Surgical Technique

smith&nephew

TRIGEN◇ META-NAIL◇

Retrograde Femoral Nail System

Including

TRIGEN◇ SURESHOT◇

Distal Targeting System

TRIGEN◇ META-NAIL◇ Retrograde Femoral Nail System Surgical Technique

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Nota Bene
The technique description herein is made available to the healthcare professional to illustrate the authors' suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient.

Indications

The TRIGEN® META-NAIL® Retrograde Femoral Nail is indicated for fractures of the femur including stable and unstable distal metaphyseal fractures, diaphyseal fractures, intraarticular fractures, periprosthetic fractures, nonunions, malunions and for the prophylactic nailing of impending pathological fractures.

TRIGEN® SURESHOT® indications

Legend

Important warnings appear in orange

Tips, tricks and important information appear in blue

Indications, contraindications, intended use and training

The Smith & Nephew TRIGEN SURESHOT Distal Targeting System is intended to be an intraoperative image-guided localization system. It is a computer-assisted orthopaedic surgery tool to aid the surgeon with drill positioning for screws during intramedullary nail implantation. It provides information to the surgeon that is used to place surgical instruments during surgery utilizing intraoperatively obtained electromagnetic tracking data. The Smith & Nephew TRIGEN SURESHOT Targeting System is indicated for long bone fractures treated with intramedullary nails in which the use of stereotactic surgery may be appropriate.

An example of a surgical procedure includes but is not limited to locating and drilling the distal holes in an intramedullary nail.

Contraindications

The screw targeting software application for this system is contraindicated for all IM nails other than Smith & Nephew TRIGEN META-NAIL®, TAN®, FAN, Humeral, Pediatric and Adolescent nails. Do not operate the TRIGEN SURESHOT Targeter within 200mm of an installed pacemaker. The magnetic field produced by the Targeter may interfere with the operation of the pacemaker.

Intended use

The TRIGEN SURESHOT Distal Targeting System is only designed for use with the indicated implants and instruments. Implants and instruments must be used in accordance with the instructions, as described in this manual and/or in the non-navigated surgical procedure.

Training

Only trained operators are allowed to use the TRIGEN SURESHOT Distal Targeting System. The various operating instructions must be fully read and understood as part of the training. If any part of the instructions is unclear, please contact your local Smith & Nephew representative.

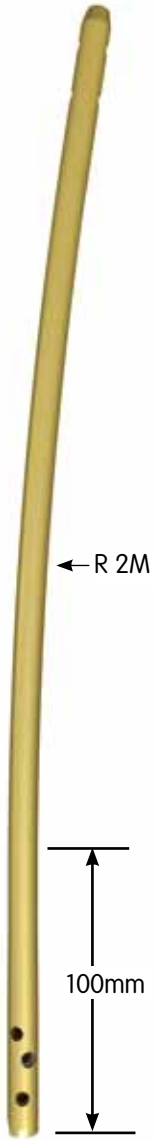
Plausibility check

As with all technical equipment, malfunctions may occur due to improper use or, more rarely, technical failure. To reduce the risks involved with such technical malfunction the operation can be completed using manually controlled instruments, providing the malfunction is detected without delay.

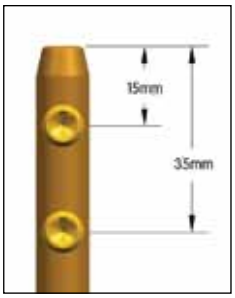
It is, therefore, important to check the plausibility of the steps, as indicated by the system, and to carry out verification of the software targeting, particularly when using the system for the first time. Should there be any doubt regarding correct functioning, the targeting should be verified or a switch made to a traditional X-Ray technique.

Refer to the SURESHOT User Manual (7118-1540) for details about the SURESHOT Distal Targeting System.

TRIGEN® META-NAIL® Retrograde Femoral Nail Specifications

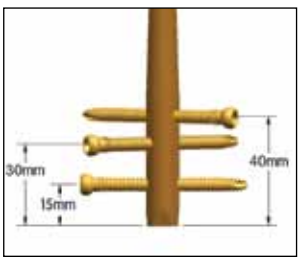


ML view



Non-driving end of nail

Top view of nail



Driving end of nail

Note These views are not to scale and should be used as a pictorial representation only.

Specifications	TRIGEN META-NAIL Retrograde Femoral
Material	TI6AL4V
Diameter	10, 11.5 & 13mm
Lengths	18-50cm*
Nail Color	Gold
Cross Section	Round
Distal Diameter (driving end)	12mm (10, 11.5 dia) 13mm (13 dia)
Proximal Diameter (non-driving end)	10, 11.5 & 13mm
Smallest Thru Diameter	5.0mm
Wall Thickness	2.3mm (10 dia) 3.0mm (11.5 dia) 2.3mm (13 dia)
Guide Bolt Thread	5/16-24 UNF
Screw Diameter	5.0mm
Screw Color	Gold
Major Diameter	5.0mm
Minor Diameter (core)	4.3mm
Screw Lengths	25-110mm
Hex Size	4.7mm
Alternative Hexdrivers	RT Femoral & Recon 7.0mm Cannulated Screw PERI-LOC® 4.7mm Hexdriver, PROFIX® 4.7mm Hexdriver
Alternative Modes	No
Distal Locking (Driving End)	
Static Lock Locations/Orientations	15mm/ML - Threaded, Can be locked with META-NAIL Cap 30mm/25° - Threaded w/bushing 40mm/25° - Threaded w/bushing
Static Locking Hole Dimensions	Threaded 4.5mm minor dia. Threaded 5.3mm major dia.
Proximal Locking (Non-Driving End)	
Static Lock Locations/ Orientations	15mm/AP 35mm/AP
Static Locking Hole Dimensions	5.3mm
Proximal Screw Hole Diameter	5.3mm
AP Bow Radius	2M
AP Bow Location	Starts 100mm from Driving End

* Set does not include all sizes; Additional sizes may be special order only

Surgical technique

Patient positioning

Position the patient supine on a radiolucent table. Flex the affected limb approximately 45° over a posterior support to assist with fracture reduction. Check for length and rotation by comparison to the unaffected limb.

Rotate the C-Arm to ensure optimal AP and lateral visualization of the entire femur. The C-Arm should be able to freely access the femur up to and including the intertrochanteric area. A distraction device may also be applied to obtain and/or maintain traction.

Intraarticular fracture components should be addressed with interfragmentary screw fixation prior to nail insertion. Care should be taken to place the screws in the anterior and posterior aspect of the distal femur and safely out of the nail's intended path.

Note Cannulated screw guide wires allow for confirmation of definitive screw placement prior to fracture fixation and nail insertion.

Use a bolster or radiolucent triangle to maintain limb position. Rotate the C-Arm to ensure optimal AP and lateral visualization of the entire femur. A distraction device may also be applied to obtain and/or maintain traction.

Caution Do not use a metal bump because it will adversely affect the accuracy of the TRIGEN® SURESHOT® system.

Warnings and cautions for TRIGEN® SURESHOT®

Refer to the SURESHOT User Manual (7118-1540) for all warnings, cautions, maintenance, cleaning and sterilization instructions.

Devices for system set up

Trauma Interface
Cat. No. 7169-2802

Power Cord
Cat. No. 6680-0193

TRIGEN® SURESHOT® Targeter
Cat. No. 7169-2801

Note The Targeter will be operated within the sterile field and may have contact with the skin of the patient. The drill sleeve inserts will be used in the incision and have direct bone contact.

Note Verify that the Targeter housing is not damaged (holes, tears, cracks). If the housing or the connector is damaged, the Targeter is no longer safe to use.

