

SURGICAL TECHNIQUE

Hand 1.2 – 2.3



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For further information regarding the APTUS product line visit www.medartis.com

Introduction

Product Materials

Plates, Screws and Washers

Unalloyed titanium (ASTM F67, ISO 5832-2),
titanium alloy (ASTM F136, ISO 5832-3)

K-Wires

Stainless steel (ASTM F138, ISO 5832-1)

Instruments

Stainless steel, aluminum, aluminum alloy, unalloyed titanium
(ASTM F67, ISO 5832-2), Nitinol, PA, PEEK, POM, PP, PPSU,
PTFE, silicone

Containers

Stainless steel, aluminum alloy, PEEK, PP, PPSU, silicone

Indications

APTUS Hand

Fractures, osteotomies and arthrodesis of the bones
of the hand

- Hand System
 - fractures of the distal, middle and proximal phalanges
 - fractures of the metacarpals
 - osteotomies of the hand
 - arthrodeses in the hand
- CMC-I Fusion plate
 - arthrodesis of the trapezium with the first metacarpal
- Scaphoid plate
 - fractures and non-unions of the scaphoid
- 4CF/STT plates
 - arthrodeses of carpal bones

Contraindications

- Preexisting or suspected infection at or near the
implantation site
- Known allergies and/or hypersensitivity to implant
materials
- Inferior or insufficient bone quality to securely anchor the
implant
- Patients who are incapacitated and/or uncooperative
during the treatment phase
- Growth plates are not to be blocked with plates and screws

Color Coding

| System Size | Color Code |
|-------------|------------|
| 1.2 | Red |
| 1.5 | Green |
| 2.0 | Blue |
| 2.3 | Brown |

Plates and Screws

Special implant plates and screws have their own color:

| | |
|---------------------|----------------------------|
| Implant plates gold | Fixation plates |
| Implant plates blue | TriLock plates (locking) |
| Implant screws gold | Cortical screws (fixation) |
| Implant screws blue | TriLock screws (locking) |



Introduction

Possible Combination of Plates and Screws

Plates and screws can be combined within one system size:

1.2/1.5 Fixation Plates

- 1.2 Cortical screws, HexaDrive 4
- 1.5 Cortical screws, HexaDrive 4
- 1.8 Emergency screws, HexaDrive 4

1.5 TriLock Plates

- 1.2 Cortical screws, HexaDrive 4
- 1.5 Cortical sScrews, HexaDrive 4
- 1.5 TriLock screws, HexaDrive 4
- 1.8 Emergency screws, HexaDrive 4

2.0/2.3 Fixation and MC Compression Plates

- 2.0 Cortical screws, HexaDrive 6
- 2.3 Cortical screws, HexaDrive 6
- 2.5 Emergency screws, HexaDrive 6

2.0 TriLock Plates

- 2.0 Cortical screws, HexaDrive 6
- 2.0 TriLock screws, HexaDrive 6
- 2.3 Cortical screws, HexaDrive 6
- 2.5 Emergency screws, HexaDrive 6

2.0/2.3 TriLock Arthrodesis Plates

- 2.0 Cortical screws, HexaDrive 6
- 2.0 TriLock screws, HexaDrive 6
- 2.3 Cortical screws, HexaDrive 6
- 2.5 Emergency screws, HexaDrive 6

Symbols



HexaDrive



TriLock screw hole on sizing templates



Non-locking screw hole on sizing templates












































Compression screw hole on sizing templates

System Overview

The APTUS Hand fixation system is used for fractures, osteotomies and arthrodesis of the hand. According to the respective APTUS system size (1.2, 1.5, 2.0 and 2.3) and plate technology (fixation vs. locking), plates are available in different designs (e.g. straight vs. grid plates, or L-, Y-, T-shape) and in various plate sizes (e.g. total length, number of holes, thickness).

For the complete implant portfolio, please refer to the APTUS Ordering Catalog, also available at www.medartis.com.

| Description | Examples | Main Feature | Plate Thickness | System | | |
|-----------------|--|--|--|-------------|--------|---------|
| Straight plates |  A-4300.03 | | 0.6 mm | 1.2/1.5 | | |
| |  A-4350.08 | locking | 0.8 mm | 1.2/1.5 | | |
| |  A-4600.03 | | 1.0 mm | 2.0/2.3 | | |
| |  A-4650.03 | locking | 1.0 mm | 2.0/2.3 | | |
| |  A-4645.03 | compression | 1.3 mm | 2.0/2.3 | | |
| |  A-4655.03 | locking | 1.3 mm | 2.0/2.3 | | |
| L, Y, T plates |  A-4300.20 |  A-4300.13 |  A-4300.11 | | 0.6 mm | 1.2/1.5 |
| |  A-4350.14 |  A-4350.41 | | locking | 0.8 mm | 1.2/1.5 |
| |  A-4600.20 |  A-4600.13 |  A-4600.11 | | 1.0 mm | 2.0/2.3 |
| |  A-4650.20 |  A-4650.13 |  A-4650.11 | locking | 1.0 mm | 2.0/2.3 |
| |  A-4645.20 |  A-4645.16 | | compression | 1.3 mm | 2.0/2.3 |
| |  A-4655.20 |  A-4655.16 |  A-4655.11 | locking | 1.3 mm | 2.0/2.3 |

| Description | | Examples | Main Feature | Plate Thickness | System |
|--------------------|--|---|--------------|-----------------|---------|
| Grid plates | |  A-4300.62  A-4300.58 | | 0.6 mm | 1.2/1.5 |
| | |  A-4350.62 | locking | 0.8 mm | 1.2/1.5 |
| | |  A-4600.62  A-4600.58 | | 1.0 mm | 2.0/2.3 |
| | |  A-4650.62  A-4650.58 | locking | 1.0 mm | 2.0/2.3 |
| | |  A-4655.56 | locking | 1.3 mm | 2.0/2.3 |
| Special plates | Hook plate |  A-4340.32 | compression | 0.6 mm | 1.2/1.5 |
| | Biconcave washers |  A-4300.70 | | 0.6 mm | 1.2/1.5 |
| | |  A-4600.70 | | 0.8 mm | 2.0/2.3 |
| | Condylar plates |  A-4340.30 | compression | 0.6 mm | 1.2/1.5 |
| | |  A-4640.30 | compression | 1.0 mm | 2.0/2.3 |
| | Scaphoid plates |  A-4350.80 | locking | 0.8 mm | 1.2/1.5 |
| | Rotation plates |  A-4350.23 | locking | 0.8 mm | 1.2/1.5 |
| | |  A-4655.24 | locking | 1.3 mm | 2.0/2.3 |
| Arthrodesis plates |  A-4660.10 | locking | 1.4 mm | 2.0/2.3 | |
| |  A-4660.15 | locking | 1.4 mm | 2.0/2.3 | |
| |  A-4655.90 | locking | 1.3 mm | 2.0 | |

Treatment Concept

The table below lists typical clinical findings which can be treated with the implants of the APTUS Hand System 1.2–2.3.

| Plates and Screws (see System Overview) | | 1.2, 1.5 Cortical Screws | 1.2/1.5 Fixation Plates | | | | 1.2/1.5 TriLock Plates | | | | | | |
|--|--------------------------------------|--------------------------------|-------------------------|------|----------|------|------------------------|-----|------|----------|----------|-----|--|
| | | straight | L / T / Y | grid | special | | straight | T | grid | special | | | |
| | | | | | condylar | hook | | | | rotation | scaphoid | | |
| plate thickness (mm) | | | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | |
| Fractures | | | | | | | | | | | | | |
| extra-articular | simple (transverse, oblique, spiral) | | XX | XXX | XXX | XXX | XXX | | XX | XX | XX | | |
| | comminuted, multifragmentary | | | X | X | X | | | XXX | XXX | XXX | | |
| intra-articular | distal | simple | XXX | | X | X | XX | | X | X | X | | |
| | | complex | XX | | X | X | | | XX | XX | | | |
| | proximal | simple | XXX | | X | X | XX | | X | XX | XX | | |
| | | complex | | | X | X | | | | XXX | XXX | | |
| bony avulsion (mallet finger, skier's thumb) | | XX | | | | | | XXX | | | | | |
| scaphoid non-union | | | | | | | | | X | X | | XXX | |
| Osteotomies | | | | | | | | | | | | | |
| rotational correction | | X | | | | | | | | X | XXX | | |
| axial correction | | | | X | X | | | | XX | XXX | | | |
| Arthrodesis | | | | | | | | | | | | | |
| DIP/IP joint | | XX | | | | | | | | | | | |
| PIP joint | | | X | | XX | | | X | | XXX | | | |

