

Part of the DePuy Synthes Locking Compression Plate (LCP®) System

# 3.5 mm LCP® Periarticular Proximal Humerus Plate

Surgical Technique





# Table of Contents

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<b>Introduction</b>	3.5 mm LCP Periarticular Proximal Humerus Plate	2
	AO Principles	4
	Indications	5

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<b>Surgical Technique</b>	Preparation	6
	Surgical Technique	8
	Implant Removal	19

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<b>Product Information</b>	Implants	20
	Instruments	22
	Set List	25

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## MR Information

The 3.5 mm LCP Periarticular Proximal Humerus Plate System has not been evaluated for safety and compatibility in the MR environment. It has not been tested for heating, migration or image artifact in the MR environment. The safety of the 3.5 mm LCP Periarticular Proximal Humerus Plate System in the MR environment is unknown. Scanning a patient who has this device may result in patient injury.

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 Image intensifier control

## 3.5 mm LCP Periarticular Proximal Humerus Plate. Part of the DePuy Synthes Locking Compression Plate (LCP) System.

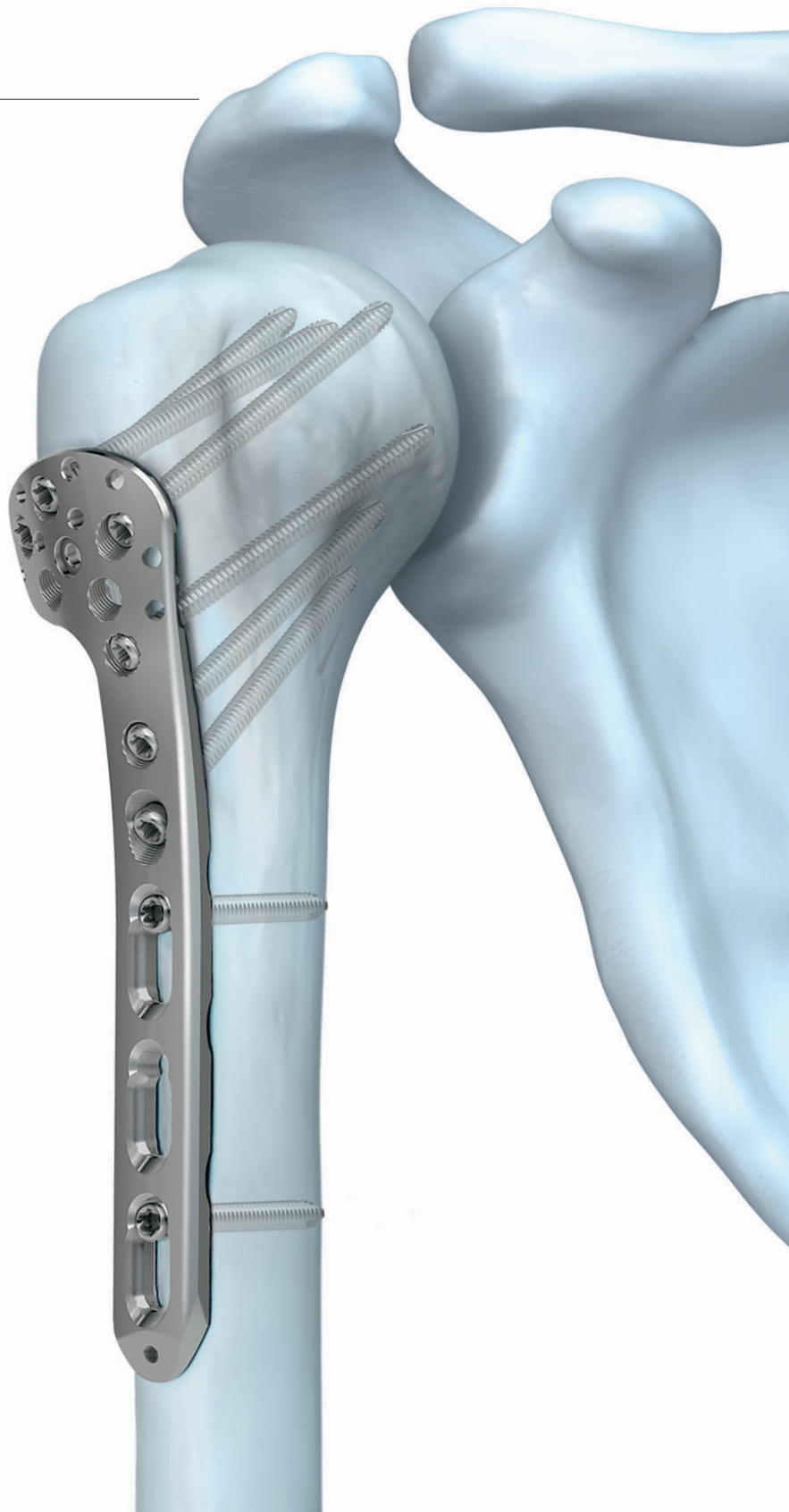
The 3.5 mm LCP® Periarticular Proximal Humerus Plates feature locking screw technology combined with conventional plating techniques.

The plates feature Combi holes that allow fixation with either locking screws in the threaded section for angular stability or cortex screws in the dynamic compression unit (DCU) section for compression.

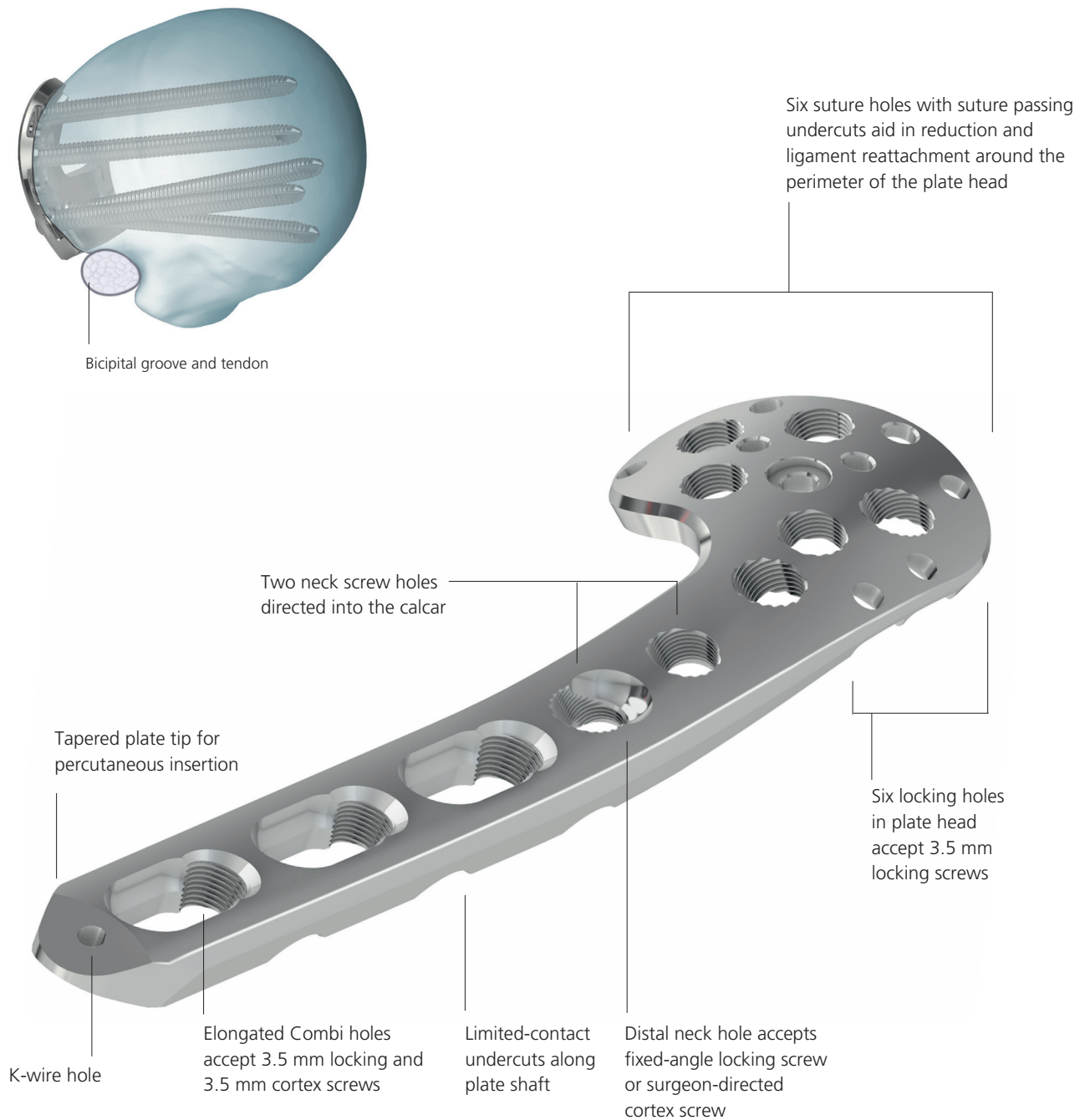
A fixed angle construct provides advantages in osteopenic bone where screws do not rely on bone to plate compression to resist patient load, but function similarly to multiple, small angled blade plates.

