babo

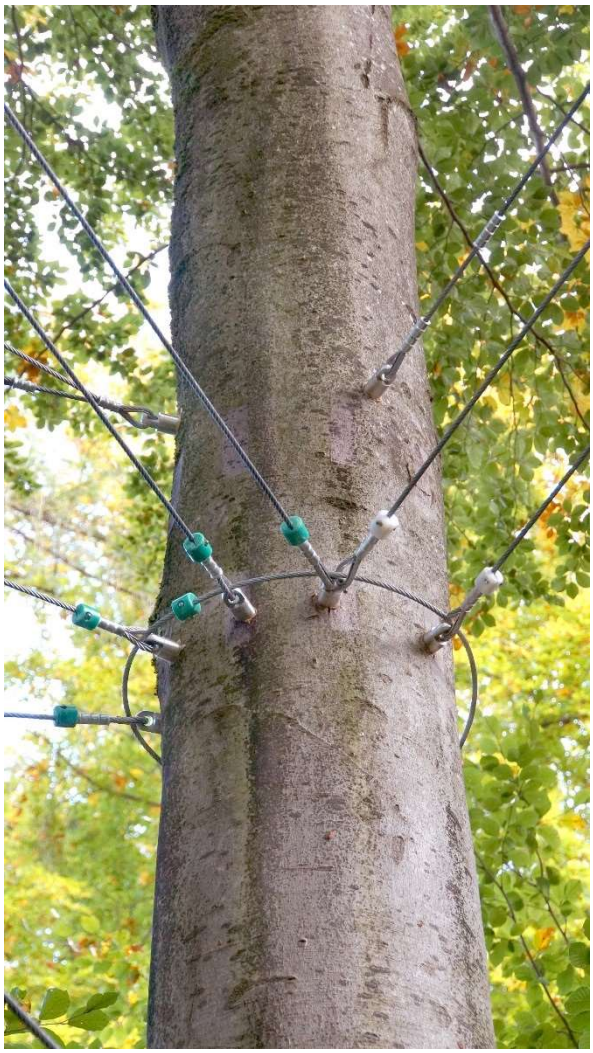
A brand of Kletterwald Plochingen GmbH

plobabo

Plochingen Tree Bolts

Installation manual babo 3.0

Additions to the installation manual babo 2.0 that relat
e to babo 3.0 are shown in red text.



Read this installation manual carefully before installation to ensure safe handli ng 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.

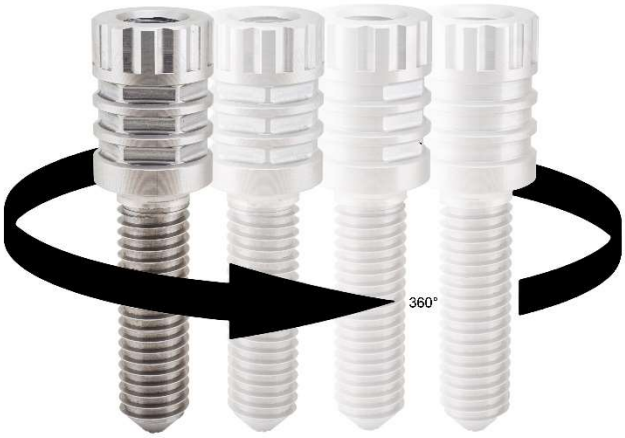
Keep the installation instructions adequately protected for later use. Leave a note indicating the storage location clearly visible in the work area.

During installation and inspection of the babo®, the following technical standards a nd accident prevention regulations, among others, must be observed:

