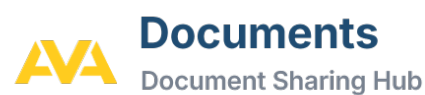


Australian/New Zealand Standard™

Scaffolding

Part 4: Suspended scaffolding



AS/NZS 1576.4:2013

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee BD-036, Scaffolding. It was approved on behalf of the Council of Standards Australia on 24 June 2013 and on behalf of the Council of Standards New Zealand on 23 April 2013.

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Australian/New Zealand Standard™

Scaffolding

Part 4: Suspended scaffolding

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PREFACE

This Standard was prepared by the Standards Australia Committee BD-036, Scaffolding, to supersede AS 1576.4—1991.

The objective of this Standard is to provide manufacturers and suppliers of suspended scaffolds and accessories with requirements for the proper operation of suspended scaffolds. Unlike independent scaffolds, suspended scaffolds have various rated capacities rather than being light, medium, heavy and special duty. Modular cradles may have different rated capacities, depending on the length of cradle.

The objective of this revision is to provide designers, manufacturers and suppliers of suspended scaffolds and accessories, up-to-date information and application on the equipment used currently in the suspended scaffold industry.

This edition incorporates the following major changes to the 1991 edition:

- (a) Rope factor of safety (as in AS 1418.2) has been reduced from 10 to 8 to align with European Standards. (All scaffold hoists are now imported and it is appropriate that the values used by the hoist designers be followed.)
- (b) Inclusion of a test to confirm the strength of a cradle assembly as an alternative to design by analysis (Appendix G).
- (c) Inclusion of mandatory secondary rope at each suspension point.
- (d) The following informative elements have been added and in some instances provide similar information to AS/NZS 4576, *Guidelines for scaffolding*:
 - (i) Examples of different configurations of suspended scaffolding (Appendix A).
 - (ii) Safety procedures for unattended cradles (Appendix B).
 - (iii) Operational guidance (Appendix C).
 - (iv) Advice on inspection and maintenance (Appendix D).
 - (v) Relevant matters to be checked before installation and use (Appendix E).
 - (vi) Flow chart outlining the different phases of the design, supply and use of suspended scaffolds (Appendix F).
 - (v) Cradle strength test (Appendix G).

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.

This Standard incorporates a Commentary on some Clauses. The Commentary directly follows the relevant clause, is designated by 'C' preceding the clause number and is printed in italics in a panel. The Commentary is intended to help readers understand the background to the clause but does not form part of the clause.

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Australian/New Zealand Standard Scaffolding

Part 4: Suspended scaffolding

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements for the materials and design of suspended scaffolding including the supporting structure. It includes guidance on the use of suspension rigs.

This Standard is complementary to AS/NZS 1576.1, but the requirements given herein take precedence over the corresponding requirements of AS/NZS 1576.1.

NOTES:

- 1 This Standard incorporates relevant text from AS/NZS 4576 for suspended scaffolding to provide industry guidance.
- 2 Examples of different configurations of suspended scaffolds are shown in Appendix A.
- 3 Safety precautions that should be taken for unattended cradles are given in Appendix B.
- 4 Operational guidance is given in Appendix C.
- 5 Guidance on inspection and maintenance of suspended scaffolding equipment is given in Appendix D.
- 6 Checklists for planning and installation are given in Appendix E.
- 7 A flow chart for the different phases of selecting, installing and using a suspended scaffold are given in Appendix F.
- 8 Cradle strength test is given in Appendix G.

This Standard is applicable to all types of suspended scaffolding regardless whether the suspension rig is fixed or has horizontal movement capability.

This Standard does not cover building maintenance units.

1.2 APPLICATION

This Standard shall be used in conjunction with AS/NZS 1576.1.

1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS

1418	Cranes, hoists and winches
1418.1	Part 1: General requirements
1418	Cranes (including hoists and winches)
1418.2	Part 2: Serial hoists and winches
1444	Wrought alloy steels—Standard and hardenability (H) series
1874	Aluminium and aluminium alloys—Ingots and castings
2317	Collared eyebolts

AS/NZS	
1170	Structural design actions
1170.2	Part 2: Wind loads
1554	Structural steel welding
1554.1	Part 1: Welding of steel structures
1576	Scaffolding
1576.1	Part 1: General requirements
1576.2	Part 2: Couplers and accessories
1576.3	Part 3: Prefabricated and tube-and-coupler scaffolding
1577	Scaffold decking components
1594	Hot-rolled steel flat products
1665	Welding of aluminium structures
1734	Aluminium and aluminium alloys—Flat sheet, coiled sheet and plate
1866	Aluminium and aluminium alloys—Extruded rod, bar, solid and hollow shapes
1867	Aluminium and aluminium alloys—Drawn tubes
2269	Plywood—Structural (all parts)
3678	Structural steel—Hot-rolled plates, floor plates and slabs
3679	Structural steel
3679.1	Part 1: Hot-rolled bars and sections

1.4 DEFINITIONS

For the purposes of this Standard, the definitions given in AS/NZS 1576.1 and those below apply.

