

# Rock Climbing Fixed Anchor Guidelines

CLIMBERS CLUB  
OF TASMANIA





- 1. Introduction ..... 3**
- 1.1. About this Document..... 3
- 1.2. About the CCT..... 3
- 1.3. Disclaimer ..... 3
- 1.4. Document Control ..... 4
- 1.5. Glossary..... 4
- 2. Safe Use of Fixed Anchors ..... 5**
- 2.1. Inspect Anchors Before Use ..... 5
- 2.2. Anchors Needing Replacement..... 5
- 3. Anchor Installation Guidelines..... 6**
- 3.1. Skills, Experience and Duty of Care ..... 6
- 3.2. Land Tenure and Responsible Access..... 6
- 3.3. Check the Structural Integrity of the Rock..... 6
- 3.4. Anchors Should Meet Strength and Use Guidelines..... 7
- 3.5. Anchors should be Suitably Positioned for Climbing Purposes ..... 7
- 3.6. Minimise the Visual Impact of the Anchor..... 8
- 4. Glue-in Type Anchors ..... 9**
- 4.1. Glue-in Anchor Minimum Standards..... 9
- 4.2. Adhesive Standards ..... 9
- 4.3. U-Anchor Installation Procedure ..... 10
- 4.4. P-Anchor Installation Procedure ..... 11
- 5. Mechanical Expansion Bolt Anchors ..... 13**
- 5.1. Sleeve Type Anchors ..... 13
- 5.1.1. *Sleeve Bolt Anchor Minimum Standards..... 13*
- 5.1.2. *Installation Procedure for Sleeved Expansion Anchors..... 13*
- 5.2. Stud/True-bolt Type Anchors..... 14
- 5.2.1. *True-Bolt Anchor Minimum Standards ..... 14*
- 5.2.2. *Installation Procedure for True-Bolt Type Anchors..... 14*
- 5.3. Hangers ..... 15
- 6. Abseil Stations..... 17**
- 7. References ..... 18**
- Appendix A - Examples of Sub Standard Fixed Anchors..... 19**

Cover photo: Jake Bresnehan on Simply the Best, 28, The Star Factory. Photo Jed Parkes.



## 1. Introduction

### 1.1. *About this Document*

This document has been prepared by the Climbers Club of Tasmania (CCT) in order to ensure a minimum standard for fixed climbing anchors in Tasmania. The information contained in this document has been obtained from a large sample of existing standards and additional input based on experience with Tasmanian rock types.

The intent of these guidelines is to provide a standard of practice for placing fixed anchors.

### 1.2. *About the CCT*

The CCT is an incorporated association representing climbers in Tasmania. It was formed in 1963 and revitalised in 2010.

The objectives of the CCT are:

- **Access and Advocacy**—ensuring access to climbing areas and representing climbers' views to public and private landowners, government and other organisations.
- **Communication**—fostering better communication between Tasmanian climbers, including maintaining guidebooks.
- **Policy**—making decisions on issues, publishing codes of conduct, and other standards.
- **Maintenance and Environmental Work**—track and crag work, signage, and anchor maintenance.

Should you find an unsafe anchor in need of replacement, or have any queries or concerns about rock-climbing and the impact it will have on a certain cliff please start a dialogue with the CCT. The CCT can be contacted by the following means:

- Visit [www.climbersclubtas.org.au](http://www.climbersclubtas.org.au) and follow the links to the CCT page.
- Via an email to [cct@climbersclubtas.org.au](mailto:cct@climbersclubtas.org.au).

### 1.3. *Disclaimer*

To limit the inherent risks associated with rock-climbing and related activities it is important participants undertake proper instruction on techniques and safety equipment.

The CCT accepts no responsibility for the suitability and strength of any rock climbing anchors within Tasmania.

Rock Climbing relies on the judgement of individual climbers to balance and control climbing risks. The CCT recommends that you seek professional instruction if you do not have the experience or judgement to understand climbing risk.

When using fixed anchors the onus is on the user to ensure the anchor is safe to use.

The CCT accepts no responsibility for the misuse of fixed anchors, or inappropriate safety procedures and equipment. Seek professional instruction as to the safe and appropriate use of fixed anchors.



### 1.4. Document Control

Version	Date	Changes	Endorsement
1.6	3/11/2014	Add specific brands of acceptable expansion bolts, remove distinction between 304 and 316 stainless in favour of using 316.	
1.7	8/12/2014	Add document control table.	Approved: Senior Engineer, Parks & Wildlife Service, (by Email), 3/11/2014.
1.8	14/09/2024	Glue recommendations updated. Email address for club changed. Note about anchors in siltstone. Note about buttering anchor legs	

### 1.5. Glossary

Like most activities, climbing has developed its own language and vocabulary of terms to help communicate ideas and techniques. *Table 1* lists a glossary of climbing terms.

