

Australian Standard™

Cranes, hoists and winches

**Part 6: Guided storing and retrieving
appliances**



This Australian Standard was prepared by Committee ME-005, Cranes. It was approved on behalf of the Council of Standards Australia on 30 June 2004. This Standard was published on 2 September 2004.

The following are represented on Committee ME-005:

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Australian Elevator Association
Australian Industry Group
Australian Institute for Non-destructive Testing
Bureau of Steel Manufacturers of Australia
Construction and Mining Equipment Association of Australia
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RECONFIRMATION

OF

AS 1418.6-2004

Cranes, hoists and winches

Part 6: Guided storing and retrieving appliances

RECONFIRMATION NOTICE

Technical Committee ME-005 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

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NOTES

Australian Standard™

Cranes, hoists and winches

Part 6: Guided storing and retrieving appliances

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-005, Cranes, to supersede AS 1418.6—1988.

The 1988 edition was reviewed by the Committee, and it was found to be technically valid. Hence, this edition does not include technical alterations to the 1988 edition; however, the referenced documents have been updated, and editorial changes have been made to align with current Standards Australia policy.

This Standard covers specific requirements for guided storing and retrieving appliances and is intended for use in conjunction with AS 1418.1, *Cranes, hoists and winches*, Part 1: *General requirements*; however, requirements given herein take precedence over corresponding requirements of that Standard. Because of the complexity of the range of this family of equipment this Standard is at present restricted to the types designated as shown in Appendix A.

Where a total storing and retrieving system of appliances and racking is established and a variation to any element of the system, including the appliance(s), is required, a complete review of the total storing and retrieving system is to be made to ensure that it complies with all the requirements of this Standard. It should be noted that there are a number of racking systems, namely—

- (a) appliances with freestanding racking;
- (b) appliances with rack-clad buildings or shelf-clad buildings;
- (c) appliances with freestanding shelving; and
- (d) appliances with mobile racking.

All these systems are subject to regulations applied in accordance with Machinery Acts, Shop and Factory Acts, and with Local Government Acts relating to fire protection.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An informative appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Cranes, hoists and winches

Part 6: Guided storing and retrieving appliances

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements for guided storing and retrieving appliances of the storage and retrieval machine and universal stacker crane types as defined in AS 2549, for appliances intended to carry out similar functions, and for the interface between the elements of the total system, e.g., racking and the appliances. It does not apply to narrow aisle storage and retrieval machines of the top support bottom guided type, storage and retrieval trucks and industrial trucks complying with AS 2359, and gravity flow systems.

NOTES:

- 1 A chart showing types of guided storing and retrieving appliances within the scope of this Standard is given in Appendix A.
- 2 A guided storing and retrieving appliance may be referred to herein as ‘(an) (the) appliance’.

1.2 APPLICATION

Guided storing and retrieving appliances shall comply with the appropriate sections of this Standard.

This Standard is complementary to AS 1418.1, but the requirements given herein take precedence over corresponding requirements in that Standard.

1.3 REFERENCED DOCUMENTS

The documents below are referred to in this Standard.

AS

1359	Rotating electrical machines—General requirements (all parts)
1360	Rotating electrical machines of particular types or for particular applications
1418	Cranes hoists and winches
1418.1	Part 1: General requirements
1418.2	Part 2: Cranes (including hoists and winches)—Serial hoists and winches
1418.3	Part 3: Bridge and gantry cranes
1532	Short pitch transmission precision roller chains and chain wheels
1657	Fixed platforms, walkways, stairways and ladders—Design, construction and installation
1663	Method for dropweight test nil-ductility transition temperature of ferritic steels
2152	Rivetless chain, trolleys and trolley attachments
2359	Powered industrial trucks (all parts)
2549	Cranes (including hoists and winches)—Glossary of terms
2752	Preferred numbers and their use
2759	Steel wire rope—Application guide

AS/NZS

- 1768(Int) Lightning protection
- 1800 Occupational protective helmets—Selection, care and use
- 1801 Occupational protective helmets
- 1891 Industrial fall-arrest systems and devices (all parts)
- 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- 3100 Approval and test specification—General requirements for electrical equipment
- 3108 Approval and test specification—Particular requirements for isolating transformers and safety isolating transformers

BS

- 3114 Specification for alloy steel chain, grade 80, polished short link calibrated load chain for pulley blocks
- 4942 Short link chain for lifting purposes
- 4942.1 Part 1: Specification for general conditions of acceptance
- 4942.3 Part 3: Specification for grade M(4) calibrated chain

1.4 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 2549 apply.

