

EXPERT Humeral Nailing System

EXPERT Humeral Nail and
EXPERT Proximal Humeral Nail

Surgical Technique



 Image intensifier control

This description alone does not provide sufficient background for direct use of DePuy Synthes products. Instruction by a surgeon experienced in handling these products is highly recommended.

Processing, Reprocessing, Care and Maintenance

For general guidelines, function control and dismantling of multi-part instruments, as well as processing guidelines for implants, please contact your local sales representative or refer to:

<http://emea.depuySynthes.com/hcp/reprocessing-care-maintenance>

For general information about reprocessing, care and maintenance of DePuy Synthes reusable devices, instrument trays and cases, as well as processing of DePuy Synthes non-sterile implants, please consult the Important Information leaflet (SE_023827) or refer to:

<http://emea.depuySynthes.com/hcp/reprocessing-care-maintenance>

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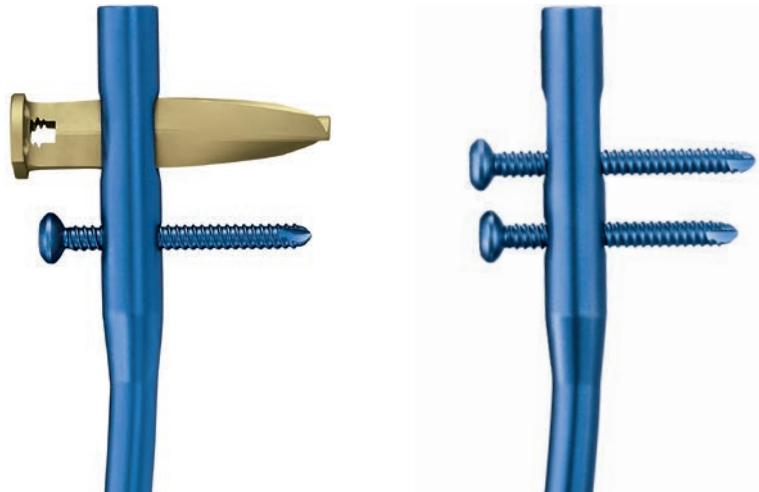
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EXPERT Humeral Nailing System

Proximal locking

Spiral blade

- Angular stable locking in the humeral head



Stability

End cap

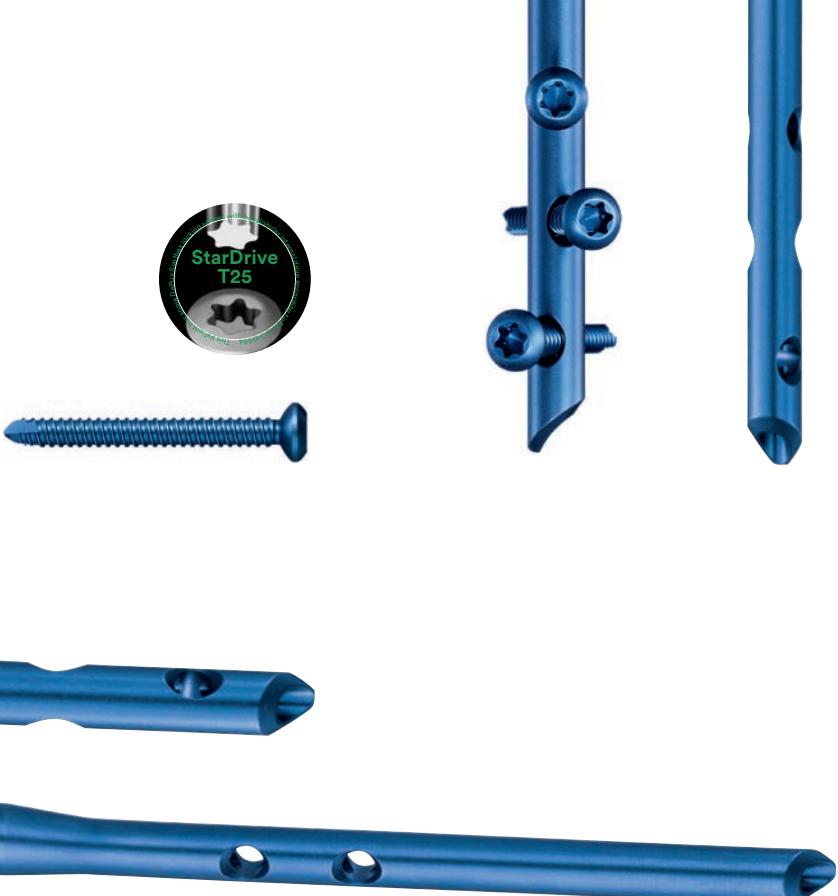
- Nail can be extended up to 15 mm
- Self-holding StarDrive™ Recess for the end cap to be picked up



A system for humeral fractures

Two nails for fractures

- EXPERT Proximal Humeral Nail for proximal fractures
- EXPERT Humeral Nail for diaphyseal and proximal-diaphyseal combined fractures
- To be used for both left and right humerus
- EXPERT Humeral Nail is for both antegrade and retrograde access
- Self-holding StarDrive Recess for pick-up of locking screw



Please refer to the corresponding Instructions for Use for specific information on Intended use, Indications, Contraindications, Warnings and Precautions, Potential Adverse Events, Undesirable Side Effect and Residual Risks.
Instructions for Use are available at www.e-ifu.com and/or www.depuysynthes.com/ifu.

The AO Principles of Fracture Management

Mission

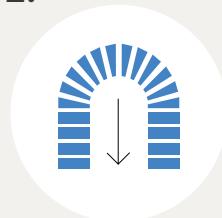
The AO's mission is promoting excellence in patient care and outcomes in trauma and musculoskeletal disorders.

AO Principles^{1,2}

1.



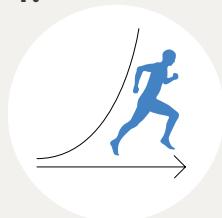
2.



3.



4.



Fracture reduction and fixation to restore anatomical relationships.

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

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

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

¹ Müller ME, Allgöwer M, Schneider R, Willenegger H. Manual of Internal Fixation. 3rd ed. Berlin, Heidelberg New York: Springer 1991.

² Buckley RE, Moran CG, Apivatthakakul T. AO Principles of Fracture Management: 3rd ed. Vol. 1: Principles, Vol. 2: Specific fractures. Thieme; 2017.

EXPERT Humeral Nail Antegrade Insertion

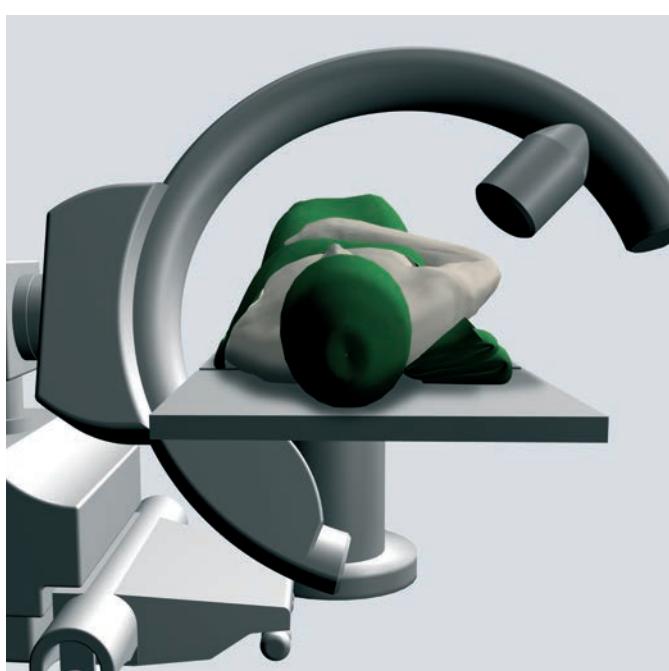
1. Position the patient

Position the patient in the “Beach Chair” position on a shoulder table. Alternatively, position the patient on his/her back with the upper body elevated at an angle of 30°. Support the shoulder with pads. The operating table must be radiolucent in the shoulder area or else the corresponding table section should be removable. It must be possible to view the whole upper arm including the elbow and the humeral head in two planes in the image intensifier. Support the fractured arm on a side rest.



A modified lateral position on a completely radiolucent OR table can also be used. Position the C-arm to enable visualization of the entire humerus in the AP and lateral planes. Place the C-arm opposite the surgeon, perpendicular to the longitudinal axis of the humeral shaft in the AP view.

Obtain a scapular “Y” lateral view by bringing the C-arm through a 90° arc and projecting the beam directly at the glenoid.



2. Confirm nail length

Instrument

03.010.022 Radiographic Ruler for EXPERT Humeral Nail

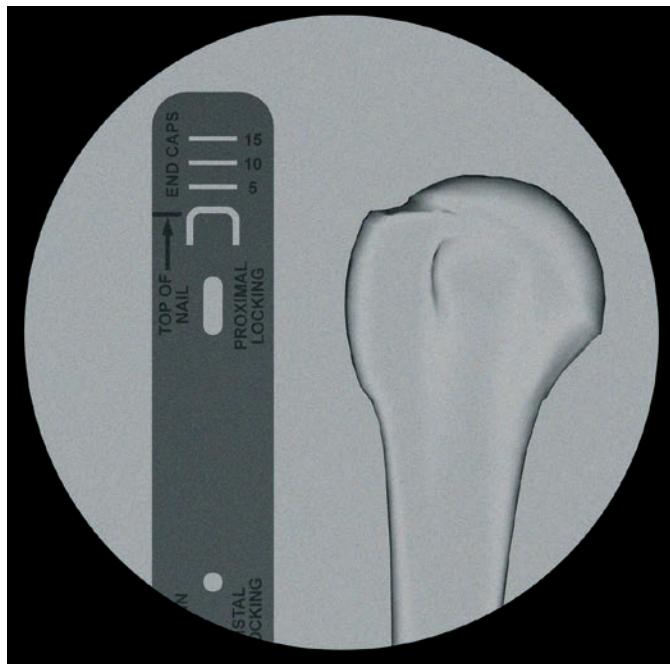
The approximate nail length can be determined preoperatively. Measure the length of the unfractured humerus from its head to the olecranon fossa and deduct 3–5 cm from the measured distance.

■ Note:

The length can be determined correctly on the fractured arm only if the fracture is first correctly reduced.



- ① Position the image intensifier for an AP view of the proximal humerus. Using long holding forceps, hold the Radiographic Ruler for EXPERT Humeral Nail parallel to the humerus so that the proximal locking slot symbolized on the ruler is located at the correct point against the proximal humerus. Mark the skin over the proximal humerus at the “top of the nail” symbolized on the ruler.



Position the image intensifier over the distal humerus, place the symbolized nail end of the ruler at the marked skin site and record an AP image. Check the reduction and read off the nail length from the image of the ruler.

■ Notes:

- The nail tip should be positioned at least 25 mm away from the cranial boundary of the olecranon fossa.
- Potential of compression must be taken into account when determining the nail length and a correspondingly shorter nail should be chosen. The locking screw in the compression slot can move by up to 8 mm distally.



3. Confirm nail diameter

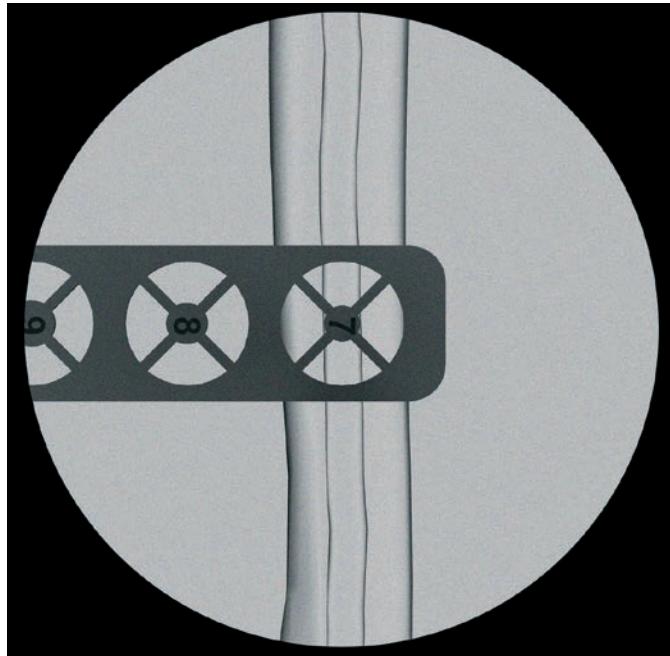
Instrument

03.010.023 Radiographic Medullary Canal Estimator

- ① Position the image intensifier for a lateromedial view of the humerus. Hold the radiographic medullary canal estimator over the humerus with the diameter gauge centered over the medullary canal at the narrowest part that will contain the nail. Read the diameter measurement on the circular indicator that fills the canal.

■ Note:

The ruler is not at the same level as the humerus, and this will affect the accuracy of the measurement.