1.4.1 Anchor point

A secure point of attachment on a structure to which a fall-arrest system may be secured.

1.4.2 Articulated cradle

A cradle of several sections hinged together, enabling users to walk from one section to another [see Figure 1.5(B)].

1.4.3 Attachment point

The point on a cradle or boatswain's chair for the independent attachment of the scaffolding hoist(s)/suspension rope(s) and secondary rope(s)/cradle fall-arrest devices.

1.4.4 Bay length

The horizontal distance between the centres of any two longitudinally adjacent support points on a cradle.

1.4.5 Boatswain's chair

A chair or similar platform designed for a person to sit in.

1.4.6 Cable reeler

A storage drum onto which an electric cable is reeled.

1.4.7 Counterweight

A weight or series of weights used to counterbalance the forces on the suspension rig against overturning.

1.4.8 Cradle

The portion of a suspended scaffold that incorporates a suspended platform.

NOTE: A cradle is also known as a gondola, swing stage or boat.

1.4.9 Cradle-attached hoist

A scaffolding hoist that is attached to the cradle.

1.4.10 Cradle restraint system

A system that attaches the cradle to the mullions or other fixtures on the building or structure and which limits the lateral movement of the cradle due to wind; also known as a stabilizing system.

1.4.11 Cradle secondary rope device

A protective device acting directly on a secondary rope, which automatically stops and holds the cradle in the event of overspeed in the down direction resulting from a failure of the hoist or the suspension rope.

1.4.12 Deck unit

A framed assembly, incorporating a walking surface, that is capable of connecting to its support structure in such a way as to not be inadvertently dislodged.

NOTE: One or more deck units are used side by side and end to end to form a working platform within a cradle.

1.4.13 Design rope tension (DRT)

The maximum tension in a suspension rope at the connection to the suspension rig when the hoist load-limiting device activates.

1.4.14 Double rope suspension system

A method of suspending a cradle using two hoists and two suspension ropes, excluding secondary ropes, at each suspension point.

1.4.15 Fixed cradle

A cradle that does not traverse horizontally but is capable of being raised and lowered.

1.4.16 Fulcrum point

The point of pivoting about which the balancing moments of the suspension rig are calculated.

1.4.17 Inboard

The horizontal distance between the fulcrum point and the fixing point (prop or tie-down) or the centre of gravity of the suspension rig, including any counterweights [see Figure 1.5(A)].

1.4.18 Inboard portion of the suspension rig

That portion of the suspension rig that is on the inside of the fulcrum point [see Figure 1.5(A)].

1.4.19 Individual cradle

A working platform supported at two locations.

1.4.20 Installer

A person who erects, alters or dismantles a suspended scaffold and its supporting components to provide an operating suspended scaffold.

1.4.21 Load-limiting device

A device that limits the lifting capacity of a scaffolding hoist to a specified load below the stalling load of the motor.

1.4.22 Manual handle/lever/wheel

A manual device, not being a brake, on the hoist that enables the cradle to be manually raised or lowered.

1.4.23 Needle

A structural member that extends from the suspension point to the extreme inboard end of the supporting structure; also known as suspension beam.

1.4.24 No-power descent

A manually operated brake release system that allows controlled descent of a power-operated cradle when power is not available.

1.4.25 Outboard

The horizontal distance between the fulcrum point and the suspension point.

1.4.26 Parapet clamp

A structure attached to the roof parapet and dependent on the parapet for location and anchorage.

1.4.27 Projection

That portion of the suspension rig that is on the outside of the fulcrum point [see Figure 1.5(A)].

1.4.28 Protective system

A system that will arrest descent in the event of the failure of the primary system of hoist and/or suspension rope.

1.4.29 Rated load of cradle

The maximum load that the cradle is designed to carry for an installation.

1.4.30 Rope reeler

A storage drum onto, or basket into, which a suspension rope or secondary rope is reeled.

1.4.31 Scaffolding hoist

A lifting appliance, manually operated or power operated, used to raise or lower a boatswain's chair, cradle or work cage.

1.4.32 Secondary rope

A rope, rigged as part of a protective system, that will support the boatswain's chair, cradle or work cage in the event of failure of the primary system of hoist and/or suspension rope.

1.4.33 Suspended scaffold

A scaffold that incorporates a platform suspended by flexible steel wire ropes, which is capable of being raised or lowered when in use by means of powered or manually operated scaffolding hoists; also known as 'swing stage'.

NOTE: A suspended scaffold may incorporate boatswain's chair, cradle, work cage, articulated cradles or multi-level cradles.

1.4.34 Suspension point

That point where the suspension rope or secondary rope are connected to the suspension rig.

