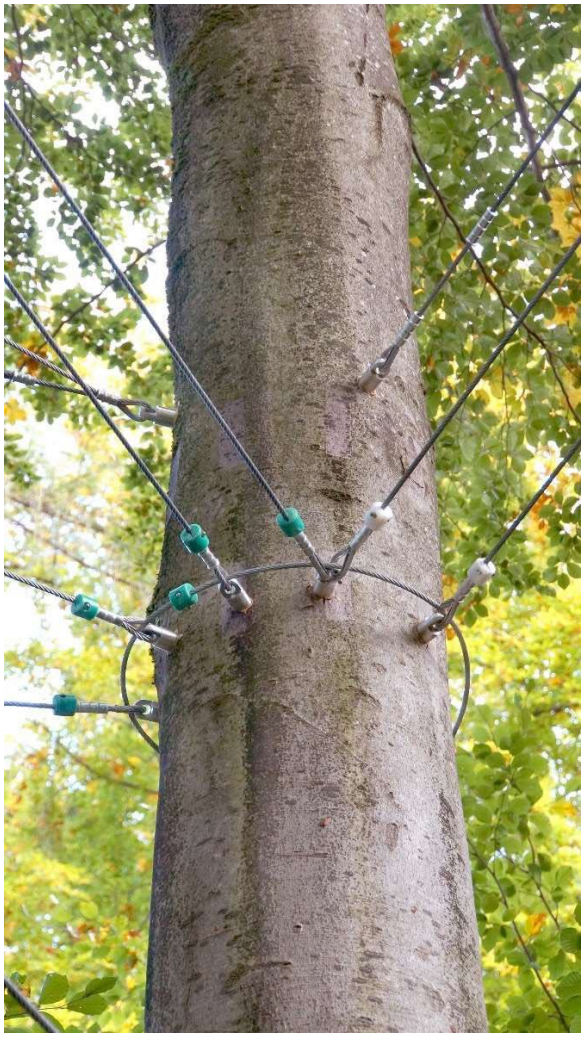
plobabo®
Plochinger Baumbolzen

Installation instructions

- Platform bolts
- Multi-bolt for action and safety system
- Rope carrier for intermediate securing



These installation instructions must be read before installation in order to guarantee safe handling of the Kletterwald Plochingen product.

The builder must make these installation instructions available to the installer and ensure that the installer has read and understood them.

Keep the installation instructions in a safe place for later use. Leave a clearly visible notice in the work area indicating the storage location.

The following technical standards and accident prevention regulations must be observed when installing and checking the Babo:

BGI 533 Safety when working with hand tools
DGUV rule 112-192 Use of eye and face protection
BG rule Use of protective gloves
3.21 Hand-held machines (Class No. 61)
EN 61029-1:2000-05 Safety of transportable power tools
BGHM Arbeitsschutz Kompakt No. 011 Working with hand drills
EN 15567-1:2020-05

Summary

1. Screw types (example)

1.1 Platform bolt (PB6KÜA50)

Hexagon bolt can be screwed in directly.

Turned section to countersink the bolt 10mm.

Optimized thread with asymmetrical thread flanks. Easy to screw in.

1.2 Multi-bolt hardwood (MBÜA70_2.0)

Optimized thread with asymmetrical thread flanks. Easy to screw in.

Rounded surfaces allow for increased hole-lining strength after over-walling.

1.3 Multi-bolt softwood (MBÜA50NH160_2.0)

Hardwood thread with a compacted profile in the thread base. Optimized with asymmetrical thread flanks.

Self-tapping drill point for airtight installation in softwood.

Rounded surfaces allow for increased hole-lining strength after over-walling.

2 Installation / Safety

2.1 Safety instructions:

We work with a living organism that is the tree. Careful handling is essential to protect it. Although our approach is minimally invasive compared to other attachment techniques, we must endeavour to prevent the entry of bacteria and fungal spores into the tree during installation by disinfecting it, as mentioned below.

Not all trees are the same and not all locations are the same. For these reasons, **the installation** of tree bolts **must be clarified with a qualified tree assessor**.

