Humeral Nail System

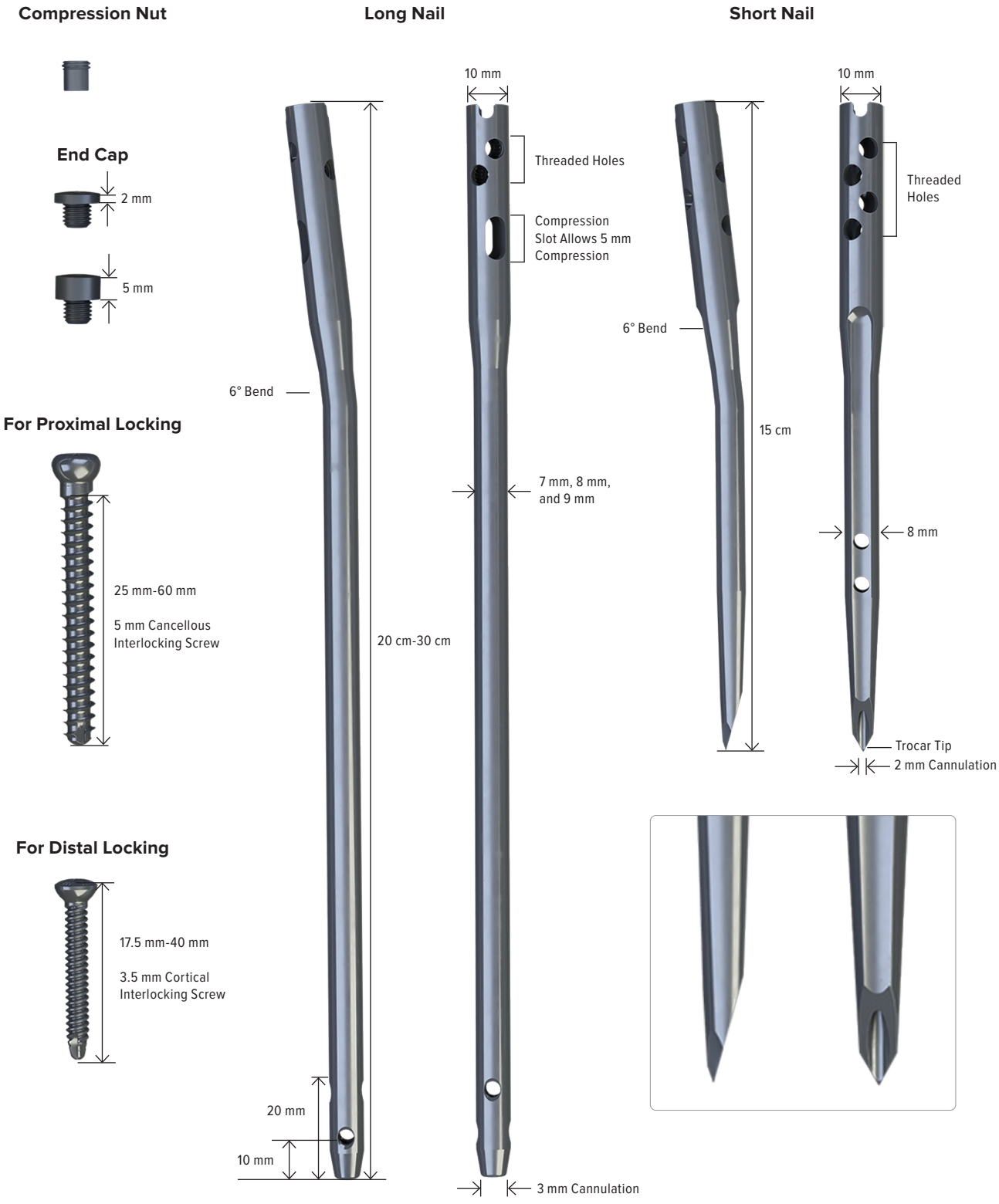
Surgical Technique

Arthrex®

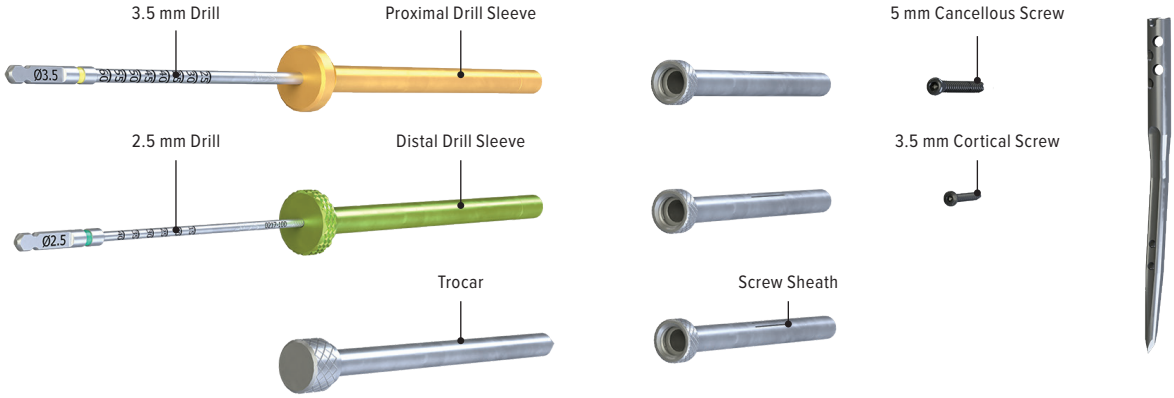
Arthrex Humeral Nail System

Features and Design

The Arthrex Humeral Nail System includes both short and long nails designed to treat fractures of the humeral neck and shaft. The short proximal locking nail has a trocar tip for easier insertion. Precise percutaneous instrumentation allows for efficient operative time and reproducible results.

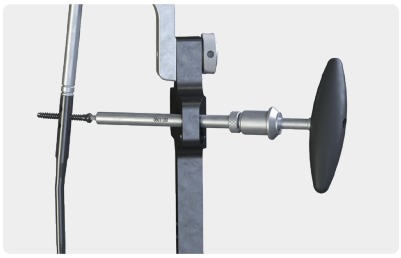


Instrumentation Overview

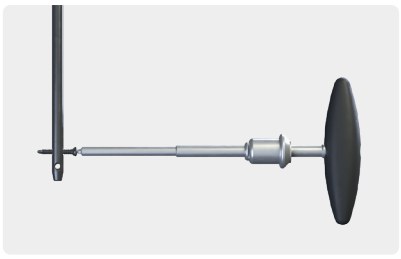


Drill sleeves are color-coordinated with their appropriate drill bits. The yellow sleeve and 3.5 mm yellow-stripe drill are used for proximal 5 mm screws and the green sleeve and 2.5 mm green-stripe drill for distal 3.5 mm screws.

