

Australian Standard<sup>®</sup>

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**Cranes (including hoists and winches)**

**Part 2: Serial hoists and winches**

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This Australian Standard was prepared by Committee ME/5, Cranes. It was approved on behalf of the Council of Standards Australia on 22 November 1996 and published on 5 January 1997.

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The following interests are represented on Committee ME/5:

Australian Chamber of Commerce and Industry  
Australian Elevator Association  
Australian Institute of Building  
Bureau of Steel Manufacturers of Australia  
Construction and Mining Equipment Association of Australia  
Crane Industry Council of Australia  
Department of Industrial Affairs, S.A.  
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**Part 2: Serial hoists and winches**

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## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/5 on Cranes, to supersede AS 1418.2—1990.

It is a consensus among representatives of this Committee that this document be produced as an Australian Standard only.

This Standard gives guidance to manufacturers on the minimum engineering requirements for the design of various types of serial hoists and winches.

This edition is a revision of the 1990 edition and incorporates the following changes:

- (a) Update of referenced documents.
- (b) Editorial changes in pursuance of Standards Australia editorial style.
- (c) Cognizance of ISO recommendations.
- (d) Restriction to the type of hoist permitted for carrying personnel.
- (e) Requirements for scaffolding hoists brought in line with European requirements.

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# STANDARDS AUSTRALIA

## Australian Standard

### Cranes (including hoists and winches)

#### Part 2: Serial hoists and winches

## SECTION 1 SCOPE AND GENERAL

**1.1 SCOPE** This Standard specifies requirements for serial hoists and winches.

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

The requirements for the safe use of serial hoists and winches are given in AS 2550.1.

**1.2 NEW DESIGN AND INNOVATIONS** This Standard does not preclude the use of novel materials, designs, methods of assembly, procedures and the like which do not comply with a specific requirement of the Standard, or are not mentioned in it, but which can be shown to give equivalent or superior results to those specified.

**1.3 APPLICATION** Serial hoists and winches shall comply with Section 1 and with the following Sections, as applicable:

- (a) Section 2 Manually operated chain hoists (chain blocks and lever hoists).
- (b) Section 3 Power-operated chain hoists (chain blocks).
- (c) Section 4 Power-operated wire rope hoists.
- (d) Section 5 Scaffolding hoists.
- (e) Section 6 Creeper winches.
- (f) Section 7 Manually operated drum winches.
- (g) Section 8 Power-operated drum winches.
- (h) Section 9 Trolleys.

Any hoist which is used to support personnel shall incorporate the design requirements of Section 5.

**1.4 REFERENCED DOCUMENTS** The following documents are referred to in this Standard:

AS	
1000	The International System of Units (SI) and its application
1418	Cranes (including hoists and winches)
1418.1	Part 1: General requirements
1532	Short pitch transmission precision roller chains and chain wheels
1831	Iron castings—Spheroidal or nodular graphite cast iron
2549	Cranes (including hoists and winches)—Glossary of terms
2550	Cranes—Safe use
2550.1	Part 1: General requirements

AS	
2752	Preferred numbers and their use
3569	Steel wire ropes
3777	Shank hooks and large-eye hooks—Maximum 25 t
AS/NZS	
ISO 8402	Quality management and quality assurance—Vocabulary
ISO	
3077	Short link chain for lifting purposes—Grade T (8), calibrated, for chain hoists and other lifting appliances
4779	Forged steel lifting hooks with point and eye for use with steel chains of grade M (4)
7597	Forged steel lifting hooks with point and eye for use with steel chains of grade T (8)
12482	Cranes—Condition monitoring
12482.1	Part 1: General
BS	
1726	Guide to the design and specification of coil springs Part 1: Guide for the design of helical compression springs
2903	Specification for higher tensile steel hooks for chains, slings, blocks and general engineering purposes
DIN	
5684	Calibrated and tested round steel link chains for lifting purposes Part 1: Grade 5 Part 2: Grade 6 Part 3: Grade 8
15400	Lifting hooks—Mechanical properties, load capacities, stresses and materials
JIS	
B 2803	Hooks

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

## 1.6 DESIGN

**1.6.1 Interchangeability of components** All corresponding components of the same model of serial hoist or winch should be interchangeable.

**1.6.2 Manual operating effort** The operating effort necessary to handle the rated capacity of an appliance shall be not greater than the appropriate value given in Table 1.6.2. For drum type serial hoists and winches, the design load shall include the maximum amount of rope that is capable of being wound on the drum.

Crank handles shall have an operating radius not greater than 400 mm.

**1.6.3 Basis of design** The design of a serial hoist or a winch shall comply with the requirements for crane mechanisms of AS 1418.1 on the following basis:

- (a) *Manually operated*—strength basis only.
- (b) *Power-operated*—
  - (i) strength basis; and
  - (ii) life (fatigue or wear or both).



**TABLE 1.6.2**  
**MANUAL OPERATING EFFORT**

Type of operating mechanism	Maximum manual operating effort N
Crank handle	250
Endless chain	500
Lever, horizontally operated	300
Lever, vertically operated	400
Push trolley	450

**1.6.4 Design for strength** The design for strength of serial hoists and winches shall comply with—

- (a) the requirements for crane loads of AS 1418.1 except that for manually operated mechanisms the design may be based on static loading, i.e. the duty factors specified in AS 1418.1 need not be applied; and
- (b) the requirements for crane mechanisms of AS 1418.1 provided that they are capable of withstanding tests in accordance with Clause 1.11.3 (for manually operated serial hoists) or Clause 1.11.4 (for power-operated serial hoists).

**1.6.5 Design for life** The mechanism of a power operated serial hoist or a winch shall be designed to comply with the requirements given in Table 1.6.5.

**TABLE 1.6.5**  
**CLASSIFICATION OF MECHANISMS OF SERIAL HOISTS AND WINCHES**

Classification	Nominal load spectrum factor* ( $K_m$ )	Rated life $h$
M1	0.50	200
M2	1.0	200
M3	1.0	400
M4	1.0	800
M5	1.0	1 600
M6	1.0	3 200
M7	1.0	6 300
M8	1.0	≥12 500

\* See AS 1418.1.

