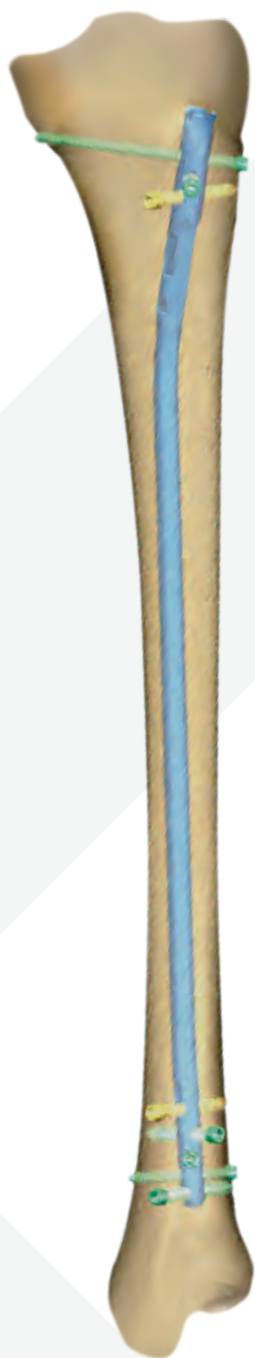


KAULMED

KN-5T Tibia Nailing System



Surgical Technique



about us

KAUL-Medizintechnik GmbH is a German manufacturer and supplier of medical items. Being part of Auxein Group and its German representative, we use its strength and experience to offer excellent products and services.

With our international brand KAULMED our products and we are there
For the Surgeons.



History of "KAULMED"

2020

Construction of KAULMEDs new manufacturing facility has started. Bone Cement and a brand new wound closure system developed in Germany have been added to our portfolio. New catalogues have been designed and published.

2019

KAULMED Spine Solutions were successfully registered and will be dispatched during Q4. Also in 2019 KAULMED gets a new website as we consider this part of our service. At MEDICA 2019 KAULMED is published and made known to the international medical market, with overwhelming success.

2018

KAUL-Medizintechnik GmbH started manufacturing Spine Solutions under KAULMED brand to support a customer and his surgeons. End of 2018 registration of these products in customers country started.

2017

KAUL-Medizintechnik GmbH started its international brand KAULMED. Now the excellent products and services can be offered to customer all over the world.

2016

In 2016 KAUL-Medizintechnik GmbH company structure was modified to ensure enough resources will be available for the new international brand. Manufacturing capacity, customer and technical service have been increased to meet the demands of international customers.

2015

The board of directors decided to use their knowledge and experience of orthopaedic implants to establish a separate international brand.



I. INTRODUCTION

- INTRAMEDULLARY OSTEOSYNTHESIS OF TIBIA consists of:
- Implants (Intramedullary nail, Locking Bolt, end cap or compression screw).
- Instrument set for Implants Insertion and extraction.
- Instruction for use (surgical technique).

Intramedullary osteosynthesis of tibia provides stable fixation of tibia shaft fractures.

Indications:

- multi-fragmental fractures of the shaft of the tibia
- tibia and fibula fractures.
- fractures with knee ligaments injury.
- tibia fractures with compartment syndrome.
- open fractures I, II, IIIA degree by Gustillo-Anderson.
- pathological fractures.
- malunion of tibia shaft fractures treated with other methods.

KAULMED provides the following methods:

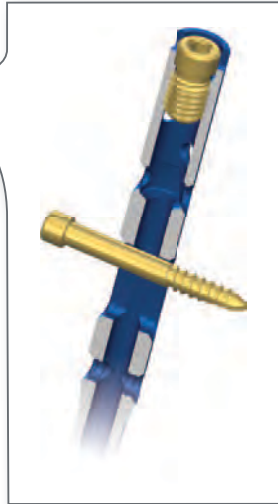
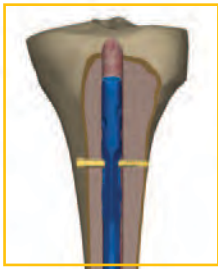


Static Method

Static fixation is used in multi-fragmental fractures with bone fragments mal-alignment.

In the static fixation to lock the nail with the locking bolt, two distal holes and two or all proximal holes should be used.

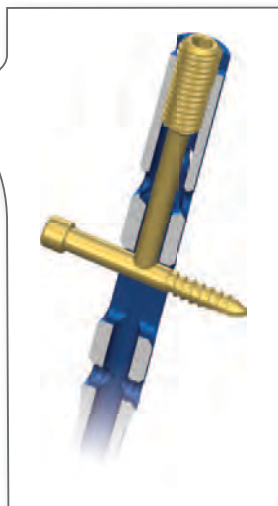
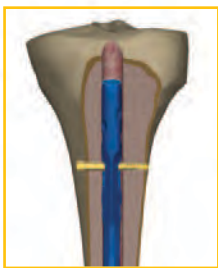


**Dynamic Method**

Dynamic fixation may be used in the case of good cortical contact of bone fragments in transversa or oblique fractures, and in false joints.

One oval shaped proximal and two distal holes of intramedullary nail should be used.

Dynamic fixation enables axial movements of bone fragments during the limb loading and stimulates creating bone scar and its reconstruction into the lamellar bone.

**Dynamic Method with Compression**

In the dynamic fixation with compression, the compression screw is axially inserted to put pressure on bolt locking the nail.

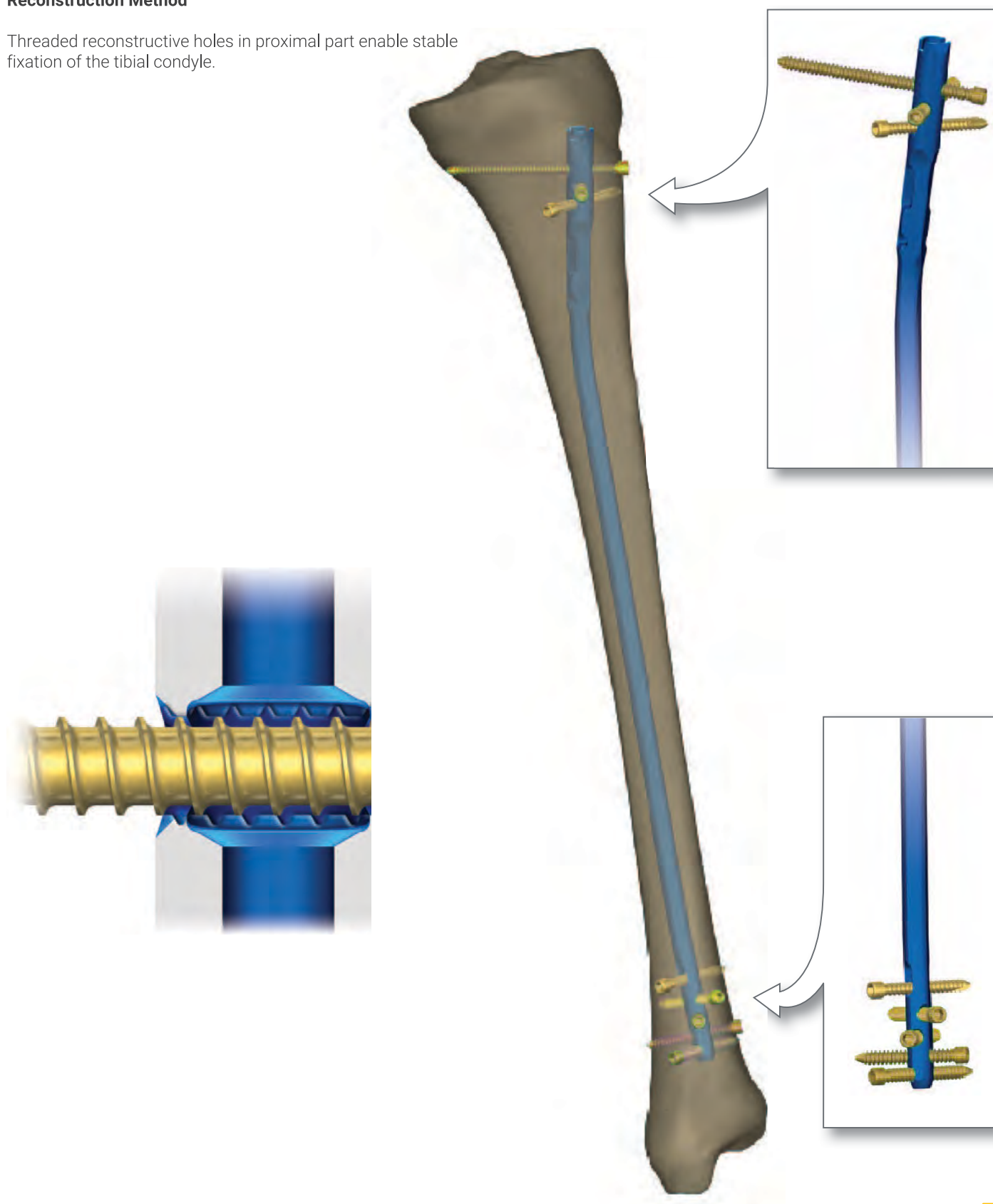
Compressive fixation eliminates all micro movements in early stage of treatment.



IMPLANTS

Reconstruction Method

Threaded reconstructive holes in proximal part enable stable fixation of the tibial condyle.



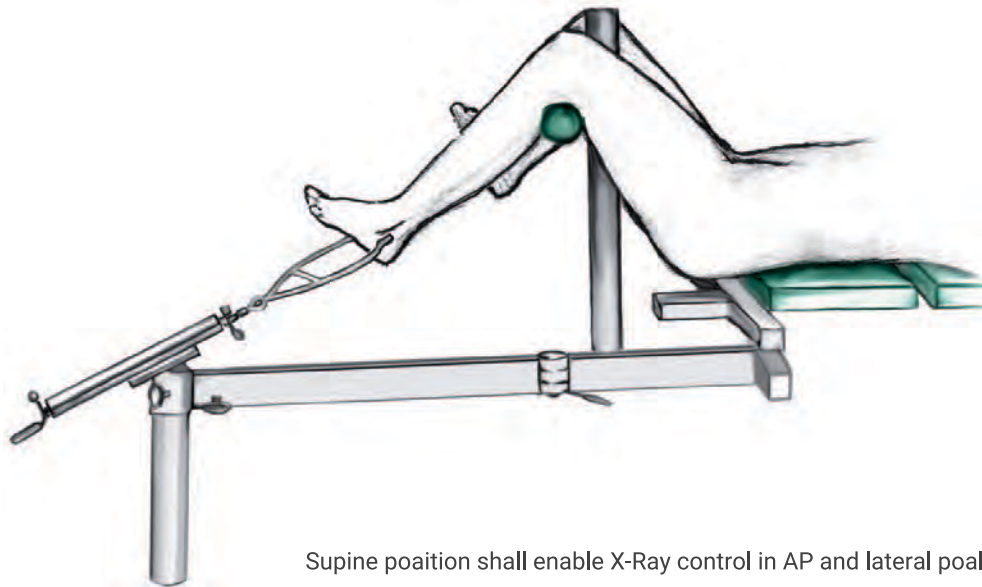
V. SURGICAL TECHNIQUE

V.1. INTRODUCTION

Each surgical procedure must be carefully planned.

X-Ray of the tibial fracture in AP and lateral position shall be performed before starting the operation in order to define the type of fracture and the size of intramedullary nail (length, diameter). To define the length of the nail, measuring the length of the fibula can be helpful. The operation shall be performed on operating table equipped with traction and C-arm device.

When patient is placed supine, the operated limb should be bent in the hip at an angle of 70-90°, abducted at an angle of 10-20° and bent at 80-90° in the knee joint; the ankle joint should stay in neutral position (foot perpendicular to tibia).



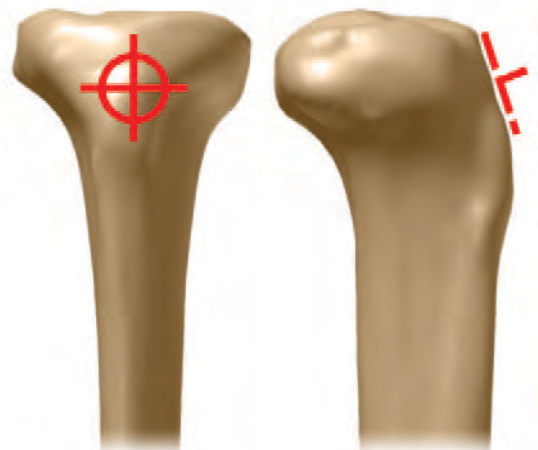
Supine position shall enable X-Ray control in AP and lateral position.

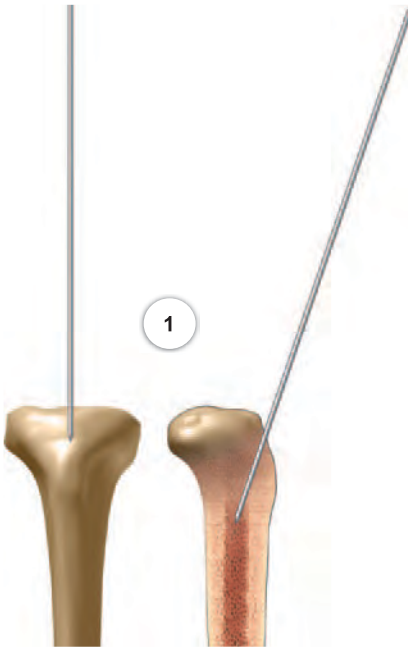
Surgical approach should be prepared by:

- longitudinal skin incision from the lower pole of patella to the point placed medially from tuberosity of tibia.
- longitudinal incision along medial edge of patella tendon and its aside move.

Insertion point is placed on extension of the line proceeding in the middle of medullary canal (X-Ray in A/P position) and on the tuberosity edge of tibia and its front epiphysis edge. Intramedullary canal should be 1.5-2.0 mm wider than the diameter of tibial nail.

In the case of reaming the canal, the intramedullary canal should be wider 1.5-2 mm than the diameter of the nail. The proximal part of the canal shall be widened for 12 mm at the depth of 5 cm.





V.2. OPENING THE MEDULLARY CANAL

1. After preparing the surgical approach and locating insertion point for the nail, use the electrical drive to Insert Kirschner wire (recommended 2/310 mm) into intramedullary canal at an angle appropriate to the deflection of the nail shaft to the main axis (13 degrees).

The process should be controlled with image intensifier.

Kirschner wire acts as the guide for the Curved Awl.
Kirschner wire is a single use instrument.

2. Open the intramedullary canal leading the Curved Awl [N5TI010] via Kirschner Wire.

Remove the Curved Awl and Kirschner Wire



Note:

It is recommended to open the intramedullary canal with technique described in step 1 and 2. However, the surgeon may use different technique depending on equipment of the surgical suite.

V. 3. PREPARATION OF INTRAMEDULLARY CANAL FOR NAIL INSERTION

OPTION : I Reamed canal

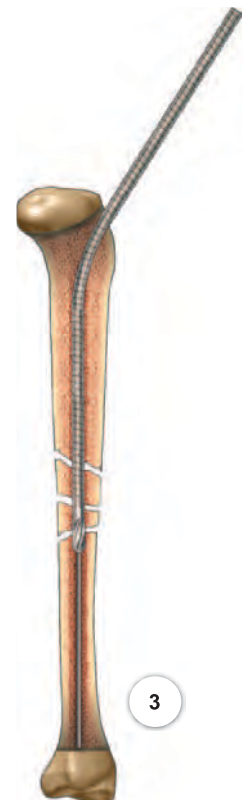
3 Insert the Guide Rod 2.5/580 [N5TI026] into the medullary canal until its tip reaches the distal epiphysis of tibia, reducing the fracture at the same time.

Gradually widen intramedullary canal using the flexible reamers with steps of 0.5 mm until it reaches the diameter 1.5 to 2 mm wider than the nail, to the depth at least equal to the nail length.

