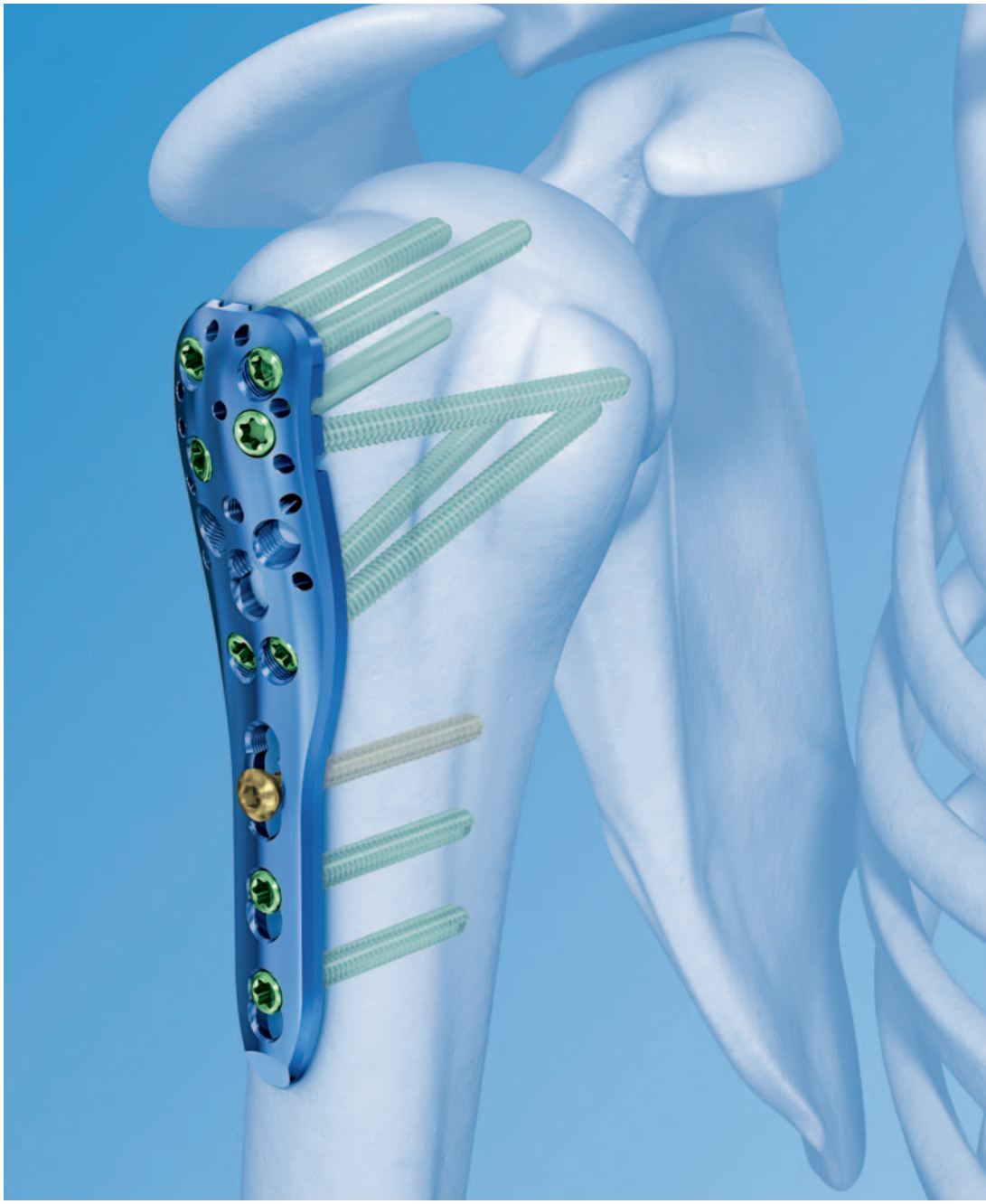
# **PHILOS and PHILOS Long.** The anatomic fixation system for the proximal humerus.

Technique Guide



SYNTHES®

Instruments and implants
approved by the AO Foundation

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Image intensifier control

**Warning**
This description alone does not provide sufficient background for direct use of the product. Instruction by a surgeon experienced in handling this product is highly recommended.

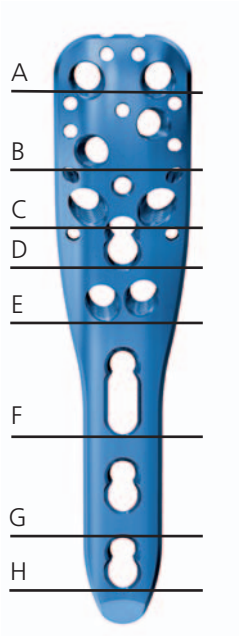
**Reprocessing, Care and Maintenance of Synthes Instruments**
For general guidelines, function control and dismantling of multi-part instruments, please refer to: www.synthes.com/reprocessing

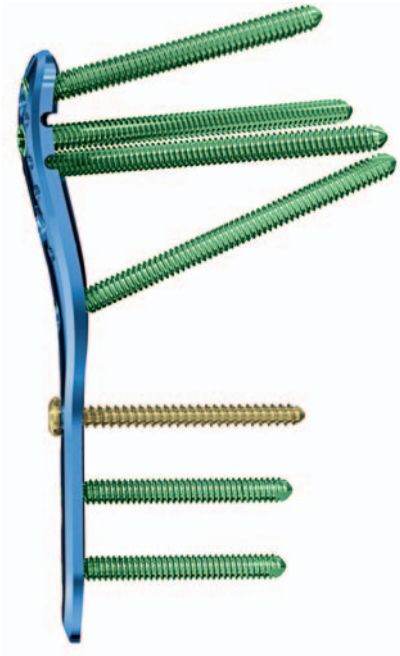
**PHILOS and PHILOS Long.** The anatomic fixation system for the proximal humerus.

## PHILOS Proximal Humeral Internal Locking System

**PHILOS**
- 9 proximal screw holes in section A–E for LCP locking screws ∅ 3.5 mm enable an angular stable construct to enhance the grip in osteoporotic bone and multi-fragment fractures
- Optimal screw placement
- 10 proximal holes for suturing to help maintain fracture reduction

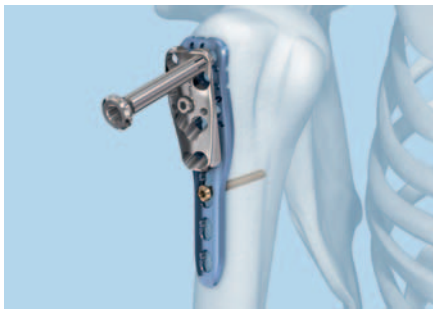
**PHILOS Long**
- Shaft reinforced to 3.7 mm
- Distal LCP long holes for maximum adaptability
- Plate length up to 290 mm



