
Design Guidelines for the Construction of Fuel Containers for use in Underground Coal Mines

MDG 36



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

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

November 1997

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FIRST PUBLISHED: NOVEMBER 1997

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**Date of Issue: November 1997
File Reference No.: C92/0698**

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**DESIGN GUIDELINES FOR THE CONSTRUCTION OF TRANSPORTABLE DISTILLATE, FUEL
CONTAINERS FOR USE IN UNDERGROUND COAL MINES**

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FOREWORD

This guideline specifies general safety requirements and tests for the design of Transportable Distillate Fuel Containers intended solely for operation at underground coal mines.

The preparation of this document involved input and support from the following persons and organisations. Greg Venticinque (Engineering Safety Systems), Gordon Jarvis/Wally Koppe/Leo Roberts/Roger Hoerndlein (Department of Mineral Resources).

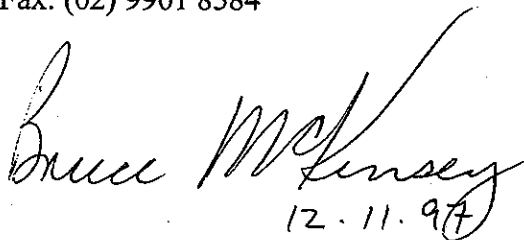
Information from the USA was also reviewed before this document was finalised. The information included both Regulations pertaining to underground coal mines and the extensive discussion document that resulted in the drafting of these regulations.

Additional contributions were provided by representatives from collieries, manufacturers and industry related experts who provided valuable input, feedback and guidance in the formulation of this document. The contribution is gratefully acknowledged and it recognised that without such contributions the document would not be to its present standard.

As required from time to time the document shall be reviewed to reflect current safety expectations. Comments on any aspect of this guideline should be submitted in writing to:

Mr L J Roberts
Senior Inspector of Mechanical Engineering
Coal Mining and Inspectorate Branch
Department of Mineral Resources
PO Box 536
ST LEONARDS 2065

Fax: (02) 9901 8584



12.11.97

B R Mckensey
Chief Inspector of Coal Mines

1 SCOPE

1.1 Clause 21 and Clause 35 of the Coal Mines Regulation (Transport - Underground Mines) Regulation 1984 requires that all containers used for storing and handling of diesel fuel underground be of a type approved for that purpose by an Inspector of Mechanical Engineering.

1.2 The following guideline is intended to help designers by indicating those parameters which will be considered in an approval assessment of Distillate (diesel) Fuel Containers. If any of the parameters as recommended are not adhered to, the approval applicant shall justify the alternative to the recommendation through a process of technical assessment, risk assessment and risk management.

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

1.3 Approval procedure shall be carried out in accordance with "The Applicants Guide to Approvals" (available from DMR). With specific regard to this guideline the following is informative.

1.3.1 Applications for approval should be supported by the following:-

- (A) General arrangement drawing identifying the relevant safety items and features.
- (B) A brief statement of compliance, variation or reason for non compliance with each item mentioned in these guidelines. A marked up and signed copy of these guidelines may be used.
- (C) Results of tests and a statement of compliance with all requirements in accordance with the relevant standards.
- (D) A copy of the technical assessment and risk assessment covering all variations from this guideline. The risk assessment should include input from appropriate operational users. MDG 1010 provides guidance for the risk assessment.
- (E) A copy of the Risk Assessment and Risk Management technique as per MDG 1010 as applied to both design and operational aspects of the fuel container.

This document shall be retained by all owners and be available upon demand by any Inspector from the Department of Mineral Resources.

1.4 The limit of application of the distillate fuel container shall be clearly identified by the manufacturer/supplier and the details shall include but be not limited to:-

- (A) Maximum capacity
- (B) Maximum height, width and length
- (C) Maximum weight

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(D) Maximum grade for operational purposes.

1.5 This guideline does not in any way negate the requirements of the NSW Coal Mines Regulation Act 67/1982 nor the NSW Occupational Health and Safety Act, 1983, N° 20.

1.6 The requirements of this Guideline, are for distillate fuel containers and are;
Recommended for containers having a capacity greater than 20 litres. and
Required for containers in excess of 200 litre capacity, when used in underground Coal Mines of NSW.

NOTE:

- (i) MDG 7 covers design guidelines for the construction of fixed bulk distillate installations underground. (supplied from surface by pipeline)
- (ii) MDG 36 Notice B14 is a general exemption for fuel containers having a capacity of 200 litres or less where compliance is to the relevant Australian Standard and includes additional specific conditions (refer appendix A).

