medartis®

PRECISION IN FIXATION

SURGICAL TECHNIQUE – STEP BY STEP

Foot System 2.0–3.5

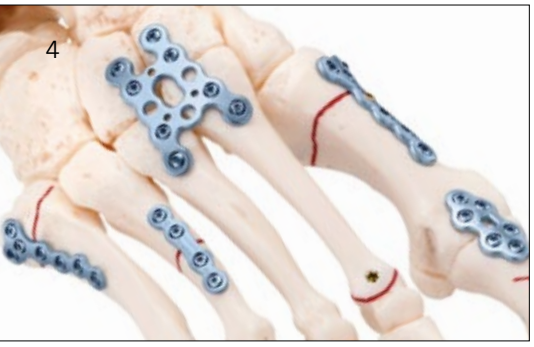
APTUS® Foot

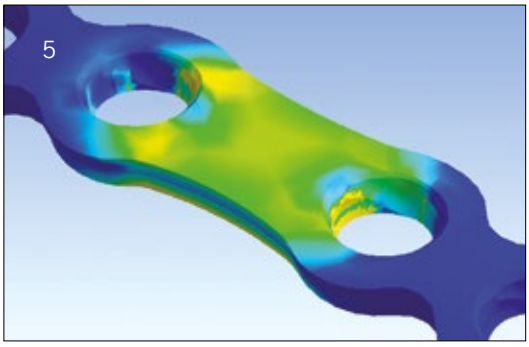
Foot System 2.0–3.5

Contents

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

Features, Technique
Combination is the Solution





1 TriLock plates in the module
2 Detail calcaneus plate
3 Grid plate with TriLock screws
4 Detail foot bone model
5 Finite element representation of a Medartis plate

For further information on the plate range, see the APTUS Ordering Catalog at www.medartis.com/meta/downloads/product-brochures

→ www.medartis.com/products/aptus/foot

- Multidirectional (± 15°) and angular stable TriLock locking technology
- Anatomic plate designs
- HexaDrive interface with patented self-holding properties

Technology

- Patented TriLock locking technology – multidirectional locking of the screw in the plate
  - Spherical three-point wedge-locking
  - Friction locking through radial bracing of the screw head in the plate – without additional tensioning components
- Screws can pivot freely by ± 15° in all directions for optimal positioning
- Fine tuning capabilities of fracture fragments
- TriLock screws can be re-locked in the same screw hole at individual angles up to three times
- Minimal screw head protrusion thanks to internal locking contour
- No cold welding between plate and screws

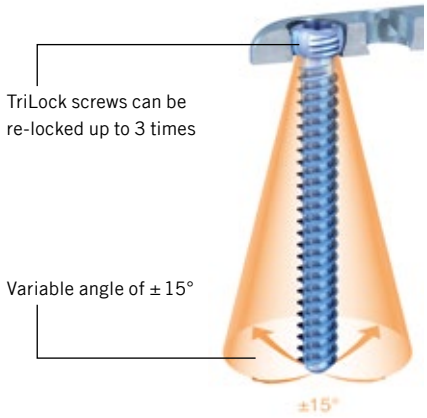
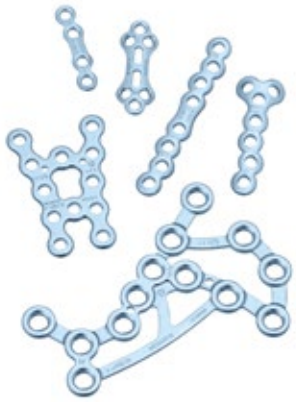


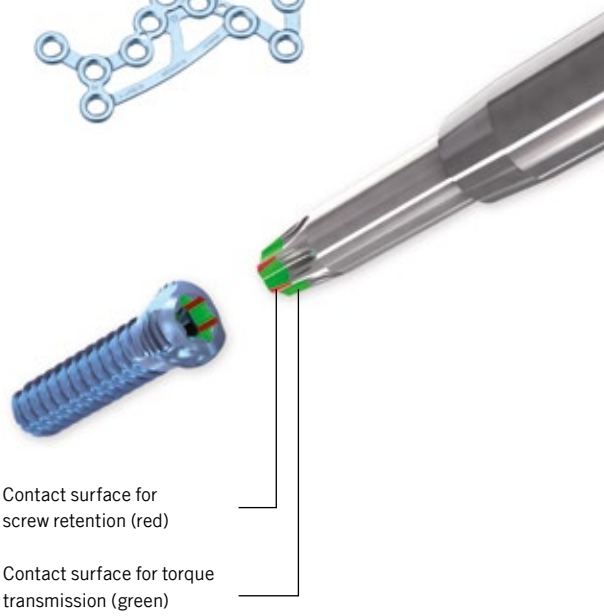
Plate Features

- Anatomically pre-contoured implant designs
- Low overall profile height and chamfered edges offering protection of the soft tissue
- Plates may be cut and bent for a wide range of applications
- Specially developed calcaneus plates for subchondral support of the subtalar joint



Screw Features

- HexaDrive – the optimal self-retaining mechanism between screw and screwdriver for increased torque transmission
- Precision cut thread profile for sharpness and self-tapping properties



→ www.medartis.com/products/aptus/foot

Introduction
2.0–3.5

Introduction

Multidirectional and angular stable treatment for the foot
APTUS Foot implants provide an optimal selection for the treatment of fractures, osteotomies and arthrodesis.
The compact implant sizes permit varied positioning options to the individual foot bones. The unique TriLock technology allows stabilization and bridging of unstable zones in accordance with the «fixateur interne» principle. Multidirectional screw positioning helps to fixate and reduce bone fragments, allowing for anatomical reconstruction. Thanks to patented self-retaining HexaDrive screwdriver properties, the screws are securely held by the screwdriver. Simplicity is achieved with an intuitive and user-friendly system.

