

# The Titanium Tibial Nail System

Solid Tibial Nails (UTN) and Cannulated Tibial Nails (CTN)

Surgical Technique

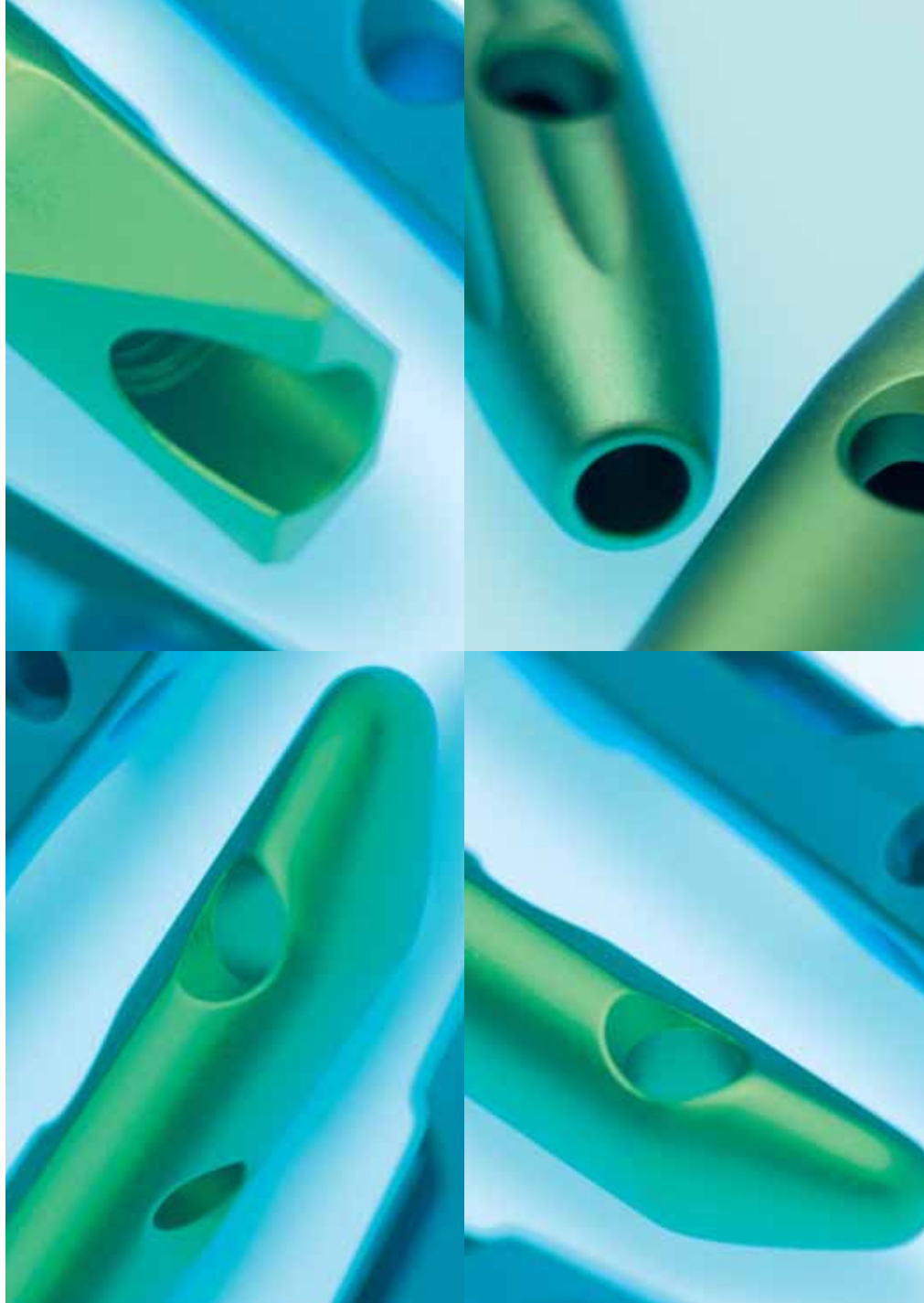


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**Warning**

This description is not sufficient for immediate application of the instrumentation. Instruction by a surgeon experienced in handling this instrumentation is highly recommended.

## Indications for the Titanium Tibial Nail

The Solid Tibial Nail UTN is intended to stabilize fractures of the tibia. Specifically it is intended for Grades I and II open tibial diaphyseal fractures; high energy, unstable closed fracture patterns; comminuted fractures of tibia with small medullary canals; and pre- and postisthmic fractures such as change of procedure after external fixator, secondary interventions, etc.

The Cannulated Tibial Nail CTN is intended to stabilize fractures of the tibia. Indications include, but are not limited to, open and closed tibial shaft fractures; pre- and postisthmic fractures such as correction of tibial malunions and tibial non-unions.

**Note:**

CTN stands for Cannulated Tibial Nail.

## Case examples

Proximal and distal locking hole configurations provide a choice of locking options, both static and dynamic, to accommodate the fracture pattern and soft-tissue injury.

