

medartis®

PRECISION IN FIXATION

SURGICAL TECHNIQUE – STEP BY STEP

Proximal Humerus System 3.5



APTUS®
Shoulder

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

Introduction

Product Materials

APTUS implants, plates and screws, are made of pure titanium (ASTM F67, ISO 5832-2) or 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 and staples are made of stainless steel (ASTM F138, ASTM F139); instruments are made of stainless steel, PEEK, aluminum or titanium.

Indications

The APTUS Proximal Humerus System is indicated for fractures, osteotomies and non-unions of the proximal humerus.

The APTUS Proximal Humerus XL Plates are indicated for fractures, osteotomies and non-unions of the proximal humerus and fractures extending to the humeral shaft.

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 3.5	Green

Plates, Screws and Blades

Special implant plates, screws and blades have their own color:

Implant plates blue	TriLock plates (locking)
Implant spiral blades blue	Spiral Blades Proximal Humerus
Implant screws gold	Cortical screws (fixation)
Implant screws blue	TriLock screws (locking), Screws for blade fixation

Symbols

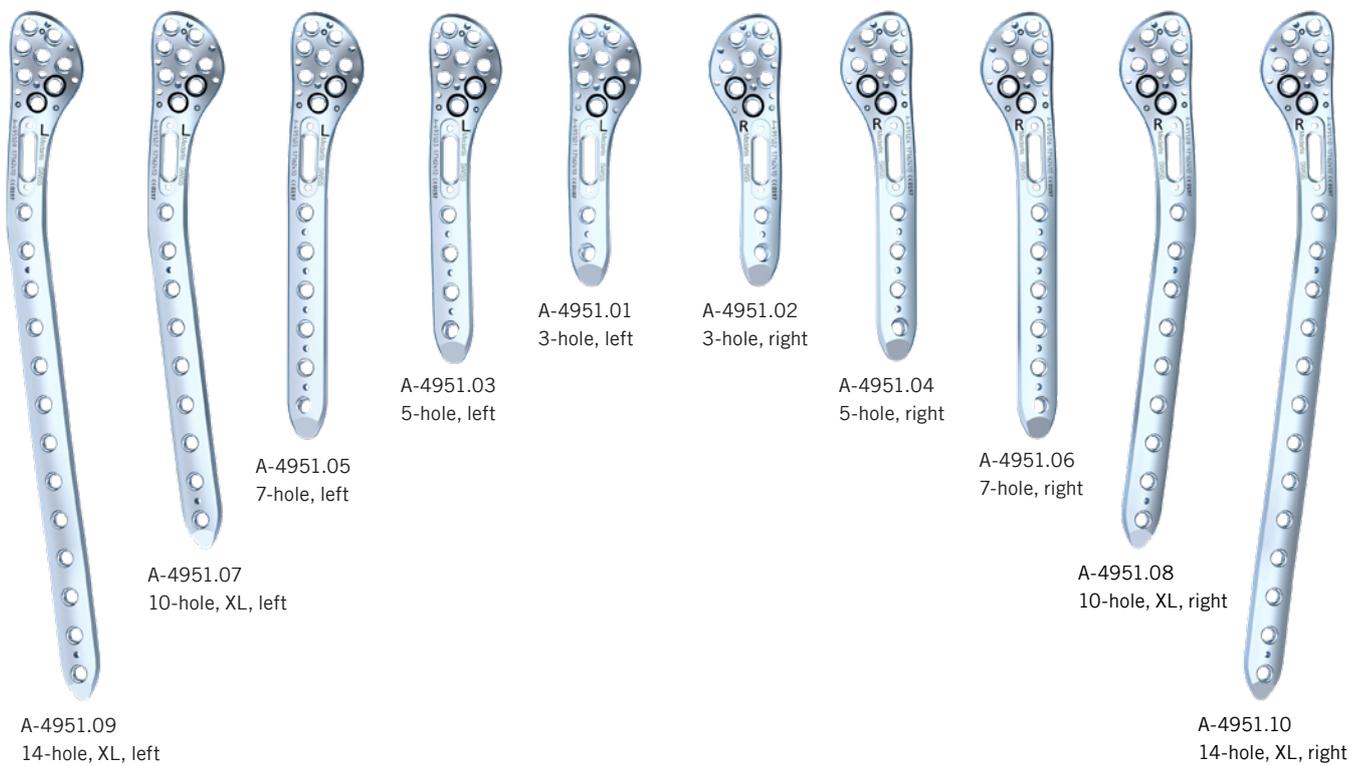


HexaDrive



System Overview

The plates of the APTUS Proximal Humerus System 3.5 (A-4951.01–10) are available in five lengths and in a left and a right version.



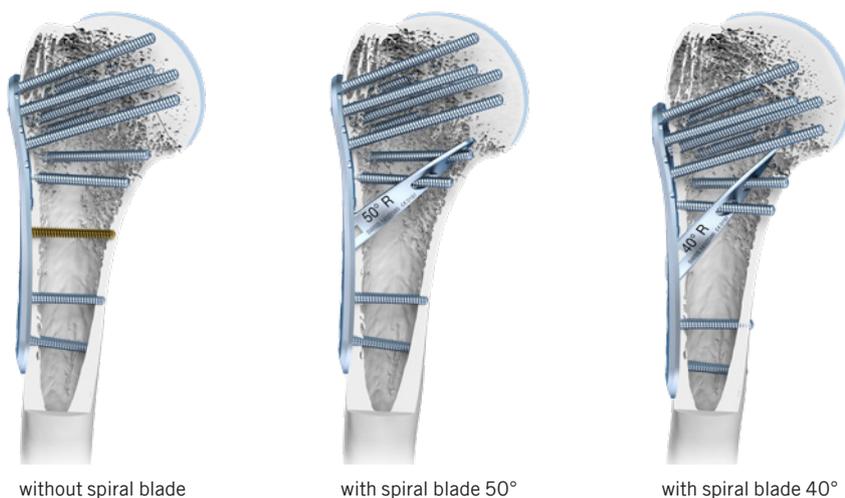
The spiral blades are available in a 40° angle (A-4951.23–24) and a 50° angle (A-4951.21–22) and in a left and a right version. Both options are compatible with all

five plate lengths. The spiral blade is fixed to the plate with two screws (A-4951.30).



When addressing a fracture pattern that requires additional medial support of the proximal humerus, the plate can be combined with the spiral blade 40° or the spiral blade 50°. These spiral blades provide additional support to the

plate-screw-construct in the medial bone tissue. In addition, the XL plate types of the system are indicated for the management of fracture patterns that extend to the humeral shaft.



Instrument Application

General Instrument Application

Drilling

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

System	Color Code
APTUS 3.5	green

There are two different types of twist drills for the system size 3.5:

The core hole drill with the diameter 3.0 mm (A-3931) is characterized by one coloured ring. The gliding hole drill with the diameter 3.6 mm (A-3933, for lag screw technique and for cortex opening) is characterized by two coloured rings.

The twist drill must always be guided through a drill guide. This prevents damage to the screw hole and protects the surrounding tissue from direct contact with the drill.

The end with one green marking of the double-ended drill guide (A-2920) can be used for all screw holes and for the insertion of isolated screws (e.g. fragment fixation with screws alone).