NOTES:

- 1 The manufacturer's designed mechanism classification is marked on the appliance in accordance with the relevant marking requirements.
- 2 Where the mechanism classification determined in accordance with AS 1418.1 for a specific application differs from the classification marked on the appliance, reference to the manufacturer or supplier is required for advice on the suitability of the appliance.
- 3 Devices are available to enable actual recording of rated life of the serial hoist to enable assessment of the remaining rated life. Guidance on such devices is given in ISO 12482.1.

**1.6.6 Lubrication** Unless materials with inherent lubricating properties are used, the design of serial hoists shall ensure that all moving parts can be effectively lubricated.

## 1.7 COMPONENTS

**1.7.1 General** Components used to connect and assemble load sustaining parts shall be designed and fitted with positive means to prevent them developing conditions which may lead to reduced safety.

### 1.7.2 Hookblock

**1.7.2.1 Hooks** Hooks should comply with AS 3777, ISO 4779, ISO 7597, BS 2903, DIN 15400, or JIS B 2803, or shall have strength and deflection characteristics not less than those specified therein for a hook of the same rated capacity. Hooks shall have provisions for the fitting of safety catches.

Safety catches shall be provided for all hooks which are intended to support personnel.

Hooks shall be secured by suitable means. Where a hook is supplied with a nut, the nut shall be fully secured.

**1.7.2.2 Crossheads for hooks** Crossheads shall be of single-piece steel construction.

**1.7.2.3 Suspension** Suspension, where fitted, shall comply with the following requirements:

- (a) *Bottom suspension*—the bottom suspension shall have a bearing which is capable of swivelling with the safe working load applied.
- (b) *Top suspension*—where the top suspension is required to swivel, it shall be fitted with a bearing which may incorporate friction washers. The top connecting hook of a hook suspended hoist shall be fitted with a safety catch or equivalent.

**1.7.3 Pawl and ratchet** Where a pawl is fitted, the following requirements shall apply:

- (a) Material shall provide the required wear resistance and toughness to comply with the requirements for the life of the equipment. With steel this is normally achieved by hardening and tempering. Where cast iron is used, it shall be spheroidal graphite complying with AS 1831.
- (b) The relative width and positioning of the ratchet wheel and the pawl shall be such as will ensure full engagement irrespective of wear on the friction faces of the brake.
- (c) Pawls shall either be spring-loaded or have equally effective means to ensure positive engagement with the ratchet wheel. Helical springs, where used, shall be designed in accordance with BS 1726.1 and provision shall be made for positive retention to prevent displacement by bowing.
- (d) The pawl shall be positioned so that engagement with the ratchet wheel is effected by gravity should its operating mechanism fail, unless an additional automatic holding device is fitted. Other devices may be used provided they achieve the same purpose. The pawl shall not be capable of rotating beyond its effective operating range.
- (e) Unless materials with inherent lubricating properties are used, provision shall be made for lubrication of the pawl pin.

**1.7.4 Mountings and attachment** Appropriate provision for attachment to the supporting medium shall be made on the serial hoist.

**1.8 ELECTRICAL EQUIPMENT AND CONTROLS** Electrical equipment and controls incorporated in serial hoists and winches shall generally comply with the requirements for electrical equipment and controls of AS 1418.1, except that deviations to motor dimensions are allowable to suit the particular arrangements of the manufacturer.

Where pendent cords are used, they shall be yoked or otherwise coupled together at the lower end.

**1.9 PNEUMATIC EQUIPMENT AND CONTROLS** Pneumatic equipment and controls incorporated in serial hoists and winches shall comply with the requirements for pneumatic equipment and controls of AS 1418.1.

Where pendent cords are used, they shall be yoked or otherwise coupled together at the lower end.

## 1.10 PERFORMANCE

**1.10.1 Rating values** The nominal magnitude of the various performance characteristics of the serial hoists or the winches should comply with the R 10 series of preferred numbers specified in AS 2752, i.e. the following values and multiples of 10 thereof should be used:

1.00	1.25	1.6	2.0	2.5
3.2	4.0	5.0	6.3	8.0

### 1.10.2 Load rating of serial hoists and winches

**1.10.2.1 Hoisting** The rated capacity, hoisting, shall be expressed in tonnes or, for values less than 1 t, in kilograms.

**1.10.2.2 Haulage** The haulage capacity shall be expressed in kilonewtons.

**1.10.3 Range of hoisting or haulage** The nominal range of hoisting or haulage shall be expressed in metres.

**1.10.4 Working speeds** For power-operated serial hoists and winches, the nominal working speeds shall be expressed in metres per minute.

## 1.11 TESTING

**1.11.1 General** The quality of design (as defined in AS/NZS ISO 8402) of each type model shall be verified by a type test (see Clause 1.11.2). The type test shall be conducted on one or more production units within the manufacturer's specifications.

NOTE: Drum winches are to be tested under the most adverse conditions of load for the particular design.

**1.11.2 Type test** Each type model of serial hoist or winch shall be subjected to the tests prescribed in Clause 1.11.3 for manually operated hoists and winches or Clause 1.11.4 for power-operated hoists and winches, except that a model manufactured to a purchaser's design specification and produced only in limited quantities need not be subjected to all of the tests but shall be subjected to such alternative test(s) as specified by the designer. Where there is only one unit made or for a large serial hoist or winch, the type test may take the form of a commissioning test.

Manually operated serial hoists and winches which have been subjected to type tests shall not be used or offered for use.

**1.11.3 Type tests for manually operated serial hoists and winches** Manually operated serial hoists and winches shall be subjected to the following tests:

- (a) A test load equal to the rated capacity shall be applied to the serial hoist or winch, and shall be hoisted or hauled for 30 cycles in a manner similar to that used in normal practice, through the test range of hoisting or haulage including the functioning of all operational devices. The test range shall be the design range of hoisting or hauling or 3 m, whichever is the lesser.

