Aesculap® Targon® TX

Intramedullary Nail for Tibial Fractures.
...going to **X**-tremes.

Aesculap Orthopaedics

B|BRAUN
SHARING EXPERTISE

Aesculap® Targon® TX

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Dear colleagues,

Today, locking nailing of tibial shaft fractures is regarded as being the "gold standard". However, in transition fractures, particularly those of the proximal moiety, locking nailing has taken a backseat to angle-stable plating because of reports about primary and secondary malalignment, although the use of transmedullary support screws (poller screws) can keep the rate of precisely this complication very low. And so, already at this level of tibial fractures the brotherhood of trauma surgeons is already divided into "nailers" and "platers".

This disagreement becomes truly evident in type A fractures according to the AO classification. The "hands off the metaphysis" warning of the proponents of plating and external fixation is making the rounds. However, there is an increasing body of evidence on rather successful intramedullary nailing of extra-articular type A fractures and even type C fractures with uncomplicated involvement of the joint. These techniques have relied on newly developed nails with extremely distal as well as proximal locking options which may also be combined with cannulated screws, should the need arise (type C fractures). The appeal of these new nailing techniques is due to the fact that not only do they result in the least amount of additional soft tissue trauma, which is particularly important for those areas of concomitant soft tissue injury adjacent to the joint, but they also offer the best postoperative comfort for the patient.

Axial compression is one more attractive benefit of locking nailing. For stable fractures and transverse osteotomies it permits very early painless ambulation under full weight bearing. Interlocking compression nailing has also been successful in the treatment of hypertrophic nonunion.

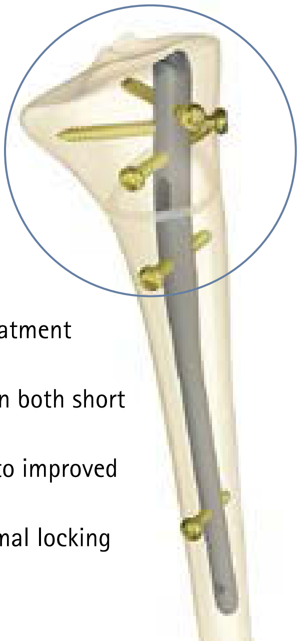
The Targon® TX nail was developed for all these indications, and for the first time this nail is also available as a short model, employed whenever the proximal tibial fracture lends itself well to intramedullary fixation while insertion of a locking nail is contraindicated due to special circumstances at the distal part of the lower leg. I am confident that compared with conventional locking nails this nail has opened up previously untapped indications for intramedullary fixation of tibial fractures.

Hans-Werner Stedtfeld
March, 2013

...going to X-tremes

Aesculap® Targon® TX System Advantages Implants

A

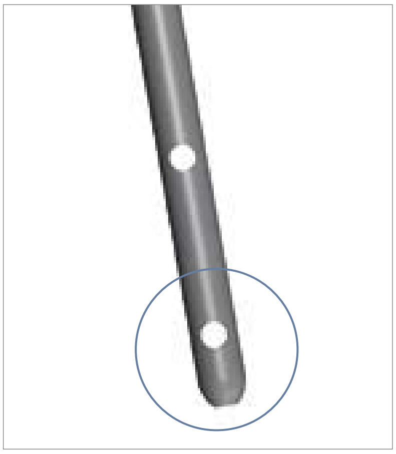


Proximal Design

- Multidirectional – angle-stable epiphyseal fixation
- Significantly more versatile treatment options proximally and distally
- Proximal nail design identical in both short and long model
- Easier passage of the nail due to improved curvature
- Optional transfixation in proximal locking

Short Nail

- Proximal fixation with the same high degree of stability if the situation at the distal tibia does not permit locking
- Threaded bore for guided implant position without tilting in wide proximal medullary canals
- Cannulated and solid nail models optional



Long Nail

- For the treatment of rather distal tibial fractures: 1 a-p and 2 m-l holes at the end of the nail
- Effortless introduction and extraction of the nail due to distal curvature of 2°
- Cannulated nail design

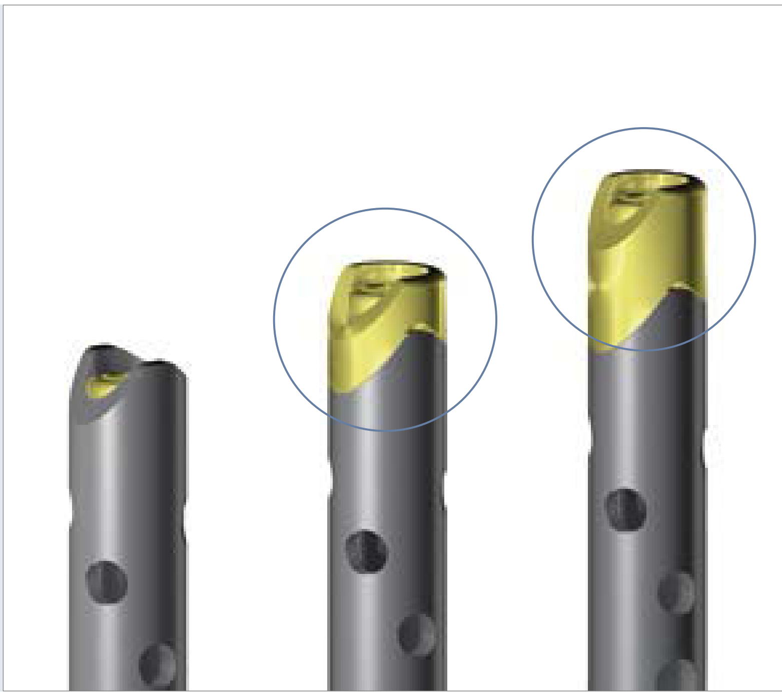
Cap Screw

Nail position close to the ankle joint

- Cap screw with length 0 mm
- 5,10 and 15 mm long extension screws for length adjustment of the 15 mm increments when the long nail is seated more deeply

Less soft tissue trauma

- Bevelled design
  Extension screws identical with proximal end of nail



Locking Screws

Multidirectional screw blocking (zero motion)

- The unique position of the proximal screws allows accurate angle-stable fixation of the fracture
- Angle-stable triple locking can be adjusted to different fracture levels (high fixation effect)
- Uniform screw design for all locking options

Aesculap® Targon® TX
System Advantages Instruments

Targeting Device

Locking of all short nail screws via the targeting device

- Angle-stable locking for extraordinary stability
- Easier handling when positioning the distal screws
- No more slipping of the nail over the locking screws

B

Targeting device + guide wire

- Reliable position assessment of the proximal screw

Snap-fit attachment

- Fast and easy system attachments

Base of targeting device

- Unrestricted extension of the knee joint after complete insertion of the nail into the medullary canal

Instruments

Proximal sliding hole for compression and dynamic fixation

- Flexible fracture treatment for individual solutions

Polygon-shaped sleeves

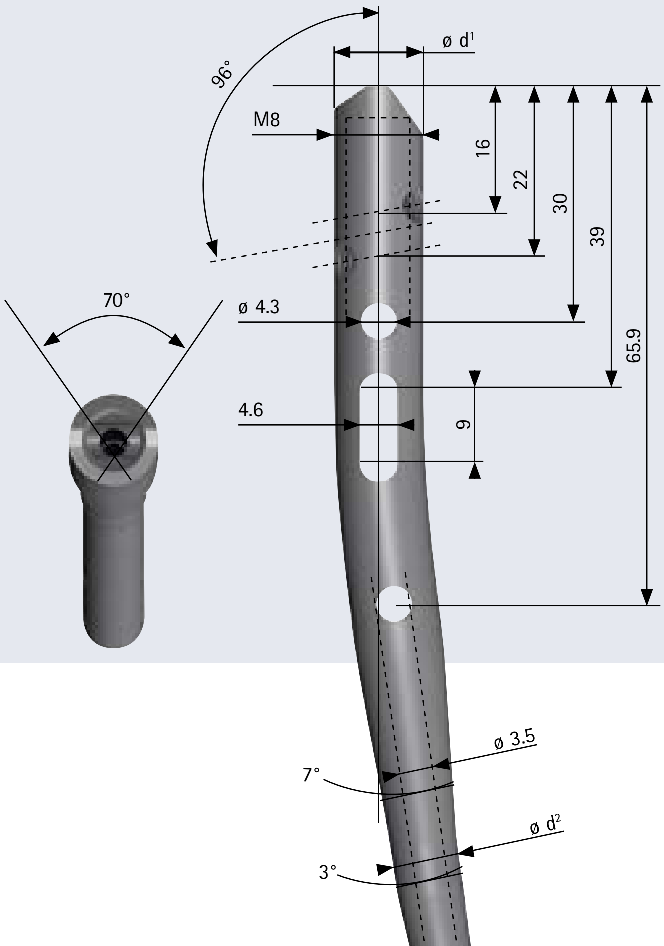
- Easy and rapid sleeve retention
- The polygon-shaped sleeve is securely jammed in the targeting device by slight twisting

Color-coded ergonomic instruments

- Intuitive orientation when handling the instruments

Aesculap® Targon® TX
The Implant

C



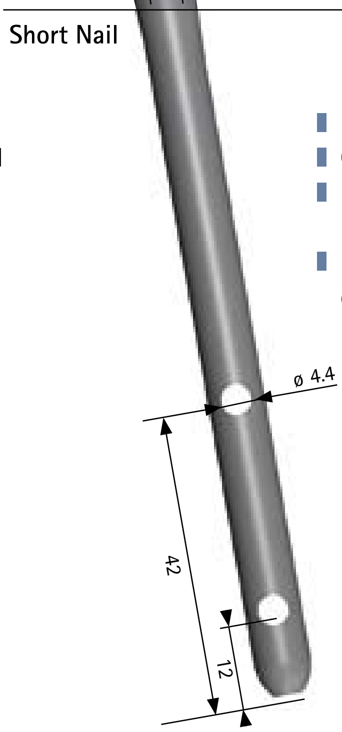
Technical characteristics – TX-Nail ø 8/9/10

- **Proximal diameter (d¹): 11.5 mm**
- **Distal diameter (d²): 8/9/10**

- **Proximal tapped holes:**
  Minor diameter: 4.3 mm
- **Proximal oblique screws:**
  – A/P Slope: Mean of 6° towards proximal end of nail
  – Included angle from cephalad: 70°
- **Herzog curvature:** 3° (shaft) + 7° (proximal) = 10°
- **Connecting thread of nail:** M8
- **Cannulation (diameter):** 3.5 mm