Alternatively, the self-holding drill sleeve (A-2921) can be locked with a clockwise turn in the TriLock holes of the plate (no more than $\pm 15^\circ$). It thus performs all of the functions of a drill guide without the need to be held.



A-3931
Core Hole Drill = one colored ring



A-3933
Gliding Hole Drill = two colored rings



A-2920
3.5 Drill Guide



A-2921
3.5 Drill Sleeve, Self-Holding



After positioning the plate, place the drill guide (A-2920, A-2921) together with the drill (A-3931) into the screw hole.

Caution

For TriLock plates ensure that the screw holes are pre-drilled with a pivoting angle of no more than $\pm 15^\circ$. A pre-drilled pivoting angle of $> 15^\circ$ no longer allows the TriLock screws to correctly lock in the plate.

The T-handle (A-2075) must always be used to lock 3.5 TriLock screws.



Assigning the Screw Length

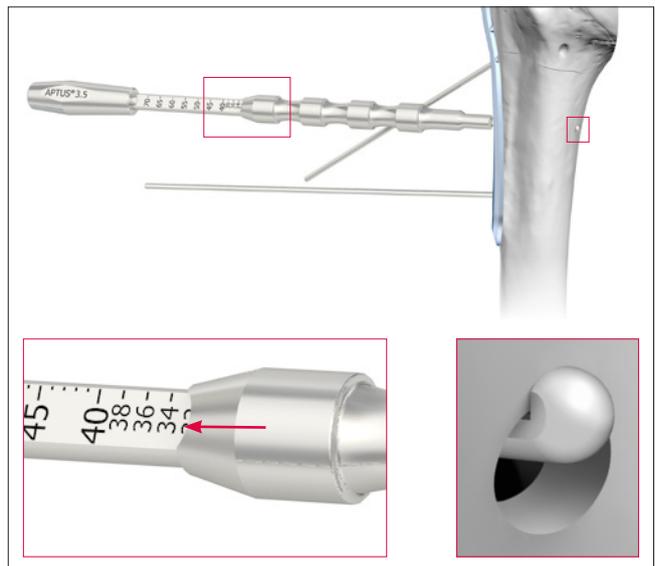
The depth gauge (A-2930) is used to assign the ideal screw length for use in monocortical or bicortical screw fixation.



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.

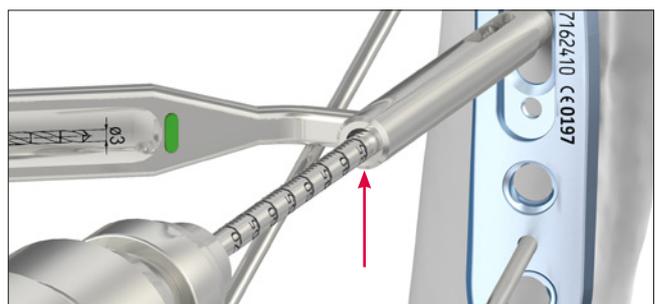


To assign the screw length, place the end of the slider onto the implant plate or directly onto the bone.

When using the lag screw technique, place the 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.

The required screw length may also be determined at the scale of the drill (A-3931). The length is read at the end of the drill guide (A-2920) or the self-holding drill sleeve (A-2921).



Screw Pick-Up

Both screwdriver blades (A-2911, A-2913.1) feature the patented HexaDrive self-holding system.



A-2911
3.5/4.0 Screwdriver Blade, Self-Holding, HD15, AO, Short



A-2913.1
3.5/4.0 Screwdriver Blade, Self-Holding, HD15, AO, Long



A-2913.2
3.5/4.0 Sleeve for Screwdriver Blade HD15 (for use with A-2913.1)



A-2074
Handle with Quick Connector, AO



A-2075
T-Handle with Quick Connector, AO

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

Notice

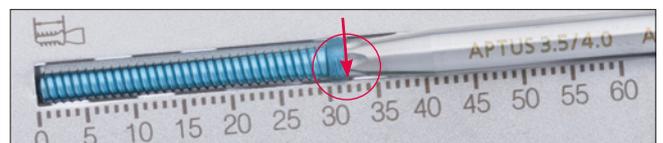
The screw will not hold without axial pressure!

Vertically extract the screw from the compartment.

Notice

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.

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.