Drum hoists shall be tested while the maximum number of layers of wire rope specified by the manufacturer is wrapped around the drum.

A serial hoist or winch shall be considered to have passed this test, if it hoists or hauls, arrests and sustains the various test loads in any working position within the range of hoisting or haulage without visible or measurable permanent distortion.

- (b) A test load equal to twice the rated capacity shall be applied to the serial hoist or winch, and shall be hoisted or hauled through a distance sufficient to rotate the slowest moving part through not less than one complete revolution, without any part or component of the serial hoist or winch showing signs of permanent distortion or the serial hoist or winch becoming inoperative.
- (c) A static load equal to 4 times the rated capacity shall be applied for 15 min to the serial hoist or winch without distortion which may result in the release of the test load.

**1.11.4 Type test for power-operated serial hoists or winches** Power-operated serial hoists or winches shall be subjected to a test load equal to 1.25 times the rated capacity and shall be operated for 30 cycles through the range of hoisting or through 3 m, whichever is the lesser.

Drum hoists shall be tested while the maximum number of layers of wire rope specified by the manufacturer is wrapped around the drum.

A serial hoist or winch shall be considered to have passed this test, if it hoists or hauls, arrests and sustains the various test loads in any working position within the range of hoisting or haulage without visible or measurable permanent distortion.

**1.11.5 Operational test** Every serial hoist and winch shall have applied to it a test load equal to the rated capacity. The test load shall be hoisted or hauled through a distance sufficient to rotate the slowest moving part of the serial hoist or winch through not less than one complete revolution for manually operated hoists and winches or not less than two complete revolutions for power-operated hoists and winches. This test shall include the functioning of all operational devices of the serial hoist or the winch.

NOTE: For large serial hoists or winches, this test may take the form of a commissioning test.

The serial hoist or winch shall hoist or haul, arrest, and sustain the test load in any working position within the full range of hoisting or haulage without adverse effects on any component.

Scaffolding hoists shall be subjected to a test load equal to 1.25 times the rated capacity.

**1.12 MARKING** The marking of each type of serial hoist and winch shall be as specified in the appropriate Section of this Standard.

Marking shall be in plain English, and values shall be in SI units (see AS 1000).

NOTE: Manufacturers making a statement of compliance with this Australian Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

**1.13 TEST CERTIFICATE** Where required by the purchaser or regulatory authority, a test certificate shall be provided, and shall contain the following information about each serial hoist or winch:

- (a) Type model identification.
- (b) Serial number.
- (c) Description.
- (d) Classification of mechanism of serial hoist or winch where powered.
- (e) Rated capacity hoisting or hauling.
- (f) Test load applied.

The name and address of the manufacturer, the name and status of the signatory and the date of issue of the certificate shall be stated.

The certificate may be an appropriate statutory form.

NOTE: It is not considered necessary to provide individual test certificates for components of these hoists or winches.

**1.14 OPERATION AND MAINTENANCE INSTRUCTIONS** Manufacturers shall make available operation and maintenance instruction manuals or the like applicable to the appropriate type of serial hoist or winch.

## SECTION 2 MANUALLY OPERATED CHAIN HOISTS (CHAIN BLOCKS AND LEVER HOISTS)

**2.1 SCOPE OF SECTION** This Section specifies requirements for manually operated chain hoists.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

**2.2 DESIGN** The design of manually operated chain hoists shall be on a strength basis so that they are capable of withstanding without failure the tests of Clause 1.11.

### 2.3 COMPONENTS

**2.3.1 Hand chain wheel** The hand chain wheel shall be of a material of strength capable of withstanding the operational loads and suitable for use with the hand chain employed.

The hand chain wheel shall be provided with flanges and accurately shaped pockets for the reception of the hand chain.

**2.3.2 Load chain drive wheel** The load chain drive wheel shall be of a material of strength capable of withstanding the operational loads and suitable for use with the load chain employed. Except for iron castings to AS 1831, cast iron shall not be used.

The design of the load chain drive wheel shall provide effective operation with the load chain. The load chain drive wheel for link chain shall have accurately shaped pockets to fit the links of the load chain which shall operate freely and smoothly over the load chain drive wheel.

**2.3.3 Idler chain wheel** Any idler chain wheel shall be of a material of strength capable of withstanding the operational loads and suitable for use with the load chain employed.

For link chain, the design of the idler chain wheel shall ensure that the pitch diameter is not less than 16 times the nominal size of the chain unless the wheel is shaped so as to prevent any bending action on the link. Where the design of the idler chain wheel provides for pockets, the wheel shall have accurately shaped pockets to fit the links of the load chain which shall operate freely and smoothly over the idler chain wheel.

**2.3.4 Roller chain sprockets** The roller chain sprockets shall comply with AS 1532.

#### 2.3.5 Chain guides and strippers

**2.3.5.1 Chain guides and strippers for load chain drive wheels** The load chain drive wheel shall be equipped with chain guides and chain strippers. Where roller guides are used for this purpose, the edges of their centre grooves shall be radiused or chamfered to prevent damage to the load chain. The guides shall prevent displacement of the load chain from the wheel, and shall be effective where the chain hoist is used in positions other than the vertical.

**2.3.5.2 Chain guides for hand chain wheels** The hand chain wheel shall be fitted with a chain guide which shall effectively guide the hand chain into the pockets of the chain wheels, prevent jamming of the chain, prevent the hand chain from leaving the wheel, and effectively protect the wheel from falling debris and the like.

**2.3.5.3 Chain guides for idler chain wheels** Any idler chain wheel shall be provided with chain guides which shall be shaped so as to prevent the chain from twisting when it is passing around the wheel or from becoming dislodged from the wheel during transport or storage. Hookblocks shall have sheave guards to prevent a hand being caught between the chain and the chain sheave.

**2.3.6 Operation of lever chain hoist** The load shall be moved by the operation of a lever and the direction of movement shall be determined by means of a positive ratchet arrangement.

It shall be possible to change the direction of movement of the load chain without releasing the load.

