FRN-ADVANCED™

Femoral Recon Nailing System (FRNA)

Surgical Technique

Greater Trochanter and Piriformis Fossa
Approaches For Intramedullary Fixation Of Femoral Shaft Fractures

AO approved by AO Technical Commission

DePuy Synthes
THE ORTHOPAEDICS COMPANY OF Johnson & Johnson


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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Note: For additional information, please refer to the package insert or www.e-ifu.com.
For detailed cleaning and sterilization instructions, please refer to www.depuysynthes.com/hcp/cleaning-sterilization or sterilization instructions, if provided in the instructions for use.

■ **Notes**
▲ **Precautions**
▲ **WARNINGS**

The AO Principles of Fracture Management

Mission

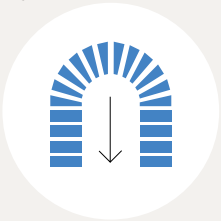
The AO's mission is promoting excellence in patient care and outcomes in trauma and musculoskeletal disorders.

AO Principles[1,2]

1.

Fracture reduction and fixation to restore anatomical relationships.

2.



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

3.

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

4.

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.

Preoperative Planning

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

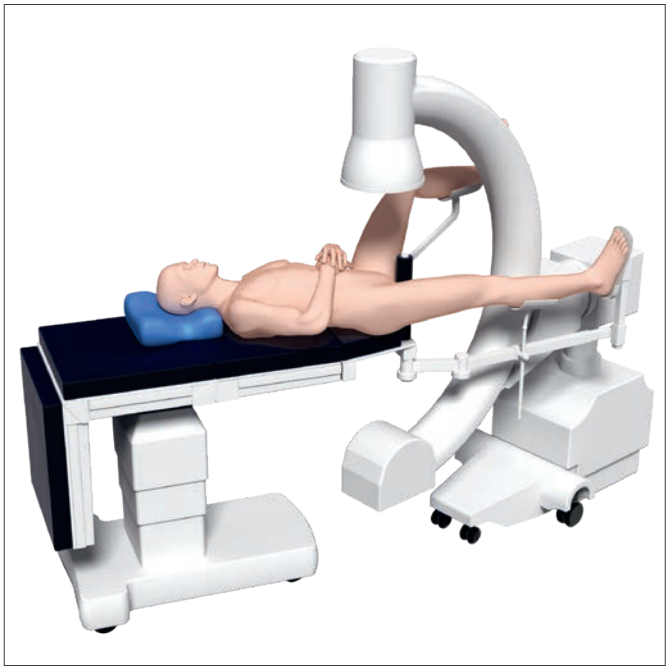
When selecting the nail size, consider canal diameter, fracture pattern, patient anatomy and post-operative protocol.

Preparation

1. Position Patient

Position the patient in the lateral decubitus or supine position on a fracture table or radiolucent operating table. Position the image intensifier to allow visualization of the proximal femur in both the AP and lateral planes.

To facilitate access to the medullary canal, abduct the upper part of the body approximately 10°–15° to the contralateral side and adduct the affected limb by 10°–15°.



Supine position

Intended Use, Indications and Contraindications can be found in the corresponding system Instructions for Use.

2. Reduce fracture

Instruments

394.350*	Large Distractor, complete

Perform closed reduction manually by axial traction under image intensifier control. If reduction cannot be achieved in a closed approach, open reduction may be considered.

The use of the large distractor may be appropriate in certain circumstances. Consult the corresponding Large Distractor – Tibia Surgical Technique.

*Also available

3. Determine nail length

Instrument	
03.010.020	Radiographic Ruler, for EXPERT™ Femoral Nails

The required nail length must be determined after reduction of the femoral fracture.

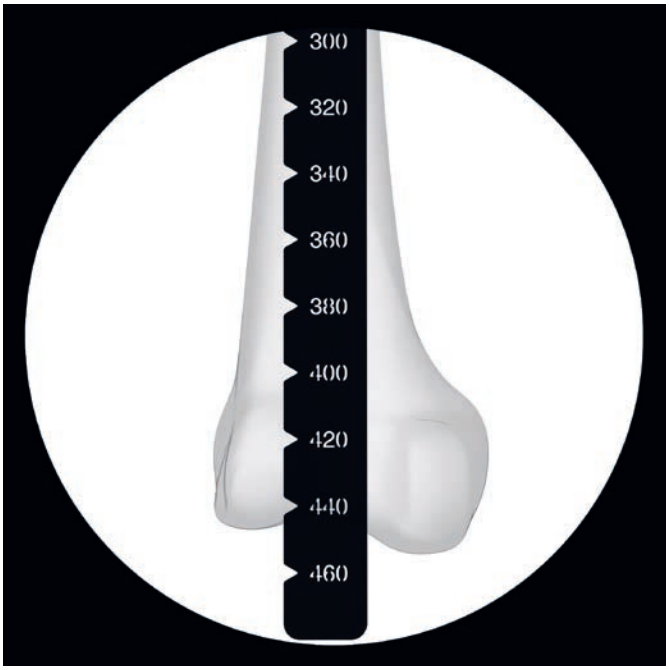
Alternatively, the length can be measured on the contralateral uninjured leg. Position the ruler over the proximal femur and take an AP image. Adjust the ruler until the proximal end is at the desired nail insertion depth. Mark the skin at the proximal end of the ruler.

Move the image intensifier to the distal femur. Verify fracture reduction. Align the proximal end of the radiographic ruler to the skin mark, and take an AP image of the distal femur.

Read nail length directly from the ruler image, selecting the measurement at or just proximal to the epiphyseal scar, or at the chosen insertion depth.

■ Notes:

- The holes in the proximal part of the ruler do not indicate the postion of the proximal locking holes of the Femoral Recon Nail.
- It is recommended that all fractures are treated with the longest nail possible, taking into account patient anatomy or a previous implant.
- Planned backstroke or dynamization must be taken into account when determining the nail length. In these cases, a shorter nail should be chosen. The proximal dynamic slot allows for 7 mm of movement and the distal dynamic slot allows for 10 mm of movement.



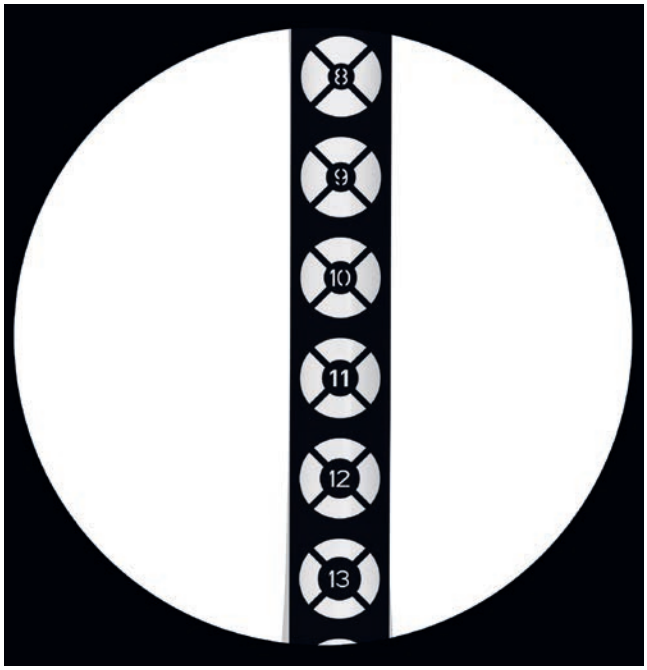
Alternative Technique

Nail length may also be determined by using a reaming rod, see the reaming section for this technique.

4. Determine nail diameter

Instrument	
03.010.023	Radiographic Ruler for Nail Diameters for EXPERT™ Femoral Nails, length 365 mm

Position the image intensifier for an AP or lateral view of the femur at the level of the isthmus. Hold the radiographic canal width estimator over the femur so that the diameter gauge is centered over the narrowest part of the medullary canal. Read the estimated diameter measurement on the circular indicator that fills the canal.



■ Note:

The distance of the radiographic ruler from the bone affects the diameter measurement.
Estimate the width as follows:

- Distance between the radiographic ruler and bone
  - 25 mm = 1 mm larger reading
  - 50 mm = 2 mm larger reading
  - 100 mm = 3 mm larger reading
- If the reamed technique is used, the diameter of the largest medullary reamer applied must be 1 mm to 2 mm larger than the nail diameter.

Open Proximal Femur

1a. Identify nail entry point: Greater Trochanter

The entry point determines the optimal anatomic position of the nail in the medullary canal. Special care should be taken to ensure an accurate entry point before continuing.

Make a longitudinal incision proximal to the greater trochanter. Carry the dissection to the gluteus medius fascia longitudinally in the direction of the wound. Separate the underlying muscle fibers and palpate the tip of the greater trochanter.

In the AP view, the nail insertion point is on the tip or slightly lateral to the tip of the greater trochanter, in the curved extension of the medullary cavity. This represents a point, 5° lateral of the femoral shaft axis, measured from a point just below the lesser trochanter, as the ML angle of the nail is 5°.

In the lateral view, the entry point for the nail is centered in the greater trochanter and in line with the medullary canal.

If proximal reconstruction locking is intended, the entry point must be selected to permit that recon screws to be placed in the center of the femoral head.

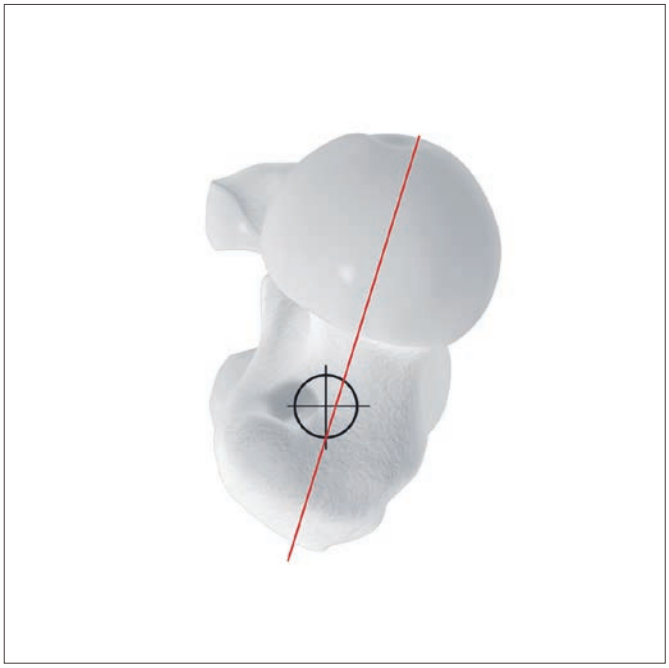
1b. Identify nail entry point: Piriformis Fossa

The entry point determines the optimal anatomic position of the nail in the medullary canal. Special care should be taken to ensure an accurate entry point before continuing.

Make a longitudinal incision proximal to the tip of the greater trochanter. Carry the dissection to the gluteus medius fascia longitudinally in the direction of the wound. Separate the underlying muscle fibers and palpate the tip of the greater trochanter.

The entry point for the piriformis fossa nail is in line with the medullary canal in the AP and lateral views. The point is posterior in the proximal femur, in the piriformis fossa, but varies with patient anatomy.

If reconstruction locking is intended, the entry point in the piriformis fossa is selected to permit the recon screws to be placed in the center of the femoral head.



2. Insert guide wire

Instruments	
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm
03.010.500	Handle, with Quick Coupling
03.033.007	Protection Sleeve, ∅ 14 mm
03.033.008	Multi Hole Drill Sleeve, ∅ 14/3.2 mm
Alternative Instruments	
03.043.001	Universal Chuck with T-Handle
393.100**	Universal Chuck with T-Handle
393.105**	Universal Chuck, small, with T-Handle
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm

Assemble the handle, protection sleeve and multi hole wire guide. Position the protection sleeve and the multi hole wire guide assembly at the insertion point.

Insert the guide wire through the wire guide. Confirm guide wire placement in both the AP and lateral planes. Insert to a depth of approximately 15 cm. Remove the multi hole wire guide.

Option: insert a second guide wire if the first guide wire was inserted in a wrong position.

If the first guide wire is inserted in an incorrect position, a second guide wire can be inserted through one of the additional holes in the multi hole wire guide at 5 mm from the central hole. The multi hole wire guide can also be rotated in 90° steps to facilitate the insertion of a second guide wire.

Once the guide wire is in the desired entry point, remove the first guide wire.

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.
** Also available

Alternative Technique

Alternatively, the guide wire can be inserted without the protection sleeve and multi hole wire guide. The protection sleeve and wire guide can then be passed over the guide wire.

Alternative Technique

Instruments	
03.037.008	Awl ∅ 8/4.7 mm, curved, cannulated
352.032*	SynReam Reaming Rod ∅ 2.5, L 950 mm
03.043.001	Universal Chuck
Alternative Instruments	
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm
03.037.007	Awl ∅ 8/4.7 mm, straight, cannulated
03.233.010*	3.0 mm Reaming Rod, 950 mm
393.100**	Universal Chuck with T-Handle
393.105**	Universal Chuck, small, with T-Handle
351.707S	Reaming Rod ∅ 2.5 mm, length 950 mm, with Olive & extension, sterile

The entry point can also be determined by using the curved awl. In place of a guide wire, the medullary canal can be initially opened with the 8 mm awl. After initial opening with the awl, insert a 950 mm reaming rod through the cannulation.

If the straight awl is used, a 3.2 mm guide wire can be used.

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.
** Also available

3. Open medullary canal

Instruments	
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm
03.010.500	Handle, with Quick Coupling
03.033.004*	Drill Bit ∅ 14 mm cannulated, flexible, for Quick Coupling for DHS™/DCS™
03.033.007	Protection Sleeve, ∅ 14 mm
Alternative Instruments	
03.033.005*	Drill Bit ∅ 14 mm cannulated, for Quick Coupling for DHS™/DCS™
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm

Using the protection sleeve and cannulated drill bit, drill over the 3.2 mm guide wire or reaming rod until the drill stop on the drill reaches the protection sleeve.

Monitor progress of the drill with the image intensifier. Ensure that the lateral and medial cortical walls are not compromised. Adjust the guide wire if necessary.

Remove the guide wire, protection sleeve, and drill bit.

■ Notes:

- To accommodate proximal nail geometry in patients with dense bone and/or tighter canals, in addition to the 14 mm drill bit, consider using a medullary reaming system to ream proximally. See Reaming section below and consult corresponding Surgical Techniques**.
- Dispose of the guide wire. Do not reuse.
- In case a reaming rod was used, removal is not necessary, since nails can be inserted over the reaming rod.

- Be mindful of soft tissue, and ensure that protection sleeve is fully pressed down to bone. Drill deep enough that the drill stop makes contact with sleeve. Advancing the solid/flexible drill bits to their stop ensures the bone is prepped for the proximal nail geometry.
- Refer to Reaming guidance (Section 4) and ream as needed to ensure proper fit, based on patient anatomy and implant dimensions.

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

** Monobloc Reamers Surgical Technique Guide, RIA 2 Surgical Technique Guide and SynReam Surgical Technique Guide

Alternative Technique: Open canal with 14 mm Awl

Instruments	
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm
03.010.041	Awl ∅ 14.0/3.2 mm, cannulated
Alternative Instruments	
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm

Alternatively, the 14 mm awl may be used to open the medullary canal.

Remove the protection sleeve. Pass the awl over the guide wire or reaming rod and open the medullary canal.

Remove the awl and the wire.

■ Notes:

- To accommodate proximal nail geometry in patients with dense bone and/or tighter canals, in addition to the 14 mm drill bit, consider using a medullary reaming system to ream proximally. See Reaming section below and consult corresponding Surgical Techniques**.
- Dispose of the guide wire. Do not reuse.