**Table 1 - Glossary of terms used in this document**

Fixed Anchor	A permanently installed fixture used to provide an anchor during climbing. Climbers often use fixed anchors where no other appropriate method of anchoring is available. Climbers will attach ropes or slings to the anchors to use as necessary, before removing their own gear and leaving the permanent anchor in situ.
Bolt	A generic term used by climbers to refer to any type of fixed protection.
Expansion bolt	A bolt mechanism that expands when tightened. Expansion bolts are used in conjunction with hangers.
Hanger	A fixture mounted to expansion bolt type anchors to provide an attachment point for carabiners or quickdraws.
Piton	An out-dated anchor rarely used anymore. A steel peg that is pounded in with a hammer, potentially causing damage to the surrounding rock. Never appropriate as a fixed anchor.
Quickdraw	Climbing equipment consisting of two carabiners and a sling, one end clipped to an anchor, catching the climber should they fall.
Red Tag	A red tag on a fixed anchor means that it should not be used.
EN 959	European Standard for Mountaineering Equipment, Rock Anchors, Safety Requirements and Test Methods. As Australia has no rock climbing specific standards, the European Standard has been used as a reference.
AS1891	Australian Standard for Industrial fall-arrest systems and devices. While not entirely relevant to rock-climbing activities it does mention relevant anchor capacity requirements.



## 2. Safe Use of Fixed Anchors

The following sections provide some guidance on the safe use of fixed anchors. The correct and safe use of all rock-climbing equipment requires experience and proper instruction.

### 2.1. *Inspect Anchors Before Use*

Before relying on any fixed anchor **perform the following assessment every time on every anchor** even on popular routes. Seek advice from an experienced climber if you are not confident of making the following assessment:

1. **The anchor is placed in sound rock**, not near any fractures, fissures or other weakness. The rock should be part of the major buttress, not in a block that could come loose.
2. **Glue-in anchors should have no surface cracks** in the adhesive between the anchor and the rock. Do not use the anchor if there is any doubt about the adhesive the bolt requires replacement.
3. **Hangers on mechanical expansion bolts are firmly fixed**. The hanger should be sitting flush against the rock and the bolt should not protrude excessively. Hangers should not be loose or spinning. When a loose hanger is found do not use until tightened as per the instructions appropriate to the expansion bolt type in the *Mechanical Expansion Bolt Anchors* section on page .
4. **Test the anchor** using a quickdraw, clip one end to the anchor, and use a series of sharp tugs to check for any egress or movement of the anchor.

**Do not use any anchor when there is any doubt as to the quality of the anchor.**

### 2.2. *Anchors Needing Replacement*

If you find an anchor in need of replacement, or have any concerns regarding any fixed anchors take a photo and contact the CCT ([cct@climbersclubtas.org.au](mailto:cct@climbersclubtas.org.au)) so an experienced climber can investigate and replace the anchor if necessary.

Please refer to *Appendix A - Examples of Sub Standard Fixed Anchors* on page for some examples of anchors needing replacement.



### 3. Anchor Installation Guidelines

The following sections provide general guidelines for placing safe climbing anchors.

#### 3.1. *Skills, Experience and Duty of Care*

Before placing any climbing anchors ensure:

1. You have the requisite skills and experience to place the anchor safely.
2. You are fulfilling your duty-of-care to the users of the anchor.

If you are interested in learning to place anchors contact the CCT for advice.

As dictated by demand, the CCT will hold bolting workshops to instruct climbers in new anchor placement and re-equipment of existing routes. A suitably qualified and experienced member of the club will provide this instruction. All training sessions will be documented, and shall include the following information:

- Name of trainer and participants, location of training, date and topics covered.

Trainers shall use this document, and any relevant manufacturers' instructions to supplement training to ensure a minimum standard of knowledge is maintained.

#### 3.2. *Land Tenure and Responsible Access*

The CCT is a socially responsible club that seeks to work with Land Owners and Managers to ensure appropriate access to climbing venues is possible. The CCT does not endorse un-authorized access to cliffs or climbing. Ensure you have the appropriate approvals before bolting on any newly discovered areas.

Use the following checklist before placing any anchors:

1. Is the placement of the anchor legal and permitted at the location?
2. Will the placement of the anchor cause any access issues?
3. Will the placement comply with the statutory requirements of management plans for national parks and/or the TWWHA?
4. Is the climb on private land?
5. Do I have permission to climb here?
6. Is the anchor in keeping with the surroundings?
7. Is the anchor consistent with the climbing ethics of the crag? (consult the CCT for advice on this topic)

#### 3.3. *Check the Structural Integrity of the Rock*

Before placing any anchor, it is important to ensure the rock is suitable:

1. Ensure the rock is part of the major mass and is not in any way loose or detached. If there is any doubt do not install an anchor.
2. Ensure there are no nearby fractures, fissures or other weaknesses in the rock within 200mm of the bolt location.
3. Tap around the location of the anchor with a hammer. Take note of any vibrations or a dull echoing sound, which may indicate loose rock. A sharp 'ping' noise generally indicates sound rock suitable for an anchor.