Large 5 mm hex driver for nail-holding bolt

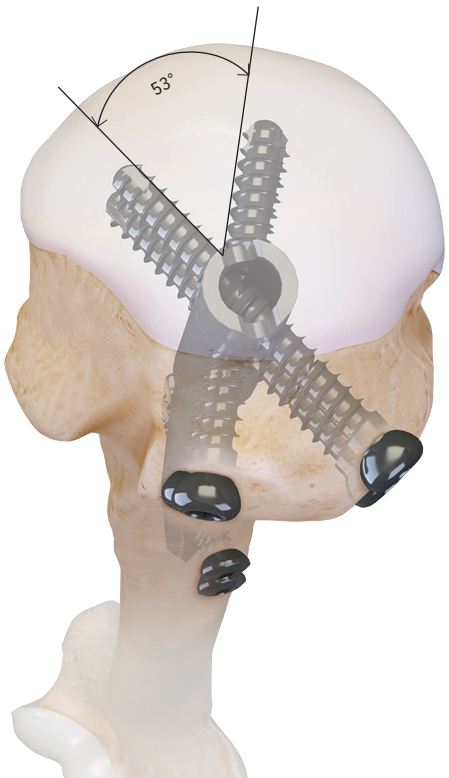


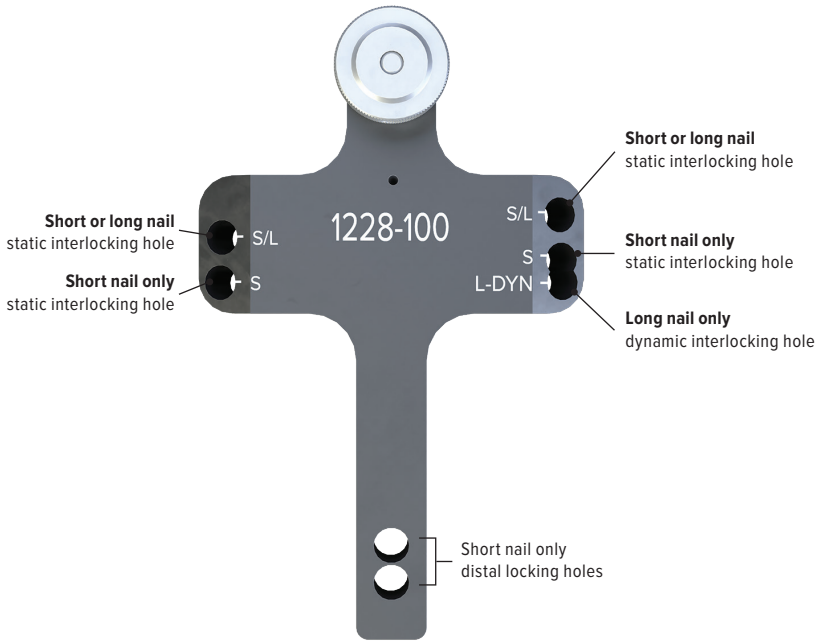
3.5 mm hex for proximal 5 mm locking screws in both nails



2.5 mm hex for distal 3.5 mm screws for both nails

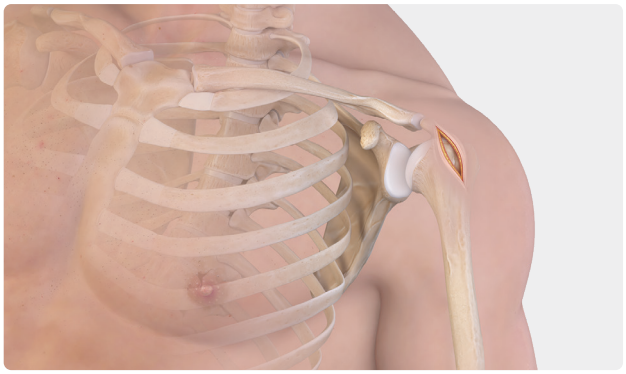
Internal compression screwdriver for long nail. Only use when the gold spacer has been implanted into the nail before the nail is placed on the targeter.





Short Nail Surgical Technique

Patient Positioning



1

Patients can be positioned in a beach chair positioner or supine on a radiolucent table. The C-arm can then be brought in from the contralateral side.

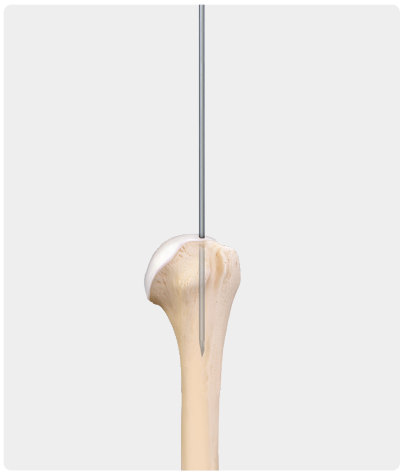
Potential advantages to positioning in the supine position include:

- Can be used by facilities that do not have a beach chair
- Generally quicker and facilitates multisite surgical care of polytrauma
- Can be used safely in patients with cervical spine precautions

Use one of the following approaches for nail insertion:

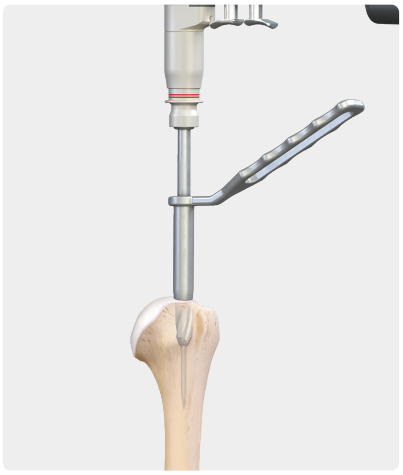
- Percutaneous Approach: Make a 1-2 cm incision after localizing the starting point by positioning the guide pin over the skin with C-arm assistance. Bluntly spread the deltoid to provide an opening for percutaneous nail placement. This approach is typically is used in two-part proximal humerus fractures.
- Mini-Open Percutaneous Approach: Start the incision at the lateral acromion and extend 3 cm distal, splitting the deltoid. This approach provides direct exposure for open tuberosity and head reduction techniques.
- Superior Approach: In this open rotator cuff approach, release the deltoid from the anterior acromion starting at the AC joint and extend 3 cm distal. A small longitudinal split can be made in the muscular portion of the supraspinatus medial to the tendinous footprint insertion. This approach addresses all types of proximal humerus fractures.