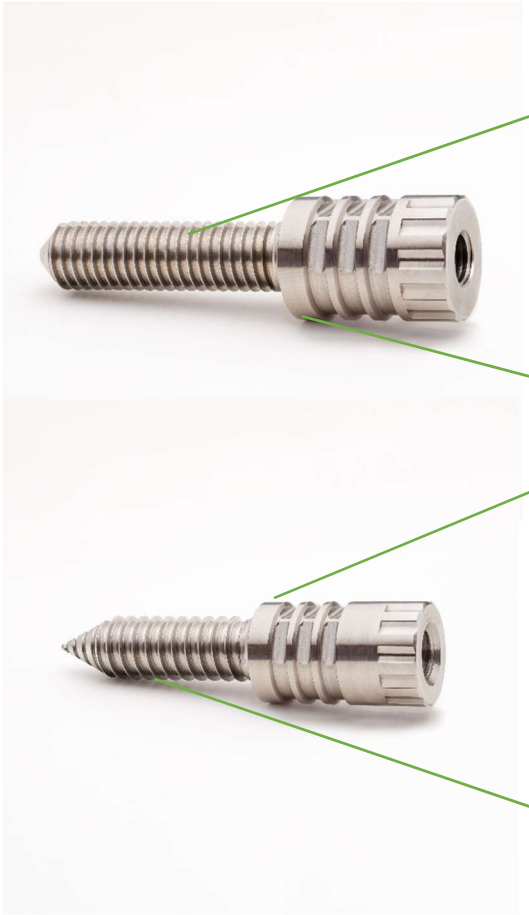
- BGI 533 Safety when working with hand tools
- DGUV Rule 112-192 Use of eye and face protection
- BG rule Use of protective gloves
- 3.21 Hand-held machines (Class. No. 61)
- EN 61029-1:2000-05 Safety of portable motor-operated elect ric tools
- BGHM Occupational Safety Compact No. 011 Working with Hand Drills
- EN 15567-1:2020-05 Sports and recreational facilities - Rope courses - Part 1: Design and safety requirements

Contents

1. Screw type babo 3.0(with further developed patented encapsulation section)



1.1 What has stayed the same



Hardwood thread, optimized by asymmetric thread flanks. Easy to screw in.

Turned section to coun tersink the bolt 10m m.

Softwood thread with a compaction profile in the thread root. Optimized with asymmetric thread flanks.

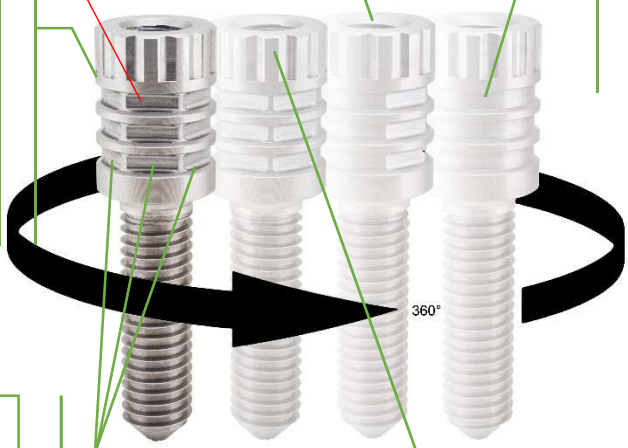
babo®
A brand of Kletterwald Plochingen GmbH

1.2 What has changed

Internal thread cut according to position. With correct instal lation of the babo, the scr ewed-in tab is automa tically parallel to the centr l bearing surface.

Profiling rings on the to p side facilitate overgro wing and, after ingrow th, serve as redundancy for the thread

Type designation e nables identific ation during initi al acceptance (correct b abo for correct application)



Three ingrowing p ressure surfaces on the underside allow aft er encapsulation an in creased

Bearing strength of the hole wall.

Optimized screwing i n via 12-point socket in 36 mm (use a rounded soc ket)

2. Assembly/Safety

2.1 Safety instructions:

We are working with the living organism tree. To protect it, careful procedures are ess ential. Although our approach is minimally invasive compared to other anchor techniques, disinfection must be used during installation to try to pr event the introduction of bacteria and fungal spores into the tree.

Tree is not the same as tree, and site is not the same as site. For these re asons, the installation of tree bolts must be clarified with a qualified tree ex pert.

Calculations of the expected load inputs on the safety or action level must be av ailable. Only a ropes course–specific static calculation is considered the necessa ry basis for installation.

The pull-test certificates attached in the appendix can only serve as planning aids in this conte xt.

To prevent harm to people and trees, we recommend conducting pull tests on site.

