

Australian Standard[®]

Artificial climbing structures and challenge courses

Part 1: Fixed and mobile artificial climbing and abseiling walls



This Australian Standard® was prepared by Committee SF-047, Artificial Climbing Structures. It was approved on behalf of the Council of Standards Australia on 20 October 2009. This Standard was published on 28 November 2009.

The following are represented on Committee SF-047:

- Association for Challenge Course Technology Australia
 - Australian Amusement Association
 - Australian Camps Association
 - Christian Camping International Australia
 - Engineers Australia
 - Indoor Rockclimbing Gyms of Australia Association
 - Outdoor Council of Australia
 - Scouts Australia
 - Sport Climbing Australia
 - WorkSafe Victoria
-

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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Australian Standard[®]

Artificial climbing structures and challenge courses

Part 1: Fixed and mobile artificial climbing and abseiling walls

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PREFACE

This Standard was prepared by Committee SF-047, Artificial Climbing Structures.

The objective of this Standard is to provide designers, manufacturers, proprietors and operating personnel with requirements and guidance specific to the design, construction, operation and maintenance of artificial climbing walls used for climbing, bouldering and abseiling in order to maximize the protection of health and safety for both operating personnel and participants.

In general, the performance requirements of this Standard are based on EN 12572-1:2007, *Artificial climbing structures—Part 1: Safety requirements and test methods for ACS with protection points* and prEN 12572-3:2007, *Artificial climbing structures—Part 3: Safety requirements and test methods for climbing holds*. Changes have been made to reflect different terminology used in Australia and to address artificial climbing structures used for a wide range of climbing, abseiling and bouldering activities.

The Committee also acknowledge the assistance provided by the following publications during preparation of this Standard:

Health and safety for artificial climbing structures and operations, WorkCover NSW, 2002.

Adventure Activity Standards, Artificial Climbing Structures (ACS), Outdoor Recreation Centre, Edition 1 (April 2003).

Adventure Activity Standards, Abseiling, Outdoor Recreation Centre, Edition 2 (April 2005).

This Standard is the first of a proposed series on artificial climbing structures and challenge courses. The Committee has identified other possible topics such as flying foxes and various components of high ropes courses.

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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FOREWORD

This Standard is concerned with the design, construction, testing and operation of artificial climbing and abseiling walls. Artificial climbing and abseiling walls originated from the desire to simulate the climbing and belaying challenges encountered in the recreational pursuit of rock climbing in a manner accessible to the general public. Climbing and abseiling solely on artificial walls is now considered to be a recreational pursuit in its own right, as well as being recognized internationally as a sport and as a valuable training or learning tool by education institutions and employers.

Climbing and abseiling, for many participants, introduces stressors (e.g. height) to increase perceived and real personal risk, forcing people and teams outside their 'comfort zone' in order to maximize the recreational experience to develop their maximum potential. These challenges can be pivotal tools for training or learning outcomes such as developing self-confidence, trust, honesty, teamwork, responsibility, humility, fear management and loyalty.

Artificial climbing and abseiling walls can provide a training and recreational activity that, when compared to a similar activity in a natural setting (i.e. bushland) provides—

- (a) a more cost effective option;
- (b) a more controlled environment with more predictable hazards and risks;
- (c) local, easier and more frequent access, reducing transport costs;
- (d) on-site logistic and medical support;
- (e) a less abrasive environment to consumable equipment, maximizing the serviceable life of equipment;
- (f) flexibility of training and learning outcomes;
- (g) tailored learning simulations for workplace exercises such as team-building and corporate training; and
- (h) reduced environmental damage.

Use of an artificial climbing wall involves two activities—climbing and belaying. Climbing is the act of an individual, under his or her own power, ascending or traversing an essentially vertical or near vertical surface by holding or standing on natural or installed surface projections, indents or aids. Belaying can be defined as affording a safeguard to a moving climber.

A belay system is used to protect a falling climber from a high velocity impact with the ground or another structure. Typically, this relies on a belayer managing a belay rope and belay device during the climber's progress. Other non-manned methods of belay (protection) can also be utilized, namely automatic mechanical belay systems.