Note If the Targeter is not recognized after connection to the system, the Targeter is defective and must be exchanged. (See also instrument connection).

Note Broken or damaged instruments must be exchanged immediately and sent back to Smith & Nephew, Inc.

Note This device is provided non-sterile and must be cleaned and sterilized per Cleaning and Sterilization (Smith & Nephew document 7138-1339) prior to use.

WARNING: The maximum temperature of the Targeter body can reach 47° Celsius at ambient room temperatures above 30° C. The Targeter body should not remain in constant contact with a patient's exposed skin for more than one minute.

Trauma Interface setup

After the sterile areas have been established, place the Trauma Interface (7169-2802) in the desired non-sterile location and turn on the power switch.

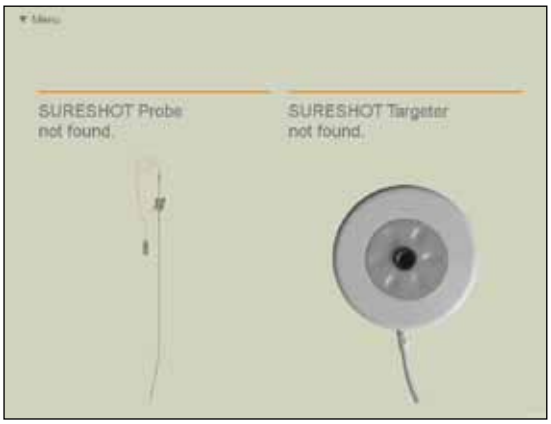
CAUTION: No other electrical devices should be placed near the Trauma Interface. See the "Guidance and Manufacturer's Declaration – Separation Distances" table at the end of this document.

Note If the Trauma Interface does not power on, make sure the switch is in the "on" position.

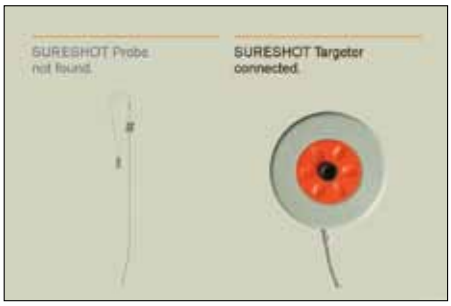
Note The means for mains disconnection of power to the Trauma Interface is the appliance inlet located below the power switch. The Trauma Interface should not be positioned such that it is difficult to reach this location.

TRIGEN® SURESHOT® Targeter connection

When the display prompts for tool connections, connect the TRIGEN SURESHOT Targeter (7169-2801) to the Targeter port on the Trauma Interface.



Surgical procedure – OR preparation



The SURESHOT Targeter will change color to orange upon successful connection to the Trauma Interface.

CAUTION: The Targeter body may have contact with the patient and must remain in the sterile field at all times. Only the cable and connector may be removed from the sterile field.

CAUTION: Connect the Targeter at least 10 minutes prior to targeting in order to ensure proper accuracy.

Note When oriented as shown, the connector should assemble easily. Do not force the connector into the port.

Note If the Targeter is properly connected to the system and the application remains in this screen for more than 30 seconds, the Targeter may have been damaged during cleaning/sterilization. In this case another Targeter has to be used.

Note It is possible at any time to disconnect and reconnect tools when the application is running. The display will show a screen reporting the missing instrument.

Instruments for opening the distal femur

3.2mm Tip Threaded Guide Wire
Cat. No. 7163-1690

12.5mm Entry Reamer
Cat. No. 7163-1116

Mini Connector
Cat. No. 7163-1186

T-handle
Cat. No. 7167-4076

Honeycomb
Cat. No. 7167-4075

Entry Portal Tube
Cat. No. 7167-4060

Entry Portal Handle
Cat. No. 7167-4092

3.2mm T-handle Trocar
Cat. No. 7167-4074

Cannulated Awl
Cat. No. 7167-4000

Incision and entry point

Assemble the Honeycomb (7167-4075), Entry Portal Handle (7167-4092) and Entry Portal Tube (7167-4060). The pieces will lock in place securely at either 0° or 180°.

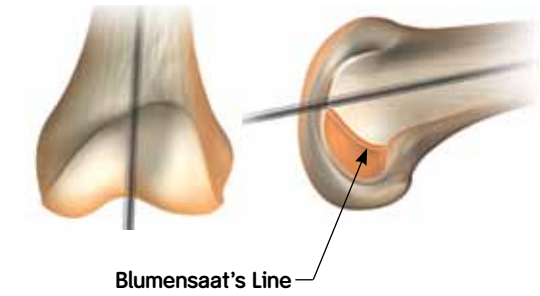
A 3-4cm midline incision is made followed by a medial parapatellar capsular incision to expose the intercondylar notch. Gently retract the patellar tendon laterally.

The entry point is located within the intercondylar notch just anterior and lateral to the femoral attachment of the posterior cruciate ligament.

Entry portal acquisition

Attach a 3.2mm Tip Threaded Guide Wire (7163-1690) to the drill via the Mini Connector (7163-1186) and insert 6-8cm into the distal femoral metaphysis. The Entry Portal Instrumentation serves as a soft-tissue protector.

The guide wire should be in line with the femoral axis in the AP view and anterior to Blumensaat's Line in the lateral view.



In the instance of suboptimal wire placement, rotate the Honeycomb within the Entry Tube to the desired location and insert another 3.2mm Tip Threaded Guide Wire.

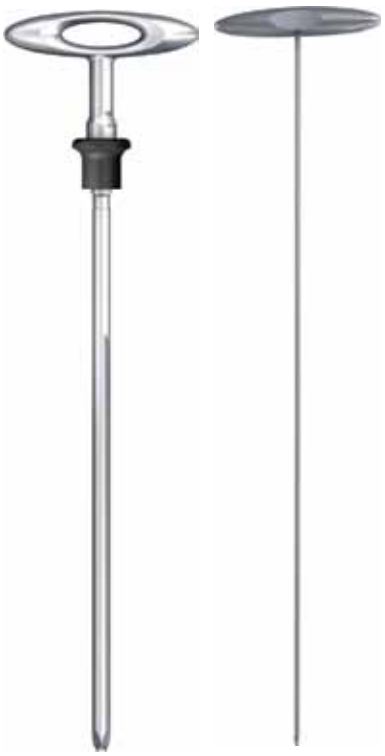
Entry portal

After definitive Guide Wire placement, remove the Honeycomb from the Entry Tube along with any additionally inserted Guide Wires and attach the 12.5mm Entry Reamer (7163-1116) to power. Advance over the Guide Wire through the Entry Tube to a depth of 6-8cm.

Check position via radiographic imaging and then remove the 12.5mm Entry Reamer and 3.2mm Tip Threaded Guide Wire.

Alternative technique: Entry portal

Attach the T-handle (7167-4076) to the Cannulated Awl (7167-4000) and insert into the distal femur to a depth of 6-8cm. Introduce the 3.2mm T-handle Trocar (7167-4074) into the back of the assembly prior to insertion in order to prevent awl slippage and accumulation of cortical bone within the cannulation.



Cannulated Awl with T-handle

3.2mm T-handle Trocar

Instruments for fracture reduction and reaming

Entry Portal Tube
Cat. No. 7167-4060

Entry Portal Handle
Cat. No. 7167-4092

Gripper
Cat. No. 7163-4080

Ruler
Cat. No. 7167-4079

T-handle
Cat. No. 7167-4076

Reamer Heads
Cat. No. 7111-8231–8242

Obturator
Cat. No. 7167-4078

Reamer Shaft
Cat. No. 7111-8200

Reducer
Cat. No. 7167-4077

3.0mm Ball Tip Guide Rod
Cat. No. 7163-1626

Fracture reduction

Insert the back end of the 3.0mm Ball Tip Guide Rod (7163-1626) into the front of the Gripper (7167-4080) and gently close the trigger grip. Connect the Reducer and Reducer Connector (7167-4077) so that the words “Slot Orientation” are in line with the opening at the tip. Complete the assembly by connecting it to the T-handle (7167-4076).