In the case of using the nail 10 mm or smaller diameter, widen proximal part of intramedullary canal with reamer to the 12 mm diameter to the depth approx. 5 cm.

Remove the flexible reamer.

Leave the flexible reamer guide in the medullar canal.





- 4 In the case of using other guide for the reamer than the Guide Rod, insert the Teflon Pipe Guide 8/400 [N5TI024] into the medullary canal.

Remove the Reamer Guide.

- 5 Mount the Guide rod handle [N5TI023] on the Guide Rod (for cannulated nail) [N5TI026] and advance into the Teflon Pipe Guide 8/400 [N5TI024] until its tip reaches the distal epiphysis of tibia.

Remove the Guide rod handle.
Remove the Teflon Pipe Guide 8/400.

- 5a Insert the Nail Length Measuring device [N5TI019] via the Guide Rod. The tip of the measure should be placed in the desired depth. Read the nail length on the measure.

Remove the Measure from the Guide Rod.

In the case of using solid nail, remove the Guide Rod from the intramedullary canal.

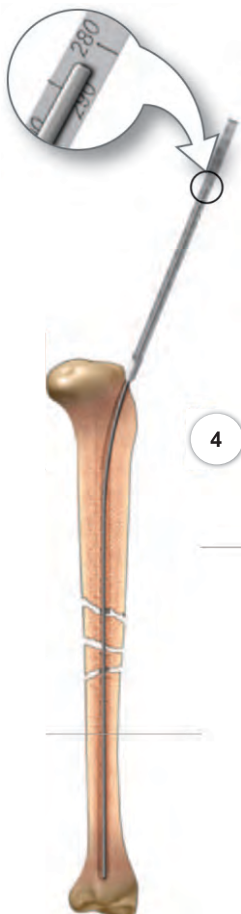


OPTION :II Unreamed canal

- 3 Mount the Guide rod handle [N5TI023] on the Guide Rod [N5TI026] and advance into intramedullary canal until its tip reaches the distal epiphysis of tibia, reducing the fracture at the same time.

Remove the Guide rod handle from the Guide Rod.

Widen the proximal part of the intramedullary canal with flexible reamers to the depth approx. 5 cm. In the case of using the nail 10 mm or smaller diameter, widen proximal part of medullary canal to the 12 mm diameter; for nail 11 mm or larger-the diameter 1.5 to 2 mm wider than the diameter of the nail.

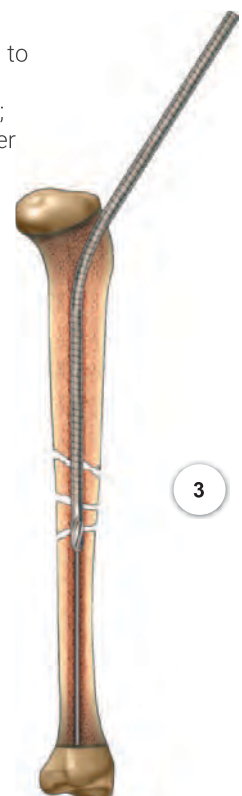


4 the diameter of the nail.

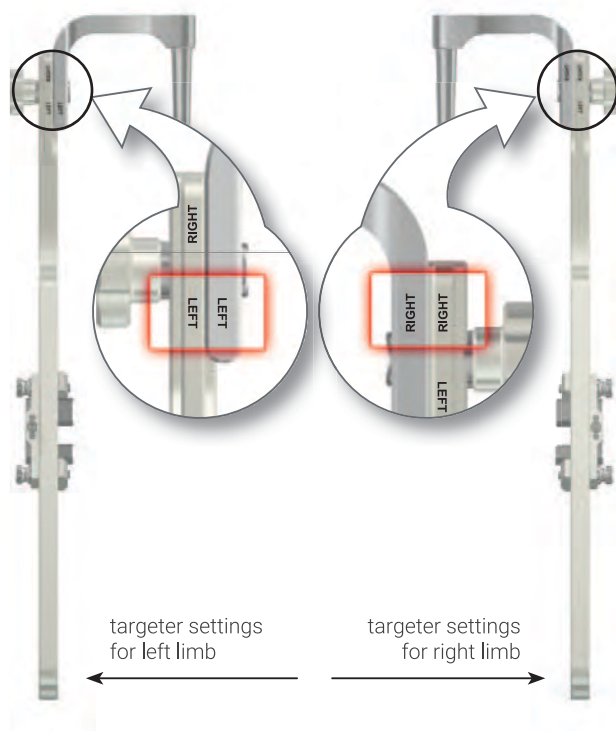
Remove the Flexible Reamer.
Leave the Guide Rod in medullary canal.

- 4 Insert the Nail Length Measuring device [N5TI019] via the Guide Rod. The tip of the Measure should be placed in desired depth of nail insertion. Read the length of the nail on the measuring device.
Remove the Nail Length Measuring device from the Guide Rod.

In the case of solid nail, remove the Guide Rod from the medullary canal.
The medullary canal is prepared for the nail insertion.



V.4. NAIL INSERTION



Note:

The way of mounting the Targeter arm B [N5TI001] with the Distal targeter D [N5TI002] and the position of the slider in distal part depends on the operated limb (left or right).

It is recommended to place the targeter in such way that its proximal part is directed to the operator and the distal bent part is directed upward.

Then:

Right leg:

- connective part of the Distal targeter D should be inserted into socket of the Targeter arm from the right side and mounted using nut.
- the slider of the Distal targeter D in distal part should be arranged in such way, that its adjusting and mounting elements are placed on the left side.

Left leg:

- connective part of Distal targeter D should be inserted into socket of the Targeter arm from left side and mounted using nut.
- slider of the Distal targeter D in distal part should be arranged in such a way, that its adjusting and mounting elements are placed on the right side.

6

Using the Socket Wrench S8 [N5TI004] fix the intramedullary nail to the Targeter arm B [N5TI001] with the Connecting Screw M8x1.25 L-91 [N5TI005].

IMPORTANT!

The accordance In direction of deflection of the nail distal part and the Distal targeter D [N5TI002] proves the mounting correctness.



7 Setting the Distal targeter D [N5TI001] to the nail. Using the Hexagonal Screwdriver 3.5 [N5TI027] adjust the sliding element of the targeter in the middle of the slider plate. With a pair of two Set Blocks 9/4.5 [N5TI014] place the slider of targeter in line with distal locking holes of the intramedullary nail. Secure the slider of targeter with screw using the Hexagonal Screwdriver 3.5 [N5TI027].

VERIFY:

If the slider is properly set and secured, the set blocks should smoothly pass through the nail holes.

Remove set blocks from the targeter slider. Dismount the Distal targeter D [N5TI002] from the Targeter arm B [N5TI001].



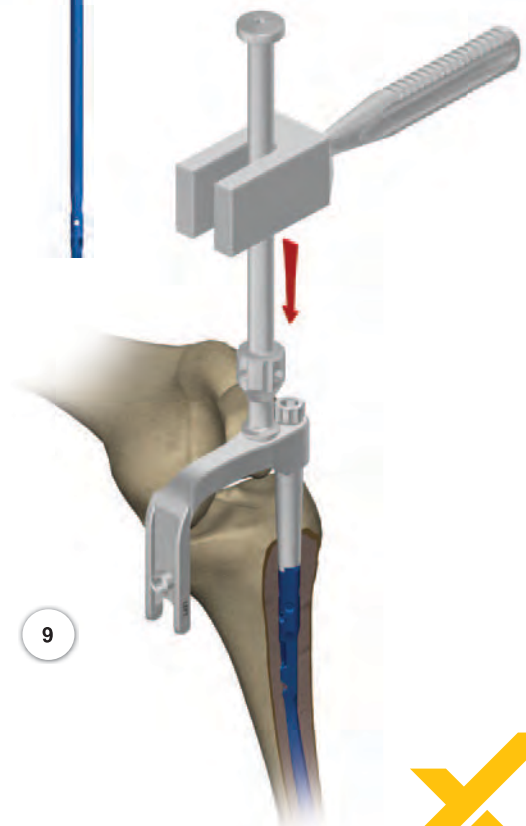
8 Connect the Impactor-Extractor [N5TI007] with the Targeter arm B [N5TI001].

9 Insert the nail into medullary canal to the appropriate depth using the Mallet [N5TI011].

Attention!

Cannulated nail should be inserted into the medullary canal via the Guide Rod [N5TI026].

Dismount the Impactor – Extractor [N5TI007] from the guide.
Remove the Guide Rod (when cannulated nail was used).



OPTION I:

V.5. DISTAL LOCKING OF INTRAMEDULLARY NAIL.

V.5. OPTION : X-Ray control

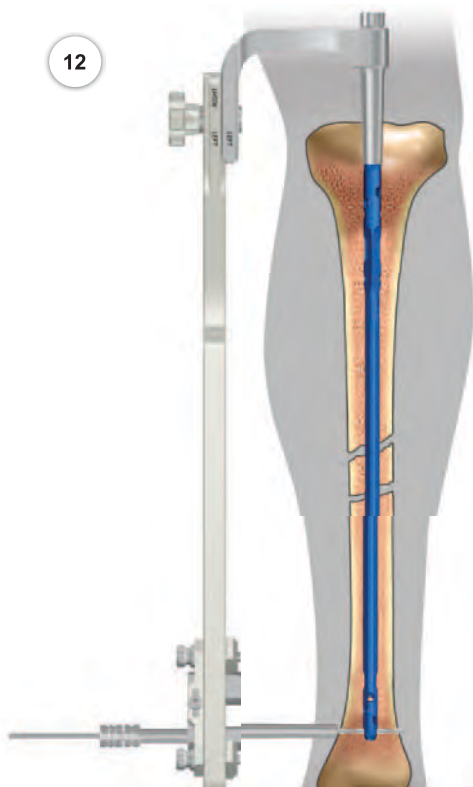
10 Verify the position of holes in the targeter slider and in the distal part of the nail using image intensifier.

- Mount the Distal targeter D [N5TI002] onto the Targeter arm [N5TI001].
- Place image intensifier in such way, that the image on display shows round shaped holes (proximal or distal in the nail).
- Insert the Protective Guide [N5TI012] into the appropriate hole of targeter slider until its tip reaches the soft tissue.
- Verify with X-Ray mutual position of the hole in the Drill Guide and the hole in the Intramedullary nail.

The holes in the nail and tile drill guide are to be congruent on the display- circle shape should be shown (*shape similar to circle is accepted*). The position of targeter should be corrected in the case shape on the display is different from circle. Then using the Hexagonal Screwdriver 3.5 [N5TI027], shift targeter slider (by turning the screw to the left or to the right) to the position when circle shape are shown on the display (shape similar to circle is accepted).



12



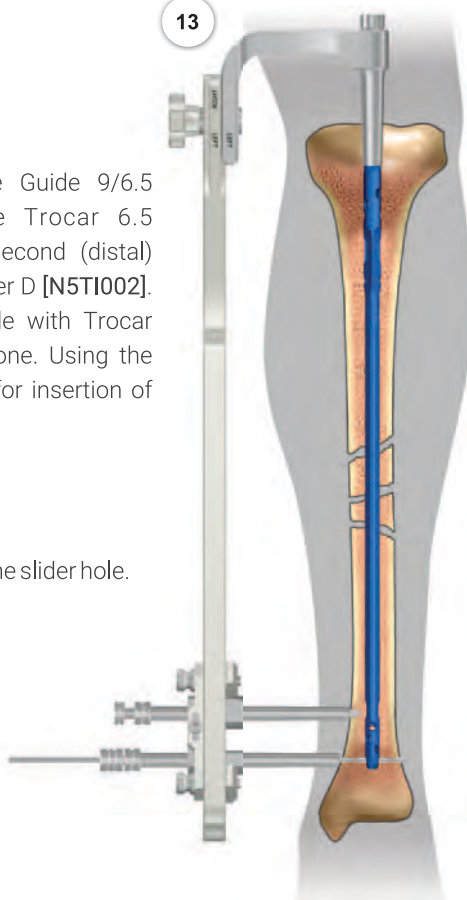
12

Insert the Drill Guide 6.5/3.5 [N5TI013] (with two grooves) Into the Protective Guide left in the slider hole. Mount the Drill With Scale 3.5/250 [N5TI028] on the surgical drive and advance it through the Drill Guide. Drill the hole In the Tibia through both cortex layers and the nail hole. The scale on the Drill shows the length of locking element.

The drilling process should be controlled with Image Intensifier.

Dismount the Surgical Drive.
Leave the Drill in the reamed hole.

13



13

Insert the Protective Guide 9/6.5 [N5TI012] with the Trocar 6.5 [N5TI015] into the second (distal) slider hole of the Distal targeter D [N5TI002]. Advance the Protective Guide with Trocar until it reaches the cortex bone. Using the Trocar mark the entry point for insertion of

locking bolt.
Remove the Trocar.
Leave the Protective Guide in the slider hole.

14



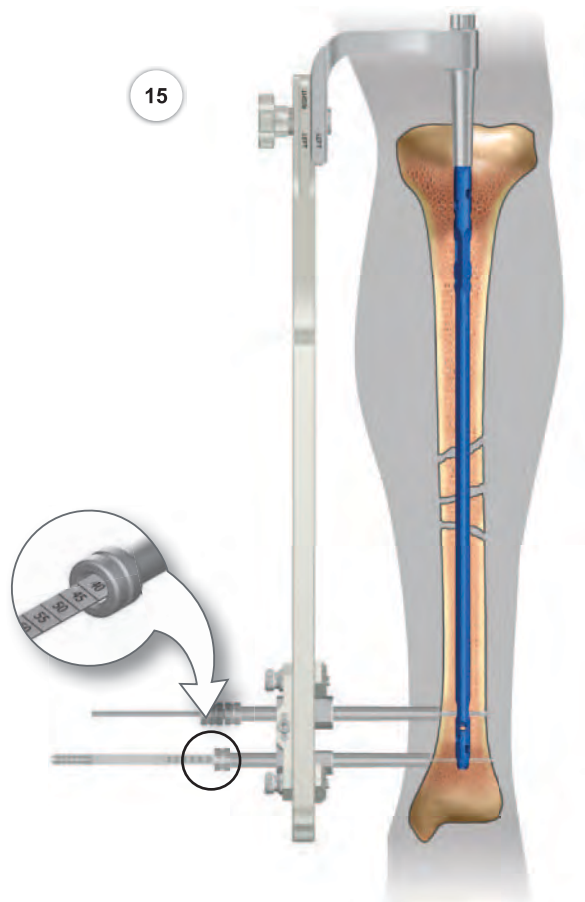
14

Insert the Drill Guide 6.5/3.5 [N5TI013] into the Protective Guide 9/6.5 [N5TI012]. Mount the Drill With Scale 3.5/250 [N5TI028] on the surgical drive and advance it through the drill guide. Drill the hole in the tibia through both cortex layers and the nail hole. The scale on the drill indicates the length of locking bolt.

The drilling process should be controlled with image intensifier.

Remove the Drill and Drill Guide.
Leave the Protective Guide in the slider.





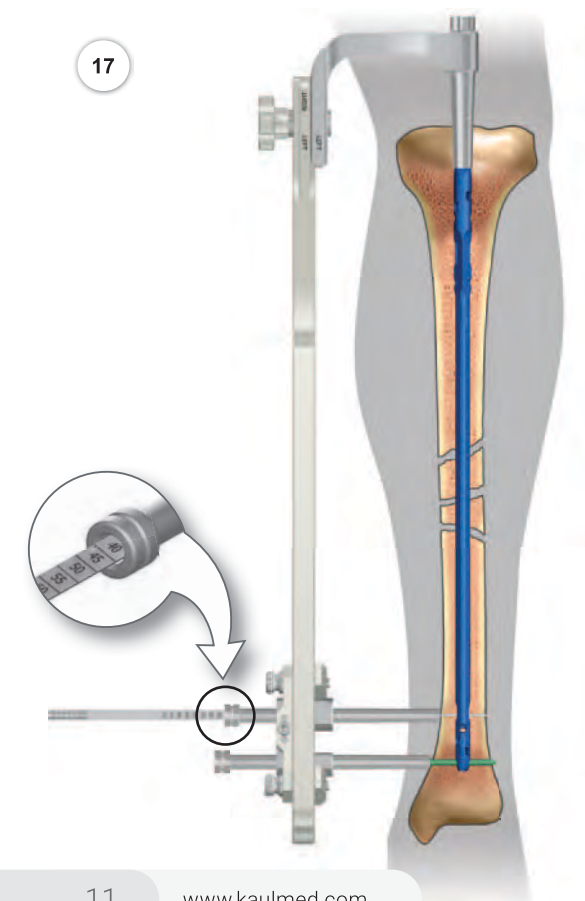
15

Insert the Hole Depth Measuring Device [N5TI018] through the Protective Guide 9/6.5 [N5TI012] into the drilled hole until its hook reaches the "exit" plane of the hole.