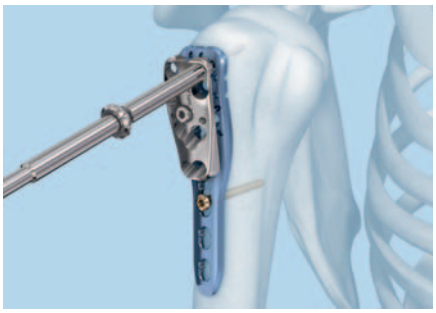



## Quick steps for insertion in osteoporotic bone

**1.** Reduce fracture
**2.** Insert plate with aiming device
**3.** Position the plate (either visual or with positioning Kirschner wire)

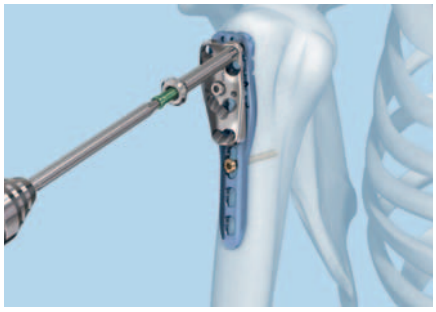


**4.** Assemble outer sleeve

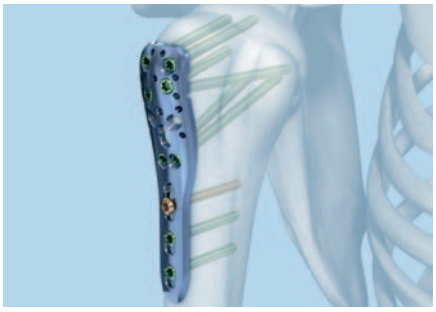


**5.** Pre-drill lateral cortex

**6.** Measure screw length



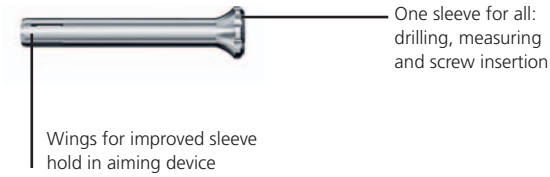
**7.** Insert screw through outer sleeve



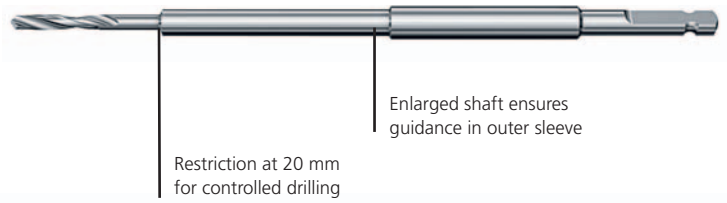
**8.** Insert shaft screws

## PHILOS instruments

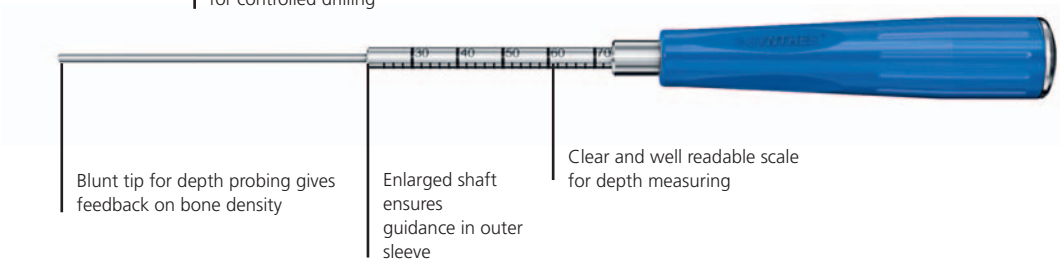
**Outer sleeve**




**Restricted drill bit**

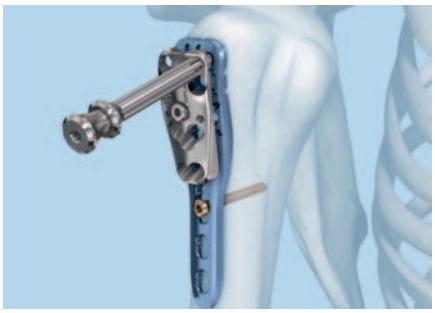



**Length probe**

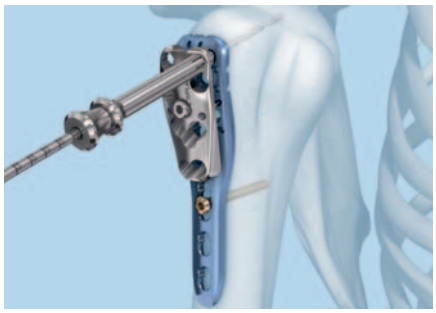



## Quick steps for insertion in good bone stock

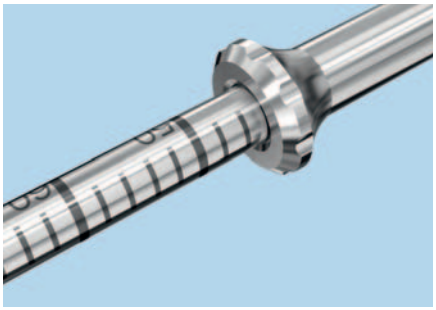
1. Reduce fracture
2. Insert plate with aiming device
3. Position the plate (either visual or with positioning Kirschner wire)



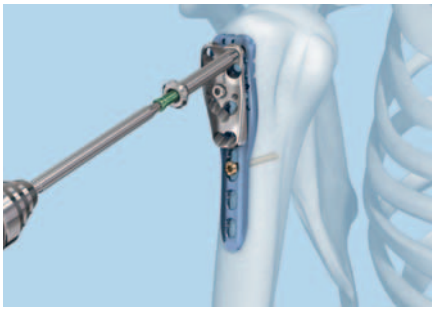
**4.** Assemble outer sleeve and drill sleeve



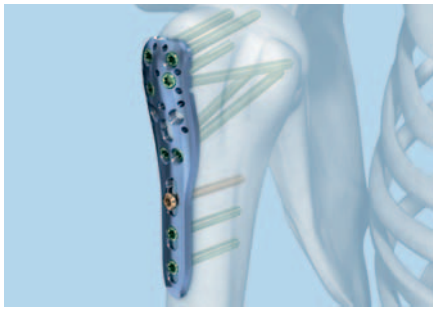
**5.** Pre-drill the screw hole



**6.** Read off the required screw length



**7.** Remove drill sleeve and insert screw through outer sleeve



**8.** Insert shaft screws

# AO Principles

In 1958, the AO formulated four basic principles, which have become the guidelines for internal fixation.[1, 2] Those principles as applied to PHILOS are:

**Anatomic reduction**
Fracture reduction and fixation to restore anatomical relationships.

**Stable fixation**
Stability by fixation or splintage, as the personality of the fracture and the injury requires. The products optimize purchase for maximum compression and stability.

