stryker®

Trauma

T2™ Femoral Nailing System

Operative Technique

Femoral Nailing System

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This publication sets forth detailed recommended procedures for using Stryker Trauma devices and instruments.

It offers guidance that you should heed, but, as with any such technical guide, each surgeon must consider the particular needs of each patient and make appropriate adjustments when and as required.

A workshop training is required prior to first surgery.

Contents

Introduction

1. Introduction

Over the past several decades **antegrade femoral nailing** has become the treatment of choice for most femoral shaft fractures. **Retrograde femoral nailing** has expanded the use of intramedullary nails (1, 2). Complicated multiple trauma injuries, associated pelvic and acetabular fractures, ipsilateral femoral shaft fractures, supracondylar and intercondylar fractures, may be better managed by utilizing retrograde femoral nailing techniques (3, 4, 5, 6, 7).

The T2™ Femoral Nailing System is one of the first femoral nailing systems to offer an option for either an antegrade or a retrograde approach to repair fractures of the femur.

One Implant, Two Approaches

Stryker Trauma has created a **new generation locking nail system**, bringing together all the capabilities and benefits of separate antegrade and retrograde nailing systems to create a **single, integrated surgical resource** for fixation of long-bone fractures.

Furthermore, the development of the T2™ Femoral Nailing System offers the competitive advantages of:

- **Not limiting the approach to a certain nailing technique**
- **Accommodating reamed or unreamed procedures**
- **Providing locking options for all types of fractures, plus the Advanced Locking Mode for increased rotational stability**

Through the development of a common, streamlined and intuitive surgical approach, both in principle and in detail, the T2™ Femoral Nailing System offers **significantly increased speed and functionality** for the treatment of fractures as well as simplifying the training requirements for all personnel involved.

1.1. Implant Features

The T2™ Femoral Nailing System is the realization of superior biomechanical intramedullary stabilization using small caliber, strong, cannulated implants for internal fixation of long bones. According to the fracture type, the system offers the option **of different locking modes**. In addition **to static locking**, a **controlled dynamization with rotational stability is optional.**

In some indications, **a controlled apposition/compression of bone fragments can be applied by introducing a Compression Screw from the top of the nail**. To further increase rotational stability, the nail can be locked statically after using the controlled dynamization and apposition/compression option.

The **Compression Screw is pushed against the Partially Threaded Locking Screw (Shaft Screw)** that has been placed in the oblong hole, **drawing either the distal or the proximal segment towards the fracture site**. In stable fractures, this has the biomechanical advantage of **creating active circumferential compression** to the fracture site, **transferring axial load to the bone**, and reducing the function of the nail as a load bearing device (8).

This ability to **transfer load back to the bone** can reduce the incidence of implant failure secondary to fatigue. Typical statically locked nails function as load bearing devices, and failure rates in excess of 20% have been reported (9).

The beneficial effect of apposition/compression in treating long-bone fractures in cases involving transverse and short oblique fractures that are axially stable is well documented (10, 11).

Common 5mm cortical screws simplify the surgical procedure and promote a minimally invasive approach. **Fully Threaded Locking Screws** are available for regular locking procedures. **Partially Threaded Locking Screws (Shaft Screws)** are designed if apposition/compression is applied. Special **Condyle Screws with adjustable washers** for improved fit are designed to fix fragments in the condyle area.

Compression Screws to close the fracture site and **End Caps** are available in various sizes to provide a **"best fit" for every indication.**

All implants of the T2™ Femoral Nailing System are **gun-drilled** and made of **Type II anodized titanium alloy (Ti6AL4V)** for **enhanced biomechanical and biomedical performance.**

See the **detailed chart on the next page** for the design specifications and size offerings.

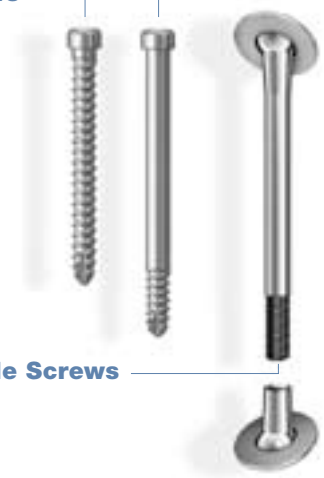
Technical Details

Nails
Diameter 9–15mm
Sizes 140–480mm

Note:
Screw length is measured from top of head to tip.

5.0mm Partially Threaded Locking Screws (Shaft Screws)
L = 25–120mm

5.0mm Fully Threaded Locking Screws
L = 25–120mm



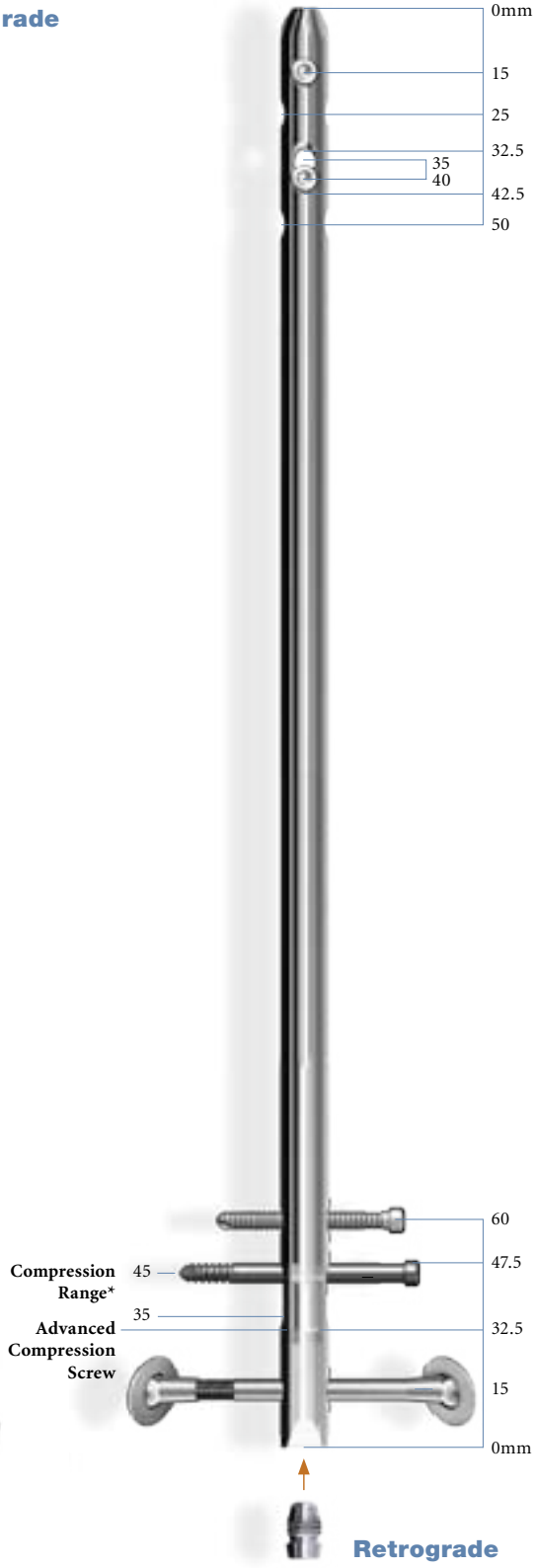
5.0mm Condyle Screws
L = 40–120mm

Condyle Nut

Compression Screws

Femur Advanced Compression Screw

Standard +5mm +10mm +15mm



End Caps

Standard +5mm +10mm +15mm +20mm +25mm +30mm +35mm

*** Compression Range**

Total Length of Slot	15mm
Less Screw Diameter (-)	5mm
Maximum Movement of Screw	**10mm**

Features

1.2. Instrument Features

The major advantage of the instrument system is a breakthrough in the integration of the instrument platform which can be used not only for the complete T2™ Nailing System, but will be the platform for all future nailing systems, thereby reducing complexity and inventory.

