

GUIDE FOR THE CONSTRUCTION OF FRICTION WINDERS

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Guide for the Construction of Friction Winders

Preface:

This Guide sets out minimum requirements for the design, installation and use of winding equipment installed in shafts for the conveyance of men and materials where the driving force is transmitted to the hoisting rope or ropes by friction between the rope drum and rope.

Manual, semi-automatic or automatic control may be adopted.

The guide has been based on an original document entitled "Requirements for the use of Friction Winders" which was prepared in 1971. This guide has been modified to incorporate the provisions of the Coal Mines Regulation Act, 1982 and its Regulations together with the references to the current Australian Standards for shaft winding equipment and attachments. Testing requirements have also been included which has been based on the experience gained over a period of 20 years of the approval testing process.

L.J.ROBERTS
SENIOR INSPECTOR OF MECHANICAL ENGINEERING

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1. **SCOPE**

- 1.1 Clause 7 of the Coal Mines Regulation Act (Shafts and Roadways - Underground Mines) Regulation, 1984, requires that a mechanically operated winding apparatus or mechanically operated rope haulage apparatus used at a mine for transporting persons through any shaft or roadway be approved by the Chief Inspector.
- 1.2 Clause 9(1) of the Coal Mines Regulation (Shafts and Roadways - Underground Mines) Regulation, 1984, requires that conveyances used at a coal mine for transporting persons through a shaft be of a type which has been approved for the purpose by the Chief Inspector.
- 1.3 This guide is intended to assist manufacturers of Friction Winders by indicating the design parameters which will be considered in the assessment for approval of equipment as referred to in 1.1 and 1.2.
- 1.4 The following definitions apply:
- "friction winder" means a shaft winding system in which conveyances are raised and lowered by means of friction between a head rope or head ropes and a driving sheave or sheaves;
- "conveyance" includes all types of equipment attached to a friction winding systems in which persons are transported;
- 1.5 The guide does not generally give quantitative information as it is not intended to restrict innovative design. Where specific values or test procedures are required in addition to or as alternatives to those included in this document, 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 required under existing legislation or as determined by the Chief Inspector.
- (b) "should" means recommended.
- 1.6 Unless otherwise specified, the appropriate Australian Standards shall apply.
- 1.7 Where reference is made to a design standard the current published version shall be utilised.

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1.8 This guide does not in any way negate the requirements of the Coal Mines Regulation Act 67/1982 nor the Occupational Health and Safety Act, 1983, No 20.

1.9 Formal submissions for approval

1.9.1 Approval applications should be supported by the following:-

- (A) 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 complete Winding System.

Note: (1) In general the risk assessment will cover situations or areas where there are no codes or standards or where variations are required.

- (2) This document may be used as an aid to assist in identification of hazards but should not solely be relied on for that purpose. Sources of other relevant information such as that contained within the First and Second Reports of the UK Health and Safety Executive entitled "Safety of Manriding in Mines" should be utilised as should details of accidents or dangerous occurrences which have occurred with existing winders.

- (B) A brief statement of compliance, variation or reason for non compliance with each item mentioned in this guide.

A marked up and signed copy of this guide may be used to indicate the status of the design.

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

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

- (E) Full details pertaining to the type of control for winder operation i.e. manual, semi-automatic or automatic.

1.9.2 Documentation covering electrical aspects as required by the Department of Mineral Resources Applicants Guide to obtaining an approval from the Chief Inspector of Coal Mines or an Accredited Assessing Authority.

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All electrical apparatus shall comply with the requirements of the Coal Mines Regulation Act 67/1982, subsequent Regulations, and relevant Australian Standards.

- 1.10 Whilst primarily intended for use with new friction winders, the guidelines where applicable will be used as an integral part of the assessment process for applications for approval of variations to existing approved friction winders.