Calculations of the expected load entries at the securing or action level must be available. Only a static calculation specific to the cable garden is a necessary basis for installation.

The tensile test certificates in the appendix can only be used as a planning aid.

To prevent damage to people and trees, we recommend on-site tensile tests.

2.1.1 It must be ensured that the minimum diameter of the supporting structure is 30cm.

2.1.2 Ensure that the installation is carried out in accordance with these installation instructions.

2.1.3 Ensure that the drill bits, countersinks, brush, cartridge tip, finished drill hole and bolt are **disinfected** before each use or installation.

2.1.4 Correct use:

The Babo may only be installed on living, healthy trees.
The Babo is not suitable for installation in dead or diseased wood! See also 2.1
Check points 2.1 - 2.1.4 before using the Babo for the first time.
Any other use is considered improper use.

The manufacturer is not liable for any resulting damage; the risk is assumed exclusively by the builder. Intended use also includes compliance with the installation, removal and inspection conditions specified by the manufacturer.

2.1.5 The suitability of the Babo for the respective application must be determined by the builder and is not subject to the manufacturer's product liability.

2.2 Tools and materials used

The relevant accident prevention regulations apply at the installation site.

2.2.1 Battery-operated screwdriver with spirit level or drilling device

Spirit level for horizontal drilling

2.2.2 Multi-drilling tool with countersink and depth stop

Depth stop adjustable to all BABO screw types

Drill and countersink interchangeable.
Drill diameter can be found in the table below, 2.8.

2.2.3 Countersink with centric pin

Countersink for surface preparation of wood species with thick bark, e.g. Quercus robur.

2.2.4 Hole brush

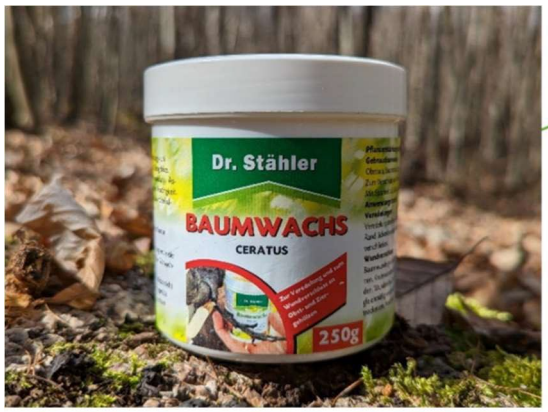
Hole brush ∅ suitable for drilling. It is used to remove wood chips from the drill hole. **CAUTION disinfect** before use!

2.2.5 Fungicidal surface disinfectant spray

Spray disinfection to minimize the introduction of fungal spores.

Hole brush, drill bits, countersinks, drill holes and bolts must be **disinfected** before use or installation.

2.2.6 Tree wax / resin



To ensure an airtight installation of bolts with hardwood threads, the **disinfected** drill hole must be filled with at least 5 pumps of resin from the bottom up.

2.2.7 Joint sprayer + empty cartridges

Fill the empty cartridge with resin. Disinfect the cartridge tip and pump the resin with the joint tip into the brushed out, **disinfected** drill hole.

2.2.8 Socket with reducer, adapter

Socket SW 41 with reduction and adapter for installation of the tree bolts.

Caution: Use a long socket for ÜA70!

2.2.9 Telescopic reversible rachet

The telescopic ratchet is used to screw in the bolts that have been tightened with the battery-powered screwdriver in 1st gear (**not an impact screwdriver**) until they reach the correct position.

2.2.10 Silicon grease or other suitable release agent (inox guard)

To prevent cold welding between VA components, the add-on parts must be treated with inox guard before installation.

2.3 Assembly of platform bolts in accordance with 2.1.3

2.3.1 Set the multi-drill tool to the screw.

2.3.2 Drill the hole to the desired depth.

2.3.3 Brush out the drill hole.

2.3.4 Disinfect the drill hole

2.3.5 Insert resin, filling approx. 1/3 of the drill hole.

2.3.6 Position the bolt horizontally using a battery-powered

2.3.7 Screw the bolt into the end position using the telescopic

2.3.8 Screw in the wooden platform holder with inox guard ratchet

2.4 Assembly of multi-bolts for hardwood in compliance with 2.1.3

The multi-bolt for hardwood is installed in the analogue way to the platform bolt.

