TFN – Titanium Trochanteric Fixation Nail System. For intramedullary fixation of proximal femur fractures.

Surgical Technique

Instruments and implants approved by the AO Foundation.

DePuy Synthes
COMPANIES OF Johnson&Johnson


Image intensifier control

Warning
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 Synthes reusable devices, instrument trays and cases, as well as processing of 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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TFN – Titanium Trochanteric Fixation Nail System. For intramedullary fixation of proximal femur fractures.

The Synthes Titanium Trochanteric Fixation Nail (TFN) System permits an intramedullary approach for the fixation of fractures of the femur. The TFN System consists of a series of cannulated nails, cannulated helical blades, cannulated femoral neck screws, cannulated end caps, and locking bolts and screws. All of the implants in the TFN System are made of titanium alloy.*

The helical blade provides improved resistance to varus collapse and rotational control of the medial fracture segment compared to single screw fixation (i.e., lag screws). The result is superior life-to-cut-out versus single screw fixation. This is accomplished through the use of the 11.0 mm helical blade. In addition, the use of the 11.0 mm helical blade results in reduced bone removal versus use of a traditional hip screw.

These helical blade features are especially advantageous in osteoporotic fracture fixation. However the TFN system also offers a lag screw fixation using an 11.0 mm femoral neck screw.

* Titanium-6% aluminum-7% niobium

Biomechanical Features

Greater resistance to cut-out

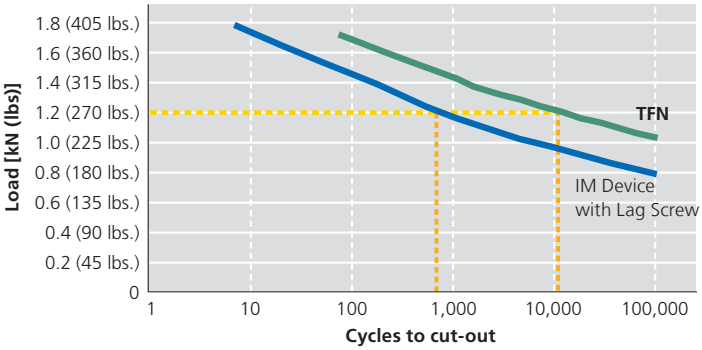
The helical blade of the Titanium Trochanteric Fixation Nail (TFN) System provides increased resistance to cut-out.[1]

The innovative helical blade design was proven to provide "superior resistance to migration and subsequent cut-out failure."[2]

Fixation life curves: number of load cycles to cut-out at varying loads.

When tested at a load of 1.2 kN, the lag screw cut-out before 1,000 cycles whereas the helical blade cut-out after 10,000 cycles.

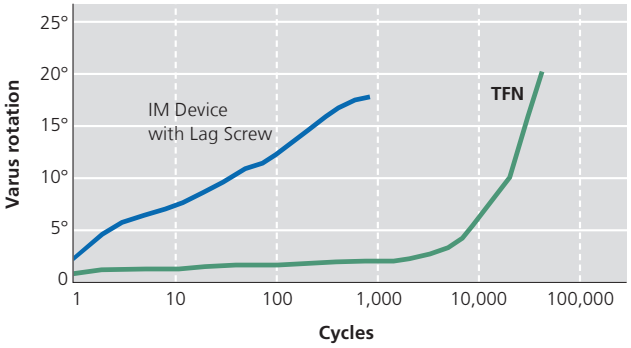
Proximal femur fixation device cut-out[3]
(Unstable pertrochanteric fracture using simulated cancellous bone)



[1] M.B. Sommers, M. Bottlang, C. Roth, H. Hall, J.C. Krieg (2004) A laboratory model to evaluate cutout resistance of implants for pertrochanteric fracture fixation. Journal of Orthopaedic Trauma, Vol 18(6):361–368
[2] Ibid.
[3] Ibid.

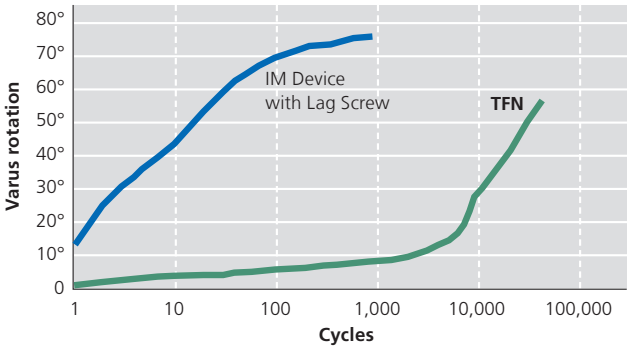
Improved resistance to varus collapse

Varus rotation of femoral head at 1000 N[4]
(Unstable pertrochanteric fracture using simulated cancellous bone)



Improved resistance to femoral head rotation

Rotation of femoral head around implant axis at 1000 N[5]
(Unstable pertrochanteric fracture using simulated cancellous bone)



[4] M.B. Sommers, M. Bottlang, C. Roth, H. Hall, J.C. Krieg (2004) A laboratory model to evaluate cutout resistance of implants for pertrochanteric fracture fixation. Journal of Orthopaedic Trauma, Vol 18(6):361–368
[5] Ibid.

The 11.0 mm helical blade reduces amount of bone removed[6]

By using the 11.0 mm helical blade, significantly less bone is removed than with a predrilled lag screw.

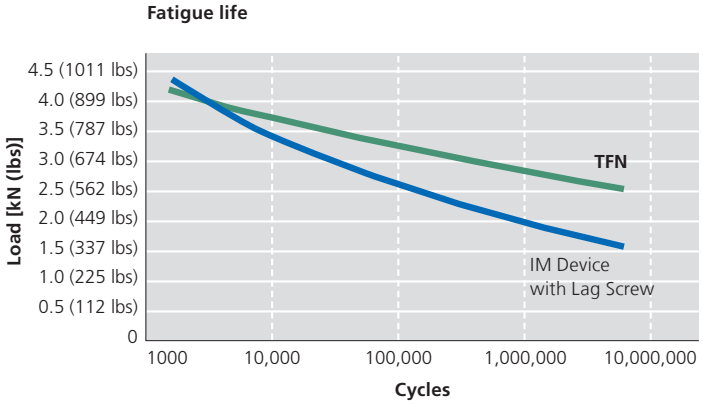
The helical blade compacts trabecular bone around the blade as it advances into the femoral head.

Note: The amount of bone removed by an implant is directly related to its cross-sectional area. The helical blade's cross-sectional area is only 38% that of a standard lag screw.

Example of bone removal with standard lag screw

Example of bone removal with helical blade

Longer fatigue life in mechanical testing[7]



[6] Test conducted at Legacy Research and Technology Center, Portland, OR.
[7] Test conducted at Synthes Mechanical Testing Lab, West Chester, PA.

AO Principles

In 1958, the AO formulated four basic principles, which have become the guidelines for internal fixation.[8,9] Those principles, as applied to the Titanium Trochanteric Fixation Nail System, are:

Anatomic reduction
The Titanium Trochanteric Fixation Nail allows controlled dynamic collapse and interfragmentary compression while maintaining rotational control of the medial segment.

Stable fixation
The Trochanteric Fixation Nail System provides improved resistance to varus collapse and rotational control of the medial fracture segment versus single screw fixation (i.e., lag screws). This results in superior life-to-cut-out versus single screw fixation.

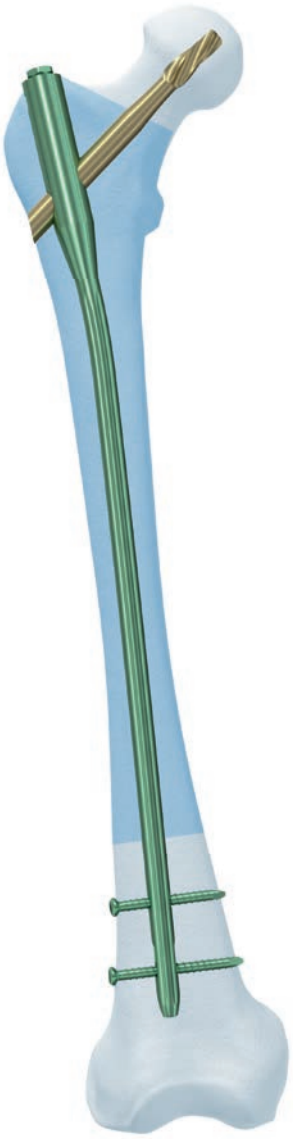
Preservation of blood supply
The instruments and implants in the Trochanteric Fixation Nail System permit a more percutaneous technique and less tissue stripping than current treatment methods. An intramedullary approach shows decreased blood loss versus plate fixation of subtrochanteric fractures.[10,11] Use of the 11.0 mm helical blade results in reduced bone removal compared to a hip screw.

Early, active mobilization
The shortened moment arm associated with an intramedullary approach permits early mobilization. In conjunction with AO principles, the Trochanteric Fixation Nail System creates an environment for bone healing and rapid rehabilitation. For stable fractures, early postoperative weightbearing is possible.

[8] M.E. Müller, M. Allgöwer, R. Schneider, and H. Willenegger (1991), Manual of Internal Fixation, 3rd Edition. Berlin: Springer
[9] Rüedi TP, Buckley RE, Moran CG (2007) AO Principles of Fracture Management. 2nd expanded ed. 2002. Stuttgart, New York: Thieme
[10] M. Baumgaertner, S. Curtin, D. Lindskog (1998). Intramedullary Versus Extramedullary Fixation for the Treatment of Intertrochanteric Hip Fractures. Clinical Orthopaedics and Related Research, 348, 87–94
[11] D. Hardy, P. Descamps, P. Krallis, et al (1998). Use of an Intramedullary Hip-Screw Compared with a Compression Hip-Screw with a Plate for Intertrochanteric Femoral Fractures. The Journal of Bone and Joint Surgery, 80-A(5), 618–630

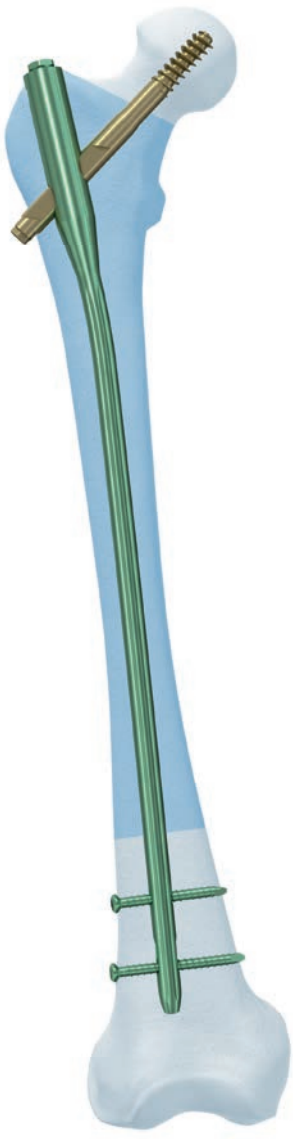
Indications

The Synthes Titanium Trochanteric Fixation Nail (TFN) is intended to treat stable and unstable pertrochanteric fractures, intertrochanteric fractures, basal neck fractures, and combinations thereof. The Long TFN is additionally indicated for subtrochanteric fractures, pertrochanteric fractures associated with shaft fractures, pathologic fractures of osteoporotic bone (including prophylactic use) in both trochanteric and diaphyseal regions, long subtrochanteric fractures, proximal or distal nonunions, malunions, and revisions.



Long (300 mm–460 mm) Trochanteric Fixation Nails with helical blade

Short (170 mm and 235 mm) Trochanteric Fixation Nails with helical blade



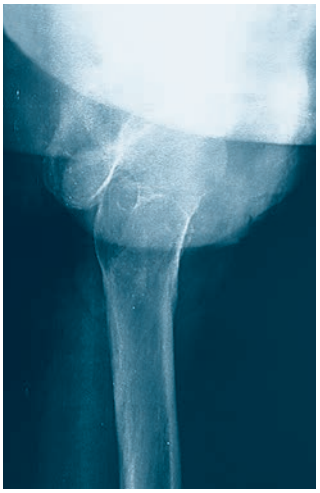
Long (300 mm–460 mm) Trochanteric Fixation Nails with screw

Short (170 mm and 235 mm) Trochanteric Fixation Nails with screw

Clinical Cases

Case 1

Preoperative AP



Preoperative lateral

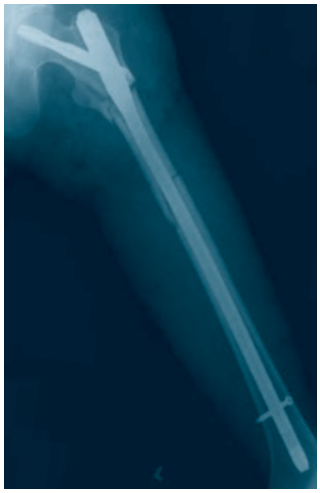
Postoperative AP

Postoperative lateral

Case 2

Preoperative AP

Preoperative lateral



Postoperative AP

Postoperative lateral

Preoperative Implant Selection

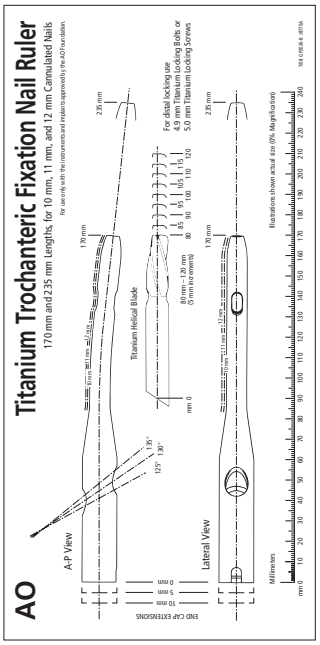
Use the AO preoperative planner rulers for the Titanium Trochanteric Fixation Nail System to determine nail length, nail diameter, femoral neck angle and head element length.