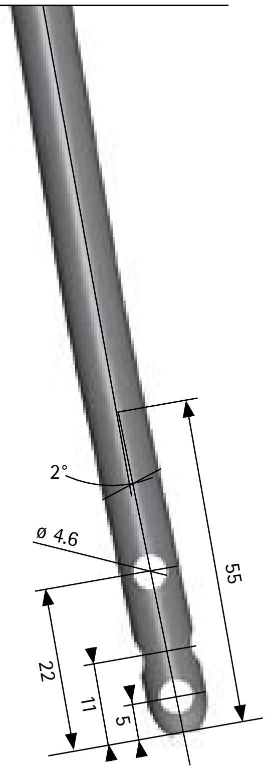
Short Nail

- **Length:** 200 mm
- **Design:** solid/cannulated
- **Distal tapped holes m-l:**
  Minor diameter: 4.4 mm



Long Nail

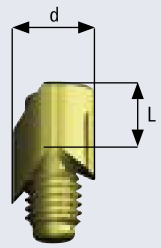
- **Length:** 240-420 mm
- **Curvature:** 2°
- **Proximal curvature:** adapted to nail end
- **Distal tapped holes m-l and a-p:**
  diameter: 4.6 mm



Implant material:
Titanium alloy Ti6Al4V
Anodized surface

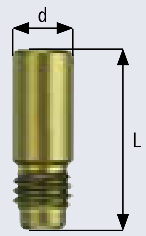
Cap Screw

- **Length**: 0 mm, 5 mm, 10 mm
- **Diameter:** 11.5 mm
- **Thread:** M8



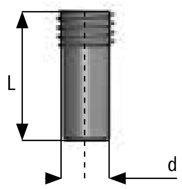
Closure Screw cannulated

- **Length**: 5 mm, 10 mm, 15 mm
- **Diameter:** 8 mm
- **Thread:** M8



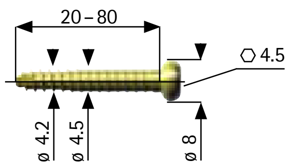
Compression Screw

- **Length**: 15 mm
- **Diameter**: 6.5 mm
- **Cannulation:** 3.5 mm
- **Thread:** M8



Locking Screw

- **Thread diameter:** 4.5 mm
- **Pitch:** 1.75 mm
- **Hexagon key diameter:** 4.5 mm
- **Self-tapping**



Implant material:
Titanium alloy Ti6Al4V
Anodized surface

Aesculap® Targon® TX Biomechanics

D

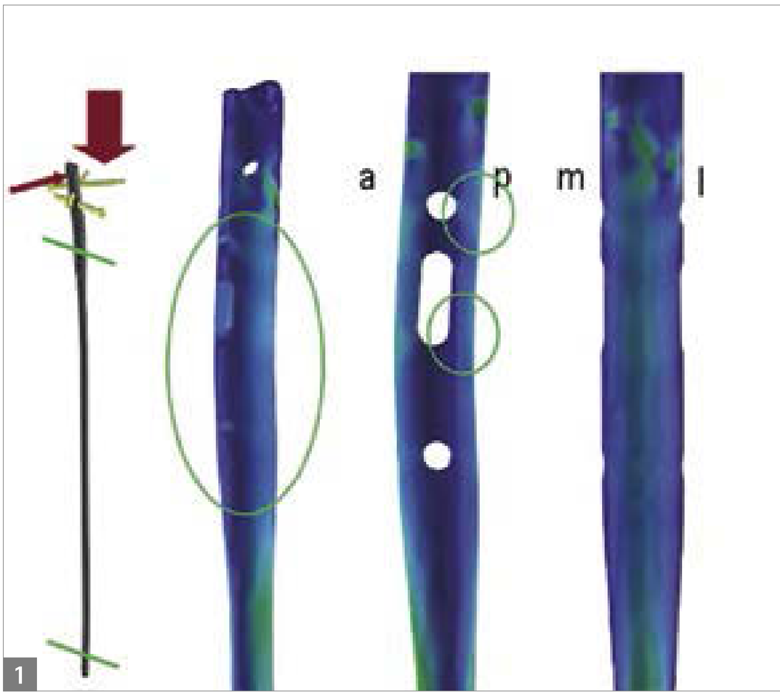


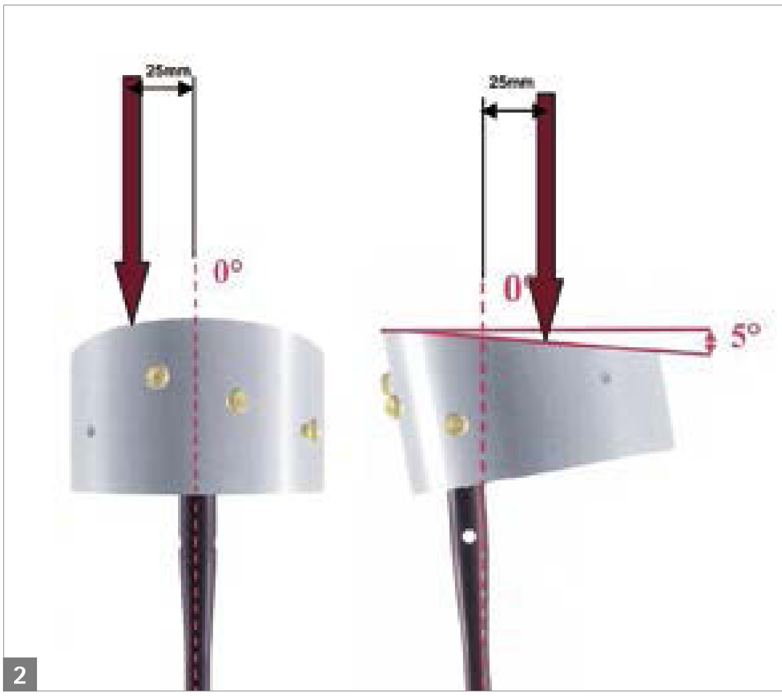
Figure 1:
Finite-Elemente-Methode (FEM) analysis of the proximal Targon® TX:
Test setup and stress distribution

- Improved design combines mechanical strength with functionality
- High strength nail despite numerous locking options and cannulation
- Uniform stress distribution in the critical area of tensile stress
- The locking options and specially designed sliding hole arrangement result in an extremely well balanced mechanical construct
- Zero motion effect allows great immobilization for the fragments

The biomechanical performance of osteosynthesis systems is determined primarily by the mechanical strength of their components and their ability to stabilize the fracture fragments.
Compared to the Targon® T, all of the most important changes in the design of the Targon® TX aim to advance intramedullary nailing into the very proximal and distal regions of the tibia while improving the fixation stability. In the design of the Targon® TX the main focus was to optimize the integration of the newly developed locking option while at the same time impairing the implant as little as possible.

Figure 1 demonstrates the stress distribution at the proximal end of the nail resulting from the FEM analysis of the locking and loading illustrated. Peak stress is seen between the holes of the proximal oblique screws. However, on the implant these holes are distributed as best as permitted by the anatomical constraints, in order to offer smooth stress transitions and low stress peaks.

Configuration and dimensions of the m-l holes have been chosen such that there is a quite homogeneous stress distribution along the areas of tensile stress.



Does the chosen design comply with the high mechanical demands?

In order to answer this question a test was set up where the nail underwent eccentric cyclic loading via the three proximal oblique screws. This allowed determination of that load which let the implant withstand one million cycles, a level which is regarded as the fatigue strength for the designated application.
For meaningful reference purposes a commercially available nail from a competitor was subjected to the same test protocol.

The results of this comparison testing were rather favorable for the Targon® TX. The load limit of the Targon® TX is 70 % higher than for the other nail.
The implants fail by cracking at the second proximal oblique hole (Targon® TX) or the a-p hole (other nail).

Figure 2:
Test setup for assessing the proximal fatigue strength

One reported common mechanism of failure in locking tibial nailing is screw fracture.
The Targon® TX solely relies on the proven Targon® locking screws with their diameter of 4.5 mm. These screws are characterized by a large minor diameter and smooth flank geometry and therefore are perfect for steady cyclic loading.

Aesculap® Targon® TX Indications

E

The indications for the Targon® TX have been expanded significantly compared to the Targon® T.

- Proximal metaphyseal fractures (AO 41-A2, A3)
- All types of shaft fractures (AO 42)
- Distal metaphyseal fractures (AO 43-A1, A2, A3)
- Combinations of these fracture types
- Simple proximal intraarticular fracture (AO 41-C1, C2) when combined with other implants, primarily cannulated screws

The Targon® TX Short Nail is indicated whenever the conditions at the distal tibia do not permit locking.

Example

- Proximal fracture

Example

- Diaphyseal fracture

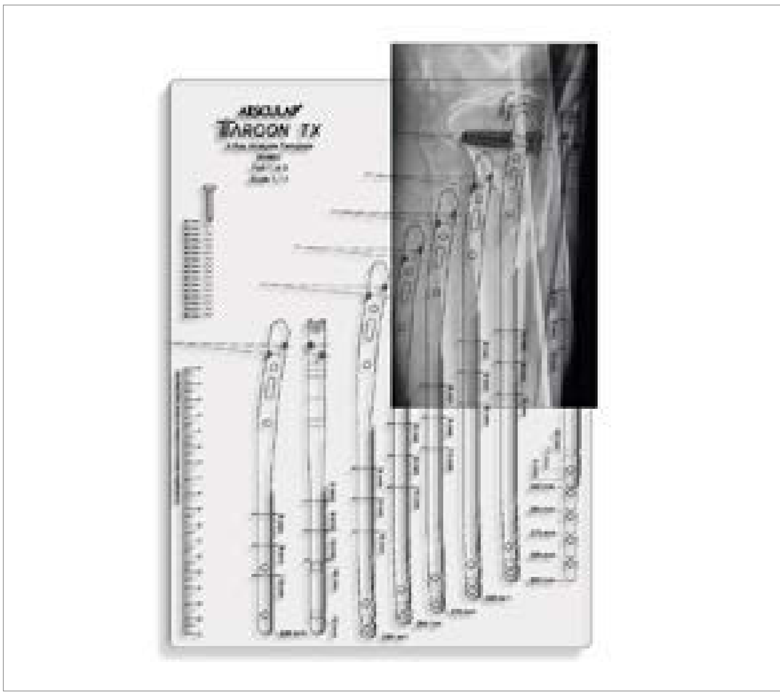
Example

- Distal fracture

Surgical Technique

Preoperative Planning

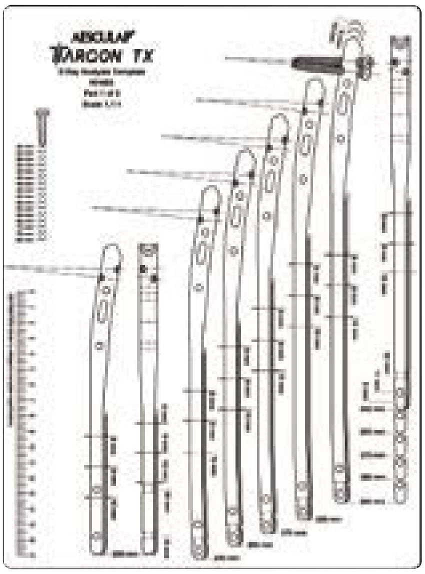
F

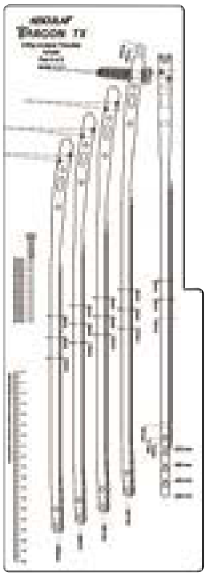


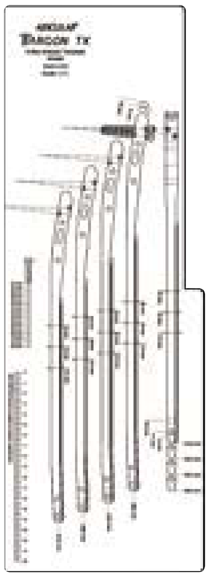
- KH483 – X-ray template Targon® TX
  (KH483200: 375 mm-420 mm
  KH483201: 315 mm-360 mm
  KH483202: 200 mm-300 mm)

The X-ray templates illustrate the real size of the implant on a radiogram enlarged by 10 %.
The films for the procedure must also be enlarged by this factor.