Read the length of the locking bolt on the B-D scale. The tip of the protective guide should rest on the cortex during the measurement.

Remove the Screw Length Measure.

Leave the Protective Guide In the slider hole.



17

17

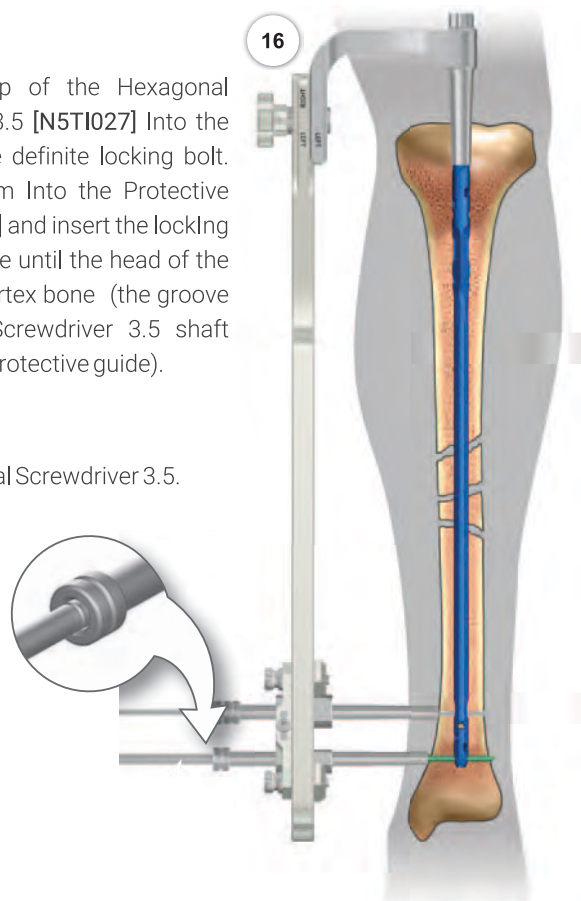
Remove the Drill With Scale 3.5/250 [N5TI028] and the Drill Guide 6.5/3.5 [N5TI013] from the second hole of slider. Leave the Protective Guide in the slider hole. Insert the Screw length Measuring device [N5TI018] through the Protective Guide [N5TI012] into the drilled hole until its hook reaches "exit" plane of the hole.

Read the length of locking bolt on the B-D scale.

The tip of the Protective Guide should rest on the cortex during the measurement.

Remove the Screw Length Measure.

Leave the Protective Guide in the slider hole.



16

16

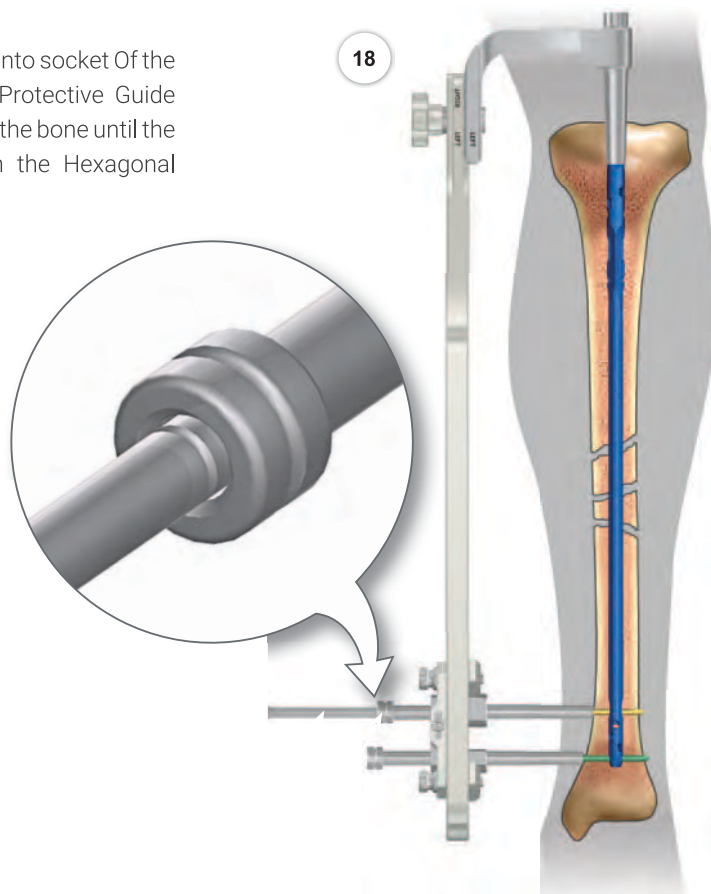
Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] into the socket of the definite locking bolt. Advance such system into the Protective Guide 9/6.5 [N5TI012] and insert the locking bolt into prepared hole until the head of the screw reaches the cortex bone (the groove on the Hexagonal Screwdriver 3.5 shaft matches the edge of protective guide).

Remove the Hexagonal Screwdriver 3.5.



- 18 Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] into socket Of the definite locking bolt. Advanced such system into the Protective Guide [N5TI012] and insert the locking bolt into prepared hole in the bone until the head of the screw reaches the cortex bone (the groove on the Hexagonal Screwdriver 3.5 shaft matches the edge of protective guide).

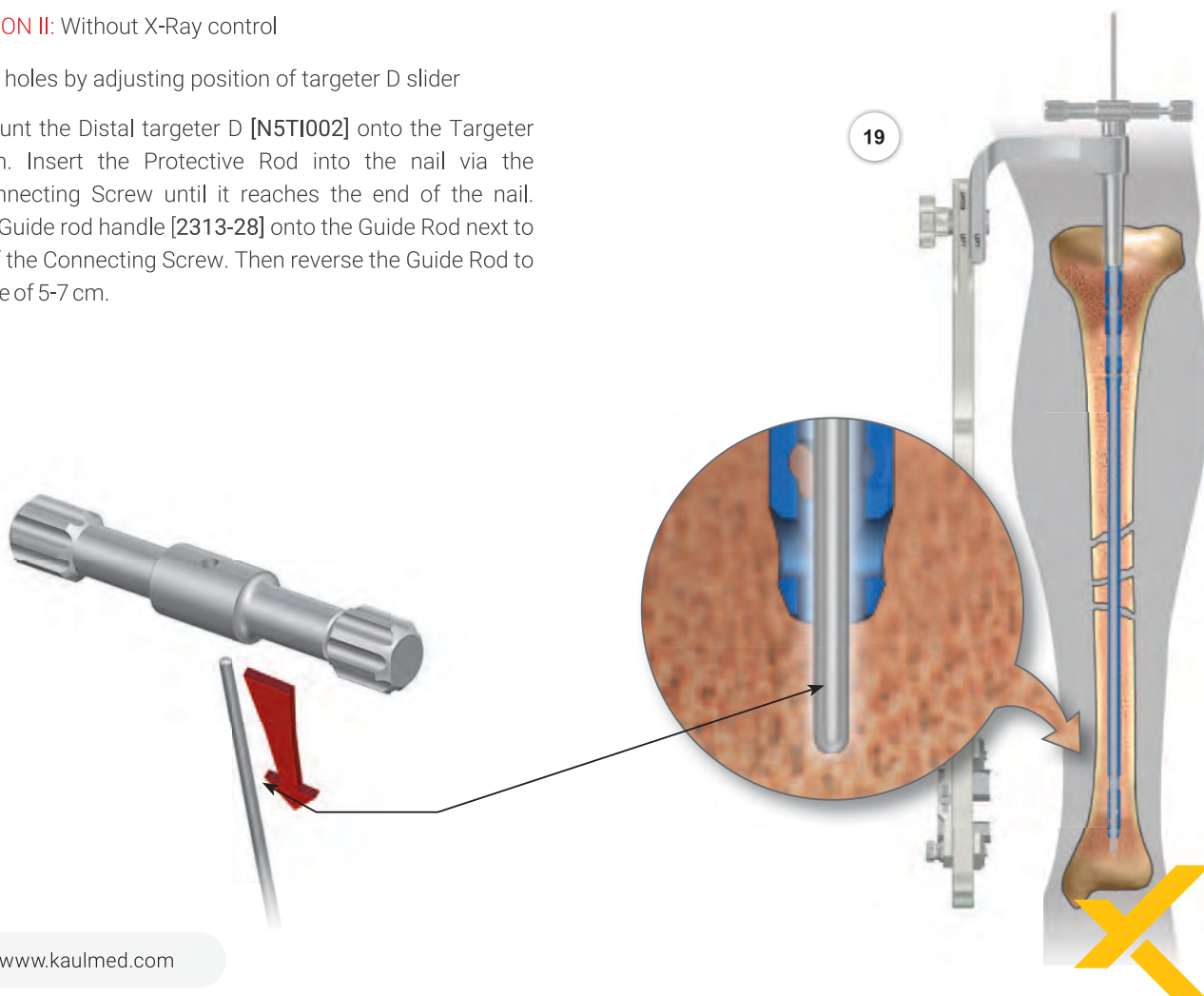
Remove the Hexagonal Screwdriver 3.5 and the Protective Guide.

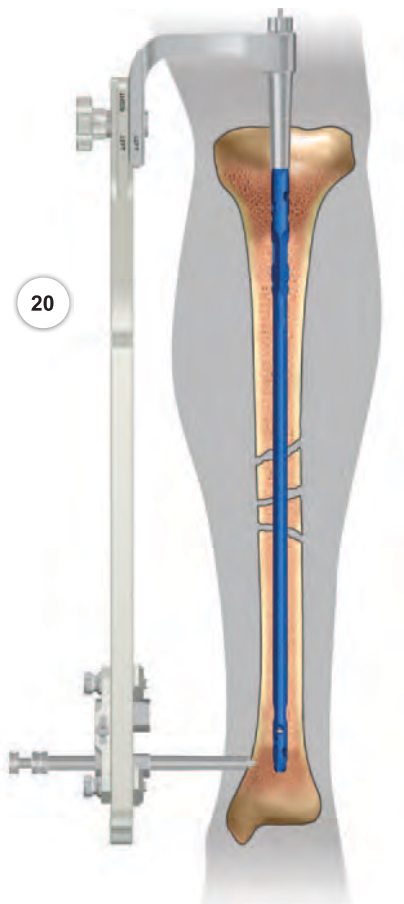


V.5.2. **OPTION II:** Without X-Ray control

Setting nail holes by adjusting position of targeter D slider

- 19 Mount the Distal targeter D [N5TI002] onto the Targeter arm. Insert the Protective Rod into the nail via the Connecting Screw until it reaches the end of the nail. Mount the Guide rod handle [2313-28] onto the Guide Rod next to the head of the Connecting Screw. Then reverse the Guide Rod to the distance of 5-7 cm.





20

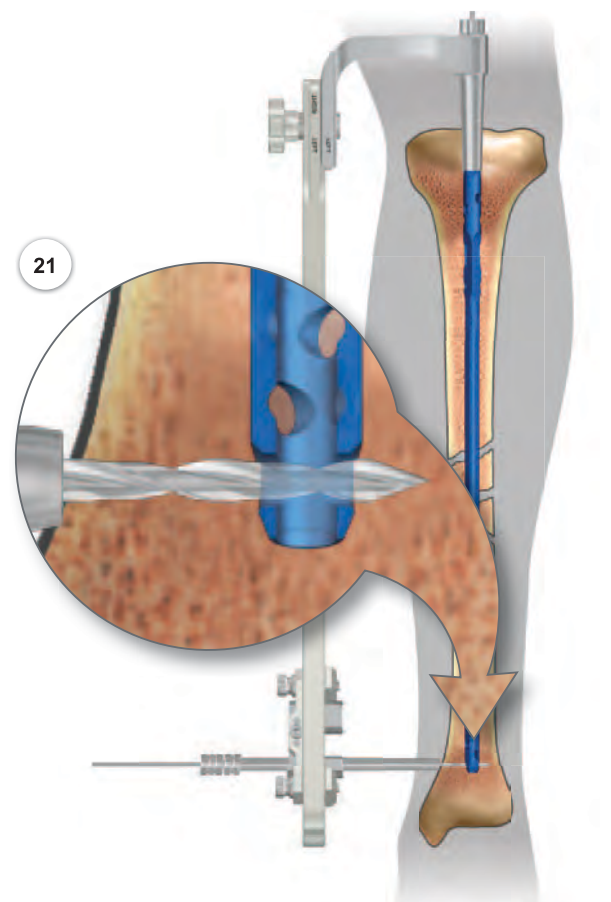
Insert the Protective Guide [N5TI012] with the Trocar [N5TI015] into the slider hole (preferred distal one). Mark on the skin the entry point and make the Incision through the soft tissues. Advance the Protective Guide with the Trocar until it reaches the cortex bone and mark the entry point for the drill.

Remove the Trocar.

21

Insert the Drill Guide 3.5mm [N5TI013] into the Protective Guide left in the slider hole. The end of the Drill Guide should rest on the soft

tissues. Mount the Drill With Scale 3.5/250 [N5TI028] on the surgical drive and advance it through the Drill Guide. Drill the hole in the tibia through first cortex layers and the nail hole.



21



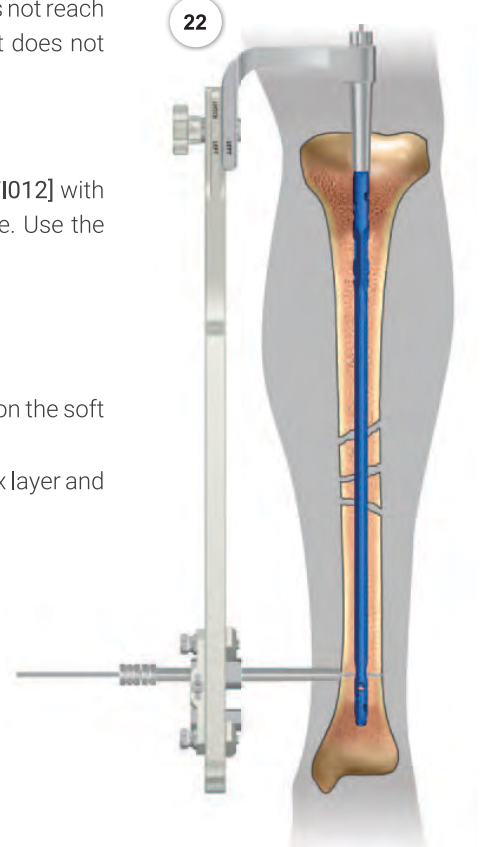
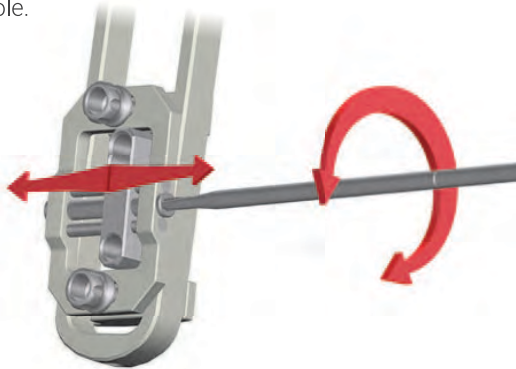
22

Use the Guide Rod [N5TI026] to verify if the drill properly hit the nail hole. If the drill properly hits the nail hole, the Guide Rod rests on the drill but the Guide rod handle does not reach the Connecting Screw. If the Drill passes through the first cortical layer but does not pass the nail hole:

- withdraw the Drill to enable movements of the slider,
- into the second hole of the Distal targeter D [N5TI002] insert the Protective Guide [N5TI012] with the Trocar [N5TI015] and advance until the Protective Guide rests on the cortex bone. Use the Trocar to mark the entry point for the drill.