- non-locking
- locking
- Primary recommendation
- Recommendation
- Possible

The above-mentioned information is a recommendation only. The operating surgeon is solely responsible for the choice of the suitable implant for the specific case.

| Plates and Screws (see System Overview) | | 2.0, 2.3 Cortical Screws | | 2.0/2.3 Fixation Plates | | | 2.0/2.3 TriLock Plates | | | | | | 2.0/2.3 MC Compr. Plates | | 2.0/2.3 TriLock Arthrodesis Plates | | | | |
|--|--------------------------------------|--------------------------------|-----------|----------------------------|----------|----------|---------------------------|-----------|-----|------|----------|-------------|-----------------------------------|-------|---|-------|-----|-----|--|
| | | straight | L / T / Y | grid | special | straight | | L / T / Y | | grid | | special | straight | L / T | special | | | | |
| | | | | | condylar | | | | | | rotation | compression | compression | 4CF | STT | CMC-I | | | |
| plate thickness (mm) | | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.3 | 1.0 | 1.3 | 1.0 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 1.4 | 1.3 | |
| Fractures | | | | | | | | | | | | | | | | | | | |
| extra-articular | simple (transverse, oblique, spiral) | xx | xxx | xxx | xxx | xxx | xx | xx | xx | xx | xx | xx | xx | xxx | xxx | | | | |
| | comminuted, multifragmentary | | x | x | x | | xxx | xxx | xxx | xxx | xxx | xxx | | | | | | | |
| intra-articular | distal | simple | xxx | | x | x | xx | x | x | x | x | x | | x | x | | | | |
| | | complex | xx | | x | x | | | | | xx | xx | | | | | | | |
| | proximal | simple | xxx | | x | x | xx | x | x | xx | xx | xx | xx | | x | x | | | |
| | | complex | | | x | x | | | | xxx | xxx | xxx | xxx | | | | | | |
| subcapital (Boxer) | | | | x | x | | | | xxx | xx | xxx | xx | | | x | | | | |
| Bennett | | xxx | | x | x | | | | x | x | x | x | | | x | | | | |
| Winterstein | | | | x | x | | | | xx | xxx | xx | xxx | | | x | | | | |
| Rolando | | | | x | x | | | | xx | xxx | xx | xxx | | | x | | | | |
| Osteotomies | | | | | | | | | | | | | | | | | | | |
| rotational correction | | x | | | | | | | | | x | x | xxx | | | | | | |
| axial correction | | | | x | x | | | | xx | xx | xxx | xxx | | | | | | | |
| Arthrodesis | | | | | | | | | | | | | | | | | | | |
| MCP-I joint | | | x | x | xx | | x | x | x | x | xx | xxx | | | x | | | | |
| CMC-I joint | | x | | | | | | | | x | | x | | | x | | | xxx | |
| Four Corner Fusion | | | | | | | | | | | | | | | | xxx | | | |
| STT Fusion | | | | | | | | | | | | | | | | | xxx | | |

- non-locking
- locking
- Primary recommendation
- Recommendation
- Possible

The above-mentioned information is a recommendation only. The operating surgeon is solely responsible for the choice of the suitable implant for the specific case.

Instrument Application




General Instrument Application

Sizing Templates

Sizing templates facilitate the intraoperative selection of the appropriate implant.

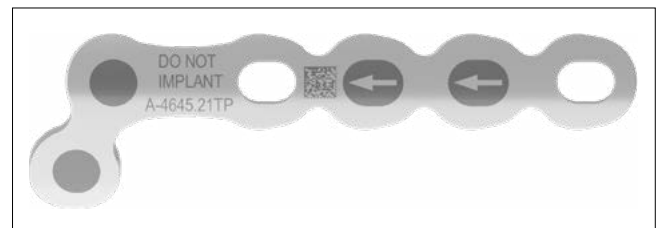
Sizing templates for the Hand System 1.2–2.3 are available according to chapter “Appendix”.

The sizing templates feature symbols that indicate the type of the screw hole and its position on the respective implant:

-  for a TriLock screw hole (locking) using a TriLock or a cortical screw
-  for a non-locking screw hole (fixation) using a cortical screw only
-  for a compression screw hole (compression/fixation) using a cortical screw only
The arrow “→” indicates the direction of the compression.



Sizing template with TriLock screw hole symbols for a TriLock plate (locking)



Sizing template with non-locking and compression screw hole symbols for a fixation plate

The article number of the sizing template (e.g. A-4655.21TP) corresponds to the article number of the sterile implant (e.g. A-4655.21S). The suffix TP stands for template.



A-4655.21TP
Template for A-4655.21S

Use appropriate K-wires to temporarily fix the sizing template to the bone, if necessary.

Notice

- Do not implant sizing templates.
- Do not bend or cut sizing templates.

Plate Holding and Positioning

The plate holding and positioning instrument (A-2350, A-2650) is used to pick up the plate in order to position it on the bone.



A-2350
1.2/1.5 Plate Holding and Positioning Instrument

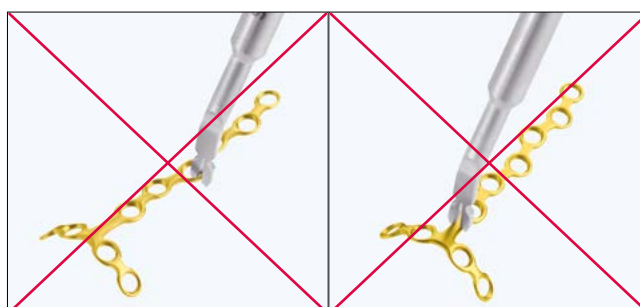
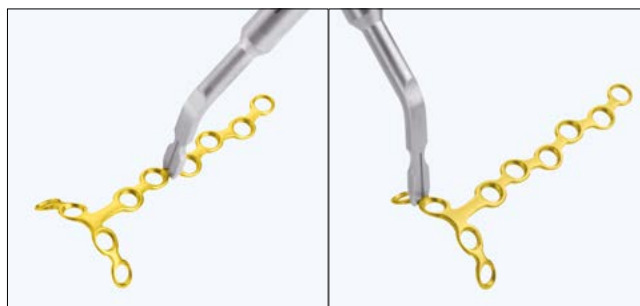


A-2650
2.0/2.3 Plate Holding and Positioning Instrument

Choose the appropriate plate holding and positioning instrument based on the system size of the plate. Pick up the plate at the bar.

Caution

The plate holding and positioning instruments are not compatible with the 1.5 TriLock plates (A-4350.xx).



The ball tip end of the 1.2/1.5 plate holding and positioning instrument (A-2350) facilitates positioning, moving and holding the implant on the bone and can be used with all system sizes.



Plate Bending

If required, plates can be bent with the plate bending pliers (A-2040). The plate bending pliers have a pin to protect the plate holes during the bending process. The pin fits all 1.2/1.5 and 2.0/2.3 APTUS Hand plates.

Warning

Wrong bending of the plate may lead to impaired functionality and postoperative construct failure.

The labeled side of the plate must always face upwards when inserting the plate into the bending pliers.

When bending a plate, the plate bending pliers must be held so that the letters "UP" are legible from above. This ensures that the plate holes are not damaged.

While bending, the plate must always be held at two adjacent holes to prevent contour deformation of the intermediate plate hole.

Warning

Do not bend the plate by more than 30°. Bending the plate further may deform the plate holes and may cause the plate to break postoperatively.

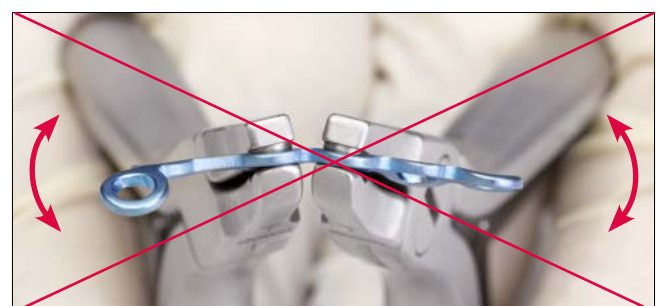
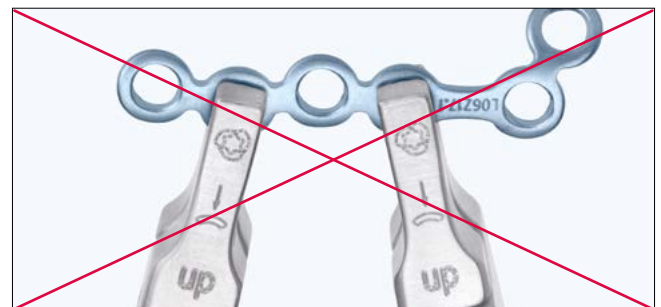
Warning

Repeatedly bending the plate in opposite directions may cause the plate to break postoperatively.