### Case 1

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#### **Diaphyseal fracture**

In simple shaft fractures, dynamic locking ensures controlled and rotationally stable impaction.

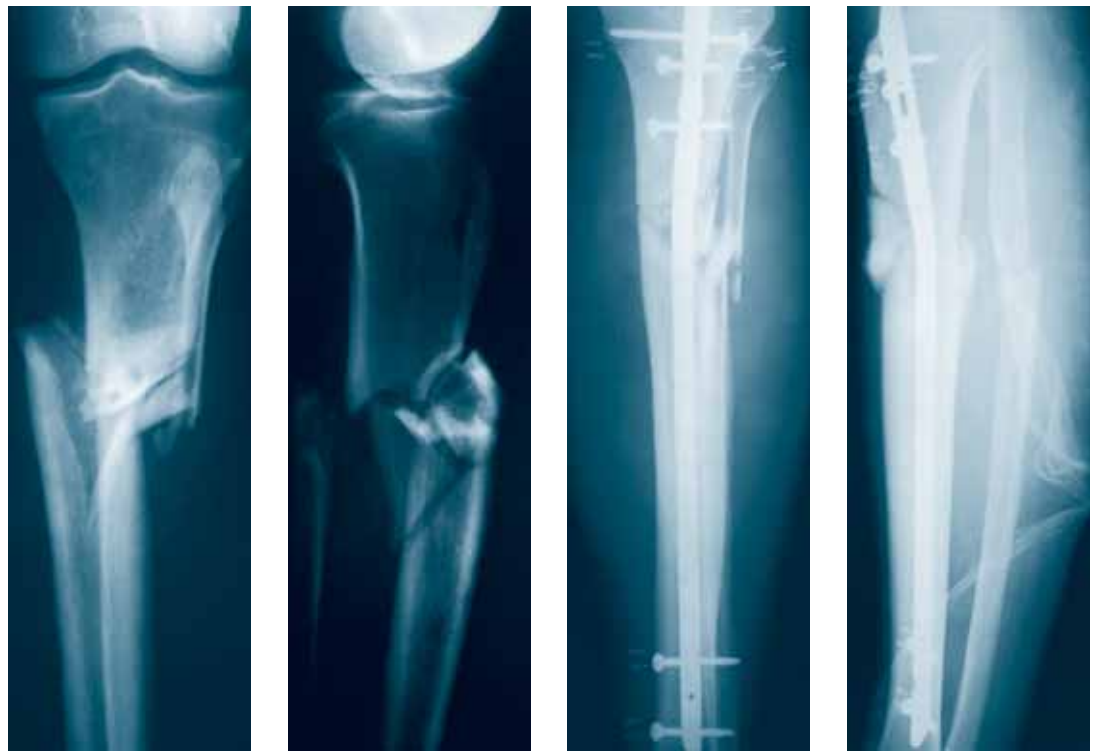


**Case 2**

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**Fracture involving the proximal third component**

Locked statically, the oblique superior bolt increases control of proximal third fractures.



### Case 3

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#### Distal fracture

Locked with distal bolts in both the frontal and sagittal planes. Distal AP interlocking allows placement of perpendicular bolts for more secure fixation of the short distal fragment.

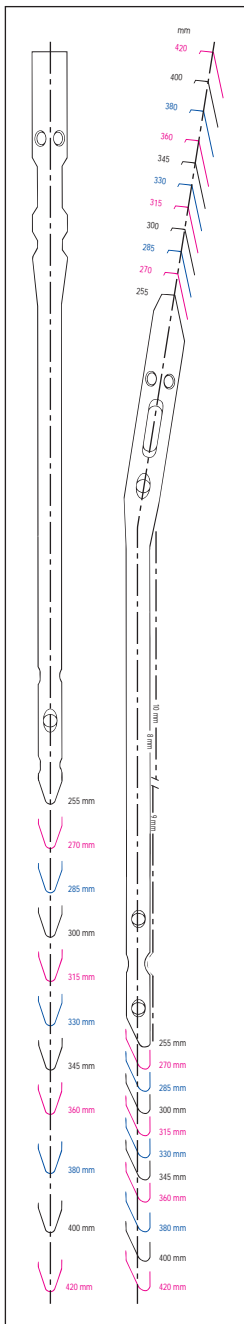


Preoperative implant selection

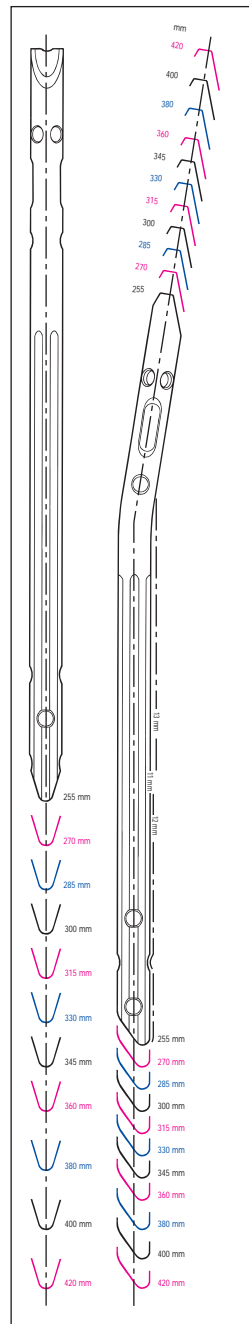
**Titanium Solid Tibial Nail Ruler**  
for 8mm, 9mm and 10mm Nails

**Titanium Cannulated Tibial Nail Ruler**  
for 11mm, 12mm and 13mm Nails

Use the AO/ASIF Preoperative Planner Ruler to determine nail length and nail diameter. Note that the ruler images are enlarged 15% to account for average radiograph magnification; however, variation in magnification levels are common.



