
Design guidelines for the construction of feeder breakers

MDG 31

Produced by Mine Safety Operations Division
New South Wales Department of
Primary Industries

August 1998



**NSW DEPARTMENT OF
PRIMARY INDUSTRIES**

*NSW Department of Primary Industries
516 High St, Maitland NSW 2320
(PO Box 344, Hunter Region
Mail Centre 2310)*

Fax: (02) 4931 6790

Phone: (02) 4931 6666

Website: www.dpi.nsw.gov.au/minesafety

PUBLISHED	August 1998
First Published	1 August 1996
Revision Date	18 August 1998
File Reference	C95/0236

DISCLAIMER

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

Use of this document does not relieve the user (or a person on whose behalf it is used) of any obligation or duty that might arise under any legislation (including the Occupational Health & Safety Act 2000, any other Act containing requirements relating to mine safety and any regulations and rules under those Acts) covering the activities to which this document has been or is to be applied.

The information in this document is provided voluntarily and for information purposes only. The New South Wales Government does not guarantee that the information is complete, current or correct and accepts no responsibility for unsuitable or inaccurate material that may be encountered.

Unless otherwise stated, the authorised version of all reports, guides, data and other information should be sourced from official printed versions of the agency directly. Neither the Department of Primary Industries, the New South Wales Government, nor any employee or agent of the Department, nor any author of or contributor to this document produced by the Department shall be responsible or liable for any loss, damage, personal injury or death howsoever caused.

Users should always verify historical material by making and relying upon their own separate inquiries prior to making any important decisions or taking any action on the basis of this information.

FOREWORD

Feeder Breakers are basically coal hopper storage/crushing machines generally comprising an armoured scraper conveyor (to transport coal from a wide receiving end to a belt conveyor) and a breaker. Feeder Breakers are normally installed at the boot end of the belt conveyor to which coal is discharged from a coal transport vehicle, eg. shuttle car.

The guideline has been prepared to assist manufacturers/suppliers of Feeder Breakers with design information that should facilitate the construction of equipment as required under the provisions of the Occupational Health and Safety Act, 1983. It is a guide and as such it is not intended that it comprehensively covers all safety related aspects of Feeder Breakers as designs may give rise to the generation of hazards not addressed herein.

The guideline has been subjected to a major review and this revision replaces the original document issued in July 1996. For ease of reference the changes have been shown in italics. The assistance of Mr W Koppe (DMR), Mr R Roberts (Engineering Safety Services) and Stamler Australia in providing comments for the review process are acknowledged.

It is to be noted that the original issue of this guideline was to replace the previously issued requirement for Feeder Breakers to be in accordance with a Certificate of Examination under the provisions of Clause 8 of the Coal Mines Regulation (Approval of Items) Regulation, 1984. Notices gazetted relating to this and this document's status have been included as appendices.

Approvals under the Coal Mines Regulation Act in relation to this class of equipment are confined to those items of electrical apparatus installed as part of the equipment and which are required to be approved under the Coal Mines Regulation (Electrical - Underground Mines) Regulation, 1984.

Information collated from the Coal Mining Inspectorate's database of Accidents and Dangerous Occurrences associated with the operation of Feeder Breakers included previously for reference purposes has been updated.

As with the original document comments on any aspect of its contents are encouraged however it is requested any comment be in writing and forwarded to:

Leo Roberts
Manager Technical Services
Division of Mine Safety and Environment
Department of Mineral Resources
PO Box 536
ST LEONARDS 1590

Fax (02) 9901 8584

B. R. McKensy
CHIEF INSPECTOR OF COAL MINES

CONTENTS

		Page
1.0	Scope	1
2.0	Definitions	3
3.0	Feeder Breaker Design & Construction	5
	3.1 General	5
	3.2 Brakes	6
	3.3 Fluid Power Systems	7
	3.4 Towing	8
	3.5 Ergonomics	8
	3.6 Controls	9
	3.7 Marking and Illumination	13
	3.8 Guarding	14
	3.9 Dust Suppression	15
	3.10 Noise	15
4.0	Documentation	15
Appendix A	List of Standards and Guidelines	16
Appendix B	Feeder Breaker Documentation Requirements	17
Appendix C	SA94-03 Safety Alert - Deputy Fatally Injured When Carried Through the Crusher of a Longwall BSL	18
Appendix D	Summary of Reportable Accidents and Dangerous Occurrences associated with Feeder Breaker operations - Period June 1984 - <i>May</i> 1996	19
Appendix E	Notice of Specification for Feeder Breakers	23
Appendix F	Notice of Revocation	24

1 Scope

- 1.1 These guidelines set out design standards for that class of equipment (mechanical apparatus) for use in underground coal mines known as Feeder Breakers.
- 1.2 Clause 42 of the Coal Mines Regulation (Mechanical - Underground Mines) Regulation 1984, states: “The Chief Inspector may require mechanical apparatus used at a mine, being apparatus with respect to which provision is not specifically made in this Regulation, to comply with design and operational standards from time to time specified by the Chief Inspector.”

This document MDG 31 - Design Guidelines for Construction of Feeder Breakers is deemed to be the design standard specified under the provision of Clause 42 for that class of mechanical apparatus.

A notice to this effect dated 26 November 1996 has been gazetted Refer Appendix E.

- 1.3 The Chief Inspector’s requirement for Feeder Breakers to have a “Certificate of Examination” prior to being taken underground after 1st January 1985 is replaced for those Feeder Breakers where the design is assessed by the Original Equipment Manufacturer to be in accordance with the intent of MDG 31.