Product Materials

All APTUS implants are made from pure titanium (ASTM F67, ISO 5832-2) or from titanium alloy (ASTM F136, ISO 5832-3). All of the titanium materials used are biocompatible, corrosion-resistant and non-toxic in a biological environment. K-wires are made of stainless steel (ASTM F138). Instruments are made of stainless steel, PEEK, aluminum or titanium.

Indications

- Fractures, osteotomies and arthrodesis of small bones, in particular of the tarsals, metatarsals, and phalanges
- Fractures and osteotomies of the calcaneus

Contraindications

- Pre-existing 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	Color Code
APTUS 2.0	blue
APTUS 2.3	brown
APTUS 2.8	orange
APTUS 3.5	green

Plates and Screws
Special implant plates and screws have their own color:

Gold implant plates:	Fixation plates
Blue implant plates:	TriLock plates (locking)
Gold implant screws:	Cortical screws (fixation)
Blue implant screws:	TriLock screws (locking)
Green implant screws:	SpeedTip screws (self-drilling)
Silver implant screws:	Transfixation screws

Treatment Concept

The table below lists the most common surgical foot indications which can be treated with the APTUS Foot implants.

Implants / Examples of Applications	SpeedTip C 2.0 A-5417.xx and A-5411.xx	SpeedTip C 2.8 A-5811.xx	Straight Plate 2.0/2.3 A-4655.01/03/08	T Plate 2.0/2.3 A-4655.12/13	Grid Plate 2.0/2.3 A-4655.67/68/69	Straight Plate 2.8 A-4850.01/03/08	T Plate 2.8 A-4850.12/13	Grid Plate 2.8 A-4850.67/68/69	Wing Plate 2.8 A-4850.70/71	MTP Fusion Plate 2.8 A-4860.10-15	MTP Revision Plate 2.8 A-4860.16-19	TMT-1 Medial Fusion Plate 2.8 A-4860.30/31	TMT-1 Plantar Fusion Plate 2.8 A-4860.36/37	Calcaneus Plate 3.5 A-4950.71-76
Fractures MT1														
Fractures MT2-5														
MTP Fusion														
MTP Revision with bone graft														
TMT-1 (Lapidus) Fusion														
Lisfranc Arthrodesis														
Distal Osteotomy MT1														
Distal Osteotomy MT2-5														
Proximal Osteotomy MT 1														
Proximal Osteotomy MT 2-5														
Talo-navicular Arthrodesis														
Calcaneo-cuboid Arthrodesis														
Cuboid Fractures														
Navicular Fractures														
Talus Fractures														
Lateral Column Lengthening (Evans)														
Calcaneus Fractures														

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General Instrument Application

Plate Pick-Up

The plates can be manually removed from the implant container or with the help of the plate holding forceps (A-2050). These forceps have a crossed end and will open when pressure is applied. The plates are kept force-free in the holding channel of the forceps tip.

A-2050
2.0–3.5 Plate Holding Forceps

Bending

If required, the TriLock foot plates can be bent with the plate bending pliers.
Depending on the associated system size of the plate there are two different plate bending pliers for the APTUS Foot System, including:

Type 1
2.0–2.8 Plate Bending Pliers, with Pins (A-2047)
for plates from the Fore- and Midfoot System 2.0/2.3, 2.8 and Hallux System 2.8

A-2047
2.0–2.8 Plate Bending Pliers, with Pins

Type 2
3.5/4.0 Plate Bending Pliers (A-2940)
for plates from the Calcaneus System 3.5

A-2940
3.5/4.0 Plate Bending Pliers

Plate bending pliers type 1

The labeled side of the plate must always face upwards when inserting the plate into the bending pliers (A-2047).

When bending flat plates (wing plates), the plate bending pliers must be held so that the letters «F – FLAT PLATE THIS SIDE UP» are legible from above.

When bending a curved plate, the letters «C – CURVED PLATE THIS SIDE UP» must be legible from above. This ensures that the plate holes are not damaged.

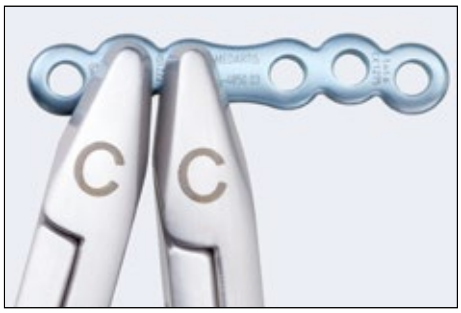
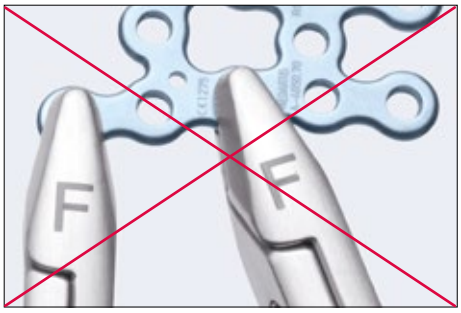


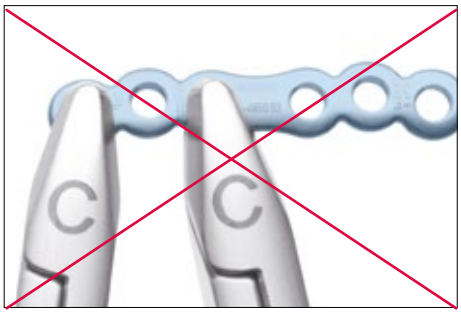
Plate bending pliers type 2

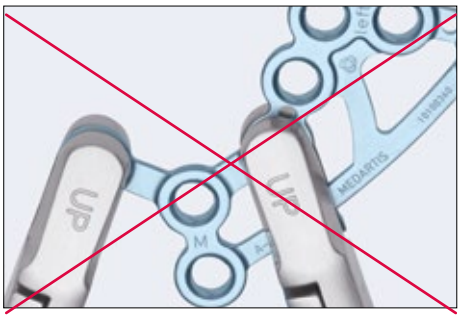
The labeled side of the plate must always face upward when inserting the plate into the bending pliers (A-2940).