0330.097



0330.098

For UTN 8 to 10mm dia. and for CTN 10mm dia. select the ruler no. 0330.097. For CTN 11 to 13mm dia. select the ruler no. 0330.098. When selecting nail size, consider canal diameter, fracture pattern, and post-operative protocol.

**Note:**  
CTN stands for Cannulated Tibial Nail.

Instruments required to open the tibia

ComPact  
Air Drive II  
511.701



Quick Coupling for Kirschner Wires  
511.790



Drill Sleeve 12.0  
360.170



Double Air Hose – 519.5X0

11.0mm Cannulated Drill Bit – 360.060



2.5mm Threaded Guide Wire – 338.000



Measuring Device for UTN/CTN – 356.590



Measuring Rod (optional) – 356.550



## Opening the tibia

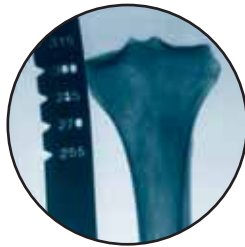
### Position the patient

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Position the patient supine on a radiolucent operating table. Ensure that the knee of the injured leg can be flexed at least 90°, and x-ray visualization of the entire tibia is possible in both the AP and lateral views. Temporary reduction and stabilization can be accomplished by manual pressure at the fracture site, or by application of a sterile tourniquet or elastic bandage around the fracture. Alternatively, the Large Distractor may be used on the medial side, with the insertion of Seldrill™ Schanz screws, in the frontal plane, as close to both tibial ends as possible. At the surgeon's discretion, the procedure can be performed on a fracture table with the leg placed in traction.



The distal tip of the measuring device should align with the desired nail insertion depth



AP image of proximal tibia

### Confirm nail length

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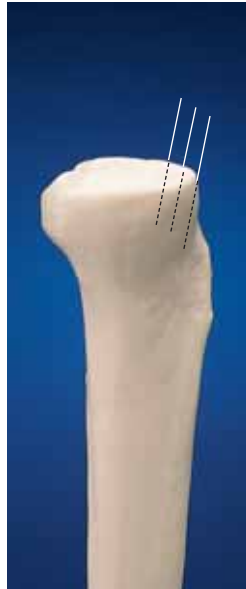
Position the image intensifier for an AP view of the distal tibia. With a long forceps, hold the measuring device alongside the leg, parallel to and at the same level as the tibia. Adjust the measuring device until the distal tip is at the level of the desired nail insertion depth. Mark the skin at the bottom of the measuring device.

Move the image intensifier to the proximal tibia, replace the distal end of the measuring device at the skin mark, and take an AP image of the proximal tibia. Read nail length directly from the device image, selecting the measurement at or just below the level of the anterior edge of the tibial plateau.

When using the large Distractor, measure the distance from the inferior border of the distal pin to the superior border of the proximal pin to determine optimal nail length.



Entry point,  
AP view



Entry point,  
lateral view

### Identify nail entry point

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The entry point for the nail is in line with the medullary canal in the AP view, and is at the anterior edge of the tibial plateau. The location of the entry point in relation to the tibial tubercle varies with patient anatomy. Make a longitudinal incision over the midline of the tubercle, extending proximally.

Retract the patellar tendon laterally, or split the tendon, depending on surgeon preference and patient anatomy.

Insert the 2.5mm Threaded Guide Wire 338.000 through the incision to the entry point. Under an AP image intensification view, centre the guide wire in line with the medullary canal.

### Note:

For treatment of fractures involving the proximal third component refer to the section titled Fractures Involving Proximal Third Component (page 22).



Insert the centering  
pin/guide wire,  
AP view



Insert the centering  
pin/guide wire,  
lateral view



### Open the canal

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With a power drill or hand chuck, insert the 2.5mm guide wire through the metaphysis and into the medullary canal. Direct the wire so it is parallel to the anterior cortex and closely approximates the 9° angulation of the proximal nail. To ensure correct wire placement, hold a sterile nail anterior to the tibia and use it as an angle guide. Confirm wire placement with the image intensifier. Place the 11mm Cannulated Drill Bit 360.060 into a Compact Air Drive II and place the Drill Sleeve 360.170 over the guide wire. Place the drill bit over the 2.5mm guide wire and through the drill sleeve. Drill an opening into the medullary canal to a depth of approximately 100mm. Remove the drill, guide wire and drill sleeve.

