

Surgical Technique



3.5
mm Screws

4.3
mm Screws

Acumed® is a global leader of innovative orthopaedic and medical solutions.



We are dedicated to developing products, service methods, and approaches that improve patient care.



Acumed® Polarus® 3 Solution

Plates and Nails

The Acumed Polarus 3 Solution is a comprehensive system designed to treat proximal humerus fractures with an array of plate and nail options. The system introduces a number of improvements to both the implants and the instrumentation when compared to prior generations.

Indications for Use

The Acumed Polarus 3 Solution includes plates, nails, screws, and accessories designed to address fractures, fusions, and osteotomies of the humerus.

Note: While they are provided together for convenience, a plate and a nail should not be used on the same fracture.



	Definition
Warning	Indicates critical information about a potential serious outcome to the patient or the user.
Caution	Indicates instructions that must be followed in order to ensure the proper use of the device.
Note	Indicates information requiring special attention.
4.3 mm Screws	This system uses 4.3 mm Low Profile Hexalobe Screws.
3.5 mm Screws	This system uses 3.5 mm Nonlocking Low Profile Hexalobe Screws.

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System Features

Polarus 3 Solution Proximal Humerus Plates

Standard Plate



Suture holes are positioned to secure tuberosities to the plate

Two bendable tabs, designed to buttress the greater tuberosity, can be secured with screws or sutures

Three medial calcar screws are designed to help provide stable medial column support to aid in preventing varus collapse

Posterior Plate



Plate Lengths

Standard

4-hole	94 mm
6-hole	115 mm
10-hole	155 mm
14-hole*	195 mm
18-hole*	235 mm
22-hole*	275 mm

Posterior

4-hole	94 mm
6-hole	115 mm

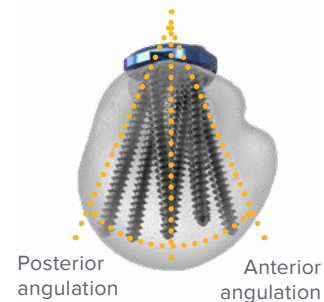
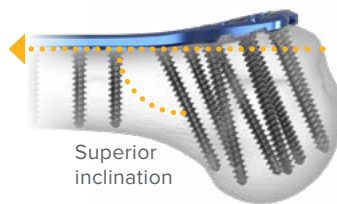
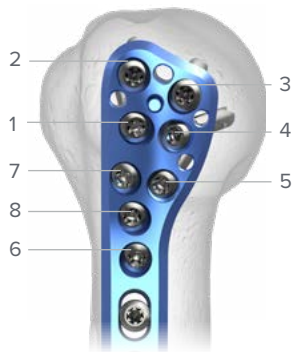
Standard and Posterior Plates are left and right specific to optimize plate placement.
*Special-order, sterile-packed only

Standard Plate Proximal Screw Approximate Trajectories

Hole

Superior Inclination (Degrees)

Anterior/Posterior (Degrees)



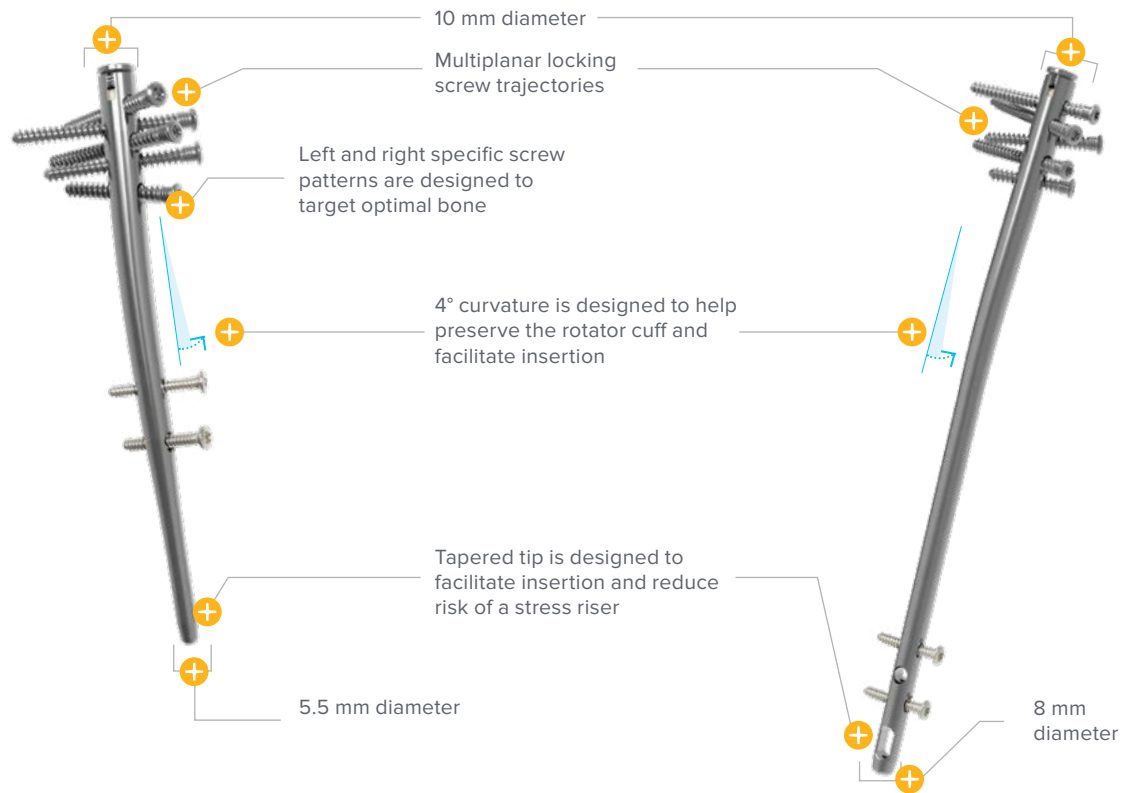
Hole #	Superior Inclination (Degrees)	Anterior/Posterior (Degrees)
1	114	13 Anterior
2	111	2 Anterior
3	114	6 Posterior
4	105	17 Posterior
5	102	11 Posterior
6	116	7 Posterior
7	115	10 Posterior
8	113	6 Anterior

System Features [continued]

Polarus 3 Solution Nails

Proximal Nail

Long Nail



Long Nails

Proximal Nails



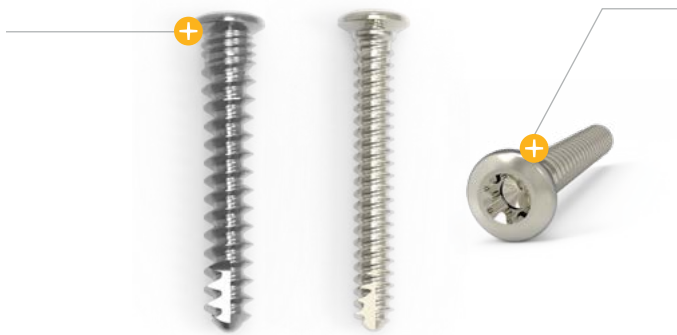
Nail Lengths

Proximal Nail	150 mm
Long Nail	200 mm
Long Nail	220 mm
Long Nail	240 mm
Long Nail	260 mm
Long Nail	280 mm

System Features [continued]

Low Profile Screw

Low Profile Screws are designed to minimize soft tissue irritation



The hexalobe driver interface is designed to reduce the possibility of stripping the screw

4.3 mm Low Profile Hexalobe Screws, which function as locking screws, may be used in any hole of the Polarus 3 plate and proximal portion of the nail



3.5 mm Nonlocking Low Profile Hexalobe Screws may be used in any hole of the Polarus 3 plate and distal portion of the nail

Screw Options	Outer Diameter	Function
3.5 mm Nonlocking Low Profile Hexalobe Screws (3025-350XX)	3.5 mm	Cortical screw
4.3 mm Low Profile Hexalobe Screws (3011-430XX)	4.3 mm	Locking cancellous screw

System Features [continued]

Versatile Instrumentation

Instrumentation is intended to streamline the surgical experience. The system includes both a traditional sharp drill and an optional blunt drill. Additionally, radiolucent carbon fiber retractors allow for visualization under fluoroscopy. A ratcheting cannula aids the surgeon during targeting.

Blunt drill is designed to help avoid perforation of the humeral head



Radiolucent carbon fiber retractors

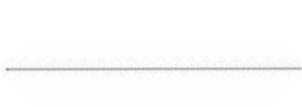
Ratcheting cannulas are designed to stay in place and assist in maintaining reduction



Instrumentation Overview



Polarus 3 Washer Cannula
(80-1792)



2.0 mm x 9" ST Guide Wire
(WS-2009ST)



Freehand Targeting Guide
(MS-0210)



Polarus 3 Drill Guide, Nail
(80-1621)



Polarus 3 Cannula, Ratcheting
(80-1619)



Polarus 3 Cap Screw Driver
(80-1635)



Polarus 3 Nail Targeting Locking Bolt
(80-1625)



Polarus 3 Targeting Awl
(80-1620)



Polarus 3 Plate Tack
(80-1595)



Polarus 3 Plate Drill Guide, Locking
(80-1588)



Polarus 3 Guide Wire Guide
(80-1600)



Polarus 3 Guide Wire "T" Handle
(80-1734)



10.0 mm Bud Drill
(DRB1015)



8 mm Flexible Reamer
(80-1925)



9 mm Flexible Reamer
(80-1926)



Polarus 3 Implant Sizer
(80-1617)



Polarus 3 Guide Wire, 20" Blunt
(35-0008)



Polarus 3 Guide Wire, 20" Trocar Tip
(35-0009)



Locking Bolt Finger Wrench
(MS-0611)



Polarus 3 Locking Knob
(80-1633)



Polarus 3 Proximal Targeting Guide
(80-1628)



Polarus 3 Proximal Targeting Guide, L
(80-1626)



Polarus 3 Proximal Targeting Guide, R
(80-1627)



Polarus 3 Nail Targeting Connector
(80-1629)

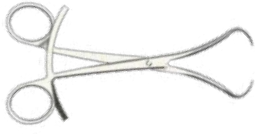


Browne-type Retractor, Carbon Fiber
(80-1599)



Blunt Hohmann Retractor, Carbon Fiber
(80-1598)

Instrumentation Overview [continued]



8" Bone Reduction Forceps
(MS-1280)



9" Bone Reduction Spanish Forceps
(MS-47107)



Rotator Cuff Retractor, 6 x 4 mm
(80-1822)



Blunt Gelpi Retractor 165 mm Long, Deep
(80-1821)



Periosteal Elevator
(MS-46213)



Medium Ratcheting Driver Handle
(80-0663)



Polarus 3 Removal Instrument
(80-1546)



Polarus 3 Depth Gauge
(80-1776)



Polarus 3 Cannulated Awl
(80-1551)



Polarus 3 Guide Wire Passer
(80-1555)



Polarus 3 Cannulated Broach
(80-1553)



Multiple Contact Hammer
(80-1538)



Polarus 3 2.8 mm Long Drill
(80-1624)



Polarus 3 2.8 mm Blunt Long Drill
(80-1634)



Polarus 3 2.8 mm Blunt Short Drill
(80-1597)



Polarus 3 2.8 mm Short Drill
(80-1592)



Polarus 3 Plate Drill Guide, Drop-In
(80-1587)



Polarus 3 4.3 mm Screw Tap
(80-1623)



Polarus 3 Tap Sleeve
(80-1593)



Polarus 3 Plate Targeting Locking Bolt
(80-1591)



Polarus 3 Reduction Device
(80-1601)



Ball Spike Reduction Tool
(80-1637)



Polarus 3 Long T15 Hexalobe Driver
(80-1618)



T15 Stick Fit Hexalobe Driver
(80-0760)



Polarus 3 Targeting Guide, Plate, Left
(80-1589)



Polarus 3 Targeting Guide, Plate, Right
(80-1590)

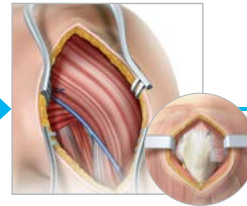
Surgical Technique Overview

Proximal Humerus:
Standard and Posterior
Plate Surgical Technique

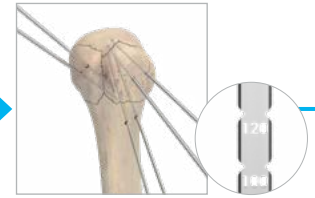
Preparation



Incision



Reduction

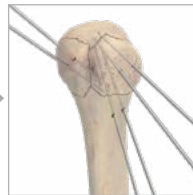


Proximal Nail
Surgical Technique

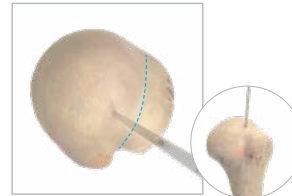
Preparation



Reduction



Wire Insertion



Canal Placement

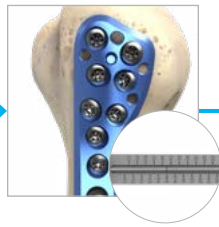


Long Nail
Surgical Technique

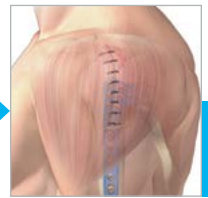
Plate Placement



Screw Placement



Closure



Targeting Guide Assembly



Implant Insertion and Proximal Screw Placement



Target Distal Screw Placement



Cap Screw Insertion



Rotator Cuff Repair



A/P Freehand Distal Screw Placement



M/L Freehand Distal Screw Placement



Proximal Humerus: Standard and Posterior Plate Surgical Technique

Figure 1

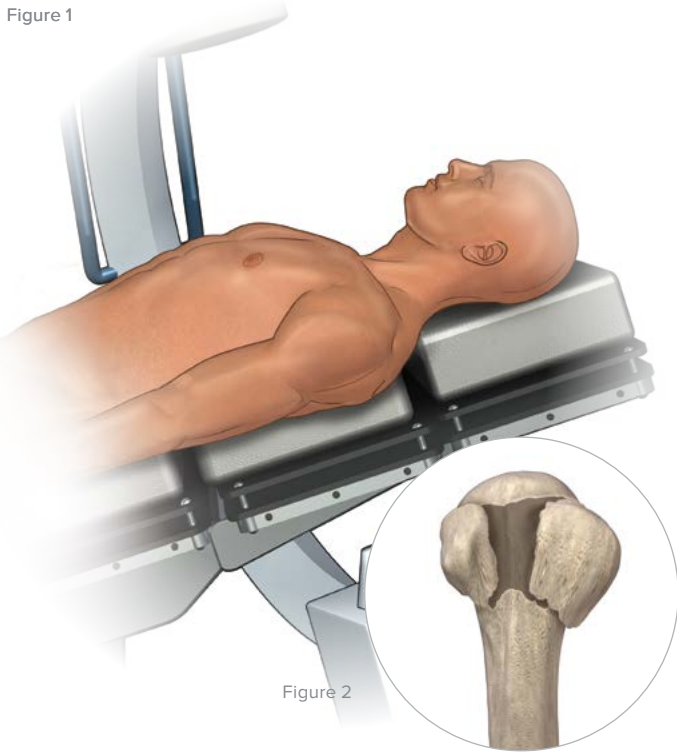
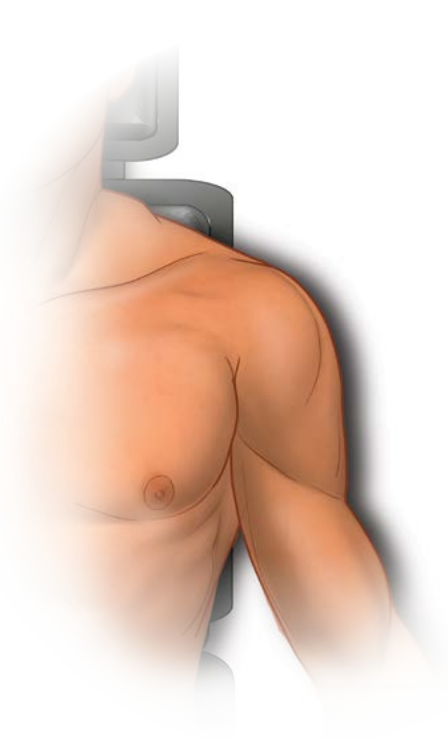


Figure 2

Figure 3



1 Preoperative Planning

Fluoroscopy should be used in all cases. Polarus 3 Plate X-ray Templates (90-0037) are available and should be used preoperatively to aid in implant selection.

