

Australian Standard[®]

Cranes, hoists and winches

Part 19: Telescopic handlers



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- Australian Chamber of Commerce and Industry
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- Australian Institute for Non-Destructive Testing
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- Australian Industrial Truck Association
-

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Part 19: Telescopic handlers

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PREFACE

This draft was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee ME-005, Cranes.

The objective of this Standard is to provide requirements for self-propelled telescopic handlers that are intended to handle loads using different types of attachments.

In the preparation of this Standard, cognizance was taken of BS EN 1459:1999, *Safety of industrial trucks—Self-propelled variable reach trucks* and AS 1418.5—2002, *Mobile cranes*.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Cranes, hoists and winches

Part 19: Telescopic handlers

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard applies to self-propelled non-slewing and slewing, not greater than 5° either side of the longitudinal axis, of seated rider-operated telescopic handlers (hereinafter referred to as ‘telehandlers’), as defined in Clause 1.3.31, intended to handle loads, including freely suspended loads, using one of the attachments defined in Clause 1.3.

NOTE: Attachments may be mounted directly on the lifting means or on an auxiliary mast fixed at the end of the lifting means.

Telescopic handlers with the ability to slew greater than 5° will have to comply with AS 1418.5 in addition to the requirements of this Standard (excluding the static stability testing procedures as defined in Clause 2.9 and Appendices B to F).

The use of the term ‘slew’ from hereon refers to those telehandlers that can slew up to five degrees, except where clearly stated otherwise.

In addition, all telescopic handlers intended to support work platforms will have to comply with AS 1418.10.

This Standard does not apply to industrial variable reach trucks (‘reach stackers’) designed to handle series 1 freight containers ≥6 m long with the dimensional and securing characteristics specified in ISO 668 and ISO 3874.

Telehandlers are also known by a variety of terms, such as ‘variable reach trucks’ and ‘multi-purpose handlers’.

Two types of telehandlers are covered in this Standard, as follows:

- (a) Telehandlers for operation on substantially firm smooth, level and prepared surfaces, known as ‘industrial telehandlers’.
- (b) Rough terrain telehandlers for operation on unimproved natural terrain and disturbed terrain or areas.

Telehandlers covered by this Standard may be equipped with fork tynes for normal industrial duties, or attachments for specific applications such as earth-moving buckets and jibs, and the like. Telehandlers may be equipped with stabilizer/outriggers, axle locking or lateral levelling devices.

For hazards occurring during construction, transportation, commissioning, decommissioning and disposal, reference should be made to ISO 12100-2.

Telehandlers manufactured to this Standard are designed to operate in a temperature range of -20°C to $+50^{\circ}\text{C}$. Telehandlers intended for use in more extreme temperatures shall be designed accordingly. The instructions shall include precautions to be taken when using the telehandler at extreme temperatures.

NOTES:

- 1 Requirements for the safe use of telescopic handlers defined in this Standard are given in AS 2550.19.
- 2 Appendix A provides a list of typical hazards associated with telehandlers.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|----------|---|
| 1418 | Cranes, hoists and winches |
| 1418.1 | Part 1: General requirements |
| 1418.5 | Part 5: Mobile cranes |
| 1418.10 | Part 10: Elevating work platforms |
| 2294 | Earth-moving machinery—Protective structures |
| 2294.2 | Part 2: Laboratory tests and performance requirements for roll-over protective structures |
| 2294.3 | Part 3: Laboratory tests and performance requirements for falling-object protective structures |
| 2294.4 | Part 4: Protective structures—Specifications for deflection-limiting volume |
| 2359 | Powered industrial trucks |
| 2359.1 | Part 1: General requirements |
| 2359.5 | Part 5: Control Symbols for operator controls and other displays |
| 2359.7 | Part 7: Terminology |
| 2359.9 | Part 9: High-lift rider trucks—Overhead guards—Specification and testing (ISO 6055:2004, MOD) |
| 2359.13 | Part 13: Brake performance and component strength |
| 2359.15 | Part 15: Fork-arm extensions and telescopic fork arms—Technical characteristics and strength requirements |
| 2402 | Traction batteries—Lead acid |
| 2402.1.1 | Part 1.1: Vented cells—Requirements |
| 2549 | Cranes (including hoists and winches)—Glossary of terms |
| 2550 | Cranes, hoists and winches—Safe use |
| 2550.19 | Part 19: Telescopic handlers |
| 4983 | Gas fuel systems for forklifts and industrial engines |