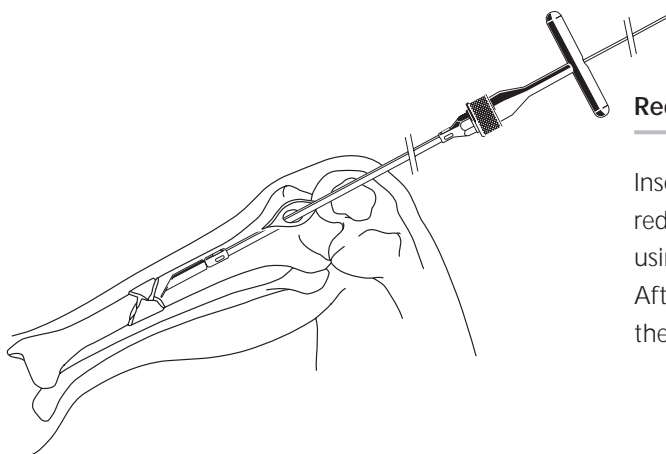
### Confirm nail length (optional)

Insert the Measuring Rod 356.550 into the tibia. Use the C-arm to verify insertion depth. Read nail length directly from the gauge at the entry site.

Open the medullary canal



### Medullary reaming guidelines (optional technique)\*

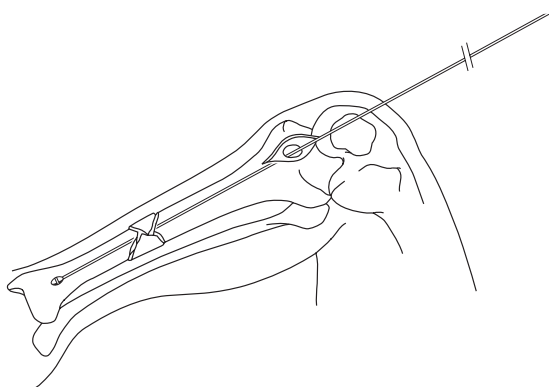


#### Reduction

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Insert the reduction system consisting of flexible shaft, reaming rod and reduction heads into the medullary canal, and reduce the fragments using image-intensifier control.

After reduction, leave the reaming rod in the medullary cavity, and remove the reduction system.



#### Medullary reaming

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##### **Important:**

The reaming rod is already in the medullary canal, if reduction has been achieved with the reduction system.

For the initial reaming, the flexible shaft is usually equipped with the 8.5mm reamer head.

Use the highest speed and slight but uniform force to advance the reamer head in the medullary canal. Move the reaming rod forwards and backwards to remove the bone chips from the reamer head. This prevents jamming of the reamer head in the medullary canal.

Use sideways cutting reamer heads for the subsequent reaming steps.

Reaming to the desired diameter is normally done in 0.5mm increments.

##### **Important:**

Remove the reaming rod before locking the intramedullary nail.

\* For a detailed description, see:  
SynReam Surgical Technique no. 0336.162

Instruments for nail insertion



Insertion Bolt  
for UTN – 356.541



Insertion Bolt for  
Cannulated Tibial  
Nail CTN – 356.539



Insertion Handle for UTN/CTN – 356.511



Inserter-Extractor for UTN/CTN – 356.490



Driving Head  
355.180



Slotted Hammer – 332.200



Ratchet Wrench, 11mm, L 140mm – 321.200



Cannulated Socket Wrench – 355.140

## Inserting the nail

### Assemble the insertion instruments

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Inserter-Extractor  
356.490

Insertion Handle  
for UTN/CTN  
356.511

Connecting  
screw for UTN  
356.541

Solid Tibial Nail  
UTN

Orient the insertion handle anteriorly, and match the flats on the handle and nail.

For solid tibial nails UTN, select the connecting screw for UTN 356.541. For cannulated tibial nails CTN, select the connecting screw for CTN 356.539.

Place the connecting screw into the insertion handle and thread it into the proximal nail end. Tighten the connecting screw with the 11mm Cannulated Socket Wrench 355.140, but do not over tighten.

Thread the Inserter-Extractor 356.490 onto the threaded post of the insertion handle.

**Note:**

Do not attach the aiming arm (356.521) for nail insertion.



Insertion of the nail

### Inserting the nail

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For the solid UTN, place the nail into the tibial opening with the insertion handle oriented anteriorly.

For the cannulated CTN, place the nail over the guide rod and into the tibial opening with the insertion handle oriented anteriorly.

Verify fracture reduction and insert the nail as far as possible by hand.

Monitor nail passage across the fracture under image intensification.

With the leg in flexion, use light blows of the slotted hammer on the inserter-extractor until the proximal end of the nail is at or below the tibial opening.

**Note:**

The nail must be fully inserted in flexion.