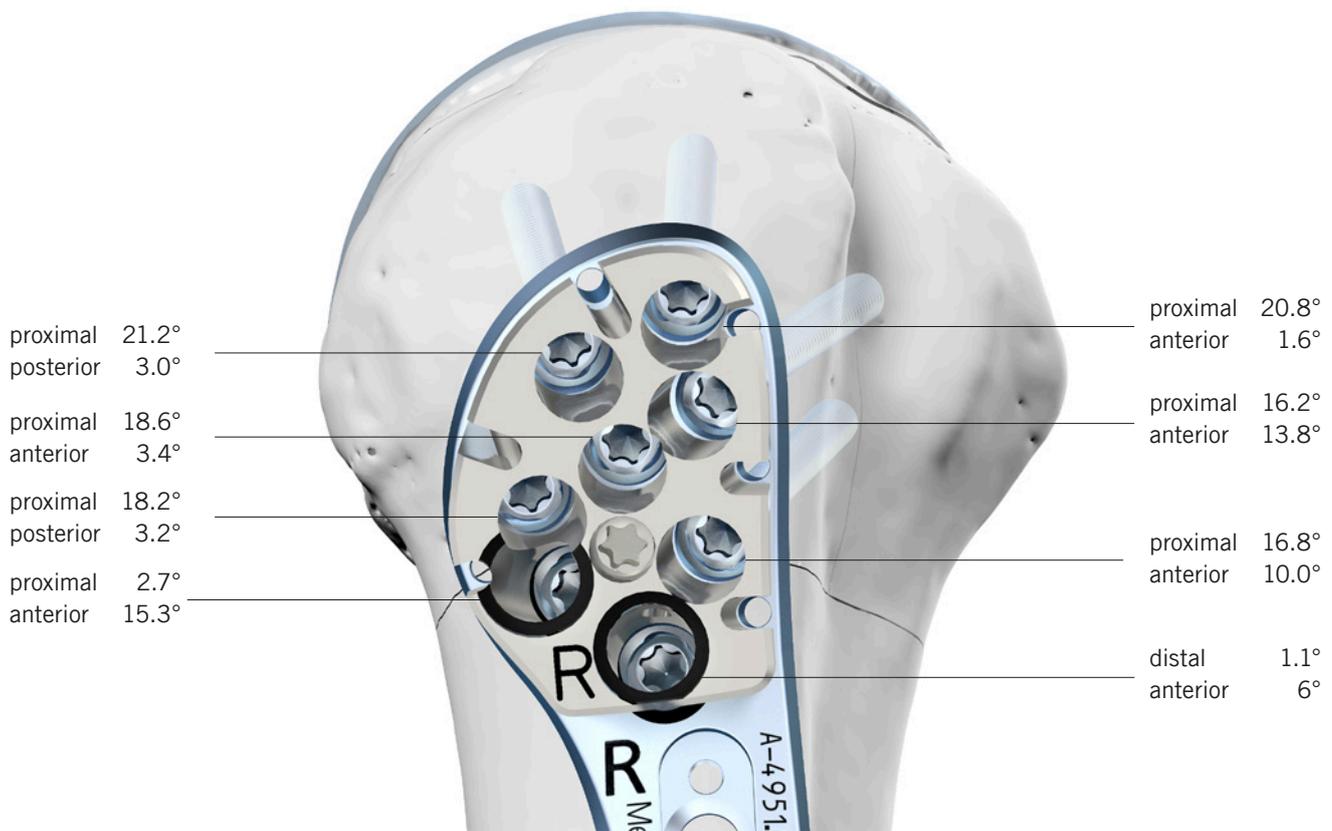


Specific Instrument Application

Drill Guide Blocks

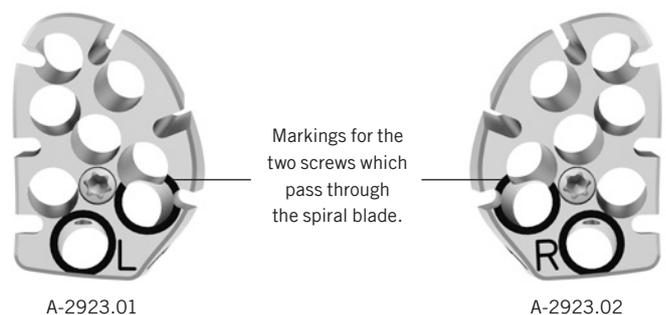
The drill guide blocks (A-2923.01 for left plates and A-2923.02 for right plates) serve to rapidly and accurately position the screws and act as a target guide for the screws which cross the spiral blade. There is no danger of drill

channels crossing during the drilling process. The corresponding axial angles* of the locking holes in the proximal area are shown in the illustration.



The drill guide blocks are adapted to the proximal plate area. They are marked with R and L for the right and the left side respectively.

The screw holes for the two screws passing through the spiral blade are both marked with a black ring on the drill guide block. If a spiral blade is used, the spiral blade must be placed before inserting the two screws.



* The axial angles relate to the oblong hole plane.

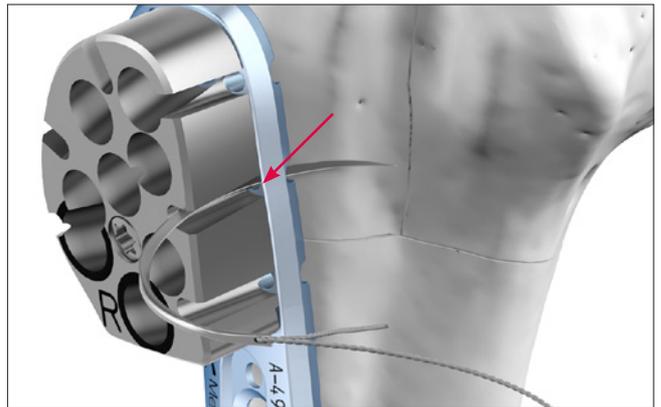
The drill guide (A-2920), the drill sleeve (A-2921) and the depth gauge (A-2930) can be used together with the drill guide block. You can drill, measure and insert the screws through the holes of the attached drill guide block.

Notice

For screw insertion through the drill guide block, the long screwdriver blade (A-2913.1) in combination with the sleeve (A-2913.2) must be used. This ensures that the screws are guided precisely and follow the pre-drilled core hole even in case of osteoporotic bone.



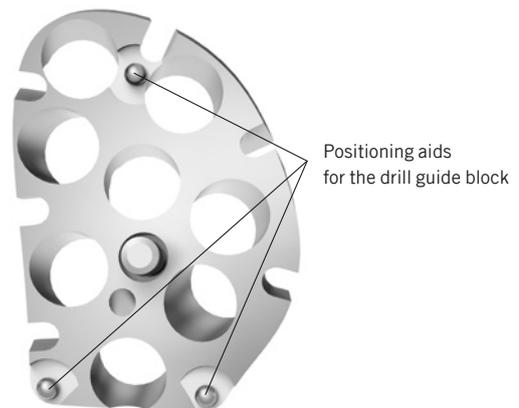
The recesses in the drill guide block allow for making use of the suture holes even when the drill guide block is fixed to the plate.



Fixing and detaching the drill guide block

Position the drill guide block in the proximal plate area so that the three positioning aids on its underside noticeably engage to the plate surface. Take care not to trap any soft tissue between the plate and the drill guide block. Use the screwdriver (A-2911, A-2913.1) to fully tighten the screw integrated in the drill guide block until there is no play between the plate and the drill guide block.

During the insertion of the spiral blade, the drill guide can remain attached to the plate. Once all screws in the proximal plate area have been fixated, the drill guide block can be detached.



Surgical Techniques

General Surgical Techniques

Lag Screw Technique

The drill guide for lag screws (A-2920) is used to perform the classic lag screw technique according to AO/ASIF.

1. Drilling the gliding hole

Use the twist drill (A-3933, two colored rings) to drill the gliding hole at a right angle to the fracture line. Use the end of the drill guide with two green markings and labeled with «LAG».



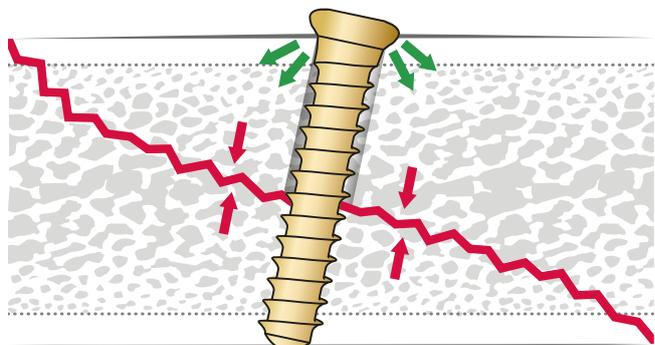
2. Drilling the core hole

Place the end of the drill guide (A-2920) with one colored marking onto the drilled gliding hole and use the twist drill for core holes (A-3931, one colored ring) to drill the core hole.



3. Compressing the fracture

Compress the fracture with the corresponding cortical screw.



Specific Surgical Techniques

Proximal Humeral Plate without Spiral Blade

1. Positioning the plate

After reduction of the fracture, the humeral plate (A-4951.01-10) can be fixed temporarily with 2.0 mm K-wires (A-5040.61, A-5042.61) in the desired position. The course of the sulcus intertubercularis may be used as orientation for positioning the anterior plate edge. The plate has an anatomical fit and comes to rest approx. 5–10 mm distally of the top of the greater tubercle.

Notice

Placing the plate too proximally increases the risk of a subacromial impingement. If the plate is placed too distally, the optimal screw positioning in the humeral head may be more difficult.



Insert a 3.5 mm cortical screw (A-5900.xx) into the center of the oblong hole. To this end, drill a core hole through the oblong hole using the drill guide (A-2920) and the twist drill \varnothing 3.0 mm (A-3931, one colored ring).

Assign the screw length with the depth gauge (A-2930).



Pick up a cortical screw of the determined length with the help of the screwdriver blade (A-2911, A-2913.1) as well as the handle (A-2074, A-2075) and insert it into the corresponding hole.