Note: The Gazettal Notice stating the above requirement has been reproduced in this document (refer Section 1.8).

A notice revoking this requirement dated 26 November 1996 has been gazetted Refer Appendix F.

- 1.4 MDG 31 is primarily intended to assist Original Equipment Manufacturers of Feeder Breakers by offering information on safety related issues known to the Inspectorate which may be taken into account during the design and construction stages. It is also available as reference documentation for the purposes of any design and/or operational risk assessment conducted by the Original Equipment Manufacturer and the end User as required by the Occupational Health and Safety Act 1983 No 20 Part 3 Division 1 clauses 15 and 18.

Note: (a) “shall” means that the requirement is strongly recommended if it is applicable to the type of equipment under consideration unless it is used in association with a legislative requirement then it is mandatory.

(b) “should” means that the requirement is recommended.

- 1.5 MDG 31 does not generally incorporate quantitative information as it is not intended to restrict innovative design. Where the Original Equipment Manufacturer proposes variations from the guidelines, a process of equipment technical assessment and risk assessment should be undertaken by the manufacturer in conjunction with the operational user.

Further advice on this issue may be sought from Inspectors of Mechanical Engineering, Coal Mining and Engineering Branch of the Department of Mineral Resources (DMR).

- 1.6 Unless otherwise specified, the appropriate Australian Standards shall apply. (Refer to Appendix A for a list of Australian Standards, Mechanical Design Guidelines and other References considered to be relevant).
- 1.7 The guidance information contained in this document does not in any way negate the requirements of the Coal Mines Regulation Act, 67/1982 or the NSW Occupational Health and Safety Act (OHS Act), 1983 No. 20.
- 1.8 Reference Documentation.

On the 5th of December 1984 the following notice was issued by the Chief Inspector to all Managers of Underground Mines:

**COAL MINES REGULATION (APPROVAL OF ITEMS)
REGULATION 1984**

“Breaker feeders, ratio feeders and machines designed to perform a similar function to such feeders are not considered to be vehicles. Accordingly, as detailed in Clause 8 of the Coal Mines Regulation (Approval of Items) Regulation 1984, I require that breaker feeders, ratio feeders and machines designed to perform a similar function to such feeders shall have a “Certificate of Examination” before being taken underground. This requirement shall relate only to such equipment first taken underground subsequent to 1st January 1985.”

2 Definitions

- 2.1 **CONTROLS - PRIMARY:** Controls that are *frequently or continuously used by the operator, eg. traction, steering, brakes, working tools.*
- 2.2 **CONTROLS - SECONDARY:** Controls that are *infrequently used by the operator, eg. start, lights, test buttons.*
- 2.3 **DEADMAN CONTROL:** A control which is physically maintained by the operator and permits movement of a machine (ie tramping of the Feeder Breaker). In the event of the deadman control release, the Feeder Breaker will come to rest.
- 2.4 **DMR:** Department of Mineral Resources (NSW).
- 2.5 **EMERGENCY STOP:** A machine mounted device using fail-safe components that override all other machine (ie. Feeder Breaker) controls, removes power from the machine (ie. Feeder Breaker) actuator(s), and causes all moving parts to stop.
- 2.6 **ERGONOMICS:** is the design of equipment, processes and environments so that tasks and activities required of humans are within their limitations but also make the best use of their capabilities. More simply, ergonomics is designing for people in the workplace. The application of ergonomics enhances people's ability to work safely and efficiently.
- 2.7 **FAIL TO SAFE (fail safe):** Any failure of the machinery (ie, Feeder Breaker), its associated safeguards, control circuits to its power supply that leaves the machinery (Feeder Breaker) in a safe condition.
- 2.8 **FEEDER BREAKER:** is defined as a unit generally consisting of an hopper or an in-feed conveyor system to receive ROM coal, a breaker assembly and an out-feed conveyor, designed to deliver product as a controlled rate and size compatible with a receiving conveyor belt system.
- 2.9 **IN-FEED CONVEYOR:** for the purposes of this guideline the in-feed conveyor may be any device which conveys material into the breaker section and includes armoured scraper conveyors, vibro feeders, screens, hoppers or gravity chutes.
- 2.10 **MDG:** Mechanical Design Guideline,
Note: Refer to Appendix A for a list of relevant MDGs and Australian Standards.
- 2.11 **O.E.M.:** refers to Original Equipment Manufacturer.
- 2.12 **OUT-FEED CONVEYOR:** for the purposes of this guideline the out-feed conveyor may be any device which conveys the sized product from the breaker section to the conveyor belt system and includes armoured scraper conveyors.
- 2.13 **RISK ASSESSMENT:** The overall process of risk analysis and risk evaluation, refer to *MDG 1010, MDG 1014 and AS4360 - Risk Management.*
- 2.14 **RISK MANAGEMENT PROCESS:** The systematic application of management policies, procedures and practices to the tasks of analysing, evaluating and controlling risk.

- 2.15 **TRAMMING:** Trimming on a roadway through a self propelling drive mechanism.

3 Feeder Breaker Design and Construction

3.1 General

- 3.1.1 The Feeder Breaker shall so far as practicable, be constructed of non-flammable material.
- 3.1.2 No external surface shall exceed a temperature of 150°C under any condition of usage of the equipment.
- 3.1.3 Aluminium or light metal alloys as defined by MDG 11 shall not be used for any external surface or components of the Feeder Breaker.
- 3.1.4 Surface protection shall not contain in metallic form any light metals or alloys of light metals (Refer MDG 11).
- 3.1.5 The Feeder Breaker may be mounted on wheels or tracks to allow movement during belt advancement and/or retraction or be part of a fixed installation. Where tracks are provided, these are usually powered.