Instruments for proximal locking

For all tibial nails

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ComPact Air  
Drive II  
511.701



Quick Coupling for Drill Bits – 511.750



Depth Gauge for Locking Bolts – 357.790



8.0mm Trocar – 355.750



11.0mm/8.0mm Protection Sleeve  
355.700



Hexagonal Screwdriver – 314.750



Holding Sleeve  
314.110



Insertion Handle for UTN/CTN – 356.511



Aiming Arm for UTN/CTN – 356.521

**For 8mm and 9mm diameter tibial nails (3.9mm Locking Bolts)**

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Length 110mm (blue), (355.722)



Drill Bit 3.2mm dia., calibrated, for quick coupling (315.330)

**For 10mm–13mm diameter tibial nails (4.9mm Locking Bolts)**

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Drill Sleeve 8.0mm/4.0mm, length 150mm (green), (357.710)



Drill Bit 4.0mm dia., calibrated, for quick coupling (356.980)

## Locking proximally

Proximal locking can be achieved with the leg in full extension. This neutralizes the deforming forces on proximal fragments caused by the quadriceps mechanism and relieves the pressure on soft tissue usually associated with tibial nail insertion instruments. This position also facilitates assessment of rotational alignment prior to locking.



## Locking options

- Oblique for the proximal locking option
- Dynamic for immediate dynamization
- Stat 1 and 2 for static transverse locking

## Attach the aiming arm

For transverse locking, orient the aiming arm for medial to lateral bolt insertion. For interlocking through the oblique locking hole, attach the aiming arm to the insertion handle for an anterolateral or anteromedial approach. Tighten the spring-loaded connecting knob to secure the aiming arm to the insertion handle. Confirm that the insertion handle is securely fastened to the nail. Tighten the connecting screw, if necessary.



Attach the aiming arm



Mount the proximal locking instrument set



Drill with the 3.2mm drill bit for 8 and 9mm UTN

### Lock proximally

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Choose the appropriate insertion hole, as marked on the aiming arm. Insert the protection sleeve and trocar into the aiming arm, and through a stab incision to the bone.

Interlock the **blue 8mm and 9mm tibial nails** with the **blue 3.9mm locking bolts**. Remove the trocar and insert the blue 8.0mm/3.2mm drill sleeve into the protection sleeve. Drill both cortices with the **3.2mm calibrated drill bit**, stopping the drill immediately after penetrating the far cortex.

Interlock the **green 10mm, 11mm, 12mm, and 13mm tibial nails** with the **4.9mm green locking bolts**. Use the green 8.0mm/4.0mm drill sleeve and drill with the **4.0mm calibrated drill bit**.



Confirm drill bit position radiographically. Be sure the drill sleeve is pressed firmly to the cortex, and read locking bolt length from the calibrated drill bit at the back of the drill sleeve.

### Note:

There is no need to calculate bolt length because the calibrated drill bit provides a direct measurement. However, since drill bit position directly represents locking bolt position in bone, the locking bolt will be too long if the drill bit is over inserted, or if the drill sleeve is not pressed down to the cortex.



Depth Gauge for Locking Bolts  
357.790

When using the depth gauge for locking bolts, remove the drill sleeve. Place the depth gauge through the protection sleeve and measure for locking bolt length. Add 2 to 4mm.



Insert transverse locking bolt

Insert the locking bolt through the protection sleeve using the screwdriver. Repeat the procedure for a second transverse proximal bolt.