1.4.35 Suspension rig

That portion of the installation (including the traversing track if fitted) that supports and positions the cradle [see Figure 1.5(A)].

1.4.36 Suspension-rig-attached hoist

A scaffolding hoist that is mounted on the suspension rig.

1.4.37 Suspension ropes

Ropes carrying the weight of the suspended scaffold, including its live load.

1.4.38 Tilt-limiting device

A device that detects and limits the longitudinal slope of the cradle when it exceeds a preset angle.

1.4.39 Traversing

Moving a suspended scaffold laterally across the face of the building or structure.

1.4.40 Traversing ropes

Ropes rigged for the purpose of traversing the suspended scaffold, but not carrying its weight.

1.4.41 Traversing stop

The attachment to any point of a rail or track to limit traversing.

1.4.42 Traversing suspension rig

A suspension rig mounted on wheels or castors.

1.4.43 Tripping limit

The load that causes the load-limiting device to operate.

1.4.44 Trolley

A wheeled mechanism intended to support a suspended scaffold and capable of travelling along a trolley track.

1.4.45 User

The person(s) authorized to utilize the installed suspended scaffold.

1.4.46 Vertical limit device

A device to limit travel at preset upper and lower points.

1.4.47 Work cage

A cradle that is operated by a single scaffolding hoist.

1.4.48 Working load limit (WLL)

The maximum unfactored load, including permanent and imposed actions, that the component or system has been designed to support.

1.4.49 Working platform

A platform on a scaffold that is positioned at a work location for supporting personnel, equipment and materials and used to provide a working area.

1.4.50 Scaffolding hoists**1.4.50.1 Drum hoist**

A hoist with a drum onto which the suspension ropes are reeled in one or more layers.

1.4.50.2 *Jaw-operated traction hoist*

A hoist where the traction assembly consists of two pairs of jaws.

1.4.50.3 *Traction hoist*

A hoist through which the suspension wire rope is moved as a result of friction between the wire rope and the traction assembly with no tail load.

1.4.50.4 *Twin capstan drum hoist*

A hoist that lifts and lowers the suspension rope around two gear-driven grooved multi-wrap capstan drums and transferred to a wire rope winder designed to apply a 'tail load' to the capstan drum system.

1.4.51 Hoist attachment points**1.4.51.1** *Cradle-mounted hoist*

A hoist that is mounted on the cradle structure.

1.4.51.2 *Top-mounted hoist*

A hoist that is mounted on the suspension rig or trolley.

1.5 ALTERNATIVE DESIGN METHODS AND MATERIALS

Alternative design methods and materials, which are not specified in this Standard, may be used, provided it can be demonstrated that the resulting scaffolding equipment satisfies the requirements of this Standard.

Service life durability shall be a consideration in any assessment.