NOTE: Where provision is made for an operator to travel on the equipment during tramming operations, *the relevant requirements of MDG 1 shall be applied in the design with respect to lighting, visibility, braking, ergonomics and protective devices. The process of risk assessment shall be used to determine the appropriateness of the relevant requirements of MDG 1 in relation to the machine's slow tramming speed and infrequent operation.*

- 3.1.6 The following potential hazards should at least be considered *via Risk Assessment* undertaken for Feeder Breaker *design and/or operation*:
- the possibility of persons being *inadvertently* carried into the breaker by in-feed conveyor
 - *unplanned machine movement due to brake failure or malfunction, or brake release for towing purposes*
 - *unplanned machine movement whilst in tramming mode which could place persons in the vicinity of the machine at risk of injury*
 - *inadvertent starting of conveyor and/or breaker under any condition, including automatic or manually remote start/stop controls*
 - *entrapment of personnel at the in-feed or discharge ends of the conveyor*
 - *outbreak of fire from any source, including failures of breaker or conveyor drive shaft bearings, drive coupling, gearbox*
 - *crush potential from items raised and lowered by hydraulic power*
 - *trailing cable damage during tramming operations.*

Note: The above listing is not intended to be representative of the only hazards which need to be considered.

3.2 Brakes

- 3.2.1 Wheeled Feeder Breaker units shall be provided with a means of locking the wheels when the unit is not attached to a prime mover. This may be achieved by jacking systems which remove the weight of the Feeder Breaker from the wheels or by wheel sprags. These provisions shall be effective before the Feeder Breaker is detached from the prime mover.

Note: Consideration shall be given to the intended prime mover unbraked trailer mass and brakes fitted as appropriate.

- 3.2.2 Self propelled Feeder Breakers shall be provided with brakes which can manually be applied and *automatically* on loss of power to the traction drive system.

Note: Specific approval is required for electric brake motors and brake motor control and protection systems.

- 3.2.3 Traction brakes shall:

- (a) be fully enclosed spring applied brakes fitted directly to the traction drive assembly (oil immersed multi-disc type is preferred). For any operational condition, the surface temperature of the brake assembly shall not exceed 150°C;
- (b) fail to safe;
- (c) have provision to ensure that traction power cannot be applied unless the *brakes* are released;
- (d) have provision to be *manually* released, refer **section 3.4.3**.

- 3.2.4 Fully loaded self propelled Feeder Breakers shall be capable of coming to a controlled stop whilst tramming down the maximum operating grade.

- 3.2.5 The O.E.M. shall nominate the maximum grades for safe operation of the Feeder Breaker *when fully loaded and empty*.

- 3.2.6 A “dead-man” control if fitted shall apply the brake(s) as part of its function. Alternatively the brakes shall apply automatically when power is removed from the traction drive system.
The dead-man features required by AS2595.1 are not mandatory provided a detailed risk assessment is conducted. It is the responsibility of the O.E.M. and user of the equipment to define alternative barriers to reduce risk and injury to an acceptable level through a risk management process.

- 3.2.7 The foregoing requirements for traction drive braking systems are specifically confined to mechanical systems and are additional to any alternative methods of braking.
- 3.2.8 Hydrostatic traction braking is permissible if the findings of a detailed risk assessment determines that the system as reviewed is safe.

3.3 Fluid Power Systems

- 3.3.1 Monitoring shall be provided for hydraulic systems oil level and temperature. Where potential for overheating exists as a result of component malfunction then control shall be installed to cut power to the hydraulic pump motor when set points of the monitoring system are exceeded.
- 3.3.2 Flexible hoses shall be compatible with the hydraulic fluid used, the maximum system pressure and operating temperature.
- 3.3.3 The hose factor of safety shall be minimum of 4 to 1 based on hose burst pressure to maximum working pressure.
- 3.3.4 Hydraulic hoses shall comply with the provision AS3791 and the requirements for flame resistance should be in accordance with testing to AS1180-10B and acceptance to AS2660 or alternatively satisfy Schedule 2G of the U.S Bureau of Mines or comply with type 1 or 3 hose specifications as listed in ISO 6805.
- 3.3.5 Where an hydraulic system incorporates an accumulator the attachment to the accumulator should be by means of a minimal length adaptor and flexible hose. Fittings should be located or otherwise guarded to provide mechanical protection. A manual bleed valve should be fitted to allow pressure relief for maintenance or lockout isolation valve fitted.

NOTE: Fluid release should return to tank

- 3.3.6 Accumulators shall be securely installed.
- 3.3.7 Conveyor booms, levelling jacks and other items raised and lowered by Hydraulic power shall be fitted with a device which hold them stationary should loss of hydraulic pressure occur *anywhere between the hydraulic power source and the cylinder*, eg. Hydraulic Load Locking Valve (Refer MDG 10).

3.4 Towing

- 3.4.1 Towing attachments, suitable for use with rigid draw bars, shall be designed to a minimum factor of safety of 2.5 times the maximum rated gross weight of the Feeder Breaker *when travelling on the maximum allowable grade.*
- 3.4.2 Provision shall be made for the connection of safety chains between the prime mover and the Feeder Breaker *where the combined rating of safety chain attachments equals the maximum rated gross weight of the Feeder Breaker when travelling on the maximum allowable grade.*
- 3.4.3 Provision shall be made for the release of the traction brakes by external means for the purpose of towing a disabled Feeder Breaker.