All parameters determined with this template must be verified during surgery in order to check correct sizing of the implant. If needed, the X-ray templates may also be supplied as digital imaging tools.







Patient Positioning

1

The supine patient is positioned on a traction table (figure 1) or on a radiolucent operating table (figure 2).

2

Whenever possible, closed reduction of the fracture by axial traction on the leg is preferred; this should be either by manual reduction with the knee strongly flexed or by calcaneus traction on the traction table.

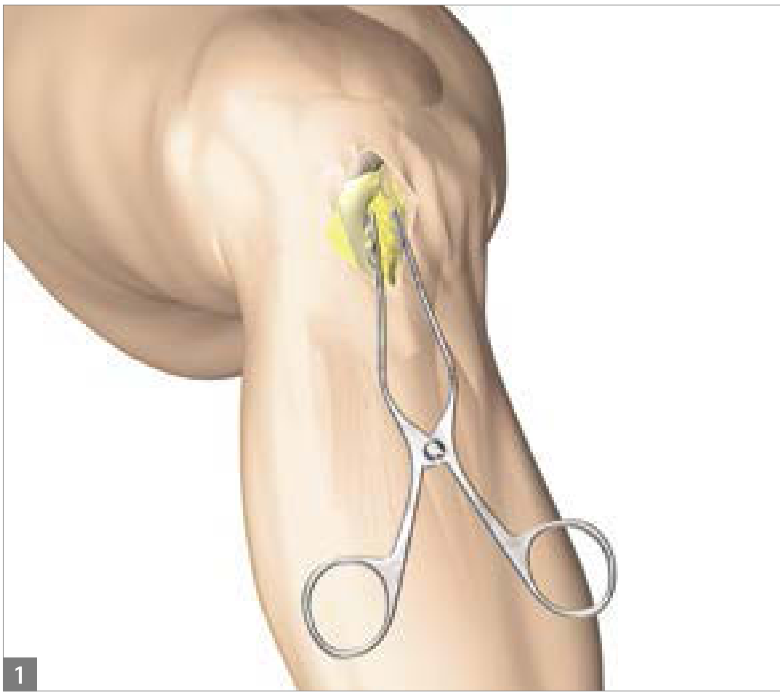
The knee should be flexed at least 90°.

In order to obtain a good panoramic view of the affected lower leg the contralateral leg is strongly flexed at the hip and knee and supported in a gynecological stirrup.

Surgical Technique

Access

1



1

The skin is incised between the tip of the patella and the tibial tuberosity. The medial third of the patellar tendon is split longitudinally.

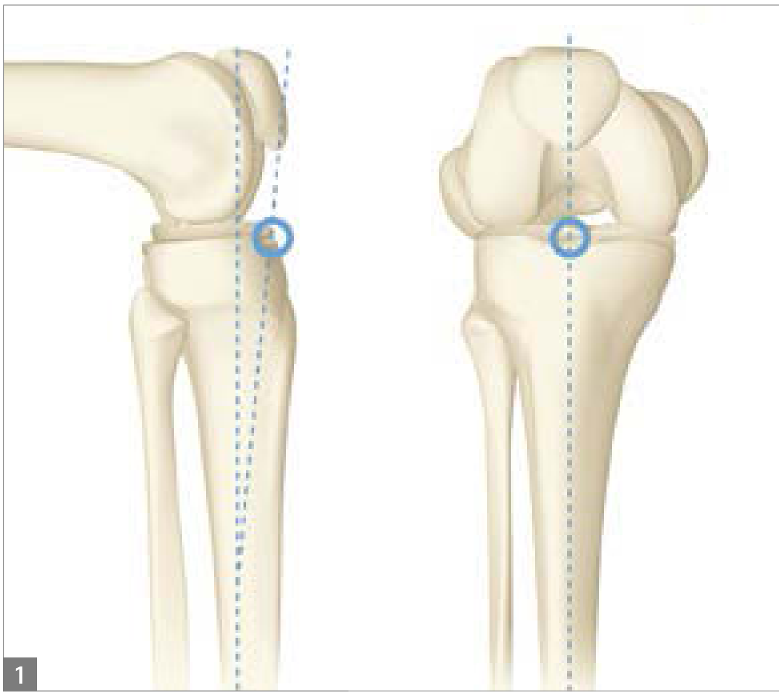
Another option is to choose an approach along the medial aspect of the patellar tendon.

After insertion of a blunt retractor the anterior rim of the tibial plateau is exposed. To this end, the infrapatellar fat pad is mobilized somewhat cephalad.

2

Nail Entry Portal

1.1



1

The entry portal of the nail should be centered on the anterior aspect of the tibial plateau. The bone is breached in the direction of the diaphyseal medullary canal.

Surgical Technique

Entry
A – Alternative

1.2


1

- KH458R – T-handle
- KH477R – Tissue protector funnel ø 12 mm
- KH319R – Universal handle
- KH476R – Guide pin with stopper ø 12 mm
- KH475R – Cannulated reamer ø 12 mm


2

With the universal handle or by power drill insert the stoppered guide pin such that it parallels the long axis of the bone (figure 1).
Check correct a-p and m-l positioning by fluoroscopy.

Slip the tissue protector funnel over the stoppered guide pin. Advance the cannulated reamer with the T-handle or power drill until it crosses the axis of the shaft (figure 2).
Check correct a-p and m-l positioning by fluoroscopy.

Remove the stoppered guide pin and cannulated reamer.

Entry
B – Alternative


3

- KH317R – Awl

Breaching with the awl

Breach the tibial plateau at its anterior aspect with the awl (figure 3).

Surgical Technique

Mounting the Nail on the Targeting Device

1.3

1

- KH441202 – Base of targeting device
- KH450R – Nail adapter screw
- KH458R – T-handle
- KH486R – Screwdriver SW 4.5

Slip nail adapter screw onto screwdriver. Insert the nail adapter screw through the base of the targeting device. Align nail with base of targeting device and secure with screwdriver.

Note:

For precise targeting of the system the nail must be seated correctly in the targeting device and tightened with force.

2

Nail Insertion

1.4

- KH441202 – Base of targeting device
- KH460R – Multi-purpose hammer
- KH459R – Multi-purpose anvil
- KH491R – Extraction adapter (optional)
- KH490R – Extractor (optional)

When inserting the nail, the base of the targeting device doubles as a handle.
It also helps to set optimum rotation and depth of insertion.

One other option would be to hammer in the nail with the multi-purpose anvil and multi-purpose hammer.
For this, the nail is attached securely to the base of the targeting device. If needed it may also be used to retract the nail.

Note:

Do not hammer in with targeting bow mounted!
The acceleration experienced during application of the multi-purpose hammer could damage the targeting device and thus impair the targeting accuracy of the system.

Surgical Technique

Nailing of Proximal Fractures

2

Fine-Tuning the Nail Position

2.1


1


2

▌ KH441202 – Base of targeting device

Nail position mandates that:
- in the m-l view the tips of the proximal oblique screws are pointing towards the posteroinferior rim of the tibial plateau.
- the end of the nail is flush with the cortex.
- when viewed from cephalad, the support screws buttress the tibial plateau evenly in the horizontal plane.

Insertion depth
The grooves at the base of the targeting device serve as scale with 5 mm gradation for determining the insertion depth and optimum length of the extension screw which might be required.
The correct depth of insertion is reached when the transition from nail to base is at the level of the bone surface (figure 1).

Angular position
For determining the angular position with the base of the targeting device, the latter can be aligned with the tibial tuberosity when viewed from cephalad. The proximal oblique screws include an angle of 70° (figure 2).

Surgical Technique

Mounting the Targeting Bow

2.2


1

- KH441202 – Base of targeting device
- KH441200 – Targeting Bow
- KT228P – Retaining screw for targeting device

Gently screw in the retaining screw into the targeting bow (figure 1).
Then mount the targeting bow on the base of the targeting device and tighten the retaining screw (figure 2).


2

Note:

For precise targeting of the system the components of the targeting device must be seated securely and tightened with force.

Preparing the Proximal Oblique Screws

- KH441200 – Targeting Bow
- KH668S – Guide wire
- KH467R – Tissue protector sleeve
- KH468R – Obturator
- KH469R – Drill sleeve 3.5 mm
- KH470R – 3.5 mm drill bit for metaphyseal locking screw
- KH473R – Screw length gauge (optional)

2.3


1


2

Screw position is checked by inserting the guide wires through the targeting bow on both sides (marking: "screw orientation"). In the precise lateral view of the targeting device they represent the projection of the screws.

Introduce the tissue protector sleeve together with the obturator. This introduction is facilitated by aligning the circular markers on both bow and sleeve.
Advance the sleeve until it contacts the bone and then tighten it by turning in the direction indicated (figure 2+3).

Note:

Turning in the opposite direction will impair the targeting precision of the system.

Replace the obturator with the drill guide. With the 3.5 mm bit drill through the cancellous bone until just beneath the opposite cortex.

Note:

Drilling should not advance more than 1 - 2 mm beyond the posterior cortical bone and be moni-tored by fluoroscopy.


3


4

Determining the length of the locking screws

The length of the screw is read off from the scale on the drill sleeve (figure 4). Alternatively, use the screw length gauge. Now remove the drill sleeve.