If the plate position needs adjustment: remove the K-wires, slightly loosen the cortical screw in the oblong hole, re-adjust the position of the plate and re-tighten the cortical screw.



2. Fixation of the plate

Fill the remaining screw holes preferably with TriLock screws (A-5950.xx) or with cortical screws (A-5900.xx) wherever indicated by the fracture pattern and remove the remaining K-wires. All screw holes with the exception of the oblong hole accept both cortical as well as TriLock screws.

Notice

The T-handle (A-2075) must always be used to lock 3.5 TriLock screws.



The choice of angular stable screws generally provides a higher stability of the construct, especially in case of a comminuted fracture or poor bone quality. The choice of non angular stable screws (cortical screws) permits to pull a fragment to the plate.

The multidirectionality of the locked ($\pm 15^\circ$) and unlocked screws allows to individually address each fragment.

Notice

When inserting the screws without using the drill guide block, care must be taken that the drilling channels do not cross. If the free choice of the angle of the TriLock screws in the proximal area is not necessary, the drill guide block (A-2923.01 left, A-2923.02 right) can be used. The drill guide block allows a fast and unidirectional insertion of the screws.



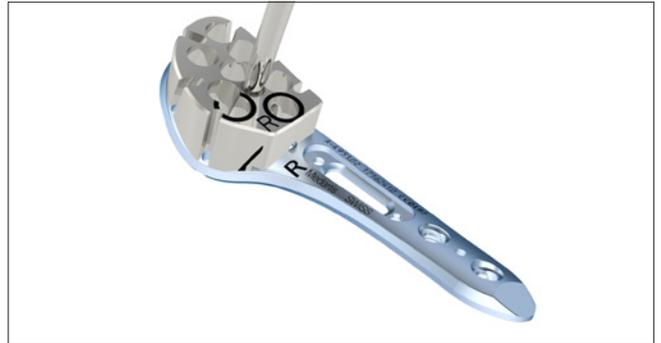
3. Attaching soft tissue

Soft tissue or bone fragments can be attached to the plate using sutures that pass through the suture holes provided in the plate.

Proximal Humeral Plate with Spiral Blade

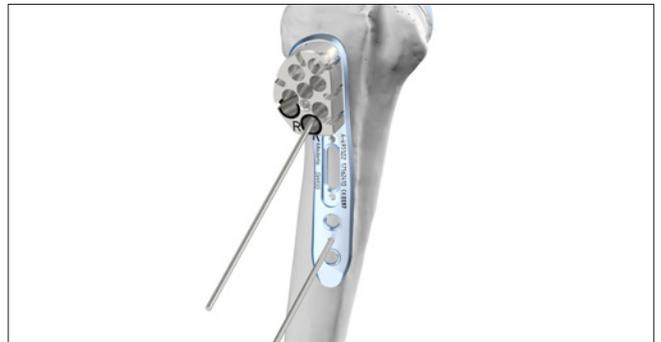
1. Fixing the drill guide block

Place the drill guide block (A-2923.01 left, A-2923.02 right) on the humeral plate (A-4951.01–10) and fix it to the plate using the screw integrated in the drill guide block.

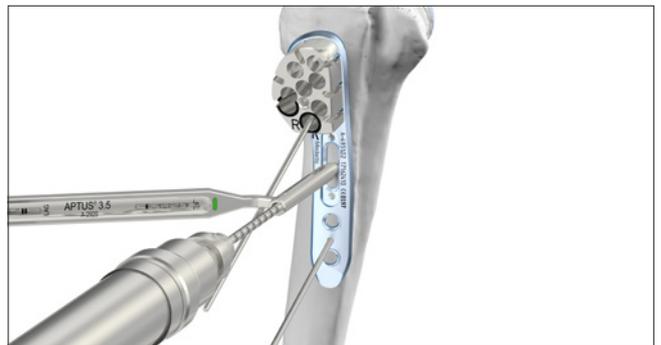


2. Positioning the plate

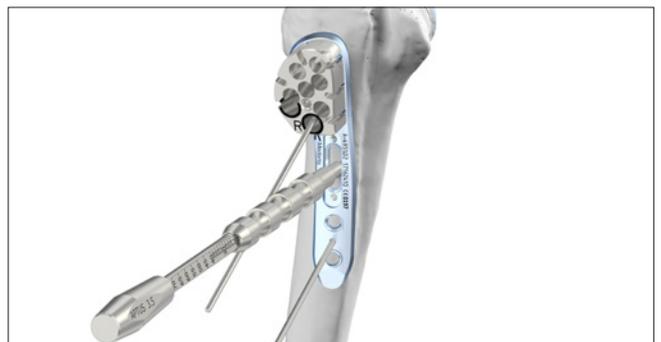
After reduction of the fracture, the plate can be fixed temporarily with 2.0 mm K-wires (A-5040.61, A-5042.61) in the desired position.



Insert a 3.5 mm cortical screw (A-5900.xx) in the center of the oblong hole. To this end, drill a core hole through the oblong hole using the drill guide (A-2920) and the twist drill \varnothing 3.0 mm (A-3931, one colored ring).

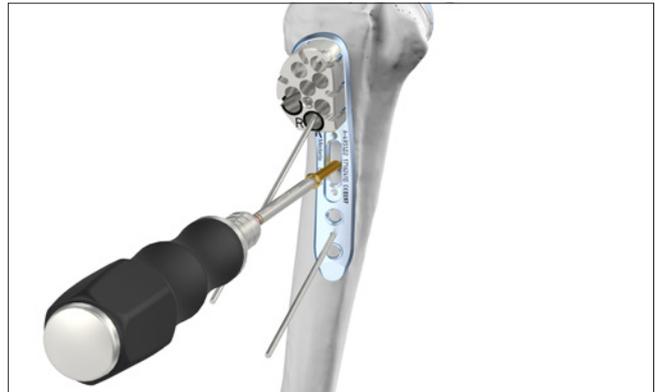


Assign the screw length with the depth gauge (A-2930).



Pick up a cortical screw of the determined length with the help of the screwdriver blade (A-2911, A-2913.1) and the handle (A-2074, A-2075) and insert it into the corresponding hole.

If the plate position needs adjustment: remove the K-wires, slightly loosen the cortical screw in the oblong hole, re-adjust the position of the plate and re-tighten the cortical screw.



3. Fixation of the plate

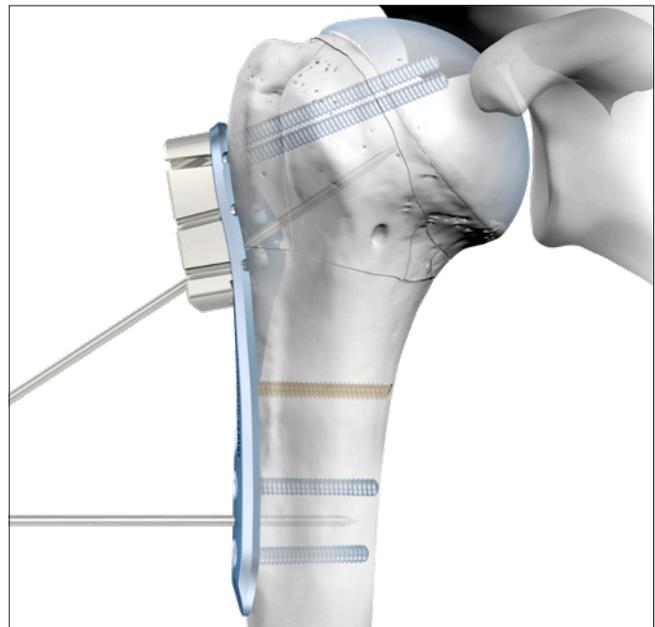
Fixate the plate with at least two TriLock screws (A-5950.xx) in the shaft as well as in the proximal area. All screw holes with the exception of the oblong hole accept both cortical and TriLock screws.