Means shall be provided to allow the operator to move slack chain quickly to its required position when the hoist is not under load, but such means shall not operate when the hoist is under load conditions.

**2.3.7 Lever mechanism** The lever mechanism shall comply with the requirements of Clause 1.11.5 without distortion.

**2.3.8 Short-link load chain** Short-link calibrated load chain shall comply with ISO 3077, DIN 5684, Part 1 to Part 3, or other equivalent Standard. The minimum safety factor based on the minimum breaking load shall be—

- (a) for through-hardened chain with elongation greater than 10% . . . . . 4:1; or
- (b) for through hardened chain with elongation greater than 5% and less than 10%, and for surface-hardened chain . . . . . 5:1.

**2.3.9 Roller chain** Roller chain shall comply with AS 1532. The safety factor of the roller chain based on the minimum breaking load shall be not less than 5.

NOTE: Roller type chains are relatively stiff in a direction transverse to the plane of rolling, and should not be used where they may be subjected to side loading.

**2.3.10 Slack end anchorage** The load chain anchorage, associated fittings and framework at the slack end, under no-load conditions, shall be capable of withstanding at the anchorage an operating effort of 750 N on a hand chain or 600 N on a lever mechanism without permanent distortion of the connecting pin.

**2.3.11 Load chain terminal fittings** Any fitting used to connect the load chain to a load-carrying anchorage shall be of a strength equivalent to that of the load chain.

**2.3.12 Hand chain** Hand chain shall have a minimum nominal size of 4.5 mm, shall be of smooth finish, and, when used with pocketed wheels, shall be calibrated.

The hand chain shall be of adequate strength to withstand, without permanent deformation, a proof load of 3 times the maximum manual effort (see Table 1.6.2) required to hoist the rated capacity of the chain hoist.

The length of the hand chain shall be as shown in AS 2549.

**2.3.13 Hand chain joining link** The hand chain shall be joined without twist. The joining link shall be of the same material and dimensions as the hand chain, and may remain unwelded.

**2.4 MARKING** Each manually operated chain hoist shall be permanently and legibly marked with the following information:

- (a) Type model identification.
- (b) Serial or batch number.
- (c) Details of load chain as follows:
  - (i) Nominal size.
  - (ii) Grade (quality).
- (d) Rated capacity hoisting and where applicable hauling.
- (e) Name or identification mark of the manufacturer of the chain hoist.

## SECTION 3 POWER-OPERATED CHAIN HOISTS (CHAIN BLOCKS)

**3.1 SCOPE OF SECTION** This Section sets out requirements for power-operated chain hoists.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

**3.2 DESIGN** The design of power-operated chain hoists shall be on a strength and life basis in accordance with Clause 1.5 and with the requirements for crane mechanisms of AS 1418.1 so that they are capable of withstanding the tests of Clause 1.11 herein.

### 3.3 COMPONENTS

**3.3.1 Load chain drive wheel** The load chain drive wheel shall be of a material of strength capable of withstanding the operational loads and suitable for use with the load chain employed. Except for iron castings to AS 1831, cast iron shall not be used.

The design of the load chain drive wheel shall be such as will provide effective operation with the load chain. The load chain drive wheel for link chain shall have accurately shaped pockets to fit the links of the load chain, which shall operate freely and smoothly over the load chain drive wheel.

**3.3.2 Idler chain wheel** Any idler chain wheel shall be of a material of strength capable of withstanding the operational loads and suitable for use with the load chain employed.

For link chain, the design of the idler chain wheel shall ensure that the pitch diameter is not less than 16 times the nominal size of the chain unless the wheel is shaped to prevent any bending action on the link. Where the design of the idler chain wheel provides for pockets, the wheel shall have accurately shaped pockets to fit the links of the load chain which shall operate freely and smoothly over the idler chain wheel.

**3.3.3 Roller chain sprockets** The roller chain sprockets shall comply with AS 1532.

#### 3.3.4 Chain guides and strippers

**3.3.4.1 Chain guides and strippers for load chain drive wheels** The load chain drive wheel shall be equipped with chain guides and chain strippers. Where roller guides are used for this purpose, the edges of their centre grooves shall be radiused or chamfered to prevent damage to the load chain. The guides shall prevent displacement of the load chain from the wheel, and shall be effective where the chain hoist is used in positions other than the vertical.

**3.3.4.2 Chain guides for idler chain wheels** Any idler chain wheel shall be provided with chain guides which shall be shaped to prevent the chain from twisting when it is passing around the wheel or from becoming dislodged from the wheel during transport or storage. Hookblocks shall have sheave guards to prevent a hand being caught between the chain and chain sheave.

**3.3.5 Chain collector** Slack chain should be freely suspended. Where necessary, a chain collector should be fitted. The chain collector shall be designed so as to permit the chain to enter the chain hoist in a manner that does not damage the chain or chain hoist. Provision shall be made for the attachment of such a collector.



**3.3.6 Short-link load chain** Short-link calibrated load chain shall comply with ISO 3077, DIN 5684, Parts 1 to 3 or other equivalent Standard. The minimum safety factor based on the minimum breaking load shall be—

- (a) for through-hardened chain with elongation greater than 10% . . . . . 5:1; or
- (b) for through-hardened chain with elongation greater than 5% and less than 10%, and for surface-hardened chain . . . . . 6:1.

In circumstances where the appliance is to be used for a mechanism classification different from that marked on the appliance by the manufacturer, it is important to maintain the above safety factor requirements.

**3.3.7 Roller chain** The roller chain shall comply with AS 1532. The safety factor of the roller chain based on the minimum breaking load shall be not less than 5.

NOTE: Roller type chains are relatively stiff in a direction transverse to the plane of rolling, and should not be used where they may be subjected to side loading.

**3.3.8 Clutches** Where slipping clutches are fitted as limiting devices, they shall not be set to greater than 1.25 times the rated capacity of the hoist.

**3.3.9 Slack end anchorage** All the components of the slack end anchorage (i.e. the load chain anchorage, associated fittings, and framework) shall withstand 2.25 times the rated capacity of the single fall of chain without permanent distortion of the connection.