When bending a calcaneus plate, the letters «UP» must be legible from above.

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

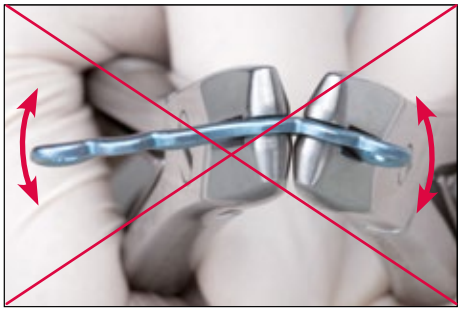






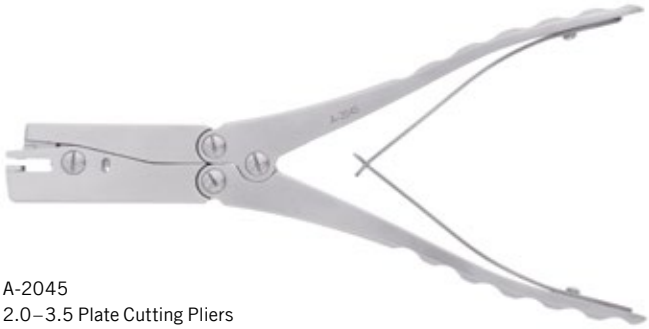
Do not bend the plate by more than 30°. Bending the plate further may deform the plate holes and may cause the plate to break postoperatively.

Notice:
Repeated bending of 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.



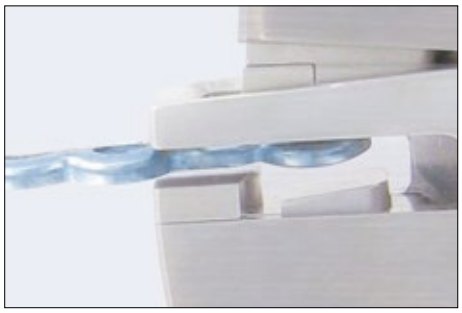
Cutting

If required, the plate cutting pliers (A-2045) can be used to cut all plates and K-wires up to a diameter of 2.0 mm.



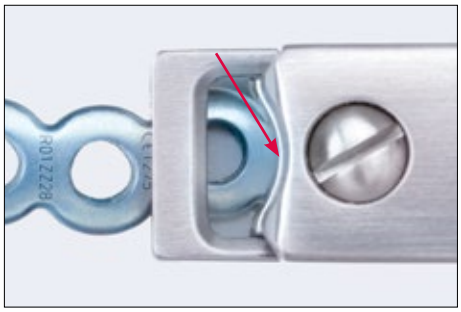
A-2045
2.0–3.5 Plate Cutting Pliers

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.



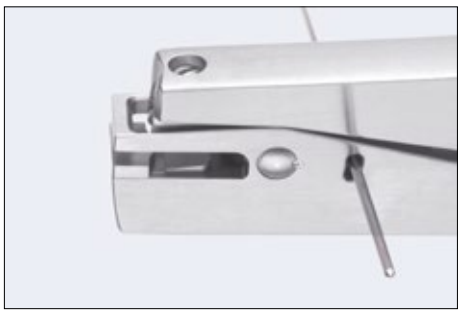
Tip:
To facilitate the insertion of the plate, support the cutting pliers slightly with your middle finger.

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.



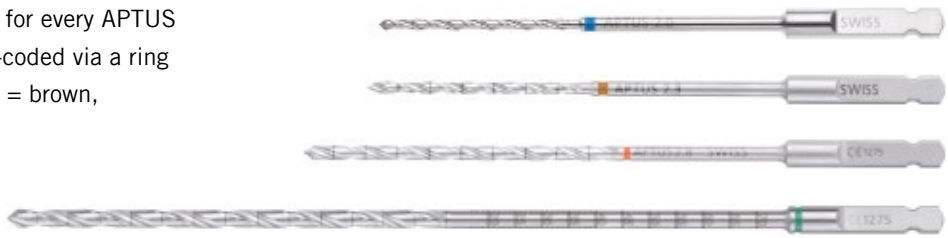
Notice:
Always cut the plate holes individually – if you want to shorten the plate by two holes, cut them in two cutting procedures.

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.



Drilling

Color-coded twist drills are available for every APTUS system size. All twist drills are color-coded via a ring system. System size 2.0 = blue, 2.3 = brown, 2.8 = orange, 3.5 = green.



Core Hole Drills = one colored ring

There are two different types of twist drills for every system: Core hole drills are labeled with one colored ring and gliding hole drills (for lag screw technique) are labeled with two colored rings.

Gliding Hole Drills = two colored rings

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

A-2021
2.0/2.3, 2.8 Drill Guide

A-2022
2.0/2.3, 2.8 Drill Guide for Lag Screws

The double-ended drill guide forTriLock^{PLUS} (A-2016) is applied as normal to perform the compression technique. The side marked with the arrow sign «⟵» is used for the compression holes only.

A-2026
2.0, 2.8 Drill Guide TriLock^{PLUS}

A-2820
2.8 Drill Guide

A-2920
3.5 Drill Guide

The self-holding drill sleeve (A-2826, A-2921) can be locked (up to ± 15°) in the TriLock holes of the plate, performing all of the functions of a drill guide without the need to be held.