The instrument platform offers advanced precision and usability, and features ergonomically styled targeting devices.

In addition to the advanced precision and usability, the instruments are both color, number and symbol coded to indicate its' usage during the surgical procedure.

Color and number coding indicates the step during the procedure in which the instrument is used. This color code system is marked on the trays to easily identify the correct instrument.

Step	Color	Number
Opening	Red	①
Reduction	Brown	②
Nail Introduction	Green	③
Guided Locking	Light Blue	④
Freehand Locking	Dark Blue	⑤

Symbol coding on the instruments indicates the type of procedure, and must not be mixed.

Symbol

■ Square = Long instruments, Femur

▲ Triangular = Short instruments, Tibia and Humerus

Drills

Drills feature color coded rings:
4.2mm = Green

For 5.0mm Fully Threaded Locking Screws and for the second cortex when using 5.0mm Partially Threaded Locking Screws (Shaft Screws).

5.0mm = **Black**
For the first cortex when using 5.0mm Partially Threaded Locking Screws (Shaft Screws) and for both corticies when using Condyle Screws.

1.3. References

1. Janzing HMJ et al.: The Retrograde Intramedullary Nail: Prospective Experience in Patients Older than Sixty-five Years. Journal of Orthopaedic Trauma 12 (5) 330-333, 1998

2. Koval KJ et al.: Distal Femoral Nonunion: Treatment with a Retrograde Inserted Locked Intramedullary Nail, Journal of Orthopaedic Trauma, Vol. 9 N°4, pp. 285-291, 1995

3. Herscovici D Jr. and Whiteman KW: Retrograde Nailing of the Femur Using an Intercondylar Approach. Clinical Orthopaedics and related Research, 332, 98-104, 1996

4. Roy Sanders, Kenneth J. Koval et al.: Retrograde Reamed Femoral Nailing. Journal of Orthopaedic Trauma 1993; Vol. 7, No. 4: 293-302

5. Ostrum F. D., et al., A Prospective Comparison of Antegrade and Retrograde Intramedullary Nailing, Friday, October 9, 1998 Session V, 11:31 a. m. OTA Vancouver

6. Ostrum F. D., Joseph DiCicco, Retrograde Intramedullary Nailing of Femoral Diaphyseal Fractures, Journal of orthopaedic Trauma, Vol. 12, N° 7, pp. 464-468, 1998

7. Lucas SE et al.: Intramedullary Supracondylar Nailing of Femoral Fractures. A Preliminary Report of the GSH Supracondylar Nail. Clinical Orthopaedics and Related Research 296 200-206, 1993

8. T. E. Richardson, M. Voor, D. Seligson, Fracture Site Compression and Motion with Three Types of Intramedullary Fixation of the Femur, Osteosynthese International (1998), 6: 261-264

9. Hutson et al., Mechanical Failures of Intramedullary Tibial Nails Applied without Reaming, Clin. Orthop. (1995), 315: 129-137

10. M.E. Muller, et al., Manual of Internal Fixation, Springer-Verlag, Berlin, 1991

11. O. Gonschorek, G. O. Hofmann, V. Bühren, Interlocking Compression Nailing: a Report on 402 Applications. Arch. Orthop. Trauma Surg (1998), 117: 430-437.

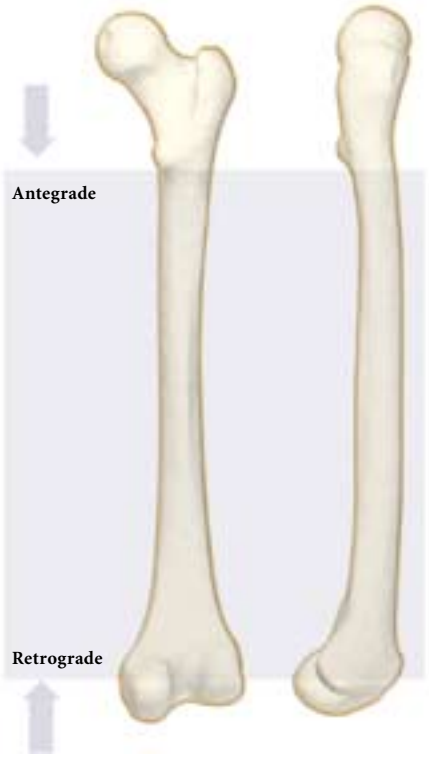
12. Mehdi Mousavi, et al., Pressure Changes During Reaming with Different Parameters and Reamer Designs, Clinical Orthopaedics and Related Research, Number 373, pp. 295-303, 2000.

Indications

2. Indications

The T2™ Femoral Nail is indicated for:

- Open and closed shaft fractures
- Ipsilateral shaft fractures
- Segmental fractures
- Supracondylar fractures including those with intra-articular extension
- Comminuted fractures with or without bone loss
- Fractures distal to a hip prosthesis
- Fractures proximal to a total knee arthroplasty
- Pathologic and impending pathologic fractures
- Tumor resections
- Non-unions
- Pseudarthrosis
- Mal-unions
- Corrective osteotomies



3. Pre-operative Planning

An X-Ray Template 1806-0005 is available for pre-operative planning.

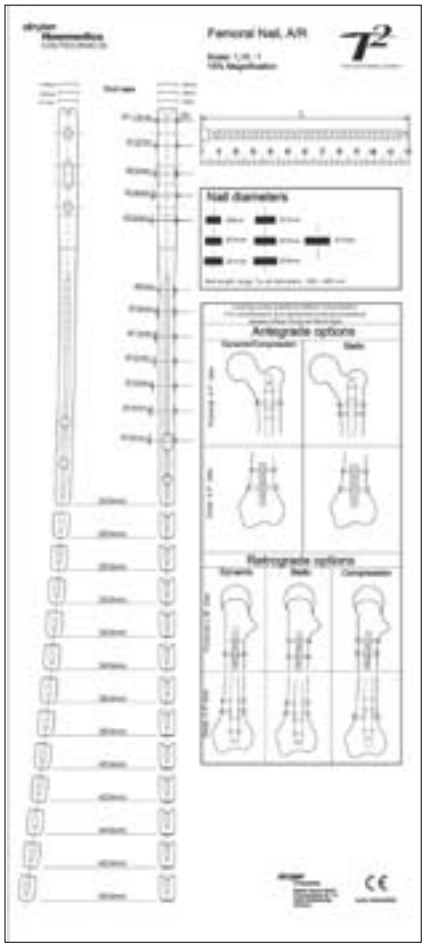
Thorough evaluation of pre-operative radiographs of the affected extremity is critical. Careful radiographic examination of the trochanteric region and intercondylar regions can prevent intra-operative complications.

The proper nail length when inserted antegrade should extend from the Tip of the Greater Trochanter to the Epiphyseal Scar.