**3.3.10 Load chain terminal fittings** Any fitting used to connect the load chain to a load-carrying anchorage shall be of strength equivalent to that of the load chain.

### 3.3.11 Motion limits

**3.3.11.1 General** A limit shall be provided on all power-operated hoists to limit the hook at each end of range of hoisting.

Limits shall be automatic in operation and positive in action. The operation of the limit shall not depend upon force provided by a spring or springs where the failure of such springs may render the limit inoperative.

**3.3.11.2 Top limit** The top limit which limits the upward travel of the hook shall either comply with AS 1418.1 or consist of a slipping clutch.

In applications where frequent operations of the final limit device will occur, final limit devices should be preceded by a working limit switch.

**3.3.11.3 Bottom limit** The bottom limit which limits the down travel of the hook shall take the form of—

- (a) a whole current switch;
- (b) a control circuit type switch; or
- (c) a slipping clutch.

The limit shall reset automatically upon return of the motion to normal operating range, and operation of such a limit shall not prevent reversal of the motion.

**3.4 MARKING** Each power-operated chain hoist shall be permanently and legibly marked with the following information:

- (a) Type model identification.
- (b) Serial number.
- (c) Details of load chain as follows:
  - (i) Nominal size.
  - (ii) Grade (quality).

- (d) Classification of mechanism of the chain hoist.
- (e) Rated capacity hoisting.
- (f) Name or identification mark of the manufacturer of the chain hoist.
- (g) Power supply requirements.

## SECTION 4 POWER - OPERATED WIRE ROPE HOISTS

**4.1 SCOPE OF SECTION** This Section sets out requirements for power-operated wire rope hoists.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

**4.2 DESIGN** The design of power-operated wire rope hoists shall be on a strength and life basis in accordance with Clause 1.5 and with the requirements for crane mechanisms of AS 1418.1 so that they are capable of withstanding the tests of Clause 1.11 herein.

### 4.3 COMPONENTS

**4.3.1 Guarding of hookblock sheaves** The hookblock shall have sheave guards to prevent a hand being caught between the wire rope and the wire rope sheave.

**4.3.2 Rope angle** The rope angle ( $\alpha$ ) should not exceed 45 degrees (see Figure 4.3.2). The included angle shall be taken into account in the determination of the minimum rope breaking load.

**4.3.3 Drum** The drum shell thickness shall comply with the requirements of AS 1418.1.

**4.3.4 Wire rope** Wire ropes shall comply with AS 3569 or the appropriate ISO, CEN, BSI, DIN, ASTM or JIS Standards. Lang's lay ropes other than non-rotating ropes (see AS 3569) shall not be used.

NOTE: The use of non-rotating ropes should be avoided unless they are required on a long hook path to avoid crossing ropes.

**4.3.5 Rope guide** Wire rope hoists shall be provided with a device which ensures the rope(s) being correctly wound on the drum.

**4.3.6 Drum anchorage** All rope-end fastening devices which are used for steel wire ropes shall have a safety factor of not less than 5 including the effect of rope friction. Where rope friction is taken into account, a friction coefficient ( $\mu$ ) of 0.1 shall be applied (see AS 1418.1).

**4.3.7 Drum and sheave diameter** The drum and sheave diameters shall comply with AS 1418.1.

A hoist may be derated and reclassified. To maintain the original drum, sheaves and rope, the ratio between the sizes of these components and those sizes required for the new rating and classification in accordance with AS 1418.1 shall not exceed 1.25.

**4.3.8 Motion limits** The motion limits shall be provided in accordance with the requirements specified in Clause 3.3.11.

**4.4 MARKING** Each wire rope hoist shall be permanently and legibly marked with the following information:

- (a) Type model identification.
- (b) Serial number.
- (c) Details of steel wire rope used on hoist as follows:
  - (i) Nominal size.
  - (ii) Grade (quality).

- (iii) Construction.
- (iv) Length.
- (d) Classification of mechanism of the wire rope hoist.
- (e) Rated capacity hoisting.
- (f) Name or identification mark of the manufacturer of the wire rope hoist.
- (g) Power supply requirements.

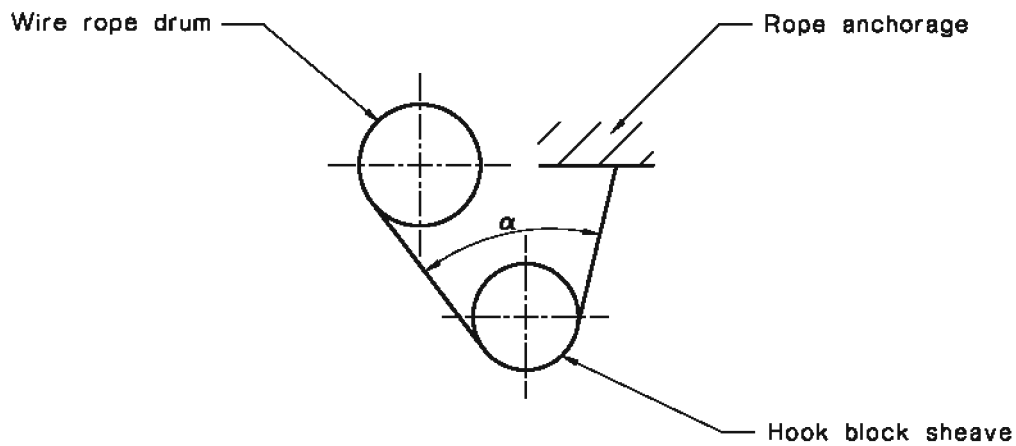


FIGURE 4.3.2 ROPE ANGLE

## SECTION 5 SCAFFOLDING HOISTS

**5.1 SCOPE OF SECTION** This Section sets out requirements for scaffolding hoists.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

A scaffolding hoist is one which is operated by personnel from a platform which it supports.