Plate selection should be based on the fracture pattern. Fracture patterns that include posterior greater tuberosity fragments will likely require the Posterior Plate (7001-020XX), while less complex fracture patterns can utilize the Standard Plate (7001-01XXX). The left plates are colored blue and the right plates are colored green. Images in this surgical technique indicate left plates only.

2 Patient Positioning

The patient is placed in a beach chair position and the arm is draped.



Posterior Plate
(7001-020XX)



Standard Plate
(7001-01XXX)

Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

3 Approach and Incision

Create an entry site for access to the proximal humerus through a 10 mm standard deltopectoral incision made obliquely, in line with the deltopectoral interval. As an alternative, a deltoid-splitting incision may be made in a more longitudinal direction, starting at the level of the acromioclavicular joint and extending distally. This approach may be more cosmetic for the patient. More detail for each approach is offered in the next section.

Deltopectoral

Sharply dissect down to the level of the fascia and elevate the skin flaps. Identify the cephalic vein and develop the interval between the deltoid and the pectoralis. Retract the cephalic vein laterally and the pectoralis major medially. Release the fascia along the lateral border of the coracobrachialis and retract it medially to expose the proximal humerus with the subscapularis tendon attachment. To help facilitate reduction and improve fracture visualization, release the superior one-third of the pectoralis major from the shaft. It is important to place a finger underneath the pectoralis major as it is being released, to protect the biceps tendon, which lies directly underneath.

Deltoid Split

Either a bra strap incision (with reflection of a distally based skin flap) or a direct lateral skin incision can be used. The deltoid is split and reflected off the acromion proximally. The axillary nerve is identified and carefully protected. The nerve is often located approximately 5.6 cm from the apex of the humeral head and 6.9 cm from the acromion.¹

Two soft-tissue windows are created through the deltoid above and below the area where the axillary nerve passes. The upper window is used for fracture reduction, plate insertion, and insertion of proximal screws into the plate. The lower window is used to ensure the plate is properly seated on the shaft of the humerus and to allow insertion of the distal screws.

Figure 4 Deltopectoral Approach

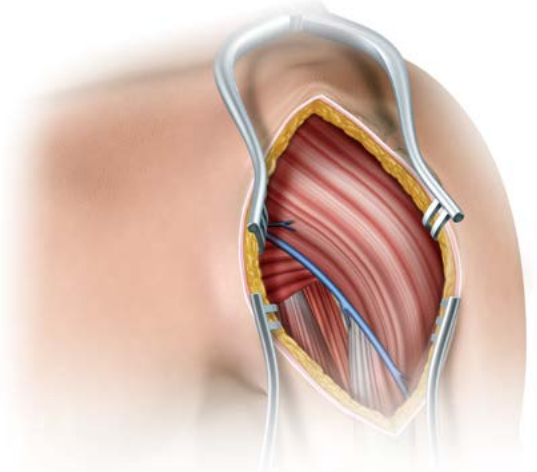


Figure 5 Deltoid split approach

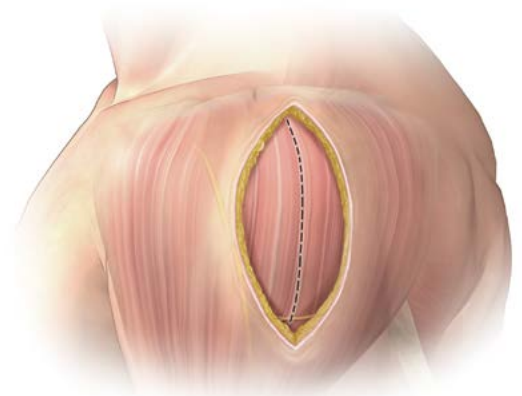
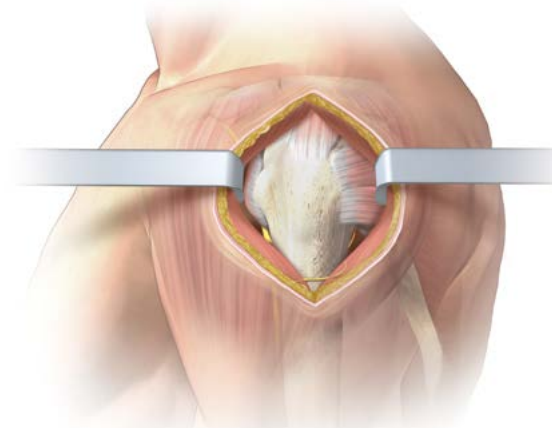
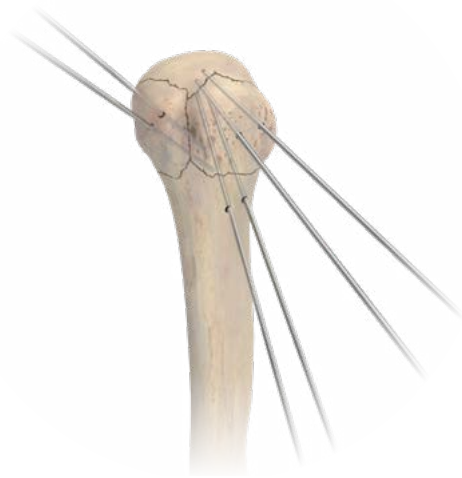


Figure 6 Humerus exposed



Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

Figure 7



4 Bone Reduction

The goals of bone reduction are:

1. Reduction of any subluxation or dislocation of the humeral head from the glenoid
2. Correction of any varus or valgus deformity of the humeral head
3. Restoration of the normal anatomic relationship between the head and tuberosities (if these are fractured)
4. Reduction of the humeral head to the shaft

The definitive fixation should aim to fix the humeral head to one or both tuberosities and to secure the humeral head to the shaft without residual subluxation or varus/valgus deformity. This may require a combination of screws separate from the plate, non-absorbable interosseous sutures, and locking plate fixation.

The Ball Spike Reduction Tool (80-1637) and 2.0 mm x 9" ST Guide Wire (WS-2009ST) can aid in reducing a fracture in the proximal aspect of the humeral head.

Note: Radiolucent carbon fiber retractors Blunt Hohmann Retractor, Carbon Fiber (80-1598) and Browne-type Retractor, Carbon Fiber (80-1599) are available to assist in reduction without obscuring radiographic visibility.



Ball Spike Reduction Tool (80-1637)



2.0 mm x 9" ST Guide Wire (WS-2009ST)



Blunt Hohmann Retractor, Carbon Fiber (80-1598)



Browne-type Retractor, Carbon Fiber (80-1599)

Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

5 Plate Selection

The Polarus 3 Proximal Humerus Plates are designed to fit an array of patient anatomies and are left and right specific. If the fracture involves the greater tuberosity, the Posterior Plate (7001-020XX) may be a good choice. If the fracture pattern includes a fracture line distal to the surgical neck, a variety of plate lengths are available. To assist with plate selection, the optional Polarus 3 Implant Sizer (80-1617) can be used under fluoroscopy. The sizer can be used externally or inserted against the periosteum. If inserted against the periosteum, care should be taken to avoid soft tissue disruption.

Note: If plates longer than 10 holes (155 mm) are desired, optional plates of up to 22 holes (275 mm) may be requested from Acumed prior to surgery.

Plate Lengths

Standard

4-hole	94 mm
6-hole	115 mm
10-hole	155 mm
14-hole*	195 mm
18-hole*	235 mm
22-hole*	275 mm

Posterior

4-hole	94 mm
6-hole	115 mm

*Special-order, sterile-packed only

Figure 8
Implant Sizer



Figure 9

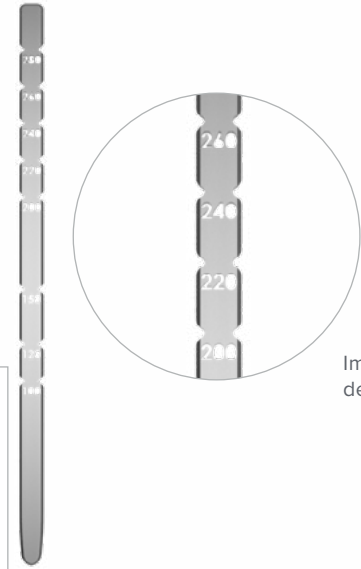


Figure 10
Implant Sizer
detail



Polarus 3 Standard Plate (7001-01XXX)



Polarus 3 Posterior Plate (7001-020XX)



Polarus 3 Implant Sizer (80-1617)

Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]



Figure 11



Posterior Tab Adjustment

Figure 12

6 Plate Placement and Reduction

Select the appropriate Polarus 3 Targeting Guide, Plate (Left: 80-1589 or Right: 80-1590) and secure to the plate's hole #8 (figure 11) with the Polarus 3 Plate Targeting Locking Bolt (80-1591).

If the Posterior Plate is selected, Polarus 3 Plate Drill Guides, Locking (80-1588) can adjust the angle of the posterior tabs prior to screw placement.

Caution: To prevent screw interference, avoid using screws longer than 26 mm in the posterior holes.

Caution: Do not bend tabs past 20 degrees and do not bend more than once.

Place the plate approximately 5 mm posterior to the bicipital groove and approximately 8–10 mm inferior from the tip of the greater tuberosity. The deltoid insertion may need to be partially recessed in order to position the plate in a sufficiently lateral position.² Confirm fracture reduction and plate height fluoroscopically. Provisionally secure one of the shaft's slots with a 3.5 mm Nonlocking Low Profile Hexalobe Screw (3025-350XX), Polarus 3 Plate Tack (80-1595), or Polarus 3 Reduction Device (80-1601).

Note: If the Polarus 3 Reduction Device is selected, the instrument should be used in the plate's longest slot to avoid blocking the surrounding screw holes. Do not fully seat the reduction device's threads under power. As the reduction device and the 4.3 mm Low Profile Hexalobe Screws (3011-430XX) have the same outer diameter, the screw can replace the reduction instrument without additional drilling.



Polarus 3 Targeting Guide, Plate (Left: 80-1589 or Right: 80-1590)



Polarus 3 Plate Targeting Locking Bolt (80-1591)



Polarus 3 Plate Drill Guide, Locking (80-1588)



3.5 mm Nonlocking Low Profile Hexalobe Screw (3025-350XX)



Polarus 3 Plate Tack (80-1595)



Polarus 3 Reduction Device (80-1601)



4.3 mm Low Profile Hexalobe Screw (3011-430XX)

Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

If a 3.5 mm Nonlocking Low Profile Hexalobe Screw (3025-350XX) is chosen, drill the center of one of the plate shaft's slots to allow for adjustment prior to definitive fixation. Use the Polarus 3 2.8 mm Short Drill (80-1592) and Polarus 3 Plate Drill Guide, Drop In (80-1587), referring to the laser markings on the drill and drill guide to determine the appropriate screw length. Screw depth can also be measured with the Polarus 3 Depth Gauge (80-1776). Insert the 3.5 mm screw using the (short) T15 Stick Fit Hexalobe Driver (80-0760).

Adjust the plate's position under fluoroscopy, using a guide wire as a reference point relative to the calcar. Position the 2.0 mm x 9" ST Guide Wire (WS-2009ST) through hole #6 (figures 13 and 14) using the Polarus 3 Guide Wire Guide (80-1600) and Polarus 3 Plate Drill Guide, Locking (80-1588). Once the plate's proper positioning is confirmed, ensure the 3.5 mm screw is inserted in a bicortical fashion.

Suture holes are available to secure tuberosities to the plate with the appropriately sized suture. The posterior plate's tabs can be used as suture holes.



Figure 13

Figure 14

Screw	Application
3.5 mm Nonlocking Low Profile Hexalobe Screws (3025-350XX)	Any hole in the plates
4.3 mm Low Profile Hexalobe Screws (3011-430XX)	Any hole in the plates

Warning: Use only the 3.5 mm Nonlocking Low Profile Hexalobe Screws included in the Polarus 3 system. Use of a **non-Polarus 3** 3.5 mm screw, from a different Acumed or competitor's system could result in the screw passing through the Polarus 3 plate. The head of the Polarus 3 3.5 mm screw has the same diameter as the 4.3 mm screw, which is larger than a traditional 3.5 mm screw.

Note: The targeting guide contains a suture cleat that can be used to temporarily maintain tension on the suture. This should be used with care to avoid damaging the suture's integrity.



Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

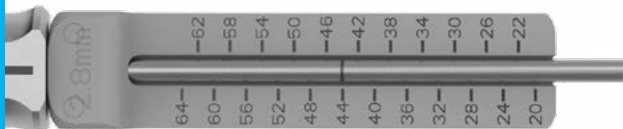
Figure 15



Blunt drill

Sharp drill

Figure 16



Depth gauge

7 Screw Preparation—Humeral Head

Standard or Posterior Plate

The Polarus 3 Plate Drill Guide, Drop In (80-1587) or Polarus 3 Plate Drill Guide, Locking (80-1588) is used with the selected drill. The drop-in drill guide allows for measuring without a traditional depth gauge. Ensure this instrument is fully seated in the Targeting Guide, Plate (Left: 80-1589 or Right: 80-1590) for accurate measurement. Place gentle pressure on the drill guide to minimize any toggle in the targeting guide. The Polarus 3 Depth Gauge (80-1776) is used in conjunction with the locking drill guide.

Insert the appropriate length 4.3 mm Low Profile Hexalobe Screw (3011-430XX) or 3.5 mm Nonlocking Low Profile Hexalobe Screw (3025-350XX) using the (short) T15 Stick Fit Hexalobe Driver (80-0760) and verify placement with fluoroscopy throughout the procedure. Screw tips should remain 5 to 10 mm from the subchondral bone.³ The 4.3 mm screw functions as a locking screw. A 3.5 mm screw can be used to reduce the plate to the bone. Proceed with drilling and filling the appropriate screws, with the exception of hole #8 (see Figure 17, Figure 18 and Caution below.) Remove sutures from the targeting guide, then remove the targeting guide from the plate. Secure sutures to the plate by passing through the respective suture holes.

Caution:

- Hole #8 should be the final screw addressed, as the locking bolt and targeting guide must be removed to insert a screw.
- Inserting 4.3 mm screws longer than 26 mm in the posterior tab holes will deflect or interfere with adjacent screws. This may cause damage to the implant or instrumentation. The risk of interference progressively increases when the tabs are bent.

Note: Replacing a 3.5 mm Nonlocking Low Profile Hexalobe Screw with a 4.3 mm Low Profile Hexalobe Screw in the humeral head is recommended to prevent screw loosening.

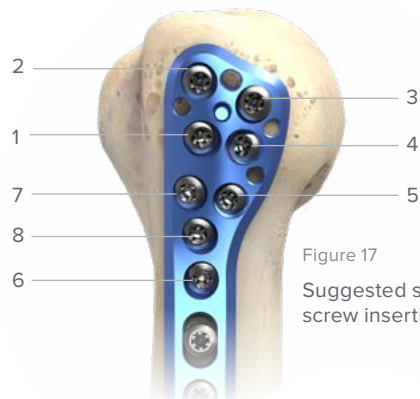


Figure 17
Suggested standard plate screw insertion order

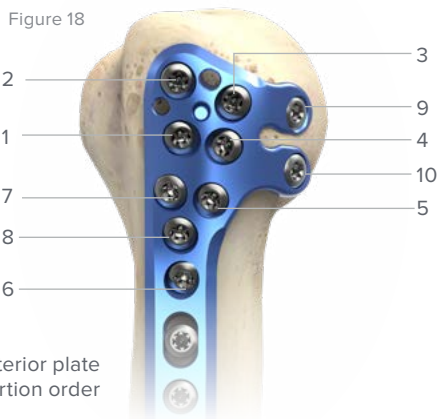


Figure 18
Suggested posterior plate screw insertion order



Polarus 3 Plate Drill Guide, Drop In (80-1587)



Polarus 3 Plate Drill Guide, Locking (80-1588)



Polarus 3 Targeting Guide, Plate (Left: 80-1589 or Right: 80-1590)



Polarus 3 Depth Gauge (80-1776)



4.3 mm Low Profile Hexalobe Screw (3011-430XX)



3.5 mm Nonlocking Low Profile Hexalobe Screw (3025-350XX)



T15 Stick Fit Hexalobe Driver (80-0760)

Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

8 Additional Shaft Screw Insertion

For the remaining shaft holes, insert 3.5 mm Nonlocking Low Profile Hexalobe Screws (3025-350XX) or 4.3 mm Low Profile Hexalobe Screws (3011-430XX). If the 4.3 mm Low Profile Hexalobe Screw is selected, the Polarus 3 Plate Drill Guide, Locking (80-1588) must be used when drilling the round locking holes.

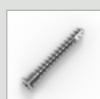
Note:

1. Take care to remove any burrs that may have formed during screw insertion.
2. If dense bone is encountered when implanting 4.3 mm Low Profile Hexalobe Screws, a Polarus 3 4.3 mm Screw Tap (80-1623) and Polarus 3 Tap Sleeve (80-1593) are available.
3. 3.5 mm screws can be inserted at a maximum angle of 20 degrees in the shaft holes or slots.

Figure 19



3.5 mm Nonlocking Low Profile Hexalobe Screw (3025-350XX)



4.3 mm Low Profile Hexalobe Screw (3011-430XX)



Polarus 3 Plate Drill Guide, Locking (80-1588)



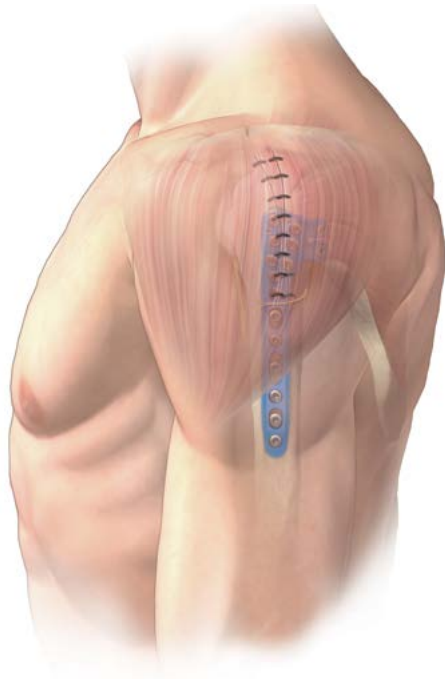
Polarus 3 4.3 mm Screw Tap (80-1623)



Polarus 3 Tap Sleeve (80-1593)

Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

Figure 20



9 Soft-Tissue Closure

Layered closure is performed using heavy, absorbable sutures. In the deltoid-splitting approach, meticulous repair of the deltoid split is important to avoid deltoid dehiscence. Direct transosseous suturing of the deltoid to the acromion is recommended. Close the wound in layers with a subcuticular stitch.

Proximal Humerus: Standard and Posterior Plate Surgical Technique [continued]

10 Postoperative Protocol

Postoperative care is at the discretion of the surgeon. The following protocol is provided as an example.

Passive range of motion exercises are initiated for the first four weeks, then active assisted for two weeks. Active range of motion and strengthening are started at approximately six weeks postoperatively. Clinical and radiological monitoring should continue until a satisfactory functional outcome and fracture union have been achieved.

11 Implant Removal

If removal of the implant is desired, prepare the exposure as in Step 3. Locate the screws and remove them with the T15 Stick Fit Hexalobe Driver (80-0760), then remove the plate. The Acumed Screw Removal System can also assist with removal.



T15 Stick-Fit
Hexalobe Driver
(80-0760)

Proximal Nail Surgical Technique

Figure 1

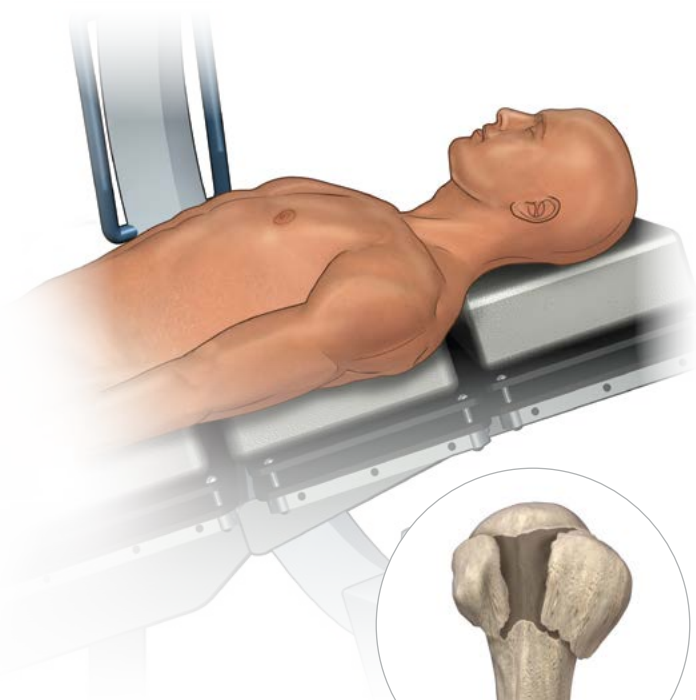
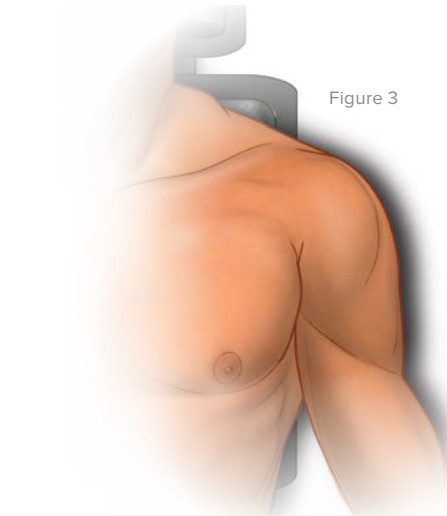


Figure 2



Figure 3



1 Preoperative Planning

Fluoroscopy should be used in all cases. Polarus 3 Nail X-ray Templates (90-0038) are available and can be used preoperatively to aid in implant selection. The proximal nails are left and right specific.

2 Patient Positioning and Surgical Exposure

The patient may be placed either supine or in a beach chair position so that fluoroscopy can be used to allow intraoperative assessments of fracture reduction, implant insertion, and a thorough evaluation of the final implant position. A radiolucent table is recommended to facilitate fluoroscopy. Position the shoulder off the edge of the table or, alternatively, a bolster can be placed beneath the scapula to elevate the shoulder. Ensure there is enough clearance to externally rotate the humerus with the targeting guide.

For an anterolateral approach, a 3–5 cm incision is made at the anterolateral aspect of the acromion extending parallel to the fibers of the deltoid. The supraspinatus tendon is then split in the direction of the fibers to expose the proximal humerus posterior to the biceps tendon. It is important not to detach the insertion of the tendon. A Rotator Cuff Retractor, 6 x 4 mm (80-1822) is available to assist with exposure.



Rotator Cuff Retractor, 6 x 4 mm (80-1822)

Proximal Nail Surgical Technique [continued]

3 Fracture Reduction

The goals of fracture reduction are:

1. Reduction of any subluxation or dislocation of the humeral head from the glenoid
2. Correction of any varus or valgus deformity of the humeral head
3. Restoration of the normal anatomic relationship between the head and tuberosities (if these are fractured)
4. Reduction of the humeral head to the shaft

The definitive fixation should aim to fix the humeral head to one or both tuberosities and to secure the humeral head to the shaft without residual subluxation or varus/valgus deformity. This may require a combination of screws separate from the nail, nonabsorbable interosseous sutures, and locking nail fixation.

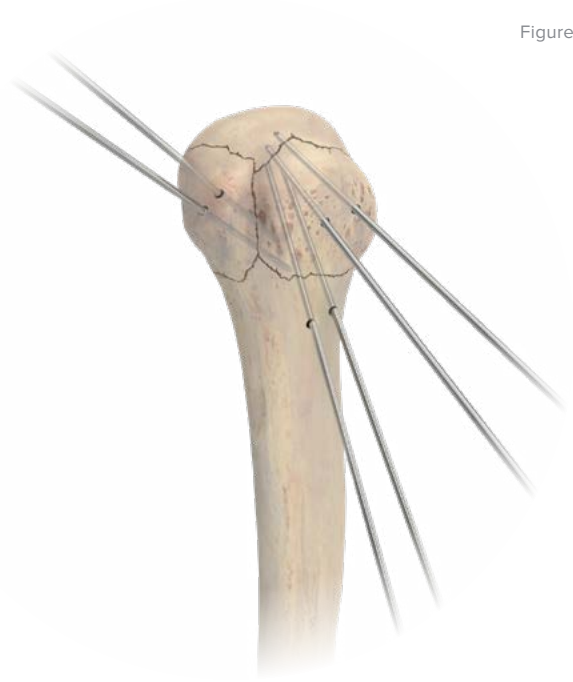
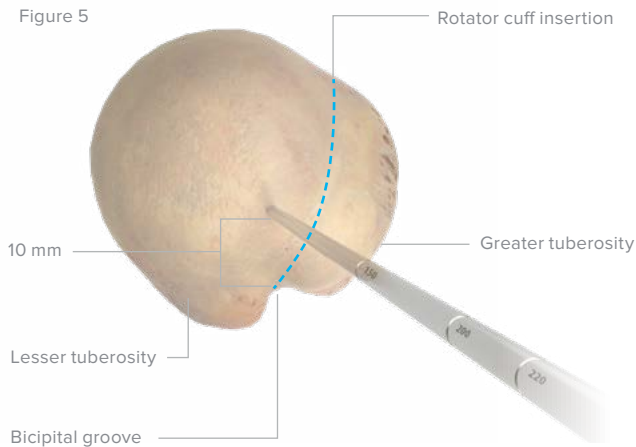


Figure 4

Proximal Nail Surgical Technique [continued]

Figure 5



4 Guide Wire Insertion

Insert the Polarus 3 Guide Wire, 20" Trocar Tip (35-0009) approximately 10 mm posterior to the bicipital groove, medial to the greater tuberosity, at the musculotendinous junction. Advance the guide wire into the proximal diaphyseal region. Next, ensure the guide wire is centered in the medullary canal, using fluoroscopy in multiple planes.

Note:

1. A "T" Handle (80-1734) for use with the Polarus 3 Guide Wires are available. Assemble the "T" Handle and the Polarus 3 Locking Knob (80-1633) onto the guide wire (Figure 7).
2. A 2.8 mm drill can also be used to perforate the cortex to pass the Polarus 3 Guide Wire, 20" Trocar Tip or 20" Blunt (35-0008) down the canal.