Open Proximal Canal



2

Place the entry point in the nonarticulating portion of the chondral surface of the humeral head in line with the axis of the humeral shaft.



2a

After C-arm confirmation of the appropriate pin placement, the nail insertion site can be opened in one of two ways:

a. A 10.5 mm entry reamer can be placed over the guide pin to the depth of the reamer.

b. A cannulated awl can be used to open the proximal canal.

2b

Note: The awl can be particularly useful in varus deformities to reduce the proximal fragment.

Short Nail Surgical Technique

Optional Shaft Reaming / Attach the Nail to the Jig

3

The short humeral nail features a trocar tip to help guide the nail down the canal. It is still recommended to use an opening reamer with the short humeral nail, as excessive stress at the top of the humeral head could cause additional fractures.

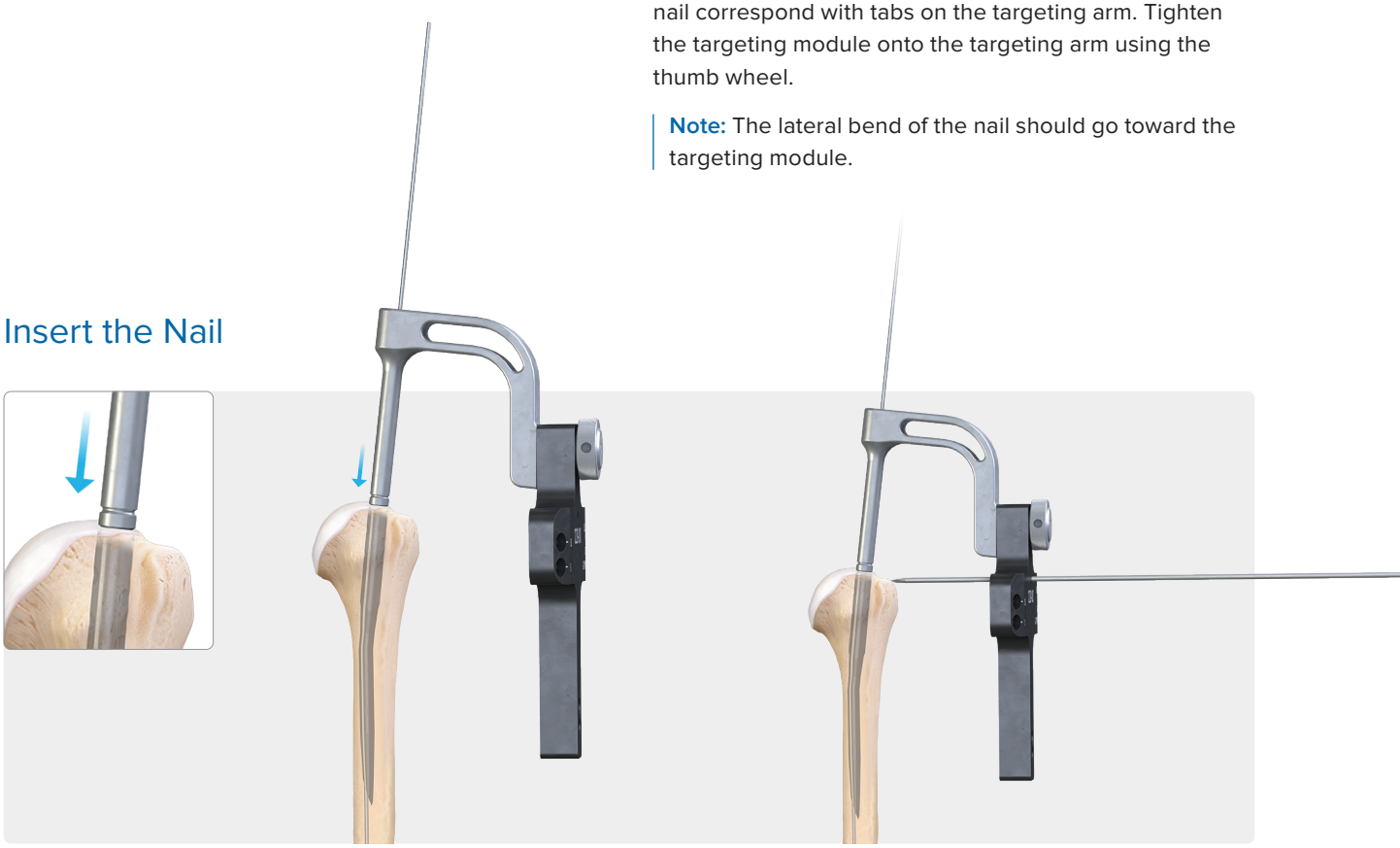
> **Note:** If reaming is desired, ream 1-2 mm over the selected construct size.

4

Use the large hex driver and T-handle to tighten the nail onto the targeting arm. Notches at the top of the nail correspond with tabs on the targeting arm. Tighten the targeting module onto the targeting arm using the thumb wheel.

> **Note:** The lateral bend of the nail should go toward the targeting module.

Insert the Nail



5

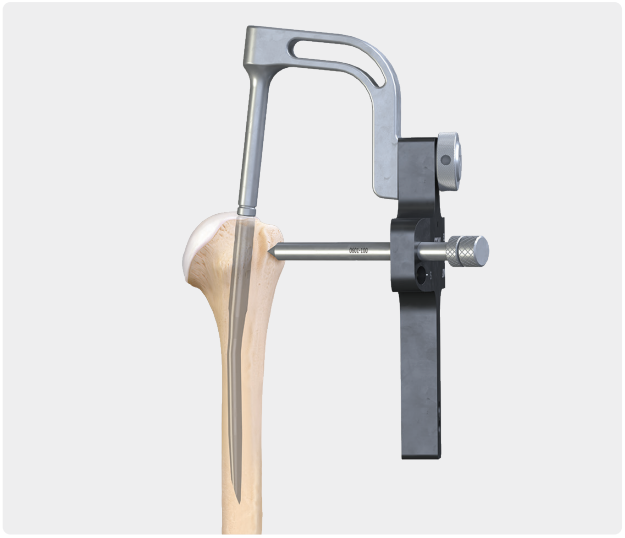
Using gentle rotations, advance the nail and assembled targeting jig into the humerus. Optionally, the nail can be advanced over the guide pin / reaming wire. An impaction pad may be threaded onto the top of the targeting arm if impaction is needed.