With any provisions made to satisfy this requirement it should not be possible to leave the Feeder Breaker parked without the brakes applied when not attached to the prime mover (see also **section 3.2.1**).

3.5 Ergonomics

- 3.5.1 The ergonomic design in this section of the guideline is based on the following fundamental premise:

Ergonomics uses the process of Risk Identification, Risk Assessment and Risk Control to examine the likelihood of risks associated with a job or a piece of equipment and how these might cause harm to a person. Ergonomics applied using this process enables the compilation on how risks might be minimised or eliminated, particularly at the design stage.

- 3.5.2 The design of the Feeder Breaker shall avoid the inclusion of sharp edges/corners.
- 3.5.3 It is the responsibility of the user to determine site specific safety issues.
- 3.5.4 Controls shall be laid out and designed to allow easy operation based on the principle that a given direction of movement of any control produces a consistent and expected effect. Where confusion may result from the motion of a control, the effect from the movement of the control shall be clearly and permanently identified (refer **section 3.7**). The controls should comply with **section 3.6.14** for zones of comfort and reach.

For specific details on control features refer section 3.6.

3.6 Controls

3.6.1 The controls and operation of the feeder unit shall be such that the receiving conveyor belt system must be operational before the out-feed conveyor of the unit can be energised.

3.6.2 Feeder conveyor and breaker drive mechanism should not be energised when the Feeder Breaker is being trammed.

NOTE: For additional information refer **section 3.8.5**.

3.6.3 Sequencing of the breaker drive and in-feed conveyor drive shall be such to prevent overloading of the breaker assembly during start-up.

3.6.4 Feeder Breakers controlled remotely shall comply with AS4240.

3.6.5 For radio control or other forms of remote control the following shall be specified by the manufacturers;

- (a) The maximum distance between the controller and Feeder Breaker.
- (b) A safe system of operation including use of a spare transmitting unit, charging of the batteries, changeover procedure and location of the spare unit.
- (c) *Operator safe standing zones (Refer MDG 5002).*

3.6.6 Systems for control of the operation of Feeder Breaker which are duplicated ie, have local manual controls and radio remote control should be provided with the following features;

- (a) 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 *with the exception of emergency stop devices. (Refer Section 3.6.13).*
- (b) Visual indication shall be provided at each point of control to indicate which mode has been selected.
- (c) A single means of selecting each mode of control shall be provided (including “OFF”).

3.6.7 All electrical equipment including components cables and glands shall comply with AS2595.1 unless otherwise stated in this guideline.

- 3.6.8 The electrical supply cable should be prevented from over tension, *crushing or other damage during tramming operations without requiring a person being located in a potentially hazardous position. Provision should be made to suitably restrain the trailing cable to the Feeder Breaker.*

The mine should develop a trailing cable handling procedure which provides for safe standing zones for personnel.

- 3.6.9 A means of isolating and locking out the incoming mains power supply to the Feeder Breaker, shall be provided for maintenance purposes. Such means of isolation shall be capable of withstanding the fault current generated by the prospective fault level caused by a short circuit and be lockable.

This isolation should include any interlocking with associated equipment such as in-feed mechanisms and out-feed receiving conveyor systems.

- 3.6.10 Gear boxes *which are operational while the Feeder Breaker is unmanned* shall be fitted with devices so that the oil level and temperature can be visually monitored and should be provided with controls to cut power to the drive system in the event of *excessive high temperature.*

Temperature monitoring of bearing assemblies fitted to conveyor idler, conveyor drive and crusher shafts should be considered:

- 3.6.11 A five (5) second *prestart* warning device shall be fitted to automatically alarm prior to the starting of the conveyor or crusher. *This warning device may be audible and/or visual.*

NOTE: Pre-start warning devices shall be operational regardless of which form of control has been selected.

- 3.6.12 All operating controls for hydraulically powered systems shall be designed to automatically return to the "OFF" position on loss of power to the machine and/or loss of hydraulic system pressure *unless a control does not introduce a hazard on restart, eg. conveyor speed select in which instance risk assessment process shall be used to assure the safety of that function.*

3.6.13 Emergency stop switches shall be provided to cut the power from all functions of the equipment and be accessible;

- (a) from at least either end of the Feeder Breaker, but preferably along the full length of the equipment;
- (b) from any remote control device;
- (c) by any person discharging material into the hopper, eg shuttle car driver.

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

NOTE 2: If radio remote control is utilised and the portable control unit is taken out of transmitting range, power to be automatically removed from the Feeder Breaker. Power shall only be capable of being restored to the Feeder Breaker by selection of local manual controls at the Feeder Breaker.