### Features

- Plate head sits approximately 15 mm distal to rotator cuff to avoid acromial impingement
- Plate shaft sits slightly anterior to reduce need for deltoid elevation
- Posterior sweep of head buttresses greater tuberosity
- Anatomically contoured left and right plates, available in 2 to 14 holes
- Available in stainless steel or titanium\*



\* Implant quality 316L stainless steel or commercially pure titanium (CP4)



# AO Principles

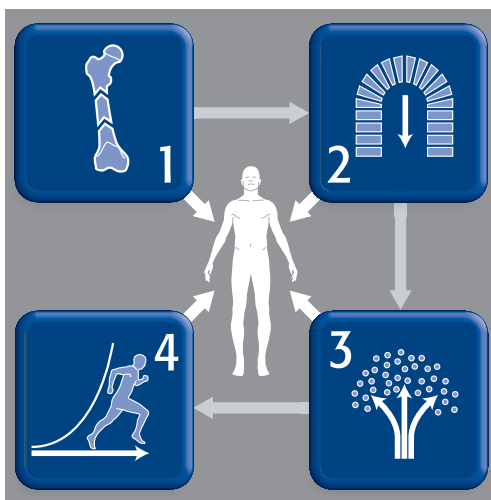
In 1958, the AO formulated four basic principles, which have become the guidelines for internal fixation.<sup>1,2</sup>

## Anatomic reduction

Fracture reduction and fixation to restore anatomical relationships.

## Early, active mobilization

Early and safe mobilization and rehabilitation of the injured part and the patient as a whole.



## Stable fixation

Fracture fixation providing absolute or relative stability, as required by the patient, the injury, and the personality of the fracture.

## Preservation of blood supply

Preservation of the blood supply to soft tissues and bone by gentle reduction techniques and careful handling.

1. Müller ME, Allgöwer M, Schneider R, Willenegger H. *Manual of Internal Fixation*. 3rd ed. Berlin, Heidelberg, New York: Springer-Verlag; 1991.  
2. Rüedi TP, RE Buckley, CG Moran. *AO Principles of Fracture Management*. 2nd ed. Stuttgart, New York: Thieme; 2007.

## Indications

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DePuy Synthes 3.5 mm Periarticular Proximal Humerus Plates are indicated for fractures, fracture dislocations, osteotomies, and nonunions of the proximal humerus, particularly in osteopenic bone.

# Preparation

## Required set

105.434/ 145.434 Small Fragment LCP Instrument and Implant Set, with self-tapping screws (stainless steel or titanium)

## Optional sets

01.122.033 Proximal Humerus Instrument Module Set

105.90 Bone Forceps Set

105.954 Small Battery Drive Set

115.700 Large Distractor Set

## Optional instruments

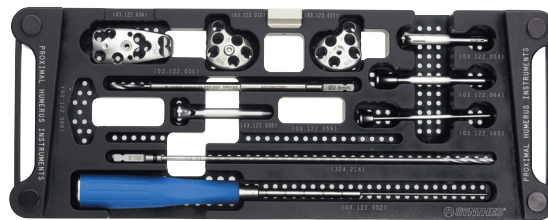
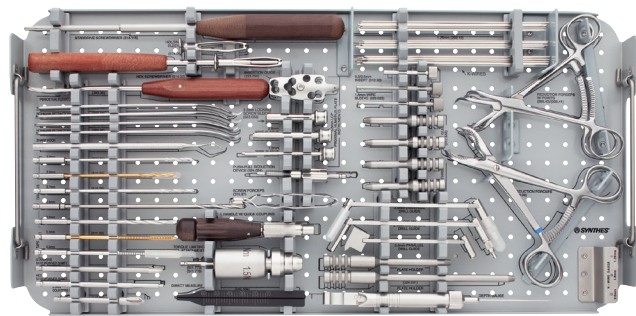
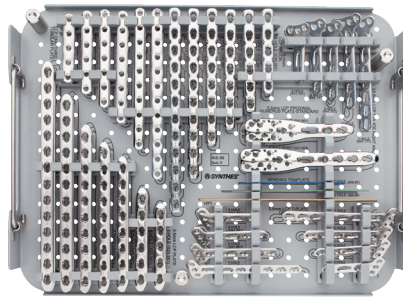
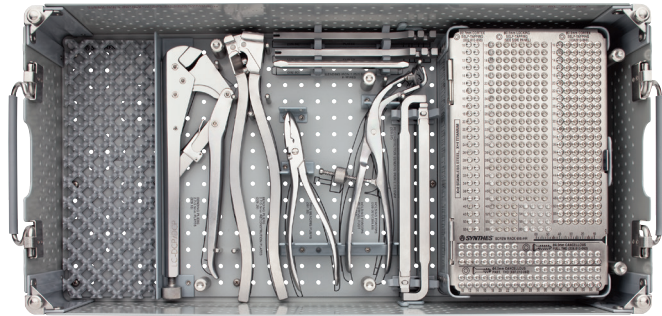
329.02 Bending Iron

329.30 Plate Bending Press

Complete the preoperative radiographic assessment and prepare the preoperative plan. Determine plate length and instruments to be used.

**Important:** The direction of the locking screws is determined by the design of the plate.

**Note:** For information on fixation principles using conventional and locked plating techniques, please refer to the *Small Fragment Locking Compression Plate (LCP) System Technique Guide*.



01.122.033



## 1

### Position patient

A beach-chair position is recommended to provide easy access to the shoulder with imaging equipment.