Insert a 3.2 mm guide pin through the lateral central hole on the targeter to identify the proximalend of the nail.

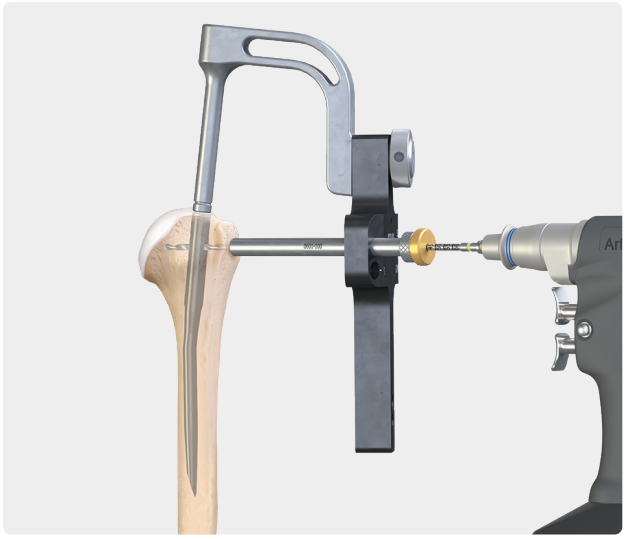
> **Note:** The targeting module should be in line with slightly anterior to the lateral shaft.

Short Nail Surgical Technique

Drill for Proximal Screws



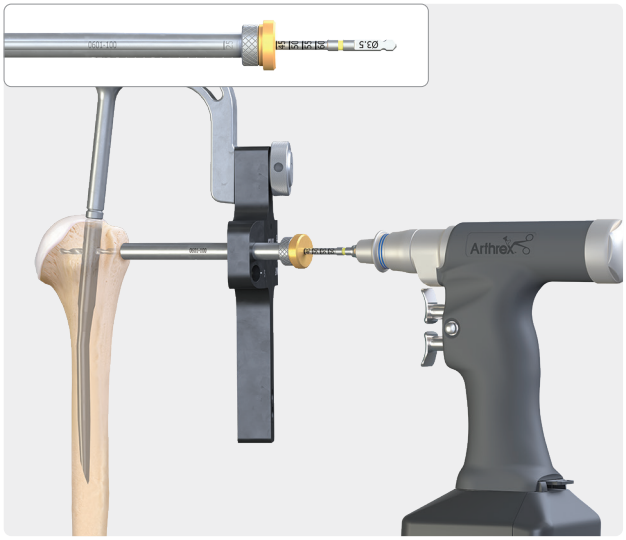
6a



6b

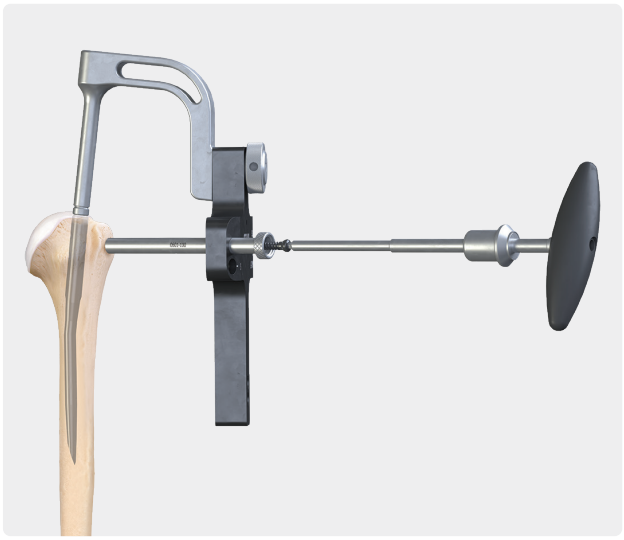
Insert the screw sheath with trocar into the targeting module. Advance the screw sheath and trocar to bone through a small incision, being careful to protect soft-tissue structures. Remove the trocar and insert the gold 3.5 mm drill guide and advance the 3.5 mm calibrated drill bit to subchondral bone under C-arm guidance.

Measure Proximal Screws / Insert Proximal Screws



7

Read the screw length off the calibration of the drill bit. Alternatively, use the hook-tip depth gauge through the screw sheath to measure for screw length. After establishing a measurement, insert the correct 5 mm cancellous interlocking screw through the screw sheath using a 3.5 mm hex driver.

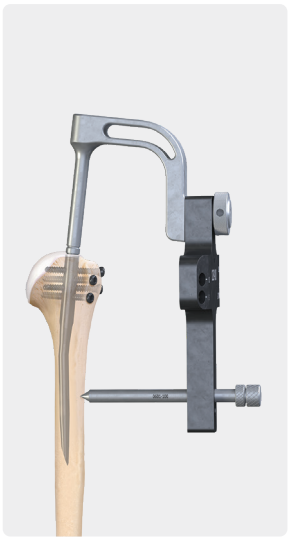


8

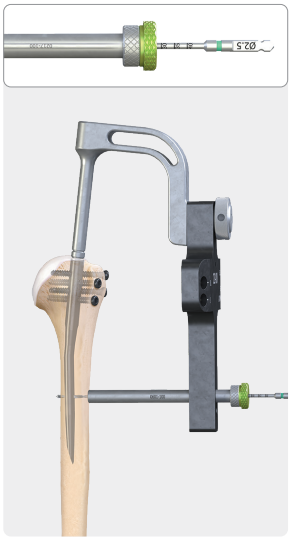
Use fluoroscopy to confirm appropriate screw length. Repeat the screw insertion steps for the remaining proximal screws.

Short Nail Surgical Technique

Drill and Insert Distal Screws

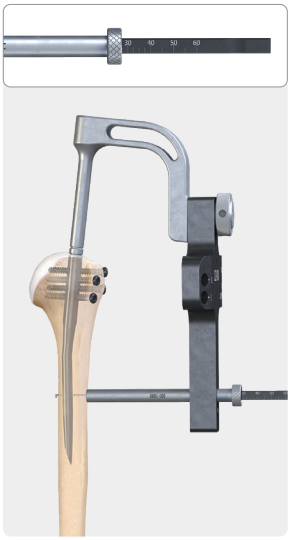


9a

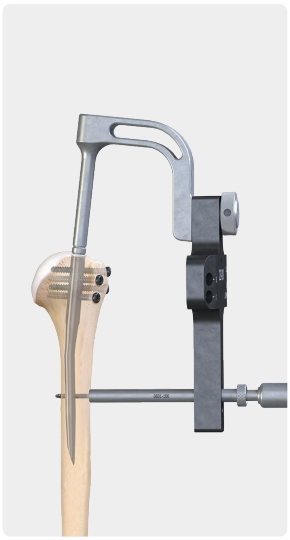


9b

There are two targeted screw options distally for short nails. Insert the drill sleeve and the trocar tip through the targeter and carefully advance to bone. Replace the trocar with the green 2.5 mm drill sleeve and drill with the 2.5 mm calibrated drill bit.