Notice

At the current stage, the screw holes with the black ring on the drill guide block must not yet be filled. The screws in these screw holes pass through the spiral blade and can only be inserted after the spiral blade has been placed.

Notice

The T-handle (A-2075) must always be used to lock 3.5 TriLock screws.



Notice

Always use the sleeve (A-2913.2) to insert the screws into the drill guide block.

The sleeve on the screwdriver blade (A-2913.1) ensures that the screws are guided precisely and follow the pre-drilled core hole even in case of osteoporotic bone.

Insert the sleeve with the smooth end pointing to the plate completely into the drill guide block. Use the long screwdriver blade to insert the screws up to the black marking through the sleeve. Remove the sleeve and lock the screw under visual control.

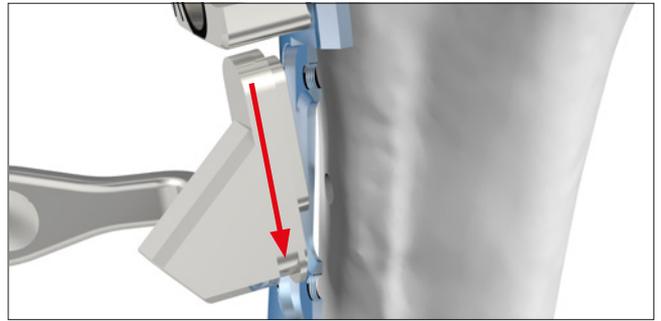


4. Determining the angle of the spiral blade

Remove the K-wires and the cortical screw in the oblong hole. Insert the K-wire guide (A-2000) either with the 40° or 50° side into the oblong hole by first hooking the nose on the K-wire guide under the distal part of the oblong hole and then inserting the entire K-wire guide into the oblong hole.

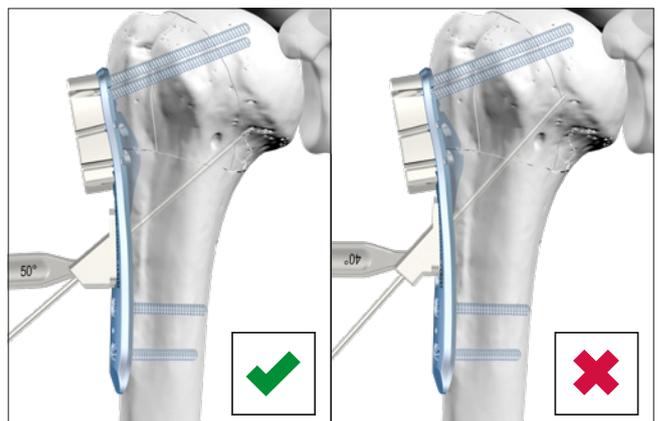
Notice

Any instrument that is placed into the oblong hole must completely snap in and rest flat in the oblong hole. Make sure that no soft tissue gets trapped under the instrument. Not completely inserting the instrument may result in a wrong guidance of the direction of the spiral blade.



Place a 2.0 mm K-wire through the K-wire guide (A-2000). This K-wire indicates the position where the spiral blade will be situated later. The tip of the K-wire should lie close to the inferomedial cortex of the humeral head. Check this position on an anteroposterior X-ray.

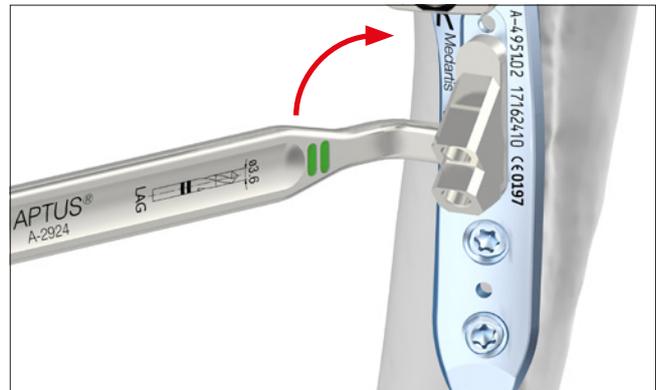
If the position is not optimal, remove the K-wire and repeat the step with the other end of the K-wire guide for the alternative spiral blade angle.



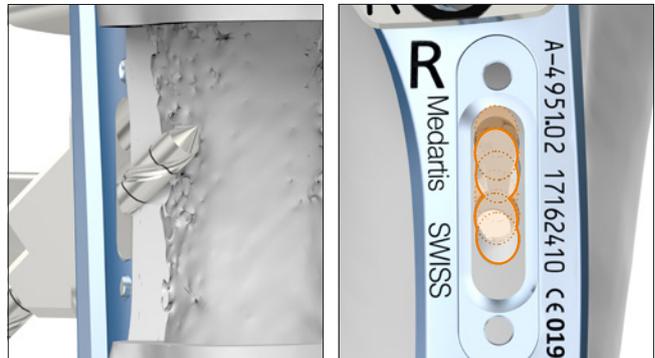
5. Opening of the cortex

The cortex in the oblong hole has to be opened in order to enable the insertion of the spiral blade.

Remove the K-wire and the K-wire guide from the oblong hole and insert the drill guide for cortex opening (A-2924) into the oblong hole.

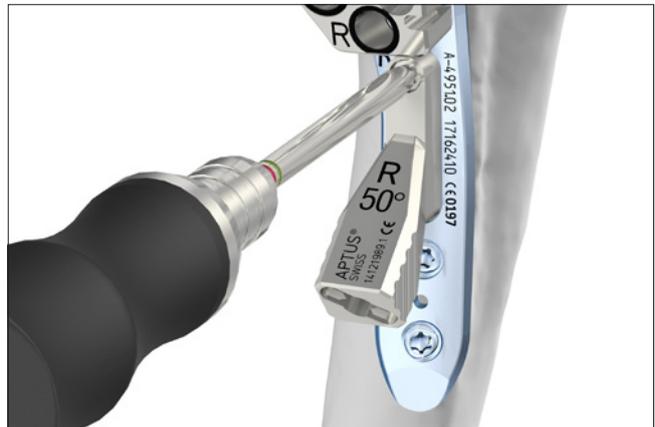


Drill two short holes through both holes of the drill guide using the twist drill (A-3933, two green rings). Only pass the first cortex. Repeat this procedure with the other end of the drill guide. Remove the drill guide for cortex opening. The four overlapping holes enable to cut a spiral channel into the bone in order to insert the spiral blade.