Surgical Technique

Inserting the Proximal Oblique Screws

2.4

1

2

- KH458R – T-handle
- KH486R – Screwdriver SW 4.5
- KT236R – Self-retaining screwdriver SW 4.5 (optional)
- GB413R / GB414R / GB636R – Connection for power drill (alternatively)

Screw in the proximal locking screws with screwdriver KH486R and T-handle KH458R. Optionally, use the self-retaining screwdriver KT236R.

Alternatively, insert the screws with the screwdriver KH486R and one of the Targon® power drill connections. The final insertion phase must be performed by hand.

The laser marking on the screwdriver indicates when the head of the screw has reached the cortical bone.

Mounting the Targeting Jig

2.5

1

- KH441203 – Targeting jig
- KH467R – Tissue protector sleeve
- KT228P – Retaining screw for targeting device

2

Slip the targeting jig with the premounted (but not fully screwed down) retaining screw medially onto the targeting bow and then tighten the retaining screw (figure 1+2).

Note:

Secure seating of the targeting device components is vital for the targeting accuracy of the system.

Surgical Technique

2.6 Inserting the Medio-Lateral Locking Screws

1

2

- KH467R – Tissue protector sleeve
- KH468R – Obturator
- KH469R – Drill sleeve 3.5 mm
- KH485R – Counterbore ø 8 mm (optional)
- KH471R – Trocar (optional)
- KH470R – Drill bit for metaphyseal locking screw 3.5 mm
- KH479R – Drill bit for diaphyseal locking screw 4.1 mm
- KH473R – Screw length gauge (optional)
- KH458R – T-handle
- KH486R – Screwdriver SW 4.5
- KT236R – Self-retaining screwdriver SW 4.5 (optional)
- GB413R / GB414R / GB636R – Connection for power drill (alternatively)

Lock as described in section 2.4.
Always drill with the 3.5 mm drill bit first.
For the entry cortex in diaphyseal locking this is followed with the 4.1 mm drill bit.

Determining the length:
When using the 3.5 mm drill bit the length of the screw is measured off the drill sleeve. When using the 4.1 mm drill bit the length of the screw is read off the tissue protector sleeve or alternatively off the screw length gauge.

Note:

If the 4.1 mm drill bit is not used when entering the diaphyseal cortex, this might result in cortical faults. If the nail was implanted with some force it may have become bent. When in doubt check by fluoroscopy and lock manually without the targeting jig.

A – Distal Locking

2.7

1

- KH471R – Trocar
- KH249R – Free-hand metaphyseal drill bit ø 3.5 mm
- KH547R – Free-hand diaphyseal drill bit ø 4.1 mm

Note:

Distal locking of the short nail relies on the targeting device, while for the long nail this is done free-hand.

When free-hand locking the diaphysis or in case of very hard thick cortical bone use the ø 4.1 mm free-hand drill bit, and in all other cases the ø 3.5 mm free-hand drill bit.

Note:

If distal locking options are left untouched, stability requires that primarily the more proximal holes be used.

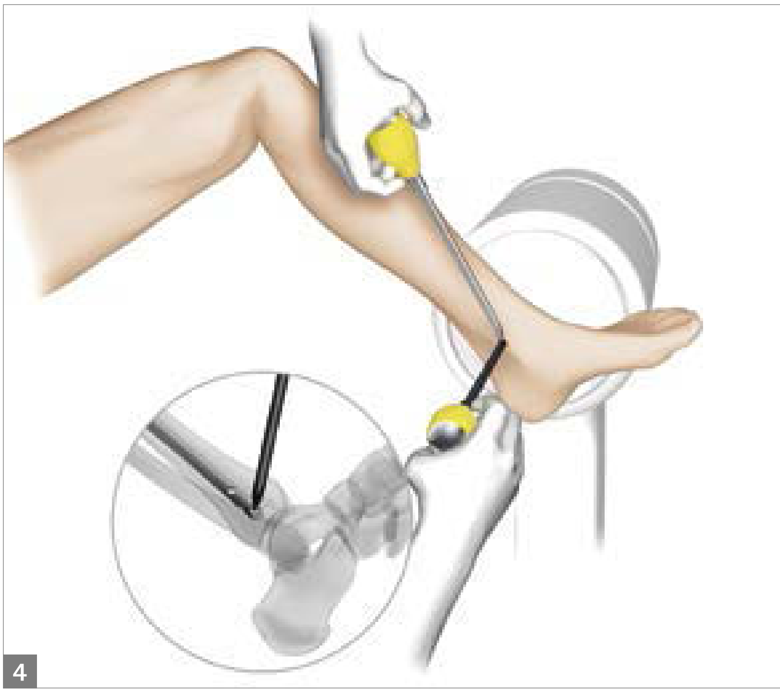
2

Surgical Technique

B – Distal Free-Hand Locking

2.8

3



4

Distal locking is carried out free-hand on the medial aspect of the lower leg.
Adjust the fluoroscope such that the hole in the nail, which is to be used for locking, appears as a circular opening in the center of the monitor.

At skin level position the tip of a scalpel into the beam projection until the tip is in the center of the locking hole.
This identifies the location of the incision.

Make a 1.5 cm long incision.

Place the tip of the trocar on the bone until it is centered on the locking hole. (monitor by fluoroscopy!!)

Straighten up the trocar until it points towards the camera housing and by slightly twisting and hammering the trocar thoroughly center punch the bone.

Place the tip of the drill bit into the center punched depression (monitor by fluoroscopy once again!!) and drill through both cortices and the hole in the nail.
After correct drilling the locking hole will appear brighter on fluoroscopy.

Screw length measurement and insertion of the appropriate screw conclude the process of distal locking.
If the screw is positioned correctly, on fluoroscopy its shadow will be obscured completely by the shadow of the nail itself.
Correct position and length of the locking screw should always be checked by final fluoroscopy in the a-p plane.

Surgical Technique

Treatment of Shaft Fractures

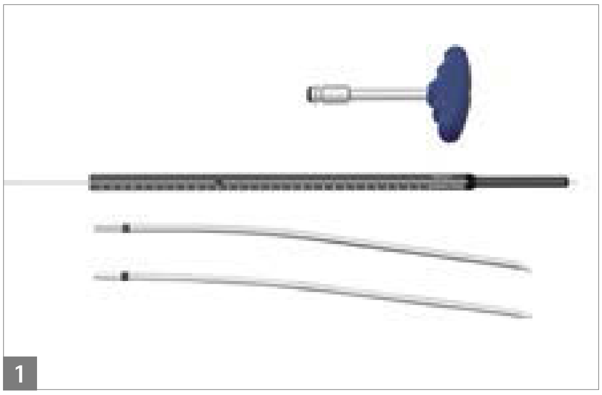
3

Reduction

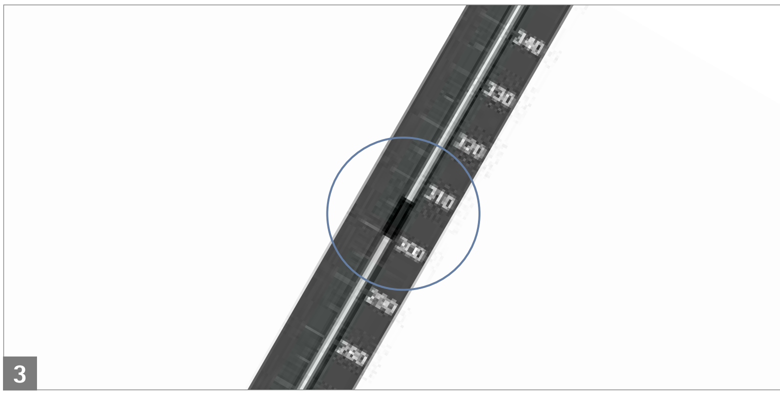
- KH463R – Reduction instrument
- KH464R – Reduction instrument, pointed (optional)
- GE663S – Guide wire ø 2.5 mm
- KH458R – T-handle
- GE661 – Intramedullary reamer bit set (optional)
- KH478P – Nail length gauge

3.1

2



1



3

Attach the reduction instrument to the T-handle, use it to reduce the fragments and then advance it beyond the fracture into the distal medullary canal.

Advance the guide wire through the reduction instrument until it reaches the location desired for the distal end of the nail.
Make sure that the olive tipped end (stopper for the intramedullary reamer bit) is inserted first.
Remove the reduction instrument, leaving the guide wire in place. (Alternatively, the fracture may also be reduced with just the guide wire and universal handle KH319R).

Slip the nail length gauge over the guide wire and advance it until it contacts the bone. Make sure that the measurement is made from the cortical bone and that the nail length gauge was not advanced into the breached medullary canal.

Note:

The length of the nail needed is read off not from the end of the wire but the laser marking on the wire ("reference to guide wire marking").

Surgical Technique

Medullary Reaming (optional)

3.2

- GE661 – Intramedullary reamer bit set (optional)
- GE663S – Guide wire ø 2.5 mm

Option:
Reaming with the flexible Aesculap intramedullary reamers.

If the medullary canal must be reamed always start with the smallest bit diameter and ream carefully.
Ream the medullary canal in 0.5 mm increments and advance slowly.

Work slowly and pause frequently since otherwise the tissue might overheat and necrotize. Reaming should be limited to the isthmic segment. Stop as soon as contact is made with the cortical bone. Ream until the diameter is 1 mm larger than the diameter of the chosen nail.

Stop the advance when the olive stopper is met. Do not advance the wire beyond the olive stopper. If needed, monitor by fluoroscopy.
Slip the nail over the guide wire, insert it into the medullary canal and then remove the guide wire from inside the nail.

1

2

Note:
When working with the Aesculap instrument set exchanging the guide wire may not become necessary.

Compression and Dynamic Fixation

3.3

- KH441205 – Sleeve guide dynamic
- KH441206 – Sleeve guide dynamic, for large-headed screws (alternatively)

Nail insertion
If it is planned to compress or dynamize the fracture, the nail should be seated below the cortex by the amount estimated for the movement (up to 9 mm).

Dynamic locking
For compression and dynamic fixation of stable fractures of the tibial shaft, a locking screw is placed into the proximal position of the sliding hole (B).
Due to the proximal locking options at the implant three medio-lateral bores will be superimposed in the targeting jig. Since the bores run into each other, the dynamic hole in the middle requires its own drill guide.
Therefore, when locking in the dynamic position (B) the "dynamic sleeve guide" must be inserted first into the targeting jig. This creates a single bore for the tissue protector sleeve.
Lock as described in section 2.4.

1


2

Note:

Lock the tissue protector sleeves by turning them in the direction indicated.