4. Determine entry point

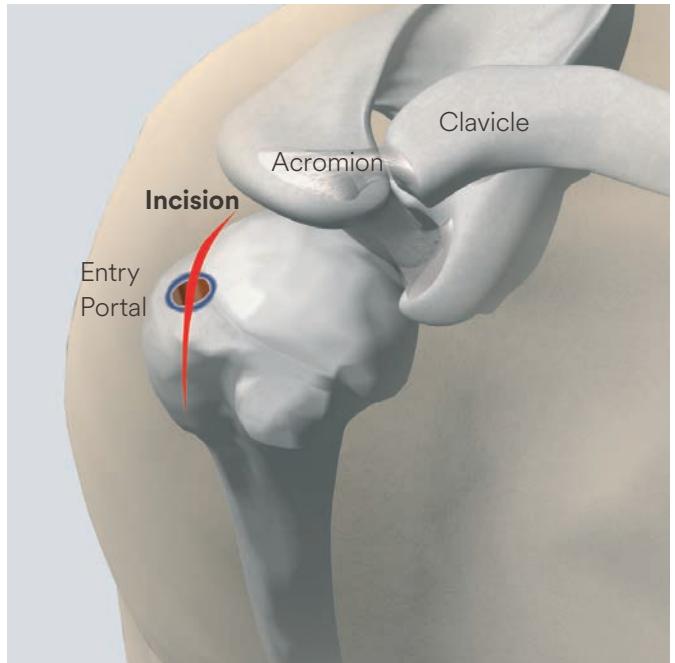
- In certain cases after a closed reduction, the humeral head may need to be fixed temporarily with a raspatory or a Kirschner Wire. The correct head position is visible in the AP view by ensuring the maximum humeral head diameter. To obtain this, the arm should be positioned in approximately 25° of external rotation.

Make the initial incision anterolateral to the acromion process and split the deltoid muscle longitudinally. Palpate the greater tuberosity, identify – but do not expose – the supraspinatus tendon and split the mid section lengthwise. Avoid any additional injury to the rotator cuff. The arm can be adducted across the chest in order to gain better access to the proximal humerus.

- The antegrade insertion point for the EXPERT Humeral Nail is located on the extended axis of the central humeral shaft in the lateral view and at the bone-cartilage transition of the humeral head in the AP view and not on the
- greater tuberosity, otherwise the tendon attachment of the supraspinatus will be affected. With the humeral head correctly positioned, the point is located just in front of, or below, the tip of the acromion process. Find this position under the image intensifier using a 2.5 mm Kirschner Wire.

▲ Precaution:

In case of greater tubercle fracture (B Type) use a slightly more medial entry point in order to avoid insertion through the fracture and subsequent lateralization of the shaft to the proximal fragment.



5. Insert Kirschner Wire

Instruments

292.260	Kirschner Wire Ø 2.5 mm with trocar tip, length 280 mm, Stainless Steel
393.105	Universal Chuck, small, with T-Handle

Using the small universal chuck with T-Handle, insert a 2.5 mm Kirschner Wire at the appropriate insertion point in the proximal humerus and advance it in the medullary canal. Check the position of the Kirschner Wire under the image intensifier in both the frontal and sagittal planes.



6a. Open medullary canal – awl

Instrument

03.010.039 Awl, cannulated

Place the cannulated awl over the Kirschner Wire to the bone. Use a twisting motion to advance the awl. Remove the awl and the Kirschner Wire.

■ Note:

Dispose of the Kirschner Wire. Do not reuse.

▲ Precaution:

Take care not to plunge the awl into the fracture site since this may displace the fracture.



6b. Open medullary canal – drill bit

Alternative Instruments

360.050 Drill Bit Ø 10.0 mm, cannulated, length 190/140 mm, 3-flute, for Jacobs Chuck

03.010.038 Protection Sleeve 10.0

Pass the drill bit over the Kirschner Wire and through the protection sleeve to the bone. Drill to the depth of the medullary canal. Remove the drill bit and the Kirschner Wire.

■ Note:

Dispose of the Kirschner Wire. Do not reuse.

▲ Precaution:

As with the awl, take care not to plunge the drill bit into the fracture site since this may displace the fracture.



7. Optional: Reaming guidelines

- Use a reaming system intended for humeral reaming procedures. Using image intensification, ensure that fracture reduction has been maintained.

Ream to a diameter at least 1.0 mm greater than the nail diameter in accordance with the surgeon's preference. Ream in 0.5 mm increments and advance the reamer with steady, moderate pressure.

■ Note:

Do not force the reamer. Frequently retract the reamer partially to clear debris from the medullary canal.

Remove the reaming assembly, leaving the reaming rod in place. All EXPERT Humeral Nails (long) can be inserted over the reaming rod.

■ Note:

Flush the surgical site after reaming to remove remaining debris and reduce the risk of heterotopic ossification.

▲ Precaution:

Reaming should be avoided in case of comminution in the area where the radial nerve contacts the bone in the radial sulcus.

Nail Diameter (Midshaft)	Nail Diameter (Proximal end)
7 mm, 9 mm	9 mm
11 mm	11 mm



Option

Optional instruments

351.920/930/940	Hand Reamer for Medullary Canal
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8. Assemble insertion instruments

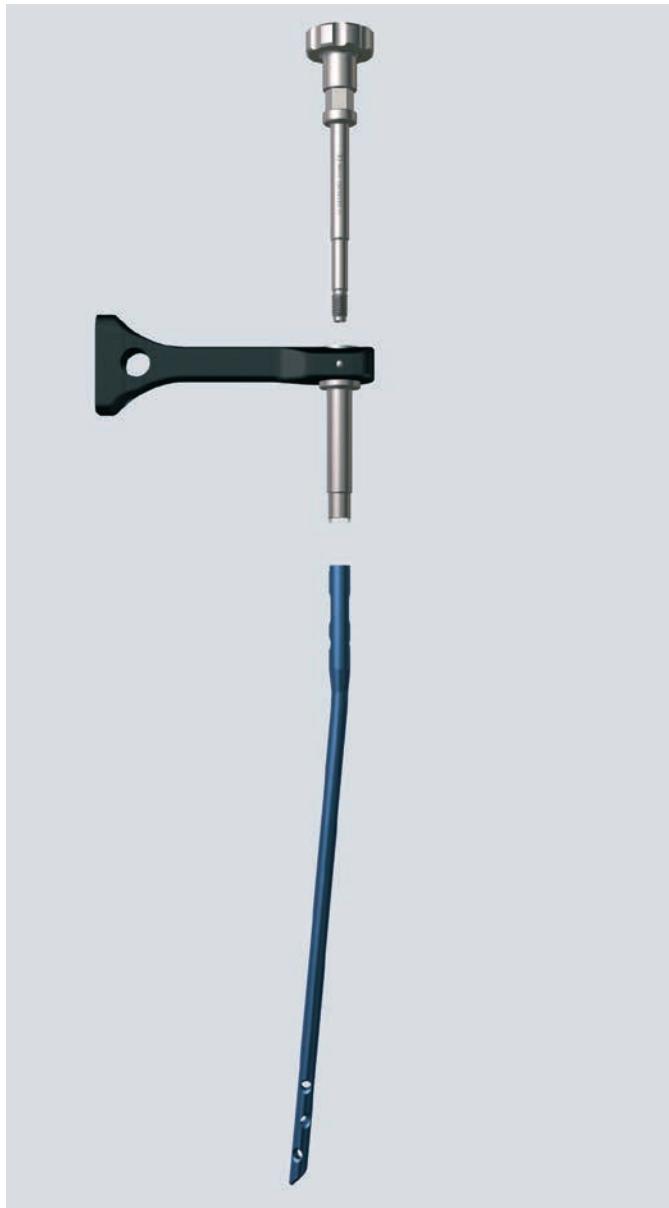
Instruments

03.010.054	Insertion Handle for EXPERT Humeral Nail
03.010.053	Connecting Screw, cannulated, for EXPERT Humeral Nail
321.160	Combination Wrench Ø 11.0 mm

Orient the insertion handle laterally and match the geometry of the handle to the nail, ensuring that the tip of the nail points towards the insertion handle. Screw the connecting screw through the insertion handle into the nail and tighten it using the combination wrench.

■ Note:

Confirm that the nail is tightly connected to the insertion handle, especially after hammering. The 11 mm combination wrench may be used to retighten the connecting screw over the reaming rod as needed. If a reaming rod has been used, it should be removed once the nail has crossed the fracture site.



9. Insert nail

Insert the nail over the reaming rod (if used) with slight rotating movements of the insertion handle. Insert the nail

- to the fracture site, reduce the fracture and continue beyond the fracture under image intensifier control. Proceed carefully to avoid injuring the radial nerve, particularly in fractures of the mid to distal third of the shaft.

If radial nerve paresis is present preoperatively, the nerve must be explored through a short anterolateral incision at the transition of the mid and distal third of the shaft.

- Check the nail position under the image intensifier. Countersink the nail fully into the humeral head to avoid irritating the shoulder structures, including during abduction (impingement risk).

If the reaming rod is used, remove it before locking.

Optional instrument

351.920/930/940	Hand Reamer for Medullary Canal
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If the nail proves very difficult to advance, check whether widening the medullary canal with the hand reamers is indicated or choose a smaller nail diameter.

▲ Precaution:

The nail should not be hammered in since this increases the risk of iatrogenic fissures or fractures at the insertion site.

■ Note:

Pressure against the elbow when advancing the nail prevents diastasis formation and potentially associated healing problems.



EXPERT Humeral Nail Antegrade Insertion – Locking with Spiral Blade

To lock with a spiral blade, the nail must always be locked first at the proximal end so that the spiral blade can be placed in the optimal position.

■ Note:

Once reduction is performed, do not move the patient's arm until locking is completed since it may result in a loss of reduction.



1. Assemble aiming arm and insert trocar combination

Instruments

03.010.055	Aiming Arm Spiral Blade for EXPERT Humeral Nail
03.010.086	Drill Sleeve 14.0/8.0, length 130 mm
03.010.087	Centering Sleeve 8.0/2.0 for Kirschner Wire, length 140 mm
03.010.088	Trocar Ø 2.0 mm, length 150 mm

Assemble the aiming arm for the spiral blade to the insertion handle. Check the connection between the insertion handle and the nail and tighten the connecting screw if necessary. Likewise, check the reduction.

■ Note:

Take into account the retroversion of the humeral head when positioning the spiral blade in the center of the head.

Make a skin incision, insert the trocar combination (drill sleeve, centering sleeve and trocar) through the hole in the aiming arm marked "Spiral Blade" and insert the trocar down to the bone. Remove the trocar.

▲ Precaution:

Only incise the skin and then perform blunt dissection to avoid injuring the axillary nerve and its branches.



2. Determine length of spiral blade and drill

Instruments

03.010.025	Kirschner Wire Ø 2.0 mm with trocar tip, length 240 mm, Stainless Steel
03.010.090	Measuring Device for Spiral Blade for EXPERT Humeral Nail
03.010.089	Drill Bit Ø 4.5 mm, cannulated

- Insert the 2.0 mm Kirschner Wire through the centering sleeve into the humeral head and use the image intensifier to check the definitive position at the height with the largest cross-section of the humeral head. The wire should extend almost to the cortex on the opposite side, but should not perforate it down to the subchondral space.

Pass the measuring device over the Kirschner Wire, advance it until the nose rests against the collar of the drill sleeve and read the length of the spiral blade at the end of the wire off the scale. Remove the measuring device and the centering sleeve; the Kirschner Wire must remain in the bone.

- Pass the cannulated drill bit over the Kirschner Wire, and drill down to perforate the lateral cortex. Remove the drill sleeve and the drill bit.



3. Attach and insert spiral blade

Instruments

358.696	Inserter for Spiral Blade, for Humeral Nails
358.697	Connecting Screw for Spiral Blades, for Humeral Nails
03.010.058	Combined Hammer 400 g

Insert the connecting screw in the inserter, mount the selected spiral blade on the cams of the inserter and tighten the connecting screw. Check for a secure fit.

Introduce the spiral blade and inserter over the Kirschner Wire, through the aiming arm and down to the lateral cortex.

The initial orientation of the T-handle of the inserter relative to the aiming arm depends on patient anatomy. If the distance from the lateral cortex to the nail is less than 10 mm, start the T-handle slightly clockwise from parallel. If the distance from the lateral cortex to the nail is more than 10 mm, start the T-handle slightly counter-clockwise from parallel.

- Advance the spiral blade by hand or by gentle hammer blows until the desired position is reached. This will cause the T-handle to rotate clockwise through 90°. Check the position of the spiral blade under the image intensifier. Unscrew the insertion instruments for the spiral blade and remove the Kirschner Wire.

▲ Precaution:

When locking with a spiral blade, an end cap must always be inserted into the nail; otherwise the spiral blade will not be properly secured.