**Preservation of blood supply**
Preservation of the blood supply to soft tissue and bone by careful handling, atraumatic surgery. Use of surgical technique that minimizes disruption of soft tissue and preserves vascular blood flow for bone healing. A limited-contact plate design reduces plate-to-bone contact and helps to preserve the periosteal blood supply.

**Early, active mobilization**
Early and safe mobilization of the part and patient. The implants, combined with AO technique, provide stable fracture fixation with minimal trauma to vascular supply. Plate features combined with AO technique create an environment for bone healing, expediting return to function.

[1] Müller ME, Allgöwer M, Schneider R, Willenegger H (1995) Manual of Internal Fixation. 3rd, expanded and completely revised ed. 1991. Berlin, Heidelberg, New York: Springer

[2] Rüedi TP, Buckley RE, Moran CG (2007) AO Principles of Fracture Management. 2nd expanded ed. 2002. Stuttgart, New York: Thieme

# Indications

**PHILOS**
- Dislocated two-, three-, and four-fragment fractures of the proximal humerus, including fractures involving osteopenic bone
- Pseudarthroses in the proximal humerus
- Osteotomies in the proximal humerus

**PHILOS Long**
- As for PHILOS, but for fractures extending into the shaft or fractures without medial support

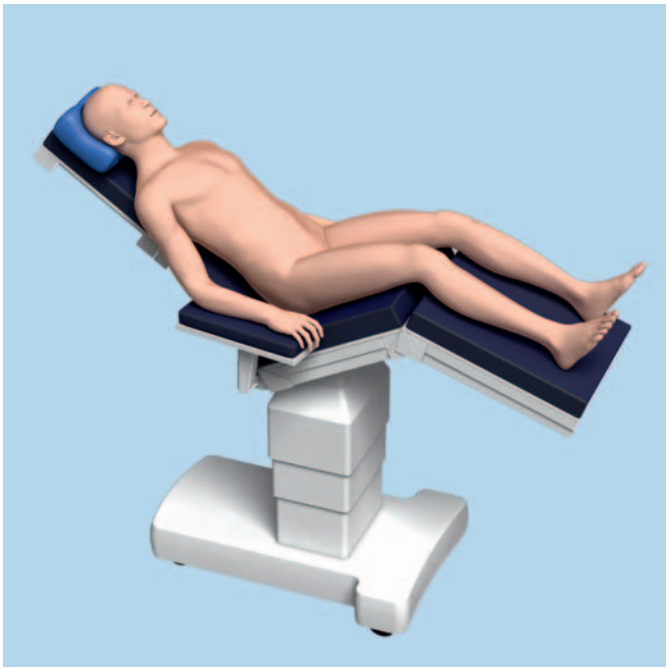
## 1

**Position the patient**

Place the patient in the beach chair position or supine position on a radiolucent table.

Ensure the fluoroscope is positioned in a way that allows visualization of the proximal humerus in two axes (AP and lateral/axial).

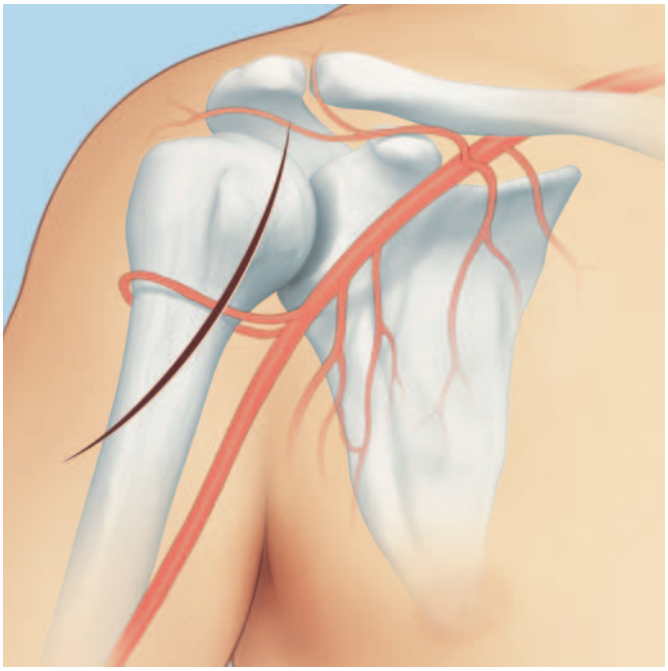
Prepare the patient's arm so that it can be mobilized intraoperatively.

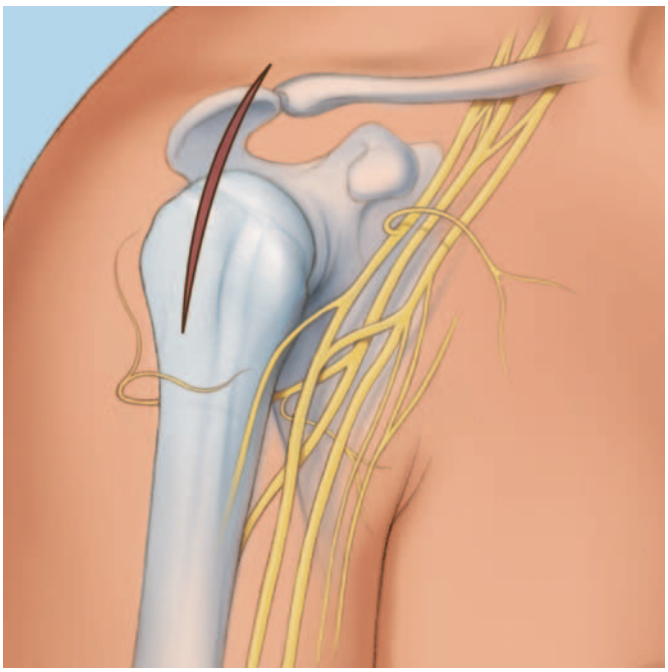


## 2
### Approach

A deltopectoral or transdeltoid approach is recommended.

If the transdeltoid approach is performed, the use of the LCP Percutaneous Aiming System 3.5 for PHILOS is recommended.





## 1

### Reduce fracture and fix temporarily

Proper reduction of the fracture is crucial for good bone healing and function. In some cases closed reduction before prepping the patient is beneficial.

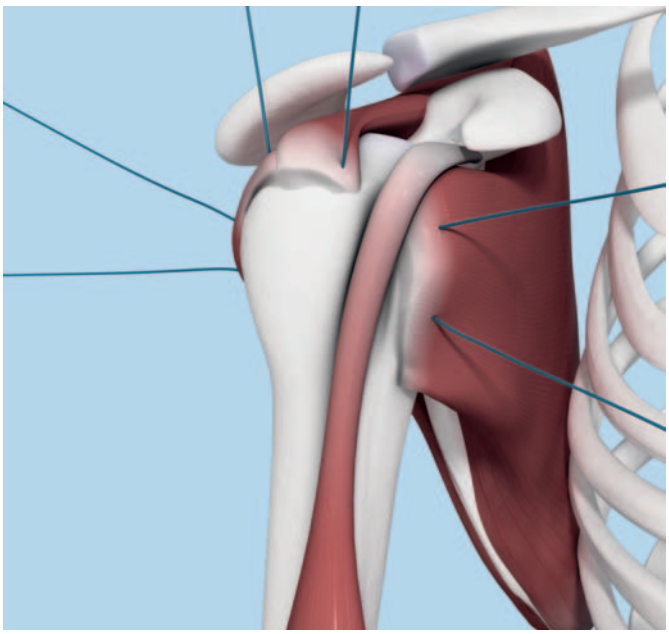
Reduce the head fragments and check the reduction under image intensifier control.