Always use the provided plate bending pliers to avoid damaging the plate holes. Damaged plate holes prevent correct and secure seating of the screw in the plate and increase the risk of system failure.



A-2040
1.2-2.3 Plate Bending Pliers with Vario Pin



Cutting

If required, the 1.2–2.8 plate cutting pliers (A-2046) can be used to cut the APTUS Hand plates 1.2/1.5 and 2.0/2.3, as well as K-wires up to a diameter of 1.8 mm.

The smaller 1.2/1.5 plate cutting pliers (A-2048) can be used to cut the APTUS Hand plates 1.2/1.5 as well as K-wires up to a diameter of 1.2 mm.

Warning

Wrong cutting of the plate may result in sharp edges and lead to injuries of the surrounding tissue.

Ensure that there are no remaining plate segments in the cutting pliers (visual check). Insert the plate from the front into the open cutting pliers. Always ensure that the labeled side of the plate is facing upwards. Hold the implantable plate segment with your hand during and after cutting.

Recommendation

To facilitate the insertion of the plate, support the cutting pliers slightly with your middle finger.

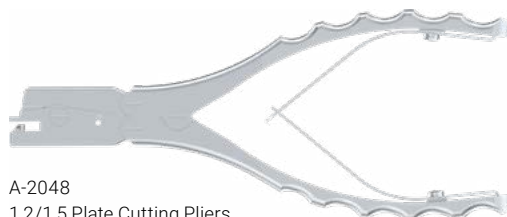
You can visually check the desired cutting line through the cutting window in the head of the pliers (see figure). Always leave enough material on the rest of the plate to keep the adjacent hole intact.

Always cut the plate holes individually. If two plate holes need to be cut off, two cutting procedures are necessary.

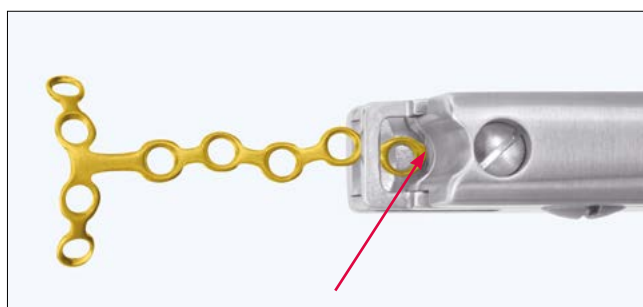
Shorten the K-wires by inserting the wire through the opening located on the side of the plate cutting pliers. Cut the wire by pressing the pliers.



A-2046
1.2–2.8 Plate Cutting Pliers



A-2048
1.2/1.5 Plate Cutting Pliers



Drilling

Color-coded twist drills are available for every APTUS system size. All twist drills are color-coded with a ring system.

| System Size | Color Code |
|-------------|------------|
| 1.2 | Red |
| 1.5 | Green |
| 2.0 | Blue |
| 2.3 | Brown |

There are two different types of twist drills available for every system size: The core hole drills are characterized by one colored ring, the gliding hole drills (for lag screw technique) are characterized by two colored rings.

Notice

Twist drills are also available in different lengths, with different stops and with different shaft ends. For details, please refer to the APTUS Ordering Catalog, also available at www.medartis.com.



A-3130



A-3230



A-3430



A-3530

Core hole drills = one colored ring



A-3131



A-3231



A-3431



A-3531

Gliding hole drills = two colored rings

Drill guides for core holes (for TriLock and cortical screws):

- for 1.2 screws A-2025 (centric drilling)
- for 1.5 screws A-2025 (centric drilling) or
 A-2023 (one green marking)
- for 2.0 screws A-2020 (centric drilling) or
 A-2024 (one blue marking)
- for 2.3 screws A-2020 (centric drilling)

Drill guides for gliding holes (only for cortical screws):

- for 1.2 screws A-2025 (centric drilling)
- for 1.5 screws A-2023 (two green markings)
- for 2.0 screws A-2020 (centric drilling) or
 A-2024 (two blue markings)
- for 2.3 screws A-2020 (centric drilling)



A-2020
2.0/2.3 Drill Guide, Centric/Excentric



A-2023
1.5 Drill Guide for Lag Screws



A-2024
2.0 Drill Guide for Lag Screws



A-2025
1.2/1.5 Drill Guide, Centric/Excentric

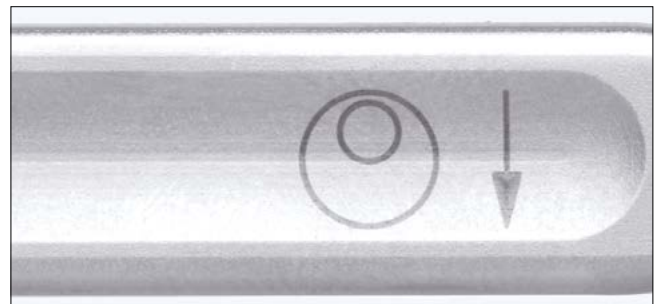
This symbol marks the end of the drill guide used for centric drilling. This end is used for all fixation and TriLock holes, as well as for lag screws.



This symbol marks the end of the drill guide used for eccentric drilling. This end is used for compression holes only.

Warning

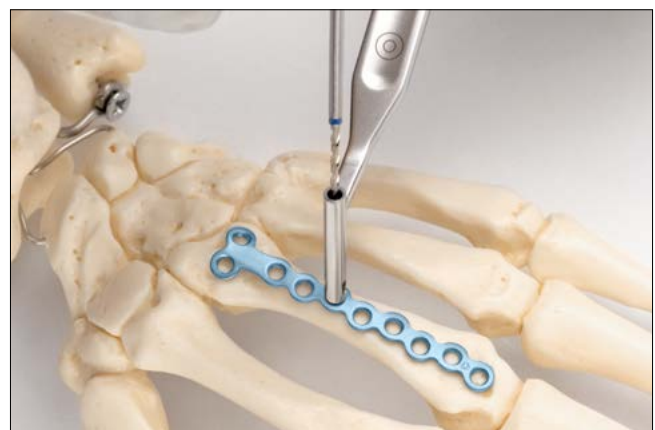
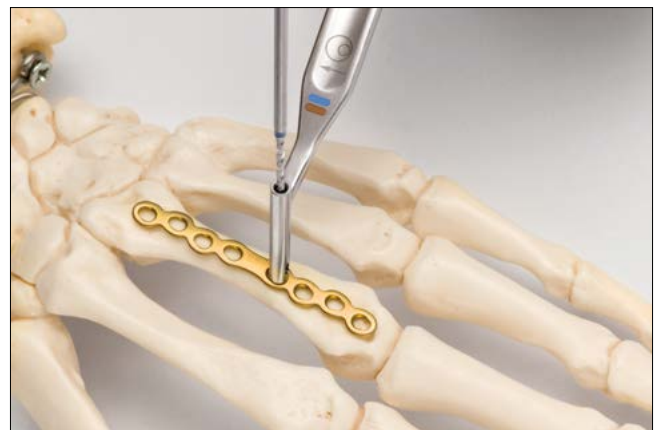
The arrow "←" indicates the direction of the compression and must always point towards the fracture line.



Warning

The twist drill must always be guided by a drill guide. This prevents damage to the screw hole and protects the surrounding tissue from direct contact with the drill. The drill guide also serves to limit the pivoting angle.

After positioning the plate, insert the drill guide and the twist drill into the screw hole. In the APTUS Hand System, the drill is guided by the drill shaft and not the drill flute.



Warning

For TriLock plates ensure that the screw holes are predrilled with a pivoting angle of no more than $\pm 15^\circ$. For this purpose, the drill guides feature a limit stop of $\pm 15^\circ$. A predrilled pivoting angle of $>15^\circ$ no longer allows the TriLock screws to correctly lock in the plate.