3.6.14 Control Layout:

- (a) Controls shall be laid out and designed to allow easy and safe operation and to prevent confusion over allocation of controls to function or direction of operation (refer AS2956.5).
- (b) Controls should be organised into primary and secondary groups as detailed in AS2956.5 or SAE J898.
- (c) All primary controls including their displacement should be located with their neutral position and, if possible, all other positions in the zone of comfort as per AS2956.5 or SAE J898.
- (d) All secondary controls should be located within the zones of reach.
- (e) Controls, control linkages, hoses, tubes and connections shall be located in such a manner that they are not likely to be damaged by foreseeable external forces and are easily accessible for inspection.
- (f) The distance between control levers, adjacent foot pedals, knobs, handles, operator's body and other machine parts shall be sufficient to allow unhindered operation without unintentional actuation of adjacent controls.
- (g) *Controls shall be protected to prevent accidental operation by either the operator or from falling roof/rib material*

3.6.15 Control Functions:

Operating controls shall be clearly marked to show their functions and preferred direction of movement controls 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
LEFT	Anti-clockwise, left
FORWARD	Forward, down
REVERSE	Backward, up
RAISE	Up, back
LOWER	Down, forward
EXTENDED	Down, forward, pull
INCREASE	Forward, away, right, clockwise
DECREASE	Backward, toward, left, anti-clockwise
OPEN VALVE	Anti-clockwise
CLOSE VALVE	Clockwise

Note: Remote controls shall comply with the requirements contained in AS 4240

3.6.16 Labelling

The following labels shall be required as applicable:

- (a) emergency stops.
- (b) location of electrical isolation.
- (c) fire extinguisher location.
- (d) date of manufacturer
- (e) manufacturer's name
- (f) equipment model number and operating parameters
- (g) net weight of unloaded Feeder Breaker plus maximum storage capacity.
- (h) maximum safe operating grade.
- (I) a warning on all accumulators that pressure must be safely released before maintenance work commences.
- (j) a warning sign stating 'Hearing protection must be worn', where noise levels for the machine exceed 85dB(A).
- (k) all controls describing functions.
- (l) the mode of control provided (eg. remote or local).
- (m) danger notice where remote control is provided, advising that the Feeder Breaker may start unexpectedly "Isolate before working on this machine".
- (n) means of releasing the traction brakes for purpose of towing the Feeder Breaker.

3.7 Marking and Illumination

- 3.7.1 Consideration should be given to provision of workplace lighting, for the purpose of illuminating the extremities of the Feeder Breaker. The lighting may be portable fittings which can be carried on the Feeder Breaker and hung from the roof at the operating location.
- 3.7.2 Marking of all controls shall be indelible and in accordance with AS2956.4.
- 3.7.3 All instrumentation should be colour coded to indicate normal and hazardous ranges as per SAE J209 *or clearly labelled to indicate hazardous ranges if the instrument does not continually indicate.*
- 3.7.4 All warning signs, action prevention tags and nameplates should comply with AS1319.

3.8 Guarding

- 3.8.1 Guarding shall be provided in the vicinity of any breaker/crusher mechanism, function drive component or track system.
- 3.8.2 Where access is provided to the top surfaces of the breaker for servicing and/or maintenance, adequate guarding, access ladders and handrailing shall be provided in accordance with Australian Standard AS1657.
- 3.8.3 Access openings for inspection of the breaker assembly *should* be effectively interlocked to prevent power being restored to the breaker and/or in-feed conveyor drive during inspection.
- 3.8.4 All exposed rotating components shall be guarded in accordance with Australian Standard AS4024.1.
- 3.8.5 Where the drive system is arranged which permits rotation of the breaker whilst the machine is being trammed the breaker section of the machine shall be fully guarded to prevent material from being inadvertently discharged during tramping operations *and prevent access to breaker inlet or outlet.*

The guarding shall be interlocked with the tramping circuit in such a way that the machine cannot be trammed unless the guarding is in place.

NOTE: The tramping process involves handling of cable which can also lead to a potential hazard as the cable is usually stored in the conveyor section.

- 3.8.6 Provision shall be made to prevent material being ejected from the breaker *in any direction and at such velocity that the ejected material may result in personnel injury.*
- 3.8.7 *An effective barrier shall be provided to prevent inadvertent access to the in-feed conveyor and/or breaker, ie. it shall not be possible to walk onto an operational conveyor and subsequently be transported to the breaker without deliberately defeating the barrier.*

A risk assessment shall be utilised to assure the adequacy of the barrier to be employed.

*Due consideration shall be given to:
in-feed conveyor run down time
breaker run down time
fail to safety of system.*

3.9 Dust Suppression

Suitable located water sprays shall be provided at the in-feed conveyor side of the breaker for dust suppression. The following should be considered in the design of any dust suppression system;

- (a) Water flow should be monitored to ensure that excess dust make does not occur.
- (b) Spray nozzles should be manufactured from corrosion resistant material and be installed and located with proper considerations to the safety of person(s) required to carry out inspections and maintenance of the system.
- (c) Adequate water filtration should be provided to prevent sprays becoming blocked.
- (d) Consideration should be given to limiting the speed of rotation of the breaker/crusher mechanism in order to reduce dust make.

3.10 Noise

The Noise level requirements in this section are related to noise generated by the Feeder Breaker itself. They are not intended to cover noise sources produced by other equipment in the underground mine environment. However, the designer should consider reduction measures that cater for the general environment where the Feeder Breaker will operate, in addition to those generated by the Feeder Breaker.

- 3.10.1 Noise levels **should** not exceed a continuous (A) weighted sound pressure level, LAeq 8h, of 85dB(A).
- 3.10.2 Noise levels **shall** not exceed:-
 - (1) A continuous (A) weighted sound pressure level, LAeq 8h, of 95dB(A).
 - (2) A peak level, Lpeak, 140dB(lin).
- 3.10.3 Noise tests of the completed unit (for a particular design) should be conducted in accordance with Australian Standard AS1269.

4 Documentation

- 4.1 Refer to Appendix B:- Documentation which should be supplied by O.E.M.s to the purchaser.

