



# Safety Standard for Shafts, Hoists and Conveyances

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## 1. Definitions

Definition of "Bell" - "bell" means a horn, buzzer or other similar audible signal.

## 2. Hoist operator

2.1. No employer shall permit a worker to operate, and no worker shall operate, a mine hoist unless the worker

- (a) has been examined by a physician and issued a certificate to the effect that, to the best of the physician's knowledge, the worker is not subject to a mental or physical ill-health to such a degree as to interfere with the efficient discharge of the worker's duties; and
- (b) holds a certificate issued by the employer certifying that the worker has been examined by employer as to the worker's knowledge of the regulations and procedures, and is considered by the employer to be competent for the safe discharge of the workers' duties.

2.2. A certificate expires at the end of one year from the date of its issue.

## 3. Disabled hoist operator

A hoist operator who suffers a physical or mental disability that could adversely affect the worker's operation of the hoist shall not operate, or be permitted to operate, a hoist at a mine until the worker has been re-examined by a physician and re-issued a certificate as referenced as above.

## 4. Suspension, cancellation of certificate

If a hoist operator in the execution of the operator's duties contravenes any provision of this Standard, OHS Regulations or the Act, the director may suspend or cancel the hoist operator's certificate.

## 5. Duties of hoist operator

5.1. Except when a hoist is operating under automatic control, a hoist operator shall

- (a) remain at the hoist controls at all times the hoist is in motion; and
- (b) before leaving the hoist room,
  - i) set the hoist brakes,
  - ii) engage the hoist clutches or cause the conveyance to be blocked on any unclutched drum, and
  - iii) isolate the hoist from its power supply.

5.2. In accordance with the procedure established in the Regulations, where a hoist is used at a shaft, the hoist operator shall

- (a) make one complete trip up and down the working portion of the shaft:
  - i) after every stoppage of hoisting for repair
  - ii) after a stoppage for any other purpose that exceeds two hours duration
  - iii) and after a blast initiated from the surface,

before any person is again hoisted.
- (b) at least once in each operating day, test the effective functioning of the overwind and underwind devices;
- (c) at the commencement of each shift and before a conveyance is raised



or lowered, ascertain that the brake or brakes are in proper condition to hold the loads suspended on the corresponding drum or drums, by testing the brakes of the drums against the normal starting current; and

- (d) when the hoist is fitted with a friction clutch, after going on shift, test the holding power of the clutch before releasing the brake of the corresponding drum while the brake of the other drum is being kept off, and power is applied.

## **6. Duties of supervisor**

The supervisor in charge of the maintenance of the shaft and headframe shall

- (a) at least once in each week, review the entries made in the shaft inspection record book during the preceding week;
- (b) ascertain that the examination required under subsection (1) has been made and that all necessary servicing and repairs are completed, in progress or scheduled for repair without undue delay;
- (c) upon completion of the review required under paragraph (a), certify in the shaft inspection record book that the supervisor has complied with paragraphs (a) and (b); and
- (d) record over the supervisor's signature in the shaft inspection record book a dangerous condition reported concerning the shaft and the action taken to correct the condition.

## **7. Unclutching procedures**

The hoist operator shall not unclutch a drum of the hoist until the test referred to in the Standard has been made.

## **8. Unclutched drums**

No person shall cause or permit

- (a) an unclutched drum to be used for lowering a load;
- (b) a person to be on or in a shaft conveyance suspended from an unclutched drum unless the conveyance is secured in position by chairing or blocking; or
- (c) the drum of a hoist to be unclutched before application of the brakes to both hoist drums.

## **9. Brakes required when persons are hoisted**

When persons are in or on a shaft conveyance, the employer shall ensure that the hoist is equipped with more than one brake and that each brake is capable of safely stopping and holding the conveyance.

## **10. Shaft conveyance attached to fixed or clutched in drum**

In a shaft inspection or shaft maintenance operation, or when changing balance in a shaft sinking operation, persons may be in or on a shaft conveyance attached to the fixed or clutched in drum.

## **11. Emergency use of one brake**

In case of emergency, the employer may authorize the hoisting of persons while the hoist is equipped with one brake, and the employer shall enter any such authorization in the hoist operator's log book.

## **12. Signaling system for hoisting shaft**

- (1) For directing the movement of the shaft conveyance, the employer shall provide in each hoisting shaft a suitable audible means that
  - (a) permits signals to be exchanged between the hoist operator and the worker in charge of the conveyance;
  - (b) has a separate system in each shaft compartment;
  - (c) in a hoisting system of hoist and conveyances, emits a sound that is readily distinguishable from the sound emitted by any other similar system in the same shaft;
  - (d) is arranged so that the hoist operator returns the same signal back to the person initiating that signal; and
  - (e) has a signalling device provided for the conveyance operator, located
    - i) at each designated stopping place, and
    - ii) within easy reach of the conveyance operator while the operator is within the conveyance.
- (2) Cage call and shaft signaling systems shall meet the requirements of the CSA Standard M421, "Use of electricity in mines," as revised.

## **13. Shaft conveyance call system**

The employer shall ensure that the signaling system employed to call for the shaft timbers has its controls located adjacent to the shaft but not attached to the shaft timbers.

## **14. Voice communication system**

Except during shaft sinking operations, the employer shall install a system to provide voice communication between an attended place on surface and

- (a) the collar of each shaft;
- (b) each landing station in use in a shaft;
- (c) each shaft hoist room;
- (d) each underground refuge station; and
- (e) all other places as might be necessary to provide emergency communications.