The risk associated with climbing without a means of protection (belay) is considered to be unacceptable, except for where the climber is said to be bouldering, i.e. in circumstances where the climber remains close to the ground and climbs without a belay rope but impact attenuating surfaces, spotters or both act as the protection system.

In an artificial setting, climbers typically support themselves during progress along the climbing route by using handholds and footholds. The holds may be integral to the structure or may be removable. Commonly, removable holds are used to allow changes to the nature and difficulty of the climbing route.

Abseiling is an act of self-descent on a fixed rope (as opposed to being lowered by a belayer). Abseilers may have limited contact with the wall during the descent.

This Standard acknowledges that many types of belay systems exist now and others are likely to be devised in the future. It is not the purpose of this Standard to specify which systems should or should not be used, but rather to define the minimum requirements of such systems.

The climber's and abseiler's reliance on themselves or another to be competent at belaying and the belayer's responsibility to be competent, is recognized by the industry to be an essential and expected component to climbing and abseiling.

Climbing is not just about getting to the top of the wall. Much of climbing's attraction can be attributed to the associated commitment elements, such as trust and responsibility.

This Standard has been developed to ensure that participants are informed of and understand the real risks, that all belayers are competent and that all associated infrastructure and equipment meets nominated criteria. Adherence to this Standard should limit any harm to those involved in incidents that are associated with human error and prevent incidents associated with equipment or structure failure, i.e. provide a safe environment to pursue the activities of climbing or abseiling.

The choice by an operator to either use or not use a belay system that will 'fail safe' in the instance of belayer error should be made on the basis of the results of a risk assessment and an examination of the rationale for owning, operating or using the climbing or abseiling wall.

Top-rope climbing and lead climbing employ the two common belay systems. Having the end of a belay rope secured to the climber's harness and having the other end rigged in a belay device which is managed correctly are critical skills common to both systems.

In top-rope climbing, the belay rope goes from the climber up to the top of the climb, is redirected over a top anchor (belay block) before being managed by the belayer.

In lead climbing, the climber locates the rope through a series of anchors during progression on the wall. The lead anchors act as intermittent top anchors in the event of a fall and during climber support or lowering.

It is intended that the climber is neither hindered nor aided by the rope. The role of the belay rope is to—

- (i) prevent or arrest a fall;
- (ii) support the climber during a rest; and
- (iii) provide a controlled means of egress from height at completion of the climb attempt.

STANDARDS AUSTRALIA

Australian Standard

Artificial climbing structures and challenge courses

Part 1: Fixed and mobile artificial climbing and abseiling walls

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the minimum requirements for the design, construction, operation, competencies for support personnel, supervision levels, maintenance and testing of fixed and mobile artificial climbing and abseiling walls (ACW) and associated components. It includes fixed, indoor, outdoor, permanent, temporary and mobile structures (including inflatable climbing structures) and facilities used for climbing, abseiling and bouldering.

This Standard is not applicable to playground equipment (see AS 4685) or structures associated with bungee jumping activities (see AS/NZS 5848), or theatrical and stunt work.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1138 Thimbles for wire rope
- 1170 Structural design actions
- 1170.4 Part 4: Earthquake actions in Australia
- 1353 Flat synthetic-webbing slings (series)
- 1353.1 Part 1: Product specification
- 1657 Fixed platforms, walkways, stairways and ladders—Design, construction and installation
- 1720 Timber structures (series)
- 2076 Wire-rope grips for non-lifting applications
- 2318 Swivels for lifting applications
- 2319 Rigging screws and turnbuckles
- 2321 Short-link chain for lifting purposes
- 2741 Shackles
- 3533 Amusement rides and devices
- 3533.1 Part 1: Design and construction
- 3533.2 Part 2: Operation and maintenance
- 3533.4.1 Part 4.1: Specific requirements—Land-borne inflatable devices
- 3569 Steel wire ropes
- 3600 Concrete structures
- 4100 Steel structures
- 4142 Fibre ropes