AS/NZS

- | | |
|------|---|
| 3000 | Electrical installations (known as the Australian/New Zealand Wiring Rules) |
|------|---|

ISO

- | | |
|------|---|
| 668 | Series 1 freight containers—Classification, dimensions and ratings |
| 2330 | Fork-lift trucks—Fork-arms—Technical characteristics and testing |
| 3795 | Road vehicles, and tractors and machinery for agriculture and forestry—Determination of burning behaviour of interior materials |
| 3874 | Series 1 freight containers—Handling and securing |
| 6683 | Earth-moving machinery—Seat belts and seat belt anchorages—Performance requirements and tests |

ISO	
21281	Construction and layout of pedals of self-propelled sit-down rider-controlled industrial trucks—Rules for the construction and layout of pedals
12100	Safety of machinery—Basic concepts, general principles for design
12100-1	Part 1: Basic terminology, methodology
12100-2	Part 2: Technical principles
EN	
1175	Safety of industrial trucks—Electrical requirements
1175-1	Part 1: General requirements for battery powered trucks
1175-2	Part 2: General requirements for internal combustion engine powered trucks
1175-3	Part 3: Specific requirements for the electrical power transmission systems of internal combustion engine powered trucks
12053	Safety of industrial trucks—Test methods for measuring noise emissions
13059	Safety of industrial trucks—Test methods for measuring vibration

European Parliament and Council Directive 2000/14/EC on the approximation of the law of the Member States, relating to the noise emission in the environment by equipment for use outdoors

1.3 DEFINITIONS

For the purposes of this Standard, the definitions in AS 2359.7, AS 2549 and ISO 12100-1 and those below apply.

1.3.1 Auxiliary mast

Mast at the end of the telescopic boom intended to reach greater lifting heights.

1.3.2 Axle locking

Mechanism designed to stop oscillation of the rear axle for improving telehandler stability during stacking and destacking operations.

1.3.3 Bucket

A device intended to carry bulk products such as sand, gravel, coal, etc.

1.3.4 Falling object protective structure (FOPS)

A device protecting the operator's position against falling objects.

1.3.5 Fixed attachments

Attachments that are mounted to the telehandler and which require the use of tools to remove them.

1.3.6 Fixed load

A load directly supported by a rigid lifting attachment, connected to the boom that prevents it from swinging (e.g., fork tyne or bucket).

1.3.7 Fork extensions

Devices fitted over the forks tynes to increase their length.

1.3.8 Forks

A device with two or more solid fork tynes (hook mounted or shaft mounted) that is fitted on the carriage and usually spread manually.

1.3.9 Forward travel

Forward direction of travel occurs when the load-handling means (e.g., forks) is leading the travel motion of the telehandler.

1.3.10 Freely suspended load

A load attached to a lifting point via a sling or other means, which allows the load to swing.

1.3.11 Front end of telehandler

The end of a telehandler, which leads the forward direction of travel described in Clause 1.3.9.

1.3.12 Hoist

A rotating drum and drive train to which a rope is attached and used for lifting loads.

1.3.13 Hook

A lifting point either fixed or via a load hoist line which allows a load to be freely suspended.

1.3.14 Jib

A device equipped with a hook, which can be attached to the telehandler boom to lift freely suspended loads.

1.3.15 Lateral levelling

Changing the angular relationship between the chassis and the load axle in order to adjust the chassis to horizontal when the telehandler is standing on a side slope and to ensure the boom operates in a vertical plane.

1.3.16 Level

A horizontal plane $\pm 1\%$ gradient.

1.3.17 Load backrest

A device fitted to the back of the fork arm carriage to prevent any part of the load from falling onto the operator's position.

1.3.18 Load push-pull

A device enabling the load to be slid forward or backward on the fork tynes.

