utilised to operate the shearer and the portable control unit is taken out of transmitting range, power should be automatically removed from the shearer.

Power should only be capable of being restored to the shearer by selection of local manual control at the shearer.

2.10 Two automatic *prestart* warning devices shall operate prior to the movement of the shearer or cutter drums as follows :-

2.10.1 An audible device.

2.10.2 Pre start operation of the main shearer water sprays. The minimum recommended flow and pressure shall be present before start up of the shearer drive.

NOTE 1 The time delay between the operation of the warning devices and commencement of any movement of the shearer shall exceed 6 seconds.

NOTE 2 Prestart warning devices shall be operational regardless of which form of control has been selected, except as provided for in NOTE 3.

NOTE 3 For maintenance purposes a system of defeating the requirement to have the water sprays in operation is permitted provided the defeat is spring return or lockable with a key operated lock and adequate procedures are in place to prevent injury to personnel.

2.11 All operating controls for systems powered hydraulically shall be designed to automatically return to the "OFF" position on loss of pressure. This is to avoid inadvertent start-up when the electrical power supply to the shearer is energised.

2.12 The shearer electrical supply cable shall be prevented from being over tensioned by a system which automatically stops at least the haulage in the event of over tensioning occurring.

2.13 A power operated lump breaker where fitted should include an automatic control system which prevents it hitting the raised sections of the pan line at face ends or other obstructions.

2.14 A means of isolating and locking out the incoming mains power supply to the shearer for maintenance purposes shall be provided on the shearer.

Such means of isolation shall be capable of withstanding the fault current generated by the prospective fault level caused by a short circuit at the shearer.

2.15 Control Functions

The operating controls shall be clearly marked to show their function and the preferred direction of movement is as specified below:-

FUNCTION	DIRECTION
EMERGENCY STOP	Push red button or pull trip wire
ON	Down, right, forward, clockwise, pull (push/pull type switch).
OFF	Up, left, backward, anti-clockwise, push.
RIGHT	Clockwise, right.

FUNCTION	DIRECTION
LEFT	Anti-clockwise, left.
FORWARD	Forward, down.
REVERSE	Backward, up.
RAISE	Up, back.
LOWER	Down, forward.
RETRACT	Up, backward, PULL.
EXTEND	Down, forward, PUSH.
INCREASE	Forward, away, right, clockwise.
DECREASE	Backward, toward, left, anti-clockwise
OPEN VALVE	Anti-clockwise.
CLOSE VALVE	Clockwise
ROTATE (clockwise)	*clockwise*
ROTATE (anti-clockwise)	*anti-clockwise*

NOTE The details of all controls shall comply with the minimum ergonomic requirements as detailed in section 2.16 of this guide-line.

2.16 Ergonomics

All relevant ergonomic aspects shall be addressed by the manufacturer in the design and manufacture of the shearer, *this includes maintenance and servicing of the shearer by Colliery Personnel.*

A suitable person shall review the ergonomic aspects of the shearer to ensure compliance with good practice.

The recommended guide for this review is "Ergonomic Design Handbook For Shearers" written by S. Mason and A. Rushworth February 1991 reference TM 9103 Published by British Coal Corporation, Ergonomics Branch of the Technical Services and Research Executive.

3. Brakes

3.1 The manufacturer shall nominate :-

3.1.1 the maximum grade for safe operation of the shearer without brakes.

3.1.2 the maximum grade for safe operation of the shearer with brakes.

3.2 The shearer shall be capable of coming to a controlled stop whilst travelling at maximum speed down the maximum operating grade.

3.3 Traction brakes where fitted shall comply with the following:-

3.3.1 oil immersed multi-disc, spring applied brakes fitted directly to the traction drive assembly are preferred. In any case the surface temperature of the brake assembly shall comply with clause 6.1.

3.3.2 be fail safe.

3.3.3 have provision to ensure that traction power cannot be applied unless the brakes are released.

3.4 A `dead-man' control if fitted (refer to Clauses 1.3 and 2.4) shall apply the brake(s) as part of its operation alternately, they shall apply automatically when haulage stops.

3.5 The foregoing requirements for traction drive braking systems are specifically confined to mechanical systems and are additional to any alternative methods of braking.

NOTE Hydrostatic traction braking will be considered provided adequate levels of safety are provided.

4. Environmental Considerations

Every effort shall be made to prevent ignition of gas due to the operation of the shearer.

The Original Equipment Manufacture (OEM) should consider:-

Report No MDG 3004 SR 94/1 Review of Reportable Frictional Ignition of Methane in NSW. Underground Coal Mines" when addressing the operational design assessment for the shearer.

Extensive use has been made of "Ignition By Machine Picks: A Review" written by F. Powell and Published in the January 1992 edition of the Colliery Guardian, in arriving at the following:-

4.1 Frictional Ignitions and Incendiary Sparking

Methods to protect against the occurrence of frictional ignitions shall be provided where ever the possibility of a gas ignition exists. This includes but is not necessarily limited to all "Class A Seams In a Mine" as defined by the "Coal Mines Regulation (Flammable Dust - Underground Mines) Regulation, 1984".

NOTE A number of frictional ignitions have occurred in New South Wales in both "A" and "B" class seams as defined above. A list of recent gas ignitions is included in Appendix A3

The following considerations shall be included to reduce ignitions:-

4.1.1 Pick point velocity shall be minimised.

4.1.2 Pick tip design

4.1.3 Pick retention to prevent inadvertent loss of picks

4.1.4 Effective pick point water flushing which shall/should include the following:-

(a) Each pick shall have a water nozzle positioned to effectively quench any heated material. These sprays should be conical and be positioned behind the pick.