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

2.1.2 It must be ensured that the installation is carried out according to the prese nt installation instructions.

2.1.3 It must be ensured that the drills, countersinks, brush, cartrid ge tip, the finished drill hole, and the bolt are disinfected again before e ach use or installation.

2.1.4 Intended use:

The babo® must be installed only on a living, healthy tree.
The babo® is not suitable for installation in dead or diseased wood! See also 2.1
Points 2.1 – 2.1.4 must be checked before the first commissioning.
Any use beyond this is considered non-intended use.
The manufacturer is not liable for damages resulting from this; the builder alone bears the risk. Intended use also includes

he compliance with the assembly, disassembly, and inspection conditions prescribed by the manufacturer.

2.1.5 The suitability of the babo® for the respective application must be determined by t he builder and is not covered by product liability from the manufacturer.

Manufacturer.

2.2 Tools and materials used

The applicable accident prevention regulations apply at the installation site.

2.2.1 Cordless screwdriver with spirit level or drilling jig

Spirit level for creating a horizontal bore.

2.2.2 Multi-drilling tool with countersink and depth stop

Adjustable depth stop

on all babo® screw types

Screw types

Drill bits and countersinks interchangeable.

The drill diameter can be found in the table below (see 2.7).

2.2.3 Countersink with centering mandrel

Countersink for surface preparation for wood species with thick bark, suc h as Quercus robur (English oak).

2.2.4 Hole brush

hole brush ∅ suitable for the drilling. Used to remove wood chips from the drill hole.

Brush with which to clean out the drill hole of wood chips. WARNING: disinfect before use!

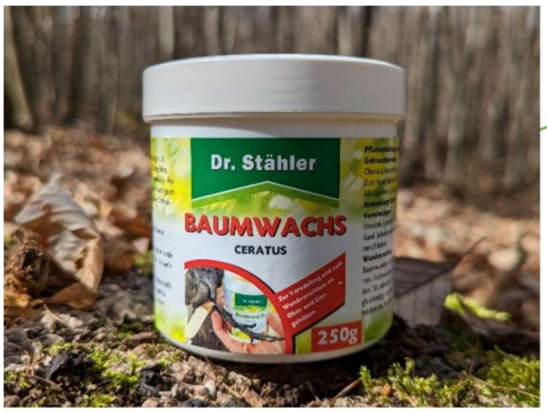
2.2.5 fungicide-equipped surface disinfectant spray

Spray disinfection around the area to keep the entry of fungal spores as low as possible.

Hole brush, drill, Countersink, drill hole and bolts must be disinfected before use or before installation.

They must be disinfected.

2.2.6 Tree Wax



To ensure an airtight installation of bolts with hardwood threads to be guaranteed, the sanitized borehole must be filled from the bottom with resin using at least 5 pump strokes.

2.2.7 Cartridge gun + empty cartridges

Fill an empty cartridge with resin. Sanitize the cartridge tip and pump the resin into the brushed-out, sanitized borehole using the joint gun.

2.2.8 Socket with reducer, adapter

Socket wrench SW 41 with red ucer and adapter for mounting the tree bolts.

Attention: for ÜA70 use a long so cket wrench!

2.2.9 Telescope switching ratchet

Telescopic ratchet will be used to the with the Akkuschrauber, in 1st gear (no Schlagschrauber), advanced bolt up to to screw in at the desired position.

2.2.10 Silicone grease or another suitable release agent (inox guard)

Um das Kaltverschweißen zwischen VA Bauteilen zu verhindern müssen die Attach fittings with inox before installation should be treated with caution.

2.2.11 USE a babo_3.0 socket with adapter or a cordless screwdriver with torque multiplier

.

Socket SW 36 12-point c hamfered

Cordless screwdriver with torque multiplier.
Safety note: Strong forces ar e released.
Be sure to follow the safety instructions of the manufacturer!!!

2.3 Installation of platform bolts with consideration of 2.1.3

2.3.1 Set the multi-drilling 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 Introduce resin, filling about one-third of the drill hole.