2. WINDING ROPES

2.1 **General**

All ropes used in the construction of the friction winder system i.e. head, balance, guide and rubbing shall comply with the requirements of:

- (a) Coal Mines Regulation (Shafts and Roadways - Underground Mines) Regulation, 1984; and
- (b) The relevant sections of Australian Standard AS3569-1989 "Steel Wire Ropes" as applicable for winder installations.

2.2 **Rope Factors of Safety**

2.2.1 **Head Ropes.**

The factor of safety for head ropes shall be in accordance with **Appendix 1 - Notice of Specification : "Head Ropes for Friction Winders."**

2.2.2 **Other Ropes.**

The factor of safety for all other ropes such as balance, guide and rubbing ropes shall be in accordance with the Coal Mines Regulation (Shafts and Roadways - Underground Mines) Regulation, 1984.

- 2.3 Galvanised ropes should be used in shafts where the quantity or chemical content of the moisture or water would cause serious corrosion to an ungalvanised rope.

- 2.4 The use of any form of rope dressing which may reduce the design coefficient of friction between the head rope and the drive sheave is not permitted.

- 2.5 The winder should be designed for multiple head ropes.

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3. WINDING SUSPENSION EQUIPMENT

3.1 Material

The material used in the manufacture of rope attachments and suspension equipment shall be in accordance with Australian Standard AS3637.1-1989 "Underground Mining - Winding Suspension Equipment - Part 1: General Requirements".

Note: Alternative materials may be acceptable providing that it can be demonstrated that they have equivalent chemical and physical properties.

3.2 Components

Rope attachments and suspension equipment shall be in accordance with the relevant sections of the following Parts of Australian Standard AS3637-1989 "Underground Mining - Winding Suspension Equipment."

Part 3: Rope Cappings.

Part 4: Drawbars and Connecting Links.

Part 5: Rope Swivels and Swivel Hooks.

Part 6: Shackles and Chains.

Note: The use of detaching hooks is prohibited.

4. SHAFT EQUIPMENT

4.1 Headframes shall be in accordance with Australian Standard AS3785.5-1991 "Underground Mining - Shaft Equipment - Part 5: Headframes".

4.2 Conveyances shall be in accordance with Australian Standard AS3785.4-1992 "Underground Mining - Shaft Equipment - Part 4: Conveyances for Vertical Shafts."

4.3 Each Friction Winder Conveyance shall be of a type which is compatible with the friction winding system and has been approved.

4.4 Sheaves shall be in accordance with Australian Standard AS3785.7-1993 "Underground Mining - Shaft Equipment - Part 7: Sheaves" except as specified in Clause 5.1.

4.5 Guides and rubbing ropes for conveyances shall be in accordance with Australian Standard AS3785.6-1992 "Underground Mining - Shaft Equipment - Part 6: Guides and Rubbing Ropes for Conveyances."

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- 4.6 Arresting systems to limit the effects of an overwind shall at least be in accordance with Australian Standard AS3785.2-1991 Underground Mining - Shaft Equipment - Part 2: "Friction Winding Arresting Systems."

Note: AS3785 Parts 1 and 3 for Drum Winding Overwind Safety Catch Systems and Grippers do not apply to friction winder installations.

4.7 Access

In addition to the provisions for access incorporated in AS3585.5 - "Headframes" the following access is required:

- 4.7.1 All platforms, walkways and ladders shall comply with Australian Standard AS 1657-1985 Fixed Platforms, Walkways, Stairways and Ladders;
- 4.7.2 Provision shall be made at all working levels for personnel to safely embark and disembark from a conveyance;
- 4.7.3 Provision shall be made in the head frame and shaft sump by way of suitable platforms and ladders, for access to an overwound cage and safe access for personnel leaving an overwound conveyance;
- 4.7.4 The space between the lowest stopping point and the shaft sump shall be equipped with ladders or other suitable means of access to permit proper inspection and maintenance of that part of the shaft. The access facilities shall be effectively enclosed;
- 4.7.5 Access landings acceptable to the authorities approved to conduct non-destructive testing of head and balance ropes over their full length shall be provided.
- 4.8 A signal line should be provided in the shaft for transmission of data to the surface for recording on testing equipment in the winder engine room.
- 4.9 The shaft sump shall be designed so that the ingress of water, debris, or other material will be limited to an extent that will prevent the balance ropes or weights from contacting such water, debris, or other material.
- 4.10 Any building or structure on the top of the shaft shall comply with the requirements of Clause 31 of the Coal Mines Regulation (Fire Control - Underground Mines) Regulation, 1984.
- 4.11 Keps or chairing devices shall not be provided in the shaft except with the written approval of the Chief Inspector.