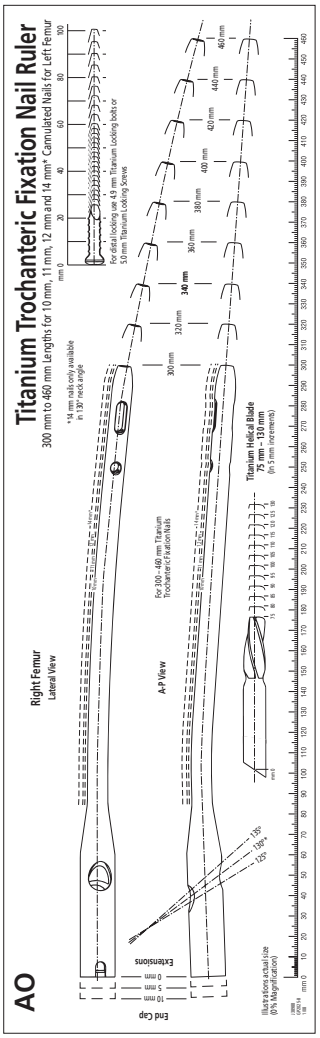
The head element should be centered in the AP and lateral views of the femoral head.

Note: Check the magnification on the specific preoperative planner ruler. Magnification levels are either 0% or 15%. Determine the typical magnification factor at your institution and then adjust measurements accordingly. To do this, divide the measured length by the magnification factor and choose the nearest nail length. Note that this will provide an estimated nail length and implant size.

Example (for 0% magnification planner ruler):
- Measured nail length is 420 mm
- Typical femoral x-ray image is enlarged by 5% (magnification factor 1.05)*
- 420/1.05 = 400
- Estimated nail length is 400 mm

When selecting nail size, consider canal diameter, fracture pattern, patient anatomy, and postoperative protocol.





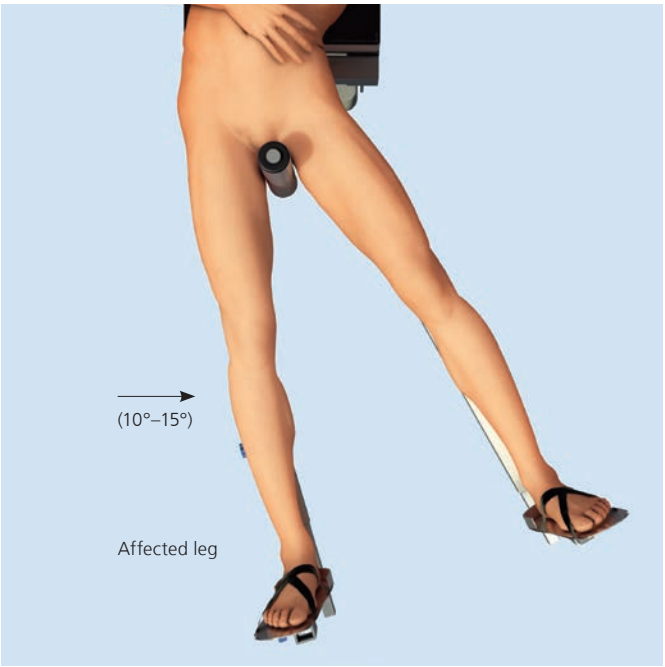
* Magnification factor may vary

1
Position patient

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

For unimpeded access to the medullary canal, abduct the upper part of the body approximately 10 –15° to the contralateral side (or adduct the affected leg by 10 –15°).

Reduce the fracture. The universal large distractor may be useful when not using a fracture table.



2
Determine femoral neck angle

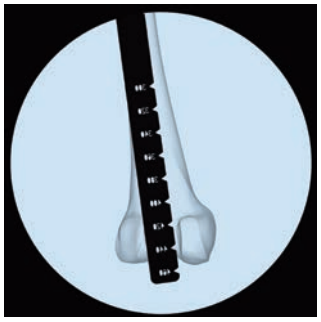
Instruments	
357.391	Radiographic Ruler for TFN
357.399	Guide Wire ∅ 3.2 mm, length 400 mm

The three oblique slots at the proximal end of the radiographic ruler can be used to determine the femoral neck angle. Select a 3.2 mm guide wire and clamp the guide wire into one of the grooves marked 125°, 130°, or 135°. Position the ruler over the proximal femur and take an AP image. Select the angle that most closely matches the angle of the femoral neck.

3

Determine nail length
(For nails 300 mm – 460 mm)

Instrument	
357.391	Radiographic Ruler for TFN



- Position the image intensifier for an AP view of the proximal femur. With long forceps, clamp the guide wire in the appropriate neck angle position as previously determined. Place the radiographic ruler over the femur. Adjust the radiographic ruler until the guide wire is centered in the femoral head. Mark the skin at the proximal end of the ruler.

- Move the image intensifier to the distal femur, replace the proximal end of the radiographic ruler at the skin mark and take an AP image of the distal femur. Verify fracture reduction. Read nail length directly from the ruler image, selecting the measurement that places the distal end of the nail at, or just proximal to, the physeal scar, or the chosen insertion depth.

Alternative technique

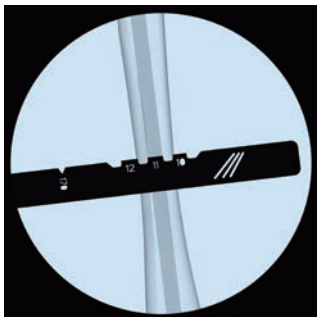
Instrument	
360.255	Measuring Device for Reaming Rod for TFN

Nail length may also be determined by using the reaming rod measuring device and a 950 mm reaming rod or guide rod. Insert the reaming rod to hold fracture reduction. Position
- the image intensifier over the distal femur and take an image to confirm reaming rod insertion depth. Pass the reaming rod measuring device over the proximal end of the reaming rod and through the incision to the bone. Read nail length directly from the measuring device.

4

Determine nail diameter

To determine nail diameter, position the image intensifier for an AP view of the femur at the level of the isthmus. Hold the radiographic ruler perpendicular to the femur and position the diameter tabs over the isthmus. Read the diameter measurement on the tab that fills the canal.



Note: Take into consideration that the ruler is not at the same level as the femur. This will affect the accuracy of the measurement.

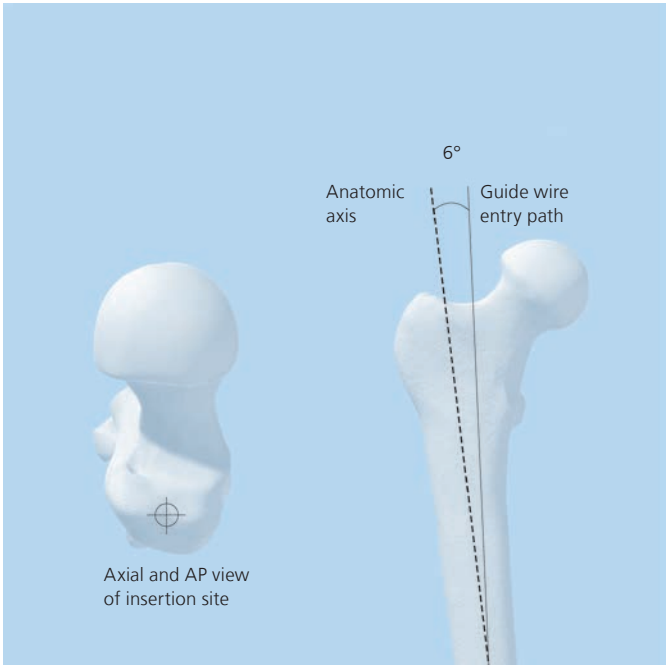
5
Identify nail entry point

Instruments	
357.392	Drill Sleeve 17.0/3.2, length 161 mm, for No. 357.410
357.393	Trocar ∅ 3.2 mm, length 172 mm, for No. 357.392
357.399	Guide Wire ∅ 3.2 mm, length 400 mm
357.410	Protection Sleeve 22.0/17.0, for No. 357.394
393.100	Universal Chuck with T-Handle

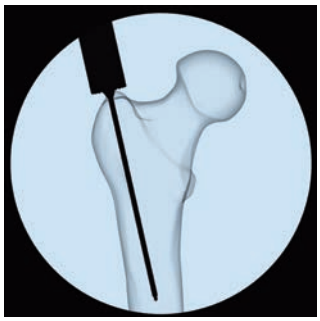
The entry point for the nail is in line with the medullary canal in the lateral view. In the AP view, the nail insertion point is slightly lateral to the tip of the greater trochanter, in the curved extension of the medullary cavity.

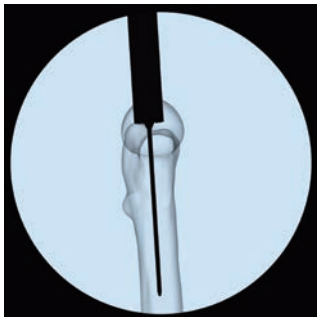
Make a longitudinal incision proximal to the greater trochanter. Carry the dissection down to the gluteus maximus fascia longitudinally in the direction of the wound. Separate the underlying muscle fibers and palpate the tip of the greater trochanter. Insert the 22.0 / 17.0 protection sleeve, the 17.0 / 3.2 drill sleeve, and the 3.2 mm trocar assembly into the incision site and down to the bone. Remove the trocar.

The lateral angle of the nail is 6°; therefore, the 3.2 mm guide wire must be inserted at an angle 6° lateral to the shaft of the femur, and intersect the centerline of the canal, just distal to the lesser trochanter. The guide wire will be centered in the canal in the lateral view. The guide wire can be inserted either manually with the universal chuck with T-handle or with a power drill.



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





6
Open canal

Instruments	
351.050	Tissue Protector
357.394	Drill Bit ∅ 17.0 mm, cannulated, length 300 mm, for Quick Coupling No. 511.760
357.399	Guide Wire ∅ 3.2 mm, length 400 mm
357.412	Awl for TFN

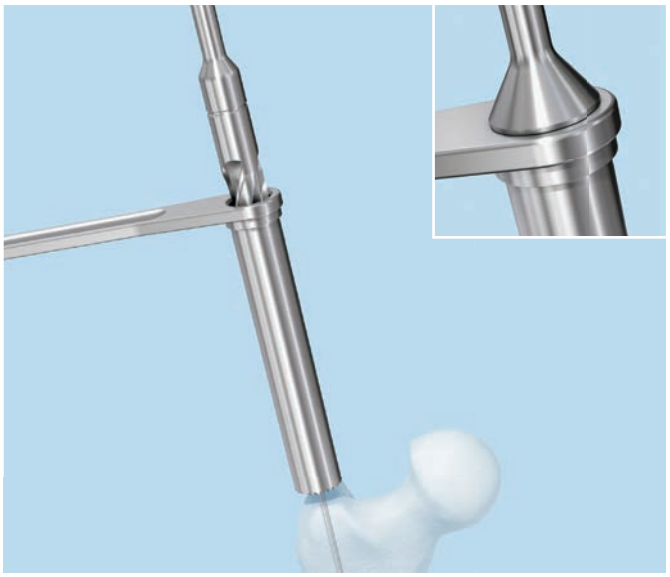
Place the 17.0 mm cannulated drill bit into a power drill. Pass the drill bit over the guide wire and through the protection sleeve to the bone. Drill to the stop.

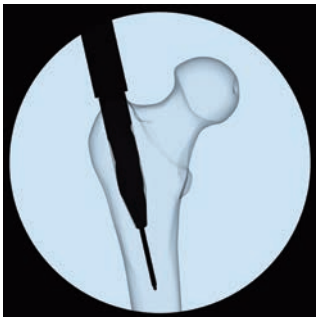
Note: If the fracture line runs through the entry point for the nail, care must be taken to remove the bone on the medial fragment to create a path for the nail and prepare an adequate opening for the proximal end of the nail. Do not plunge the drill bit through the fracture as this may displace the fracture and cause the fracture to be fixed in varus.

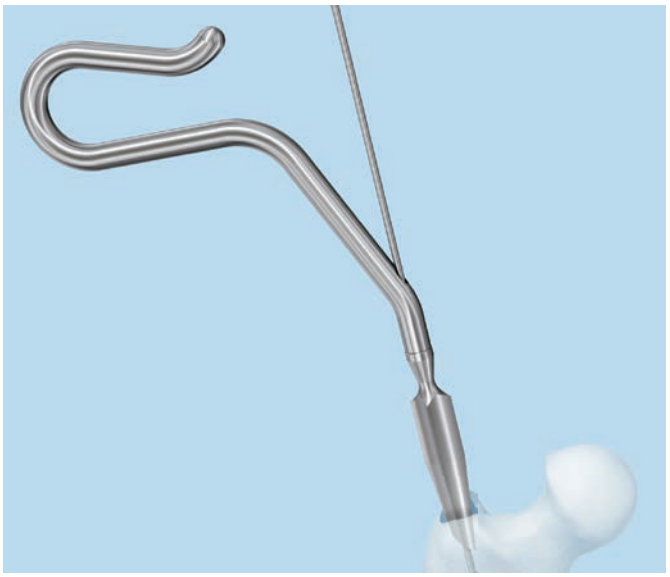
When the 17.0 mm drill bit is removed, the 3.2 mm guide wire may be captured and removed simultaneously. If the guide wire remains in the bone, remove it by hand.

