

Australian/New Zealand Standard™

Underground mining—Shaft equipment
Part 8: Conveyances for inclined shafts



AS/NZS 3785.8:2016

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Australasian Institute of Mining and Metallurgy
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Department of Industry, Skills and Regional Development, NSW
Department of Mines and Petroleum, WA
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Australian/New Zealand Standard™

Underground mining—Shaft equipment
Part 8: Conveyances for inclined shafts

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-018, Mining Equipment, to supersede AS 3785.8—1994, *Underground mining—Shaft equipment*, Part 8: *Personnel conveyances in other than vertical shafts*.

The objective of this Standard is to specify general requirements for conveyances used in inclined shafts that do not exceed a gradient of one in three.

It is one of a series of Standards on shaft equipment for underground mines. The other Standards in the series are as follows:

AS(/NZS)

3785	Underground mining—Shaft equipment
3785.1	Part 1: Shaft overwind safety catch system
3785.2	Part 2: Shaft winding arresting systems
3785.3	Part 3: Drum winding gripper systems
3785.4	Part 4: Conveyances for vertical shafts
3785.5	Part 5: Headframes
3785.6	Part 6: Fixed guides, rope guides and rubbing ropes for conveyances
3785.7	Part 7: Sheaves

The principal differences between this and the previous edition are as follows:

- (a) Expansion of the scope to cover all types of conveyances.
- (b) Introduction of functional safety principles in the design philosophy of conveyances.
- (c) Introduction of commissioning the conveyance on site.
- (d) Introduction of in-service brake testing of the emergency braking system.
- (e) Introduction of maintenance of conveyances.

The term ‘normative’ has been used in this Standard to define the application of the appendix to which it applies. A ‘normative’ appendix is an integral part of a Standard.

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Australian/New Zealand Standard
Underground mining—Shaft equipment

Part 8: Conveyances for inclined shafts

1 SCOPE

This Standard specifies general requirements for conveyances used in inclined shafts that do not exceed a gradient of one in three. The conveyance system may be driven by a mounted or remote operator.

The conveyances are mounted on flanged wheels that operate on a railway track and hauled by a rope driven by a winder.

This Standard does not include requirements for the winder, rope, rope guidance system in the incline or the railway track.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|---------|---|
| 1710 | Non-destructive testing—Ultrasonic testing of carbon and low alloy steel plate and universal sections—Test methods and quality classification |
| 3637 | Underground mining—Winding suspension equipment |
| 3637.1 | Part 1: General requirements |
| 3637.3 | Part 3: Rope cappings |
| 3637.4 | Part 4: Drawbars and connecting links |
| 3751 | Underground mining—Slope haulage—Couplings, drawbars, and safety chains |
| 3990 | Mechanical equipment—Steelwork |
| 4100 | Steel structures |
| 60204 | Safety of machinery—Electrical equipment of machines |
| 60204.1 | Part 1: General requirements (IEC 60204-1, Ed. 5 (FDIS) MOD) |

AS/NZS

- | | |
|--------|---|
| 1269 | Occupational noise management |
| 1269.1 | Part 1: Measurement and assessment of noise immission and exposure |
| 1554 | Structural steel welding |
| 1554.1 | Part 1: Welding of steel structures |
| 1554.4 | Part 4: Welding of high strength quenched and tempered steels |
| 1554.5 | Part 5: Welding of steel structures subject to high levels of fatigue loading |
| 2080 | Safety glass for land vehicles |
| 4024.1 | Safety of machinery (series) |
| 4871 | Electrical equipment for mines and quarries (series) |

AS/NZS ISO

- | | |
|-------|---|
| 31000 | Risk management—Principles and guidelines |
|-------|---|

- ISO
3411 Earth-moving machinery—Physical dimensions of operators and minimum operator space envelope
- Guide 73 Risk management—Vocabulary
- ISO/IEC
31010 Risk Management—Risk assessment techniques

3 DEFINITIONS

For the purposes of this Standard the definitions below apply:

3.1 Attachment

An assembly of components used to connect the permanent main load bearing component of the conveyance to another conveyance or to the haulage rope.

NOTE: Attachments include couplings, safety chains, draw bars, rope cappings and bridles.

3.2 Bridle

An attachment fitted to the rope capping and connected to the conveyance with chains as a redundant load path in the event of failure of the pin or coupling. See Figure 6.1.

3.3 Call function (release function)

The function of the mode selection switch that allows the control conveyance to be automatically sent to a call station.

3.4 Call station

Permanent stations that are located at various places in the inclined shaft for the calling of the control conveyance to that location.

3.5 Close inspection

Inspection that requires the conveyance to be removed from service and, where appropriate, components dismantled to be assessed to manufacturer's specifications.

3.6 Control conveyance (control car)

A conveyance, which incorporates a control station, attached to the haulage rope.

3.7 Control station

Any one fixed or mobile location from which the control of the haulage system can be independently operated.

3.8 Control stop

Normal operating stop function of the system.

3.9 Conveyance

A personnel conveyance, a control conveyance in which persons are transported or a materials conveyance that uses rope haulage on a conventional rail track with gradient not exceeding 1:3.