6. Cutting the spiral channel

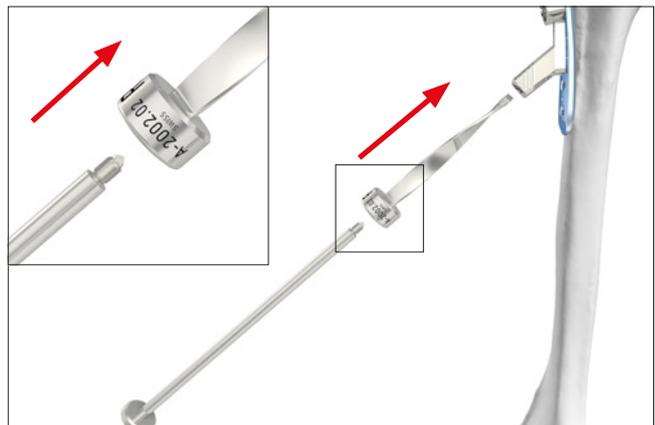
As the spiral blade has a blunt end, a spiral channel has to be cut into the bone beforehand, using the spiral cutter for blade (A-2002.01 for left plates, A-2002.02 for right plates). To this end, insert the guide for spiral cutter for the chosen blade angle (A-2001.01/03 for left plates or A-2001.02/04 for right plates) into the oblong hole. Tighten the integrated screw using the screwdriver blade (A-2911, A-2913.1) and the handle (A-2074, A-2075).



Place the spiral cutter for blade into the guide fixed to the plate and carefully tap it in up to the stop with the mallet (A-2004).

Notice

To facilitate the handling, you may screw the handle for spiral blade (A-2003) on the spiral cutter.



Remove the spiral cutter using the handle for spiral blade (A-2003) and the slotted mallet (A-2004). Remove the guide for spiral cutter.

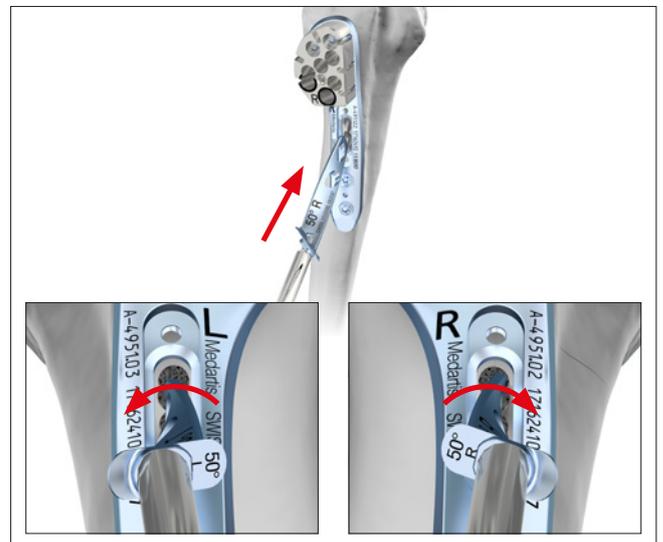


7. Inserting the spiral blade

Pick up the adequate spiral blade (A-4951.21/23 for left plates or A-4951.22/24 for right plates) from the container using the handle (A-2003).



The spiral blade can be inserted manually with applying slight pressure into the pre-cut channel. During the insertion, the spiral blade rotates clockwise for right plates and counter-clockwise for left plates. If necessary, carefully tap it in with the mallet (A-2004).



Notice

The spiral blade must be flush with the oblong hole.



Remove the handle.

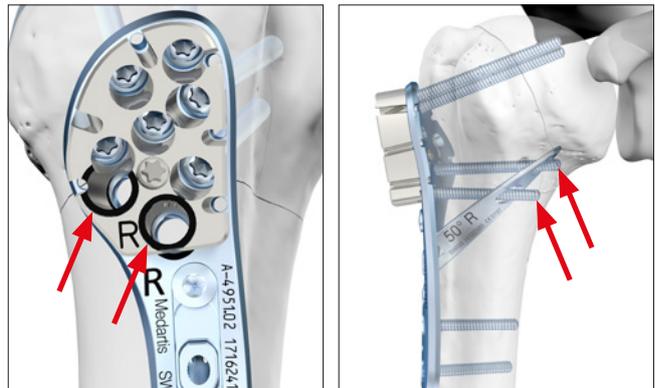
Fixate the spiral blade with two screws for spiral blade (A-4951.30) to the plate. Start with the distal screw.

Notice

The two screws for fixation of the spiral blade can only be inserted if the spiral blade is flush with the oblong hole.



The plate-spiral blade-construct is additionally stabilized with two TriLock screws that pass through the two recesses in the spiral blade. The corresponding screw holes are indicated with two rings on the drill guide block and on the plate.



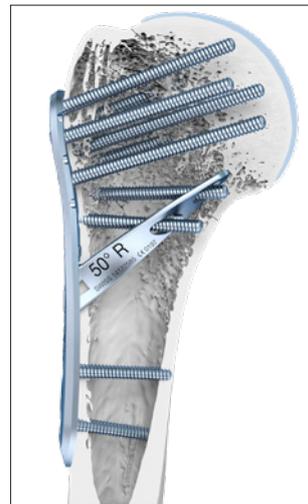
Drill two core holes using the twist drill (A-3931, one green ring) together with the drill guide (A-2920) or the drill sleeve (A-2921). Insert a TriLock screw in each of them using the screwdriver blade (A-2913.1) and the sleeve (A-2913.2).

Notice

The two screws that pass through the spiral blade always need to be placed with the drill guide block.

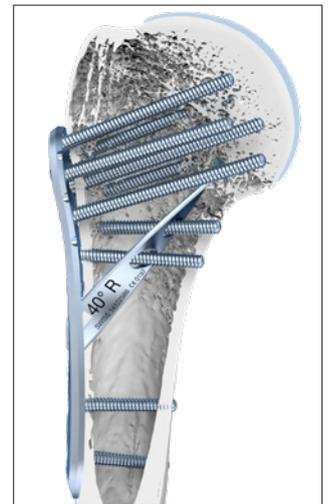


For these two screws and dependent on the chosen angle of the spiral blade, use the minimal screw lengths as indicated.



with spiral blade 50°

Proximal screw: at least 36 mm
(A-5950.36/1)
Distal screw: at least 26 mm
(A-5950.26/1)



with spiral blade 40°

Proximal screw: at least 28 mm
(A-5950.28/1)
Distal screw: at least 22 mm
(A-5950.22/1)

8. Filling the remaining screw holes

Fill the remaining screw holes preferably with TriLock screws (A-5950.xx) or cortical screws (A-5900.xx) as indicated by the fracture. All screw holes accept cortical screws as well as TriLock screws. The remaining screws may be inserted without drill guide block if multidirectionality is desired in the proximal plate area.

Notice

When using the spiral blade 40° without the drill guide block, ensure that the screws highlighted in color in the image are inserted divergently. Otherwise there is a danger of a collision with the spiral blade in the marked area.



9. Attaching soft tissue

Soft tissue or bone fragments can be attached to the plate by passing sutures through the suture holes provided in the plate.

Remove the drill guide block.