■ Note:

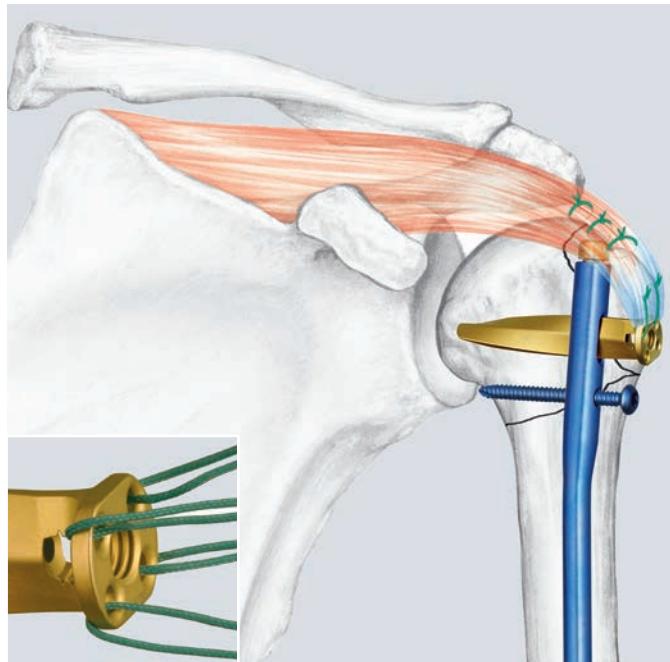
If a 0 mm end cap has been indicated, leave the insertion handle, aiming arm and spiral blade insertion assembly in place since the 0 mm end cap can be inserted through the insertion handle.



Option

Optionally, a 4.0 mm Locking Screw may be used in the proximal locking hole. For locking this screw, see “3. Insert locking screws” section. This locking screw may be bicortical or unicortical depending upon its placement relative to the articular surface.

For fractures with avulsion of the greater tuberosity (B fractures), the latter must always be reduced and fixed as well. Often minor displaced fractures are fixed by the base plate of the spiral blade and the more or less intact rotator cuff. Otherwise, this can be achieved either with a covered technique or by extending the cranial incision. The tuberosity can be fixed with a 4.0 mm cannulated titanium screw or with tension-band wiring. In the latter technique, a suture or wire loop, for example, can be anchored in the holes in the spiral blade. In case of poor bone quality, the tension-band wiring technique is preferable.



Locking at the distal end is normally done using the radiolucent drive or the “freehand” technique.

Choose the most suitable distal holes depending on the fracture and on the anatomy. Be aware of the position of the median nerve and the brachial artery in the medial bicipital groove. Avoid using locking screws which can interfere with this position. If in doubt, use a larger skin incision to localize the structures and protect them while drilling and inserting the locking screws.

For a fracture and a standard anatomy, the two most proximal holes should be used for the left humerus.

For the right humerus, the most proximal hole and the most distal hole should be used.

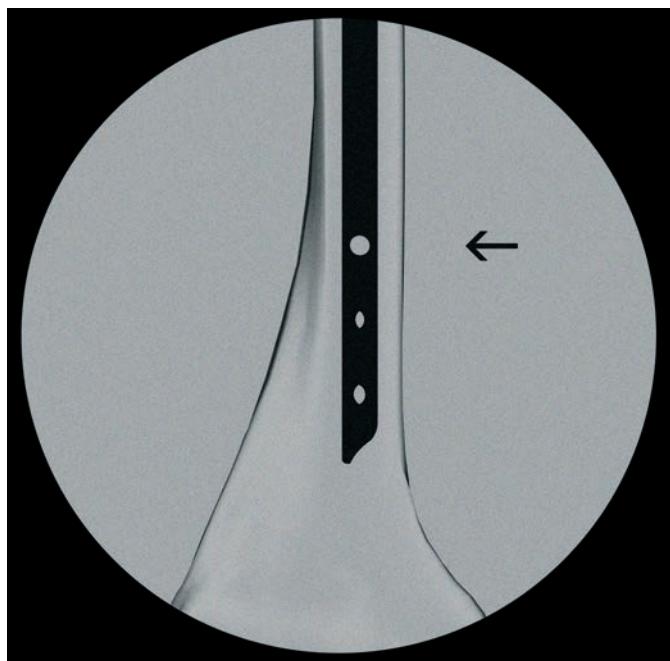
Distal locking with the Radiolucent Drive is described below.

1. Position insertion handle and adjust image

Check the connection between the insertion handle and the nail and tighten the connecting screw if necessary.

- Check the position of the distal fragment since a fracture gap could have resulted from nail insertion.
- Align the image intensifier with the distal nail holes so that the holes appear perfectly round in the image.

To visualize the round holes always move the image intensifier without moving the arm since this can cause severe malrotation.

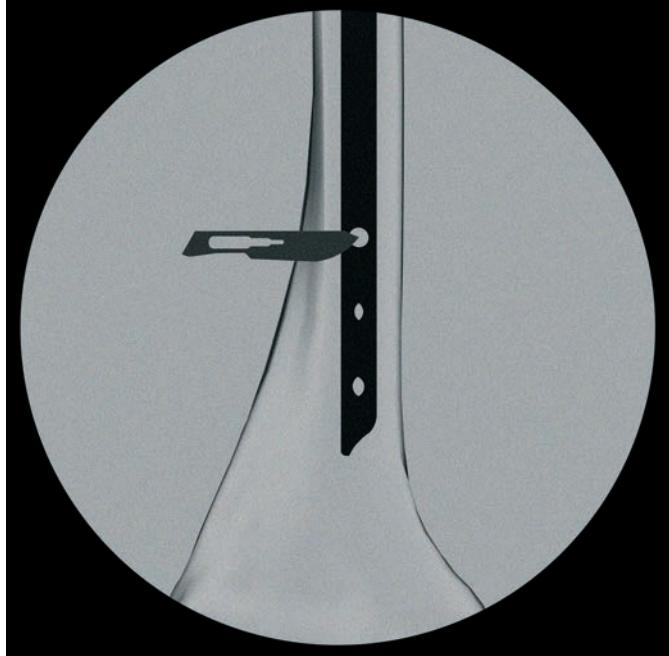


2. Perform incision

- Determine the entry point on the skin and perform a skin incision with the scalpel.

▲ Precaution:

Only incise the skin and then perform blunt dissection down to the bone to avoid injuring the brachial artery or median nerve.

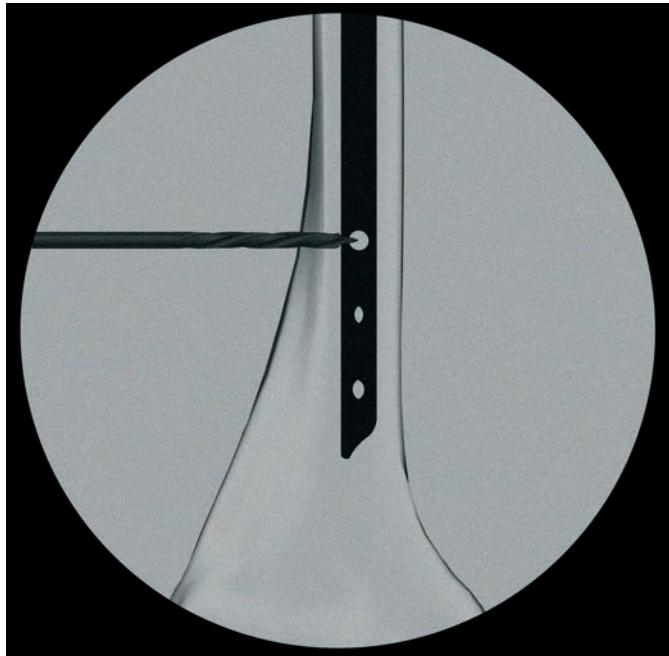


3. Drill

Instrument

03.010.100	Drill Bit Ø 3.2 mm, calibrated, length 145 mm, 3-flute, with Coupling for RDL
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- Insert the drill bit into the radiolucent drive and introduce it through the incision down to the bone.

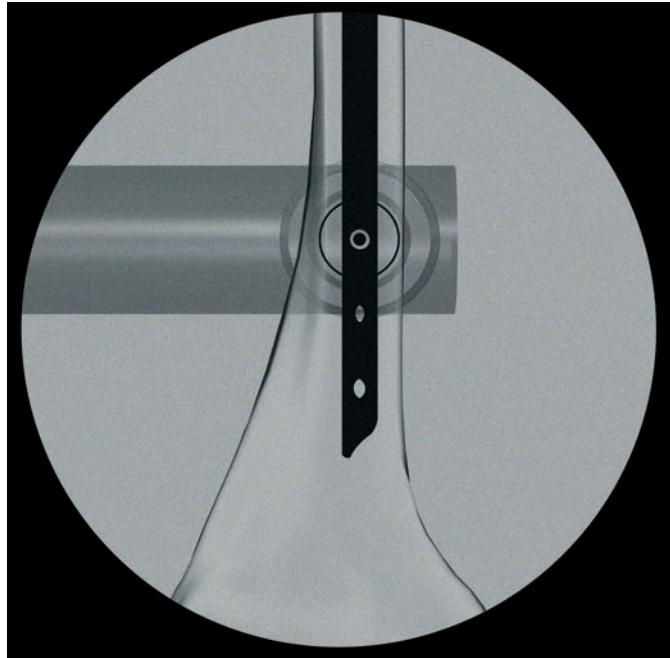


- C** Incline the radiolucent drive so that the tip of the drill bit is centered over the locking hole. The drill bit should almost completely fill the circular locking hole. Holding the drill bit in this position, drill through both cortices until the tip just penetrates the posterior cortex.

Alternative instrument

03.010.103 Drill Bit Ø 3.2 mm, calibrated, length 145 mm, 3-flute, for Quick Coupling

If there is no radiolucent drive available, the standard freehand locking technique can be performed with the drill bit for quick coupling.



4. Determine length of locking screws

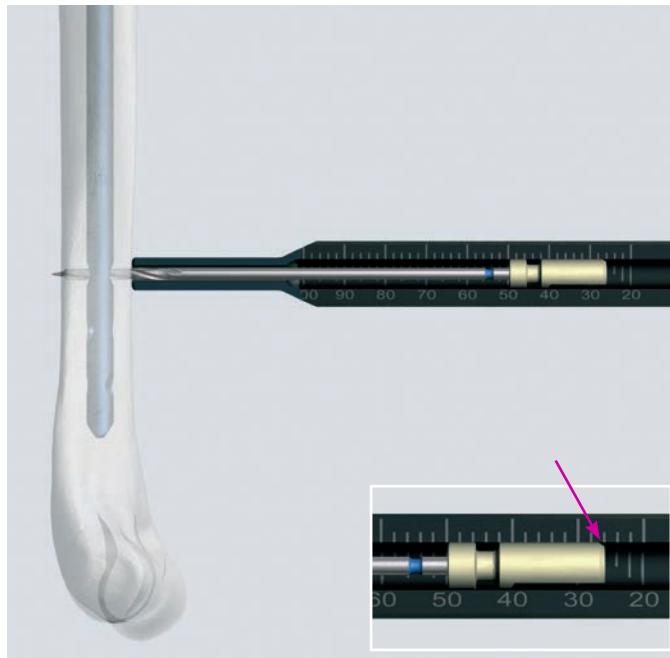
Instrument

03.010.106 Direct Measuring Device for Drill Bits of length 145 mm, for Nos. 03.010.100 to 03.010.105

Leaving the drill bit in place, detach the drill. Place the direct measuring device against the drill bit with the tip of the measuring device pressed against the bone. Read the graduation against the end of the drill bit to determine locking screw length.

Note:

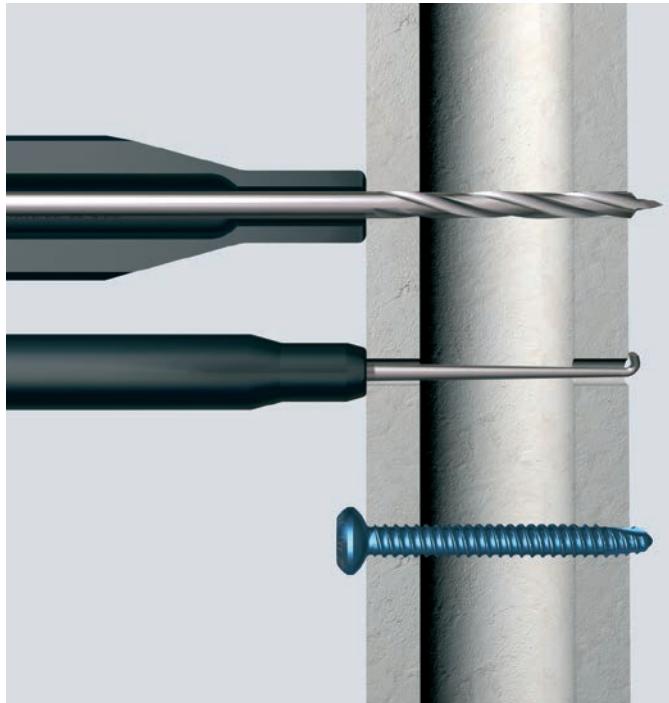
To avoid measurement errors, it is important that the tip of the direct measuring device is pressed against the bone.