9c



9d

Screw length can be determined with the hook-tip depth gauge. Insert the 3.5 mm cortical screw through the screw sleeve with the 2.5 mm hex driver and T-handle. If necessary, a 3.5 mm cortical tap may be used.

Final Construct

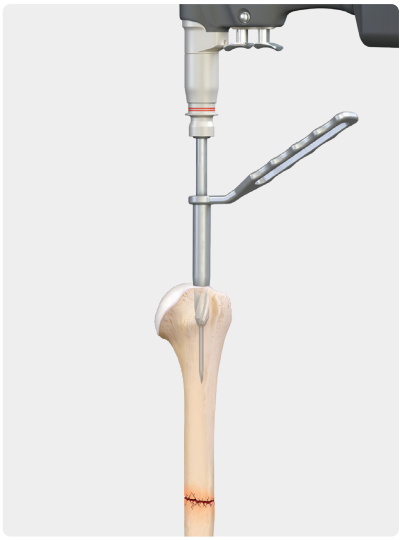
10a

10b

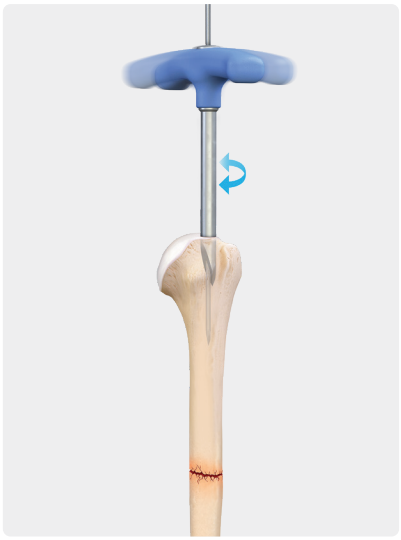
Remove the targeting jig using the 5 mm hex driver and assess the final implant position and reduction with fluoroscopy.

Long Nail Surgical Technique

Open Proximal Canal



1a



1b

Use the 3.2 mm guide pin to establish the entry point in the nonarticulating portion of the chondral surface of the humeral head, in line with the axis of the humeral shaft.

After C-arm confirmation of the appropriate pin placement, the nail insertion site can be opened in one of two ways:

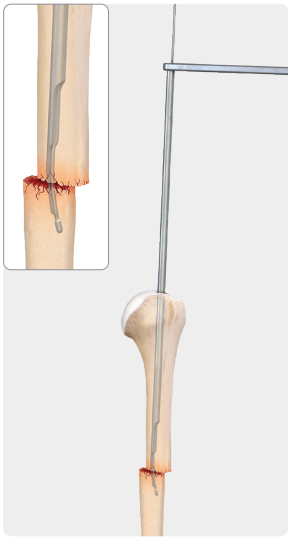
a. A 10.5 mm entry reamer can be placed over the guide pin to the depth of the reamer.

b. A cannulated awl can be used to open the proximal canal.

Obtain Nail Length and Ream

2a

Once the entry point is opened, pass the long 2 mm × 800 mm ball-tip guidewire down the canal of the humerus using the guidewire gripper.



2b

Note: The fracture reduction tool may be used to help pass the ball-tip wire across a fracture site.

2c

Use the guidewire-measuring gauge and black line on the guidewire to determine the length of the humeral nail needed.

2d

Ream the canal by passing flexible reamers over the ball-tip guidewire until cortical chatter is achieved. It is recommended to ream 1-2 mm above the size of the desired nail diameter.

Note: The nail is available in diameters of 7 mm, 8 mm, and 9 mm and lengths of 20 cm, 22.5 cm, 27.5 cm, and 30 cm.

Note: Do not run the humeral canal reamer in reverse. Doing so will cause the shaft of the reamer to unravel.

Long Nail Surgical Technique

Attach Nail to Jig

3

After determining the nail length, use the large hex driver and T-handle to tighten the nail onto the targeting arm. Notches at the top of the nail correspond with tabs on the targeting arm. Tighten the targeting module onto the targeting arm using the wheel.

> **Note:** The lateral bend of the nail should go toward the targeting module.

The compression nut, if used, must be advanced into the nail using the driver before attaching the nail to the targeting arm. The compression nut should be left flush with the superior aspect of the oblong hole.

Insert Nail

4

Thread the impaction pad onto the top of the targeting arm. Advance the nail over the guidewire to the desired depth using gentle mallet blows. The nail should be inserted below the first circumferential line on the insertion guide. If compressing, ensure the nail is countersunk sufficiently. A 3.2 mm guide pin can be inserted through the lateral central hole on the targeter to identify the most proximal end of the nail.

> **Note:** The targeting module should be in line or slightly anterior to the lateral shaft.

> **Note:** If intraoperative compression using the nail is not desired, proximal interlocking may be performed at this point.

If compression is necessary, continue to step 5. Otherwise, proceed to step 10.

Long Nail Surgical Technique

Optional Dynamic Compression Nail

5

When compressing, countersink the nail 5 mm to ensure the nail remains recessed after fracture compression. Notches at the end of the targeting arm indicate distances 2 mm and 5 mm from the top of the nail.

Insert Distal Screws

6a

6b

After nail insertion, place a distal screw in the nail using the green-stripe 2.5 mm drill bit and drill guide. Measure the screw depth with the hook-tip depth gauge.

Long Nail Surgical Technique

Drill and Insert Proximal Screws / Compression

7a

7b

7c

Once locked distally, insert the outer drill sleeve and trocar through the L-DYN hole on the targeting module. Carefully place the trocar down to bone. Replace the trocar with the yellow 3.5 mm drill guide and drill using the 3.5 mm drill bit. Measure off the drill bit calibrations and insert a 5 mm screw using the 3.5 mm hex driver and T-handle.