## 2

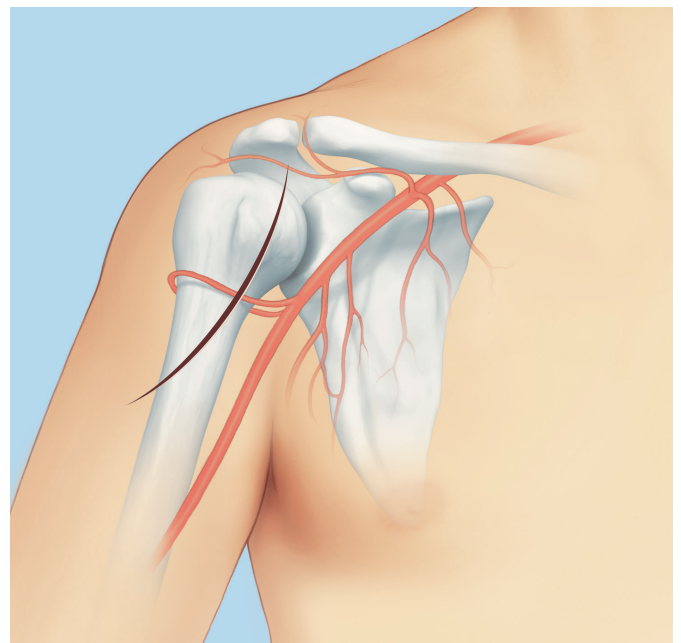
### Approach

The standard surgical approach for internal fixation of proximal humerus fractures is the interval between the deltoid and pectoral muscles. The skin incision starts from the coracoid process and is slightly convex toward the medial side, extending distally as far as the insertion of the deltoid muscle on the lateral humeral shaft.

For long plates, the incision may be extended as an anterior approach to the humeral shaft, proceeding distally between the biceps and the brachialis, and then down the anterolateral aspect of the arm to just above the elbow flexion crease.

During the dissection, avoid damaging the vasculature of the bone fragments. Avoid ligation or coagulation of the anterior circumflex humeral artery. This can normally be ensured by keeping all dissection lateral to the intertubercular groove.

**Note:** For information on open reduction approaches for proximal humerus, please refer to T.P. Rüedi and M. Murphy: *AO Principles of Fracture Management*. Stuttgart, New York: Thieme, 2000, pp.274-277.



### Warnings:

Do not injure the axillary nerve. The axillary nerve can be palpated at the lower margin of the incision.

To avoid damaging the axillary nerve, do not split the deltoid more than 4 cm distal to its origin.

# Surgical Technique

## 3

### Reduce fracture

#### Instrument

292.71      1.6 mm Kirschner Wire with thread

- ① Reduce the fracture fragments and confirm the reduction under image intensification.

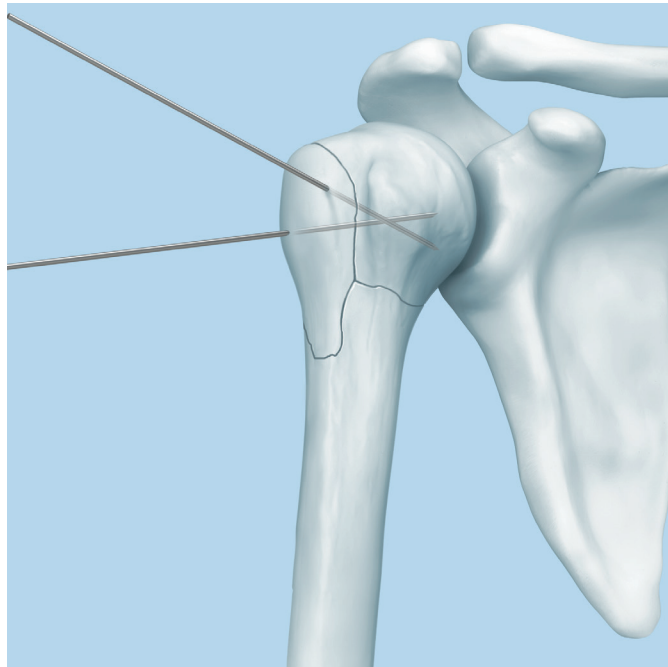
The humeral head and tuberosity fragments may be manipulated and provisionally fixed with sutures and/or Kirschner wires. When using K-wires, place where they will not interfere with plate application.

**Note:** Locking screws do not provide any compression for a lag screw effect. Therefore, humeral head fragments must be reduced, and any desired interfragment compression obtained before applying the 3.5 mm LCP Periarticular Proximal Humerus Plate with locking screws.

#### Optional technique: tension band with sutures

The stability of the construct can be increased with the insertion of sutures. Use sutures attached to the tuberosity fragments to manipulate them until provisional fixation is obtained. The sutures can later be attached to the plate by passing them through the suture holes with undercuts.

**Note:** If the insertion guide is attached to the plate while passing the sutures, remove the insertion guide so that the sutures can be attached to the plate.



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**4****Attach insertion guide to plate**

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**Instruments**

03.123.010/ Insertion Guide, for 3.5 mm LCP Periarticular  
03.123.011 Proximal Humerus Plate (right or left)

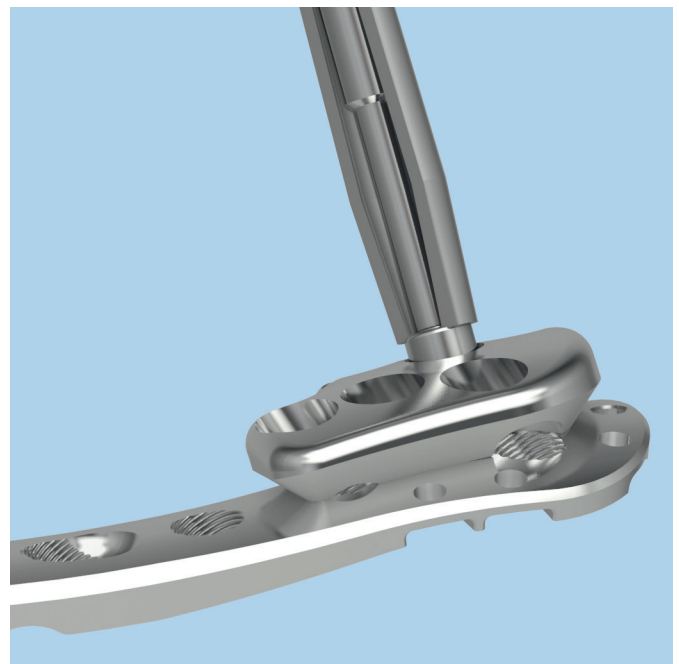
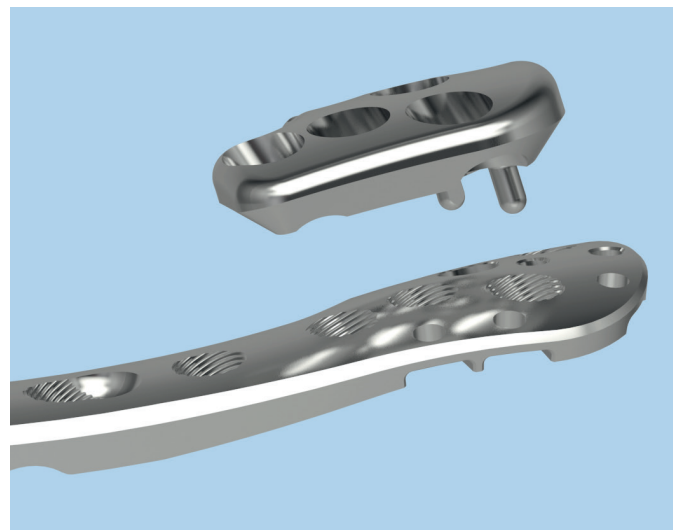
314.02 Small Hexagonal Screwdriver with Holding  
Sleeve

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To facilitate insertion of the proximal locking screws, place the insertion guide against the plate and tighten the guide's attachment screw with the small hexagonal screwdriver, to lock the guide against the plate.