- 4142.3 Part 3: Man-made fibre rope for static life rescue lines
- AS
- 4497 Roundslings—Synthetic fibre
- 4497.1 Part 1: Product specification
- 4685 Playground equipment (series)
- AS/NZS
- 1170 Structural design actions
- 1170.0 Part 0: General principles
- 1170.1 Part 1: Permanent, imposed and other actions
- 1170.2 Part 2: Wind actions
- 1170.3 Part 3: Snow and ice actions
- 1664 Aluminium structures (series)
- 1891 Industrial fall-arrest systems and devices
- 1891.4 Part 4: Selection, use and maintenance
- 1892 Portable ladders (series)
- 2269 Plywood—Structural (series)
- 2512 Methods of testing protective helmets
- 2512.1 Part 1: Definitions and headforms
- 3002 Electrical installations—Shows and carnivals
- 4676 Structural design requirements for utility service poles
- 5848 Code of practice for bungy jumping
- BS
- 7188 Impact absorbing playground surfacing—Performance requirements and test methods
- EN
- 341 Personal protective equipment against falls from a height—Descender devices
- 354 Personal protective equipment against falls from a height—Lanyards
- 358 Personal protective equipment for work positioning and prevention of falls from a height—Belts for work positioning and restraint and work positioning lanyards
- 361 Personal protective equipment against falls from a height—Full body harnesses
- 362 Personal protective equipment against falls from a height—Connectors
- 564 Mountaineering equipment—Accessory cord—Safety requirements and test methods
- 566 Mountaineering equipment—Slings—Safety requirements and test methods
- 567 Mountaineering equipment—Rope clamps—Safety requirements and test methods
- 813 Personal fall protection equipment—Sit harnesses
- 892 Mountaineering equipment—Dynamic mountaineering ropes—Safety requirements and test methods
- 1891 Personal protective equipment for the prevention of falls from a height—Low stretch kernmantel ropes
- 12275 Mountaineering equipment—Connectors—Safety requirements and test methods
- 12277 Mountaineering equipment—Harnesses—Safety requirements and test methods
- 12278 Mountaineering equipment—Pulleys—Safety requirements and test methods

ISO

6487 Road vehicles—Measurement techniques in impact tests—Instrumentation

10333 Personal fall-arrest systems

10333-5 Part 5: Connectors with self-closing and self-locking gates

Australian Building Codes Board

BCA Building Code of Australia

1.3 DEFINITIONS

For the purposes of this Standard, the definitions below apply.

1.3.1 Abseiling

Descending vertical (or near vertical) features using fixed ropes and descender (friction) devices.

1.3.2 Acceleration

A vector that specifies the time-derivative (rate of change) of velocity. Acceleration measurement is usually made with an accelerometer.

1.3.3 Acceleration pulse

A non-oscillatory acceleration of a short duration.

1.3.4 Accelerometer

A sensor that measures the acceleration for a specified axis and frequency range.

1.3.5 Anchor

Any load bearing attachment on or about the ACW to which a climber's or abseiler's rope is attached directly or indirectly during his or her progress on the structure. The anchor can be fixed or movable. Four classes of anchors are defined: lead anchors, top-rope anchors, stance anchors and ground anchors. An anchor constructed to accommodate more than one rope is defined as a multiple anchor of that class. An anchor may comprise more than one element, in which case the elements are connected.

1.3.6 Artificial climbing wall (ACW)

A wall or wall-like structure built for the purpose of climbing or abseiling. It may be inside or outside, movable or immovable or mobile. A specific type of ACW is one used only for bouldering. Anchors and impact resistance of the surface to pendular falls do not apply to bouldering ACWs.

1.3.7 Autobelley system

A device that acts as a belay system and that provides for the safe retardation of the climber to a controlled rate of descent such that there is no hazardous impact with the ground.

1.3.8 Belay system

The means by which the climber or abseiler is protected from an uncontrolled fall or descent. This may include a back-up of the primary belay system in some circumstances.

1.3.9 Bouldering

A form of climbing activity, limited in height and for which fall safety can be achieved by the provision of an impact absorbing system, by a spotter providing control of a fall or by a combination of these measures.

1.3.10 Climbing route

The surface of the ACW on which a climber progresses including all the holds and belay anchors, commonly but not necessarily indicated by the presence of a top-rope anchor and rope.

1.3.11 Competent person

A person who has acquired through training, qualifications or experience, or a combination of these, the knowledge and skills enabling that person to perform a specified task.