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4.12 There shall be provided in the shaft, headframe, or tower such devices as will remove the power from the winder and, by automatic application of the brakes, bring the winding sheaves to rest before any conveyance, cage, skip, counterweight, or rope attachment reaches any permanent obstruction to its passage. Such devices shall be in addition to the automatic contrivance required by Clause 5.6.

5. WINDING MACHINERY

5.1 Sheaves/Rope Configuration

5.1(i) The ratio of winding sheave to rope diameter shall not be less than the following:-

Rope Size	Stranded		Locked Coil	
	No Reverse Bending	Bending	No Reverse Bending	Bending
Up to 31.75mm dia.	70:1	80:1	85:1	95:1
From 31.75mm to 44.45mm dia	80:1	90:1	95:1	105:1
Above 44.45mm dia.	85:1	95:1	100:1	110:1

5.1(ii) The coefficient of friction between the rope treads on the driving sheave and the winding ropes shall be such that there will be no slip under normal out-of-balance loading, acceleration, and retardation. Such coefficient shall not be less than 0.2.

5.1(iii) The grooves in a multi-grooved sheave shall be the same sheave diameter.

5.1(iv) The diameter of any deflecting sheaves shall be not less than 0.9 times the diameter of the corresponding driving sheave.

5.1(v) The angle of contact of the rope on deflecting sheaves shall be sufficient to prevent the rope slipping on the sheaves.

5.2 Unless otherwise approved in writing by the Chief Inspector:

5.2(i) In raising or lowering material the maximum winding speed shall not exceed 20 metres per second.

5.2(ii) In raising or lowering persons the maximum winding speed shall not exceed 15 metres per second.

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- 5.2(iii) In raising or lowering persons the maximum approach speed to the shaft top and bottom shall not exceed 3.5 metres per second.
- 5.3 Every friction winding engine shall be provided with two or more mechanical brake systems each of which:
- 5.3(i) Howsoever applied shall act directly on the driving sheave;
- 5.3(ii) Shall be designed, adjusted and maintained to safely stop and hold the conveyance, cage or skip under all conditions of loading, direction of travel and speed;
- 5.3(iii) Will be capable of producing a braking torque of not less than two and a half times the maximum static torque which will be applied to the winding sheave by the normal load;
- 5.3(iv) Is sufficient to cause retardation under worst conditions of not less than 1 m/sec² when winding personnel and 0.5 m/sec² when winding material;
- 5.3(v) Will result in a retardation rate of not more than 3.5 m/sec² when winding personnel;
- 5.3(vi) When applied by any means other than those set out in sub-paragraph (ii) above will produce a braking torque less than will cause the winding rope to slip unduly on the winding sheave;
- 5.3(vii) Howsoever applied will not produce a braking torque which will cause a dangerous rate of retardation;
- 5.3(viii) Can be applied irrespective of the action of any safety device that may act to apply the brake, or brakes;
- 5.3(ix) Will be automatically applied when the supply of power to the winder fails;
- 5.3(x) Will be automatically applied when the pressure of any fluid or other medium used as a means of controlling the brake falls below the value necessary to produce the braking torque required by sub-paragraph (iii) of this condition;
- 5.3(xi) Shall be provided with a steel tension member between individual soleplates of brake shoes;
- 5.3(xii) Will be automatically applied if an earth fault occurs in the control circuit;
- 5.3(xiii) Will be automatically applied if the relative speed between the ropes and the sheave periphery differs by 1.5 metres per second or more;