Alternative instrument

03.010.072 Depth Gauge for Locking Screws,
measuring range up to 110 mm,
for No. 03.010.063

Alternatively, the depth gauge can be used. Remove the drill bit and insert the scaled probe to grasp the far cortex of the bone with the hook. Read the scale at the edge of the sleeve to determine locking screw length.



5. Insert locking screws

Instruments

03.010.107	Screwdriver StarDrive, SD25, length 330 mm
03.010.112	Holding Sleeve, with Locking Device

Insert the appropriate locking screw and tighten it using the StarDrive screwdriver (alone or in combination with the holding sleeve) until the screw head rests against

- the anterior cortex. The tip of the locking screw should project beyond the posterior cortex by 1–2 mm.



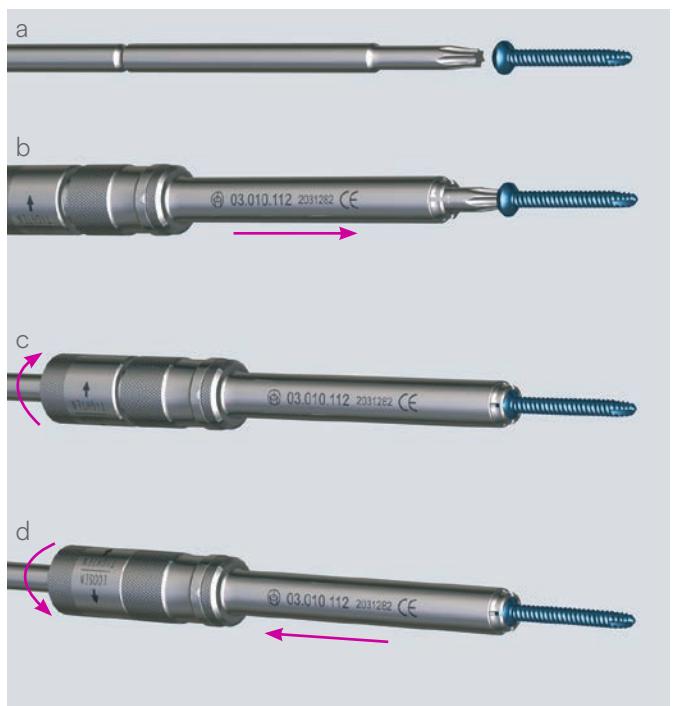
Use the holding sleeve as described below:

- Insert the holding sleeve onto the shaft of the screwdriver and place the tip of the screwdriver in the recess of the locking screw.
- Push the holding sleeve toward the locking screw; the sleeve now holds the locking screw.
- Lock the holding sleeve by tightening it counter-clockwise.
- After insertion of the locking screw release the holding sleeve by loosening it clockwise and pushing backwards.

Insert the second locking screw in the same way.

Note:

Care should be taken to partially disassemble and distract the holding sleeve during cleaning before placing in the case for sterilization.



Insert end cap into nail

When locking with a spiral blade, the end cap must always be inserted into the nail; otherwise the spiral blade will not be properly secured.

During insertion, increased resistance is encountered during the final few turns as a result of the notch on the thread. Tighten the end cap securely.

The end cap is available in four lengths (extension of 0, 5, 10 or 15 mm) and can, if necessary, be used to extend the nail and thus allow flexible placement of the spiral blade in the head.

To minimise the possibility of cross threading, turn the end cap counterclockwise until the thread of the end cap aligns with that of the nail.

Ensure that the nail and the end cap are fully countersunk in the humeral head so that shoulder function remains unhindered, including during abduction.

0 mm end cap

Instruments

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

03.010.054 Insertion Handle for
EXPERT Humeral Nail

If the nail has not been overinserted, use an end cap with 0 mm extension. After removing the connecting screw, leave the insertion handle on the nail. Using the StarDrive screwdriver, place the end cap 0 mm in the proximal end of the nail through the insertion handle.



5 mm, 10 mm and 15 mm end cap

Instruments

292.260	Kirschner Wire Ø 2.5 mm with trocar tip
03.010.055	Aiming Arm Spiral Blade for EXPERT Humeral Nail
03.010.107	Screwdriver StarDrive, SD25, length 330 mm

If the nail has been overinserted, insert a 2.5 mm Kirschner Wire through one of the small holes in the aiming arm and estimate the extension length using an AP image of the nail end. The end cap should not protrude beyond the insertion site. Align the end cap with the nail axis to prevent cross-threading. Fully seat the end cap using the StarDrive screwdriver.

■ Note:

Moving the patient's arm before the end cap is completely seated may shift the nail from the entry site. This displaced alignment may cause difficulty in placing the end cap.



Postoperative management

Additional splinting of the arm is not required.

Check radial nerve function when the anesthetic has worn off.

Active and passive movements and muscle-tensing exercises in the shoulder and elbow area can begin immediately, although rotational movements against resistance should be avoided until the fracture has healed.

X-ray follow-up

X-rays are recorded immediately after the operation. Further X-rays controls are recommended after two, six, twelve weeks and beyond, depending on the course of the healing process.

EXPERT Humeral Nail Antegrade Insertion – Locking with Screws (Standard Locking)

If the fracture gap is properly reduced, proximal locking may be done first. If applying compression is desired, see the paragraph “Applying Compression”.

■ Note:

Once reduction is performed, do not move the patient’s arm until the locking is completed since it may result in a loss of reduction.



Proximal locking is performed using the insertion handle with the attached aiming arm which should be aligned precisely in the mediolateral plane.

Standard proximal locking is performed through the proximal locking hole (static hole), and optionally the superior end of the proximal slot (compression hole).

1. Assemble aiming arm and insert trocar combination

Instruments

03.010.091	Aiming Arm, Standard, for EXPERT Humeral Nail
03.010.063	Protection Sleeve 12.0/8.0, length 188 mm
03.010.064	Drill Sleeve 8.0/3.2, for No. 03.010.063
03.010.069	Trocar Ø 3.2 mm, for No. 03.010.064

Assemble the standard aiming arm to the insertion handle. Check the connection between the insertion handle and the nail and tighten it if necessary. Likewise, check the reduction.



- Insert the trocar combination (protection sleeve, drill sleeve and trocar) through the desired hole in the aiming arm (STATIC or COMP), make a skin incision and insert the trocar down to the bone. Remove the trocar.

▲ Precaution:

Only incise the skin and then perform blunt dissection to avoid injuring the axillary nerve and its branches.

2. Drill and determine length of locking screw

Instruments

03.010.060	Drill Bit Ø 3.2 mm, calibrated, length 340 mm, 3-flute, for Quick Coupling, for No. 03.010.064
03.010.072	Depth Gauge for Locking Screws

- ① Drill through the lateral cortex with the calibrated 3.2 mm three-fluted drill bit. Monitor drill bit insertion radiographically, since the position of the drill bit tip directly represents locking screw tip position in the bone. This locking screw may be bicortical or unicortical depending upon its placement relative to the articular surface. The required length of the locking screw can be determined either by reading it directly off the calibrated drill bit at the back of the drill sleeve, or by measuring with the depth gauge. Press the drill sleeve firmly to the cortex to avoid measurement errors.

To use the depth gauge, remove the scaled probe portion from the sleeve, and remove the drill sleeve from the protection sleeve. Insert the scaled probe through the protection sleeve so that the hook of the depth gauge grasps the far cortex of the bone. Read the scale at the edge of the protection sleeve to determine the appropriate locking screw length. Press the protection sleeve firmly to the cortex to avoid measurement errors.

In order to pass the hook through the protection sleeve, the sleeve of the depth gauge must be removed.



3. Insert locking screws

Instrument

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

Insert the appropriate locking screw through the protection sleeve, and tighten it using the StarDrive screwdriver until the screw head rests against the lateral cortex.

A second transverse locking screw may be inserted through the superior end of the slot by repeating this procedure through the hole in the standard aiming arm marked "COMP." This locking screw may only be used unicortically.

Insert two locking screws into each main fragment, particularly into short fragments.

Distal locking

See Locking with Spiral Blade – distal locking.



Insert end cap into nail

During insertion, increased resistance is encountered during the final few turns as a result of the notch on the thread. Tighten the end cap securely.

The end cap is available in four lengths (extensions of 0, 5, 10 or 15 mm) and can, if necessary, be used to extend the nail and thus allow flexible placement of the locking screws in regions with better bone quality.

To minimise the chance of cross-threading, turn the end cap counter clockwise until the thread of the end cap aligns with that of the nail.

Ensure that the nail and the end cap are fully countersunk in the humeral head so that shoulder function remains unhindered, including during abduction.

0 mm end cap

Instruments

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

03.010.054 Insertion Handle for
EXPERT Humeral Nail

If the nail has not been overinserted, use an end cap with 0 mm extension. After removing the connecting screw, leave the insertion handle on the nail. Using the StarDrive screwdriver place the end cap 0 mm in the proximal end of the nail through the insertion handle.



5 mm, 10 mm and 15 mm end cap

Instruments

292.260	Kirschner Wire Ø 2.5 mm with trocar tip
03.010.091	Aiming Arm, Standard, for EXPERT Humeral Nail
03.010.107	Screwdriver StarDrive, SD25, length 330 mm

- If the nail has been overinserted, insert a 2.5 mm Kirschner Wire through one of the small holes in the aiming arm, and estimate the extension length using an AP image of the nail end. The end cap should not protrude beyond the insertion site. Align the end cap with the nail axis to prevent cross-threading. Fully seat the end cap using the StarDrive screwdriver.

■ Note:

Moving the patient's arm before the end cap is completely seated may shift the nail from the entry site. This displaced alignment may cause difficulty in placing the end cap.



Compression (optional)

Applying compression facilitates the controlled joining of the fragments by closing the fracture gap or by exerting interfragmental compression.

Applying compression

Instruments

03.010.113 Compression Screw
for EXPERT Humeral Nail

03.010.053 Connecting Screw, cannulated,
for EXPERT Humeral Nail

321.160 Combination Wrench Ø 11.0 mm

- Open the humerus and insert the nail as described above.
- ① Over-insert the nail by the anticipated amount of interfragmentary travel. The maximum amount of travel produced by the compression device is 8 mm.

▲ Precaution:

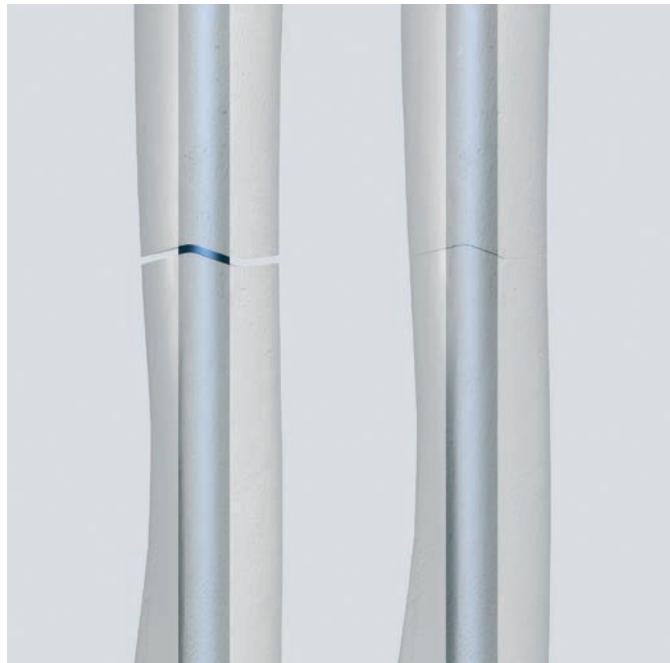
Ensure that the nail is not left proud after compression because this may cause impingement.



Lock the nail in the distal fragment under image intensifier control as described in Locking with Spiral Blade, distal locking. Lock the proximal fragment using the compression slot as described in Locking with screws, proximal locking.

Insert the compression screw into the connecting screw. Tightening the compression screw with the combination wrench moves the screw in the compression slot and therefore the distal fragment in a proximal direction.

- The compression must be checked under the image intensifier since the base of the nail can move proximally (risk of impingement).



To secure the reduction, insert an additional screw in the static locking hole. Then remove the compression and the connecting screws and insert an end cap into the end of the nail as described above.



Postoperative management

Additional splinting of the arm is not required.

Check radial nerve function when the anesthetic has worn off.

Active and passive movements and muscle-tensing exercises in the shoulder and elbow can begin immediately, although rotational movements against resistance should be avoided until the fracture has healed.

X-ray follow-up

X-rays are recorded immediately after the operation. Further X-rays controls are recommended after two, six, twelve weeks and beyond, depending on the course of the healing process.

EXPERT Humeral Nail Retrograde Insertion

When inserted in the retrograde direction, the EXPERT Humeral Nail is locked with screws.