Dispose of the guide wire. Do not reuse.

Note: The cannulated reverse awl may also be used to open the canal or expand the opening created by the 17.0 mm drill bit. Use the tissue protector to spare the soft tissues. Place the awl over the guide wire and to the bone. Use a twisting motion to advance the awl. As with the cannulated drill bit, take care not to plunge the awl into the fracture site because this may displace the fracture and cause the fracture to be fixed in varus. Take care to remove the bone on the medial segment of the fracture to prepare an adequate opening for the proximal end of the nail.







7
Reaming guidelines (optional)

Instrument	
360.255	Measuring Device for Reaming Rod for TFN

Using image intensification, ensure that fracture reduction has been maintained. Insert the 2.5 mm reaming rod with olive ball tip into the medullary canal to the desired insertion depth.

Ream in 0.5 mm increments and advance the reamer with steady, moderate pressure. Do not force the reamer. Partially retract the reamer often to clear debris from the medullary canal.

Ream to a diameter at least 1.0 mm greater than the nail diameter as determined by surgeon preference.

After reaming, remove the reaming assembly, leaving the reaming rod in place.

Note: The trochanteric fixation nail can be passed over the 2.5 mm reaming rod, with olive ball tip, if used. No reaming rod exchange is required.

Nail length may be determined by using the reaming rod measuring device and a 950 mm reaming rod or guide rod. Insert the reaming rod to hold fracture reduction. Position the image intensifier over the distal femur and take an image to confirm reaming rod insertion depth. Pass the reaming rod measuring device over the proximal end of the reaming rod and through the incision to the bone. Read nail length directly from the measuring device.

1
Assemble insertion instruments

Instruments	
357.397	Connecting Screw, cannulated, for TFN
357.411	Insertion Handle for TFN
357.515	Screwdriver, hexagonal, with spherical head ∅ 8.0 mm
357.406	Screwdriver, hexagonal, ∅ 5.0 mm, flexible

The sterile nail is packaged with a protective plug in the proximal end of the nail. Remove and dispose of the plug.

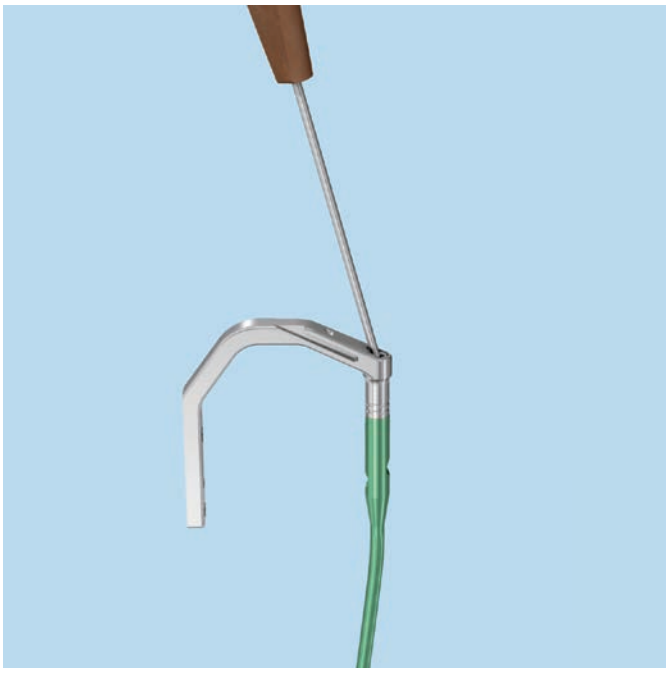
Orient the insertion handle laterally and match the geometry of the handle to the nail.

Note: For long (300 mm to 460 mm) nails, the bow of the nail must be aligned with the anterior bow of the femur. Also confirm left or right nail is being assembled for correct affected limb.

Pass the cannulated connecting screw through the insertion handle and into the nail. Secure using the ball hexagonal screwdriver.

To verify appropriate position of the locking mechanism for the head element, pass the 5.0 mm flexible hexagonal screwdriver through the cannulated connecting screw and turn counterclockwise until it stops.

Important: Ensure that the connecting screw is tight to avoid misalignment when inserting the head element through the aiming arm. Do not attach the aiming arm to the handle until after the nail is fully inserted.



2
Insert nail

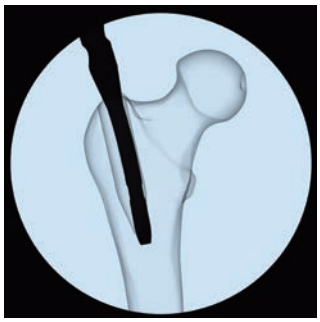
Instrument	
357.411	Insertion Handle for TFN

For short nails (170 mm and 235 mm), orient the insertion handle laterally, taking into consideration the anteversion of the femoral head and neck. 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.

Optional technique
Ensure correct anteversion of the nail by placing a guide wire ventral to the femoral neck and into the femoral head.

Under image intensification, verify fracture reduction and insert the nail as far as possible by hand. Use the insertion assembly to manipulate the nail across the fracture.

When inserting a short nail, no hammer blows should be required.



To aid with the insertion of long nails, orient the insertion handle anteriorly until the nail reaches the isthmus. As the nail is advanced, rotate the handle so it is positioned laterally for final seating. This will allow the bow of the long nails to aid nail passage through the 6° laterally angled entry point.

For long nails, insertion can be aided by light hammer blows. When using a hammer, monitor the tip of the nail using image intensification. Verify that there is no evidence of impingement distally.

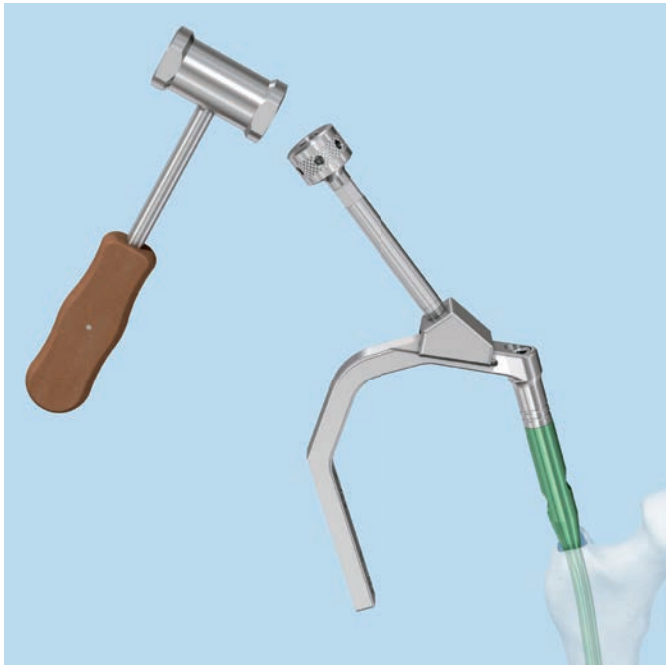
Instruments

321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm
321.250	Spanner Wrench, for Nos. 357.180, 357.181, 359.201 and 359.219
357.220	Hammer Guide, for No. 357.250
357.250	Slide Hammer, for Nos. 357.220 and 357.221
357.395	Connector for TFN, for No. 357.411
357.398	Shaft, hexagonal ∅ 8.0 mm, cannulated, short, length 125 mm

To use a hammer, slide the connector into the grooves on the insertion handle and secure it in place using the 11 mm ratchet wrench or spanner wrench. A free hammer can be used to strike the connector directly. If desired, the slide hammer and hammer guide can be threaded into the driving cap and light blows used to seat the nail. Remove the connector once the nail has been seated.

Important: Confirm that the nail is tightly connected to the insertion handle, especially after hammering. The cannulated shaft with 8 mm hex and 11 mm ratchet wrench may be used to retighten the connecting screw over the reaming rod as needed.

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



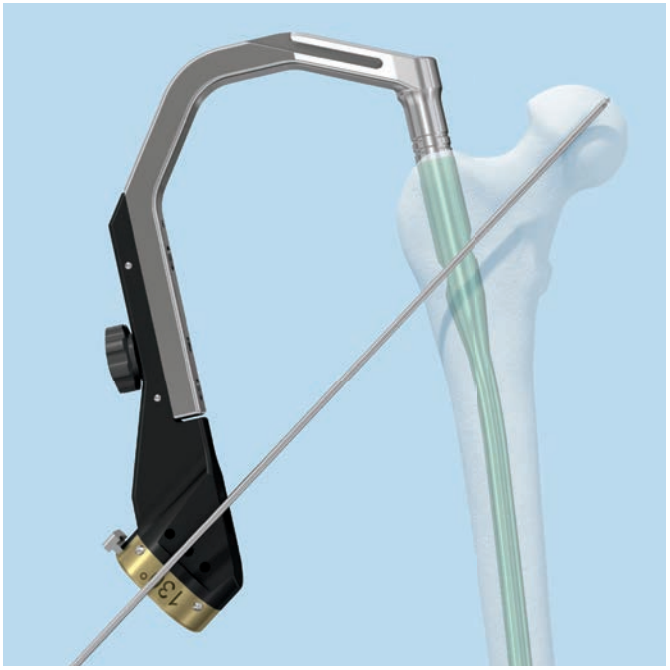
1
Verify nail insertion depth and anteversion

Instruments	
357.365	Aiming Arm for TFN, 125°
357.366	Aiming Arm for TFN, 130°
357.367	Aiming Arm for TFN, 135°
357.399	Guide Wire 3.2 mm, length 400 mm

Ensure that the nail is tightly connected to the insertion handle.

Securely attach the appropriate aiming arm to the insertion handle.

Nail insertion depth can be confirmed by inserting a 3.2 mm guide wire through the aiming arm. To ensure the correct anteversion of the nail, an additional guide wire can be inserted ventral to the femoral neck and into the femoral head. Take a lateral image of the proximal femur to verify nail rotation and ensure that the head element will be aimed toward the center of the femoral head.



2
Insert blade guide sleeve

Instruments	
357.369	Guide Sleeve for Helical Blade for TFN
357.371	Buttress/Compression Nut, for No. 357.369
357.381	Drill Sleeve 11.0/3.2, length 222 mm, for No. 357.369
357.383	Trocar ∅ 3.2 mm, length 232 mm, for No. 357.381

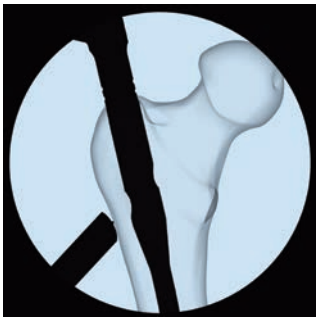
Thread the buttress/compression nut onto the blade guide sleeve. Place the yellow blade guide sleeve, 11.0 / 3.2 drill sleeve and 3.2 mm trocar assembly through the aiming arm and to the skin. Make an incision to accommodate the path of the sleeve assembly. Ensure that the incision and dissection of the fascia are in line with the path of the blade guide sleeve. Pass the sleeve assembly through the soft tissue to the bone. The buttress/compression nut will snap into the aiming arm.

Technique tip: When assembling the buttress/compression nut onto the blade guide sleeve, locate it approximately in the middle of the threaded portion of the blade guide sleeve for insertion into the aiming arm.

Important: The blade guide sleeve should rest on the lateral cortex. Do not overtighten on the cortex as this may affect the accuracy of the aiming assembly.

Turn the buttress/compression nut counterclockwise to advance the blade guide sleeve to the bone. The buttress/compression nut is locked into the aiming arm, ensuring that the blade guide sleeve will remain in position on the lateral cortex throughout the remainder of the procedure for head element insertion. Take an AP C-arm image to confirm that the blade guide sleeve is on the lateral cortex.

Reconfirm fracture reduction using image intensification.



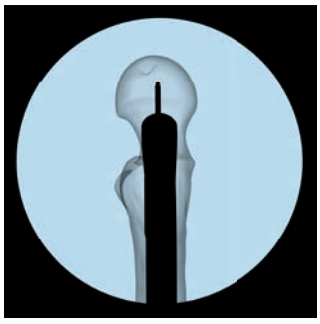
3
Insert guide wire for head element

Instruments	
357.383	Trocar ∅ 3.2 mm, length 232 mm, for No. 357.381
357.399	Guide Wire ∅ 3.2 mm, length 400 mm

Remove the 3.2 mm trocar and pass a new 3.2 mm guide wire through the drill sleeve to the bone. Advance the guide wire, under power, into the femoral head, stopping approximately 5 mm from subchondral bone. The guide wire should be centered in the femoral head and neck in both the AP and lateral planes. The tip of the guide wire is positioned where the tip of the head element will be when it is properly inserted.

- Confirm guide wire placement, in both planes, using the image intensifier.