1.3.12 Descender device

A device by means of which a person can, at a limited velocity, descend from a higher to a lower position either on his or her own or assisted by a second person.

1.3.13 Design load

Nominal load multiplied by a factor of 1.5.

1.3.14 Fall height

The vertical distance between the climber's or abseiler's lowest body element and the surface beneath. For belayed areas, the fall height is deemed to be 1.5 m. For non-belayed areas such as bouldering walls, the fall height is the actual measured fall distance from the highest foreseeable level of the climber's lowest body element to the surface beneath.

1.3.15 Fall zone

The surface that can be hit by a climber falling from the ACW.

NOTES:

- 1 Persons falling from an ACW do not necessarily land directly underneath it. If a person falls while jumping or making a dynamic move, the person is more likely to fall slightly away from the ACW. The area underneath and around the ACW in which persons are likely to fall or over which they could swing (pendulum) is included in the fall zone.
- 2 The extent of the fall zone will depend on the height and configuration of the ACW.

1.3.16 Free space

Space in, on or around the ACW that can be occupied by a climber using the ACW.

1.3.17 g

The acceleration due to the earth's gravity at sea level. It varies with the latitude and elevation of the observer. By international agreement, the value 9.80665 m/s^2 is the nominal international standard acceleration due to gravity.

1.3.18 g_{max}

The maximum acceleration experienced during the impact attenuation test.

1.3.19 Ground anchor

Anchor at the base of the ACW used to anchor the belayer.

1.3.20 Head injury criteria (HIC)

A measure of impact severity that considers the duration over which the most critical section of the acceleration pulse persists as well as the peak level of that acceleration.

1.3.21 Impact attenuation system

Pad, floor mat, carpet and foam composite flooring system, foam filled bag, or another system that transforms the kinetic energy from falls into controlled acceleration/time behaviour during impact.

1.3.22 Impact height

The distance between the surface and the lowest boundary of the headform.

1.3.23 Impact measurement

Determination of the HIC and $g_{\max}$ values from the recorded acceleration of the headform falling from one fall height onto one test position of the specimen.

1.3.24 Impact attenuation test

A series of at least four impact measurements carried out from a specified impact height.

1.3.25 Impact attenuation test position

A position on the impact attenuating system to be tested, located perpendicularly below the centre of the headform.

1.3.26 Lead anchor

Anchor on the ACW that is clipped by a roped climber during his or her progress on the wall.

1.3.27 Minimum breaking load

The magnitude of the load below which failure must not occur during load testing.

1.3.28 Mobile artificial climbing wall

A mobile structure that has been purpose-built for climbing or abseiling and for transport from place to place.

1.3.29 Multiple ground anchor system

Anchor or system at the base of the ACW used to anchor the belayers or self-belaying systems of more than one climber.

1.3.30 Multiple top-rope anchor system

Anchor system or device at the top of a climbing route or routes designed to take the ropes of several climbers at once.

1.3.31 Nominal load

The maximum load that can be generated in normal use.

1.3.32 Out of service

Not in use but still subject to environmental loadings, e.g. wind loads.

1.3.33 Proof test load

The load applied to in-situ components of the ACW for the purposes of verifying good installation practice or current fitness for use.

1.3.34 Shall

Indicates a statement is mandatory.

1.3.35 Should

Indicates a recommendation.

1.3.36 Span

Part of a multiple top-rope anchor measured between two consecutive supports or attachments (see Figure B2).

1.3.37 Spotter

A person providing physical protection of the head and upper body of the climber if a fall occurs during bouldering.

1.3.38 Stability design loads

Those design loads that are relevant to the calculation of the stability of the ACW.

1.3.39 Stance anchor

An anchor consisting of one or more elements at a position on the wall where a climber can stop, attach himself or herself and protect fellow climbers who can join him or her at that position before the climb is continued.

1.3.40 Top-rope anchor system

Anchor device or system at the top of a climbing route designed to take the rope of one climber.

1.3.41 Transducer

A device that translates the magnitude of an impact into an electrical signal that is proportional to this impact.

1.3.42 Tri-axial accelerometer

An accelerometer used to measure the components of acceleration relative to three orthogonal spatial axes.