1. Position patient

The patient is preferably placed in the prone position, supported by pads, on the ipsilateral edge of the table. Position the fractured upper arm on an additional arm board or armrest fastened to the table. The elbow is flexed at 90°. If necessary, it should be possible to flex the elbow up to approx. 120°. In this position, the surgeon has a good view of the operating field from the dorsal side.

■ Note:

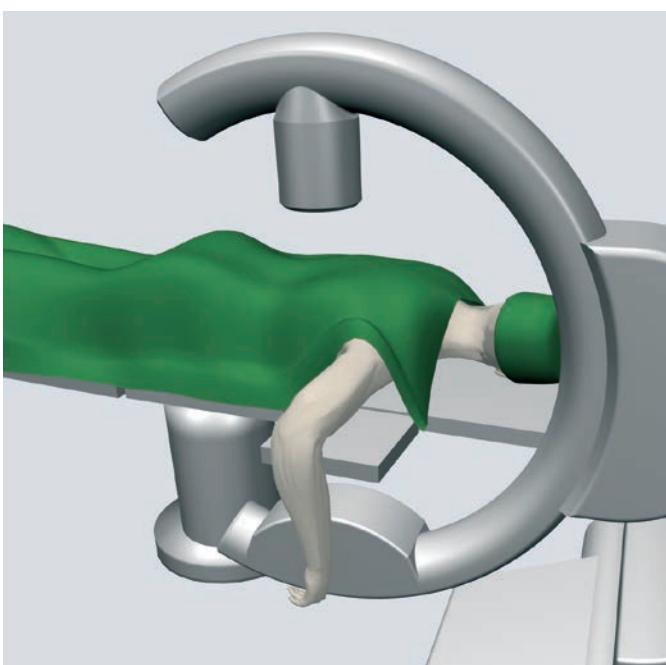
It must be possible to view the whole upper arm, including the elbow and humeral head, in two planes in the image intensifier. The hanging forearm usually adopts the correct rotation by itself.

If the patient's general condition or injuries prevent the adoption of the prone position, the operation can also be performed with the patient in the lateral or supine position.

If the patient is placed in the lateral position, the arm to be treated should be positioned over a foam wedge. It must be possible to bend the elbow joint up to approx. 120°. The patient must be adequately supported.

If the patient is supine, a position approximating the lateral position should be achieved by using supporting pads. With the elbow flexed, the assistant holds the humerus under tension.

- The ability to view the entire humerus in the image intensifier should be checked preoperatively, bearing in mind that this is much more difficult with the lateral and supine positions than with the prone position.



2. Confirm nail length

Instrument

03.010.022 Radiographic Ruler
for EXPERT Humeral Nail

The approximate nail length can be determined preoperatively. Measure the length of the unfractured humerus from its head to the olecranon fossa and deduct 5–6 cm from the measured distance.

■ Note:

The length can be determined correctly on the fractured arm only if the fracture is first correctly reduced.



- Position the image intensifier for an AP view of the distal humerus. Using long holding forceps, hold the radiographic ruler parallel to the humerus so that the proximal locking slot symbolized on the ruler is located at the correct point against the distal humerus. Mark the skin over the distal humerus at the "top of the nail" symbolized on the ruler.



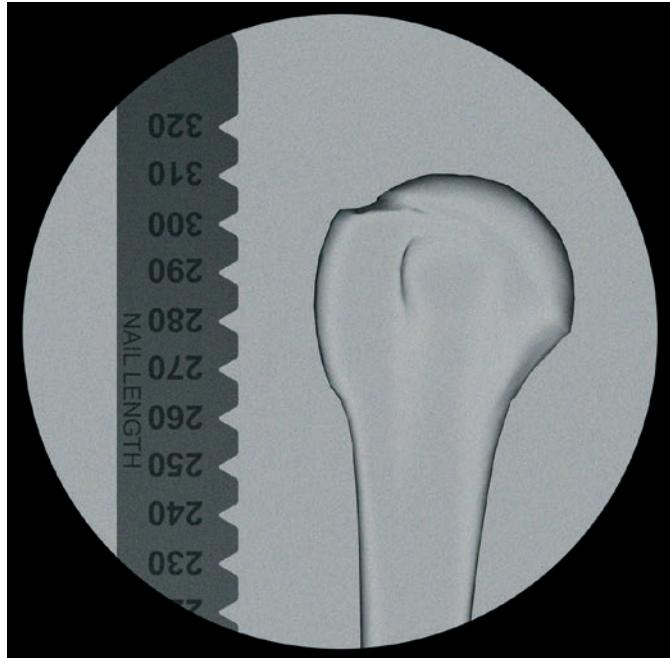
-
- ④ Position the image intensifier over the proximal humerus, place the symbolized nail end of the ruler at the marked skin site and record an AP image. Check the reduction and read off the nail length from the image of the ruler.

The nail tip should only project a little way into the humeral head.

■ Note:

Potential compression must be taken into account when determining the nail length and a correspondingly shorter nail should be chosen.

The locking screw in the compression slot can move proximally by up to 8 mm.



3. Confirm nail diameter

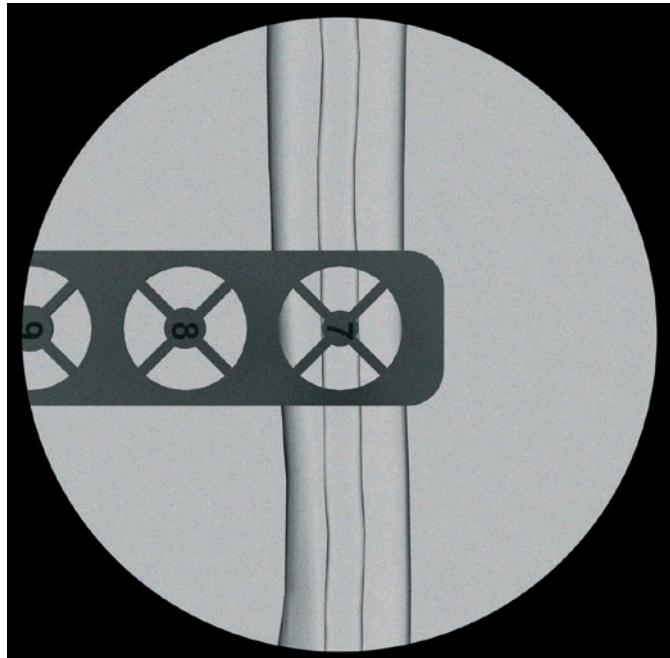
Instrument

03.010.023 Radiographic Medullary Canal Estimator

- ⑤ Position the image intensifier for a lateromedial view of the humerus. Hold the radiographic medullary canal estimator over the humerus with the diameter gauge centered over the medullary canal at the narrowest part that will contain the nail. Read the diameter measurement on the circular indicator that fills the canal.

■ Note:

The ruler is not at the same level as the humerus, and this will affect the accuracy of the measurement.



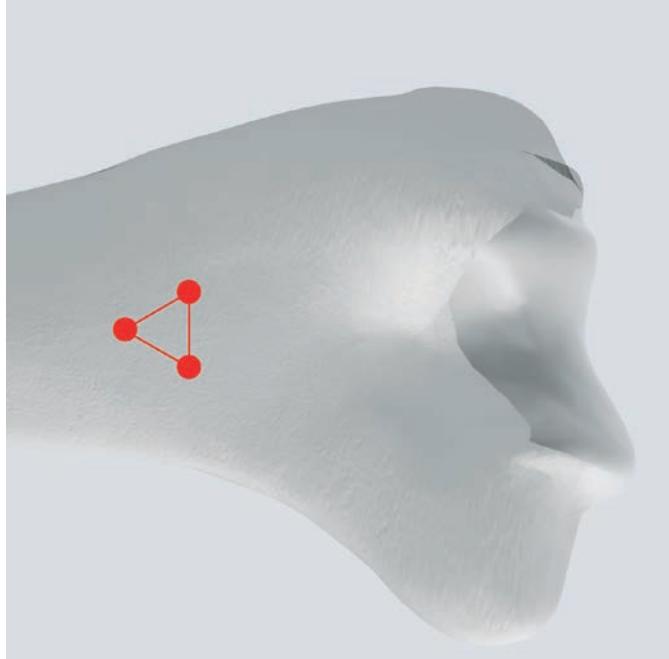
4. Determine entry point

With the elbow flexed at 90°, the longitudinal skin incision begins slightly distal to the olecranon. Split the triceps tendon where it extends beyond the distal humeral shaft. It should be possible to view a bone area starting at the upper edge of the olecranon fossa and proceeding approx. 40 mm in the proximal direction. Do not open the elbow joint.

The insertion point in the medullary canal is located in the centre of an imagined triangle between the medial and lateral supracondylar edge and the roof of the olecranon fossa.

▲ Precaution:

Be sure to be exactly at the midline, since an eccentrically insertion point will cause excessive shearing forces during insertion, resulting in fissures or even fractures.



5. Open medullary canal

Instruments

310.440 Drill Bit Ø 4.5 mm

332.062 Router

358.682 Projectile Burr

First use the drill bit to drill three holes perpendicular to the medullary canal.



Continue drilling and progressively lower the drill until the drill bit is in line with the medullary canal in the lateral view.

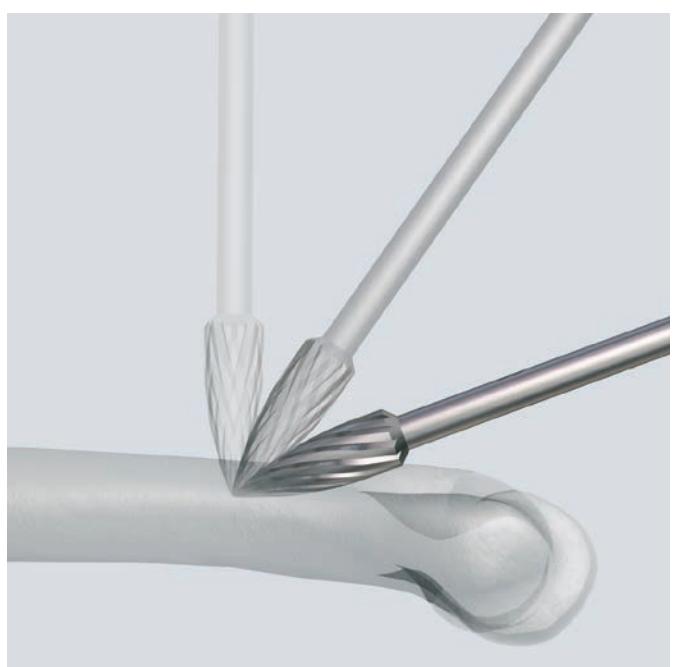


Using the router and the burr, open up an entry portal at least 10 mm wide and 20 mm long. The router allows rapid reaming, while the cylindrical projectile burr facilitates the shaping of the insertion point.

Chamfer and smooth the distal edge of the insertion hole so that the nail can be introduced unhindered.

▲ Precaution:

The opening of the medullary canal should be opened with great care; otherwise an iatrogenic fracture may easily occur.



6. Assemble insertion instruments

Instruments

03.010.054	Insertion Handle for EXPERT Humeral Nail
03.010.053	Connecting Screw, cannulated, for EXPERT Humeral Nail
321.160	Combination Wrench Ø 11.0 mm

Orient the insertion handle laterally and match the geometry of the handle to the nail, ensuring that the tip of the nail points towards the insertion handle. Screw the connecting screw through the insertion handle into the nail and tighten it using the combination wrench.

■ Note:

Confirm that the nail is tightly connected to the insertion handle, especially after hammering. The 11mm combination wrench may be used to retighten the connecting screw over the reaming rod, as needed.

If a reaming rod has been used, it should be removed once the nail has crossed the fracture site.



7. Insert nail

Insert the nail with slight rotating movements of the insertion handle. Insert the nail up to the fracture site,

- reduce the fracture and continue beyond the fracture under image intensifier control. Proceed carefully to avoid injuring the radial nerve, particularly in fractures of the mid to distal third of the shaft.

If radial nerve paresis is present preoperatively, it is necessary to explore the nerve through a short anterolateral incision at the transition of the mid and distal third of the shaft.



Continue advancing the nail until the tip projects slightly into the humeral head.

Check the nail position under the image intensifier.

Optional instruments

351.920/930/940 Hand Reamer for Medullary Canal

If the nail proves very difficult to advance, check whether widening the medullary canal with the hand reamers is indicated or choose a smaller nail diameter.

▲ Precaution:

The nail should not be hammered in since this increases the risk of iatrogenic fissures or fractures at the insertion site.

■ Note:

Pressure against the humeral head when advancing the nail prevents diastasis formation and potential associated healing problems.



Proximal locking

If the fracture gap is properly reduced, proximal locking may be done first. If applying compression is desired, see the paragraph “Compression”.