Note If blocking screws are desired at this point in the procedure, refer to the blocking screws technique section (pp. 43-49).

Advance the Reducer into the intramedullary canal and use the curved tip to direct the 3.0mm Ball Tip Guide Rod past the fracture into the region of the proximal femur.

The guide rod should be center-center in the AP and lateral views.

Reducer removal

Once the guide rod is at the desired depth, detach the Gripper and remove the Reducer from the femoral canal. Slide the Obturator (7167-4078) into the back of the T-handle during extraction in order to maintain guide rod position within the canal.

Implant measurement

After Reducer removal, reconfirm guide rod placement within the proximal femur and slide the Ruler (7167-4079) over the guide rod to the desired depth. The metal tip of the Ruler denotes the driving end of the META-NAIL◇ Retrograde Femoral Nail.

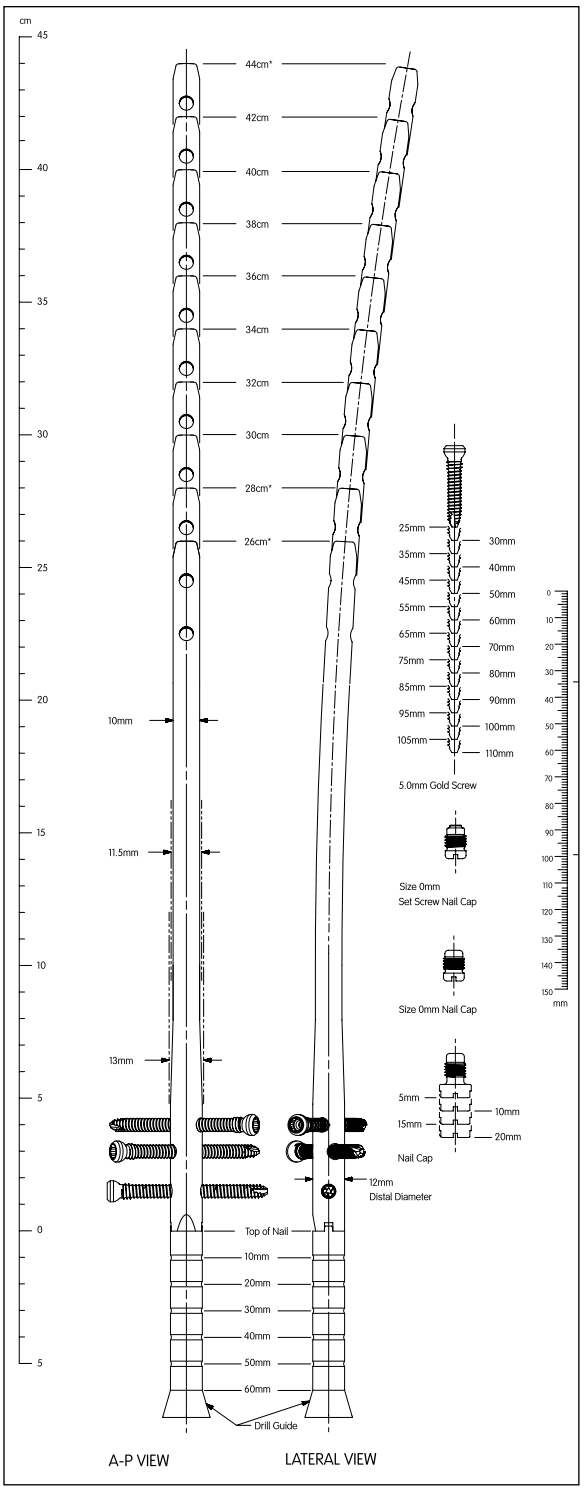
Confirm guide rod position in the window at the opposite end of the Ruler as shown in order to ensure accurate implant measurement. Push down on the top of Ruler until contact is made with the 3.0mm guide rod. Implant length is read from the exposed calibrations at the end of the Ruler.

Note Implant length selection should take into consideration the fact that the nail must be countersunk past the articular surface of the distal femur.

Note Confirm that the Ruler opens easily and adjust the thumb-wheel connection at the end to allow for free movement.

Unreamed technique

Radiographic templating is used to determine nail size. The appropriate diameter implant will provide translational fill within the isthmus of the intramedullary canal. Generally, selection of a nail at least 1-1.5mm less than the narrowest canal measurement on the lateral radiograph assists in avoiding implant incarceration during insertion.



TRIGEN® META-NAIL® Femoral Retrograde Nail Radiographic Template
Cat. No. 7118-0811

Reamed technique

Radiographic templating and intraoperative measurement will determine nail size. Beginning with the 9.0mm Front Cutting Reamer Head (7111-8231) and Flexible Reamer Shaft (7111-8200), ream the intramedullary canal sequentially in half millimeter increments to a size 1-1.5mm larger than the selected nail size.

Ensure guide rod placement during reaming by inserting the Obturator into the back of the Reamer unit during retraction. Continue to confirm Guide Rod placement in the proximal femur throughout reaming. Periodically move the Reamer back and forth in the canal to clear debris from the cutting flutes.

Instruments for nail assembly and insertion

Guide Bolt Wrench
Cat. No. 7163-1140

META-NAIL Drill Guide
Cat. No. 7165-4502

Guide Bolt Long
Cat. No. 7165-4506

Cannulated Impactor-Short
Cat. No. 7165-4554

T-handle
Cat. No. 7167-4076

META-NAIL Standard Drill Guide Probe
Cat. No. 7169-2814

Guide Bolt Wrench
Cat. No. 7163-1140

META-NAIL° Anterior Drop
Cat. No. 7165-4501

9.0mm Drill Sleeve
Cat. No. 7163-1152

4.0mm Drill Sleeve
Cat. No. 7167-4083

4.0mm Long Pilot Drill*
Cat. No. 7163-1110

Cannulated Impactor-Medium
Cat. No. 7167-5081

Slotted Hammer
Cat. No. 7167-4082

META Set Stop
Cat. No. 7169-2806

* 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Nail assembly

Attach the META-NAIL® Drill Guide (7165-4502) to the nail with the Guide Bolt Long (7165-4506) and tighten with the Guide Bolt Wrench (7163-1140) and T-handle. The nail is correctly aligned when:

1. The line on the insertion barrel matches the line on the back of the nail.
2. The “A” on the nail matches the “A” on the insertion barrel.
3. The apex of the nail’s AP Bow and the drill guide itself are oriented anterior.

The bevel on the front of the nail marks the connection to the drill guide and can be seen in the lateral view as a means for determining distal insertion depth.

Note: Do not use the META-NAIL Extension Drill Guide to insert the Retrograde Femoral Nail as the Insertion Barrel is too short to allow for adequate countersinking of the nail. It is recommended to use the standard drill guide and Long Guide Bolt due to the longer Insertion Barrel.

Attach the Anterior Drop (7165-4501) to the drill guide and verify targeting accuracy by inserting a gold 9.0mm Drill Sleeve (7163-1152) and silver 4.0mm Drill Sleeve (7167-4083) into the Drop and passing a 4.0mm Long Pilot Drill (7163-1110)* through the assembly. An incorrectly attached nail will not target.