2 REFERENCES AND STANDARDS AND GUIDELINES

Unless otherwise specified, the following Australian Standard shall apply;

AS1554 Structural steel welding

AS1692 Tanks for Flammable and Combustible Liquids

AS2683 Hose and Hose assemblies for distribution of petroleum and petroleum products (excepting LPG)

AS3711.6 Tank Containers

MDG 7 Design Guidelines for the Construction of Fixed Bulk Distillate Installations Underground in Coal Mines

MDG 30 Mechanical Compendium - Notices to Mines and Manufacturers.

MDG 34 Guidelines for the Design, Construction and use of Underground Garages and Workshops.

MDG 36 Design Guidelines for the Construction of Transportable Distillate Fuel Containers for use in Underground Coal Mines.

MDG 1010 Risk Management Handbook for the Mining Industry.

MDG 1014 Guide to Reviewing a Risk Assessment of Mine Equipment and Operations.

3 DEFINITIONS

3.1 **APPROVED:** approved by the Chief Inspector of Coal Mines in accordance with the Coal Mines Regulation Act 1982 (unless otherwise stated).

3.2 **DMR:** Department of Mineral Resources (NSW)

3.3 **MDG:** Mechanical Design Guideline.

- 3.4 **OEM:** refers to the Original Equipment Manufacturer
- 3.5 **RISK ASSESSMENT:** the overall process of risk analysis and risk evaluation, refer to MDG 1010 and MDG 1014.
- 3.6 **RISK MANAGEMENT PROCESS:** the systematic application of management policies, procedures and practices to the tasks of analysing, evaluating and controlling risk.
- 3.7 **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.
- 3.8 **Should** Means that the requirement is recommended.

If any of the parameters as recommended under a "shall" or "should" instruction are not adhered to, the approval applicant shall justify the alternative to the recommendation through a process of technical assessment, risk assessment and risk management.

4 CORE REQUIREMENTS.

Two major or core requirements need to be considered in the design and operation of Transportable Distillate Fuel containers. These are;

- (1) Every practical effort shall be made to prevent spillage of diesel fuel during;
- (a) Transport of the container
 - (b) During the filling or emptying of the container and
 - (c) De-canting of fuel from the container to vehicles.

NOTE:

It is recommended but not mandatory that a system of fuel transfer be adopted such that fuel is delivered into the vehicle tank via a "closed" circuit which will prevent the ingress of dirt and/or foreign materials into the vehicle fuel tank and also prevent spillage of fuel during transfer.

APPENDIX B of this guideline contains an outline of desirable features of such a system.

- (2) Every effort should be made to prevent ignition of diesel fuel by any source during the use of the container, including but not limited to;
- (a) Any pumping system shall be suitable for the fluid being handled
 - (b) The use of exposed aluminium or aluminium alloys as defined in MDG 11, is not permitted.

5 CONSTRUCTION - OPERATIONAL ASPECTS

The following operational aspects should be reviewed before design commences:-

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- 5.1** The maximum total amount of distillate permitted underground at any time is not to exceed the total consumption at the mine (with normal operation) over seven days.[Coal Mines Regulation(Transport - Underground Mines) Regulations 1984, clause 21(d) and clause 35(d)]

The stores register should be checked to ensure that this amount is not exceeded in the design and operation of any distillate fuel transport and underground storage system.

- 5.2** In addition to the requirements of the CMRA, the capacity of distillate fuel of any single transport or storage unit is limited to 2000 litres.

The mine shall implement a system for the regular and safe removal of spilled fuel from the spill tray.

- 5.3** For further details on the locations for the dispensing of fuel refer to the following:-
- a) The requirements of "Coal Mines Regulation (Transport - Underground Mines) Regulation 1984
 - b) MDG 34

- 5.4** The transport of distillate fuel is required to be included in the Mine Managers Transport Rules as specified in section 101 of the Transport Rules contained in Division 7 of the Coal Mines Regulation Act, 1982 N° 67.

6 CONSTRUCTION - DESIGN ASPECTS

- 6.1** Tanks generally should not be constructed using bolted or crimped joints in contact with the stored fuel, except that it is permissible to provide bolted and gasketed joints on the top surfaces to allow for inspection and cleaning of the tank interior.

- 6.2** There shall be visual means to check the level of the fuel in the storage tank without the need of a dip stick.