SECTION 2 DESIGN, CONSTRUCTION AND EQUIPMENT REQUIREMENTS

2.1 DESIGN

2.1.1 Structural requirements

The ACW shall be designed to accommodate the most adverse combination of loading that will be applied according to the appropriate Australian Standards for structural components, in particular the following:

- (a) For structural design actions, see Clause 2.2.
- (b) For structural steel, AS 4100.
- (c) For concrete structures, AS 3600.
- (d) For aluminium structures, AS/NZS 1664 (series).
- (e) For timber structures, AS 1720 (series).
- (f) For poles, AS/NZS 4676.
- (g) For wire rope, AS 3569.
- (h) For chain, AS 2321.
- (i) For fittings used with wire rope, AS 1138, AS 2076, AS 2318, AS 2319 and AS 2741.
- (j) For synthetic fibre components, AS 1353.1 and AS 4497.1.

A tree shall only be used as part of an ACW structure or anchor system if a documented risk assessment has indicated that the tree is suitable for the purpose.

For inflatable ACW, AS 3533.4.1 shall be applied.

2.1.2 Access ways and platforms

Access shall be provided for places normally used by operating, inspection, maintenance and servicing personnel for device set-up, inspection and maintenance. Where access ways and platforms are required for these non-climbing activities, they shall comply with AS 1657.

2.1.3 Hydraulic, pneumatic and propelling equipment

Such equipment shall be capable of handling the design loads and comply with relevant requirements in AS 3533.1.

2.1.4 Combustibility of materials

Designers should consider the combustibility of materials.

NOTE: The provisions of the BCA may apply.

2.1.5 Lightning protection

An assessment of the risk of lightning strike shall be made in accordance with AS 3533.1.

2.2 VERIFICATION OF THE STRENGTH AND STABILITY OF AN ACW

2.2.1 General

Where possible, the strength and stability of an ACW and the fixings to any surrounding structure shall be verified by calculation, using the design loads in Table 1, in accordance with Clauses 2.2.2 and 2.2.3.

Where there are elements that are non-verifiable by calculation, the strength and stability of the wall and components shall be verified by using the relevant minimum breaking loads in Table 1 applied in accordance with Appendix A.

In the assessment of strength and stability, the load of a falling user shall be applied at the point of connection to the ACW structure at the most unfavourable angle between $\pm 12.5^\circ$ from the vertical axis.

TABLE 1
LOADS

Load type	Nominal load for design kN	Minimum breaking load (Appendix A) kN	Proof test load (Appendix B) kN
Normal load of a user	0.8	—	—
Load applied to an anchor or multiple system in the case of responding to a fall	6.6	20	8
Load applied to an anchor or multiple anchor system by the suspension of an individual climber or a climbing team	2.5	—	—

2.2.2 Verification of strength

2.2.2.1 General

The strength of all aspects of an ACW structure (resistance to failure due to excessive deformation or rupture), details of anchor points and their connections and load paths to basic structure and connection of the structure to buildings or the like shall be verified by calculation.

2.2.2.2 Loadings

Strength shall be assessed by limit states methodology and shall consider the following actions:

- (a) Permanent and self weight in accordance with AS/NZS 1170.
- (b) Working loads in use as specified in Table 1.
- (c) Live loads (where permanent access ways may be included in the design) in accordance with AS 1657.
- (d) Wind loads in accordance with Clause 2.2.2.4.
- (e) Test loads in accordance with Appendix B.
- (f) Seismic loads in accordance with AS 1170.4.
- (g) Special loads as may apply to the specific ACW and due to—
 - (i) loads due to thermally produced expansion or contraction;
 - (ii) snow (see AS/NZS 1170.3);
 - (iii) ponding of rain or hail;
 - (iv) differential settlement of foundations;
 - (v) errors in fabrication;
 - (vi) transport;
 - (vii) rescue and evacuation; and
 - (viii) handling and erection.