S E C T I O N 2 M A T E R I A L S

2.1 SCOPE OF SECTION

This Section sets out requirements for materials used in the manufacture of guided storing and retrieving appliances.

2.2 MATERIALS FOR NORMAL TEMPERATURE ENVIRONMENTS

Materials used in the manufacture of an appliance that will be subject to normal temperature environments shall comply with the relevant requirements of AS 1418.1.

2.3 MATERIALS FOR LOW TEMPERATURE ENVIRONMENTS

Where suitable temperature-rated materials are used in the manufacture of an appliance that will be subjected to environments with temperatures less than 0°C, no testing shall be applied to such materials.

Steels selected for use in such an environment shall comply with the tests specified in AS 1663 provided that a 10° safety margin is allowed relative to the nominated operating temperature of the facility, i.e., where operating at –20°C the test temperature shall be –30°C.

NOTE: Materials used in the manufacture of an appliance that is subjected to environments with temperatures less than 0°C need special scrutiny as to fitness for purpose related to the specific applications and environments expected to be experienced both while operating and in the out-of-service condition.

SECTION 3 APPLIANCE DESIGN

3.1 SCOPE OF SECTION

This Section sets out general requirements for the design of guided storing and retrieving appliances.

3.2 CLASSIFICATION

The classification of an appliance shall be selected from the appropriate requirements of AS 1418.1 for classification, structure and mechanism, on the basis of a minimum design life of 10 years.

NOTE: Guidance on typical minimum classifications of an appliance is provided in Appendix B.

3.3 RANGE OF HOISTED LOADS

The hoisted load shall be in accordance with the R 10 series of preferred numbers specified in AS 2752, e.g.,—

250, 315, 400, 500, 630, 800, 1.0, 1.25, 1.6, 2.0, 2.5.

The hoisted load shall be expressed in tonnes or, for values less than 1 t, in kilograms.

3.4 RANGE OF WORKING VELOCITIES

The working velocities of the travel and hoist mechanisms (main and creep hoisting in metres per second) shall be in accordance with the R 10 series of preferred numbers specified in AS 2752, e.g.,—

1, 1.25, 1.6, 20, 25, 31.5, 40, 63, 80, 100, 125, 160.

3.5 DESIGN WORKING LOAD

The design working load shall be the mass of personnel, equipment and platform, designated dead load, materials, designated hoisted load, and dynamic allowances, as follows:

- (a) Dead load to include—
 - (i) total mass of the hoisting carriage and its accessories;
 - (ii) driver; and
 - (iii) mass of the load-carrying means (ropes, chains and the like).
- (b) Hoisted load to include—
 - (i) lifted load including load-safeguarding material such as shrinking foil and packing material; and
 - (ii) load make-up accessory, e.g., pallet.
- (c) Dynamic allowances to include—
 - (i) acceleration;
 - (ii) deceleration;
 - (iii) resistance of hoisting carriage to motion; and
 - (iv) effects due to emergency operation in all motions.

3.6 HANDLING OF THE HOISTED LOAD

3.6.1 Size of the hoisted load

The size of the hoisted load to be carried by the appliance shall not exceed the dimensions of the applicable elements of the design working load.

The profile of the hoisted load, including a pallet or container in good condition, where used, shall be within the tolerances of the applicable elements of the design working load.

3.6.2 Moving the hoisted load

The design of the appliance shall be based on an assumption that the following requirements apply to the moving of the hoisted load:

- (a) The placement of incoming hoisted loads into the storing and retrieving appliance system shall be within the tolerances specified by this Standard and, where applicable, the appliance manufacturer.
- (b) The driver of a cabin-operated appliance shall ensure that the hoisted load is properly aligned on the carriage.
- (c) The appliance manufacturer and the user of the storing and retrieving appliance system shall ensure that the stability of the hoisted load is achieved.
- (d) The driver shall not hoist or travel while anyone is on the carriage outside the cabin, except as approved or authorized.
- (e) The driver shall not carry hoisted loads over personnel.

For automated appliances the operation of the appliance shall be interlocked with sensing systems to prevent operation when the hoisted load is oversized, misaligned or askew.