(b) The conical water nozzle should be part of the pick holder as this is a more reliable method of ensuring that the position of the spray aligns correctly with the pick.

(c) Spray nozzles shall be manufactured from corrosion resistant material and be easy to change.

(d) The water flow rate, pressure and spray cone diameter shall be matched to ensure that ignitions do not occur.

(e) Adequate water filters shall be provided to prevent sprays becoming blocked. The filters should be located both in the main supply to the shearer and at the supply to each individual cutter drum. The suggested maximum filter size is 25um, *means for easy clearing shall be provided, eg reverse flush design.*

(f) Adequate water pressure should be available at the pick point sprays to prevent coal blocking the sprays during cutting and to quench hot materials.

NOTE:- Some authorities state that a minimum of 100 bar water pressure is necessary to prevent ignitions.

(g) Means shall be provided for the automatic shut down of the shearer drum rotation if the water flow rate drops below the minimum recommended value.

(h) Means shall be provided for the automatic shut down of the shearer drum rotation if the water pressure drops below the minimum recommended value.

(i) The water flow and pressure monitoring referred to above in (g) and (h) should be located as close as practical to each shearer drum.

(j) Compliance with section 2.10.2 will also minimise blocked sprays.

4.1.5 Effective horizon control should be provided.

4.2 Gas Build-up.

Positive ventilation shall be provided to prevent a build up of any seam gas in the vicinity of the cutter drums to a level which could constitute a hazard. The effectiveness of this system shall be demonstrated by the manufacturer.

4.3 Airborne Dust Control.

The minimising of dust make is required. Considerations shall include:-

4.3.1 Pick point velocity shall be minimised.

4.3.2 Pick tip design.

4.3.3 Pick retention to minimise inadvertent loss of picks.

4.3.4 Effective pick point water flushing which shall/should include the following:-
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(a) Each pick shall have a water spray nozzle to effectively minimise airborne dust.

(b) Spray nozzles shall be manufactured from corrosion resistant materials and shall be easy to change.

(c) The water flow rate, pressure and spray pattern shall be matched to minimise airborne dust make.

(d) Adequate water filters should be provided in the main supply to the shearer and at the supply to each individual cutter drum.

(e) Adequate water pressure should be available at the pick point sprays to prevent coal blocking the sprays during cutting operations.

(f) Means should be provided for the automatic shut down of the shearer drum rotation if the water flow or pressure drops below the minimum recommended levels.

(g) Adequate design of water supply system to and through the machine to ensure sufficient water quantity and pressure are available to suit maximum cutting and loading rate. Actual pressure and quantity of water delivered by sprays and maximum coal cutting rate in tonnes per hour shall be specified.

4.3.5 Positive ventilation of the cutting zone.

4.3.6 Minimise recirculation of coal by the loading drums.

4.3.7 Effective horizon control should be provided.

4.4 Noise.

Noise level at the driver's head at any normal control station during normal underground operation of the shearer should not exceed 90dB(A), for normal exposure.

If the noise level exceeds 85dB(A) then a sign shall be fixed on the shearer in a prominate position which states that hearing protection should be worn.

The Original Equipment Manufacturer (OEM) shall provide sufficient information to the purchaser to allow the Colliery to conduct a noise management programme with respect to the shearer. For additional information refer to AS 1269-1989 and the National Standard for Occuptional Moise [NOHSC: 1007(1993)].

5. Fluid Power Systems.

5.1 Hydraulic systems and components shall comply with Australian Standard AS 2671 Fluid power - hydraulic systems and components.

5.2 Where potential for overheating exists in a hydraulic system (for example due to a component failure) then a temperature control and monitoring system should be provided.

5.3 Flexible hoses shall be compatible with hydraulic fluid used and the maximum system pressure and temperature.

5.4 The hose factor of safety shall be a minimum of 4 to 1 based on hose burst pressure to maximum working pressure.

5.5 Hydraulic hose shall comply with the provisions of AS.3791-1991 Hydraulic Hose and the requirements for flame resistance should be in accordance with testing to AS.1180-10B and acceptance to AS.2660 or alternately satisfy the flame requirements of the U.S.A Code of Federal Regulations Title 30 Part 18 Section 18.65 or comply with type 1 or 3 hose specifications as listed in ISO.6805.

5.6 Where a hydraulic system incorporates an accumulator the attachment to the accumulator shall be by means of a minimal length adaptor and flexible hose. Fittings shall be located or otherwise guarded to provide mechanical protection. A manual bleed valve shall be fitted to allow pressure relief for maintenance. Fluid should return to tank.

5.7 Accumulators shall be securely installed.

5.8 Ranging arms and cowls raised and lowered by hydraulic power shall be fitted with a device which will hold them stationary should a loss of hydraulic pressure occur.

A typical device fitted directly to hydraulic lift cylinders is called a load locking valve.

It is preferred that these devices be fitted directly to the cylinders and be *readily accessible.* If this is not feasible the connection between the device and the cylinder shall be made with steel pipe.

In all respects the device shall comply with the requirements of the Mine Safety and Health Administration of the U.S. Department of Labour issued on 17th October, 1980.

6.0 General

6.1 (a) No external surface shall exceed a temperature of 150 degrees C under any condition of shearer usage.

(b) The oil temperature of critical gear boxes should be continuously monitored and possibly alarmed to prevent oil becoming overheated.

6.2 Where chain haulage of the shearer is used then:-

(a) the system should be so designed that there is no possibility of the chain entering the walkway area used for normal access along the longwall face.

(b) if the system does not comply with the above clause 6.2(a) then effective hold down or restraining devices shall be provided to prevent the chain "flicking" up or across into the walkway.