2.3.6 Position the bolt horizontally with a battery-powered screwdriver .

2.3.7 Drive the bolt with the telescopic ratchet into the final position.

2.3.8 Screw in the platform timbe r holder with inox guard

2.3.9 Screw in the bolt with a cordle s screwdriver + torque multiplier.

2.3.10 Screw in the bolt until the middl e load-bearing surface faces downward. he tabs are screwed in horizontally.

2.4 Installation of multi-bolts for hardwood observing 2.1.3 The in

stallation of the multi-bolt for hardwood is carried out analogously to the installation o f the platform bolt.

If the multi-bolt is to be loaded in the shear plane in extraction, the countersink can be omitted (the multi-drilling tool must be adapt ed accordingly).

Once installed, the multi-bolts can be fitted with vario us rope-attachment options (see 3. Accessories).

2.5 Installation of multi-bolts for softwood observing 2.1.3 The insta

llation of the multi-bolt for softwood is carried out analogously to the installation of the platform bolt.

If the multi-bolt is to be loaded in the shear plane in extraction, the countersink can be omitted (the multi-drilling tool must be adapt ed accordingly).

Once installed, the multi-bolts can be fitted with vario us rope-attachment options (see 3. Accessories).

2.6 Installation of rope supports for intermediate safety taking into account 2.1.3

2.6.1 Drill a smooth surface using a picket drill Ø 40mm.

2.6.2 Pilot drill 4cm deep with a 4 mm drill bit.

2.6.3 Cover the drill hole with resin.

2.6.4 Screw in the rope carrier with an Allen key SW6.

2.6.5 For softwood, installation with RAMPA sleeve type SKL, stainless steel 1.430 5, D 18.5, d M10, L 80mm is optionally recommended. ETA-12/048 1

2.7 Tabelle Bohrdaten, sofern kein Multibohrwerkzeug verwendet wird.

Platform-		bolt	Multi-bolt Hardwood*	Multi-bolt Softwood*	
Article No.		PB6KÜA50**	MBÜA50**	MBÜA50NH100**	MBÜA50NH160**
Drilling depth		80mm	100mm	80mm	130mm
Depth reduction		10mm	10mm	10mm	10mm
Total depth***		90mm	110mm	90mm	140mm
Article No.		PBÜA55_3.0**	MBÜA55_3.0**	MBÜA55NH100_3.0**	MBÜA55NH160**
Drilling depth		100mm	100mm	100mm	160mm
Depth reduction		10mm	10mm	10mm	10mm
Total depth***		110mm	110mm	110mm	170mm
Ø countersink		40mm	40mm	40mm	40mm
Drill diameter in mm	Maple	22	21	-	-
	Beech	22	21	-	-
	Douglas fir	20	-	22	22
	Oak	22	21	-	-
	Ash	22	21	-	-
	Spruce	20	-	21	21
	Pine	20	-	21	21
	Larch	21	-	22	22
	Black locust (Robinia)	22	21	-	-
	Fir	20	-	21	21
	European beech	22	21	-	-

*If MBÜA50 or MBÜA50NH160 is loaded in pullout, countersinking is not necessary. Values also apply to bolts with ÜA70.

Depth of the borehole with countersinking of the bolt.

WARNING! If a control measurement determines that the hole has been drilled too deep, the borehole base must be filled with tree resin (see 2.2.7).

3. babo Accessories (Example)

3.1 Single plate LMB1F

Rope attachment Single rope.
To establish a connection
with stainless steel ferrule
Material thickness min. 2 mm.
Breaking load 11.98 t see
Test report (4.1)