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

** Monobloc Reamers Surgical Technique Guide, RIA 2 Surgical Technique Guide and SynReam Surgical Technique Guide

Option: Reduce fracture

Instruments	
03.010.369*	Reduction Instrument for Medullary Nails
352.032**	SynReam Reaming Rod ∅ 2.5, L 950 mm

Alternative Instruments	
03.010.495*	Intramedullary Reduction Tool, curved, with Quick Coupling, Hex 12 mm
03.010.496*	T-Handle, cannulated, with Quick Coupling, Hex 12 mm
03.233.010*	3.0 mm Reaming Rod, 950 mm
351.707S	2.5 mm Reaming Rod with ball tip and extension, 950 mm, sterile

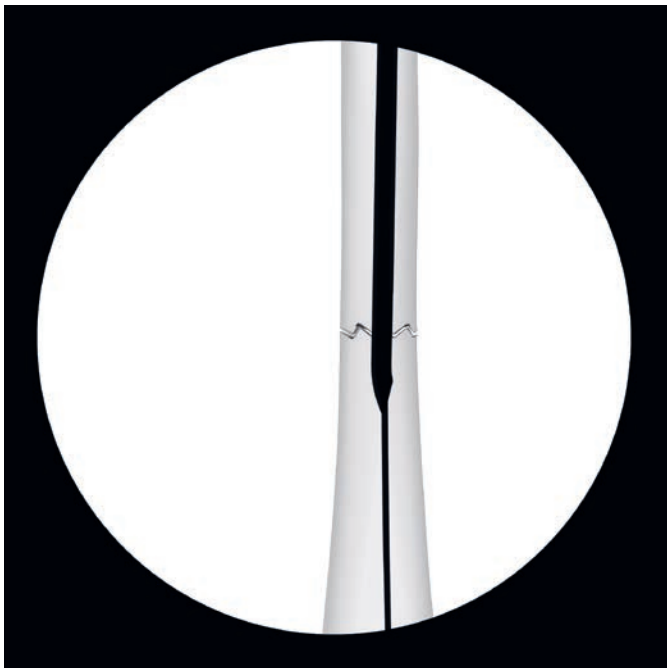
The use of the Reduction Instrument for Medullary Nails helps achieving alignment of the proximal and distal fragments and guiding the reaming rod to the distal fragment.

Insert the reduction instrument or finger to the desired depth. Pass the reaming rod trough the cannulation of the instrument.

Remove the reduction instrument.

■ Note:

Use the rod pusher to help retain the reaming rod during the extraction of the reduction instrument.



* Also available
** Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

Option: Determine nail length over reaming rod

Instruments	
03.045.035	Direct measuring device for IM nails
03.045.036	Tube for direct measuring device
Alternative Instruments	
351.719	Elogation Tube for Reaming Rods, for Depth Gauge for Medullary Nails, for Nos. 351.717 and 03.019.001
351.717	Depth Gauge for Medullary Nails
03.037.036*	Depth Gauge for Trochanteric Nailing System

Nail length can be determined over a 950 mm reaming rod. Confirm reaming rod insertion depth under image intensification and account for a possible distraction at the fracture site.

Assemble the depth gauge and tube and pass the assembly over the reaming rod and down to the nail entry point. Read nail length directly from the measuring device.

If a 1150 mm reaming rod is used, the nail length measurement should be read off the etched line on the reaming rod.

*Also available

4. Ream medullary canal for 14 mm diameter nails. Optional for 9–12 mm nails

Required Set	
01.045.034–01.045.039	Monobloc Flexible Reamer Sets
Instrument	
03.010.093	Rod Pusher for Reaming Rod with Hexagonal Screwdriver ∅ 8.0 mm
Alternative Set	
189.060	SynReam Intramedullary Reaming System
01.404.000	RIA 2 Instrument Set

In patients with dense bone and/or tighter canals, in order to accommodate proximal nail geometry, consider proximally reaming beyond the lesser trochanter, and as deep as into the upper 1/3 of the femur, to ensure proper fit. Based on patient anatomy, when reaming for nails sized ∅ 9–13 mm, proximally ream up to 13 mm, and for nails sized ∅ 14 mm nail, proximally ream up to 14 mm.

If necessary, enlarge the femoral canal with the medullary reamer to the desired diameter using the medullary reamer. Consult the corresponding Surgical Techniques*.

Use image intensification to confirm fracture reduction. Insert the reaming rod into the medullary canal to the desired insertion depth. The tip must be correctly positioned in the medullary canal since it determines the final distal position of the nail. Use image intensification in AP and lateral view to ensure that the reaming rod is placed in a central position.

Reaming

Start with the smallest diameter reaming head and ream to a diameter of 1.5 mm to 2 mm greater than the nail diameter. Ream in 0.5 mm increments and advance the reamer with steady, moderate pressure. Do not force the reamer. Partially retract the reamer repeatedly to clear debris from the medullary canal.

Notes:

- Use the rod pusher to help retain the reaming rod during reamer extraction.
- Take into consideration the indication for overreaming, patient anatomy, bone density, and the dimensions of the proposed nail.
- Additional reaming may be necessary to overcome patient anatomy in case 2 mm is not enough. If nail doesn't advance while hammering, overream to make sure taper of nail will sit correctly.

*Monobloc Reamers Surgical Technique Guide, RIA 2 Surgical Technique Guide and SynReam Surgical Technique Guide

Option: Reaming protection system

Instruments	
03.010.500	Handle, with Quick Coupling
03.033.007	Protection Sleeve, ∅ 14 mm
03.033.009	Protection Tube for Medullary Reamers, ∅ 14/12 mm
03.033.010	Trocar for Reamer Protection Tube, ∅ 12/4.6 mm

The reaming protection system is used to help protect the proximal metaphysis during reaming avoiding undesired enlargement of the entry point or reaming of the lateral wall.

Assemble the reamer protection tube, trocar and protection sleeve together. Insert the reaming protection tube assembly over the reaming rod, sliding the trocar and reamer protection tube into the bone.

Remove the inner trocar from the assembly and pass the reamer over the reaming rod and through the protection tube. Ream according to the technique described in previous steps.

When removing the reamer head through the reamer protection tube, be sure to align the angle of the reamer shaft to the protection tube. This will help ensure the reamer head will not get caught on the reamer protection tube upon removal.

■ Note:

The reamer protection tube can only be used with reamer heads up to 12 mm.

1. Assemble insertion instruments

Instruments	
03.043.027	T-Handle Ball Hex Screwdriver Cannulated, ∅ 8 mm
03.033.001	Insertion Handle, radiolucent, Femoral Recon Nail
03.033.006	Cannulated Connecting Screw
Alternative Instrument	
03.010.517*	Screwdriver, hexagonal ∅ 8.0 mm, with T-Handle, with spherical head, length 322 mm

Assemble the ball hexagonal screwdriver to the connecting screw by inserting the tip of the screwdriver until it clicks into the recess of the connecting screw.

Match the geometry of the handle to the nail by aligning the arrow on the nail with the line on the barrel of the insertion handle and connect the nail to the insertion handle. The nail will click-in and self-retain.

Pass the connecting screw through the insertion handle and securely tighten with the ball hexagonal screwdriver. Remove the hexagonal screwdriver.

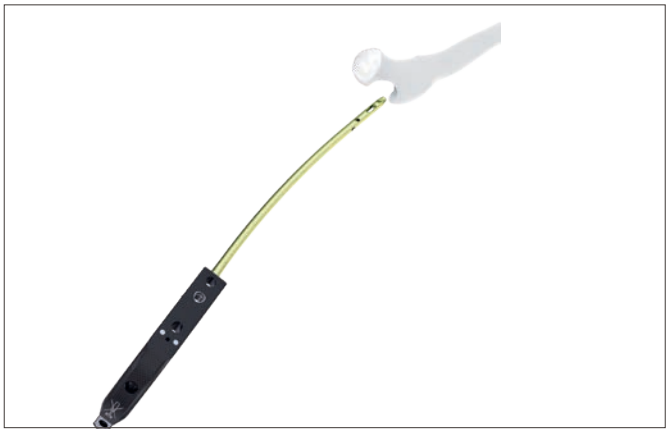
▲ Precautions:

- Ensure that the connection between the nail and the insertion handle is tight. Retighten if necessary.
- Do not attach the aiming arm to the handle yet.
- Reconfirm that the correct nail (e.g. type of entry point nail, right or left sides) is assembled.

*Also available

2. Insert Nail

Instruments	
03.043.027	T-Handle Ball Hex Screwdriver Cannulated, ∅ 8 mm
03.033.001	Insertion Handle, radiolucent, Femoral Recon Nail
03.033.006	Cannulated Connecting Screw
Alternative Instrument	
03.010.517*	Screwdriver, hexagonal ∅ 8.0 mm, with T-Handle, with spherical head, length 322 mm



Greater trochanter entry point nails:

Orient the insertion handle anteriorly until the nail reaches the isthmus. Manually insert the nail into the femoral opening. When using a reaming rod, pass the cannulated nail over the reaming rod and into the femoral opening. As the nail is advanced, rotate the handle so it is positioned laterally for final seating.

Under image intensification, verify fracture reduction and nail insertion in AP and lateral views. Insert the nail as far as possible by hand. Use the insertion assembly to manipulate the nail across the fracture. Insertion can be aided by light hammer blows on the driving cap, as described in the next step.

If a reaming rod has been used, do not remove it before the nail has crossed the fracture site.

■ Notes:

- Do not mount the aiming arm until the nail has been completely inserted.
- If nail insertion is difficult, use the C-arm to confirm that there is no obstruction of the intramedullary canal. If no obstruction was found, choose a smaller diameter nail or ream the intramedullary canal to a larger diameter.

*Also available

Piriformis fossa entry point nails:

Orient the insertion handle laterally during insertion. Manually insert the nail into the femoral opening. When using a reaming rod, pass the cannulated nail over the reaming rod and into the femoral opening.

Under image intensification, verify fracture reduction and nail insertion in AP and lateral views. Insert the nail as far as possible by hand. Use the insertion assembly to manipulate the nail across the fracture. Insertion can be aided by light hammer blows on the driving cap, as described in the next step.

If a reaming rod has been used, do not remove it before the nail has crossed the fracture site.

■ Notes:

- Do not mount the aiming arm until the nail has been completely inserted.
- If nail insertion is difficult, use the C-arm to confirm that there is no obstruction of the intramedullary canal. If no obstruction was found, choose a smaller diameter nail or ream the intramedullary canal to a larger diameter.

3. Insert nail with hammer (optional)

Instruments	
03.033.001	Insertion Handle, radiolucent, Femoral Recon Nail
321.170	Pin Wrench ∅ 4.5 mm, length 120 mm
321.160	Combination Wrench ∅ 11.0 mm
03.010.522	Combined Hammer, 500 g
03.010.523	Driving Cap with thread, for Insertion Handle

Alternative Instruments	
03.010.170	Hammer Guide
321.200*	Ratchet Wrench, 11 mm Width Across Flats

To use a hammer, screw the driving cap into the insertion handle and tighten with the ratchet wrench.

While applying light blows, monitor the tip of the nail using image intensification. Verify that there is no evidence of impingement distally. Remove the driving cap once the nail has been seated.

■ Notes:

- Using light blows, the hammer can also be used with the driving cap to back slap the nail if the nail has been slightly over inserted. Alternatively, the hammer guide can be attached to the driving cap to facilitate the use of the hammer.
- Confirm that the driving cap is tightly connected to the insertion handle, as hammering may loosen the connection.

▲ Precautions:

- Confirm that the nail is tightly connected to the insertion handle, as hammering may loosen the connection. Retighten if necessary.
- Do not strike the insertion handle directly.

*Also available

4. Check proximal nail position

If a greater trochanter entry point has been chosen, insert the nail until it is at or below the femoral opening.

If a piriformis fossa entry point has been chosen, insert the nail until it is at or below the level of the top of the greater trochanter.

Check final nail position under image intensification in AP and lateral views.

Notes:

- The grooves on the insertion handle facilitate visualization of the nail position. The first, most distal groove represents the nail end. The subsequent distances between the grooves on the insertion handle represent 5 mm and correspond to the extensions of the end caps.
- If dynamization is planned, it is recommended to take in account the movement permitted by the dynamization slots. The proximal dynamic slot allows 7 mm of movement and the distal dynamic slot allows for 10 mm of movement.
- If the use of recon screws is planned, nail insertion must be performed based on the estimated position of the recon screws in the femoral neck.

5. Check distal nail position

Use image intensification to ensure the nail is centered in both AP and lateral views. Verify fracture alignment.

6. Close fracture gap (optional)

It is recommended to close fracture gaps if necessary. The FRN-ADVANCED™ System offers the following options:

Proximal:

a. Backstroke technique

Insert at least two locking screws in the distal part of the nail (see distal locking section). After distal locking, strike back the nail to pull back the locked nail and the distal fragment.

b. Proximal dynamization

Insert a locking screw in the dynamic position of the locking slot (proximal part of the locking slot, see proximal locking section).

Distal:

c. Distal dynamization

Insert a locking screw in the dynamic position of the distal locking slot (distal part of the locking slot, see distal locking section).

■ Notes:

- Consider over insertion of the nail if the backstroking technique is planned. Account for the planned position of the recon or proximal locking screws.
- If distal dynamization is planned, the tip of the nail will slide maximum 10 mm distally. In order to protect the articulating surface of the distal femur, this movement must be taken into account when choosing the length and insertion of the implant.

Proximal Dynamization (b)

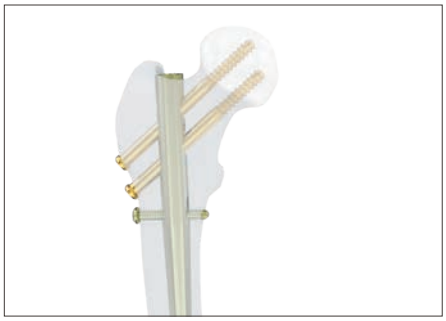
Distal dynamization (c)

Proximal Locking

Proximal Locking Options

Standard Locking
Proximal locking with an antegrade locking hole (GT 140°, PF 135°) and a transverse locking slot that offers static and dynamic locking options.

Recon Locking
Proximal locking with 2 recon screws.



Recon Locking with transverse locking screw
Proximal locking with 2 recon screws and one transverse locking screw in the static locking position.

■ Note:

If the use of recon screws is planned, it is recommended to perform proximal locking prior to distal locking.

▲ Precautions:

- Proximal locking with the antegrade locking option is not permitted when using recon screws.
- If the use of recon screws is intended in combination with one transverse locking screw, the locking screw must be inserted in the static position of the locking slot (distal position of the transverse locking slot). This prevents the transverse locking screw from interfering with the recon screw. Consult the recon locking section for detailed steps.

■ Note:

The targeting holes in the insertion handle and aiming arms are color coded according to the type of screws to be used:

- Green lines on the insertion handle and aiming arms to target the insertion of 5.0 mm locking screws
- Yellow lines on the aiming arms: to target the insertion of 6.5 mm Recon Screws.

Proximal Locking – Standard Locking

The FRN-ADVANCED System offers three standard locking options:

1. The antegrade locking hole allows for static locking (GT 140°, PF 135°).

2. The dynamic locking option corresponds to the proximal position the transverse locking slot.

3. The static locking option corresponds to the distal position of the transverse locking slot.

Proximal standard locking options:

A. It is recommended to use the antegrade locking option together with the transverse static locking option unless immediate (primary) proximal dynamization is intended.

B. For immediate (primary) dynamization, insert only one proximal locking screw in the dynamic position of the transverse locking slot.

C. If dynamization may be required due to secondary dynamization, use both, the antegrade and the transverse dynamic locking positions. Remove the antegrade locking screw if required to allow dynamization.

1. Mount aiming arm

Instruments	
03.043.027	T-Handle Ball Hex Screw Driver, cannulated, ∅ 8 mm
03.033.002	Radiolucent Aiming Arm, FRN Piriformis Fossa
or	
03.033.003	Radiolucent Aiming Arm, FRN Greater Trochanter
Alternative Instrument	
03.010.517*	Screwdriver, hexagonal ∅ 8.0 mm, with T-Handle, with spherical head, length 322 mm

Confirm that the nail is securely connected to the insertion handle using the 8 mm ball hex screwdriver. Mount the appropriate aiming arm (piriformis fossa or greater trochanter) to the insertion handle.

■ Note:

The aiming arm is engraved with GREATER TROCHANTER or PIRIFORMIS FOSSA identifying the corresponding entry point the used nail was designed for.

*Also available

2. Insert trocar combination

Instruments	
03.045.019	Protection Sleeve, ∅ 11/8
03.045.020	Drill Sleeve, ∅ 4.2 mm
Alternative Instruments	
03.010.070*	Trocar ∅ 4.2 mm
03.025.040*	Protection Sleeve 11.0/8.0, length 188 mm
03.010.065*	Drill Sleeve 8.0/4.2, for No. 03.010.063

Insert the three-part trocar combination (protection sleeve, drill sleeve and trocar) through the desired hole in the aiming arm (STAT/STATIC for static locking, DYNA/DYNAMIC for dynamic locking). Make a stab incision and push the three-part trocar combination to the bone. Remove the trocar.

If using the antegrade locking option, insert the trocar combination through the corresponding hole in the insertion handle.

*Also available

Alternative Instruments

03.010.491	Long Scalpel Handle

The scalpel handle may be used through the aiming arm and insertion handle for precise placement of the incision. Make a stab incision and ensure the dissection of the fascia is in line with the path of the protection sleeve. Advance the three-part trocar combination to the bone as described before.

Remove the trocar.