**5.2 RATING** Scaffolding hoists shall be rated according to their rated capacity in kilograms.

NOTE: It is recommended that the R 20 series of preferred numbers be used for the purposes of uniformity. The scaffolding hoists should be designed for rated capacities of—

280 kg, 355 kg, 450 kg, 560 kg, 710 kg.

### 5.3 DESIGN

**5.3.1 Basis of design** Scaffolding hoists shall be designed to comply with Clause 1.6, with the requirements of AS 1418.1 for crane mechanisms and with the requirements of this Section as applicable.

**5.3.2 Design life of mechanism for power-operated scaffolding hoists (fatigue and wear)** The design life of the mechanism of power-operated scaffolding hoists shall comply with classification M6 of Table 1.6.5.

**5.3.3 Design strength of mechanism for power-operated and manually operated hoists** Where scaffolding hoists are equipped with emergency stopping devices, no component or part exposed to the influence of the impact forces upon the application of the device shall be stressed beyond 75 percent of the yield stress.

NOTE: This requirement may be considered to be complied with where such components or parts show no permanent deformation when subjected to the influence of a load of 1.33 times the rated capacity.

**5.3.4 Manual operation** Manually operated scaffolding hoists shall be designed so that—

- (a) a positive force on the mechanism is required to lift and lower the load; and
- (b) rapid handle movement, fast unreeling or uncontrolled descent does not occur.

**5.3.5 Gripping-jaw mechanism** The gripping-jaw mechanism shall not kink, distort, or damage the wire rope.

**5.3.6 Slipping clutch** A slipping clutch shall not be provided in a device used for the support of personnel, and no form of clutch shall be used which can be unintentionally disengaged.

**5.3.7 Traction sheave hoist** Traction sheave hoist mechanisms shall be designed to lift and lower the load without the aid of external forces applied to the tail end of the wire rope. The rope shall not slip on the traction sheave at a load equal to 1.5 times the rated capacity.

**5.3.8 Emergency retrieval** Power-operated scaffolding hoists shall incorporate a mechanism to provide means of safe and controlled emergency retrieval of a working platform supported by the hoist. Retrieval shall require the ability to raise and lower the platform.

**5.3.9 No-power ascent or descent for power-operated hoists** Power-operated scaffolding hoists shall have a manually operated facility to enable controlled ascent or descent of a working platform, supported by the hoists in the event of failure of the motive power. Where this facility involves a manual crank, it shall be operated without danger to the operator. Where descent is affected by manual release of the hoist brake, the heat so generated shall not affect the safe working of the brake.

## 5.4 COMPONENTS

**5.4.1 Gears** Gears shall comply with the requirements specified in AS 1418.1 and, except for iron castings to AS 1831, cast iron shall not be used.

**5.4.2 Ropes and reeved systems** Ropes and reeved systems shall comply with the requirements of AS 1418.1 except that—

- (a) the minimum diameter of the wire rope shall be not less than 8 mm; and
- (b) the safety factor of the wire rope based on the minimum breaking load shall be not less than—
  - (i) for hand-operated scaffolding hoists . . . . . 7; or
  - (ii) for power-operated scaffolding hoists . . . . . 10.

### 5.4.3 Load-holding devices

**5.4.3.1 General** Scaffolding hoists shall be equipped with two independent load-holding devices and each independent system shall be capable of withstanding the appropriate full test load prescribed in either Clause 5.7.2 or 5.7.3.

All load-holding devices which require manual effort to keep them disengaged during operation of the hoist shall—

- (a) be under the sole control of the operator;
- (b) be capable of being held out of engagement without the need for relaxing the operator's grip on the operating lever or handle of the hoist;
- (c) automatically return to the effective engaged position on relaxation of the operator's grip on the load-holding device;
- (d) be interlocked so that power may not be reintroduced when the load-holding device has returned to the effective engaged position; and
- (e) incorporate means to lower the scaffold in a controlled manner when power is lost.

**5.4.3.2 Manually operated scaffolding hoists** Manually operated scaffolding hoists shall be equipped with a spring-actuated pawl engaging a ratchet mounted on or integral with the drum or traction sheave shaft, and the other load-holding device shall be one of the following, as appropriate:

- (a) *For a lever-operated hoist*—a spring-actuated pawl engaging an additional ratchet mounted on or integral with the drum, or mounted on or integral with the hand or primary shaft.
- (b) *For a crank-handle-operated hoist*—an automatic brake operating on the hand or primary shaft, or, where a worm gear drive is used with the worm incorporated in the hand or primary shaft, a spring-actuated or gravity-actuated lock which automatically engages and retains the hand lever or handle at its lowest position.

**5.4.3.3 Power-operated scaffolding hoists** Power-operated scaffolding hoists shall be equipped with an automatic service brake and an automatic holding brake or holding device.

The automatic holding brake or holding device shall be capable of arresting the motion and sustaining the load in the event of the service brake being incapable of controlling the motion.

**5.4.4 Mechanism enclosures** Mechanism enclosures shall adequately protect personnel from inadvertent injury and protect the mechanism from falling debris and the like. Such mechanism enclosures shall not prevent the engaged condition of the pawls and the wound condition of the wire rope on the drum from being viewed, except where some other additional type of automatic holding device is fitted whose engaged condition may be viewed.

**5.4.5 Rope guides** Scaffolding hoists which operate on the wrap-traction drive principle shall be equipped with rope guides which ensure that the rope remains at all times within the sheave grooves and is effectively guided at its emergence from the final groove. Such guides shall be adequately rounded where they are in contact with the rope.

Entrance to holes through which ropes pass shall also be rounded.

**5.4.6 Rope stop** A rope stop shall be provided to prevent the rope from being totally unwound from the scaffolding hoist during operation.

**5.5 ELECTRICAL EQUIPMENT** The electrical equipment of a scaffolding hoist shall comply with the requirements for electrical equipment and controls of AS 1418.1.

Where electrically powered hoists are fitted with an emergency crank handle, use of the crank handle shall automatically cause power to be disconnected from the motor.