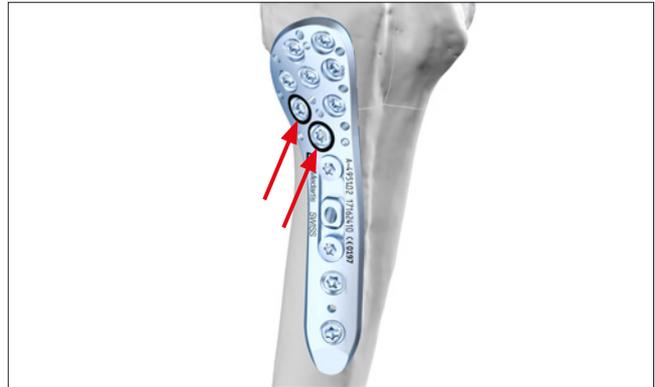
Explantation

1. Removing the screws passing through the spiral blade

If a spiral blade was used, it is important to first remove the two screws passing through the recesses in the spiral blade. Use the screwdriver blade (A-2911, A-2913.1) together with the handle (A-2074, A-2075). The two screws are both marked with a ring around the screw hole.

Notice

When removing the screws, make sure that the screwdriver/screw head connection is aligned in axial direction.



2. Removing the screws fixating the spiral blade

Afterwards remove the two screws (A-4951.30) which fixate the spiral blade to the plate.

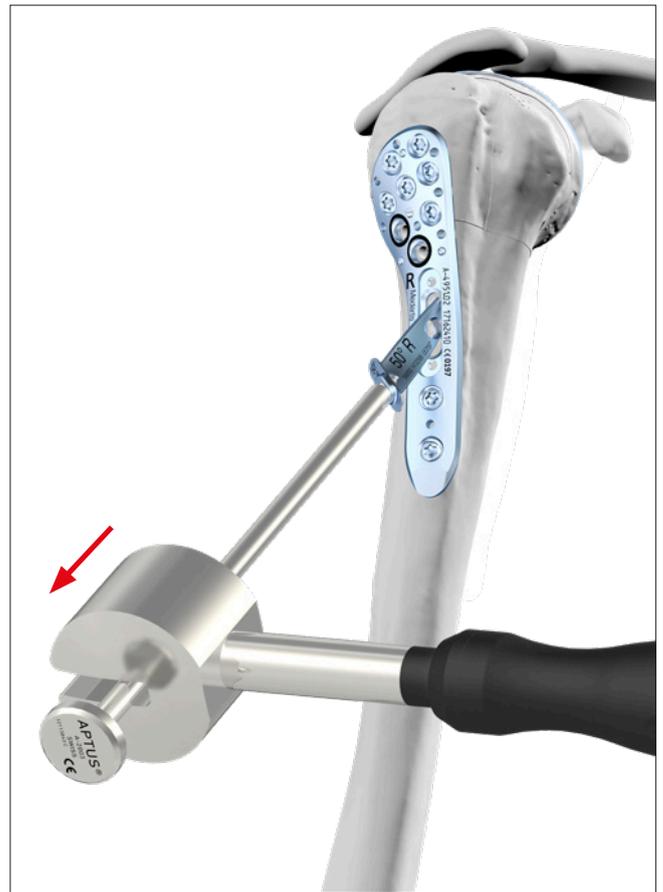


3. Removing the spiral blade

Insert the handle for spiral blade (A-2003) into the spiral blade.



Extract the spiral blade. If necessary, carefully tap with the slotted mallet (A-2004) away from the bone against the metallic disc on the rear part of the handle (A-2003).



4. Removing the remaining screws

Unlock all remaining screws. Now remove the unlocked screws in random order. In case the plate sticks to the bone, use a periosteal elevator to carefully lift and detach it from the bone.

TriLock[®] Locking Technology

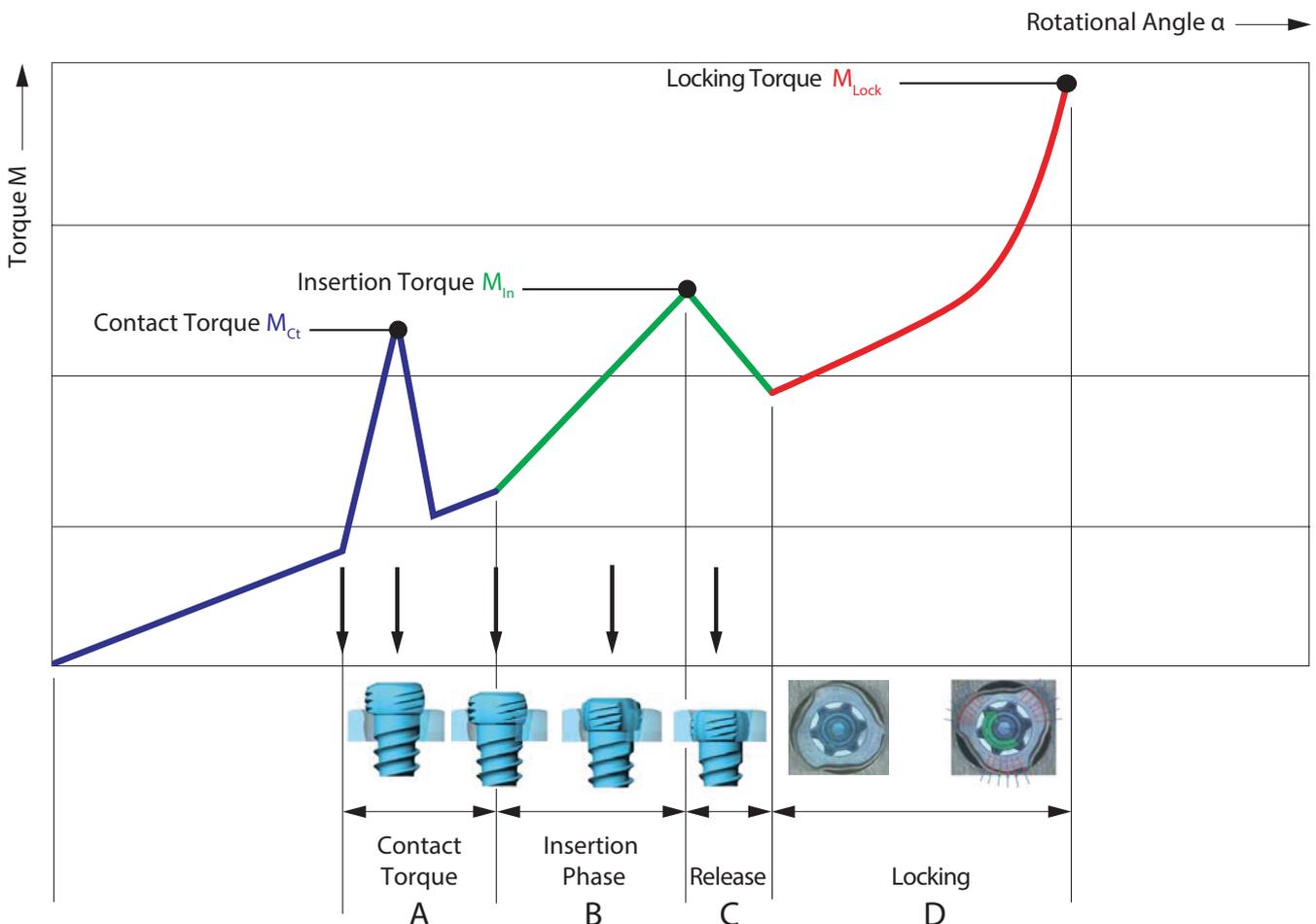
Correct Application of the TriLock Locking Technology

The screw is inserted through the plate hole into the predrilled bone. A «contact torque» will be felt once the screw head makes contact with the plate surface; for the TriLock 3.5 Proximal Humerus System this torque increase is easily perceived (section «A» in the diagram).