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- 5.3(xiv) The brake system components shall be designed against fatigue failure;
- 5.3(xv) Where a system of electrical braking is included, its use shall not be prevented by any emergency stop; and
- 5.3(xvi) The winder shall be provided with a device to automatically apply the brake before the brake becomes worn sufficiently to effect its safe operation.
- 5.4 Every winder shall be provided with a stop switch so designed and constructed as to ensure that when it is operated the brakes will be applied, and all power, except that required for electrical braking will be removed from the winder.
- 5.5 Every winder shall be provided with depth and speed indicators driven from a sheave shaft and so placed as to be readily seen.
- 5.6 Every winder shall be provided with an effective automatic contrivance to prevent over-winding and over-speeding so constructed as:-
- 5.6(i) To prevent the descending conveyance or skip from exceeding a speed 15% greater than the maximum designed speed and to ensure progressive reduction of speed during retardation to prevent overwinding at excessive speed, under any condition of loading;
- 5.6(ii) To control the movement of the ascending cage or skip to prevent danger to any person therein; and
- 5.6(iii) To stop the winder when the conveyance carrying personnel travels beyond the brace.
- 5.7 Every winder shall be provided with a device which will automatically synchronise the depth indicator and the automatic contrivance required by Clause 5.6 with the position of the cage or skip in the shaft. Such synchronising adjustment shall take place only while the brakes are applied and the winder is not winding.
- 5.8 When a winder is being used for the carriage of persons and its operation is under push button control from within the cage it shall be incapable of motion unless all shaft doors and cage or skip doors in connection with that winder are properly closed. All limit switches used for this purpose shall be series duplicated.
- 5.9 Any device provided to permit backing out of an overwind position shall respond to manual control only and shall not permit backing out in a wrong direction.

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- 5.10 Where it is arranged that the winder may be controlled by more than one method (manual, push-button and/or other) the device for selecting any control method shall be available only to authorised persons.
- 5.11 Push-button controls located at any landing shall only be accessible to a person inside a conveyance when the conveyance door is open.
- 5.12 Push-button controls shall be effective from one point only until that operation is completed. All automatic controls shall fail to safety.
- 5.13 Where it is arranged for push-button control of the winder from within a conveyance, a stop button shall be provided which, when operated, will cause the winder to stop.
- 5.14 In every case where the winder is situated in the headframe or tower of a shaft effective precautions shall be taken to prevent any flammable liquid used in connection with the winder or any apparatus installed in the headframe or tower from entering the shaft.
- 5.15 In every such case where the winder is not under supervision an automatic fire suppression system with the capacity of extinguishing any fire which may break out in the winder room and with a suitable alarm system shall be provided.
- 5.16 Provision to be made in the winder control circuit for recording apparatus, to monitor the winding cycle and record maximum winding speed, acceleration and retardation rates and position of the conveyance(s), cage(s) or skip(s) in the shaft.
- These provisions will be required for commissioning tests and regular inservice testing throughout the life of the installation.
- 5.17 Production winding installations to be provided with interlocks to indicate and control the winding cycle to pre-set parameters when the winding equipment is being used to transport personnel.

6. TESTING FOR COMPLIANCE

Part A - Inspection

The following matters are required to be included in the manufacturer's program for inspection prior to commencing operational commissioning tests.

6.1 Design

6.1.1 Statements to be supplied by equipment manufacturers setting out the design standard adopted for structural components of headframe, shaft landings, machinery and tower foundations etc.