**3.4. Anchors Should Meet Strength and Use Guidelines**

The following guidelines are the minimum expected for anchors placed in Tasmanian rock:

1. All climbing anchors should be 316-grade stainless steel.
2. Avoid mixing metal types as this causes galvanic corrosion.
3. All anchors should have an Ultimate Strength of at least 25kN in shear and 15kN tension (as per EN-959 and AS/NZS1891.4).
4. All belay stations and abseil stations are to consist of two independent anchors. These should be no closer than 200mm and be placed in a fashion that ensures that are loaded evenly. Abseil stations should have sacrificial shackles or rings that can be replaced when worn out.
5. ‘Carrot – bash-in’ type anchors are an out-dated technology that can be dangerous, and SHOULD NOT be installed for any reason.
6. Choose an anchor type suitable for the rock type. Anchor types suitable for rock types found in Tasmania are summarised in Table 2. Refer to the following sections for more details on anchor types.

**Table 2 - Anchor - Rock suitability matrix**

	Hard – Medium Rock Types					Soft Rock Types		
	Granite	Dolerite	Quartzite	Conglomerate	Basalt	Sandstone	Limestone	Mudstone / Siltstone
<b>U Anchor</b> 8-10mm Stainless	✓	✓	✓	✓	✓	✓	✓	*
<b>P Anchor</b> 10mm Stainless	✓	✓	✓	✓	✓	✓	✓	*
<b>Sleeve Bolts</b> 12mm Stainless	✓	✓	✓	✓	✓	✗	✗	✗
<b>True Bolts</b> 10-12mm Stainless	✓	✓	✓	✓	✓	✗	✗	✗
Carrot Bolts, Mild Steel Bolts, all other types	✗	✗	✗	✗	✗	✗	✗	✗

\*Testing of anchors in Tasmanian mudstone / siltstone has found rock failure at low (7KN) loads. Testing of anchors in this rock type should be undertaken first, prior to use.

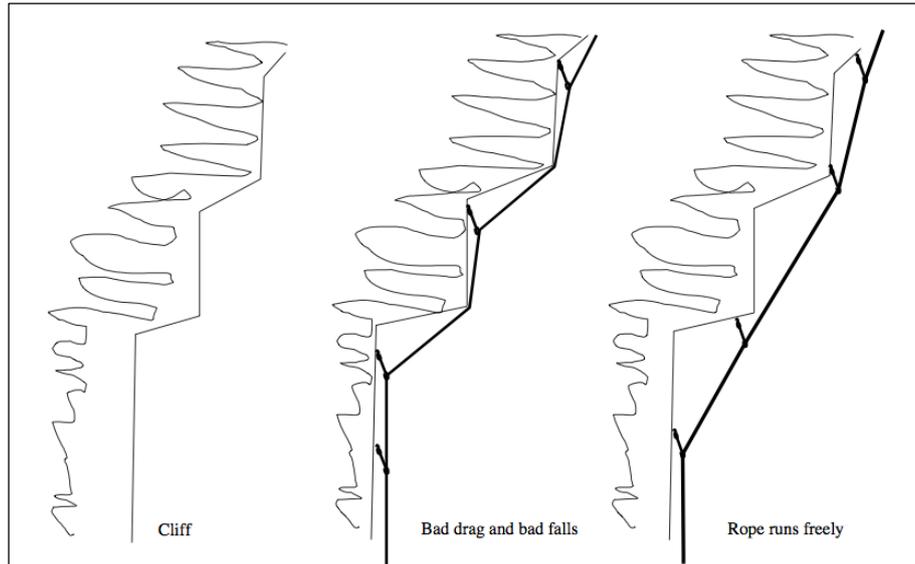
**3.5. Anchors should be Suitably Positioned for Climbing Purposes**

When placing anchors on a route it is important that the placement does not detract from the climbing experience for most users. The following guidelines provide some hints on good placement:

1. All anchors should be positioned to ensure that they are in the optimal location for their intended purpose. It is important that anchors can be used safely and efficiently by competent climbers, using standard equipment, who may not be familiar with the route.
2. Anchors should be placed in a straight line as much as practical to prevent excessive rope drag.

3. Carabiners should hang freely from any anchor so as not to be cross-loaded over any edges or bumps.
4. Consider all users when at a stance. Do not place anchors so high as to make clipping dangerous for climbers with a shorter reach.
5. Pitch length should be based on climbers using 60m ropes, as much as practical.

An example of thoughtful placement is shown in Figure 1.



**Figure 1 - Correct placement of anchors minimises rope drag**

### **3.6. Minimise the Visual Impact of the Anchor**

To reduce the visual impact for other climbers and recreational users is an important consideration:

1. Consider painting the anchor to minimise reflection in sunlight.
2. When replacing old, worn-out or dangerous anchors, remove the old anchor and if possible and return the hole to as close to its natural state as possible.
3. Consider filling the hole with suitable epoxy. This can prevent a rust stain appearing over time. Care should be taken to limit amount of adhesive as it can become unsightly if poorly done. Local dust or grit can be mixed in to the epoxy to ensure the colour matches the surrounding rock.