Kirschner wires can be used for reduction as joysticks in the fragments as well as for temporary fixation. Ensure that Kirschner wires do not interfere with correct plate placement.

**Note:** The locking screws are not suitable for reduction since they cannot exert compression. The head fragments must be reduced before insertion of locking screws.

**Suturing**
Provisionally reduce the tubercles using sutures through the insertions of the musculi subscapularis, infra- and supraspinatus. The sutures will help to maintain the stability of the reconstruction when fixing them to the plate later.

Insertion of sutures is especially recommended in weak bone where only short screws can be used due to the risk of penetration through settling.

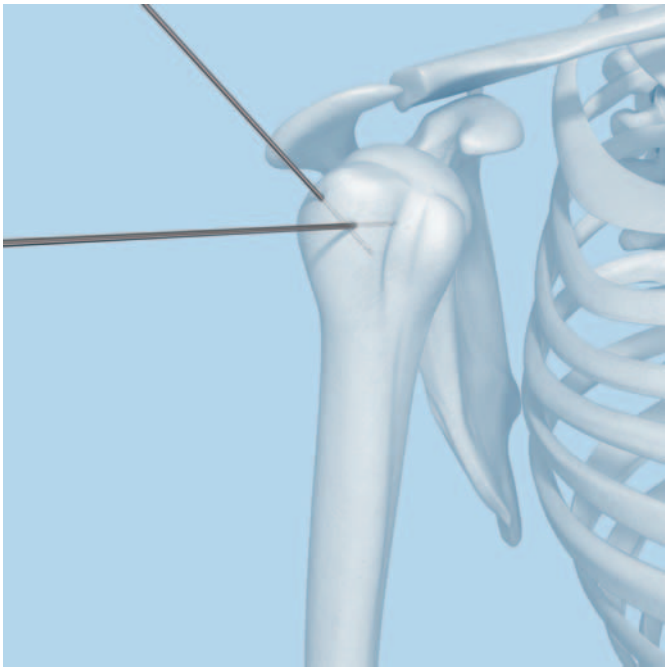


## 2

### Prepare plate position

For optimal plate positioning, insert two positioning Kirschner wires 2 – 4 mm lateral to the bicipital groove and 5 – 7 mm below the tip of the greater tubercule.

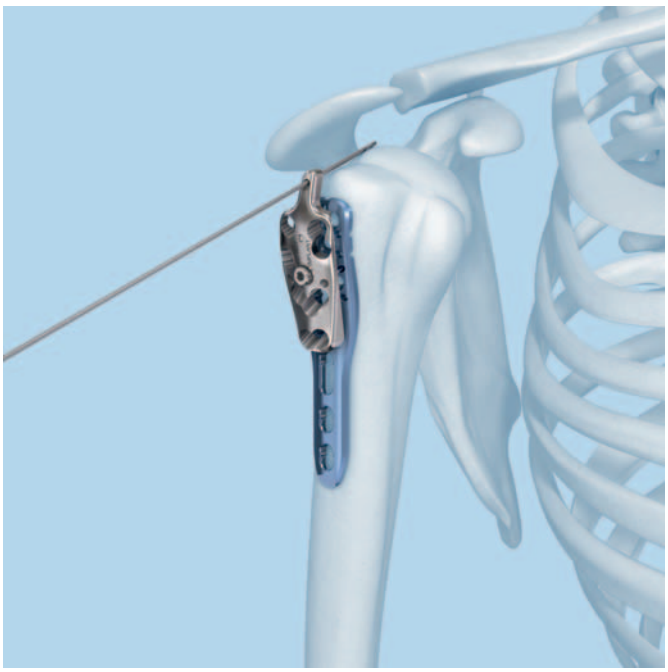
**Note:** Placing the plate too high increases the risk of subacromial impingement. Placing the plate too low can prevent the optimal distribution of screws in the humeral head and make it impossible to insert screws in section "E" (see page 2).



### Alternative technique

| Instruments | |
|---|---|
| 03.122.056 | PHILOS Aiming Device, with Nose |
| 03.122.066 | PHILOS Aiming Device Stardrive, with Nose |

Determine the position of the plate using the PHILOS aiming device with nose (see step 3 for attachment of the aiming device). Insert a Kirschner wire into the proximal guide hole below the rotator cuff so that the Kirschner wire aims at the proximal joint surface.



## 3
**Attach aiming device to plate**

| Instruments | |
|---|---|
| 03.122.057 | PHILOS Aiming Device, without Nose |
| 03.122.067 | PHILOS Aiming Device Stardrive, without Nose |
| 03.122.056 | PHILOS Aiming Device, with Nose |
| 03.122.066 | PHILOS Aiming Device Stardrive, with Nose |
| 311.431 | Handle with Quick Coupling |
| 314.030<br>or<br>314.116 | Screwdriver Shaft hexagonal<br><br>Screwdriver Shaft Stardrive T15 |

Insert the stabilization pin of the aiming device in the specially provided hole on the PHILOS plate. Use the screwdriver to tighten the securing screw of the aiming device.