The retrograde nail length is determined by measuring the distance between a point 5mm–15mm proximal to the Intercondylar Notch to a point at/or proximal to the Lesser Trochanter.

In either approach this allows the surgeon to consider the apposition/compression feature of the T2™ Femoral Nail, knowing that up to 10mm of active apposition/compression is possible, prior to determining the final length of the implant. If apposition/compression is planned, the nail should be 10mm to 15mm shorter.

Note:
Check with local representative regarding availability of nail sizes.



Additional Information

4. Locking Options

Antegrade

Retrograde

Static Mode

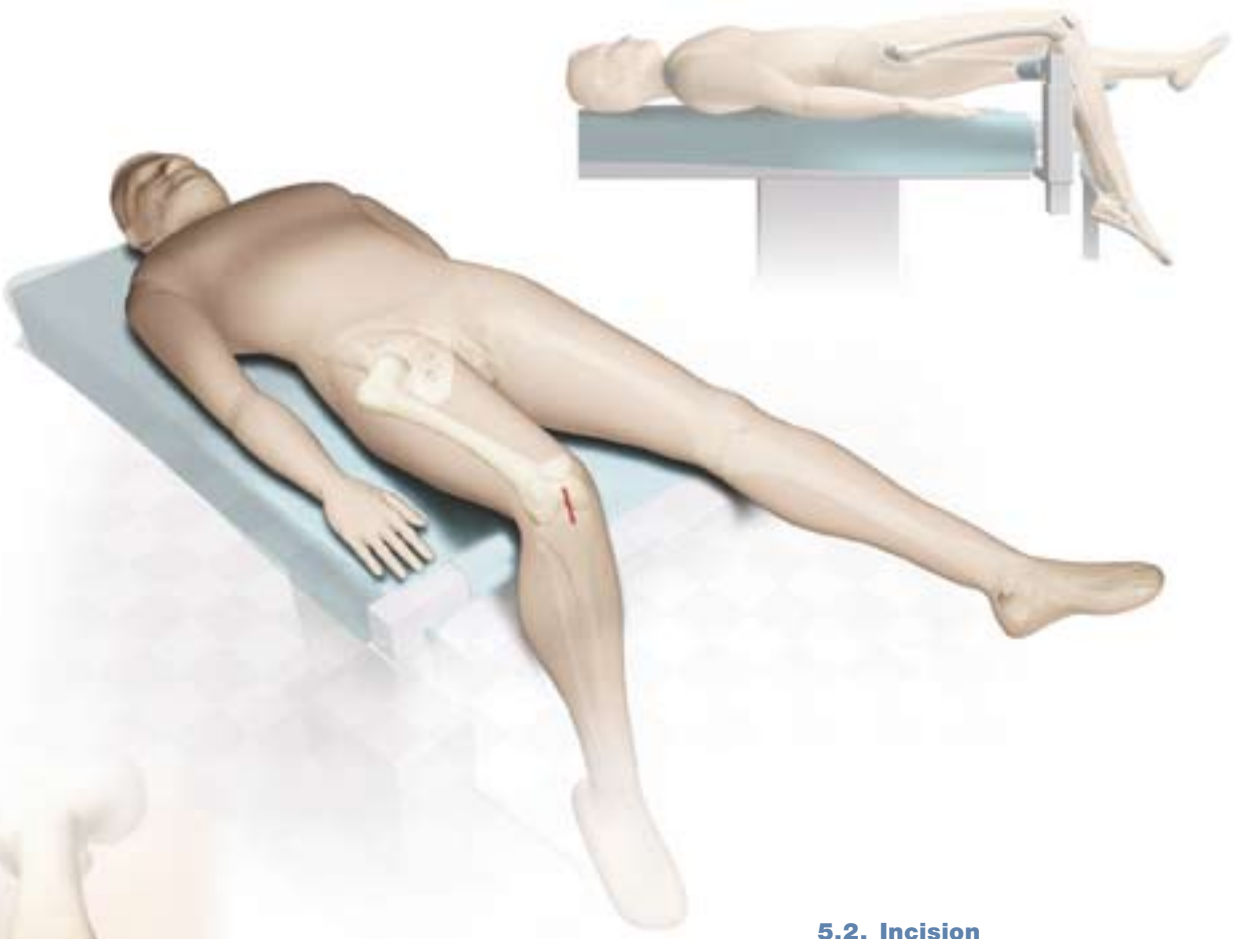
Additional Information

Dynamic Mode

Apposition/Compression Mode

Advanced Locking Mode

Retrograde Technique



5. Retrograde Technique

5.1. Patient Positioning

Retrograde nail insertion is performed with the patient supine on a radiolucent table. The affected lower extremity and hip region are freely draped, and the knee is placed over a sterile bolster. This will allow for 45 degrees of knee flexion. Manual traction through a flexed knee or a distraction device may be used to facilitate reduction for most acute femoral shaft fractures.

5.2. Incision

A 3cm midline skin incision is made extending from the inferior pole of the Patella to the Tibial Tubercle, followed by a medial parapatellar capsular incision. This should be sufficient to expose the Intercondylar Notch for retrograde nail insertion. Occasionally, a larger incision may be needed, especially if the fracture has intra-articular extension and fixation of the condyles is necessary.

Distal femoral fractures are often complicated by intra-articular fracture line extension. These fractures should be anatomically reduced and secured with the aid of titanium Asnis III® 6.5mm/8.0mm Large Cannulated Screws in the anterior and posterior aspect of the femoral condyles. This will allow for adequate space when inserting the nail retrograde. Cannulated Screws are advantageous, allowing the surgeon to use intra-operative radiographs to check Guide Wire placement prior to screw insertion. An alternative is to reduce and maintain reduction of the femoral condyles with a pointed reduction forceps.

Retrograde Technique

5.3. Entry Point

The 3×285mm K-Wire (1806-0050S)* can easily be fixed to the Guide Wire Handle (1806-0095 and 1806-0096) (Fig. 1). With the condyles secured, the entry point for retrograde nail insertion is made by centering the 3×285mm K-Wire through the Retrograde Protection Sleeve (703165) and positioning within the Intercondylar Notch anterior to Blumensaat's line on the M/L radiograph using the Slotted Hammer (1806-0170) (Fig. 2).

Fig. 1

This point is found by palpating a distinct ridge just anterior to the Posterior Cruciate Ligament (Fig. 2).

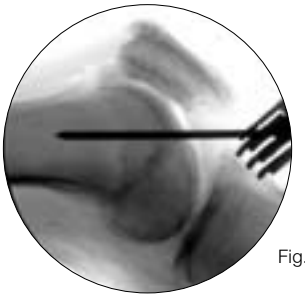


Fig. 2

The K-Wire is advanced manually or with the Slotted Hammer approximately 10cm confirming its placement within the center of the distal femur on an A/P and Lateral radiograph.