## 5.6 EQUIPMENT CONTROLS

**5.6.1 Operating controls** The controls of each power-operated scaffolding hoist shall be constructed and designed so that one person is able to actuate the controls by one-hand operation. Such controls when released shall automatically return to the neutral position and effectively interrupt the power supply. Control switch contacts shall be mechanically linked for the control handle to effect positive opening of the contacts. Spring assistance is permitted. All control gear shall be fail-safe.

**5.6.2 Emergency retrieval controls** When the emergency retrieval mechanism of a power-operated scaffolding hoist is used, the power shall be disconnected automatically from the motor.

## 5.7 TESTING

**5.7.1 General** The testing of scaffolding hoists shall be in accordance with Clause 1.11 except for the requirements of Clauses 5.7.2 and 5.7.3.

**5.7.2 Type test for manually operated scaffolding hoist** A manually operated scaffolding hoist shall be subjected to the tests specified in Clause 1.11.3 except that for the test specified in Item (a) the distance shall be not less than 6 m.

Where rope slippage occurs with hoists which operate on the wrap-traction drive principle, during testing to Clause 1.11.3 Items (b) and (c), appropriate measures shall be taken to secure the rope so that every part of the hoist is subjected to the full test load (see Clause 5.3.3).

**5.7.3 Type test for power-operated scaffolding hoist** A power-operated scaffolding hoist shall be subjected to the test specified in Clause 1.11.4 except that the distance shall be not less than 6 m.

**5.8 MARKING** Each scaffolding hoist shall be permanently and legibly marked with the following information:

- (a) Type model identification.
- (b) Serial number.
- (c) Details of steel-wire rope used with the hoist as follows:
  - (i) Nominal size.
  - (ii) Grade (quality).
  - (iii) Construction.
  - (iv) Maximum length, where applicable.
- (d) Classification of mechanism of the scaffolding hoist.
- (e) Rated capacity hoisting.
- (f) Name or identification mark of the manufacturer of the scaffolding hoist.
- (g) Reeving requirements, where applicable.
- (h) Power supply requirements, where applicable.



## SECTION 6 CREEPER WINCHES

**6.1 SCOPE OF SECTION** This Section sets out requirements for manually operated and power-operated creeper winches.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

### 6.2 DESIGN

#### 6.2.1 General

**6.2.1.1 Manually operated creeper winches** The design of manually operated creeper winches shall be on a strength basis; they shall comply with Clause 1.6 and with the requirements for crane mechanisms of AS 1418.1 so that they are capable of withstanding the tests of Clause 1.11 herein.

**6.2.1.2 Power-operated creeper winches** The design of power-operated creeper winches shall be on a strength and life (fatigue and wear) basis and shall comply with Clause 1.6 and with the requirements for crane mechanisms of AS 1418.1 so that they are capable of withstanding the tests of Clause 1.11 herein.

**6.2.2 Movement** It shall be possible to change the direction of the load movement without releasing the load. This is normally achieved by a lever operation. Means shall be provided to allow rapid movements of slack rope to the required position when the creeper winch is not under load, but such means shall not operate under load conditions.

**6.2.3 Protection against overloading** Protection shall be provided on the 'UP' or 'PULL' direction operating mechanism to prevent overloading. Where shear pins are used, they shall be readily accessible, and the holding device shall be arranged so that in the event of the pin's shearing, the load will be arrested and sustained.

**6.2.4 Operation** The creeper winch shall arrest and sustain the load when the operating force is released. Operation of the mechanism shall not kink, distort or damage the wire rope.

### 6.3 COMPONENTS

**6.3.1 Wire rope** Wire ropes shall comply with AS 3569 or the appropriate ISO, CEN, BSI, DIN, ASTM or JIS Standards, and shall be of steel wire core or fibre core appropriate to the design of the hoist mechanism construction. A reel should be provided for the storage and transport of the winch rope.

The safety factor of the wire rope for power-operated creeper winches shall comply with AS 1418.1, and for manually operated creeper winches the safety factor based on the minimum breaking load shall be not less than 4.

**6.3.2 Hooks** Hooks used on creeper winches shall comply with Section 1, and shall be fitted with safety catches. Where the creeper winch is applied to hoisting, the load hook shall have a bearing which is capable of swivelling with the rated capacity applied.

### 6.4 TESTING

#### 6.4.1 Type test

**6.4.1.1 Manually operated creeper winches** The manually operated creeper winch shall be subjected to the tests prescribed in Clause 1.11.3 except the distance shall be not less than 1 m for Item (a) and 150 mm for Item (b). Where shear pins are used, special provision may be required to pass the test prescribed in Clause 1.11.3, Item (b).

**6.4.1.2** *Power-operated creeper winches* The power-operated creeper winches shall be subjected to the tests prescribed in Clause 1.11.4.

**6.4.2** **Operational test** The creeper winch shall be subjected to the test prescribed in Clause 1.11.5, except that in lieu of the one complete revolution a distance of not less than 150 mm shall be travelled.

**6.5** **MARKING** Each creeper winch shall be permanently and legibly marked with the following information:

- (a) Type model identification.
- (b) Serial number.
- (c) Details of steel wire rope used with creeper winch as follows:
  - (i) Nominal size.
  - (ii) Grade (quality).
  - (iii) Construction.
- (d) Rated capacity hoisting or hauling.
- (e) Name or identification mark of the manufacturer of the creeper winch.
- (f) Reeving requirements.
- (g) Power supply requirements, where applicable.

## SECTION 7 MANUALLY OPERATED DRUM WINCHES

**7.1 SCOPE OF SECTION** This Section sets out requirements for manually operated drum winches.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

### 7.2 DESIGN

**7.2.1 General** Manually operated ratchet lever drum winches are normally portable units consisting of a drum which is rotated by means of a ratchet and pawl arrangement attached to a lever. Another pawl is attached to the body of the winch and arranged so that during lowering this pawl is moved out of mesh by the pawl attached to the handle and the load is then held by the pawl on the handle. By this means, one pawl is engaged at all times during both the raising and lowering operations. The drum is generally supported by side plates and a hook is attached to the uppermost part of the side plates for the suspension of the winch. Steel wire rope is used as the lifting medium and a hook or similar device is attached to the end of such rope.