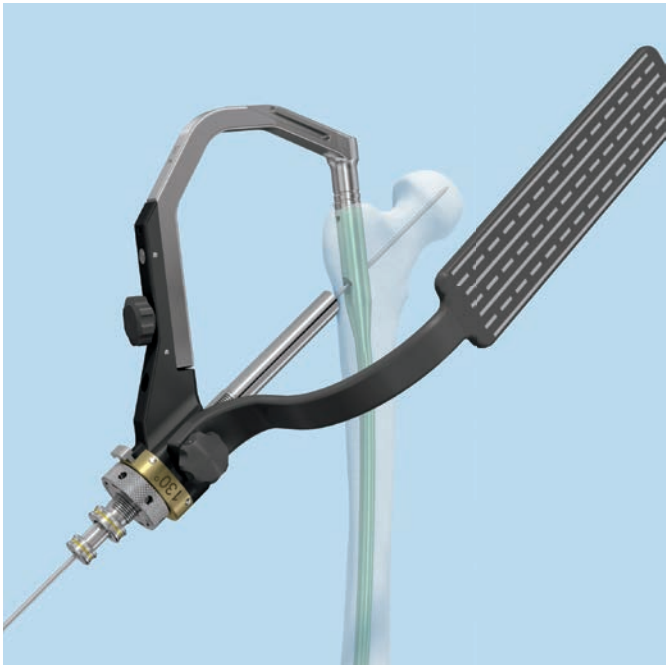
Note: If the nail must be repositioned to improve guide wire placement, use the insertion handle to make the adjustments. Do not pull on the blade guide sleeve or the guide wire to make this adjustment as this could affect the accuracy of the aiming assembly.



Optional technique:
Position guide wire with aiming device

Instruments	
03.010.412	Guide Wire Aiming Device for TFN, for anterior posterior orientation
03.010.415	Connecting Screw for Guide Wire Aiming Device, for TFN
03.010.471	Guide Wire Aiming Device Offset Block

Insert the guide wire aiming device for AP orientation into the three holes on the anterior side of the aiming arm (where the Miss-A-Nail jig is normally attached). Lock the guide wire aiming device in place using the connecting screw for guide wire aiming device.



Note: The guide wire aiming device offset block can be added to obtain an additional 10 cm of soft tissue clearance.

Position the C-arm for an AP image. Rotate the C-arm until any two orientation lines are symmetric to the blade guide sleeve.

The midline (line between the two orientation lines) represents the guide wire trajectory.

Notes
- The outer lines can be used to determine the center of the femoral head.
- If the nail must be repositioned to improve guide wire placement, turn the buttress/compression nut clockwise to retract the blade guide sleeve and use the insertion handle to make the adjustments. Do not pull on the blade guide sleeve or the guide wire to make this adjustment as this could affect the accuracy of the aiming assembly.

Optional technique:
Using Miss-A-Nail aiming jig

Instruments	
321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm
357.399	Guide Wire ∅ 3.2 mm, length 400 mm
357.413	Drill Sleeve 5.6/3.2, length 198 mm
357.920	Aiming Jig for "Miss-A-Nail" Technique for TFN

If the fracture line is perpendicular to the axis of the head element or if rotational control of the femoral head during head element insertion is a concern, the following technique may be utilized.

After the guide wire has been inserted, attach the Miss-A-Nail jig to the aiming arm either anterior or posterior to the nail. Set the thumbscrews to desired wire spread position and tighten using the 11 mm ratchet wrench. Leave the 11.0 / 3.2 drill sleeve assembled in the blade guide sleeve. Pass the 5.6 / 3.2 drill sleeve through the Miss-A-Nail jig. Make a stab incision and pass the sleeve to the bone. Advance a 3.2 mm guide wire into the femoral head. Monitor passage with the image intensifier.

Repeat to place a second guide wire.

The guide wires will converge toward the tip of the head element, in the lateral view, but will not touch it. The guide wires should be used for provisional fixation only and removed once the head element has been inserted.

4
Measure for length of head element

Instruments	
357.369	Guide Sleeve for Helical Blade for TFN
357.385	Measuring Device for Guide Wire ∅ 3.2 mm, for No. 357.399

Using the measuring device for guide wire, measure for head element length. Pass the measuring device over the guide wire to the back of the blade guide sleeve. Length (to tip of guide wire) is read directly from the measuring device.
No calculations are required.

5
Drill for head element

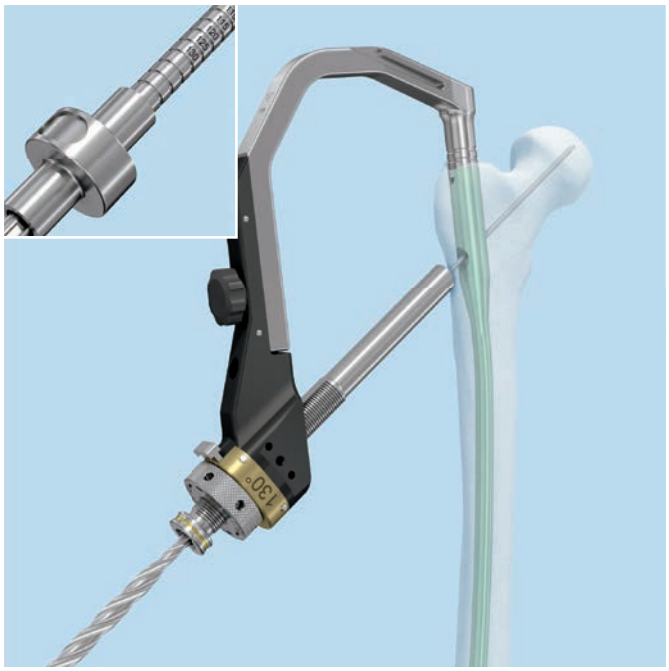
Instruments	
357.369	Guide Sleeve for Helical Blade for TFN
357.403	Reamer ∅ 6.0/10.0 mm, cannulated, length 435 mm, for Quick Coupling No. 511.760
357.404	Drill Bit ∅ 11.0 mm, conical, cannulated, length 280 mm, for Quick Coupling No. 511.760
357.405	Fixation Sleeve

Remove the drill sleeve from the blade guide sleeve. Place the 11.0 mm drill bit in a power drill. Pass the drill bit over the guide wire, through the blade guide sleeve, and advance under power. Drill to the stop. This will open the lateral cortex.

Note: If the guide wire has deflected severely as it passed into the femoral head/neck, it may be removed before drilling and head element insertion. If the guide wire falls out or comes out when the drill bit is removed, it may be left out for head element insertion. Care should be taken to ensure the orientation of the insertion handle and aiming arm is not altered.

For dense bone, the 6.0 mm / 10.0 mm cannulated reamer should be used to prepare a path for the full length of the shaft of the head element. The reamer should be used only after the cortex has been opened using the 11.0 mm drill bit.

Pass the fixation sleeve over the back end of the reamer and adjust the setting to the measured head element length. Pass the reamer over the guide wire, through the blade guide sleeve and advance under power. Drill to the stop.



6
Tap/ream (Optional)

Instrument	
357.430	Tap/Reamer for TFN Femoral Neck Screw

Important: Only use the tap/reamer when proximal locking is done with the TFN screw.

The tap/reamer may be used to prepare a pathway for the TFN screw.

Important: Only use the tap/reamer in dense bone.

Pass the tap/reamer over the guide wire, through the blade guide sleeve and through the nail. Advance the tap/reamer manually by turning clockwise until the tip of the tap/reamer reaches the desired screw placement in the femoral head.

Important: There is no stop on the tap/reamer so monitoring insertion via the following methods is recommended:
- Monitor the depth under fluoroscopy.
- Monitor the respective graduations on the instrument shaft in relation to the blade guide sleeve.

Remove the tap/reamer by turning counterclockwise.

7

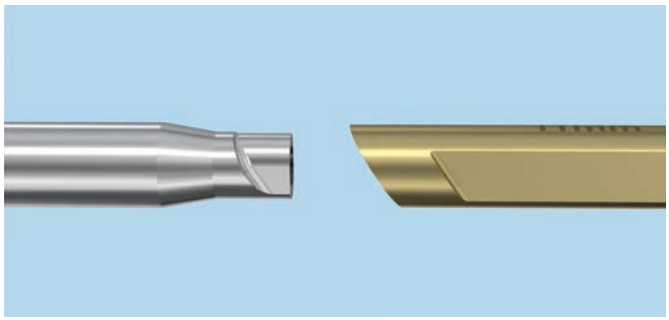
Option A
Proximal locking with helical blade

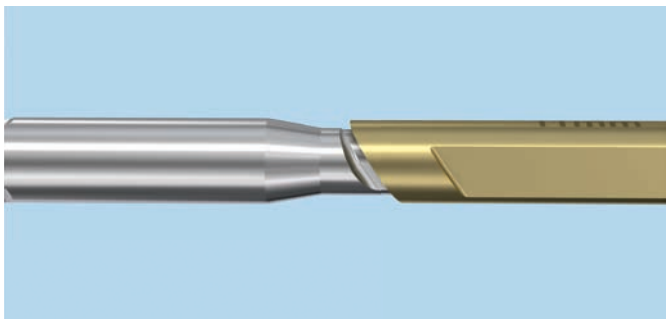
Instruments	
357.372	Impactor for Helical Blade for TFN
357.377	Connecting Screw for Helical Blade for TFN

Insert the cannulated helical blade connecting screw into the impactor for helical blade. Select the appropriate length 11.0 mm helical blade as measured. Align the back end of the helical blade with the impactor. Thread the connecting screw into the helical blade and finger-tighten the assembly.

Pass the helical blade insertion assembly through the blade guide sleeve. Align the pins on the impactor with the grooves in the blade guide sleeve. They will only align in one orientation, which is indicated when the gold pin on the back of the impactor is positioned toward the patient's head. Hold the gold handle of the inserter and advance the blade as far as possible by hand. Use light hammer blows on the back of the connecting screw to seat the helical blade. Insert to the stop. The blade is fully inserted when the helical blade impactor comes to a stop at the back of the blade guide sleeve.

The helical blade MUST be fully inserted.



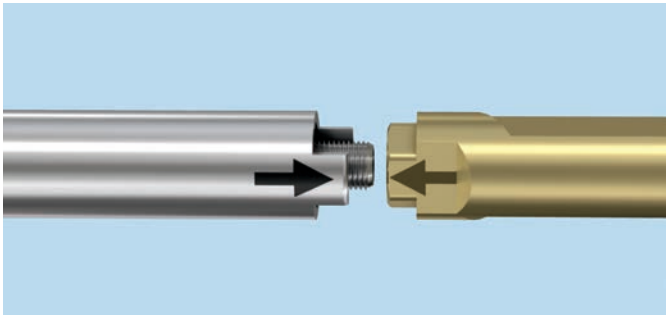


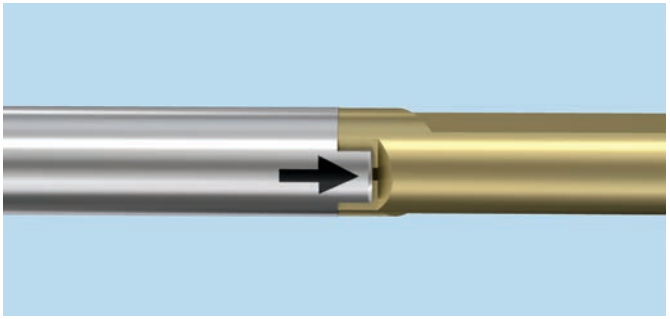
Option B
Proximal locking with screw

Instruments	
357.052	Compression Nut, for No. 357.048
357.377	Connecting Screw for Helical Blade for TFN
357.428	Inserter/Extractor for TFN Femoral Neck Screw

Thread the compression nut completely onto the screw inserter/extractor. Insert the helical blade connecting screw into the screw inserter/extractor. Align the arrows on the tabs of the inserter/extractor with the flats on the back end of the screw. Thread the connecting screw into the screw and fingertighten the assembly.

Pass the screw insertion assembly over the guide wire, through the blade guide sleeve and through the nail. Advance the screw by turning the inserter/extractor clockwise until the mark on the inserter meets the flange surface of the blade guide sleeve. At this depth the screw tip will be positioned at the tip of the guide wire.





Align the inserter handle so it is in the same plane as the femoral shaft (parallel with the femoral shaft axis when viewed laterally).

Notes

- The handle may be off axis clockwise by as much as 10°. It may not be off axis counterclockwise, as this will prevent the locking mechanism from fully engaging the screw.
- Advance the 11 mm screw in 1.75 mm increments by turning the handle 180° (or 3.5 mm by turning 360°).
- When aligning the inserter handle, always rotate the handle clockwise, further engaging the screw in the bone. Do not rotate counterclockwise, as this will leave a gap between the screw and the bone.

8
Engage locking mechanism

Instruments	
357.406	Screwdriver, hexagonal, ∅ 5.0 mm, flexible
357.417	Flexible Hexagonal Screwdriver ∅ 5.0 mm, coated
357.427	Screwdriver, hexagonal ∅ 5.0 mm

The preassembled locking mechanism in the nail should be advanced to control the rotation of the head element. Pass the 5.0 mm flexible hexagonal screwdriver through the cannulated connecting screw and insertion handle until it is seated in the hex of the lock drive. Turn clockwise to advance the locking mechanism. Advance to the stop. The head element is now locked in rotation, but can still slide (see figures A and B).