6.1.2 Brake systems designed against fatigue using reserve factor concept.

6.2 Details of Equipment

6.2.1 Shafts:

- (a) Overtravel limits; to be duplicated.
- (b) Mechanical brake dump valve.
- (c) Arrestors for conveyances and counterweight - specifications required.
- (d) Drop back catches - design details required.
- (e) Keps, chairing devices or grippers - not allowed except with approval of Chief Inspector of Coal Mines.
- (f) Conveyance, cage or counterweight detaching - not allowed.
- (g) Provision for drainage of sump.
- (h) Provision of access to landings and enclosures.
- (i) Provision of access landings for non-destructive rope testing.
- (j) No flammable fluids to enter shaft from tower winding engine room.
- (k) Automatic fire extinguishing equipment in tower.

6.2.2 Machinery:

- (a) Deflecting sheaves not less than 0.9 times rope drum diameter.
- (b) Rope drum tread diameter to rope diameter ratio: should be between 70 to 1 and 110 to 1 depending on rope type and size.
- (c) Coefficient of friction between the rope and rope drum not less than 0.2.
- (d) Rope grooves on multi-rope drums to be identical diameters.
- (e) Type of rope groove tread material and specification.
- (f) Drawing details for engine components and control components to be checked.

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6.2.3 Mechanical Brakes:

- (a) Two or more brake assemblies to be provided and applied directly to the winding drum.
- (b) Steel tension members between the brake sole plates - post brakes.
- (c) Brake wear limits and brake released limits to be fitted.
- (d) Provision for independent application.
- (e) Provision of depth and speed indicators in winding engine room.
- (f) Provision for winder operation in event of power failure - emergency only.
- (g) Method of synchronising cage position control and depth indicator of automatic contrivance - Only with winder stationary and brakes applied.

6.2.4 Control Systems:

- (a) Overwind back out by manual control only.
- (b) Landing push buttons not accessible from conveyance with doors closed.
- (c) Conveyance and landing door interlocks to be duplicated in series.
- (d) Control from one push button point at a time.
- (e) Conveyance controls to be provided with stop button.
- (f) Conveyance to be ventilated.

6.2.5 Ropes and Rope Attachments:

- (a) Manufacturer's test reports for all ropes used on the installation.
- (b) Calculations for each rope showing:
 - (i) Maximum load applied to the rope.
 - (ii) Factors of safety based on maximum load and rope breaking loads.
 - (iii) Minimum factor of safety as required by the requirements for use of friction winding equipment.
- (c) Arrangement drawings for all rope attachments.
- (d) Guide rope anchorage and tensioning details.
- (e) Material specifications and test certificates for all attachments.

6.2.6 Compliance with Australian Standards.

Statements of compliance provided for any relevant item of equipment supplied as an integral part of the winder.

Part B - Testing

The following matters are to be considered for inclusion in the manufacturer's program for commissioning the winder.

6.3 General Inspection

Before commencing a test of the winding installation, checks should be made to ensure that the general condition of the winding equipment is satisfactory for the tests to be carried out, and that:-

- (1) Pivots, levers, etc. on the automatic contrivance are free and appear to be functioning correctly.
- (2) Brake linings are not unduly worn and brake paths are free of grease and oil and are not in danger of becoming contaminated.
- (3) Brake posts and brake shoes are properly adjusted to give correct clearance and motion, linings are correctly bedded and the brake engine or cylinders are within the limits of their travel. Where overtravel and wear switches are fitted these should be checked and operated manually.
- (4) Winding ropes and winding sheaves rope treads are free from excessive contamination, such as dirt, grease or water.
- (5) In the case of A.C. winding engines, the supply voltage is noted.
- (6) Any rope creep compensating device, depth indicator, automatic contrivance and cam gear in the winding engine house is correctly set relative to the conveyance(s).

6.4 Where dynamic testing of a winding engine with an equivalent man load in one conveyance is carried out, it is implicit that the test be repeated with the load changed over to the other conveyance. The standard test load should be declared and be equivalent to the maximum number of men specified as the manriding load for conveyance, at 88 kg per man.

6.5 For a conveyance and counterweight system the standard test load should be used when testing with reference to the conveyance but the conveyance should be empty when testing with reference to the counterweight.