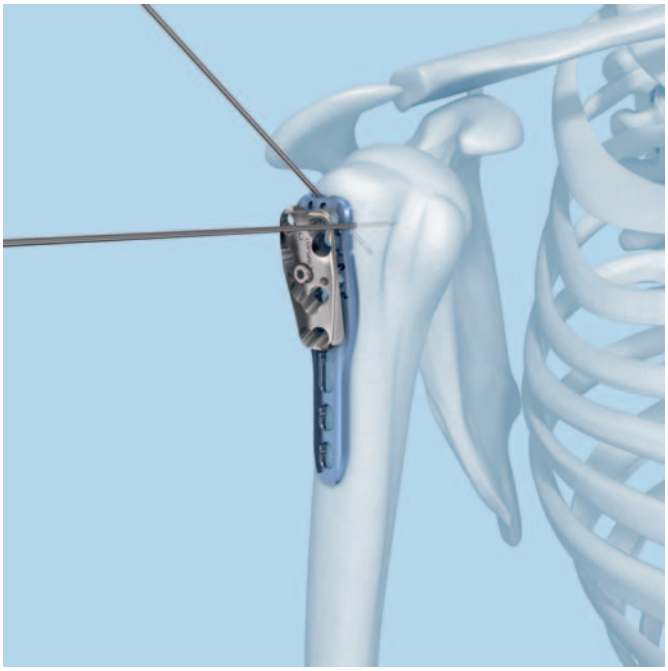
## 4

### Insert plate and fix temporarily

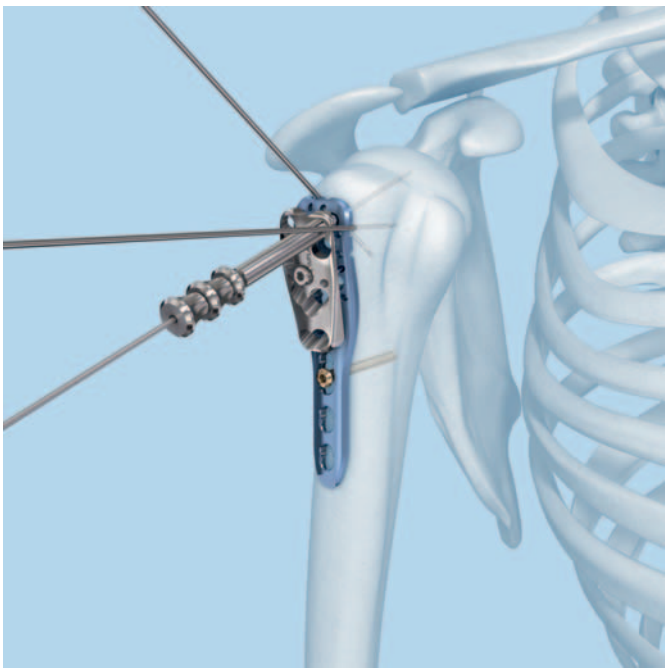
| Instruments | |
|---|---|
| 03.122.053 | Outer Sleeve 6.0/5.0 for PHILOS Aiming Device |
| 03.122.054 | Drill Sleeve 5.0/2.9, for No. 03.122.053 |
| 03.122.055 | Centering Sleeve for Kirschner Wire ∅ 1.6 mm, for No. 03.122.054 |

Insert the plate and position it on the reduced bone between the Kirschner wires, which were set in step 2.

Attach the plate temporarily with a cortex screw in the elongated combi-hole in the plate shaft (see step 7 for shaft screw insertion).



If required, use Kirschner wires through the triple sleeve system for temporary fixation of the humeral head.

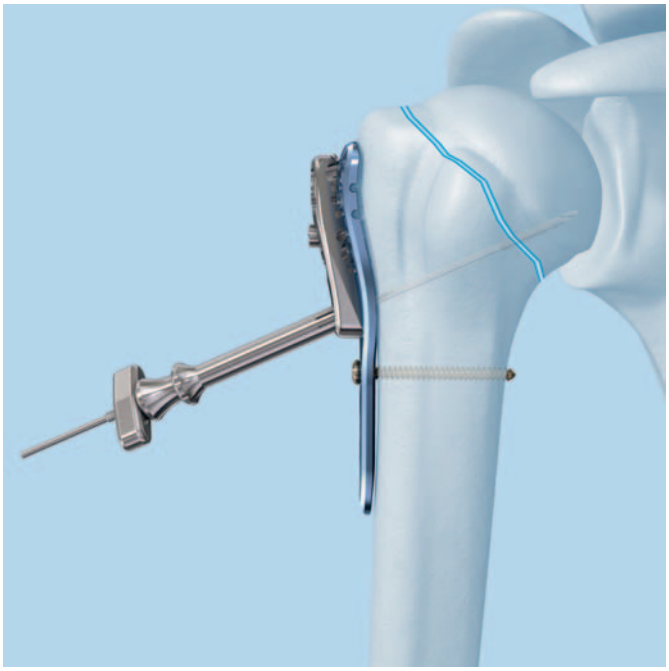


**Option: Temporarily reduce with pull reduction device**

| **Instruments** | |
|---|---|
| 03.122.059 | Pull Reduction Device for use with No. 03.122.060 for Drill Sleeves |
| 03.122.060 | Wing Nut for Pull Reduction for use with No. 03.122.059 for Drill Sleeves |

In good bone stock, the pull reduction device can optionally be used for temporary reduction. Using a power tool, insert the pull reduction device through the drill sleeve to the desired depth. Slide the wing nut over the wire and tighten. In this way, bone fragments are pulled towards the plate.

**Warning:** Do not penetrate the joint surface with the pull reduction device.



## 5

**Predrill the lateral cortex and determine proximal screw length**

Proximal humerus fractures are common in osteoporotic bone. The following technique describes screw measuring optimized for weak bone quality.

If good bone stock is present, change to options A or B for pre-drilling the screw hole and depth measuring.

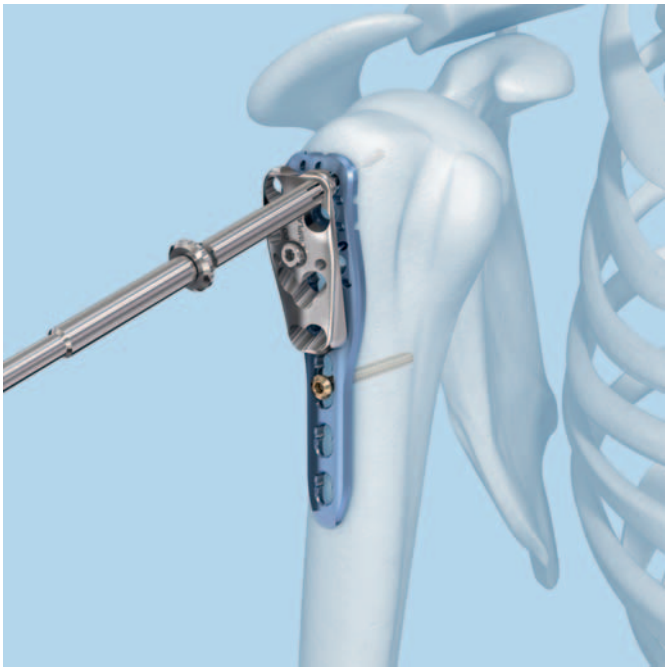
| **Instruments** | |
|---|---|
| 03.122.053 | Outer Sleeve 6.0/5.0 for PHILOS Aiming Device |
| 03.122.051 | Drill Bit ∅ 2.8 mm, with Stop, for Quick Coupling |
| 03.122.052 | Length Probe for Nos. 03.122.053 and 03.122.058 |

Insert the outer sleeve in the desired hole of the aiming device. Predrill the lateral cortex using the drill bit with stop through the outer sleeve.

Repeat this step for all required proximal screw holes.

| **Optional instrument** | |
|---|---|
| 03.122.058 | Drill Sleeve 6.0/2.9 with thread |

Use the drill sleeve with thread independently from the aiming device.



Use the length probe through the outer sleeve and push it carefully into the humeral head. Stop pushing when increased bone density is felt. Read off the required screw length from the length probe.