**Countersinking**

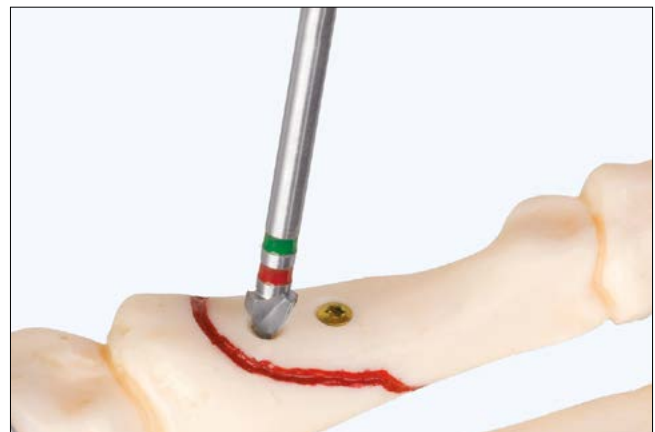
In case of inserting a cortical screw without plate, the corresponding countersink (A-3310, A-3610) may be used to create a recess in the bone for the screw head.



A-3310
1.2/1.5 Countersink for Cortical Screws, Dental



A-3610
2.0/2.3 Countersink for Cortical Screws, Dental

**Caution**

Use the handle (A-2071) instead of a power tool to reduce the risk of countersinking too far through the near cortex.



A-2071
Handle with Quick Connector, Dental

Assigning the Screw Length

The depth gauge (A-2030, A-2032) is used to assign the ideal screw length for use in monocortical or bicortical screw fixation.



A-2030
1.2/2.3 Depth Gauge



A-2032
2.0/2.3 Depth Gauge

Retract the slider of the depth gauge.

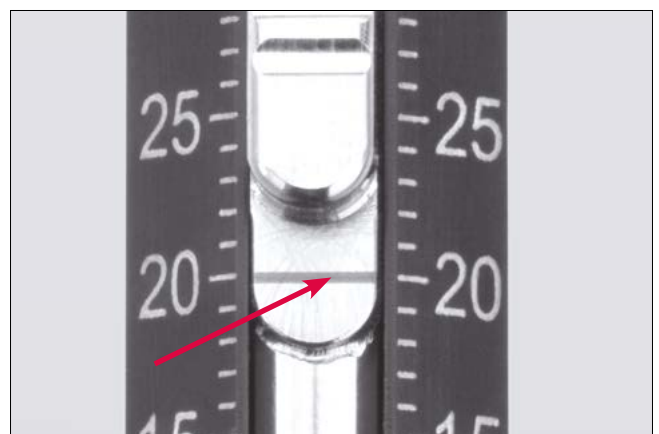
The depth gauge caliper has a hooked tip that is either inserted to the bottom of the hole or is used to catch the far cortex of the bone. When using the depth gauge, the caliper stays static, only the slider is adjusted.



To assign the screw length, place the distal end of the slider onto the implant plate or directly onto the bone (e.g. for fracture fixation with lag screws).



The ideal screw length for the assigned drill hole can be read on the scale of the depth gauge.



Screw Pick-Up

The screwdrivers (A-2310, A-2610) and the screwdriver blades (A-2311, A-2611) feature the HexaDrive self-holding system.



A-2310
1.2/1.5 Screwdriver, HD4, Self-Holding



A-2610
2.0/2.3 Screwdriver, HD6, Self-Holding



A-2311
1.2/1.5 Screwdriver Blade, HD4, AO



A-2611
2.0/2.3 Screwdriver Blade, HD6, AO



A-2073
Cannulated Handle with Quick Connector, AO

To remove the screws from the implant container, insert the appropriately color-coded screwdriver perpendicularly into the screw head of the desired screw and pick up the screw with axial pressure.

Notice

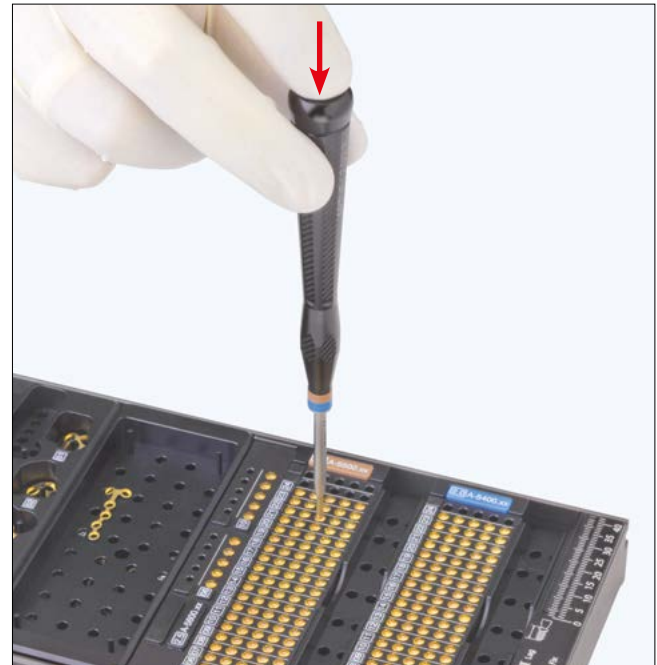
The screw will not hold without axial pressure.

Caution

Vertically extract the screw from the compartment. Picking up the screw repeatedly may lead to permanent deformation of the self-retaining area of the HexaDrive inside the screw head. Therefore, the screw may no longer be able to be picked up correctly. In this case, a new screw has to be used.

Notice

Check the screw length and diameter at the scale of the measuring module. The screw length is determined at the end of the screw head.



For stainless steel containers:

Notice

All screws up to 7 mm in length are secured with a securing element. To remove these screws, turn the securing element to the right with the screwdriver. This releases the screws.



Notice

After removing screws up to a length of 7 mm it is important to ensure that the securing elements are closed again to prevent the screws from dropping out. To do this, lightly press down on the outer left of the securing element and it will close of its own accord.



Surgical Techniques

General Surgical Technique

Lag Screw Technique

Warning

Incorrect application of the lag screw technique may result in postoperative loss of reduction.

1. Drilling the core hole

Use the twist drill for core holes (one colored ring) of the required system size (see chapter "Drilling") and drill through both cortices. Drill perpendicular to the fracture line.



2. Drilling the gliding hole

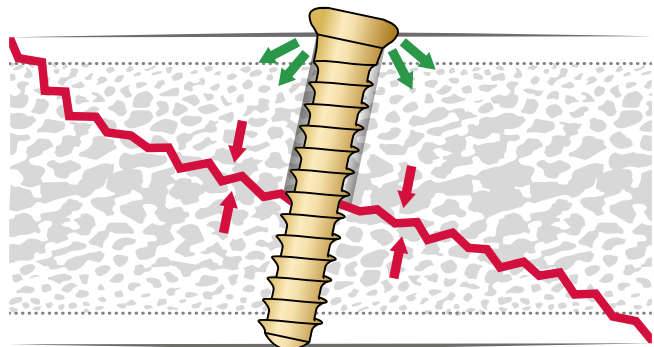
Use the twist drill for gliding holes (two colored rings) of the same system size (see chapter "Drilling") to drill through the near cortex.

Do not drill further than the fracture line.



3. Compressing the fracture

Compress the fracture with the corresponding cortical screw.



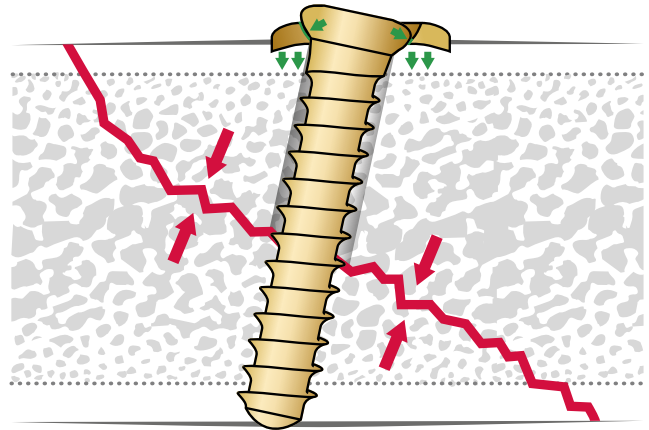
4. Optional steps before compression

If required, use the corresponding countersink (A-3310, A-3610) to create a recess in the bone for the screw head (see chapter "Countersinking").