A-2826
2.5/2.8 Drill Sleeve, Self-Holding

A-2921
3.5 Drill Sleeve, Self-Holding

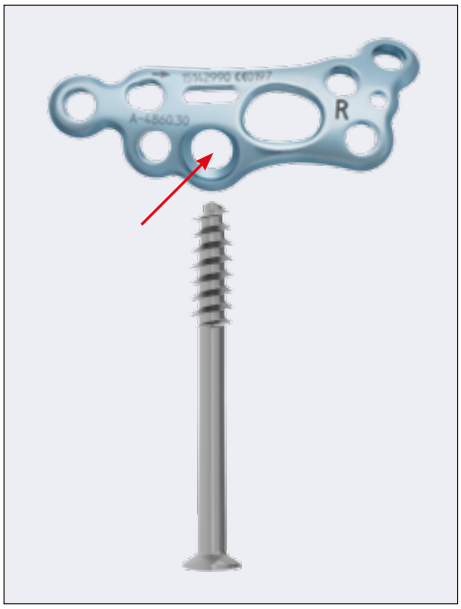
→ www.medartis.com/products/aptus/foot

Position the plate onto the bone. Insert the drill guide and the corresponding color-coded twist drill into the plate hole. In the APTUS system, the drill is guided by the shaft of the drill and not the drill flute.

Notice:
For TriLock plates ensure that the screw holes are pre-drilled with a pivoting angle of no more than ±15°. For this purpose the drill guides show a limit stop of ±15°. A pre-drilled pivoting angle of > 15° no longer allows the TriLock screws to lock in the plate correctly.

Surgical Technique Transfixation Screws

Classic Lapidus Arthrodesis
2.8 TriLock TMT-1 medial fusion plates (A-4860.30 and A-4860.31) have a specific hole to insert an optional transfixation screw in the second metatarsal. This fixation from the first to the second metatarsal is often referred to as «classic Lapidus arthrodesis».



1. Drilling the hole for the transfixation screw
Perform the Lapidus arthrodesis according to the surgeon's technique.

Pre-drill the transfixation screw with the twist drill (A-3832, single orange ring). Use the «LAG» side of the drill guide (A-2820) to center the twist drill in the transfixation hole and protect the surrounding tissue from direct contact.

Tip:
Typically, an angle of 20° dorsally is needed for the ideal placement of the screw into the second metatarsal

2. Assigning the screw length and screw insertion
Assign the depth of the resulting hole with the depth gauge (A-2837). Insert a transfixation screw using a screwdriver blade (A-2013).

For an extended surgical technique, refer to www.medartis.com.

Lag Screw Technique
Transfixation screws can be used as lag screws separate from the plate.

1. Drilling the core hole
Use the twist drill (A-3832, single orange ring) to drill the core hole in combination with the drill guide (A-2820).

2. Compressing the fracture/arthrodesis
Compress the fracture/arthrodesis with a transfixation screw of the correct length.

3. Optional steps before compression
If required, use the countersink (A-3930) to create a recess in the bone for the screw head.

Tip:
Use the handle (A-2070, A-2071, A-2073 or A-2074) instead of a power tool.

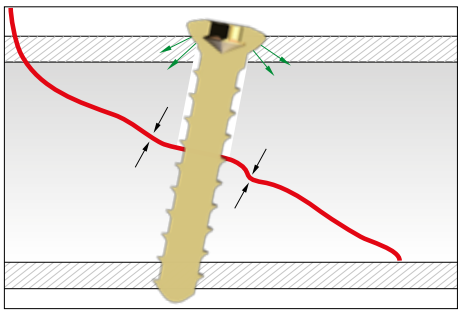
Surgical Technique Lag Screws

The drill guides (A-2022 for Fore- and Midfoot System 2.0/2.3, 2.8, A-2820 for Hallux System 2.8 and A-2920 for Calcaneus System 3.5) for lag screws are used to perform the classical lag screw technique according to AO/ASIF.

1. Drilling the gliding hole
Use the twist drill for gliding holes (two colored rings) of the required system size to drill at a right angle to the fracture line. The Fore- and Midfoot System has a special drill guide for drilling gliding holes (A-2022; labeled with «LAG»). In the case of the Hallux System, use the end of the drill guide A-2820 with one orange marking labeled with «LAG». In the case of the Calcaneus System, use the end of the drill guide A-2920 with the two green markings (also labeled with «LAG»).

2. Drilling the core hole
Insert the end of the drill guide of the same system size (A-2021, A-2820 or A-2920 with one colored marking) into the gliding hole and use the twist drill for core holes (one colored ring) to drill the core hole.

3. Compressing the fracture
Compress the fracture with the cortical screw of the corresponding system size.



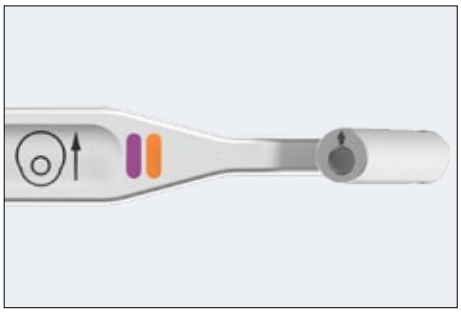
4. Optional steps before compression
If required, use the corresponding countersink for cortical screws (A-3835 or A-3930) to create a recess for the screw head.

Recommendation: Use the handle (A-2070, A-2071, A-2073 or A-2074) instead of a power tool.

Surgical Technique TriLock^{PLUS}

TriLock^{PLUS} allows for 1 mm compression and angular stable locking in one step.