- 6.3** Any sight tube used shall be adequately protected against accidental damage and should be fitted with means to isolate the sight tube to permit its replacement, without emptying the tank.

- 6.4** If more than one tank is contained on the distillate fuel transport unit then each tank shall be capable of being separately isolated.

- 6.5** Sufficient baffle plates shall be installed within tanks so as to prevent spillage.

- 6.6** A spill tray shall be located beneath tanks. The spill tray shall be capable of containing full tank capacity plus an allowance for transport on a grade.

The spill tray shall be capable of being drained and readily cleaned.

Tanks shall be mounted so that all external surfaces are available for inspection.

- 6.7** Construction of all tanks (surface and UNDERGROUND) shall comply with Australian Standards AS1692-1983 "Tanks for Flammable and Combustible Liquids" and AS/NZ3711.6 "Tank Containers"

Minimum required material thickness for the fuel containment tank is 4 mm.

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Welding associated with the construction of any distillate fuel transport or storage unit, should be SP but at least GP Category and carried out in accordance with procedures contained in Australian Standard AS1554.1 "Structural Steel Welding Code"

- 6.8** To prevent the storage tank from becoming pressurised it shall be fitted with a vent large enough to handle the inflow and so arranged that spillage through the vent does not occur during transport or operation.

In order to minimise the danger from external heating of the tank eg. a fire in the vicinity of the fuel container, a means of safely venting excess pressure shall be provided for each separate tank compartment.

This venting device can be incorporated in other venting systems provided

- 6.9** The venting system should be provided with a filter system to prevent entry of dust.

- 6.10** Means of isolating the tank from any discharge pipework shall be provided.

- 6.11** A tank fill point shall be provided and so arranged to minimise spillage and foaming, refer Appendix B for recommendations.

- 6.12** A tank drain point shall be provided. This point shall be provided with an isolation valve and a positive plug. This point should be below the normal dispensing system take off point.

- 6.13** Any dispensing hose shall comply with Australian Standard. AS2683-1989 "Hose and Hose assemblies for distribution of petroleum and petroleum products (excepting LPG)

Dispensing hoses should be arranged to automatically re-tract the delivery nozzle to within the confines of the spill tray referred to in Clause 5.7 above.

- 6.14** Dispensing hoses shall be provided with a positive shut off valve which shall automatically shut off fuel delivery if not held open manually.

- 6.15** Where powered pumps are provided for dispensing they should:-

- a) automatically shut down when the dispensing shut off valve is closed.
- b) be fitted with a readily accessible manual shut off point.
- c) be air operated in preference to electric powered.
- d) automatically shut down after a pre-determined time has elapsed. This to be so arranged that the continued discharge of distillate from a ruptured hose or other major leak is prevented if the discharge is situated after the pump.

- 6.16** The use of a system of pressurisation of the tank in lieu of a pump for the dispensing of fuel is not permitted. Tank pressurisation may increase the potential for significant spillage.

- 6.17** The tank and its accessories including pumps, hoses, controls etc. shall be located on a frame such that the tank and accessories are within the confines of the frame at its base and at least at the sides so as to minimise the potential for damage to the tank and accessories during transport. To further minimal damage during transport an armour rail should be provided around the periphery of the tank and its accessories.

- 6.18** Lifting points shall be provided on the frame and their purpose clearly identified.

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- 6.19** The overall height of the distillate fuel transport container during transport should be at least 200mm less than the roof of the roadway, any roof supports, conveyor structure, barriers, or other obstructions which may be located in the mine where the distillate fuel container is to be used.
- 6.20** A positive means of fixing the distillate fuel container to the transport equipment shall be provided. eg tie down points provided or fixed/bolted to vehicle or flat top.
- 6.21** Galvanised steel containers are not recommended because the zinc may cause oxidation and gum formation which can block filters and injectors. The galvanising releases a fine powder of zinc oxide which can pass through filters to form deposits in the induction and combustion systems of piston engines. It can also cause unpleasant odours from small quantities of sulphur in the fuel.

7 FIRE FIGHTING FACILITIES

Fire fighting equipment appropriate for the hazard shall be located in the near vicinity of the fuel container at all times.

8 LABELLING/MARKING

Labelling shall be provided which is clear, in English and be permanently fixed and located for the following:-

- a) fill point also to be painted red.
- b) maximum level
- c) dispensing level
- d) drain point
- e) function of all other valves
- f) maximum tank capacity
- g) type of liquid within the tank and its classification
- h) maximum operating grade
- i) not to enter hazardous zone
- j) dispensing limited to use in a garage (reference clause 34(1) of Transport regulations)
- k) standard used in tank manufacture
- l) maximum transport weight
- m) operating instructions

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- n) file number of approval
- o) approval number
- p) "Diesel Fuel" in large letters
- q) "no smoking" in large letters

9 DOCUMENTATION

The following information should be supplied with each transportable fuel container supplied to a NSW Coal Mine.

