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

3.5 mm LCP® Proximal Humerus Plates

Surgical Technique

DePuy Synthes

PART OF THE Johnson & Johnson FAMILY OF COMPANIES

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MR Information
The 3.5 mm LCP Proximal Humerus Plates have 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 Proximal Humerus Plates in the MR environment is unknown. Scanning a patient who has this device may result in patient injury.

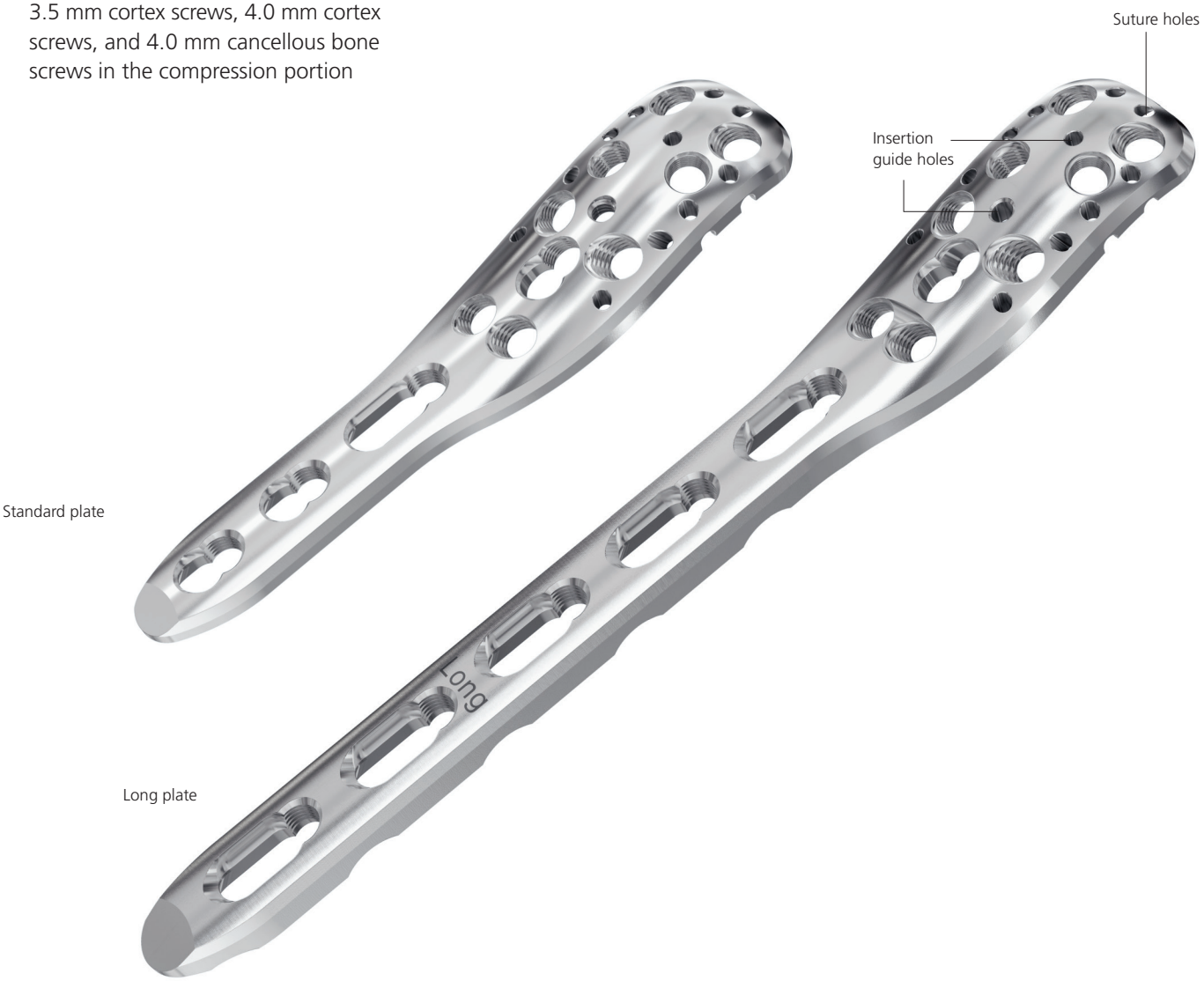
Image intensifier control

3.5 MM LCP PROXIMAL HUMERUS PLATES

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

Plate features

- Anatomically shaped
- Same plate for right or left humerus
- Locked construct in humeral head (levels A–E)
- Proximal locking holes accept 3.5 mm locking screws
- Distal holes accept 3.5 mm locking screws in the threaded portion, and 3.5 mm cortex screws, 4.0 mm cortex screws, and 4.0 mm cancellous bone screws in the compression portion
- Ten suture holes around the perimeter of the proximal end
- Distal shaft of standard plate consists of three or five Combi holes, including one elongated hole to aid in plate positioning
- Distal shaft of long plates consists of 5–12 elongated Combi holes, contains limited-contact undercuts, and is thicker for additional strength
- Available in stainless steel or titanium*

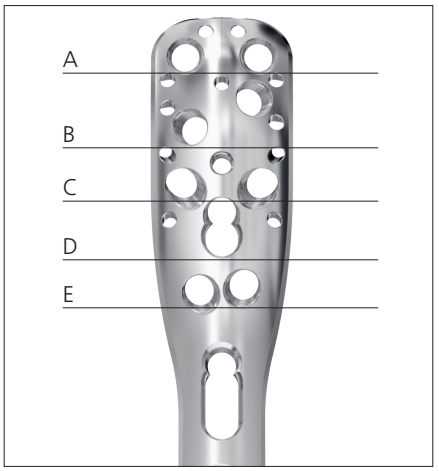


* Implant-quality 316L stainless steel or titanium alloy (TI-6AI-7Nb).

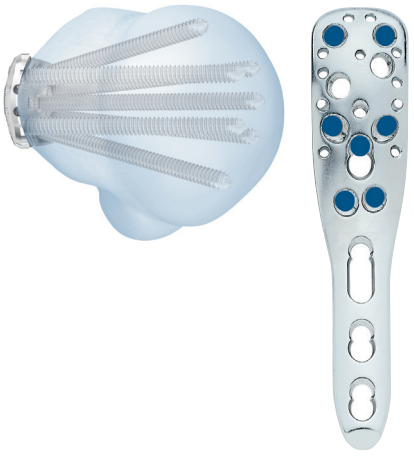
Proximal locking holes

- Provide flexibility in screw placement, allowing different constructs
- Permit multiple points of fixation to support the humeral head

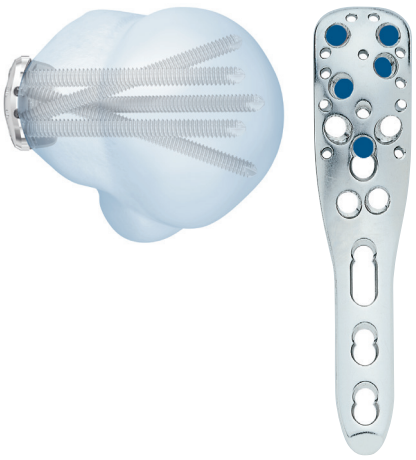
Note: **For information on fixation principles using conventional and locked plating techniques, please refer to the *Small Fragment Locking Compression Plate (LCP) System Technique Guide*.**



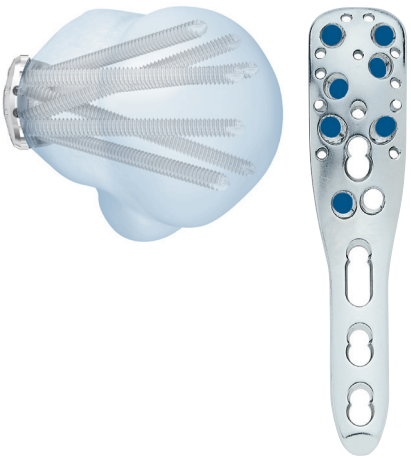
A, C, D, and E level screws for a "diverging" screw pattern



A, B, and D level screws for a "converging" screw pattern



Clinical example using A, B, C, and E level screws

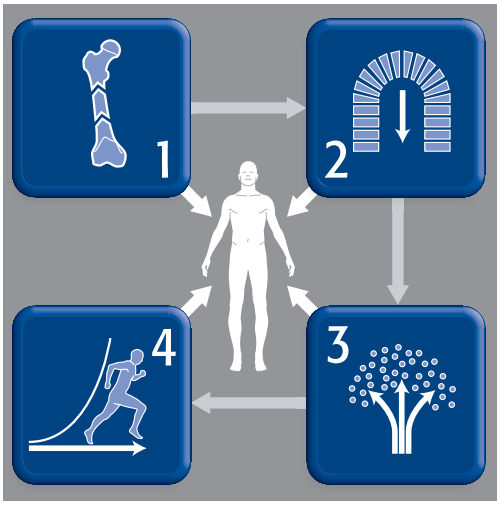


AO PRINCIPLES

In 1958, the AO formulated four basic principles, which have become the guidelines for internal fixation.[1,2]

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

The 3.5 mm LCP Proximal Humerus Plate is part of the small fragment LCP system. This plate addresses complex fractures of the proximal humerus.

The 3.5 mm LCP Proximal Humerus Plate is indicated for fractures and fracture dislocations, osteotomies, and nonunions of the proximal humerus, particularly for patients with osteopenic bone.

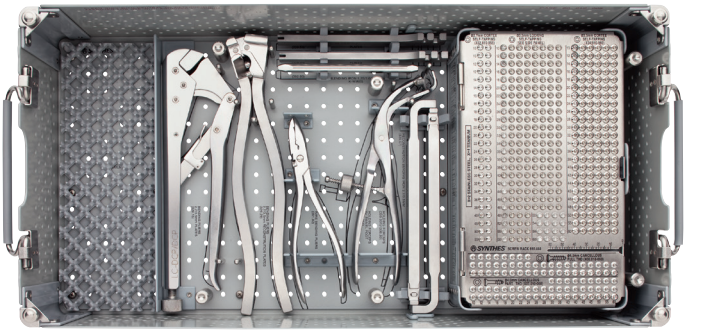
STANDARD TECHNIQUE— SMALL FRAGMENT LCP INSTRUMENTS AND PROXIMAL HUMERUS INSTRUMENT SET

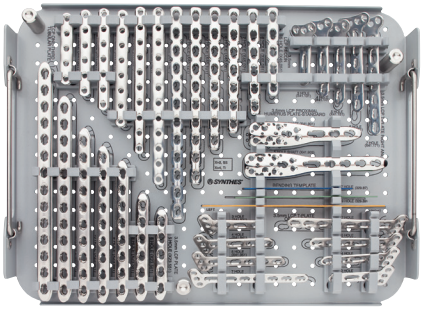
1
Preparation

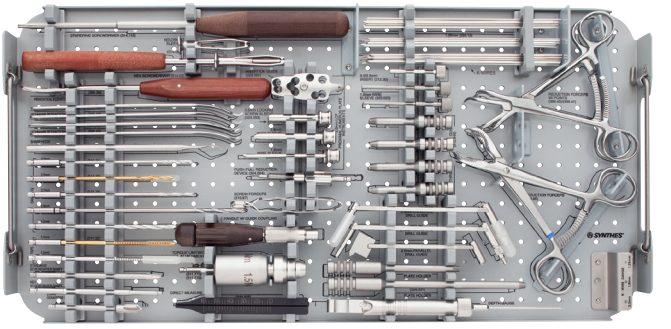
Required sets	
105.434/ 145.434	Small Fragment LCP Instrument and Implant Set, with self-tapping screws (stainless steel or titanium)
and	
01.122.033/ 01.122.032	Proximal Humerus Instruments Module Set Proximal Humerus Instruments Set
Optional sets	
105.90	Bone Forceps Set
105.954	Small Battery Drive Set, with 14.4 V Battery Pack
115.700	Large Distractor Set
Optional instruments	
329.02	Bending Iron
329.30	Plate-Bending Press

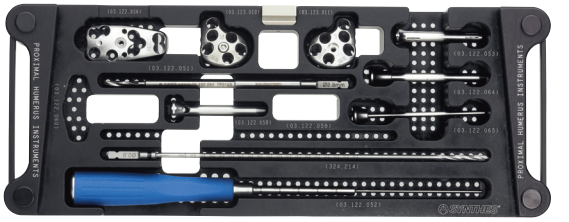
Warning: **The direction of locking screws is determined by the design of the plate.**

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









2

Patient position

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

3

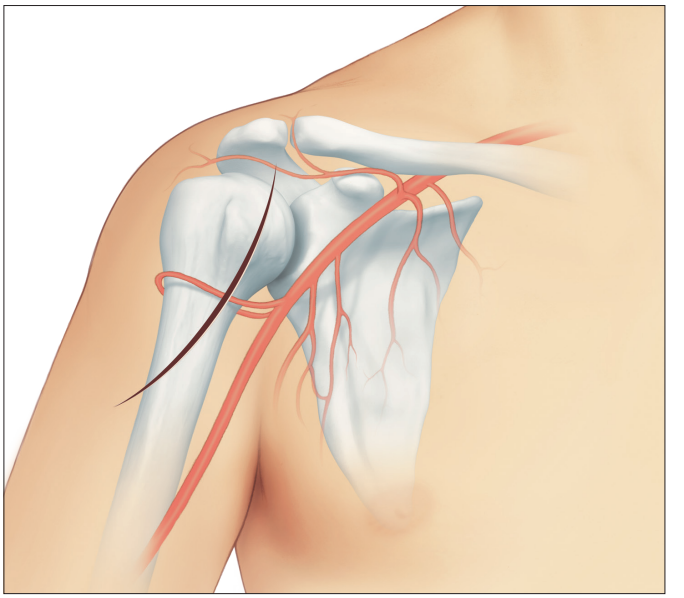
Approach

The standard surgical approach for internal fixation of proximal humerus fractures is the interval between the deltoid and pectoral muscles proximally. 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, which proceeds 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, care should be taken to avoid damaging the vasculature of the bone fragments. Care should also be taken to avoid ligation or coagulation of the anterior circumflex humeral artery. This can normally be assured by keeping all dissection lateral to the intertubercular groove.