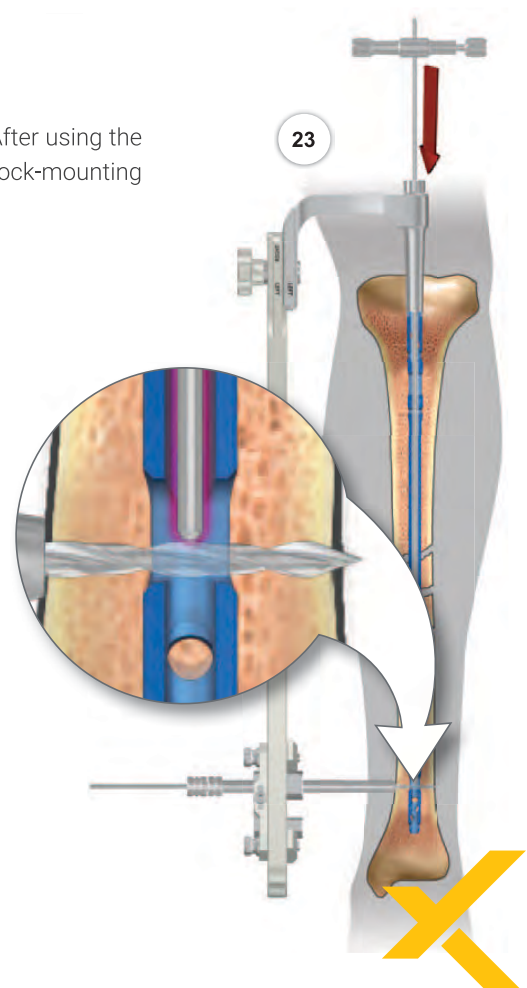
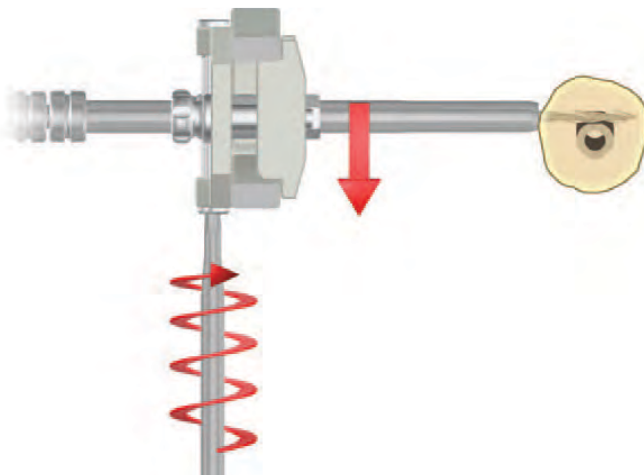
Remove the Trocar but leave the Protective Guide in the slider hole.

- Insert the Protective Drill3.5 [N5TI013] into Protective Guide [N5TI012] until its tip rests on the soft tissues.
- Mount the Drill Guide [N5TI013] on the surgical drive and drill hole through the first cortex layer and the nail hole.



If one of the holes (distal or proximal) is localized, locating another hole is not necessary.

If the drill passes the nail hole, the second cortex layer should be drilled through. After using the surgical drive, leave the drill in the hole. The scale on the drill shows the length of the lock-mounting elements.



NOTE:
Clockwise turn of Hexagonal Screwdriver S3.5 [N5TI027] moves the slider "top",
the turn in the opposite direction moves it "down."

- 24** Insert the Protective Guide [N5TI012] with the Trocar [N5TI015] into the second (distal) slider hole of the Distal targeter D [N5TI002]. Advance the Protective Guide with the Trocar until it rests on the cortex bone. Use the Trocar to mark the entry point to insert the Drill.

Remove the Trocar.

Leave the Protective Guide in the slider hole.



- 25** Insert the Drill Guide 3.5 [N5TI013] into the Protective Guide [N5TI012]. Mount the Drill With Scale 3.51250 [N5TI028] on the surgical drive and advance it through the Drill Guide. Drill the hole in tibia through first cortex layer and the nail hole.

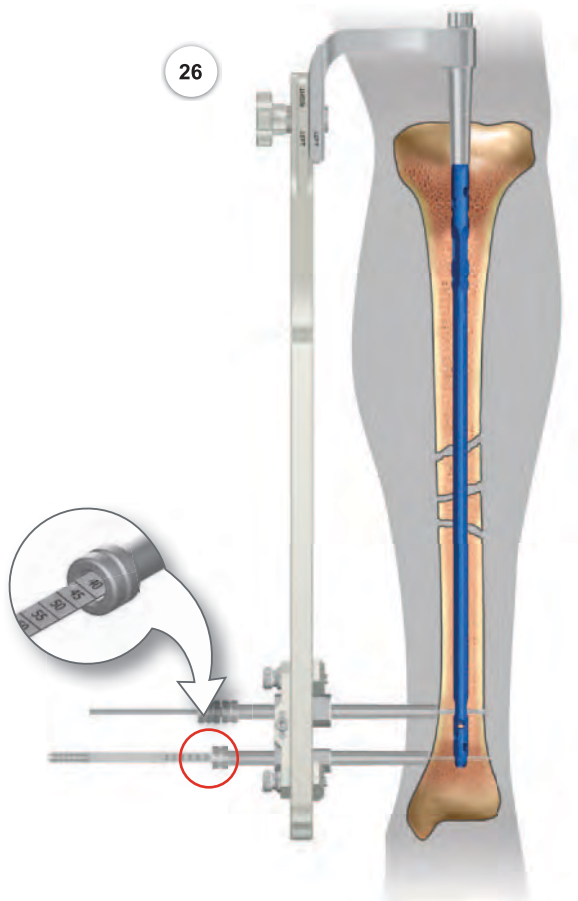
Verify if the drill is located in the hole using the rod. The tip of the Guide Rod should rest on the drill.

If the drill passes through the nail hole, drill it through the second cortex layer. The scale on the drill indicates the length of the locking elements.

Remove the Drill and the Drill Guide.

Leave the Protective Guide in the slider hole.





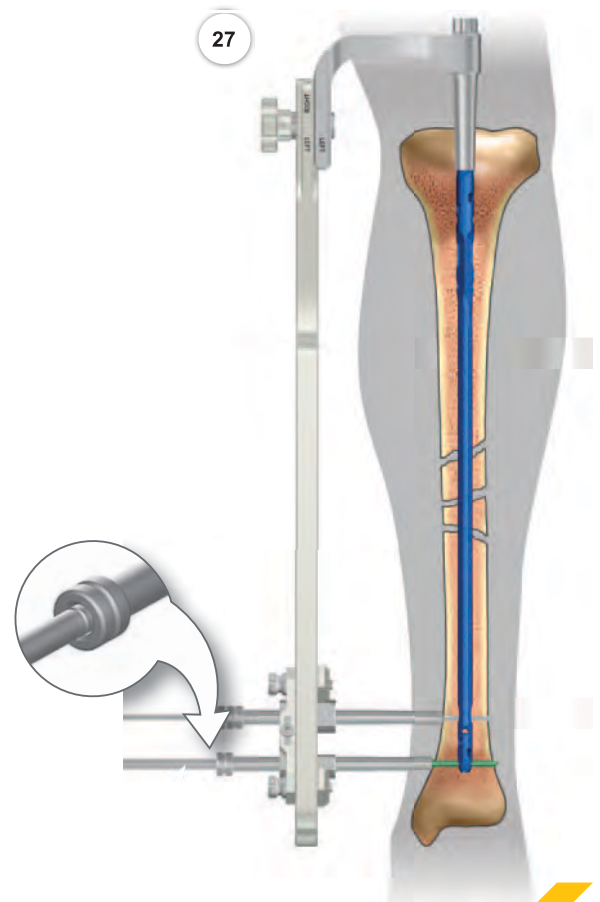
- 26** Insert the Screw Length Measuring device [N5TI018] through the Protective Guide [N5TI012] into the drilled hole until its hook reaches the "exit" plane of the hole. Read the length of the locking screw on the B-D scale.

The tip of the Protective Guide should rest on the cortex during the measurement.

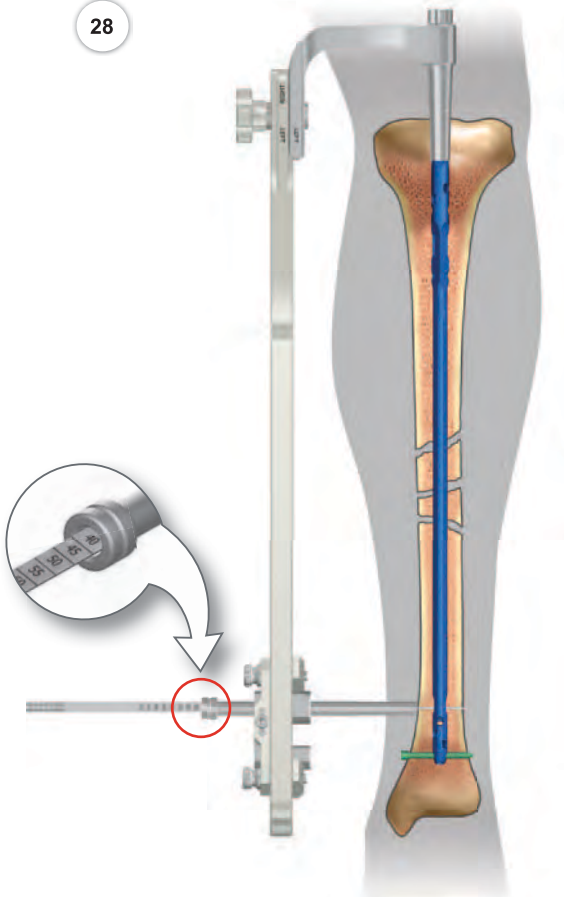
Remove the Screw Length Measure.
Leave the Protective Guide in the slider hole.

- 27** Insert the Up of the Hexagonal Screwdriver 3.5 [N5TI027] into socket of the definite locking screw. Then advance such combined system Into the Protective Guide [N5TI012] and insert the locking bolt Into prepared hole In the bone until the head of the screw reaches the cortex bone (the groove on the hexagonal screwdriver 3.5 matches the edge of protective guide).

Remove the Hexagonal Screwdriver 3.5 and the Protective Guide.



28



28

Remove the Drill With Scale 3.5/250 [N5TI028] and the Drill Guide 6.5/3.5 [N5TI013] from the slider hole but leave the Protective Guide 9/6.5

[N5TI012]. Insert the Screw Length Measuring device [N5TI018] through the Protective Guide 9/6.5 [N5TI012] into the drilled hole until its hook reaches the exit plane of the hole. Read the length of locking bolt on the B-D scale.

The tip of the Protective Guide should rest on the cortex during the measurement.

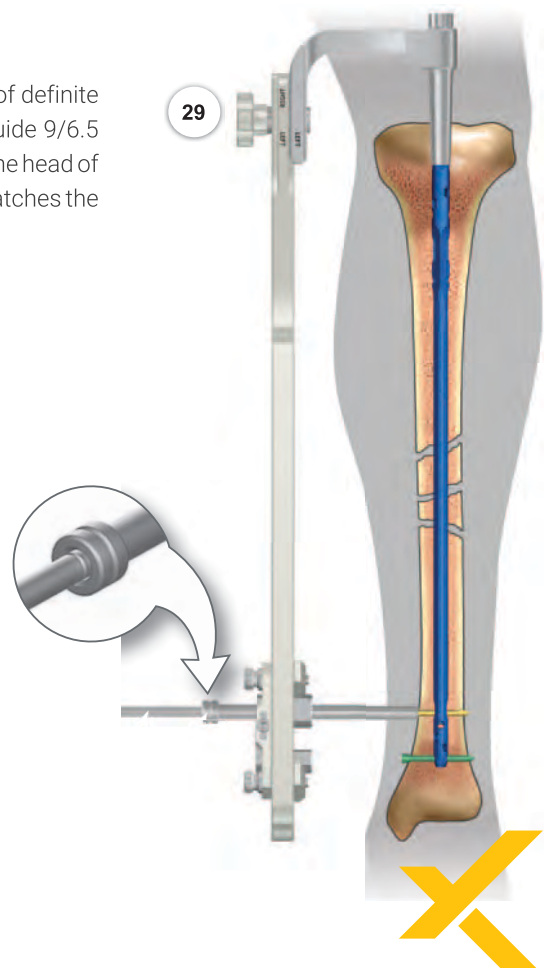
Remove the Screw Length Measuring device.
Leave the Protective Guide In the slider hole.

29

Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] Into the socket of definite locking bolt. Then advance such combined system into the Protective Guide 9/6.5 [N5TI012] and Insert the locking screw Into prepared hole in the bone until the head of the screw reaches the cortex bone (the groove on the Hexagonal Screwdriver 3.5 matches the edge of Protective Guide).

Remove the Hexagonal Screwdriver 3.5 and the Protective Guide.

29



V.5.3. Insertion of instrument into slider holes of Distal targeter

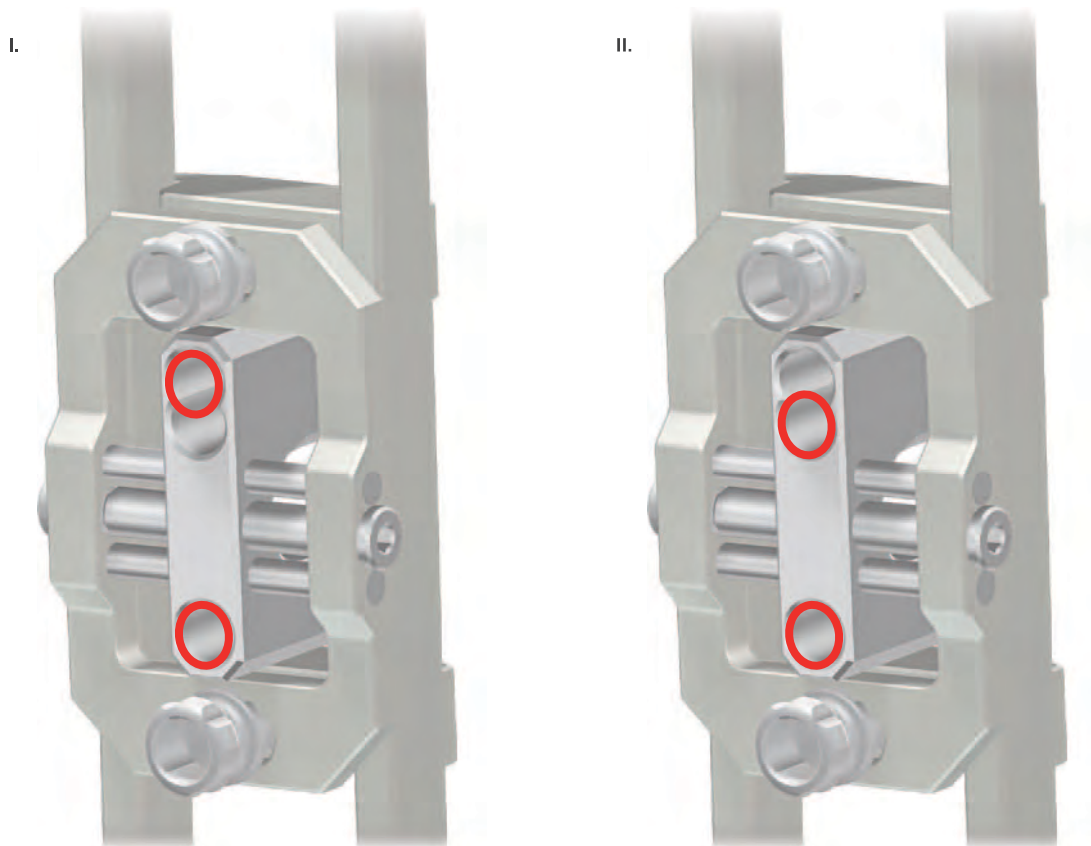
Insertion of the devices into the slider hole of the Distal targeter is possible and depends on the chosen method.