1.3.19 Load stabilizer

A device clamping the load vertically and stabilizing it to prevent it from falling.

1.3.20 Luffing (lifting)

Angular movement of the boom or jib in the vertical plane.

1.3.21 Maximum capacity

The maximum load that the telehandler or telehandler/attachment combination is capable of lifting.

1.3.22 Normal operating position

Position in which the operator will be able to control all functions for driving and load handling, as defined by the manufacturer.

1.3.23 Pick and carry

The act of travelling with a load.

1.3.24 Quick coupler

A structure fitted at the end of the lifting boom to grip and lock interchangeable attachments without the use of a tool.

1.3.25 Rated capacity of removable attachments

Maximum load (in kilograms) that the attachment is designed to handle in normal operation under specified conditions.

1.3.26 Rated capacity of telehandler

The load, in kilograms, (depending on lift height H (see Figure 1.5.1), attachment, load centre distance and reach) permitted by the design, taking into account the stability test results, which the telehandler is capable of transporting or lifting under specific conditions.

NOTE: Rated capacity is also known as ‘actual capacity’ in some countries.

1.3.27 Rear end of telehandler

The end of a trailing telehandler.

1.3.28 Roll-over protective structure (ROPS)

System of structural members whose primary role is to reduce the possibility of a seat-belted operator being crushed should the telehandler roll over. Structural members include any subframe, bracket, mounting, socket, bolt, pin, suspension or flexible shock absorber used to connect to the telehandler frame, but exclude mounting provisions that are integral with the machine frame.

1.3.29 Side grabs

A device comprising two plates clamping uniform loads (boxes, cartons, barrels, blocks, etc.) horizontally.

1.3.30 Stabilizer/outrigger

Extendible mechanical supports used to improve stability of a stationary telehandler.

1.3.31 Telehandler

A mobile, rider-mounted, self-propelled counterbalanced lifting device with a telescopic boom whose lifting is primarily achieved by luffing and telescoping of the boom.

NOTE: Telehandlers are usually fitted with fork tynes as the standard lifting device but may be fitted with a variety of attachments, including ones incorporating hoisting mechanisms.

1.3.32 Wood grab

A device comprising a curved pressing fork arm specially designed for handling logs or round timber.

1.4 NEW DESIGNS, INNOVATIONS AND DESIGN METHODS

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

1.5 DESIGNATION OF TELEHANDLER TYPE

1.5.1 Nominal rated capacity of telehandler with forks

Load (Q) in kilograms, specified by the manufacturer, that the telehandler type is capable of transporting or lifting in normal operation under specific conditions. It shall be equal to the maximum load (Q) with centre of gravity at point (G), [where G is the load centre of gravity positioned in the longitudinal plane that passes through the central point between the front wheels (see Figure 1.5.1)], which the telehandler is designed to carry on forks at the standard load centre distance (D) as specified in Clause 1.5.4 and stack at the standard lift height (H) as specified in Clause 1.5.3.