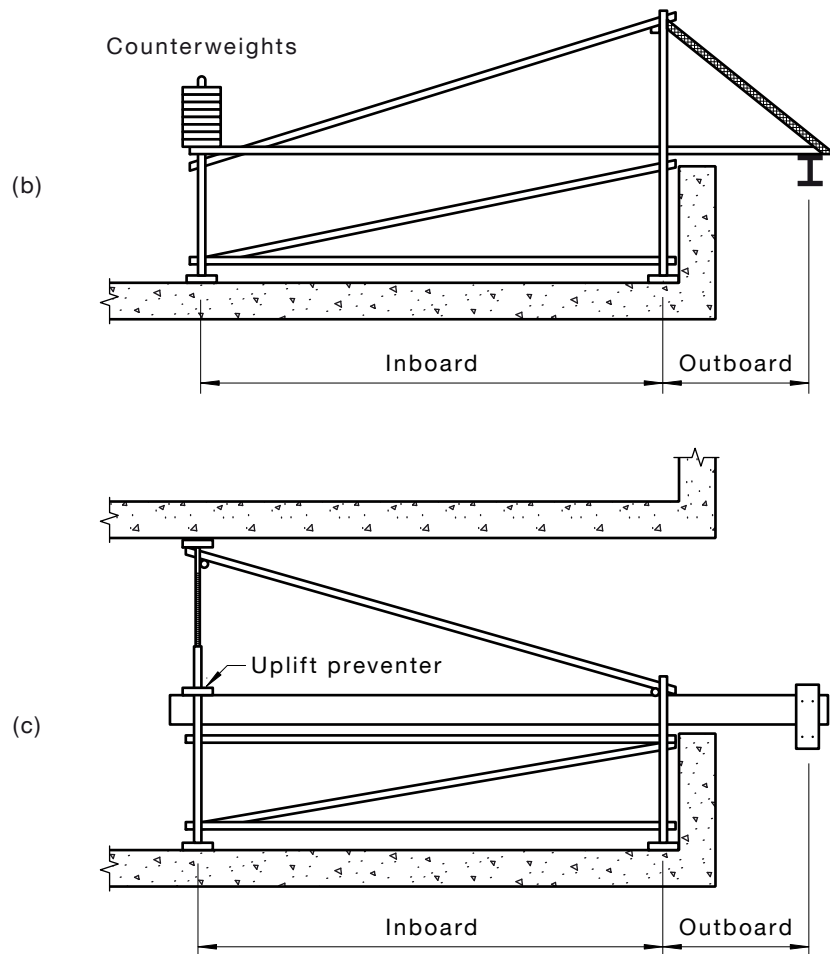
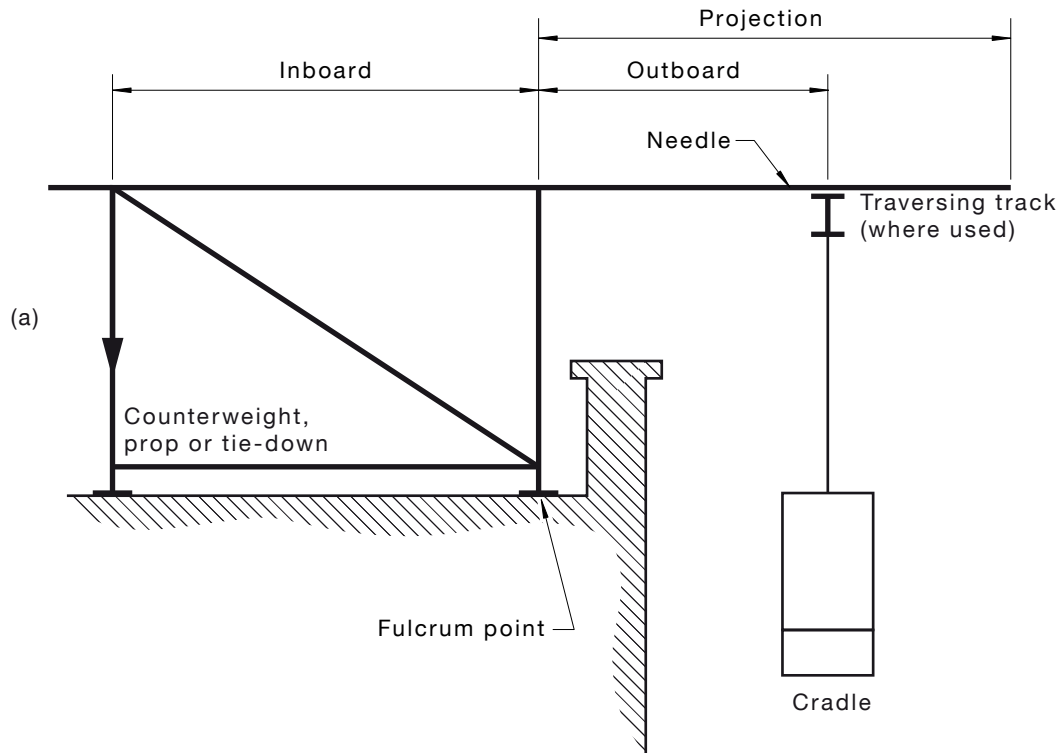