## **15. Code of signals**

15.1. The following code of signals shall be used at each mine:

Number of Bell Rings	Action Required
1 Bell	Stop Immediately - if in motion (executive signal);
1 Bell	Hoist (executive signal);
2 Bells	Lower (executive signal);
3 Bells	<p>Person about to ascend or descent (cautionary signal)- if given by cagetender.</p> <p>(i) the 3 bell signal shall be given by the cagetender before persons are permitted to enter the shaft conveyence, and the cagetender alone, or with other persons already on the conveyence, are to be moved to another level,</p> <p>(ii) hoist locked, when given by hoist operator,</p> <p>(iii) the 3 bell signal shall be given by the hoist operator before the cagetender leaves, or permits other persons to leave, the conveyence at any level or other designated stopping place;</p>
4 Bells	<p>Blasting signal (special cautionary signal):</p> <p>(i) the hoist operator shall answer by raising the shaft conveyence approximately 1 m and lowering it back slowly</p> <p>(ii) following a 4 bell signal, only a 1 bell signal shall be required to signal for hoisting persons away from a blast, and the hoist operator shall remain at the controls until the act of hoisting is completed;</p>
5 Bells	<p>Release signal (executive signal):</p> <p>(i) the hoist operator shall move the shaft conveyance from level when signal was given and may perform movement or series of movements before bringing conveyance to rest at a place in the shaft that is not a recognized stopping place,</p> <p>(ii) when return bell signal is installed, the hoist opertor shall return the signal before moving conveyance,</p> <p>(iii) the person giving the release signal shall remain to guard the conveyance until it is moved from place from which the release signal given;</p>
9 Bells	<p>Danger signal (special cautionary signal):</p> <p>(i) To be given only in case of fire, serious injury or other emergency,</p> <p>(ii) The signal for the level at which danger exists shall be given following the giving of a danger signal</p> <p>(iii) The danger signal shall not be given on the hoist signal system unless the danger involves the safety of the hoisting system;</p>
1 Bell followed by 2 bells	Chairing the conveyance;
3 bells followed by 3 bells followed by 1 bell	Hoist slowly;
3 bells followed by 3 bells followed by 2 bells	Lower slowly;

15.2. A copy of the code of signals referred to in the table above shall be printed and posted at every hoist room and shaft collar and at every working level or designated landing place in every shaft.

15.3. In addition to the code of signals, the following signals shall be posted

- (a) signals to designate all regular landings and working levels;
- (b) special signals, as approved by the division, to designate all special hoisting movements.

## **16. Signals when conveyance stops**

When persons are riding in a conveyance, and the shaft conveyance is brought to rest at the collar or at any working level or designated stopping place, and the brakes have been set, the hoist operator shall give the 3 bell hoist locked signal before the door of the conveyance is opened but the signal shall not be answered by the cagetender.

## **17. Procedure after persons leave shaft conveyance**

After persons leave the shaft conveyance, the cagetender shall not re-enter the conveyance or permit other persons to enter until a new sequence of signals has been initiated by giving the 3 bell cautionary signal and receipt of the 3 bell return signal from the hoist operator.

## **18. Hoist operator procedures**

On receipt of a 3 bell signal, every hoist operator shall

- (a) ensure that the hoist brake or brakes are set;
- (b) where a return bell signal system is installed, return the 3 bell signal to permit the entry of persons to the conveyance;
- (c) remain at the hoist controls until the operator receives the signal designating the movement required and completes that movement; and
- (d) not release the brakes until a further proper sequence of signals is received.

## **19. Procedures when hoisting persons and time delay**

19.1. When hoisting persons, the hoist operator shall

- (a) upon receipt of the proper sequence of signals, not move the shaft conveyance within five seconds of returning the signal sequence, except that if an "on-cage" signaling system is employed, the conveyance may be moved after allowing a distinct pause following the receipt and return of a proper sequence of signals; and
- (b) if unable to act within one minute after the return of a correct signal sequence, not move the conveyance until a complete signal is again received.

19.2. In the event of an inadvertent stop at a point in the shaft other than a station from which signals can be given, the hoist operator may move the shaft conveyance only

- (a) on receipt of a signal from the cagetender; or
- (b) on instructions to do so from the person in charge at the mine.

19.3. No person without authorization shall

- (a) give any signal on the hoist signal system
- (b) interfere with the hoist signal system; or
- (c) operate or interfere with any equipment controlling the movement of the hoist.

19.4. The person authorized to give the hoisting signal shall be at the same level as the conveyance.

19.5. Where the shaft conveyance has been released, and is not at the same level as the person authorized to give the hoisting signal, the hoist operator shall be contacted by means other than by the signal system to move the shaft conveyance to that level.

19.6. In case of an emergency endangering the hoist or shaft, any person may give the danger signal on the hoist signal system.

## **20. Emergency signal line**

The employer shall ensure that a line is installed in each hoisting compartment of every shaft to permit the communication of signals from any portion of the shaft.

## **21. Communication with hoist operator**

21.1. While the hoist is in motion, no person shall talk to the hoist operator and the employer shall ensure that a sign is posted to that effect, plainly visible to anyone approaching the hoist controls.

21.2. In an emergency, or by pre-arrangement with the hoist operator before testing, maintenance or adjustment of the hoist, subsection 21.1 does not apply.

21.3. A communication system to communicate with a hoist operator using radio frequencies may be installed, provided that it is tested and complies with the Institute of Makers of Explosives, Safety Library Publication No. 20, titled "Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electrical Detonators (Blasting Caps)".