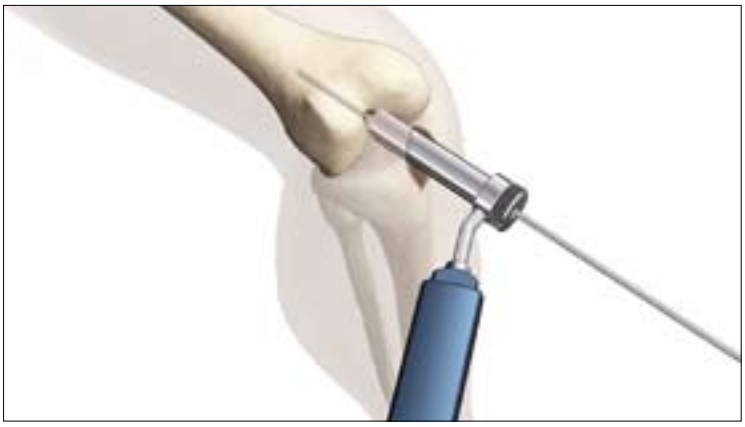


Fig. 3

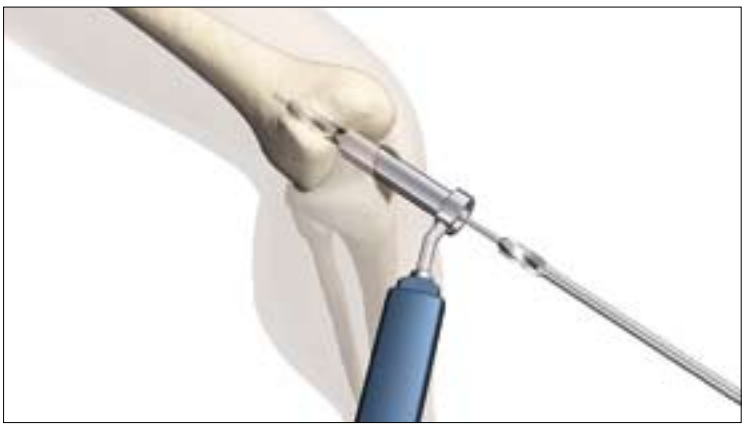


Fig. 4

The Retrograde Protection Sleeve is contoured to fit the profile of the Intercondylar Notch. It is designed to help reduce the potential for damage during reaming, and also provide an avenue for the reamer debris to exit the knee joint (Fig. 3).

When the inner Retrograde K-Wire Guide is removed, the Ø12mm Rigid Reamer (1806-2012) is inserted over the 3×285mm K-Wire and through the Retrograde Protection Sleeve. The distal most 8cm of the femur is reamed (Fig. 4).

The Ø12mm Rigid Reamer is used for nails 9mm–11mm in diameter. Larger nail diameters may be reamed with a flexible reamer 1mm larger than the nail.

Note:
Prior to advancing the K-Wire within the distal femur, check the correct guidance through the Ø12mm Rigid Reamer. Do not use bent K-Wires.

Note:
During opening the entry portal with the Awl, dense cortex may block the tip of the Awl. An Awl Plug (1806-0032) can be inserted through the Awl to avoid penetration of bone debris into the cannulation of the Awl shaft.

* Outside of the U.S., product with an "S" may be ordered non-sterile without the "S" at the end of the corresponding Cat. Number.

Retrograde Technique

5.4. Unreamed Technique

If an unreamed technique is preferred, the 3×1000mm Ball Tip Guide Wire (1806-0085S) is passed through the fracture site using the Guide Wire Handle. The Universal Rod (1806-0110) with Reduction Spoon (1806-0125) may be used as a fracture reduction tool to facilitate Guide Wire insertion (Fig. 5). Internal rotation during insertion will aid in passing the Guide Wire down the femoral shaft. The Guide Wire is advanced until the tip rests at/or just above the Lesser Trochanter. The Guide Wire should lie in the center of the metaphysis in the A/P and M/L views to avoid offset positioning of the nail. The Guide Wire Handle is removed, leaving the Guide Wire in place.

Fig. 5

5.5. Reamed Technique

For reamed techniques, the 3×1000mm Ball Tip Guide Wire is inserted through the fracture site and does not require a Guide Wire exchange. The Universal Rod with Reduction Spoon may be used as a fracture reduction tool to facilitate Guide Wire insertion through the fracture site (see Fig. 5).

Note:
The Ball Tip at the end of the Guide Wire will stop the reamer head.

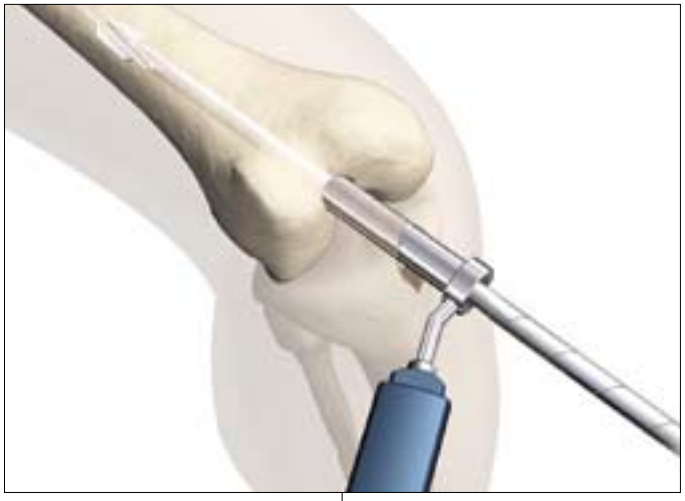


Fig. 6

Reaming (Fig. 6) is commenced in 0.5mm increments until cortical contact is appreciated. Final reaming should be 1mm larger than the diameter of the nail to be used.

Note:
The diameter of the driving end of the 9mm–11mm diameter nails is 11.5mm. Additional metaphyseal reaming may be required to facilitate nail insertion. Nail sizes 12–15mm have a constant diameter.

Note:
Thoroughly irrigate the knee joint to remove any debris.

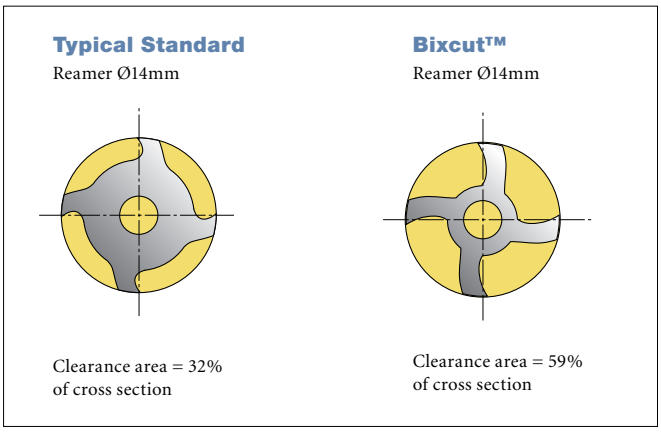
Retrograde Technique

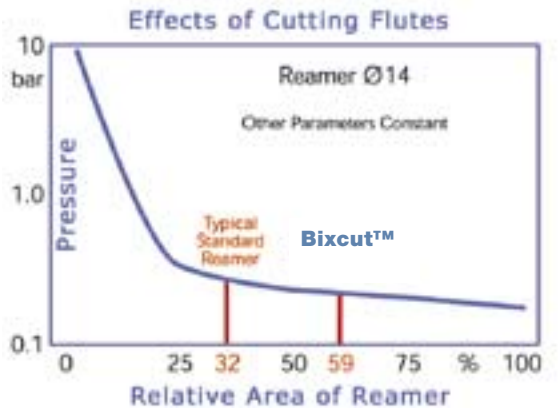
Bixcut™ Reamer*

The complete range of Bixcut™ reamers is available with either modular or fixed heads.