If the multi-bolt in the securing level is subjected to a tension load, the countersink can be omitted (the multi-drilling tool must be adapted accordingly).

Once installed, the multi-bolts can be equipped with a wide range of rope connection options (see 3. Accessories).

2.5 Assembly of multi-bolts for softwood, in accordance with 2.1.3

The multi-bolt for softwood is installed in the analogue way to the platform bolt.

If the multi-bolt in the securing level is subjected to a tension load, the countersink can be omitted (the multi-drilling tool must be adapted accordingly).

Once installed, the multi-bolts can be equipped with a wide range of rope connection options (see 3. Accessories).

2.6 **Installation of cable support for intermediate securing** in accordance with 2.1.3

2.6.1 Create a flat surface with a Ø 40 mm stick drill.

2.6.2 Prepare a 4 cm deep hole with a 4 mm drill bit.

2.6.3 Cover the drill hole with resin

2.6.4 Screw in cable carrier with SW6 Allen key.

2.6.5 In softwood, installation with RAMPA socket type SKL, stainless steel 1.4305, D 18.5, d M10, L 80 mm is recommended as an option. ETA-12/048 1

2.7 Table of drilling data, unless a multi-drilling tool is used.

		Platform bolts	Multi-bolts Hardwood*	Multi-bolt Softwood*	
Article n°		PB6KÜA50**	MBÜA50**	MBÜA50NH100**	MBÜA50NH160**
Depth of hole		80mm	100mm	80mm	130mm
Depth of countersink		10mm	10mm	10mm	10mm
Total depth***		90mm	110mm	90mm	140mm
Ø countersink		40mm	40mm	40mm	40mm
Drilling diameter in mm	Maple	22	21	-	-
	Beech	22	21	-	-
	Douglas	20	-	21	21
	Oak	22	21	-	-
	Ash	22	21	-	-
	Spruce	20	-	21	21
	Pine	20	-	21	21
	Larch	21	-	21	21
	Robinia	22	21	-	-
	Fir	20	-	21	21
	Hornbeam	22	21	-	-

*If MBÜA50 or MBÜA50NH160 is loaded on pull-out, countersinking is not necessary.
**Values also apply to bolts with ÜA70.
***Depth of the hole with countersinking of the bolt.
ATTENTION! If a check measurement reveals that the hole has been drilled too deep, the base of the hole must be filled with tree resin (see 2.2.7).

3. babo Accessories (example)

3.1 Single bracket LMB1F

Rope stop Single rope. Connection to be made with VA thimble, material thickness min. 2mm. Breaking load 11.98 t, see appendix 4.1

3.2 Double bracket LMB2F

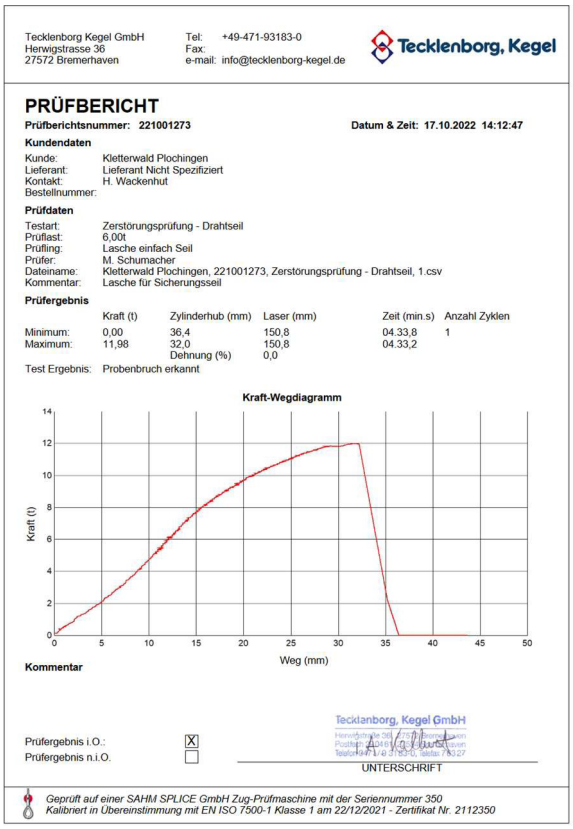
Rope stop Double rope. Connection to be made with VA thimble, material thickness min. 2 mm. Breaking load 7.64 t, see test reports 4.2