The torque then decreases before it starts increasing again during the «Insertion Phase», as the screw head enters the locking hole (section «B» in the diagram).

Once the screw head has entered the locking hole, a second decrease of torque occurs (section «C» in the diagram). Finally, the actual locking is initiated (section «D» in the diagram) as a friction connection is established between screw and plate when tightening firmly. The torque applied in section «D» is decisive for the quality of the locking.

In summary, two intermediate torque maxima have to be overcome before the final locking of the screw.



Correct Locking ($\pm 15^\circ$) of the TriLock Screws in the APTUS Proximal Humerus System 3.5

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 locking contour (figures 1 + 3).

However, if there is still a noticeable protrusion (figures 2 + 4), the screw head has not completely entered the locking contour of the plate. 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.

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

Correct: LOCKED

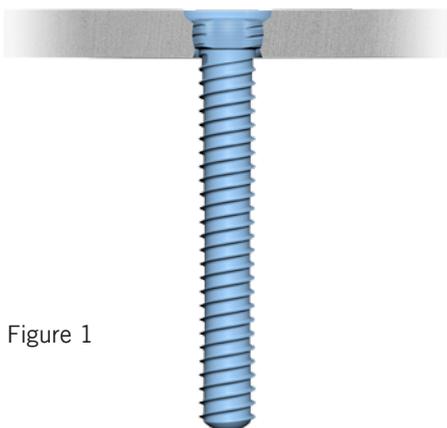


Figure 1

Incorrect: UNLOCKED

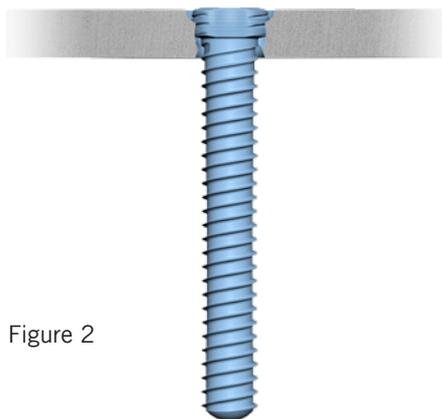


Figure 2

Correct: LOCKED

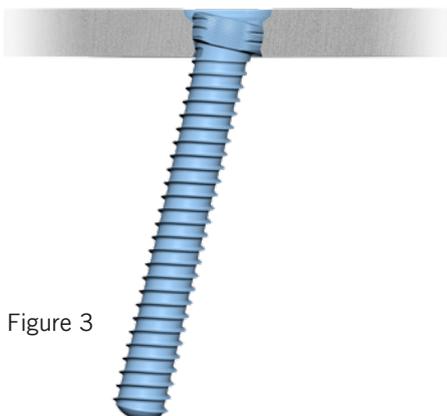


Figure 3

Incorrect: UNLOCKED

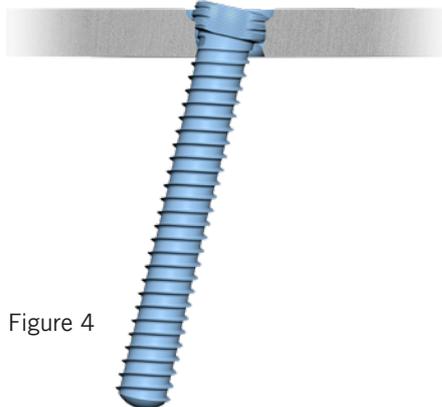


Figure 4

Appendix

Implants and Instruments

For detailed ordering information, please refer to the APTUS Ordering Catalog, also available at www.medartis.com.

Implants

Référence
A-4951.01
A-4951.01S
A-4951.02
A-4951.02S
A-4951.03
A-4951.03S
A-4951.04
A-4951.04S
A-4951.05
A-4951.05S
A-4951.06
A-4951.06S
A-4951.07
A-4951.07S
A-4951.08
A-4951.08S
A-4951.09
A-4951.09S
A-4951.10
A-4951.10S
A-4951.21
A-4951.21S
A-4951.22
A-4951.22S
A-4951.23
A-4951.23S
A-4951.24
A-4951.24S
A-4951.30
A-4951.30/2S

Screws and K-Wires

Art. No.	Art. No.
A-5040.61	A-5950.18/1
A-5040.61/2S	A-5950.18/1S
A-5042.61	A-5950.20/1
A-5042.61/2S	A-5950.20/1S
A-5900.16/1	A-5950.22/1
A-5900.16/1S	A-5950.22/1S
A-5900.18/1	A-5950.24/1
A-5900.18/1S	A-5950.24/1S
A-5900.20/1	A-5950.26/1
A-5900.20/1S	A-5950.26/1S
A-5900.22/1	A-5950.28/1
A-5900.22/1S	A-5950.28/1S
A-5900.24/1	A-5950.30/1
A-5900.24/1S	A-5950.30/1S
A-5900.26/1	A-5950.32/1
A-5900.26/1S	A-5950.32/1S
A-5900.28/1	A-5950.34/1
A-5900.28/1S	A-5950.34/1S
A-5900.30/1	A-5950.36/1
A-5900.30/1S	A-5950.36/1S
A-5900.32/1	A-5950.38/1
A-5900.32/1S	A-5950.38/1S
A-5900.34/1	A-5950.40/1
A-5900.34/1S	A-5950.40/1S
A-5900.36/1	A-5950.42/1
A-5900.36/1S	A-5950.42/1S
A-5900.38/1	A-5950.44/1
A-5900.38/1S	A-5950.44/1S
A-5900.40/1	A-5950.45/1
A-5900.40/1S	A-5950.45/1S
A-5900.45/1	A-5950.46/1
A-5900.45/1S	A-5950.46/1S
A-5900.50/1	A-5950.48/1
A-5900.50/1S	A-5950.48/1S
A-5900.55/1	A-5950.50/1
A-5900.55/1S	A-5950.50/1S
A-5900.60/1	A-5950.55/1
A-5900.60/1S	A-5950.55/1S
A-5950.16/1	A-5950.60/1
A-5950.16/1S	A-5950.60/1S

RCI

Art. No.
A-3931
A-3931S
A-3933
A-3933S

Instruments

Art. No.
A-2000
A-2001.01
A-2001.02
A-2001.03
A-2001.04
A-2001.05
A-2002.01
A-2002.02
A-2003
A-2004
A-2060
A-2074
A-2075
A-2911
A-2913.1
A-2913.2
A-2920
A-2921
A-2923.01
A-2923.02
A-2923.03
A-2924
A-2930

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