8

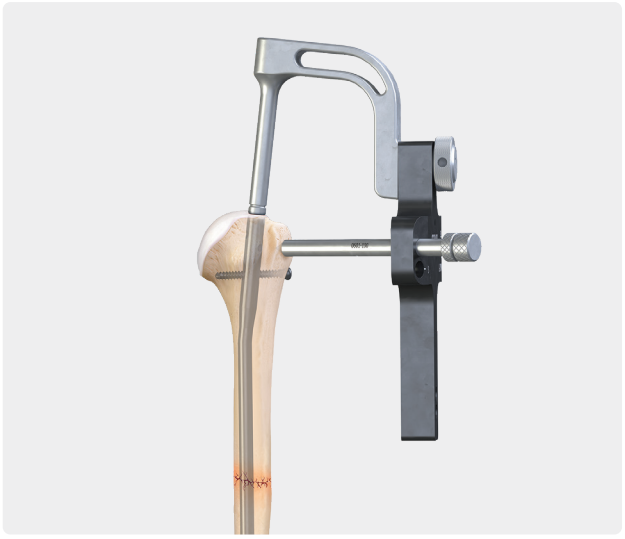
Option A: Preloaded, built-in compression nut
Introduce the long 2.5 mm hex driver from the top of the targeting arm and engage with the gold compression nut inside the nail. Tighten the compression nut against the proximal screw until desired fracture compression is achieved.

Repeat proximal locking steps for the remaining two screws to maintain adequate compression.

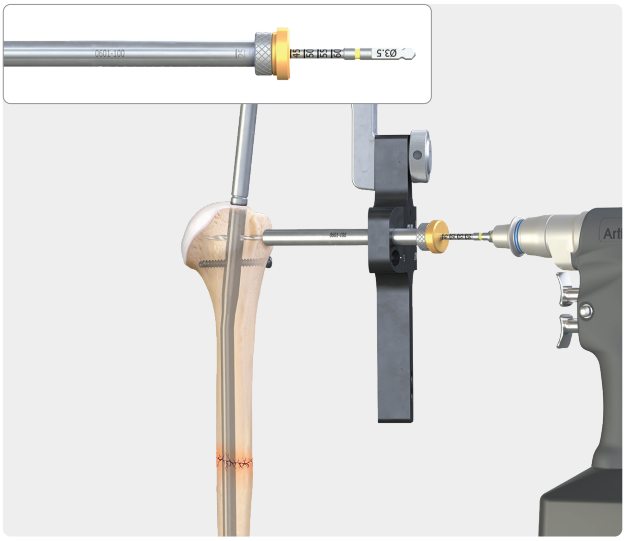
Option B (not pictured): Backslap technique
After the nail is locked distally, thread the nail extraction rod into the proximal portion of the nail. Backslap the extraction rod with repeated mallet strikes to compress the fracture. Then, insert the proximal screws.

Long Nail Surgical Technique

Insert Proximal Screws



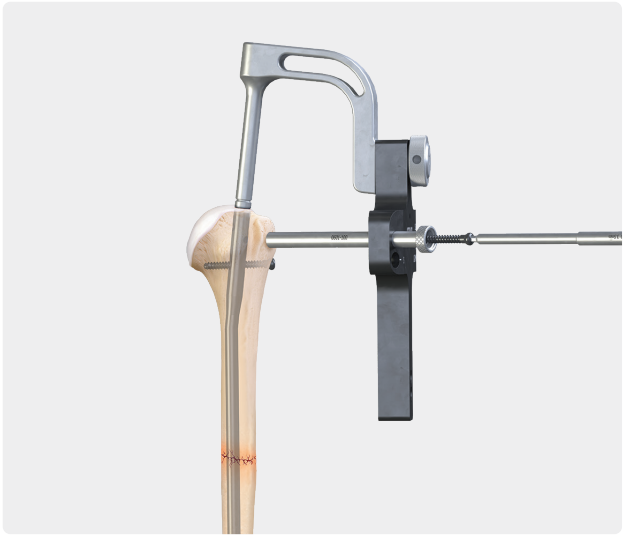
9a



9b

Insert the drill sleeve with the trocar through the desired hole on the targeting module. Remove the trocar and insert the yellow 3.5 mm drill guide. Drill with the 3.5 mm drill to subchondral bone. Measurements can be taken off calibrations on the drill bit.

> **Note:** It is recommended to not drill through subchondral bone. If between sizes for screw length, it is recommended to size down as the screws must remain unicortical. Make sure the drill sleeve is down to bone as this will affect the calibration measurement on the drill bit.



9c

9d

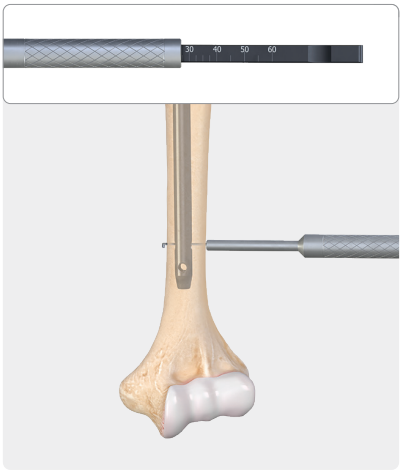
Repeat drill, measure, and screw techniques for the remaining proximal screws.

Long Nail Surgical Technique

Drill and Insert Distal Screws

10a

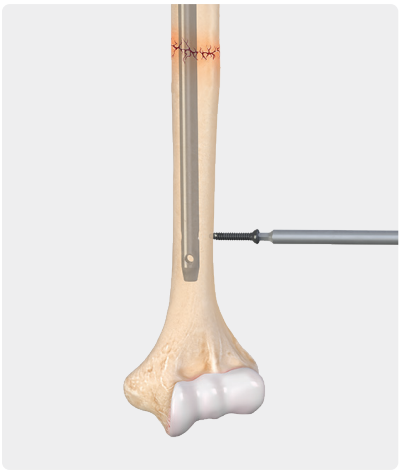
Make a small incision, using blunt spreading, directly to the humeral bone. Position the drill in line with the screw hole. Using the 2.5 mm drill and C-arm assistance, drill in an oscillating fashion to avoid slippage.



10b

Use fluoroscopy to verify drill placement through the bone. Use the hook-tip depth gauge to determine screw length.

Alternatively, slide the distal sheath over the 2.5 mm drill to measure the screw length.



10c

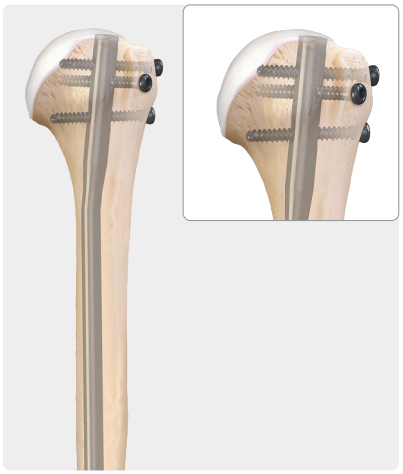
Use the 2.5 mm hex driver shaft and T-handle to insert the 3.5 mm screws.