Figure 6

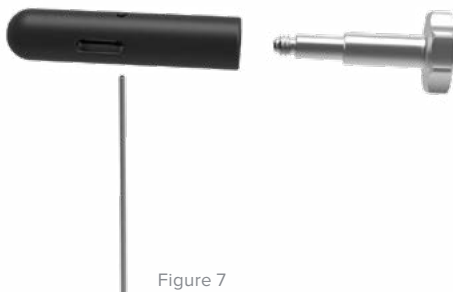


Figure 7



Polarus 3 Guide Wire, 20" Trocar Tip (35-0009)



Polarus 3 Guide Wire "T" Handle (80-1734)



Polarus 3 Locking Knob (80-1633)



Polarus 3 Guide Wire, 20" Blunt (35-0008)

Proximal Nail Surgical Technique [continued]

5 Canal Preparation

There are three options available:

1. Polarus 3 Cannulated Awl (80-1551). Insert over the guide wire to the groove's depth, 50 mm from the tip of the awl (Figure 8).
2. 10 mm Bud Drill (DRB1015). Insert over the guide wire to the first groove's depth, 50 mm from the tip of the drill (Figure 9).
3. Polarus 3 Cannulated Broach (80-1553). Insert over the guide wire to the level of the last cutting tooth. The lateral side of the broach is designated by the direction of the broach handle (Figure 10).

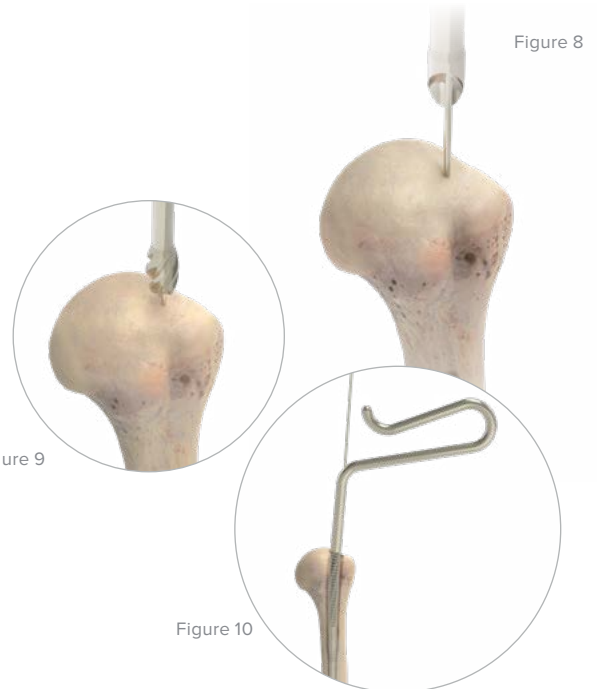


Figure 9

Figure 10

Figure 8

6 Targeting Guide Assembly

1. Attach the Polarus 3 Nail Targeting Connector (80-1629) to the appropriate Polarus 3 Proximal Targeting Guide (Left: 80-1626 or Right: 80-1627), securing with a Polarus 3 Locking Knob (80-1633).
2. Insert the Polarus 3 Nail Targeting Locking Bolt (80-1625) through the barrel of the targeting connector.

Note: When removing the implant from sterile packaging, take care not to disengage the polyether ether ketone (PEEK) insert from the head of the nail. The insert should be visible through the slot in the nail prior to insertion. Make sure the internal PEEK sleeve is still fully seated in the head of the nail prior to attaching the targeting guide.

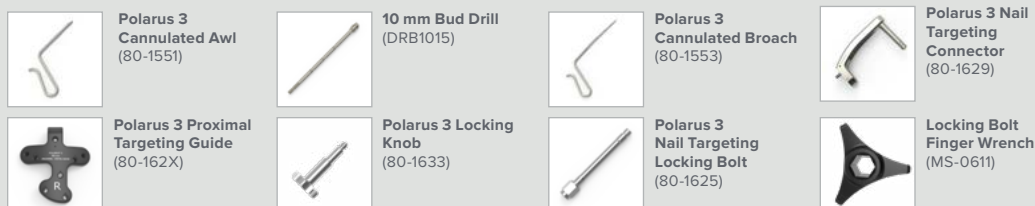
3. Assemble the implant onto the targeting connector, aligning the reference marks on the implant and targeting connector.

Note: The slot on the implant is offset to prevent misalignment.

4. Firmly tighten the locking bolt into position with the provided Locking Bolt Finger Wrench (MS-0611). When assembled properly, the nail should curve toward the targeting guide.



Figure 11



Proximal Nail Surgical Technique [continued]

Figure 12

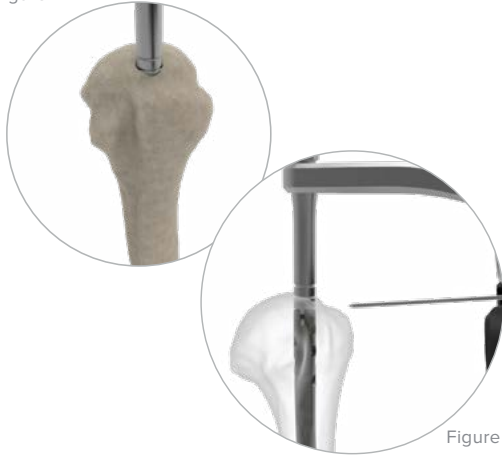


Figure 13

Figure 14



Figure 16

Figure 15

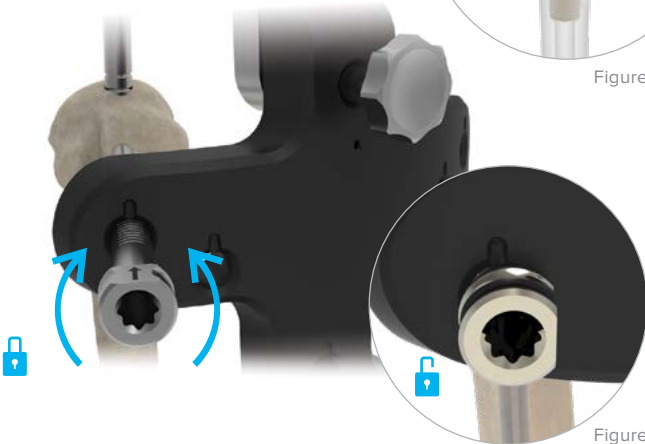


Figure 17

7 Implant Insertion

Insert the appropriate left or right Polarus 3 Proximal Locking Nail 150 mm (4001-1015L-S or 4001-1015R-S) over the Polarus 3 Guide Wire, 20" Trocar Tip (35-0009) or Polarus 3 Guide Wire, 20" Blunt (35-0008) until the proximal end is 5 mm to 10 mm below the surface to avoid impingement. The targeting connector's distal groove on the barrel represents 5 mm below the surface and the proximal groove represents 10 mm below the surface (Figure 12).

The depth of the nail may also be verified by inserting a 2.0 mm x 9" Guide Wire (WS-2009ST) through the small hole located below the knob on the targeting guide (Figure 13). Under fluoroscopy, the wire will point to the top of the nail.

Caution: Remove the central guide wire prior to drilling.

Warning: To avoid injury to the axillary nerve, do not insert the nail more than 10 mm deep relative to the surface.

Screws

Application

4.3 mm Low Profile Hexalobe Screws (3011-430XX)

Proximal portion of nail

3.5 mm Nonlocking Low Profile Hexalobe Screws (3025-350XX)

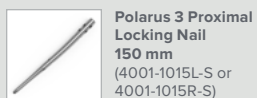
Distal portion of nail

Warning: Do not use 3.5 mm Nonlocking Low Profile Hexalobe Screws (3025-350XX) in the proximal portion of the nail. There is risk of these backing out.

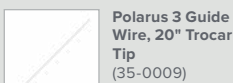
8 Proximal Screw Placement

Implant the anterior-oblique screw first (Figure 14 and Figure 15) to ensure it sits posterior to the bicipital groove. The remaining screws' orientation will be based on the first screw's placement.

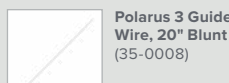
Make a stab incision and place the Polarus 3 Targeting Awl (80-1620) in the Polarus 3 Cannula, Ratcheting (80-1619) to protect the soft tissue and insert through the Polarus 3 Proximal Targeting Guide (80-162X). Make a small indent in the bone with the Polarus 3 Targeting Awl for targeting accuracy. The Multiple Contact Hammer (80-1538) is available for light tapping on the awl. The ratcheting cannula can assist with fracture reduction and locks when the arrow and flat edge are facing up (Figure 15). The ratcheting cannula is unlocked by rotating a quarter-turn left or right (Figure 17).



Polarus 3 Proximal Locking Nail 150 mm
(4001-1015L-S or 4001-1015R-S)



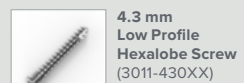
Polarus 3 Guide Wire, 20" Trocar Tip
(35-0009)



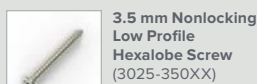
Polarus 3 Guide Wire, 20" Blunt
(35-0008)



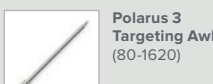
2.0 mm x 9" Guide Wire
(WS-2009ST)



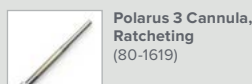
4.3 mm Low Profile Hexalobe Screw
(3011-430XX)



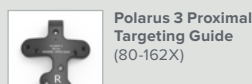
3.5 mm Nonlocking Low Profile Hexalobe Screw
(3025-350XX)



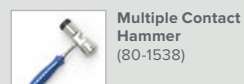
Polarus 3 Targeting Awl
(80-1620)



Polarus 3 Cannula, Ratcheting
(80-1619)



Polarus 3 Proximal Targeting Guide
(80-162X)



Multiple Contact Hammer
(80-1538)

Proximal Nail Surgical Technique [continued]

Next, remove the awl and fully insert the Polarus 3 Drill Guide, Nail (80-1621) in the cannula (Figure 18). Proceed to drill with the Polarus 3 2.8 mm Long Drill (Sharp: 80-1624 or Blunt: 80-1634).

Measure by aligning the laser band marked “NAIL” on the drill with the measurement markings on the drill guide.

Warning: If the Polarus 3 2.8 mm Long Drill Sharp or Blunt do not have markings indicating “PLATE” or “NAIL” on them, measure screw length by referencing the drill guide’s laser band, subtracting by one size.

Insert the appropriate 4.3 mm Low Profile Hexalobe Screw (3011-430XX) using the Polarus 3 Long T15 Hexalobe Driver (80-1618). Screw tips should remain 5 to 10 mm from the subchondral bone.³ The screw head is fully seated when the groove on the driver’s shaft aligns with the end of the cannula and the cannula is seated against the bone. Repeat these steps to insert the remaining proximal screws, using fluoroscopy, throughout the procedure.

Warning:

1. Use only 4.3 mm Low Profile Hexalobe Screws in the proximal portion of the nail. Do not use 3.5 mm Nonlocking Low Profile Hexalobe Screws, as there is risk of these backing out.
2. Use fluoroscopy in multiple views to confirm final position of the screws in the humeral head.

Note:

1. The Polarus 3 Washer Cannula (80-1792) is used to insert a Polarus 3 8 mm Washer, Locking (7001-03001-S). The Washer Cannula is not ratcheting.
2. The blunt drill is available to help avoid perforation of the humeral head.
3. The insertion torque of the screw into the nail may increase as the screw engages the proximal PEEK insert of the nail. This resistance will lock the screw into position.

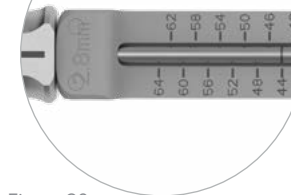
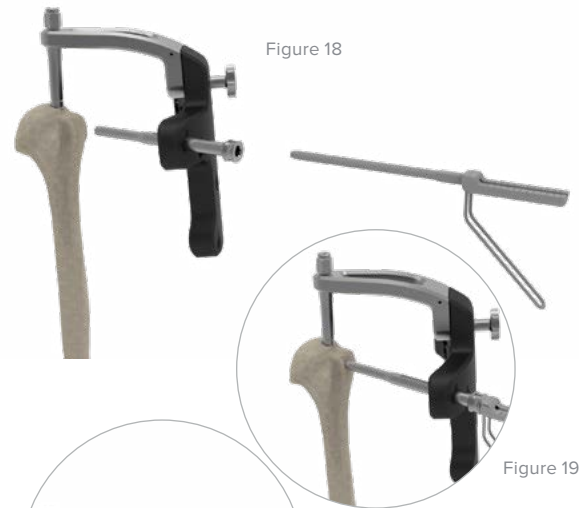


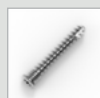
Figure 20



Polarus 3 Drill Guide, Nail (80-1621)



Polarus 3 2.8 mm Long Drill (Sharp: 80-1624 or Blunt: 80-1634)



4.3 mm Low Profile Hexalobe Screw (3011-430XX)



Polarus 3 Long T15 Hexalobe Driver (80-1618)



Polarus 3 Washer Cannula (80-1792)



Polarus 3 8 mm Washer, Locking (7001-03001-S)

Proximal Nail Surgical Technique [continued]



Figure 21



Figure 22

9 Targeting Distal Screws

Ensure the arm is in neutral rotation. Following a stab incision for the proximal of the two distal holes, place the Polarus 3 Targeting Awl (80-1620) in the Polarus 3 Cannula, Ratcheting (80-1619) and proceed to insert through the Polarus 3 Proximal Targeting Guide (80-162X), making a small indent in the bone for targeting accuracy. Remove the awl and fully insert the Polarus 3 Drill Guide, Nail (80-1621) in the cannula. Proceed to drill with the Polarus 3 2.8 mm Long Drill (80-1624) and measure by aligning the laser bands on the drill and drill guide.

Insert a 3.5 mm Nonlocking Hexalobe Screw (3025-350XX) in a bicortical fashion, using the Polarus 3 Long T15 Hexalobe Driver (80-1618). Repeat the same steps for the most distal screw.

Note: The distal holes should be angled relative to each other by 15 degrees to provide multiplanar fixation (Figure 21 and Figure 22).