## **22. Duties of hoist operator Log Book**

Every hoist operator shall record in the hoist operator's log book for every shift

- (a) a report of the working condition of the hoist including the brakes, clutches, interlocking devices between the brake and clutch, depth indicators, and all other devices pertaining to the safe operation of the hoist;
- (b) a report of the working condition of the signalling apparatus, and a notation of any signal received by the hoist operator, the accuracy of which the hoist operator has questioned;
- (c) an entry of any special instruction issued respecting the safety of persons, signed by the person issuing the instructions and the hoist operator;
- (d) a report of the working condition, record of any test performed upon the operation, which includes all overwind and underwind devices under the Regulations;

- (e) a report of any abnormal circumstance in connection with the operation of the hoist or attachments to it, and any abnormal condition as comes to the hoist operator's knowledge in connection with hoisting operations in the shaft;
- (f) a report of the tests and trial trips required under the Regulations; and
- (g) an entry to notify the hoist operator on a succeeding period of duty of any special circumstance or matter affecting the continued operation of the hoist or the safety of persons in the shaft, and the entry shall be countersigned by the hoist operator assuming duty for the succeeding period.

### **23. Duty of oncoming hoist operator**

When the required daily tests of the overwind and underwind devices have been conducted by a hoist operator on another shift, the hoist operator assuming duty shall examine the entry in the hoist operator's log book of the hoist operator who performed the tests and indicate by signing the hoist operator's log book.

### **24. Log book entries by hoist operator**

Every hoist operator shall make and sign such entries as are required under this Standard and the Regulations for the hoist operator's period of duty on each hoist and shall record the time and duration of each period of duty.

### **25. Supervisor to initial entries**

The supervisor in charge of the hoisting equipment shall read and initial the log book entry on each day that the hoist is operated.

### **26. Instructions before non-routine operation**

Before commencement of non-routine operations, written instructions shall be

- (a) discussed with the hoist operator;
- (b) entered in the log book;
- (c) signed by the person notifying the hoist operator; and
- (d) countersigned by the hoist operator.

### **27. Rope Certificate**

27.1. An employer shall not install or use, or permit the installation or use, of a shaft rope at a mine

- (a) unless the employer has on record a certificate from the manufacturer showing the
  - i) name and address of the manufacturer,
  - ii) manufacturer's rope or reel number,
  - iii) date of manufacture,
  - iv) diameter of the rope,
  - v) weight per unit length of the rope,
  - vi) trade name of the interior rope lubricant,
  - vii) percentage by mass of lubricant in the core,
  - viii) construction and class of core,

- ix) number of strands,
- x) number of wires per strand,
- xi) breaking stress of the steel of which the wires are made,
- xii) diameter of wires,
- xiii) standard torsion test of wires,
- xiv) actual breaking load of rope,
- xv) extension of the rope at the breaking load, and
- xvi) length of rope;

(b) unless the employer holds a breaking test certificate issued for the tests prescribed in this Standard and the Regulations; and

(c) if the rope has been previously used and the employer does not possess

- i) the records of its previous use, and
- ii) the results of tests and examinations at the time of installation showing it to be safe for use.

27.2. An employer shall not install or use, or permit the installation or use of, a shaft rope that has been spliced.

27.3. Where a shaft compartment is abandoned for hoisting purposes, the employer shall ensure that the hoisting rope is immediately removed from the shaft.

## 28. Drum hoist

An employer shall ensure that the factor of safety of each shaft rope when installed on a drum hoist at a mine is

- (a) not less than 8.5 at the end of the rope, where it is attached to the shaft or winze conveyance or to the counterweight;
- (b) not less than 5 at the point where the rope leaves the head sheave and, the rope being fully let out, the total weight consisting of the weight of the conveyance, plus the weight of the material hoisted and the weight of the portion of the rope that extends from the head sheave to the conveyance;
- (c) on a friction hoist, not less than is determined from the following formula:  
Factor of safety =  $8.0 - .00164d$ , where "d" is the maximum length in metres of rope suspended below the head sheave, but the factor of safety shall not be less than 5.5 for any depth of shaft when the rope is installed;
- (d) not less than 7 for each tail rope when installed; and
- (e) not less than 5 for each rubbing rope.

## 29. Rope dressing treatment

29.1. Every employer shall ensure that, except for plastic impregnated ropes, a drum hoist rope is treated with a rope dressing as often as necessary, but not less than once each month, to protect the rope from corrosion.

29.2 A worker who treats a hoist rope with rope dressing shall record the treatment in the machinery record book and shall sign the entry.

### 30. Rope attachment

An employer shall ensure that

- (a) a shaft rope is attached to the conveyance by a device that will not inadvertently disconnect;
- (b) a device for attaching a shaft rope to a conveyance or another suspension point has a factor of safety that is greater than the factor of safety of the rope when the device is carrying its maximum load; and
- (c) on a drum hoist installation, the hoisting rope from a shaft conveyance or counterweight is securely fastened to the spinder of the drum or around the drum shaft.

### 31. Examination and test of attachments

Following the installation of a new hoisting rope or after the cutting of a previously installed rope, an employer shall ensure that

- (a) a competent person examines the connecting attachments between the rope and the conveyance or counterweight and the connection between the rope and the drum;
- (b) the results of the examination prescribed above are recorded in the machinery record book and the entry signed by the person making the examinations;
- (c) before the transportation of persons, 2 complete test trips of the conveyance or counterweight are made through the working portion of the shaft, with the conveyance or counterweight bearing its maximum permissible load; and
- (d) the hoist operator records the trips prescribed above in the hoisting log book.