SECTION 4 APPLIANCE STRUCTURE

4.1 SCOPE OF SECTION

This Section sets out requirements for the structure of guided storing and retrieving appliances.

4.2 CONSTRUCTION

The appliance structure shall comply with the requirements of AS 1418.1 for crane structures generally and additionally universal stacker cranes shall comply with the requirements in AS 1418.3 for structure.

4.3 SLENDERNESS RATIOS OF BRIDGE SECTION

For universal stacker cranes the slenderness ratio of the bridge section shall comply with the relevant requirements of AS 1418.3.

4.4 DEFLECTION

The limits of deflection shall comply with the specific requirements relating to operation, design criteria, clearances (see Section 5), and the interface between the elements of the total system.

NOTES:

- 1 This may involve vertical, lateral and torsional deflections, individually and collectively.
- 2 For automated appliances, the accuracy of alignment for loading and unloading, taking into consideration deflection and tolerances, individually and collectively, needs detailed evaluation.

4.5 AMBER

For universal stacker cranes, the camber shall comply with the relevant requirements of AS 1418.3.

4.6 MAST-TO-WHEELBASE RATIO

The ratio of the mast to wheelbase of a storage and retrieval machine shall be not greater than 7.

NOTE: The regulatory authority may approve another ratio.

4.7 BUFFERS, END STOPS, ANTI-DROP PADS AND ANTI-RISE BRACKETS

The buffers, end stops, anti-drop pads and anti-rise brackets used on an appliance or in association with an appliance shall comply with the relevant requirements of AS 1418.1 and the following:

- (a) *General* Anti-drop pads and anti-rise brackets, where provided, shall be designed and installed so that their performance is compatible with the safe and effective operation of the storing and retrieving appliance system.

The storing and retrieving appliance system shall be provided with buffers and runway end stops.

- (b) *Buffers* Buffer(s) shall be designed in accordance with the relevant requirements of AS 1418.1, except that they shall be capable of reducing the velocity of the storing and retrieving appliance to not greater than 70% of the design travel velocity.

Where the buffer(s) of a storing and retrieving appliance system comes in contact with another buffer or stop and the buffer(s) has reached the buffer working limit, no other part of the appliance shall come in contact with a part of another appliance or obstruction except the end stops (see Clause 14.5).

- (c) *Anti-drop pads* For an appliance or part of an appliance, means shall be incorporated in the structure of the appliance, or part of the appliance, to prevent it from falling more than 25 mm in the event of wheel or axle failure. In some circumstances, additional lateral restraint may be required.
- (d) *Anti-rise brackets* For bottom-supported appliances, anti-rise brackets shall be fitted to prevent the whole appliance rising more than 25 mm above its normal running surface.
- (e) *Lateral restraint* For a bottom-supported top-guided appliance, the top guiding assembly of the appliance shall have means incorporated in the structure of the appliance or part of the appliance to prevent it from moving more than 25 mm laterally in the event of wheel or axle failure.

4.8 FOUNDATIONS AND SUPPORTING STRUCTURE

The foundations and supporting structure of the appliance shall be capable of withstanding the loads imposed by the total storing and retrieving system.

4.9 TOP GUIDE RAIL

The top guide rail for a storage and retrieval machine shall be integral with the racking structure. The type, material, form and position of the top guide rail shall comply with the requirements of the storage and retrieval machine manufacturer.

NOTE: The racking manufacturer is normally responsible for the supply and installation of the top guide rail.

The racking structure shall be designed to support the top guide rail and be capable of withstanding the loadings and dynamic forces transmitted to the top guide rail from the storage and retrieval machine. The distance between the top guide rail supports shall comply with the requirements of the storage and retrieval machine manufacturer.

All tolerances relating to the top guide rail shall be compatible with the interface requirements between the storage and retrieval machine and the applicable elements of the total storing and retrieving system (see Clause 8.5). Flanges and webs of adjoining top guide rail sections shall align within ± 1 mm.

NOTE: Guidance on a typical top guide rail is provided in Appendix C.

SECTION 5 TOLERANCES AND CLEARANCES

5.1 SCOPE OF SECTION

This Section sets out requirements for appliance tolerances and clearances for the storing and retrieving total system.