## 4. Glue-in Type Anchors

Glue-in anchors are found across many cliffs in Tasmania. They are extremely strong, have a very good life span and are the most user-friendly fixed anchor option. There are two types of glue-in anchor with different shapes: U-anchors and P-anchors.

U-anchors are extensively used across Tasmania. They are stainless steel rod, bent into a U shape before having both stems glued into the rock. They are the most common type of glue-in anchor found in the state. U-anchors are suitable for all rock types and especially suitable for soft rock.

P-anchors (or 'eye' anchors) are very similar except they are constructed with a single stem that is bent to form an eyelet then welded to the stem forming a P shape. P-anchors require the head of the P to be recessed into a shallow slot to avoid falls rotating the anchor in its hole and breaking the adhesive bond and substantially reducing the anchor's strength.

Glue-in anchors are suitable for threading ropes directly through the anchor, as they have rounded surfaces that won't damage ropes or carabiners.

### 4.1. *Glue-in Anchor Minimum Standards*

All fixed anchors should comply with the requirements of EN 959, and also as a minimum be made of:

1. One piece construction;
2. 316 (A4) Grade Stainless Steel;
3. Bar/rod diameter minimum 8mm<sup>1</sup>;
4. Minimum embedment depth 75mm;
5. Stem must be both notched and ground to ensure a good mechanical bond and be cleaned to ensure a good chemical bond; and
6. Minimum Ultimate Strength of 25kN in shear and 15kN in tension.

### 4.2. *Adhesive Standards*

The adhesive used should be a high quality adhesive specifically designed for masonry applications. Suitable products include, but are not limited to:

1. Ramset Chemset 502;
2. Ramset Chemset 801;
3. Hilti RE-500;
4. Dewalt AC100 Pro
5. Sika 31/41;

While these adhesive types have slightly different characteristics, they share some common attributes. They will bond well with stainless steel to provide a secure fixing. They cannot be used under 5 degrees Celsius, as the curing process is affected. Epoxy glues are greatly preferred for use compared to vinyl-ester glues, due to their longer lifespan and greater overall strength. Polyester glues such as Ramset 101 are unsuitable and must not be used.

Ensure the anchor has any residual grease cleaned off it with warm soapy water and is rinsed thoroughly. Notches and grooves must be ground into the stem to ensure good surface contact with the rock. Failure to

---

<sup>1</sup> 8mm U Bolts are currently widely deployed in Tasmania as the most common diameter of U Bolts. In ad hoc testing their strength has been shown to be more than adequate, however more documented formal test results would be useful.



do this has shown to significantly weaken the anchor and can cause anchor failure under extremely low loads.

All holes should be brushed and cleaned thoroughly to ensure a good bond. It is vital that the adhesive has mixed correctly. For cartridge-style adhesive, this involves squeezing out a small amount to allow the two parts to mix in the nozzle before application. This initial test will allow the installer to physically see the adhesive cure. If there is ever any doubt as to the age or suitability of the adhesive, do not use it. When installing, be diligent in trying to limit the amount of adhesive left around the anchor stems because excess adhesive leaves an unsightly mark on the rock.

Notches, threads and glued portions of the anchor should be 'battered' with glue prior to installation. The use of nitrile gloves can be used to aid in this process.

New anchors should be left to cure for a period of at least 24 hours before use to allow the highest strength possible.

Many chemical adhesives pose a health risk. Avoid breathing the vapours and unnecessary skin contact. Wear gloves and goggles when using injection systems. Ensure you fully understand the product application, precautions and limitations before using it.

### **4.3. U-Anchor Installation Procedure**

1. Follow the general guidelines contained in the *Anchor Installation Guidelines*.
2. Drill an initial hole with a diameter 2mm greater than the bar/rod diameter (i.e. drill a 10mm hole for an 8mm U anchor). This allows enough space for the adhesive. Using an anchor as a guide, drill the second hole. Ensure the holes are the correct depth (at least 85mm hole for 75mm anchor embedment), and that no notches or grind marks are exposed.
3. Thoroughly clean the hole. Brush then blow the hole at least three (3) times to ensure there is NO dust left in the hole. This is the most critical step as a dirty or excessively wet hole creates a weak anchor.
4. The hole should then be filled with the correct amount of adhesive (i.e. allow for the volume of the anchor within the hole). With any system for applying adhesive to the hole it is critical to fill from the back of the hole to ensure there are no air pockets in the adhesive.
5. Wipe the anchor clean to remove any contaminants that may affect the anchor strength. It is important to try not to handle the anchor with bare skin as the oils in your skin can reduce the bond strength. 'Butter' the glued portions of the legs to ensure the notches are pre-filled with glue. Ensure the anchor is not pushed in too far: the anchor must provide enough space for multiple carabiners.
6. Clean away any excess adhesive on the surface. Smooth off the adhesive with a rag to ensure no sharp edges are left. Avoid excessive smearing of the adhesive as this will create an ugly scar on the rock.
7. Leave anchor to cure for at least 24 hours before use. Place a red warning tag on new anchors if in a popular area to ensure no premature use. Anchors placed in roofs will need some tape or the like to hold the anchor in place while the adhesive cures.