6.6 During testing, a person should be stationed at an appropriate safe place in the pit bottom to detect any unusual circumstances which may arise, eg fouling of the balance ropes or displacement of the test load.

6.7

It is important that the following points be observed during winding engine testing.

- (1) The testing engineer should direct and control testing operations and only persons essential to the performance of these operations should be present in the winding engine house.
- (2) The Mine Mechanical and Electrical Engineers or their nominees should be present and be responsible for control of the winding engine during loading and unloading of the conveyance(s) and when adjustments are being made.
- (3) The testing engineer should be positioned or provided with means, to give clear instructions to the person operating the winding engine and have a clear view of the graph on the recording instrument at the same time.
- (4) Notwithstanding that the person operating the winding engine will be operating under the instructions of the testing engineer, he should be advised to stop the winding engine if he becomes aware of anything that will affect the safety of personnel or equipment.
- (5) When adjustments are made, a check should follow to ensure that they are correct, by a safe method, before attempting to resume the testing sequence. For some adjustments this may involve a brake holding test or a trip at low speed with an ascending load.
- (6) The testing engineer should ascertain whether rope slip has occurred.

A method of detecting rope slip is outlined in Appendix II Clause I.

6.8

Operation of Mechanical Brakes and Safety Circuit

These tests are designed to ensure that the level of braking torque is adequate and that the safety circuit is functioning properly before tests at speed are made.

Before these tests are carried out ensure that the depth indicator and conveyance position are synchronised.

Carryout procedure outlined in Appendix II Clause I for the detection of rope slip.

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6.8.1 Preliminary test of brake holding power - service brake.

Test 1A

Winding engines with balance conveyances.

Position the empty conveyances near mid-shaft and apply power torque with the brakes fully on.

Note maximum value of current applied before the rope drum moves through the brakes.

Test 1B

Winding engines with conveyance and counterweight.

Position the conveyance and counterweight near mid shaft and with the brakes fully on apply power torque in the direction of maximum out-of-balance load.

Note the maximum value of current applied before the rope drum moves through the brakes.

6.8.2 Brake holding test, maximum out-of-balance load:- Service Brake.

Test 2A

Winding engines with balanced conveyances.

- (a) With the standard test load in one of the conveyances lower the loaded conveyance to near the shaft bottom.
- (b) Apply power to raise this conveyance and note maximum motor current which will hold the load without the use of brakes.
- (c) Raise the conveyance several drum turns out of shaft bottom, then with the brakes fully on apply motor power in favour of the loaded conveyance up to a maximum of 1.5 times the current noted in (b) above or until the rope drum moves through the brakes whichever first occurs.
- (d) Note the maximum motor current obtained.

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Test 2B

Winding engines with conveyance and counterweight.

(a) Determine maximum out-of-balance condition for the system ie - with conveyance loaded or unloaded.

(b,c,d) With the maximum out-of-balance load near the shaft bottom proceed as in Test 2A items (b), (c) and (d) above.

Note Test 2A and 2B

If the rope drum moves through the brakes before the motor current attains a value of 1.5 times the current noted in (b), then the brake system is deemed to have failed to comply with design requirements for friction winding engines.

6.8.3

Application Test - Emergency Brakes

Test 3

Position loaded conveyance near mid-shaft.

Release the brakes and allow the out-of-balance load to accelerate the winding engine to approximately half speed; trip the safety system by operating the emergency stop device.

The brakes should apply automatically.

Test 4

Repeat Test 3 at full speed, applying power if necessary.

During Test 3 and 4 period of application of brakes and initial conveyance speed are to be recorded to allow retardation rates to be determined.

Test 5

Where brake operation is dependent on fluid pressure repeat Test 3 and apply brakes by simulated loss of brake operating fluid pressure.

6.8.4 Landing Speed Test

An artificial landing will need to be established for one or other of the conveyances during the following tests.