Note: **For information on open reduction approaches for proximal humerus, please refer to Rüedi TP and Murphy WM: *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.**

4
Reduce fracture

Instrument	
292.71	1.6 mm Kirschner Wire with Thread

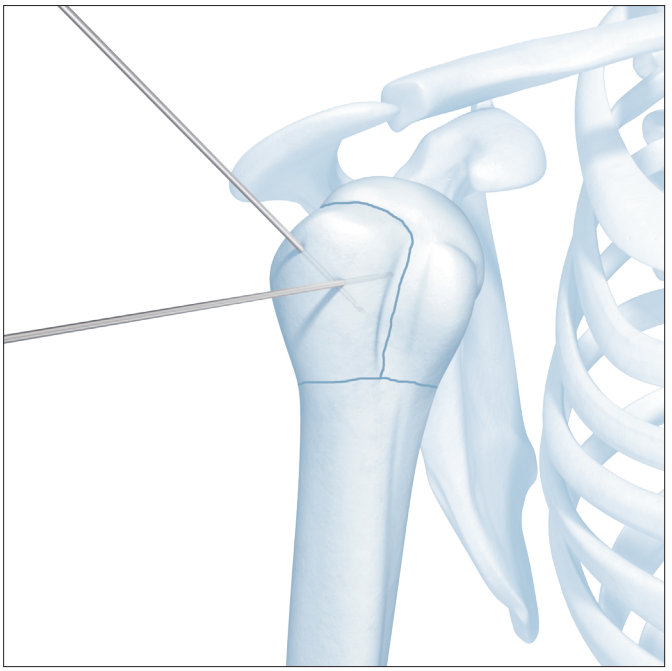
Reduce the fracture fragments and confirm the reduction under image intensification.

The humeral head and tuberosity fragments may be manipulated and provisionally fixed with sutures and/or Kirschner wires. However, Kirschner wires should be placed where they will not interfere with plate application.

Note: **The locking screws do not provide any compression for a lag screw effect. Therefore, humeral head fragments must be reduced, and any desired interfragmentary compression must be obtained prior to applying the 3.5 mm LCP 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.**

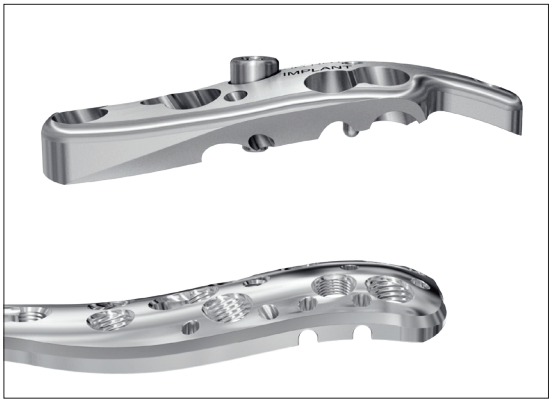


5
Attach insertion guide to plate

Instruments	
03.122.056	Insertion Guide with Nose
03.122.057*	Insertion Guide without Nose
314.02	Small Hexagonal Screwdriver with Holding Sleeve

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.

Insertion guide: top view (left) and bottom view (right).



*Also available

6

Position plate on bone

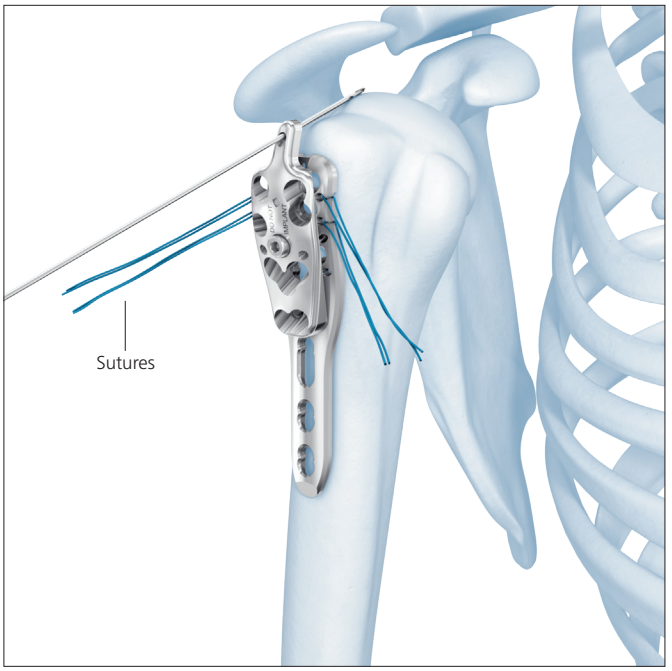
Instruments	
03.122.053	Outer Sleeve for Insertion Guide
03.122.064	2.8 mm Drill Sleeve
03.122.065	1.6 mm Wire Sleeve
292.71	1.6 mm Kirschner Wire with Thread

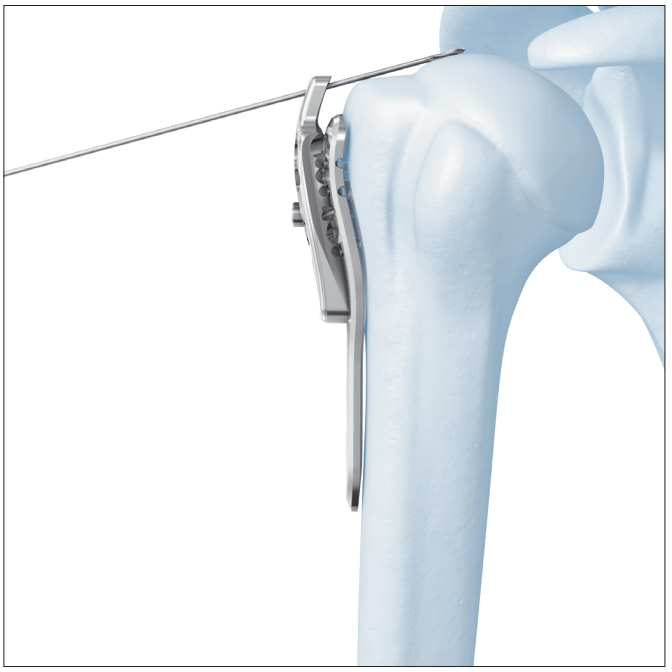
Positioning from AP view
The plate should be placed approximately 8 mm distal to the rotator cuff attachment on the upper edge of the greater tuberosity.

Determine plate position by placing a 1.6 mm K-wire through the proximal guide hole of the insertion guide so that the K-wire rests on top of the humeral head and aims at the proximal joint surface.

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.**

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.**



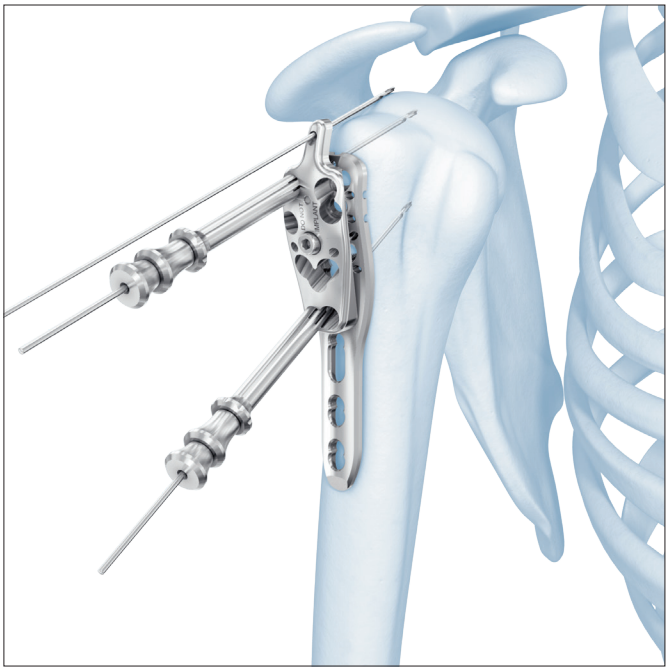


Positioning from a lateral view
The plate should be centered against the lateral aspect of the greater tuberosity, ensuring that a sufficient gap is maintained between the plate and the long biceps tendon (to avoid interfering with arterial blood supply).

To check final placement of the plate, 1.6 mm K-wires and two sleeve assemblies can be used: one in the hole for the most proximal screw and one in the hole for the most distal screw to be placed in the humeral head. If possible, the distal K-wire should be positioned approximately 5 mm above the calcar.

Additional considerations for long plates
The additional length of the long plates will usually require a plan for handling the deltoid insertion distally. Depending on the length of the plate used, a slightly anterior placement of the distal shaft, contouring of the plate shaft to wrap anteriorly around the humerus, or partial elevation of the deltoid insertion may be required.

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



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

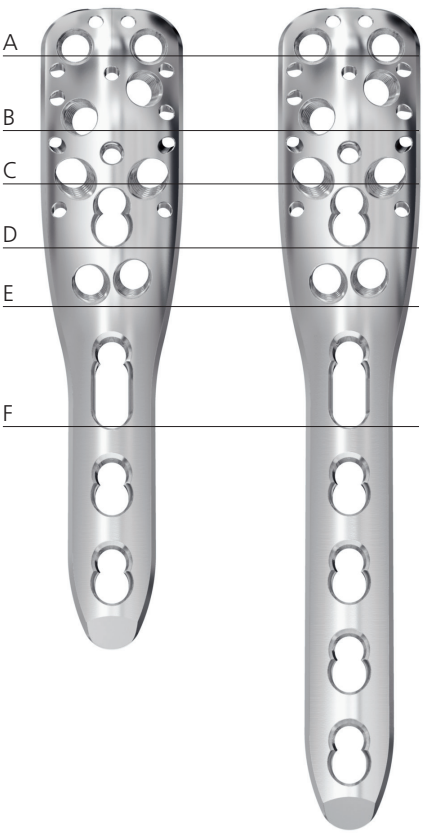
Insertion of a proximal screw first
This technique permits fixation of the proximal fragments first and then fixation with or without compression distally.

It is necessary to control the height of the plate in the AP view under image intensification before insertion of the screws.

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 into the compression portion of hole F (elongated hole) of the standard plate, or in any of the elongated holes of a long plate. After making a final height adjustment, insert proximal locking screws.



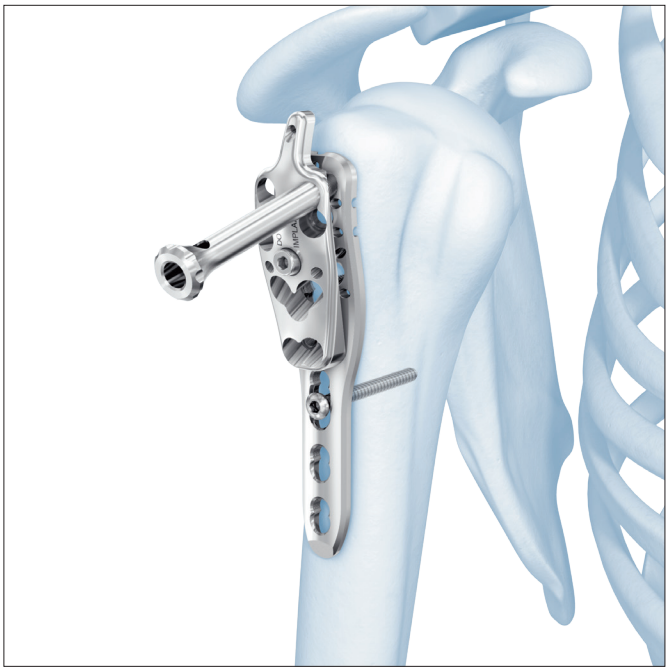
Proximal locking screws in osteoporotic bone
The following technique is recommended for measuring screw length in osteoporotic bone. If normal bone is present, use the alternative technique on page 15.