FIGURE 1.5(A) TYPICAL SUSPENSION RIGS

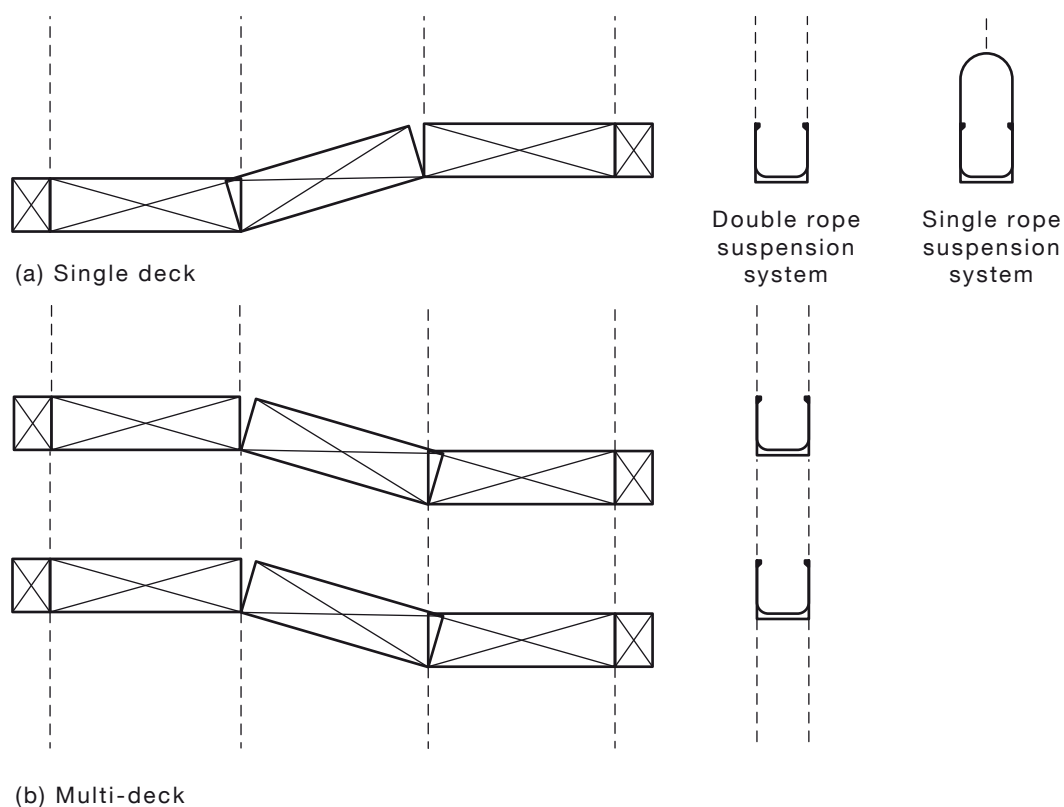


FIGURE 1.5(B) TYPICAL ARTICULATED CRADLES

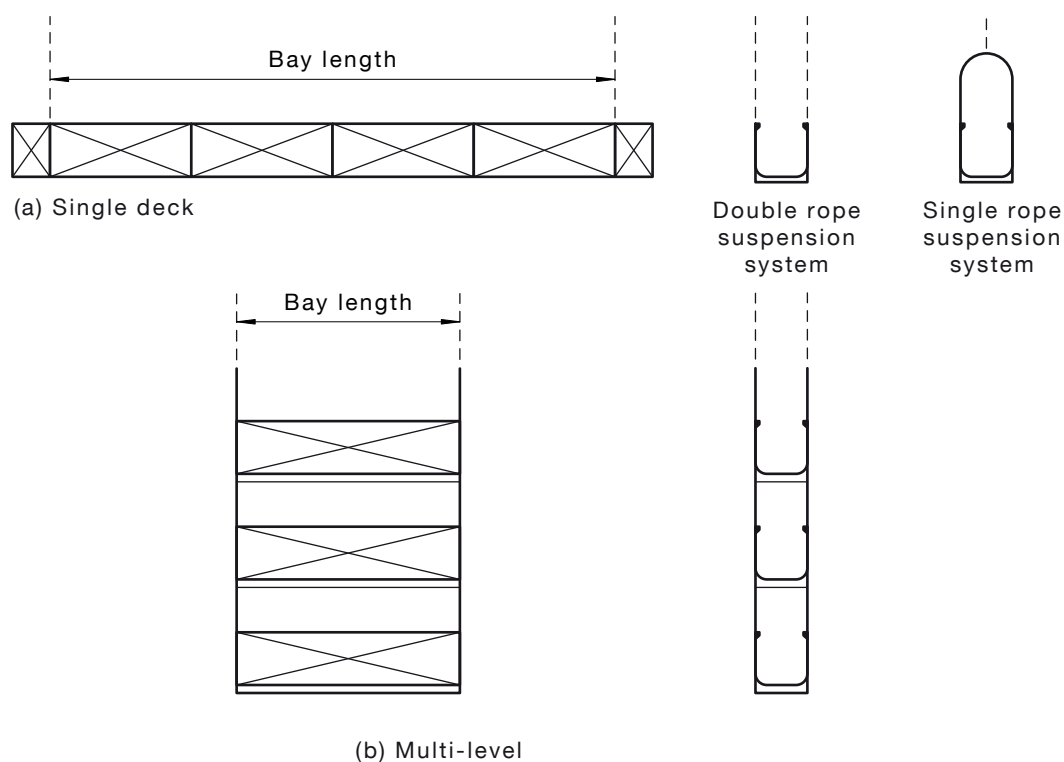


FIGURE 1.5(C) TYPICAL INDIVIDUAL CRADLES

1.6 DESCRIPTION OF SUSPENDED SCAFFOLDING

1.6.1 General

Suspended scaffolding is described according to the system of attachment to the supporting structure, the horizontal movement of the cradle, the suspension system, and the type of cradle.

1.6.2 System of attachment to structure

The system of attachment to the supporting structure may be one of the following:

- (a) A system that relies on counterweights for its stability.
- (b) A system that is secured to the building or supporting structure.
- (c) A combination of systems described in Items (a) and (b).

1.6.3 Horizontal movement capability

The horizontal movement capability may be one of the following:

- (a) Fixed.
- (b) Traversing cradle.
- (c) Traversing suspension rig.

1.6.4 Suspension system

The suspension system shall include a hoisting system and a secondary rope system for each suspension rope, except where a double rope suspension system is used and either hoist at the suspension point is capable of supporting the full load without creating excessive cradle tilt.