LIST OF STANDARDS, GUIDELINES AND REFERENCES.

Australian Standards

- AS 1180 10B Methods of Test for Hose made from Elastomeric Materials - Determination of Combustion Propagation Characteristics of Horizontally Oriented Specimen of Hose Using Surface Ignition.
- AS 1269 Acoustic-Hearing Conservation.
- AS 1319 Safety Signs for the Occupational Environment
- AS 1657 Fixed Platforms, walkways, stairways and ladders - Design, construction and Installation.
- AS 2595.1 Electrical Equipment for Coal Mines - Electrical Requirements for Underground Mining Machines and Accessories - Equipment for Use in Hazardous Areas.
- AS 2660 Hose and Hose Assemblies - Air/Water for Underground Coal Mines.
- AS 2956.4 Instrumentation and Operator's Controls- Symbols.
- AS 2956.5 Zones of comfort and reach for controls.
- AS 4024.1 Safety Guarding of Machinery - General Principles.
- AS 4240 Remote Controls for Mining Equipment.
- AS 4360 Risk Management

ISO Standards

- ISO 6805 Rubber Hoses and Hose Assemblies for Underground mining - Wire Reinforced Hydraulic Types for Coal Mining - Specification

SAE Standards

- SAE J209 Instruments Face Design and Location for Construction and Industrial Equipment.
- SAE J898 Includes Control Locations for Off- Road Vehicles.

Mechanical Design Guidelines

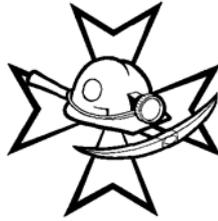
- MDG 1 Design Guidelines for Free Steered Vehicles
- MDG 10 Design Guidelines for Hydraulic Load Locking Valves.
- MDG 11 Design Guidelines for the Use of Aluminium Underground.
- MDG 1010 Risk Management Handbook for the Mining Industry
- MDG 1014 Guide to Reviewing a Risk Assessment of Mine Equipment & Operations
- MDG 5002 Guideline for the use of Remote Controlled mining Equipment

RECOMMENDED REQUIREMENTS FOR FEEDER BREAKER DOCUMENTATION

MANUFACTURER TO SUPPLY TO PURCHASER

The following information should be supplied with each new Feeder Breaker supplied to a NSW Coal Mine.

- 1.0 General arrangement drawing. This drawing should include:
 - 1.1 The overall dimensions of the Feeder Breaker
 - 1.2 Indication for the position of the:
 - * Location of all controls *and indicators*
 - * Location of *towing and brake release points*
 - * Location of all safety devices and their function *including guards*.
 - 1.3 *Tare and gross weight*
 - 1.4 *Maximum operating grades for tare and gross weights*
- 2.0 Hydraulic schematic circuit.
- 3.0 Brake schematic circuit (including description of operation).
- 4.0 Electrical circuit which includes:
 - 4.1 Electrical approval numbers
 - 4.1 The complete base operating systems for the breaker feeder.
 - 4.2 All safety related voltages, currents, fuse ratings, overload setting etc.
 - 4.3 A list of associated approval numbers for electrical components where applicable.
- 5.0 A letter on the O.E.M.'s letter head which includes:
 - 5.1 The Feeder Breaker model number, serial number, and date of manufacture.
 - 5.2 A statement indicating that the Feeder Breaker conforms with the intent of the safety related provisions incorporated in MDG 31
 - 5.3 A list of all relevant documentation such as Risk Assessment Reports, results of testing conducted prior to despatch on operation of all safety devices eg. emergency stops, noise test report, etc.
 - 5.4 The signature of the person and title of the person attesting to the above.
- 6.0 The O.E.M. should supply manuals that adequately address all aspects for the operation, inspection, examination, testing, maintenance and repair of the Feeder Breaker.



SAFETY ALERT

Report No: SA94-03

File No: C94/0401

This SAFETY ALERT has been issued to provide coal mines with earliest possible advice in order that appropriate action can be undertaken to avoid any occurrence of a similar nature.

SUBJECT: DEPUTY FATALLY INJURED WHEN CARRIED THROUGH THE CRUSHER OF A LONGWALL BSL

On 15 September 1994 a deputy in charge of an operating longwall production district suffered fatal when he passed through the crusher of the BSL. There were no eye witnesses to the accident and investigations are continuing in an attempt to discover how the deputy came to be on the chain conveyor and then was carried through the machinery.

RECOMMENDATION:

1. Conduct an audit of the face conveyor and BSL control switches to ensure their adequacy of operation and actual use by employees.
2. Conduct an audit of the face conveyor and BSL isolation procedure to ensure their adequacy of operation and actual use by employees. NB Control switches are generally not isolation switches.
3. Review means of access to longwall face areas and the system in place to restrict access to the A.F.C and B.S.L. conveyor system.
4. Review systems in place for safety of person working in and around the BSL and face entry areas including the system in place for the removal of rib supports and debris from the face side of the BSL.

B R McKensy
Chief Inspector of Coal Mines

Summary of Incidents associated with the operation of Feeder Breakers reportable under the Coal Mines Regulation Act, 1982.