**Precaution:** To maintain proper alignment between the insertion guide and the plate, intraoperative bending of the proximal portion of the plate is not recommended.

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## 6

### Position plate on bone

#### Instruments

312.648	2.8 mm Threaded Drill Guide
324.214	2.8 mm Drill Bit, 100 mm calibration

#### Optional instruments

03.122.053	Outer Sleeve for Insertion Guide
03.122.064	2.8 mm Drill Sleeve
03.122.065	1.6 mm K-Wire Sleeve
292.71	1.6 mm Kirschner Wire with Thread

#### Positioning from AP view

The superior edge of the plate should be placed approximately 15 mm distal to the insertion of the rotator cuff.

Position the plate low enough to allow locking screws in the two distal head holes to be placed into the calcar of the proximal humerus. To avoid subacromial impingement, do not place the plate too high.

**Precaution:** 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.

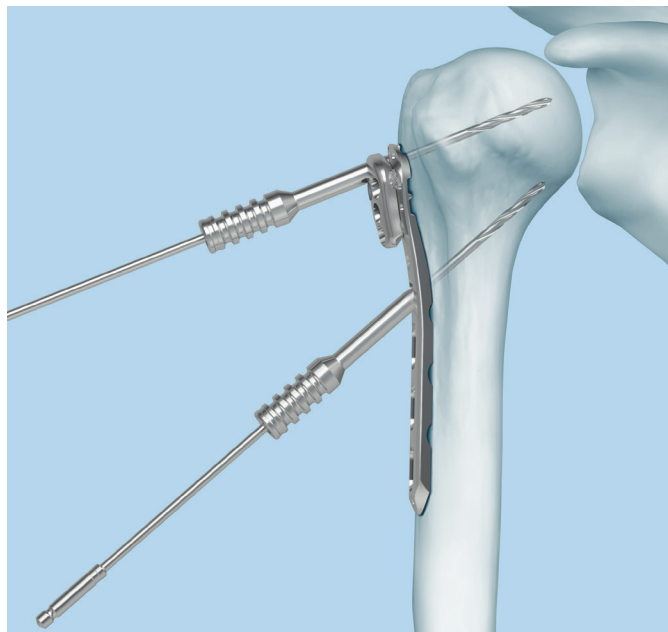
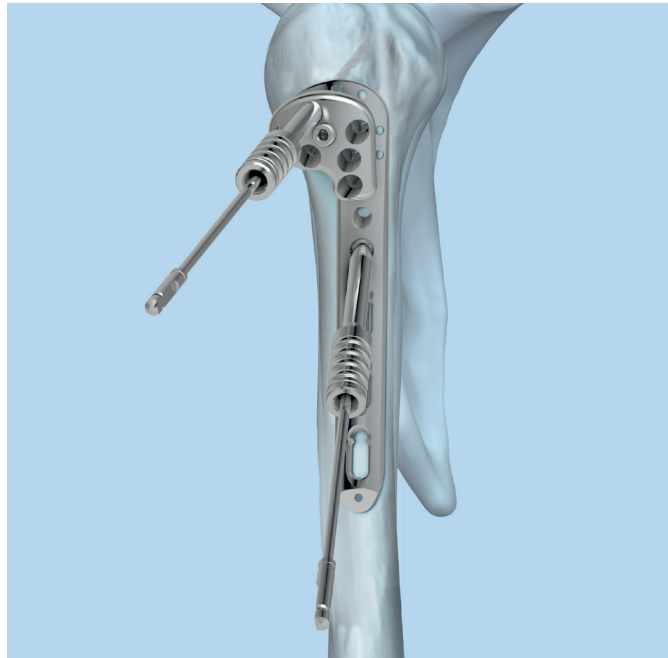
#### Positioning from lateral view

Position the plate's anterior edge immediately lateral to the bicipital groove.

To check final placement of the plate, use a 2.8 mm threaded drill guide and 2.8 mm drill bit in the most proximal and the most distal (into the calcar) screw hole in the head of the plate.

#### Additional consideration for long plates

The additional length of long plates will usually require a plan for handling the deltoid insertion.



#### Warnings:

Do not penetrate the joint surface with the Kirschner wires.

Do not injure the axillary nerve. The axillary nerve can be palpated at the lower margin of the incision.

To avoid damaging the axillary nerve, do not split the deltoid more than 4 cm distal to its origin.

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## 7

### Insert screws

Determine the combination of screws to be used for fixation. If a combination of locking and cortex screws will be used, cortex screws should be inserted first to pull the plate to the bone.

The placement of the initial screw will depend on the fracture type and the reduction achieved. There are two options for the order of screw insertion.

#### **Option 1: Insertion of a proximal screw first**

This technique permits fixation of the proximal fragments first and then fixation with or without compression distally.

- ① Insert a locking screw in one of the two neck holes in the head of the plate. Control the height of the plate in the AP view under image intensification before insertion of the screw.

#### **Option 2: Insertion of a distal screw first**

This technique permits reduction of the distal shaft fragment against the plate and a final height adjustment prior to the insertion of the other screws in the shaft

Insert a standard cortex screw in any of the elongated holes in the shaft of the plate. After making a final height adjustment, insert proximal locking screws.

## 8

### Insert screws in plate head

#### Proximal locking screws in osteoporotic bone

The following technique is recommended for measuring screw length in osteoporotic bone. If normal bone is present use the alternative technique on page 14.

#### Instruments

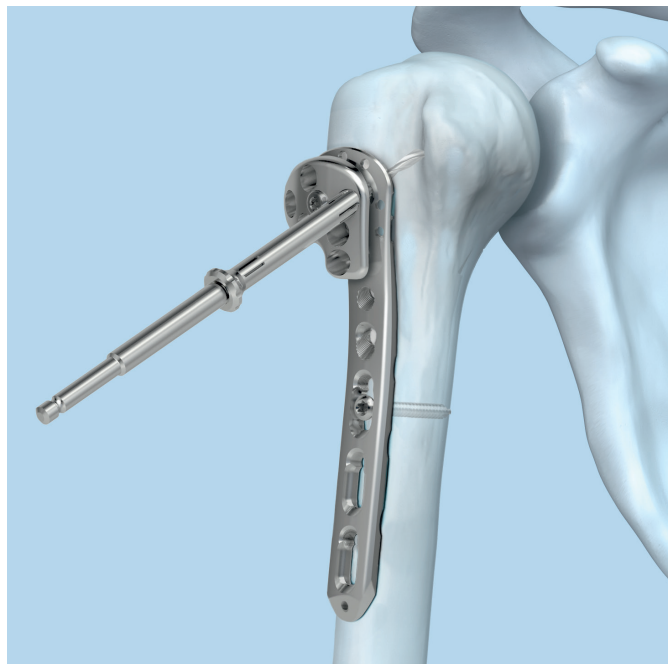
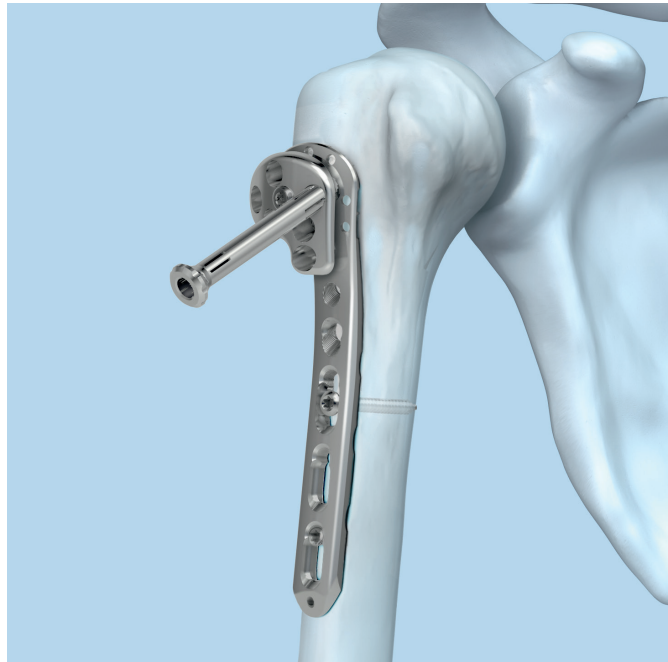
03.123.010/	Insertion Guide, for 3.5 mm LCP Periarticular
03.123.011	Proximal Humerus Plate (right or left)
03.122.051	2.8 mm Drill Bit with stop, quick coupling
03.122.052	Depth Probe
03.122.053	Outer Sleeve for Insertion Guide
314.115	StarDrive Screwdriver, T15
314.116	StarDrive Screwdriver Shaft, T15
511.776*	Torque Limiting Attachment