■ Notes:

- Do not exert forces on the aiming arm, protection sleeves and drill sleeves. These forces may prevent accurate targeting through the proximal locking holes and damage the drill bits.
- In order to ensure that the Protection Sleeve (03.045.019) is secure in the Aiming Arm, make sure it is positioned such that the triangle on the sleeve is facing in the direction of the opposite hole (i.e. if sleeve is inserted in the “Dynamic” hole, it should be twisted and locked such that the triangle is facing the “Static” hole and vice-versa).

3. Drill and determine locking screw length

Instrument	
03.045.022*	Drill Bit ∅ 4.2 mm, calibrated, 120 mm

Alternative Instrument	
03.010.061**	Drill Bit ∅ 4.2 mm, calibrated, length 340 mm, 3-flute, for Quick Coupling, for No. 03.010.065

Ensure the drill sleeve is pressed firmly to the lateral cortex. Using the 4.2 mm drill bit, drill through both cortices until the tip of the drill bit just penetrates the far cortex.

Confirm drill bit position.

Ensure that the drill sleeve is pressed firmly to the lateral cortex and read the measurement from the calibrated drill bit at the back of the drill sleeve. This measurement corresponds to the appropriate length locking screw.

Remove the drill bit and drill sleeve.

* Available nonsterile or sterile packaged. Add "S" to product number to indicate sterile product.
** Also available

Alternative Technique

Instrument	
03.019.017	Depth Gauge
Alternative Instruments	
03.010.072*	Depth Gauge for Locking Screws, measuring range up to 110 mm, for No. 03.010.063
03.010.428*	Depth Gauge for Locking Screws to 100 mm, for intramedullary nails

After drilling both cortices, remove the drill bit and drill sleeve.

For 03.019.017:

Insert the depth gauge into the protection sleeve. Make sure that the hook grasps the far cortex for bi-cortical screws or touches the end of the screw hole for mono-cortical screws, and that its sleeve is on the bone.

Read the measurement from the back of the depth gauge's sleeve, which indicates the appropriate length locking screw.

For 03.010.072:

Disassemble the depth gauge into two parts: the outer sleeve and the measuring device with hook. Insert the measuring device into the protection sleeve. Make sure that the hook grasps the far cortex.

Ensure that the protection sleeve is firmly pressed against the lateral cortex.

Read the measurement from the back of the protection sleeve, which indicates the appropriate length locking screw.

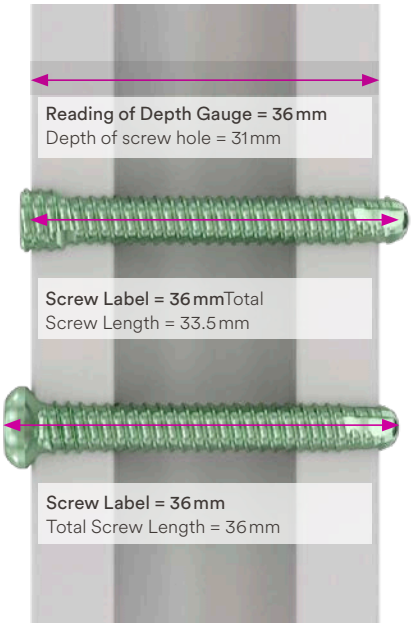
*Also available

4. About measuring screw length

Screw length is measured by using either of two methods.

1. Read length from the calibrated drill bits
2. Measure length using depth gauge for locking screws

Readings do not reflect the measured distance, they indicate the required screw length. The reading on the scale will correspond to the screw length as indicated on the screw label, taking into account the amount of screw tip protrusion required to get full screw thread engagement in the far cortex.



Notes:

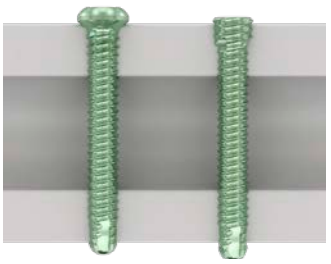
- Drill bit location with respect to the far cortex is critical for measuring the appropriate locking screw length.
- Beware depth gauges are implant specific. Always use the appropriate depth gauge as specified in Surgical Technique Guide.

5. Screw options

FRN-ADVANCED System offers two different types of screws:

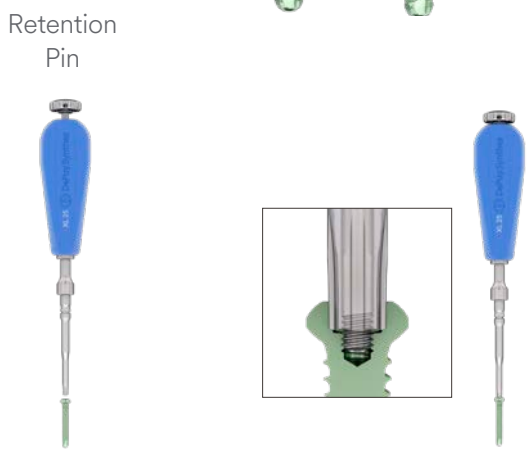
1. Locking Screw
   Standard IM nail locking screw.

2. Low Profile Locking Screw
   The low profile screw has reduced implant prominence.



■ Note:

Both types of screws have a threaded recess and can be securely attached to the screwdriver by using the retention pins. To do so, slide the retention pin through the back of the screwdriver until it stops. Further advance it by turning it clockwise, until its tip extends out of the tip of the screwdriver.



Engage the screwdriver in the recess of the locking screw and thread the retention pin into the screw's recess to lock the screw to the screwdriver.

Alternatively, the screw can be partially inserted with a power tool, by using the screwdriver shaft with its retention pin, following the same steps as described above.

▲ Precaution:

The screw must not be tightened with the power tool. Disengage the power tool from the screwdriver shaft before the screw is fully seated and use the manual handle to bring the screw to its final position.

5. Option: Low Profile Screw

5.OPT.A The low profile screw can be used instead of the standard locking screw, by following the same basic steps for screw insertion.

5.OPT.B An optional sleeve is available to indicate when the screw is fully seated. Slide it over the tip of the screwdriver until it locks in place.

5.OPT.C In its initial position, it will cover the head of the screw, protecting surrounding soft tissues from the screw head's cutting flutes. Advance the screw until the sleeve touches the cortex.

■ Note:

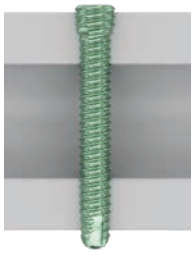
Pay attention not to damage the cortex with the sleeve.

5.OPT.D Then retract the sleeve by pushing the release button and pulling it backwards towards the screwdriver handle.

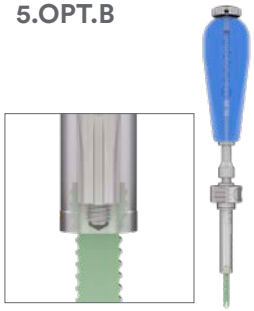
Continue to advance the screw, now sinking the threaded screw head into the bony cortex. Once the sleeve touches the cortex a second time the screw head will be 0.5 mm proud of the cortex.

The cutting flutes in the 5 mm low-profile screw's threaded head allow insertion of the screw without any extra steps. However, in hard bone it is recommended to enlarge the near cortex with the ∅ 5.5 reamer (03.045.029), to make room for the screw head, and avoid excessive insertion torque.

5.OPT.A Low Profile Locking Screw

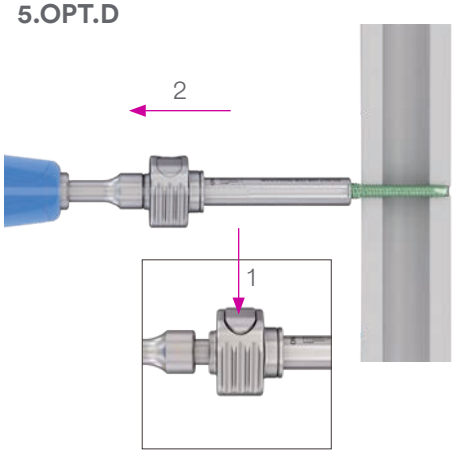


5.OPT.B



5.OPT.C

5.OPT.D



6. Insert locking screw

Instrument	
03.045.001	Screwdriver XL25
03.045.002	Retention Pin for Screwdriver XL25
Alternative Instrument	
03.010.518*	Screwdriver STARDRIVE™, T25, self-holding, length 319 mm

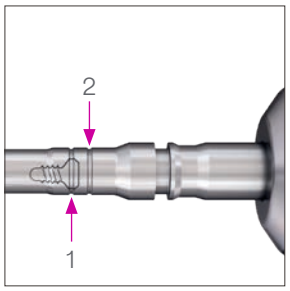
Insert the appropriate 5.0 mm locking screw through the protection sleeve using the STARDRIVE™ screwdriver. Verify locking screw length under image intensification.

The tip of the locking screw should not project more than 4 mm beyond the far cortex.

Repeat steps for the second, antegrade locking screw if desired.

Remove protection sleeves and the aiming arm.

The shaft of the screwdriver has two lines, one of which indicates insertion depth of the locking screw (1), and the other indicating insertion depth of the low profile locking screw (2) relative to the tip of the protection sleeve.

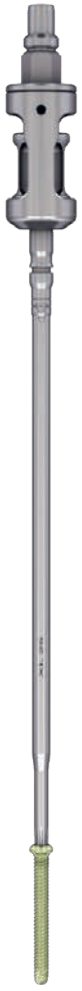


Screws are fully seated, when the line is flush with the head of the protection sleeve.

*Also available

Option: Powered screw insertion

Instrument	
03.045.005	Screwdriver XL25 Quick Coupling Hex 12 mm
03.045.006	Retention Pin for Screwdriver Quick Coupling, Hex 12 mm
03.140.027	Handle, large, cannulated, with Quick Coupling, Hex 12 mm



Alternatively, the screw can be partially inserted with a power tool, by using the screwdriver shaft (03.045.005) with its retention pin (03.045.006), following the same steps as described above.

▲ Precaution:

Screws must not be fully tightened with power tool. Disengage the power tool from the screwdriver shaft before the screw is fully seated and use the manual handle (03.140.027) to bring the screw to its final position.

Option: Low profile locking screw

Instruments	
03.045.009	Sleeve for Screwdriver
03.045.029	Reamer, ∅ 5.5 mm

The low-profile screw can be used instead of the standard locking screw, by following the same basic steps for screw insertion.

An optional sleeve is available to indicate when the screw is fully seated. Slide it over the tip of the screwdriver until it locks in place.

The use of a ∅ 5.5 mm reamer, to make room for the screw head is recommended in hard bone.

Proximal Locking – Reconstruction Locking

1. Mount aiming arm

Instruments	
03.043.027	T-Handle Ball Hex Screw Driver, Cannulated, ∅ 8 mm
03.033.002	Aiming Arm, radiolucent, for Piriformis Fossa, Femoral Recon Nail
or	
03.033.003	Aiming Arm, radiolucent, for Greater Trochanter, Femoral Recon Nail

Alternative Instrument	
03.010.517*	Screwdriver, hexagonal ∅ 8.0 mm, with T-Handle, with spherical head, length 322 mm

Confirm that the nail is securely connected to the insertion handle using the 8 mm ball hex screwdriver. Mount the appropriate aiming arm (piriformis fossa or greater trochanter) to the insertion handle.

■ Note:

The aiming arm is engraved with GREATER TROCHANTER or PIRIFORMIS FOSSA identifying the corresponding entry point the used nail was designed for.

*Also available

2. Verify nail insertion depth

In the AP view, adjust the nail insertion depth to ensure that the two recon screws can be placed into the femoral neck.

Alternative Technique: Plan position of guide wires with guide wire aiming device

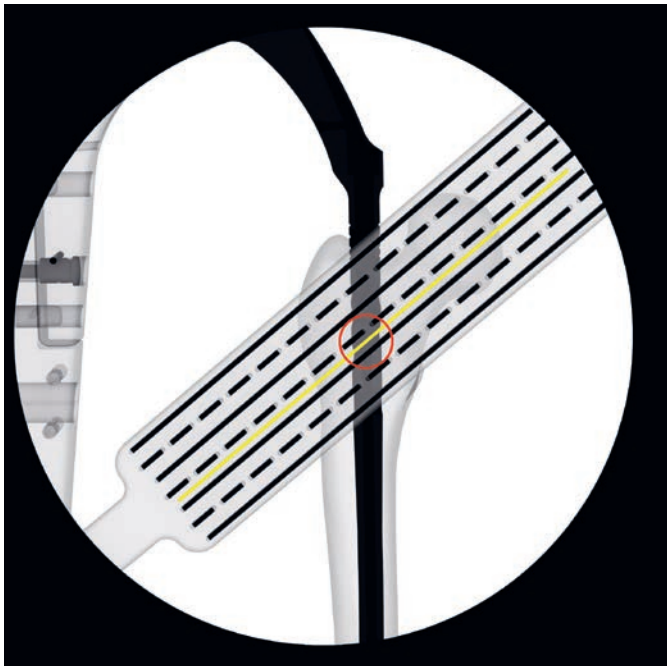
Instruments	
03.010.412	Aiming Device for Guide Wire, for PFNA and TFN, for AP Orientation
03.010.415	Connecting Screw for TFN, for No. 03.010.412
03.010.471	Guide Wire Aiming Device Offset Block, 100 mm

Insert the aiming device for AP orientation into the two holes on the anterior side of the aiming arm and lock in place using the connecting screw.

▲ Option:

The guide wire aiming device offset block can be added between the aiming arm and the guide wire aiming device to obtain an additional 10 cm of soft tissue clearance.

Position the image intensifier for an AP image. Rotate the image intensifier until any of the orientation lines (solid or dotted) is on the center of the inferior recon hole. This line will represent the guide wire trajectory.



3. Verify nail anteversion

Instrument	
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm

Alternative Instrument	
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm

Position the image intensifier in the true lateral view (alignment of the axis of the femoral neck parallel to the axis of the femoral shaft).

Adjust nail rotation until the two radiographic lines on the insertion handle are parallel to the nail as shown in images a and b.

Option: A 3.2 mm guide wire can be inserted into the corresponding hole in the insertion handle to predict the location of the recon screws as shown in images c and d. Image d is the preferred lateral image to assess screw position.

■ Notes:

- The guide lines are located in the handle portion of the insertion handle and are made from a radio-opaque material. The lines provide a visual reference for guide wire insertion verifying nail anteversion.
- The visualization of the femoral head is limited when using a piriformis fossa entry point nail.

* Available nonsterile or sterile packaged. Add "S" to product number to indicate sterile product.

4. Insert trocar combinations into recon screw holes

Instrument	
03.010.075	Protection Sleeve 11.5/8.5 for LFN™ Reconstruction Locking
03.010.076	Drill Sleeve 8.5/3.2, for No. 03.010.075
03.010.077	Trocar ∅ 3.2 mm, for No. 03.010.076
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm

Alternative Instrument	
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm

Assemble both three-part trocar combinations (protection sleeve, wire guide and trocar) and insert through the desired recon holes in the aiming arm. The cam lock lever must be in the unlocked position to insert the assembly.

Make a stab incision and ensure the dissection of the fascia is in line with the path of the protection sleeves.

Advance the three-part trocar combinations to the bone.

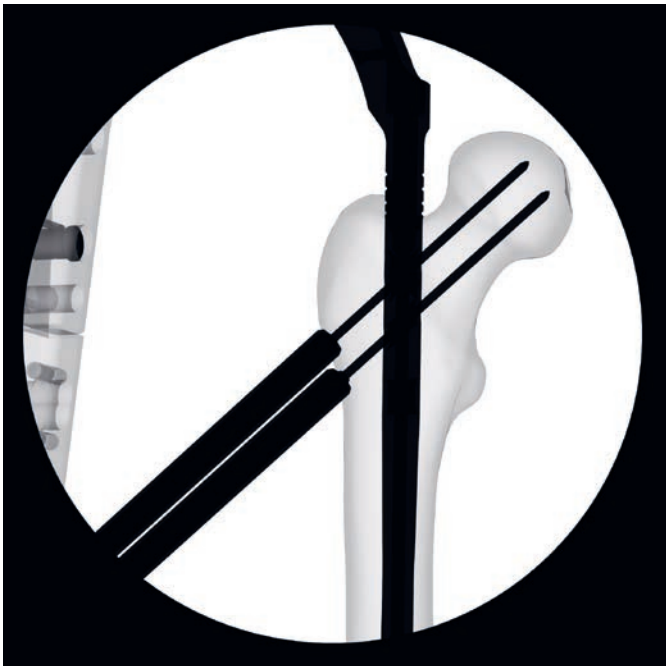
Remove the inferior trocar.