Polarus 3 Targeting Awl (80-1620)



Polarus 3 Cannula, Ratcheting (80-1619)



Polarus 3 Proximal Targeting Guide (80-162X)



Polarus 3 Drill Guide, Nail (80-1621)



Polarus 3 2.8 mm Long Drill (80-1624)



3.5mm Nonlocking Hexalobe Screw (3025-350XX)



Polarus 3 Long T15 Hexalobe Driver (80-1618)

Proximal Nail Surgical Technique [continued]

10 Cap Screw Insertion

Polarus 3 Cap Screws (4004-1000X-S) are available to use at the surgeon's discretion. Place the cap screw (0, 2, 4, or 6 mm) onto the Polarus 3 Cap Screw Driver (80-1635) and thread into the top of the nail. Advance until fully seated.

Caution: Do not over-torque when inserting cap screw.

The 0 mm cap screw is a true 0 mm cap, as it sits fully within the nail when properly inserted, and does not stick out above the nail end.

Warning: Never leave the construct proud.

Note: A cap screw is not required to lock the proximal screws as the PEEK insert creates locking screw friction.



Figure 23

11 Rotator Cuff Repair

It is important to close the rotator cuff after insertion of the nail. A permanent suture such as a Number 2 suture may be utilized to close the rotator cuff. Generally, two figure-eight sutures are used to close the small longitudinal incision of the rotator cuff. After this, the deltoid is closed. The wound is then closed in layers, with the deltoid closed with Number 1 absorbable suture and the skin is closed in standard fashion.

Postoperative protocol is at the discretion of the surgeon.

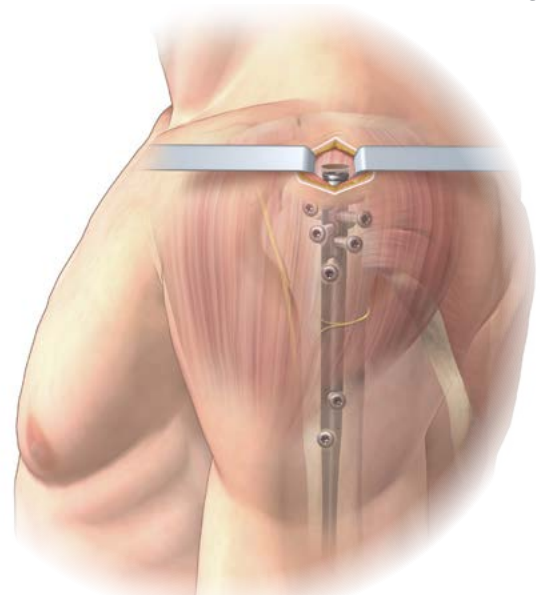


Figure 24



Polarus 3
Cap Screw
(4004-1000X-S)



Polarus 3
Cap Screw Driver
(80-1635)

Proximal Nail Surgical Technique [continued]

12 Implant Removal

Warning: The Polarus 3 Removal Instrument (80-1546) is specific to the Polarus 3 nailing system only.

Remove only the proximal screws with the Polarus 3 Long T15 Hexalobe Driver (80-1618). Next, if a cap screw was implanted, remove using the Polarus 3 Cap Screw Driver (80-1635). Thread the Polarus 3 Removal Instrument (80-1546) four degrees laterally into the nail to accommodate the curvature. The instrument's cutting flutes help remove soft tissue. Remove the distal screws with the same driver. Following the removal of all screws, back-slap the removal instrument with the Multiple Contact Hammer (80-1538).

Warning: Remove all screws before attempting to remove the nail.

Figure 25

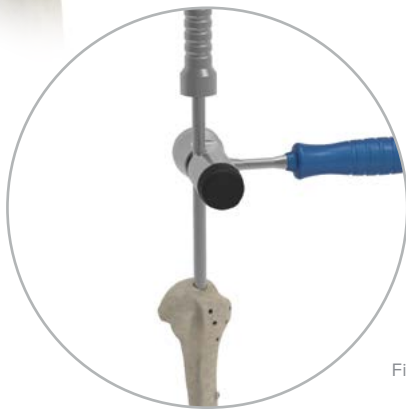


Figure 26



Polarus 3 Removal Instrument (80-1546)



Polarus 3 Long T15 Hexalobe Driver (80-1618)



Polarus 3 Cap Screw Driver (80-1635)



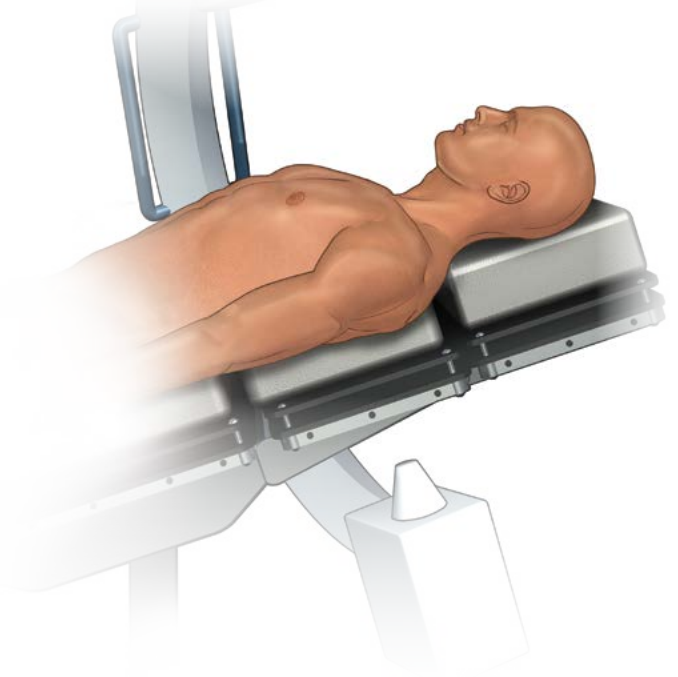
Multiple Contact Hammer (80-1538)

Long Nail Surgical Technique

1 Preoperative Planning

Fluoroscopy should be used in all cases. Polarus 3 Nail X-ray Templates (90-0038) are available and should be used preoperatively to aid in implant selection. Select a nail that extends the appropriate length past the fracture. The Polarus 3 Locking Nails (200–280 mm) (4002-102X0-S) are not left or right specific.

Figure 1



2 Patient Positioning, Surgical Exposure, and Nail Length Assessment

The patient may be placed either supine or in a beach chair position so that fluoroscopy can be used to allow intraoperative assessments of fracture reduction, implant insertion, and a thorough evaluation of the final implant position. A radiolucent table is recommended to facilitate fluoroscopy. Position the shoulder off the edge of the table or, alternatively, a bolster can be placed beneath the scapula to elevate the shoulder. The Polarus 3 Implant Sizer (80-1617) is available to determine the appropriate nail. The depth markings on the Polarus 3 Guide Wire, 20" Trocar Tip (35-0009) or 20" Blunt (35-0008) are also available to assess the appropriate length.

For an anterolateral approach, a 3–5 cm incision is made at the anterolateral aspect of the acromion extending parallel to the fibers of the deltoid. The supraspinatus tendon is then split in the direction of the fibers to expose the proximal humerus posterior to the biceps tendon. It is important not to detach the insertion of the tendon. A Rotator Cuff Retractor, 6 x 4 mm (80-1822) is available to assist with exposure.

Figure 2

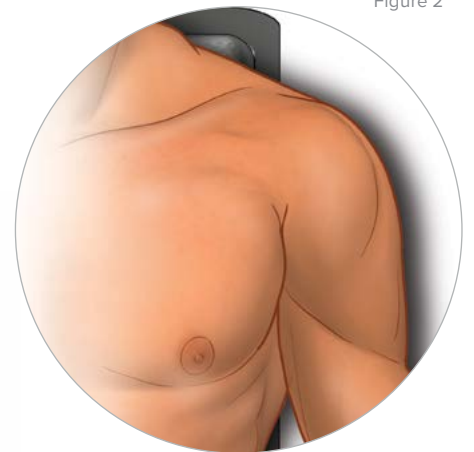


Figure 3



Polarus 3 Locking Nail (200–280 mm) (4002-102X0-S)



Polarus 3 Implant Sizer (80-1617)



Polarus 3 Guide Wire, 20" Trocar Tip (35-0009)



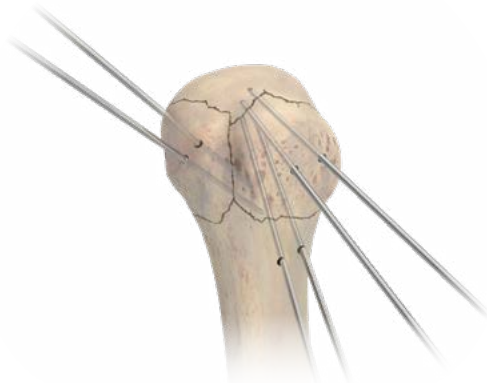
Polarus 3 Guide Wire, 20" Blunt (35-0008)



Rotator Cuff Retractor, 6 x 4 mm (80-1822)

Long Nail Surgical Technique [continued]

Figure 4



3 Fracture Reduction

The goals of fracture reduction are:

1. Reduction of any subluxation or dislocation of the humeral head from the glenoid
2. Correction of any varus or valgus deformity of the humeral head
3. Restoration of the normal anatomic relationship between the head and tuberosities (if these are fractured)
4. Reduction of the humeral head to the shaft

The definitive fixation should aim to fix the humeral head to one or both tuberosities and to secure the humeral head to the shaft without residual subluxation or varus/valgus deformity. This may require a combination of screws separate from the nail, nonabsorbable interosseous sutures, and locking nail fixation.

Figure 5



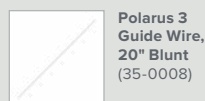
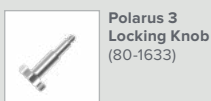
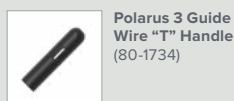
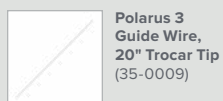
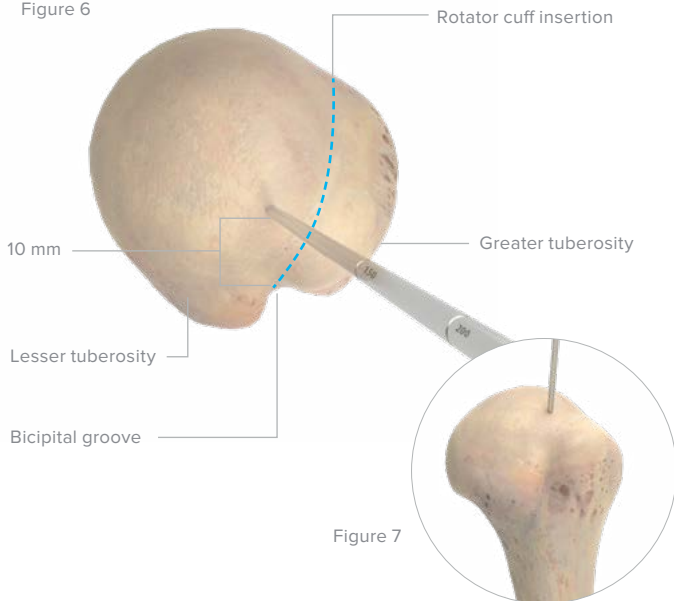
4 Guide Wire Insertion

Insert the Polarus 3 Guide Wire, 20" Trocar Tip (35-0009), approximately 10 mm posterior to the bicipital groove, medial to the greater tuberosity, at the musculotendinous junction. Advance the guide wire into the proximal diaphyseal region. Next, ensure the guide wire is centered in the medullary canal, using fluoroscopy in multiple planes.

Note:

1. A "T" Handle (80-1734) for use with the Polarus 3 Guide Wires are available. Assemble the "T" Handle and the Polarus 3 Locking Knob (80-1633) onto the guide wire (Figure 5).
2. A 2.8 mm drill can also be used to perforate the cortex to pass the Polarus 3 Guide Wire, 20" Trocar Tip or 20" Blunt (35-0008) down the canal.

Figure 6



Long Nail Surgical Technique [continued]

5 Canal Preparation

There are three options available:

1. Polarus 3 Cannulated Awl (80-1551). Insert over the guide wire to the groove's depth, 50 mm from the tip of the awl (Figure 8).
2. 10 mm Bud Drill (DRB1015). Insert over the guide wire to the first groove's depth, 50 mm from the tip of the drill (Figure 9).
3. Polarus 3 Cannulated Broach (80-1553). Insert over the guide wire to the level of the last cutting tooth. The lateral side of the broach is designated by the direction of the broach handle (Figure 10).

After preparing the proximal portion of the canal, advance the guide wire past the fracture. The Polarus 3 Guide Wire Passer (80-1555) is available to aid with passing the guide wire past the fracture. Ensure the guide wire is centered in the medullary canal, using fluoroscopy in multiple planes. Before inserting the Polarus 3 Locking Nail (200–280 mm) (4002-102X0-S), ensure the canal can accommodate the 8 mm distal diameter by preparing the canal with the 8 mm Flexible Reamer (80-1925), followed by the 9 mm Flexible Reamer (80-1926).

Pushing the reamer across the fracture site can help protect the radial nerve from the instrument and thermal injury. Isolating the radial nerve through a small, separate incision and allowing for direct visualization during canal reaming should be considered.

Warning: Not preparing the canal, relative to the nail's length and diameter, can result in undue resistance when inserting the nail.⁴ Note that meticulous technique should be used, as canal reaming weakens the humerus and does not prevent deformity from off-axis entry sites.⁴



Figure 8



Figure 9



Figure 10



Polarus 3
Cannulated Awl
(80-1551)



10 mm Bud Drill
(DRB1015)



Polarus 3
Cannulated Broach
(80-1553)



Polarus 3 Guide
Wire Passer
(80-1555)



Polarus 3
Locking Nail
(200–280 mm)
(4002-102X0-S)



8 mm Flexible
Reamer
80-1925



9 mm Flexible
Reamer
80-1926

Long Nail Surgical Technique [continued]

Figure 11



6 Targeting Guide Assembly

1. Attach the Polarus 3 Nail Targeting Connector (80-1629) to the Polarus 3 Proximal Targeting Guide (80-1628), securing with a Polarus 3 Locking Knob (80-1633).
2. Insert the Polarus 3 Nail Targeting Locking Bolt (80-1625) through the barrel of the Targeting Connector.