3.3 Rope clamp lug SKL12SS

Rope stop for 12 mm rope clamp.

4. Test reports

4.1 Destruction test, single bracket



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PRÜFBERICHT

Prüfberichtsnummer: 221001273 **Datum & Zeit: 17.10.2022 14:12:47**

Kundendaten

Kunde: Kletterwald Plochingen
Lieferant: Lieferant Nicht Spezifiziert
Kontakt: H. Wackenhut
Bestellnummer:

Prüfdaten

Testart: Zerstörungsprüfung - Drahtseil
Prüflast: 6,00t
Prüfling: Lasche einfach Seil
Prüfer: M. Schumacher
Dateiname: Kletterwald Plochingen, 221001273, Zerstörungsprüfung - Drahtseil, 1.csv
Kommentar: Lasche für Sicherungsseil

Prüfergebnis

	Kraft (t)	Zylinderhub (mm)	Laser (mm)	Zeit (min.s)	Anzahl Zyklen
Minimum:	0,00	36,4	150,8	04.33,8	1
Maximum:	11,98	32,0	150,8	04.33,2	
		Dehnung (%)	0,0		

Test Ergebnis: Probenbruch erkannt

Kraft-Wegdiagramm

Kommentar

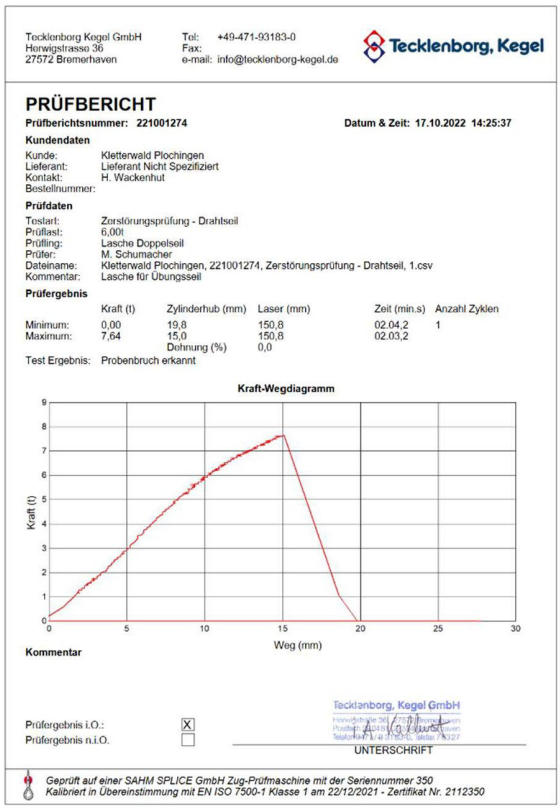
Tecklenborg, Kegel GmbH

Prüfergebnis i.O.: X
Prüfergebnis n.i.O.:

UNTERSCHRIFT

Geprüft auf einer SAHM SPLICE GmbH Zug-Prüfmaschine mit der Seriennummer 350
Kalibriert in Übereinstimmung mit EN ISO 7500-1 Klasse 1 am 22/12/2021 - Zertifikat Nr. 2112350

4.2 Destruction test, double bracket



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Tecklenborg, Kegel

PRÜFBERICHT

Prüfberichtsnummer: 221001274 **Datum & Zeit: 17.10.2022 14:25:37**

Kundendaten

Kunde: Kletterwald Plochingen
Lieferant: Lieferant Nicht Spezifiziert
Kontakt: H. Wackenhut
Bestellnummer:

Prüfdaten

Testart: Zerstörungsprüfung - Drahtseil
Prüflast: 6,00t
Prüfling: Lasche Doppelseil
Prüfer: M. Schumacher
Dateiname: Kletterwald Plochingen, 221001274, Zerstörungsprüfung - Drahtseil, 1.csv
Kommentar: Lasche für Übungsseil

Prüfergebnis

	Kraft (t)	Zylinderhub (mm)	Laser (mm)	Zeit (min.s)	Anzahl Zyklen
Minimum:	0,00	19,8	150,8	02.04,2	1
Maximum:	7,64	15,0	150,8	02.03,2	
		Dehnung (%)	0,0		

Test Ergebnis: Probenbruch erkannt

Kraft-Wegdiagramm

Kommentar

Tecklenborg, Kegel GmbH

Prüfergebnis i.O.: X
Prüfergebnis n.i.O.:

UNTERSCHRIFT

Geprüft auf einer SAHM SPLICE GmbH Zug-Prüfmaschine mit der Seriennummer 350
Kalibriert in Übereinstimmung mit EN ISO 7500-1 Klasse 1 am 22/12/2021 - Zertifikat Nr. 2112350

4.3 Extraction test multi-bolt hardwood, exemplary

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PRÜFBERICHT

Prüfberichtsnummer: 221001256 **Datum & Zeit: 17.10.2022 11:25:38**

Kundendaten

Kunde:	Kletterwald Plochingen
Lieferant:	Lieferant Nicht Spezifiziert
Kontakt:	H. Wackenhut
Bestellnummer:	

Prüfdaten

Testart:	Zerstörungsprüfung - Drahtseil
Prüflast:	3,00t
Prüfling:	Esche - Laubholzgewinde
Prüfer:	M. Schumacher
Dateiname:	Kletterwald Plochingen, 221001256, Zerstörungsprüfung - Drahtseil, 1.csv
Kommentar:	Nr.16 90 Grad zum Stamm Drehmoment 220NM Bohrung 22mm

Prüfergebnis

	Kraft (t)	Zylinderhub (mm)	Laser (mm)	Zeit (min.s)	Anzahl Zyklen
Minimum:	0,00	60,7	0	02.37,0	1
Maximum:	4,37	24,3	0	02.26,0	
		Dehnung (%)	0,0		

Test Ergebnis: Probenbruch erkannt

Kraft-Wegdiagramm

Kommentar

Prüfergebnis i.O.: [X]
Prüfergebnis n.i.O. [ ]

Tecklenborg, Kegel GmbH

UNTERSCHRIFT

Geprüft auf einer SAHM SPLICE GmbH Zug-Prüfmaschine mit der Seriennummer 350
Kalibriert in Übereinstimmung mit EN ISO 7500-1 Klasse 1 am 22/12/2021 - Zertifikat Nr. 2112350

5 Installation instructions

5.1 Tree selection, tree species

For the installation of tree screws, tree species that are described in the literature as being good ground material should be used. Corresponding lists can be found in specialist literature (see DUJESIEFKEN & LIESE 2008, Wessolly & Erb 2014)

The following, for example, are considered as good ground support:

Ground sealing material

Pedunculate and sessile oak	European beech	Hornbeam
Field Maple	Larch	Silver spruce and pine

A somewhat lower degree of sealing should be assumed for the following tree species:

Sycamore and Norway Maple	Ash	Robinia
Lime	Elm	Douglas Fir

This list does not claim to be exhaustive. Not all evaluations in the specialist literature are the same. In case of doubt, an experienced tree expert should be consulted.

5.2 Vitality

The ability of a tree to limit damage and compensate for it through growth depends on its vigour. The vitality of the tree should be categorised by tree experts. A purely visual inspection is usually sufficient for this purpose.