Alternative Instrument	
03.010.491	Handle for Scalpel, long

The scalpel handle may be used through the aiming arm for precise placement of the incision.

Insert the inferior guide wire into the femoral head approximately 5 mm from the subchondral bone. Check guide wire placement radiographically in both AP and lateral planes.
Remove the superior trocar.
Insert the second, superior guide wire into the femoral head. Check the guide wire placement in both the AP and lateral Planes.

* Available nonsterile or sterile packaged. Add "S" to product number to indicate sterile product.

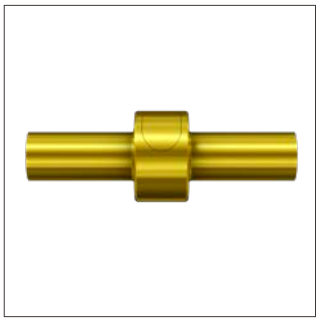


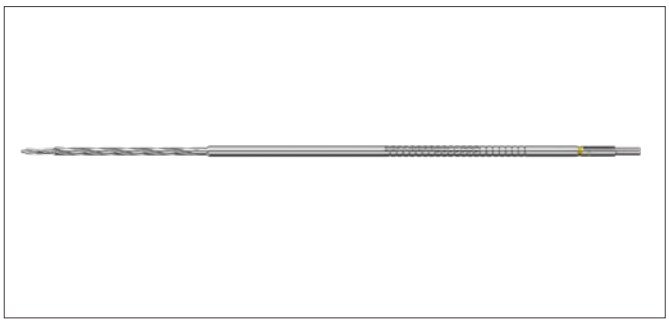
Notes:

- Do not exert forces on the aiming arm, protection sleeves and wire guide. These forces may prevent accurate targeting through the locking holes.
- It is recommended to place the inferior guide wire first and then the superior guide wire.

Check Drill Stop wear

Instruments	
03.010.078	Reamer ∅ 4.5/6.5 mm, length 484 mm, for Hip Screws LFN™
03.010.079	Fixation Sleeve, for No. 03.010.078





Possible damage

If excessive wear occurs, the Drill stop can slip, resulting in incorrect drilling depth.

Before use:

- Slide the Drill Stop onto the drill bit.
- Press on the Drill Stop with the thumb without pressing the button. If the Drill Stop moves under pressure, replace it.
- Do the same test in the opposite direction. If the Drill Stop moves, replace it.

Recommendations:

- Drill only under periodic image intensifier control.
- While drilling, do not force.
- Replace Drill Stops that do not pass the described wear test.

5. Determine length and drill for recon screws

Instruments	
03.010.078	Reamer ∅ 4.5/6.5 mm, length 484 mm, for Hip Screws LFN™
03.010.079	Fixation Sleeve, for No. 03.010.078
03.010.493	Direct Measuring Device for Guide Wires ∅ 3.2 mm, length 400 mm
Alternative Instrument	
03.010.085	Direct Measuring Device for Guide Wires ∅ 3.2 mm, length 400 mm

Measure for the inferior screw.

Ensure that the protection sleeve is pressed firmly to the near cortex and depress the cam lock lever to lock the protection sleeve in position. Remove the wire guide and insert the specialty locking measuring device over the guide wire, into the protection sleeve and to the bone. Read the length of the required recon screw directly on the measuring device (a).

Remove the measuring device and the inferior guide wire.

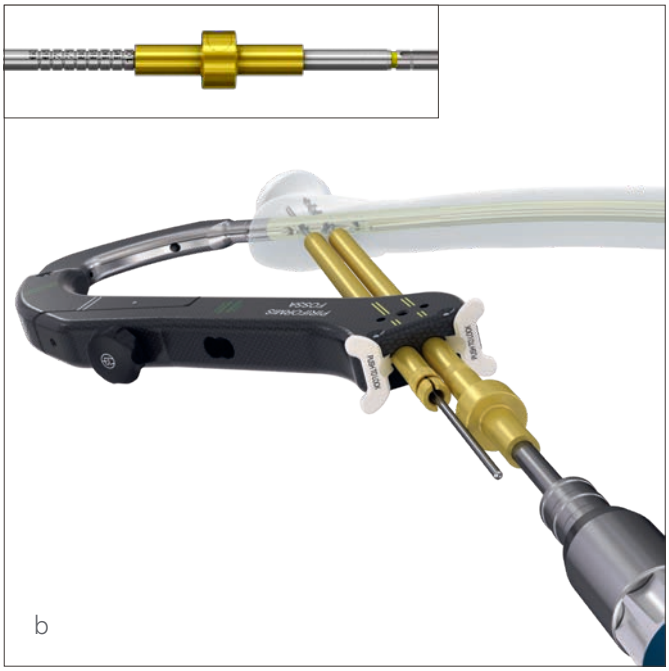
Attach the drill stop to the stepped drill bit for the appropriate screw length.

Set the previously measured length for the screw on the reamer by fixing the Drill Stop in the corresponding position. Read off the correct length on the side of the fixation sleeve pointing towards the tip of the reamer (b).

Guide the stepped drill bit through the protection sleeve to the bone. Drill to the stop. Monitor the position of the stepped drill bit under image intensification.

The fixed fixation sleeve prevents further drilling. Verify the position of the reamer under image intensification in AP view.

a



b

■ Note:
Always depress the cam lock lever to lock the protection sleeve in position.

6. Insert recon screws

Instruments	
03.045.013	Screwdriver, extra-long, XL40
03.045.014	Retention Pin f/Screwdriver, extra-long, XL40
Alternative Instruments	
03.045.015	Screwdriver, w/Quick Coupling DHS™, extra-long, XL40
03.045.017	Tap, for Hip Screw, ∅ 6.5 mm
03.010.080*	Tap for 6.5 mm Recon Screws
03.010.519*	Screwdriver STARDRIVE™, T25, self-holding, length 440 mm

■ Note:

Prior to screw insertion in dense bone, consider using the recon screw tap.

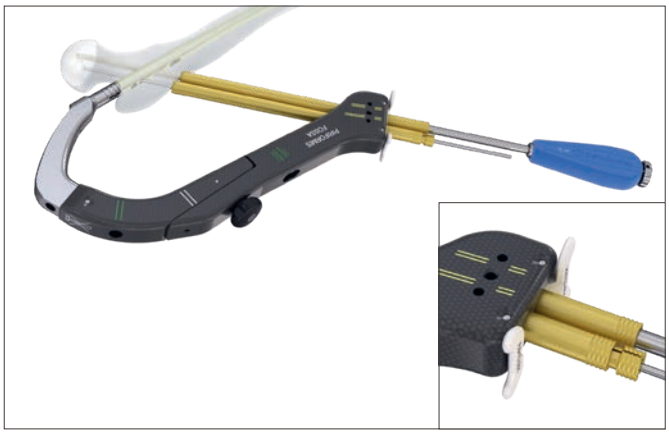
If desired, the recon screws can be locked to the screwdriver.

To do so, slide the retention pin through the back of the screwdriver until it stops. Further advance it by turning the pin clockwise, until its tip extends out through the tip of the screwdriver. Engage the screwdriver with the recess of the recon screw and thread in the retention pin to lock the screw to the screwdriver.

Use the screwdriver to insert the appropriate length recon screw through the protection sleeve into the femoral head. Verify the position of the recon screw under image intensifier in both planes.
A groove on the screwdriver indicates when the recon screw is fully inserted.

Repeat steps 5 and 6 for the second, superior recon screw.

Remove protection sleeves and the aiming arm.



■ Note:

Screws can be partially inserted under power using the screwdriver with quick coupling (until its collar contacts the tissue protection sleeve), followed by final tightening with the manual screwdriver.

*Also available

7. Option: Insert static transverse locking screw

Instruments	
03.045.019	Protection Sleeve, ∅ 11/8
03.045.020	Drill Sleeve ∅ 4.2 mm
Optional instrument	
03.010.491	Handle for Scalpel, long
Alternative Instruments	
03.025.040*	Protection Sleeve 11.0/8.0, length 188 mm
03.010.065*	Drill Sleeve 8.0/4.2, for No. 03.010.063
03.010.070*	4.2 mm Trocar 210 mm

The FRN-ADVANCED System offers the option of inserting a transverse locking screw after the insertion of recon screws.

Confirm that the planned transverse locking screw will not interfere with recon screws.

Insert the three-part trocar combination (protection sleeve, drill sleeve and trocar) through the STATIC hole in the aiming arm (STATIC/STAT for static locking in the aiming arm). Make a stab incision and insert the trocar to the bone.

Under image intensification, verify that the protection sleeve does not interfere with the head of the inferior recon screw.

Insert locking screw

After confirmation, follow the steps for screw insertion described in the section proximal locking – standard locking.

▲ Precautions:

- The insertion of the transverse locking screw is not permitted if the protection sleeve interferes with the head of the inferior recon screw.
- The insertion of the locking screw in the dynamic position of the locking slot (DYNAMIC/DYNA for dynamic locking in the aiming arm) is NOT permitted.

*Also available

Distal Locking

1. Distal locking

Distal locking is performed with the freehand technique. There are four distal locking options:

A. One transverse, lateral to medial static hole.

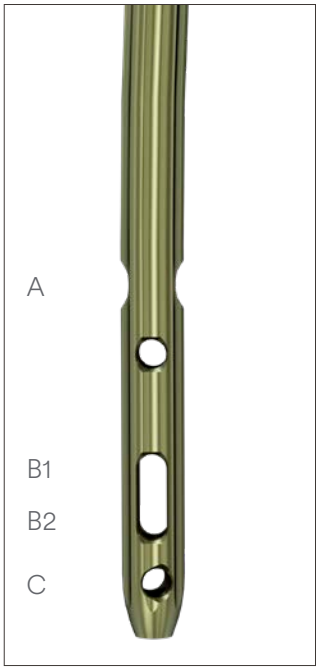
B. One transverse, lateral to medial slot that allows for static or dynamic locking options.
- B1: Static locking position.
- B2: Dynamic locking position (offers 10 mm of dynamization).

C. One oblique locking hole, from anterior lateral to posterior medial, for additional stability.

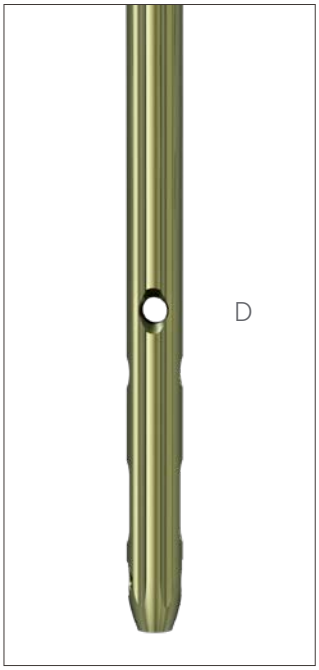
D. One anterior to posterior static hole.

■ Note:

If distal dynamization is planned, the tip of the nail will slide maximum 10 mm distally. In order to protect the articulating surface of the distal femur this movement has to be taken into account when choosing the length and insertion of the implant.



Lateral View



A/P view

2. Align image

Confirm reduction and correct alignment with AP and lateral images.

Align the image intensifier with the hole in the nail closest to the fracture until a perfect circle is visible in the center of the screen.

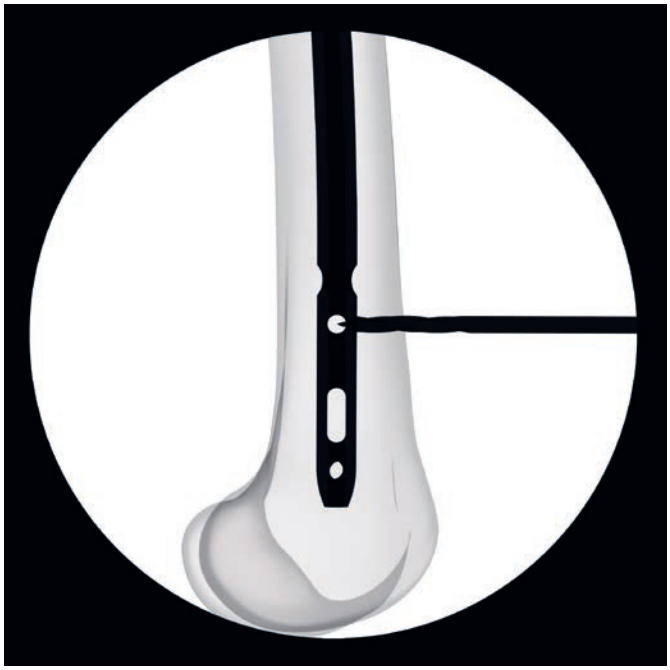
3. Determine incision point

Place a scalpel blade or the tip of a drill bit on the skin over the center of the hole to mark the incision point and make a stab incision.

4. Drill

Instrument	
03.010.104*	Drill Bit ∅ 4.2 mm, calibrated, length 145 mm, 3-flute, for Quick Coupling

Alternative Instrument	
03.010.101*	Drill Bit ∅ 4.2 mm, calibrated, length 145 mm, 3-flute, with Coupling for RDL



Using the radiolucent drive under image intensification, insert the tip of the appropriate drill bit through the incision and down to the bone.

Incline the drive so that the tip of the drill bit is centered over the locking hole. The drill bit should almost completely fill the circle of the locking hole. Hold the drill bit in this position and drill through both cortices.

■ Note:

For greater drill bit control, discontinue drill power after perforating the near cortex. Manually guide the drill bit through the nail before resuming power to drill the far cortex.

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

5. Determine length of locking screw

Instruments	
03.010.104*	Drill Bit ∅ 4.2 mm, calibrated, length 145 mm, 3-flute, for Quick Coupling
03.010.429	Direct Measuring Device for Locking Screws To 100 mm, for intramedullary nails
Alternative Instruments	
03.010.101*	Drill Bit ∅ 4.2 mm, calibrated, length 145 mm, 3-flute, with Coupling for RDL
03.010.106	Direct Measuring Device, for Drill Bits of length 145 mm, for Nos. 03.010.100 to 03.010.105

Stop drilling immediately after penetrating the far cortex. Disassemble the power drive or radiolucent drive from the drill bit.

Under image intensification, ensure the correct position of the drill bit in regard to the far cortex of the femur.

Place the direct measuring device onto the drill bit. Read the screw length directly from the measuring device at the end of the drill bit. This corresponds to the appropriate locking screw length.

■ Note:

Drill bit location with respect to the far cortex is critical for measuring the appropriate locking screw length.

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

Alternative Technique

Instrument	
03.019.017	Depth Gauge
Alternative Instruments	
03.010.072*	Depth Gauge for Locking Screws, measuring range up to 110 mm, for No. 03.010.063
03.010.428*	Depth Gauge for Locking Screws, measuring range to 110 mm
03.010.494*	Depth Gauge, for Locking Screws to 100 mm

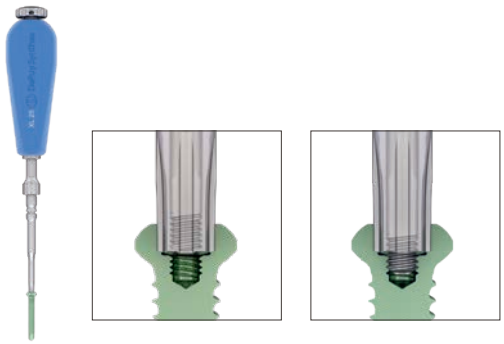
Measure the locking screw length using the depth gauge for locking screws. Ensure the outer sleeve is in contact with the bone and the hook grasps the far cortex.

Read the locking screw length directly from the depth gauge at the back of the outer sleeve.

*Also available

6. Insert locking screw

Instruments	
03.045.003	Screwdriver, short, XL25
03.045.004	Retention Pin for Screwdriver, short
03.045.010	Sleeve for Screwdriver, short
Alternative Instruments	
03.045.007	Screwdriver, with Quick Coupling, hexagonal 12 mm, short, XL25
03.045.008	Retention Pin for Screwdriver with Quick Coupling, hexagonal 12 mm, short
03.010.513	Screwdriver STARDRIVE™, T25, self-holding, length 250 mm
03.010.112	Holding Sleeve, with Locking Device
03.010.518*	Screwdriver STARDRIVE™, T25, self-holding, length 319 mm



Refer to proximal locking screw guidance when inserting distal locking screw.

Insert the appropriate length locking screw using the screwdriver. Verify locking screw length under image intensification. The tip of the locking screw should not project more than 2 mm beyond the far cortex.

Alternatively, the screw can be partially inserted with a power tool, by using the screwdriver shaft (03.045.007) with its retention pin (03.045.008), following the same steps as described above.