Refer to SURESHOT® User Manual for the Field Accuracy check instructions.

* 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Surgical procedure – after IM Nail Assembly to the Drill Guide

Probe selection and assembly

Assemble the appropriate probe and set the stop for the the TRIGEN® IM Nail and Drill Guide that will be used.

CAUTION: Proper orientation of the probe to the set stop as shown is required. Failure to do so may result in inaccurate targeting.

TRIGEN SURESHOT® META-NAIL® Standard Drill Guide Probe (7169-2814)

Red probe
Use only with META-NAIL Standard Drill Guide (7169-2814)

For META-NAIL, notches should face anteriorly

Set the probe to the length of the TRIGEN IM Nail.

Probe connection

Connect the probe to either of the probe sensor ports on the Trauma Interface.

Confirm that the tool connection has been verified.

Note When oriented as shown, the connector should assemble easily. Do not force the connector into the port. Simply try rotating the connector until the keys are oriented in the 12 o'clock position.

Note If the probe is properly connected to the system and the application reports "Probe not found" for more than 10 seconds, the probe may be damaged or defective. In this case, the probe has to be exchanged.

Note It is possible at any time to disconnect and reconnect tools when the application is running. The display will show a screen reporting the missing instrument.

Surgical procedure – after IM Nail Assembly to the Drill Guide

Drill sleeve selection

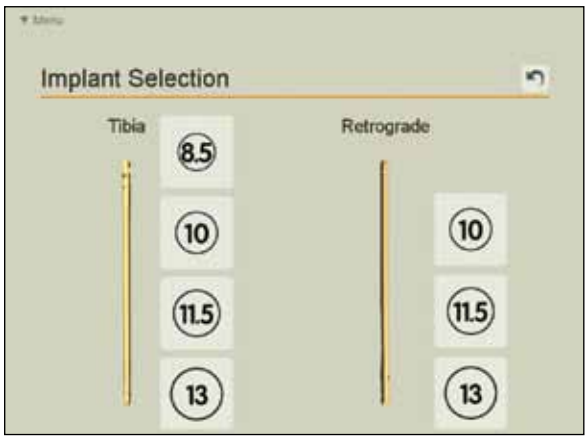
Select the length of the drill sleeve (7169-2804, 7169-2805, or 7169-1165 and 7169-1166) that will be used.

A different sleeve can be selected at any time during the procedure by choosing the drill sleeve option from the drop down menu OR by pressing the drill sleeve tab located in the lower right corner of the navigation screen.

Implant selection screen

Select the TRIGEN® IM Nail and size that will be used.

META-NAIL®



Note A different TRIGEN IM Nail and/or size can be selected at any time during the procedure by choosing the Implant option from the drop down menu OR by pressing the implant tab located in the lower left corner of the navigation screen.

Surgical procedure – after IM Nail Assembly to the Drill Guide

Drill sleeve attachment

Tightly secure the selected drill sleeve to the Targeter.

Note The short, long and long combo drill sleeves (7169-2805, 7169-2804, and 7169-1166) can be loosened from the Targeter using the slot in the TRIGEN® Hammer (7167-4082).

Nail insertion

Detach wing and set stop and attach impactor

Remove the Anterior Drop and attach the Cannulated Impactor-Medium (7167-5081) to the drill guide. Orient the drill guide assembly in the AP position and advance the nail over the guide rod by light blows from the Slotted Hammer (7167-4082) to the desired depth.

Additional reaming of the intramedullary canal may be necessary if excessive force is required to insert the nail.

Verify fracture reduction as the nail crosses the fracture site paying close attention to rotation, length, alignment, distraction and/or shortening. Check final nail position in both the AP and lateral views for correct alignment.

Check nail depth

Distal

In the AP and lateral views, confirm nail position within the distal femur. The notch at the nail/drill guide junction will be visible in the lateral. Each gauge on the insertion barrel represents a 10mm depth interval.

Proximal

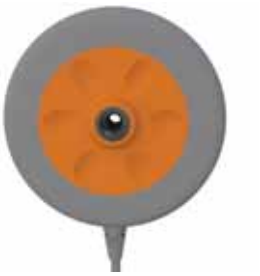
In the AP view, confirm that the nail has been inserted to the desired depth. Femoral fractures should be treated with the longest nail possible in order to reduce the likelihood of stress risers. Remove the guide rod once the nail has been fully seated and attach the Anterior Drop.

Note Following nail insertion, confirm that the nail and drill guide are securely connected as hammering can loosen the Guide Bolt.

Devices to lock distally

Trauma Interface
Cat. No. 7169-2802

Power Cord
Cat. No. 6680-0193



TRIGEN° SURESHOT° Targeter
Cat. No. 7169-2801

Inner Drill Sleeve, Long
Cat. No. 7169-1165

Outer Screw Sleeve, Long
Cat. No. 7169-1166

Drill Sleeve, Long
Cat. No. 7169-2804

Drill Sleeve, Short
Cat. No. 7169-2805

AO Drill Bit, Short
Cat. No. 7169-2810

AO Drill Bit, Long
Cat. No. 7169-2811

Hexdriver
Cat. No. 7169-2809

META Set Stop
Cat. No. 7169-2806

META-NAIL° Standard Drill Guide Probe
Cat. No. 7169-2814

Note When the Targeter is out of the preferred range or there is metal or electrical interference, the green and red Targeter circles on the Trauma Interface screen may become unstable and/or a warning message will be displayed. If the interference is excessive, the IM nail image on the Trauma Interface screen will disappear. If interference cannot be avoided, a standard X-Ray technique must be used.

Note All tool cables should be uncoiled completely and any excess cables should be kept out of the Targeter measurement volume.

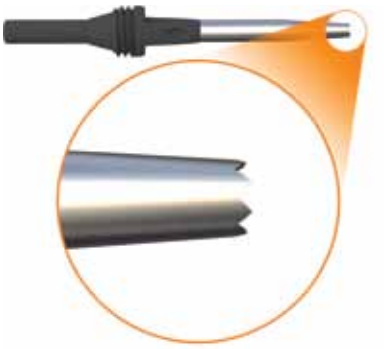
Detach Cannulated Impactor-Medium (7167-5081) from drill guide. Reattach META Set Stop (7169-2806) and insert META-NAIL° Standard Drill Guide Probe (7169-2814) in the nail. Adjust probe to nail length.

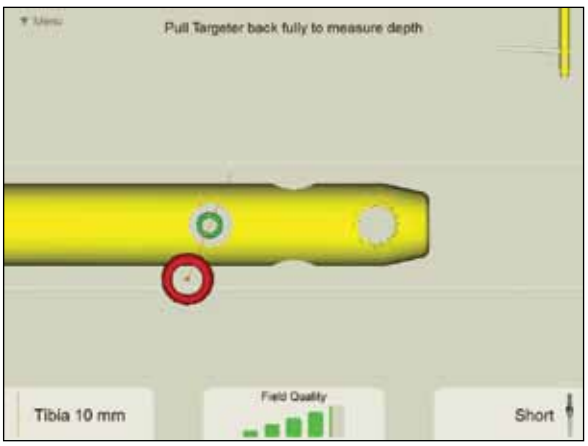
Skin incision

Use serrated tip of Drill Sleeve to identify where to make incision. The tip is at the right position when the green circle is aligned with the desired hole on screen.

Make incision and place tip of the drill sleeve down to bone where the green circle is aligned directly over the hole on screen.

Note No X-Rays necessary.