### 32. Test of hoist rope attachment

An employer shall ensure that a hoist rope attachment is tested non-destructively before use and at intervals not exceeding 8 months to confirm that the required factor of safety is maintained and certified at intervals not exceeding 6 years by a competent person or by the manufacturer.

### 33. Operation of drum hoist and rope lengths

33.1. An employer shall not direct or permit to be operated a drum hoist where

- (a) the bucket, cage, skip or counterweight at the lowest point in the shaft from which hoisting is effected, less than 3 turns of rope upon the drum;
- (b) the drum has helical or spiral grooving, or does not have grooving, more than 3 complete layers of rope on a drum when the conveyance is at the highest point of travel in the shaft; or
- (c) the drum has parallel and half pitch grooving, more than 4 complete layers of rope on a drum when the conveyance is at the highest point of travel in a shaft.



33.2. A drum hoist shall be equipped with a device for detecting slack hoist rope.

### **34. Hoisting rope standards**

An employer shall not direct or permit a shaft rope to be used in a shaft if in a part of the rope

- a) the existing strength has decreased to less than
  - (I) 90% of the actual breaking load specified on the manufacturer's certificate for a hoisting rope,
  - (II) 85% of the actual breaking load specified on the manufacturer's certificate for a balance rope, or
  - (III) 75% of the actual breaking load specified on the manufacturer's certificate for a guide or rubbing rope
- (b) the extension of a test piece has decreased to less than 60% of the extension specified on the manufacturer's certificate, when tested to destruction;
- (c) the number of broken wires in a section of the rope equaling the length of one lay exceeds 6;
- (d) significant corrosion or significant deterioration appears on the crown of the strand;
- (e) the rate of stretch in the hoisting rope begins to show a significant increase over the normal stretch noted during its service;
- (f) a visual or other examination, or non-destructive testing indicates a defect that could endanger the safety of a person; or
- (g) the plastic covering on plastic impregnated ropes has cracked or deteriorated to a point where excessive corrosion of the metal wires has occurred.

### **35. Breaking tests of shaft ropes**

An employer at a mine, at which a shaft rope is used, shall make destructive breaking tests of specimens of the rope

- (a) at the time of installation, where more than 2 years have elapsed since issuance of the certificate referred to in this Standard and the Regulations;
- (b) when a rope has been in service on a drum hoist for 18 months, and thereafter at intervals not exceeding 6 months;
- (c) from the end of a hoisting rope on a friction hoist, when test specimens are available during the life of the rope.

### **36. Non-destructive tests of shaft ropes**

Where shaft ropes are used at a mine, the employer shall ensure that suitable non-destructive tests are made throughout the working length of

- (a) all hoisting rope on drum and friction hoists, within the first 6 months of service and thereafter at intervals not exceeding 4 months, or at an interval shorter than 4 months as determined when, by extrapolation of past test results, the loss in breaking strength will reach 10%; and
- (b) all tail ropes, guide ropes and rubbing ropes at the end of 12 months service and thereafter at regular intervals not exceeding 8 months, except where a previous test has disclosed a loss exceeding 5% of the breaking strength in which case the interval shall not exceed 4 months.

### **37. Test certificate**

When a breaking test or non-destructive test has been made on a shaft rope, the employer shall ensure that

- (a) a certificate of the test and all graphs and interpretations signed by the person making the interpretation are placed on file at the mine and retained for the life of the rope.
- (b) a summary of the test results and the date of the tests are recorded in the rope record book.

### **38. Maintenance of shaft ropes**

Where a hoist is used at a mine, an employer shall ensure that

- (a) on a drum hoist, after every 6 months of service, the portion of the rope at the conveyance end within the clamps is cut off and discarded;
- (b) on a friction hoist, after every 6 months of service, the position of the rope between the clamps is changed, or the portion of the rope within the clamps is thoroughly cleaned and examined;
- (c) the guide and rubbing rope attachments and tensioning devices are thoroughly cleaned and examined every 6 months;
- (d) sockets used are thoroughly cleaned and examined after 6 months of service, and a systematic schedule and procedure for resocketing is established; and
- (e) the results of the examinations and procedures referred to above are recorded in the machinery record book.

### **39. Tail and guide rope clearance**

An employer shall ensure that

- (a) water and muck spillage in the shaft sump is removed in order that the tail ropes have a clear passage at all times; and
- (b) all guide and rubbing rope tensioning devices are clear of obstructions.

### **40. Maintenance of ropes**

An employer shall document a procedure for the examination, designate a competent person to examine, and ensure that an examination is carried out,

- (a) at least once in each working day that a hoist is operated, of the exterior of each hoisting rope within the shaft to detect the presence of kinks or visible damage and to note the condition of the rope dressing;
- (b) at least once every month
  - i) of the shaft ropes to determine the amount of wear, corrosion and distortion of the ropes, the condition of the rope dressing, the condition the ropes at crossover points, and the number and location of the broken wires, and
  - ii) of the hoisting ropes of a friction hoist for rope stretch; and
- (c) at least once in every 6 months of service,
  - i) of the hoisting ropes of a friction hoist within the attachments at the drum and at the drum spout; and
  - ii) of the hoisting ropes of a friction hoist within the attachments at the shaft conveyance or counterweight in accordance with a procedure established by the employer.