Insert the outer sleeve for insertion guide into the insertion guide with nose.

**Precaution:** Do not push the depth probe through the joint surface. Do not hammer on the length probe.

Pre-drill the lateral cortex using the 2.8 mm drill bit with stop.

**Warning:** In porotic bone, only drill the lateral cortex.



\* Also available

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Insert the depth probe through the outer sleeve. Stop when increased resistance from the subchondral bone is felt. Read the required screw length on the length probe.

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- **Note:** The depth probe tip should come as close as possible to the subchondral bone, approximately 5 mm – 8 mm from the joint surface. Since it may not always be possible to feel the resistance from the subchondral bone, and the depth probe represents the final position of the locking screw, the use of image intensification is recommended.
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**Warning:**

Do not push the depth probe through the joint surface.

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Use the StarDrive™ Screwdriver to insert the appropriate length locking screw through the outer sleeve for insertion guide.

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**Warnings:**

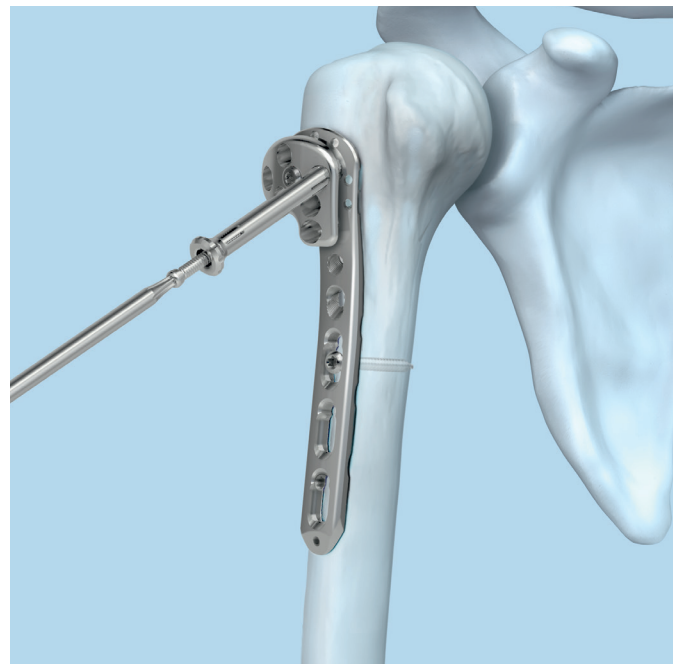
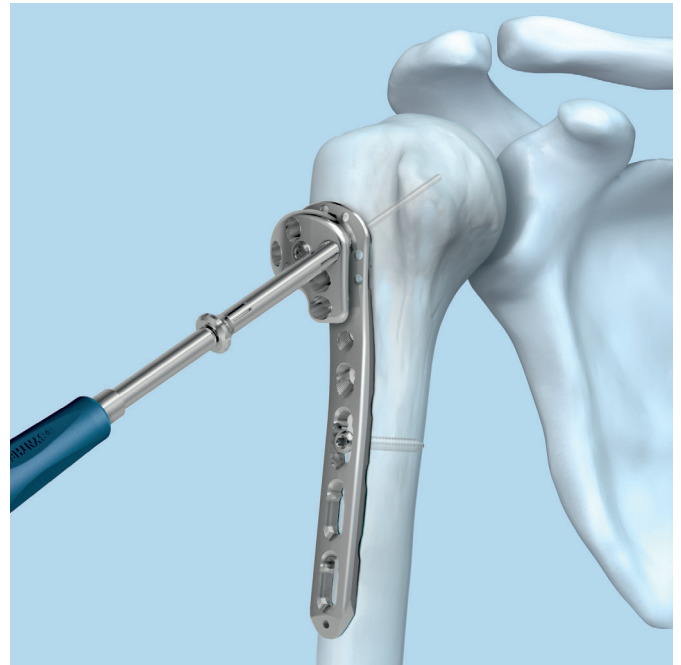
Locking screws should be inserted under power using the torque limiting attachment. The audible “click” will notify the surgeon that the maximum torque value has been reached and that power insertion is complete.

Ensure that locking screws are not cross threaded in plate holes.

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**Technique tip:** Inserting screws through outer sleeve helps to direct the screw in correct orientation and reduces the likelihood of cross threading.

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8. Insert screws in plate head

**Proximal locking screws in normal bone**

The following technique is recommended for measuring screw length in normal bone.

**Instruments**

03.123.010/	Insertion Guide, for 3.5 mm LCP Periarticular
03.123.011	Proximal Humerus Plate (right or left)
03.122.053	Outer Sleeve for Insertion Guide
03.122.064	2.8 mm Drill Sleeve
314.115	StarDrive Screwdriver, T15
314.116	StarDrive Screwdriver Shaft, T15
324.214	2.8 mm Drill Bit, 100 mm calibration
511.776	Torque Limiting Attachment