Warning

If the cortical bone is soft, a biconcave washer (A-4300.70, A-4600.70) can be used for the cortical screw in order to distribute the forces over a larger bone surface around the screw head.



Specific Surgical Techniques

Hook Plate

A-4340.32 for mallet fractures (avulsion fractures)

1. Picking up and positioning the plate

Remove the hook plate (A-4340.32) from the implant container and place it on a firm and sterile surface. Pick up the hook plate with the plate holding and positioning instrument (A-2350) in a 90° angle with axial pressure.

Press the hooks into the avulsed fragment of the extensor tendon and reduce the fracture to its original anatomical shape.

Caution

Subperiosteal elevation of the nail matrix will prevent pression of the plate on the nail matrix with the risk of nail growth disturbance.



2. Drilling

Drill a hole using the drill guide (A-2025) while keeping the plate in place with the holding instrument.

Warning

To apply compression, the end of the drill guide marked for eccentric drilling has to be used (see chapter "Drilling"). Correct compression is only achieved if the drill guide is hold in a 90° angle to the plate.



3. Assigning the screw length

Use the depth gauge (A-2030) to assign the required screw length for bicortical fixation.

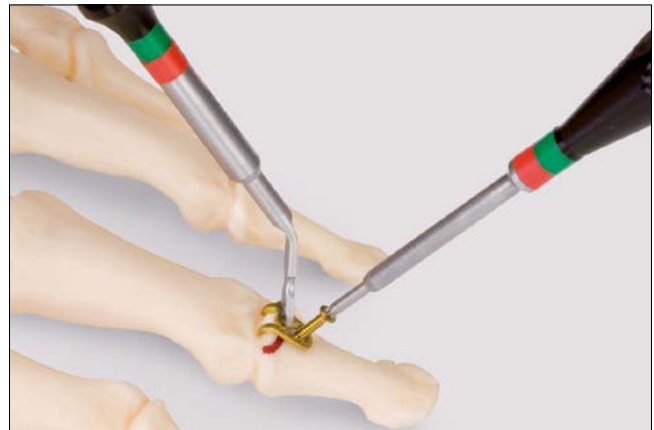


4. Fixation of the plate

Carefully insert the cortical screw (A-5100.xx, A-5200.xx) and fix the avulsed fragment to the bone.

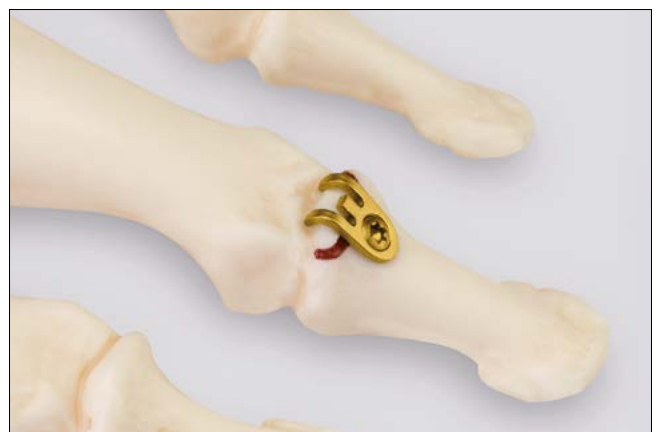
Warning

To apply compression, the screw has to be inserted perpendicularly to the plate into the predrilled eccentric hole (see step 2).



Caution

Check that the hooks of the plate do not impinge the distal joint surface of the middle phalanx.



Rotation Plates

A-4350.23 for rotational malalignment in phalanges
 A-4655.24 for rotational malalignment in metacarpals

1. Positioning the plate

Position the rotation plate (at the long bar for A-4350.23, at the laser marking for A-4655.24) over the fracture line or the planned site for the osteotomy. If required, bend the plate with the bending pliers (A-2040) to adapt it to the individual shape of the bone.



2. Prefixation of the plate

Fix the straight part of the plate on the bone shaft with two TriLock screws (A-5250.xx, A-5450.xx). To do so, drill the core hole using the drill guide and the twist drill of the corresponding system size, assign the screw length with the depth gauge and insert the screws (see chapter "Drilling" and "Assigning the Screw Length").

In case of an osteotomy, the plate can now be removed and refixed after performing the osteotomy cut.



3. Correcting the rotation

Fix the plate on the ulnar or radial side of the oblong hole with a cortical screw (A-5200.xx, A-5400.xx) depending on the necessary correction. Do not fully tighten the screw.



Adjust the alignment by sliding the cortical screw along the oblong hole. Once the correct alignment is reached, tighten the screw.

Recommendation

Flex the fingers almost completely (i.e. fist position) to check successful alignment.



4. Fixation of the plate

Fill the screw holes with TriLock screws (A-5250.xx, A-5450.xx).



Scaphoid Plates

A-4350.79 small

A-4350.80

A-4350.81 large

1. Surgical approach

Access the scaphoid volarly through soft tissue. Open the radioscapohcapitate ligament in a longitudinal fashion. Reduce the scaphoid. Position the wrist in extension and ulnar deviation. Apply axial traction to the thumb. Correct humpback deformity and check the position of the lunate (DISI). Transfixate the scaphoid non-union with a longitudinal K-wire.

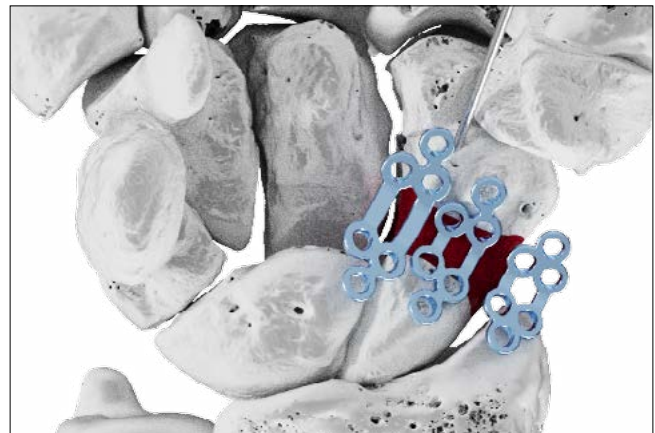
Debride sclerotic and divitalized bone (ischemic tissue) from both sides of the non-union.

Fill the non-union defect with autologous bone graft (cancellous chips or structural cortico-cancellous graft) to restore the carpal height and correct humpback deformity.

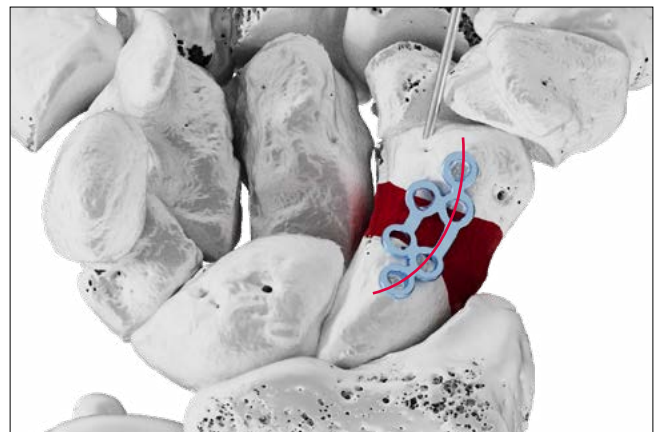


2. Selecting and positioning the plate

Select the appropriate plate size according to the size of the scaphoid.

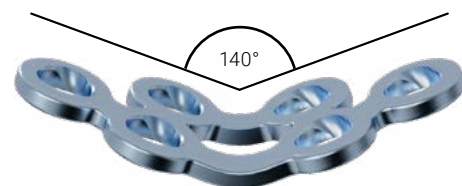


Position the selected plate onto the scaphoid. The side of the plate with the bars should be positioned laterally.