For this technique, a TriLock screw, the 2.5/2.8 drill guide TriLock^{PLUS} (A-2026) as well as a plate containing a TriLock^{PLUS} hole are required. The TriLock^{PLUS} hole and the corresponding side of the drill guide (A-2026) are both marked with an arrow sign «←» indicating the direction of the compression.



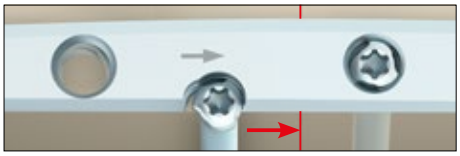
1. Positioning of the drill guide in the plate
Following the direction of the compression, insert the 2.5/2.8 drill guide TriLock^{PLUS} (A-2026) perpendicular to the plate. The arrow sign on the drill guide and the plate both indicate the direction of the compression.

Caution:
Correct compression in the following steps is only achieved if the drill guide is inserted in a 90° angle into the plate.

2. Drilling through the TriLock^{PLUS} drill guide
Use the twist drill for core holes (one orange ring) to completely drill through the bone (bicortically).

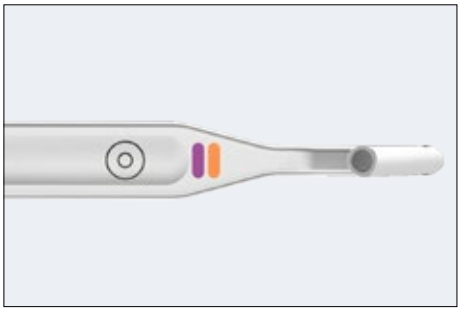
3. Insertion of the screw and locking in final position

Insert a TriLock screw into the pre-drilled hole. Final position is reached when the screw has locked into the TriLock plate hole.



Caution:

TriLock^{PLUS} holes can also be used as conventional TriLock holes allowing for multidirectional (±15°) and angular stable locking with TriLock screws or for the insertion of cortical screws. For conventional drilling, use the respective side of the drill guide (A-2021, A-2026 or A-2820), see also chapter «Drilling».

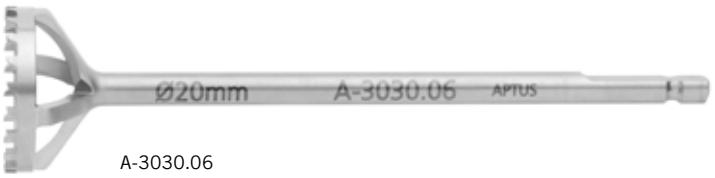


A-2026

Surgical Technique
MTP Joint Reamers

Cup and cone shaped reamers to prepare the MTP joint are available in five pairs.

Paired sizes are:
16 mm, 18 mm, 20 mm, 22 mm and 24 mm
Cannulation for 1.6 mm K-wire

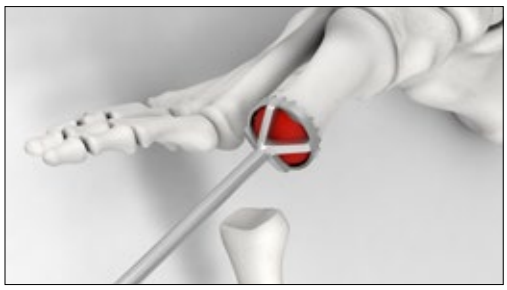


A-3030.06
Cannulated MTP Reamer, Cone 20 mm

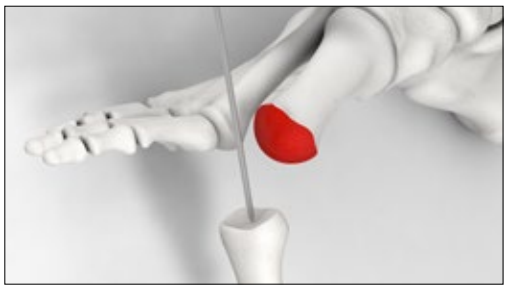
A-3030.05
Cannulated MTP Reamer, Cup 20 mm

1. K-wire insertion
Insert the 1.6 mm K-wire into the first metatarsal head.
Ensure the wire is coaxial to the central canal.

2. Proximal reaming
Select the appropriate proximal reamer. Always start with a larger size and work down to a smaller size.



3. K-wire insertion
Remove the K-wire from the metatarsal.
Insert a K-wire into the center of the proximal phalanges.
Ensure the wire is coaxial to the central canal.



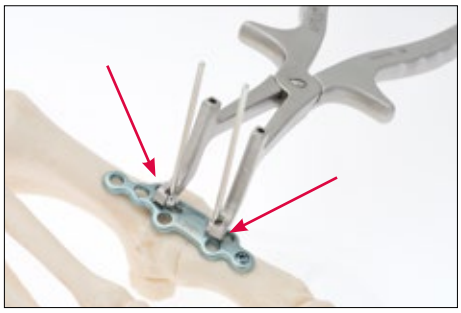
4. Distal reaming
Slide the appropriate distal reamer over the K-wire and ream to remove cartilage from the joint.

Surgical Technique
Compression via Compression and Distraction Forceps and Olive K-wires

APTUS Hallux MTP, MTP revision and medial TMT plates feature a K-wire hole and a K-wire slot for compression with 1.6 mm Olive K-wires or standard 1.6 mm K-wires.

1. Forceps (A-2049) application

When using olive K-wires (A-5045.xx) always have the curved ends of the instrument pointing towards the plate.