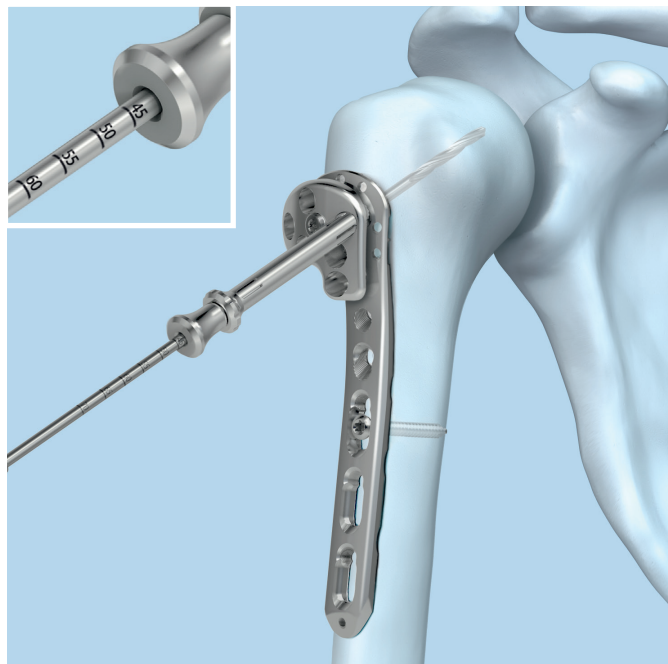
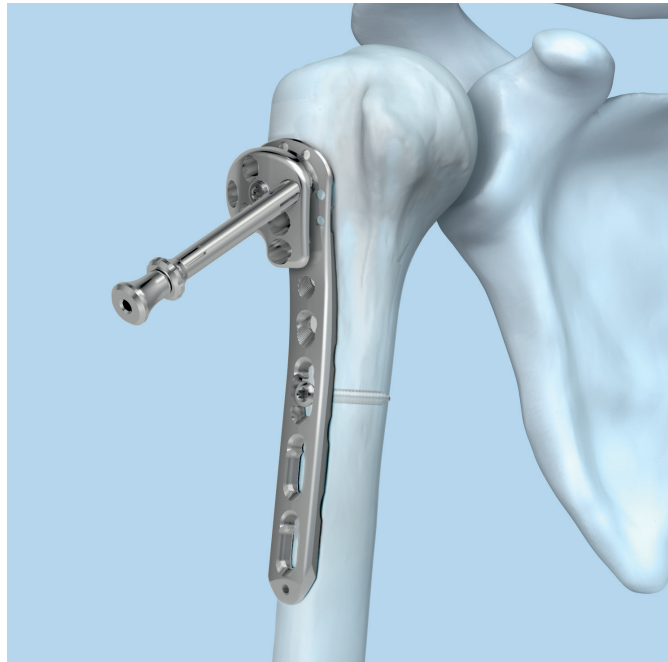
Insert the outer sleeve and 2.8 mm drill sleeve into the insertion guide with nose.

Using the 2.8 mm calibrated drill bit through the 2.8 mm drill sleeve, drill to the desired depth in the bone.

Read the measurement directly from the calibrated drill bit.

**Note:** The drill bit tip should come as close as possible to the subchondral bone, approximately 5 mm – 8 mm from the joint surface. Since it may not always be possible to feel the resistance from the subchondral bone, and the drill bit represents the final position of the locking screw, the use of image intensification is recommended.

**Warning:** Do not push the drill bit through the joint surface.





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Remove the 2.8 mm drill sleeve. Use the StarDrive Screwdriver to insert the appropriate length locking screw through the outer sleeve for insertion guide.

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**Warnings:**

Locking screws should be inserted under power using the torque limiting attachment. The audible “click” will notify the surgeon that the maximum torque value has been reached and that power insertion is complete.

Do not insert overly long screws in order to prevent primary or secondary screw penetration.

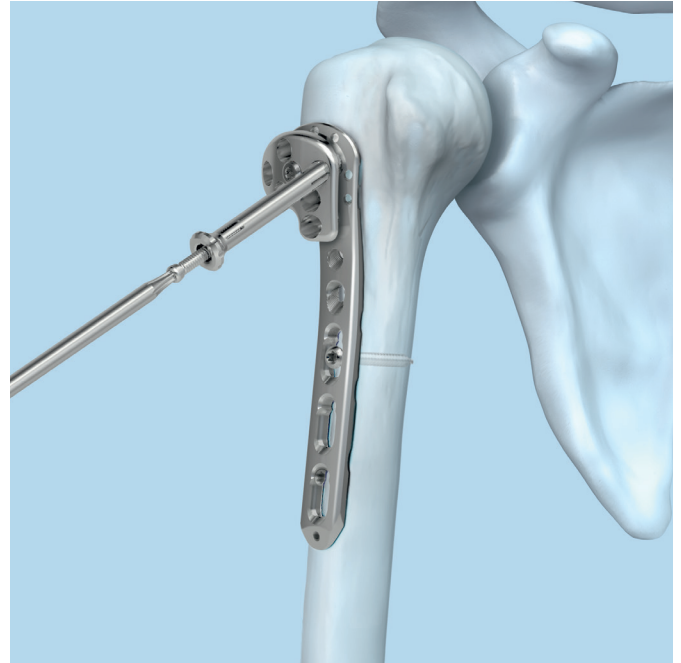
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**Precaution:** When selecting the appropriate screw length, the possibility of bone resorption at the fracture site must be taken into account. Ensure that the screw tip is at sufficient distance from the joint surface. Check that the plate supports the lateral aspect of the greater tuberosity.

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**Note:** If a combination of cortex and locking screws is used, cortex screws must be inserted first to pull the plate to the bone.

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8. Insert screws in plate head

**Alternative technique: Proximal locking screws in normal bone**

**Instruments**

312.648	2.8 mm Threaded Drill Guide
314.115	StarDrive Screwdriver, T15
314.116	StarDrive Screwdriver Shaft, T15
324.214	2.8 mm Drill Bit, 100 mm calibration
511.773	Torque Limiting Attachment, 1.5 Nm, quick coupling

Insert a 2.8 mm threaded drill guide into a hole in the head of the plate.

Using the 2.8 mm calibrated drill bit through the 2.8 mm threaded drill guide, drill to the desired depth in the bone.

Read the measurement directly from the calibrated drill bit.

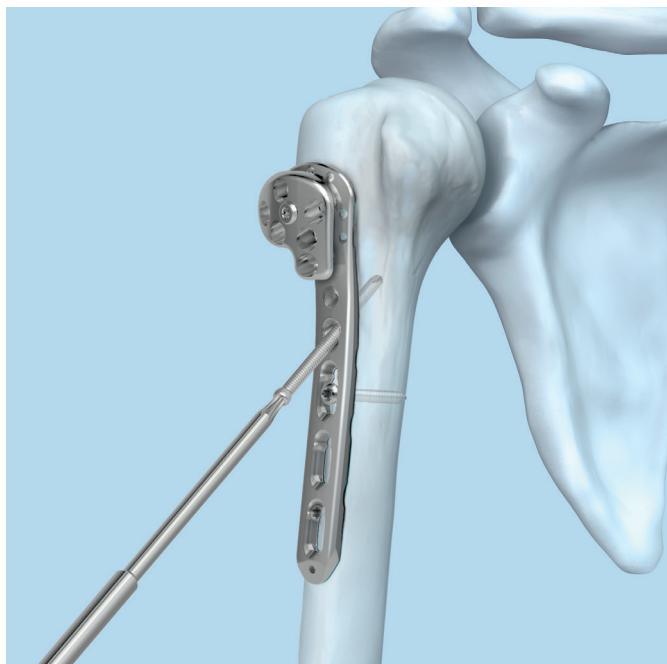
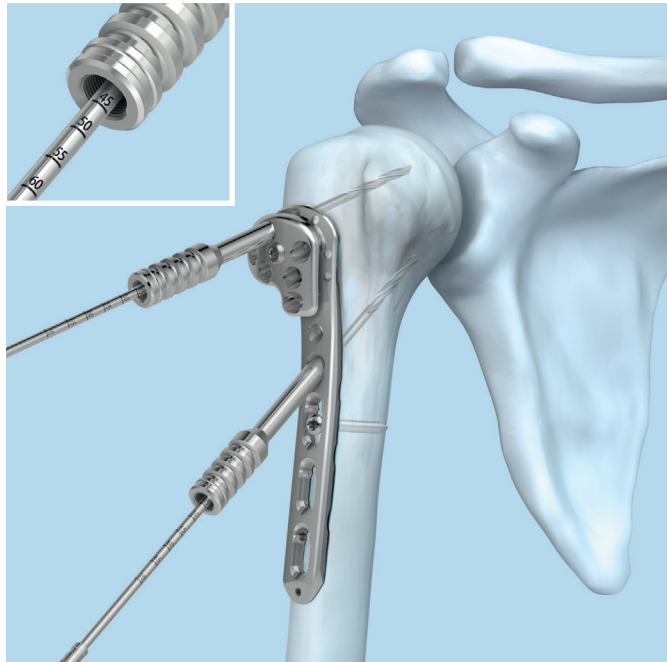
**Note:** The drill bit tip should come as close as possible to the subchondral bone, approximately 5 mm – 8 mm from the joint surface. Since it may not always be possible to feel the resistance from the subchondral bone, and the drill bit represents the final position of the locking screw, the use of image intensification is recommended.