Targeting the locking hole

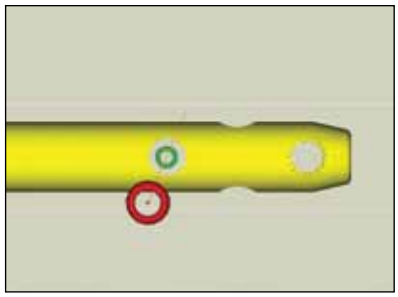
With the appropriate length TRIGEN® SURESHOT® 4.0mm Drill Bit (7169-2810 or 7169-2811) inserted into the Targeter, insert the tip of the drill sleeve (represented by the green circle) through the incision and down to bone.

Critical Verify there are no other metal objects (including metal triangles) in the field. Metal interference will cause the system to be inaccurate.

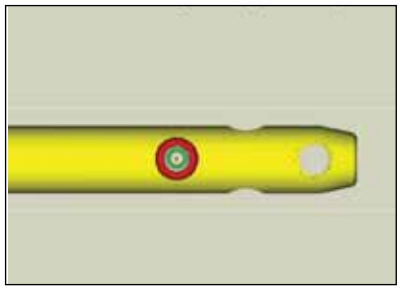
Perfect circles

Align the tip of the drill sleeve over the desired hole in the nail. This will be represented on the screen when the green circle is centered in the hole as shown. Push serrated tip firmly against bone to keep the green circle static on the screen.

Note The orientation of the view is determined based on the orientation of the Targeter relative to the implant. For example, if the desired hole to target is an AP hole, direct the Targeter generally on the Anterior side of the leg. For more options, please see section: "Trauma Interface Screen Operation."



Adjust the trajectory (represented by red line between two circles) of the red circle until both circles are concentric and centered with the desired hole on the screen. Then start drilling.



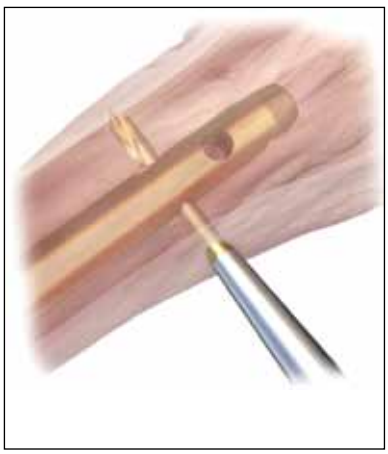
Note The green ring must be fully within the hole of the IM nail displayed on the Trauma Interface screen to ensure accurate drilling.

Drilling distal hole

Drill through near cortex and the nail using the TRIGEN® SURESHOT® 4.0mm Drill Bit (7169-2810 or 7169-2811). Before drilling through far cortex, obtain the screw measurement.

Note Important: if standard 4.0mm drill from TRIGEN set is used, magnetic metal can adversely affect accuracy causing the drill to miss. Verify there is no other magnetic metal object in area other than the items shown.

A note will appear on screen warning of compromised targeting field, if magnetic metal is close. If it is in the field, image disappears.



Drill Depth Measurement
Refer to User Manual Page 16 and 17 for drill depth measurements.

Screw insertion

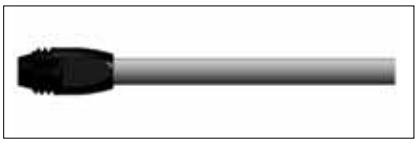
Using the TRIGEN® SURESHOT® Hexdriver (7169-2809), the screw may be inserted using the Targeter.

WARNING The standard TRIGEN Hexdrivers are made from magnetic stainless steel that will cause interference with the system and cannot be used.

Using the Combo Drill Sleeve

TRIGEN SURESHOT Inner Drill Sleeve, Long
Cat. No. (7169-1165)

TRIGEN SURESHOT Outer Screw Sleeve, Long
Cat. No. (7169-1166)



1. While holding the Targeter to bone, remove the SURESHOT Inner Drill Sleeve-Long (7169-1165) from the SURESHOT Outer Screw Sleeve-Long (7169-1166).
2. Use the TRIGEN SURESHOT Hexdriver (7169-2809) to insert the appropriate length screw through the SURESHOT Outer Screw Sleeve-Long.
3. When screw insertion is complete, remove the probe from the IM nail.

Instruments for standard, dynamic and compression locking

Screw Length Sleeve
Cat. No. 7167-4085

Nail Cap Set Screw
Cat. No. 7165-6000

META-NAIL° Anterior Drop
Cat. No. 7165-4501

Medium Hexdriver
Cat. No. 7163-1066

Mini Connector
Cat. No. 7163-1186

4.0mm Drill Sleeve
Cat. No. 7167-4083

9.0mm Drill Sleeve
Cat. No. 7163-1152

Screwdriver Release
Cat. No. 7167-4084

4.0mm Long Pilot Drill*
Cat. No. 7163-1110

T-handle
Cat. No. 7167-4076

Universal META-NAIL Compression Driver
Cat. No. 7165-4528

4.0mm Short Drill**
Cat. No. 7163-1117

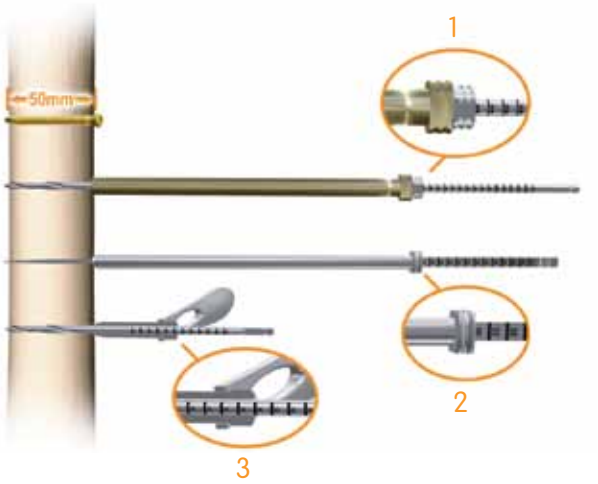
Screw Depth Gauge
Cat. No. 7163-1189

* 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)
** 4.0mm Short Drill (7163-1117) is interchangeable with 4.0mm AO Short Drill (7163-1123)

Locking screw measurement

There are three methods:

1. Gold 9.0mm Drill Sleeve, silver 4.0mm Drill Sleeve and 4.0mm Long Pilot Drill*.
2. Screw Depth Gauge (7163-1189).
3. Long Screw Length Sleeve (7165-4520) and 4.0mm Long Pilot Drill*.



Locking screw insertion

Distal locking options include three statically locked threaded holes that are targeted through the orange and green color-coded holes on the Anterior Drop.

Proximal locking options include two statically locked, nonthreaded AP holes.

Gold 5.0mm locking screws are compatible with 10, 11.5 and 13mm diameter nails.

Note The 4.0mm Short Step Drill (7164-1123) may be used to drill for a gold 5.0mm locking screw in the instance of hard cortical bone. The 4.7-4.0mm width transition facilitates easier screw insertion without compromising purchase.

*4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Note Make sure to remove probe before proximal locking.

Distal locking without the use of TRIGEN® SURESHOT®

Make a small incision at the site of screw entry and insert the gold 9.0mm Drill Sleeve and silver 4.0mm Drill Sleeve through the desired slot on the Anterior Drop down to bone. Drill both cortices with the 4.0mm Long Pilot Drill*.

Measure for screw length using either the calibrations on the 4.0mm Long Pilot Drill* or by removing the 4.0mm Drill Sleeve and using the Screw Depth Gauge. Attach the appropriate length screw to the end of the Medium Hexdriver (7163-1066) and insert through the gold 9.0mm Drill Sleeve on power until the laser etched ring on the Hexdriver reaches the back of the Drill Sleeve. Attach the T-handle to the Hexdriver and tighten the screw by hand.