The optimized cutting flute geom-etry is designed to largely reduce intramedul-lary pressure and temperature. This is achieved by the forward and side cutting face combination of the reamer blades. The large clearance rate resulting from the reduced number of reamer blades, coupled with the reduced length of the reamer head, relieves the intramedullary pressure and provides efficient removal of reamed material.

See pages 42–45 for additional **Bixcut™ Reamer** system details.





Retrograde Technique

5.6. Nail Selection

Diameter

The diameter of the selected nail should be 1mm smaller than that of the last reamer used. Alternatively, the nail diameter may be determined using the Femur X-Ray Ruler (1806-0015) (Fig. 7.1 and 7.2).

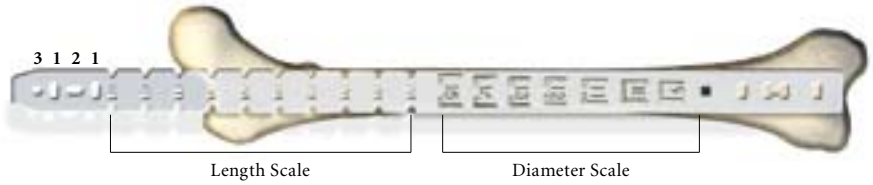


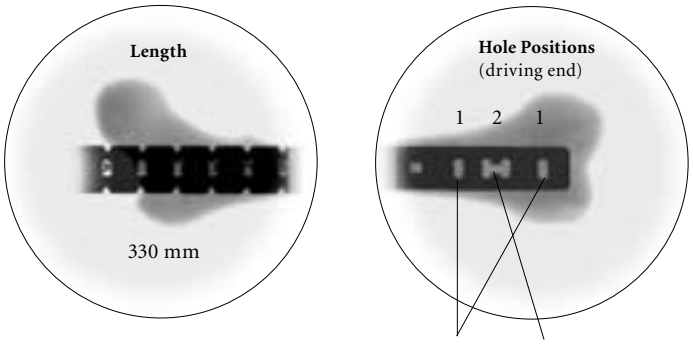
Fig. 7.1

Fig. 7.1 Hole Positions (nondriving end) Antegrade or Retrograde*

1. Static Locking – both M/L holes
2. Oblong hole – depending on Antegrade or Retrograde; static or dynamic modes – A/P
3. Static Locking – A/P

Fig. 7.2 Hole Positions (driving end) Antegrade or Retrograde*

1. Static Locking – both M/L holes
2. Oblong hole – depending on Antegrade or Retrograde; static, dynamic, apposition/compression, advanced locking modes – M/L



Length Calibration

Static and **Dynamic** Slot Locking Options

Fig. 7.2

Length

Nail length may be determined by measuring the remaining length of the Guide Wire. The Guide Wire Ruler (1806-0020) may be used by placing it on the Guide Wire reading the correct nail length at the end of the Guide Wire on the Guide Wire Ruler (Fig. 8 and Fig. 9).

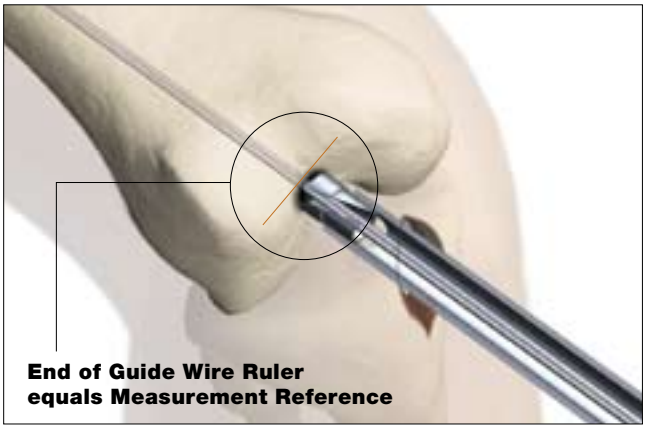


Fig. 8

Alternatively, the X-Ray Ruler (1806-0015) may be used to determine nail diameter and length (Fig. 7.1, 7.2). Additionally, the X-Ray Ruler can be used as a guide for locking screw positions.

Note:
X-Ray Ruler and Guide Wire Ruler can be used for nail length determination beginning from 240mm. Shorter nail length can be determined via the template.

Note:
If the fracture is suitable for apposition/compression, the implant selected should be 10–15mm shorter than measured, to help avoid migration of the nail beyond the insertion site.

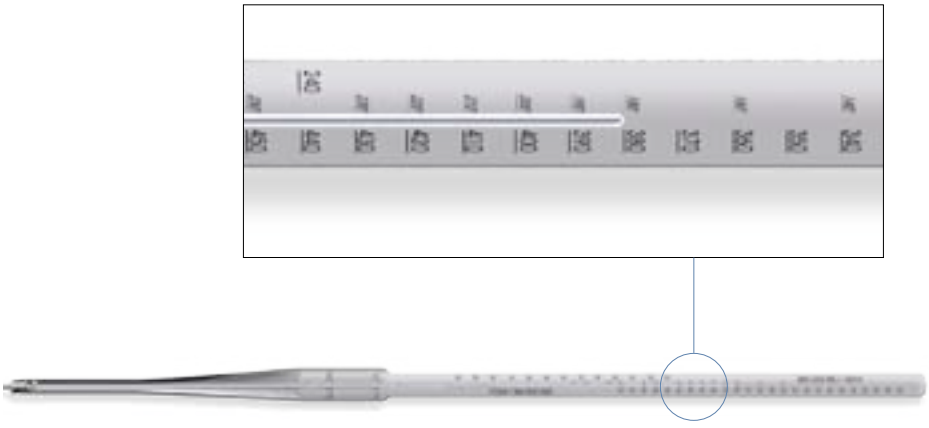


Fig. 9

* see pages 8–9 for detailed illustrations of Antegrade and Retrograde Locking Options.

Retrograde Technique

5.7. Nail Insertion

The selected nail is assembled onto the Femoral Target Device (1806-1005) with the Femoral Nail Holding Screw (1806-0165) (Fig. 10). Tighten the Nail Holding Screw with the Universal Joint Socket Wrench (1806-0400) securely so that it does not loosen during nail insertion.

Note:
Prior to nail insertion please check correct alignment by inserting a drill bit through the assembled Tissue Protection- and Drill Sleeve placed in the required holes of the targeting device.

Upon completion of reaming, the appropriate size nail is ready for insertion. Unique to the T2™ Femoral Nail, the 3×1000mm Ball Tip Guide Wire does not need to be exchanged. The Strike Plate (1806-0150) may be threaded into the hole next to the Nail Holding Screw and the nail is advanced through the entry point past the fracture site to the appropriate level.

Additionally, the 3×285mm K-Wire may be inserted through the Targeting Device which identifies the junction of the nail and insertion post (see Fig. 10.1).

Insertion of the 3×285mm K-Wire into the lateral cortex may also help to lock the targeting device to the distal femur and prevent rotation of the nail in cases where the Apposition/ Compression Locking Mode is utilized.

Note:
Curvature of the nail must match the curvature of the femur.