3.2 Double plate LMB2F

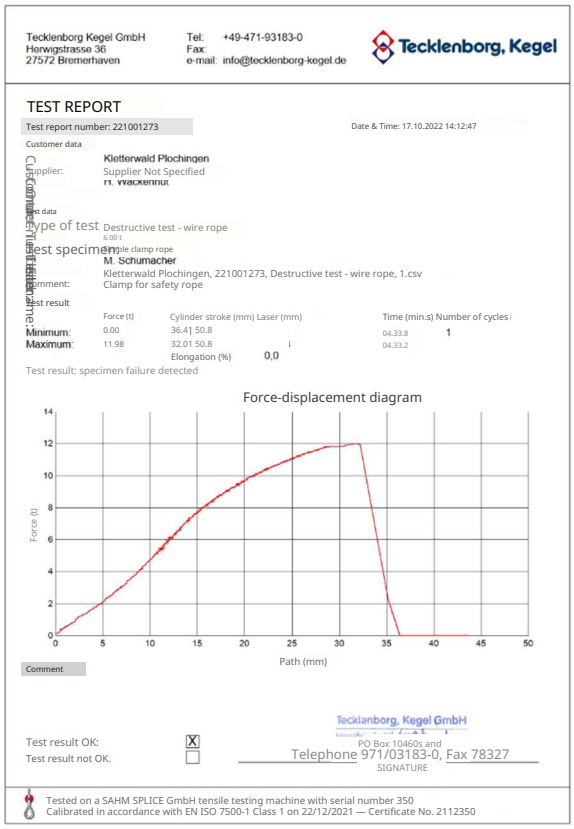
Rope attachment double rope.
To establish a connection
with stainless steel ferrule
Material thickness min. 2 mm.
Breaking load 7.64 t see
Test report (4.2)

3.3 Rope clamp plate SKL12SS

Rope attachment for 12 mm
rope clamp.

4. Test Reports

4.1 Destructive Test Single Plate



Tecklenborg Kegel GmbH
Herwigstrasse 36
27572 Bremerhaven

Tel: +49-471-93183-0
Fax:
e-mail: info@tecklenborg-kegel.de

Tecklenborg, Kegel

TEST REPORT

Test report number: 221001273

Date & Time: 17.10.2022 14:12:47

Customer data

Supplier: Kletterwald Plochingen
Supplier Not Specified
H. Wackernut

Test data

Type of test: Destructive test - wire rope
6.00 t

Test specimen: Double clamp rope
M. Schumacher

Comment: Kletterwald Plochingen, 221001273, Destructive test - wire rope, 1.csv
Clamp for safety rope

Test result

	Force (t)	Cylinder stroke (mm) Laser (mm)	Time (min.s)	Number of cycles
Minimum:	0.00	36.4 | 50.8	04.33.8	1
Maximum:	11.98	32.01 50.8	04.33.2	
		Elongation (%) 0,0		

Test result: specimen failure detected

Force-displacement diagram

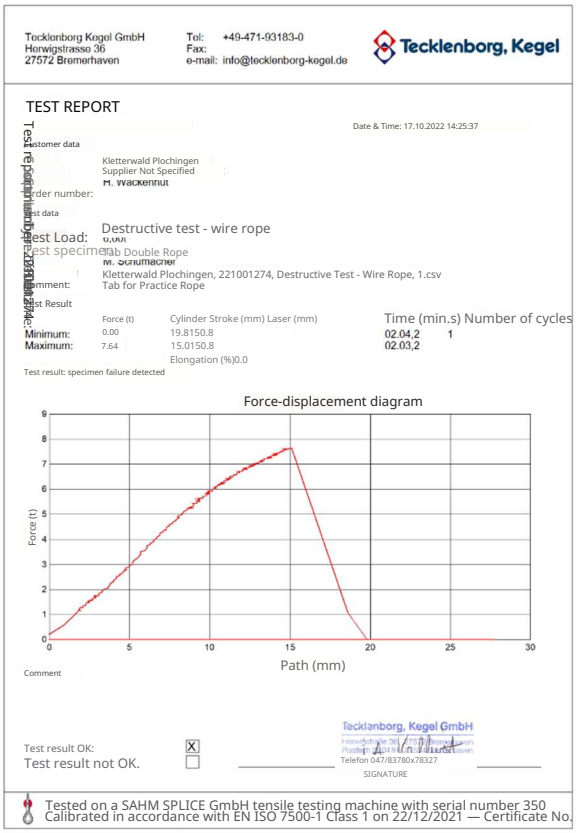
Comment

Test result OK: X
Test result not OK.