Surgical Technique

Compression and Dynamic Fixation

A – Alternative

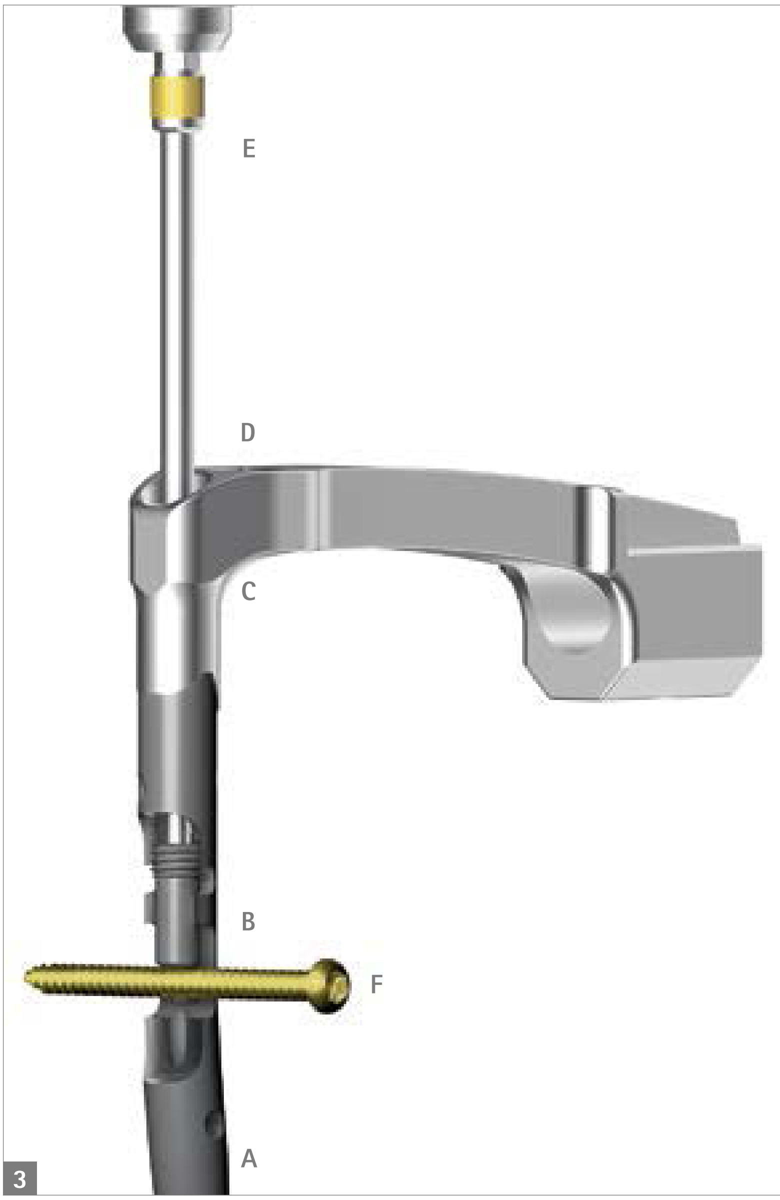
3.3

- KH441202 – Base of targeting device
- KH450R – Nail adapter screw
- KH458R – T-handle
- KH486R – Screwdriver SW 4.5 mm
- KH472R – Compression screwdriver
- KT236R – Self-retaining screwdriver SW 4.5 mm (optional)

Compression with internal compression screw

Mounting the nail to the targeting device:

With the compression screwdriver (E) screw the compression screw (B) into the nail (A) before the latter is mounted to the base of the targeting device (D), as described in section 1.3.
Turn the screw until it appears in the sliding hole, when viewed from the side, and then turn it back until it does not touch the sliding hole anymore.
This ensures that the compression screw will not be touched when drilling in the "dynamic position" and that during mounting the nail adapter screw (C) (in the figure concealed in the base of the targeting device) will not ride on the compression screw.



3

Fracture compression:
Distal locking must be completed before compression is started.
After a locking screw (F) has been placed into the dynamic position of the sliding hole, the compression screw can be screwed in and the fracture compressed.
A 9 mm distance is available for compression.
When employing a compression screw, the m-l bore proximal to the sliding hole may not be used under any circumstances.

B – Alternative

- KH441202 – Base of targeting device
- KH450R – Nail adapter screw
- KH458R – T-handle
- KH486R – Screwdriver SW 4.5 mm
- KH474R – Compression instrument
- KT236R – Self-retaining screwdriver SW 4.5 mm (optional)

Compression with external compression instrument

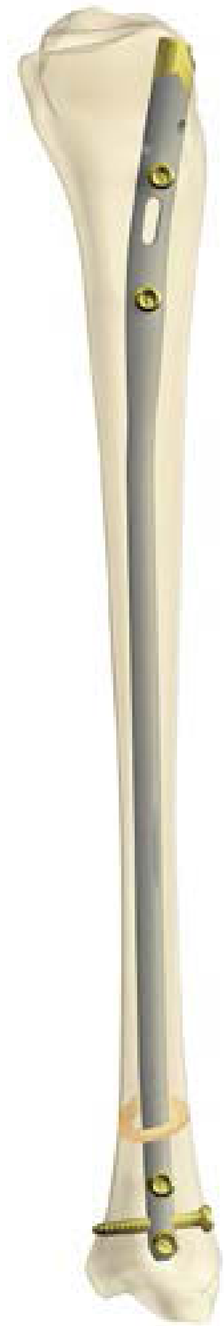
Screw the compression instrument into the base of the targeting device in order to exert pressure on the locking screw in the sliding hole.
The fracture approximation achieved is indicated on the scale of the compression instrument.
In order to keep this approximation the subsequent static hole is used before the compression instrument is removed.

4

Surgical Technique

Treatment of Distal Fractures

4



Distal Locking and use of the Extension Screws

4.1

- KH471R – Trocar
- KH249R – Free-hand metaphyseal drill bit ø 3.5 mm
- KH547R – Free-hand diaphyseal drill bit ø 4.1 mm
- KH458R – T-handle
- KH486R – Screwdriver SW 4.5 mm
- KH488R – Screwdriver cannulated SW 4.5mm
- KT236R – Self-retaining screwdriver SW 4.5 mm (optional)

If the fracture is rather distal, the tip of the nail must be positioned as close to the ankle joint as possible.
In certain cases this requires that the nail be seated more deeply at the entry portal.

In order to stop the bone from growing over the nail and to facilitate nail extraction later on, the gap between the proximal end of the nail and the surface of the tibial plateau is filled by an extension screw. To stop any irritation of the patellar tendon this screw has the same bevelled design as the nail.

One-piece cannulated closure screws are available in sizes 5, 10 and 15 mm as alternative to the modular ones. The cannulated closure screws will be inserted with the cannulated screwdriver KH488R.

Surgical Technique

Additional Steps for Axial Correction in Transition Fractures

5

Transmedullary support screw (TMS) procedure
In acute tibial fractures treated by intramedullary nailing on a standard operating table, the TMS screw can be a valuable indirect aid in reduction and fixation.

Particularly the antecurvature malalignment of acute fractures of the proximal tibia can be reduced indirectly in a rather simple fashion with the help of a TMS screw inserted close to the fracture from the mediolateral and posterior aspect.

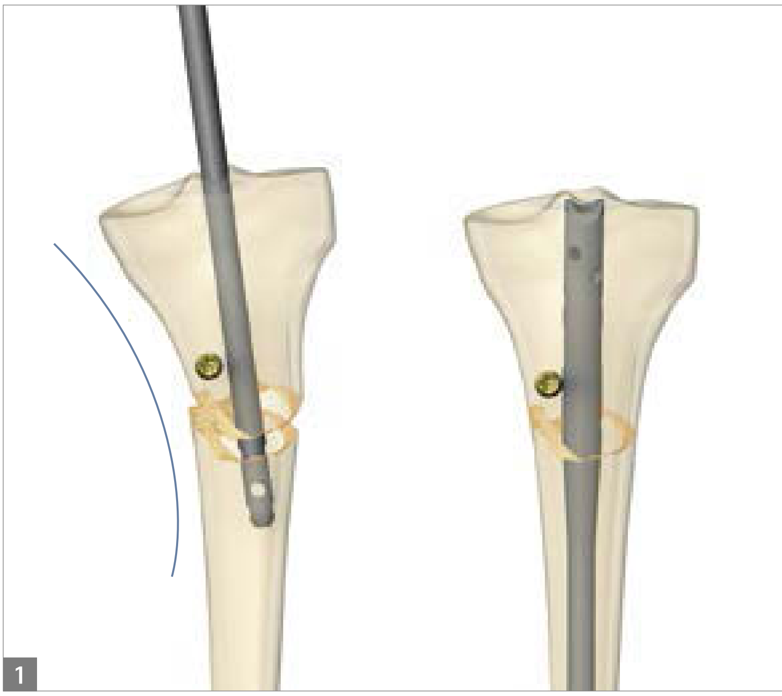
TMS screws increase the angular stability of the fixation and compensate for any missing cortical buttress. Combined with the intramedullary nail and the locking screws they represent yet another principle of fixation.

Reduction in the sagittal plane

- Malalignment with nail but without TMS screw

- Malalignment with TMS screw but without nail

- Correct alignment with TMS screw and nail



1

Reduction in the frontal plane

TMS reduction

Always place the TMS screw close to the fracture on the concave aspect of the metaphyseal fragment.

Examples:

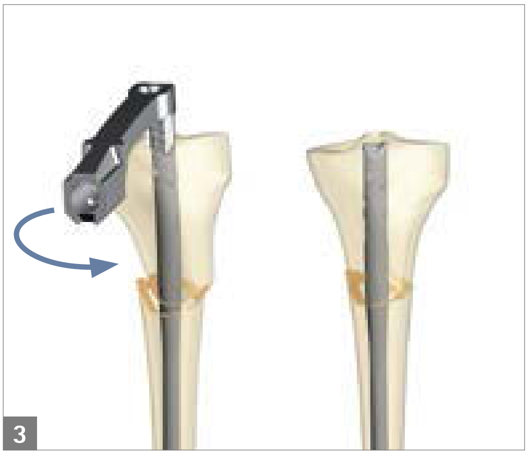
Proximal transition fractures (figure 1)
Distal transition fractures (figure 2)

2

Reduction by rotating the nail

Valgus and varus malalignment can be neutralized by slight rotation of the nail in the medullary canal (figure 4).

References: H.-W. Stedtfeld Osteosynthese International (Suppl. 1) (2000) 8: S170-S172.



3

Surgical Technique

Nail Extraction

6

- KH458R – T-handle
- KH490R – Extractor (optional)
- KH492R – Extraction adapter (optional)
- KH486R – Screwdriver SW 4.5 mm
- KH460R – Multi-purpose hammer

Nail extraction

Skin and patellar tendon are incised longitudinally at the original scar. Expose the proximal end of the nail and remove the cap screw while the nail is still being held in place by the locking screws.