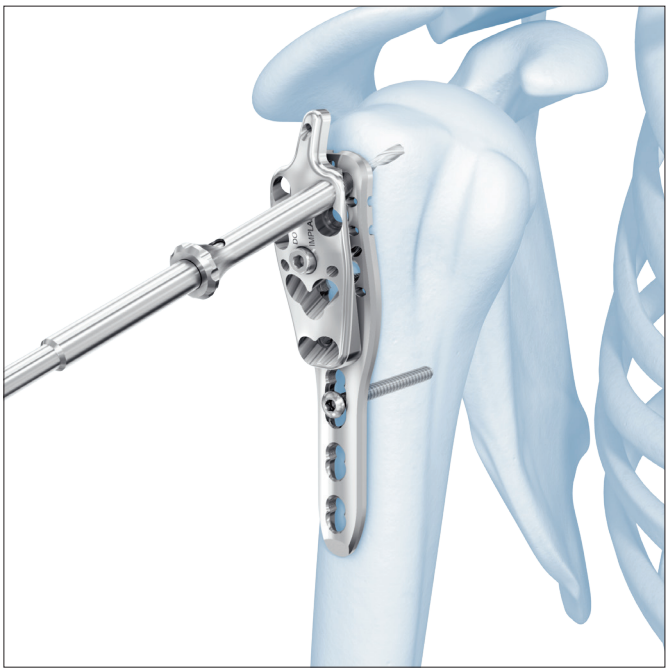
Instruments	
03.122.051	2.8 mm Drill Bit with stop, quick coupling
03.122.052	Depth Probe
03.122.053	Outer Sleeve for Insertion Guide
03.122.056	Insertion Guide with Nose
314.115	StarDrive Screwdriver, T15
314.116	StarDrive Screwdriver Shaft, T15
511.776*	Torque Limiting Attachment

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

Predrill the lateral cortex using the 2.8 mm drill bit with stop.

Warnings:
- **In porotic bone, only drill the lateral cortex.**
- **Do not drill through the joint surface.**
- **Do not insert overly long screws in order to prevent primary or secondary screw penetration.**





* Also available

7. Insert screws
Proximal locking screws in osteoporotic bone (continued)

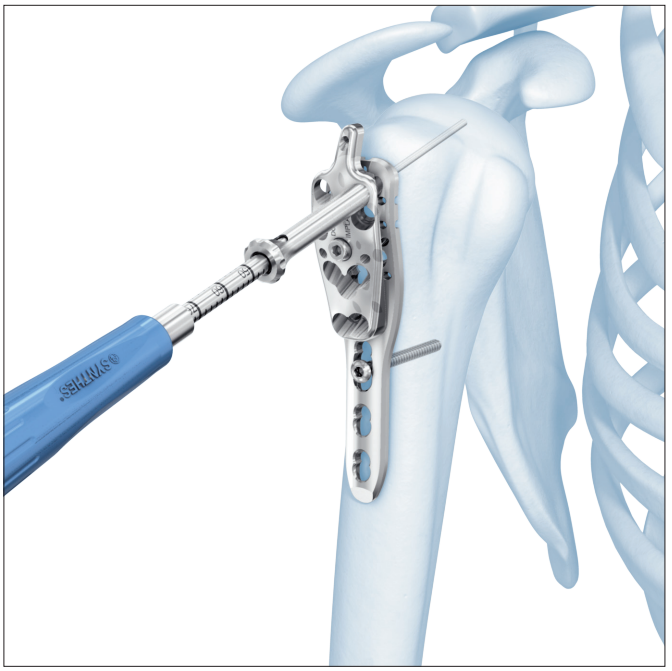
Insert the depth probe through the outer sleeve. Stop when increased resistance from the subchondral bone is felt. Read the required screw length on the depth probe.

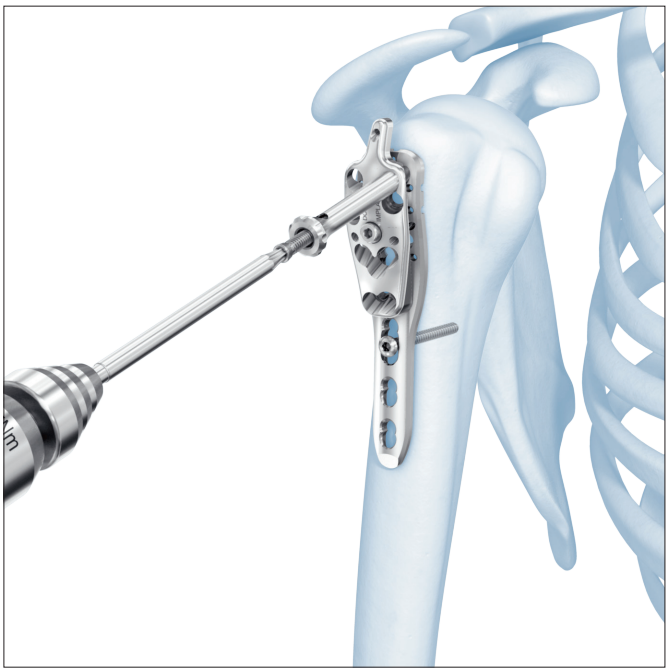
Note: **The depth probe tip should come as close as possible to the subchondral bone, approximately 5 mm–8 mm from the joint surface. Since it may not always be possible to feel the resistance from the subchondral bone, and the depth probe represents the final position of the locking screw, the use of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

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

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

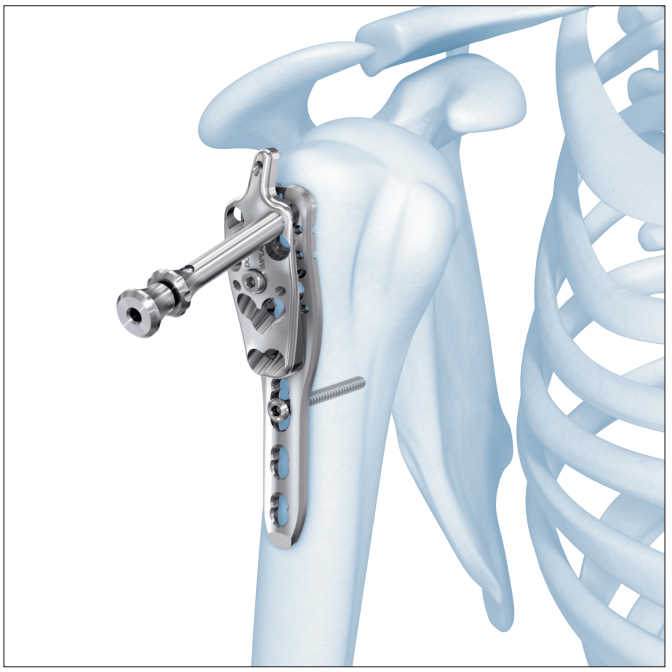
Warning: **Locking screws should be inserted under power using the torque limiting attachment. The audible click will notify the surgeon that the maximum torque value has been reached and that power insertion is complete.**



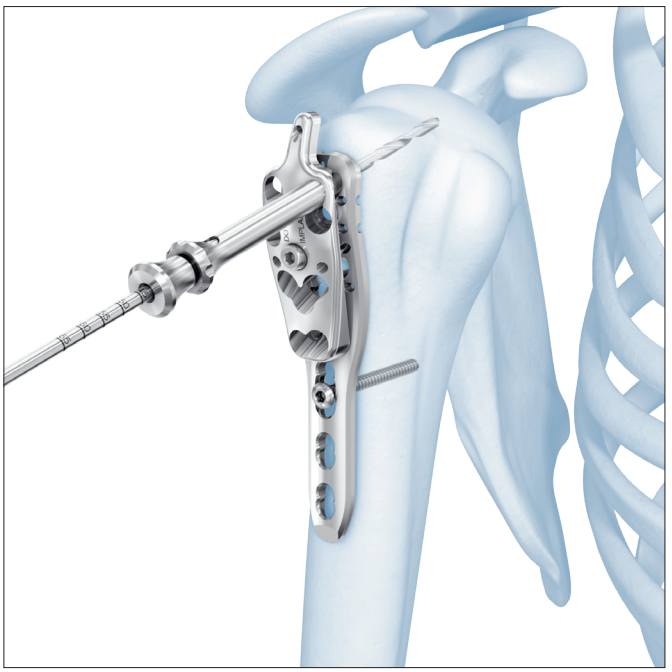


Proximal locking screws in normal bone
The following techniques are recommended for measuring screw length in normal bone.

Instruments	
03.122.053	Outer Sleeve for Insertion Guide
03.122.056	Insertion Guide with Nose
03.122.064	2.8 mm Drill Sleeve
314.115	StarDrive Screwdriver, T15
314.116	StarDrive Screwdriver Shaft, T15, self-retaining, quick coupling
324.214	2.8 mm Percutaneous Drill Bit, 200 mm, 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 drill sleeve, drill to the desired depth.

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

Precaution: **The plate should be secured with at least 4 proximal screws of Ø 3.5 mm. In poor bone stock, multiple fixation points using all screws is recommended.**

*Also available

7. Insert screws
Proximal locking screws in normal bone (continued)

Read the measurement directly from the calibrated drill bit.

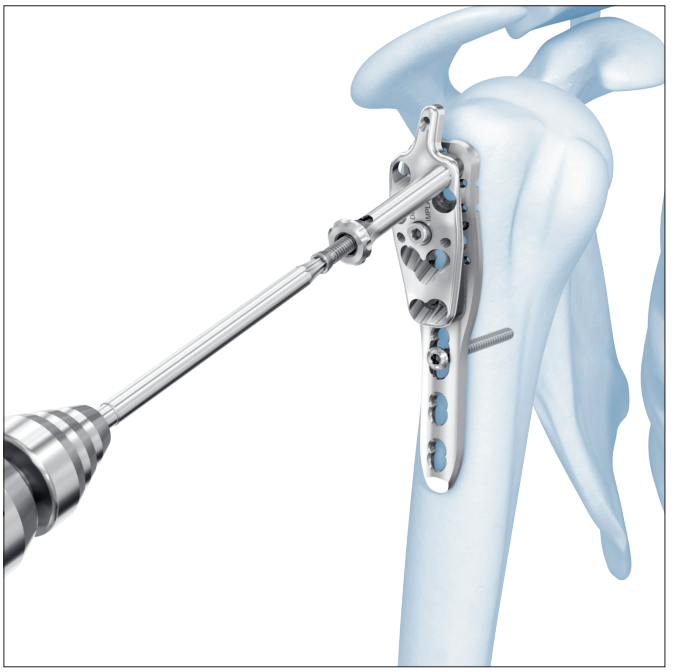
Note: **The drill bit tip should come as close as possible to the subchondral bone, approximately 5 mm–8 mm from the joint surface. Since it may not always be possible to feel the resistance from the subchondral bone, and the drill bit represents the final position of the locking screw, the use of image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

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

Remove the 2.8 mm drill sleeve.

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

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.**



Distal locking screw

Instrument	
312.648	2.8 mm Threaded Drill Guide

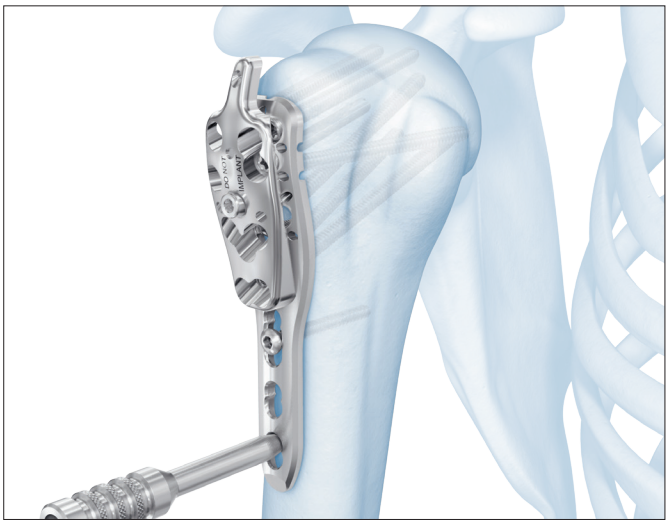
For proper drilling of the shaft holes, the 2.8 mm threaded drill guide must be used.

Thread the drill guide into the threaded part of the shaft hole.

Drill with the 2.8 mm drill bit and remove the drill guide.

Measure screw length with the depth gauge.

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



Distal standard screw
For nonlocking screws, use the standard AO screw insertion technique.