▲ Precaution:

Screws must not be fully tightened with power tool. Disengage the power tool from the screwdriver shaft before the screw is fully seated and use the manual handle (03.140.027) to bring the screw to its final position.

Alternative Technique

Use the holding sleeve as described below:

a. Insert the holding sleeve onto the shaft of the screwdriver and place the tip of the screwdriver in the recess of the locking screw.
b. Push the holding sleeve in the direction of the locking screw, the sleeve now holds the locking screw.
c. Lock the holding sleeve by tightening it counterclockwise.

Release the holding sleeve after insertion of the locking screw, by loosening it clockwise and pushing backward. Repeat Steps 2 through 6 for the remaining locking screws.

*Also available

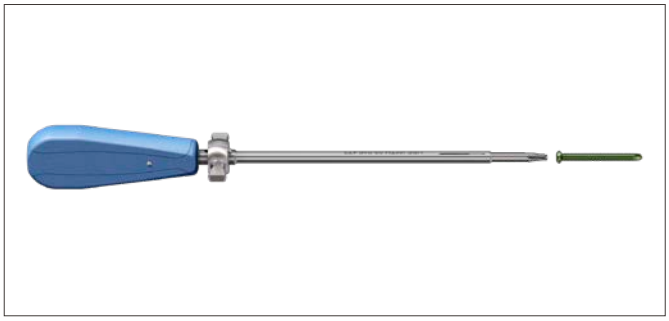
Alternative Technique

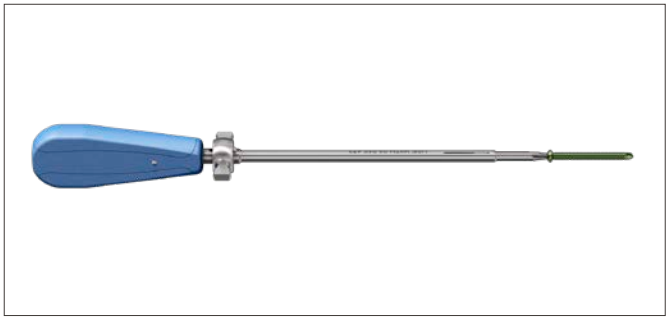
Instrument	
03.010.473	Inter-Lock Screwdriver, combined, STARDRIVE™, T25/hexagonal ∅ 3.5, length 224 mm

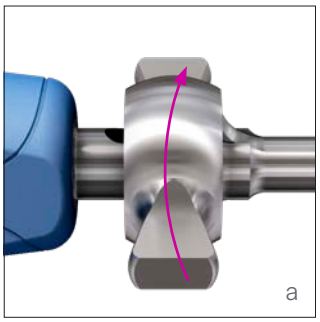
Ensure that the slider of the screwdriver is fully retracted (a). Seat the inter-lock screwdriver tip in the screwhead recess (b). Turn the nut clockwise (c) until the top of the slider is fully wedged into the screwhead recess (d).

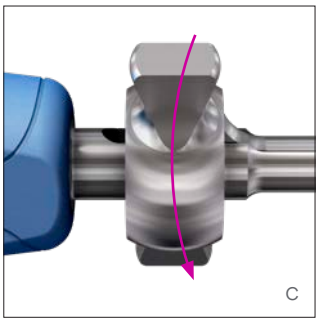
Always use the standard screwdriver for final tightening of the screw.

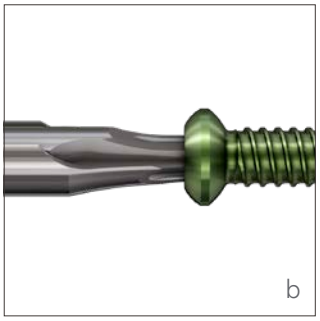
To disengage the screw from the screwdriver, turn the nut counter-clockwise until the slider is ejected from the screwhead recess.

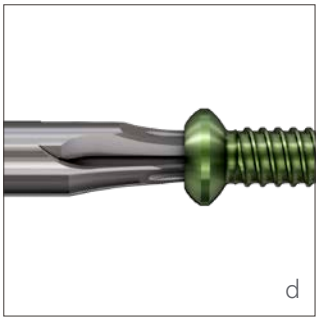












Optional Nut and Washer Technique

■ Note:

Nut and washers are compatible with standard ∅ 5.0 mm Locking Screws only (04.045.026 through 04.045.120).

The number of nuts and washers to be used is according to surgeon preference, patient anatomy, and/or clinical condition.

■ Note:

The nut includes a friction feature to secure nut onto the screw. The surgeon may experience tactile friction during nut insertion on the screw.

The use of nuts and/or washers may be limited in patients with a knee prosthesis, due to interference of the prosthesis, including the prosthesis box, pegs and borders.

The use of nuts may be limited by the location of the distal locking holes relative to the condyles.

■ Note:

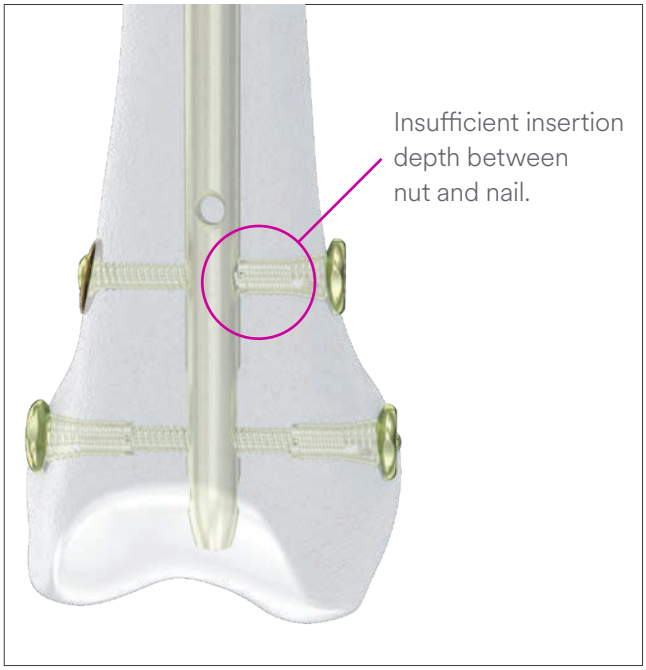
Ensure sufficient insertion depth between nut and nail is available prior to nut insertion to avoid contact between nut and nail. If the nut contacts the nail before being fully seated, the nut may protrude off the bone.

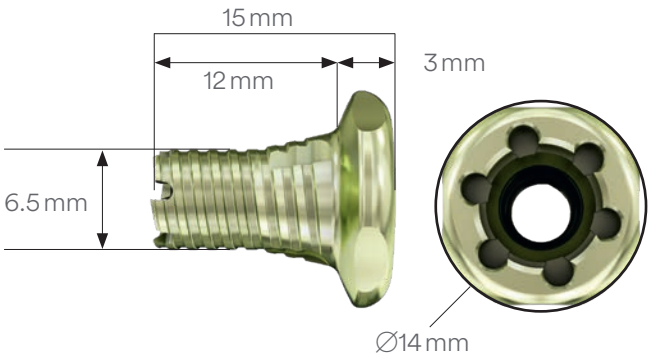
While the actual length of the nut is 15 mm, a minimum depth gauge/drill bit measurement of 20 mm from outer cortex to nail surface is needed to ensure sufficient insertion depth for the nut.

■ Note:

If more than one screw with nut assembly is planned consider the final position of adjacent screws/nuts to avoid interference. A screw with nut in the dynamic locking position may interfere with a screw with nut in the most distal locking hole.

Two techniques are described for insertion of nuts and washers, “nut-over-screw” technique and “nut-over-drill bit” technique.





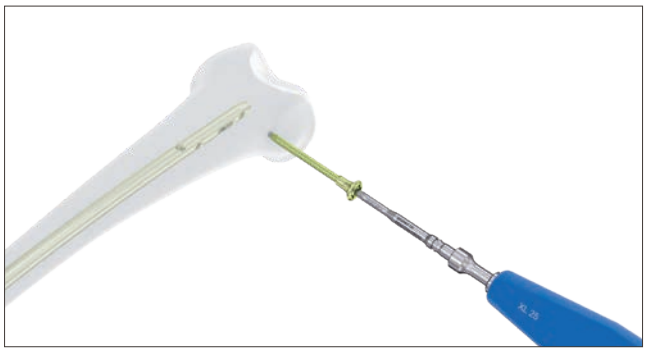
Screw with Nut | Screw with Washer | Nut with Washer

Nut and Washer: Nut-Over-Screw Technique

1. Insert Locking Screw

Instruments	
03.045.003	Screwdriver, short, XL25
03.045.004	Retention Pin for Screwdriver, short
Optional Instruments	
03.045.034	Countersink, QC, 7.4 mm

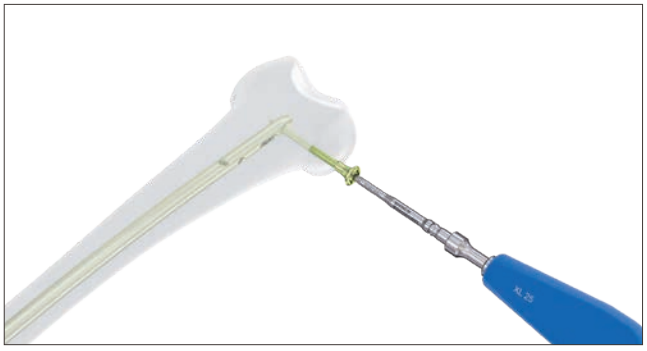
After drilling according to the distal locking technique, nuts and/or washers can be used with the distal, medial-lateral locking screws in the condylar region. Countersink can be used to ease insertion of nut in patients with hard bone. Drill with countersink until the stop on the countersink contacts the cortical surface.



■ Note:

Consider anatomy and/or position the nail in the bone. A minimum distance of 20 mm measured with the drill bit/depth gauge from the surface of the bone to the outer surface of the nail is needed to ensure the nut does not contact the nail at final tightening.

Select the appropriate length screw according to the distal locking technique.



With the retention pin inserted into the screwdriver, insert the screwdriver into the screw head recess. Thread the retention pin into the screw head until secure.

■ Notes:

- If using a nut at screw head, thread the nut onto the screw until secure, prior to inserting the screw into bone.
- If using washer for screw or washer for nut, position washer prior to inserting screw into bone.
- Prior to inserting the nut into bone, forceps can be used to hold the nut during screw insertion. Once screw head is seated in the nut, insertion of screw and nut assembly can continue.
- There are two types of washers that can be used. Select appropriate washer based on the desired construct profile and nut contact area.

Proceed with inserting screw until it is seated in the bone. If nut is used at the screw head, the screw head should be seated flush with nut when fully inserted.

■ Note:

Consider anatomy and/or position of the nail in the bone. A minimum distance of 20 mm measured with the drill bit/depth gauge from the surface of the bone to the outer surface of the nail is needed to ensure the nut does not contact the nail at final tightening.

2. Insert Distal Nut and Final Tighten

Instruments	
03.045.033	Driver for Nut
03.045.003	Screwdriver, short, XL25
03.045.004	Retention Pin for Screwdriver, short

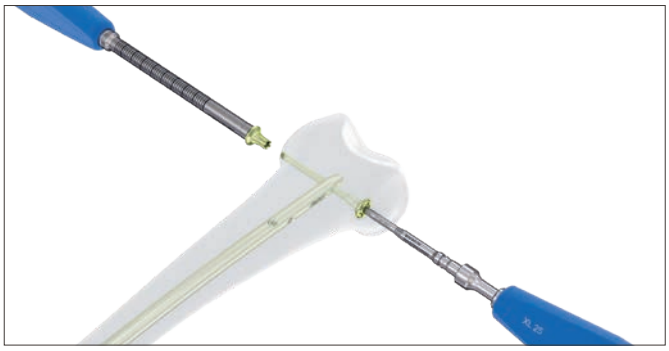
Make an incision at the contralateral position over the tip of the screw.

Attach the nut to the nut driver.

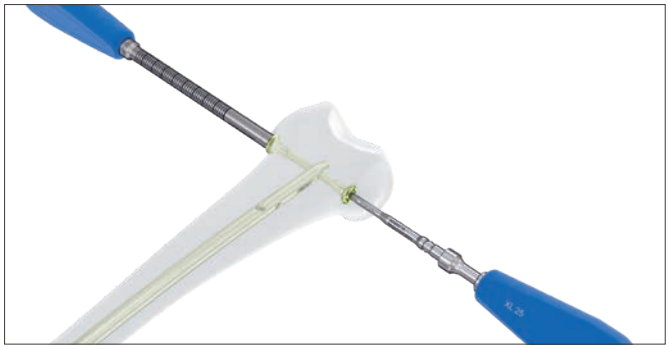
■ Note:
If using washer for nut, position washer over the nut prior to advancing the nut to bone.

Advance nut to the bone, ensuring alignment with the screw tip.

While holding the screwdriver in position, tighten nut with nut driver until seated. The nut should be fully seated or protrusion into soft tissue may occur.



Remove nut driver and screwdriver.



Nut and Washer:
Nut-Over-Drill Bit Technique

1. Insert Distal Nut

Instruments	
03.010.104*	4.2 mm Three Fluted Drill Bit
03.045.033	Driver for Nut

After drilling according to the distal locking technique, nuts and/or washers can be used with the distal, medial-lateral locking screws in the condylar region.

■ Note:
Consider anatomy and/or position of the nail in the bone. A minimum distance of 20 mm measured with the drill bit/depth gauge from the surface of the bone to the outer surface of the nail is needed to ensure the nut does not contact the nail at final tightening.

Select the appropriate length screw according to the distal locking technique using the drill bit.

Keep the drill bit in position in the bone.

Make an incision at the contralateral position over the tip of the drill bit.

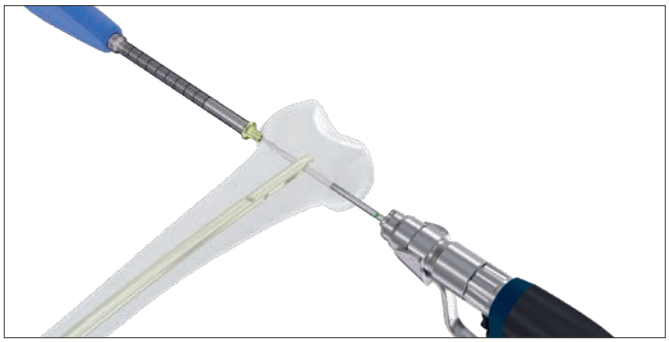
Attach a nut to the nut driver.

■ Note:
If using a washer for a nut, position the washer over the nut prior to advancing the nut to the bone.

Advance the nut to the bone, ensuring alignment with the tip of the drill bit.

While holding the drill bit in position, tighten the nut with the nut driver until seated.

Keep the nut driver engaged in the nut. Remove the drill bit.



*Available nonsterile or sterile packaged. Add "S" to product number to indicate sterile product.

2. Insert locking screw

Instruments	
03.045.003	Screwdriver, short, XL25
03.045.004	Retention Pin for Screwdriver, short

With the retention pin inserted into the screwdriver, insert the screwdriver into the screw head recess. Thread the retention pin into the screw head until secure.

Use the screwdriver to insert the appropriate length locking screw.

■ Notes:

- If using nut at screw head, thread nut onto screw until secure, prior to inserting the screw into bone.
- If using washer for screw or washer for nut, position washer prior to advancing screw to the bone.
- Prior to inserting nut into bone, forceps can be used to hold nut during screw insertion. Once the screw head is seated into the nut, insertion of the screw and nut assembly can continue.

After insertion of screw through the nail, use radiographic imaging to ensure the screw tip is aligned with the nut in the bone.

Use nut driver to provide counter-torque to nut while inserting screw through nut. Continue insertion of screw until seated.

If nut is used at screw head, the screw head should be seated flush with nut when fully inserted.

Nut should be fully seated or protrusion into soft tissue may occur.

Remove nut driver and screwdriver.

7. Remove insertion handle

Instrument	
03.043.027	T-Handle Ball Hex Screwdriver, cannulated, ∅ 8 mm
Alternative Instrument	
03.010.517*	Screwdriver, hexagonal ∅ 8.0 mm, with T-Handle, with spherical head, length 322 mm

If the insertion of an endcap is not intended, the insertion handle can be removed. Otherwise consult the section insert endcap.

Remove the connecting screw using the ball hexagonal screwdriver. Remove the insertion handle by pulling the insertion handle away from the nail.

■ Note:

In case of difficulties removing the connecting screw or insertion handle, push the insertion handle towards the medial or lateral side to neutralize soft tissue pressure.