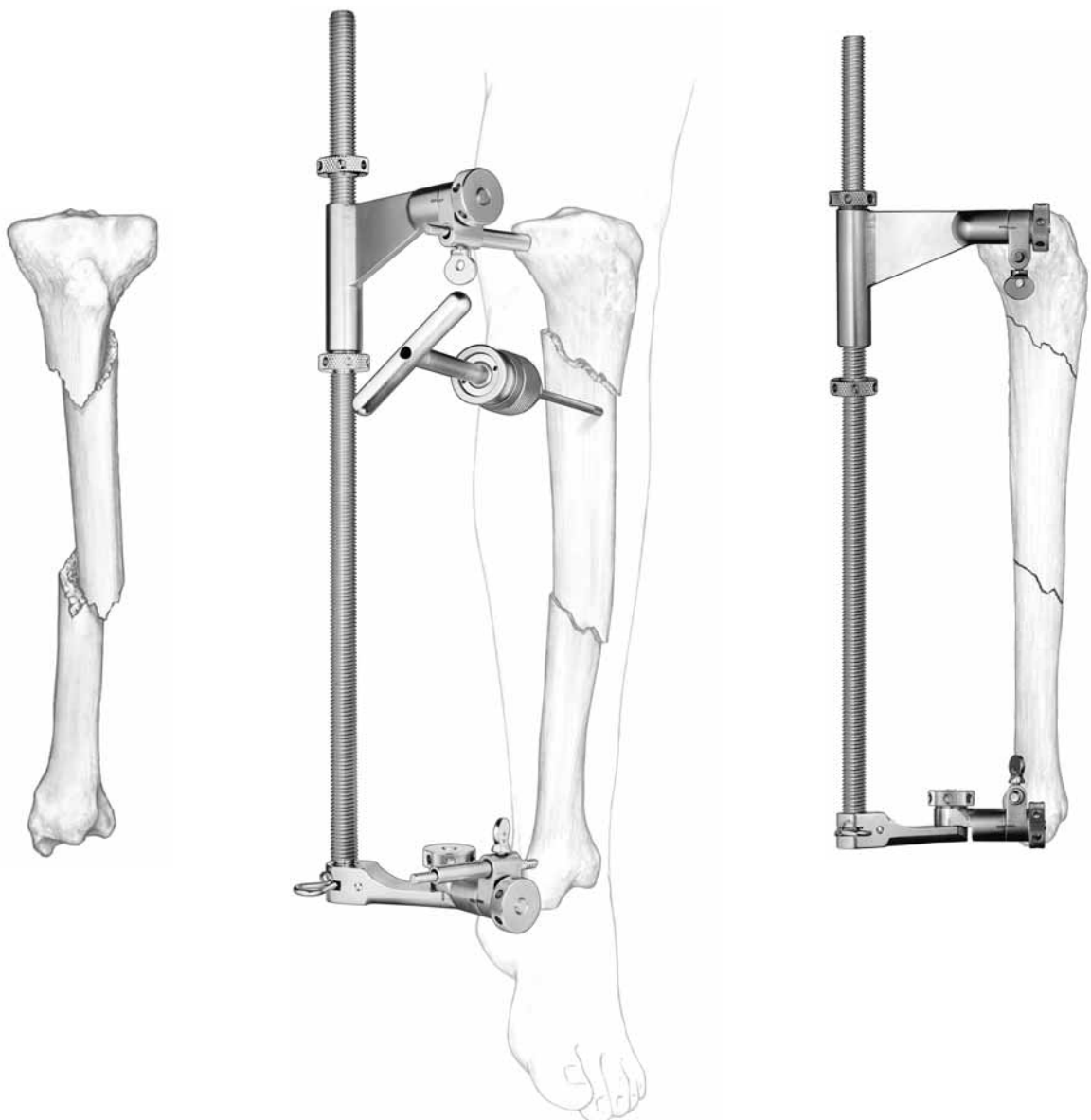
Insert oblique locking bolt

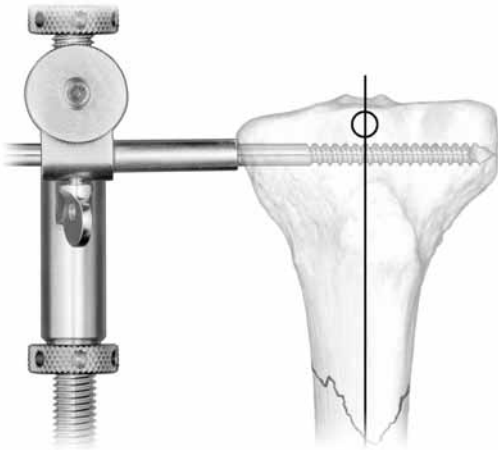
## Fractures involving proximal third component

### Apply large distractor

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The large Distractor 117.700 is applied on the medial side. The distractor will help to keep the fracture out to length and aid reduction. To correct overlapping fragments, which are usually posterior, it may be necessary to introduce a Schanz screw or Seldrill™ into the floating fragment and pull it into reduction. Place it outside the medullary canal, if possible, to keep the path of the nail clear.





### Identify nail entry point

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For fractures in the proximal third of the tibia, it is essential to select an entry site for the nail which is as superior as possible and in line with the lateral intercondylar eminence. It is important to align the guide wire with the lateral spine of the tibial plateau. Hyperflexion of the proximal fragment assists placement of the nail as anterior and parallel to the anterior cortex as possible. The sagittal plane entry site is critical.



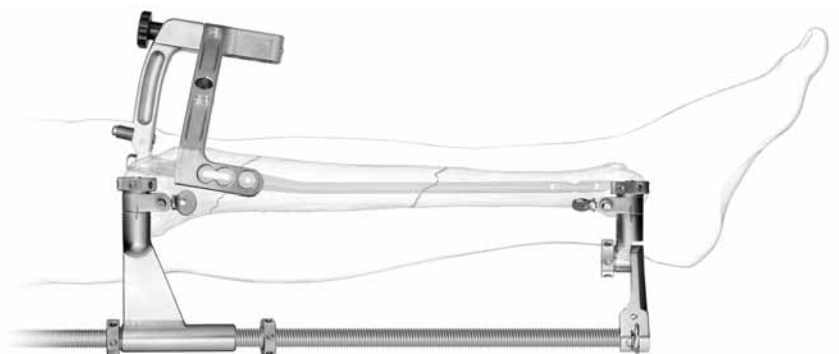
### Insert and lock the nail

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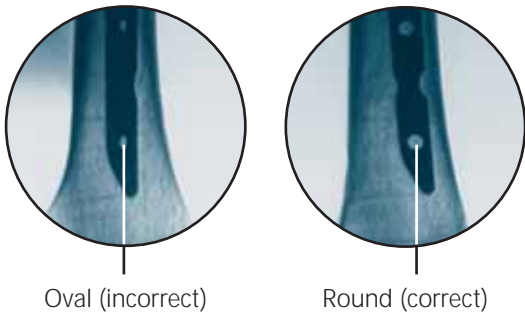
When the nail has been fully inserted as indicated in the „Inserting the Nail“ section on page 15, the leg can be placed in extension. Locking is then performed with the fractured leg in full extension. Proximal locking can be performed as described in the previous sections.