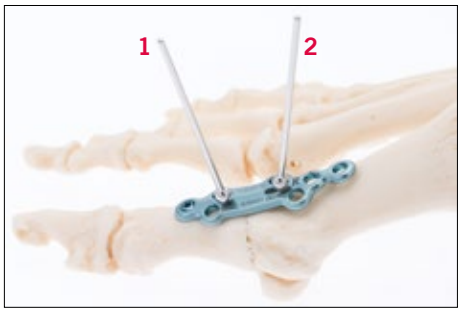


2. Insertion of olive K-wires

Align the plate and fix it on one side with a TriLock screw. Choose two olive K-wires with adequate length for bicortical fixation.

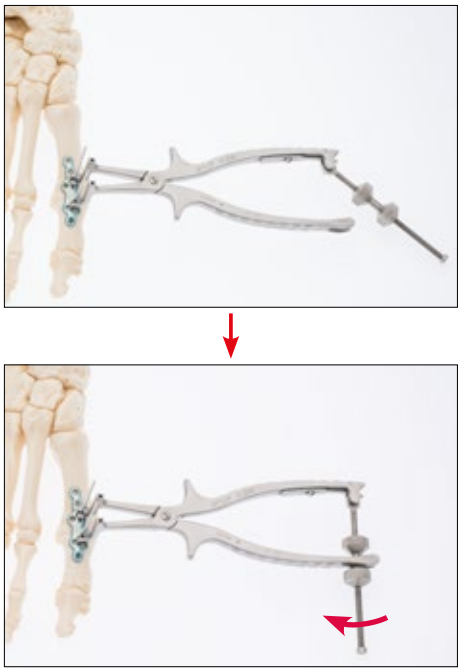
Insert the first olive K-wire through the K-wire hole until the olive gets in contact with the plate surface. Do not over-tighten the olive K-wire as this would lead to stripping of the thread inside of the bone.

Insert the second olive K-wire through the far end of the K-wire slot until the olive is in contact with the plate.



3. Applying compression

Place the curved end with the cupped mouth pieces of the compression and distraction forceps over the olives and apply a gentle compression. Slide the knurled nut into the slot of the handle. Turn the nut clockwise to gradually apply additional compression and to sustain the interfragmentary compression.



Notice:

Do not over-compress! Too high compression could possibly damage either the bone or the K-wires.

Verify correct reduction and compression under X-ray control.

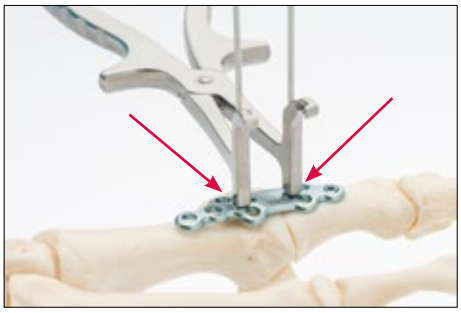
Fix the plate to the bone using TriLock screws.

Surgical Technique
Compression or Distraction via Compression and Distraction Forceps with Standard 1.6 mm K-wires

The compression and distraction forceps (A-2049) can also be used for compression or distraction in combination with standard 1.6 mm K-wires (A-5042.41 or A-5040.41) through the holes in its jaws.

Notice:
Distraction can only be carried out with standard 1.6 mm K-wires. The olive K-wires are not suitable for distraction!

1. Forceps (A-2049) application
Always use the forceps with the flat or straight side towards the bone or plate. The curved side has to point up.

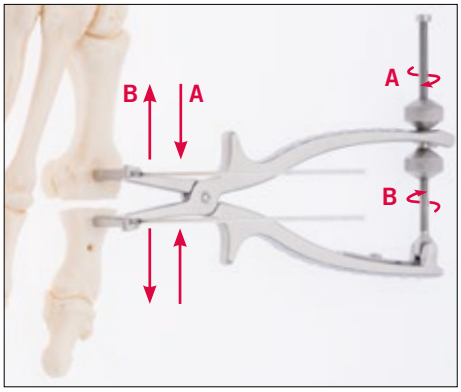


2. Insertion of K-wires
Place one K-wire first more or less perpendicularly to the bone surface. Slide the forceps over the wire and insert the second K-wire through the second hole. The instrument should be in direct contact with the bone or the plate surface.

OR
Insert both K-wires through the forceps using the holes as K-wire guide.

Notice:
Do not place both K-wires free handed!

3. Applying compression or distraction
For **compression (A)** close the forceps until the bone fragments get into contact with each other. Slide the knurled nut into the slot of the handle and turn the nut clockwise to apply the desired compression.



For **distraction (B)** pull the handles apart. Slide the knurled nut into the slot of the handle and turn the nut counter-clockwise until the desired distraction is reached.

Notice:
Over-compression or over-distraction could damage the bone and/or the K-wires. If the forceps is placed at a too high distance from the bone, the K-wires could possibly bent.

Assigning the Screw Length

The depth gauges A-2031 (Fore- and Midfoot System 2.0/2.3, 2.8), A-2837 (Hallux System) and A-2930 (Calcaneus System 3.5) are used to assign the ideal screw length for use in monocortical or bicortical screw fixation.

A-2031
2.0–2.8 Depth Gauge

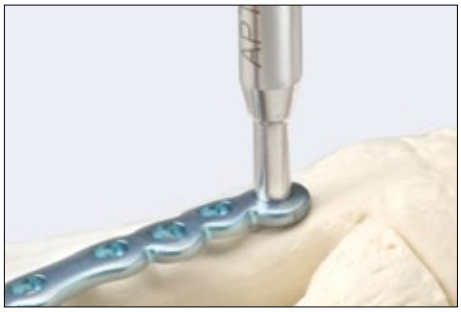
A-2837
2.8 Depth Gauge

A-2930
3.5/4.0 Depth Gauge

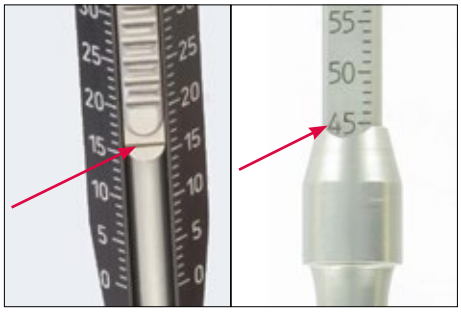
Retract the slider of the depth gauge.
The depth gauge caliper has a hooked tip that is either inserted to the bottom of the hole or is used to catch the far cortex of the bone. When using the depth gauge, the caliper stays static, only the slider is adjusted.