#### **41. Employer to designate worker to make examination**

An employer at a mine, where a hoist is in use, shall designate a competent worker who shall examine at least once in every week

- (a) the sheave wheels;
- (b) the attachments of the hoisting rope to the drums and to the counterweights, buckets, cages or skips;
- (c) the brakes;
- (d) interlocks;
- (e) the depth indicators;
- (f) the buckets, cages, skips and counterweights;
- (g) the external parts of the hoist;
- (h) the signaling equipment;
- (i) the shaft dumping and loading arrangements;
- (j) sinking doors and blasting sets and attachments to them; and
- (k) the hoist motor and control apparatus, and electric safety devices.

#### **42. Adjustment of hoists**

A person shall not repair, adjust or modify a part, device or control of a hoist unless authorized by the supervisor in charge of the hoisting equipment.

### 43. Head and deflection sheaves

An employer at a mine at which a hoist is installed shall ensure that each head sheave and deflection sheave installed at a mine shaft

- (a) bears a serial number and the date of its manufacture;
- (b) is certified by a professional engineer or the manufacturer of the sheave as to
  - i) its maximum rated load,
  - ii) the diameter of rope for which it was designed,
  - iii) the breaking strength of the rope for which it was designed, and
  - iv) the maximum amount of groove wear that is permitted;
- (c) is made of materials that can safely withstand the effect of ambient temperatures;
- (d) has a diameter that is sufficient to provide the same ratio of sheave to rope diameter as is prescribed for the drum to rope diameter in this Standard;
- (e) is grooved and maintained to fit the rope being used;
- (f) is not loaded in excess of the maximum rated load stated in the certificate; and
- (g) is equipped with a wobble indicating switch.

### 44. Hoist drums

44.1. An employer shall ensure that each drum of a mine hoist has

- (a) a diameter not less than 100 times the diameter of a hoisting rope of locked-coil construction;
- (b) a diameter not less than 80 times the diameter of a hoisting rope of stranded construction;
- (c) a diameter not less than 60 times the diameter of the hoisting rope of stranded construction when the diameter of that rope is not greater than 25 millimetres; and
- (d) grooving that properly fits the rope used.

44.2. An employer shall ensure that each drum of a mine hoist

- (a) if conical, has grooving that prevents the rope from slipping off the drum;
- (b) has flanges of sufficient height to contain all the rope, as permitted by this Standard, and which are strong enough to withstand any loading by the rope; and
- (c) where multiple layer winding is used, has an arrangement to direct the rope to rise evenly from one layer to another and to wind properly without cutting down through a lower layer.

## 45. Location of a hoist and head sheaves

An employer shall ensure that the hoist and the head sheaves are so located in relation to one another as to permit the proper winding of the rope on the hoist drum.

## 46. Locking devices

An employer shall ensure that bolts or other fitting of the drums, brakes and clutches that could be a source of danger if they are loosened are made secure by means of locking devices.

## 47. Brakes

47.1. An employer shall ensure that every hoist used at a mine is equipped with a mechanical brake or brakes that

- (a) can be applied directly to each drum;
- (b) are designed, adjusted and maintained so as to safely stop and hold the conveyance under normal conditions of loading, direction of travel, and speed;
- (c) are arranged so that they can be tested separately;
- (d) are maintained in a condition that no part of the brake mechanism can come to the limit of travel before the full power of the brake or brakes is applied;
- (e) are equipped with a device which
  - i) gives a positive indication of brake tread wear or slack linkage so that adjustment is necessary, and
  - ii) in the case of electric hoists, prevents starting of the hoist in the event of a slack brake;
- (f) are applied automatically when
  - i) the hoist safety circuit is interrupted, or
  - ii) the pressure in a hydraulic or pneumatic system for applying brakes drops below the designed pressure.
- (g) are applied by control levers that are pulled unless brake and power control levers are common.

47.2. An employer shall ensure that a hoist used for hoisting persons

- (a) is equipped with more than one independent means of braking, each of which can stop and hold the drum when the shaft conveyance is operating at maximum load; and
- (b) has the brakes arranged to decelerate the hoist at a rate greater than 1.5 metres per second per second and less than 3.7 metres per second per second when braking is initiated by an interrupted safety circuit and the hoist is operating the normal speed for hoisting persons.

## 48. Hoist and clutched drum and locking gear

An employer shall ensure that on each hoist fitted with a clutched drum

- (a) the operating gear of the clutch of the drum is provided with a locking gear to prevent the inadvertent withdrawal or insertion of the clutch;
- (b) the brake and clutch operating devices are so installed that it is not possible to
  - i) unclutch a drum unless the brake on the drum is fully applied, or
  - ii) release the brake until the clutch on the drum is fully engaged; and
- (c) on a hoist on which only one drum is clutched and a cage counterweight system is employed, the cage is attached to the fixed drum.

## 49. Indicator

An employer shall ensure that every hoist is provided with depth indicators that continuously, accurately and clearly show to the hoist operator the position

- (a) of the shaft conveyance and counterweight;
- (b) at which a reduction in speed is prescribed by the employer;
- (c) at which the over wind, under wind and track limit devices are set to operate;
- (d) beyond which the conveyance shall not be moved above or below the limits referred to above;
- (e) of collar doors, dump doors and crosshead landing chairs;
- (f) of an intermediate shaft obstructions; and
- (g) with a means of readjusting the depth indicator after a migration from the original proximity settings.