- Tighten the extraction adapter.
- Mount the extractor to the T-handle.
- Attach the extractor to the extraction adapter and tighten the safety sleeve.
- Remove compression screw and locking screws.
- Extract the nail with the coupled extractor and multi-purpose hammer.

Note:

Whenever nail extraction is planned we always recommend keeping the special instruments ready.
Order rental instrument sets 0-0011 and 0-0012 through our rental service hotline: **+49 7461 95-2300.**

Follow-Up

7

1

Classification and location of the fracture, the condition of the soft tissues and the extent of osteoporosis have a decisive impact on postoperative weight bearing.

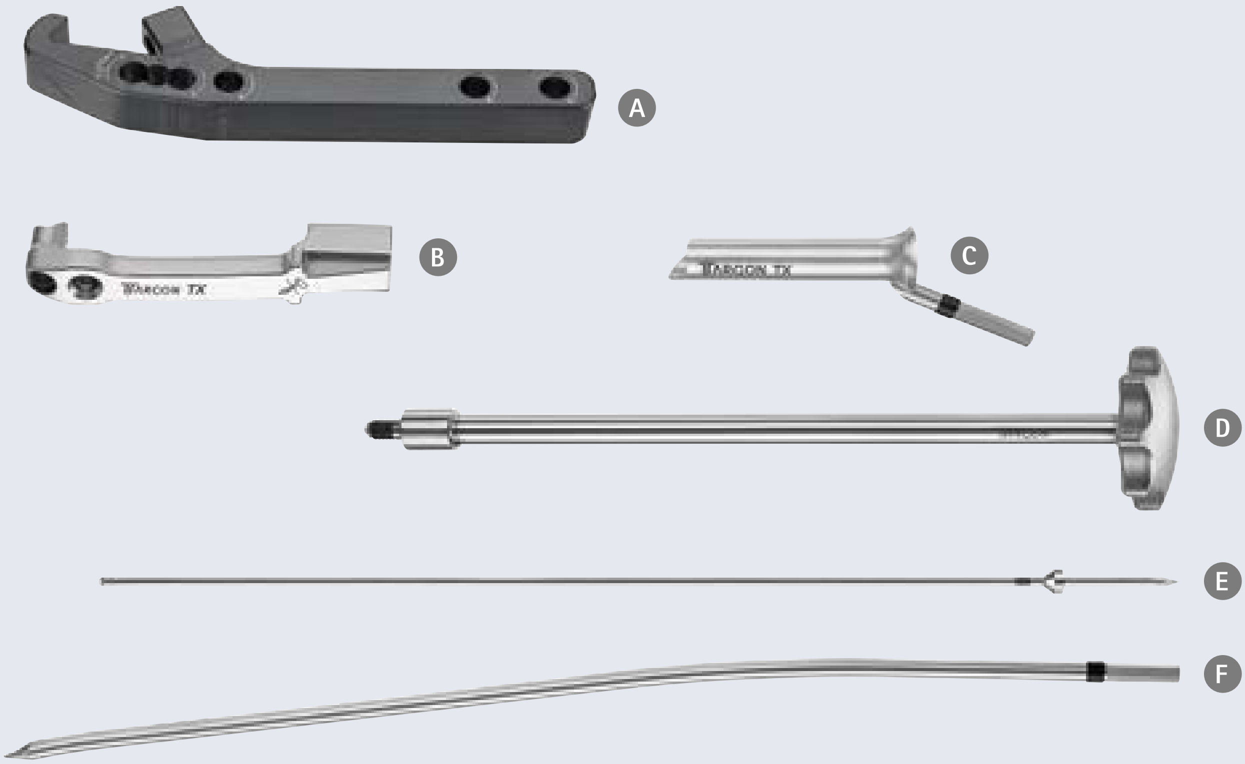
Partial weight bearing of the reduced lower leg fixated by intramedullary nailing is specified in terms of kilograms. The lowest level is just placing the leg on the ground while standing and loading the sole of the foot with 15 kg while walking.

In stable fractures with secure cortical buttressing of the fragments primary loading to full weight bearing can be permitted.
The increase in the level of weight bearing is determined by the healing progress of the fracture.

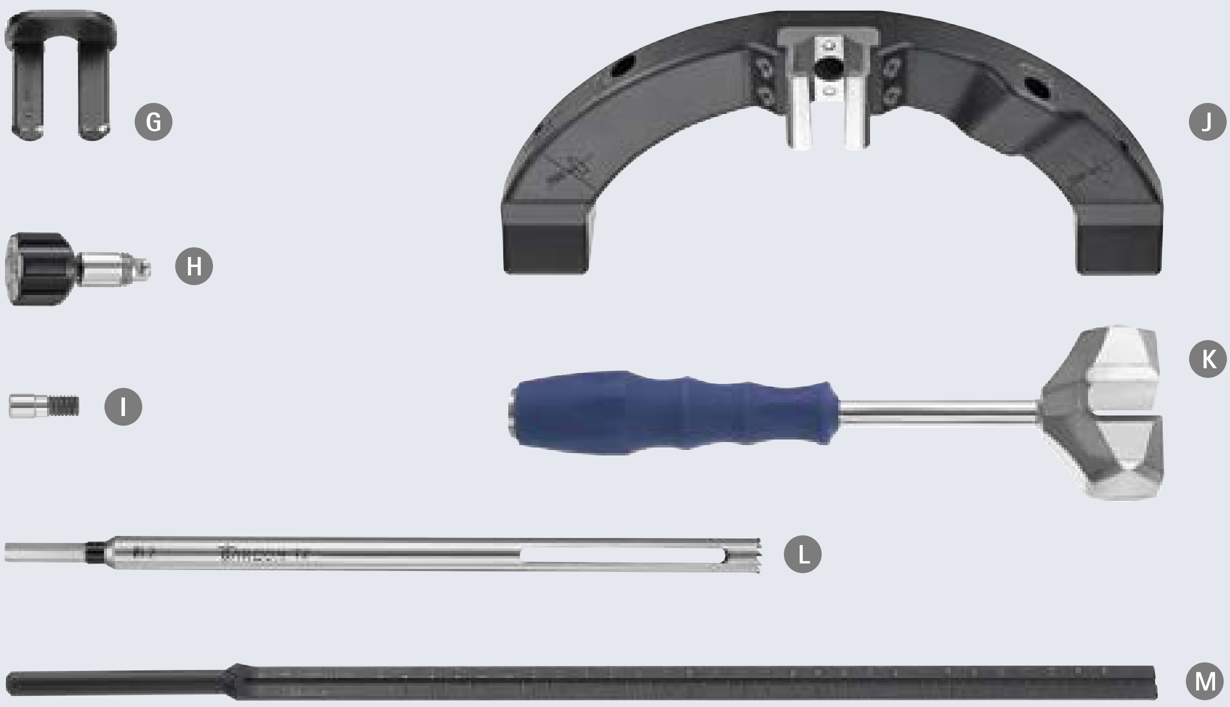
2

Instruments – Overview

KH500 Basic Instrument Set Targon® TX – Tray 1



	Article No.	Description
A	KH441203	Targeting jig
B	KH441202	Base of targeting device
C	KH477R	Tissue protector funnel, ø 12 mm
D	KH459R	Multi-purpose anvil
E	KH476R	Guide pin with stopper, ø 12 mm
F	KH463R	Reduction instrument



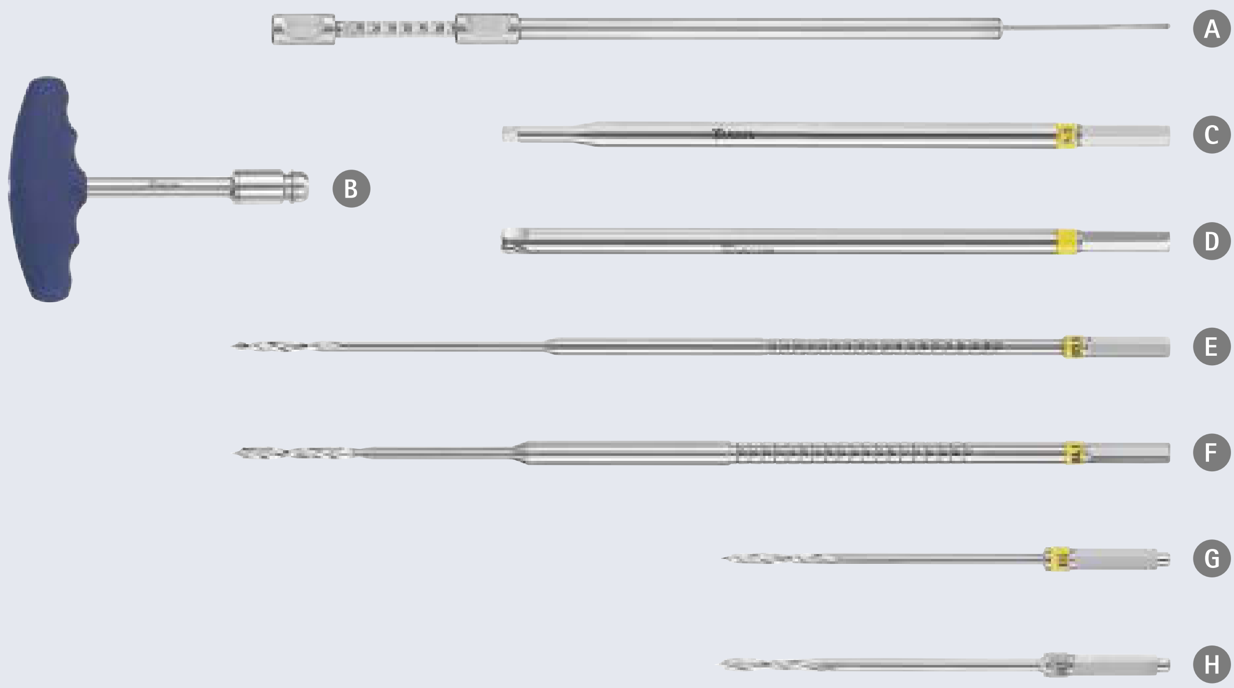
	Article No.	Description
G	KH441205	Sleeve guide, dynamic
H	KT228P	Retaining screw for Targon® targeting device
I	KH450R	Nail adapter screw
J	KH441200	Targeting bow
K	KH460R	Multi-purpose hammer
L	KH475R	Cannulated reamer, ø 12 mm
M	KH478P	Nail length gauge