NOTES:

- 1 Guidance on typical tolerances for the racking of the total system is set out in Appendix D.
- 2 Guidance on calculation of cumulative tolerances of the total system to determine clearances is set out in Appendix E.
- 3 For typical storage and retrieval machine layouts see Appendix F.
- 4 For typical storing and retrieving system layouts see Appendix G.

5.2 TOLERANCES AND CLEARANCES

The tolerances and clearances shall comply with the criteria given in Table 5.2 and Figure 5.2, provided that the bottom rail complies with the applicable requirements of AS 1418.1.

NOTES:

- 1 The top guide rail is normally provided with the racking and complies with the appliance manufacturer's specifications (see Clause 4.9).
- 2 Guidance on typical top guide rails and bottom support rails is given in Appendices C and H.

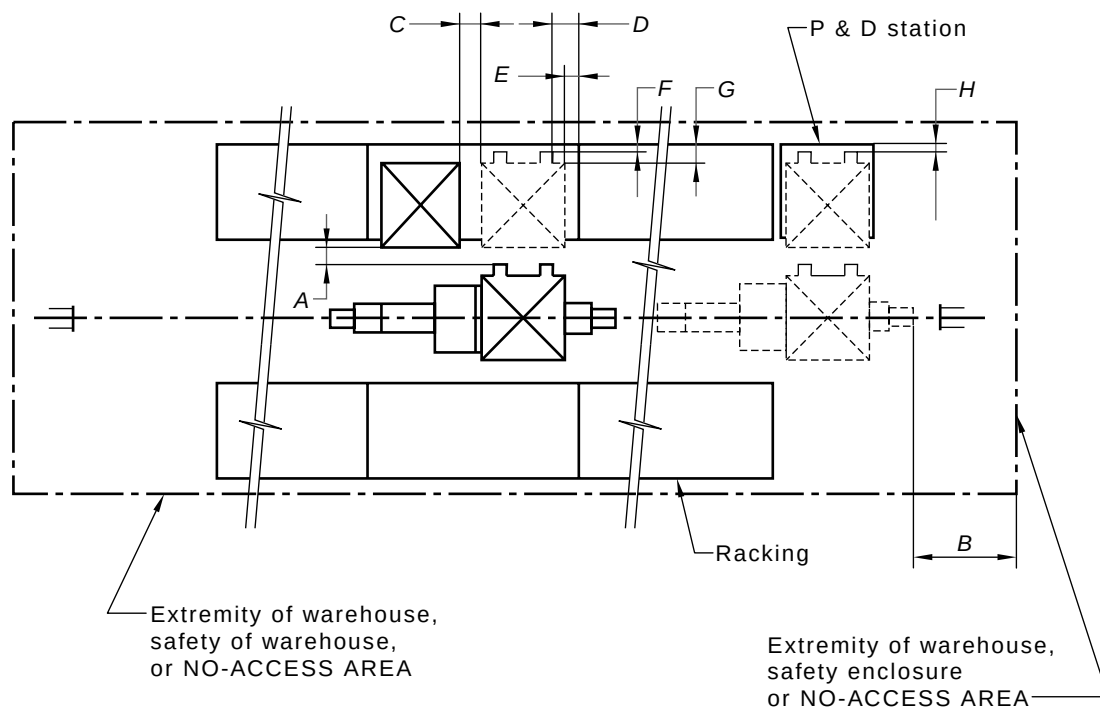
TABLE 5.2
TYPICAL TOLERANCES AND CLEARANCES
(see Figure 5.2)

Dimension (see Figure 5.2)	Description	Millimetres	
		Tolerances (see Note 1)	Clearances (see Note 1)
<i>A</i>	A part of the appliance or hoisted load nearest to the face of the rack, pick-up and despatch (P & D) station or stored load while travelling in the X-Y plane.	+20 –0	100
<i>B</i>	A part of the appliance or hoisted load nearest to the safety enclosure, wall or part of the building at the service and non-service ends:		
	(a) Height ≤2 m	Not applicable	600 min.
	(b) Height >2 m	Not applicable	450 min.
<i>C*</i>	Hoisted load to hoisted load in rack	—	—
<i>D*</i>	Forks to rack load support beam (see Figure E3.5.1, Appendix E)	—	—
<i>E*</i>	Hoisted load to rack column (see Figure E3.5.1, Appendix E)	—	—
<i>F*</i>	Forks to full traverse depth where forks project beyond hoisted load (see Note 2)	—	—
<i>G*</i>	Hoisted load to full traverse depth (see Note 2)	—	—
<i>H*</i>	Forks to full traverse depth when forks project beyond hoisted load at P & D station	—	—
<i>J</i>	A part of the appliance other than the top carriage assembly or hoisted load to underside of top guide rail (see Note 3)	Not applicable	50 min.
<i>K*</i>	Hoisted load to rack load beam or other fixed intrusions (see Note 4)	—	—
<i>L*</i>	Hoisted load to sprinklers (see Note 5)	—	—
<i>M</i>	Forks to rack load beam (see Figure E3.5.1, Appendix E)	See Note 6	See Note 6