*Also available

Insert End Cap

1. Insert end cap

Instruments	
03.045.011	Screwdriver XL40
03.045.012	Retention Pin for Screwdriver XL40
03.043.027	T-Handle Ball Hex Screwdriver, cannulated, ∅ 8 mm
Alternative Instruments	
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm
03.010.520**	Screwdriver STARDRIVE™, T40, with spherical head, cannulated, length 277 mm
03.010.515	Inter-Lock Screwdriver STARDRIVE™, T40, length 377 mm
03.010.517**	Screwdriver, hexagonal ∅ 8.0 mm, with T-Handle, with spherical head, length 322 mm

End cap insertion is an optional procedure.

The grooves on the insertion handle facilitate visualization of the nail position. The first, most distal groove represents the nail end.The subsequent distances between the grooves on the insertion handle represent 5 mm and correspond to the extensions of the end caps.

End caps for femoral nails are available in extension lengths of 0 mm, 5 mm, 10 mm, 15 mm, and 20 mm. The end cap prevents bone ingrowth into the proximal nail end and thus may facilitate insertion of the extraction screw. In over-inserted nails it extends the length of the nail and thus facilitates surgical detection of the nail end.

If desired, End Caps can be locked to the screwdriver.

To do so, slide the retention pin through the back of the screwdriver until it stops. Further advance it by turning the pin clockwise, until its tip extends out through the tip of the screwdriver.

Engage the screwdriver with the recess of the recon screw and thread in the retention pin to lock the screw to the screwdriver.

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.
** Also available

Inserting the 0 mm end cap

Remove the connecting screw using the ball hexagonal screwdriver while leaving the insertion handle connected to the nail.

Insert the 0 mm end cap using the screwdriver through the insertion handle.

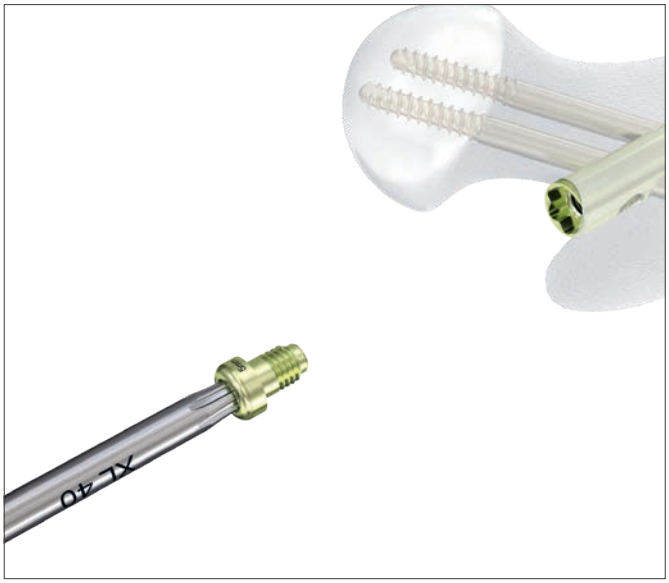
After the end cap is inserted, remove the insertion handle from the nail by pulling the insertion handle away from the nail.

Inserting the 5–20 mm end cap

Remove the connecting screw using the ball hexagonal screwdriver, remove the insertion handle from the nail by pulling the insertion handle away from the nail.

Engage the end cap with the screwdriver. To prevent cross-threading, align the end cap with the nail axis and turn the end cap counterclockwise, until the thread of the end cap aligns with that of the nail. Turn the end cap clockwise to thread the end cap into the nail until it is fully inserted.

Remove screwdriver.



■ Notes:

- In case of difficulties removing the connecting screw or insertion handle, push the insertion handle towards the medial or lateral side to neutralize soft tissue pressure.
- The end cap prevents bone ingrowth into the proximal nail end and thus may facilitate insertion of the extraction screw. In over-inserted nails it extends the length of the nail and thus facilitates surgical detection of the nail end.
- If using cannulated STARDRIVE screwdriver, a 3.2 mm guide wire can be used to help ensure alignment while inserting the end cap.

Always use the T40 cannulated STARDRIVE Screwdriver for final tightening of the endcap and not the interlock screwdriver.

Alternative Technique

Alternative Instrument	
356.717	Guide Wire ∅ 2.8 mm, length 460 mm, with Hook

Instead of the guide wire, a guide wire with hook can be used. Insert the guide wire hook into the proximal end of the nail to help securing the end cap during insertion.

Implant Removal

1. Remove end cap and locking or recon screws

Removal of End Caps and Recon Screws	
03.045.011	Screwdriver XL40
03.045.012	Retention Pin for Screwdriver XL40
Alternative Instruments	
03.045.013	Screwdriver XL40, extra long
03.045.014	Retention Pin for Screwdriver XL40, extra long
357.399*	Guide Wire, 3.2 mm, length 400 mm
03.010.518*	Screwdriver, STARDRIVE™, T25, self-holding, length 319 mm
03.010.520*	Screwdriver STARDRIVE™, T40, with spherical head, cannulated, 277 mm
Removal of Locking Screws	
03.045.001	Screwdriver XL25
03.045.002	Retention Pin for Screwdriver XL25
Alternative Instruments	
03.045.003	Screwdriver XL25, short
03.045.004	Retention Pin for Screwdriver XL25, short

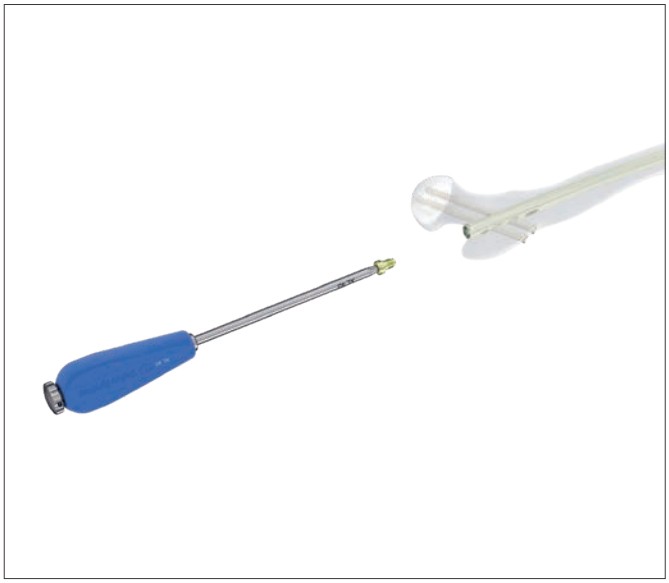
■ Note:

End caps and recon screws are compatible with existing T40 screwdrivers, and T25 screwdrivers are compatible with locking screws.

Implant removal is an optional procedure.

If using STARDRIVE Screwdrivers:
Clear the STARDRIVE socket of the end cap and the locking implants of any ingrown tissue. Insert the guide wire for easy aligning of the screwdriver into the cannulated end cap.

*Also available



Remove the end cap using the T40 screwdriver.

Remove all locking screws except one proximal locking screw or recon screw using the STARDRIVE screwdriver.

Alternative Technique	
Alternative Instruments	
03.010.111	Screwdriver STARDRIVE™, T40, Cannulated, length 190 mm, with Lever Arm
03.010.512	Holding Sleeve with Locking Device
03.010.515	Inter-Lock Screwdriver STARDRIVE™, T40, length 377 mm

Alternatively, the T40 Inter-Lock screwdriver, or the cannulated STARDRIVE screwdriver, T40, with lever handle may be used with the 11 mm ratchet wrench to remove the end cap.

■ Note:

When removing implants after long-term implantation, especially in presence of large amounts of bony ingrowth, first use a solid screwdriver to loosen the end cap. The Inter-Lock screwdriver can be used to remove the end cap from the surgical site.

Screw Removal Tools

03.045.030	Extractor Shaft for XL25
03.045.031	Curette for XL25
03.045.032	Extraction Screw, conical
03.900.001	Straight Sharp Hook

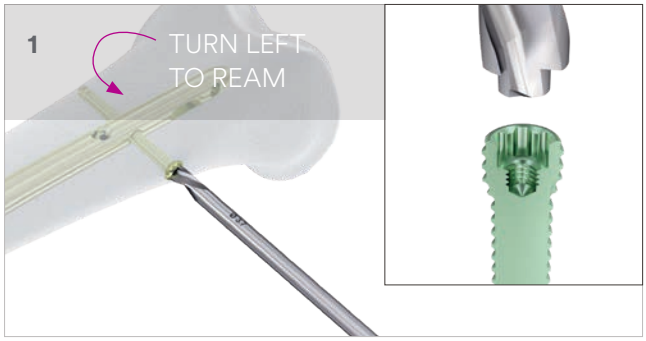
If screw heads are overgrown or the recess is damaged, additional instruments are available for screw removal. They can be used with all XL25 screw types.

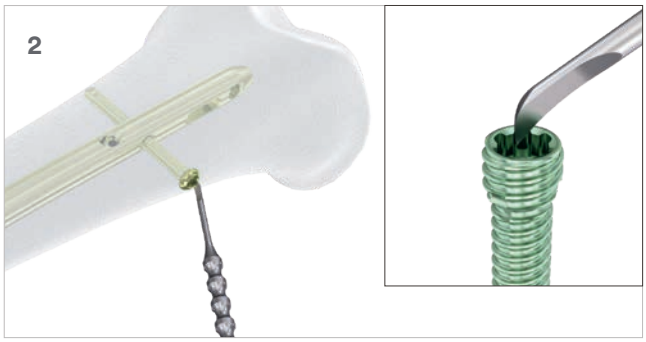
1. Clear recess and screw head with the curette. The curette turns counter-clockwise

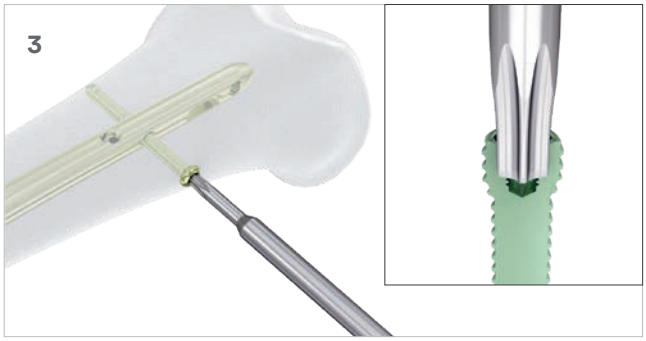
2. Use the sharp hook to clean out any remaining tissue

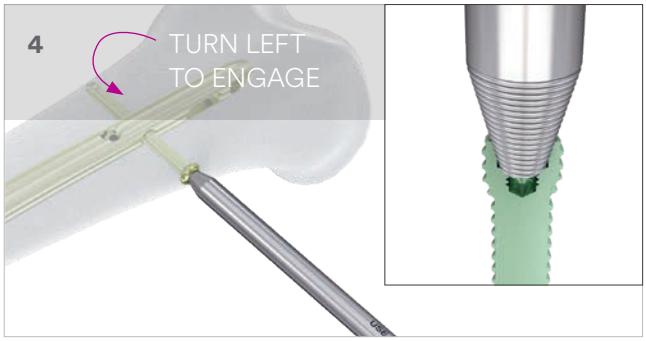
3. Engage the extractor shaft to remove the screw

4. If 3. does not work, use the conical extraction screw to remove the screw. The conical extraction screw turns counter-clockwise









2. Attach extraction screw and hammer guide

Instruments	
03.010.000	Extraction Screw for Tibial and Femoral Nails
03.010.170	Hammer Guide
321.160	Combination Wrench ∅ 11.0 mm
Removal of Locking Screws	
03.045.001	Screwdriver XL25
03.045.002	Retention Pin for Screwdriver XL25
Removal of Recon Screws	
03.045.011	Screwdriver XL40
03.045.012	Retention Pin for Screwdriver XL40
Alternative Instrument	
03.010.518*	Screwdriver STARDRIVE™, T25, self-holding, length 319 mm

Before removing the final locking screw, screw the extraction screw into the nail and tighten it using the ratchet wrench.

The locking screw will prevent nail rotation as the extraction screw is tightened.

Attach the hammer guide to the extraction screw. Remove the remaining screw using the XL40 Screwdriver for a recon screw, or an XL25 for a locking screw.

*Also available

3. Remove nail

Instruments	
03.010.000	Extraction Screw for Tibial and Femoral Nails
03.010.522	Combined Hammer, 500 g
321.170	Pin Wrench ∅ 4.5 mm, length 120 mm
321.160	Combination Wrench ∅ 11.0 mm

Extract the nail by applying gentle blows with the hammer.

Once the Nail has been extracted, use the ratchet wrench to remove the extraction screw from the Nail. The pin wrench can be inserted in one of the proximal holes to help rotating the nail clockwise facilitating the extraction of the nail from the the extraction instrument.

■ Note:

The nail will rotate similarly to how it was inserted.

Alternative Technique –
extraction hook for removal of a broken nail

Instruments	
355.399	Extraction Hook ∅ 3.7 mm, for cannulated Nails
03.043.001	Universal Chuck
Alternative Instruments	
393.100* or 393.105*	Universal Chuck with T-Handle Small Universal Chuck with T-Handle

Begin with step 1 of the standard implant removal removing all locking or recon screws.

Option 1. Extract all fragments in one step

1. Assemble extraction hook and universal chuck

Insert the extraction hook into the universal chuck with T-Handle. The hook should be parallel with the T-Handle. This facilitates visualization of the hook position in the bone.

2. Insert extraction hook through nail

Pass the extraction hook through the cannula of the nail, including the distal fragment.

■ Note:

Under image intensification, verify that the hook has passed through and engaged the distant end of the nail.

3. Extract nail

Extract both nail fragments.

■ Note:

Keep the patient's limb restrained to facilitate extraction.

*Also available

Option 2: Extract near fragment first

1. Remove near nail fragment

Remove the near nail fragment using the technique described in steps 1 to 3 of the implant removal.

■ Note:

The extraction hook can be used as an alternative to extraction instrumentation.

2. Ream canal

Ream the medullary canal 1 mm larger than the nail diameter to clear a path for the distant nail fragment.

3. Align extraction hook

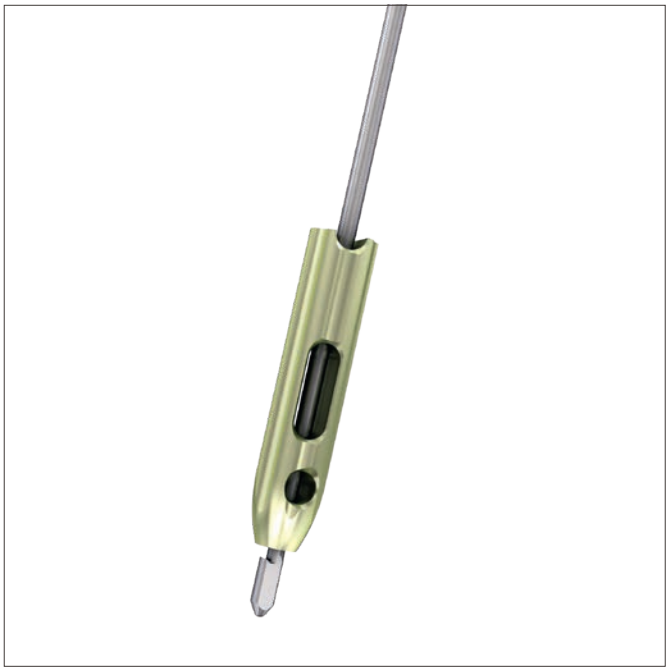
Insert the extraction hook and explanted near nail fragment into the medullary canal. The near nail fragment aligns the extraction hook with the cannulation of the distant nail fragment.

4. Engage distant fragment

Pass the extraction hook through the cannula of the distant nail fragment.

■ Note:

Under image intensification, verify that the hook has passed through and engaged the distant end of the nail.



3. Extract distant fragment

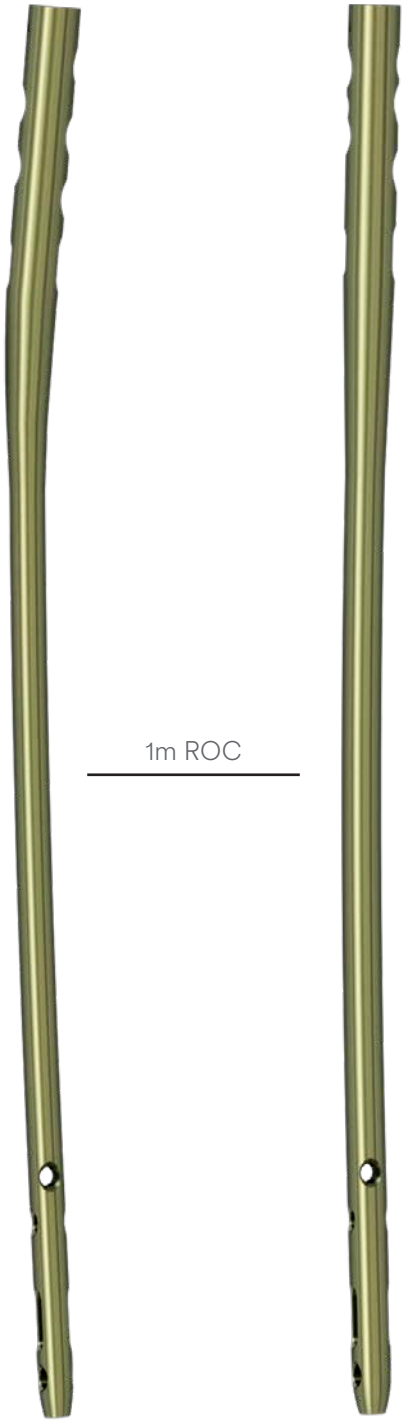
Extract distant fragment.