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

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

8

Remove insertion guide

ALTERNATIVE TECHNIQUE—SMALL FRAGMENT LCP INSTRUMENTS

1
Preparation

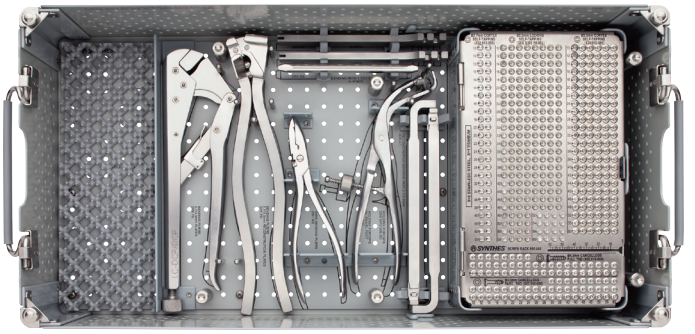
Required set	
105.434/ 145.434	Small Fragment LCP Instrument and Implant Set, with self-tapping screws (stainless steel or titanium)

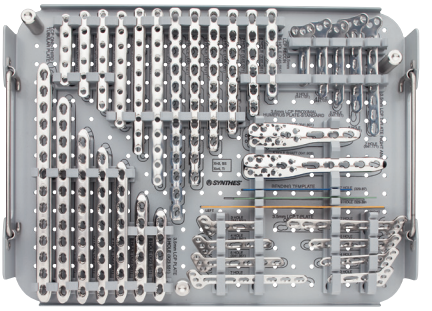
Optional sets	
105.90	Bone Forceps Set
105.954	Small Battery Drive Set, with 14.4 V Battery Pack
115.700	Large Distractor Set

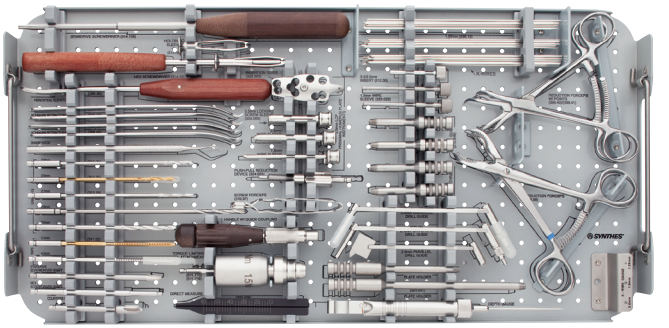
Optional instruments	
329.02	Bending Iron
329.30	Plate-Bending Press

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

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





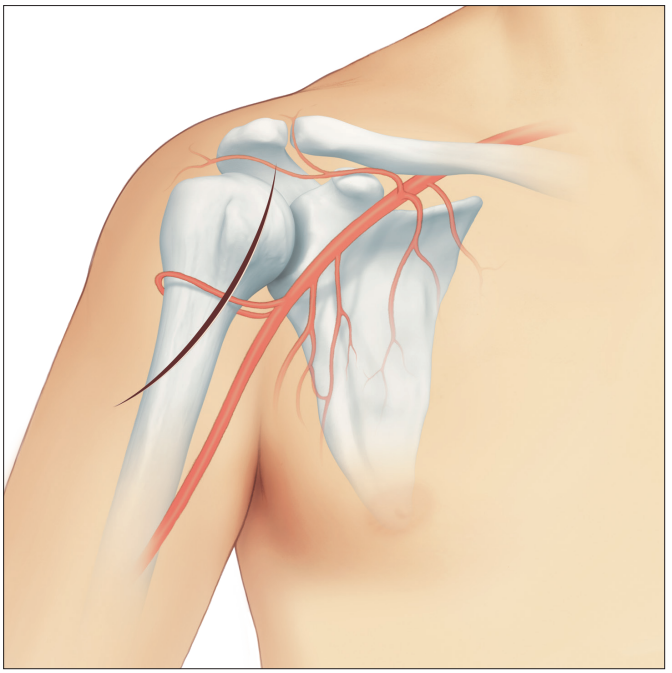


2

Patient position

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

3
Approach



The standard surgical approach for internal fixation of proximal humerus fractures is the interval between the deltoid and pectoral muscles proximally. 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, which proceeds 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, care should be taken to avoid damaging the vasculature of the bone fragments. Care should also be taken to avoid ligation or coagulation of the anterior circumflex humeral artery. This can normally be assured by keeping all dissection lateral to the intertubercular groove.

Note: **For information on open reduction approaches for proximal humerus, please refer to Rüedi TP and Murphy WM: *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.**

4
Reduce fracture

Instrument	
292.71	1.6 mm Kirschner Wire with Thread

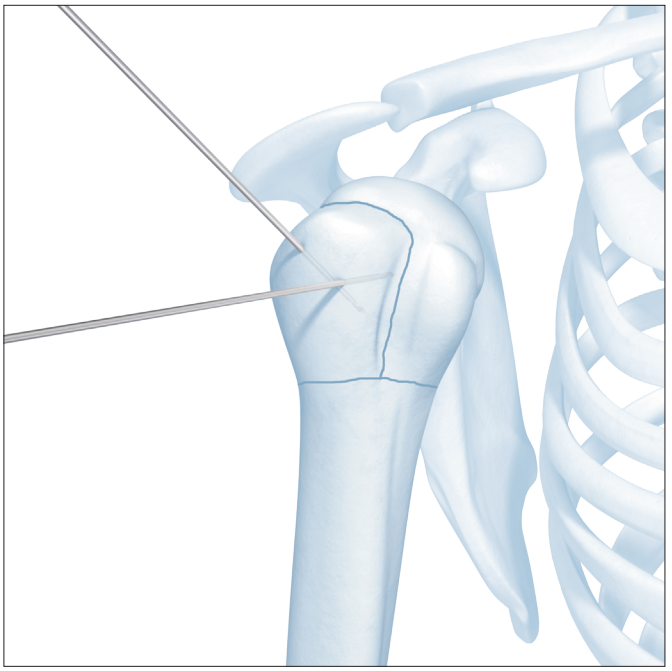
Reduce the fracture fragments and confirm the reduction under image intensification.

The humeral head and tuberosity fragments may be manipulated and provisionally fixed with sutures and/or K-wires. However, K-wires should be placed where they will not interfere with plate application.

Note: **The locking screws do not provide any compression for a lag screw effect. Therefore, humeral head fragments must be reduced, and any desired interfragmentary compression must be obtained prior to applying the 3.5 mm LCP 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.**



5
Attach insertion guide to plate

Instruments	
314.02	Small Hexagonal Screwdriver with Holding Sleeve
323.050	Insertion Guide

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.

Note: **The stability of the construct can be increased by the insertion of sutures. If sutures are to be used with the plate, they should be passed through the plate before attaching the insertion guide.**

Insertion guide: top view (left) and bottom view (right).

6

Position plate on bone

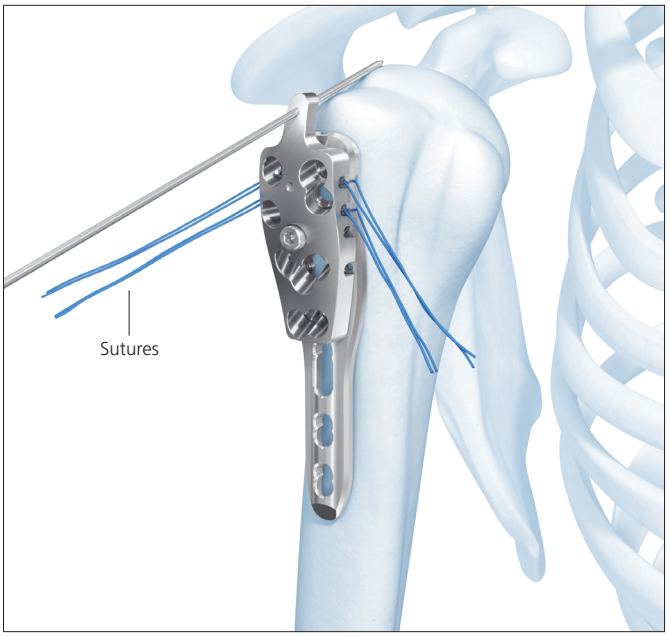
Instruments	
292.71	1.6 mm Kirschner Wire with Thread
323.053	3.5 mm Locking Screw Sleeve
323.054	2.8 mm Drill Sleeve
323.055	1.6 mm Wire Sleeve

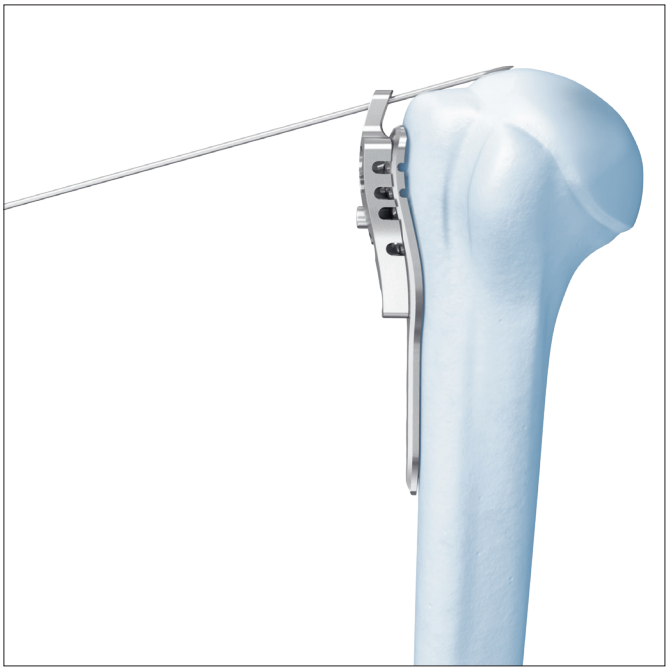
Positioning from AP view
The plate should be placed approximately 8 mm distal to the rotator cuff attachment on the upper edge of the greater tuberosity.

Determine plate position by placing a 1.6 mm K-wire through the proximal guide hole of the insertion guide so that the K-wire rests on top of the humeral head and aims at the proximal joint surface.

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.

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.**





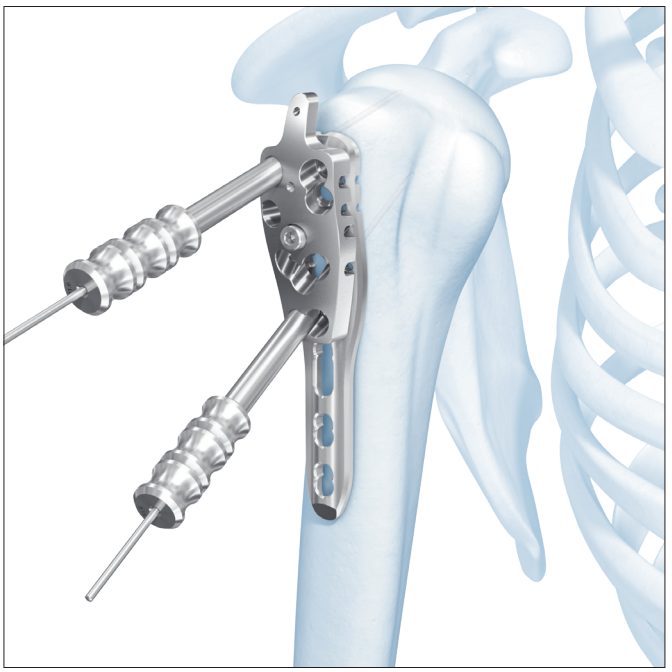
6. Position plate on bone (continued)

Positioning from a lateral view
The plate should be centered against the lateral aspect of the greater tuberosity, ensuring that a sufficient gap is maintained between the plate and the long biceps tendon (to avoid interfering with arterial blood supply).

To check final placement of the plate, 1.6 mm K-wires and two sleeve assemblies can be used: one in the hole for the most proximal screw and one in the hole for the most distal screw to be placed in the humeral head. If possible, the distal K-wire should be positioned approximately 5 mm above the calcar.

Additional considerations for long plates
The additional length of the long plates will usually require a plan for handling the deltoid insertion distally. Depending on the length of the plate used, a slightly anterior placement of the distal shaft, contouring of the plate shaft to wrap anteriorly around the humerus, or partial elevation of the deltoid insertion may be required.

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



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.


323.053


323.054


323.055

Instruments	
292.71	1.6 mm Kirschner Wire with Thread, 150 mm
323.025	Direct Measuring Device
323.050	Insertion Guide
323.053	3.5 mm Locking Screw Sleeve
323.054	2.8 mm Drill Sleeve
323.055	1.6 mm Wire Sleeve

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

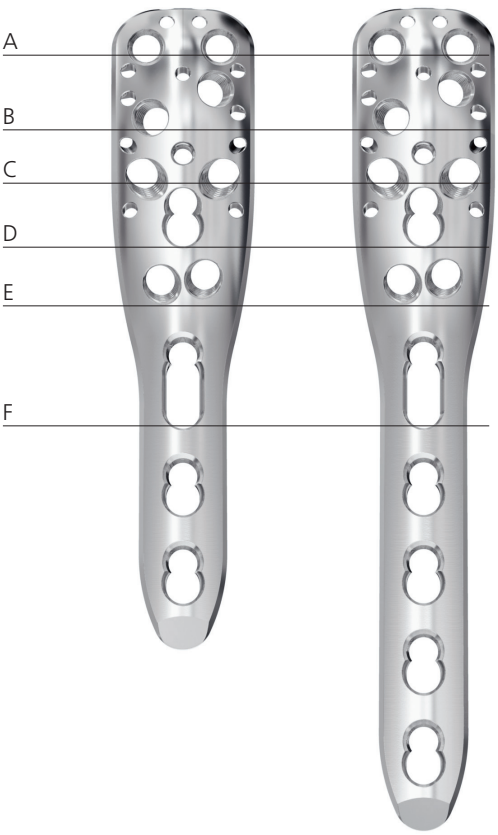
Insertion of a proximal screw first
This technique permits fixation of the proximal fragments first and then fixation with or without compression distally.