Optional technique

Instruments	
321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm
357.415	Shaft, hexagonal ∅ 5.0 mm, length 210 mm

Use the 5.0 mm hexagonal shaft, 210 mm in conjunction with the ratchet wrench to advance the locking mechanism.

Note: If the locking mechanism is not advanced, use of an end cap is not possible.

Figure A: Locking mechanism disengaged

Figure B: Locking mechanism engaged

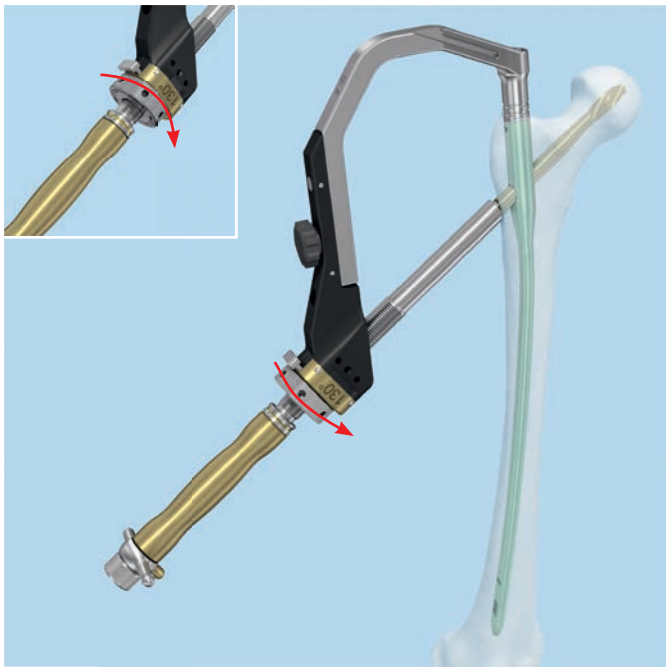
Optional technique for interfragmentary compression

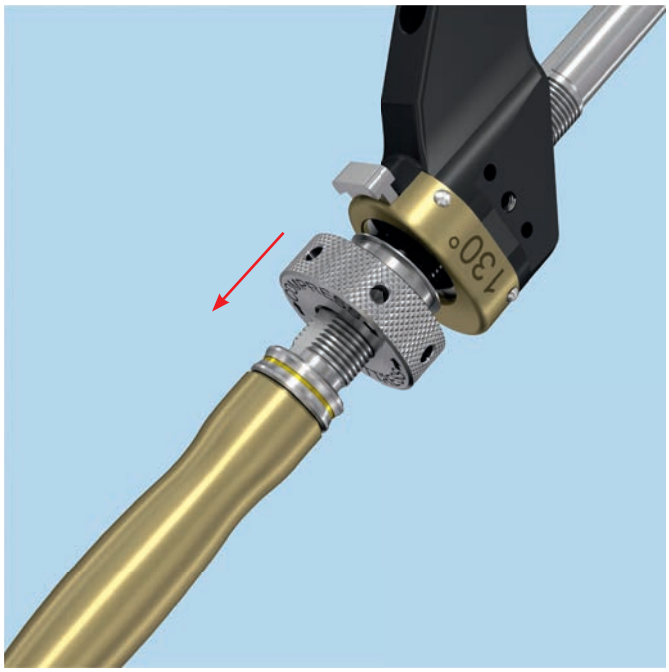
Instruments	
357.406	Screwdriver, hexagonal, ∅ 5.0 mm, flexible
321.170	Pin Wrench ∅ 4.5 mm, length 120 mm

Once the head element has been locked in rotation, interfragmentary compression can be obtained.

Advance the compression nut until it abuts the blade guide sleeve. At this point, interfragmentary compression can be obtained by turning either the buttress/compression nut (attached to the impactor) clockwise by hand or with the assistance of the 4.5 mm pin wrench.

Remove the connecting screw from the head element and inserter. If the connecting screw cannot be loosened by hand, use the 5.0 mm flexible hexagonal screwdriver to loosen the connection. Remove the blade guide sleeve from the aiming arm by depressing the button on the aiming arm and pulling out the blade guide sleeve.





Distal Locking – Short Nails (170 mm and 235 mm)

1
Reconfirm reduction

Confirm reduction of the fracture with AP and lateral images.

2
Drill and measure for locking bolt

Instruments	
357.386	Protection Sleeve 11.0/8.0, for TFN
357.387	Trocar ∅ 4.0 mm, length 176 mm, for No. 357.389
357.389	Drill Sleeve 8.0/4.0, length 164 mm, for No. 357.386
357.407	Drill Bit ∅ 4.0 mm, calibrated, length 260/60 mm, 3-flute, for Quick Coupling

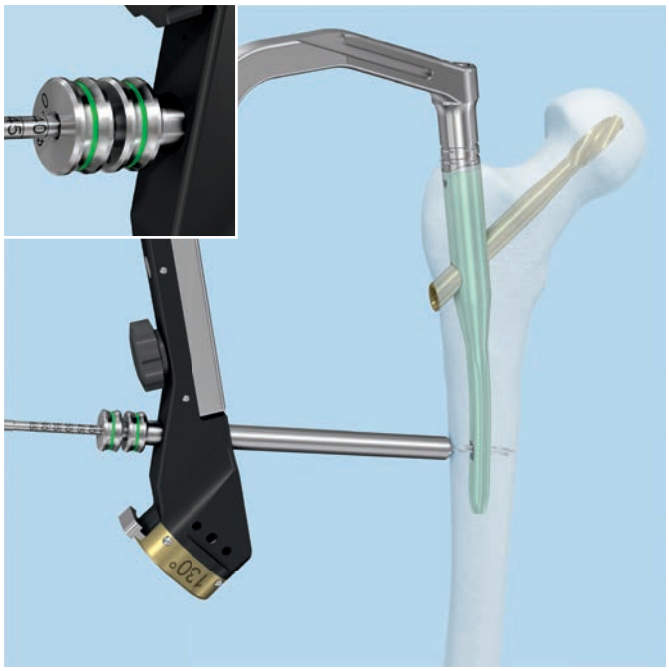
Make a stab incision. Alternatively use the incision for the blade guide sleeve. The incision for the blade guide sleeve may be used for distal locking.

Note: Ensure that the path of the incision and dissection of the fascia are in line with the path of the protection sleeve.

Insert the triple trocar assembly through the aiming arm to the bone.

Remove the trocar and drill through both cortices using the calibrated 4.0 mm three-fluted drill bit.

Read the length of the locking bolt directly from the drill bit at the back of the drill sleeve. Press the drill sleeve to the bone to ensure accurate measurement.



Alternative technique

Instruments	
357.386	Protection Sleeve 11.0/8.0, for TFN
357.389	Drill Sleeve 8.0/4.0, length 164 mm, for No. 357.386
357.402	Depth Gauge for Locking Screws ∅ 5.0 mm

The depth gauge may be used through the 11.0 / 8.0 protection sleeve to determine locking bolt length. Remove the 8.0 / 4.0 drill sleeve and pass the measuring hook through the 11.0 / 8.0 protection sleeve. Read locking bolt length directly from the depth gauge at the back of the protection sleeve.

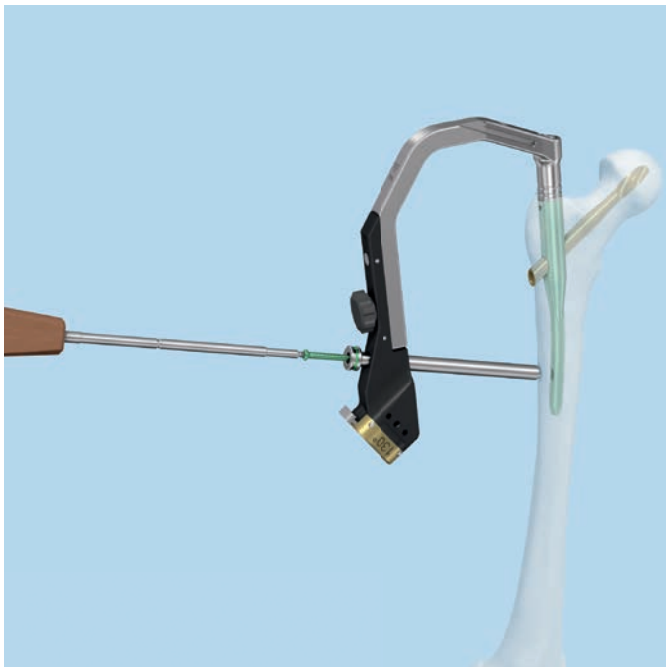
Note: In order to pass the measuring hook through the protection sleeve, the sleeve of the depth gauge must be removed.

3
Insert locking bolt

Instruments	
314.750	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove
321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm
357.386	Protection Sleeve 11.0/8.0, for TFN
357.398	Drill Sleeve 8.0/4.0, length 164 mm, for No. 357.386
357.515	Screwdriver, hexagonal, with spherical head ∅ 8.0 mm

Insert the appropriate 4.9 mm locking bolt through the protection sleeve using the hexagonal screwdriver.

Remove the protection sleeve and aiming arm. Note the insertion depth of the nail as indicated by the rings on the insertion handle. This will help in end cap selection. Remove the connecting screw and insertion handle using the ball hexagonal screwdriver or the cannulated shaft and ratchet wrench.



SureLock Distal Targeting Device – Long Nails (300 mm to 460 mm)

Set

01.010.201	SureLock Distal Aiming Device for long Proximal Femoral Nails (PFN, PFNA and TFN) in Vario Case

The SureLock device is designed to facilitate distal locking of Synthes titanium trochanteric fixation nails, by providing:
– Simple, precise targeting
– Reduced exposure to radiation
– Increased working space

Historically, distal locking of intramedullary nails with an aiming device has been challenging; once inserted, the nail follows the bow of the medullary canal and may be deformed in different planes.

The SureLock system addresses nail deflection in a simple and effective manner. The design of the SureLock aiming arm and its specific techniques allow accurate distal locking for long trochanteric fixation nails.

Note: For information on distal locking technique using the SureLock device, please refer to the SureLock Distal Targeting Device Technique Guide (036.000.778).

For more information on the SureLock System, please contact your Synthes consultant.

Freehand Distal Locking – Long Nails (300 mm to 460 mm)

1
Reconfirm reduction

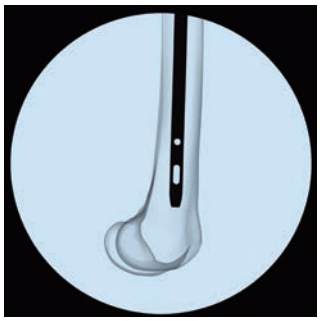
- Confirm reduction of the fracture with AP and lateral images.

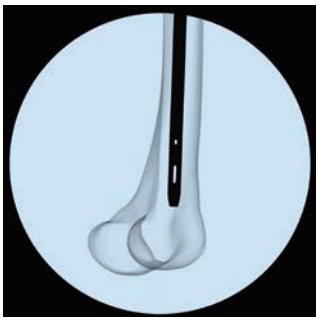
For static interlocking, use the superior locking hole. For dynamic interlocking, use the inferior locking hole only.

2
Align image

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

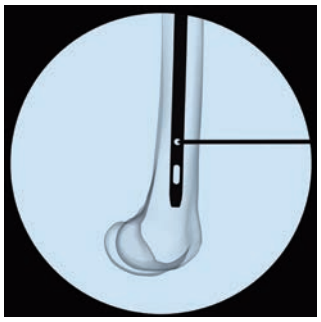
Important: Confirm that the nail is securely connected to the insertion handle, especially after hammering.


Round (correct)


Oblique (incorrect)

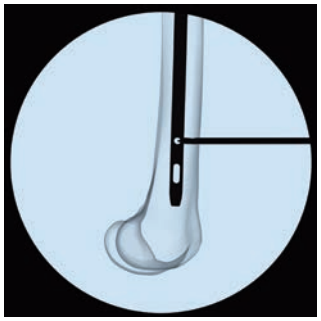
3
Determine incision point

Place a scalpel blade or Kirschner-wire on the skin over the center of the hole to mark the incision point and make a stab incision.



4
Center drill bit in locking hole

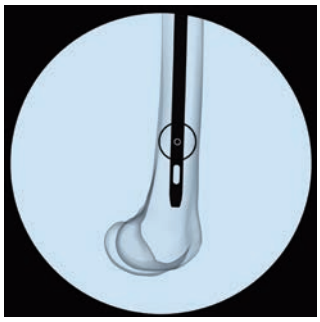
Instrument	
511.417	Drill Bit ∅ 4.0 mm with centering tip, length 148/122 mm, 3-flute, with Coupling for RDL



Under image intensification, insert the tip of the 4.0 mm three-fluted drill bit for the radiolucent drive through the incision and place it onto the bone. Keep the drill bit oblique to the x-ray beam until the tip is centered in the locking hole.

5
Drill

Tilt the drive until the drill bit is in line with the beam and appears centered in the outer ring. The drill bit will nearly fill the locking hole image. Hold the drill bit firmly in this position and drill through both cortices.