*4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Proximal locking without the use of TRIGEN° SURESHOT°

Proximal locking is performed in the AP plane using a free-hand technique. Confirm fracture reduction and align the C-Arm over the desired locking hole. Obtain a “perfect circle” image of the locking hole and use a blunt object to approximate the location of the locking hole by dimpling the skin.

Make a stab incision at the site, insert the 4.0mm Long Pilot Drill*, and drill both cortices. Measure for screw length using the Screw Depth Gauge. Alternatively, leave the 4.0mm Long Pilot Drill* in place, insert the Long Screw Length Sleeve down to bone, and read the exposed calibrations off the drill. Insert the appropriate length screw using the Medium Hexdriver/T-handle assembly.

Instruments for blocking screw insertion

Retrograde Femoral Blocking Screw Attachment
Cat. No. 7165-4508

11.0mm T-handle Awl
Cat. No. 7165-4522

T-handle
Cat. No. 7167-4076

8.5mm/10.0mm Screw Cartridge
Cat. No. 7165-4511

11.5mm/13.0mm Screw Cartridge
Cat. No. 7165-4513

Offset Blocking Screw Cartridge
Cat. No. 7165-4514

Blocking Screw Alignment Pin
Cat. No. 7165-4523

4.0mm Long Pilot Drill*
Cat. No. 7163-1110

4.0mm Drill Sleeve
Cat. No. 7163-1156

9.0mm Drill Sleeve
Cat. No. 7163-1152

Medium Hexdriver
Cat. No. 7163-1066

Blocking Screw Device
Cat. No. 7165-4515

Mini Connector
Cat. No. 7163-1186

* 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Blocking screw technique

Incision and entry point

A 3-4cm midline incision is made followed by a medial parapatellar capsular incision to expose the intercondylar notch. Gently retract the patellar tendon laterally.

The entry point is located within the intercondylar notch just anterior and lateral to the femoral attachment of the posterior cruciate ligament.

Entry portal acquisition

Insert the 11.0mm T-handle Awl (7165-4522) manually to a depth just distal to the fracture.

Note When creating the initial entry point, pay close attention to the trajectory of the Awl and the relationship to the anatomic axis of the femur. Correct Awl trajectory in the distal fragment must be established prior to alignment with the anatomic axis of the proximal fragment. This will ensure accurate fracture reduction when the nail is inserted.

AP blocking screw insertion

In order to prevent varus or valgus malalignment of the distal fragment, blocking screws may be placed in the AP plane. Attach the Blocking Screw Device (7165-4515) to the 11.0mm T-handle Awl and move it into the desired position in the AP plane.

Note The Blocking Screw Alignment Pins (7165-4523) can be screwed into the three (3) threaded holes on the metal handle of the Blocking Screw Device to serve as external points of reference during fracture alignment.

Tighten the device to the Awl and insert the appropriate Blocking Screw Cartridge (7165-4511, 7165-4513, 7165-4514). Adjust the Cartridge proximally or distally within the Blocking Screw Device to determine blocking screw position.

Insert the gold 9.0mm Drill Sleeve and silver 4.0mm Drill Sleeve into the desired cartridge hole and down to bone. Drill both cortices with the 4.0 mm Long Pilot Drill*. Screw length is determined by reading the exposed drill bit calibrations or by removing the 4.0mm Drill Sleeve and measuring with the Screw Depth Gauge. Insert the screw with the Medium Hexdriver/T-handle assembly until the screw engages the far cortex.

Note Use caution during drilling and insertion of blocking screws in the AP plane. Plunging the drill bit past the posterior cortex or insertion of a screw that is too long may damage neurovascular structures located posterior to the distal femur.

* 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)

Following implantation of the distal blocking screw and fracture reduction, pass the 11.0mm T-handle Awl into the proximal fragment.

Reposition either the Blocking Screw Cartridge or the Awl as necessary and follow the previously described technique for blocking screw insertion.

ML blocking screw insertion

In order to prevent anterior or posterior malalignment of the distal fragment, blocking screws may also be placed in the ML plane. Attach the Blocking Screw Device to the 11.0mm T-handle Awl and rotate it into the desired position in the ML plane.

Tighten the device to the Awl and insert the appropriate Blocking Screw Cartridge. Adjust the Cartridge proximally or distally within the Blocking Screw Device to determine blocking screw position. Blocking screw insertion follows the previously described technique.

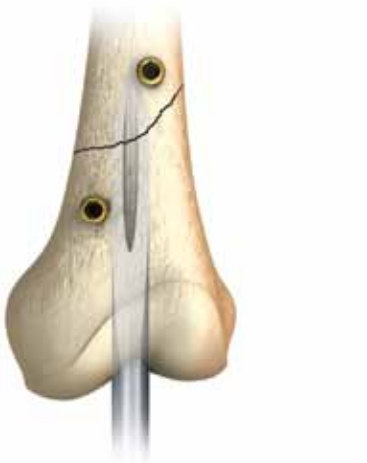
Blocking screw insertion with reducer

Blocking screw insertion can also be performed by attaching the Blocking Screw Device to the Reducer instead of the 11.0mm T-handle Awl. Blocking screw insertion follows the previously described technique.

Final view: AP and ML blocking screw insertion

Once blocking screw insertion is complete, remove the Blocking Screw Device from the 11.0mm T-handle Awl or Reducer and obtain both AP and lateral radiographic images to confirm accurate placement.

The Awl or Reducer provides a good indication of the nail's insertion trajectory based upon the location of the blocking screws. Following confirmation of proper screw placement, proceed with nail insertion following the META-NAIL◇ system insertion technique.



Stability blocking screw insertion

Following nail insertion and confirmation of fracture reduction, blocking screws can be placed on either side of the nail in the metaphyseal region for additional stability. Screws may be inserted in both the AP and ML planes.

With the nail inserted, attach the Retrograde Femoral Blocking Screw Attachment (7165-4508) to the Anterior Drop, matching the orange shape found on the Blocking Screw Attachment to the corresponding one on the Drop (Triangle to Triangle for AP screws and Square to Square for ML screws). Follow the previously described technique for Cartridge positioning and blocking screw insertion.

Note The AP blocking screws targeted through the two (2) holes built into the Anterior Drop cannot be used if the most superior oblique distal locking screw has been inserted.

Final view:
Stability blocking screws

Once stability blocking screw insertion is complete, remove the Blocking Screw Attachment and Anterior Drop from the drill guide and obtain both AP and lateral radiographic images to confirm accurate placement.

TRIGEN◊ nail cap and nail cap Set screw insertion: optional

Remove the drill guide/Anterior Drop assembly. Attach the selected Nail Cap or Nail Cap Set Screw to the Medium Hexdriver/T-handle assembly and insert into the end of the nail until tight.

Note The TRIGEN Nail Cap does not engage with the most distal locking screws to create a fixed angle construct.

Note If cross-threading occurs, rotate the Nail Cap or Nail Cap Set Screw counterclockwise until its threads line up with those of the nail. Proceed with insertion until tight.