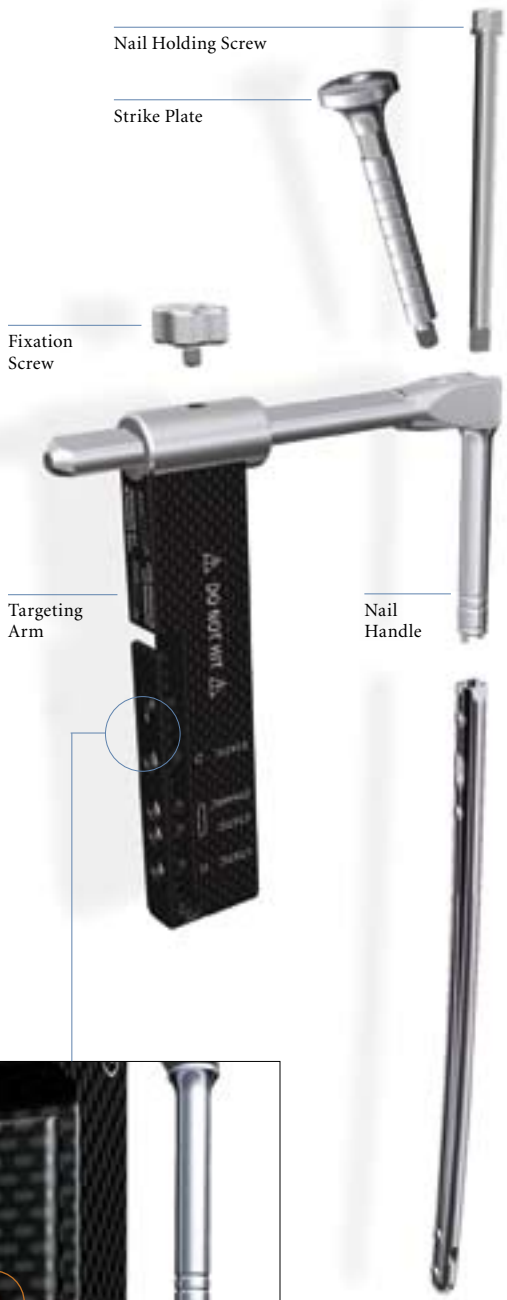


Fig. 10

Fig. 10.1

Retrograde Technique

The Slotted Hammer can be used on the Insertion Wrench that is placed onto the Nail Holding Screw to insert the nail over a Guide Wire (Fig. 11).

Note:
Prior to insertion, check for correct assembly into the nail by passing a Drill Bit through the Target Device. DO NOT hit the Target Device. Only hit upon the Insertion Wrench.

Note:
A chamfer is located on the driving end of the nail to denote the end under X-Ray. Three circumferential grooves are located on the insertion post at 2mm, 10mm, and 15mm from the driving end of the nail. Depth of insertion may be visualized with the aid of fluoroscopy.

Fig. 11

Repositioning should be carried out either by hand or by using the Strike Plate attached to the Target Device. The Universal Rod and Slotted Hammer may then be attached to the Strike Plate to carefully and smoothly extract the assembly (Fig. 12). DO NOT hit on the Target Device.

Fig. 12

When locking the retrograde nail in the Static Mode, the nail is countersunk a minimum of 5mm to the chondral surface. When the implant is inserted in the Dynamic Mode, without active apposition/compression, the recommended insertion depth is 10mm. When the implant is inserted with active apposition/compression or in the Advanced Locking Mode, the recommended depth of insertion is 15mm (Fig. 13).

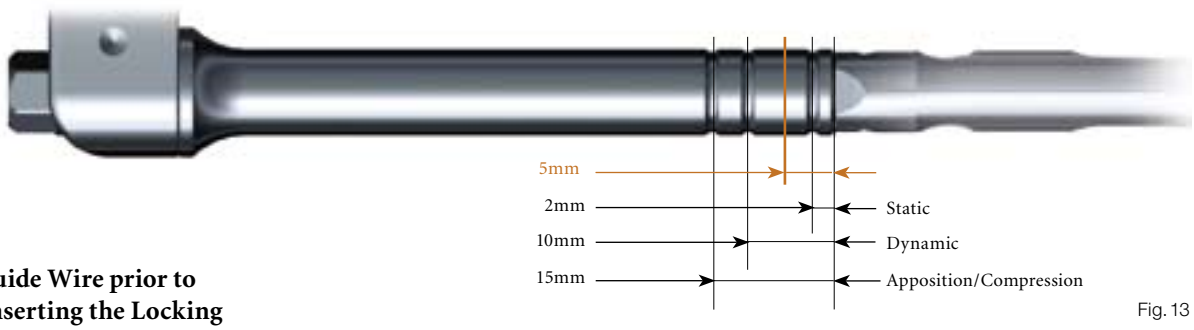


Fig. 13

Note:
Remove the Guide Wire prior to drilling and inserting the Locking Screws.

Retrograde Technique

5.8. Guided Locking Mode (via Target Device)

Before locking the nail distally, the Nail Holding Screw must be firmly tightened using the Universal Joint Socket Wrench to ensure that the nail is correctly aligned with the Target Device.

The Target Device is designed to provide four options for proximal locking (Fig. 14.1–14.3).

In Static Locking Mode, all three indicated holes may be used (Fig. 14.1).

1. Static
2. Static
3. Static

In controlled Dynamic Mode, and/or controlled Apposition/Compression Mode, the dynamic hole is required. This hole is also used for compression (Fig. 14.2).

4. Dynamic

In Advanced Locking Mode, the dynamic hole is required. After utilizing compression with the Advanced Compression Screw, either or both static holes are used. (Fig. 14.3).

4. Dynamic
1. Static
3. Static

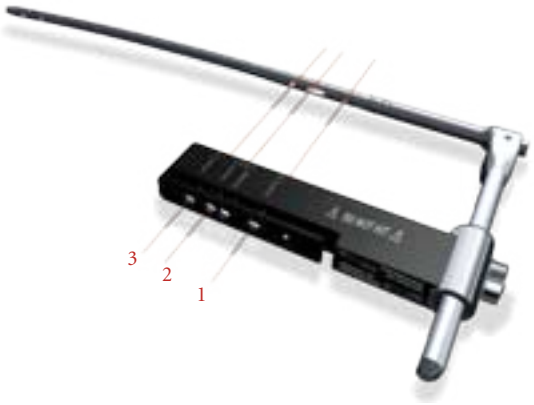


Fig. 14.1

Fig. 14.2

Fig. 14.3

The Long Tissue Protection Sleeve (1806-0185) together with the Long Drill Sleeve (1806-0215) and the Long Trocar (1806-0315) is inserted into the Target Device by pressing the safety clip (Fig. 15). The mechanism will keep the sleeve in place and prevent it from falling out.
It will also prevent the sleeve from sliding during screw measurement. To release the Tissue Protection Sleeve, the safety clip must be pressed again.

Fig. 15

5.9. Static Locking Mode

When treating supracondylar fractures, three screws should be used whenever possible. The screw placed within the oblong hole should be in the static position. Always start with the most proximal screw.

If secondary dynamization is planned, it is recommended to dynamize at the proximal portion of the nail. This is achieved by putting a Fully Threaded Locking Screw at the proximal location of the A/P oblong hole at the top of the nail. This allows dynamization of the fracture in case of delayed union after removal of the most proximal screw.

The Long Tissue Protection Sleeve together with the Long Drill Sleeve and Long Trocar, are positioned through the static locking hole on the Target Device. A small skin incision is made, and the assembly is pushed through until it is in contact with the lateral cortex of the femur (Fig. 16).