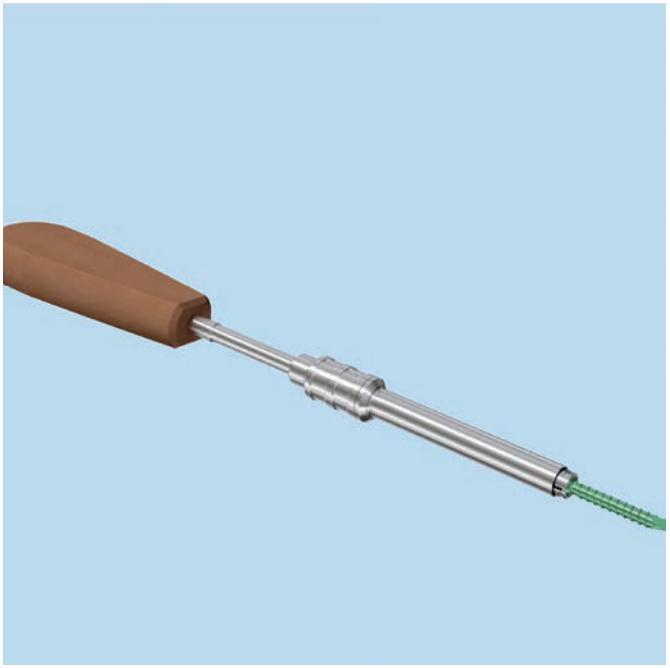
6
Measure

Instrument	
357.402	Depth Gauge for Locking Screws ∅ 5.0 mm

Use the depth gauge to measure locking bolt length. Read locking bolt length directly from the depth gauge.

7
Insert locking bolt

Instruments	
314.110	Holding Sleeve, large
314.750	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove
321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm
357.398	Shaft, hexagonal ∅ 8.0 mm, cannulated, short, length 125 mm
357.515	Screwdriver, hexagonal, with spherical head ∅ 8.0 mm
360.253	Locking Device for Holding Sleeve No. 314.110



Insert the appropriate length 4.9 mm locking bolt using the hexagonal screwdriver, holding sleeve, and holding sleeve locking device.

Note: The insertion depth of the nail is indicated by the rings on the insertion handle. This will help in end cap selection. Remove the connecting screw and insertion handle using the ball hexagonal screwdriver or the cannulated shaft and ratchet wrench.

Standard freehand technique

Instrument	
315.400	Drill Bit ∅ 4.0 mm, length 195/170 mm, 3-flute, for Quick Coupling

Use the 4.0 mm three-fluted drill bit to perform freehand distal locking.

Insert End Cap

1
Insert end cap

Instruments	
321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm
357.399	Guide Wire ∅ 3.2 mm, length 400 mm
357.406	Screwdriver, hexagonal, ∅ 5.0 mm, flexible
357.414	Socket, hexagonal, ∅ 11.0 mm, length 180 mm
357.415	Shaft, hexagonal ∅ 5.0 mm, length 210 mm
357.427	Screwdriver, hexagonal ∅ 5.0 mm

Use of an end cap is recommended if bony ingrowth into the proximal end of the nail is of concern. Also, for reverse oblique intertrochanteric and high subtrochanteric fractures, the nail should sit slightly proud of the greater trochanter to provide an added point of fixation. If the nail has been over-inserted, it should be extended by the use of an end cap of appropriate length.

The end cap for the Titanium Trochanteric Fixation Nail System is cannulated and can be inserted over a guide wire. Place a 3.2 mm guide wire through the incision and into the top of the nail. Select the appropriate end cap and slide the end cap over the guide wire and into the top of the nail. Place the 11 mm cannulated hexagonal socket over the guide wire and onto the external hex of the end cap. Use the 11 mm ratchet wrench to tighten the end cap. The top of the end cap should protrude slightly from the top of the trochanter when fully seated.

The 5.0 mm flexible hexagonal screwdriver, the 5.0 mm hexagonal screwdriver or the 5.0 mm hexagonal shaft and ratchet wrench may also be used to insert the end cap without the use of the guide wire.

1
Disengage locking mechanism

Instruments	
357.396	Extraction Screw for TFN
357.406	Screwdriver, hexagonal, ∅ 5.0 mm, flexible
357.414	Socket, hexagonal, ∅ 11.0 mm, length 180 mm
357.415	Shaft, hexagonal ∅ 5.0 mm, length 210 mm
357.427	Screwdriver, hexagonal ∅ 5.0 mm

Use the 5.0 mm flexible hexagonal screwdriver, 5.0 mm hexagonal shaft, the 5.0 mm hexagonal screwdriver or 11 mm cannulated hexagonal socket to remove the end cap. Thread the nail extraction screw into the top of the nail. Pass the 5.0 mm flexible hexagonal screwdriver through the extraction screw and engage the hex in the locking mechanism. Turn the locking mechanism counterclockwise until it stops. The locking mechanism is now disengaged.

Technique tip: It may be easier to align the extraction screw with the top of the nail if the flexible screwdriver is passed through the extraction screw first and then both instruments placed in the top of the nail.

Important: Do not attempt to extract the nail at this point.

2

Option A
Remove helical blade and locking bolt

Instruments	
357.220	Hammer Guide, for No. 357.250
357.250	Slide Hammer, for Nos. 357.220 and 357.221
357.378	Extraction Instrument for Helical Blade for TFN
314.750	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove

Thread the helical blade extractor into the helical blade. Align the shaft of the extractor with the notch in the helical blade. The extractor is aligned when the flat points toward the patient's head. Pass the slide hammer over the hammer guide and thread the hammer guide into the back end of the helical blade extractor. Hold onto the shaft of the helical blade extractor and use light blows of the slide hammer to remove the helical blade.

Remove the locking bolt using the 3.5 mm hexagonal screwdriver.

Option B
Remove screw and locking bolt

Instruments	
357.377	Connecting Screw for Helical Blade for TFN
357.428	Inserter/Extractor for TFN Femoral Neck Screw
314.750	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove

Align the inserter/extractor with the back end of the screw. The inserter is aligned when the tabs on the inserter mate with the flats on the screw. Insert the connecting screw. Extract the screw by turning the inserter/extractor counter-clockwise.

Remove the locking bolt using the 3.5 mm hexagonal screw-driver.

3
Extract nail

Instruments	
357.220	Hammer Guide, for No. 357.250
357.250	Slide Hammer, for Nos. 357.220 and 357.221

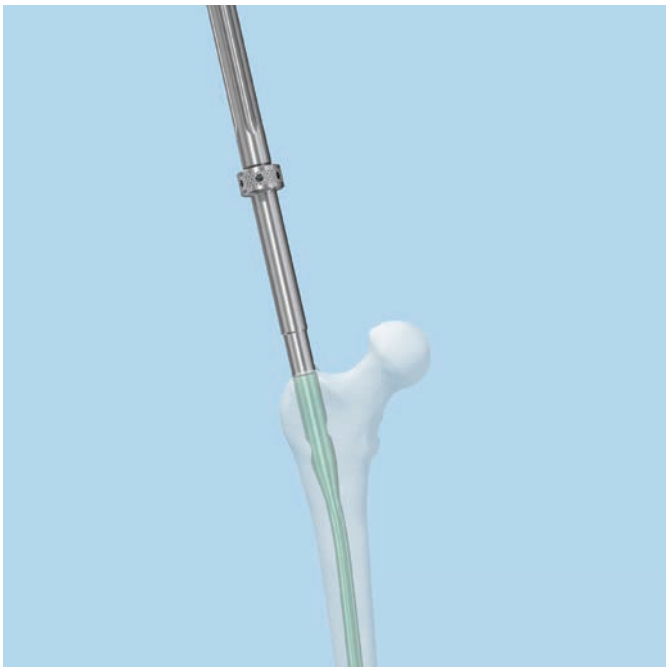
To remove the nail, thread the hammer guide and slide hammer assembly onto the back end of the nail extraction screw. Hold onto the extraction screw and use light hammer blows to extract the nail.

Optional instruments

357.420	Conical Extraction Bolt for TFN
357.421	Extraction Screw Guide for TFN

Use the extraction screw guide to help center the extraction screw in the top of the nail.

The conical extraction bolt can be used instead of the extraction screw.



Alternative Technique – Extraction Hook

For removal of broken nail

Instruments	
355.399*	Extraction Hook ∅ 3.7 mm, for Cannulated Nails
393.100	Universal Chuck with T-Handle
or	
393.105	Universal Chuck, small, with T-Handle

Begin with Steps 1 and 2 of Implant Removal, then remove the extraction screw from the nail.

* Available nonsterile or sterile-packed.
Add "S" to catalog number to order sterile product.

Option 1

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 distant 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.

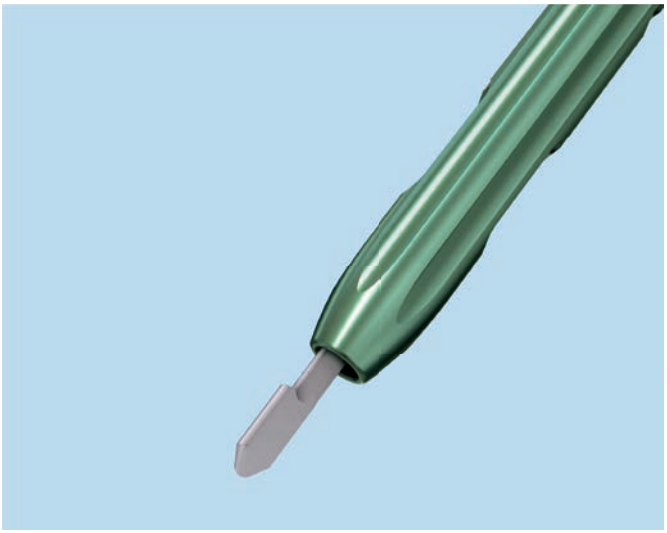
Note: Keep the patient's limb restrained to increase the efficiency of the extraction force.

Option 2

1
Remove near nail fragment

Attach the appropriate extraction bolt or extraction screw to the nail. Remove the near nail fragment using the extraction bolt or extraction screw.

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

5
Extract nail

Extract both nail fragments.

Note: Keep the patient's limb restrained to increase the efficiency of the extraction force.

Instrument Cleaning

Intraoperative and postoperative cleaning of instruments

Instruments	
357.369	Guide Sleeve for Helical Blade for TFN
357.408	Cleaning Stylet ∅ 3.2 mm

Clear the cannulations of the instruments intraoperatively using the cleaning stylet.

Always ensure that the grooves in the blade guide sleeve are free of debris.

Clean only with neutral pH detergents approved for use on anodized aluminum.

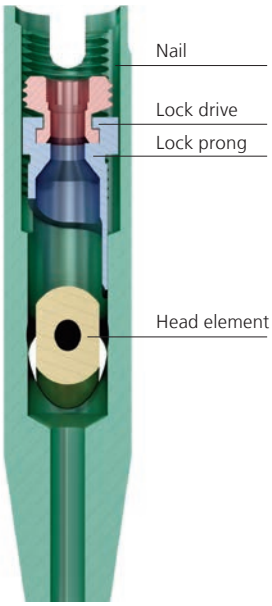
Locking Mechanism Assembly

There is no need to remove the preassembled locking mechanism from the nail. If the locking mechanism is removed, it can be reassembled by following the steps below. The locking mechanism consists of two parts: the lock drive and the lock prong. The lock prong fills the void made by the flat on the head element, controlling the rotation of the head element. The lock drive advances and retracts the lock prong.

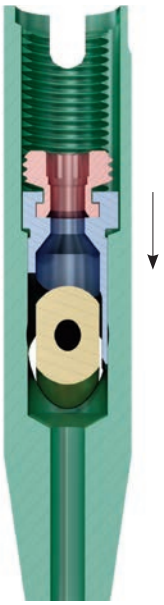
Steps for assembly

1 Slide the lip of the lock drive into the mating groove on the lock prong, forming one assembly.
2 Align the two lobes on the lock prong with the channels in the proximal end of the nail. The lobes are asymmetrical and will only fit into the nail in one orientation.
3 Drop the lock drive and lock prong, as one piece, into the top of the nail.
4 Place the head element through the hole in the nail with the flat facing the distal end of the nail and use the 5.0 mm flexible hexagonal screwdriver to advance the locking mechanism until it touches the head element.
5 Back the locking mechanism off the head element by turning the screwdriver in a counterclockwise direction one full turn, and remove the head element.

The nail is now ready for insertion.