Correctly prepared and installed U-Anchors are shown Figure 2.



Note the stems are both ground and notched with an angle-grinder



Note that there is at least 16mm clearance to allow carabiners to rotate freely and load correctly

Figure 2 - U Anchor Examples

#### 4.4. P-Anchor Installation Procedure

1. Follow the general guidelines contained in the *Anchor Installation Guidelines* on page .
2. Drill a hole with a diameter 2mm greater than the bar/rod diameter (i.e. drill a 10mm hole for an 8mm P-bolt). This allows enough space for the adhesive. Ensure the hole is the correct depth. Drill a slot to embed the anchor eyelet. This should be in the direction of the anticipated load. The groove should be as deep as the diameter of the bar/rod.
3. Thoroughly clean the hole. Brush then blow the hole at least three (3) times to ensure there is NO dust left in the hole. This is the most critical step as a dirty or excessively wet hole creates a weak anchor.
4. The hole should then be filled with the correct amount of adhesive (i.e. allow for the volume of the anchor in the hole). With an injection system it is critical to start with the nozzle at the back of the hole to ensure there are no air-pockets. Ensure that the head of the anchor in the groove is covered with sufficient adhesive.
5. Wipe the anchor clean to remove any contaminants that may affect the anchor strength. It is important to try not to handle the anchor with bare skin as the oils in your skin can reduce the bond strength. Ensure the anchor is not pushed in too far: the anchor must provide enough space for multiple karabiners.
6. Clean away any excess adhesive on the surface. Smooth off the adhesive with a rag to ensure no sharp edges are left. Avoid excessive smearing of the adhesive as this will create an ugly scar on the rock.
7. Leave anchor to cure for at least 24 hours before use. Place a warning tag on new anchors if in a popular area to ensure no premature use. Anchors placed in roofs will need some tape or the like to hold the anchor in place while the adhesive cures.

A range of P-anchors and the correct embedment depth is shown in Figure 3.



In-correct ring-bolt placement. Ring can be twisted in a fall resulting in glue bond failure.



Correct ring-bolt placement. Ring is well recessed into rock notch and unable to be twisted. Glue fills the notch to the rock surface.



Only use glue from an injection gun when placing ring-bolts. Capsules do not contain enough glue to fill the notch for the 'eye ring'.

Figure 3 - P Anchor Installation guidelines

## 5. Mechanical Expansion Bolt Anchors

An alternative to glue-in anchors is a two-part anchor that uses an expansion bolt and a suitably rated hanger. Expansion bolt anchors can be installed when the rock is suitable and unlike glue-ins expansion anchors are purely mechanical fasteners that require no setting time before use so they can be used immediately after placement. They do however require slightly more maintenance as there is a nut that can come loose.

There are many masonry fasteners on the market designed for construction use. Many of these fasteners are unsuitable for climbing anchors. The following sections provide information on suitable masonry fasteners as a general point always buy a trusted brand and avoid inferior products that may look identical.

There are two recommended types of mechanical bolts, sleeve-bolts and true-bolts. These are only suitable in hard rock types, refer to Table 2 - Anchor - Rock suitability matrix on page . Loctite or Nyloc style nuts may be used in areas with large temperature differentials between winter and summer to ensure the nut doesn't become loose.

Mechanical expansion anchors are only used with a hanger specifically designed for rock-climbing. Home-made hangers should never be used. Ensure the nut is tensioned to the required torque setting, and that there is thread protruding through the nut. If the nut is not filled with thread, the anchor needs replacing.

### 5.1. Sleeve Type Anchors



**Figure 4 - A Ramset Dynabolt**

Sleeve type anchors, such as the Dynabolt shown in Figure 4 rely on an internal bolt expanding the outer sleeve to provide a solid fixing. Sleeve type anchors require larger sizes to provide a safe anchor because the sleeve itself provides little load carrying ability. Typically 12mm sleeve type anchors provide the same load carrying as a 10mm True-Bolt anchor.

When using sleeve type anchors it is important to ensure the sleeve can pass through the hanger hole.

Use only anchors which have been specifically made and tested for climbing (such as Petzl, Fixe and Raumer brands) or are reputable construction brands that have available test strengths in a Technical Data Sheet (TDS) or other technical documentation (such as Hilti, Ramset and Powers). Never use "no name" or unrated construction anchors.