#### Note:

The nail must be fully inserted in flexion. Once the nail is fully inserted, extension may be accomplished and the distractor removed.



## Locking distally



### Align image

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Align the image intensifier with the most distal hole in the nail until a perfect circle is visible.



Determine incision point

### Determine incision point

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Place a knife blade on the skin to determine the incision point, and make a stab incision. Carefully dissect the underlying tissues to reduce the risk of saphena perforation.



Centre drill bit in locking hole

### Centre drill bit in locking hole

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

**Important:**

Use the 3.2mm drill bit 511.414 with coupling for radiolucent drive MK II for 8mm and 9mm diameter nails.

Use the 4.0mm drill bit 511.417 with coupling for radiolucent drive MK II for 10mm–13mm nails.



Align drill bit

**Drill**

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

**Measure**

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Measure for the locking bolt using the depth gauge for locking bolts. Add 2 to 4mm to the reading.



Depth Gauge for Locking Bolts  
357.790

**Insert locking bolt**

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Insert the appropriate size titanium locking bolt using the screwdriver and holding sleeve.

### Inserting the end cap



Remove the insertion instruments. Select the appropriate end cap or end cap extension piece. Align the end cap with the proximal nail end, and insert it into the coupling threads with the screwdriver. Turn the end cap until it is fully seated within the nail.

Insert end cap

## Implant removal

Inserter-Extractor  
356.490



Extraction Screw  
356.543



### Remove locking bolts and end cap

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Clean tissue ingrowth from the hex of the end cap and locking bolts. Use the screwdriver to remove the end cap and locking bolts. Using the Holding Sleeve 314.110 together with the screwdriver allows pulling force to ease locking bolt extraction.

#### Note:

Before removing the last locking bolt, thread the extraction screw into the proximal nail end. This will prevent the nail from rotating in the medullary canal. The Extraction Screw 356.543 can be used for all UTN/CTN diameters.



### Remove the nail

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Insert the extraction screw and thread it into the proximal nail end. Tighten the extraction screw with the 11mm wrench. Thread the inserter-extractor onto the connecting screw, and remove the nail with blows of the slotted hammer.

## Implant specifications

### Titanium Tibial Nails

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**Material:**

Titanium alloy TAN implant material

**Colour-coded:**

8mm and 9mm nails are blue for use with blue, 3.9mm locking bolts.

10mm–13mm nails are green for use with green, 4.9mm locking bolts.

### Solid Tibial Nails UTN (blue and green)

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**Size:**

- Diameters: 8, 9 and 10mm
- Lengths: 255–360mm in 15mm increments;  
lengths: 380–420mm in 20mm increments

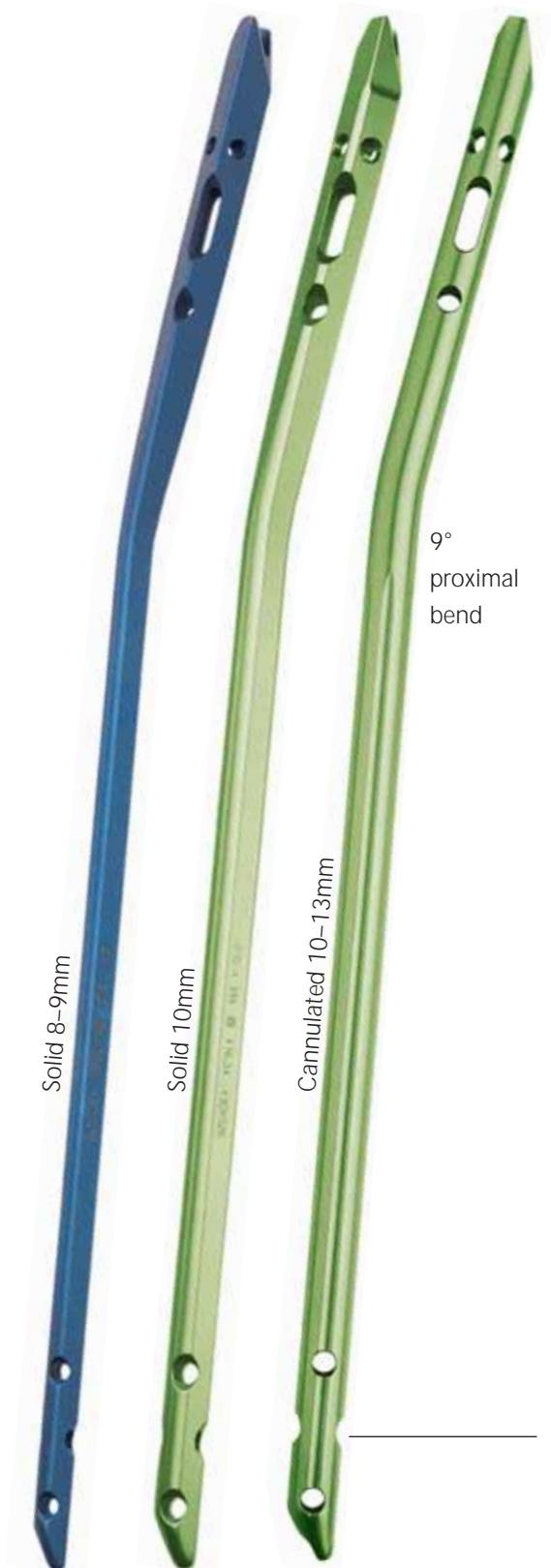
### Cannulated Tibial Nails CTN (green)