**Warning:** Do not push the drill bit through the joint surface.

Remove the 2.8 mm threaded drill guide.

Use the StarDrive Screwdriver to insert the appropriate length locking screw

**Warning:** Locking screws should be inserted under power using the torque limiting attachment. The audible “click” will notify the surgeon that the maximum torque value has been reached and that power insertion is complete



**9****Insert screws in plate shaft****Instruments**

312.648	2.8 mm Threaded Drill Guide
314.115	StarDrive Screwdriver, T15
314.116	StarDrive Screwdriver Shaft, T15
324.214	2.8 mm Drill Bit, 100 mm calibration
511.773	Torque Limiting Attachment, 1.5 Nm, quick coupling

For proper drilling of shaft holes, the 2.8 mm threaded drill guide must be used.

Thread the drill guide into the threaded portion of the elongated shaft hole.

Drill with the 2.8 mm drill bit and read the measurement directly from the calibrated drill bit.

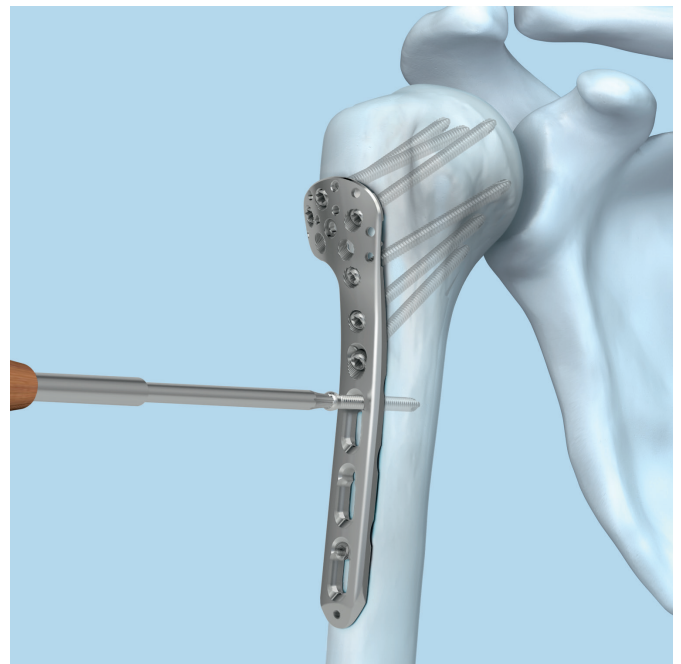
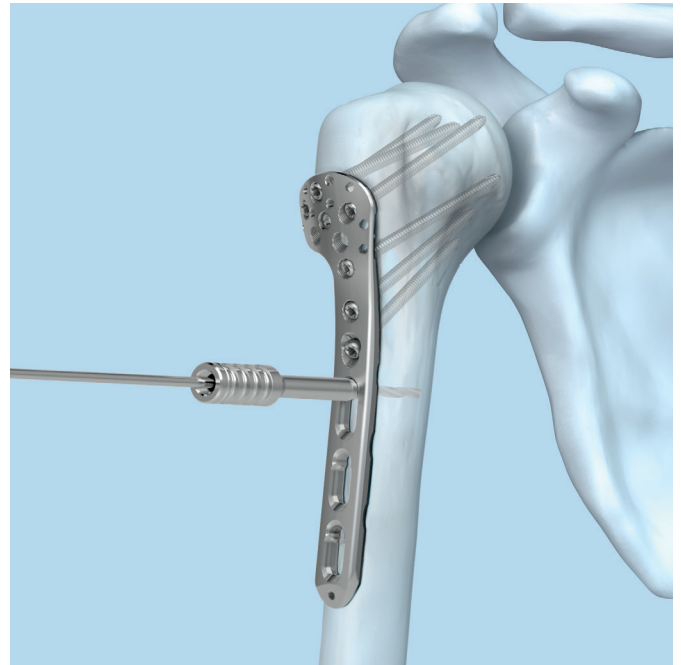
Remove the drill guide and insert the appropriate screw, using the torque limiting attachment (TLA) and the StarDrive Screwdriver shaft.

**Notes:**

For more stable fixation, insertion of the locking screw through both cortices is recommended.

Always use the StarDrive Screwdriver shaft with a TLA.

Use the standard AO screw insertion technique to insert a 3.5 mm cortex screw in the DCU portion of the Combi hole.



## 10

### Confirm screw placement and suture stability

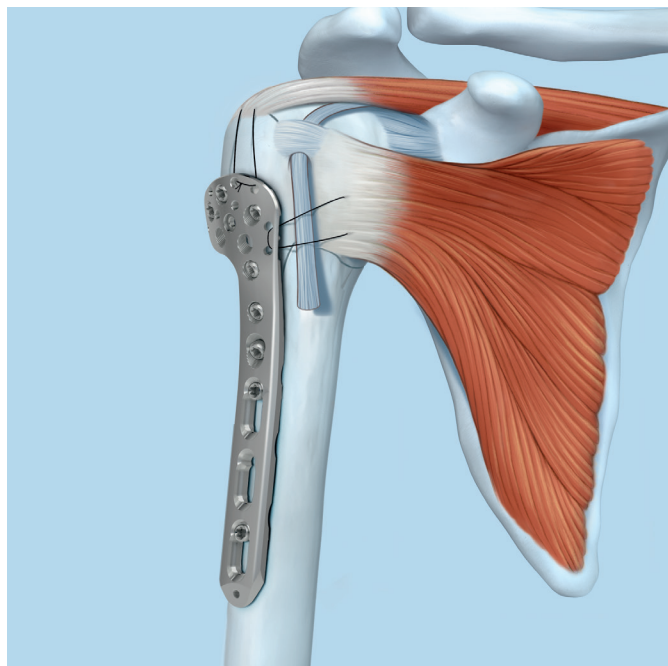
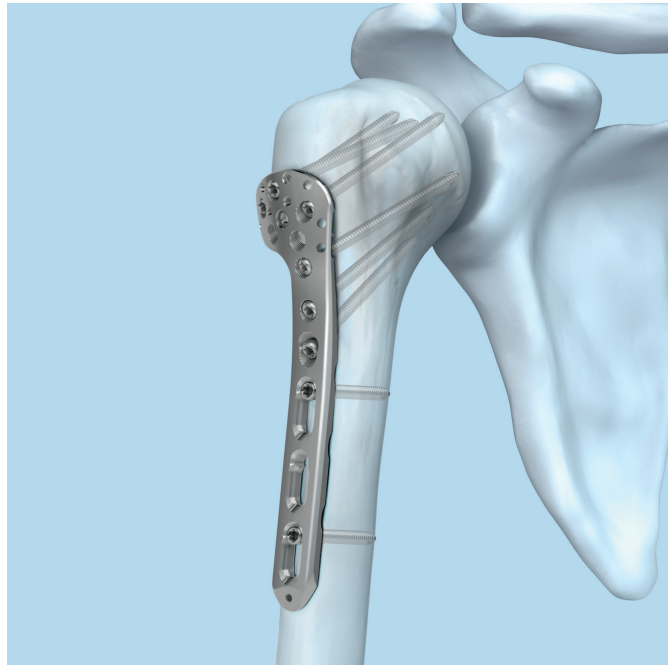
- Before closing the incision, check the screw placement and the stability of the suture fixation. Check the screws, using image intensification, for control of the full range of glenohumeral motion and to ensure that the screws do not penetrate the articular surface.

