

## APPENDIX I

### MECHANICAL DESIGN GUIDELINES FOR THE CONSTRUCTION OF CONTINUOUS MINER PROTECTIVE CANOPIES

Issue Date: 24th May, 1989

#### SCOPE

Clause 32(1) of the Coal Mines Regulation (Mechanical-Underground Mines) Regulation, 1984 requires that all continuous mining machines operating at the mine and designed to carry a driver shall be equipped with a protective canopy of an approved type.

The following guidelines are intended to assist continuous miner canopy designers by indicating those parameters which will be considered in an approval assessment of the protective canopy.

The guidelines do not generally give quantitative information as it is not intended to restrict innovative design.

Where specific values or tests procedure information, or even changes to the guidelines are required advice should be sought from Inspectors of Mechanical Engineering, Coal Mining Inspectorate of the Department of Mineral Resources.

#### BACKGROUND

The installation of approved protective canopies on continuous miners was made mandatory in 1979 under General Rule 49, Section 54 of the Coal Mines Regulation Act, 1912.

The requirements for approval which have been applied since the inception of canopies were adopted from the U.S. Bureau of Mines. Basically the canopy had to be capable of elastically withstanding a vertical load of 8.2 tonnes applied to the canopy roof. It is to be noted that the ultimate strength of the canopy to withstand vertical loading had not been incorporated in the assessment of canopies submitted for approval.

From a review of damage to canopies as a result of roof falls it has been verified that the criteria of an 8.2 tonne load test provides for canopy designs that will allow protection to a practical degree. The review however established that resistance against side loading was warranted. The design criteria for canopies now includes in these guidelines provision for the additional evaluation of the design to elastically withstand a side load of 2.0 tonne applied both laterally and longitudinally.

In these guidelines, except in so far as the context or subject matter otherwise indicates or requires -

"canopy roof"	includes the platework and any associated bracing commonly utilised to provide protection above the driver's enclosure.
"lateral edge"	defines the edge of the canopy roof usually located at 90 degrees to the centreline running from the head to the tail of the continuous miner.
"longitudinal edge"	defines the edge of the canopy roof usually located parallel to the centreline defined above.
"support"	includes the support legs and any associated steel work, other than the canopy roof, which interconnects the support legs.
"support leg"	is the vertical or near vertical member connecting the continuous miner chassis or driver's enclosure to the canopy roof.

## 1.0 **CONCEPTUAL ASPECTS**

- 1.1 In the event of the canopy being subjected to a fall of roof which exceeds the elastic limit of the canopy design then yielding should be progressive and limited to the extent that the driver can safely remain within the operator compartment i.e. 1000mm minimum headroom space remains between the seat and canopy roof.

Note: Consideration should be given to suspending the driver's seat from the underside of the canopy roof.

- 1.2 It is acknowledged that there are practical limitations in the design of canopies. However, each canopy design together with the operator compartment should endeavour to provide an enclosure which will prevent driver injury in the event of a fall from the roof.
- 1.3 The canopy design should consider access into the operator compartment and the driver's visibility in all directions particularly to the driver's front and rear and as far as reasonably practical to the sides.

2.0 **CANOPY DESIGN MATERIAL AND LOADING CRITERIA**

2.1 Materials

All main load bearing components used in the construction of protective canopies shall be in accordance with Standards Australia AS1250 - Steel Structures Code.

2.2 Welding

2.2.1 All welding carried out during the construction of protective canopies shall be in accordance with Standards Australia AS1554-Part 1 - Structural Welding Code for Weld Category SP.

2.2.2 All welded joints shall be non-destructively examined in accordance with the above welding code.

2.3 There shall be a minimum of four supports for the canopy roof.

2.4 It is preferred that the canopy roof be attached to the support legs by either bolted or welded-connections.

However, where pinned connections are used, maximum clearances shall not exceed Standards Australia AS1654-H7 and C9.

2.5 The base of the canopy support legs shall be securely bolted or welded to the main frame of the continuous miner or driver enclosure.

2.6 The canopy roof shall be constructed by utilising a substantial one piece solid plate devoid of uneven structural protrusions above the roof line (including cable support structures etc).

2.7 The design of the canopy roof and seat should be such that when the driver leans slightly to his right, as is customary by many drivers, his head remains underneath the canopy roof.

3.0 **TESTING CRITERIA**

All types of continuous miner canopy shall be load tested either in the presence of an Inspector of Mechanical Engineering of the Coal Mining Inspectorate or by a N.A.T.A. Laboratory registered for the tests specified under this section.

3.1 Vertical Load Test

The protective canopy is required to have a minimum structural capacity to support elastically a static uniform load of 8.2 tonnes or a force equivalent to a static load of 105 kilopascals distributed uniformly over the greatest plan view area of the canopy roof whichever is the lesser.

An acceptable method of test provides for the test load to be distributed within the middle ninth of the roof's plan view area.

3.2 Horizontal Load Test

The protective canopy is required to have a minimum structural capacity to support elastically a static uniform load of 2 tonnes applied horizontally to the edge of the canopy roof.

An acceptable method of test provides for the test load to be distributed along the middle third of the longitudinal and lateral edge of the roof separately.

The horizontal loading must be applied in both the longitudinal and lateral directions separately and the results must be satisfactory in both directions.

3.3 Test Criteria

For all the load tests as per 3.1 and 3.2 the permanent set shall be less than 10% of the maximum deflection measured with the load applied.

A dial indicator is suitable for measurement of the maximum deflection and the permanent set caused by the application of the test load.

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Senior Inspector of Mechanical Engineering

File Ref.  
Approval No.:

**TEST DATA SHEET  
CONTINUOUS MINER PROTECTIVE CANOPIES**

Date.....