To assign the screw length, place the distal end of the slider onto the implant plate or directly onto the bone.

When using the lag screw technique, place the distal end of the slider directly onto the bone.



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



Screw Pick-Up

All screwdrivers (A-2610 and A-2810) and screwdriver blades (A-2611, A-2013 and A-2911) feature the patented HexaDrive self-holding system.

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

A-2810
2.8 Screwdriver, HD7, Self-Holding

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

A-2013
2.5/2.8 Screwdriver Blade, HD7, AO

A-2073
Cannulated Handle with Quick Connector, AO

A-2911
3.5/4.0 Screwdriver Blade, HD15, AO

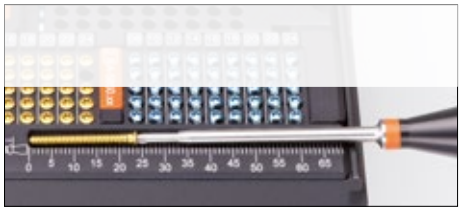
A-2074
Handle with Quick Connector, AO

To remove the screws from the implant container, insert the screwdriver vertically with the corresponding color code into the screw head of the desired screw and pick up the screw with axial pressure.

Caution:
The screw will not hold without axial pressure!
Extract the screw vertically from the compartment.
The screw is held securely by the blade.
If self-retention between screwdriver and screw cannot be achieved despite being picked up correctly, usually the screw has already been picked up before. This may lead to a permanent deformation of the self-retaining area of the HexaDrive inside the screw head. In this case a new screw has to be used.

SpeedTip C-Snap screws feature a snap-off pin for connecting to a 1.8 mm K-wire driver as well as the HexaDrive self-holding system. The HexaDrive is only accessible after the pin has snapped off.

Check the screw length and diameter at the scale of the measuring module. The screw is measured at its head.



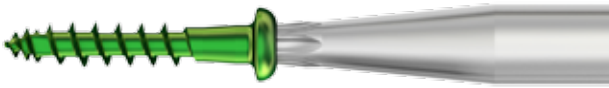
Insertion of SpeedTip C Screws

2.0, 2.8 SpeedTip C Screws

SpeedTip is the patented technology of self-drilling screws. SpeedTip C screws feature a partially threaded shaft for compression. 2.0 SpeedTip C-Snap screws feature a snap-off pin for insertion using a K-wire driver. All SpeedTip C screws are available with standard HexaDrive connection.

Notice:
Use the power tool to insert SpeedTip C and SpeedTip C-Snap screws only! Do not use power tool for insertion of TriLock or cortical screws.

A-5417.xx
2.0 SpeedTip C-Snap Screw, HD6

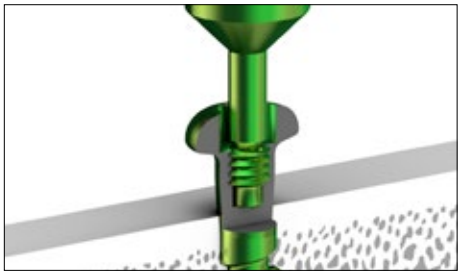


A-5411.xx
2.0 SpeedTip C Screw, HD6

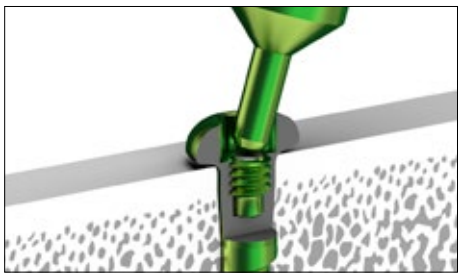
A-5811.xx
2.8 SpeedTip C Screw, HD7

2.0 SpeedTip C-Snap Screws

1. SpeedTip C-Snap screw pick-up
After selecting the appropriate length, pick up the SpeedTip C-Snap screw using a K-wire driver (∅ 1.8 mm) or an appropriate three-jaw chuck.

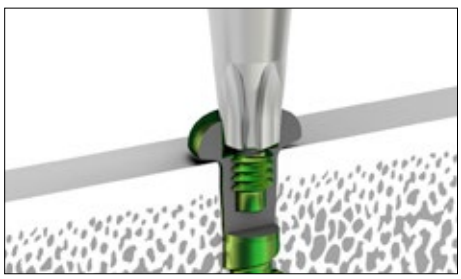


2. Screw insertion
Advance the SpeedTip C-Snap screw until the head is flush and «snap-off» occurs.



3. Manual snap-off (optionally)
In patients with soft or osteoporotic bone, it might be necessary to break off the pin manually from the screw by tilting off the snap-pin.

4. Final tightening (optionally)
After the pin is separated from the screw, final tightening can be done using the HexaDrive screwdriver HD6 (A-2610 or A-2611/A-2073).