I. static method:

The instruments should be inserted into the distal slider hole and in proximal part of the double hole.

II. dynamic and compressive method:

The instruments should be inserted into the distal slider hole and in distal part of the double hole.



V.6.1. PROXIMAL NAIL LOCKING

V.6.1. Dynamic method and dynamic method with compression

IMPOTANT!

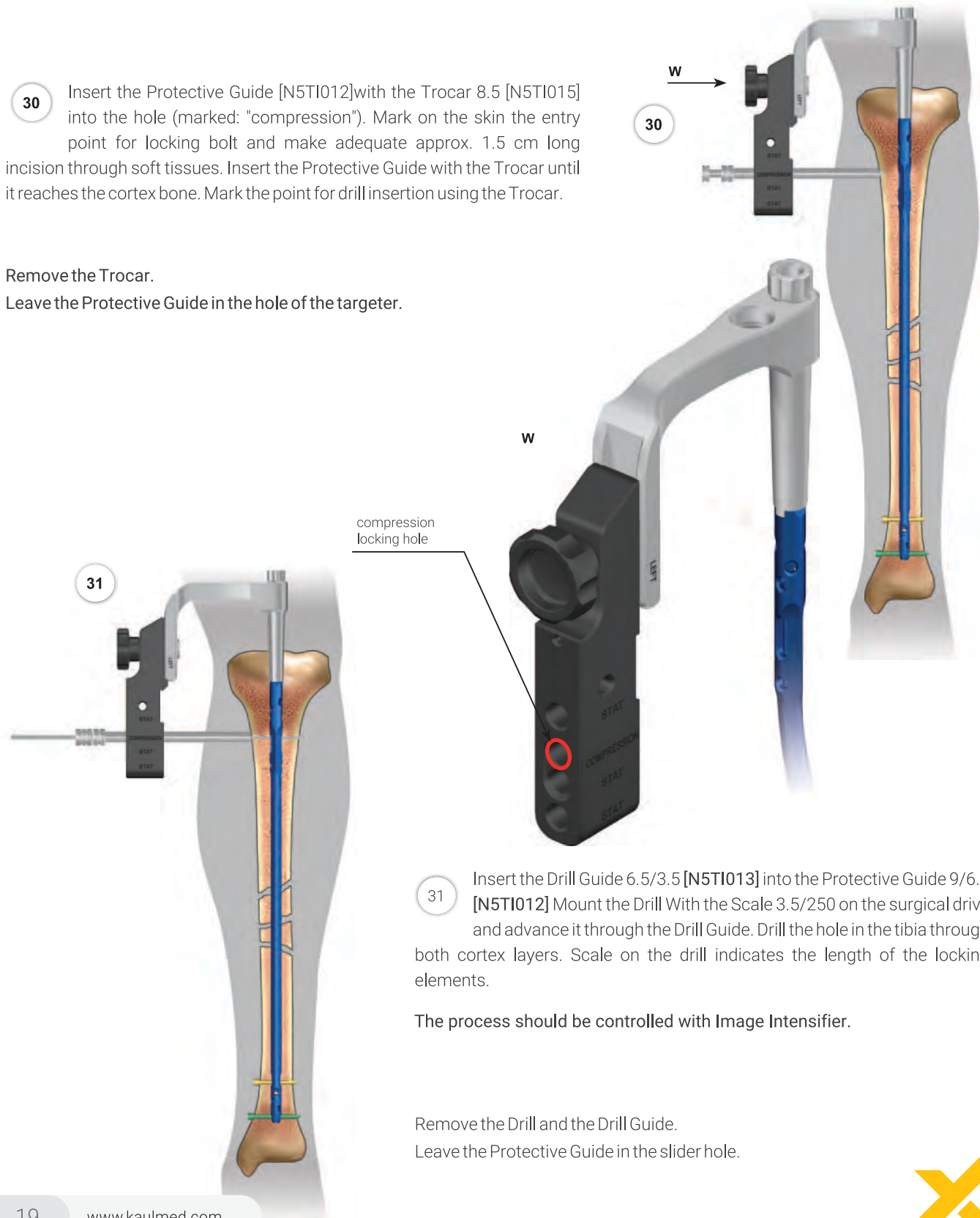
There are four holes in proximal part of the targeter for locking the nail.

The central hole of the targeter, marked COMPRESSION, should be used in dynamic or compression method for locking the nail in proximal part (correspondingly oval shaped hole in the intramedullary nail).

30 Insert the Protective Guide [N5TI012] with the Trocar 8.5 [N5TI015] into the hole (marked: "compression"). Mark on the skin the entry point for locking bolt and make adequate approx. 1.5 cm long incision through soft tissues. Insert the Protective Guide with the Trocar until it reaches the cortex bone. Mark the point for drill insertion using the Trocar.

Remove the Trocar.

Leave the Protective Guide in the hole of the targeter.



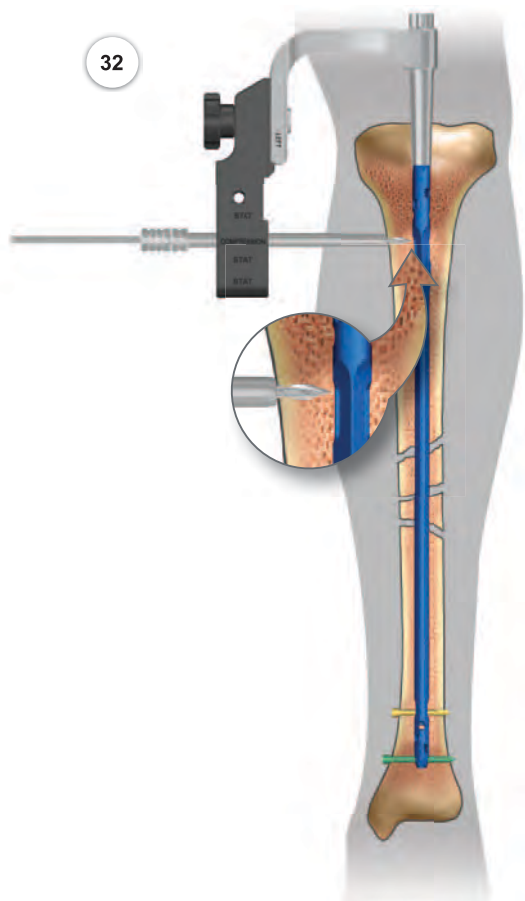
31 Insert the Drill Guide 6.5/3.5 [N5TI013] into the Protective Guide 9/6.5 [N5TI012]. Mount the Drill With the Scale 3.5/250 on the surgical drive and advance it through the Drill Guide. Drill the hole in the tibia through both cortex layers. Scale on the drill indicates the length of the locking elements.

The process should be controlled with Image Intensifier.

Remove the Drill and the Drill Guide.

Leave the Protective Guide in the slider hole.



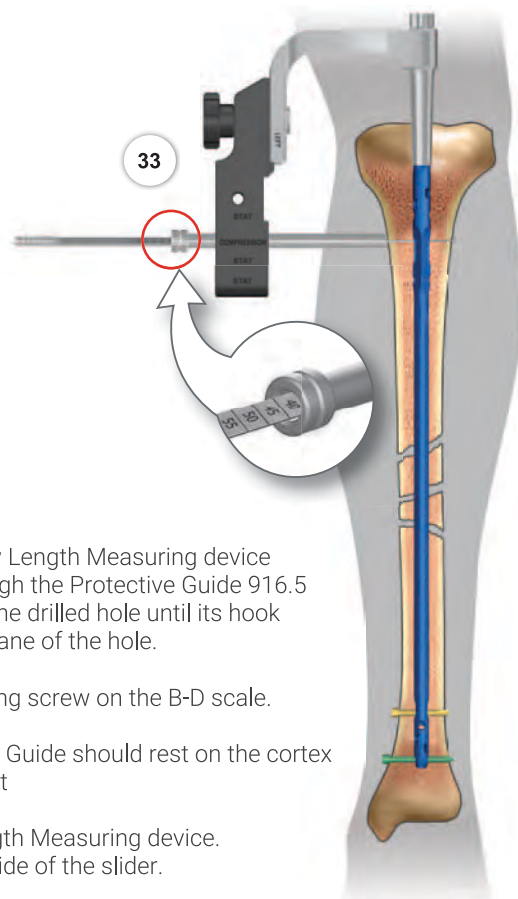


32

- 32 Insert the Drill Guide 6.5/4.5 [N5TI013] into the Protective Guide 9/6.5 [N5TI012]. Insert the Drill 4.5/250 [N5TI030] into the Drill Guide and widen the hole in first cortex layer .

The widening process should be controlled with image intensifier

Remove the Drill and the Drill Guide.
Leave the Protective Guide in the target hole.



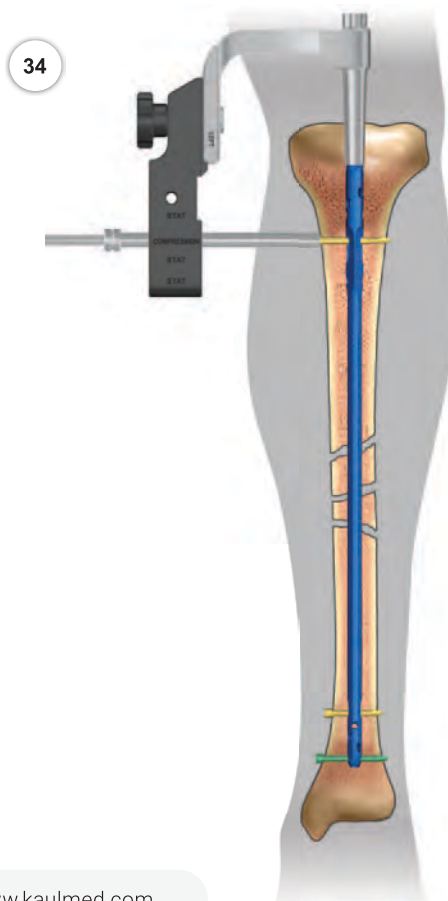
33

- 33 Insert the Screw Length Measuring device [N5TI018] through the Protective Guide 9/6.5 [N5TI012] into the drilled hole until its hook reaches "exit" plane of the hole.

Read the length of locking screw on the B-D scale.

The tip of the Protective Guide should rest on the cortex during the measurement

Remove the Screw Length Measuring device.
Leave the Protective Guide of the slider.

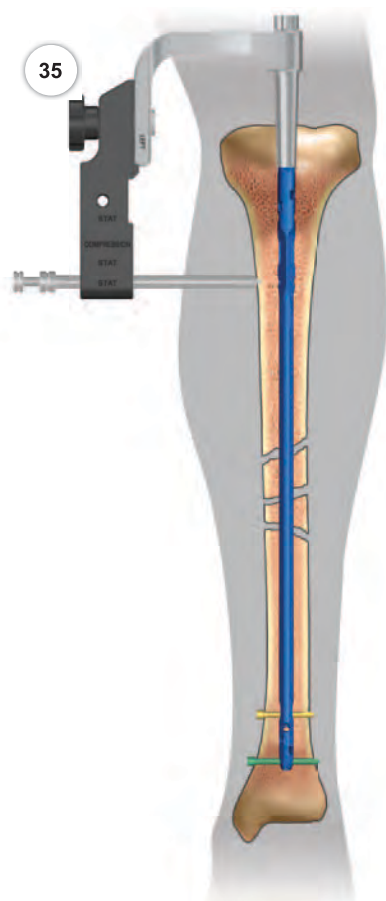


34

- 34 Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] into the socket of the defined locking bolt. Advance such combined system into the Protective Guide 9/6.5 [N5TI012] and insert the locking bolt into prepared hole in the bone until the head of the screw reaches the cortex bone (the groove on the Hexagonal Screw driver 3.5 matches the edge of the Protective Guide).

Remove the Hexagonal Screwdriver 3.5 and the Protective Guide.

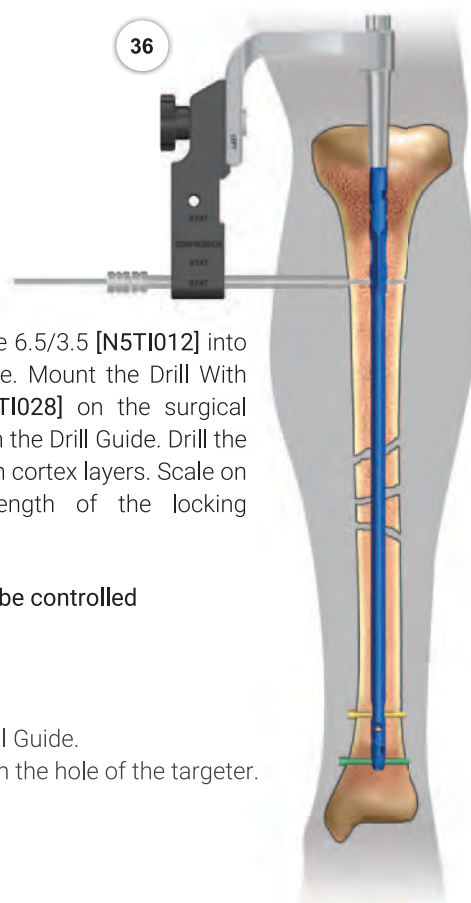




V.8.2. Static method

It is recommended to lock a nail in proximal part using two screws. One of round holes should be used in every case of nail locking.

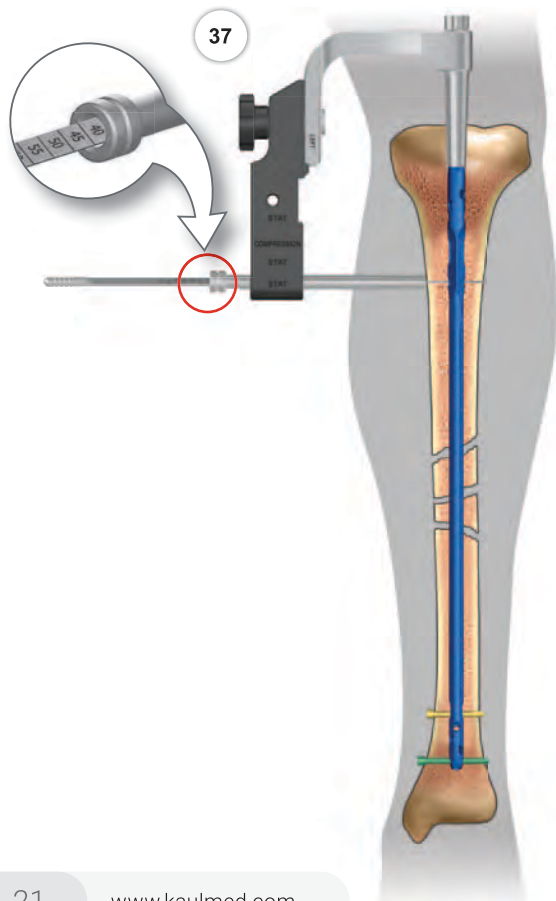
- 35** Insert the Protective Guide 9/6.5 [N5TI012] with the Trocar 6.5 [N5TI015] into the hole of the Targeter B [N5TI003]. Mark on the skin the entry point for the locking bolt and make adequate 1.5 cm long incision through the soft tissues. Insert the Protective Guide with the Trocar until it reaches the cortex bone. Mark the entry point for drill insertion using the Trocar.