6.3 Guarding shall be provided in the vicinity of any chain sprockets.

6.4 Chains shall have a breaking strength of at least 6 times the maximum load for which they are to be used.

6.5 Lump breakers where fitted should include the following features:-

(a) be adequately guarded.

(b) be limited in speed of rotation to minimise dust and noise.

6.6 Mechanical stops shall be provided for the ranging arms and cowls to enable safe access under them if access is required for maintenance purposes. The stops shall be capable of being installed without requiring access beneath the items being supported.

Mechanical stops if provided shall be stored on the shearer and be easily accessible.

6.7 Shearer drums should be capable of being mechanically disengaged for maintenance purposes and rotated manually (for changing picks and sprays) after being effectively isolated from the power source.

6.8 The clearance between the armoured face conveyor chain and the shearer and its trapping shoes shall be such that inadvertent contact will not occur. This shall include an allowance for normal wear. *(To prevent the shearer being hauled by the face conveyor).*

6.9 A water outlet and control valve should be provided on the shearer to enable connection of a hose for the purpose of assisting in the control of fire or heat sources.

6.10 Exposed aluminium or light metal alloys shall not be used in the construction of the shearer.

For specific guide-lines refer Appendix II.

6.11 The shearer shall so far as practicable, be constructed of non-flammable material.

6.12 The original equipment manufacturer shall supply and detail the location of lifting attachment points for maintenance purposes. This includes but is not limited to the following points:-

1. The fully assembled shearer

2. Individual shearer drums

3. Cowls

4. Ranging Arms

5. Other major components

6.13 Original Equipment Manufacturer information to client

A manual detailing the operational and maintenance requirements which are specific for the shearer shall be provided. The manual shall include recommendations for the systematic examination and/or testing of the shearer as provided for by the Section 103 Schemes for testing of Electrical or Mechanical Apparatus under the Coal Mines Regulation Act 1982 No67.

Sufficient information must be supplied by the manufacture to ensure that the requirements of the Occupational Health and Safety Act, 1983. No 20 are complied with, this includes but is not limited to Section 18.

7. Labelling.

The labels required shall include the following where applicable:-

7.1 Emergency stops.

7.2 Location of isolation for electrical, hydraulic water and air circuits.

7.3 Water outlet for fire fighting.

7.4 Date of manufacture.

7.5 Manufacturers name.

7.6 Shearer model number.

7.7 Shearer gross weight.

7.8 Maximum safe operating grade.

7.9 A warning at all accumulators that pressure must be safely released before work commences.

7.10 A warning that "hearing protection must be worn" if noise level exceed 85 dB(A).

7.11 The mode of control that has been selected (eg. remote or local.)

7.12 Oil temperature and operating limits.

7.13 All controls.

7.14 Danger notice for chain haulage warning of chain movement.

7.15 Danger notice for remote control advising that shearer can start unexpectedly.

7.16 Danger notices that stops shall be fitted to support ranging arms and cowls prior to access.

8.0 Review of Guidelines

To keep abreast of progress in industry, Guide-lines are subject to periodic review and are kept up-to-date by the issue of amendments or new editions as necessary. It is important therefore that users ensure that they are in possession of the latest edition, and any amendments.

Suggestions for improvements to Design Guide-lines, addressed to the Senior Inspector of Mechanical Engineering are welcomed. Notification of any inaccuracy or ambiguity in any Guide-line should be made without delay in order that the matter may be investigated and appropriate action taken.

Appendices

1. Hydraulic load locking valves.

2. Industry guide-lines for the use of aluminium underground.

3. A Summary of Recent Gas Ignitions in N.S.W. underground coal mines.

4. Summary of Revisions

APPENDIX 1

DESIGN GUIDELINES FOR HYDRAULIC LOAD LOCKING VALVES

MDG 10

Issue Date: 26th May, 1989
Reprinted: September, 1994
File Reference No.: M81/0198

Issue Date: 26th May, 1989
File Reference No.: M81/0198

Note This is an extract of the Mine Safety and Health Administration of the U.S. Department of Labour issued on 17th October, 1980

1. Scope

All hydraulic cylinders used to elevate cutting heads and conveyor boom loading machines and continuous mining machines shall be equipped with hydraulic load locking valves meeting this criteria.

2. Requirements

The hydraulic cylinder assemblies which elevate conveyor booms and cutting head shall be equipped with load locking valves to prevent unintentional fall of the boom or cutting head in the event of hydraulic circuit failure. If the boom or cutting head is elevated to more than one cylinder, each cylinder shall be equipped with a load locking valve capable of holding the boom or cutting head in position.

Each cylinder load locking valve must meet the following requirements:

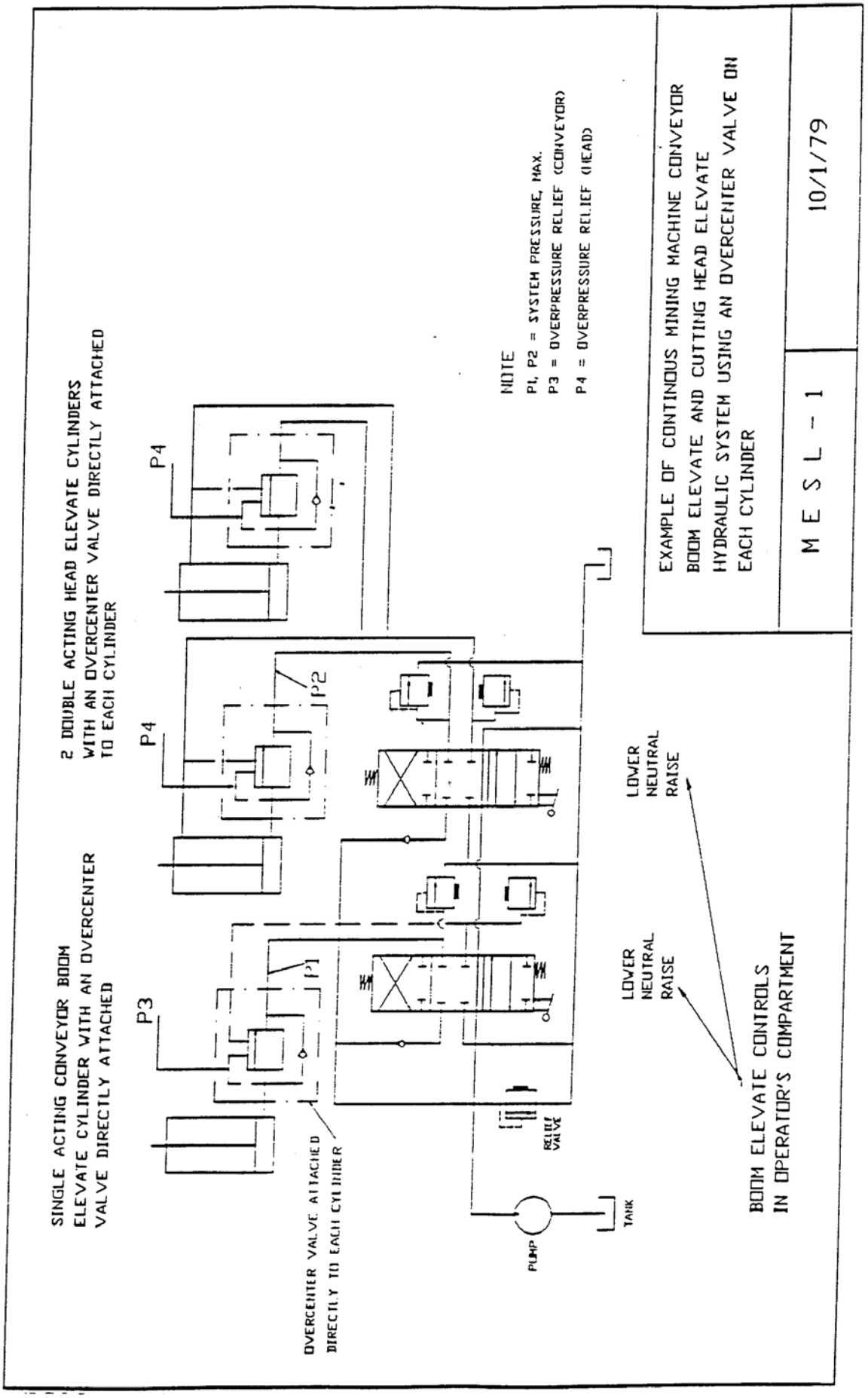
1. The load locking valve must be attached directly to the cylinder port that is subject to the hydraulic pressure induced by the weight of the boom or cutting head.

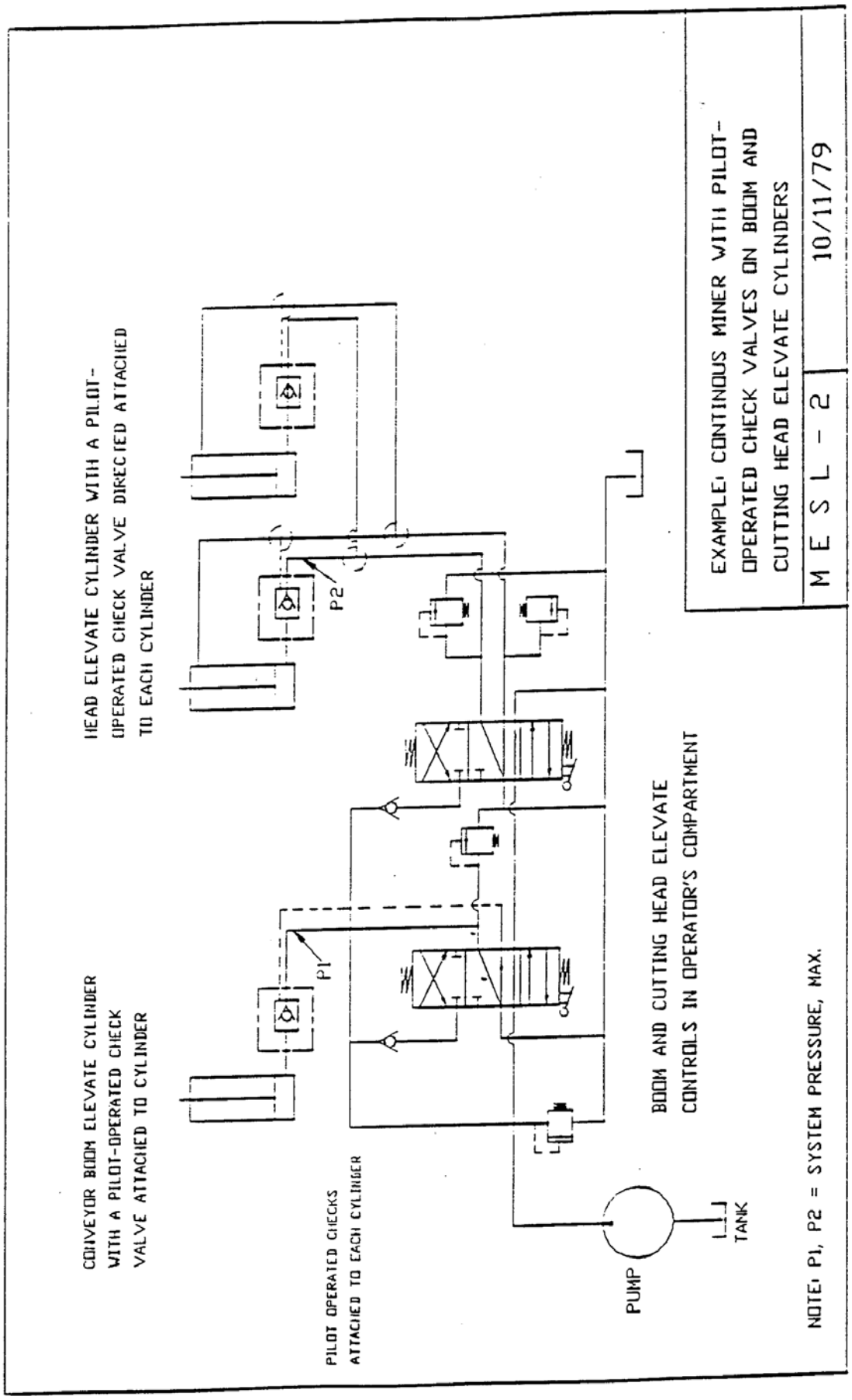
2. The rated working pressure of the load locking valve must be greater than the system operating pressure.