Instruments for implant removal

3.2mm Tip Threaded Guide Wire
Cat. No. 7163-1690

Mini Connector
Cat. No. 7163-1186

12.5mm Entry Reamer
Cat. No. 7163-1116

Disposable Nail Extractor**
Cat. No. 7163-1320

Cannulated Impactor-Medium
Cat. No. 7167-5081

Cannulated Impactor-Long
Cat. No. 7163-1185

T-handle
Cat. No. 7167-4076

3.0mm x 1000mm Ball Tip Guide Rod*
Cat. No. 7163-1626

Medium Hexdriver
Cat. No. 7163-1066

Slotted Hammer
Cat. No. 7167-4082

* Additional guide rods listed on page 52
** The Cannulated Impactor-Long is located in the original TRIGEN® Instrument Set (7163-1326)
*** The Disposable Nail Extractor (7163-1320) is interchangeable with the Large Nail Extractor (7163-1278) located in the original TRIGEN Instrument Set (7163-1326) and the HFN® Instrument Set (7170-0001)

Nail extraction: optional

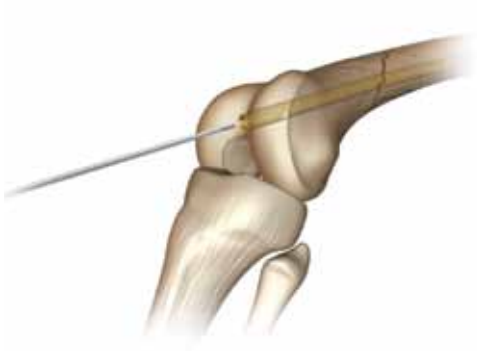
Standard technique

Remove the Nail Cap or Nail Cap Set Screw if implanted and all of the proximal locking screws with the Medium Hexdriver/T-handle assembly. Remove all of the distal locking screws except for one in the same manner.

Thread the Extraction Bolt (7163-1320) into the Cannulated Impactor-Medium (7167-5081) or Cannulated Impactor-Long (7163-1185)* and introduce the extraction assembly into the end of the nail. Remove the remaining distal locking screw and then extract the nail with a back-slapping motion using the Slotted Hammer.

Percutaneous technique

This technique assumes the absence of a Nail Cap or Nail Cap Set Screw. Remove all proximal locking screws and all but one of the distal locking screws as previously described. Under fluoroscopy, insert a 3.2mm Tip Threaded Guide Wire (7163-1690) into the end of the nail on power or by hand. Make a 2cm incision around the Wire and advance the 12.5mm Entry Reamer over the Wire and into the end of the nail to remove any bony ingrowth.



Thread the Cannulated Impactor-Medium or Cannulated Impactor-Long (7163-1185) into the back of the Disposable Nail Extractor** (7163-1320) and then thread the assembly into the end of the nail. Remove the remaining distal locking screw and then extract the nail with a back-slapping motion.

Note The tip of the Entry Reamer is straight for approximately 1cm before flaring out. It is this portion of the Entry Reamer that enters the top of the nail.

*The Cannulated Impactor-Long is located in the original TRIGEN® Instrument Set (7163-1326)

**The Disposable Nail Extractor (7163-1320) is interchangeable with the Large Nail Extractor located in the original TRIGEN Instrument Set (7163-1326) and the HFN® Instrument Set (7170-0001)

An alternative method for extraction

Guide rod jamming technique

Advance the end of a 3.0mm Ball Tip Guide Rod through the end of the nail. Insert a 2.0mm Smooth Guide Rod (7111-8280) in the same manner. With both guide rods in place, attach the Gripper to the end of the 3.0mm Ball Tip Guide Rod and pull it back so that it wedges the ball tip against the 2.0mm Smooth Guide Rod. Backslap against the Gripper with the Slotted Hammer to extract the nail.

Guide rods

Cat. No.	Description
7111-8280	2.0mm x 900mm Smooth (RUSSELL-TAYLOR® System)*
7111-8202	3.0mm x 900mm Ball Tip (RUSSELL-TAYLOR System)*
7163-1626	3.0mm x 1000mm Ball Tip (TRIGEN® System)

Additional removal items

Cat. No.	Description
115074	Large Extractor Hook*
115073	Small Extractor Hook*
914658	Large Easy Out**
914659	Small Easy Out**

*Available sterile packed. For nail removal only, do not use for nail insertion

**Located in RUSSELL-TAYLOR Extraction Kit (Set #7508) available through Loaners

Catalog information – TRIGEN® META-NAIL® Implants

5.0mm Internal Captured Screws (Gold)

Cat. No.	Length
7164-2225	5.0mm x 25mm
7164-2230	5.0mm x 30mm
7164-2235	5.0mm x 35mm
7164-2240	5.0mm x 40mm
7164-2245	5.0mm x 45mm
7164-2250	5.0mm x 50mm
7164-2255	5.0mm x 55mm
7164-2260	5.0mm x 60mm
7164-2265	5.0mm x 65mm
7164-2270	5.0mm x 70mm
7164-2275	5.0mm x 75mm

Cat. No.	Length
7164-2280	80mm
7164-2285	85mm
7164-2290	90mm
7164-2295	95mm
7164-2200	100mm
7164-2205	105mm
7164-2210	110mm

5.0mm Gold Screw

TRIGEN META-NAIL 10mm Retrograde Femoral

Set No. 7165-1000

Cat. No.	Length
7165-3018	18cm
7165-3020	20cm
7165-3022	22cm
7165-3024	24cm
7165-3026	26cm
7165-3028	28cm
7165-3030*	30cm
7165-3032*	32cm
7165-3034*	34cm

Cat. No.	Length
7165-3036*	36cm
7165-3038*	38cm
7165-3040*	40cm
7165-3042*	42cm
7165-3044	44cm
7165-3046	46cm
7165-3048	48cm
7165-3050	50cm

* Contained in the standard implant set

Catalog information – TRIGEN◇ META-NAIL◇ Implants

TRIGEN META-NAIL 11.5mm Retrograde Femoral

Set No. 7165-1001

Cat. No.	Length
7165-3218	18cm
7165-3220	20cm
7165-3222	22cm
7165-3224	24cm
7165-3226	26cm
7165-3228	28cm
7165-3230*	30cm
7165-3232*	32cm
7165-3234*	34cm

Cat. No.	Length
7165-3236*	36cm
7165-3238*	38cm
7165-3240*	40cm
7165-3242*	42cm
7165-3244	44cm
7165-3246	46cm
7165-3248	48cm
7165-3250	50cm

TRIGEN META-NAIL 13mm Retrograde Femoral

Set No. 7165-1002

Cat. No.	Length
7165-3418	18cm
7165-3420	20cm
7165-3422	22cm
7165-3424	24cm
7165-3426	26cm
7165-3428	28cm
7165-3430*	30cm
7165-3432*	32cm
7165-3434*	34cm

Cat. No.	Length
7165-3436	36cm
7165-3438*	38cm
7165-3440*	40cm
7165-3442*	42cm
7165-3444	44cm
7165-3446	46cm
7165-3448	48cm
7165-3450	50cm