- 36** Insert the Drill Guide 6.5/3.5 [N5TI012] into the Protective Guide. Mount the Drill With Scale 3.5/250 [N5TI028] on the surgical drive and advance it through the Drill Guide. Drill the hole in the tibia through both cortex layers. Scale on the Drill indicates the length of the locking elements.

The drilling process should be controlled with image intensifier.

Remove the Drill and the Drill Guide.
Leave the Protective Guide in the hole of the targeter.



- 37** Insert the Screw Length Measuring device [N5TI018] through the Protective Guide 9/6.5 [2313-15] into the drilled hole until its hook reaches "exit" plane of the hole. Read the length of the locking screw on the 8-D scale.

The tip of the Protective Guide should rest on the cortex during the measurement.

Remove the Screw Length Measure.
Leave the Protective Guide in the hole of the targeter.

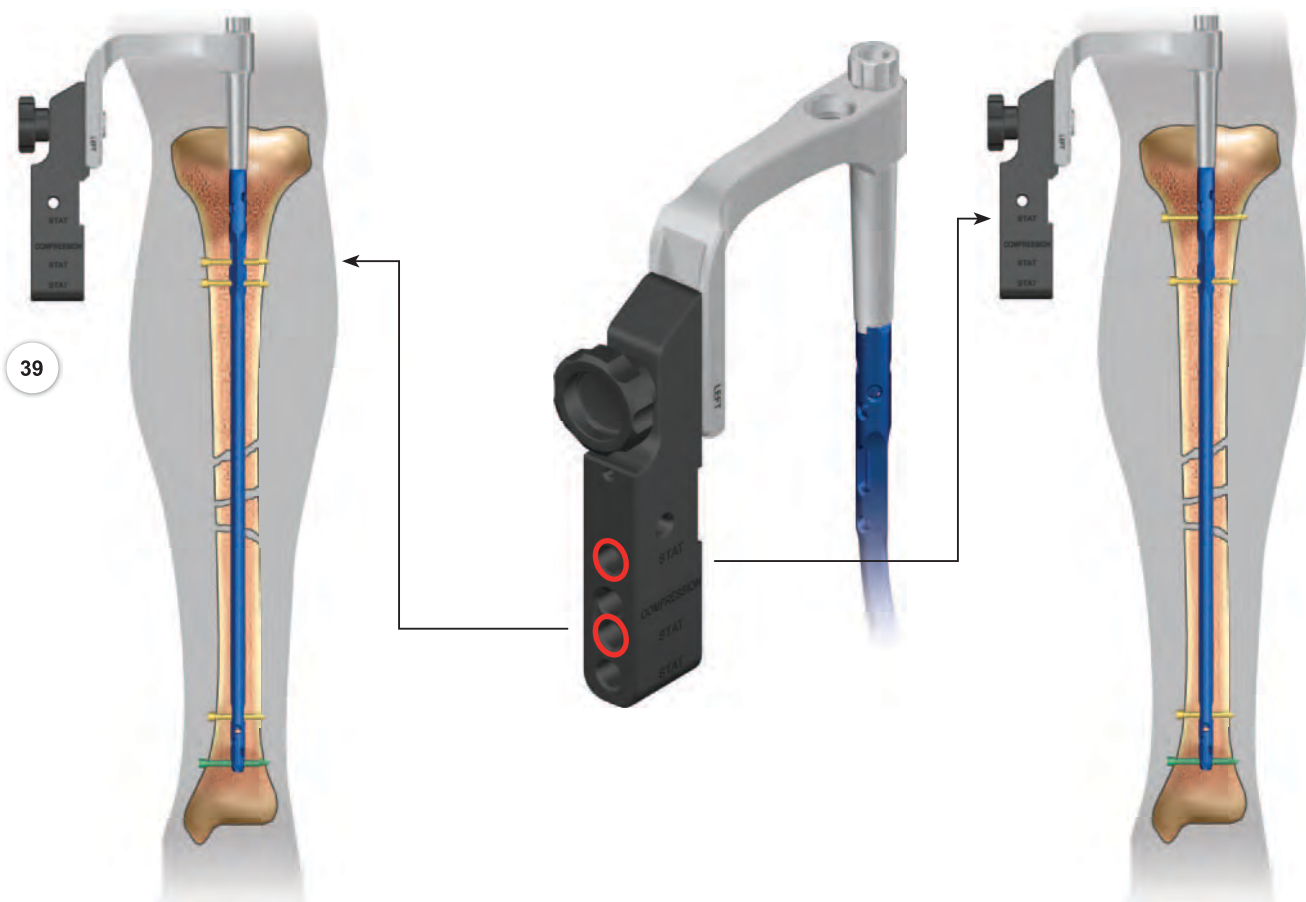
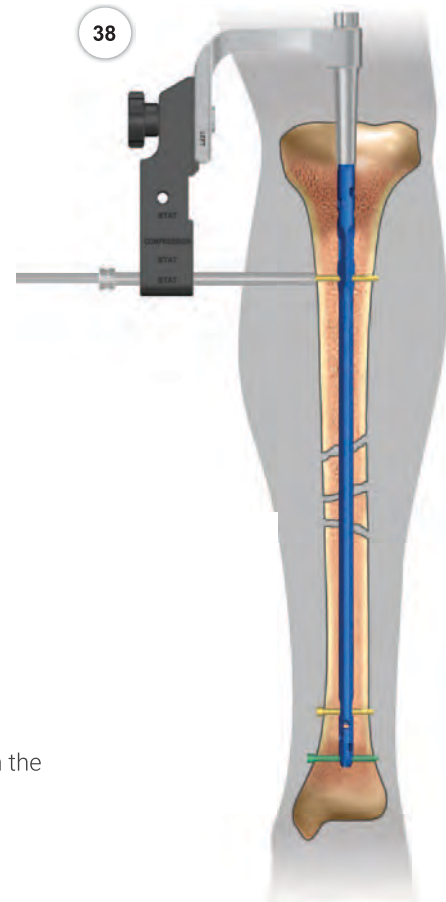


- 38** Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] into the head of the definite locking screw and then advance such system into the Protective Guide 9/6.5 [N5TI012] and insert the locking bolt into prepared hole in the bone until the head of the screw reaches the cortex bone (the groove on the Hexagonal Screwdriver 3.5 matches the edge of the Protective Guide).

Remove the Hexagonal Screwdriver 3.5 and the Protective Guide.

- 39** Use the second locking screw to lock the nail in the proximal part through the chosen targeter hole.

To lock the nail follow the steps from 35 to 38.

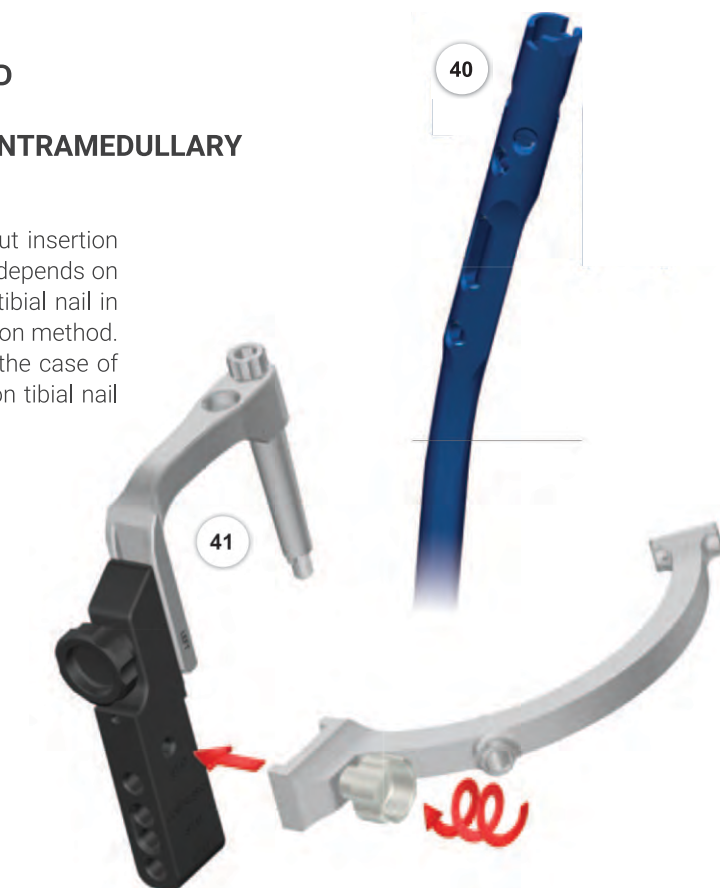
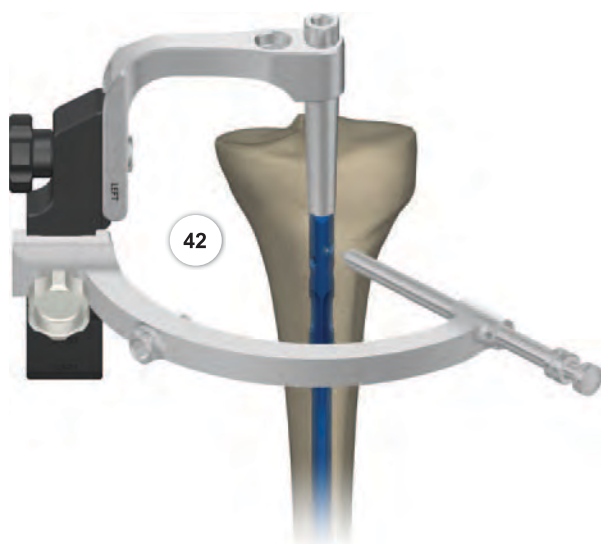


VI. SURGICAL TECHNIQUE- RECONSTRUCTIVE METHOD

VI.1. PROXIMAL LOCKING OF THE RECONSTRUCTION INTRAMEDULLARY NAIL

40 Reconstruction nail has 5 holes in proximal part. Decision about insertion site and number of used screws is to be made by surgeon and depends on the type of fracture. It is not necessary to lock reconstruction tibial nail in the reconstruction holes. In such case, lock the nail as in the compression method. It is important to pay attention to lack of compression possibilities in the case of using the reconstruction holes. In the case of locking the reconstruction tibial nail in the proximal part follow steps [30]-[39].

41 Mount the Reconstruction targeter [N5TI006] on the Targeter B [N5TI003] to lock the nail using reconstruction holes. Insert threaded arbor of the Reconstruction targeter into lateral hole of the Targeter arm B [N5TI001] and connect both elements using the nut.

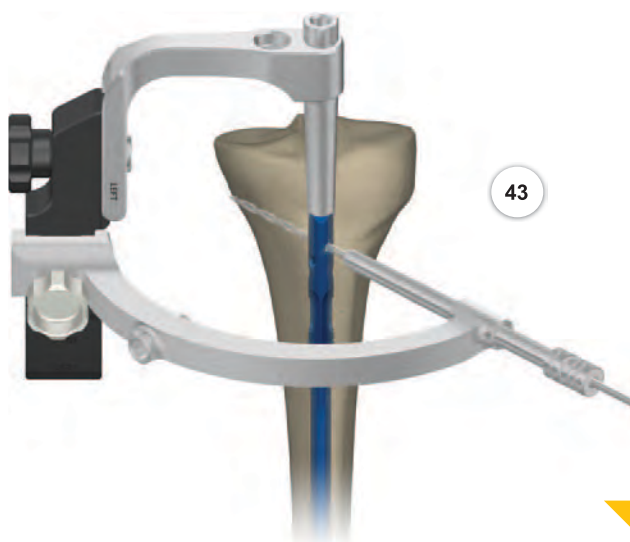


42 Insert the Protective Guide 9/6.5 [N5TI012] with the Trocar 6.5 [N5TI015] into the hole of the Reconstruction targeter. Mark on the skin the entry point for locking bolt and make 1.5 cm long incision of the soft tissues. Advance the Protective Guide together with the Trocar until it reaches the cortex bone. Use the Trocar to mark the entry point for the drill.

Remove the Trocar.
Leave the Protective Guide in the hole of the targeter.

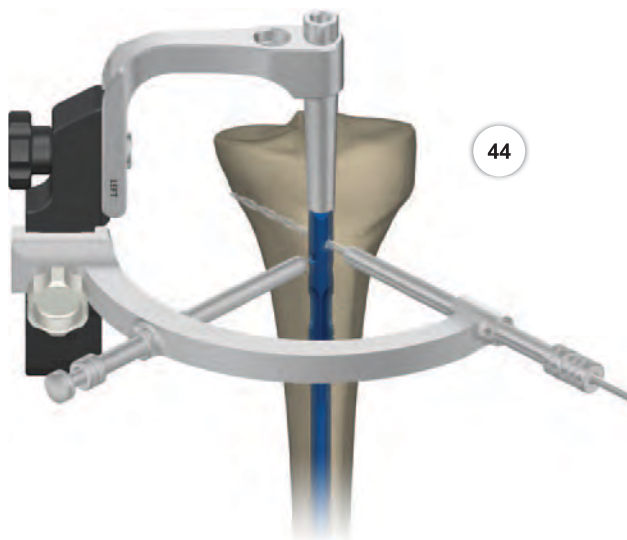
43 Insert the Drill Guide 6.5/3.5 [N5TI013] into the Protective Guide 9/6.5 [N5TI012] left in the hole of the targeter. Mount the Drill With Scale 3.5/250 [N5TI028] on the surgical drive and advance it through the Drill Guide. Drill the hole in the tibia to the appropriate depth. The scale on the Drill indicates the locking elements.

Leave the Protective Guide together with Drill and Drill Guide in the hole of the targeter.



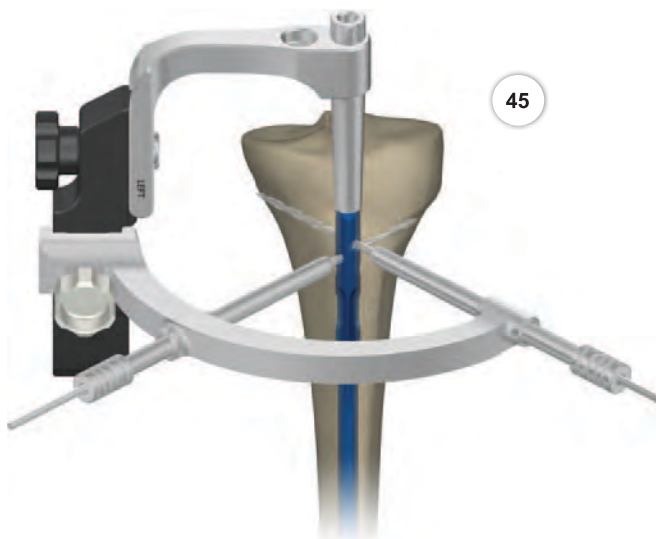
44 Insert the Protective Guide 9/6.5 [N5TI012] with the Trocar 6.5 [N5TI015] into second reconstruction hole of the targeter. Mark on skin entry point for the locking bolt and 1.5 cm long incision of the soft tissues across the point. Advance the Protective Guide together with Trocar until it reaches the cortex bone. Use the Trocar to mark the entry point for the drill .

Remove the Trocar.
Leave the Protective Guide in the hole of the targeter.