3. If the load locking valve has over-pressure relief capability, the pressure needed to support the static weight of the boom.

4. If the load locking valve is pilot operated, the hydraulic system shall ensure that the residual pilot pressure will not hold the load locking valve open when the control valve (located in the operator's compartment) is in the neutral position.

L.J. Roberts
Senior Inspector of Mechanical Engineering
FOR CHIEF INSPECTOR OF COAL MINES


EXAMPLE OF CONTINOUS MINING MACHINE CONVEYOR
BOOM ELEVATE AND CUTTING HEAD ELEVATE
HYDRAULIC SYSTEM USING AN OVERCENTER VALVE ON
EACH CYLINDER
M E S L - 1
10/1/79
NOTE
P1, P2 = SYSTEM PRESSURE, MAX.
P3 = OVERPRESSURE RELIEF (CONVEYOR)
P4 = OVERPRESSURE RELIEF (HEAD)
2 DOUBLE ACTING HEAD ELEVATE CYLINDERS
WITH AN OVERCENTER VALVE DIRECTLY ATTACHED
TO EACH CYLINDER
SINGLE ACTING CONVEYOR BOOM
ELEVATE CYLINDER WITH AN OVERCENTER
VALVE DIRECTLY ATTACHED
P4
P4
P3
P2
P1
LOWER
NEUTRAL
RAISE
LOWER
NEUTRAL
RAISE
BOOM ELEVATE CONTROLS
IN OPERATOR'S COMPARTMENT
OVERCENTER VALVE ATTACHED
DIRECTLY TO EACH CYLINDER
RELIEF
VALVE
PUMP
TANK


EXAMPLE: CONTINOUS MINER WITH PILOT-OPERATED CHECK VALVES ON BOOM AND CUTTING HEAD ELEVATE CYLINDERS
M E S L - 2
10/11/79
HEAD ELEVATE CYLINDER WITH A PILOT-OPERATED CHECK VALVE DIRECTED ATTACHED TO EACH CYLINDER
CONVEYOR BOOM ELEVATE CYLINDER WITH A PILOT-OPERATED CHECK VALVE ATTACHED TO CYLINDER
P1
P2
PILOT OPERATED CHECKS ATTACHED TO EACH CYLINDER
BOOM AND CUTTING HEAD ELEVATE CONTROLS IN OPERATOR'S COMPARTMENT
PUMP
TANK
NOTE: P1, P2 = SYSTEM PRESSURE, MAX.

APPENDIX 2

DESIGN GUIDELINES FOR THE USE OF ALUMINIUM IN UNDERGROUND COAL MINES

MDG 11

Original Issue Date: 26th May, 1989
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File Reference No.: M84/5001

Issue Date: 26th May, 1989
File Reference:. M84/5001

The prohibition on use of aluminium and light metal alloys in underground coal mines is covered under Clause 39 of "Coal Mines Regulation (Mechanical-Underground Mines) Regulation, 1984."

This clause is as follows:

" (1) The Manager of a mine shall ensure that no aluminium or light metal alloy as specified shall be used on the external parts of any machinery, equipment or other item underground at the mine.

(2) Notwithstanding subclause (1), aluminium or light metal alloys may be used where it is determined by the Chief Inspector that there is no reasonable alternative to such use and such use has been approved."

A copy of the Notice of Specification No. 845001 covering Aluminium and Light Metal Alloys as published in the Government Gazette No. 86 of 1st June 1984 is attached.

In relation to Clause 39(2) the following guidelines shall be applied for the use of aluminium and light metal alloys in underground coal mines.

1. Aluminium or light metal alloy is not permitted where a reasonable alternative can be found. An applicant to use aluminium or light metal alloy must first demonstrate "no reasonable alternative".

2. Where no reasonable alternative exists:-

   (a) for apparatus of a portable nature, normally kept in possession of a person, then this apparatus may be approved to be taken and used underground subject to being protected or enclosed other than during actual use, so as to prevent contact with other metal

   (b) for other apparatus, approval may be given provided that the aluminium or light metal alloy is covered by an approved metal spray coating and is protected by a substantial guard, so arranged eg. by the use of limit switches that the guard must be in place for the equipment to carry out its function

   (c) and (a) or (b) cannot be applied eg. diesel engine fuel pump, then approval may be given for installations in which the component is well protected by reason of its location in the apparatus.