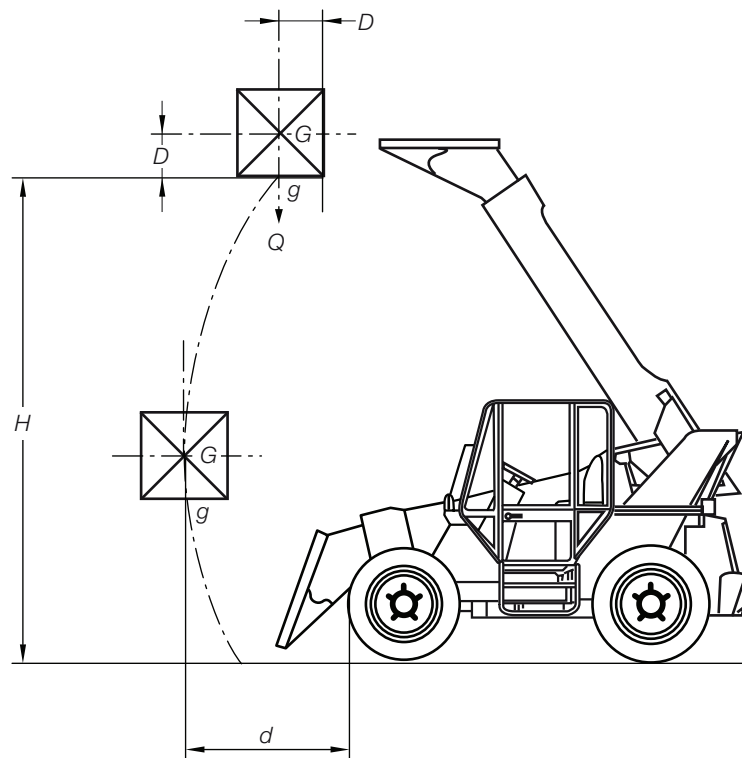


FIGURE 1.5.1 PARAMETERS FOR THE DESIGNATION OF THE NOMINAL RATED CAPACITY OF THE TELEHANDLER WITH FORK TYNES

1.5.2 Nominal reach (d)

Distance between two vertical parallel planes, one plane tangent to the front of the outside diameter of the front tyres, the other plane tangent to the curve described by g moving from position H to its lowest position. Point (g) is the vertical projection of the centre of gravity (G) onto the plane of the top surface of the fork tynes blades (see Figure 1.5.1).

1.5.3 Standard lift height

Height (H) from the ground to the upper face of the fork blades or to the underside of the load.

The standard height (H) shall be as follows:

- (a) For telehandlers with capacities of 10 000 kg or less 3.3 m.
- (b) For telehandlers with capacities greater than 10 000 kg..... 5.0 m.

1.5.4 Standard load centre distance (*D*)

Distance (*D*) in millimetres from the centre of gravity (*G*) of the load measured horizontally to the front of the fork shanks and vertically to the upper face of the fork blades, as specified in Table 1.5.4.

TABLE 1.5.4
STANDARD LOAD CENTRE DISTANCE

Rated load (<i>Q</i>), kg		Standard load centre distance (<i>D</i>), mm					
		400	500	600	900	1200	1500
	<1000	O	O	R			
≥1000	<5000		O	R			
≥5000	≤10000			R			
>10000	<20000			R	R	R	
≥20000	<25000				R	R	
≥25000						R	R

R = Required

O = Optional

NOTE: Telehandlers may be rated for special applications with load centres related to those applications.

SECTION 2 DESIGN

2.1 BASIS OF DESIGN

2.1.1 General

The basis of design/classification of the telehandler shall be in accordance with AS 1418.1.

2.1.2 Structure

The basis of design for the telehandler structure shall be in accordance with the loadings specified in Clause 2.2 and the relevant requirements of AS 1418.1. The magnitude of locally induced stresses in the areas of the attachment of the boom lugs, trunnions, and the support bearings of the telescopic boom shall be considered.

2.1.3 Stabilizer/outriggers

Stabilizer/outriggers, where provided, shall comply with the following requirements:

- (a) Where stabilizer/outriggers are extendible, means shall be provided to securely locate each stabilizer/outrigger in the retracted position and in each extended position at which the stabilizer/outrigger is to support the telehandler.
- (b) Each stabilizer/outrigger shall be equipped with a footplate that is self-aligning in at least one plane.
- (c) Where the stabilizer/outrigger is power operated, means shall be provided to prevent loss of support under load.
- (d) Where stabilizer/outriggers are horizontally extendible, means shall be provided, by use of paint marks or other suitable means, to make it clear to the operator when each stabilizer/outrigger is extended to the correct position to support the telehandler in conformance with the rated capacity chart.

2.1.4 Counterweights

Means shall be provided to adequately secure all counterweights to the telehandler.

Each detachable counterweight shall be marked with its identification and mass, and provided with means by which it may be lifted and secured.

2.2 LOADINGS

2.2.1 General

For design purposes, design loadings shall be not less than the rated capacity (see Clause 1.3.25 and 1.3.26) multiplied by a hoisting factor (ψ) of 1.15 and a dead load factor (ϕ) of 1.00.