#### 5.1.1. Sleeve Bolt Anchor Minimum Standards

All fixed anchors should comply to the requirements of EN 959, and also as a minimum be made of:

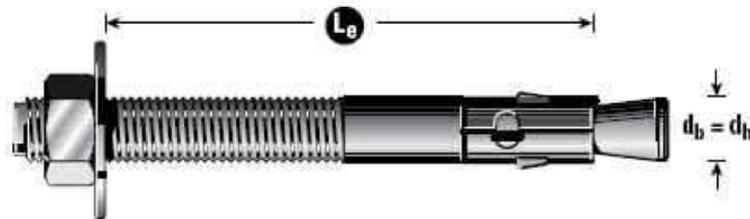
1. Minimum diameter of 12mm, ensuring an M10 thread;
2. The hanger hole diameter MUST be 12mm, to ensure a solid fixing;
3. All components should be 316 (A4) Stainless Steel;
4. Minimum embedment depth of 75mm; and
5. Suitable for medium to hard rock types only, not suitable for sandstone.

#### 5.1.2. Installation Procedure for Sleeved Expansion Anchors

1. Follow the general guidelines contained in the *Anchor Installation Guidelines* on page .

2. Drill a hole, with diameter as per anchor manufacturer's instructions. Ensure the hole is drilled perpendicular to the rock. Ensure that the hole is 15mm deeper than the total length of the anchor. This allows it to be recessed into the cliff and glued over when it comes time to replace the anchor.
3. Thoroughly clean the hole. Brush then blow the hole at least three (3) times to ensure there is NO dust left in the hole. This is the most critical step as a dirty hole creates a weak anchor. All mechanical expansion bolts will work in wet holes.
4. Use a sleeve-bolt with the hanger already attached, ensuring the hanger hole clears the sleeve. Often the fixing will need a light tap with a hammer to seat it correctly. If much force is required something is wrong, and the anchor must be removed. Using a torque wrench, tighten the nut to the recommended force. Ensure the hanger is positioned to take the anticipated load across its strongest axis.

## 5.2. Stud/True-bolt Type Anchors



**Figure 5 - A True Bolt**

True bolts are torque controlled masonry anchors that rely on expansion. Their advantage is that you get an M10 thread from a 10mm drilled hole, saving battery power. Again these are always to be used with a rated 'Hanger' specifically designed for rock-climbing. Home-hangers should not be used.

Use only anchors which have been specifically made and tested for climbing (such as Petzl, Fixe and Raumer brands) or are reputable construction brands that have available test strengths in a Technical Data Sheet (TDS) or other technical documentation (such as Hilti, Ramset and Powers). Never use "no name" or unrated construction anchors.

### 5.2.1. True-Bolt Anchor Minimum Standards

As a minimum standard all true bolt anchors should be:

1. M10 or M12 diameter;
2. The diameter of the hole in the hanger MUST match the bolt;
3. All components should be 316 (A4) Stainless Steel;
4. Minimum embedment depth of 75mm; and
5. Only used in medium to hard rock types. Note: these anchors have proven totally unreliable in sandstone.

### 5.2.2. Installation Procedure for True-Bolt Type Anchors

1. Follow the general guidelines contained in the *Anchor Installation Guidelines* on page .
2. Drill a hole, with diameter as per anchor manufacturer's instructions. Ensure the hole is drilled perpendicular to the rock. Ensure that the hole is 15mm deeper than the total length of the bolt. This allows it to be recessed into the cliff and glued over when it comes time to replace the anchor.

3. Thoroughly clean the hole. Brush then blow the hole at least three (3) times to ensure there is NO dust left in the hole. This is the most critical step as a dirty hole creates a weak anchor. All mechanical expansion bolts will work in wet holes.
4. Use a true-bolt bolt with the hanger already attached, ensuring the hanger hole clears the sleeve. The fixing will require firm hammering to seat it correctly. If excessive force is required something is wrong, and the anchor must be removed. Using a torque wrench, tighten the nut to the recommended force. Ensure the hanger is positioned to take the anticipated load across its strongest axis. It is critical to ensure the bolt has taken up. If it keeps turning continuously, remove hangers, hammer bolt to recess it and start again. This is usually due to a dusty hole.

### 5.3. Hangers

A hanger is the fixture mounted to expansion bolt type anchors. There are many on the market, only hangers made for rock-climbing should be used. They must be rated as per EN 959. Only Stainless Steel should be used within Tasmania, specifically 316 (A4) Stainless Steel. Loose or spinning hangers should not be trusted, and a competent person should tighten as soon as practically possible.