L.J Roberts
Senior Inspector of Mechanical Engineering
for Chief Inspector of Coal Mines

Department of Industrial Relations
Sydney, 3rd May, 1984

COAL MINES REGULATION ACT, 1982
NOTICE OF SPECIFICATION

Specification: 845001
File No:. 84-5001

ALUMINIUM AND LIGHT METAL ALLOYS

IT is hereby notified that the Chief Inspector of Coal Mines, for the purposes of the Regulation cited as the "Coal Mines Regulation (Mechanical-Underground Mines) Regulation 1984" under the Coal Mines Regulation Act, 1982, has specified that the material described below is aluminium or light metal alloy for the purposes of clause 39 of the Regulation.

Any metal or alloy which includes aluminium and/or magnesium and/or titanium in which the total content of these three constituents exceed 15 percent by weight but in any case in which the content of magnesium and titanium together exceeds 6 percent by weight.

APPENDIX 3

Summary of Recent Gas Ignition in NSW Coal Mines

Mine: Teralba **Date: 20/07/89**
Class A Mine

Methane gas was ignited in the sump of a downcast shaft when sparks from a cutting and burning operation fell to the water level in the sump. The gas ignited was bubbling to the surface of the water and was thought to be sourced in underlying coal measures. Future similar incidents are to be prevented by increasing ventilation turbulence.

Mine: Lemington **Date: 1/08/89**
Class A Mine (FRICTIONAL)

A gas ignition occurred at roof level in a face area. No person was injured and the gas quickly extinguished with a dry chemical extinguisher. The source of ignition was attributed to frictional heat generated by a continuous miner roof bolting rig boring a hole through a steel roof strap. Gas was issuing from a break in the roof and ventilation was assessed as good. The practice of boring through roof straps, instead of locating the drill through the punched holes, has been discontinued at the mine and tools used for the purpose removed.

Mine: Liddell State **Date: 8/11/89**
Class A Mine

Electrical discharge within an 11kV blanked adaptor on a 11kV/1000-415V transformer caused the emission of hydrogen which was then ignited by the electrical discharge. The transformer suffered severe damage to the 11kV cubicle. A number of people suffered injuries and nausea from the fumes evolved. The incident was attributed to inadequate high voltage maintenance procedures.

Mine: Kemira **Date: 1/03/90**
Class A Mine (FRICTIONAL)

An ignition of gas occurred when picks of a longwall shearer, striking a quartz nodule, generated an incedive spark in the presence of methane. Continued attention to the replacement of broken and damaged picks, post pick flushing sprays, and provision of ventilation sufficient to prevent accumulations of flammable gas were identified as measures to prevent a recurrence.

Mine: Ellalong **Date: 24/09/90**
Class A Mine (FRICTIONAL)

An ignition of methane occurred. When the left hand bolter clogged on the in seam miner and the right bolt was installed leaving a gap over the strap on the left hand side. Methane issuing from the bolt hole accumulated along the strap and was ignited when the left hand drill steel hit the strap, causing a shower of sparks. A requirement for both bolts to be installed simultaneously was introduced before the miner was removed from the mine.

Mine: Kemira **Date: 3/10/90**
Class B Mine (FRICTIONAL)

An ignition of gas occurred on a longwall face due to frictional sparking of a tungsten carbide cutter pick or picks which contacted a high silica content nodule within the seam. The resulting gas fire was extinguished by the longwall operators within a short period using a dry chemical fire extinguisher. The ignition was attributed to poor design of through-the-pick flushing system, inadequate recognition and replacement of blocked sprays and non operating of the high pressure water supply system.

Mine: Appin **Date: 25/10/90**
Class A Mine (FRICTIONAL)

An ignition of gas occurred on a longwall face due to frictional sparking of a tungsten carbide cutter pick or picks which contacted a high silica content sandstone lens in the floor which was being cut to a depth of 400mm due to thinning of the seam. The resulting gas fire was extinguished by the longwall operators within a short period using a dry chemical fire extinguisher. The ignition was attributed to failure to operate the high pressure water supply system, and the fact that the equipment was put in that the minimum height required by the supports was 2.4m. The seam height in the area of the ignition was generally less than 2.2m. Controls now placed on the high pressure water supply during cutting and interlocking of the high pressure water supply will reduce the risk of recurrence.

Mine: Kemira **Date: 21/12/90**
Class B Mine (FRICTIONAL)

An ignition of gas occurred at the face of a heading due to frictional sparking of de-tripped miner cutter or picks which contacted a high silica content nodule within the seam. The resulting gas fire lasted some five seconds and self extinguished apparently after the source blower of gas was consumed. The ignition was attributed to inadequate and untimely replacement of defective picks.

Mine: Munmorah State **Date: 27/12/90**
Class A Mine (FRICTIONAL)

A frictional ignition of methane occurred when a picks struck the coal and sandstone roof immediately following a stoppage to allow the face to be supported. A layering of methane occurred in the left hand corner of the face which burnt for a couple of seconds before being extinguished by the sprays. Miner drivers were instructed not to bring the miner picks in contact with the roof until the sprays and swirling action of the drum removes any possible build-up of methane following any prolonged stoppage.

Mine: Appin **Date: 8/02/91**
Class A Mine

An arc of a miner cable following by an ignition of methane occurred during the breaking away of an intersection in a development panel. The arc was the result of impact damage by the conveyor boom of the continuous miner with its cable. The gas ignition extended over an area of 1m square in a thin layer fed by desorbing methane from freshly mined coal. Recurrence should be avoided by implementation of changed cable location procedures which take account of and deal with the problem of separating machine and cable during breakaways.