Check the sutures to ensure that they are tightened to create a tension band and that the sutures do not rupture during motion.

#### Precautions:

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

The plate should be secured with at least 4 proximal screws whereas in poor bone stock multiple fixation points using more screws is recommended.



**Precaution:** Remove the aiming device from the plate before closing the wound.

# Implant Removal

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## Implant removal

To remove locking screws, first unlock all screws from the plate and then remove the screws completely from the bone. This will prevent rotation of the plate when removing the last locking screw.

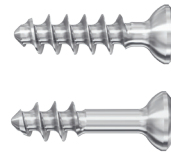
# Screws Used With the 3.5 mm LCP Periarticular Proximal Humerus Plate

## Stainless Steel and Titanium

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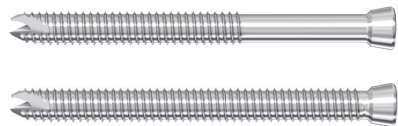
### 4.0 mm Cancellous Bone Screws\*

- May be used in the DCU portion of the Combi holes
- Compress the plate to the bone or create axial compression
- Fully or partially threaded shaft



### 3.5 mm Conical Screws, self-tapping

- May be used in the DCU portion of the Combi holes in the plate shaft or in round locking holes
- Smooth conical head
- Fully or partially threaded shaft



### 3.5 mm Locking Screws, self-tapping\*

- Used in the locking portion of the Combi holes or in round locking holes
- Create a locked, fixed-angle screw/plate construct
- Fully threaded shaft



### 3.5 mm Cortex Screws, self-tapping\*

- May be used in the DCU portion of the Combi holes
- Compress the plate to the bone or create axial compression
- Fully threaded shaft



Screws available in implant quality 316L stainless steel and Titanium alloy (Ti-6Al-7Nb)

\* Found in the Small Fragment LCP Set

## 3.5 mm LCP Periarticular Proximal Humerus Plates

Stainless Steel and Titanium

- 
- Available nonsterile and sterile in 2, 3, 4, 5, 6, 8, 10, 12, and 14 (sterile only) shaft holes
  - 91 mm to 307 mm lengths
  - Right and left designs
  - 316L stainless steel



## Instruments (from 01.123.002)

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03.123.010 Insertion Guide, for 3.5 mm LCP Periarticular Proximal Humerus Plate, right



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03.123.011 Insertion Guide, for 3.5 mm LCP Periarticular Proximal Humerus Plate, left



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324.214 2.8 mm Drill Bit, 100 mm calibration





## Selected Instruments (from 01.122.033)

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03.122.051 2.8 mm Drill Bit with stop, quick coupling



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03.122.052 Depth Probe



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03.122.053 Outer Sleeve for Insertion Guide



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03.122.064 2.8 mm Drill Sleeve



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03.122.065 1.6 mm Wire Sleeve



## Selected Instruments (from 105.434)

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292.71 1.6 mm Kirschner Wire with Thread,  
150 mm, 5 mm thread length



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310.288 2.8 mm Drill Bit, quick coupling, 165 mm



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312.648 2.8 mm Threaded Drill Guide



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314.02 Small Hexagonal Screwdriver with  
Holding Sleeve



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314.115 StarDrive Screwdriver, T15, self-retaining



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314.116 StarDrive Screwdriver Shaft, T15



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319.01 Depth Gauge



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323.025 Direct Measuring Device



## 3.5 mm LCP Periarticular Proximal Humerus Set

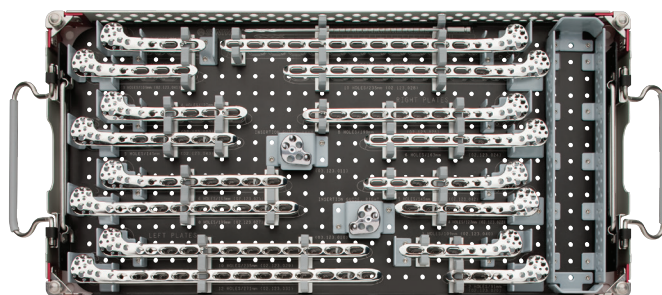
Stainless Steel (01.123.002) and Titanium (01.123.004)

### Graphic Case

60.123.001 Graphic Case for 3.5 mm LCP Periarticular Proximal Humerus Plate Set (includes lid)

### Instruments

03.123.010 Insertion Guide, for 3.5 mm LCP Periarticular Proximal Humerus Plate, right  
 03.123.011 Insertion Guide, for 3.5 mm LCP Periarticular Proximal Humerus Plate, left  
 324.214 2.8 mm Drill Bit, quick coupling, 100 mm calibration, 2 ea.



### Implants

3.5 mm LCP Periarticular Proximal Humerus Plates<sup>◇</sup>

Stainless Steel	Titanium	Length (mm)	Holes	
02.123.020	04.123.020	91	2	right
02.123.021	04.123.021	91	2	left
02.123.040	04.123.040	109	3	right
02.123.041	04.123.041	109	3	left
02.123.022	04.123.022	127	4	right
02.123.023	04.123.023	127	4	left
02.123.042	04.123.042	145	5	right
02.123.043	04.123.043	145	5	left
02.123.024	04.123.024	163	6	right
02.123.025	04.123.025	163	6	left
02.123.026	04.123.026	199	8	right
02.123.027	04.123.027	199	8	left
02.123.028	04.123.028	235	10	right
02.123.029	04.123.029	235	10	left
02.123.030	04.123.030	271	12	right
02.123.031	04.123.031	271	12	left

### Also Available

3.5 mm LCP Periarticular Proximal Humerus Plates, sterile

Stainless Steel	Titanium	Length (mm)	Holes	
02.123.032S	04.123.032S	307	14	right
02.123.033S	04.123.033S	307	14	left

### Required Set

105.434/ 145.434 Small Fragment LCP Instrument and Implant Set, with self-tapping screws (stainless steel or titanium)

### Optional Sets

01.122.033 Proximal Humerus Instruments Module Set  
 105.90 Bone Forceps Set  
 105.954 Small Battery Drive Set, with 14.4 V Battery Pack  
 115.700 Large Distractor Set

<sup>◇</sup> Available nonsterile and sterile-packed. Add "S" to product number for sterile product.

Note: For additional information, please refer to the package insert or [www.e-ifu.com](http://www.e-ifu.com).

For detailed cleaning and sterilization instructions, please refer to [www.depuy-synthes.com/hcp/cleaning-sterilization](http://www.depuy-synthes.com/hcp/cleaning-sterilization) or sterilization instructions, if provided in the instructions for use.

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Please also refer to the package insert(s) or other labeling associated with the devices identified in this surgical technique for additional information.

CAUTION: Federal Law restricts these devices to sale by or on the order of a physician.

Some devices listed in this technique guide may not have been licensed in accordance with Canadian law and may not be for sale in Canada. Please contact your sales consultant for items approved for sale in Canada.

Not all products may currently be available in all markets.



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4528 Zuchwil, Switzerland

To order (USA): 800-523-0322

To order (Canada): 844-243-4321

*Note: For recognized manufacturer, refer to the product label.*

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