## 50. Hoist safety devices

An employer shall provide and maintain on every hoist

- (a) when the shaft at which the hoist operates exceeds 90 metres in depth below the collar, a device
  - i) that gives audible warning to the hoist operator of the arrival of the conveyance at points in the shaft, the distances of which from the top and bottom landing places are not less than the equivalent of 3 revolutions of the drum of the hoist, and
  - ii) that gives audible warning only when the conveyance is approaching the top or bottom landing, not leaving them;
- (b) when the hoist is electrically powered, an ammeter which indicates at all time the load on the hoist drive motor;

- (c) a manually operated emergency switch that
  - i) is installed within easy reach of the hoist operator when at the controls, and
  - ii) permits the hoist operator to stop the hoist in an emergency;
- (d) a device that in the event of loss of drive to the safety devices
  - i) in the case of a manually-operated hoist, warns the operator of the loss of drive, or
  - ii) in the case of an automatic hoist, brings the hoist to rest; and
- (e) a device that indicates the speed of the conveyance.

## **51. Hoist safety control devices**

- 51.1. An employer shall ensure that every hoist is equipped with the following safety devices to initiate automatic deceleration and bring the hoist safely to rest under all conditions of permissible load, direction of travel or speed before the conveyance, counterweight or their rope attachments can reach a permanent obstruction:
- (a) over wind and under wind devices operated at definite points within the upper and lower limits of regular travel of the conveyance or counterweight;
  - (b) a track limit switch in each hoisting compartment activated directly by the conveyance or counterweight;
  - (c) over speed devices that operate when the maximum authorized rope speed is exceeded by 12%; and
  - (d) retardation devices that enforce a gradual reduction in speed as the conveyance or counterweight approaches the regular end of travel.
- 51.2. An under wind device referred to in 52 is not required in shaft sinking where a controller cam is profiled so as to provide enforced slow down to creep speed when approaching a check point near the shaft bottom.

## **52. Intermediate obstructions**

Where an ore or waste dump, loading box, collar door or spill door is installed in a shaft or winze at points other than the upper and lower limits of normal travel of a conveyance, and where a part of the dump, box or door interferes with the free passage of a conveyance, an employer shall ensure that

- (a) travel-limiting and enforced slow-down devices are installed;
- (b) positive locking devices for maintaining obstructions out of the operating position in the shaft or winze are installed;
- (c) devices required under 52 (a) are automatically activated upon the obstruction moving from its fully open-locked position;
- (d) dual position indicating lights are installed, which

- i) show a red light when an obstruction to the free passage of the conveyance is caused,
- ii) show a green light when the door or doors are in the fully open position to allow the free passage of the conveyance,
- iii) are arranged so that the green light does not show until each part of a door or obstruction reaches its full travel to the open position,
- iv) have the light switches located so that they are activated directly by the door or obstruction when it reaches its full travel to the open position; and
- v) have the circuit supplied from a source of power independent of the hoist circuit

### **53. Skips for hoisting persons**

An employer shall ensure that whenever persons are being hoisted in skips, or in the skips of skip-cage assemblies, a device is installed and operated that

- (a) prevents the skip from being hoisted to the dumping position;
- (b) provides an audible or visual signal to the persons about to enter the skip that the control devices for the hoist are set in operation;
- (c) prevents travel in excess of 2.5 metres per second; and
- (d) has the circuit arranged so that the failure of a part cannot render the device inoperative.

### **54. Electric hoists**

54.1. An employer shall ensure that each electrically operated hoist is provided with protective devices and protective circuits which

- (a) when actuated, initiate automatic control of the power circuits in conjunction with automatic application of the brakes to bring the hoist and conveyance safely to rest under all conditions of permissible load, direction of travel, and speed;
- (b) are so designed that the failure of a part initiates emergency braking action to bring the hoist safely to rest;
- (c) when installed and maintained, provides positive protection at all times; and
- (d) are designed to operate at a potential not exceeding 250 volts.

54.2. A device or circuit referred to above may be altered or adjusted only by qualified persons.

54.3. An employer shall ensure that each electrically operated hoist has

- (a) low voltage protective devices on the hoist control circuits to effect the safe operation of the hoisting plant;
- (b) protective devices on the hoist power circuit which operate when a load on the hoist motors is of a magnitude and duration that exceeds an operation overload;



- (c) short circuit protective devices on the hoist power circuit; and
- (d) a manually operated back out device which prevents the release of the brakes or brakes holding a conveyance or counterbalance when in an over wound or under wound position until sufficient drive motor current is developed to ensure movement of the conveyance or counterbalances in the correct direction.

## 55. Friction hoists

In addition to the other requirements for electric hoists, an employer shall ensure that in every friction hoist installation

- (a) the hoist has a device that
  - i) initiates emergency stopping in the event of a slip between the hoisting rope or ropes and the hoist drum in excess of a predetermined amount,
  - ii) synchronizes the position of the shaft conveyance with safety devices driven from the drum,
  - iii) initiates emergency stopping in the event of abnormal movement of the tail rope loops, and
  - iv) initiates emergency stopping in the event of abnormal tread wear; and
- (b) the shaft is equipped with tapered guides or other suitable arresting devices arranged so as to brake and stop an over wound or under wound conveyance when entering the end zone at the maximum speed permitted by the hoist controls.