The Trocar is removed, with the Tissue Protection Sleeve and the Drill Sleeve remaining in position.

To ensure accurate drilling and easy determination of screw length, use the center tipped, Ø4.2×340 calibrated Drill (1806-4260S). The centered Drill is forwarded through the Drill Sleeve and pushed onto the cortex.

Fig. 16

Fig. 17

Retrograde Technique

After drilling both cortices, the screw length may be read directly off of the calibrated Drill at the end of the Drill Sleeve. If measurement with the Screw Gauge, Long is preferred, first remove the Drill Sleeve, Long and read the screw length directly at the end of the Tissue Protection Sleeve, Long (Fig. 17 and Fig. 18).

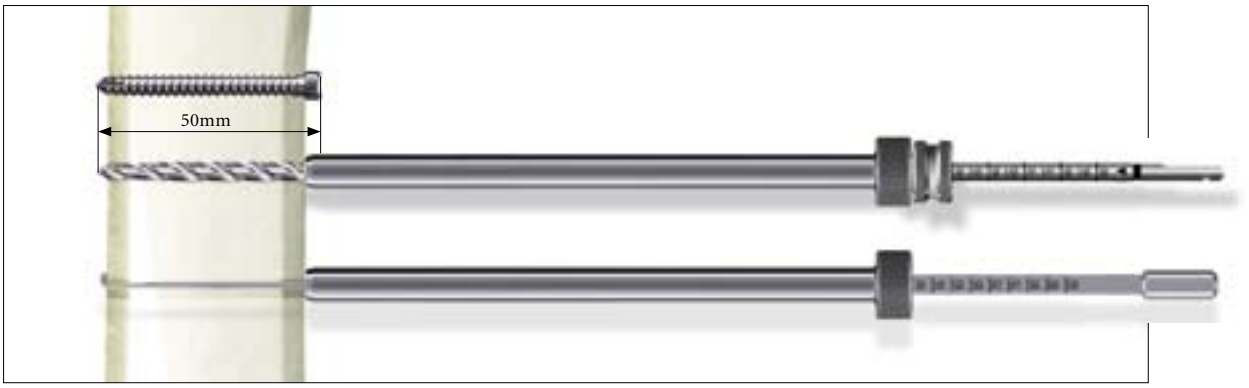


Fig. 18

Note:
The position of the end of the Drill as it relates to the far cortex is equal to where the end of the screw will be. Therefore, if the end of the Drill is 3mm beyond the far cortex, the end of the screw will also be 3mm beyond.

Fig. 19

Note:
The Screw Gauge, Long is calibrated so that with the bend at the end pulled back flush with the far cortex, the screw tip will end 3mm beyond the far cortex (Fig. 18). When the Drill Sleeve is removed, the correct Locking Screw is inserted through the Tissue Protection Sleeve using the Long Screwdriver Shaft (1806-0227) with Teardrop Handle (702429). The screw is advanced through both cortices. The screw is near its' proper seating position when the groove around the shaft of the screwdriver is approaching the end of the Tissue Protection Sleeve (Fig. 19).

Repeat the locking procedure for the other statically positioned Cross Locking Screws.

Retrograde Technique

Condyle Screw Locking
If a Condyle Screw is to be inserted, both cortices are drilled with the Ø5×340mm Drill (1806-5020S) (Fig. 20). After drilling both cortices, the screw length may be read directly off of the calibrated Drill at the end of the Drill Sleeve. The Condyle Screw K-Wire (0152-0218S) is inserted from the lateral side through the Tissue Protection Sleeve to the medial side. At the medial point of the perforation a skin incision is made for the Condyle Screw.

From the medial side, the Condyle Screw is now brought forward over the Condyle Screw K-Wire and inserted using the Condyle Screw Screwdriver (1806-0255).

To insert the Condyle Nut, the Tissue Protection Sleeve and the Drill Sleeve are removed, and the K-Wire is withdrawn to the medial side. This allows for the nut to be positioned between the Target Device and the level of the skin and onto the Condyle Screw K-Wire (Fig. 21).

Alternatively, if the patient anatomy allows, the Condyle Screw may be introduced from Lateral to Medial in a similar manner as described above (Fig. 21a).

Using both Condyle Screw Screwdrivers, the Condyle Nut and the Condyle Screw are tightened. Once tightened, the K-Wire is removed.

The adjustable screw washer of the Condyle Screw and the Condyle Nut adapt to the surface of the bone eliminating the need to countersink both.

The geometry of the implant allows three Condyle Screws to be used. At least two of the three distal holes should be engaged with either Locking Screws and/or Condyle Screws (Fig. 22). Always lock the most proximal hole.

Note:
If necessary, contour the bone geometry to optimize the seating of the washer.

Fig. 20

Condyle Screw-introduced M-L

Fig. 21

Condyle Screw-introduced L-M

Fig. 21a

Fig. 22

5.10. Freehand Proximal Locking

The freehand technique is used to insert Locking Screws into both the A/P oblong hole and A/P round hole in the nail. In Static, Apposition/ Compression and Advanced Locking Mode, the Locking Screw placed in the oblong hole should be positioned in the distal position. Rotational alignment must be checked prior to locking the nail statically.

Note:
Only one Locking Screw is inserted in the Dynamic Locking Mode. The Locking Screw is placed in the proximal position of the A/P oblong hole in order to optimize dynamization at the proximal end of the nail.

The M/L holes may also be used alternatively or in addition to A/P Locking Screws by adjusting the C-arm and leg position to locate the holes.

Multiple locking techniques and radiolucent drill devices are available for freehand locking. The critical step with any freehand locking technique, proximal or distal, is to visualize a perfectly round locking hole, or perfectly oblong locking hole with the C-Arm.

The center-tipped Ø4.2×230 Drill (1806-4290S) is held at an oblique angle to the center of the locking hole (Fig. 23 and 24). Upon X-Ray verification, the Drill is placed perpendicular to the nail and drilled through the anterior and posterior cortex. Confirm that the Drill passes through the hole in the nail in both the A/P and M/L planes by X-Ray.

After drilling both cortices the screw length may be read directly off of the calibrated Screw Scale, Long (1806-0365) at the green ring on the center-tipped Drill (Fig. 25).
As with proximal locking (Fig. 17, p. 18), the position of the end of the drill is equal to the end of the screw as they relate to the far cortex.

Routine Locking Screw insertion is employed with the assembled Long Screwdriver Shaft and the Teardrop Handle (Fig. 26).