The hoisting system may be one of the following:

- (a) *Hoist reeling* Where the hoist reels the wire rope on to a drum within the hoist.
- (b) *Hoist climbing* Where the hoist 'climbs' up the wire rope leaving a tail end of the rope hanging or reeled onto a separate device.

The secondary rope system shall arrest movement and support the cradle in the event of an overspeed in the downward direction or failure of the suspension rope. It may be incorporated into the hoist or separately connected to the cradle.

1.6.5 Types of cradles

The cradles may be one of the following:

- (a) *Articulated cradle*—the working area of which is a single deck or several decks linked to each other longitudinally by hinges.
- (b) *Individual cradle*—the working area of which is a single deck or multiple decks beneath each other.
- (c) *Boatswain's chair*.
- (d) *Work cage*.
- (e) *Special purpose cradle*.

NOTE: Examples of different configurations of suspended scaffolds are shown in Appendix A.

1.7 INSTALLATION INFORMATION

The installer shall be provided with the following documented information:

- (a) Instructions for installation, dismantling, transportation, storage and maintenance.
- (b) A guide to safe working practices, including means of ensuring the stability of the installed scaffold.
- (c) Guidance on the type of connection to use when attaching overhead protection, guidance ties and other accessories.
- (d) Rated load of the cradle.
- (e) Method of connection of cradles, where the design permits this.
- (f) Any limitations on the use of the suspended scaffolding, including maximum operating wind speed.

1.8 SUPPLIER'S INFORMATION

The user shall be provided with the following documented information:

- (a) The checks to be carried out each day prior to use of the equipment, including—
 - (i) integrity of the suspension rig and that no counterweights have been interfered with or removed;
 - (ii) the condition of all power cables or hoses, limit switches, wire ropes and platform structural parts; and
 - (iii) ensuring there are no protrusions from the building that might contact the cradle during its operation.
- (b) Description of manual controls.
- (c) Means of stopping (particularly emergency stop).
- (d) Description of how to operate the no-power descent and, where fitted, the manual winching function.
- (e) Rated load of the cradle.
- (f) Actions to be taken in the event the secondary device is activated.
- (g) How to control undue swaying of the cradle.
- (h) Instructions for fault identification and location for remedying and restarting after intervention of any safety or control device.
- (i) Any limitations on the use of the suspended scaffolding, including maximum operating wind speed.
- (j) Emergency contact details.

SECTION 2 MATERIALS AND COMPONENTS

2.1 SCOPE OF SECTION

This Section specifies the materials to be used in the construction of suspended scaffolding equipment.

2.2 STEEL

Steel components shall be manufactured from steel complying with AS 1444, AS/NZS 1594, AS/NZS 3678 or AS/NZS 3679.1, as appropriate.

2.3 ALUMINIUM

Aluminium components shall be manufactured from aluminium complying with AS 1734, AS 1866, AS/NZS 1867 or AS 1874, as appropriate.

2.4 SCAFFOLD TUBES AND COUPLERS

2.4.1 Tube

Steel and aluminium tube shall comply with AS/NZS 1576.1.

2.4.2 Couplers and accessories

Couplers and accessories shall comply with AS/NZS 1576.2.

2.5 SUSPENSION AND SECONDARY ROPES

Steel wire rope shall meet the specification of the manufacturer of the scaffolding hoist and the cradle secondary protective device. The specification shall include at least the rope diameter, rope lay, number of strands, the number of wires, core construction, tensile strength and surface finish.

2.6 SCAFFOLDING HOISTS

Scaffolding hoists shall comply with AS 1418.2.

2.7 COUNTERWEIGHTS

Counterweight material shall be durable, such that the weight shall remain constant under working conditions. Sand, water and other flowable materials shall not be used for counterweights.

The mass of the counterweight, in kilograms, shall be indelibly marked on the counterweight.