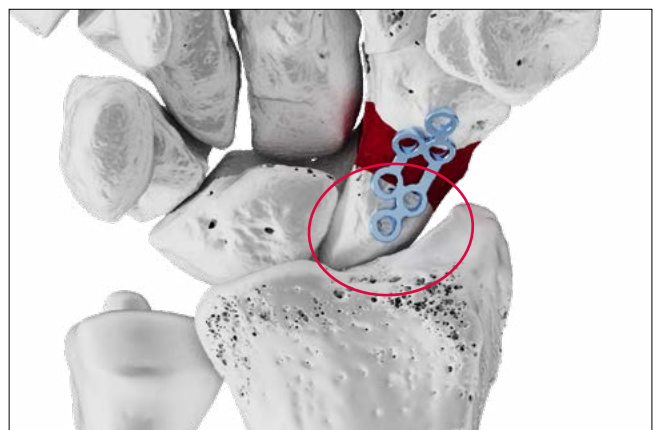


The plate is already prebent in the center (140°) to support reduction in case of humpback deformity.

Optional: Additionally bend the external plate holes – proximally and distally – to match the shape of the bone as needed. Use the plate bending pliers (A-2040, see chapter "Plate Bending").



Evaluate possible impingement between the plate – on the proximal end of the scaphoid – with the distal radius during wrist flexion.



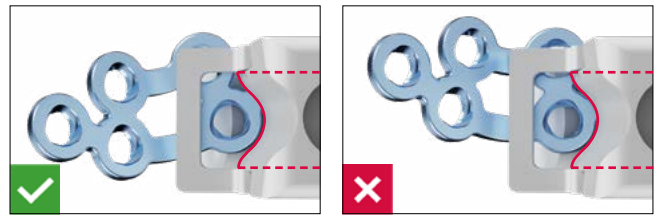
Warning

After successful healing respectively union, remove the plate in case of impingement against the volar rim of the distal radius.

Optional: The most proximal plate hole may be cut to reduce the risk of impingement. Use the plate cutting pliers (A-2048, see chapter "Cutting").

Caution

The small scaphoid plate (A-4350.79) may neither be bent nor cut.



3. Initial plate fixation

Prefix the plate using an olive K-wire or a cortical screw to pull the plate to the scaphoid.

Drill, assign the screw length and insert a TriLock screw on the other side of the bone graft.

Use intraoperative X-ray control to verify the correct plate position.



4. Final plate fixation

Insert TriLock screws into the remaining screw holes.

Replace the olive K-wire or the cortical screw with a TriLock screw.

Use intraoperative X-ray control to verify the final position and stability of the osteosynthesis.



5. Wound closure and aftercare

Close wound. Remove sutures after 12–14 days.

Immobilize for 8 weeks in a forearm cast or plastic bandage including the thumb basal joint. Thereafter, perform standard X-rays in 3 planes (AP, lateral, Stecher). If bony healing is not reliably recognizable on plain X-rays, a CT scan is recommended. Up to 12 weeks postoperatively, no heavy manual tasks and contact sports are allowed. At 12 weeks, perform CT scan to confirm bony union. Increased weightlifting may now start.

Plate removal after 6 months, if bony union is complete.

Explantation

Explantation of Hand Plates

1. Removing the screws

Unlock/loosen all screws and remove them. The order in which the screws are removed is not relevant. In case the plate sticks to the bone, use a periosteal elevator to carefully lift and detach it from the bone.

Caution

When removing the screws, ensure that any bone ingrowth in the screw head has been removed, that the screwdriver/screw head connection is aligned in axial direction, and that a sufficient axial force is used between blade and screw.

TriLock Locking Technology

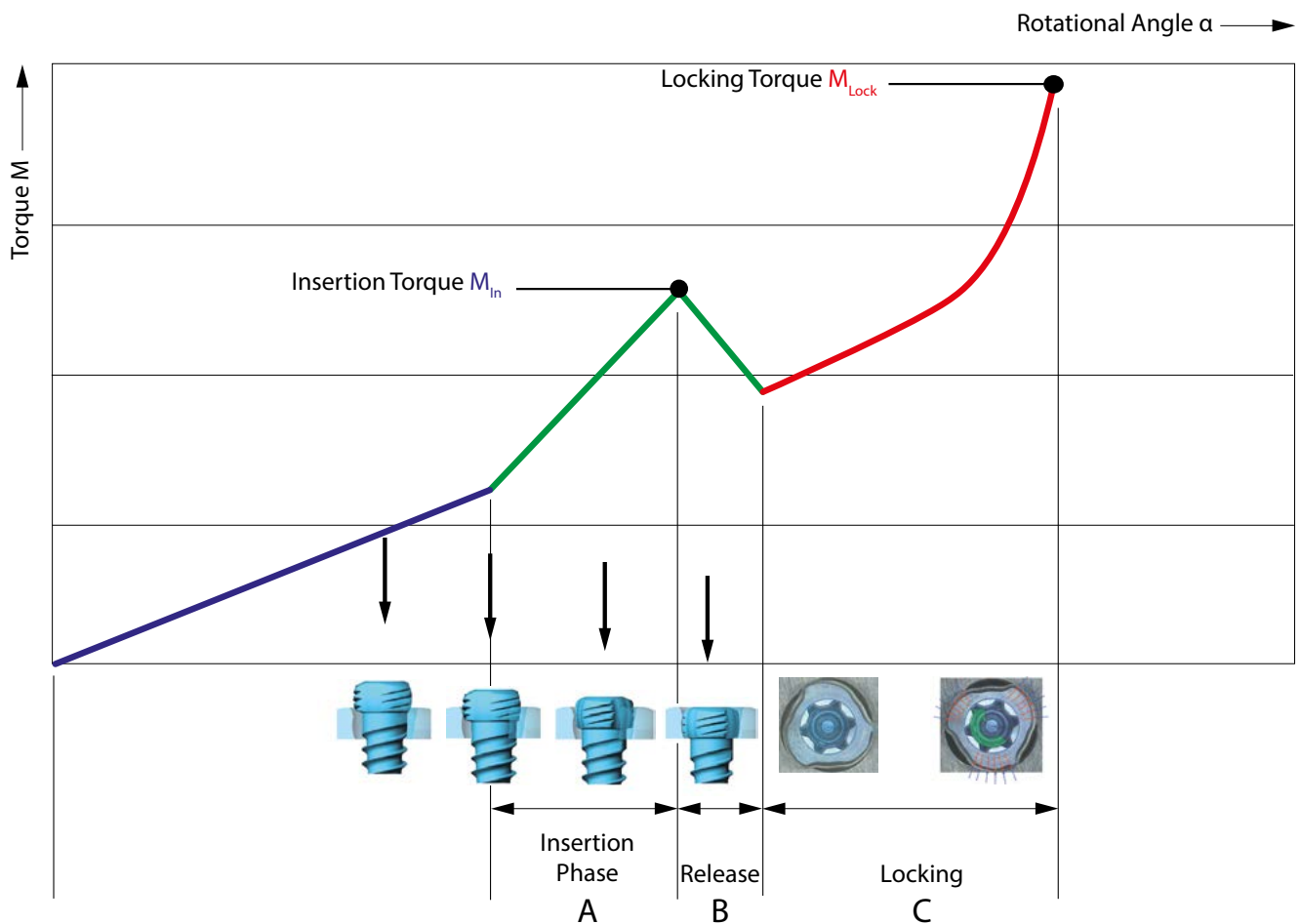
Correct Application of the TriLock Locking Technology

The screw is inserted through the plate hole into a predrilled canal in the bone. An increase of the tightening torque will be felt as soon as the screw head gets in contact with the plate surface.

This indicates the start of the "Insertion Phase" as the screw head starts entering the locking zone of the plate (section "A" in the diagram). Afterwards, a drop of the tightening torque

occurs (section "B" in the diagram). Finally, the actual locking is initiated (section "C" in the diagram) as a friction connection is established between screw and plate when tightening firmly.

The torque applied during fastening of the screw is decisive for the quality of the locking as described in section "C" of the diagram.



Correct Locking ($\pm 15^\circ$) of the TriLock Screws in the Plate

The example below representatively depicts the correct locking position of a 2.0 mm screw in a straight 1.0 mm thick plate. Correct locking occurs only when the screw head is locked flush with the locking contour (fig. 1 and 3).

However, if there is still a noticeable protrusion (fig. 2 and 4), the screw head has not completely reached the locking position. In this case, the screw has to be retightened to obtain full penetration and proper locking. In case of poor

bone quality, a slight axial pressure might be necessary to achieve proper locking. Due to the system characteristics, a screw head protrusion of max. 0.2 mm exists when using plates with 1.0 mm thickness or thinner.

After having reached the locking torque (M_{Lock}), do not further tighten the screw, otherwise the locking function cannot be guaranteed anymore.