Note: When removing the Polarus 3 Locking Nail (200–280 mm) (4002-102X0-S) implant from sterile packaging, take care not to disengage the polyether ether ketone (PEEK) insert from the head of the nail. The insert should be visible through the slot in the nail prior to insertion. Make sure the internal PEEK sleeve is still fully seated in the head of the nail prior to attaching the targeting guide.

3. Assemble implant onto the targeting connector, aligning the reference mark on the implant and targeting connector. When assembled properly, the nail will curve toward the targeting guide.

Note: The slot on the implant is offset to prevent misalignment.

4. Firmly tighten the locking bolt into position with the provided Locking Bolt Finger Wrench (MS-0611).



Polarus 3 Nail Targeting Connector (80-1629)



Polarus 3 Proximal Targeting Guide (80-1628)



Polarus 3 Locking Knob (80-1633)



Polarus 3 Nail Targeting Locking Bolt (80-1625)



Polarus 3 Locking Nail (200–280 mm) (4002-102X0-S)



Locking Bolt Finger Wrench (MS-0611)

Long Nail Surgical Technique [continued]

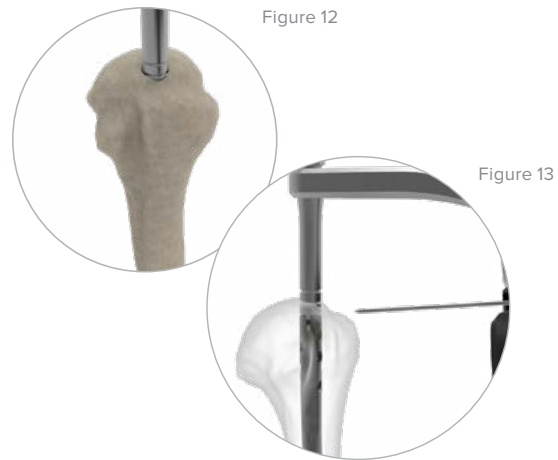
7 Implant Insertion

Insert the appropriate Polarus 3 Locking Nail (200–280 mm) (4002-102X0-S), over the Polarus 3 Guide Wire, 20" Trocar Tip (35-0009) or Polarus 3 Guide Wire, 20" Blunt (35-0008), until the proximal end is 5 mm to 10 mm below the surface to avoid impingement. This will allow for manual reduction of the fracture in Step 9 if compression is desired.

The targeting connector's distal groove on the barrel represents 5 mm below the surface and the proximal groove represents 10 mm below the surface (Figure 12). The depth of the nail may also be verified by inserting a 2.0 mm x 9" Guide Wire (WS-2009ST) through the small hole located below the knob on the targeting guide. Under fluoroscopy, the wire will point to the top of the nail.

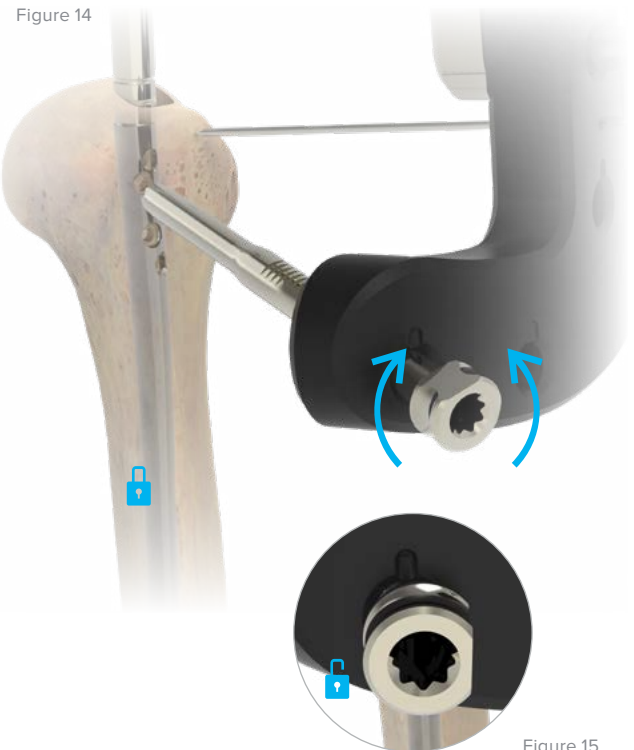
Caution: Remove the central guide wire prior to drilling.

Warning: To avoid injury to the axillary nerve, do not insert the nail more than 10 mm deep relative to the surface.



Screws	Application
4.3 mm Low Profile Hexalobe Screws (3011-430XX)	Proximal portion of nail
3.5 mm Nonlocking Low Profile Hexalobe Screws (3025-350XX)	Distal portion of nail

Warning: Do not use 3.5 mm Nonlocking Low Profile Hexalobe Screws in the proximal portion of the nail. There is risk of these backing out.



8 Proximal Screw Placement

Implant the anterior-oblique screw first (Figure 14) to ensure that it sits posterior to the bicipital groove. The remaining screws' orientation will be based on the first screw's placement.

Make a stab incision, place the Polarus 3 Targeting Awl (80-1620) in the Polarus 3 Cannula, Ratcheting (80-1619) to protect the soft tissue and insert through the Polarus 3 Proximal Targeting Guide (80-1628). Make a small indent in the bone with the Polarus 3 Targeting Awl for targeting accuracy. The Multiple Contact Hammer (80-1538) is available for light tapping on the awl. The ratcheting cannula can assist with fracture reduction and locks when the arrow and flat edge are facing up (Figure 14). The ratcheting cannula is unlocked by rotating a quarter-turn left or right (Figure 15).



Long Nail Surgical Technique [continued]

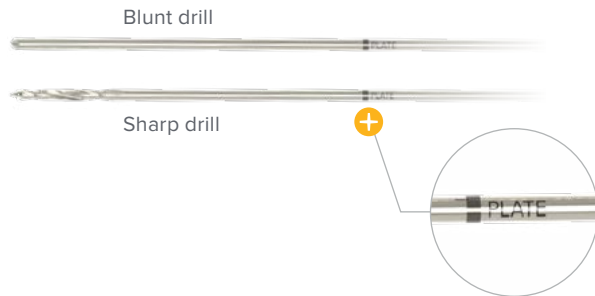
Figure 16



Figure 18



Figure 17



Remove the awl and fully insert the Polarus 3 Drill Guide, Nail (80-1621) in the cannula (Figure 16). Proceed to drill with the Polarus 3 2.8 mm Long Drill (Sharp: 80-1624 or Blunt: 80-1634) aligning the laser bands on the drill and drill guide..

Measure by aligning the laser band marked “NAIL” no the drill with the measurements markings on the drill guide.

Warning: If the Polarus 3 2.8mm Long Drill Sharp or Blunt do not have markings indicating “PLATE” or “NAIL” on them, measure screw length by referencing the drill guide’s laser band, subtracting by one size.

Insert the appropriate 4.3 mm Low Profile Hexalobe Screws (3011-430XX) using the Polarus 3 Long T15 Hexalobe Driver (80-1618). Screw tips should remain 5 to 10 mm from the subchondral bone.³ The screw head is fully seated when the groove on the driver shaft aligns with the end of the cannula and the cannula is seated against the bone. Repeat these steps to install the remaining proximal screws, using fluoroscopy throughout the procedure.

Warning:

1. Use only 4.3 mm Low Profile Hexalobe Screws in the proximal portion of the nail. Do not use 3.5 mm Nonlocking Low Profile Hexalobe Screws, as there is risk of these backing out.
2. Use fluoroscopy in multiple views to confirm placement of screws in the humeral head.

Note:

1. The Polarus 3 Washer Cannula (80-1792) is used to insert a Polarus 3 8 mm Washer, Locking (7001-03001-S). The Washer Cannula is not ratcheting.
2. The blunt drill is available to help avoid perforation of the humeral head.
3. The insertion torque of the screw into the nail may increase as the screw engages the proximal PEEK insert of the nail. This resistance will lock the screw into position.



Polarus 3 Drill Guide, Nail (80-1621)



Polarus 3 2.8 mm Long Drill (80-1624)



Polarus 3 2.8 mm Blunt Long Drill (80-1634)



4.3 mm Low Profile Hexalobe Screw (3011-430XX)



Polarus 3 Long T15 Hexalobe Driver (80-1618)



Polarus 3 Washer Cannula (80-1792)



Polarus 3 8 mm Washer, Locking (7001-03001-S)

Long Nail Surgical Technique [continued]

9 Freehand Targeting and Insertion of the Distal Screws

The freehand (perfect circle) technique is used to insert the 3.5 mm Nonlocking Low Profile Hexalobe Screws (3025-350XX) in the A/P or M/L holes.

Ensure the arm is in neutral rotation. If desired, manually reduce the extremity to achieve cortical contact and apply compression at the fracture site.⁵ Remain aware of the proximal portion of the nail relative to the surface. Next, identify the proximal portion of the distal slot. Carefully dissect, enlisting a mini-open or limited open approach to help identify and prevent damage to the radial nerve.⁵

Using fluoroscopy liberally, proceed with tapping the bone, using the Freehand Targeting Guide (MS-0210) to create a starting dimple prior to drilling. This helps prevent “skiving” of the drill. Next, using the Polarus 3 Plate Drill Guide, Drop In (80-1587), insert the Polarus 3 2.8 mm Short Drill (80-1592) through the first cortex. Verify in multiple views that the drill is appropriately placed. Following verification, drill to the far cortex. Assess the appropriate screw length using the drill’s laser band and reading off the drill guide’s markings.

Screw depth can also be measured with the Polarus 3 Depth Gauge (80-1776). Using the T15 Stick Fit Hexalobe Driver (80-0760), insert a 3.5 mm nonlocking screw in a bicortical fashion, using fluoroscopy in multiple views to ensure proper placement. Proceed to implant additional screws per the surgeon’s discretion.

10 Cap Screw Insertion

Polarus 3 Cap Screws (4004-1000X-S) are available to use at the surgeon’s discretion. Place the cap screw (0, 2, 4, or 6 mm) onto the Polarus 3 Cap Screw Driver (80-1635) and thread into the top of the nail. Advance until fully seated.

Caution: Do not over-torque the cap screw during insertion.

The 0 mm cap screw is a true 0 mm cap, as it sits fully within the nail when properly inserted, and does not stick out above the nail end.

Warning: Never leave the construct proud.

Note: A cap screw is not required to lock the proximal screws as the PEEK insert creates locking screw friction.

Figure 19



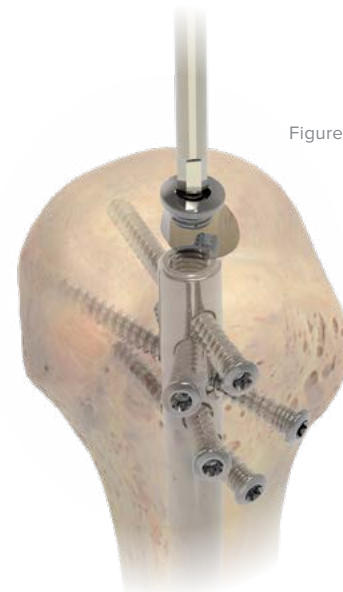
A/P plane

Figure 20



M/L plane

Figure 21



3.5mm Nonlocking
Hexalobe Screw
(3025-350XX)



Freehand
Targeting Guide
(MS-0210)



Polarus 3 Plate
Drill Guide, Drop In
(80-1587)



Polarus 3
2.8 mm Short Drill
(80-1592)



Polarus 3 Depth
Gauge
(80-1776)



T15 Stick Fit
Hexalobe Driver
(80-0760)



Polarus 3 Cap
Screw
(4004-1000X-S)



Polarus 3 Cap
Screw Driver
(80-1635)

Long Nail Surgical Technique [continued]

Figure 22

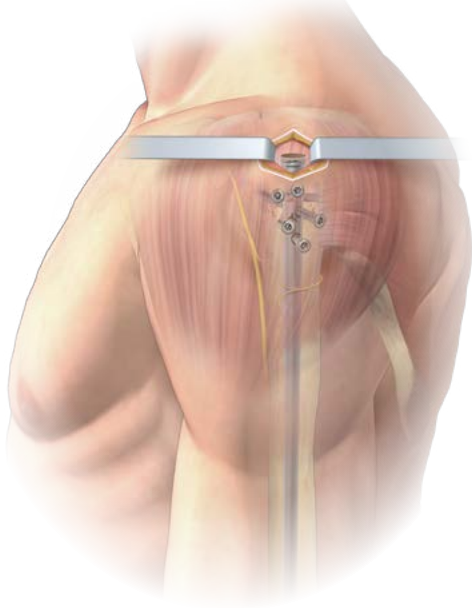


Figure 23



Figure 24

11 Rotator Cuff Repair

It is important to close the rotator cuff after insertion of the nail. A permanent suture such as a Number 2 suture may be utilized to close the rotator cuff. Generally, two figure-eight sutures are used to close the small longitudinal incision of the rotator cuff. After this the deltoid is closed. The wound is then closed in layers, with the deltoid closed with Number 1 absorbable suture, and the skin is closed in standard fashion.

12 Postoperative Protocol

Postoperative care is at the discretion of the surgeon. The following protocol is provided as an example.

Postoperatively, the patient is placed in an arm sling and a pain pump may be placed in the subacromial space to help with postoperative pain relief. The patient is started on pendulum motion exercises at one to two weeks, a passive motion program for two to six weeks, and active strengthening at six weeks when signs of healing are evident.

13 Implant Removal

Warning: The Polarus 3 Removal Instrument (80-1546) is specific to the Polarus 3 nailing system only.

Remove the proximal screws with the Polarus 3 Long T15 Hexalobe Driver (80-1618). If a cap screw was implanted, remove it using the Polarus 3 Cap Screw Driver (80-1635). Thread the Polarus 3 Removal Instrument four degrees laterally into the nail to accommodate the curvature. The instrument's cutting flutes help remove soft tissue. Remove the distal screws with the same driver. Following the removal of all screws, back-slap the removal instrument with the Multiple Contact Hammer (80-1538).

Warning: Remove all screws before attempting to remove the nail.