2.2.2.3 Combination of loads

The following combinations shall be used in the verification of strength limit state:

$$\gamma_G G_k + \gamma_Q Q_{k,1} + \sum_{i>1} \psi_i \gamma_Q Q_{k,i} \leq R/\phi$$

where

γ_G = partial safety factor for permanent effects

G_k = load due to permanent effects (see Item 2.2.2.2(a))

γ_Q = partial safety factor for variable effects

Q_k = load due to variable effects (see Items 2.2.2.2 (b) to (g))

ψ = combination factor for variable effects

R = resistance of the structure

ϕ = partial safety factor for materials

The following partial safety factors for effects shall be used:

γ_G 1.0 for favourable effects

γ_G 1.35 for unfavourable effects

γ_Q 0 for favourable effects

γ_Q 1.5 for unfavourable effects

The following combination factor for variable effects of the climber shall be used (simplified method of calculation):

$\psi = 0.8$

2.2.2.4 Wind loads

Wind actions for the design and verification of an ACW shall be assessed according to the following:

ACW type/application	In-service wind speed	Out-of-service wind speed
Fixed, exposed	24.5 m/s	V_{500} for the site in accordance with AS/NZS 1170.2 (Note 2)
Mobile	24.5 m/s	56 m/s (Note 2)
Fixed, enclosed	Wind actions on an enclosing building may affect an ACW within. Any effects likely to be transmitted to the ACW shall be assessed by the designer	

NOTES:

- 1 Wind speeds included above are to be interpreted as limit state.
- 2 In the case of a documented agreement between a purchaser and the designer/manufacturer or where the design allows for the timely reconfiguration of an ACW to accommodate storm conditions (the procedure for which is fully described in the operating manual), the out-of-service wind speed may be reduced to the agreed or declared figure.
- 3 The Beaufort Scale for assessing wind speed is shown in Appendix C.

2.2.3 Verification for stability

The stability of an ACW shall be assessed by calculation in accordance with Appendices D and E. The partial and combination factors for applicable loads involved in the determination of stabilizing and destabilizing effects shall be in accordance with

Appendix E, unless the designer can demonstrate that more appropriate factors apply in a particular application.

In assessing the combinations of loads producing destabilizing effects ($E_{d,dst}$), a combination factor (ψ_c) of 1.2 for the permanent (self-weight) loads or 1.5 shall be used for wind and imposed action loads (climbing load and protection loads on the structure).

NOTE: Appendix E provides worked examples of stability assessments.

2.3 IMPACT STRENGTH OF THE ACW SURFACE

Except for an inflatable ACW and surfaces of an ACW where a user making a pendular fall cannot impact, e.g. bouldering, the impact strength of the climbing surface shall be tested in accordance with Paragraph F2 of Appendix F and there shall be no penetration (i.e. an open split) of the sample and no permanent deformation of or release by the fastening system.

For an inflatable ACW, the impact strength shall be tested in accordance with Paragraph F2 of Appendix F and there shall be no penetration (i.e. an open split) of the sample and no permanent deformation of or release by the fastening system.

2.4 BELAY SYSTEMS

2.4.1 General

For all climbing and abseiling activities other than bouldering, the ACW shall provide a belay system for each user. Belay systems shall be configured to sustain a participant and limit impact forces in any circumstance where the primary means of support or suspension fails or where the participant loses his or her support. Examples of primary means of support for participants are ropes, ascenders, descender devices or their grip on a rock face, ladder, pole or other arrangement on which they climb or move. Generally, the belay system is a secondary means of support and is designed and operated in such a manner as to offer the least impediment to the primary experience as possible (i.e. before it comes into action, some degree of fall will occur) and to provide a means to leave the wall in a controlled manner.

NOTE: Some belay systems may include more than one person.

2.4.2 Types of belay systems

Belay systems shall be one of the following types, as appropriate to the activity:

- (a) *Type A Non-anchored*—a Type A belay shall be arranged so control of the belay is by a belaying person or persons without additional anchorage to the structure of the ACW or a ground fixing. See Figure 1 for climbing and Figure 4 for abseiling.
- (b) *Type B Anchored*—a Type B belay shall be arranged so control of the belay is by a belaying person and the principal restraint forces are accepted by an anchorage to the structure of the ACW or a ground fixing. See Figure 2 for climbing and Figure 5 for abseiling.
- (c) *Type C Automatic belayer*—a Type C belay shall be arranged to provide control of the belay by use of a self-adjusting device (either local or remote to the user) that reacts to the dynamics of the climber or abseiler. See Figure 3 for climbing and Figure 6 for abseiling.
- (d) *Type D Single rope for abseiling*—a Type D belay shall be arranged to provide control of the belay where the same rope is used for both descending and belaying. See Figure 7.