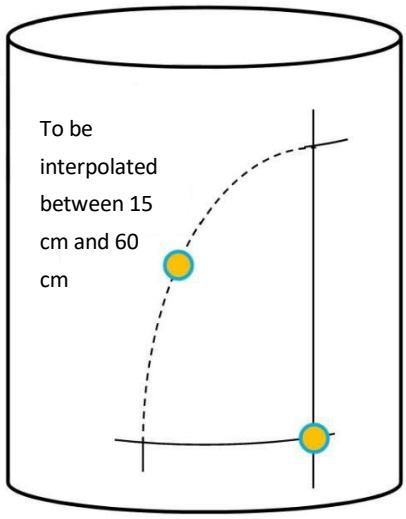
5.3 Number of tree screws and spacing between them

When installing tree screws, the damage to the living tissue and conduction system must be limited in order to prevent impact on the crown nourishment. Based on the circumference, the damage should be less than 10% of the tree's circumference.

Tree species	Diameter in cm	Bolts Quantity	Tree species	Diameter in cm	Bolts Quantity
Beech	30-40	2	Pine	30-40	2
	40-55	3		40-55	3
	55-65	4		55-70	4
	65-75	5		70-85	5
	75-90	6		85-100	6

The lateral spacing of the screws, which are attached at the same height around the trunk diameter, should not be less than 15 cm.

A distance of at least 30 cm should be respected between two drill holes at the top and bottom along the trunk axis. For screws that are positioned at an angle to each other and are attached both at different points on the circumference of the trunk and at different heights, the minimum distance should be determined by interpolating the position between these values on an elliptical graph.



5.4 Load direction

In order to avoid transverse loads as far as possible, the drill channels of the screws should be aligned in the direction of mechanical load wherever possible.
Deviations from the load direction of around 20° do not have a significant effect on the load-bearing capacity and only have a minor effect on the deformations that occur under load.
If the screw axis deviates from the load direction by around 30° or more, depending on the type of wood, a significant deformation increase of the wooden structure can be expected with a load transmission greater than 6 kN.

5.5 Time of installation

The tree screws should not be installed during prolonged freezing temperatures below -5° Celsius or in summer temperatures above 30° Celsius, as this would increase the damage to the cambium around the wound area. The wound edges should also be protected with wound treatment substances as a preventive measure when temperatures are around 0° Celsius.

After long dry periods during the vegetation period, the air embolisms can probably penetrate further into the water-conducting tissue due to the high suction tensions in the xylem. These periods should therefore also be avoided.

It is recommended to install the tree screws during the vegetation period from March to September in order to maximise the tree's own wound healing reaction.

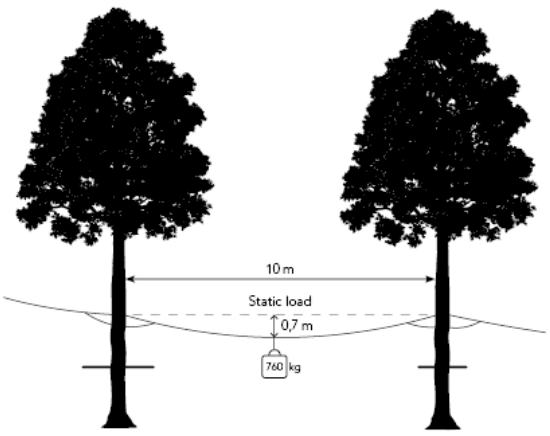
5.6 Load application and tensile tests

The tree species used for the tensile tests, spruce and beech, represent the upper and lower end of the range of strengths of Central European tree species that are frequently used in cable gardens. While the compressive and tensile capacity of European beech along the trunk axis is in the upper range according to the so-called "Stuttgart Strength Catalogue of Green Woods" (WESSOLLY & ERB 2014), the transverse tensile strength of the wood from living spruce is particularly low.

During fall tests in climbing forests, peak loads at the anchor point of the safety ropes were always less than 12 kN (Wenger & Wittmann 2009). A peak load of almost 6 kN has been recorded at the drop weight with a mass of 80 kg. In order to avoid injuries, this value must not be exceeded during an active fall. It can therefore be assumed that in the case of a fall, the load-bearing capacity of the tree bolts will exceed twice the peak load of 12 kN measured in the cable installation. A fall into a vertical rope would even reach 20 kN, more than three times the permissible impact force of 6 kN.