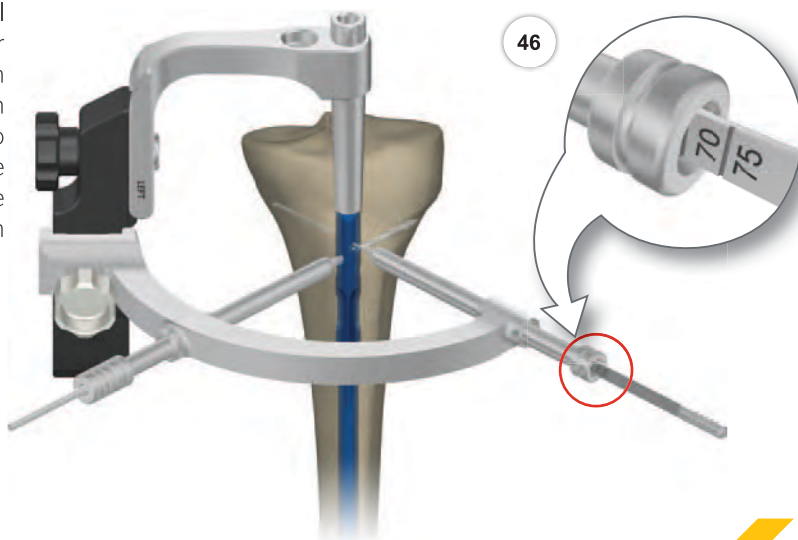
45 Insert the Drill Guide 6.5/3.5 [N5TI013] into the Protective Guide 9/6.5 [N5TI012] left in the hole of the targeter. Mount the Drill With Scale 3.5/250 [N5TI028] on the surgical drive and advance it through the Drill Guide. Drill the hole in the tibia to the appropriate depth. The scale on the drill Indicates the locking elements

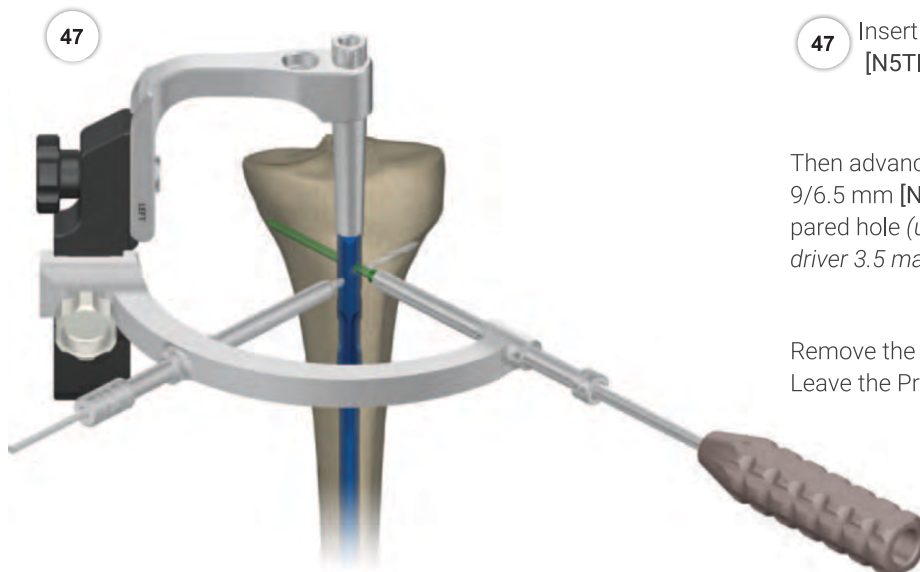
Leave the Protective Guide together with Drill and Drill Guide in the hole of the targeter.



46 Remove the Drill With Scale [N5TI028] and the Drill Guide 6.5/3.5 [N5TI013] from one of the targeter holes. Leave the Protective Guide 9/6.5 mm [N5TI012] in the targeter hole. Insert the Screw Length Measuring device [N5TI018] through the Protective Guide into the drilled hole until its tip reaches the end of hole. Read the length of the locking bolt on the B-D scale. During the measurement the end of the Protective Guide should rest on the cortex.

Remove the Screw Length Measuring device.
Leave the Protective Guide in the hole of the targeter.





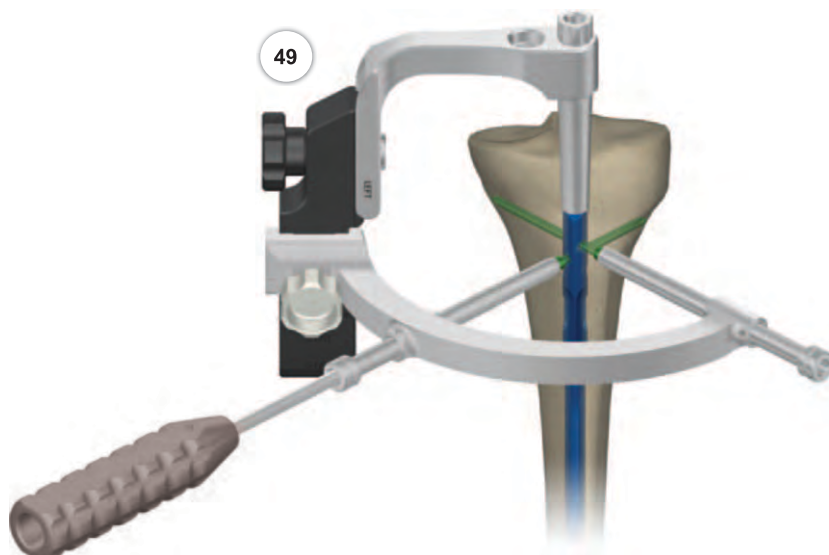
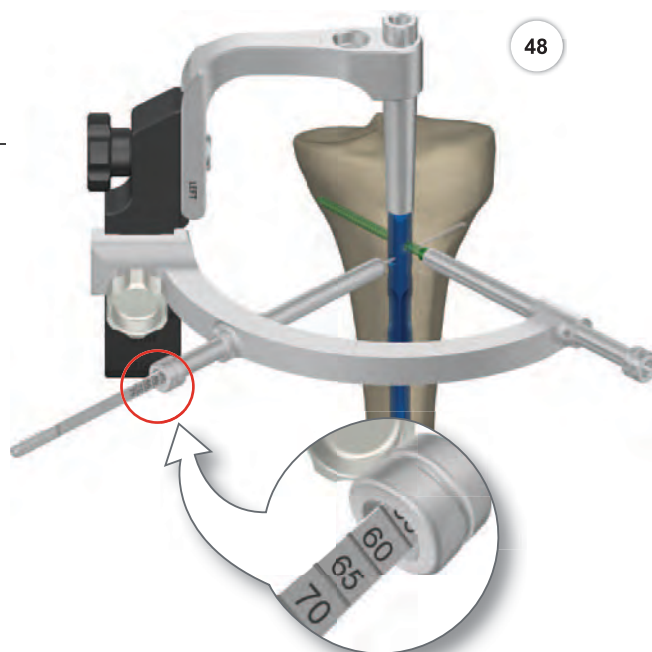
- 47 Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] into the socket of the locking bolt

Then advance such system into the Protective Guide 9/6.5 mm [N5TI012]. Insert the locking bolt in the prepared hole (until the groove on the Hexagonal Screwdriver 3.5 matches the edge of the Protective Guide).

Remove the Hexagonal Screwdriver 3.5.
Leave the Protective Guide.

- 48 Remove the Drill With Scale 3.5/250 [N5TI028] and the Drill Guide 6.5/3.5 [N5TI013] from the second hole of the reconstruction targeter. Leave the Protective Guide 9/6.5 mm [N5TI012] in the targeter hole. Insert the Screw Length Measuring device [N5TI018] through the Protective Guide into the drilled hole until its tip reaches the end of hole.
Read the length of the locking bolt on the B-D scale.
During the measurement the end of the Protective Guide should rest on the cortex.

Remove the Screw Length Measuring device.
Leave the Protective Guide in the hole of the targeter.



- 49 Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] into the socket of the locking screw:

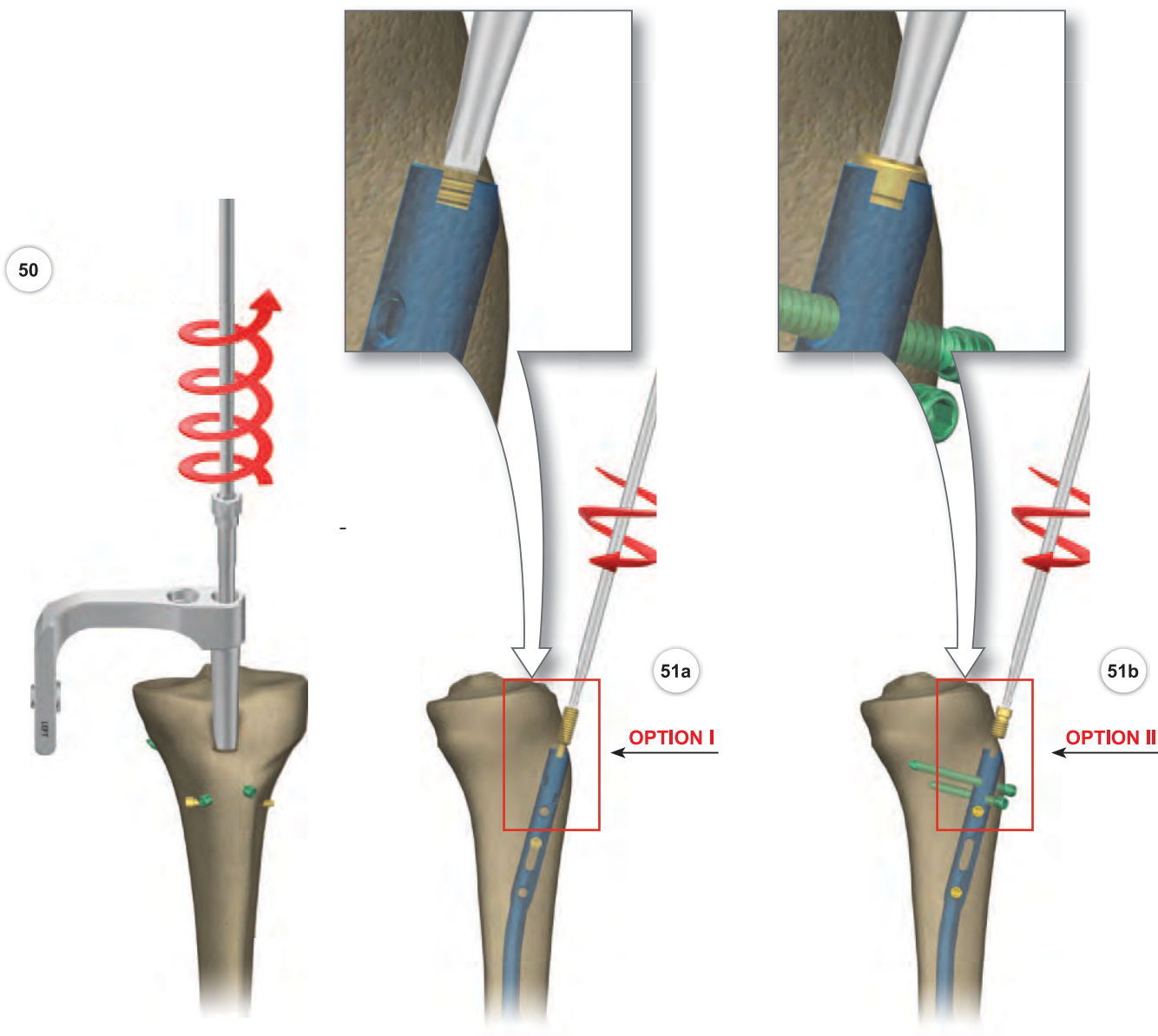
Then advance such system into the Protective Guide 9/6.5 mm [N5TI012]. Insert the locking bolt in the prepared hole (until the groove on the Hexagonal Screwdriver 3.5 matches the edge of protective guide).

Remove the Hexagonal Screwdriver 3.5 and the Protective Guide.



VI.2. INSERTING COMPRESSION SCREW OR END CUP

- 50 Unscrew the Connecting screw M8x1.25 L-91 [N5TI005] using the Socket Wrench S8 [N5TI004].
Dismount the the Targeter arm [N5TI001] from the nail.



- 51 Insertion of Compression Screw or End Cap.

OPTION I Inserting the Compression Screw refers to dynamic method with compression.
Use the Screwdriver [N5TI027] to insert the Compression Screw (implant) into the threaded hole of the nail.

OPTION II Inserting the End Cap refers to dynamic and static methods
To secure the inner thread of the nail form bone ingrowth, insert the End Cap (implant) using the Screwdriver [N5TI027].



VII. LOCKING OF INTRAMEDULLARY NAIL USING TARGETER D [N5TI020] AND TARGETER ARM B [N5TI001]

VII.1. DISTAL LOCKING OF THE NAIL USING TARGETER D [N5TI020]- "FREEHAND TECHNIQUE"

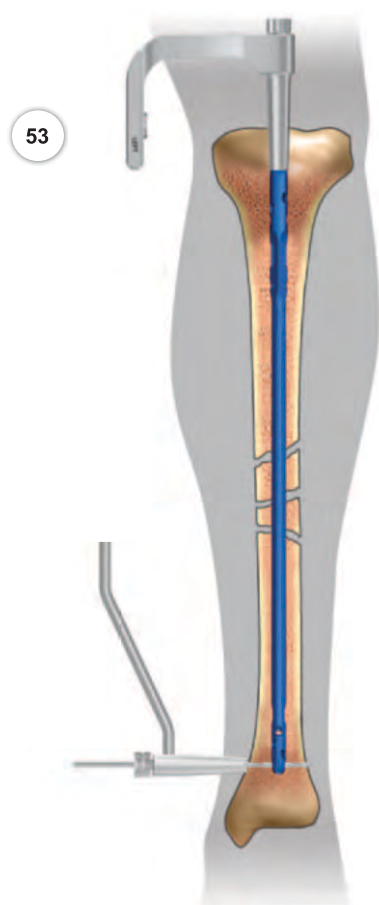
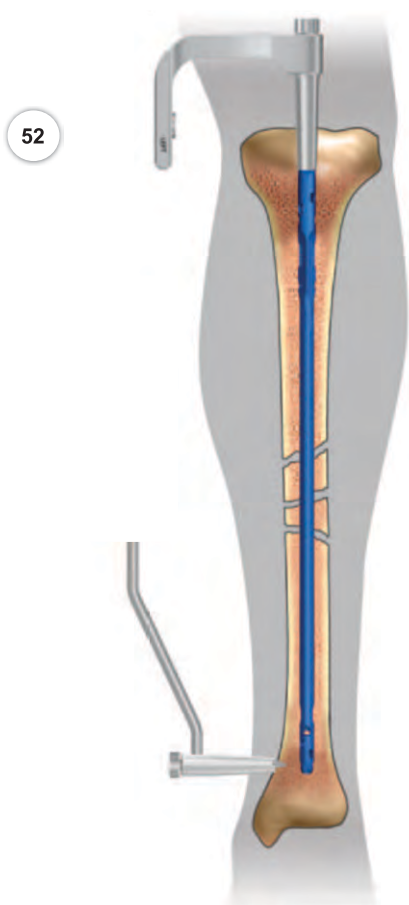
In this technique an image intensifier is used to verify the entry points for the Drill and to control the drilling processes. It is recommended to use angular attachment with the surgical drive while drilling the holes, so that surgeon's hands are not directly exposed to X-rays. After marking the entry points on the skin, make incisions through the soft tissues, each about 1.5 cm in length.

- 52** Use the image intensifier to establish the place of the Targeter D [N5TI020] in line with the nail hole. The centers of the holes in the targeter and the nail have to match. The teeth of the targeter have to be merged in the cortex. Insert the Short Trocar [N5TI021] into the Targeter D hole, advance it until it reaches cortex and mark the entry point for the drill.

Remove the Trocar.
Leave the Targeter D in place.

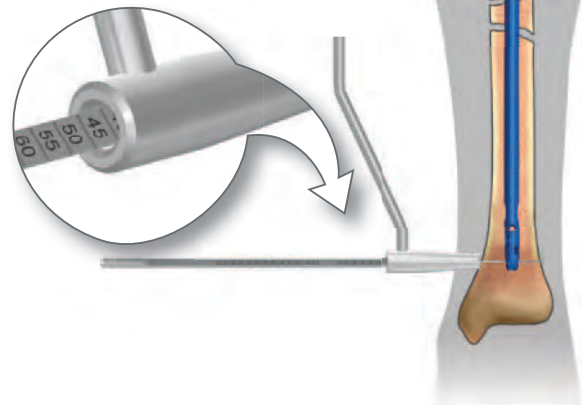
- 53** Insert the Drill Guide Short 7/3.5 [N5TI022] into the hole in Targeter D [N5TI020]. Mount the Drill 3.5/150 mm [N5TI029] or Drill 3.5/250 [N5TI028] on the surgical drive and advance such system through the Drill Guide. Drill the hole through both cortex layers.