Polarus 3 Removal Instrument (80-1546)



Polarus 3 Long T15 Hexalobe Driver (80-1618)



Polarus 3 Cap Screw Driver (80-1635)



Multiple Contact Hammer (80-1538)

References

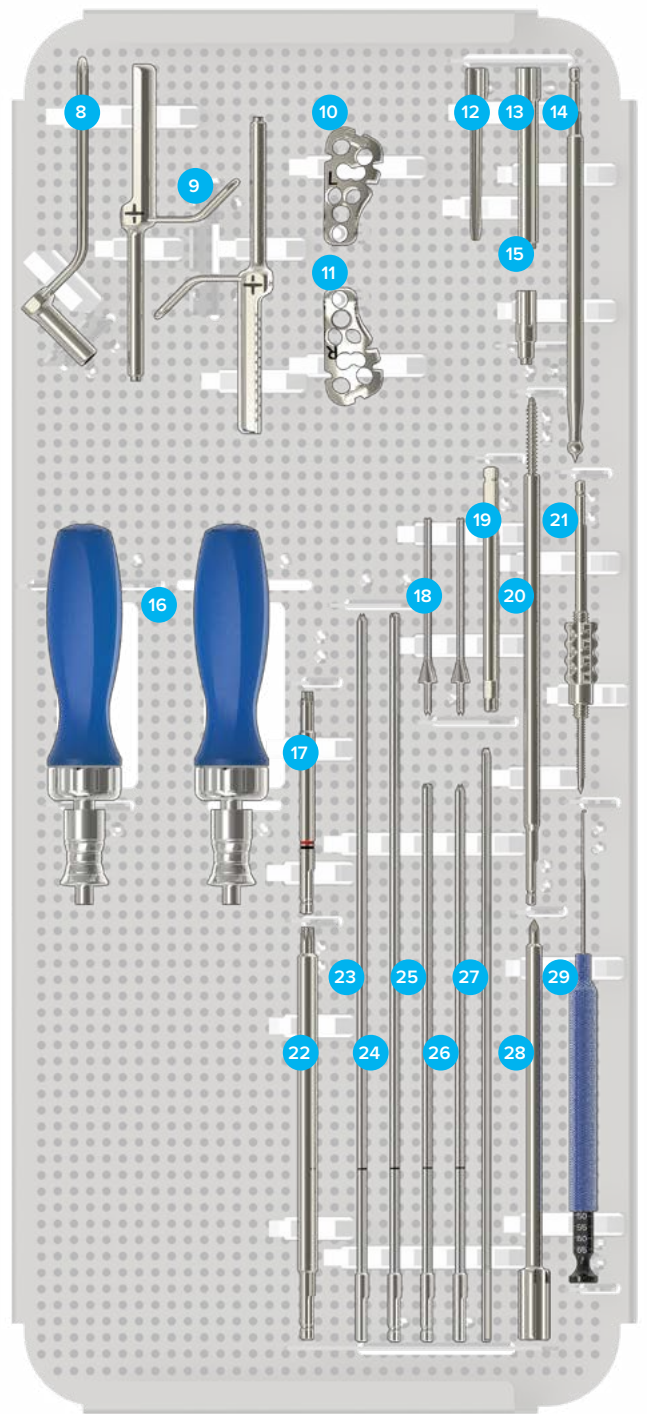
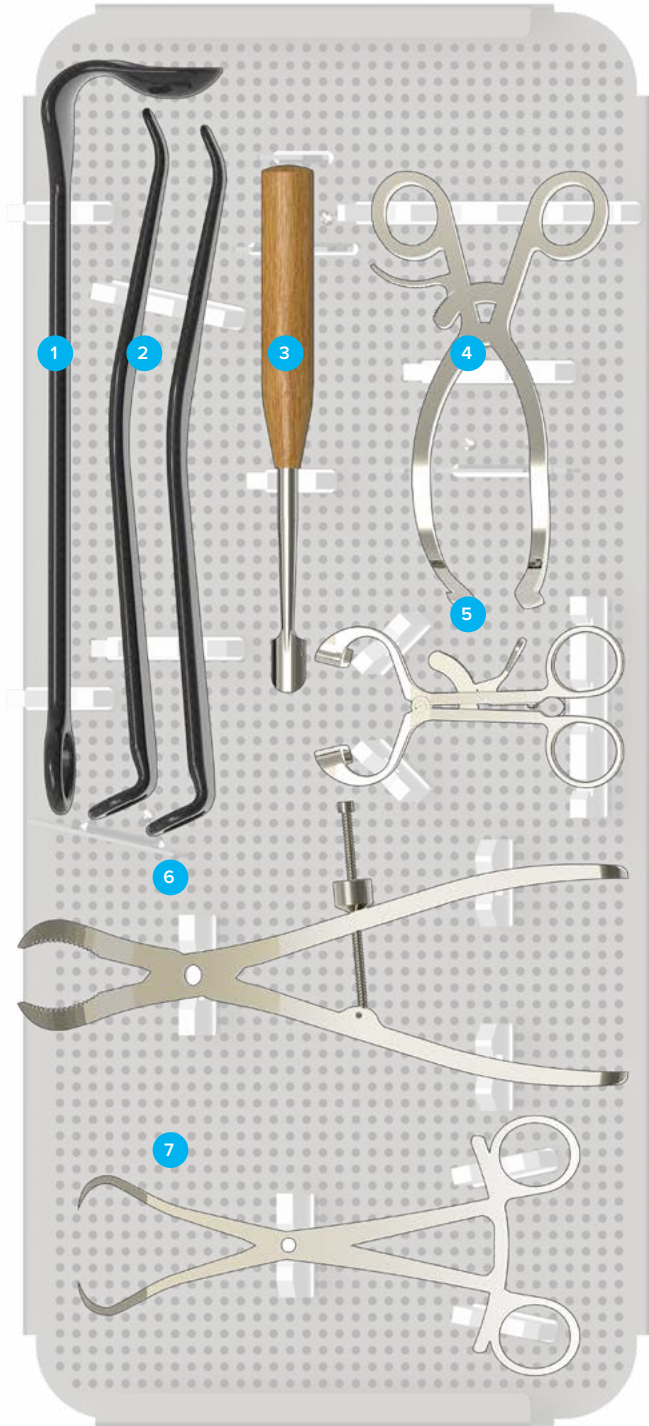
1. Stecco C, Gagliano G, Lancerotto L, et al. Surgical anatomy of the axillary nerve and its implication in the transdeltoid approaches to the shoulder. *J Shoulder Elbow Surg.* 2010;19(8):1166-1174.
2. Ricchetti E, Warrender W, Abboud J. Use of locking plates in the treatment of proximal humerus fractures. *J Shoulder Elbow Surg.* 2010;19:66-75.
3. Owsley K, Gorczyca T. Fracture displacement/screw cutout after open reduction and locked plate fixation of proximal humeral fractures. *J Bone Joint Surg Am.* 2008;90:223-240.
4. Steffner, R. Emerging concepts in upper extremity trauma: humeral shaft fractures. *Orthop Clin North Am.* 2013; 44(1):21-33.
5. Cole P, Wijdicks, C. The operative treatment of diaphyseal humeral shaft fractures. *Hand Clin.* 2007;23:437-448.

Ordering Information

Tray Components

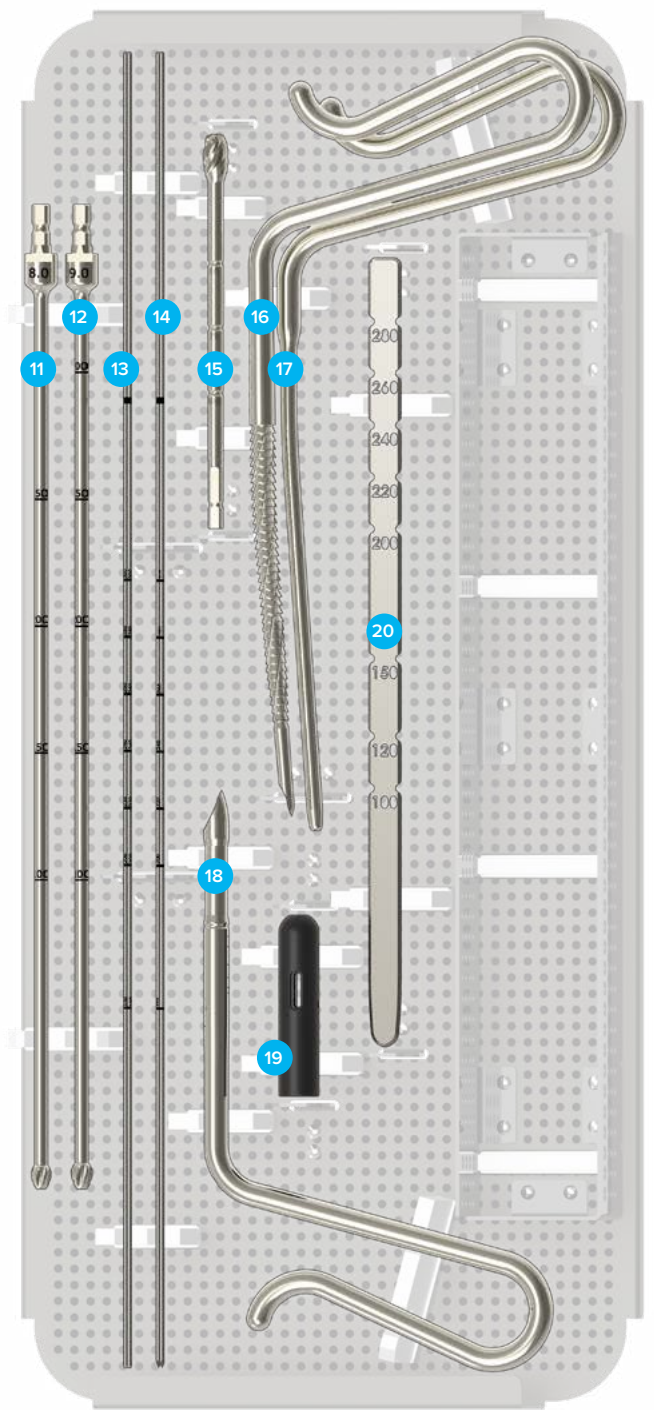
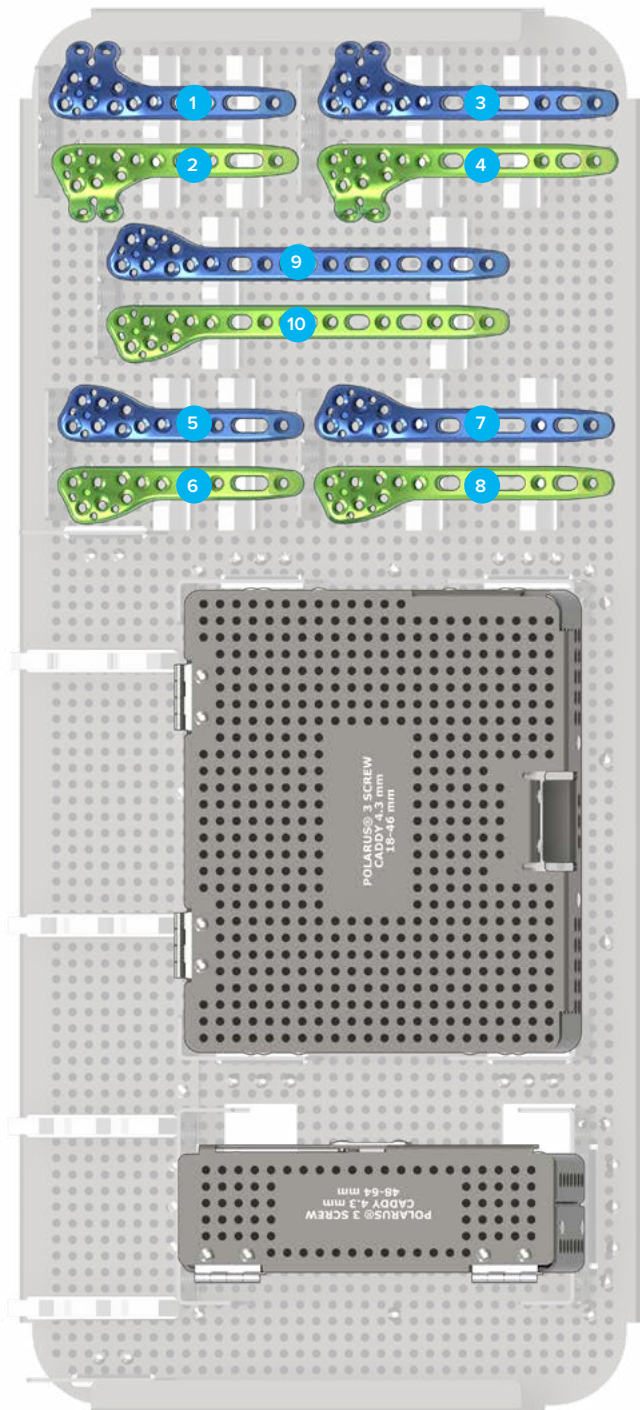
Polarus 3 Instruments

1	Browne-type Retractor, Carbon Fiber	80-1599	17	T15 Stick Fit Hexalobe Driver	80-0760
2	Blunt Hohmann Retractor, Carbon Fiber	80-1598	18	Polarus 3 Plate Tack	80-1595
3	Periosteal Elevator	MS-46213	19	Polarus 3 Cap Screw Driver	80-1635
4	Blunt Gelpi Retractor 165 mm Long, Deep	80-1821	20	Polarus 3 4.3 mm Screw Tap	80-1623
5	Rotator Cuff Retractor, 6 x 4 mm	80-1822	21	Polarus 3 Reduction Device	80-1601
6	9" Bone Reduction Spanish Forceps	MS-47107	22	Polarus 3 Long T15 Hexalobe Driver	80-1618
7	8" Bone Reduction Forceps	MS-1280	23	Polarus 3 2.8 mm Long Drill	80-1624
8	Polarus 3 Tap Sleeve	80-1593	24	Polarus 3 2.8 mm Blunt Long Drill	80-1634
9	Polarus 3 Plate Drill Guide, Drop-In	80-1587	25	Polarus 3 2.8 mm Blunt Short Drill	80-1597
10	Polarus 3 Targeting Guide, Plate, Left	80-1589	26	Polarus 3 2.8 mm Short Drill	80-1592
11	Polarus 3 Targeting Guide, Plate, Right	80-1590	27	2.0 mm x 9" ST Guide Wire	WS-2009ST
12	Polarus 3 K-Wire Guide	80-1600	28	Polarus 3 Targeting Awl	80-1620
13	Polarus 3 Plate Drill Guide, Locking	80-1588	29	Polarus 3 Depth Gauge	80-1776
14	Ball Spike Reduction Tool	80-1637			
15	Polarus 3 Plate Targeting Locking Bolt	80-1591			
16	Medium Ratcheting Driver Handle	80-0663			