The lateral loading shall comply with one of the following:

- (a) Four percent of the rated capacity at the boom head plus the force on the boom resulting from a wind velocity of 10 m/s (36 km/h).
- (b) Six percent of the rated capacity at the boom head representing all lateral loads.

2.2.2 Load combinations

The telehandler shall be designed to withstand the application of the vector combination of the loadings that produces the governing design criteria in the part of the telehandler under consideration (see AS 1418.1).

For example, consideration should be given to the reaction of slewing and wind effects, which cause lateral loading on stabilizer/outriggers.

2.2.3 Wind loads

In-service wind loads and out-of-service wind loads shall be calculated as follows:

- (a) *In-service wind loads* Telehandlers shall be designed for lifting in wind speeds of 10 m/s [36 km/h; see Clause 2.2.1(a)]. Telehandler configurations designed for wind speeds other than 10 m/s shall have the design wind speed marked on the rated capacity chart.
- (b) *Out-of-service wind loads* Telehandlers shall be designed to meet strength and stability considerations when subjected to a minimum wind speed of 15 m/s (54 km/h) when in the out-of-service configuration. Where appropriate, the designer shall specify each wind speed limit and any special precautions to be taken by the user.

2.3 SECURITY

2.3.1 Protection against unintended use

The telehandler shall be provided with a device (e.g., a key) that prevents use by unauthorized persons.

2.3.2 Protection against unintentional start-up

A parking brake shall be provided conforming to the requirements specified in Clause 2.4.

Internal combustion engine powered telehandlers shall be fitted with a device which prevents the engine being started whilst the transmission is engaged.

All telehandlers, irrespective of their driving mode (torque converter, hydrostatic transmission, battery powered) shall have a travel control with 3 positions, that is, neutral, forward travel, reverse travel.

NOTE: In the neutral position the transmission is not engaged.

2.4 BRAKES

Service and parking brakes shall comply with AS 2359.13.

For telehandlers with capacities greater than 50 000 kg, the brakes shall also comply with AS 2359.13.

Electromechanical brakes shall be applied mechanically and released electrically. They shall meet the relevant requirements of EN 1175-1.

Failure of the power supply for automatically acting brakes shall not result in loss of braking.

2.5 CONTROLS

2.5.1 General

Controls shall, where practicable, be consistent with the telehandler motions being operated and shall be confined within the plan view outline of the telehandler.

Travel controls on battery-powered telehandlers shall comply with the relevant requirements of EN 1175-1.

Means shall be provided to prevent powered travel when the operator leaves the normal operating position. On engine-powered telehandlers, the parking brake and neutral travel control may be used to satisfy this requirement. Devices on battery-powered telehandlers shall comply with the relevant requirements of EN 1175-1.

2.5.2 Travel and braking controls

2.5.2.1 Pedal-operated travel and braking controls

Pedal-operated travel and braking controls shall be in accordance with ISO 21281.

2.5.2.2 Differential locking pedal

If the telehandler is fitted with a differential lock that is pedal operated, depression of the pedal shall lock the differential.

2.5.2.3 Hand-operated direction control lever

The movement of a hand-operated direction control lever shall correspond to the required direction of travel.

2.5.2.4 Manually operated accelerator control lever

The movement of a manually operated accelerator control lever shall be parallel to the longitudinal axis of the telehandler. Movement of the control lever towards the front of the telehandler shall increase travel speed.

2.5.2.5 Hand-operated transmission gear change lever

The positions for gear engagement shall be clearly indicated.

2.5.2.6 Hand-operated differential locking lever

If the telehandler is fitted with a hand-operated differential lock, the engaged and disengaged positions of the lock shall be clearly indicated.

2.5.3 Steering controls

2.5.3.1 General requirements

The steering control shall be easy to grasp and operate. The steering mechanism shall be designed to ensure a progressive response to the movement of the control.

2.5.3.2 Steering requirements

In the event of an interruption of the power supplied to the steering system (including a dead engine), it shall be possible to maintain the direction being steered just before the breakdown until the telehandler is brought to a controlled stop.

For electric telehandlers, the relevant requirements of EN 1175-1 shall be met.