Period: June 1984 - May 1996

Serious Bodily Injuries

Mine: LEMINGTON 1
Date: 29/02/88

A machine man was cleaning around the tail end of a breaker feeder when a shuttle car hit the moveable wing of the **breaker feeder**. This wing then swung and hit the machine man in the chest, resulting in fractures of the left hand side ribs. These wings were normally swung back against the ribs to prevent spillage, however the **breaker feeder** is designed for them to be used as spill plates on the other side. This accident could have been avoided had the breaker feeder been set up in the manner normally used and had the wings on the **breaker feeder** had a better designed mechanism for locking the wings in position.

Mine: ELLALONG
Date: 05/09/94

An electrician received first degree burns to his lower right arm when a short circuit fault occurred on the 1000 volt secondary terminals of a 11,000 volt/1000 volt transformer located at the surface of the mine. The Electrician was attempting to apply 1000 volt power to a Stamler Ratio **Feeder** and found that the 1000 volt outlet on the transformer would not energise. He opened the door of the medium voltage cubicle of the transformer, removed the cover from the earth continuity relay and tapped the armature of the relay several times with the aid of a screwdriver. The contactor supplying the 1000 volt outlet opened and closed several times resulting in a loud "bang" and a flash, causing first degree burns to his lower right arm. 1. The Managers Rules for isolation of electric circuits were not obeyed. 2. The Managers Rules for the use of danger tags were not obeyed. 3. The medium voltage enclosure of the transformer was not guarded against accidental contact with live conductors. 4. The medium voltage enclosure was not rated for the environment in which it was installed, and was the main contributing factor in the deterioration and failure of the 1000 volt terminals of the transformer.

Mine: CLARENCE
Date: 06/11/95

Medical treatment did not indicate fracture. The accident was investigated by mine Electrical Engineer and Safety Officer. This report is included in the subsequent investigation. The electrician in a production panel decided to add twenty metres of shuttle car cable to the drum to allow for further production. The power supply was via a 210m shuttle car cable and a 40m jumper cable. The cable was lowered from the roof hangers and the slack cable required moved to the other side of the **ratio feeder**. When the webbing of the anchor was released the shuttle car cable drum started reeling, because the pump was powered. The electrician was knocked from the platform into a **ratio feeder**. Changes to the system are to review Isolation tagging procedures. Refresher training for the new procedures will be required for appropriate employees. Run on timers for ratio feeders is reduced from 15 minutes to 5 minutes because of the dangers from the crusher in a **feeder**. Remote starters are repositioned on **ratio feeders** to allow shuttle car drivers to stop the **feeder** without getting off their shuttle cars. Procedures are being developed for shuttle car anchoring.

Design Guidelines for Construction of
Feeder Breakers

Mine: MUSWELLBROOK O/C
Date: 29/08/95

A plant operator received a depressed fracture to the back of the skull when hit in the head by a piece of coal thrown from coal **crusher** with a chain **feeder**. Causal Factors: Insufficient guarding and isolation of the crusher. Action Taken: The guarding of the crusher is to be improved. An isolation area is to be erected prohibiting access around the crusher whilst it is in action.

Mine: MYUNA
Date: 02/05/90

A mineworker sustained a fractured pelvis when crushed between a **feeder/breaker** and the rib when assisting in preparation for a conveyor extension. Shortly after commencing to tram the track mounted **feeder/breaker** the machine slewed on its tracks and crushed the worker against the rib. The provision of remote control or better provision for the machine operator may have prevented the incident.

Mine: LEMINGTON
Date: 09/04/90

The injury sustained was a broken coccyx. The injury resulted from an attendant climbing over a moving conveyor at the front end of a Stamler **breaker feeder**, and falling onto the moving conveyor belt.

Mine: ELOUERA
Date: 07/02/94

A fitter reaching over a **Feeder Breaker** slipped and stated that his shoulder dislocated and "popped" back in when he fell against the **Feeder Breaker** side. Time was lost due to soft tissue damage. The mines doctor accepted the cause as a dislocated shoulder and it was so reported. The investigation is ongoing.

Mine: SOUTH BULLI
Date: 11/02/92

A shuttle car driver sustained a fractured right radius when his lower arm became jammed between a **ratio feeder** switch and part of the body of the shuttle car drivers compartment. At the time of the accident the driver was operating the switch as coal was being discharged into the **ratio feeder**. The shuttle car rolled forward at that time thus jamming his extended lower arm. The positioning of the switch was seen as a direct causal factor to the accident. Re-positioning of the switch to a more elevated position will prevent recurrence. This action has been undertaken on all **ratio feeder** switches in the mine.

Dangerous Occurrences

Mine: LEMINGTON
Date: 25/09/87

A fire occurred on a Stamler **breaker feeder** when an outrigger bearing supporting a breaker chain drive sprocket collapsed and seized. No persons were injured. At this point in time it is suspected that the seized bearing was caused by a failure of the grease line to the bearing.

Mine: WEST CLIFF
Date: 08/12/87

A fire occurred on the drive shaft of a Stamler **Feeder/Breaker** when a bearing on the drive shaft overheated. The fire or extreme heating occurred on an enclosed bearing on the breaker shaft due to inadequate lubrication procedures.

Mine: WEST CLIFF
Date: 11/03/89

An outbreak of fire was observed in the vicinity of a belt conveyor return roller when coal fines were ignited. The striking of a **ratio feeder** by a shuttle car or shuttle cars whilst unloading coal caused the **ratio feeder** to move forward. The steel track guard made heated sufficiently to ignite the coal fines. The fire was quickly extinguished by the use of a fire extinguisher and water. The occurrence may have been avoided if:- The shuttle car driver(s) had avoided the car(s) striking the **feeder**. Those responsible for cleaning and for inspecting the belt conveyor system had been more diligent and observant in their duties. The **ratio feeder** had been secured to prevent inadvertent movement.