Instruments

03.010.103	Drill Bit Ø 3.2 mm, calibrated, length 145 mm, 3-flute
03.010.106	Direct Measuring Device for Drill Bits of length 145 mm
03.010.072	Depth Gauge for Locking Screws
03.010.107	Screwdriver StarDrive, SD25, length 330 mm
03.010.112	Holding Sleeve, with Locking Device

Optional instruments

511.300	Radiolucent Drive
03.010.100	Drill Bit Ø 3.2 mm, calibrated, length 145 mm, 3-flute, with Coupling for RDL

Normally, locking with two screws is performed at the proximal end, using the Radiolucent Drive (see EXPERT Humeral Nail – Antegrade insertion, Locking with Spiral Blade, distal locking) or the “freehand” technique.

Choose the appropriate proximal locking holes taking into consideration that the main trunk of the axillary nerve runs approximately 55 mm distal to the acromion and considering the definitive position of the nail as dictated by the fracture pattern.

-
- Check the position of the proximal fragment since a fracture gap could have formed during nail insertion. If required, manipulate the distal fragment to close the fracture gap. Use the appropriate drill bit. Determine the length of the locking screw with the direct measuring device or the depth gauge. Insert the appropriate length locking screw using the StarDrive screwdriver and the holding sleeve.

▲ Precaution:

To avoid jeopardizing the trunk or branches of the axillary nerve after the skin incision, the underlying muscle should be prepared by blunt dissection and spread apart carefully.

Distal locking is performed using the insertion handle with the attached aiming arm. Normally, parallel double locking is performed at the distal end, i.e. both the static and the compression holes are used.

1. Assemble aiming arm and insert trocar combination

Instruments

03.010.091	Aiming Arm, Standard, for EXPERT Humeral Nail
03.010.063	Protection Sleeve 12.0/8.0, length 188 mm
03.010.064	Drill Sleeve 8.0/3.2, for No. 03.010.063
03.010.069	Trocar Ø 3.2 mm, for No. 03.010.064

Assemble the standard aiming arm on the insertion handle. Check the connection between the insertion handle and the nail and tighten if necessary. Likewise, check the reduction.

■ Note:

Do not move the patient's arm until locking is complete since it may result in a loss of reduction.

Insert the trocar combination (protection sleeve, drill sleeve and trocar) through the desired hole in the aiming arm (STATIC or COMP), make a stab incision and insert the trocar down to the bone. Remove the trocar.



2. Drill and determine length of locking screw

Instruments

03.010.060	Drill Bit Ø 3.2 mm, calibrated, length 340 mm, 3-flute, for Quick Coupling, for No. 03.010.064
03.010.072	Depth Gauge for Locking Screws

Insert the calibrated drill bit, and drill through both cortices until the tip of the drill bit just breaks through the anterior cortex. The required length of the locking screw can be determined either by reading it directly off the calibrated drill bit at the back of the drill sleeve or by measuring with the depth gauge. Press the drill sleeve firmly to the cortex to avoid measurement errors.

To use the depth gauge, remove the scaled probe portion from the sleeve, and remove the drill sleeve from the protection sleeve. Insert the scaled probe through the protection sleeve so that the hook of the depth gauge grasps the far cortex of the bone. Read the scale at the edge of the protection sleeve to determine the appropriate locking screw length. Press the protection sleeve firmly to the cortex to avoid measurement errors.

In order to pass the hook through the protection sleeve, the sleeve of the depth gauge must be removed.



3. Insert locking screws

Instrument

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

Insert the appropriate locking screw through the protection sleeve and tighten it using the StarDrive screwdriver until the screw head rests against the posterior cortex.

- The tip of the locking screw should project beyond the anterior cortex by 1–2 mm.

Insert the second locking screw in the same way, using the other hole of the aiming arm (STATIC or COMP).

Insert two locking screws into each main fragment, particularly into short fragments.



Insert end cap into nail

During insertion, increased resistance is encountered during the final few turns as a result of the notch on the thread. Tighten the end cap securely.

The end cap is available in four lengths (extensions of 0, 5, 10 or 15 mm) and can, if necessary, be used to extend the nail and thus allow flexible placement of the locking screws in regions with better bone quality.

To minimise the chance of cross-threading, turn the end cap counterclockwise until the thread of the end cap aligns with that of the nail.

Ensure that the nail and the end cap are fully countersunk in the humeral shaft, so that elbow function remains unhindered.

0 mm end cap

Instruments

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

03.010.054 Insertion Handle for
EXPERT Humeral Nail

If the nail has not been overinserted, use an end cap with 0 mm extension. After removing the connecting screw, leave the insertion handle on the nail. Using the StarDrive screwdriver, place the end cap 0 mm in the proximal end of the nail through the insertion handle.



5 mm, 10 mm and 15 mm end cap

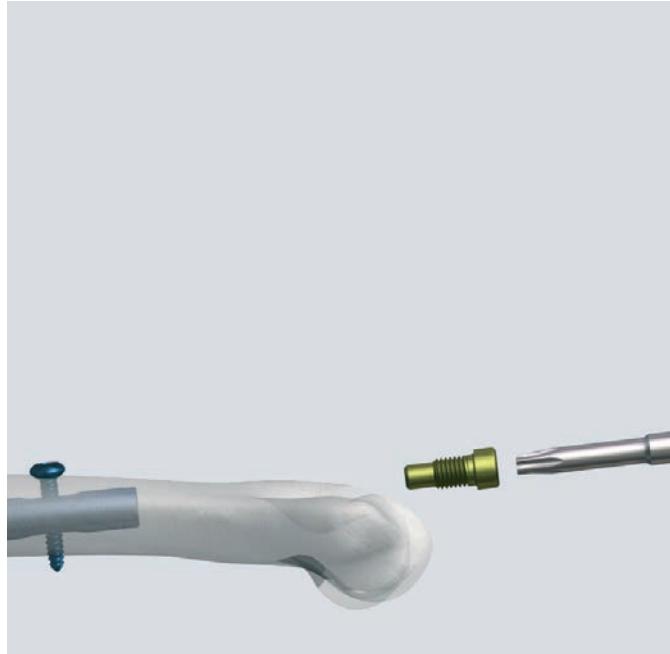
Instruments

292.260 Kirschner Wire Ø 2.5 mm with trocar tip

03.010.091 Aiming Arm, Standard,
for EXPERT Humeral Nail

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

If the nail has been overinserted, insert a 2.5 mm Kirschner Wire through one of the small holes in the aiming arm, and estimate the extension length using an AP image of the nail end. The end cap should not protrude beyond the insertion site. Align the end cap with the nail axis to prevent cross-threading. Fully seat the end cap using the StarDrive screwdriver.



Compression (optional)

Applying compression facilitates the controlled joining of the fragments to close the fracture gap or exert interfragmental compression.

Applying compression

Instruments

03.010.113 Compression Screw
for EXPERT Humerus Nail

03.010.053 Connecting Screw, cannulated,
for EXPERT Humeral Nail

321.160 Combination Wrench Ø 11.0 mm

Open the humerus and insert the nail as described above. Over-insert the nail by the anticipated amount of interfragmentary travel. The maximum amount of travel produced by the compression device is 8 mm.



-
- ④ Lock the nail in the proximal fragment under image intensifier control. Lock the distal fragment using the compression slot as described above.

Insert the compression screw into the connecting screw. Tightening the compression screw with the combination wrench moves the screw in the compression slot and hence moves the proximal fragment in a distal direction.

- ⑤ The compression must be checked under the image intensifier since the base of the nail can move distally (risk of impingement).



To secure the reduction, insert an additional screw in the static locking hole. Then remove the compression and the connecting screws and insert an end cap into the end of the nail as described above.



Postoperative management

Additional splinting of the arm is not required.

Check radial nerve function when the anesthetic has worn off.

Active and passive movements and muscle-tensing exercises in the shoulder and elbow can begin immediately, although rotational movements against resistance should be avoided until the fracture has healed.

X-ray follow-up

X-rays are recorded immediately after the operation. Further X-rays controls are recommended after two, six, twelve weeks, and beyond, depending on the course of the healing process.

EXPERT Proximal Humeral Nail Antegrade Insertion

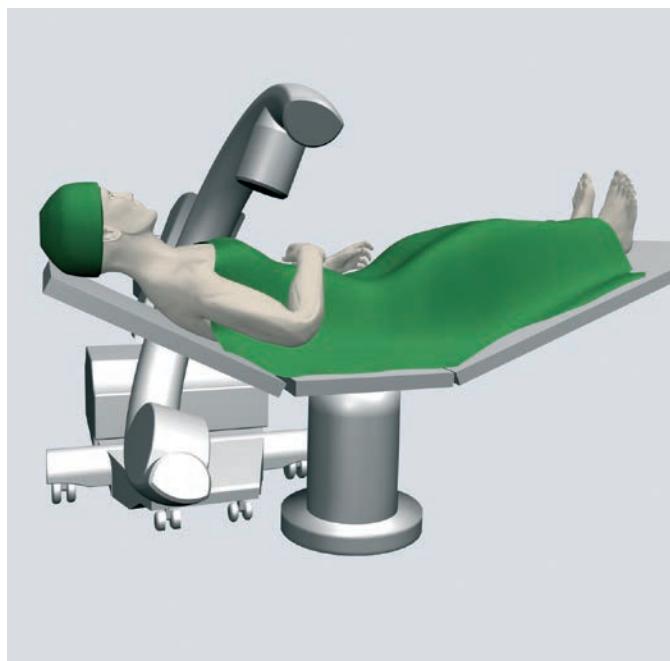
For fractures of the proximal humerus, the EXPERT Proximal Humeral nail can be used. To obtain good stability in the humeral head, the nail is locked with the spiral blade.



1. Position patient

Position the patient in the “Beach Chair” position on a shoulder table. Alternatively, position the patient on his/her back with the upper body elevated at an angle of 30°. Support the shoulder with pads. The operating table must be radiolucent in the shoulder area or else the corresponding table section should be removable. The humerus including the humeral head must be visible in two planes in the image intensifier. Support the fractured arm on a side rest.

A modified lateral position on a complete radiolucent OR table can also be used. Position the C-arm to enable visualization of the humeral head in the AP and lateral planes.



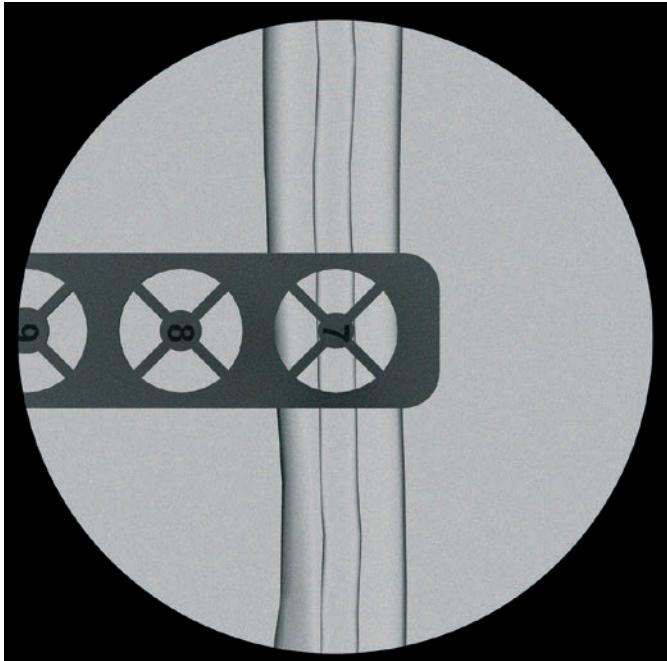
2. Confirm nail diameter

Instrument

03.010.023 Radiographic Medullary Canal Estimator

- Position the image intensifier for a lateromedial view of the humerus. Hold the radiographic medullary canal estimator over the humerus with the diameter gauge centered over the medullary canal at the narrowest part that will contain the nail. Read the diameter measurement on the circular indicator that fills the canal.

The ruler is not at the same level as the humerus, and this will affect the accuracy of the measurement.



3. Determine entry point

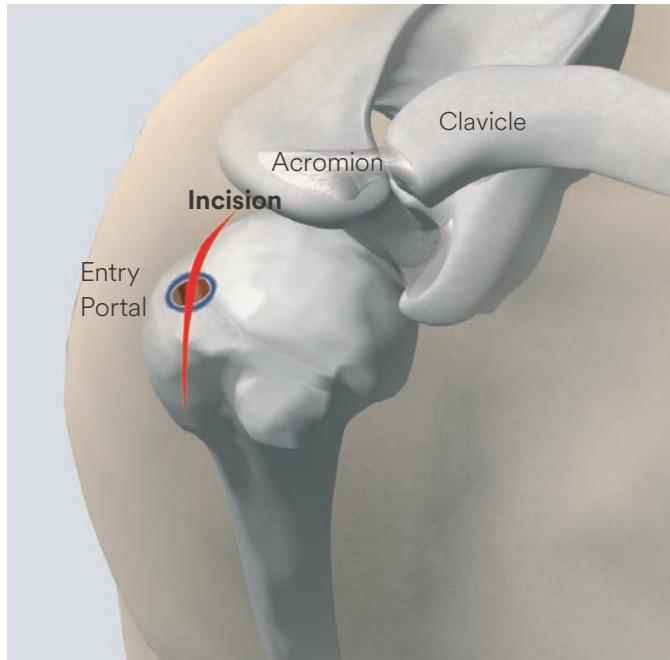
In certain cases after a closed reduction, the humeral head may need to be fixed temporarily with a raspatory or a Kirschner Wire. The correct head position is visible in the AP view by ensuring the maximum humeral head diameter. To obtain this, the arm should be positioned in approximately 25° of external rotation.