2.5.3.3 Steering shock limitation

The transmission of shocks from the ground to the steering controls of the telehandler shall be limited and meet the requirements of Appendix G.

2.5.3.4 Strength

The steering control shall be capable of withstanding an actuating force of 900 N applied in the normal manner of operation without sustaining any functional damage.

2.5.3.5 Actuating force

The actuating force at the rim of a steering wheel for a stationary telehandler shall not exceed 250 N when turning lock to lock in 8 s. Compliance with this requirement shall be verified in a type test of a telehandler, laden or unladen, whichever is the least advantageous, with the engine at low idle and on a surface as specified in AS 2359.13.

2.5.3.6 *Steering directions—Steering wheel control*

Clockwise rotation of a steering wheel shall steer the telehandler to the right when the telehandler is travelling in the forward direction. If a reversible control unit or dual controls are fitted, clockwise rotation of a steering wheel shall also steer the telehandler to the operator's right when the telehandler is travelling in reverse with the operator facing in that direction.

2.5.3.7 *Steering direction—Single lever control*

On telehandlers for which steering is controlled by means of a single lever controller, pushing the lever to the right shall cause the telehandler to be steered to the right in the direction of travel.

2.5.4 Load-handling control

All load-handling controls shall automatically return to neutral when released, thus stopping all load movements.

The controls for the main functions shall be clearly separated from the driving controls. They should be located so as to be operated by the operator's right hand.

The function of the controls shall be clearly and durably marked. When using graphic symbols, these shall be in accordance with AS 2359.5, and each symbol shall be affixed on or in close proximity to the control lever to which it applies.

2.5.5 Other controls

2.5.5.1 *Stabilizer/outrigger controls*

When there are stabilizer/outriggers operated by control levers, these shall be put in place by a forward motion of the control and shall be withdrawn by a backward motion.

If other control methods are used, they shall follow the same logic.

2.5.5.2 *Chassis-levelling control*

When there is chassis levelling operated by a control lever, the desired correction shall be made by moving the control in the lateral plane of the telehandler.

If other control methods are used, they shall follow the same logic.

2.5.5.3 *Axle-locking control*

When axle locking is used, operated by a control lever, locking shall be engaged by forward or downward motion of the control and disengaged by backward or upward motion of the control.

If other control methods are used, they shall follow the same logic.

2.5.6 Marking

Controls shall be legibly and indelibly marked with graphic symbols in accordance with AS 2359.5.

All written instructions on the controls shall be in English and SI units.

2.6 POWER SYSTEMS AND ACCESSORIES

2.6.1 Exhaust system

The exhaust system shall be designed so that the health and safety of the operator is not impaired by temperature rises or exhaust gases. In particular, the exhaust pipe shall have its outlet arranged to minimize discomfort to the operator.

2.6.2 Cooling system

The airflow through cooling system shall be arranged in such a manner that the health and safety of the operator is not impaired.

2.6.3 Fuel tanks

If a fuel tank is within or contiguous to the engine compartment and if the temperature could cause ignition of fuel, the tank and/or filling arrangements shall be isolated from the electrical and exhaust systems by suitable protection such as separate enclosure or baffles. The tank location and facilities for filling shall be such that spillage or leakage drains to the ground and not into the engine or operator's compartment or onto electrical or exhaust system parts.

Fuel spillage shall not be possible under normal operating conditions.

2.6.4 Access to engine and other compartments

Where there are unguarded moving parts within the engine compartment, access shall only be possible by means of a key or tool, or by a release handle within an operator's lockable cab. The engine cover shall be designed so that a device (or devices) is required to hold it securely in its open position and prevent uncontrolled closures.

Where access to other components requires the opening of covers, such covers shall require a device (or devices) to hold the cover securely in its open position and prevent uncontrolled closure.

Means shall be provided to allow one person to perform routine inspections without using workshop equipment.

2.6.5 Additional requirements for internal combustion engine-driven telehandlers using gas fuel systems

Internal combustion engines using gas fuel systems, such as LPG, shall comply with AS 4983.

2.6.6 Electrical requirements

All electrical systems and equipment shall comply with AS/NZS 3000, EN 1175-1, EN 1175-2 and EN 1175-3.