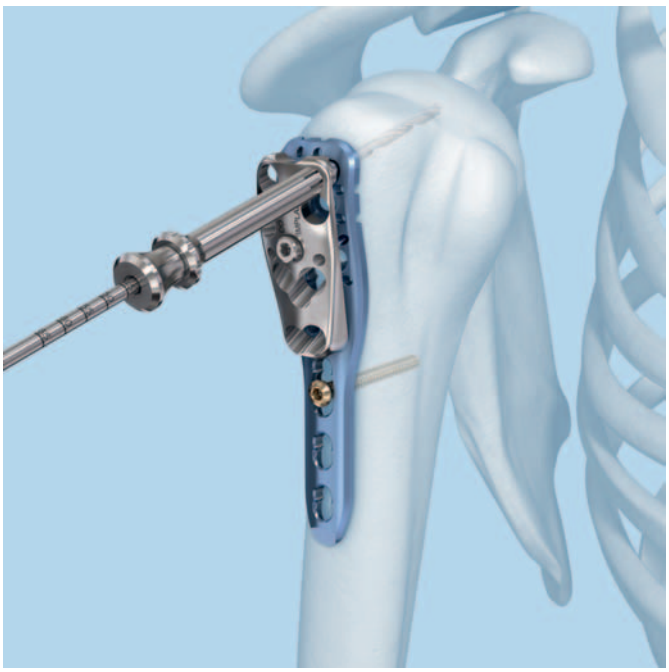
**Warning:** Do not push the length probe through the joint surface.

**Note:** The tip of the length probe should be located approximately 5 – 8 mm below the joint surface.

**Alternative techniques for good bone stock**

If the bone stock is good, choose one of the following options:

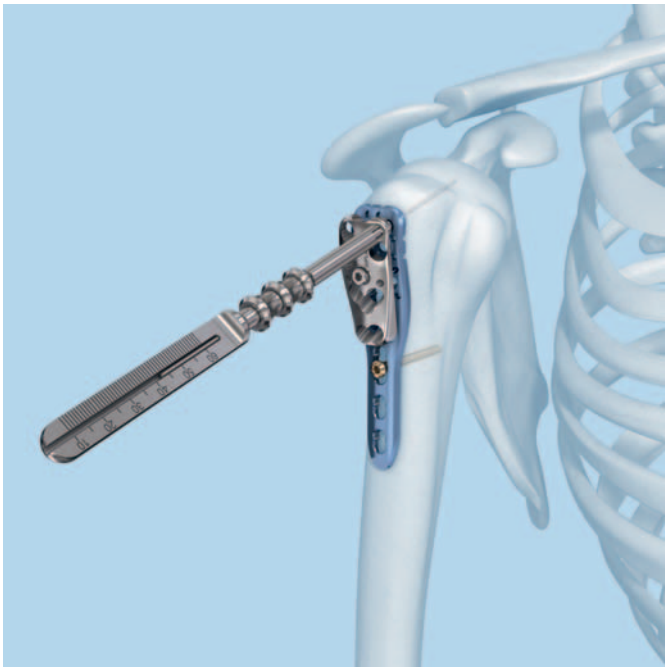
**Option A:** Use a 2.8 mm drill bit through the drill sleeve and drill 5 – 8 mm below the joint surface. Read off the required screw length from the drill bit.



**Option B:** Check the subsequent position of the screws using Kirschner wires. Attach the triple sleeve system, consisting of a outer sleeve, a drill sleeve, and a centering sleeve for the Kirschner wire onto the aiming device and insert a Kirschner wire 1.6 mm, 150 mm long.

- Check the position of the Kirschner wire. The tip of the Kirschner wire should be located in the subchondral bone (5 – 8 mm below the joint surface).

  Slide the PHILOS direct measuring device for Kirschner wire 1.6 mm over the Kirschner wire and determine the length of the required screw.



## 6
**Insert proximal screws**

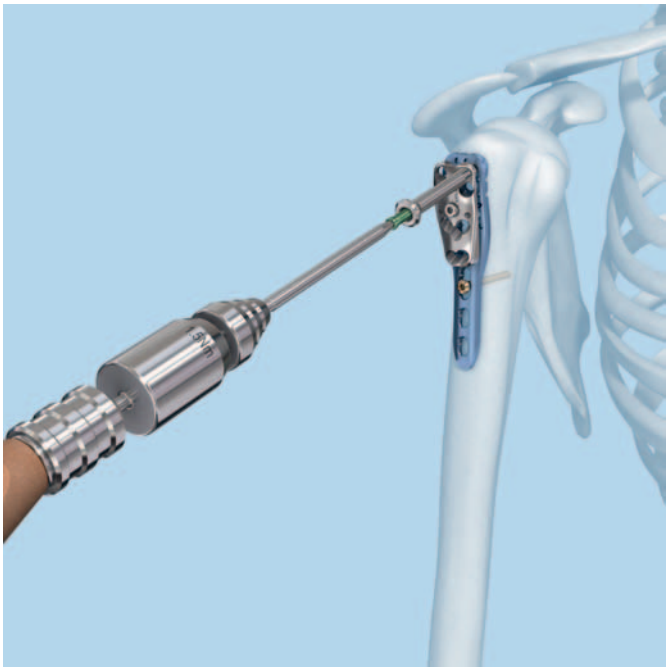
| Instruments | |
|---|---|
| 511.770<br>or<br>511.773 | Torque limiter, 1.5 Nm |
| 314.030<br>or<br>314.116 | Screwdriver Shaft hexagonal<br><br>Screwdriver Shaft Stardrive T15 |
| 311.431<br>or<br>397.705 | Handle with Quick Coupling<br><br>Handle for Torque Limiter |

Insert the screw with the appropriate screwdriver shaft (hexagonal or Stardrive recess) and 1.5 Nm torque limiting attachment through the outer sleeve. The sleeve ensures that the locking screw is correctly locked in the plate. The angular stability is reduced if a locking screw is inserted obliquely.

Insert the screw manually or with power until a click is heard. If using power, reduce speed when tightening the head of the locking screw into the plate.

Repeat the above step for all required proximal screw holes.

**Note:** The plate should be secured with at least 4 proximal screws. In poor bone stock, multiple fixation points using all screws is recommended.