> **Note:** It is recommended to use the A/P distal screw to avoid the path of the radial nerve at this location; orientation to obtain perfect fluoroscopic circles for drilling and screw placement is also easier.

Final Construct

11a

Remove the targeting jig using the 5 mm hex driver and assess the final images with fluoroscopy.



11b

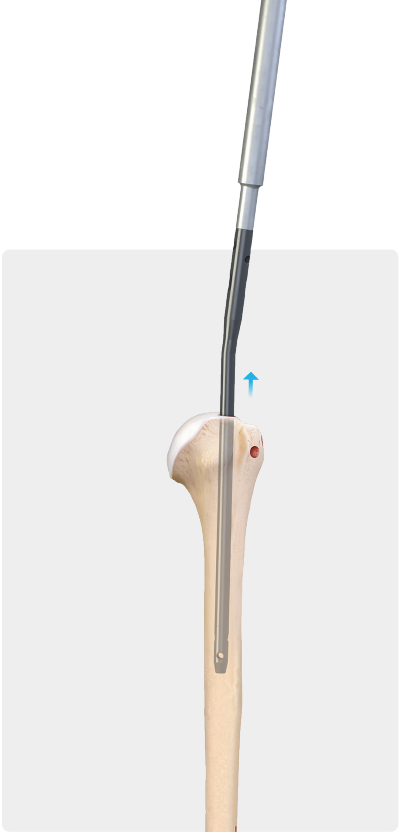
11c

> **Note:** An optional 2 mm or 5 mm end cap may be inserted onto the top of the nail following targeting jig detachment. Use the 3.5 mm hex driver and make sure to fully seat the end cap to prevent loosening and impingement.

Optional Nail Removal

12a

12b



12c

To remove the nail, remove the end cap (if used) and proximal screws. Thread the nail extractor into the top of the nail **before removing the distal screws** to prevent the nail from spinning or migrating. Once the extraction device is threaded into the nail, the remaining distal screws can be removed and the nail extracted.

Supporting Products

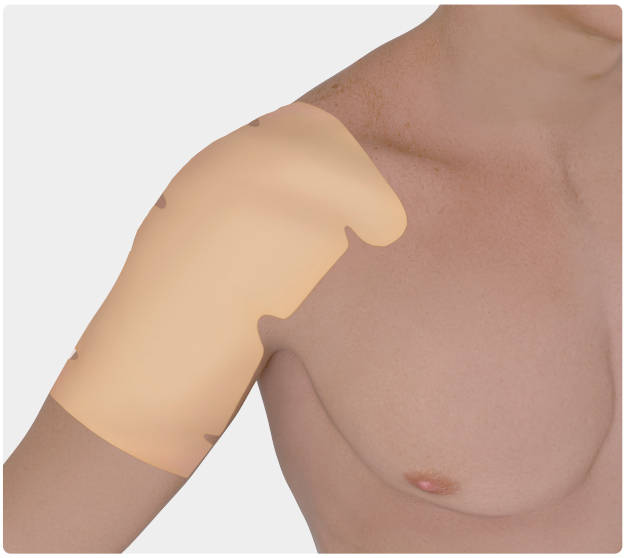
FiberTape® Cerclage
The FiberTape cerclage system is a strong, simple, and reproducible solution for replacing metal cables and wires traditionally used for fracture fixation. The low-profile, broad footprint of the FiberTape cerclage suture provides superior compression and ultimate load compared to traditional metal cables and wires.[1] The system includes FiberTape and TigerTape™ cerclage sutures, various passing instruments, tensioner, handle, and an instrument tray.

Disposable Tensioner

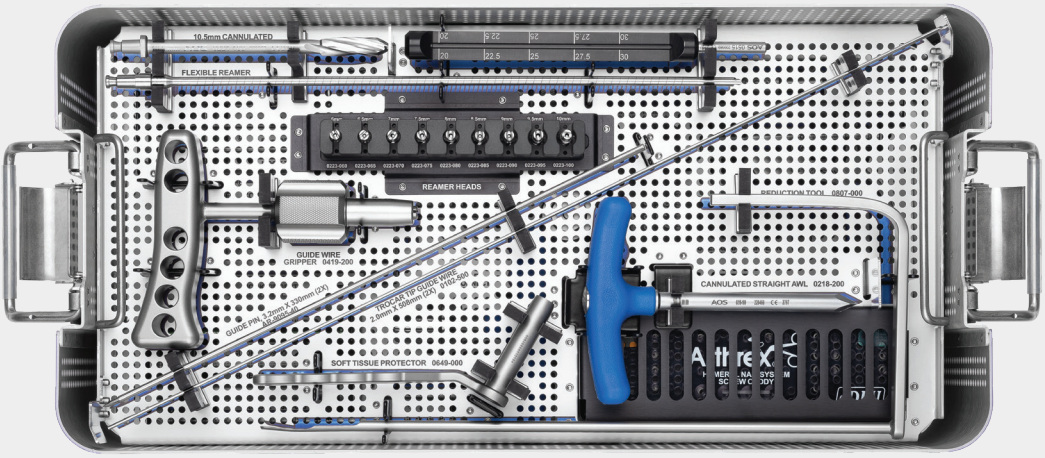
Orthobiologics Solutions

JumpStart® Antimicrobial Wound Dressing
Powered by V.Dox™ technology, JumpStart dressings provide sustained, antimicrobial protection against a broad spectrum of microbes, including harmful multidrug-resistant and biofilm-forming pathogens.[2-4] JumpStart dressings are embedded with islands of elemental silver and zinc, which create microcell batteries that generate electrical currents and kill pathogens. These microcurrents also promote keratinocyte migration and re-epithelialization, which are essential to the healing process.[5]