→ www.medartis.com/products/aptus/foot

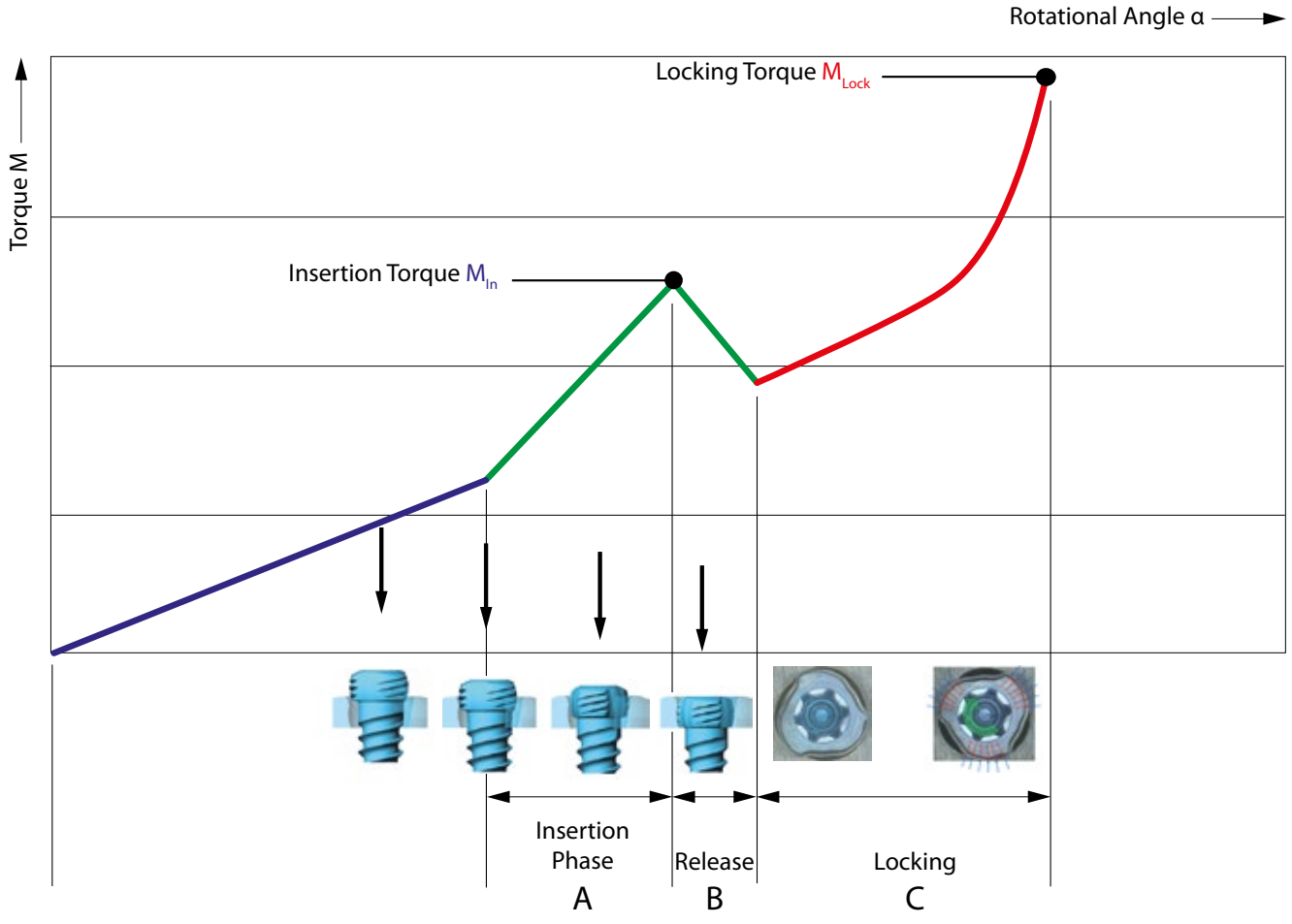
TriLock® Locking Technology

Correct Application of the TriLock® Locking Technology

The screw is inserted through the plate hole into a pre-drilled 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.



→ www.medartis.com/products/aptus/foot

Correct Locking (± 15°) of the TriLock® Screws in the Plate

Visual inspection of the screw head projection provides an indicator of correct locking. Correct locking has occurred only when the screw head has locked flush with the plate surface (figures 1 + 3).

However, if there is still a noticeable protrusion (figures 2 + 4), the screw head has not completely entered the plate and 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 around 0.2 mm exists when using plates with 1.0 mm thickness.

Do not overtighten the screw, otherwise the locking function cannot be guaranteed anymore.

Correct: LOCKED

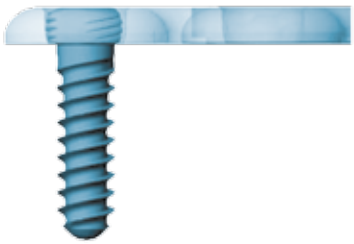


Figure 1

Incorrect: UNLOCKED

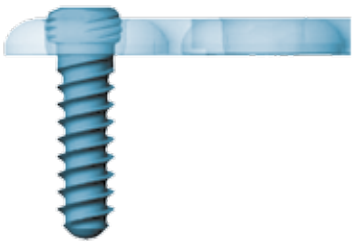


Figure 2

Correct: LOCKED

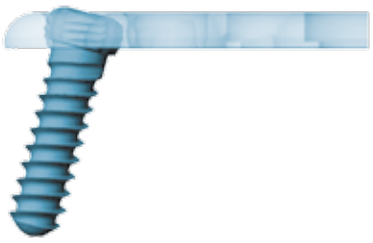


Figure 3

Incorrect: UNLOCKED

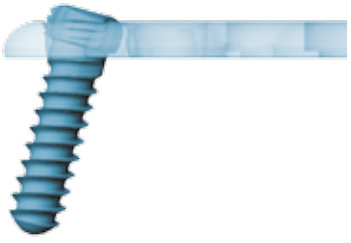


Figure 4

MANUFACTURER & HEADQUARTERS

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