The drilling process should be controlled with image intensifier.



- 54** Insert the Saew Length Measuring device [N5TI018] through the Targeter D [N5TI020] hole into the drilled hole until its hook reaches the "exit" plane of the hole. Read the length of the locking bolt on the D scale.

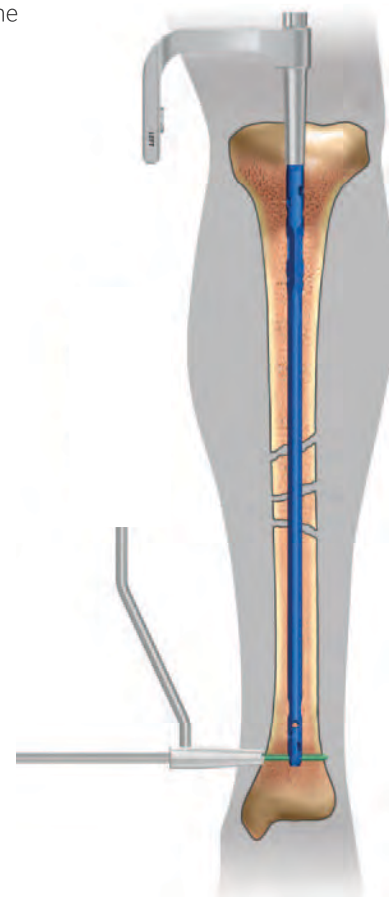
Remove the Screw Length Measuring device.
Leave the Targeter D.



- 55** Insert the tip of the Hexagonal Screwdriver 3.5 [N5TI027] into the socket of the selected locking bolt. Then advance such system into the hole of Targeter D [N5TI020]. Insert the locking bolt into the prepared hole until its head reaches the cortex of the bone.

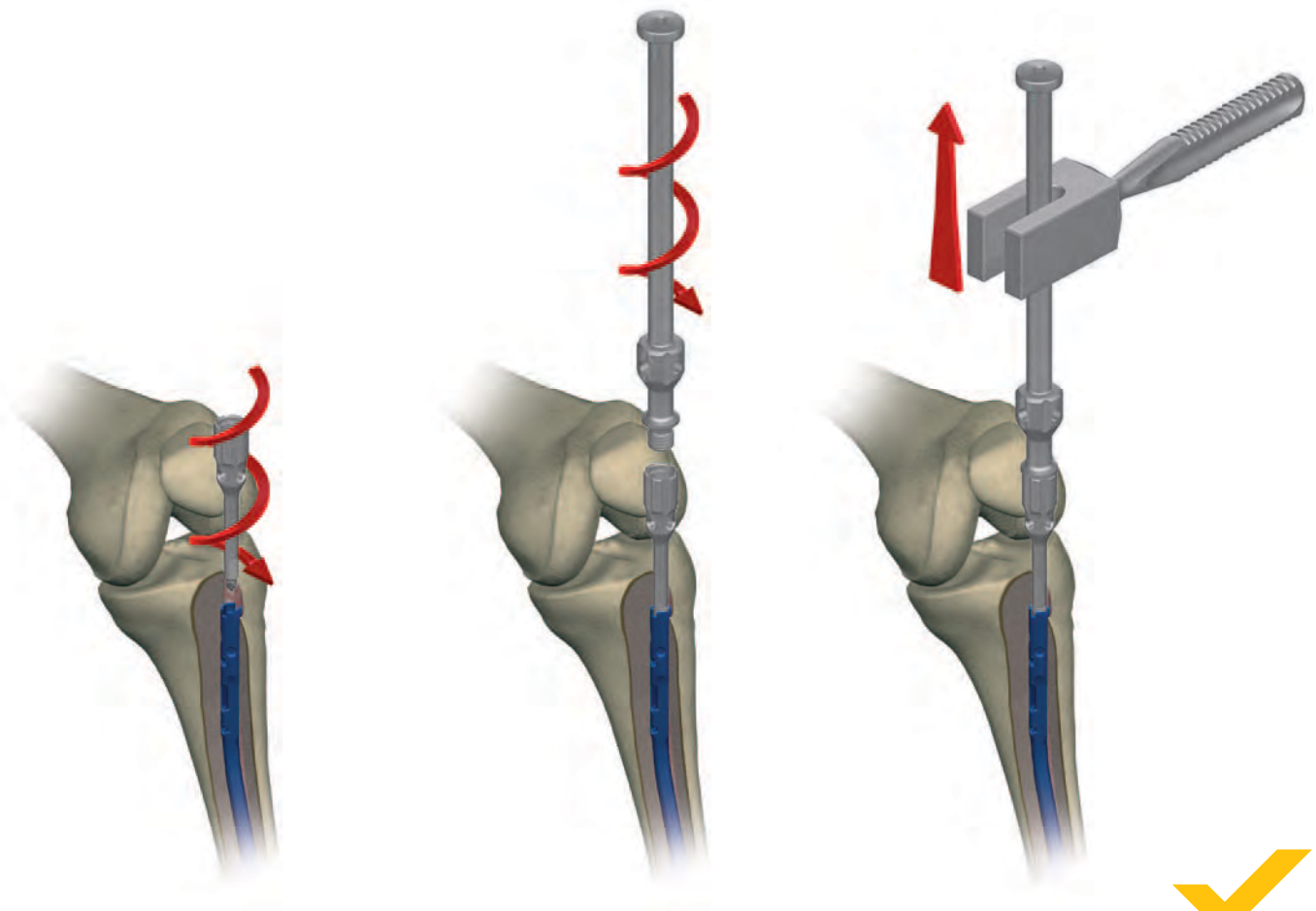
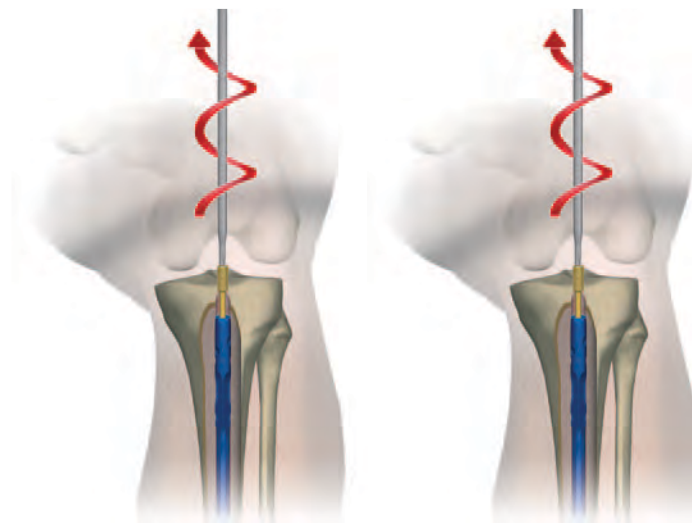
Remove the Hexagonal Screwdriver 3.5 and the Targeter D.

NOTE!!!
In order to lock the nail in the second distal hole follow the steps [32] to [35].



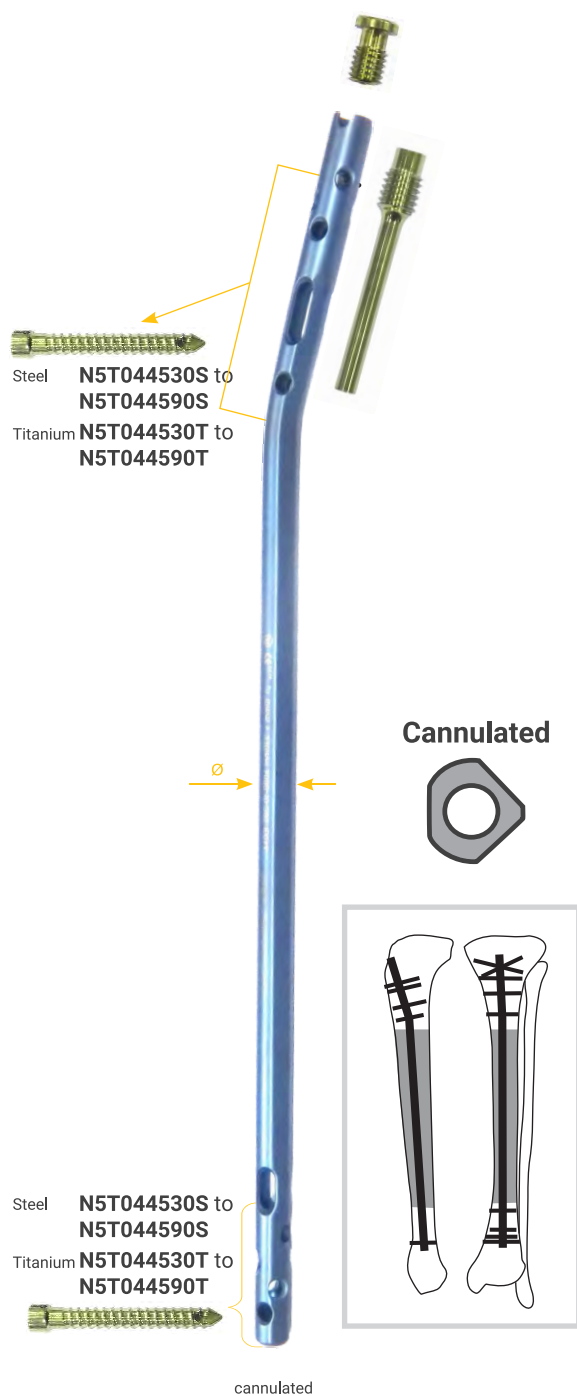
VIII. NAIL EXTRACTION

- 56 Use the Hexagonal Screwdriver 3.5 [N5TI027] to remove the End Cap (or compression screw) and all locking bolts. Insert the Connector M8x1.25 [N5TI008] Into the threaded nail hole. Attach the Impactor-Extractor [N5TI007] to the Connector and using the Mallet [N5TI011] remove the nail from the medullary canal.



II. IMPLANTS

Interlocking Cannulated Tibial Nail



Length	Dia	Stainless Steel	Titanium
270mm	8mm	N5T018270S	N5T018270T
285mm	8mm	N5T018285S	N5T018285T
300mm	8mm	N5T018300S	N5T018300T
315mm	8mm	N5T018315S	N5T018315T
330mm	8mm	N5T018330S	N5T018330T
345mm	8mm	N5T018345S	N5T018345T
360mm	8mm	N5T018360S	N5T018360T
375mm	8mm	N5T018375S	N5T018375T
390mm	8mm	N5T018390S	N5T018390T
270mm	9mm	N5T019270S	N5T019270T
285mm	9mm	N5T019285S	N5T019285T
300mm	9mm	N5T019300S	N5T019300T
315mm	9mm	N5T019315S	N5T019315T
330mm	9mm	N5T019330S	N5T019330T
345mm	9mm	N5T019345S	N5T019345T
360mm	9mm	N5T019360S	N5T019360T
375mm	9mm	N5T019375S	N5T019375T
390mm	9mm	N5T019390S	N5T019390T
270mm	10mm	N5T0110270S	N5T0110270T
285mm	10mm	N5T0110285S	N5T0110285T
300mm	10mm	N5T0110300S	N5T0110300T
315mm	10mm	N5T0110315S	N5T0110315T
330mm	10mm	N5T0110330S	N5T0110330T
345mm	10mm	N5T0110345S	N5T0110345T
360mm	10mm	N5T0110360S	N5T0110360T
375mm	10mm	N5T0110375S	N5T0110375T
390mm	10mm	N5T0110390S	N5T0110390T
270mm	11mm	N5T0111270S	N5T0111270T
285mm	11mm	N5T0111285S	N5T0111285T
300mm	11mm	N5T0111300S	N5T0111300T
315mm	11mm	N5T0111315S	N5T0111315T
330mm	11mm	N5T0111330S	N5T0111330T
345mm	11mm	N5T0111345S	N5T0111345T
360mm	11mm	N5T0111360S	N5T0111360T
375mm	11mm	N5T0111375S	N5T0111375T
390mm	11mm	N5T0111390S	N5T0111390T
270mm	12mm	N5T0112270S	N5T0112270T
285mm	12mm	N5T0112285S	N5T0112285T
300mm	12mm	N5T0112300S	N5T0112300T
315mm	12mm	N5T0112315S	N5T0112315T
330mm	12mm	N5T0112330S	N5T0112330T
345mm	12mm	N5T0112345S	N5T0112345T
360mm	12mm	N5T0112360S	N5T0112360T
375mm	12mm	N5T0112375S	N5T0112375T
390mm	12mm	N5T0112390S	N5T0112390T



III. LOCKING ELEMENTS



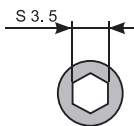
End Cap for Tibial Nail

A	Steel	Titanium
0	N5T02S	N5T02T

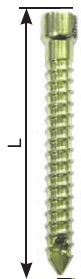


Compression Screw for Tibial Nail

Steel	Titanium
N5T03S	N5T03T



4.5mm Locking Bolt



L [mm]	Steel	Titanium
30	N5T044530S	N5T044530T
35	N5T044535S	N5T044535T
40	N5T044540S	N5T044540T
45	N5T044545S	N5T044545T
50	N5T044550S	N5T044550T
55	N5T044555S	N5T044555T
60	N5T044560S	N5T044560T
65	N5T044565S	N5T044565T
70	N5T044570S	N5T044570T
75	N5T044575S	N5T044575T
80	N5T044580S	N5T044580T
85	N5T044585S	N5T044585T
90	N5T044590S	N5T044590T

L [mm]	16 ÷ 100
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IV. INSTRUMENT SET

Instrument set [N5TI] is used for tibia shaft fixation, and implant removal after finished treatment. All instruments are placed in a stand with a lid to facilitate sterilization and transportation to the surgical suite.

Instrument set consists of:

N5TI

No.		Name	Pcs	Catalogue No.
1		Targeter arm B	1	N5TI001
2		Distal targeter D	1	N5TI002
3		Targeter B	1	N5TI003
4		Wrench S8	1	N5TI004
5		Connecting screw M8x1.25 L-91	1	N5TI005
6		Reconstruction targeter	1	N5TI006
7		Impactor-extractor	1	N5TI007
8		Connector M8x1.25/M14	1	N5TI008
9		Compression screw	1	N5TI009
10		Curved awl 8.0	1	N5TI010
11		Mallet	1	N5TI011
12		Protective guide 9/6.5	2	N5TI012
13		Drill guide 6.5/3.5	2	N5TI013
14		Set block 9/4.5	2	N5TI014
15		Trocar 6.5	1	N5TI015
16		Drill guide 6.5/4.5	1	N5TI016
17		Depth Gauge	1	N5TI017
18		Hole depth measuring device	1	N5TI018
19		Nail length measuring device	1	N5TI019



No.		Name	Pcs	Catalogue No.
20		Targeter D	1	N5TI020
21		Trocac short 7	1	N5TI021
22		Drill guide short 7/3.5	1	N5TI022
23		Guide rod handle	1	N5TI023
24		Teflon pipe guide 8/400	1	N5TI024
25		Aiming insert 9.0	2	N5TI025
26		Guide rod 2.5/580	1	N5TI026
27		Hexagonal screwdriver 3.5	1	N5TI027
28		Drill with scale 3.5/250	2	N5TI028
29		Drill 3.5/150	1	N5TI029
30		Drill 4.5/250	1	N5TI030
31		Sterilization Container	1	N5TI032

To perform the surgery, some other basic devices : each operating room should be equipped with are needed

- electric drive
- set of flexible intramedullary reamers (Ø 8.0-13.0 mm) with the drill guide and handle
- set of surgical drills
- Kirschner wires
- set of awls (standard and cannulated)
- mallets and others.



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