Ordering Information [continued]

Tray Components			
Polarus 3 Posterior Plates		Polarus 3 Instruments	
1	Polarus 3 Posterior Plate 4-Hole, Left	7001-0204L	11 8 mm Flexible Reamer 80-1925
2	Polarus 3 Posterior Plate 4-Hole, Right	7001-0204R	12 9 mm Flexible Reamer 80-1926
3	Polarus 3 Posterior Plate 6-Hole, Left	7001-0206L	13 Polarus 3 Guide Wire, 20" Blunt 35-0008
4	Polarus 3 Posterior Plate 6-Hole, Right	7001-0206R	14 Polarus 3 Guide Wire, 20" Trocar Tip 35-0009
Polarus 3 Standard Plates		15 10.0 mm Bud Drill DRB1015	
5	Polarus 3 Standard Plate 4-Hole, Left	7001-0104L	16 Polarus 3 Cannulated Broach 80-1553
6	Polarus 3 Standard Plate 4-Hole, Right	7001-0104R	17 Polarus 3 Guide Wire Passer 80-1555
7	Polarus 3 Standard Plate 6-Hole, Left	7001-0106L	18 Polarus 3 Cannulated Awl 80-1551
8	Polarus 3 Standard Plate 6-Hole, Right	7001-0106R	19 Polarus 3 Guide Wire "T" Handle 80-1734
9	Polarus 3 Standard Plate 10-Hole, Left	7001-0110L	20 Polarus 3 Implant Sizer 80-1617
10	Polarus 3 Standard Plate 10-Hole, Right	7001-0110R	



Ordering Information [continued]

Tray Components

Polarus 3 Instruments

1	Polarus 3 Cannula, Ratcheting	80-1619	8	Polarus 3 Drill Guide, Nail	80-1621
2	Polarus 3 Washer Cannula	80-1792	9	Polarus 3 Proximal Targeting Guide, Right	80-1627
3	Polarus 3 Nail Targeting Connector	80-1629	10	Polarus 3 Proximal Targeting Guide, Left	80-1626
4	Polarus 3 Nail Targeting Locking Bolt	80-1625	11	Multiple Contact Hammer	80-1538
5	Locking Bolt Finger Wrench	MS-0611	12	Polarus 3 Removal Instrument	80-1546
6	Polarus 3 Locking Knob	80-1633	13	Freehand Targeting Guide	MS-0210
7	Polarus 3 Proximal Targeting Guide	80-1628			

Sterile-Packed*

Polarus 3 Standard Plates

Polarus 3 Standard Plate 14-Hole, Left	7001-0114L-S
Polarus 3 Standard Plate 14-Hole, Right	7001-0114R-S
Polarus 3 Standard Plate 18-Hole, Left	7001-0118L-S
Polarus 3 Standard Plate 18-Hole, Right	7001-0118R-S
Polarus 3 Standard Plate 22-Hole, Left	7001-0122L-S
Polarus 3 Standard Plate 22-Hole, Right	7001-0122R-S

Polarus 3 Proximal Nails

Polarus 3 Proximal Locking Nail 150 mm, Left	4001-1015L-S
Polarus 3 Proximal Locking Nail 150 mm, Right	4001-1015R-S

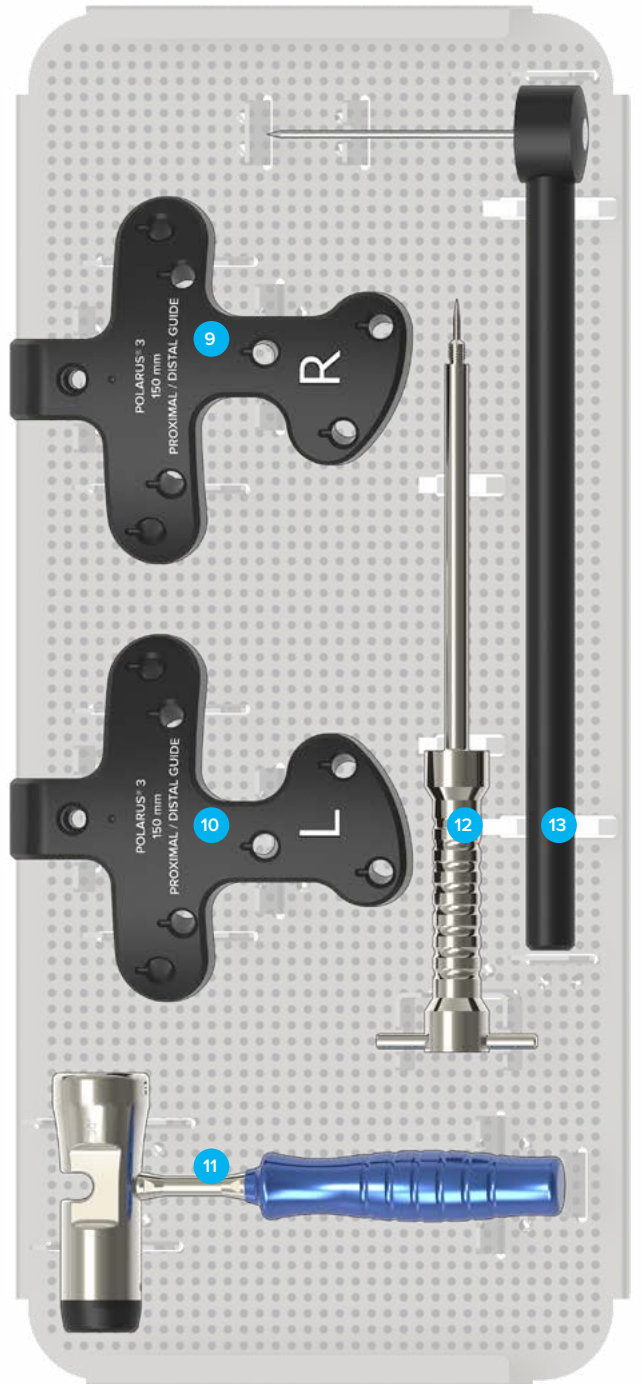
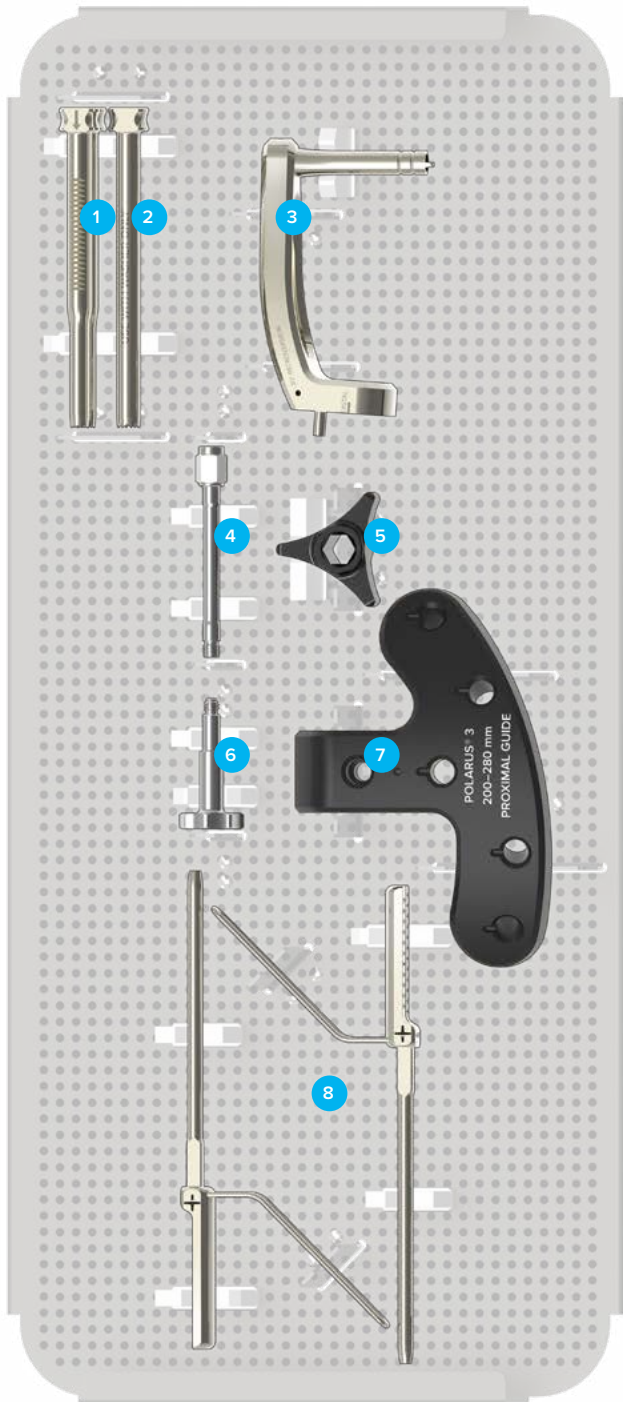
Polarus 3 Long Nails

Polarus 3 Locking Nail 200 mm	4002-10200-S
Polarus 3 Locking Nail 220 mm	4002-10220-S
Polarus 3 Locking Nail 240 mm	4002-10240-S
Polarus 3 Locking Nail 260 mm	4002-10260-S
Polarus 3 Locking Nail 280 mm	4002-10280-S

Polarus 3 Cap Screws and Washers

Polarus 3 Cap Screw 0 mm	4004-10000-S
Polarus 3 Cap Screw 2 mm	4004-10002-S
Polarus 3 Cap Screw 4 mm	4004-10004-S
Polarus 3 Cap Screw 6 mm	4004-10006-S
Polarus 3 8 mm Washer, Locking	7001-03001-S

Note: *Sterile-packed and available upon request. Contact Acumed prior to surgery for these special-order plates.



Ordering Information [continued]

Polarus 3 Screws			
Polarus 3 4.3 mm Low Profile Hexalobe Screws			
4.3 mm x 18 mm Low Profile Hexalobe Screw	3011-43018	4.3 mm x 42 mm Low Profile Hexalobe Screw	3011-43042
4.3 mm x 20 mm Low Profile Hexalobe Screw	3011-43020	4.3 mm x 44 mm Low Profile Hexalobe Screw	3011-43044
4.3 mm x 22 mm Low Profile Hexalobe Screw	3011-43022	4.3 mm x 46 mm Low Profile Hexalobe Screw	3011-43046
4.3 mm x 24 mm Low Profile Hexalobe Screw	3011-43024	4.3 mm x 48 mm Low Profile Hexalobe Screw	3011-43048
4.3 mm x 26 mm Low Profile Hexalobe Screw	3011-43026	4.3 mm x 50 mm Low Profile Hexalobe Screw	3011-43050
4.3 mm x 28 mm Low Profile Hexalobe Screw	3011-43028	4.3 mm x 52 mm Low Profile Hexalobe Screw	3011-43052
4.3 mm x 30 mm Low Profile Hexalobe Screw	3011-43030	4.3 mm x 54 mm Low Profile Hexalobe Screw	3011-43054
4.3 mm x 32 mm Low Profile Hexalobe Screw	3011-43032	4.3 mm x 56 mm Low Profile Hexalobe Screw	3011-43056
4.3 mm x 34 mm Low Profile Hexalobe Screw	3011-43034	4.3 mm x 58 mm Low Profile Hexalobe Screw	3011-43058
4.3 mm x 36 mm Low Profile Hexalobe Screw	3011-43036	4.3 mm x 60 mm Low Profile Hexalobe Screw	3011-43060
4.3 mm x 38 mm Low Profile Hexalobe Screw	3011-43038	4.3 mm x 62 mm Low Profile Hexalobe Screw	3011-43062
4.3 mm x 40 mm Low Profile Hexalobe Screw	3011-43040	4.3 mm x 64 mm Low Profile Hexalobe Screw	3011-43064

Ordering Information [continued]

Polarus 3 Screws

Polarus 3 3.5 mm Nonlocking Low Profile Hexalobe Screws

3.5 x 18 mm Nonlocking Low Profile Hexalobe Screw	3025-35018	3.5 x 42 mm Nonlocking Low Profile Hexalobe Screw	3025-35042
3.5 x 20 mm Nonlocking Low Profile Hexalobe Screw	3025-35020	3.5 x 44 mm Nonlocking Low Profile Hexalobe Screw	3025-35044
3.5 x 22 mm Nonlocking Low Profile Hexalobe Screw	3025-35022	3.5 x 46 mm Nonlocking Low Profile Hexalobe Screw	3025-35046
3.5 x 24 mm Nonlocking Low Profile Hexalobe Screw	3025-35024	3.5 x 48 mm Nonlocking Low Profile Hexalobe Screw	3025-35048
3.5 x 26 mm Nonlocking Low Profile Hexalobe Screw	3025-35026	3.5 x 50 mm Nonlocking Low Profile Hexalobe Screw	3025-35050
3.5 x 28 mm Nonlocking Low Profile Hexalobe Screw	3025-35028	3.5 x 52 mm Nonlocking Low Profile Hexalobe Screw	3025-35052
3.5 x 30 mm Nonlocking Low Profile Hexalobe Screw	3025-35030	3.5 x 54 mm Nonlocking Low Profile Hexalobe Screw	3025-35054
3.5 x 32 mm Nonlocking Low Profile Hexalobe Screw	3025-35032	3.5 x 56 mm Nonlocking Low Profile Hexalobe Screw	3025-35056
3.5 x 34 mm Nonlocking Low Profile Hexalobe Screw	3025-35034	3.5 x 58 mm Nonlocking Low Profile Hexalobe Screw	3025-35058
3.5 x 36 mm Nonlocking Low Profile Hexalobe Screw	3025-35036	3.5 x 60 mm Nonlocking Low Profile Hexalobe Screw	3025-35060
3.5 x 38 mm Nonlocking Low Profile Hexalobe Screw	3025-35038	3.5 x 62 mm Nonlocking Low Profile Hexalobe Screw	3025-35062
3.5 x 40 mm Nonlocking Low Profile Hexalobe Screw	3025-35040	3.5 x 64 mm Nonlocking Low Profile Hexalobe Screw	3025-35064

Please Note: Implants are provided sterile-packed, separate from the system tray.

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