Appendix II Clause 2 describes methods of setting up an artificial landing.

With the loaded conveyance at the artificial landing mark the winding ropes, drum and depth indicator to establish an accurate reference point.

Ensure that the automatic contrivance is set for man winding speed.

Test 6

Raise the loaded conveyance approximately two (2) drum revolutions above the artificial landing then lower it until an overspeed trip occurs.

Test 7

Repeat Test 6 for three increasing trip speeds up to maximum man winding speed starting further above the artificial landing if necessary.

Test 8

Accelerate the conveyance from normal maximum man winding speed to obtain a trip at the maximum speed permitted by the automatic contrivance, just prior to the retardation portion of the trip curve.

Check the temperature of the brake path during these tests and allow cooling time if necessary.

During Tests 6, 7 and 8 the following records should be taken where appropriate.

- (a) Trip speed.
- (b) Distance of trip point from artificial landing.
- (c) Retardation.
- (d) Distance of loaded conveyance from artificial landing when stopped.
- (e) Maximum landing speed.
- (f) Rope slip or creep.

When the above tests are completed the artificial landing is to be removed. (See Appendix II, Clause 3.)

6.9 Winding Cycle Control Functions

These tests are intended to ensure that, winding speeds, landing speeds, travel limits, interlocks and control points are correctly adjusted.

These tests are to be carried out with empty conveyances or balanced conditions in conveyance and counterweight systems.

Test 9

With the conveyance initially at the surface landing, apply power and accelerate the conveyance in the down direction through the complete cycle to the bottom landing.

Note reading on the depth indicator at intermediate and bottom landings. Complete the wind in the up direction noting the depth indicator reading when the conveyance returns to the surface landing.

During Test 9, readings of maximum winding speed, commencement of retardation, landing approach speed and winding cycle times are to be recorded.

Test 10

Overtravel limits.

Raise the conveyance slowly above the surface landing in turn through each of the overtravel limits.

Note the depth indicator readings at each trip of the winding engine control circuit.

Ensure that when each limit is reset, the winding engine cannot be driven in a direction which would aggravate the overwind.

Test 11

Repeat Test 10 with the cage at the shaft bottom.

APPENDIX I

[Published in Government Gazette No. 44 of 23rd March, 1984.]
(4471) Department of Industrial Relations,
Sydney, 23rd March, 1984.
COAL MINES REGULATION ACT, 1982-NOTICE OF SPECIFICATION
Specification: 845002
File No.: M. 84-5002

HEAD ROPES FOR FRICTION WINDERS

IT is hereby notified that the Chief Inspector of Coal Mines, for the purposes of the Regulation cited as the "Coal Mines Regulation (Shafts and Roadways-Underground Mines) Regulation 1984", under the Coal Mines Regulation Act, 1982, has specified that the factor of safety for head ropes when newly installed on a friction winder under Clause 13 (2) shall be as indicated below.

Each set of winding ropes used to suspend a cage in any friction winding apparatus shall have a combined factor of safety not less than F₁ (transport of persons) and F₂, (transport of mineral or material) as defined in the following formulae:

1. Personnel Transportation

For the purposes of the above the factor F, is defined as:

$$F_1 = 1.0 + \frac{4.5(R + C)}{R(1 + 0.0051 L^{0.5}) - 13.5}$$

where

- F₁ = the factor of safety (personnel)
- R = the ratio of the diameter of the winding sheave to diameter of the winding rope
- C = 35 where there is not a nearby deflecting sheave, or 43 where there is a nearby deflecting sheave
- L = the vertical distance in metres between the level of the top of the highest winding sheave and the level at which the winding ropes meet the suspension gear of the cage when at its lowest position in the shaft.

2. Mineral or Material Transportation

For the purposes of the above the factor F₂ is defined as:

$$F_2 = F_1 - 1.0$$

where

- F₂ = the factor of safety (mineral or material)
- F₁ = the factor of safety (personnel)

This notice shall take effect on and from 26th March, 1984.