**The hanger must be rated to a shear load of 25kN, and a tensile load of 15kN (Figure 7 - UIAA 123 / EN-959 Fixed anchor standards for expansion bolts with hangers).**

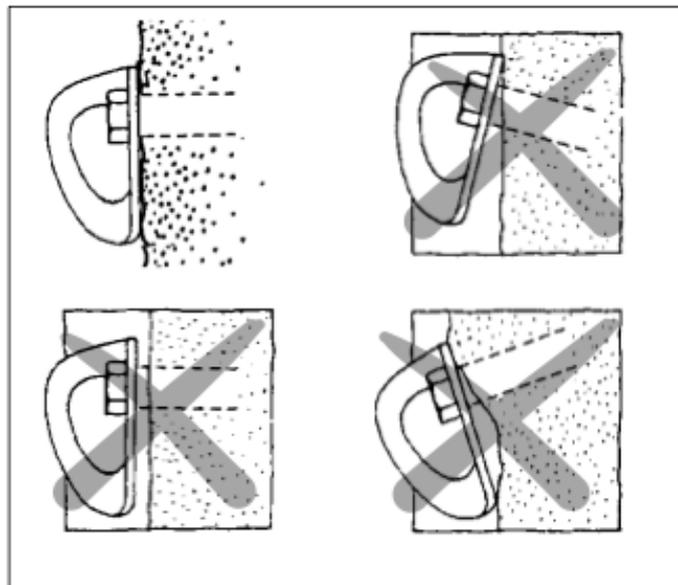
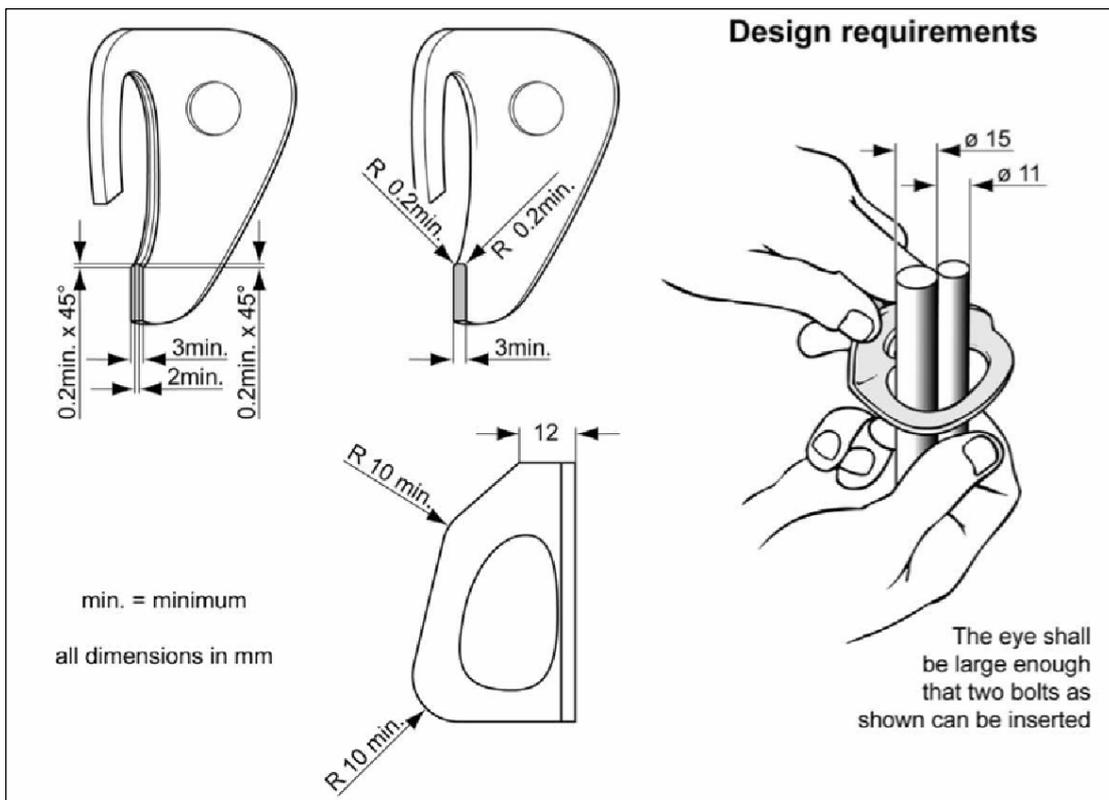
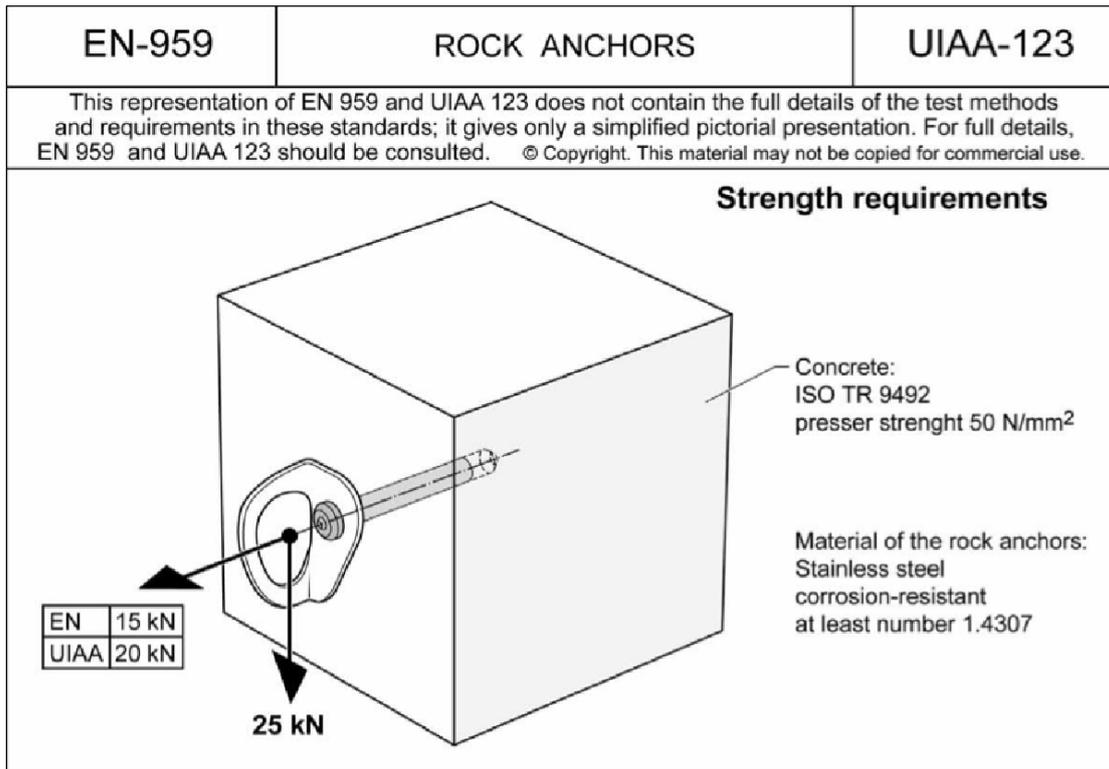