2.7 SYSTEMS FOR LIFTING, TILTING, REACHING AND SLEWING

2.7.1 Chains and wire ropes

2.7.1.1 Chains

When the lifting mechanism (lifting, telescoping) includes a chain or chains, the telehandler manufacturer shall use only leaf or roller chains that, in relation to the minimum breaking load certified by the manufacturer of the chain, shall provide a factor K_1 , as given by the following equation:

$$K_1 = \frac{\text{Min. breaking load for new chain} \times \text{number of chains}}{\text{Max. capacity of the telehandler} + \text{dead weight of the lifting mechanism}}$$

where

for telehandlers $\leq 10\,000$ kg capacity $K_1 \geq 5$

for telehandlers over 10 000 kg capacity $K_1 \geq 5 - 0.2 (Q' - 10)$

K_1 shall be not less than 4

Q' = telehandler maximum capacity, in tonnes

Sheave(s) diameters shall be at least three times the pitch of the chains.

Loads in the chain(s) due to friction in the lifting mechanisms shall be taken into account.

2.7.1.2 Wire ropes

When the lifting mechanism includes one or more wire ropes, the telehandler manufacturer shall select wire ropes that, in relation to the minimum braking load certified by the manufacturer of the wire rope, will provide a factor of K_2 as follows:

- (a) For lifting and telescoping at least 6:1.
- (b) For hoisting at least 4:1.

where

$$K_2 = \frac{\text{Min. breaking load for new wire rope} \times \text{number of wire ropes}}{\text{Max. capacity of the telehandler} + \text{dead weight of the lifting mechanism carried by the wire rope(s)}}$$

The diameter of the wire rope guide sheaves, measured from the bottom of the groove, shall be at least 18 times the diameter of the wire rope.

2.7.2 Hydraulic lifting system

2.7.2.1 Load holding

The descent of the load caused by internal leakage in the hydraulic system in the least favourable load position shall not exceed 150 mm during 10 min with the oil in the hydraulic system at normal working temperature.

The average forward tilting speed resulting from leakage shall not exceed half a degree per minute.

2.7.2.2 Maximum load-lowering speed

The maximum permissible load-lowering speed shall be such that, even with the maximum load in the event of unintentional operation, a sudden drop of the lowering means, the telehandler shall remain stable.

NOTE: The rear wheels may momentarily lift during such unintentional operation.

2.7.2.3 Limitation of stroke

All movements with limited travel shall be provided with stops to prevent over-travel.

2.7.3 Hydraulic system

2.7.3.1 Hydraulic circuit

Hoses, piping and all connections shall be capable of withstanding, without bursting, a pressure at least equal to three times the operating pressure of the hydraulic circuit, as indicated by the manufacturer.

The hydraulic system shall be designed and installed in such a way that its performance and reliability are not reduced or its components damaged as a result of external stresses, vibration or movements of the telehandler or components thereof.

Hoses and piping shall be positioned to avoid physical damage and adverse effects in the event of bursts, pinholes, or other such occurrences.

The hydraulic system shall be so designed that the oil in circulation is continuously filtered.

2.7.3.2 Pressure-relief valves

All hydraulic systems shall include a device that prevents the pressure in the system from exceeding a preset safe level.

The device shall be so designed and fitted that accidental loosening or adjustment is avoided and that a tool or key is required to alter the pressure settings.

2.7.3.3 *Failure of energy supply or hydraulic circuit*

In the case of a fault or interruption of the supply of energy, the design of the hydraulic installation shall be such that the hydraulic pressure in the system prevents the pump from functioning as a hydraulic motor.

In the event of a failure in the hydraulic circuit of the load lifting, tilting, telescoping, stabilizing or lateral levelling system(s) or in the event of failure of the driving power supply, means shall be provided to maintain the load or telehandler in its position.

The requirement shall be considered to be fulfilled when the maximum descent of the load is as specified in Clause 2.7.2.1 when failure occurs during load lifting or lowering. The load shall be immobilized within the limits of functional leakage as specified in this subclause.