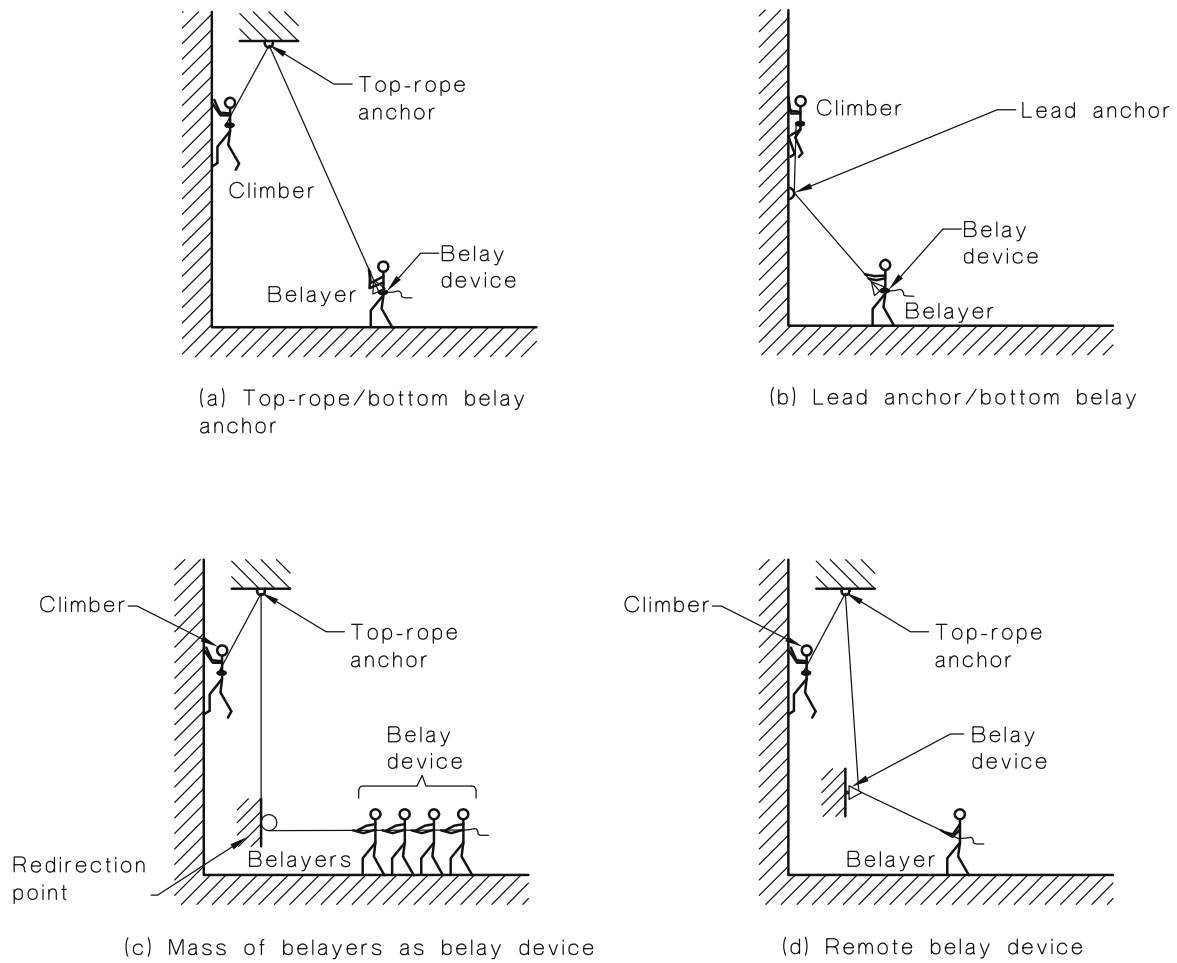


FIGURE 1 EXAMPLES OF TYPE A, NON-ANCHORED BELAY SYSTEMS FOR CLIMBING