2.8 STRUCTURAL PLYWOOD

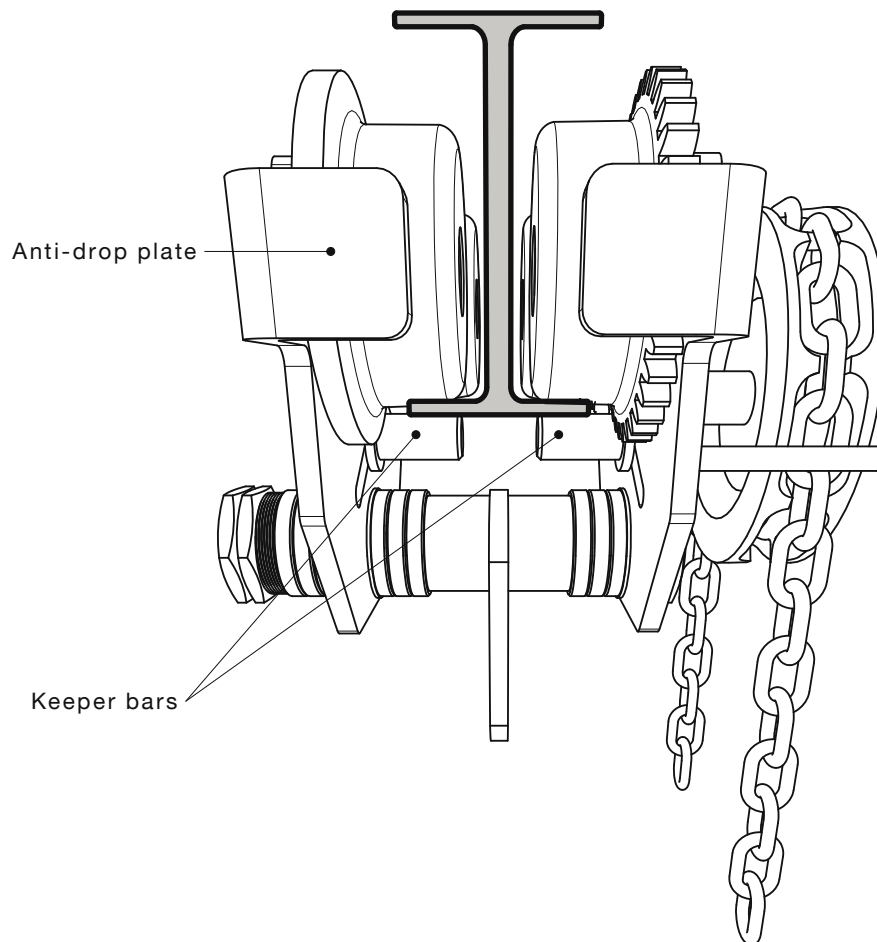
Structural plywood shall comply with AS/NZS 2269 series.

2.9 TROLLEYS

Trolleys, monorail or traversing shall comply with AS 1418.2 and the following requirements:

- (a) Where intended for use in multiples, the trolley installation shall incorporate a link to maintain the intended separation.
- (b) The WLL shall be not less than 1.25 times the maximum rope tension.

NOTE: For a typical chain drive trolley, see Figure 2.9.



NOTE: To prevent a chain-driven trolley from dislodging due to uplift when operating the drive chain, lower keeper bar(s) or plate(s) should be used. Trolleys that are not fitted with such a system should be removed from service. Guidance should be obtained from manufacturers and designers on effective systems to use.

FIGURE 2.9 TYPICAL CHAIN DRIVE TROLLEY

SECTION 3 SYSTEM DESIGN

3.1 SCOPE OF SECTION

This Section specifies the parameters that need to be applied to produce a safe suspended scaffold that is fit for its intended purpose.

C3.1 *A system design is the design of the suspended scaffolding system, including its constituent components, which may be combined to form a suspended scaffold for a particular installation.*

Another form of design relates to design for a particular installation of a suspended scaffold, based on its intended usage and all the anticipated loads. This will result in either the use of system components or purpose-designed components for the installation, resulting in specific load capacities being set for that installation. This form of design is specified in Section 4.

3.2 VERTICAL SPEED

The vertical speed of any suspended scaffold shall not exceed 18 m/min and be nominally uniform for each hoist connected to the cradle.

3.3 CRADLE

3.3.1 Marking

The rated load, in kilograms, shall be marked legibly on the cradle, in a place where it is clearly visible to persons in the cradle. The rated load shall specify any limitation on the grouping of live loads (see Clause 4.2).

3.3.2 Width

The width of the platform shall be not less than 450 mm at any point.

3.3.3 Cantilever extensions

Cantilever extensions to the cradle shall be limited in length and configuration to that allowed by the cradle design.

3.3.4 Decking

The decking of the platform may comprise one or more deck units. It shall have a slip-resistant surface in accordance with AS/NZS 1577 and be positively retained so that it cannot be displaced by operational or environmental actions (e.g. wind). The decking shall be closely boarded, planked, or plated and shall not have any gaps through which materials could fall, except where specific operational requirements may require an open mesh deck. Drainage holes of maximum diameter 10 mm shall be provided to prevent a build-up of rainwater on the floor of the cradle.

3.3.5 Edge protection

Edge protection shall be designed in accordance with AS/NZS 1576.1 and fitted to the perimeter of the platform.

Where there is a need for the inner edge protection to be altered or removed whilst suspended, the cradle shall be specifically designed to ensure retention of its structural integrity.

Before the inner edge protection is opened, removed or altered, the cradle shall be attached to the structure in such a manner as to prevent any gap increase between the cradle and the adjacent structure.

Any gap between the cradle deck and structure shall be closed by a positively retained infill panel, which shall be specifically designed for the purpose. The continuity of guardrails and midrails shall be retained, at all times, between the cradle and adjacent structure.