Make the initial incision anterolateral to the acromion process, and split the deltoid muscle longitudinally. Palpate the greater tuberosity, identify – but do not expose – the supraspinatus tendon and split the mid section lengthwise. Avoid any additional injury to the rotator cuff. The arm can be adducted across the chest in order to gain better access to the proximal humerus.

The antegrade insertion point for the EXPERT Humeral Nail is located on the extended axis of the central humeral shaft in the lateral view and at the bone-cartilage transition of the humeral head in the AP view, and not on the greater tuberosity. Otherwise the tendon attachment of the supraspinatus will be affected. With the humeral head correctly positioned, the point is located just in front of, or below, the tip of the acromion process. Find this position under the image intensifier using a 2.5 mm Kirschner Wire.

▲ Precaution:

If greater tubercle is fractured (B Type) use a slightly more medial entry point to avoid insertion through the fracture and subsequent lateralization of the shaft to the proximal fragments.



4. Insert Kirschner Wire

Instruments

292.260	Kirschner Wire Ø 2.5 mm with trocar tip, length 280 mm, Stainless Steel
393.105	Universal Chuck, small, with T-Handle

Using the small universal chuck with T-Handle, insert a 2.5 mm Kirschner Wire at the appropriate insertion point in the proximal humerus, and advance it in the medullary canal. Check the position of the Kirschner Wire under the image intensifier in both the frontal and sagittal planes.



5a. Open medullary canal – awl

Instrument

03.010.039	Awl, cannulated
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Place the cannulated awl over the Kirschner Wire to the bone. Use a twisting motion to advance the awl. Remove the awl and the Kirschner Wire.

■ Note:

Dispose of the Kirschner Wire. Do not reuse.

▲ Precaution:

Take care not to plunge the awl into the fracture site because this may displace the fracture.



5b. Open medullary canal – drill bit

Alternative Instruments

360.050 Drill Bit Ø 10.0 mm, cannulated,
length 190/140 mm, 3-flute,
for Jacobs Chuck

03.010.038 Protection Sleeve 10.0

Pass the drill bit over the Kirschner Wire and through the protection sleeve to the bone. Drill to the depth of the medullary canal. Remove the drill bit and the Kirschner Wire.

■ Note:

Dispose of the Kirschner Wire. Do not reuse.

▲ Precaution:

As with the awl, take care not to plunge the drill bit into the fracture site because this may displace the fracture.



6. Optional: Reaming guidelines

Instruments

352.032 SynReam Reaming Rod Ø 2.5 mm

Optional Instrument

03.010.093 Rod Pusher for Reaming Rod
with Hexagonal Screwdriver Ø 8.0mm

- Using image intensification, ensure that fracture reduction
has been maintained. Insert the 2.5 mm Reaming Rod into
the medullary canal to the desired insertion depth.

7. Optional: Reaming guidelines

- Use a reaming system intended for humeral reaming procedures. Using image intensification, ensure that fracture reduction has been maintained.

Ream to a diameter at least 1.0 mm greater than the nail diameter in accordance with the surgeon's preference. Ream in 0.5 mm increments and advance the reamer with steady, moderate pressure.

■ Note:

Do not force the reamer. Frequently retract the reamer partially to clear debris from the medullary canal.

Remove the reaming assembly, leaving the reaming rod in place. All EXPERT Humeral Nails can be inserted over the reaming rod.

■ Note:

Flush the surgical site after reaming to remove remaining debris and reduce the risk of heterotopic ossification.

▲ Precaution:

Reaming should be avoided in case of comminution in the area where the radial nerve contacts the bone in the radial sulcus.

Nail Diameter (Midshaft)	Nail Diameter (Proximal end)
7 mm, 9 mm	9 mm
11 mm	11 mm

Optional instruments

351.920/930/940

Hand Reamer for
Medullary Canal

8. Assemble insertion instruments

Instruments

03.010.054	Insertion Handle for EXPERT Humeral Nail
03.010.053	Connecting Screw, cannulated, for EXPERT Humeral Nail
321.160	Combination Wrench Ø 11.0 mm

Orient the insertion handle laterally and match the geometry of the handle to the nail, ensuring that the tip of the nail points towards the insertion handle. Screw the connecting screw through the insertion handle into the nail and tighten it using the combination wrench.



9. Insert nail

Insert the nail over the reaming rod if used with slight rotating movements of the insertion handle. Insert the nail up to the fracture site, reduce the fracture and

- continue beyond the fracture under image intensifier control.

Check the nail position. Countersink the nail fully into the humeral head to avoid irritation of the shoulder structures, including during abduction (impingement risk).

If the reaming rod is used, remove it before locking.



The nail must always be locked first at the proximal end so that the spiral blade can be placed in the optimal position.

■ Note:

Once reduction is performed, don't move the patient's arm until locking is complete since it may result in a loss of reduction.

1. Assemble aiming arm and insert trocar combination

Instruments

03.010.055	Aiming Arm Spiral Blade for EXPERT Humeral Nail
03.010.086	Drill Sleeve 14.0/8.0, length 130 mm
03.010.087	Centering Sleeve 8.0/2.0 for Kirschner Wire, length 140 mm
03.010.088	Trocar Ø 2.0 mm, length 150 mm

- Assemble the aiming arm for spiral blade to the insertion handle. Check the connection between the insertion handle and the nail and tighten the connecting screw if necessary. Likewise, check the reduction.

Take into account the retroversion of the humeral head when positioning the spiral blade in the center of the head.

Make a skin incision, insert the trocar combination (drill sleeve, centering sleeve and trocar) through the hole in the aiming arm marked "Spiral Blade" and insert the trocar down to the bone. Remove the trocar.

▲ Precaution:

Only incise the skin and then perform blunt dissection to avoid injuring the axillary nerve and its branches.



2. Determine length of spiral blade and drill

Instruments

03.010.025	Kirschner Wire Ø 2.0 mm with trocar tip, length 240 mm, Stainless Steel
03.010.090	Measuring Device for Spiral Blade for EXPERT Humeral Nail
03.010.089	Drill Bit Ø 4.5 mm, cannulated

- Insert a 2.0 mm Kirschner Wire through the centering sleeve into the humeral head and use the image intensifier to check the definitive position at the transition between the medial and lower third of the humeral head. The wire should extend almost to the cortex on the opposite side, but should not perforate it down to the subchondral space.

Pass the measuring device over the Kirschner Wire, advance it until the nose rests against the collar of the drill sleeve and read the length of the spiral blade at the end of the wire off the scale. Remove the measuring device and the centering sleeve; the Kirschner Wire must remain in the bone.

- Pass the cannulated drill bit over the Kirschner Wire, and drill down to perforate the lateral cortex. Remove the drill sleeve and the drill bit.



3. Attach and insert spiral blade

Instruments

358.696	Inserter for Spiral Blade, for Humeral Nails
358.697	Connecting Screw for Spiral Blades, for Humeral Nails
03.010.058	Combined Hammer 400 g

Insert the connecting screw in the inserter, mount the selected spiral blade on the cams of the inserter, and tighten the connecting screw. Check for a secure fit.

Introduce the spiral blade and inserter over the Kirschner Wire, through the aiming arm and down to the lateral cortex.

The initial orientation of the T-handle of the inserter relative to the aiming arm depends on patient anatomy. If the distance from the lateral cortex to the nail is less than 10 mm, start the T-handle slightly clockwise from parallel. If the distance from the lateral cortex to the nail is more than 10 mm, start the T-handle slightly counter-clockwise from parallel.

- Advance the spiral blade by hand or by gentle hammer blows until the desired position is reached. This will cause
- the T-handle to rotate clockwise through 90°. Check the position of the spiral blade under the image intensifier. Unscrew the insertion instruments for the spiral blade, and remove the Kirschner Wire.

▲ Precaution:

When locking with a spiral blade, an end cap must always be inserted into the nail; otherwise the spiral blade will not be properly secured.

■ Note:

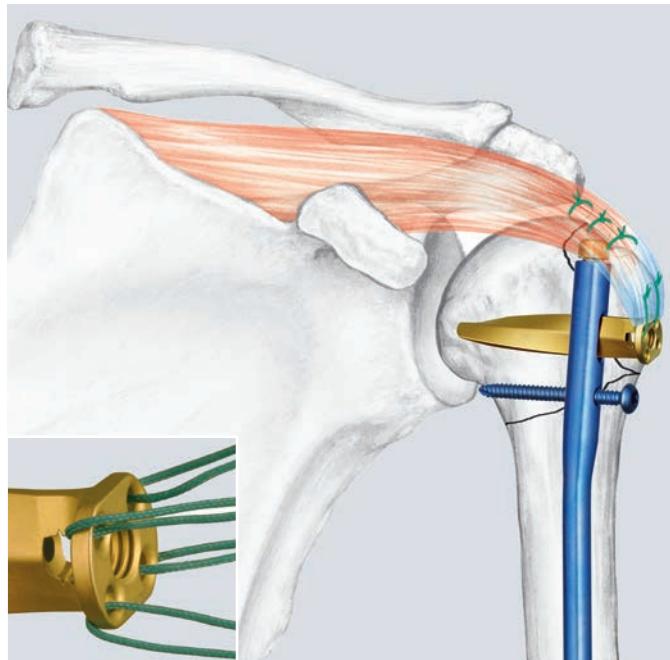
If a 0 mm end cap has been indicated, leave the insertion handle, aiming arm and spiral blade insertion assembly in place since the 0 mm end cap can be inserted through the insertion handle.



Option

Optionally, a 4.0 mm Locking Screw may be used in the proximal transverse locking hole. To insert a transverse locking screw, remove the spiral blade insertion assembly. For locking this screw, see “3. Insert locking screws” section. This locking screw may be bicortical or unicortical depending upon its placement relative to the articular surface.

For fractures with avulsion of the greater tuberosity (B fractures), the latter must always be reduced and fixed as well. Often minor displaced fractures are fixed by the base plate of the spiral blade and the more or less intact rotator cuff. Otherwise, this can be achieved either with a covered technique or by extending the cranial incision. The tuberosity can be fixed with a 4.0 mm cannulated titanium screw or with tension-band wiring. In the latter technique, a suture or wire loop, for example, can be anchored in the holes on the spiral blade. In case of poor bone quality, the tension-band wiring technique is preferable.



Distal locking of the EXPERT Proximal Humeral Nail is targeted locking with the aiming arm for the spiral blade.

1. Insert trocar combination

Instruments

03.010.063	Protection Sleeve 12.0/8.0, length 188 mm
03.010.064	Drill Sleeve 8.0/3.2, for No. 03.010.063
03.010.069	Trocar Ø 3.2 mm, for No. 03.010.064

Insert the trocar combination (protection sleeve, drill sleeve and trocar) through one of the distal holes in the aiming arm, make a skin incision, and insert the trocar down to the bone. Remove the trocar.

▲ Precaution:

Only incise the skin and then perform blunt dissection to avoid injuring the axillary nerve and its branches.



2. Drill and determine length of locking screws

Instruments

03.010.060	Drill Bit Ø 3.2 mm, calibrated, length 340 mm, 3-flute, for Quick Coupling, for No. 03.010.064
03.010.072	Depth Gauge for Locking Screws

Insert the calibrated drill bit, and drill through both cortices until the tip of the drill bit just breaks through the medial cortex. The required length of the locking screw can be determined either by reading it directly off the calibrated drill bit at the back of the drill sleeve, or by measuring with the depth gauge. Press the drill sleeve firmly to the cortex to avoid measurement errors.



To use the depth gauge, remove the scaled probe portion from the sleeve, and remove the drill sleeve from the protection sleeve. Insert the scaled probe through the protection sleeve so that the hook of the depth gauge grasps the far cortex of the bone. Read the scale against the edge of the protection sleeve to determine the appropriate locking screw length. In order to pass the hook through the protection sleeve, the sleeve of the depth gauge must be removed.

▲ Precaution:

Avoid deep perforation as this might cause radial nerve injury.



3. Insert locking screws

Instrument

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

Insert the appropriate locking screw through the protection sleeve and tighten it using the StarDrive screwdriver until the screw head rests against the lateral cortex.

- The tip of the locking screw should project beyond the medial cortex by 1–2 mm.

Insert the second locking screw in the same way.

The distal locking screws can be inserted using only one skin incision due to the mobility of the skin in this area.