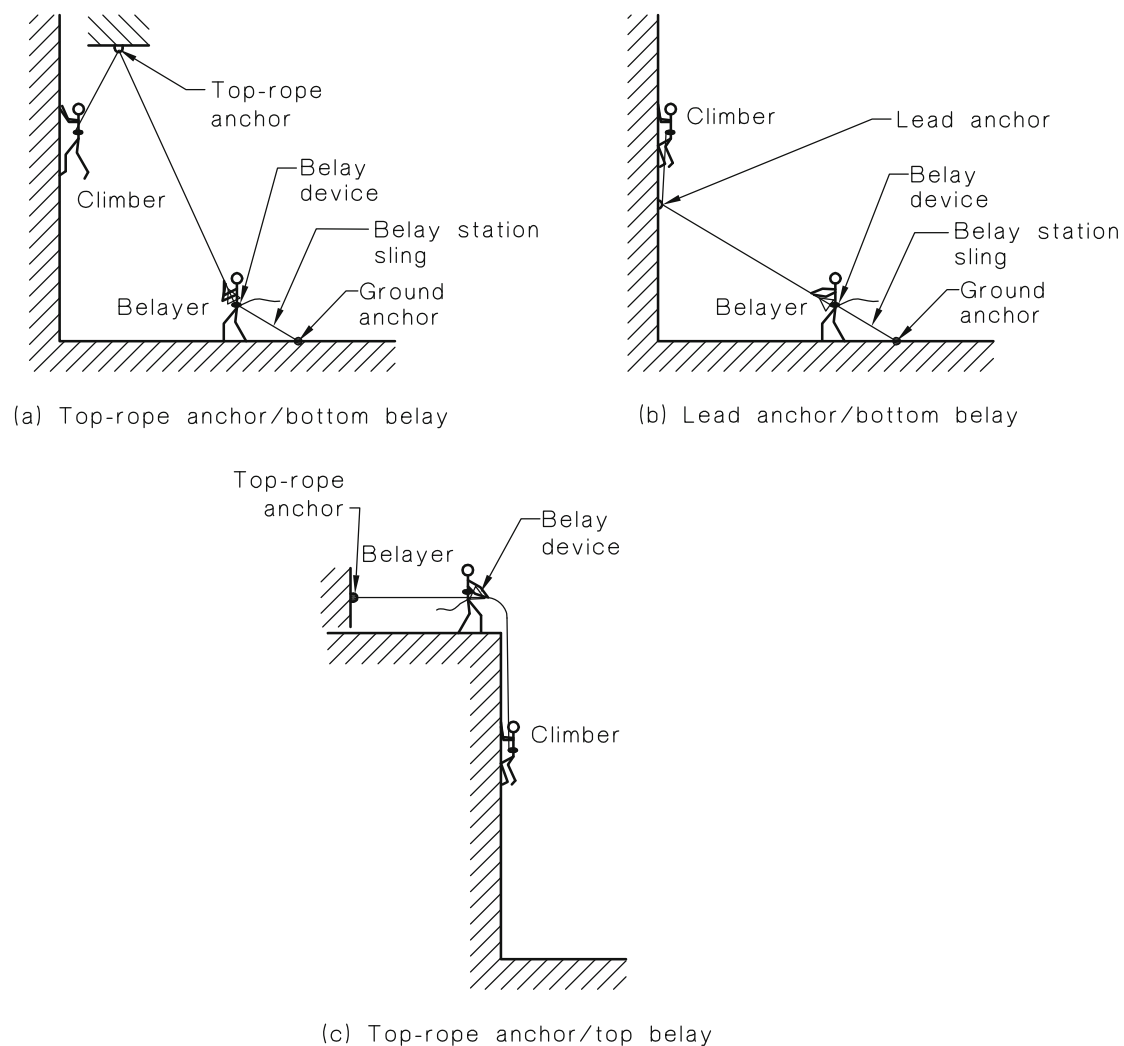


FIGURE 2 EXAMPLES OF TYPE B, ANCHORED BELAY SYSTEMS FOR CLIMBING