It is necessary to control the height of the plate in the AP view under image intensification before insertion of the screws.

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 into the compression portion of hole F (elongated hole) of the standard plate, or in any of the elongated holes of a long plate. After making a final height adjustment, insert proximal locking screws.



7. Insert screws (continued)

Proximal locking screw insertion

Insert the 3.5 mm locking screw sleeve, the 2.8 mm drill sleeve, and the 1.6 mm wire sleeve into the insertion guide.

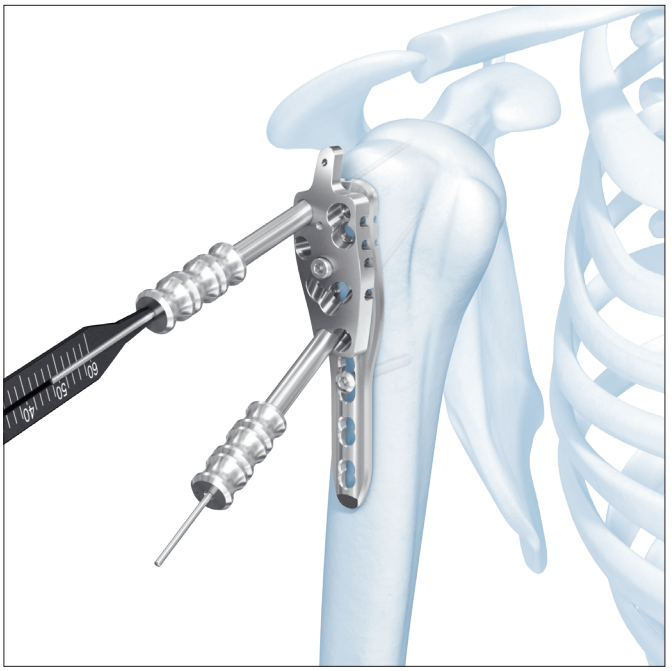
Insert a 1.6 mm K-wire through the sleeve assembly. Stop when increased resistance from the subchondral bone is felt. Since it may not always be possible to feel this resistance, the use of image intensification is recommended.

Note: **The K-wire tip should come as close as possible to the subchondral bone, approximately 5 mm–8 mm from the joint surface.**

Slide the direct measuring device over the K-wire and push it against the sleeve assembly.

Note: **All three sleeves must be present. The direct measuring device provides an approximate screw length.**

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

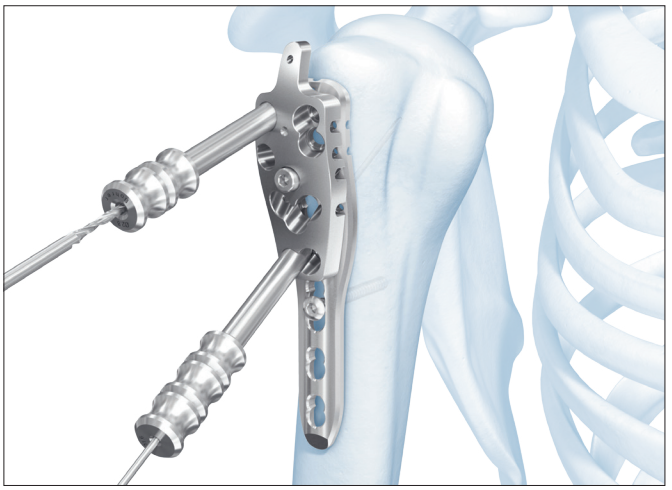


Instruments

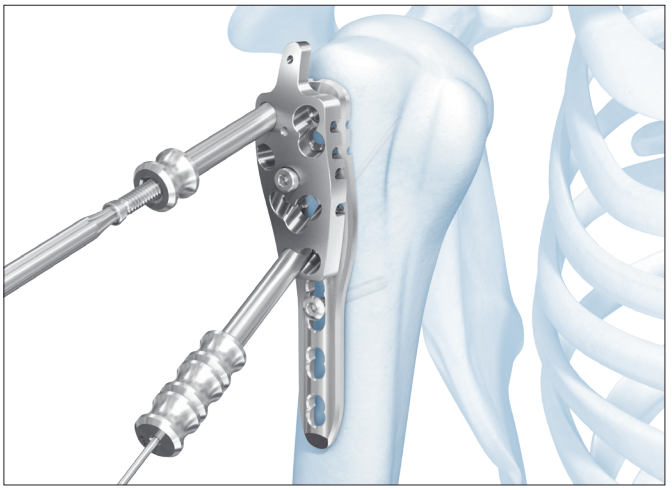
310.288	2.8 mm Drill Bit
314.115	StarDrive Screwdriver, T15
314.116	StarDrive Screwdriver Shaft, T15
511.776*	Torque Limiting Attachment

Remove the K-wire and the K-wire centering sleeve.

Drill the near cortex with the 2.8 mm drill bit through the drill sleeve. Remove the drill sleeve.



Use the StarDrive Screwdriver to insert the appropriate length locking screw through the 3.5 mm locking screw sleeve.



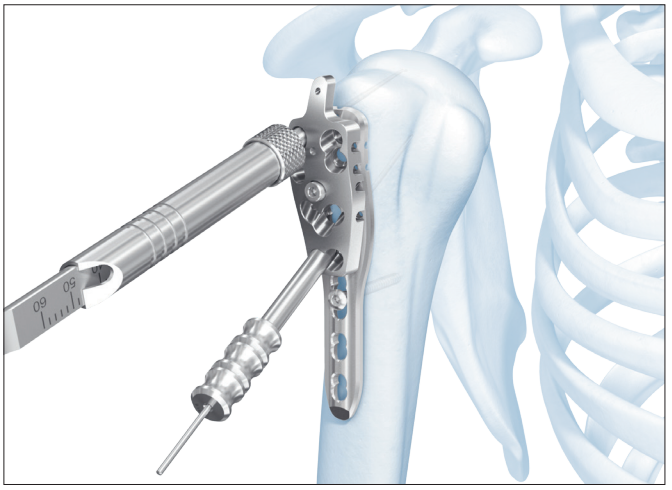
Note: **Since it may not always be possible to feel resistance from the subchondral bone, and the drill bit represents the final position of the locking screw, the use of image intensification is recommended.**

Warning: **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.**

Alternative instrument

319.01	Depth Gauge

The depth gauge may also be used to determine screw length. This depth gauge will give an approximate measurement for the proximal screws when used through the insertion guide and will give an approximate measurement for the distal screws when placed against the plate. To ensure that the screw tip is a sufficient distance from the joint surface, 10 mm should be deducted from depth gauge readings for the proximal screw.

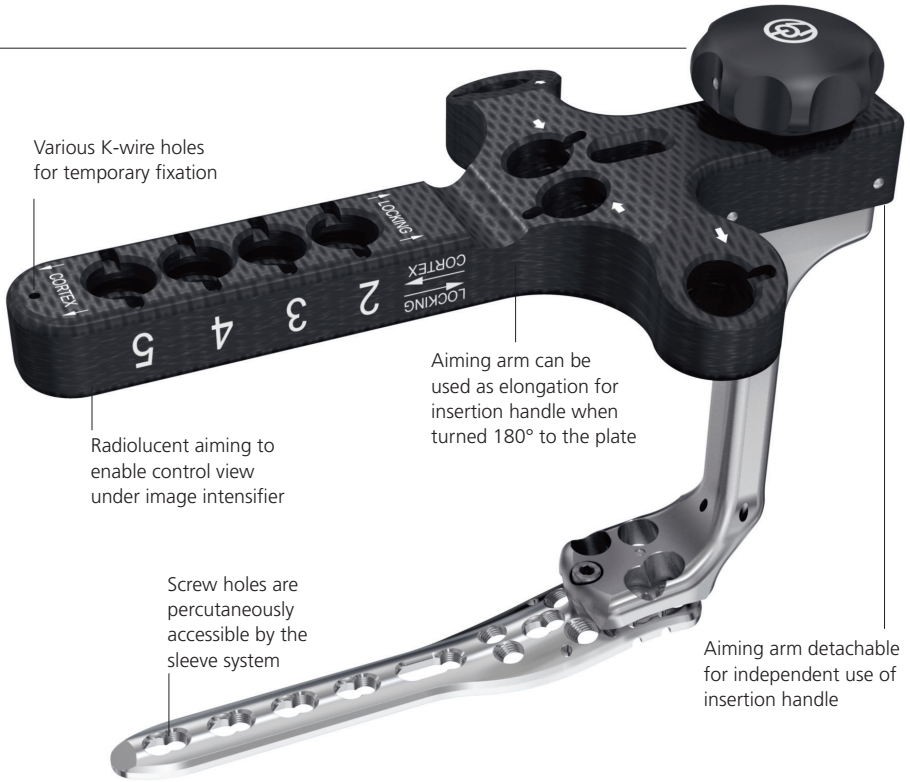


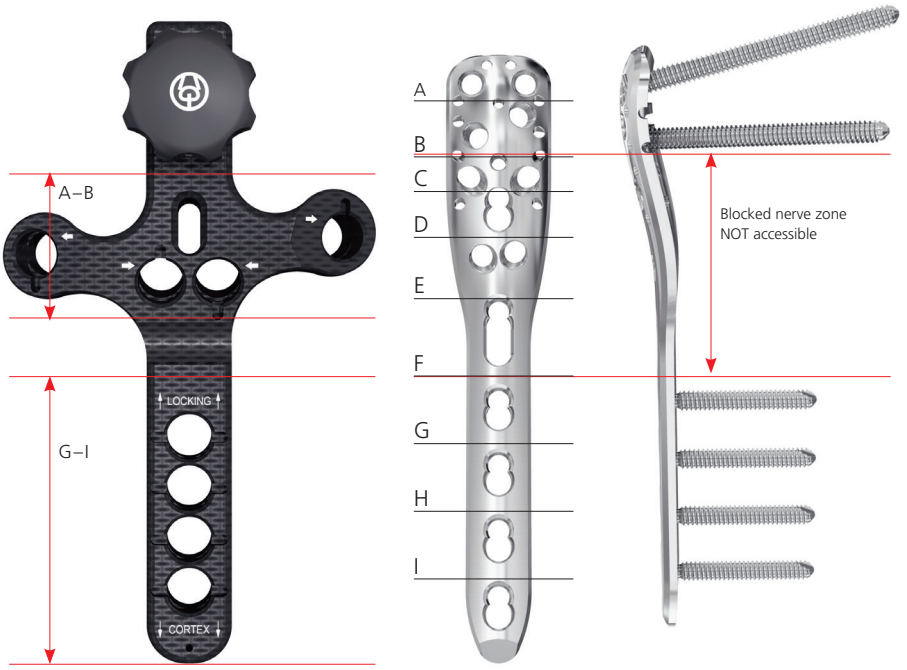
*Also available

ALTERNATIVE TECHNIQUE—LCP PERCUTANEOUS AIMING SYSTEM

The design of the LCP Percutaneous Aiming System and technique facilitate less invasive plate fixation of the proximal humerus via the transdeltoid approach, while reducing the risk of interfering with the axillary nerve.

To protect the axillary nerve, screw levels C–F are blocked. Screw holes in these sections cannot be accessed through the LCP Percutaneous Aiming System.





The Sleeve System

- Screw holes are accessible by sleeve system for percutaneous screw insertion
- Outer sleeves snap into the aiming arm for quick assembly and removal
- Different drill sleeves for locking and cortex screw insertion
- Color-coding facilitates system orientation

1. 2.8 mm Percutaneous Threaded Drill Guide
2. 1.6 mm Percutaneous Threaded Wire Guide
3. Neutral Drill Guide, for 3.5 mm cortex screws
4. Compression Drill Guide, for 3.5 mm cortex screw
5. Trocar with Handle, for use with outer sleeve for 3.5 mm LCP Percutaneous Aiming System
6. Optional: Handle for Percutaneous Threaded Drill Guides (03.113.014)
7. Outer Sleeve, for 3.5 mm LCP Percutaneous Aiming System, self-retaining, small

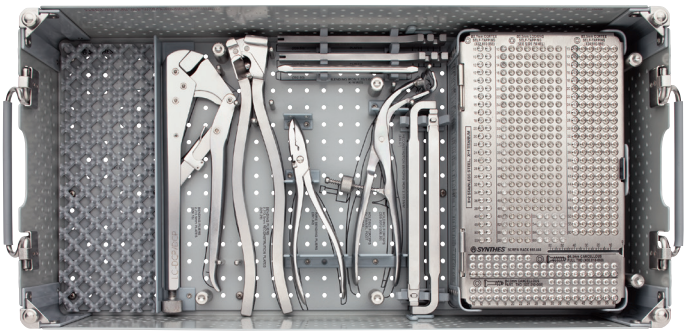
1
Preparations

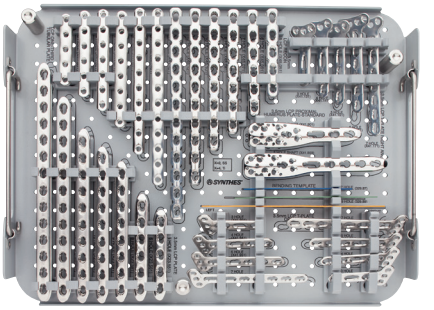
Required sets	
105.434/ 145.434	Small Fragment LCP Instrument and Implant Set, with self-tapping screws (stainless steel or titanium)
01.113.005	LCP Small Fragment Percutaneous Instrument Set

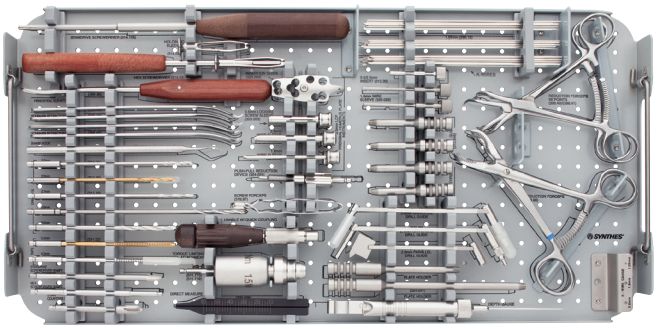
Optional sets	
105.90	Bone Forceps Set
105.954	Small Battery Drive Set, with 14.4 V Battery Pack
115.700	Large Distractor Set

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

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







2

Position patient

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

A lateral side table is recommended to place the abducted arm and to relax the deltoid muscle.