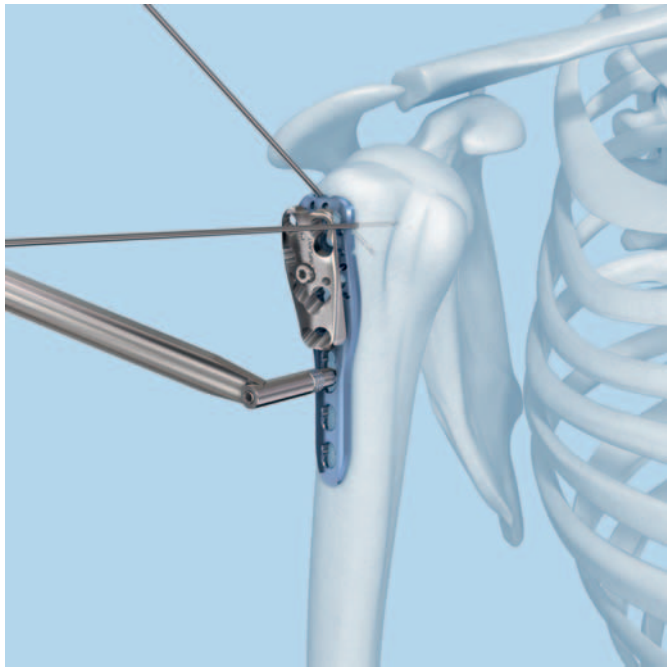


## 7

**Insert shaft screws: Cortex**

| Instrument | |
|---|---|
| 323.360 | Universal Drill Sleeve 3.5 |

Plate holes in the plate shaft (distal to section E) are LCP combi-holes (see page 2). An LCP combi-hole can be fixed with a cortex screw to generate interfragmentary compression. In this case, the screws are inserted according to the technique for fixing LC-DCP standard plates, but using the universal drill guide instead of the LC-DCP drill guide.



## 8

**Insert shaft screws: Locking**

## 8a

**Insert LCP drill sleeve in shaft hole**

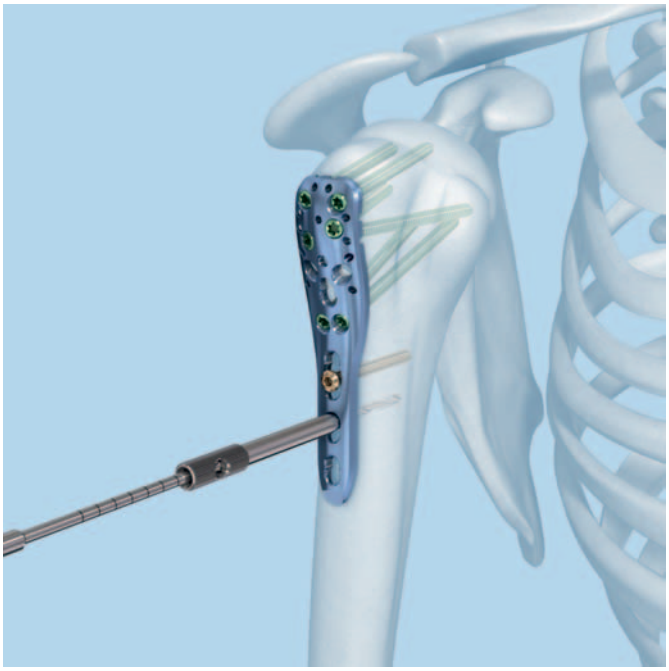
| Instrument | |
|---|---|
| 323.027 | LCP Drill Sleeve 3.5 |

Carefully screw the LCP drill sleeve into the threaded section of the desired combi-hole until it is gripped completely by the thread. The LCP drill sleeve ensures that the locking screw is correctly locked in the plate. The angular stability is reduced if a locking screw is inserted obliquely.

## 8b

**Predrill screw hole and insert screw**

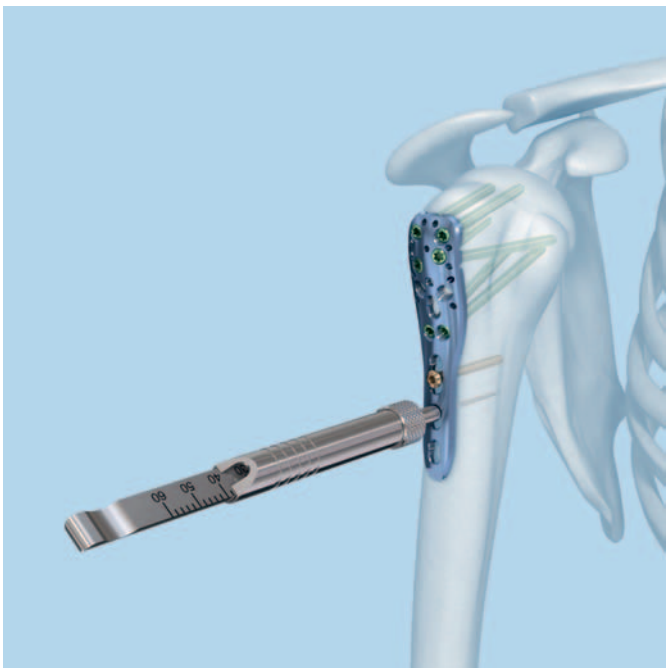
| Instruments | |
|---|---|
| 310.284 | LCP Drill bit ∅ 2.8 mm |
| 310.010 | Depth gauge |
| 511.770<br>or<br>511.773 | Torque limiter, 1.5 Nm |
| 314.030<br>or<br>314.116 | Screwdriver Shaft hexagonal<br><br>Screwdriver Shaft Stardrive T15 |
| 311.431<br>or<br>397.705 | Handle for Torque Limiter |



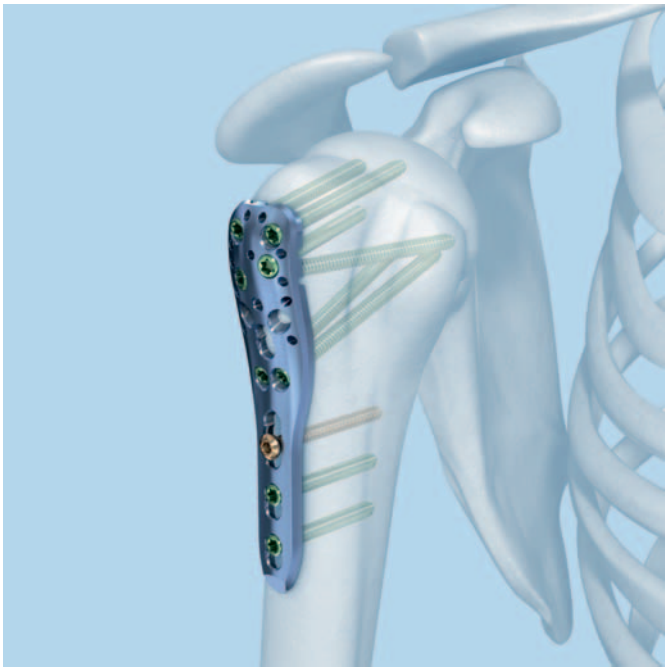
Predrill the screw hole with a 2.8 mm drill bit passing through both cortices.

Remove the LCP drill sleeve.

Using the depth gauge, determine the required screw length.



Insert the locking screws manually or with the use of a power tool as described in step 6. The distal locking screws must be locked in the combi-hole at an angle of 90° to ensure optimal stability.



## 9

### Attach sutures

Remove the aiming device from the plate.

Knot the sutures through the designated holes in the plate if this has not already been done. This construct functions as a tension band and transmits the forces of the rotator cuff over the plate and into the shaft, while preventing fragment displacement during the early rehabilitation period.