Tecklenborg, Kegel GmbH
PO Box 10460s and
Telephone 971/03183-0, Fax 78327
SIGNATURE

Tested on a SAHM SPLICE GmbH tensile testing machine with serial number 350
Calibrated in accordance with EN ISO 7500-1 Class 1 on 22/12/2021 — Certificate No. 2112350

4.2 Destructive Test Double Plate



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27572 Bremerhaven

Tel: +49-471-93183-0
Fax:
e-mail: info@tecklenborg-kegel.de

Tecklenborg, Kegel

TEST REPORT

Date & Time: 17.10.2022 14:25:37

Customer data

Kletterwald Plochingen
Supplier Not Specified
H. Wackernut

Test data

Test Load: Destructive test - wire rope

Test specimen: Tab Double Rope
M. Schumacher

Comment: Kletterwald Plochingen, 221001274, Destructive Test - Wire Rope, 1.csv
Tab for Practice Rope

Test Result

	Force (t)	Cylinder Stroke (mm) Laser (mm)	Time (min.s)	Number of cycles
Minimum:	0.00	19.8150.8	02.04,2	1
Maximum:	7.64	15.0150.8	02.03,2	
		Elongation (%)0.0		

Test result: specimen failure detected

Force-displacement diagram

Comment

Test result OK: X
Test result not OK.

Tecklenborg, Kegel GmbH
Telefon 047/83780x78327
SIGNATURE

Tested on a SAHM SPLICE GmbH tensile testing machine with serial number 350
Calibrated in accordance with EN ISO 7500-1 Class 1 on 22/12/2021 — Certificate No. 2112350

4.3 Extraction test Multibolt Hardwood exemplary

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Fax:
e-mail: info@tecklenborg-kegel.de

Tecklenborg, Kegel

TEST REPORT

Test Report Number: 221001256 Date & Time: 17.10.2022 11:25:38

Customer data

Customer: Kletterwald Plochingen
Supplier Not Specified
Contact: H. Wackenhut

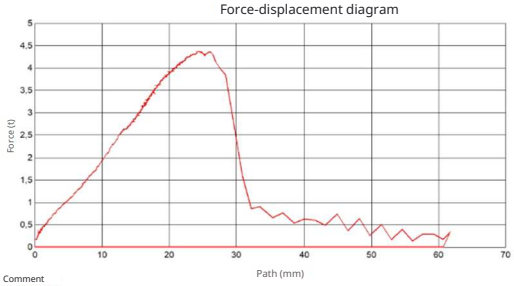
Test data

Test Load: Destructive test - wire rope
Test specimen: - Hardwood thread
Tester: M. Schumacher
Comment: Kletterwald Plochingen, 221001256, Destructive test - wire rope, 1.csv
No. 16 90 degrees to the trunk Torque 220 NM Drill hole 22 mm
Test result

	Force (t)	Cylinder stroke (mm)	Laser (mm)	Time (min.s)	Number of cycles
Minimum:	0.00	60.7	0	02.37,0	1
Maximum:	4,37	24.3	0	02.26,0	
		Elongation (%)	0,0		

Test result: specimen failure detected

Force-displacement diagram



Comment

Test result OK: X
Test result not OK.

Tecklanborg, Kegel Ltd.
P.O. Box 046327

SIGNATURE

Telephone 97/8 3183-0, Fax 2

Tested on a SAHM SPLICE GmbH tensile testing machine with serial number 350
Calibrated in accordance with EN ISO 7500-1 Class 1 on 22/12/2021 — Certificate No. 2112350

5. Installation instructions

5.1 Selection of tree species

For the installation of tree screws, tree species that are predominantly described i n the literature as good sound insulators should be used. Corresponding lists can be taken from specialist literature (see DUJESIEFKEN & LIESE 2008, Wessolly & Erb 2014).

Examples of species considered good sound insulators include:

Pedunculate oak and sessile oak	European beech	Hornbeam
Field maple	Larch	Spruce and Pine

A somewhat lower level of compartmentalization should be assumed for the f ollowing tree species:

Sycamore (Acer pseudoplatanus) and Norway maple (Acer platanoides)	Ash	Black locust (Robinia)
Lime (Tilia)	Elm (Ulmus)	Douglas fir

This list does not claim to be exhaustive. Evaluations in the professional liter ature are not all the same. In case of doubt, an experienced tree expert (certified arborist) should be consulted.