Ensure the fluoroscope is located to allow visualization of the proximal humerus in two axes (AP and lateral/axial).

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

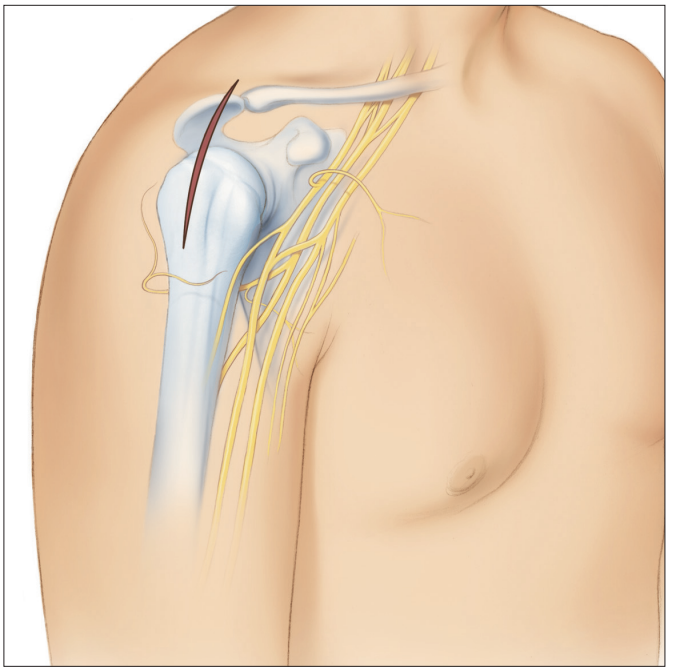
3

Approach

Perform a transdeltoid approach. Begin the incision at the anterolateral tip of the acromion and extend it about 4 cm distally over the deltoid muscle.

Precaution: **The axillary nerve runs approximately transverse at the level of the surgical neck.**

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



4

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.

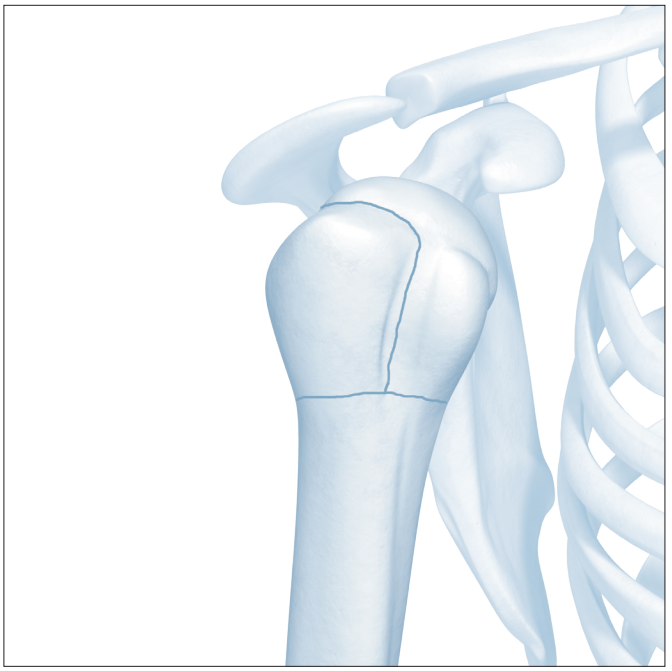
- Reduce the head fragments and check the reduction under imaging.

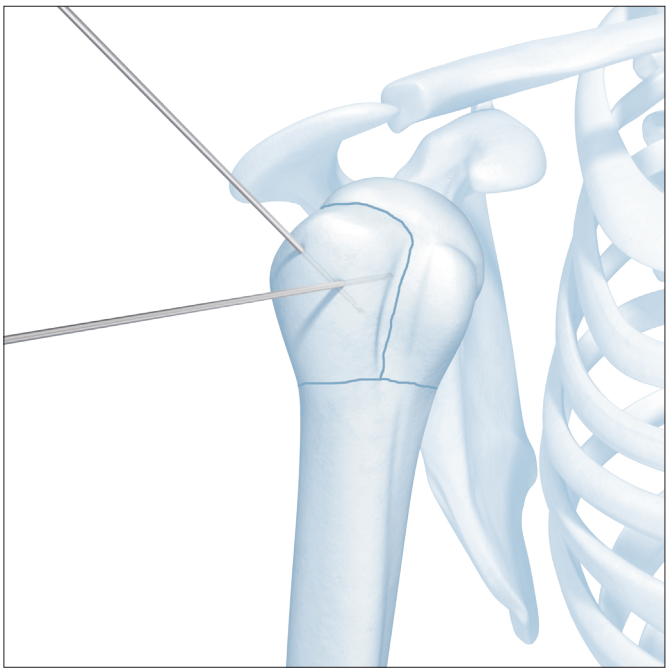
K-wires can be used as joysticks in the fragments for reduction and for temporary fixation. Ensure that K-wires do not interfere with correct plate placement.

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.

Provisionally reduce the tuberosities using sutures through the insertions of the subscapularis, infraspinatus, and supraspinatus. The sutures will help to maintain the stability of the reconstruction when fixing them to the plate later.

The insertion of sutures is especially recommended in weak bone where only short screws can be used because of the risk of penetration through settling.





5

Prepare plate position

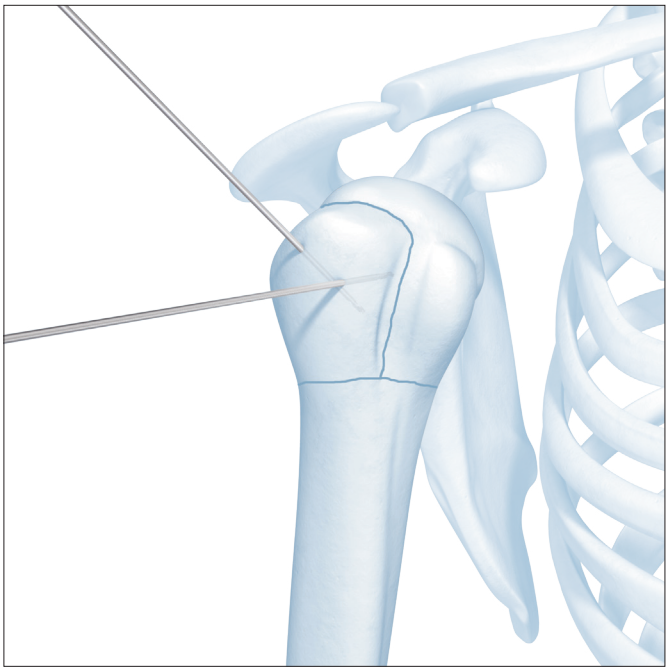
For optimal plate positioning, insert two positioning K-wires, 2 mm–4 mm lateral to the bicipital groove and 5 mm–7 mm below the tip of the greater tuberosity.

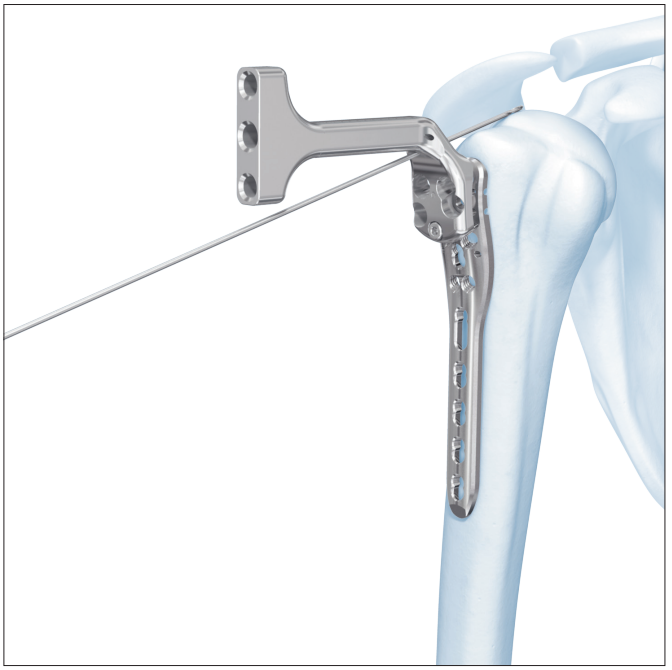
Precaution: **Placing the plate too high increases the risk of subacromial impingement. Placing the plate too low can prevent the optimal distribution of screws in the humeral head.**

Alternative technique

Instruments	
03.122.007	Aiming Arm for LCP Proximal Humerus Plate
03.122.035	Insertion Handle for LCP Proximal Humeral Plate, StarDrive

Determine the position of the plate using a K-wire. Assemble the aiming system as described in Step 6. Insert the K-wire into the proximal guide hole of the insertion handle (analogous to the proximal guide hole of the aiming block) below the rotator cuff, so that the K-wire aims at the proximal joint surface.





6

Assemble aiming system

Instruments	
03.113.019	StarDrive Screwdriver Shaft, 165 mm
03.113.021	StarDrive Screwdriver, T15, self-retaining, 272 mm
03.122.007	Aiming Arm for LCP Proximal Humerus Plate
03.122.035	Insertion Handle for LCP Proximal Humerus Plate, StarDrive

Attach the insertion handle to the plate by aligning the stabilization pin of the insertion handle with the connection hole in the plate. Use the appropriate screwdriver to tighten the connecting screw of the insertion handle and securely connect the insertion handle to the plate.

Note: **The aiming arm can be connected to the insertion handle before or after plate insertion. The proximal screws may be inserted through the aiming arm, or through the insertion handle using the insertion handle as a guide.**

The following technique describes insertion of proximal screws through the aiming arm.

Precautions:

- **Intraoperative bending of the proximal portion of the plate is not recommended for maintaining proper alignment between the aiming device and the plate.**
- **Do not attempt to use the LCP Percutaneous Aiming System with longer Proximal Humerus Plates.**

7

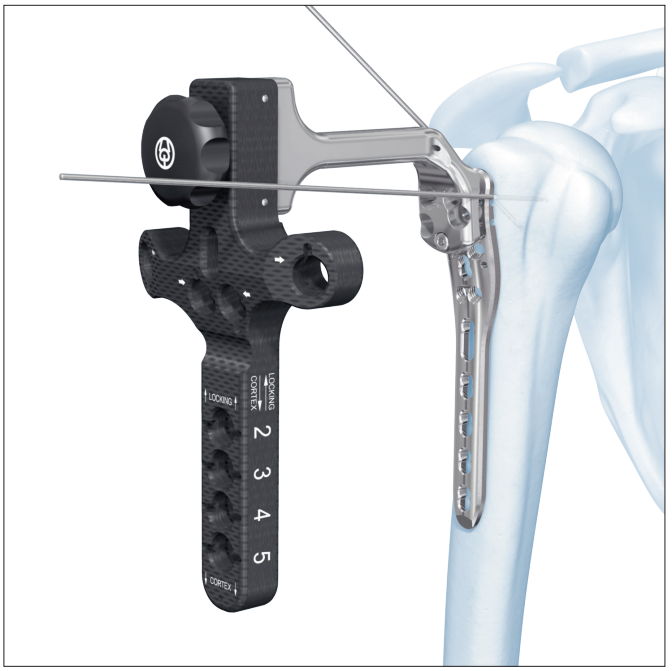
Insert plate

Caution:

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

Slide the plate into the subdeltoid space and along the bone. Always keep the plate in contact with the bone.

Precaution: Do not use the insertion handle and the plate for soft tissue retraction, or for release or dissection of the deltoid insertion.