The safety factor for securing people in typical cable garden installations would be even higher, as the anchor points would be loaded almost horizontally.

When using the longer screw for the tree species spruce (130 mm), at least 33 kN were measured, with the only 80 mm long screw for the tree species beech already approx. 39 kN were achieved. Consequently, in the case of a fall (horizontal rope force max. 12 kN) with the longer screw, at least the safety factor preventing failure would be around a factor of almost 3.



Example of calculation for the required rope slack for softwood, using the "Siebert Formula" and considering EN15567

5.7 Maximum authorised load

When installing tree bolts, the load direction must be respected.

A softwood bolt should always be loaded in the pull-out direction. If other load directions are used, this must be determined in a static calculation by the builder company.

See also: Expert report on the technical assessment of trees

Subject: Load-bearing capacity and compatibility of the Plobao tree screw in living trees.

Expert report no.: 23-0182

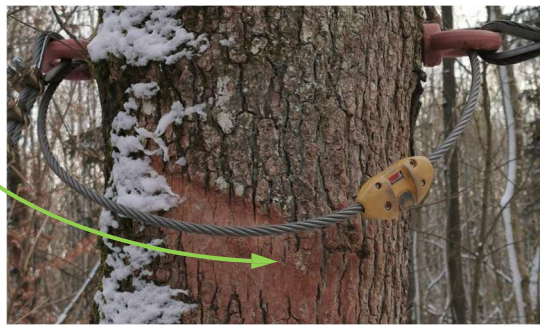
TREECONSULT

BRUDI & PARTNER Graduate engineer: ANDREAS DETTER

5.8 Backup at the securing level

Despite the values shown above, it is essential to attach a backup to the safety rope. A steel cable with a standardised end connection is passed around the tree through the VA eye of the safety cable.

Make sure that the rope does not damage the tree's bark, e.g. by rubbing. If necessary, an anti-abrasion device (see also 2.6) must be installed.)



5.9 Backup in the action level

The omission of a backup in the action level must be justified in the risk analysis. If values above 6 kN occur in the static calculations, a backup must be installed, analogue to 5.7.

Regarding high loads in case of strong wind conditions, which happen more and more frequently, a redundant safety device or a mooring rope generally seems to be appropriate.

6. Inspection

6.1 Daily routine visual inspection

The following points must be checked during the daily inspection when opening the installation:

- Lateral shifting of the screw in the borehole.
- Any signs of deformation of the screw.
- An increased rope slack, especially after strong wind conditions.

6.2 Operational inspection

During the monthly operational inspection of the installation, the following points must be checked and documented in analogue or digital form:

- Lateral shifting of the screw in the borehole.
- Cracks in the supporting wood body including the newly formed wound wood.
- Bark damage or fungal proliferation around the drill hole.
- Signs of deformation of the screw.
- An increased rope slack, especially after strong wind conditions.

6.3 Commissioning inspection, modification inspection, annual general inspection

If the Plochinger beam bolts are used in a critical installation (regardless of whether it is a safety or action level), a pre-commissioning inspection or a modification inspection must be carried out.

The inspection must be carried out by an inspection authority with the required skills and experience, in accordance with DIN EN 17020: 2012, section 6.1.

7. Maintenance

Depending on the type and vitality of the tree, as well as the length of the installed overhang section, it should be expected that, after 5 to 10 years, the tree bolt will be so far overgrown that a new overhang section will have to be installed.

This period is highly dependent on the individual site circumstances and the condition of the tree.

By taking a core hole from a reference tree at the site, a more precise statement can be made about the diameter growth of the tree population. Regular maintenance can prevent damage to the tree and ensure appropriate supervision.

This maintenance work should be checked by tree experts as part of the regular inspection of the trees and, if necessary, commissioned.

« Rev A // 06-06-2024 »

Many thanks for your confidence in our products.

We hope that you were satisfied with the information and instructions you received and that you were able to carry out the installation successfully.

Should you require any further assistance, please do not hesitate to contact us at any time

phone +49 (0)152-34168948

mail office@babo-solutions.de

Good luck for your installation of our babo!