Mine or Company .....

Mine or Company Address .....

.....

Test Carried out at .....

Canopy for continuous miner type: .....

..... model number .....

Drawing Number .....

Manufacturer's stated strength (based on U.T.S.)  
in vertical direction .....

in lateral horizontal direction .....

in longitudinal horizontal direction .....

- Note
1. A canopy will only be approved if it can elastically resist a minimum test load of 8.2 tonnes applied vertically and a minimum test load of 2.0 tonnes applied horizontally in both longitudinal and transverse directions independently.
  2. Larger test loads should be considered by applicant where considered appropriate for conditions where canopy is to be used. The approval document will record the maximum load for which tests are successful.

Test Method

With canopy fully extended unless otherwise stated the following tests shall be conducted:-

1. Apply vertical test load to middle ninth plan view area i.e. to one third span of width and length.

- (a) For fixed type canopy apply preload of between 300-500 Kg to remove slack from joints, set dial indicator to zero then apply test load. Record deflection "A" under the test load and the residual deflection "B" on removal of the test load.

"B" divided by "A" must be less than 10% for the canopy to be satisfactory.

NOTE It may be necessary to repeat this test or other tests in order to further eliminate any initial movement in pinned or bolted connections.

- (b) For canopies initially supported by hydraulic cylinders measure pressure and load at hydraulic cylinders when full test load is applied then increase test load till cylinders yield, record yield pressure and load. Ensure that pressure relief system reseats when load is reduced i.e. reload a second time. NOTE If the yield testing of the hydraulics requires a load which is beyond the elastic limit of the canopy then separate bench testing of the hydraulics will be permitted.

With canopy lowered to its minimum height and oil removed from the support cylinders i.e. canopy resting on its mechanical stops apply test load and record deflections as for fixed canopy previously mentioned.

2. Re extend canopy to maximum height and apply horizontal test load along the middle one third of the canopy edge directing the load away from the centreline of the machine.

Preload and deflection measurements are as in 1(a) above.

3. Repeat test 2 but with the load applied towards the centreline of the machine. This test is only necessary if there is a significant difference in the strength of the canopy supports between the 2 directions.

4. Apply horizontal test load along the middle one third of the canopy edge directing the load from the rear to the front of the machine.

Preload and deflection are as in 1(a) above. For canopies fitted with rear hydraulic cylinders the cylinder should not be the item that stops any upward movement that may occur i.e. a mechanical stop should prevent over extension of the canopy.

5. Repeat test 4 but with the load applied directed from the front to the back of the machine. This test is only necessary if there is a significant difference in the strength of the canopy supports between the 2 directions.

Note: Test 1(b) is only applicable for canopies with hydraulic height adjustment where the support cylinders are required to elastically support the test load without pressure relief occurring. Canopies having different philosophy of hydraulic system design will require an alternative test procedure. This procedure will be determined by the Inspectorate of Mechanical Engineering upon request.

**Test Results**

	<u>Test</u>	<u>Remarks</u>
1. <u>Vertical test</u> <ul style="list-style-type: none"> <li>- test load (KN)</li> <li>initial deflection "A" (mm)</li> <li>residual deflection "B" (mm)</li> <li><math>\frac{B}{A} \times 100</math> (%)</li> </ul>		
<u>Additional Vertical test-hydraulic supported canopies</u> <ul style="list-style-type: none"> <li>- test load (KN)</li> <li>pressure in cylinders (kPa)</li> <li>effective area of canopy cylinders mm<sup>2</sup></li> <li>calculated load on canopy cylinders (kN)</li> <li>yield pressure on canopy cylinders (kPa)</li> <li>calculated yield load on canopy cylinders (kN)</li> <li>does relief system reset</li> </ul>		
2. <u>Horizontal test away from machine centreline</u> <ul style="list-style-type: none"> <li>test load - (KN)</li> <li>initial deflection "A" (mm)</li> <li>residual deflection "B" (mm)</li> <li><math>\frac{B}{A} \times 100</math> (%)</li> </ul>		
3. <u>Horizontal test towards machine centreline</u> <ul style="list-style-type: none"> <li>test load - (KN)</li> <li>initial deflection "A" m.m.</li> <li>residual deflection "B" m.m.</li> <li><math>\frac{B}{A} \times 100</math> (%)</li> </ul>		
4. <u>Horizontal test towards front of machine</u> <ul style="list-style-type: none"> <li>test load - (KN)</li> <li>initial deflection "A" m.m.</li> <li>residual deflection "B" m.m.</li> <li><math>\frac{B}{A} \times 100</math> (%)</li> </ul>		
5. <u>Horizontal test towards rear of machine</u> <ul style="list-style-type: none"> <li>test load - (KN)</li> <li>initial deflection "A" m.m.</li> <li>residual deflection "B" m.m.</li> <li><math>\frac{B}{A} \times 100</math> (%)</li> </ul>		
6. Distance from underside of canopy in the vicinity of a mans head to the top of the horizontal section of the drivers seat with the canopy in its lowest position (must be +1m)		
7. Welding specifications as per Design Guidelines		

**comment**

8. Spatial and other relevant requirements as per  
Design Guidelines.

**comment**

NOTE pass or fail must be nominated in remarks column for each test.

Tests may be carried out by a NATA Registered Testing Laboratory or alternatively witnessed by an Inspector of Mechanical Engineering from the Coal Mining Inspectorate and Engineering Branch.

Name and Number of NATA registered testing laboratory

Signed: Authorised NATA signatory

OR

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Signed:

Inspector of Mechanical Engineering

Date:

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Approval recommended: YES/NO

Signed:

Inspector of Mechanical Engineering

Date:

revised 6th March, 1990  
Guideline reference No M86/308/152