Mine: Munmorah State **Date: 14/07/92**
Class A Mine

An ignition of methane occurred in the hazardous zone when the miner picks ignited a blower after striking the conglomerate roof. The ignition was self extinguishing after 20 seconds.

Investigation indicated that extra water volume was required to be delivered to the miner to allow adequate pressure to operate the ventura sprays. Larger hoses are to be used for delivery.

Mine: Munmorah State **Date: 6/08/92**
Class A Mine

In Kanwal 3 Panel, Great Northern Seam, a frictional ignition of methane occurred. The ignition occurred when the picks struck the coal and conglomerate roof whilst coal cutting operations were in progress. The methane ignition extended across the cutter picks on the machine and ignition methane issuing from the cut coal on the floor. Improved face ventilation, additional venturi sprays and variation to coal cutting methods have been introduced in an attempt to prevent a re-occurrence.

Mine: Teralba **Date: 26/08/92**
Class A Mine

A methane gas ignition occurred at the face of a longwall development unit. A stone intrusion was running parallel to heading and partially across the face. Whilst cutting the stone an ignition occurred. Although the legal quantity of air was available at the face, it was insufficient to dilute the methane.

Mine: Seaham No 2 **Date: 14/12/92**
Class A Mine

Whilst filling a discontinued mine shaft, a methane explosion occurred. Large lumps of concrete building material were being used to plug the bottom of the shaft. The use of a water cart whilst filling the shaft might have prevented the incident. Nobody on the surface was injured although lumps of rock were ejected by the explosion.

Mine: Cooranbong **Date: 28/04/93**
Class A Mine

An ignition of methane gas occurred when a methane gas blower was ignited as the roof at the coal face was brushed with a continuous miner to remove coal tops. The incident was caused by frictional ignition when the conglomerate roof at the coal face was brushed in the vicinity of a methane gas blower. He sparks created from the continuous miner cutting the conglomerate, ignited the methane gas issuing from a gas blower in the roof. To prevent a similar occurrence a risk assessment of face operations in south intakes will be conducted by mine personnel, and a document management plane adopted to reduce the possibility of further frictional ignition. Whilst the risk assessment was being done, another ignition in the same section of the Mine took place on May 7th 1993.

Mine: Cooranbong **Date: 7/05/93**
Class A Mine

In south intake section, great northern seam, an ignition of methane gas occurred at the face. The incident occurred when methane gas was ignited as the roof at the coal face was brushed with a continuous miner to remove coal tops. The incident was caused as a result of frictional ignition when the conglomerate roof at the coal face was brushed in the vicinity of methane gas. The sparks created from the continuous cutter picks cutting the conglomerate, ignited the methane gas which had accumulated near the roof at the face. To prevent a similar occurrence a risk assessment of face operations in south intakes was conducted by mine personnel, and a document plane adopted to reduce the possibility of further frictional ignition

Mine: South Bulga **Date: 26/11/93**
Class A Mine

In the tailgate No. 1 Panel "A" Heading, an ignition of gas occurred on the right hand side of the heading only, during a sumping in operation. It is thought that an incendive spark from the action of the picks on hard bands in the cowpat bord ignited two small blowers just below this band. The heading had been inspected before cutting commenced, ventilation was up to date and adequate. Management have introduced extra sprays on to the continuous miner, have changed the fan for a larger capacity miner, have introduced extra sprays

Mine: South Bulga **Date: 14/2/94**
Class A Mine

An ignition of gas occurred. The ignition occurred due to an incendive spark from the continuous mine picks igniting small blower in the face. The extinguisher from the continuous miner used to put out the flame.

Mine: South Bulga **Date: 25/2/94**
Class A Mine

Description : On the 25th February, 1994 at approximately 12.55 am. in the tailgate No 1 panel of the Wybrow Seam at South Bulga Underground Mine an ignition of methane gas occurred

The ignition occurred due to an incendive spark from the continuous miner picks igniting a small blower in the face.

The extinguisher from the continuous miner was used to put out the small flame.

Mine: Newvale 2 **Date: 26/4/94**
Class A Mine

An ignition of gas occurred at the face whilst the continuous miner was cutting coal. The ignition occurred when the continuous miner picks came into contact with the roof and a spark ignited a small amount of methane that appeared to have been liberated from a small fault, 0.1m. The shuttle car driver extinguished the flame, which lasted about 30 seconds, with a hand held extinguisher.

Mine: Newvale 2 **Date: 24/11/94**
Class A Mine

An ignition of methane occurred during a cutting cycle. The ignition occurred on the left hand side of the roadway when the continuous miner picks struck the roof. A small blower of methane was found and quickly dispersed by extending the brattice. Had the brattice been closer to the face the ignition was a small blower of methane (5%)very close to the roof. The continuous miner was at an angle the left hand side higher than the right hand side due the floor of the seam. The sprays on the left hand side were not 100% efficient, consequently when the picks struck the roof causing sparking the lack of water contributed to a frictional ignition. The ventilation in the district was not the best but knowing this the brattice should have been as close to the face as possible. The night shift crew where given refresher in the art of ventilation, and tool box talks were extended to the other shifts. A large gap between the brattice and the rib, was established, and the wing extended closer to the face. The face area was re-dusted and the trickle duster checked for working order. The damage water sprays where replaced and a new extinguisher put on the continuous miner. There is a new continuous miner to go into the district with a new system of water sprays fitted to it. A ventilation survey for the whole of the mine has been completed, and the options are being examined, in effort to increase ventilation to that section of the mine.

Mine: South Bulga **Date: 9/3/95**
Class A Mine

Description: At approximately 5.45pm on the 9/3/95 in No 2 panel B heading in the Wybrow seam at Bulga Underground Mine, and ignition of methane took place, no person was injured.