Figure 6 - Correct placement of hangers on expansion bolts



**Figure 7 - UIAA 123 / EN-959 Fixed anchor standards for expansion bolts with hangers**

## 6. Abseil Stations

Fixed abseil stations, sometimes called rappel or rap stations, can be strategically placed to provide a convenient means of returning to the start of a climb.

Abseil stations help minimise the impact of erosion and unsightly slings while adding to the enjoyment of users. They also minimise the hazards associated with descending through hazardous terrain where accidental displacement of debris and rocks or personal injury may be significant risks.

Abseil stations should meet the following individual guidelines:

1. Comprise two independent and solid anchors, both individually rated to 25kN in shear.
2. Have a shackle, welded ring or some other rounded edge that will not damage a rope when threaded through the anchors.
3. Replaceable shackles should be placed on all abseil stations, as it is easier to replace a shackle than a Glue-in anchor.
4. Shackles and chain should always be 316 (A4) Stainless Steel, and be of a minimum diameter of 8mm.
5. Climbers should never top-rope directly off the anchor, as this decreases its life. Instead have the rope running through your own locking-carabiners. The last person can then thread the rope through the anchor, remove the equipment and abseil off.



Figure 8 – Abseil Station examples



## 7. References

European Standard EN 959:2007 - Mountaineering equipment. Rock anchors. Safety requirements and test methods

Australian Standard AS1891.4:2009 - Industrial Fall Arrest Systems and Devices

Union Internationale Des Associations D'Alpinisme – UIAA 123 Mountaineering and Climbing Equipment - 'ROCK ANCHORS'

Available at [http://www.theuiaa.org/upload\\_area/cert\\_files/UIAA\\_123\\_rock\\_anch\\_2009.pdf](http://www.theuiaa.org/upload_area/cert_files/UIAA_123_rock_anch_2009.pdf)

Strength and Reliability of Chemically Bonded Rock Climbing Anchors in Sandstone

Undergraduate Honours Thesis 2003 By Stephen Hawkshaw, Department Of Civil Engineering - The University Of Sydney. Available at <http://www.chockstone.org/TechTips/SandstoneBolting.pdf>

## Appendix A - Examples of Sub Standard Fixed Anchors

The images below of anchors found elsewhere in Australia illustrate some types of anchors which DO NOT meet the guidelines in this document and need replacing.

Note none of these examples were found in Tasmania.



Homemade hanger on mild steel bolt. All bolts and hangers should be stainless steel and hangers should conform with EN-959.



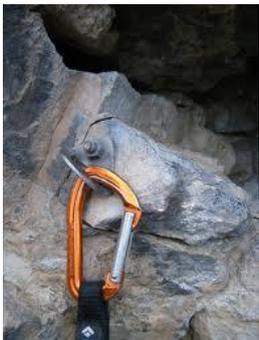
Rusting mild steel expansion bolt. All bolts and hangers should be stainless steel.



Captive chain where nut has limited thread. Chains links used this way can place large outward forces on the bolt.



Worn and poorly placed U-bolt. Anchors with any visible signs of wear should be immediately replaced.



Example of a Sub-Standard Anchor. While the anchor assembly complies to EN 959, the fractured rock becomes the weak point.



Example of a solid Fixed Anchor safe for use. Rock is solid with no fractures; hanger sits flush with the rock and cannot spin.