2.7.3.4 *Oil filtration*

Hydraulic systems shall be protected against hazards due to oil pollution (for example, by means of a filter or magnet).

2.7.4 Fork tynes

Fork tynes shall be manufactured and tested in accordance with ISO 2330.

Devices (slot, pin, lock, etc.) shall be provided to prevent unintentional lateral displacement of the fork tynes on the fork carrier.

2.7.5 Fork extensions

Fork extensions shall be positively fixed to the fork tynes and be designed to prevent accidental disengagement from the fork tynes and be in accordance with the requirements of AS 2359.15. A rated capacity chart shall be provided.

2.7.6 Fork carriers

Positive stops shall be provided on the fork carrier to prevent lateral disengagement of the fork tynes from the fork carrier at its extremities. If a fork tyne removal slot is provided at the bottom of the carrier, it shall not be positioned opposite a slot at the top of the carrier unless means are provided to prevent the fork tyne from being inadvertently displaced.

2.7.7 Load-handling attachments

Load-handling attachments shall comply with the following:

- (a) Attachments (e.g., clamps, side-shifters, elevators, scoops, etc.) shall be designed and manufactured in such a way that unintentional lateral displacement and detachment from the telehandler are prevented.
- (b) Clamping devices shall be so designed that clamping pressure is sustained for at least 10 min after the engine has been shut down by means of non-return valves or any other effective system when the telehandlers control mechanisms are in the neutral position. In the event of malfunctions in the power supply system for the attachment, means shall be provided to prevent the load being dislodged or unintentionally shifted.
- (c) Telehandlers equipped with quick couplers, as defined in Clause 1.3.24, for attachments shall be designed and manufactured in such a way that the locking devices can be seen by the operator to be correctly engaged into the attachment from the normal operating position. Means shall be provided to prevent loss of the attachment in the event of system failure.

- (d) If an attachment has its own separate hydraulic system, it shall comply with Clause 2.7.3.
- (e) If an attachment has a hydraulic system that is connected to the telehandler hydraulic system, then the two systems shall be compatible and the combined systems shall comply with Clause 2.7.3.
- (f) Attachments shall be so designed and fitted to the telehandler that, in the normal operating position, visibility of the roadway by the operator is not reduced.

2.7.8 Load sustainability

Telehandlers shall be designed in such a way that they can be equipped with load-retention devices such as load backrest extensions and top clamp stabilizer/outriggers. Where fitted, load backrest extensions shall comply with the requirements of AS 2359.1.

2.8 OPERATOR POSITION

2.8.1 Seat

The seat shall be designed to provide a comfortable position for, and be constructed to reduce the transmission of vibration to, the telehandler operator and shall fulfil the following requirements:

- (a) Fore and aft seat adjustments shall be provided to allow ready access to controls.
- (b) If a weight-adjustable suspension seat is fitted, the adjustment shall cater at least for weights of 55 to 110 kg.
- (c) If a swivelling seat is fitted, swivelling shall be possible in all positions of adjustment.
- (d) The adjustment of the seat shall be possible without the use of tools.
- (e) All adjustments shall be clearly and indelibly marked with symbols on the seat-control devices.

2.8.2 Operator access

Telehandlers shall be designed to permit easy access and egress to minimize the risk of slipping and falling. Steps, running boards and grab handles shall be provided to ensure a three-point grip at all heights (that is, one hand and two feet or two hands and one foot).

Steps may be of open construction but shall have slip-resistant surfaces.

The first step shall be not more than 550 mm from the ground, and succeeding steps shall be at regular intervals of 250 to 350 mm.

The size of apertures for feet shall be as follows:

- (a) Single foot steps at least 160 mm wide.
- (b) Double foot steps.....at least 320 mm.
- (c) All steps.....at least 150 mm deep.

The operator compartment floor and any walkways shall have a slip-resistant surface.

2.8.3 Protection from wheels

Telehandlers shall be provided with devices that ensure the protection of the operator, when in the normal operating position, against contact with the telehandler wheels or against objects thrown up by the wheels (e.g., mud, gravel, stones or bolts).

NOTE: The protection device for the steered wheels need only cover the wheels in the straight ahead position.