9.1 General arrangement drawing. This drawing should include:

- a) The overall dimensions of the fuel container
- b) Indication for the position of the:
 - * Location of all indicators
 - * Location of all safety devices and their function.

9.2 Pneumatic circuit.

9.3 Brake system

9.4 Electrical circuit if provided which includes:

- 9.4.1** Electrical approval numbers
- 9.4.2** The complete base operating systems for the breaker feeder.
- 9.4.3** All safety related voltages, currents, fuse rating, overload settings etc.
- 9.4.4** A list of associated approval numbers for electrical components where applicable.

9.5 A letter on the OEM's letter head which includes:

- 9.5.1** The model number, serial number, and date of manufacture.
- 9.5.2** A statement indicating that the fuel container conforms with the intent of the safety related provisions incorporated in MDG 36.
- 9.5.3** A list of all relevant documentation such as Risk Assessment Reports, results of testing conducted prior to despatch on operation of all safety devices.
- 9.5.4** The signature of the persons and title of the person attesting to the above.

9.6 The OEM should supply manuals that adequately address all aspects for the operation, inspection, examination, testing, maintenance and repair of the fuel container.

9.7 A list of operational related issues that need to be considered by the end user.

This list may :-

- (a) need to be extended by the end user for site specific reasons;
- (b) include the operational issues identified in section 5 of this guideline.

APPENDIX B

FUEL TRANSFER USING A CLOSED CIRCUIT

The following recommendations are informative and as such are not a specific requirement.

Current methods of decanting fuel in vehicle tanks in underground environments, provide many opportunities for the fuel and vehicle tank to become contaminated with dirt, moisture and other foreign materials as well as producing foaming (excessive aeration) of the fuel in the vehicle tank, which can result in unsatisfactory operation of the vehicle's diesel engine.

The consequences of fuel contamination can be avoided if a "closed" system of fuel transfer is adopted. The desirable features of such a system are;

- 1 The vehicle fuel tank is provided with an internal delivery pipe which directs fresh fuel to the bottom of the tank and below existing fuel level in the tank. This will reduce the risk of "foaming" of the fuel during delivery.
- 2 The fuel delivery hose nozzle to vehicle tank connection to be such that;
 - a) Fuel transfer is only possible while the nozzle is connected to the vehicle tank.
 - b) Fuel delivery automatically shuts off the flow of fuel when the vehicle tank is full.
 - c) Vents are provided on the vehicle fuel tank which will prevent fuel leakage and pressurisation of the vehicle tank.
 - d) Fuel can not be delivered through the nozzle unless it is connected to a mating connection on the vehicle fuel tank.
- 3 Provision is made for disconnection of the fuel delivery hose in the event that the vehicle is driven away with the hose connected.

This control should be arranged such that the remaining fuel in the delivery hose is not released and the leakage of fuel from the bulk storage unit is prevented.
- 4 A "holster" for parking the delivery nozzle when not in use, located within the confines of the spill tray of the fuel storage unit and arranged to prevent dirt and/or other material coming into contact with the connection faces of the nozzle.

File No.: CM84/0687
Date: 16th June 1994

Dear Sir

NOTICE TO THE OWNER OF

Order Under Section 174 (5) Coal Mines Regulation Act, 1982

Pursuant to the provisions of Section 174 (5) of the Coal Mines Regulation Act, 1982, I hereby order that all Underground Coal and Shale mines in New South Wales are exempted from the need to comply with the requirements of Clauses 21 (b) and 35 (b) of the Coal Mines Regulation (Transport - Underground Mines) Regulation 1984 which states as follows:-

"Fuel is taken underground only in a container of a type approved by an Inspector of Mechanical Engineering."

This general exemption applies from 30th June 1994 and specifically only for those containers used to transport diesel fuel underground which:

- a) have a capacity of 200 litres or less; and
- b) are manufactured from steel; and
- c) comply with the specifications for closed (non-removable) head type 1 containers as required in Australian Standard AS2905- 1986.

A copy of this exemption shall be posted on the Colliery notice board for 28 days.

Yours faithfully

B. McKensy
Chief Inspector of Coal