## 10
### Final check

Before closing the wound, check the screw lengths under image intensifier control in the full range of gleno-humeral-motion and ensure that they do not penetrate the articular surface.

**Note:** It is important to check the screw lengths in all planes as their angulation and direction may be difficult to visualize.

Check the stability of the suture fixation. The sutures must not rupture during motion.

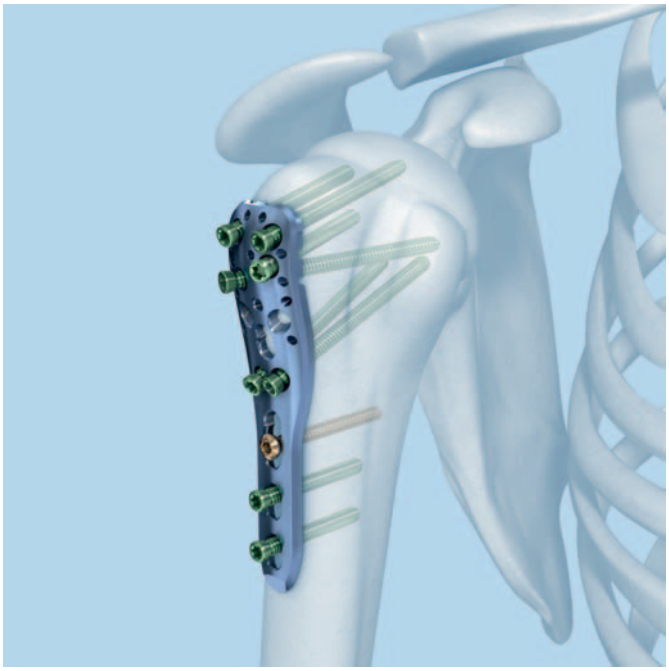
# Implant Removal

**Instruments**

| | |
|---|---|
| 314.030<br>or<br>314.116 | Screwdriver Shaft hexagonal<br><br>Screwdriver Shaft Stardrive T15 |
| 311.431 | Handle with Quick Coupling |
| 309.521 | Extraction Screw for Screws ∅ 3.5 mm |

To remove the plate, first unlock all screws with the screwdriver before removing them definitively in a second step, otherwise the plate may rotate while the last screw is being removed and cause soft tissue damage.

If the LCP locking screws cannot be removed with the screwdriver (e.g., if the screw recess is damaged), use an extraction screw with lefthanded thread. Loosen the screw by turning the handle counterclockwise.



# Implants

## PHILOS – Proximal Humeral Plate 3.5

| Stainless steel | Titanium | Shaft holes | Length (mm) |
|---|---|---|---|
| 241.901 | 441.901 | 3 | 90 |
| 241.903 | 441.903 | 5 | 114 |

## PHILOS Long – Proximal Humeral Plate 3.5

| Stainless steel | Titanium | Shaft holes | Length (mm) |
|---|---|---|---|
| 241.916 | 441.916 | 3 | 110 |
| 241.917 | 441.917 | 4 | 120 |
| 241.918 | 441.918 | 5 | 140 |
| 241.919 | 441.919 | 6 | 160 |
| 241.920 | 441.920 | 7 | 180 |
| 241.921 | 441.921 | 8 | 200 |
| 241.922 | 441.922 | 9 | 210 |
| 241.923 | 441.923 | 10 | 230 |
| 241.924 | 441.924 | 11 | 250 |
| 241.925 | 441.925 | 12 | 270 |
| 241.926 | 441.926 | 13 | 290 |

## Screws used with PHILOS

| | |
|---|---|
| X12.102 – 124 | Locking Screw Stardrive ∅ 3.5 mm, length 12 – 60 mm, self-tapping |
| X13.012 – 060 | Locking Screw ∅ 3.5 mm, length 12 – 60 mm, self-tapping, with hexagonal recess |
| X04.814 – 860 | Cortex Screw ∅ 3.5 mm, length 12 – 60 mm, self-tapping, with hexagonal recess |

Stardrive
Hexagonal

X=2: Stainless steel
X=4: TAN

All implants are available nonsterile or sterile packed. Add suffix "S" to article number to order sterile product.

# Instruments

**PHILOS sizing templates**

| | Shaft holes |
|---|---|
| 03.122.003 | 3 |
| 03.122.004 | 5 |
| 03.122.005 | long |

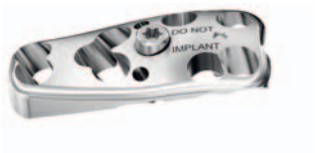

| | |
|---|---|
| 03.122.051 | Drill Bit ∅ 2.8 mm, with Stop, for Quick Coupling |


| | |
|---|---|
| 03.122.052 | Length Probe for Nos. 03.122.053 and 03.122.058 |

| | |
|---|---|
| 03.122.053 | Outer Sleeve 6.0/5.0 for PHILOS Aiming Device |

| | |
|---|---|
| 03.122.054 | Drill Sleeve 5.0/2.9, for No. 03.122.053 |

| | |
|---|---|
| 03.122.055 | Centering Sleeve for Kirschner Wire ∅ 1.6 mm, for No. 03.122.054 |

| | | |
|---|---|---|
| 03.122.056 | PHILOS Aiming Device, with Nose |  |
| 03.122.057 | PHILOS Aiming Device, without Nose |  |
| 03.122.066 | PHILOS Aiming Device Stardrive, with Nose |  |
| 03.122.067 | PHILOS Aiming Device Stardrive, without Nose |  |

**Optional instruments**

| | | |
|---|---|---|
| 03.122.058 | Drill Sleeve 6.0/2.9 with thread |  |
| 03.122.060 | Wing Nut for Pull Reduction for use with No. 03.122.059 for Drill Sleeves |  |
| 03.122.059 | Pull Reduction Device for use with No. 03.122.060 for Drill Sleeves |  |

# Sets

| | |
|---|---|
| 01.122.031 | Proximal Humerus Instruments, in Modular Tray, Vario Case System |
| 01.122.013 | Small Fragment Basic Instruments, in Modular Tray, Vario Case System |

**Optional sets**

| | |
|---|---|
| 01.122.014 | Small Fragment Reduction Instruments, in Modular Tray, Vario Case System |
| 01.122.015 | Screw Insertion 3.5/4.0, in Modular Tray, Vario Case System |

# Bibliography

Babst R, Brunner F. Plating in Proximal Humeral Fractures. Eur J Trauma Emerg Surg 2007; 33:345

Brunner F, Sommer C, Bahrs C, Heuwinkel R, Hafner C, Rillmann P, Kohut G, Ekelund A, Muller M, Audigé L, Babst R. Open Reduction and Internal Fixation of Proximal Humerus Fractures Using a Proximal Humeral Locked Plate: A Prospective Multicenter Analysis. J Orthop Trauma. 2009 Mar; 23(3):163-72

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