5.2 Vitality

The ability of a tree to limit damage and compensate through growth depend s on its vigor. The assessment of a tree's vitality should be performed by tree experts. In most cases, a purely visual inspection is sufficient.

5.3 Number of tree screws and spacing between the

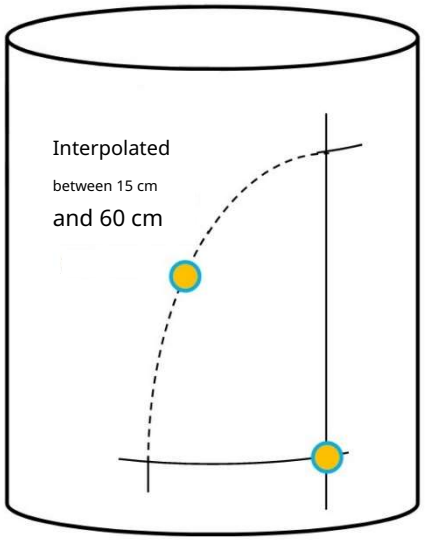
m When installing tree screws, the proportion of destroyed living tissue and

vascular system must be limited to prevent impairment of the crown's nourishment. The damage should be less than 10 % of the circumference.

Tree species	Diameter in cm	Screws Quantity	Tree species	Diameter in cm	Screws Quantity
Beech	30-40	2	Spruce	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

he lateral spacing of the screws placed at the same height around the trunk diameter should not be less than 15 cm.

Along the trunk axis upward and downward, a distance of at le ast 30 cm between two drillings should be maintained. For screws offs et diagonally relative to each other, which are placed both at different positio ns around the trunk circumference and at different heights, the minimum sp acing should be interpolated along an elliptical arc between these values depen ding on the positions.



5.4 Direction of Loading

To largely avoid transverse loads, the drill channels of the screws should, if possible, be aligned with the direction of loading.
Deviations from the load direction of about 20 degrees do not significantly affect the load-bearing capacity and only have a minor effect on the deformations occurring i n the load case.

With a deviation of the screw axis from the load direction of about 30 degrees, d epending on the wood species, a significant increase in deformations of the w ood body should be expected for a load input greater than 6 kN.

5.5 Installation Timing

The installation of the tree screws should not be carried out during persistent frost below –5 °C and not at summer temperatures above 30 °C, since here a
An increase in damage to the cambium around the wound margin would be to be expected. Even at t emperatures around 0 °C, the wound margin should as a precaution be treated with should be protected with wound treatment substances.
After long dry periods during the growing season, air embolisms ca n likely spread further into the xylem due to the high suction tensions.

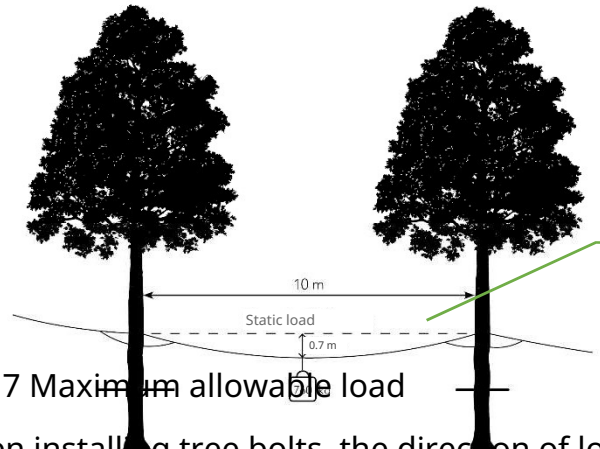
water-conducting fabrics to penetrate. Therefore, these times should also be avoided
.
It is recommended to install the tree screws, with regard to achieving the tree's best possible wound reaction, generally during the growing season from March to September.

5.6 Load application and pull tests

The tree species used for the pull tests, spruce and beech, represent the upper and lower bounds of the strength spectrum of Central European tree species that are commonly used in rope courses. While the compressive and tensile strength of European beech along the trunk axis is in the upper range according to the so-called Stuttgart strength catalog for green woods (WESSOLLY & ERB 2014), the tangential tensile strength of the wood of living spruces is particularly low.