Due to the specialized nature of such an occurrence, the means used to ensure continuity of edge protection shall be designed specifically to provide this protection.

3.3.6 Suspension link

The design of the link used to attach the hoist to the cradle shall take into account any forces resulting from out of level of the cradle in any direction.

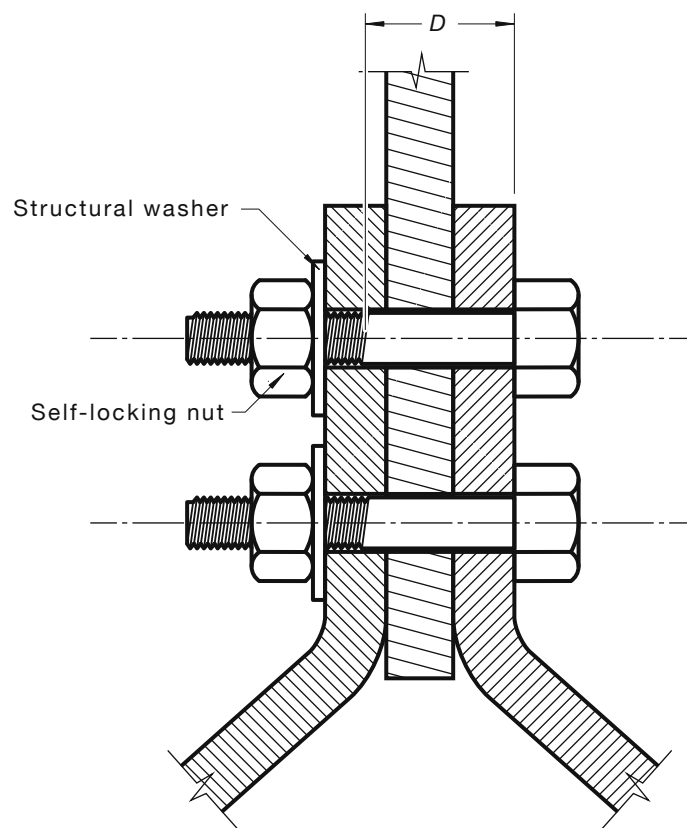
The suspension link and its connections shall withstand, without permanent deformation, a static load three times the WLL of the hoist. The suspension link shall incorporate a minimum of two (2) connection elements.

Bolts, connecting pins (or similar connecting elements) connecting the cradle suspension point to the scaffolding hoist shall comply with the hoist designer's specifications.

Where bolts are used, they shall comply with the following:

- (a) The bolts shall have an unthreaded shank length such that no threads on the bolt shall be in the shear plane of connection members.
- (b) Nuts on the bolts shall be provided with a feature that prevents the nuts from becoming unintentionally disengaged (e.g. self-locking nut).
- (c) When tightened, the bolt shall not prevent design movement of the connection.

NOTE: An example of a suspension link by bolting is shown in Figure 3.3.6.



NOTE: No thread within distance 'D' on bolts.

FIGURE 3.3.6 EXAMPLE OF A SUSPENSION LINK CONNECTION BY BOLTING

3.3.7 Articulated cradles

Articulated cradles shall be designed to take into account the configurations and resulting loads.

The hinged area shall be designed with a flexible cover over the hinge area to ensure there is no gap through which objects could fall. Edge protection shall be designed such that it is not reduced at the hinge portion of the cradle and shall not produce a crush point.

3.3.8 Other shapes

Various shaped cradles may be used. The configurations and the required suspension rig shall be specifically designed for each shape. In addition to the requirements of Clause 3.1, the design shall take into account the following:

- (a) Hoist location to maintain stability in horizontal plane.
- (b) Structural strength of the cradle.
- (c) Access within the cradle.
- (d) Additional loads that may be applied to individual hoists.

3.3.9 Boatswain's chair

The shape of a boatswain's chair shall ensure that the user is able to operate the scaffolding hoist in a safe manner as well as in an emergency or power failure.

3.3.10 Multi-deck cradles

Movement of the cradle upwards or downwards shall require a positive action on the part of a user on other occupied levels, in addition to that by a user at the main control box.

Where a multi-deck cradle system is required to pass obstructions, each level shall have a readily accessible emergency stop.

Multi-deck cradles shall have provision for access between each level. A hatch shall be provided to cover the access to a ladder between levels. The hatch shall open upwards, and shall not obstruct entry to the ladder or remain in the open position.

The minimum clear height between levels of the cradle shall be not less than 2 m. Where the distance between cradle levels is greater than 2.5 m, protection hoops shall be provided for the access ladder and shall start at 2 m height above the deck of the lower cradle. Edge protection rails shall extend to within 500 mm of the underside of the protection hoops and for a distance of not less than 1 m from the base of the ladder as shown in Figure 3.3.10.