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M. J. MUIR, Chief Inspector of Coal Mines.

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APPENDIX II - EXPLANATORY NOTES

Clause 1 - Detection of Rope Slip

A method of detecting rope slip is to mark the rope(s) before testing with tape at a position which coincides with a mark on the drum and corresponds to a mark on the depth indicator.

At any time during testing when it is suspected that rope slip has occurred, and always at the completion of testing, the relationship of the three marks should be checked.

A convenient time for marking and checking for rope slip is when setting and removing an artificial landing.

An accumulation of rope creep can be detected by the same method.

Clause 2 - Setting an Artificial Landing

Method 1

Where the automatic contrivance is fitted with moveable cam dials for each conveyance.

(a) Place the declared test load in one conveyance.

(b) Wind the loaded conveyance to the lowest level and stop it at the normal landing position. Suitably mark the sliding part of the automatic contrivance cam dial in relation to the non-sliding part. Note the clearance between the overwind cam and its roller at the shaft bottom position. Wind the conveyance about ten completed drum turns up the shaft; loosen the sliding part of the dial and move it bodily, complete with the cams, to its shaft bottom position. The dial should then be made secure and temporary marks put on the ropes, depth indicator and drum showing the position of the artificial landing. It is normal practice to mark the drum relative to a fixed point as a check and to facilitate resetting. The setting of the overwind switch should then be checked by slowly lowering the loaded conveyance until an overwind trip occurs.

Method 2

For Other Automatic Contrivances

Additional protection should be afforded for the loaded conveyance when ascending. For this purpose (during testing) a limit switch should be introduced into the trip circuit and arranged to operate when the required loaded conveyance is at a distance from the highest landing equal to the distance for normal retardation from maximum speed.

(a) Place the declared test load in one conveyance.

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- (b) Wind the loaded conveyance to the lowest level and stop it at the normal landing position. Suitably mark the two halves of the drive coupling nearest to the automatic contrivance relative one to the other and with reference to a fixed point. Wind the conveyance about ten completed drum turns up the shaft noting the number of revolutions of the automatic contrivance coupling. Uncouple the drive and reset the automatic contrivance by hand, turning back the same number of revolutions to the fixed mark previously made, and reconnect the coupling. This position may now be regarded as the artificial landing and temporary marks should be made on the ropes, depth indicator and drum. It is normal practice to mark the drum relative to a fixed point as a check and to facilitate resetting. The setting of the overwind switch should be checked by slowly lowering the loaded conveyance until an overwind trip occurs.

Clause 3 - Restoration of Normal Landings

These procedures apply to Method 1 and Method 2 respectively of Clause 2.

Method 1

The procedure of resetting to the normal landing is as follows.

Wind the conveyance to the artificial landing. Loosen the sliding part of the dial and turn it until the marks on both the sliding and the non-sliding parts of the dial coincide. Secure the two parts together and remove the temporary marks on the ropes, depth indicator and drum. Wind SLOWLY to the rope creep compensating position and compensate if necessary. Check the setting of the dial on the automatic contrivance which refers to the conveyance just tested and, if necessary, wind this conveyance to the other end of the wind to enable this to be done. Test the overwind trips as described in Test 10.

Method 2

The procedure for resetting to the normal landing is as follows.

Wind the conveyance to the artificial landing, uncouple the drive and reset the automatic contrivance by hand until the marks on the two half couplings coincide, making sure that the number of revolutions of the automatic contrivance half coupling is the same as that previously noted when setting the artificial landing. Reconnect the coupling and remove the temporary marks on the ropes, depth indicator, drum and coupling. Lower the conveyance SLOWLY to the rope creep compensating position and compensate if necessary. Check the setting of the dial on the automatic contrivance which refers to the conveyance just test and, if necessary, wind this conveyance to the other end of the wind to enable this to be done. Test the overwind trips as described in Test 10.