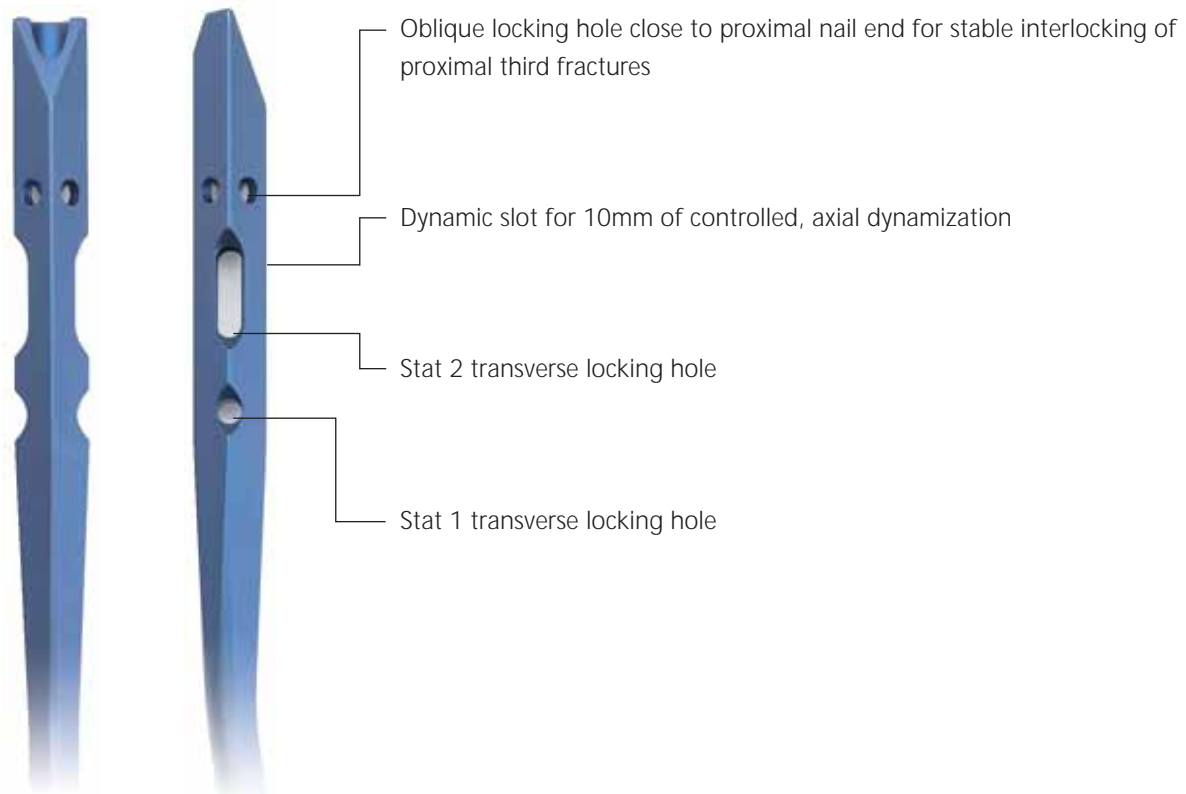
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**Size:**

- Diameters: 10, 11, 12, and 13mm
- Lengths: 255–360mm in 15mm increments;  
lengths: 380–420mm in 20mm increments

Three distal locking holes for locking in both frontal and sagittal planes:  
allow perpendicular bolt fixation of distal fractures.







**3.9mm Locking Bolt (blue) 458.XXX**

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- Lengths:  
26–80mm, in 2mm increments  
from 64mm length on, in 4mm increments
- 3.3mm core diameter
- Fully threaded
- Self-tapping trocar tip
- 3.5mm hex drive



**4.9mm Locking Bolt (green) 459.XXX**

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- Lengths:  
26–60mm, in 2mm increments  
64–80mm, in 4mm increments  
85–100mm, in 5mm increments
- 4.3mm core diameter
- Fully threaded
- Self-tapping trocar tip
- 3.5mm hex drive



**End Cap for Solid Tibial Nail UTN (458.100)**

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- 6mm diameter
- Protects nail threads from tissue ingrowth
- Sits flush with proximal nail end



**End Cap for Cannulated Tibial Nail CTN (458.120)**

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- 8mm diameter
- Protects nail threads from tissue ingrowth
- Sits flush with proximal nail end



**End Cap with 15mm extension (458.110) for Solid Tibial Nail UTN**

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- Extends length of nail by one size
- Spares changing of nail if the chosen nail is too short



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