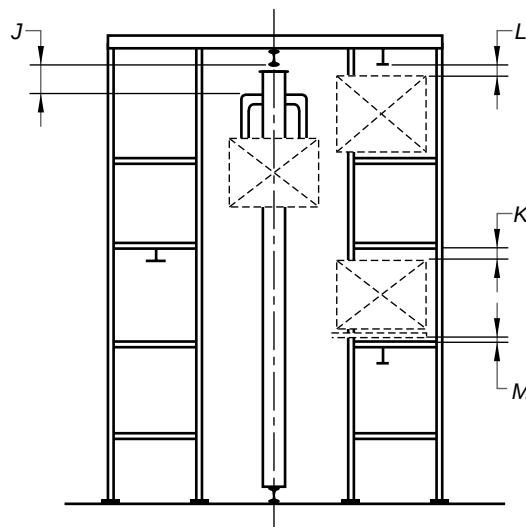
* Reference dimensions only, and may vary with each system.

NOTES:

- 1 The clearances and tolerances are to be assessed for each total system taking into consideration all features and functions of the various elements of the particular total system. Guidance is provided in Appendix E.
- 2 Where pairs of racks between adjacent aisles are provided with a sprinkle system, dimensions (*F*) and (*G*) and the clearance between the racks may have to be increased to accommodate sprinkler system requirements.
- 3 The minimum clearance (*J*) nominated applies after operation of the whole current limit.
- 4 The minimum clearance (*K*) to be specified is required operationally and no intrusion is permitted. A greater clearance may be required for the proper function of the sprinkler system dependent on the requirements of insurance organizations and authorities having jurisdiction.
- 5 The dimension (*L*) does not encompass any additional sprinkler system requirements for specific installations.
- 6 The dimension (*M*) is dependent on the design and manufacture of the fork.



(a) Top view



(b) Cross-section

FIGURE 5.2 TOLERANCES AND CLEARANCES

SECTION 6 ANCILLARY EQUIPMENT

6.1 SCOPE OF SECTION

This Section sets out requirements for ancillary equipment used on guided storing and retrieving appliances.

6.2 GENERAL

The various elements of the ancillary equipment for the total system shall comply with and be compatible with the requirements of this Standard to ensure safe and effective operation of the system as a whole.

NOTE: The ancillary equipment used in a total system may include either individually or in combination the following:

- (a) Pick-up and despatch station (P & D station).
- (b) Sprinkler system.
- (c) Racking system.
- (d) Shelving or binning system.
- (e) Flooring.
- (f) Building structure.
- (g) Top and bottom rail(s).
- (h) Conveyor systems.
- (i) Hoisted load size checking device.
- (j) Fencing and guarding.
- (k) Maintenance facilities.
- (l) Transfer system.

6.3 SAFETY ENCLOSURE

Where required, a safety enclosure shall be constructed of wire mesh or equivalent complying with the following requirements (see also Clause 14.5):

- (a) Mesh shall be either—
 - (i) 9 mm of wire thickness not less than 1.5 mm; or
 - (ii) 50 mm of wire thickness not less than 3 mm.
- (b) The enclosure shall be 1370 mm or 1800 mm high depending on the distance set back from the danger point, i.e., the storage and retrieval machine or load or both, the distance between the enclosure and the danger point being as follows:
 - (i) For a 1370 mm high enclosure, the distance shall be not less than 450 mm.
 - (ii) For an 1800 mm high enclosure, the distance shall be—
 - (A) for mesh up to and including 9 mm (i.e., the same as sheet metal), not less than the working clearance (see Clauses 5.2 and 14.5); or
 - (B) for mesh above 9 mm up to 50 mm, not less than 150 mm.