Color-Coding – New Tray Layout

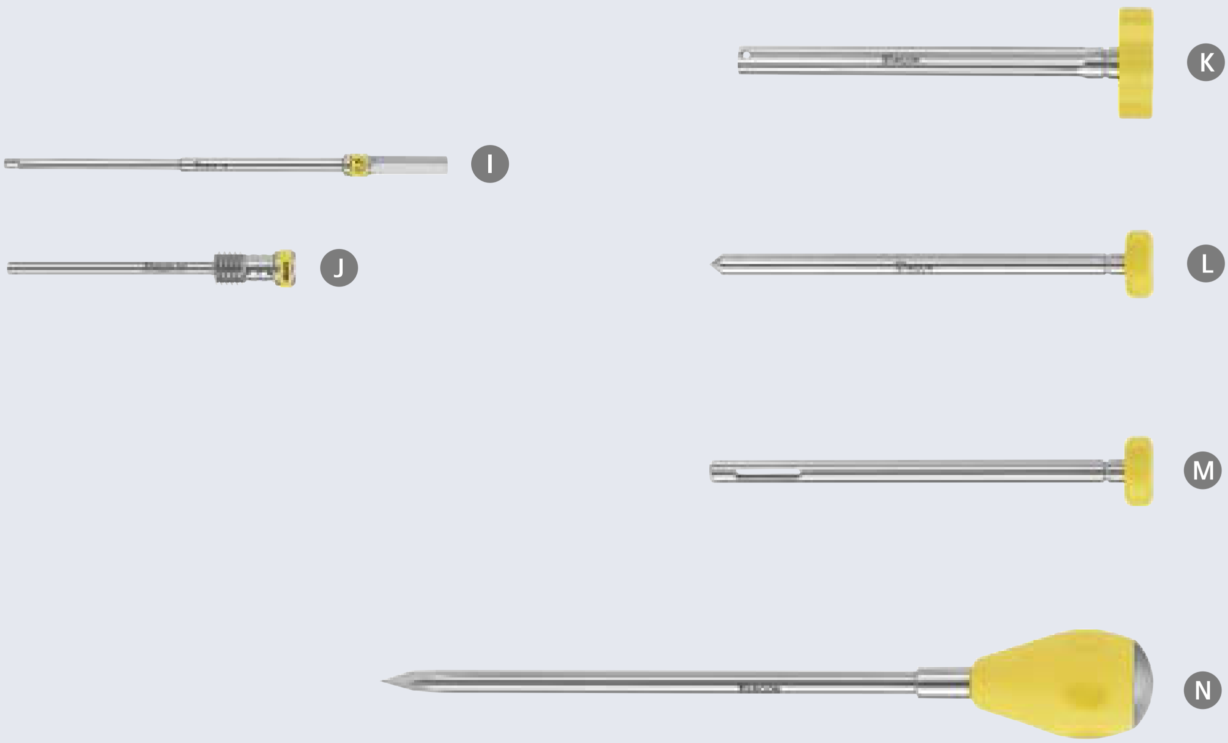
- Access
- Locking
- General instruments
- Extraction

Instruments – Overview

KH500 Basic Instrument Set Targon® TX – Tray 2



	Article No.	Description
A	KH473R	Screw length gauge
B	KH458R	T-handle with Targon® connection
C	KH486R	Screwdriver SW 4.5
D	KH485R	Counterbore, small
E	KH470R	Locking screw drill bit, metaphyseal, ø 3.5 mm
F	KH479R	Locking screw drill bit, diaphyseal, ø 4.1 mm
G	KH249R	Free-hand locking screw drill bit, metaphyseal, ø 3.5 mm
H	KH547R	Free-hand locking screw drill bit, diaphyseal, ø 4.1 mm



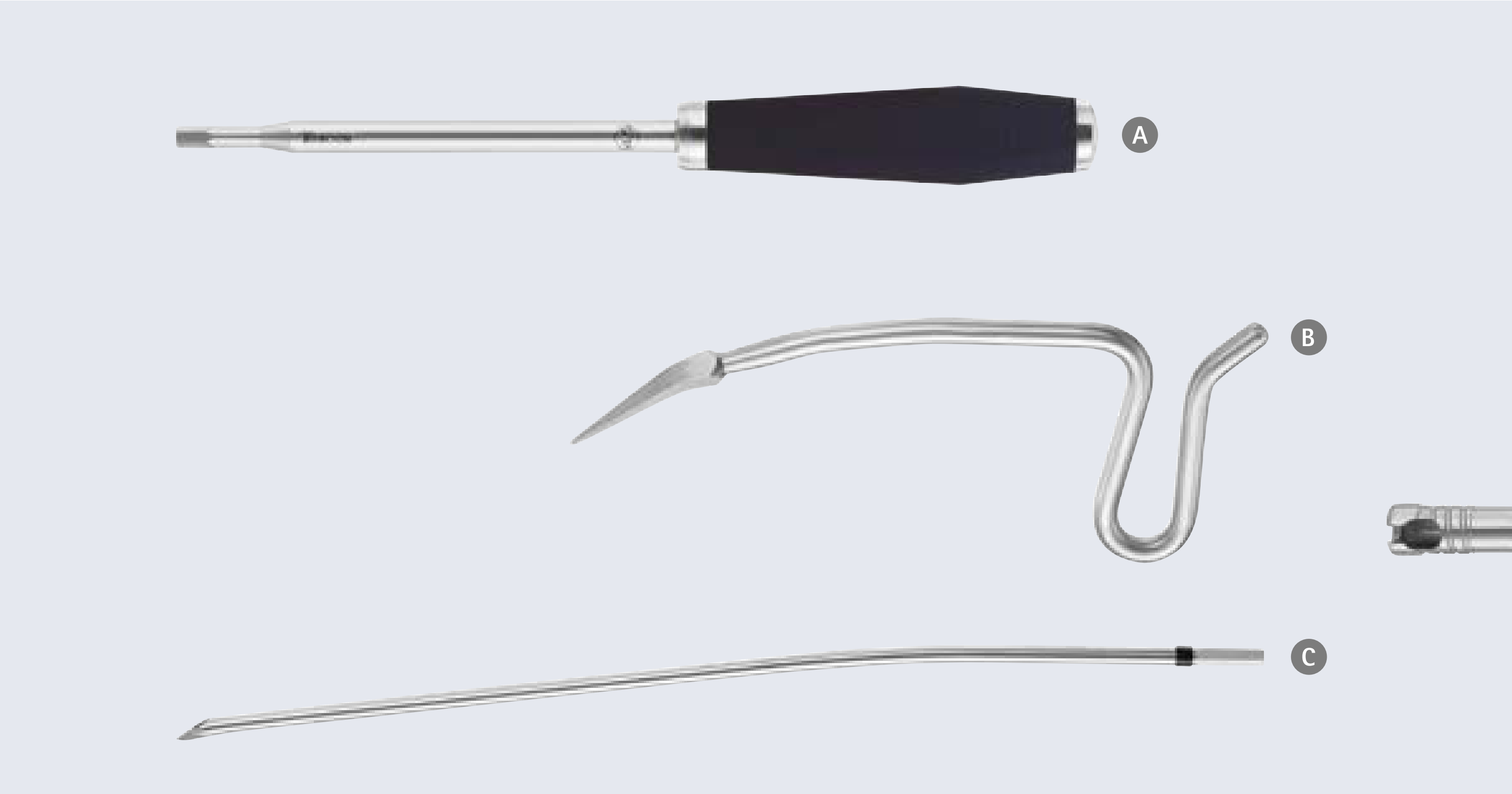
	Article No.	Description
I	KH472R	Compression screwdriver SW 3.5
J	KH474R	Bone compressor
K	KH467R	Tissue protector sleeve
L	KH468R	Obturator
M	KH469R	Drill sleeve, 3.5 mm
N	KH471R	Trocar

Color-Coding – New Tray Layout

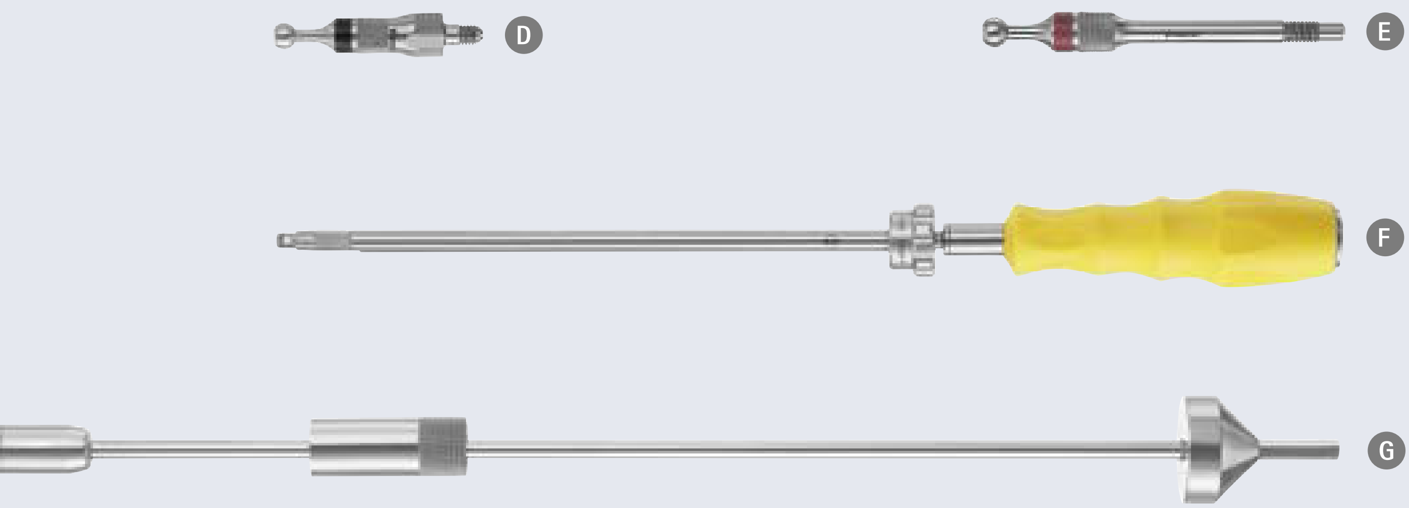
- Access
- Locking
- General instruments
- Extraction

Instruments – Overview

Optional Instruments Targon® TX (Storage)



	Article No.	Description
A	KH488R	Screwdriver cannulated, SW 4.5
B	KH317R	Awl
C	KH464R	Reduction instrument, pointed
D	KH491R	Extraction adapter for targeting device
E	KH492R	Extraction adapter for nail
F	KT236R	Self-retaining screwdriver, SW 4.5
G	KH490R	Extractor