The design of manually operated drum winches shall be on a strength basis and shall comply with Clause 1.6 and with the requirements for crane mechanisms of AS 1418.1 so that they are capable of withstanding without failure the tests of Clause 1.11 herein.

Manually operated drum winches having an arrangement where one pawl is engaged at all times in a manner that prevents the drum from rotating freely under load, need not be provided with a service brake.

**7.2.2 Rope anchorage at drum** Rope anchorages shall comply with the following requirements:

- (a) The rope end anchorage at the drum shall be capable of withstanding without failure a load of twice the maximum design load of the hoist. Friction between the rope and the drum shall not be taken into account.
- (b) The type of anchorage used shall be capable of ready detachment from the rope so that it may be used again on a replacement rope.

**7.2.3 Safety factor** The safety factor based on the minimum breaking load of the steel wire rope shall be not less than 4.

NOTE: Other types of rope may require a higher safety factor.

**7.2.4 Rope movement** For ratchet lever type drum winches only, means shall be provided to allow rapid movements of slack rope to the required position when the drum winch is not under load, but such means shall not operate under loaded conditions.

### 7.3 COMPONENTS

**7.3.1 Mechanism enclosures** Where required, mechanism enclosures shall protect personnel from injury and protect the mechanism from falling debris and the like. Such mechanism enclosures shall not prevent the wound condition of the wire rope on the drum from being viewed.

**7.3.2 Rope retention on drum** For ratchet lever type drum winches, a suitable device shall be provided which will prevent the rope from building up on the drum and becoming displaced between the drum and the supporting side plates.

**7.3.3 Suspension** Suspensions for drum winches shall comply with the requirements of Clause 1.7.2.3 except that the bottom suspension does not require a swivel.

**7.3.4 Hooks** Hooks used on drum winches shall comply with Section 1, and shall be fitted with safety catches.

**7.4 MARKING** Each manually operated drum winch shall be permanently and legibly marked with the following information:

- (a) Type model identification.
- (b) Serial or batch number.
- (c) Details of rope used with drum winch (wire or fibre) as follows:
  - (i) Nominal size.
  - (ii) Grade (quality).
  - (iii) Construction.
  - (iv) Maximum length.
- (d) Rated capacity hoisting and hauling.
- (e) Name or identification mark of the manufacturer of the drum winch.
- (f) Reeving requirements.
- (g) Direction of rope winding.

## SECTION 8 POWER-OPERATED DRUM WINCHES

**8.1 SCOPE OF SECTION** This Section sets out requirements for power-operated drum winches.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

**8.2 DESIGN** The design of power-operated drum winches shall be on a strength and life basis in accordance with Clause 1.6 and with the requirements for crane mechanisms of AS 1418.1 so that they are capable of withstanding the tests of Clause 1.11 herein.

**8.3 MECHANISM ENCLOSURES** Where required, mechanism enclosures shall protect personnel from injury and protect the mechanism from falling debris and the like. Such mechanism enclosures shall not prevent the wound condition of the rope on the drum from being viewed.

**8.4 ELECTRICAL EQUIPMENT** The electrical equipment of a drum winch shall comply with the requirements for electrical equipment and controls of AS 1418.1.

NOTE: Mechanical limiting devices which fulfil the same functions may be used in lieu of electrical devices.

**8.5 MARKING** Each power-operated drum winch shall be permanently and legibly marked with the following information:

- (a) Type model identification.
- (b) Serial number.
- (c) Details of rope used with drum winch (wire or fibre) as follows:
  - (i) Nominal size.
  - (ii) Grade (quality).
  - (iii) Construction.
  - (iv) Maximum length.
- (d) Classification of mechanism of the power-operated drum winch.
- (e) Rated capacity hoisting and hauling.
- (f) Name or identification mark of the manufacturer of the drum winch.
- (g) Reeving requirements.
- (h) Power supply requirements.

## SECTION 9 TROLLEYS

**9.1 SCOPE OF SECTION** This Section sets out requirements for trolleys.

It is supplementary to Section 1, but the requirements given in this Section take precedence over corresponding requirements in Section 1.

**9.2 DESIGN** Manually operated and power-operated trolleys shall be designed on the basis of the requirements as specified in this Standard for the respective serial hoist which it is intended to support.

The trolley shall be designed so that it is safely retained on the monorail or runway in the event of—

- (a) failure of a wheel or axle; or
- (b) excessive lateral forces.

The trolley with its suspended load shall run freely and the manual effort required for movement in the direction of travel as applied by the respective methods shall comply with Clause 1.6.2.

### 9.3 TESTING

**9.3.1 Type test for integral manually operated or power-operated trolleys** The integral trolley is automatically type tested when the attached hoist is subjected to loads specified in Clause 1.11.3, Items (a), (b), and (c) for a manually operated hoist, or Clause 1.11.4 for a power-operated hoist, except that the loaded trolley shall travel not less than 1 m along the monorail or runway.

**9.3.2 Type test for other (non-integral) manually operated or power-operated trolleys** The type test to be applied to other (non-integral) manual or power trolleys shall be as follows:

- (a) A load as specified in Clause 1.11.3, Item (b) for a manually operated trolley or Clause 1.11.4 for a power-operated trolley, except that the loaded trolley shall travel not less than 1 m along the monorail or runway.
- (b) A static load as specified in Clause 1.11.3, Item (c).

**9.4 MARKING** Each non-integral trolley shall be permanently marked with the following information:

- (a) Type model identification (nominate if only for manually operated serial hoist).
- (b) Classification of mechanism (for power-operated trolleys only).
- (c) Rated capacity hoisting.
- (d) Name or identification mark of manufacturer of the trolley.
- (e) Range of monorail beam sizes which suit the trolley.
- (f) Power supply requirements where applicable.

NOTE: For an integral trolley, the hoist marking is deemed to include the trolley.



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