Peak loads reached at the anchor point of the safety ropes during fall tests in climbing forests were always below 12 kN (Wenger & Wittmann 2009).
With a test mass of 80 kg, a peak load of almost 6 kN already occurred. This value must not be exceeded in an actual fall in order to avoid injuries. Therefore, it can be assumed that in a fall the load-bearing capacity of the tree screws in any case exceeds twice the peak load of 12 kN measured in the rope course. In a fall into a vertical rope, with 20 kN even more than three times the allowable
arresting impulse of 6 kN would be reached.

The safety factor for personal protection in typical rope course installations would be even significantly higher, since the anchor points would be loaded almost horizontally. When using the longer screw for the spruce species (130 mm), at least 33 kN were reached; with the only 80 mm long screw in beech about 39 kN were already reached. Accordingly, in the event of a fall (horizontal rope force max. 12 kN) the safety factor against failure with the longer screw would be roughly a factor of nearly 3.



Example calculation of the required Rope sag for softwood, calculated using the “Siebert formula” taking into account EN 15567.

5.7 Maximum allowable load

When installing tree bolts, the direction of loading must be observed.

A softwood bolt should generally be loaded in tension (pull-out). If other load directions are to be applied, the installing company must have this statically calculated.

See also: Expert report on the arboricultural assessment

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

Expert report no.: 23-0182

TREECONSULT

BRUDI & PARTNER Dipl.-Ing. ANDREAS DETTER

5.8 Backup in the safety layer

Despite the values shown above, the installation of a backup on the safety rope is essential. A steel cable with a standard-compliant end termination is routed around the tree through the stainless steel thimble of the safety rope.

It must be ensured that the cable does not damage the tree's bark, e.g., by abrasion. If necessary, an abrasion protection (here rope carrier; see also 2.6) must be installed.

5.9 Backup in the action layer

If a backup is omitted at the action level, this must be justified in the risk analysis. If values above 6 kN occur in the static calculations, a backup must be installed analogously to 5.7.

In view of the high loads during strong wind events, which occur increasingly often, a redundant safety measure or a sacrificial rope generally seems advisable.

6. Inspection

6.1 Visual Routine Inspection

During the daily inspection carried out when opening the facility, the following items sho uld be checked:

- lateral displacement of the screw in the borehole
- signs of bending of the screw
- increase in rope sagging, especially after a strong wind event

6.2 Operational Inspection

During the monthly operational inspection of the facility, the following items should be checked and recorded either analogously or digitally:

- lateral displacement of the screw in the borehole
- cracks in the surrounding wood body, including newly formed w ound wood
- Bark damage or fungal fruiting bodies in the vicinity of the drilling
- signs of bending of the screw
- Increase in rope sagging, especially after a severe wind event

6.3 Inspection before commissioning, inspection after changes, annual main inspection

When Plochinger tree screws are used in a critical application (whether at the safety or action level), an inspection before commissioning or an inspection after changes must take place.

The inspection must be carried out by an inspection body with sufficient knowledge and experience in accordance with DIN EN 17020:2012, paragraph 6.1.

7. Maintenance

Depending on the tree species, the vitality of the tree, and the length of the installed overgrowth section, one should assume that after 5 to 10 years the tree bolt will be overgrown to such an extent that a new overgrowth section must be installed.

This period strongly depends on the individual site conditions and the condition of the tree.

By extracting a core sample from a reference tree at the site, a more precise statement on the radial growth of the tree population can be made. Regular maintenance can prevent damage to the tree and ensure proper inspection.

These maintenance activities should be reviewed and, if necessary, ordered by tree experts as part of the regular inspection of the trees.

« Rev A // 06-06-2024 »

We thank you for your trust in our products.

We hope that you were satisfied with the information and instructions received a nd were able to complete the installation successfully.

Should you require further assistance, we are available at any time.

phone +49 (0)152-34168948

mail office@babo-solutions.de

We wish you every success with the installation of our babo®!