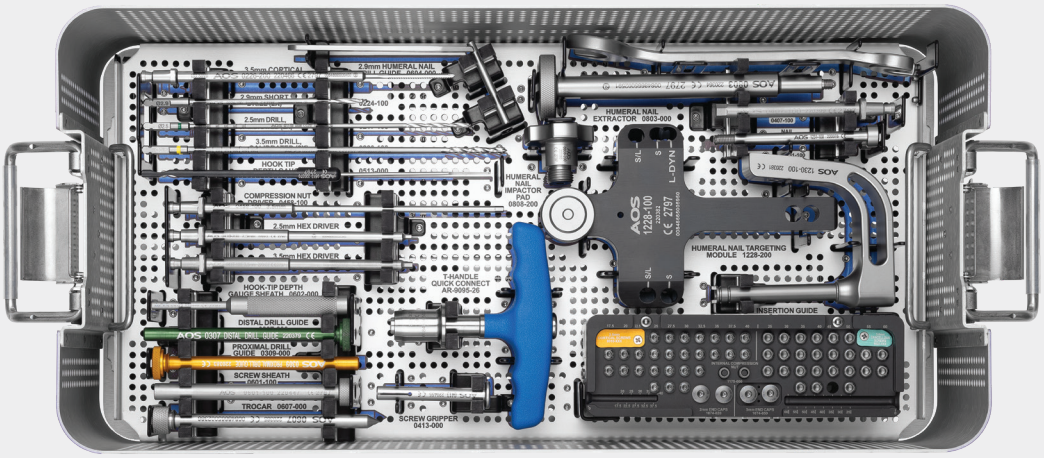
JumpStart dressings are available in multiple sizes and configurations to meet the needs of all orthopedic physicians.



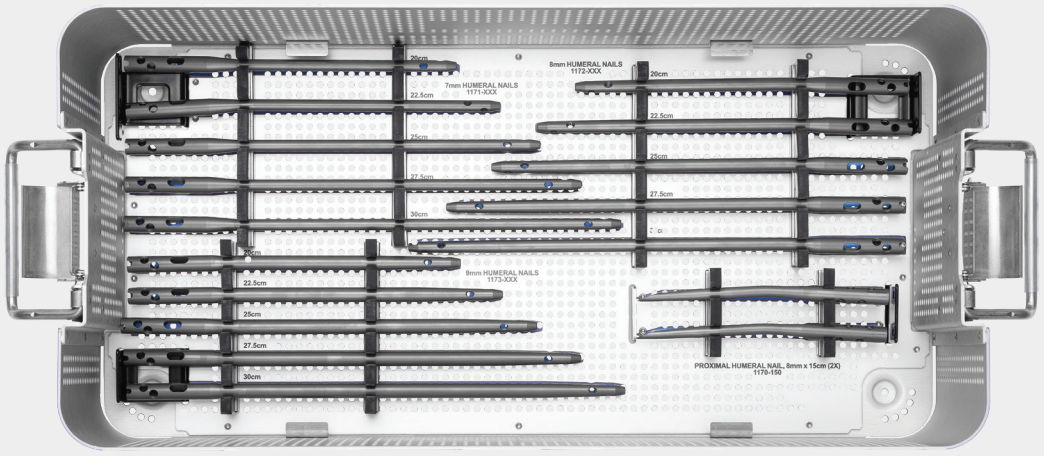
Humeral Nail Case Top Layer



Humeral Nail Case Middle Layer



Humeral Nail Case Bottom Layer



Humeral Nail System (9903-200S)

Instruments	
Straight awl, cannulated	0218-000
Entry reamer, cannulated, 10.5 mm	0221-100
Flexible shaft	0222-200
Reamer head, 6 mm	0223-060
Reamer head, 6.5 mm	0223-065
Reamer head, 7 mm	0223-070
Reamer head, 7.5 mm	0223-075
Reamer head, 8 mm	0223-080
Reamer head, 8.5 mm	0223-085
Reamer head, 9 mm	0223-090
Reamer head, 9.5 mm	0223-095
Reamer head, 10 mm	0223-100
Drill drill guide, 2.5 mm	0307-000
Proximal drill guide, gold, 3.5 mm	0309-000
Driver, hex	0407-100
T-handle	0411-000
Screw gripper	0413-000
Screw driver, hex, 2.5 mm	0416-200
Screw driver, hex, 3.5 mm	0417-100
Guidewire gripper, 2 mm/3 mm	0419-200
Depth gauge, hook tip	0513-000
Guidewire depth gauge for humeral nail	0515-000
Screw sheath	0601-100
Distal sheath	0602-000
Drill guide, 2.9 mm	0604-000
Screw trocar	0607-000
Extractor, humeral nail	0803-000
Reduction tool	0807-000
Impactor pad	0808-100
Combination wrench	0813-000
Targeting module, humeral nail	1228-100
Insertion guide	1230-100
Locking bolt	1231-100
Humeral nail case	9903-200

Nails	
Proximal humeral nail, 8 mm × 15 cm	1170-150
Humeral nail, 7 mm × 20 cm	1171-200
Humeral nail, 7 mm × 22.5 cm	1171-225
Humeral nail, 7 mm × 25 cm	1171-250
Humeral nail, 7 mm × 27.5 cm	1171-275
Humeral nail, 7 mm × 30 cm	1171-300
Humeral nail, 8 mm × 20 cm	1172-200
Humeral nail, 8 mm × 22.5 cm	1172-225
Humeral nail, 8 mm × 25 cm	1172-250
Humeral nail, 8 mm × 27.5 cm	1172-275
Humeral nail, 8 mm × 30 cm	1172-300
Humeral nail, 9 mm × 20 cm	1173-200
Humeral nail, 9 mm × 22.5 cm	1173-225
Humeral nail, 9 mm × 25 cm	1173-250
Humeral nail, 9 mm × 27.5 cm	1173-275
Humeral nail, 9 mm × 30 cm	1173-300
Screws	
Cancellous screw, 5 mm × 25 mm-60 mm (5 mm increments)	8022-025–060
Cortical screw, 3.5 mm × 17.5 mm-40 mm (2.5 mm increments)	8010-175–400
End cap, 2 mm	1074-020
End cap, 5 mm	1074-050
Fracture reduction screw	1175-000
Disposables	
Guide pin, 3.2 mm × 330 mm	0100-000
Guidewire w/ trocar tip, 2 mm	0102-500
Guidewire, ball nose, 2 mm	0103-800s
Drill bit, calibrated, green, 2.5 mm	0217-100
Drill bit, calibrated, gold, 3.5 mm	0220-100
Drill bit, short, 2.9 mm	0224-100
Tap, cortical, 3.5 mm	0226-000

References

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This description of technique is provided as an educational tool and clinical aid to assist properly licensed medical professionals in the usage of specific Arthrex products. As part of this professional usage, the medical professional must use their professional judgment in making any final determinations in product usage and technique. In doing so, the medical professional should rely on their own training and experience and should conduct a thorough review of pertinent medical literature and the product's directions for use. Postoperative management is patient-specific and dependent on the treating professional's assessment. Individual results will vary and not all patients will experience the same postoperative activity level or outcomes.

Arthrex manufacturer, authorized representative, and importer information (Arthrex eIFUs)

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