Locking mechanism disengaged


Locking mechanism engaged

Implants for Titanium Cannulated Trochanteric Fixation Nails

11.0 mm Helical Blades (gold)
- Titanium alloy*
- Lengths 75 mm – 130 mm (5 mm increments)
- 11.0 mm diameter
- Cannulated

Helical Blade for TFN ∅ 11.0 mm, Titanium Alloy (TAN), gold, sterile

	Length (mm)		Length (mm)
456.300S	75	456.306S	105
456.301S	80	456.307S	110
456.302S	85	456.308S	115
456.303S	90	456.309S	120
456.304S	95	456.310S	125
456.305S	100	456.650S	130

11.0 mm Femoral Neck Screws (gold)
- Titanium alloy*
- Lengths 70 mm – 130 mm (5 mm increments)
- 11.0 mm diameter
- Cannulated

Femoral Neck Screw for TFN ∅ 11.0 mm, Titanium Alloy (TAN), gold, sterile

	Length (mm)		Length (mm)
04.032.070S	70	04.032.105S	105
04.032.075S	75	04.032.110S	110
04.032.080S	80	04.032.115S	115
04.032.085S	85	04.032.120S	120
04.032.090S	90	04.032.125S	125
04.032.095S	95	04.032.130S	130
04.032.100	100		

* Titanium-6% aluminum-7% niobium

End Caps (green)
- Titanium alloy*
- 0 mm, 5 mm, and 10 mm extensions
- Cannulated

End Cap for TFN, Titanium Alloy (TAN), green, sterile

	Extension (mm)
456.311S	0
456.312S	5
456.313S	10

* Titanium-6% aluminum-7% niobium

4.9 mm Locking Bolts (green)

- Titanium alloy*
- Lengths
  26 mm – 60 mm (2 mm increments)
  64 mm – 80 mm (4 mm increments)
  85 mm – 100 mm (5 mm increments)
- 4.3 mm core diameter
- Fully threaded
- Self-cutting trocar tip
- 3.5 mm hexagonal drive

Locking Bolt ∅ 4.9 mm, self-tapping, Titanium Alloy (TAN), green◊

	Length (mm)		Length (mm)
459.260	26	459.540	54
459.280	28	459.560	56
459.300	30	459.580	58
459.320	32	459.600	60
459.340	34	459.640	64
459.360	36	459.680	68
459.380	38	459.720	72
459.400	40	459.760	76
459.420	42	459.800	80
459.440	44	459.850	85
459.460	46	459.900	90
459.480	48	459.950	95
459.500	50	459.100	100
459.520	52		

* Titanium-6% aluminum-7% niobium
◊ Available nonsterile or sterile-packed.
Add "S" to catalog number to order sterile product.

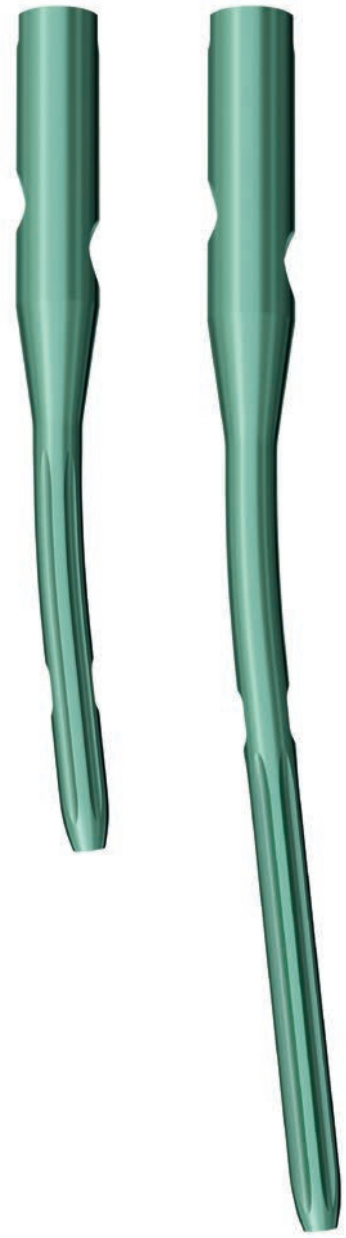
Titanium Trochanteric Fixation Nails (green) – Short

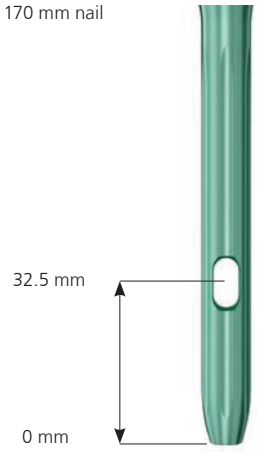
10 mm – 12 mm Cannulated Nails
170 mm and 235 mm lengths

Material
– Titanium-6% aluminum-7% niobium alloy

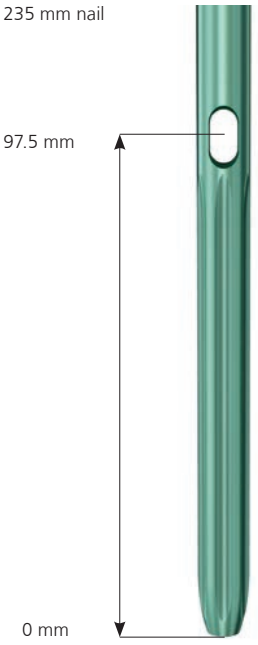
Angles
– 125°
– 130°
– 135°

Features of the short (170 mm and 235 mm) nails
– Proximal diameter of 17 mm
– Anatomic 6° lateral angle
– Distal diameters of 10 mm, 11 mm, 12 mm
– Preassembled locking mechanism for controlling rotation and amount of travel of the head element
– Static interlocking
– Universal design for left and right femurs





Distal locking slot accepts
4.9 mm locking bolts or
5.0 mm locking screws



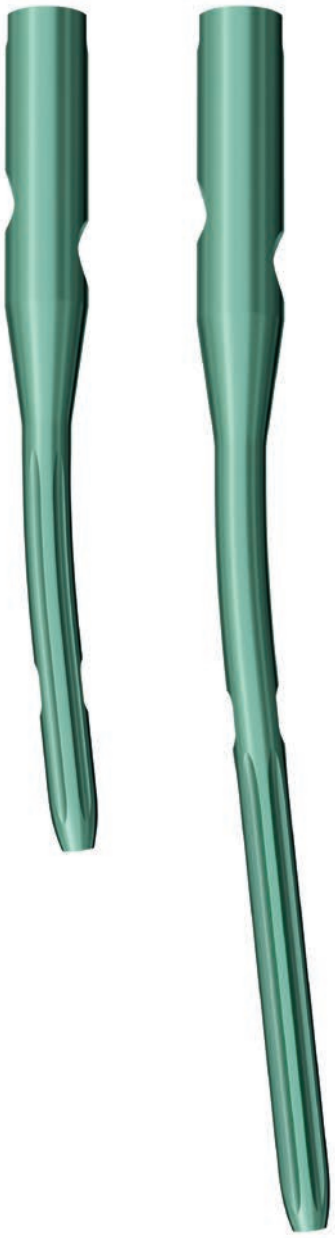
Distal locking slot accepts
4.9 mm locking bolts or
5.0 mm locking screws

TFN – Cannulated Trochanteric Fixation Nail, length 170 mm Titanium Alloy (TAN), green, sterile

	Diameter (mm)	Angle
456.314S	10	125°
456.315S	10	130°
456.316S	10	135°
456.317S	11	125°
456.318S	11	130°
456.319S	11	135°
456.321S	12	125°
456.322S	12	130°
456.323S	12	135°

TFN – Cannulated Trochanteric Fixation Nail, length 235 mm, Titanium Alloy (TAN), green, sterile

	Diameter (mm)	Angle
456.324S	10	125°
456.325S	10	130°
456.326S	10	135°
456.327S	11	125°
456.328S	11	130°
456.329S	11	135°
456.510S	12	125°
456.511S	12	130°
456.512S	12	135°



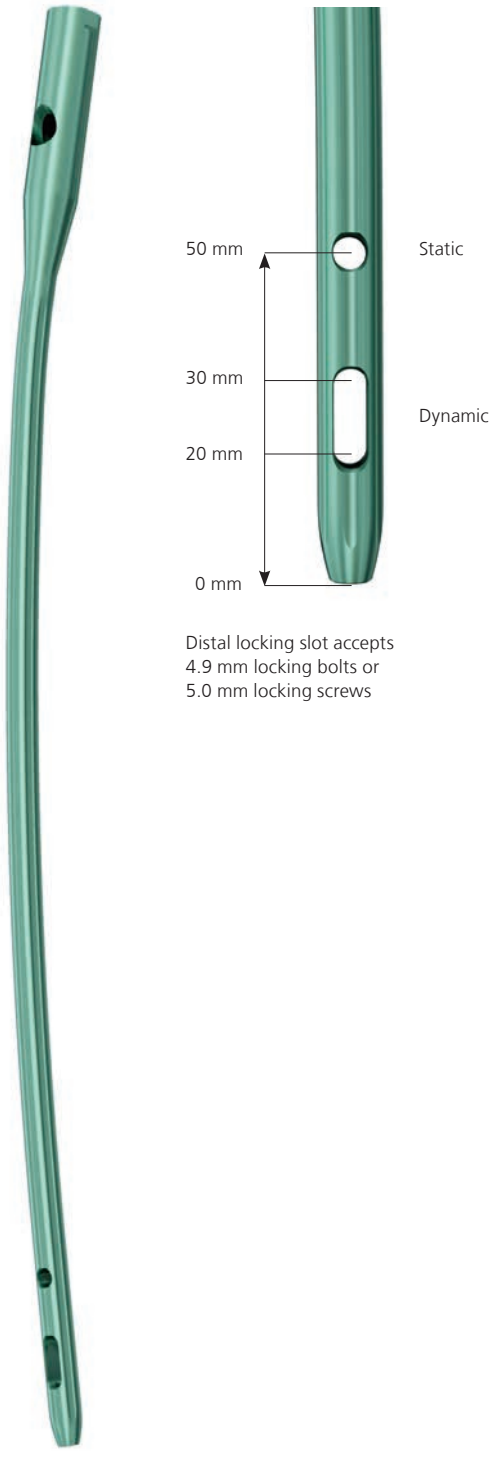
Titanium Trochanteric Fixation Nails (green) – Long

10 mm – 14 mm Cannulated Nails
300 mm – 460 mm lengths (20 mm increments)

Material
– Titanium-6% aluminum-7% niobium alloy

Angles
– 125°
– 130°*
– 135°

Features of the long (300 mm – 460 mm) nails
– Proximal diameter of 17 mm
– Anatomic 6° lateral angle
– Distal diameters of 10 mm, 11 mm, 12 mm and 14 mm
– Preassembled locking mechanism for controlling rotation and amount of travel of the head element
– Anatomic 1.5 m radius of curvature
– Static or dynamic interlocking with controlled dynamization of 10 mm
– Anatomic 10° anteversion
– Nail designs for both left and right femurs



* 14 mm diameter nails are available in 130° only

TFN – Cannulated Trochanteric Fixation Nail, length 300 – 400 mm, Titanium Alloy (TAN), green, sterile

10 mm distal dia. right	10 mm distal dia. left	Length (mm)	Angle	11 mm distal dia. right	11 mm distal dia. left	Length (mm)	Angle
456.330S	456.331S	300	125°	456.390S	456.391S	300	125°
456.332S	456.333S	320	125°	456.392S	456.393S	320	125°
456.334S	456.335S	340	125°	456.394S	456.395S	340	125°
456.336S	456.337S	360	125°	456.396S	456.397S	360	125°
456.338S	456.339S	380	125°	456.398S	456.399S	380	125°
456.340S	456.341S	400	125°	456.400S	456.401S	400	125°
456.342S	456.343S	420	125°	456.402S	456.403S	420	125°
456.344S	456.345S	440	125°	456.404S	456.405S	440	125°
456.346S	456.347S	460	125°	456.406S	456.407S	460	125°
456.350S	456.351S	300	130°	456.410S	456.411S	300	130°
456.352S	456.353S	320	130°	456.412S	456.413S	320	130°
456.354S	456.355S	340	130°	456.414S	456.415S	340	130°
456.356S	456.357S	360	130°	456.416S	456.417S	360	130°
456.358S	456.359S	380	130°	456.418S	456.419S	380	130°
456.360S	456.361S	400	130°	456.420S	456.421S	400	130°
456.362S	456.363S	420	130°	456.422S	456.423S	420	130°
456.364S	456.365S	440	130°	456.424S	456.425S	440	130°
456.366S	456.367S	460	130°	456.426S	456.427S	460	130°
456.370S	456.371S	300	135°	456.430S	456.431S	300	135°
456.372S	456.373S	320	135°	456.432S	456.433S	320	135°
456.374S	456.375S	340	135°	456.434S	456.435S	340	135°
456.376S	456.377S	360	135°	456.436S	456.437S	360	135°
456.378S	456.379S	380	135°	456.438S	456.439S	380	135°
456.380S	456.381S	400	135°	456.440S	456.441S	400	135°
456.382S	456.383S	420	135°	456.442S	456.443S	420	135°
456.384S	456.385S	440	135°	456.444S	456.445S	440	135°
456.386S	456.387S	460	135°	456.446S	456.447S	460	135°

TFN – Cannulated Trochanteric Fixation Nail, length 300 – 460 mm, Titanium Alloy (TAN), green, sterile

12 mm distal dia. right	12 mm distal dia. left	Length (mm)	Angle	14 mm distal dia. right	14 mm distal dia. left	Length (mm)	Angle
456.450S	456.451S	300	125°	456.630S	456.631S	300	130°
456.452S	456.453S	320	125°	456.632S	456.633S	320	130°
456.454S	456.455S	340	125°	456.634S	456.635S	340	130°
456.456S	456.457S	360	125°	456.636S	456.637S	360	130°
456.458S	456.459S	380	125°	456.638S	456.639S	380	130°
456.460S	456.461S	400	125°	456.640S	456.641S	400	130°
456.462S	456.463S	420	125°	456.642S	456.643S	420	130°
456.464S	456.465S	440	125°	456.644S	456.645S	440	130°
456.466S	456.467S	460	130°	456.646S	456.647S	460	130°
456.470S	456.471S	300	130°				
456.472S	456.473S	320	130°				
456.474S	456.475S	340	130°				
456.476S	456.477S	360	130°				
456.478S	456.479S	380	130°				
456.480S	456.481S	400	130°				
456.482S	456.483S	420	130°				
456.484S	456.485S	440	130°				
456.486S	456.487S	460	130°				
456.490S	456.491S	300	135°				
456.492S	456.493S	320	135°				
456.494S	456.495S	340	135°				
456.496S	456.497S	360	135°				
456.498S	456.499S	380	135°				
456.500S	456.501S	400	135°				
456.502S	456.503S	420	135°				
456.504S	456.505S	440	135°				
456.506S	456.507S	460	135°				

Instruments

03.010.405	Insertion Handle, radiolucent, for PFNA	
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	
03.010.427	Curved Awl ∅ 8.0 mm, for intramedullary Reduction	
03.010.471	Guide Wire Aiming Device Offset Block, 100 mm	
03.010.474	Connecting Screw, cannulated, for TFN, for No. 03.010.405	

03.010.475	Connector for Insertion Handle for PFNA	
03.019.030	Connecting Screw for MultiLoc Humeral Nailing System, for Nos. 03.019.008 and 03.019.012	
314.110	Holding Sleeve, large	
314.750	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove	
315.400*	Drill Bit ∅ 4.0 mm, length 195/170 mm, 3-flute, for Quick Coupling	
321.170	Pin Wrench ∅ 4.5 mm, length 120 mm	
321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm	
321.250	Spanner Wrench, for Nos. 357.180, 357.181, 359.201 and 359.219	

* Available nonsterile or sterile-packed.
Add "S" to catalog number to order sterile product.