Insert end cap into nail

As the EXPERT Proximal Humeral Nail is locked with a spiral blade, the end cap must always be inserted into the nail; otherwise the spiral blade will not be properly secured.

During insertion, increased resistance is encountered during the final few turns as a result of the notch on the thread. Tighten the end cap securely.

The end cap is available in four lengths (extensions of 0, 5, 10 or 15 mm) and can, if necessary, be used to extend the nail and thus allow flexible placement of the spiral blade in the head.

To minimise the chance of cross-threading, turn the end cap counterclockwise until the thread of the end cap aligns with that of the nail.

Ensure that the nail and the end cap are fully countersunk in the humeral head so that shoulder function remains unhindered, including during abduction.

0 mm end cap

Instruments

03.010.107 Screwdriver StarDrive, SD25,
length 330 mm

03.010.054 Insertion Handle for
EXPERT Humeral Nail

If the nail has not been overinserted, use an end cap with 0 mm extension. After removing the connecting screw, leave the insertion handle on the nail. Using the StarDrive screwdriver, place the end cap 0 mm in the proximal end of the nail through the insertion handle.



5 mm, 10 mm and 15 mm end cap

Instruments

292.260	Kirschner Wire Ø 2.5 mm with trocar tip
03.010.055	Aiming Arm Spiral Blade for EXPERT Humeral Nail
03.010.107	Screwdriver StarDrive, SD25, length 330 mm

If the nail has been overinserted, insert a 2.5 mm

- ④ Kirschner Wire through one of the small holes in the aiming arm and estimate the extension length using an AP image of the nail end. The end cap should not protrude beyond the insertion site. Align the end cap with the nail axis to prevent cross-threading. Fully seat the end cap using the StarDrive screwdriver.

■ Note:

Moving the patient's arm before the end cap is completely seated may shift the nail from the entry site. This displaced alignment may cause difficulty in placing the end cap.



Postoperative management

No immobilization is required if the situation is stable (A fractures).

Physiotherapy can be started immediately. Rotational exercises should not be initiated until the end of the third week.

If there is doubt about the stability of tubercle fixation, initial physiotherapy should be restricted to pendulum exercises and passive abduction and elevation. As soon as tuberosity stability is reached, active and active assisted rotational movements should be encouraged.

X-ray follow-up

X-rays are taken immediately after the operation. Further X-rays controls are recommended after two, six, twelve weeks, and beyond, depending on the course of the healing process.

Implant Removal

1. Remove end cap, spiral blade and locking screws

Instruments

03.010.107	Screwdriver StarDrive, SD25, length 330 mm
358.696	Inserter for Spiral Blade, for Humeral Nails
358.697	Connecting Screw for Spiral Blades, for Humeral Nails
03.010.058	Combined Hammer 400 g
03.010.112	Holding Sleeve, with Locking Device

Perform a blunt dissection to visualize the locking implants.

Clear any ingrown tissue from the StarDrive socket of the end cap and the locking screws from any ingrown tissue. Remove the end cap with the StarDrive screwdriver.

Connect the inserter and the spiral blade connecting screw for spiral blade to the spiral blade. Manually turn the inserter counterclockwise to remove the spiral blade. If resistance is encountered, the connecting screw may be used alone. Use light, controlled blows of the combined hammer to remove the spiral blade.



Using the StarDrive Screwdriver and the holding sleeve with locking device, remove all the locking screws except one.



2. Attach connecting screw and remove nail

Instruments

03.010.053	Connecting Screw, cannulated, for EXPERT Humeral Nail
03.010.058	Combined Hammer 400 g
03.010.059	Hammer Guide for Combined Hammer 400 g

Connect the connecting screw to the nail. Remove the last locking screw then the nail.

If resistance is encountered, thread the hammer guide onto the end of the connecting screw and use light, controlled blows of the hammer to remove the nail.

▲ Precaution:

Always mount the connecting screw prior to the removal of the screws. This will prevent the nail from rotating in the medullary canal.

■ Note:

Care should be taken to partially disassemble and distract the holding sleeve with locking device while cleaning before placing it in the graphic case for sterilization.



Implants

Nails

EXPERT Proximal Humeral Nail cannulated*

Length mm	7.0 mm diameter	9.0 mm diameter	11.0 mm diameter
150	04.001.210	04.001.410	04.001.610

EXPERT Humeral Nail cannulated*

Length mm	7.0 mm diameter	9.0 mm diameter	11.0 mm diameter
190	04.001.218	04.001.418	04.001.618
200	04.001.220	04.001.420	04.001.620
210	04.001.222	04.001.422	04.001.622
220	04.001.224	04.001.424	04.001.624
230	04.001.226	04.001.426	04.001.626
240	04.001.228	04.001.428	04.001.628
250	04.001.230	04.001.430	04.001.630
260	04.001.232	04.001.432	04.001.632
270	04.001.234	04.001.434	04.001.634
280	04.001.236	04.001.436	04.001.636
290	04.001.238	04.001.438	04.001.638
300	04.001.240	04.001.440	04.001.640
310	04.001.242	04.001.442	04.001.642
320	04.001.244	04.001.444	04.001.644



EXPERT Proximal
Humeral Nail

EXPERT Humeral Nail

* Available non-sterile or sterile packed. Add "S" to the catalogue number to order sterile products.

All implants are available in TAN (Ti-6Al-7Nb).

Locking implants for EXPERT Humeral Nails

Locking Screws StarDrive Ø 4.0 mm, blue

Article No.	Length (mm)
04.005.408	18
04.005.410	20
04.005.412	22
04.005.414	24
04.005.416	26
04.005.418	28
04.005.420	30
04.005.422	32
04.005.424	34
04.005.426	36
04.005.428	38
04.005.430	40
04.005.432	42
04.005.434	44
04.005.436	46
04.005.438	48
04.005.440	50
04.005.442	52
04.005.444	54
04.005.446	56
04.005.448	58
04.005.450	60



All locking implants are also available sterile (Add "S" or "TS" at the end of the Article No).

Spiral blades, gold

Article No.	Length (mm)
462.634	34
462.636	36
462.638	38
462.640	40
462.642	42
462.644	44
462.646	46
462.648	48
462.650	50
462.652	52
462.654	54

**End caps, gold**

Enable angular stable fixation of the spiral blade

Article No.	Extension (mm)
04.001.000	0
04.001.001	5
04.001.002	10
04.001.003	15

**End caps, blue**

For use with locking screws only

Article No.	Extension (mm)
04.001.007	0
04.001.008	5
04.001.009	10
04.001.010	15

All locking implants are also available sterile (Add "S" at the end of the Article No).

Instruments

Standard instrumentation

292.260	Kirschner Wire Ø 2.5 mm with trocar tip, length 280 mm, Stainless Steel
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310.440	Drill Bit Ø 4.5 mm, length 145/120 mm, 2-flute, for Quick Coupling
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319.970	Screw Forceps, self-holding, length 85 mm
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321.160	Combination Wrench Ø11.0 mm
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321.170	Pin Wrench Ø 4.5 mm, length 120 mm
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332.062	Router, length 130 mm, for Quick Coupling
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358.682	Projectile Burr, for Quick Coupling
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-
- 358.696 Inserter for Spiral Blade,
for Humeral Nails



-
- 358.697 Connecting Screw for Spiral Blades,
for Humeral Nails



-
- 360.050 Drill Bit Ø 10.0 mm, cannulated,
length 190/140 mm, 3-flute,
for Jacobs Chuck



-
- 393.105 Universal Chuck, small, with T-Handle



-
- 03.010.022 Radiographic Ruler for
EXPERT Humeral Nail



-
- 03.010.023 Radiographic Medullary Canal Estimator,
length 365 mm



-
- 03.010.025 Kirschner Wire Ø 2.0 mm with trocar tip,
length 240 mm, Stainless Steel



03.010.038 Protection Sleeve 10.0



03.010.039 Awl, cannulated



03.010.053 Connecting Screw, cannulated,
for EXPERT Humeral Nail



03.010.054 Insertion Handle for
EXPERT Humeral Nail



03.010.055 Aiming Arm Spiral Blade
for EXPERT Humeral Nail



03.010.058 Combined Hammer 400 g



03.010.059 Hammer Guide
for Combined Hammer 400 g



03.010.060 Drill Bit Ø 3.2 mm, calibrated,
length 340 mm, 3-flute,
for Quick Coupling, for No. 03.010.064



03.010.063 Protection Sleeve 12.0/8.0,
length 188 mm



03.010.064 Drill Sleeve 8.0/3.2, for No. 03.010.063



03.010.069 Trocar Ø 3.2 mm, for No. 03.010.064



03.010.072 Depth Gauge for Locking Screws,
measuring range up to 110 mm,
for No. 03.010.063



03.010.086 Drill Sleeve 14.0/8.0, length 130 mm



03.010.087 Centering Sleeve 8.0/2.0
for Kirschner Wire, length 140 mm



03.010.088 Trocar Ø 2.0 mm, length 150 mm



03.010.089 Drill Bit Ø 4.5 mm, cannulated



03.010.090 Measuring Device for Spiral Blade
for EXPERT Humeral Nail



03.010.091 Aiming Arm, Standard,
for EXPERT Humeral Nail



03.010.103 Drill Bit Ø 3.2 mm, calibrated,
length 145 mm, 3-flute,
for Quick Coupling



03.010.106 Direct Measuring Device for Drill Bits
of length 145 mm, for Nos. 03.010.100 to
03.010.105



03.010.107 Screwdriver StarDrive, SD25,
length 330 mm



03.010.112 Holding Sleeve, with Locking Device



03.010.113 Compression Screw
for EXPERT Humerus Nail



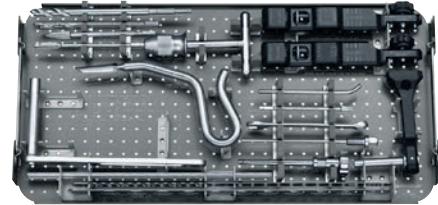
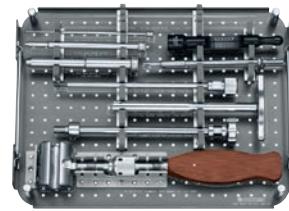
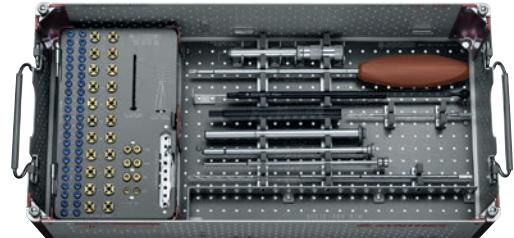
Optional instrumentation

03.010.100 Drill Bit Ø 3.2 mm, calibrated,
length 145 mm, 3-flute,
with Coupling for RDL



Graphic Case

69.001.300 Graphic Case for EXPERT Humeral Nail,
without Contents



MRI Information

A patient implanted with the DePuy Synthes device may be safely scanned under the following conditions.

Failure to follow these conditions may result in injury to the patient. The recommendations below only apply to the implantable devices and not to instrumentation.

Nominal values of Static Magnetic Field (Bo)	1.5 Tesla or 3 Tesla
Maximum Spatial Field Gradient (SFG)	Up to 20 T/m (2,000 gauss/cm) Note: 20 T/m is a standardized value often used in labeling
Static Magnetic Field (Bo) Orientation	Horizontal, Cylindrical Bore
RF Excitation	Circularly polarized
RF Transmit Coil Type	Transmit quadrature-driven coil only
Maximum Whole-body SAR	Normal Operating Mode or 2 W/kg for 1.5 T 2 W/kg for 3.0 T
Maximum expected temperature rise	9.5 °C in 1.5 T system 5.9 °C in a 3.0 T system
Limits on Scan Duration	1.5 T (64 MHz) environment – Scan for 6 minutes of continuous RF exposure with one or more MR imaging pulse sequences (scan or series) 3.0 T (128 MHz) environment – Scan for 15 minutes of continuous RF exposure with one or more MR imaging pulse sequences (scan or series)
MR Artifact	The presence of the device may produce an image artifact. Imaging protocol modifications may be necessary to compensate for the image artifact.

▲ Precautions:

The above-mentioned test relies on non-clinical testing. The actual temperature rise in the patient will depend on a variety of factors beyond the SAR and time of RF application. Thus, it is recommended to pay particular attention to the following points:

- It is recommended to thoroughly monitor patients undergoing MR scanning for perceived temperature and/or pain sensations.
- Generally it is recommended to use a MR system with low field strength in the presence of conductive implants. The employed specific absorption rate (SAR) should be reduced as far as possible.
- Using the ventilation system may further contribute to reduce temperature increase in the body.

Please refer to the corresponding Instructions for Use for specific information on Intended use, Indications, Contraindications, Warnings and Precautions, Potential Adverse Events, Undesirable Side Effect and Residual Risks. Instructions for Use are available at www.e-ifu.com and/or www.depuySynthes.com/ifu

Not all products are currently available in all markets.
This publication is not intended for distribution in the USA.



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