NOTE: Some authorities may limit the choice of enclosure height.

SECTION 7 CABINS, PLATFORMS AND LADDERS

7.1 SCOPE OF SECTION

This Section sets out requirements for cabins, platforms and ladders on guided storing and retrieving appliances.

7.2 CABINS

7.2.1 General

7.2.1.1 *Provision of cabin*

Where the appliance is capable of being operated from a position on the appliance, a cabin shall be provided. The cabin shall comply with the appropriate requirements of Clauses 7.2.2 to 7.2.6 and shall be either the fully enclosed cabin or partially enclosed cabin type.

NOTE: The cabin of a storing and retrieving appliance is normally carriage-mounted except for universal stacker cranes. The cabin for a universal stacker crane is generally mounted on a mast suspended from a crab or on a carriage suspended from the mast and ingress and egress is from floor level. The cabin is normally of a partially enclosed configuration.

7.2.1.2 *External working area*

Where an external working area on the carriage adjacent to the cabin is required, a platform shall be provided. The platform shall comply with the relevant requirements for platforms specified in AS 1657 (see Clause 7.3).

7.2.2 Cabin construction

The cabin construction shall comply with the following requirements:

- (a) The clear height inside the cabin for the driver shall be at least 1800 mm.
- (b) The cabin interior construction shall protect the driver from contact with knobs, edges, or corners in the event of sudden appliance accelerations or decelerations.
- (c) Windowpanes, where provided, shall be of approved safety type glass or equivalent.
- (d) The cabin shall be provided with a roof or an overhead guard for protection of the driver from falling objects.
- (e) The cabin shall be constructed and installed so that sway or vibration will not affect the safe and effective operation of the appliance.
- (f) For a cabin with a driver ingress and egress door or gate that opens outwards, a platform of width not less than the door or gate width shall be provided, as an extension of the cabin floor. The door or gate shall be interlocked to prevent appliance motion until the door or gate is closed.
- (g) For a cabin with a driver ingress or egress door or gate that opens inwards or is of the sliding type, an external platform is not required. The door or gate shall be interlocked to prevent appliance motion until the door or gate is closed.
- (h) Emergency egress shall be provided directly from the cabin to the floor of the building or other approved location for all positions of a carriage-mounted cabin. Where emergency egress by means of a fixed ladder is selected, the requirements of Clause 7.4.2 shall apply.

- (i) While the appliance is in motion, the driver shall be wholly contained within the cabin and, for a partially enclosed cabin, the design shall ensure compliance with the following requirements, as appropriate:
 - (i) The driver shall have both hands on the controls to initiate and continue motion.
 - (ii) For a universal stacker crane, the requirements of Item (i) shall apply.
 - (iii) For a narrow aisle appliance, the requirements of Item (i) shall apply and additionally a back-pressure switch or other approved means shall be provided.

NOTE: Effective physical protection approved by the statutory authority may be provided as an alternative.
 - (iv) For a narrow aisle appliance where picking is involved with a raising work table, the requirements of Item (iii) shall apply. Additionally, when the appliance is raising and lowering through the shear range, both feet of the driver shall engage separate foot-operated controls.

Failure to maintain constant pressure on any of these controls (i.e., backrest switch and on all four limbs) shall bring the appliance to a stop when in motion or shall prevent motion when at rest.
- (j) Means shall be provided to prevent horizontal displacement of the hoisted load, on a carriage or raising work table, toward the driver, e.g., an upturned edge on a ball-type raising work table.
- (k) Materials used in the construction of the cabin shall be primarily self-extinguishing or non-combustible.

7.2.3 Fire extinguisher

A fire extinguisher shall be permanently located in the cabin and shall be of a type specified in AS 1418.1.

7.2.4 Thermal environment

The requirements for thermal environment shall comply with the appropriate requirements of AS 1418.1 and, in addition, when an appliance is to operate in a cool room or cold room, the driver shall be effectively protected to ensure that safe and effective operation of the appliance is achieved.

7.2.5 Communications

Where a means of communication is provided, it shall comply with the appropriate requirements of AS 1418.1, and may be one of the following:

- (a) Radio.
- (b) Telephone.
- (c) Radiotelephone.
- (d) Walkie-talkie.

NOTE: The means of communications is the province and the responsibility of the owner/user of the appliance and licences may be required dependent on frequency and range of operation.