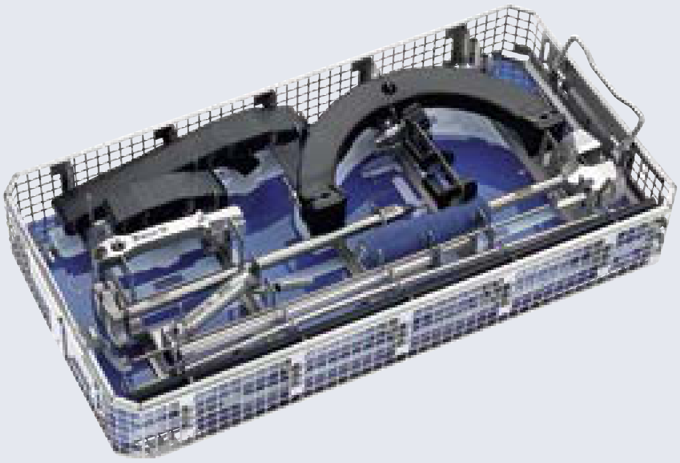


Color-Coding – New Tray Layout

- Access
- Locking
- General instruments
- Extraction

Instruments and Implants

KH500 Basic Instrument Set Targon® TX – Tray 1



Consisting of:	
X-ray template Targon® TX Standard	KH483
Reduction instrument	KH463R
Guide pin with stopper, ø 12 mm	KH476R
Tissue protector funnel, ø 12 mm	KH477R
2 x Nail adapter screw	KH450R
Multi-purpose anvil	KH459R
Multi-purpose hammer	KH460R
Nail length gauge	KH478P
Cannulated reamer, ø 12 mm	KH475R
2 x Retaining screw for Targon® targeting device	KT228P
Targeting device, comprising:	KH441P
– Targeting bow	KH441200
– Base of targeting device	KH441202
– Targeting jig	KH441203
– Sleeve guide, dynamic	KH441205

Tray container with layout 1	KH501R
Graphic template 1	TE956
2 x Cover for tray container	JH217R
Instructions for use	TA012039

Recommended container:
JK444 Bottom 187 mm high,
JP002 Cover

Service note KH441P:
The targeting device KH441P comprises the components KH441200, KH441202, KH441203 and KH441205.
For accurate targeting components should not be replaced on an individual basis.
For repair or when reordering always regard KH441P as a unit.

Tray 2

Consisting of:	
Obturator	KH468R
Drill sleeve, 3.5 mm	KH469R
Locking screw drill bit, metaphyseal, ø 3.5 mm	KH470R
Counterbore, small	KH485R
Free-hand locking screw drill bit, metaphyseal, ø 3.5 mm	KH249R
Free-hand locking screw drill bit, diaphyseal, ø 4.1 mm	KH547R
Trocar	KH471R
Screw length gauge	KH473R
Compression screwdriver SW 3.5	KH472R
T-handle with Targon® connection	KH458R
Tissue protector sleeve	KH467R
Locking screw drill bit, diaphyseal, ø 4.1 mm	KH479R
Bone compressor	KH474R
Screwdriver SW 4.5	KH486R
Tray with layout 2	KH502R
Graphic template 2	TE957
Guide wire, sterile (2 pcs.)	KH668S
Guide wire, 2.5 mm, length 800 mm	GE663S
2 x Container label	JB787B

Instruments and Implants

Optional Instruments Targon® TX (to be ordered individually)

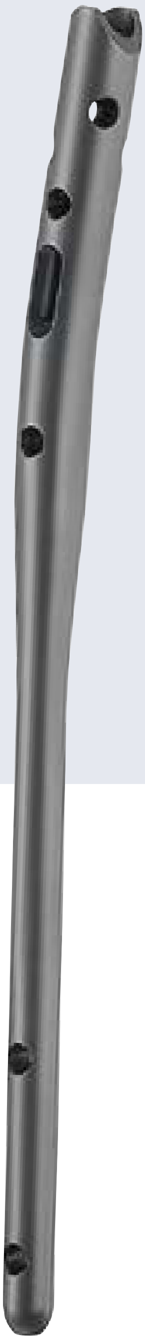
To be ordered individually:	
Screwdriver cannulated SW 4.5	KH488R
Awl	KH317R
Reduction instrument, pointed	KH464R
Extractor	KH490R
Extraction adapter for targeting device	KH491R
Extraction adapter for nail	KH492R
Self-retaining screwdriver, SW 4.5	KT236R
Power drill connection	GB413R or GB414R
Tray container with layout 1	KH513R
Graphic template 1	TE937
2 x Container label	JG790B
Cover for tray container	JH217R

Recommended container:
JK440 Bottom 90 mm high,
JP002 Cover

1 KH668S Guide wire, length 440 mm, sterile (2 pcs.)
1 KH319R Multi-purpose handle, part of intramedullary reamer bit set GE661
1 GE663S Guide wire 2.5 mm, length 800 mm, diameter of olive tip 3.2 mm

Instructions for Use
TA no. 012039
Targon® Instruments

Ordering Information – Implants (packaged sterile)

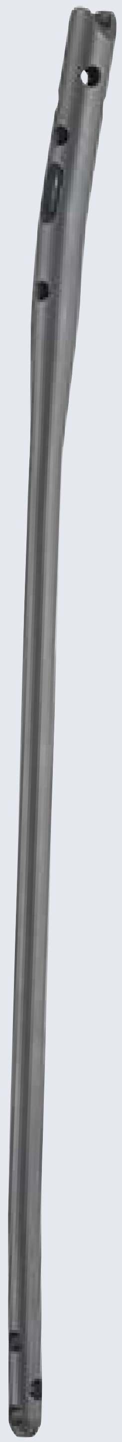


Short nail, solid, Length 200 mm	
ø 8 mm	KE546T
ø 9 mm	KE646T
ø 10 mm	KE746T

Short nail, cannulated, Length 200 mm	
ø 8 mm	KE549T
ø 9 mm	KE649T
ø 10 mm	KE749T

Instruments and Implants

Ordering Information – Implants (packaged sterile)

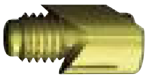


Long nail, cannulated, ø 8 mm	
240 mm	KE552T
255 mm	KE553T
270 mm	KE555T
285 mm	KE556T
300 mm	KE558T
315 mm	KE559T
330 mm	KE561T
345 mm	KE562T
360 mm	KE564T
375 mm	KE565T
390 mm	KE567T
405 mm	KE568T
420 mm	KE570T

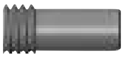
Long nail, cannulated, ø 9 mm	
240 mm	KE652T
255 mm	KE653T
270 mm	KE655T
285 mm	KE656T
300 mm	KE658T
315 mm	KE659T
330 mm	KE661T
345 mm	KE662T
360 mm	KE664T
375 mm	KE665T
390 mm	KE667T
405 mm	KE668T
420 mm	KE670T

Long nail, cannulated, ø 10 mm	
240 mm	KE752T
255 mm	KE753T
270 mm	KE755T
285 mm	KE756T
300 mm	KE758T
315 mm	KE759T
330 mm	KE761T
345 mm	KE762T
360 mm	KE764T
375 mm	KE765T
390 mm	KE767T
405 mm	KE768T
420 mm	KE770T

Ordering Information – Implants (packaged sterile)



Cap screw	
0 mm	KB206T
5 mm	KB207T
10 mm	KB208T



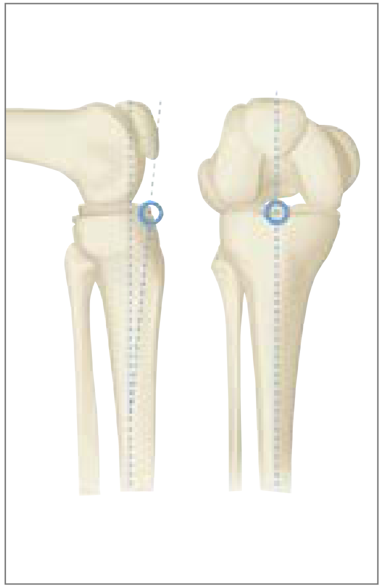
Compression screw	
	KB205T

Closure screw cannulated	
5 mm	KB211T
10 mm	KB212T
15 mm	KB213T

Locking screws, ø 4.5 mm	
20 mm	KB320TS
22 mm	KB322TS
24 mm	KB324TS
26 mm	KB326TS
28 mm	KB328TS
30 mm	KB330TS
32 mm	KB332TS
34 mm	KB334TS
36 mm	KB336TS
38 mm	KB338TS
40 mm	KB340TS
44 mm	KB344TS
48 mm	KB348TS
52 mm	KB352TS
56 mm	KB356TS
60 mm	KB360TS
64 mm	KB364TS
68 mm	KB368TS
72 mm	KB372TS
76 mm	KB376TS
80 mm	KB380TS

Aesculap® Targon® TX

Operative procedure



Access alternative A

guide pin

+ trephine

B

awl

C

flexible reamers

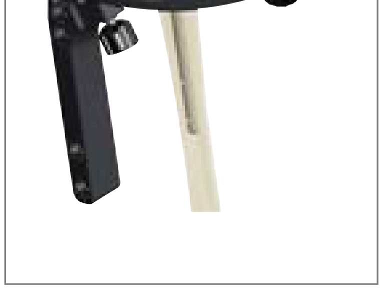
Nail impaction

Fine adjustment

Depth control of proximal screws

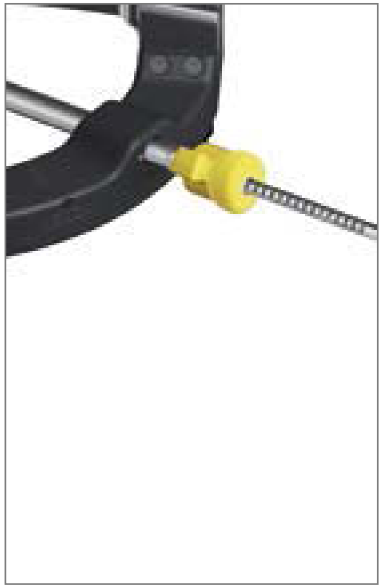
Mounting the aiming device

Standard



Placement of proximal oblique screws

preparation

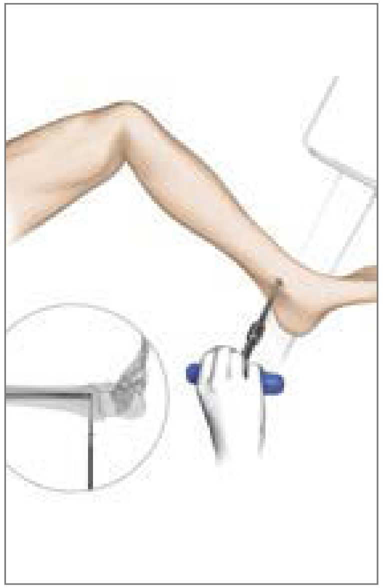


screw insertion

Distal interlocking long nail freehand technique

preparation

screw insertion



Distal interlocking short nail

Aesculap AG | Am Aesculap-Platz | 78532 Tuttlingen | Germany | www.aesculap.com

B|BRAUN
SHARING EXPERTISE

Notes

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