■ Note:

Keep the patient's limb restrained to facilitate extraction.

Implants

Titanium Cannulated FRN-ADVANCED Nails



Entry Points

Greater Trochanter (5° lateral angle)
Piriformis Fossa

Material

Titanium alloy* (TAN)
Light Green

Diameters

Distal Diameters: 9, 10, 11, 12 and 14 mm, cannulated
Proximal Diameters: 9–12 mm nails – 13 mm proximal diameter
14 mm diameter nails – 14 mm proximal diameter

Lengths

9, 10 mm distal diameter: 280–480 mm (20 mm increments)
11, 12, 14 mm distal diameter: 300–480 mm (20 mm increments)

Cross Section

9, 10 mm nails non-fluted
11, 12, 14 mm nails fluted

Proximal Locking (4 holes)

One antegrade locking:
140° for GT Nails,
135° for PF Nails
One dynamic transverse locking slot with controlled dynamization of 7 mm
Two 130° CCD recon locking holes

Distal Locking (4 holes)

One static locking hole (AP)
One static transverse locking hole (LM)
One dynamic transverse locking slot with controlled dynamization of 10 mm
One 10° offset locking hole, from superior,
anterior lateral to posterior medial

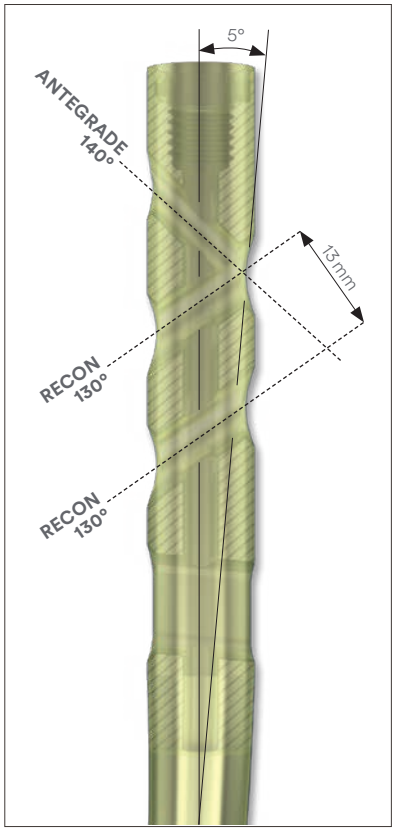
Screw Compatibility

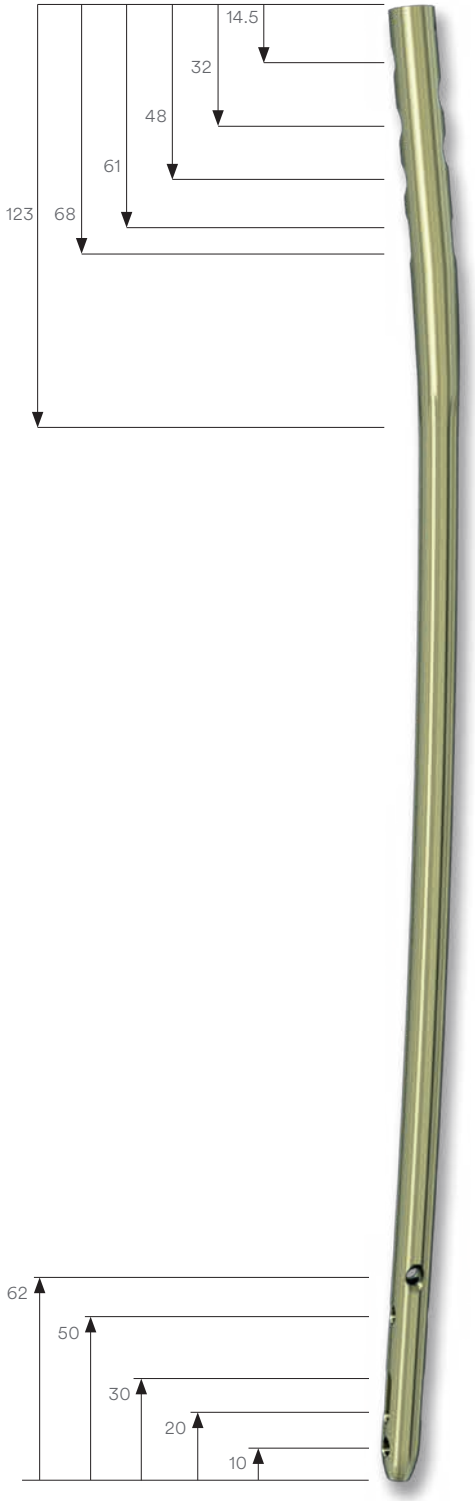
All nails use 5.0 mm titanium locking screws (green)
All nails use 6.5 mm titanium recon screws (yellow)

Features

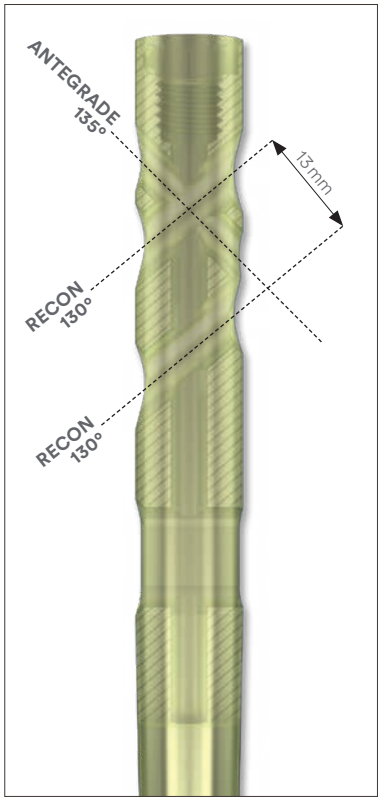
Anterior Posterior bend – 1 m radius of curvature
Anatomic 14° anteversion
Nail designs for left and right femurs

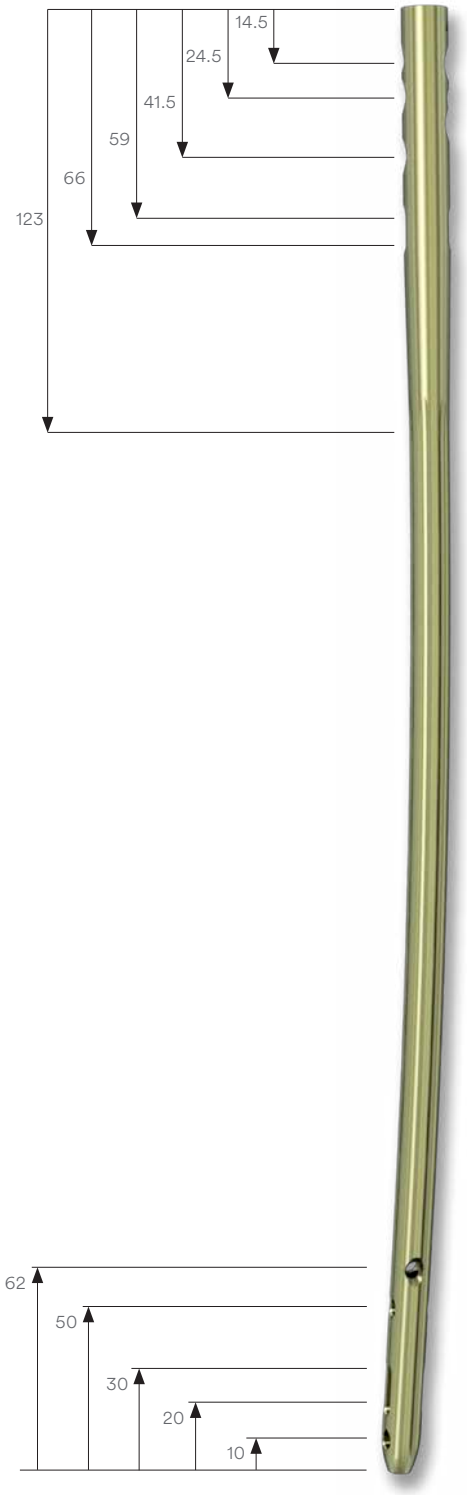
*6% Aluminum-7% Niobium Alloy (TAN)





FRN-ADVANCED Nail
GT





FRN-ADVANCED Nail
PF

Femoral Recon Nail, Greater Trochanter

Femoral Recon Nail, Greater Trochanter ∅ 9 mm

Right	Left	Length
04.033.958S	04.033.959S	280
04.033.960S	04.033.961S	300
04.033.962S	04.033.963S	320
04.033.964S	04.033.965S	340
04.033.966S	04.033.967S	360
04.033.968S	04.033.969S	380
04.033.970S	04.033.971S	400
04.033.972S	04.033.973S	420
04.033.974S	04.033.975S	440
04.033.976S	04.033.977S	460
04.033.978S	04.033.979S	480

Femoral Recon Nail, Greater Trochanter ∅ 10 mm

Right	Left	Length
04.033.058S	04.033.059S	280
04.033.060S	04.033.061S	300
04.033.062S	04.033.063S	320
04.033.064S	04.033.065S	340
04.033.066S	04.033.067S	360
04.033.068S	04.033.069S	380
04.033.070S	04.033.071S	400
04.033.072S	04.033.073S	420
04.033.074S	04.033.075S	440
04.033.076S	04.033.077S	460
04.033.078S	04.033.079S	480

Femoral Recon Nail, Greater Trochanter ∅ 11 mm

Right	Left	Length
04.033.160S	04.033.161S	300
04.033.162S	04.033.163S	320
04.033.164S	04.033.165S	340
04.033.166S	04.033.167S	360
04.033.168S	04.033.169S	380
04.033.170S	04.033.171S	400
04.033.172S	04.033.173S	420
04.033.174S	04.033.175S	440
04.033.176S	04.033.177S	460
04.033.178S	04.033.179S	480

Femoral Recon Nail, Greater Trochanter ∅ 12 mm

Right	Left	Length
04.033.260S	04.033.261S	300
04.033.262S	04.033.263S	320
04.033.264S	04.033.265S	340
04.033.266S	04.033.267S	360
04.033.268S	04.033.269S	380
04.033.270S	04.033.271S	400
04.033.272S	04.033.273S	420
04.033.274S	04.033.275S	440
04.033.276S	04.033.277S	460
04.033.278S	04.033.279S	480

Femoral Recon Nail, Greater Trochanter ∅ 14 mm

Right	Left	Length
04.033.460S	04.033.461S	300
04.033.462S	04.033.463S	320
04.033.464S	04.033.465S	340
04.033.466S	04.033.467S	360
04.033.468S	04.033.469S	380
04.033.470S	04.033.471S	400
04.033.472S	04.033.473S	420
04.033.474S	04.033.475S	440
04.033.476S	04.033.477S	460
04.033.478S	04.033.479S	480

Length in mm

Femoral Recon Nail, Piriformis Fossa

Femoral Recon Nail, Piriformis Fossa ∅ 9 mm

Right	Left	Length
04.033.928S	04.033.929S	280
04.033.930S	04.033.931S	300
04.033.932S	04.033.933S	320
04.033.934S	04.033.935S	340
04.033.936S	04.033.937S	360
04.033.938S	04.033.939S	380
04.033.940S	04.033.941S	400
04.033.942S	04.033.943S	420
04.033.944S	04.033.945S	440
04.033.946S	04.033.947S	460
04.033.948S	04.033.949S	480

Femoral Recon Nail, Piriformis Fossa ∅ 10 mm

Right	Left	Length
04.033.028S	04.033.029S	280
04.033.030S	04.033.031S	300
04.033.032S	04.033.033S	320
04.033.034S	04.033.035S	340
04.033.036S	04.033.037S	360
04.033.038S	04.033.039S	380
04.033.040S	04.033.041S	400
04.033.042S	04.033.043S	420
04.033.044S	04.033.045S	440
04.033.046S	04.033.047S	460
04.033.048S	04.033.049S	480

Femoral Recon Nail, Piriformis Fossa ∅ 11 mm

Right	Left	Length
04.033.130S	04.033.131S	300
04.033.132S	04.033.133S	320
04.033.134S	04.033.135S	340
04.033.136S	04.033.137S	360
04.033.138S	04.033.139S	380
04.033.140S	04.033.141S	400
04.033.142S	04.033.143S	420
04.033.144S	04.033.145S	440
04.033.146S	04.033.147S	460
04.033.148S	04.033.149S	480

Femoral Recon Nail, Piriformis Fossa ∅ 12 mm

Right	Left	Length
04.033.230S	04.033.231S	300
04.033.232S	04.033.233S	320
04.033.234S	04.033.235S	340
04.033.236S	04.033.237S	360
04.033.238S	04.033.239S	380
04.033.240S	04.033.241S	400
04.033.242S	04.033.243S	420
04.033.244S	04.033.245S	440
04.033.246S	04.033.247S	460
04.033.248S	04.033.249S	480

Femoral Recon Nail, Piriformis Fossa ∅ 14 mm

Right	Left	Length
04.033.430S	04.033.431S	300
04.033.432S	04.033.433S	320
04.033.434S	04.033.435S	340
04.033.436S	04.033.437S	360
04.033.438S	04.033.439S	380
04.033.440S	04.033.441S	400
04.033.442S	04.033.443S	420
04.033.444S	04.033.445S	440
04.033.446S	04.033.447S	460
04.033.448S	04.033.449S	480

Length in mm

∅ 6.5 mm Recon Screw for IM nail, XL40

Material

Titanium alloy** (TAN)
Yellow

Lengths

60 mm–130 mm (5 mm increments)

Design

Recess: XL40 with threaded retention
Self-tapping tip

Offering

Screws available non-sterile or in sterile packaging. Corresponding sterile article number with suffix "TS" for tube packaging or "S" for standard pouch packaging.