7.2.6 Emergency warning devices

Emergency warning devices may be provided to allow the driver to be alerted by personnel at ground level either in the immediate precincts or in a remote location.

NOTE: The warning devices should be aural and may be supplemented by visual indication.

7.3 PLATFORMS

Any platform on an appliance shall comply with the relevant requirements of AS 1657.

A platform shall be provided where the door or gate to the cabin opens outwards. The platform shall be an extension of the cabin floor and be of not less than the width of the door or gate.

NOTE: Platforms may also be required for the following purposes:

- (a) Cabin ingress and egress.
- (b) Working areas as extensions of the cabin.
- (c) Maintenance.
- (d) Inspection.

Platforms are not required on the appliance where all equipment requiring access is accessible from one or a combination of the following:

- (i) The standing surface.
- (ii) A remote permanent platform.
- (iii) An ingress and egress facility.

7.4 LADDERS

7.4.1 General

Ladders on the appliance shall comply with the requirements for fixed ladders specified in AS 1657 except as otherwise required by Clause 7.4.2, for the following functions:

- (a) Ingress and egress to a maintenance or inspection platform(s) which is installed on the appliance.
- (b) Emergencies.

7.4.2 Emergency ladders

For emergencies, emergency ladders shall be of the fixed type and comply with AS 1657, except that they may be vertical without cages and intermediate landings.

An emergency safety device, which incorporates safety belts or harnesses complying with AS/NZS 1891, friction brakes or sliding attachments compatible with the design requirements of the ladders that they serve, shall be provided.

7.5 CABIN INGRESS AND EGRESS

The provision of ingress and egress to the standing surface of the cabin, whether integral or remote from the cabin, shall be in accordance with the requirements of AS 1657.

7.6 DRIVER CONTROLS AND INDICATORS

7.6.1 Location and operation of controls

Controls shall comply with the relevant requirements of AS 1418.1.

Control equipment shall be located in the cabin so that all devices necessary to select, initiate, or terminate an automatic cycle or to start or stop each manually controlled operation are within convenient reach of the driver.

7.6.2 Interlocking of controls

Controls shall comply with the relevant requirements of AS 1418.1 and Clause 10.10.2.

7.6.3 Controls and indicators for ancillaries

Controls and indicators for ancillaries, where required, shall comply with the relevant requirements of AS 1418.1 and the applicable clauses of this Standard.

SECTION 8 APPLIANCE MECHANISMS

8.1 SCOPE OF SECTION

This Section sets out requirements for appliance mechanisms and related components for guided storing and retrieving appliances.

8.2 MOTION LIMITS, INDICATORS AND WARNING DEVICES

Motion limits, indicators and warning devices shall comply with the relevant requirements of AS 1418.1 and Section 10 of this Standard.

Depending on the mode of operation and application of the appliance some or all of the following limit switches or limit devices shall be provided as indicated:

- (a) Hoist lower working limit.
NOTE: The hoist lower working limit switch or device may not be required where a slack rope limit switch is provided and where its exclusion is approved.
- (b) Hoist upper working limit.
NOTE: The hoist upper working limit switch or device may not be required by some authorities, in which event the requirements of AS 1418.1 may apply.
- (c) Hoist upper final limit switch or device.
- (d) Slack rope limit switch or device.
- (e) Governor limit switch or device.
- (f) Broken rope limit switch or device.
- (g) Travel working limit switch or device.
NOTE: Where an appliance is captive in an aisle see also Clause 10.3.2.
- (h) Travel supervisory limit switch or device (see Clause 10.3.2).
- (i) Fork centre limit switch or device (see Clauses 10.3.3 and 10.10.2(a)).
- (j) For an automatically operated appliance, an additional fork centre limit switch or device (see Clause 10.10.2(f)).
- (k) Slew working limit switch or device.

8.3 DRUM AND SHEAVE DIAMETERS

Drum and sheave diameters shall comply with the relevant requirements of AS 1418.1, and shall have a minimum classification of M6, in accordance with AS 1418.1.

8.4 STEEL WIRE ROPES AND REEVED SYSTEMS

Steel wire ropes and reeved systems shall comply with the relevant requirements of AS 1418.1. Where personnel are supported by the steel wire rope, the safety factor shall be based on the minimum breaking load and shall be not less than 10 to 1 on the unfactored design working load, i.e., excluding dynamic allowances.