## 56. Automatic hoist controls

Where a hoist is operated by means of automatic controls, an employer shall ensure that

- (a) there is a device for the selection of manual, semi-automatic or automatic control located where it is readily accessible to the manual controls;
- (b) a system is installed that, in an emergency stop during automatic hoisting operations, sounds an alarm at a location where it can be heard by a person authorized to give assistance;
- (c) when designed to be operated from control stations located at shaft levels and within a shaft conveyance, the switch for affecting the change-over of the control mode between that at the shaft levels and at the shaft conveyance is effective only at the shaft level at which the shaft conveyance is stopped;
- (d) devices installed on the levels for the purpose of selecting the conveyance destination are operable only at the level at which the conveyance is stopped;
- (e) when hoisting persons, a device installed for the purpose of initiation of hoist motion
  - i) operates only when the shaft gate at the level at which the conveyance is stopped is in the closed position;
  - ii) is located so that it can be operated from inside the conveyance stopped at the level, and

- iii) causes a delay of 5 seconds between the operation of the device and the actual motion;
- (f) any device for jogging the conveyance
  - i) is located so that it cannot be operated from inside the conveyance,
  - ii) can be activated while the shaft gate is open, and
  - iii) can be activated without a delay of 5 seconds;
- (g) the operating procedures are written and implemented;
- (h) in the case of a hoist used for hoisting persons, an operator competent to operate the hoist manually is readily available whenever persons are underground or being hoisted;
- (i) the device referred to in (a) is operated only by authorized persons; and
- (j) after an emergency stop, the hoist is manually operated through one complete cycle before it is put on automatic control.

## 57. Shaft requirements

- (1) An employer shall provide and maintain in each shaft in which a shaft conveyance operates
  - (a) sufficient clearance to provide a distance for an overwind and underwind that exceeds the greater of
    - (i) twice the stopping distance of the hoist at the maximum speed permitted by the hoist controls, and
    - (ii) 3 metres;
  - (b) secure timbering, lining or casing;
  - (c) means to guide each shaft conveyance to prevent its contact with another shaft conveyance or shaft furnishing;
  - (d) a gate at each shaft opening on the surface, each level, and each loading pocket, that is not otherwise securely closed off, which
    - (i) has not more than 40 millimetres clearance beneath its lower edge, and
    - (ii) is capable of withstanding impact by a vehicle travelling on rails leading up to the shaft, or a mobile equipment which can approach the shaft;
  - (e) a derail or other precaution, additional to the requirement of paragraph (d), if an officer considers it necessary;
  - (f) a suitable walkway or ladderway that is
    - (i) constructed as prescribed in Part XI, and
    - (ii) separated from the compartment or division of the shaft in which material is hoisted, by a partition that prevents a person in the walkway or ladderway from contacting the shaft conveyance and prevents falling material from entering the walkway or ladderway;
  - (g) at each level or other access to the mine workings from the shaft,
    - (i) suitable standing room outside the shaft, and

- (ii) a suitable passageway from each shaft compartment in which persons can be hoisted, and from the shaft manway to the level or other access to the mine workings;
- (h) about each counterweight,
  - (i) in a timbered shaft, a separate compartment suitably guarded to prevent inadvertent access, or
  - (ii) in an untimbered shaft, suitable guards that prevent a hazard to persons at pass points, landing places or another place of access to the shaft; and
  - (iii) means to prevent a hoisting conveyance carrying persons from being lowered into water in the bottom of the shaft.
- (2) No person shall be transported in a shaft conveyance
  - (a) that is a cage, unless the cage doors are closed;
  - (b) while the hoist that is raising or lowering the shaft conveyance is being used to transport ore or waste;
  - (c) that is a multi-deck cage, where supplies or service rolling stock are being transported, except that persons may be carried on the top deck when
    - (i) such materials are carried on another deck,
    - (ii) the materials are adequately secured,
    - (iii) the doors of the top deck are closed,
    - (iv) the combined load does not exceed 85 per cent of the material load limit of the conveyance, and
    - (v) the scheduled trips for persons have been completed
  - (d) where personal hand tools or equipment are being transported, unless such tools or equipment are
    - (i) protected by guards,
    - (ii) secured, and
    - (iii) the combined load does not exceed 85 per cent of the material load limit of the conveyance.
  - (e) unless a worker authorized to give signals is in charge of the conveyance; and
  - (f) with explosives, supplies or service rolling stock.
- (3) Despite clause (1) (f), those workers required to handle explosives, supplies or service rolling stock may be transported with the explosives, supplies or service rolling stock if space is provided for the safety of the workers and the combined load does not exceed 85 per cent of the material load limit of the conveyance.
- (4) Where a mine shaft exceeds 100 metres in vertical depth, a shaft conveyance shall be provided for the raising and lowering of workers.

## 58. Compartment lining at levels

Except during sinking operations, the employer shall provide and maintain in each timbered shaft where material is handled, a partition

- (a) around each compartment at the collar and at all levels except on the sides on which material is loaded or unloaded; and
- (b) that extends above the collar and all levels a distance not less than the height of the hoisting conveyance plus 1.8 metres and extends below the collar and all levels at least 1.8 metres.