Nail Cap Set Screw

Cat. No. 7165-6000

TRIGEN Nail Caps

Cat. No.	Length
7163-4000	0mm
7163-4005	5mm
7163-4010	10mm

Cat. No.	Length
7163-4015	15mm
7163-4020	20mm

* Contained in the standard implant set

Catalog Information – TRIGEN® META-NAIL® Instruments

TRIGEN META-NAIL Blocking Screw Instruments

Set No. 7165-4001

Blocking Screw Device
Cat. No. 7165-4515

11.0mm T-handle Awl
Cat. No. 7165-4522

8.5mm/10mm Blocking Screw Cartridge
Cat. No. 7165-4511

11.5mm/13mm Blocking Screw Cartridge
Cat. No. 7165-4513

Offset Blocking Screw Cartridge
Cat. No. 7165-4514

Blocking Screw Alignment Pin
Cat. No. 7165-4523

Retrograde Femoral Blocking Screw Attachment
Cat. No. 7165-4508

Blocking Screw Instrument Case
Cat. No. 7165-4552

Blocking Screw Instrument Lid
Cat. No. 7165-4553

Catalog information – TRIGEN◇ META-NAIL◇ Instruments

TRIGEN META-NAIL Blocking Screw Instruments

Set No. 7165-4002

META-NAIL Anterior Drop
Cat. No. 7165-4501

META-NAIL Drill Guide
Cat. No. 7165-4502

META-NAIL Extension Drill Guide
Cat. No. 7165-4503

Extension Guide Bolt (23mm)
Cat. No. 7165-4505

Guide Bolt Long (51mm)
Cat. No. 7165-4506

META-NAIL Instrument Case
Cat. No. 7165-4551

META-NAIL Instrument Lid
Cat. No. 7165-4550

Long Screw Length Sleeve
Cat. No. 7165-4520

Cannulated Impactor-Short
Cat. No. 7165-4554

Instruments used if you have TRIGEN® Base Set

Set No. 7167-4012

Medium Hexdriver
Cat. No. 7163-1066

Short Hexdriver
Cat. No. 7163-1068

12.5mm Entry Reamer
Cat. No. 7163-1116

Guide Bolt Wrench
Cat. No. 7163-1140

9.0mm Drill Sleeve
Cat. No. 7163-1152

Multipurpose Driver
Cat. No. 7163-1161

Mini Connector
Cat. No. 7163-1186

Screw Depth Gauge
Cat. No. 7163-1189

Cannulated Awl
Cat. No. 7167-4000

Entry Portal Tube
Cat. No. 7167-4060

3.2mm T-handle Trocar
Cat. No. 7167-4074

Honeycomb
Cat. No. 7167-4075

Flexible Reamer Shaft
Cat. No. 7111-8200

Reamer Heads
Cat. No. 7111-8231-8246

Catalog information – TRIGEN◇ META-NAIL◇ Instruments

T-handle
Cat. No. 7167-4076

Reducer
Cat. No. 7167-4077

Obturator
Cat. No. 7167-4078

Ruler
Cat. No. 7167-4079

Gripper
Cat. No. 7167-4080

Cannulated Impactor-Medium
Cat. No. 7167-5081

Slotted Hammer
Cat. No. 7167-4082

4.0mm Drill Sleeve
Cat. No. 7167-4083

Screwdriver Release
Cat. No. 7167-4084

Screw Length Sleeve
Cat. No. 7167-4085

Entry Portal Handle
Cat. No. 7167-4092

Instruments used if you have existing TRIGEN® set

Set No. 7163-1326

Medium Hexdriver
Cat. No. 7163-1066

Short Hexdriver
Cat. No. 7163-1068

Gripper
Cat. No. 7163-1100

Entry Tool
Cat. No. 7163-1114

12.5mm Entry Reamer
Cat. No. 7163-1116

Obturator
Cat. No. 7163-1122

Reducer
Cat. No. 7163-1124

Ruler
Cat. No. 7163-1128

Guide Bolt Wrench
Cat. No. 7163-1140

Hammer
Cat. No. 7163-1150

9.0mm Drill Sleeve
Cat. No. 7163-1152

4.0mm Drill Sleeve
Cat. No. 7163-1156

Multipurpose Driver
Cat. No. 7163-1161

T-handle
Cat. No. 7163-1172

Catalog information – TRIGEN◇ META-NAIL◇ Instruments

Mini Connector
Cat. No. 7163-1186

Screw Depth Gauge
Cat. No. 7163-1189

Screw Driver Release Handle
Cat. No. 7163-1208

Cannulated Impactor-Long
Cat. No. 7163-1185

Flexible Reamer Shaft
Cat. No. 7163-1192

Reamer Heads
Cat. No. 7111-8231-8242

META-NAIL Disposables

Set No. 7165-4003

4.0mm Long Pilot Drill*
Cat. No. 7163-1110

4.0mm Short Drill**
Cat. No. 7163-1117

3.0mm x 1000mm Ball Tip Guide Rod
Cat. No. 7163-1626

3.2mm Tip Threaded Guide Wire
Cat. No. 7163-1690

Disposable Compression Driver
Cat. No. 7165-4517

Disposable Nail Extractor***
Cat. No. 7163-1320

* 4.0mm Long Pilot Drill (7163-1110) is interchangeable with 4.0mm AO Long Drill (7163-1121)
** 4.0mm Short Drill (7163-1117) is interchangeable with 4.0mm AO Short Drill (7163-1123)
*** The Disposable Nail Extractor (7163-1320) is interchangeable with the Large Nail Extractor (7163-1278) located in the original TRIGEN Instrument Set (7163-1326) and the HFN◇ Instrument Set (7170-0001)

TRIGEN SURESHOT Targeting Interface

Cat. No. 7165-7000

Cat. No.	Device	Case Qty
7169-2802	Trauma Interface	1

TRIGEN SURESHOT Targeting Instrument Set

Set No. 7165-7001

Cat. No.	Description	Tray Qty
7169-2801	Targeter	1
7169-2804	Drill Sleeve - Long	2
7169-2805	Drill Sleeve - Short	2
7169-2806	META Set Stop	1
7169-2807	TAN® Set Stop	1
7169-2808	Field Accuracy Gauge	1
7169-2809	Hexdriver	1
7169-2816	TAN Anteversion Locking Guide	1
7169-2830	Targeting Instrument Tray	1
7169-2831	Targeting Instrument Tray Lid	1

Other TRIGEN SURESHOT Instruments

Cat. No.	Description	Qty
7169-1165	Inner Drill Sleeve, Long	1
7169-1166	Outer Screw Sleeve, Long	1

TRIGEN SURESHOT Targeting Disposables Set

Set No. 7165-7002

Cat. No.	Description	Qty
7169-2810	AO Drill Bit - Short	2
7169-2811	AO Drill Bit - Long	1

Additional Disposable

Cat. No.	Description
7169-2814	META-NAIL® Standard Drill Guide Probe (used with TRIGEN META-NAIL Instrument Set, 7165-4002)

TRIGEN SURESHOT Country Kit – North America

Cat. No. 7165-7003

Cat. No.	Description	Qty
6680-0193	Power Cord, 125 Volt 10 Amp – North America (Hospital Grade)	1
7118-1927	User Manual, English	1

Additional country kits

TRIGEN SURESHOT Country Kit – Australia

Cat. No. 7165-7004

Cat. No.	Description	Qty
6680-0303	Power Cord, 250 Volt 10 Amp – Australia/NZ	1
7118-1927	User Manual, English	1

TRIGEN SURESHOT Country Kit – Continental Europe

Cat. No. 7165-7005

Cat. No.	Description	Qty
6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1927	User Manual, English	1

TRIGEN SURESHOT Country Kit – Germany

Cat. No. 7165-7006

Cat. No.	Description	Qty
6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1538	User Manual, German	1

TRIGEN SURESHOT Country Kit – Spain

Cat. No. 7165-7007

Cat. No.	Description	Qty
6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1539	User Manual, Spanish	1

TRIGEN® SURESHOT® Country Kit – Italy

Cat. No. 7165-7009

6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1536	User Manual, Italian	1

TRIGEN SURESHOT Country Kit – United Kingdom

Cat. No. 7165-7011

Cat. No.	Description	Qty
6680-0213	Power Cord, 250 Volt 10 Amp – UK	1
7118-1927	User Manual, English	1

TRIGEN SURESHOT Country Kit – South Africa/India

Cat. No. 7165-7012

Cat. No.	Description	Qty
6680-0302	Power Cord, 250 Volt 10 Amp – So. Africa/India	1
7118-1927	User Manual, English	1

Notes

Notes

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