351.050	Tissue Protector	
357.052	Compression Nut, for No. 357.048	
357.220	Hammer Guide, for No. 357.250	
357.250	Slide Hammer, for Nos. 357.220 and 357.221	
357.365	Aiming Arm for TFN, 125°	
357.366	Aiming Arm for TFN, 130°	
357.367	Aiming Arm for TFN, 135°	

357.369	Guide Sleeve for Helical Blade for TFN	
357.371	Buttress/Compression Nut, for No. 357.369	
357.372	Impactor for Helical Blade for TFN	
357.377	Connecting Screw for Helical Blade for TFN	
357.378	Extraction Instrument for Helical Blade for TFN	
357.381	Drill Sleeve 11.0/3.2, length 222 mm, for No. 357.369	
357.383	Trocar ∅ 3.2 mm, length 232 mm, for No. 357.381	
357.385	Measuring Device for Guide Wire ∅ 3.2 mm, for No. 357.399	
357.386	Protection Sleeve 11.0/8.0, for TFN	

357.387	Trocar ∅ 4.0 mm, length 176 mm, for No. 357.389	
357.389	Drill Sleeve 8.0/4.0, length 164 mm, for No. 357.386	
357.391	Radiographic Ruler for TFN	
357.392	Drill Sleeve 17.0/3.2, length 161 mm, for No. 357.410	
357.393	Trocar ∅ 3.2 mm, length 172 mm, for No. 357.392	
357.394	Drill Bit ∅ 17.0 mm, cannulated, length 300 mm, for Quick Coupling No. 511.760	
357.395	Connector for TFN, for No. 357.411	
357.396	Extraction Screw for TFN	
357.397	Connecting Screw, cannulated, for TFN	

357.398	Shaft, hexagonal ∅ 8.0 mm, cannulated, short, length 125 mm	
357.399	Guide Wire ∅ 3.2 mm, length 400 mm	
357.402	Depth Gauge for Locking Screws ∅ 5.0 mm	
357.403	Reamer ∅ 6.0/10.0 mm, cannulated, length 435 mm, for Quick Coupling No. 511.760	
357.404	Drill Bit ∅ 11.0 mm, conical, cannulated, length 280 mm, for Quick Coupling No. 511.760	
357.405	Fixation Sleeve	
357.406	Screwdriver, hexagonal, ∅ 5.0 mm, flexible	
357.407	Drill Bit ∅ 4.0 mm, calibrated, length 260/60 mm, 3-flute, for Quick Coupling	
357.410	Protection Sleeve 22.0/17.0, for No. 357.394	

357.411	Insertion Handle for TFN	
357.412	Awl for TFN	
357.413	Drill Sleeve 5.6/3.2, length 198 mm	
357.414	Socket, hexagonal, ∅ 11.0 mm, length 180 mm	
357.415	Shaft, hexagonal ∅ 5.0 mm, length 210 mm	

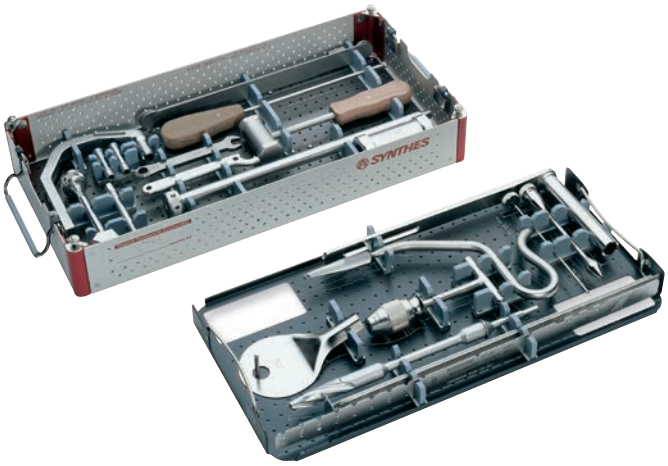
357.417	Flexible Hexagonal Screwdriver ∅ 5.0 mm, coated	
357.418	Percutaneous Insertion Handle for TFN	
357.419	Percutaneous Connecting Screw, cannulated	
357.420	Conical Extraction Bolt for TFN	
357.421	Extraction Screw Guide for TFN	
357.427	Screwdriver, hexagonal ∅ 5.0 mm	
357.428	Inserter/Extractor for TFN Femoral Neck Screw	
357.430	Tap/Reamer for TFN Femoral Neck Screw	

357.515	Screwdriver, hexagonal, with spherical head ∅ 8.0 mm	
357.920	Aiming Jig for “Miss-A-Nail” Technique for TFN	
360.253	Locking Device for Holding Sleeve No. 314.110	
360.255	Measuring Device for Reaming Rod for TFN	
393.100	Universal Chuck with T-Handle	
399.420	Hammer 500 g	

Titanium Trochanteric Fixation Nail Insertion Set

Graphic Case	
690.339	Graphic Case for TFN Insertion Instrument Set, without Contents

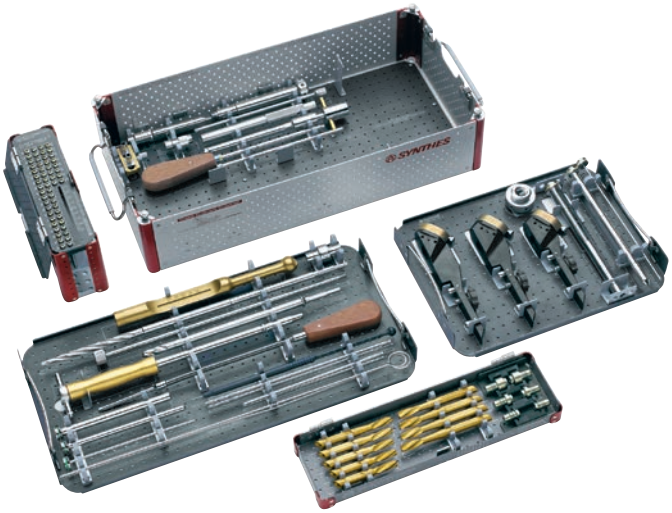
Instruments	
321.200	Ratchet Wrench for Nut, hexagonal, 11.0 mm
321.250	Spanner Wrench, for Nos. 357.180, 357.181, 359.201 and 359.219
351.050	Tissue Protector
357.220	Hammer Guide, for No. 357.250
357.250	Slide Hammer, for Nos. 357.220 and 357.221
357.391	Radiographic Ruler for TFN
357.392	Drill Sleeve 17.0/3.2, length 161 mm, for No. 357.410
357.393	Trocar ∅ 3.2 mm, length 172 mm, for No. 357.392
357.394	Drill Bit ∅ 17.0 mm, cannulated, length 300 mm, for Quick Coupling No. 511.760
357.395	Connector for TFN, for No. 357.411
357.397	Connecting Screw, cannulated, for TFN
357.398	Shaft, hexagonal ∅ 8.0 mm, cannulated, short, length 125 mm
357.399	Guide Wire ∅ 3.2 mm, length 400 mm
357.410	Protection Sleeve 22.0/17.0, for No. 357.394
357.411	Insertion Handle for TFN
357.412	Awl for TFN
357.515	Screwdriver, hexagonal, with spherical head ∅ 8.0 mm
360.255	Measuring Device for Reaming Rod for TFN
393.100	Universal Chuck with T-Handle
399.420	Hammer 500 g



Titanium Trochanteric Fixation Nail Locking Set

Graphic Case	
690.340	Graphic Case for TFN Locking Instrument Set, without Contents

Instruments	
314.110	Holding Sleeve, large
314.750	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove
315.400*	Drill Bit ∅ 4.0 mm, length 195/170 mm, 3-flute, for Quick Coupling
357.365	Aiming Arm for TFN, 125°
357.366	Aiming Arm for TFN, 130°
357.367	Aiming Arm for TFN, 135°
357.369	Guide Sleeve for Helical Blade for TFN
357.371	Buttress/Compression Nut, for No. 357.369
357.372	Impactor for Helical Blade for TFN
357.377	Connecting Screw for Helical Blade for TFN
357.378	Extraction Instrument for Helical Blade for TFN
357.381	Drill Sleeve 11.0/3.2, length 222 mm, for No. 357.369
357.383	Trocar ∅ 3.2 mm, length 232 mm, for No. 357.381
357.385	Measuring Device for Guide Wire ∅ 3.2 mm, for No. 357.399
357.386	Protection Sleeve 11.0/8.0, for TFN
357.387	Trocar ∅ 4.0 mm, length 176 mm, for No. 357.389
357.389	Drill Sleeve 8.0/4.0, length 164 mm, for No. 357.386
357.396	Extraction Screw for TFN
357.402	Depth Gauge for Locking Screws ∅ 5.0 mm



* Available nonsterile or sterile-packed.
Add "S" to catalog number to order sterile product.

357.403	Reamer ∅ 6.0/10.0 mm, cannulated, length 435 mm, for Quick Coupling No. 511.760
357.404	Drill Bit ∅ 11.0 mm, conical, cannulated, length 280 mm, for Quick Coupling No. 511.760
357.405	Fixation Sleeve
357.406	Scre wdriver, hexagonal, ∅ 5.0 mm, flexible
357.407	Drill Bit ∅ 4.0 mm, calibrated, length 260/60 mm, 3-flute, for Quick Coupling
357.408	Cleaning Stylet ∅ 3.2 mm
357.413	Drill Sleeve 5.6/3.2, length 198 mm
357.414	Socket, hexagonal, ∅ 11.0 mm, length 180 mm
357.415	Shaft, hexagonal ∅ 5.0 mm, length 210 mm
357.920	Aiming Jig for "Miss-A-Nail" Technique for TFN
360.253	Locking Device for Holding Sleeve No. 314.110

Titanium Trochanteric Fixation Nail Auxiliary Instrument Set

Graphic Case	
690.474	Graphic Case for TFN Auxiliary Instrument Set, without Contents

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
03.010.427	Curved Awl, 8 mm intramedullary reduction tool (for intramedullary reduction)
03.010.471	Guide Wire Aiming Device Offset Block, 100 mm
321.170	Pin Wrench ∅ 4.5 mm, length 120 mm
357.052	Compression Nut, for No. 357.048
357.418	Percutaneous Insertion Handle for TFN
357.419	Percutaneous Connecting Screw, cannulated
357.420	Conical Extraction Bolt for TFN
357.421	Extraction Screw Guide for TFN
357.427	Screwdriver, hexagonal ∅ 5.0 mm
357.428	Inserter/Extractor for TFN Femoral Neck Screw
357.430	Tap/Reamer for TFN Femoral Neck Screw

Also Available

Sets	
01.010.201	SureLock Instrument Set
105.309	Reamer/Irrigator/Aspirator Set
189.060	SynReam Intramedullary Reaming System in Vario Case
175.500	SynReam Instrument Set in SynCase

Instruments	
351.706S	Reaming Rod ∅ 2.5 mm, length 950 mm, with Olive, sterile
351.707S	Reaming Rod ∅ 2.5 mm, length 950 mm, with Olive and extension, sterile
394.350	Large Distractor, complete
399.430	Hammer 700 g

Power Equipment	
511.300	Radiolucent Drive
511.750	AO/ASIF Quick Coupling, for Compact Air Drive and Power Drive
511.761	Quick Coupling for DHS/DCS Triple Reamers
511.791	Quick Coupling for Kirschner Wires ∅ 0.6 to 3.2 mm, for Compact Air Drive and Power Drive
511.417	Drill Bit ∅ 4.0 mm with centering tip, length 148/122 mm, 3-flute, with Coupling for RDL
530.100	Power Drive
530.200	Battery for Power Drive
530.250	Sterile Cover for Power Drive, for No. 530.280
530.280	Battery Casing for Power Drive, for No. 530.200

MRI Information

Torque, Displacement and Image Artifacts according to ASTM F 2213-06, ASTM F 2052-06e1 and ASTM F2119-07

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 F2182-11a

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 thermo regulation 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.

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This publication is not intended for distribution in the USA.

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