Correct: LOCKED

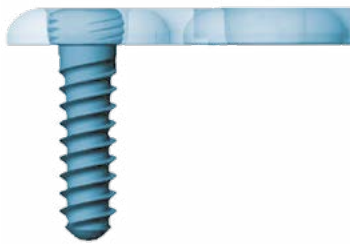


Figure 1

Incorrect: UNLOCKED

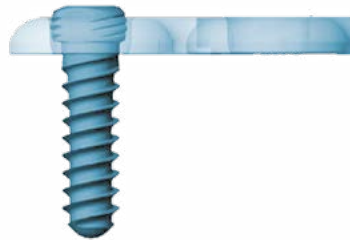


Figure 2

Correct: LOCKED

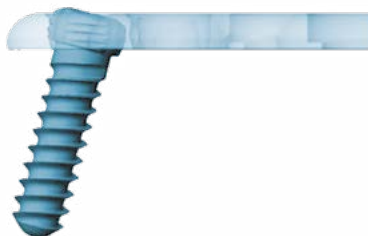


Figure 3

Incorrect: UNLOCKED



Figure 4

Appendix

Implants, instruments and containers

| | | | | |
|--------------------------|-------------|-------------|-------------|-------------|
| Plates, Templates | A-4300.56TP | A-4350.14S | A-4600.06 | A-4600.67TP |
| A-4300.01 | A-4300.58 | A-4350.14TP | A-4600.10 | A-4640.11 |
| A-4300.01S | A-4300.59 | A-4350.17 | A-4600.10S | A-4640.12 |
| A-4300.01TP | A-4300.60 | A-4350.17S | A-4600.10TP | A-4640.30 |
| A-4300.03 | A-4300.60S | A-4350.17TP | A-4600.11 | A-4640.30S |
| A-4300.03S | A-4300.60TP | A-4350.23 | A-4600.11S | A-4640.30TP |
| A-4300.03TP | A-4300.61 | A-4350.23S | A-4600.11TP | A-4640.31 |
| A-4300.04 | A-4300.61S | A-4350.23TP | A-4600.13 | A-4640.31S |
| A-4300.04S | A-4300.61TP | A-4350.41 | A-4600.13S | A-4640.31TP |
| A-4300.04TP | A-4300.62 | A-4350.41S | A-4600.13TP | A-4650.03 |
| A-4300.05 | A-4300.62S | A-4350.41TP | A-4600.20 | A-4650.03S |
| A-4300.06 | A-4300.62TP | A-4350.50 | A-4600.20S | A-4650.03TP |
| A-4300.10 | A-4300.64 | A-4350.50S | A-4600.20TP | A-4650.10 |
| A-4300.10S | A-4300.64S | A-4350.50TP | A-4600.21 | A-4650.10S |
| A-4300.10TP | A-4300.64TP | A-4350.56 | A-4600.21S | A-4650.10TP |
| A-4300.11 | A-4300.65 | A-4350.56S | A-4600.21TP | A-4650.11 |
| A-4300.11S | A-4300.65S | A-4350.56TP | A-4600.51 | A-4650.11S |
| A-4300.11TP | A-4300.65TP | A-4350.62 | A-4600.52 | A-4650.11TP |
| A-4300.12 | A-4300.66 | A-4350.62S | A-4600.53 | A-4650.13 |
| A-4300.12S | A-4300.66S | A-4350.62TP | A-4600.54 | A-4650.13S |
| A-4300.12TP | A-4300.66TP | A-4350.6 | A-4600.55 | A-4650.13TP |
| A-4300.13 | A-4300.67 | A-4350.66S | A-4600.56 | A-4650.20 |
| A-4300.13S | A-4300.67S | A-4350.66TP | A-4600.56S | A-4650.20S |
| A-4300.13TP | A-4300.67TP | A-4350.79 | A-4600.56TP | A-4650.20TP |
| A-4300.20 | A-4340.11 | A-4350.79S | A-4600.58 | A-4650.21 |
| A-4300.20S | A-4340.12 | A-4350.79TP | A-4600.59 | A-4650.21S |
| A-4300.20TP | A-4340.30 | A-4350.80 | A-4600.60 | A-4650.21TP |
| A-4300.21 | A-4340.30S | A-4350.80S | A-4600.60S | A-4650.51 |
| A-4300.21S | A-4340.30TP | A-4350.80TP | A-4600.60TP | A-4650.51S |
| A-4300.21TP | A-4340.31 | A-4350.81 | A-4600.61 | A-4650.51TP |
| A-4300.50 | A-4340.31S | A-4350.81S | A-4600.61S | A-4650.56 |
| A-4300.51 | A-4340.31TP | A-4350.81TP | A-4600.61TP | A-4650.56S |
| A-4300.51S | A-4340.32 | A-4600.01 | A-4600.62 | A-4650.56TP |
| A-4300.51TP | A-4340.32S | A-4600.01S | A-4600.62S | A-4650.58 |
| A-4300.54 | A-4340.32TP | A-4600.01TP | A-4600.62TP | A-4650.59 |
| A-4300.54S | A-4350.01 | A-4600.03 | A-4600.64 | A-4650.62 |
| A-4300.54TP | A-4350.01S | A-4600.03S | A-4600.65 | A-4650.62S |
| A-4300.55 | A-4350.01TP | A-4600.03TP | A-4600.66 | A-4650.62TP |
| A-4300.55S | A-4350.08 | A-4600.04 | A-4600.66S | A-4650.67 |
| A-4300.55TP | A-4350.08S | A-4600.04S | A-4600.66TP | A-4650.67S |
| A-4300.56 | A-4350.08TP | A-4600.04TP | A-4600.67 | A-4650.67TP |
| A-4300.56S | A-4350.14 | A-4600.05 | A-4600.67S | A-4655.01 |