The continuous miner was cutting the lower part of the seam, when the deputy heard a pop and saw flames, at the right hand side of the continuous miner. This was quickly extinguished by the use of a fire extinguisher off the continuous miner. An examination of the area revealed a small blower just above the cow pat band. There was evidence of the hands of material that have caused the ignitions in the past and 2.5% of methane was coming from the blower. The continuous miner is to be fitted with the Senior Engineering device in an attempt to prevent a further incident.

Causal Factors: There are small bands of hard material that appear in the coal just the cow pat band and there together with a small methane blower appear to be the ingredients for ignitions. It has been found that the sparks come from the material and not from the metal of the cutter picks.

Action Taken: It is intended to fit the continuous miner with a Senior Engineering device that will pass a current of air over the cutting head and prevent the cutting head from operating if the pressure of air fails. This has been done and it is found that 2.9 cu mt pass over the cutting head.

Mine: South Bulga **Date: 20/3/95**
Class A Mine

Description: An ignition of flammable gas occurred at the face on the left hand side of a continuous miner whilst coal cutting operations were in progress.

Causal Factors: The incident occurred when the miner picks came in contact with a stone band, causing a spark of sufficient heat and duration to ignite a mixture of methane that was present at the working face. There has been a change in drivage sequence, which resulted in a ventilation change which was not compatible with the ventilation change which was not compatible with the ventilation flow created by the venturi sprays on the continuous miner.

Action Taken: Ventilation surveys were carried out to ascertain face ventilation.

Mine: Newvale 2 **Date: 28/4/95**
Class A Mine

In 4 heading, 407 panel 2-3 cut through an ignition of methane took place, no person was injured. The ignition was caused by continuous miner picks struck the hard material in the roof at the same time a small pocket of gas released. The flames where extinguished by the hand held extinguisher on the continuous miner. In an attempt to prevent a further occurrence a fan spray system has been fitted to the continuous miner. The hardness of the roof and the release of a small pocket of methane appear to be the causal factors. The sequence of events eg, the hardness of the roof and the methane where probably caused by the nearness to a dyke. The Manager has looked at the Senior Engineering instrument, and decided to sick with the American fan spray system. This system causes a flow of air over the continuous miner picks induced by the water sprays. The system been fitted and is currently under review.

Mine: South Bulga **Date: 19/5/95**
Class A Mine

Description: At approximately 8.07 pm on the 19/05/95 in panel sequence 3 breakaway lw3 relief headings at South Bulga Underground Mine, an ignition of methane took place. No persons were injured.

The ignition took place on the right hand side of the continuous miner cutting head, the picks struck the hard band of material and igniting a small blower. The flame was self extinguishing. Although the Senior Engineering instrument was fitted to this continuous miner, it was found to be incorrectly adjusted. There was a loose venturi and contaminated air feed. The Senior Engineering staff have visited the mine and adjusted the faults and are to fit strainers into the air feed to this continuous miner. They also instructed the staff at the mine on these points.

Causal Factors: The Senior Engineering instrument was not correctly fitted and maintained, the main problem being the newness of the instrument and the rush to operate it.

Action Taken: The Senior Engineering Staff have visited the sit and adjusted the instrument and are have filters fitted into the air feed to the instruments. The mine staff have also been instructed in the correct adjustment of the instrument, in an attempt to prevent a further incident.

Mine: South Bulga **Date: 14/6/95**
Class A Mine

Description: At approximately 9pm on the 14/6/95 in No 3 Panel South Bulga Underground Mine, an ignition of gas took place, no person was injured.

The continuous miner was sumping down, as per the managers rules, when the ignition took place on the left hand side close to the roof.

The flames where extinguished by the water hose from the continuous miner. The Senior Engineering instrument has been fitted to the continuous miner. The senior Engineering instrument has been fitted to the continuous miner on the day shift, and calibrated, and was in working order, all the picks where in good condition, and the ventilation was 8cumt at the face. In an attempt to prevent a recurrence a larger fan has been installed (18 cumt) instead of the 12cumt one.

Causal Factors: A small blower of methane gas approximately 700mm from the roof was ignited by sparks from the picks striding a module of hard material in the coal.

Action Taken: The 12.5 cumt fan has been changed over fro a 18 cumt fan, this has increased the ventilation at the face and reduced the general body methane from 0.8% to 0.4%. It intended to take face readings once the heading is in its full length. The method of stonedusting has been changed, now the heading will be stonedusted at the end of every cutting shift, instead of the customary 30mt.

APPENDIX 4

Summary of Revisions
(All typed in itallics)

Clause	1.5.1(F)	First paragraph of note deleted
	1.5 (H)	Transport Schedule added.
	2.5	Reference to AS4240 added for remote control.
	2.9	NOTE 2 reworded
	2.10	Prestart added to wording
	2.10.2	Reworded
	2.10.2 NOTE 3	New clause added to permit defeat of drum rotation water control inter-locks for maintenance purposes.
	2.15	Rotate fuction/dirction added
	2.16	Referecne to maintenance and servicing added
	4	Reference to review of reportable frictional ignitions of methane in NSW Underground Mines added.
	4.1.4(e)	Filter cleaning added
	4.1.4(g)	Revised to remove ambiguity
	4.1.4(i)	wording modified
	4.4	Additional requirements and references added.
	6.8	Explanation for requirement added.
	6.12	Requirements for lifting points added
	6.13	Requirements for manuals added
	7.2	Labelling of isolation for hydraulic, water and air circuits added.
	Appendix A3	Summary of Recent Gas Ignitions in NSW Coal Mines - Updated.