	Length (mm)*
04.046.660	60
04.046.665	65
04.046.670	70
04.046.675	75
04.046.680	80
04.046.685	85
04.046.690	90
04.046.695	95
04.046.700	100
04.046.705	105
04.046.710	110
04.046.715	115
04.046.720	120
04.046.725	125
04.046.730	130

∅ 6.5 mm Titanium Recon Screws*, with T25 STARDRIVE Recess, for IM nails

Material

Titanium alloy** (TAN)
Yellow

Lengths

60 mm–130 mm (5 mm increments)

Design

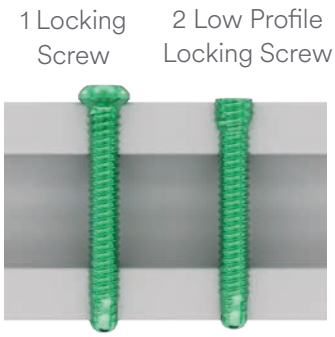
Recess: T25 STARDRIVE
Self-tapping tip

	Length (mm)*
04.003.022	60
04.003.023	65
04.003.024	70
04.003.025	75
04.003.026	80
04.003.027	85
04.003.028	90
04.003.029	95
04.003.030	100
04.003.031	105
04.003.032	110
04.003.033	115
04.003.034	120
04.003.035	125
04.003.036	130

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.
** 6% Aluminum-7% Niobium Alloy (TAN)

Locking Screw for Medullary Nails, ∅ 5 mm

- Titanium alloy
- Lengths 26 mm– 90 mm (2 mm increments)
- Lengths 90 mm–120 mm (5 mm increments)
- Fully Threaded
- Self-tapping, blunt tip
- XL25 recess with threaded retention



Length (mm)	Locking Screws*	Low Profile Locking Screws*
26	04.045.026	04.045.326
28	04.045.028	04.045.328
30	04.045.030	04.045.330
32	04.045.032	04.045.332
34	04.045.034	04.045.334
36	04.045.036	04.045.336
38	04.045.038	04.045.338
40	04.045.040	04.045.340
42	04.045.042	04.045.342
44	04.045.044	04.045.344
46	04.045.046	04.045.346
48	04.045.048	04.045.348
50	04.045.050	04.045.350
52	04.045.052	04.045.352
54	04.045.054	04.045.354
56	04.045.056	04.045.356
58	04.045.058	04.045.358
60	04.045.060	04.045.360
62	04.045.062	04.045.362
64	04.045.064	04.045.364

Length (mm)	Locking Screws*	Low Profile Locking Screws*
66	04.045.066	04.045.366
68	04.045.068	04.045.368
70	04.045.070	04.045.370
72	04.045.072	04.045.372
74	04.045.074	04.045.374
76	04.045.076	04.045.376
78	04.045.078	04.045.378
80	04.045.080	04.045.380
82	04.045.082	04.045.382
84	04.045.084	04.045.384
86	04.045.086	04.045.386
88	04.045.088	04.045.388
90	04.045.090	04.045.390
95	04.045.095	04.045.395
100	04.045.100	04.045.400
105	04.045.105	04.045.405
110	04.045.110	04.045.410
115	04.045.115	04.045.415
120	04.045.120	04.045.420

*Also available non-sterile

5.0 mm Titanium Locking Screws*, with T25 STARDRIVE Recess, for IM Nails

Material

Titanium Alloy** (TAN)
Light green

Drill

4.2 mm diameter drill

Lengths

26 mm–80 mm (2 mm increments)
85 mm–100 mm (5 mm increments)

Design

Recess: STARDRIVE T25, self tapping

	Length (mm)*
04.005.516	26
04.005.518	28
04.005.520	30
04.005.522	32
04.005.524	34
04.005.526	36
04.005.528	38
04.005.530	40
04.005.532	42
04.005.534	44
04.005.536	46
04.005.538	48
04.005.540	50
04.005.542	52
04.005.544	54
04.005.546	56

	Length (mm)*
04.005.548	58
04.005.550	60
04.005.552	62
04.005.554	64
04.005.556	66
04.005.558	68
04.005.560	70
04.005.562	72
04.005.564	74
04.005.566	76
04.005.568	78
04.005.570	80
04.005.575	85
04.005.580	90
04.005.585	95
04.005.590	100

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.
** 6% Aluminum-7% Niobium Alloy (TAN)

End Caps with XL40 recess for IM Nails

Material

Titanium Alloy* (TAN)
Green

Lengths

0 mm–20 mm (5 mm increments)

Features

Recess: XL40 with threaded retention

Ability to extend nail height if nail is over-inserted

∅ 12 mm	Extension (mm)**
04.045.800S	0
04.045.805S	5
04.045.810S	10
04.045.815S	15
04.045.820S	20

Titanium End Caps**, with T40 STARDRIVE recess, for IM Nails

Material

Titanium Alloy* (TAN)
Gray

Lengths

0 mm–20 mm (5 mm increments)

Features

Recess: T40 STARDRIVE

Ability to extend nail height if nail is over-inserted

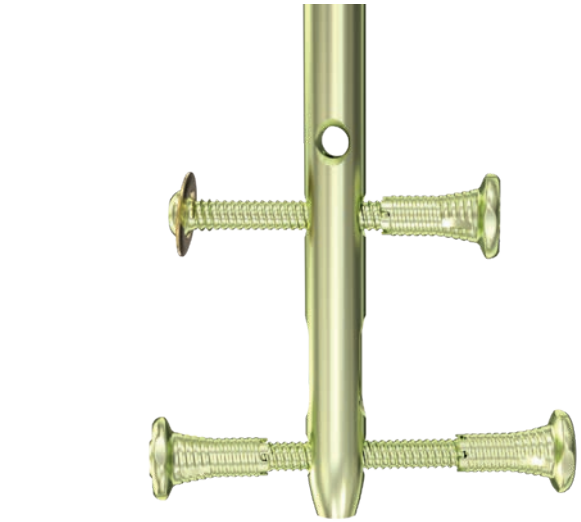
∅ 12 mm	Extension (mm)**
04.003.000	0
04.003.001	5
04.003.002	10
04.003.003	15
04.003.004	20

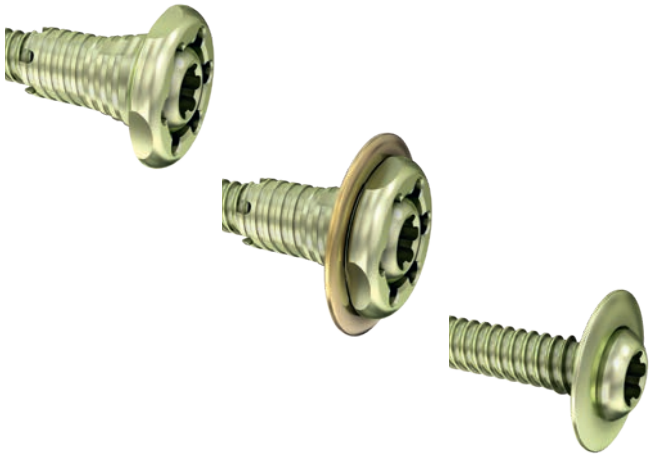
* Titanium-6% Aluminum-7% Niobium Alloy (TAN)
** Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

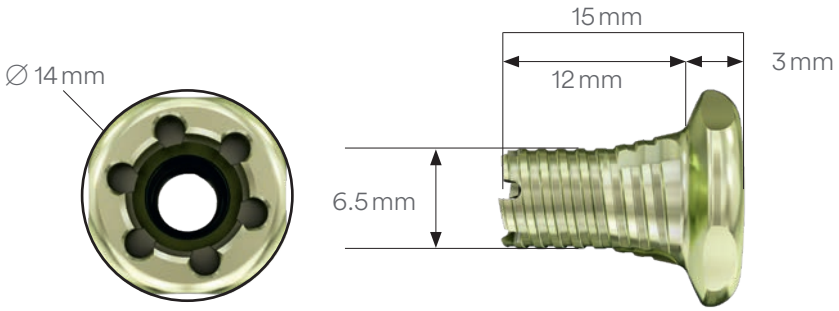
Titanium Nuts and Washers for Locking Screws

- Nuts are made of Titanium alloy
- Washers are made of titanium.
- Nut is inserted over standard locking screws, either at the screw tip or screw head
- Washer for Nut, 1.1 mm thickness, to increase overall diameter to 17 mm
- Washer for Screw, 1.2 mm thickness, to increase diameter to 14 mm, without use of nut

04.045.780S	Washer for Screw
04.045.781S	Nut
04.045.782S	Washer for Nut



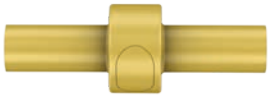




Instruments

357.133	Extraction Screw, for Titanium Femoral and Tibial Nails	
03.010.000	Extraction Screw, for Tibial and Femoral Nails	
03.010.020	Radiographic Ruler for EXPERT™ Femoral Nails	
03.010.023	Radiographic Ruler for Nail Diameters for EXPERT™ Femoral Nails, length 365 mm	
03.010.041	Awl ∅ 14.0/3.2 mm, cannulated	
03.010.061*	Drill Bit ∅ 4.2 mm, calibrated, length 340 mm, 3-flute, for Quick Coupling, for No. 03.010.065	
03.010.065	Drill Sleeve 8.0/4.2, for No. 03.010.063	
03.010.070	Trocar ∅ 4.2 mm, for No. 03.010.065	

*Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

03.010.075	Protection Sleeve 11.5/8.5, for LFN™ Reconstruction Locking	
03.010.076	Drill Sleeve 8.5/3.2, for No. 03.010.075	
03.010.077	3.2 mm Trocar for Recon Locking	
03.010.078	Reamer ∅ 4.5/6.5 mm, length 484 mm, for Hip Screws LFN™	
03.010.079	Fixation Sleeve, for No. 03.010.078	
03.010.101*	Drill Bit ∅ 4.2 mm, calibrated, length 145 mm, 3-flute, with Coupling for RDL	
03.010.104*	Drill Bit ∅ 4.2 mm, calibrated, length 145 mm, 3-flute, for Quick Coupling	
03.010.170	Hammer Guide	
03.010.428	Depth Gauge for Locking Screws, measuring range to 110 mm	

* Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

03.010.429	Direct Measuring Device for Drill Bits, length 145 mm	
03.010.472	Inter-Lock Screwdriver, combined, STARDRIVE™, T25/hexagonal ∅ 3.5, length 330 mm	
03.010.491	Handle for Scalpel, long	
03.010.493	Direct Measuring Device for Guide Wires ∅ 3.2 mm, length 400 mm	
03.010.500	Handle, with Quick Coupling	
03.010.517	Screwdriver, hexagonal ∅ 8.0 mm, with T-Handle, with spherical head, length 322 mm	
03.010.518	Screwdriver STARDRIVE™, T25, self-holding, length 319 mm	
03.010.519	Screwdriver STARDRIVE™, T25, self-holding, length 440 mm	

03.010.520	Screwdriver STARDRIVE™, T40, with spherical head, cannulated, length 277 mm	
03.010.522	Combined Hammer, 500 g	
03.010.523	Driving Cap with thread, for Insertion Handle	
03.025.040	Protection Sleeve 11.0/8.0, length 188 mm	
03.033.001	Insertion Handle, radiolucent, Femoral Recon Nail	
03.033.002	Aiming Arm, radiolucent, for Piriformis Fossa, Femoral Recon Nail	
03.033.003	Aiming Arm, radiolucent, for Greater Trochanter, Femoral Recon Nail	

03.033.004*	Drill Bit ∅ 14 mm, cannulated, flexible, for Quick Coupling for DHS™/DCS™	
03.033.005*	Drill Bit ∅ 14 mm, cannulated, for Quick Coupling for DHS™/DCS™	
03.033.006	Cannulated Connecting screw	
03.033.007	Protection Sleeve, ∅ 14 mm	
03.033.008	Multi Hole Drill Sleeve, ∅ 14/3.2 mm	
03.033.009	Protection Tube for Medullary Reamers, ∅ 14/12 mm	
03.033.010	Trocar for Protection Tube, ∅ 12/4.6 mm	

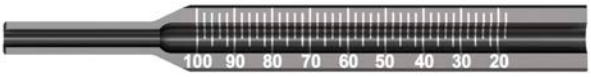
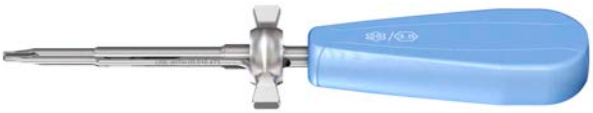
*Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

03.037.008	Awl ∅ 8/4.7 mm, curved, cannulated	
03.037.036	Depth Gauge for Nails	
321.170	Pin Wrench ∅ 4.5 mm, length 120 mm	
351.719	Elongation Tube for Reaming Rods, for Depth Gauge for Medullary Nails, for Nos. 351.717 and 03.019.001	
357.399*	Guide Wire ∅ 3.2 mm, length 400 mm	
393.100	Universal Chuck with T-Handle	
356.717	Guide Wire ∅ 2.8 mm, length 460 mm, with Hook	

*Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

03.010.412	Aiming Device for Guide Wire, for PFNA and TFN, for AP Orientation	
03.010.415	Connecting Screw for TFN, for No. 03.010.412	
03.010.471	Guide Wire Aiming Device Offset Block	
394.350	Large Distractor, complete	
03.010.495	Intramedullary Reduction Tool, curved, with Quick Coupling, Hex 12 mm	
03.010.496	T-Handle, cannulated, with Quick Coupling, Hex 12 mm	
03.010.072	Depth Gauge for Locking Screws, measuring range up to 110 mm, for No. 03.010.063	

*Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

351.707S	Reaming Rod ∅ 2.5 mm, length 950 mm, with Olive & extension, sterile	
03.037.007	Awl ∅ 8/4.7 mm, straight, cannulated	
03.010.085	Direct Measuring Device for Guide Wires ∅ 3.2 mm, length 400 mm	
03.010.106	Direct Measuring Device for Drill Bits of length 145 mm, for Nos. 03.010.100 to 03.010.105	
03.010.112	Holding Sleeve, with Locking Device	
03.010.473	Inter-Lock Screwdriver, combined, STARDRIVE™, T25/hexagonal ∅ 3.5, length 224 mm	
03.010.515	Inter-Lock Screwdriver STARDRIVE™, T40, length 377 mm	

03.010.111	Screwdriver STARDRIVE™, T40, cannulated, length 190 mm, with Lever Arm	
355.399	Extraction Hook ∅ 3.7 mm, for cannulated Nails	
03.010.093	Rod Pusher for Reaming Rod with Hexagonal Screwdriver ∅ 8.0 mm	
03.010.513	Screwdriver STARDRIVE™, T25, self-holding, length 250 mm	
321.160	Combination Wrench ∅ 11. 0 mm	
393.105	Universal Chuck, small, with T-Handle	
03.010.369	Reduction Instrument for Medullary Nails	

03.045.001	Screwdriver XL25	
03.045.002	Retention Pin for Screwdriver XL25	
03.045.003	Screwdriver, short, XL25	
03.045.004	Retention Pin for Screwdriver, short	
03.045.005	Screwdriver XL25 Quick Coupling Hex 12 mm	
03.045.006	Retention Pin for Screwdriver Quick Coupling, Hex 12 mm	
03.045.007	Screwdriver, with Quick Coupling, hexagonal 12 mm, short, XL25	
03.045.008	Retention Pin for Screwdriver with Quick Coupling, hexagonal 12 mm, short	
03.045.009	Sleeve for Screwdriver	

03.045.010	Sleeve for Screwdriver, short	
03.045.011	Screwdriver XL40	
03.045.012	Retention Pin for Screwdriver XL40	
03.045.013	Screwdriver, extra-long, XL40	
03.045.014	Retention Pin f/Screwdriver, extra-long, XL40	
03.045.015	Screwdriver, w/Quick Coupling DHS™, extra-long, XL40	
03.045.017	Tap, for Hip Screw, ∅ 6.5 mm	
03.045.018*	Guide Wire ∅ 3.2 mm, w/drill tip, 400 mm	
03.045.019	Protection Sleeve, ∅ 11/8	

*Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

03.045.020	Drill Sleeve, ∅ 4.2 mm	
03.045.022*	Drill Bit ∅ 4.2 mm, calibrated, 120 mm	
03.045.029	Reamer, ∅ 5.5 mm	
03.045.030	Extractor Shaft for XL25	
03.045.031	Curette for XL25	
03.045.032	Extraction Screw, conical	
03.045.033	Driver for Nut	
03.045.034	Countersink, QC, 7.4 mm	
03.045.035	Direct measuring device for IM nails	

*Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

03.045.036	Tube for direct measuring device	
03.043.001	Universal Chuck with T-Handle	
03.043.027	T-Handle Ball Hex Screwdriver Cannulated, ∅ 8 mm	
03.019.017	Depth Gauge	
03.140.027	Handle, large, cannulated, with Quick Coupling, Hex 12 mm	
03.900.001	Straight Sharp Hook	
321.200	Ratchet Wrench, 11 mm Width Across Flats	
03.010.080	Tap for 6.5 mm Recon Screws	
03.010.494	Depth Gauge, for Locking Screws to 100 mm	
352.032*	SynReam Reaming Rod ∅ 2.5, L 950 mm	

*Available nonsterile or sterile packaged. Add “S” to product number to indicate sterile product.

MRI Information

Torque, Displacement and Image Artifacts according to ASTM F 2213, ASTM F 2052 and ASTM F 2119

Non-clinical testing of worst case scenario in a 3 T MRI system did not reveal any relevant torque or displacement of the construct for an experimentally measured local spatial gradient of the magnetic field of 3.69 T/m. The largest image artifact extended approximately 169 mm from the construct when scanned using the Gradient Echo (GE). Testing was conducted on a 3 T MRI system.

Radio-Frequency-(RF-)induced heating according to ASTM F 2182

Non-clinical electromagnetic and thermal testing of worst case scenario lead to peak temperature rise of 9.5 °C with an average temperature rise of 6.6 °C (1.5 T) and a peak temperature rise of 5.9 °C (3 T) under MRI Conditions using RF Coils (whole body averaged specific absorption rate [SAR] of 2 W/kg for 6 minutes [1.5 T] and for 15 minutes [3 T]).

▲ 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.
- Patients with impaired thermoregulation or temperature sensation should be excluded from MR scanning procedures.
- 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.

Not all products are currently available in all markets.
This publication is not intended for distribution in the USA.
Intended use, Indications and Contraindications can be found in the corresponding system Instructions for Use.
All Surgical Techniques are available as PDF files at www.depuysynthes.com/ifu

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