Mine: METROPOLITAN
Date: 13/12/89

Arcing occurred about a **Feeder Breaker** cable when the cable was stowed in a damp area beneath a leaking water valve. Examination of the cable revealed a cut in the sheath which had allowed the ingress of water. The cause of the cable damage could not be ascertained.

Mine: SOUTH BULLI
Date: 15/6/90

Arcing external to the sheath of a **feeder/breaker** motor cable occurred when the cable became dislodged from its retaining brackets and was crushed during a tramming operation. A more effective system of securing the cable and more adequate maintenance may have prevented the incident.

Mine: SOUTH BULLI
Date: 27/08/92

An arc occurred on a shuttle car cable when the cable was pulled in two as a result of the cable becoming entangled with the hairpin. The formation of loose loops of cable preceded this event because of the displacement of the indexing drive chain as a result of structural damage to the cable reel compartment caused by contact with the **feeder**.

Design Guidelines for Construction of
Feeder Breakers

Mine: NEWVALE 2
Date: 22/04/93

An outbreak of fire occurred below ground when a **Ratio Feeder** cable was damaged by shuttle car. A small flame occurred when the cable conductor insulation caught fire when shuttle car No. 443 was turning a corner into the belt heading and jammed the Ratio Feeder cable against the rib side. The shuttle car operator extinguished the flame using a fire extinguisher from the shuttle car. Electrical protection had operated satisfactorily and rapidly cleared and resultant two phase to ground fault. The primary cause of the incident was that the cable had become dislodged from a cable tie and was hanging too low. Contributory causes were driver error and bad housekeeping. The Mine Manager agreed to implement the following action:- Retrain colliery employees on handling and installation procedures at the mine. Such training to highlight causes of cable damage and steps reduce such causes.

Mine: TAHMOOR
Date: 20/07/93

A fire occurred below ground in the hazardous zone on the tail pulley of the low height boot end in 314L.W. development panel. It was reported that this was the third tail pulley failure in 6 months in this panel. The lubrication was provided from a single hose which led into two, one hose for each bearing. One of the hoses to the failed bearing was damaged at a fitting preventing grease getting to the failed bearing. Deterioration of the bearing had not been detected earlier because the adjacent auxiliary fan masked any noise, the boot end is in the return airway so smoke and fumes were taken away from where men work and the excessive coal spillage which was over the top of the roller coupled with the bulk of the **breaker feeder** made it difficult to check/touch the tail pulley shaft. The extent of the spillage, lack of satisfactory follow up on previous failures and confusion on whose responsibility it was to grease the pulley and poor lubrication system suggests an unsatisfactory management system. The incident investigation highlighted the need for regular spot audits of management systems at the "grass roots" level.

Mine: ELOUERA
Date: 03/11/93

A glowing ember fire was discovered on a coupling connecting a motor to an hydraulic pump on a **Feeder Breaker** in a panel hazardous zone. When the motor stopped the embers self extinguished but the coupling was very hot. A fault was later discovered in the coupling. A mechanical investigation is continuing.

Mine: CORDEAUX
Date: 09/08/92

A 1000v reticulation cable was damaged when it was struck by a **Feeder Breaker** which was being trammed forward during a belt extension. This resulted in arcing external to the cable sheathing in a hazardous zone. When the cable damage occurred the power to the section did not trip off. Subsequent investigations revealed that the fault was not of sufficient duration to activate the earth leakage protection at the transformer.

Mine: BRIMSTONE
Date: 20/5/96

A fire occurred on the conveyor idler assembly of a Feeder Breaker when the chain was overtensioned whilst it was being operated with failed bearings. Bearing condition could not be readily identified by external examination and the manufacturers tensioning system was inappropriate.

APPENDIX E

COAL MINES REGULATION ACT, 1982, as amended

NOTICE OF SPECIFICATION FOR FEEDER BREAKERS

FILE NO: C95/0236
DATE: 26 NOVEMBER 1996

It is hereby notified that the Chief Inspector of Coal Mines, pursuant to the provisions of Clause 42 of the Coal Mines Regulation (Mechanical - Underground Mines) Regulation, 1984, SPECIFIES that machines generically classified as Feeder Breakers comply with a design standard.

MDG 31 - "Design Guidelines for Construction of Feeder Breakers" issued July 1996 under File Reference C95/0236 is nominated as the design standard.

MDG 31 shall be utilised as an integral part of any occupational health and safety assessment conducted for the design of machinery classified as Feeder Breakers manufactured after 1 January 1997.

B R McKensy
CHIEF INSPECTOR OF COAL MINES

APPENDIX F

COAL MINES REGULATION ACT, 1982, as amended

NOTICE OF REVOCATION

FILE NO: C95/0236
DATE: 26 November 1996

It is hereby notified that the Chief Inspector of Coal Mines, pursuant to the provisions of Section 5(17) of the Coal Mines Regulation Act 1982, as amended, **REVOKES** the requirement for machines generically classified as **Feeder Breakers** to be issued with a Certificate of Examination before being taken into an underground coal mine.

The requirement for a Certificate of Examination for this class of machinery was issued under the provision of Clause 8 of the Coal Mines Regulation (Approval of Items) Regulation, 1984, on 5 December 1984.

This revocation takes effect on 1 January 1997.

B R McKensy
CHIEF INSPECTOR OF COAL MINES