## 59. Construction of cages and skips

An employer shall ensure that all cages or skips used for hoisting persons

- (a) are so constructed as to prevent a portion of the body of a person riding on it or a part of material that could be transported on it from accidentally coming into contact with the timbering or sides of the shaft;
- (b) have a hood made of mild steel plate not less than 5 millimetres in thickness or of a material of equivalent strength;
- (c) have a casing of mild steel plate, not less than 3 millimetres in thickness, or of a material of equivalent strength, and the casing
  - (i) extends from the floor to a height not less than 2.0 metres above the floor, and
  - (ii) encloses the full area of the floor;
- (d) have positive protection against inadvertent dumping;
- (e) have an exit in the roof that can be opened from inside or outside the cage for the emergency exit of persons;
- (f) in the case of a cage, is equipped with doors which
  - (i) have a device for positively latching the door in the closed position,
  - (ii) have a clearance of not more than 20 millimetres above the floor of the cage,
  - (iii) extend not less than 1.5 metres above the floor of the cage, and
  - (iv) are constructed and arranged so that it is not possible for the doors to open outwards;
- (g) are equipped, if suspended from a single rope or attachment, with safety catches and mechanisms which have sufficient strength to hold the shaft conveyance, with its maximum static load, at any point in the shaft, and
- (h) are designed with a factor of safety, when carrying its maximum static load, of not less than
  - (i) 10 for all load bearing parts attaching the conveyance to the rope and to other conveyances,
  - (ii) 8 for all other parts of the conveyance; and
- (i) are thoroughly inspected annually by a competent person for wear, damage or structural deterioration which could reduce the factor of safety; and
- (j) have ventilation, adequate for the persons being transported.

## 60. Certification of load capacity

Before the installation of a shaft conveyance in a shaft, an employer shall obtain a certificate issued by the manufacturer of the conveyance or a

professional engineer showing

- (a) the load capacity of the conveyance and attachments;
- (b) the weight of a tail rope and other suspended load; and
- (c) the designed factor of safety.

## 61. Free fall tests

- (1) Before a shaft conveyance equipped with safety catches and mechanisms is used for hoisting persons, an employer shall conduct free fall tests in accordance with subsection (2).
- (2) Free fall tests shall consist of 2 tests where the deceleration rates are within 15%, and 3 tests where the deceleration rates of the first 2 tests differ by more than 15% and shall be performed under the following conditions:
  - (a) the shaft conveyance shall carry a weight equal to its maximum permitted load of persons;
  - (b) the shaft conveyance shall travel at a speed equal to its designed hoisting speed when transporting persons; and
  - (c) the guides on which the test is made shall be representative of those in the shaft.
- (3) A free fall test is considered to be successful if
  - (a) the shaft conveyance is decelerated to a stop within one and 3 times the rate of gravity; and
  - (b) there is no damage to the safety dogs and mechanisms; and
  - (c) the safety dogs engage the guides continuously during deceleration; and
  - (d) a calculation shows that the safety dogs will stop the cage or skip when it is carrying its maximum material load.
- (4) The employer shall enter a report of the free fall test in the machinery record book and send a copy of the report to the division.
- (5) When alterations or significant repairs are made to safety catches or mechanisms which could affect their performance, the employer shall conduct
  - (a) a drop test in accordance with s. 92 (1) (b) of the Regulation before the conveyance is used; and
  - (b) a free fall test in accordance with subsection (2) within 3 days after the day the alterations or repairs are made.

## 62. Shaft sinking requirements

Where preliminary development work is conducted during shaft sinking, the employer shall install and maintain

- (a) a vertical shaft that has reached a depth of 100 metres below the head sheaves, and a crosshead to guide the sinking bucket which shall be
  - (i) equipped with a safety device for attaching the bucket to the crosshead in a manner that the crosshead cannot stick in the shaft compartment without stopping the bucket,
  - (ii) landed on at least 2 chairs, at the bottom crosshead stop, to prevent distortion of the crosshead, and
  - (iii) of a type that encloses the bucket;
- (b) dump doors shall
  - (i) prevent material from falling down the shaft when the bucket is being dumped, and
  - (ii) be provided with devices that automatically latch the dump doors when the sinking bucket is moved out of the shaft;
- (c) service doors shall cover the sinking compartment of the shaft completely at the collar and another location in the shaft where tools and other materials are loaded or unloaded from the bucket, except the shaft bottom, and shall be
  - (i) equipped with mechanical devices that automatically latch the doors open, clear of the shaft compartment,
  - (ii) kept closed when a bucket is being loaded or unloaded with tools and other materials at that location, and
  - (iii) kept closed when persons are entering or leaving the bucket at that location except where a closed crosshead provides equal protection;
- (d) a suitable landing or platform at each service point to ensure the safe loading and unloading of persons;
- (e) dual lights that indicate to the hoist operator that
  - (i) the dump doors are in or out of the shaft compartment,
  - (ii) the service doors are in or out of the shaft compartment, and
  - (iii) the bucket is not descending without the crosshead from the bucket dumping position;
- (f) timbering, lining or casing which secures the shaft walls and provides for safe operation of a conveyance, and which is maintained within a distance of the bottom not exceeding 20m;
- (g) an auxiliary ladder that extends from the permanent ladders to the shaft bottom and that can be lowered promptly; and
- (h) where multi-deck staging is used, staging that is designed by a professional engineer.

### 63. Work activity in a shaft

- (1) When work or an examination is taking place in the compartment of a shaft or in that part of the headframe used in conjunction therewith,
  - (a) hoisting operations in that compartment, except for those necessary to perform the work or examination, shall be suspended;
  - (b) protection from accidental contact with any moving shaft conveyance or counterweight, or falling objects shall be provided for a worker performing the work or examination; and
  - (c) the power supply to all conveyor belts, gates and other devices that are located above a worker and that could cause material to flow into the shaft shall be locked and tagged in the safe position and the gates shall be mechanically secured in the closed position.
- (2) Before the commencement of work or of an examination below a loading pocket in a shaft, a competent person who is authorized by the employer to proceed, and who proceeds, below the loading pocket shall inspect it to ensure that the work or examination can proceed safely.