8

Position and align plate

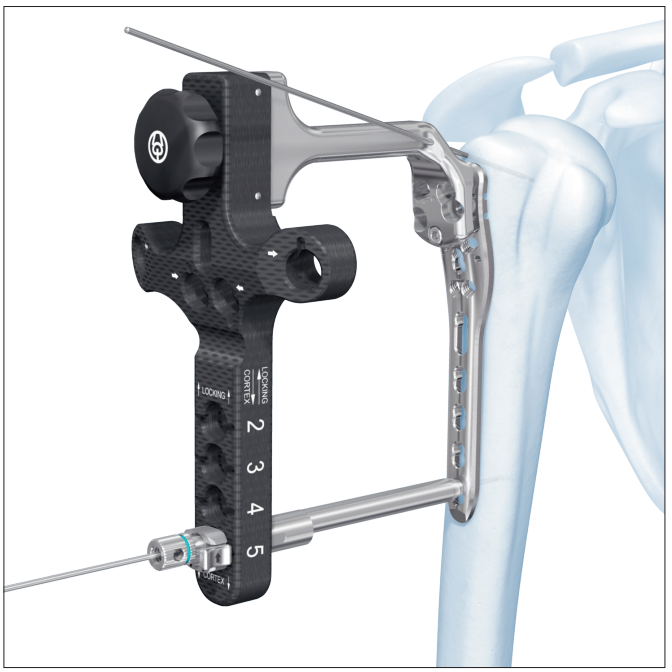
Optional instruments	
02.113.001	1.6 mm Threaded Tip Guide Wire, 200 mm
03.113.009	Outer Sleeve, for 3.5 mm LCP Percutaneous Aiming System, self-retaining, small
03.113.022	1.6 mm Percutaneous Threaded Wire Guide

Position the plate between the positioning K-wires described in Step 4.

Ensure the plate shaft is aligned with the bone. To aid this alignment, a K-wire can be placed through the insertion handle. Alternatively, plate alignment can be palpated through the skin.

Provisionally fix the plate to the bone, using the K-wire holes in the aiming device and wire sleeves, if needed. Insert the K-wires monocortically to ensure they do not constrain subsequent movement.

Important: **It is advisable to thread the sutures of the infraspinatus, supraspinatus, and the subscapularis tendon through the suture holes in the plate before placing the plate on the bone.**



9

Determine proximal screw lengths

Instruments	
02.113.001	1.6 mm Threaded Tip Guide Wire, 200 mm
03.113.009	Outer Sleeve, for 3.5 mm LCP Percutaneous Aiming System, self-retaining, small
03.113.022	1.6 mm Percutaneous Threaded Wire Guide
323.060	Direct Measuring Device

Warning: **To prevent primary or secondary screw penetration, do not drill through the joint surface.**

Insert the outer sleeve into one of the proximal holes of the aiming arm (section "A" and "B" in the plate; see page 28). The arrows on the sleeve should point in the same direction as the arrow next to the hole in the aiming arm.

Add the percutaneous threaded wire guide (aqua mark) and insert a 1.6 mm threaded tip guide wire.

Check the position of the K-wire by image intensification in several planes. Verify it does not perforate the articular surface.

Note: **The tip of the K-wire should be located in the subchondral bone (approximately 5 mm below the joint surface).**

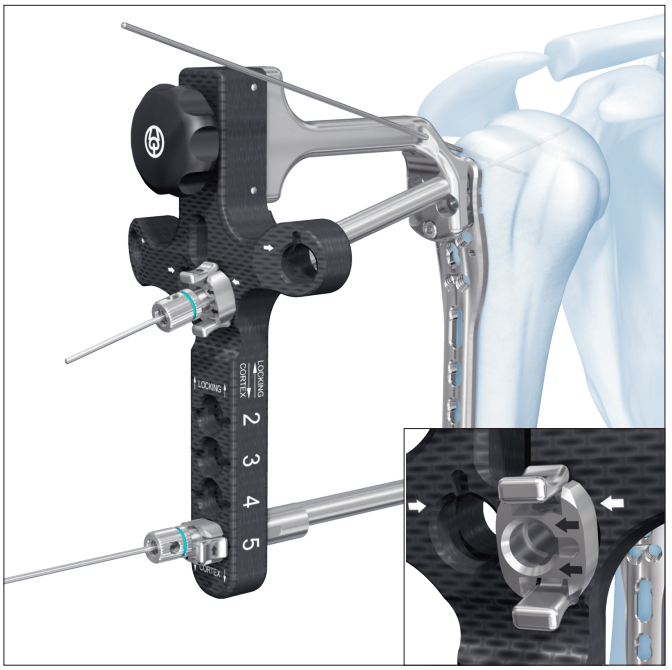
Slide the direct measuring device over the K-wire and determine the required screw length.

Alternatively, read the required screw length on the drill bit, as described in Step 10.

Note: **Always use a 1.6 mm threaded tip guide wire with the sleeves of the aiming system.**

Warnings:

- **Do not penetrate the joint surface with the K-wires.**
- **Do not insert overly long screws in order to prevent primary or secondary screw penetration.**



10

Insert proximal screws

Instruments	
03.113.009	Outer Sleeve, for 3.5 mm LCP Percutaneous Aiming System, self-retaining, small
03.113.019	StarDrive Screwdriver Shaft, 165 mm
03.113.020	2.8 mm Percutaneous Threaded Drill Guide
03.113.021	StarDrive Screwdriver, T15, self-retaining, 272 mm
03.113.024	2.8 mm Calibrated Drill Bit (with stop)
311.431	Large Handle with quick coupling
511.773	Torque Limiting Attachment, 1.5 Nm, quick coupling

Remove the direct measuring device, K-wire, and threaded wire guide. Insert the locking threaded drill guide (black mark) and predrill the screw hole, using the 2.8 mm drill bit. Remove the drill bit and drill guide.

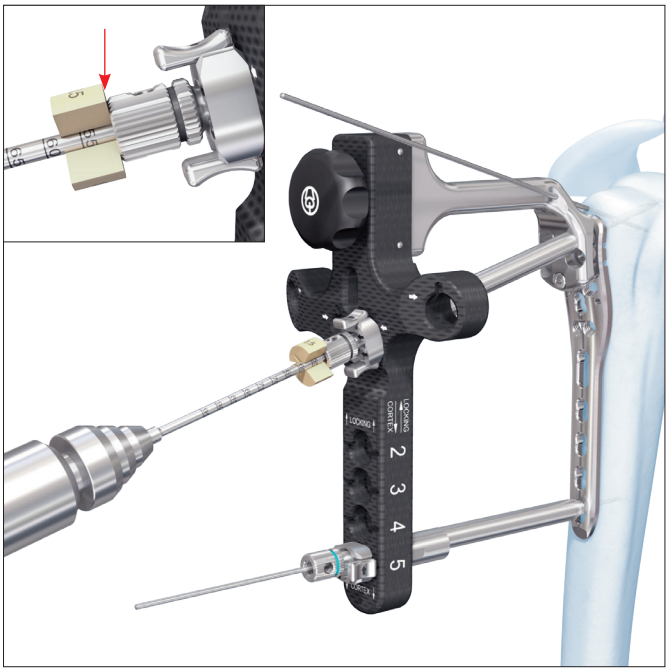
Warning: **Do not push the drill bit through the joint surface.**

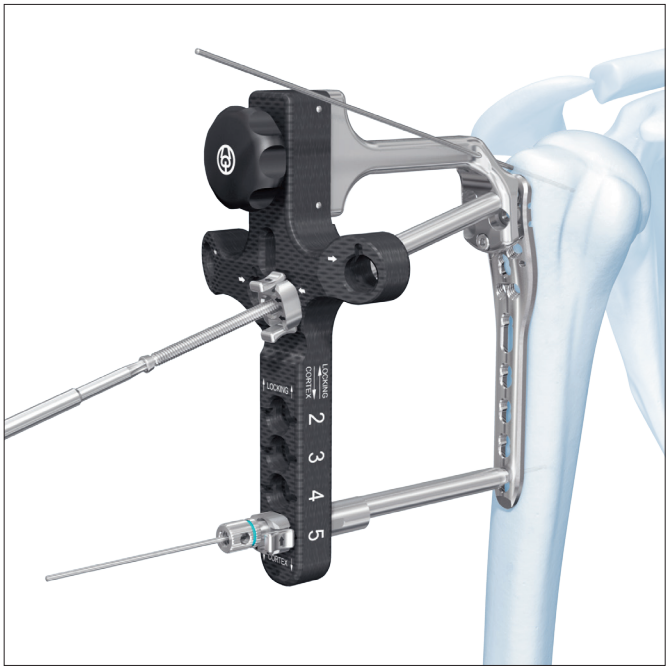
Note: **The drill stop is designed to ride up against the percutaneous drill guide. The side of the stop facing the drill guide indicates the correct drilling depth as shown.**

Warning: **In osteoporotic bone, it is recommended to predrill only the lateral cortex.**

Use the StarDrive Screwdriver shaft to insert the appropriate length locking screw through the outer sleeve.

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.**





Repeat the above steps for all required proximal screw holes.

Precaution: **The plate should be secured with all 4 proximal screws.**

11

Insert shaft screws

Instruments	
03.113.009	Outer Sleeve, for 3.5 mm LCP Periarticular Aiming System, self-retaining, small
03.113.010	Trocar with Handle for use with Outer Sleeve, for 3.5 mm LCP Periarticular Aiming System
03.113.012	Neutral Drill Guide for 3.5 mm Cortex Screws
03.113.013	Compression Drill Guide for 3.5 mm Cortex Screws
03.113.019	StarDrive Screwdriver Shaft, 165 mm
03.113.020	2.8 mm Percutaneous Threaded Drill Guide
03.113.021	StarDrive Screwdriver, T15, self-retaining, 272 mm
03.113.023	2.5 mm Calibrated Drill Bit (with stop)
03.113.024	2.8 mm Calibrated Drill Bit (with stop)
311.431	Large Handle with quick coupling
314.55	Small Hexagonal Screwdriver Shaft, long
314.57	Small Hexagonal Screwdriver, long
511.773	Torque Limiting Attachment, 1.5 Nm, quick coupling

Note: **To protect the axillary nerve, the plate holes in section C to F (see page 12) can not be accessed percutaneously through the aiming arm.**

Attach the aiming arm to the insertion handle.

Sleeve System Technique
Insert the outer sleeve through the aiming arm.

Precautions:
- **If a cortex screw will be used, the arrows on the sleeve should correspond to the arrow under the etched "CORTEX" on the aiming arm.**
- **If a locking screw will be used, ensure the arrows on the sleeve correspond to the arrow under the etched "LOCKING" on the aiming arm.**

Cortex

Locking

Make a small skin incision, and use the outer sleeve with the trocar to stab down to the plate.

Note: If necessary, mark the incision point on the skin with a marker and remove the aiming arm to obtain good access and visibility during blunt dissection.

Insert cortex screws

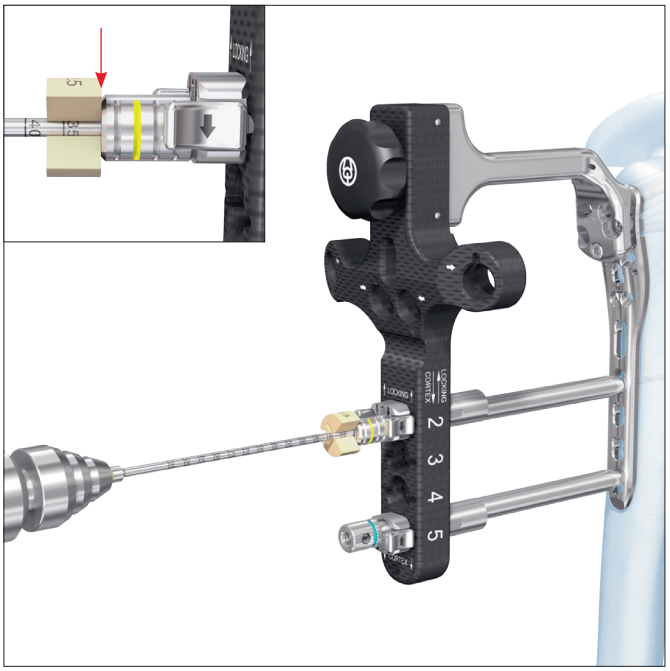
Precaution: To ensure plate-device alignment, the aiming arm must be locked to the plate on both ends. An outer sleeve and a threaded drill guide must be threaded into the most distal locking hole, to create a stable box.

Insert the neutral drill guide (yellow mark, neutral) into the outer sleeve.

Use the 2.5 mm drill bit (yellow mark) to drill toward the far cortex. Verify drill depth under radiograph. Read the calibration directly from drill bit and select the appropriate screw.

Option: If interfragment compression is required, use the compression drill guide (yellow mark, load) for predrilling the hole. This technique, using the compression drill guide, is analogous to the technique for standard LC-DCP® Plates, using the LC-DCP Drill Guide.

Note: The drill stop is designed to ride up against the percutaneous drill guide. The side of the stop facing the drill guide indicates the correct drilling depth as shown.