3.10 Conveyance suspended load

That portion of the conveyance assembly weight which is utilized to apply the conveyance track braking system.

3.11 Dead load

The load due to the mass of all permanent components of the conveyance.

3.12 Derail device

A device mounted on the conveyance directly above the rails that will detect when the conveyance has disengaged from the rails.

3.13 Dump stop

A manual or automatic system that activates the track braking system and also the winder braking system.

3.14 Emergency stop

An emergency operation intended to stop a process or a movement that has become hazardous.

3.15 Field inspection

Inspection carried out in situ but removed from immediate operation to enable components to be removed for testing.

3.16 Held function

Mode selection switch position that prevents movement while persons are accessing the train.

3.17 In service inspection

Visual inspection carried out in situ.

3.18 Life inspection

Inspection that requires the conveyance to be removed from service to allow structural integrity testing of the load bearing components to be carried out and for refurbishment of all components.

3.19 Live load

The load resulting from the operation of the conveyance.

3.20 Main load-bearing component (chassis)

A component that lies in the load transfer path to the attachments for the purpose of supporting the rated load.

3.21 Materials conveyance (materials transporter)

Any conveyance that is not a personnel or control conveyance which may be used to transport materials.

3.22 Mode selection switch

A device fitted externally to the control conveyance that selects between the call, held and local functions of the winder.

3.23 Overspeed device

A device mounted on the control conveyance that will register that the train is in an overspeed condition.

3.24 Overwind (over travel)

Unintentional travel of a conveyance beyond its normal operating limits.

3.25 Personnel conveyance (mancar)

A conveyance in which persons are transported using rope haulage.

3.26 Quick stop

A stop function of the system that arrests the train in a shorter time and distance than in a control stop.

3.27 Rated load

The maximum load the conveyance is designed to carry during normal use on the nominated gradient.

3.28 Regulatory authority

An authority having regulatory powers to register the design, manufacture and use of mine shaft equipment in the jurisdiction in which such equipment is used.

3.29 Rope break force

The minimum breaking force of a rope as given by the rope manufacturer's specification.

3.30 Rope capping

A rope socket fitted to the end of a wire rope for the purpose of attaching a conveyance to the rope.

3.31 Track braking system

A mechanism mounted on the conveyance designed to arrest the motion of the train, by action on the track rails.

3.32 Train

A number of personnel conveyances or materials conveyances, or both, coupled to a control conveyance.

NOTE: A control conveyance need not be used if the train comprises only materials conveyances.

3.33 Turnout

A mechanical installation enabling trains to be guided from one railway track to another.

3.34 Winder

A machine used for raising and lowering conveyances in a shaft by means of a winding rope or ropes.

3.35 Winding system

A system for raising and lowering personnel and materials in a mine shaft.

4 DESIGN PHILOSOPHY

4.1 Functional safety

A functional safety approach may be taken for the conveyance control and communication systems design to ensure compatibility and safe integration with the winder control system.

4.2 Design risk assessment

A design risk assessment incorporating site-specific criteria shall be carried out. The outcome risk controls shall be used to formulate the site operational risk assessment. The mine environment and track configuration information that is required to be supplied by the purchaser is shown in Appendix A.

For a design risk assessment the entire life cycle requirements of the conveyance should be considered. As well as design this should include installation, operation and maintenance of the conveyance. Reference is made to AS/NZS ISO 31000, ISO/IEC 31010 and ISO Guide 73.

Areas to be covered for risk assessment include the following:

- (a) Isolation for energy sources.
- (b) Brakes, including emergency use and redundancies.
- (c) Considerations regarding safe transport of materials including vision, manning, communication, operating speeds, operating modes and operating clearances throughout the travelways, etc.
- (d) Emergency stop and other control provisions such as quickstops, lanyards, alarms, sirens, call inhibit functions and other safety control devices.
- (e) Lighting and visibility including camera and headlights to provide forward vision to operator.
- (f) Protection against unplanned conveyance movements such as derail, slack rope, etc.
- (g) Protection for personnel from obstructions whilst travelling in the inclined shaft.
- (h) Safe boarding and disembarking.
- (i) Seating.
- (j) Ergonomics.
- (k) Emergency preparedness.
- (l) Electrics and hydraulics.
- (m) Safety control devices.
- (n) Build up and accumulation of materials.
- (o) Environmental effects such as corrosion.
- (p) Maintenance, service and test requirements.
- (q) Transportation and handling.
- (r) Compatibility with existing conveyances.
- (s) Consequences of human error.

5 STRUCTURAL DESIGN

5.1 General

The minimum information to be provided by the purchaser and by the supplier is given in Appendices A and B, respectively.

5.2 Load determination

When calculating the loading imposed on components of the conveyance, the following shall be determined:

- (a) *Dead loads*
- (b) *Live loads*—which, while coupled as part of the train on the nominated gradient, shall include—
 - (i) rated load (distributed and concentrated) carried by the conveyance;
 - (ii) maximum loads coupled to the conveyance;
 - (iii) dynamic load resulting from acceleration and deceleration of the train;
 - (iv) reactions from wheel assemblies resulting from friction and transverse movement of the conveyance; and
 - (v) loading and unloading of the conveyance.