| | | | | |
|-------------|------------------------|--------------|--------------|--------------|
| A-4655.01S | A-4655.66TP | A-5100.04/1 | A-5200.06/1S | A-5200.23 |
| A-4655.01TP | A-4645.01 | A-5100.04/1S | A-5200.07 | A-5200.23/1 |
| A-4655.02 | A-4645.01S | A-5100.05 | A-5200.07/1 | A-5200.23/1S |
| A-4655.02S | A-4645.01TP | A-5100.05/1 | A-5200.07/1S | A-5200.24 |
| A-4655.02TP | A-4645.02 | A-5100.05/1S | A-5200.08 | A-5200.24/1 |
| A-4655.03 | A-4645.02S | A-5100.06 | A-5200.08/1 | A-5200.24/1S |
| A-4655.03S | A-4645.02TP | A-5100.06/1 | A-5200.08/1S | A-5250.04 |
| A-4655.03TP | A-4645.03 | A-5100.06/1S | A-5200.09 | A-5250.04/1 |
| A-4655.08 | A-4645.03S | A-5100.07 | A-5200.09/1 | A-5250.04/1S |
| A-4655.08S | A-4645.03TP | A-5100.07/1 | A-5200.09/1S | A-5250.05 |
| A-4655.08TP | A-4645.08 | A-5100.07/1S | A-5200.10 | A-5250.05/1 |
| A-4655.10 | A-4645.08S | A-5100.08 | A-5200.10/1 | A-5250.05/1S |
| A-4655.10S | A-4645.08TP | A-5100.08/1 | A-5200.10/1S | A-5250.06 |
| A-4655.10TP | A-4645.10 | A-5100.08/1S | A-5200.11 | A-5250.06/1 |
| A-4655.11 | A-4645.10S | A-5100.09 | A-5200.11/1 | A-5250.06/1S |
| A-4655.11S | A-4645.10TP | A-5100.09/1 | A-5200.11/1S | A-5250.07 |
| A-4655.11TP | A-4645.16 | A-5100.09/1S | A-5200.12 | A-5250.07/1 |
| A-4655.16 | A-4645.16S | A-5100.10 | A-5200.12/1 | A-5250.07/1S |
| A-4655.16S | A-4645.16TP | A-5100.10/1 | A-5200.12/1S | A-5250.08 |
| A-4655.16TP | A-4645.20 | A-5100.10/1S | A-5200.13 | A-5250.08/1 |
| A-4655.17 | A-4645.20S | A-5100.11 | A-5200.13/1 | A-5250.08/1S |
| A-4655.17S | A-4645.20TP | A-5100.11/1 | A-5200.13/1S | A-5250.09 |
| A-4655.17TP | A-4645.21 | A-5100.11/1S | A-5200.14 | A-5250.09/1 |
| A-4655.20 | A-4645.21S | A-5100.12 | A-5200.14/1 | A-5250.09/1S |
| A-4655.20S | A-4645.21TP | A-5100.12/1 | A-5200.14/1S | A-5250.10 |
| A-4655.20TP | A-4645.22 | A-5100.12/1S | A-5200.15 | A-5250.10/1 |
| A-4655.21 | A-4645.22S | A-5100.13 | A-5200.15/1 | A-5250.10/1S |
| A-4655.21S | A-4645.2TP | A-5100.13/1 | A-5200.15/1S | A-5250.11 |
| A-4655.21TP | A-4645.23 | A-5100.13/1S | A-5200.16 | A-5250.11/1 |
| A-4655.22 | A-4645.23S | A-5100.14 | A-5200.16/1 | A-5250.11/1S |
| A-4655.22S | A-4645.23TP | A-5100.14/1 | A-5200.16/1S | A-5250.12 |
| A-4655.22TP | A-4655.90 | A-5100.14/1S | A-5200.17 | A-5250.12/1 |
| A-4655.23 | A-4655.90S | A-5100.16 | A-5200.17/1 | A-5250.12/1S |
| A-4655.23S | A-4655.90TP | A-5100.16/1 | A-5200.17/1S | A-5250.13 |
| A-4655.23TP | A-4660.10 | A-5100.16/1S | A-5200.18 | A-5250.13/1 |
| A-4655.24 | A-4660.10S | A-5100.18 | A-5200.18/1 | A-5250.13/1S |
| A-4655.24S | A-4660.10TP | A-5100.18/1 | A-5200.18/1S | A-5250.14 |
| A-4655.24TP | A-4660.11 | A-5100.18/1S | A-5200.19 | A-5250.14/1 |
| A-4655.51 | A-4660.11S | A-5100.20 | A-5200.19/1 | A-5250.14/1S |
| A-4655.51S | A-4660.11TP | A-5100.20/1 | A-5200.19/1S | A-5250.16 |
| A-4655.51TP | A-4660.15 | A-5100.20/1S | A-5200.20 | A-5250.16/1 |
| A-4655.56 | A-4660.15S | A-5200.04 | A-5200.20/1 | A-5250.16/1S |
| A-4655.56S | A-4660.15TP | A-5200.04/1 | A-5200.20/1S | A-5250.18 |
| A-4655.56TP | | A-5200.04/1S | A-5200.21 | A-5250.18/1 |
| A-4655.62 | Screws, Washers | A-5200.05 | A-5200.21/1 | A-5250.18/1S |
| A-4655.62S | A-4300.70 | A-5200.05/1 | A-5200.21/1S | A-5250.20 |
| A-4655.62TP | A-4300.70/1 | A-5200.05/1S | A-5200.22 | A-5250.20/1 |
| A-4655.66 | A-4300.70/1S | A-5200.06 | A-5200.22/1 | A-5250.20/1S |
| A-4655.66S | A-5100.04 | A-5200.06/1 | A-5200.22/1S | A-5300.06 |

| | | | | |
|----------------------|----------------|----------------------|--------------------|-------------------|
| A-5300.06/1 | A-3414 | A-5040.21/1 | A-5045.46/2S | Containers |
| A-5600.10 | A-3414S | A-5040.21/2S | A-5045.47/1 | A-0810.10 |
| A-5600.10/1 | A-3420 | A-5040.41 | A-5045.47/2S | A-0810.11 |
| A-5600.10/1S | A-3420S | A-5040.41/1 | A-5046.11/1 | A-0810.11.1 |
| | A-3421 | A-5040.41/2S | A-5046.11/2S | A-0810.20 |
| Twist Drills, | A-3421S | A-5040.90 | A-5046.21/1 | A-0810.22 |
| Countersinks | A-3424 | A-5040.90/1 | A-5046.21/2S | A-0810.30 |
| A-3110 | A-3424S | A-5040.90/1S | A-5046.22/1 | A-0810.31 |
| A-3110S | A-3430 | A-5042.00 | A-5046.22/2S | A-0810.31.1 |
| A-3112 | A-3430S | A-5042.00/1 | A-5046.41/1 | A-0810.32 |
| A-3112S | A-3431 | A-5042.00/1S | A-5046.41/2S | A-0810.40 |
| A-3120 | A-3431S | A-5042.10 | A-5046.42/1 | A-0842.20 |
| A-3120S | A-3434 | A-5042.10/1 | A-5046.42/2S | A-0844.10 |
| A-3130 | A-3434S | A-5042.10/1S | | A-0844.20 |
| A-3110S | A-3510 | A-5042.21 | Instruments | A-0846.10 |
| A-3111 | A-3510S | A-5042.21/1 | A-2020 | A-0846.20 |
| A-3111S | A-3511 | A-5042.21/2S | A-2021 | A-0847.20 |
| A-3113 | A-3511S | A-5042.41 | A-2022 | A-0849.10 |
| A-3113S | A-3512 | A-5042.41/1 | A-2023 | A-0849.20 |
| A-3121 | A-3512S | A-5042.41/2S | A-2024 | A-0850.10 |
| A-3121S | A-3513 | A-5043.00 | A-2025 | A-0851.20 |
| A-3131 | A-3513S | A-5043.00/1 | A-2030 | A-0851.30 |
| A-3131S | A-3520 | A-5043.00/1S | A-2031 | A-0852.10 |
| A-3210 | A-3520S | A-5043.00 | A-2032 | A-0853.10 |
| A-3210S | A-3521 | A-5043.00/1 | A-2040 | A-0853.20 |
| A-3211 | A-3521S | A-5043.00/1S | A-2046 | A-0853.20.1 |
| A-3211S | A-3530 | A-5043.10 | A-2047 | A-0853.21 |
| A-3212 | A-3530S | A-5043.10/1 | A-2048 | A-0853.21.1 |
| A-3212S | A-3531 | A-5043.10/1S | A-2050 | A-0853.70 |
| A-3213 | A-3531S | A-5043.90 | A-2060 | A-0853.70.1 |
| A-3213S | A-3610 | A-5043.90/1 | A-2071 | A-0883.80 |
| A-3220 | A-3610S | A-5043.90/1S | A-2073 | A-0853.80.1 |
| A-3220S | | | A-2310 | A-0854.10 |
| A-3221 | Reamers | Olive K-Wires | A-2311 | A-0854.11 |
| A-3221S | A-3630 | A-5045.21/1 | A-2350 | A-0854.11.1 |
| A-3230 | A-3630S | A-5045.21/2S | A-2610 | A-0854.20 |
| A-3230S | A-3631 | A-5045.22/1 | A-2611 | A-0854.21 |
| A-3231 | A-3631S | A-5045.22/2S | A-2620 | A-0854.21.1 |
| A-3231S | A-3635 | A-5045.41/1 | A-2650 | A-0856.10 |
| A-3310 | A-3635S | A-5045.41/2S | A-7001 | A-0856.20 |
| A-3310S | | A-5045.42/1 | A-7002 | A-0857.10 |
| A-3410 | K-Wires | A-5045.42/2S | A-7005 | A-0859.10 |
| A-3410S | A-5040.00 | A-5045.43/1 | A-7009 | A-0860 |
| A-3411 | A-5040.00/1 | A-5045.43/2S | A-7010 | A-0860.1 |
| A-3411S | A-5040.00/1S | A-5045.44/1 | A-7011 | A-0861.10 |
| A-3412 | A-5040.10 | A-5045.44/2S | A-7012 | A-0863.10 |
| A-3412S | A-5040.10/1 | A-5045.45/1 | A-7013 | A-0865.10 |
| A-3413 | A-5040.10/1S | A-5045.45/2S | | A-0870.04 |
| A-3413S | A-5040.21 | A-5045.46/1 | | A-0870.05 |

A-0877
A-0880
A-0880.1
A-0881.1
A-0883
A-0890
A-0890.1
A-0891
A-0892
A-0893
A-0894
A-0895
A-0896
A-6001
A-6010.10
A-6010.12
A-6010.16
A-6020
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A-6602.061
A-6604.051
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A-6604.905
A-6604.914
A-6604.915
A-6604.921
A-6604.922
A-7003
A-7006
A-7007
M-6706
M-6707
M-6727

R_HAND-01010001_v4 / 2024-03, Medartis AG, Switzerland. All technical data subject to alteration.

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