Insert locking screws

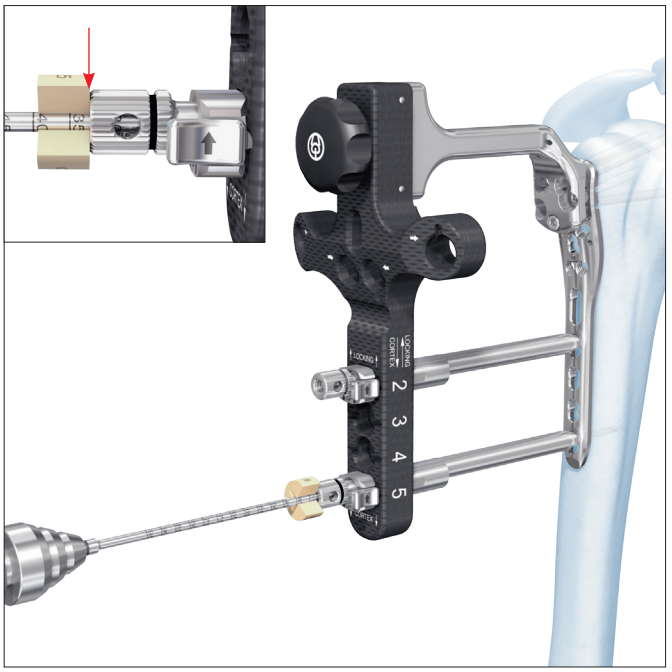
Screw the threaded drill guide (black mark) through the outer sleeve into the threaded section of the desired Combi hole.

Use the 2.8 mm drill bit (black mark) to drill toward the far cortex. Verify drill depth under radiograph. Read the calibration directly from drill bit and select the appropriate screw.

Note: **The drill stop is designed to ride up against the percutaneous drill guide. The side of the stop facing the drill guide indicates the correct drilling depth as shown.**

Use the StarDrive Screwdriver shaft to insert the appropriate length locking screw through the outer sleeve.

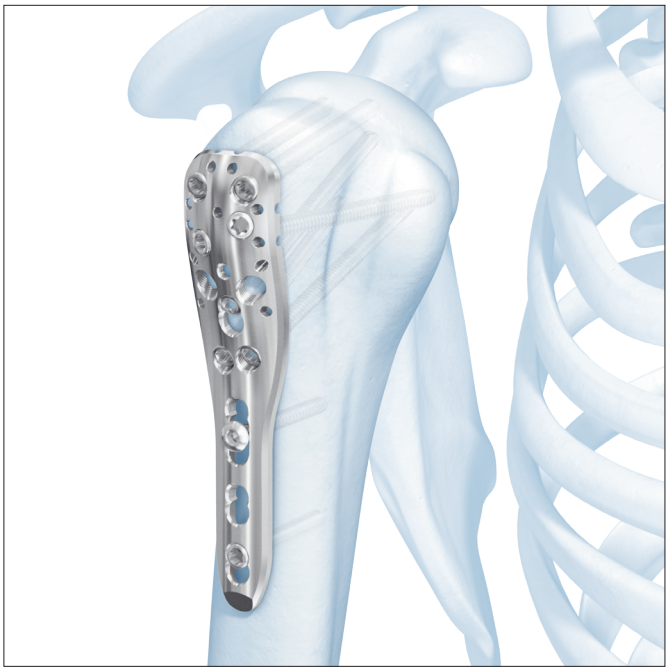
Warning: **Locking screws should be inserted under power using the torque limiting attachment. The audible click will notify the surgeon that the maximum torque value has been reached and that power insertion is complete.**



12

Remove aiming arm

Remove the sleeves and aiming arm assembly from the plate.



13

Suture attachment

Knot the sutures through the designated holes in the plate. This construct functions as a tension band and transmits the forces of the rotator cuff over the plate into the shaft, and serves to prevent fragment displacement during the early rehabilitation period.

14

Final check

Before closing the wound, check screw lengths and the stability of the suture fixation. Check screws under imaging in the full range of glenohumeral motion and ensure they do not penetrate the articular surface. The sutures must not rupture during motion.

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

IMPLANT REMOVAL

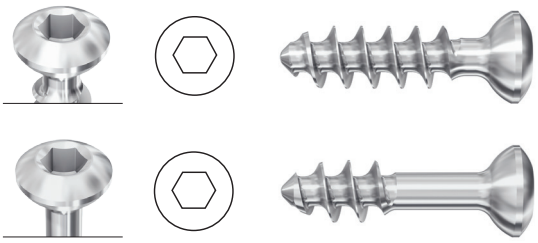
Implant removal

To remove locking screws, unlock all screws from the plate and then begin to remove the screws completely from the bone. This avoids rotation of the plate when removing the last locking screw.

SCREWS USED WITH THE 3.5 MM LCP PROXIMAL HUMERUS PLATE

Stainless Steel and Titanium

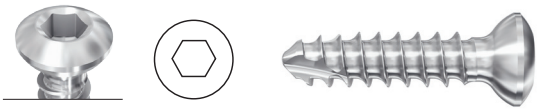
4.0 mm Cancellous Bone Screws
Found in the Small Fragment LCP Set
- May be used in the DCU portion of the Combi holes
- Compress the plate to the bone or create axial compression
- Fully or partially threaded shaft



4.0 mm Cortex Screws
Found in the 4.0 mm Cortex Screw, self-tapping, Instrument and Implant Set (105.405)
- May be used in the DCU portion of the Combi holes
- Compress the plate to the bone
- Stainless steel only

3.5 mm Locking Screws
Found in the Small Fragment LCP Set
- Used in the locking portion of the Combi holes or in round locking holes
- Create a locked, fixed-angle screw/plate construct
- Self-tapping tip
- Stainless steel and titanium alloy (Ti-6Al-7Nb)

3.5 mm Cortex Screws
Found in the Small Fragment LCP Set
- May be used in the DCU portion of the Combi holes
- Compress the plate to the bone or create axial compression



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

Except where otherwise noted, screws are available in implant-quality 316L stainless steel and commercially pure (CP) titanium.

3.5 MM LCP PROXIMAL HUMERUS PLATES

Stainless Steel and Titanium

Standard plates

241.901
441.901

241.903
441.903

Long plates*

241.918
441.918

241.919
441.919

241.921
441.921

241.923
441.923

241.925
441.925

***Precaution:** Do not attempt to use the LCP Percutaneous Aiming System with longer Proximal Humerus Plates.

241.xxx: implant-quality 316L stainless steel
441.xxx: titanium alloy (Ti-6Al-7Nb)

SELECTED INSTRUMENTS (FROM SET 01.122.033)

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	
03.122.056	Insertion Guide With Nose	
03.122.064	2.8 mm Drill Sleeve	
03.122.065	1.6 mm Wire Sleeve	

SELECTED INSTRUMENTS (FROM SET 105.434 OR 145.434)

292.71	1.6 mm Kirschner Wire with Thread, 150 mm, 5 mm thread length	
310.288	2.8 mm Drill Bit, quick coupling, 165 mm	
312.648	2.8 mm Threaded Drill Guide	
314.02	Small Hexagonal Screwdriver with Holding Sleeve	
314.115	StarDrive Screwdriver, T15, self-retaining	
319.01	Depth Gauge	

SELECTED INSTRUMENTS (FROM SET 105.434 OR 145.434)

323.025	Direct Measuring Device	
323.050	Insertion Guide	
323.053	3.5 mm Locking Screw Sleeve	
323.054	2.8 mm Drill Sleeve	
323.055	1.6 mm Wire Sleeve	

ALSO AVAILABLE INSTRUMENTS

03.122.057	Insertion Guide Without Nose	
03.122.058	Threaded Drill Sleeve for Depth Probe	

INSTRUMENTS FOR LCP PERCUTANEOUS AIMING SYSTEM

02.113.001	1.6 mm Threaded Tip Guide Wire, 200 mm	
03.113.009	Outer Sleeve, for 3.5 mm LCP Percutaneous Instrument System	
03.113.010	Trocar with Handle, for 3.5 mm LCP Percutaneous Instrument System	
03.113.012	Neutral Drill Guide, for 3.5 mm LCP Percutaneous Instrument System	
03.113.013	Compression Drill Guide, for 3.5 mm LCP Percutaneous Instrument Set	
03.113.014	Handle, for Percutaneous Threaded Drill Guides	

03.113.019	StarDrive Screwdriver Shaft, 165 mm	
03.113.020	2.8 mm Percutaneous Threaded Drill Guide	
03.113.021	StarDrive Screwdriver, T15, self-retaining, 272 mm	
03.113.022	1.6 mm Percutaneous Threaded Wire Guide	
03.113.023	2.5 mm Calibrated Drill Bit, quick coupling, 250 mm/95 mm	
03.113.024	2.8 mm Calibrated Drill Bit, quick coupling, 250 mm/95 mm	
03.113.030◊	3.1 mm Drill Bit for 3.7 mm Dynamic Locking Screw	
03.113.031	3.1 mm Drill Guide for 3.7 mm Dynamic Locking Screw	

◊Available non-sterile or non-sterile packed.
Add S to product number for sterile product.

03.122.007	Aiming Arm for LCP Proximal Humerus Plate	
03.122.035	Insertion Handle for LCP Proximal Humerus Plate, StarDrive	
314.55	Small Hexagonal Screwdriver Shaft, long	
314.57	Small Hexagonal Screwdriver, long	
323.060	Direct Measuring Device	

3.5 MM LCP LONG PROXIMAL HUMERUS PLATE IMPLANT SETS

Stainless Steel (01.109.602) and Titanium (01.109.604)

Graphic Case

690.441	3.5 mm LCP Long Proximal Humerus Plate Set Graphic Case

Implants

3.5 mm LCP Proximal Humerus Plates, long

Stainless Steel	Titanium	Holes	Length (mm)
241.918	441.918	5	142
241.919	441.919	6	160
241.921	441.921	8	196
241.923	441.923	10	232
241.925	441.925	12	268

3.5 mm LCP Proximal Humerus Plates, standard*
(in set 105.434/145.434)

Stainless Steel	Titanium	Holes	Length (mm)
241.901	441.901	3	90
241.903	441.903	5	114

Required Sets

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

Optional Sets

105.90	Bone Forceps Set
105.954	Small Battery Drive Set, with 14.4 V Battery Pack
115.700	Large Distractor Set

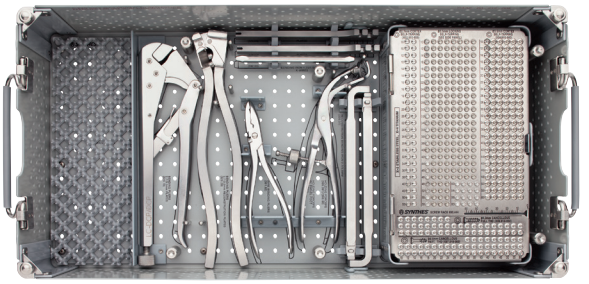
Optional Instruments

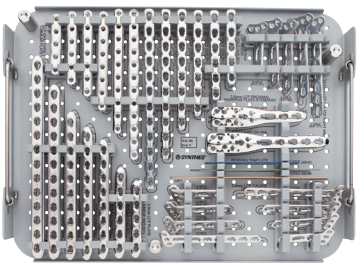
329.02	Bending Iron
329.30	Plate-Bending Press
511.776	Torque Limiting Attachment, 0.8 Nm, quick coupling

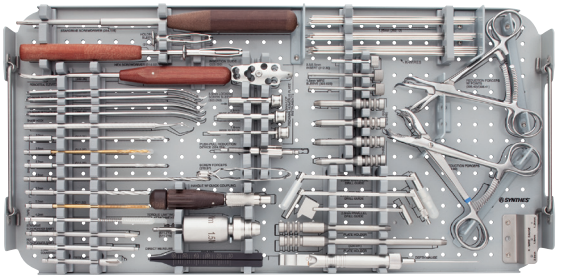
*Also available.

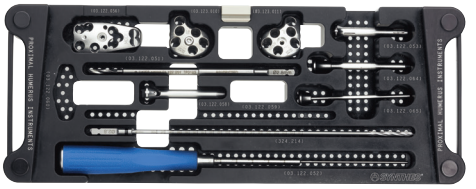
Note: For additional information, please refer to the package insert or www.e-ifu.com.

For detailed cleaning and sterilization instructions, please refer to www.depuysynthes.com/hcp/cleaning-sterilization or sterilization instructions, if provided in the instructions for use.



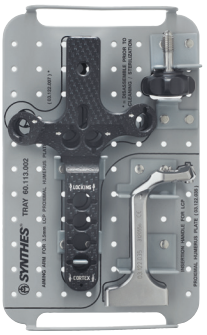






ALSO AVAILABLE

01.113.005	3.5 mm LCP Small Fragment Percutaneous Instrument System
61.113.001	Graphic Case, for 3.5 mm LCP Percutaneous Instrument System
61.113.002	Proximal Humerus Aiming Arm Pullout Tray, for 60.113.001



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