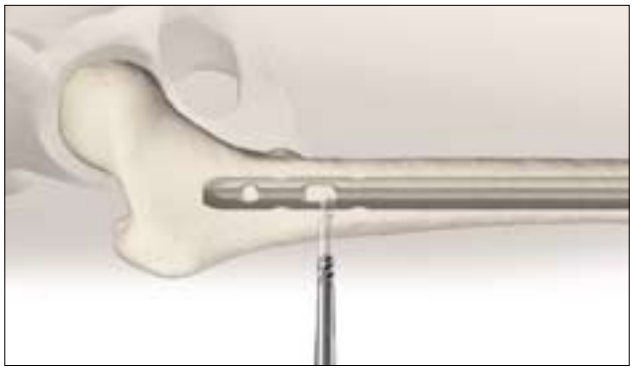


Fig. 23

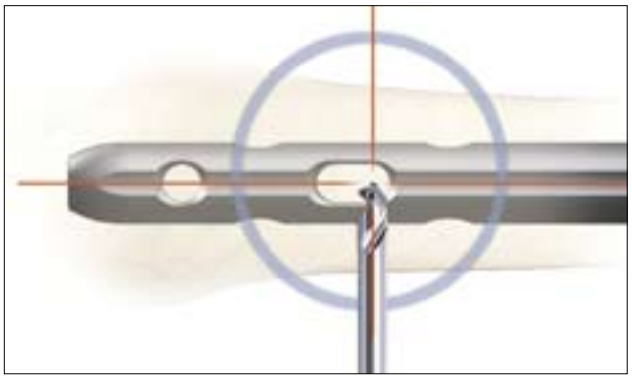


Fig. 24

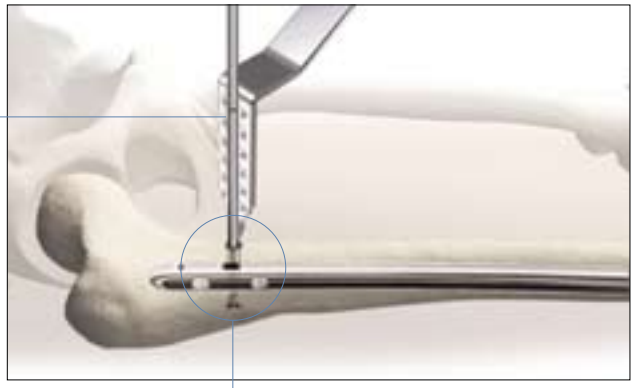


Fig. 25

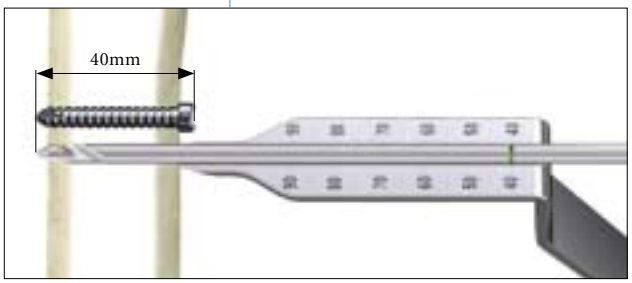


Fig. 26

Retrograde Technique

5.11. End Cap Insertion

After removal of the Target Device, an End Cap is used. Eight different sizes of End Caps are available to adjust nail length and to reduce the potential for bony ingrowth into the proximal thread of the nail (Fig. 27).

Fig. 27

Note:
All End Caps are designed to tighten down onto the locking screw at the working end of the nail. This will help prevent the nail from M/L sliding.

The End Cap is inserted with the Long Screwdriver Shaft and Teardrop Handle after intra-operative radiographs show satisfactory reduction and hardware implantation (Fig. 28). Fully seat the End Cap to minimize the potential for loosening.

Fig. 28

Note:
Final verification of implants should be confirmed by X-Ray at this time.

Thoroughly irrigate the wound to prevent debris from remaining within the knee joint. Close the wound using standard technique.

5.12. Dynamic Locking Mode

When the fracture profile permits, controlled dynamic locking may be utilized for transverse or axially stable fractures. While dynamic locking can be performed at either end of the nail, routine retrograde dynamic locking should utilize the oblong hole at the proximal end of the nail. The potential for nail migration into the joint is thereby reduced.

Retrograde dynamization is performed by statically locking the nail distally via the Target Device.

The freehand Locking Screw is then placed in the dynamic position of the oblong hole. This allows the nail to move and the fracture to settle while torsional stability is maintained (Fig. 29).

Fig. 29

5.13. Apposition/Compression Locking Mode

In transverse or axially stable fracture patterns, active apposition/compression increases fracture stability, may enhance fracture healing, and allow for early weight bearing. The T2™ Femoral Nail provides the option to treat a femur fracture with active mechanical apposition/compression prior to leaving the operating room.

Note:
Proximal freehand static locking with at least two Fully Threaded Locking Screws must be performed prior to applying active, controlled apposition/compression to the fracture site.

If active apposition/compression is required, a Partially Threaded Locking Screw (Shaft Screw) is inserted via the Target Device in the dynamic position of the oblong hole. This will allow for a maximum of 10mm of active, controlled apposition/compression. In order to insert the Shaft Screw, drill both cortices with the Ø4.2×340 Drill (1806-4260S). Next, drill the near cortex, ONLY, with the Ø5×230mm Drill (1806-5000S).

Note:
After the opposite cortex is drilled with the Ø4.2×340mm Drill, the correct screw length can be read directly off of the calibrated Drill at the end of the Drill Sleeve.

After the Shaft Screw is inserted, the Nail Holding Screw securing the nail to the insertion post is removed, leaving the insertion post intact with the nail (Fig. 30). This will act as a guide for the Compression Screw. The Compression Screw is inserted with the Compression Screwdriver Shaft (1806-0268) assembled on the Teardrop Handle through the insertion post. When the ring marked with an "F" on the Compression Screwdriver Shaft is close to the Target Device, it indicates the engagement of the apposition/compression feature of the nail.

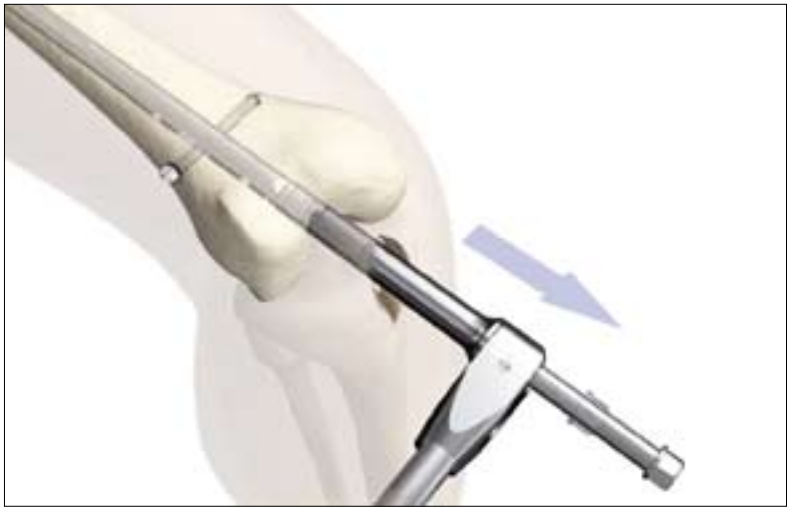


Fig. 30

Retrograde Technique

Note:
The ring marked with a "T" is for the Tibial Compression Screw.

The Long Tissue Protection Sleeve is removed and the Compression Screw is gently tightened utilizing the two-finger technique. As the Compression Screw is advanced against the 5.0mm Partially Threaded Locking Screw (Shaft Screw), it draws the proximal fracture segment towards the fracture site, employing active apposition/compression (Fig. 31). Image intensification will enable the surgeon to visualize active apposition/compression (Fig. 32). Some bending of the transverse Shaft Screw may be seen.

Note:
Apposition/compression must be carried out under X-Ray control. Over compression may cause the nail or the Shaft Screw to fail.

Note:
When compressing the nail, the implant must be inserted a safe distance from the entry point to accommodate for the 10mm of active compression. The three grooves on the insertion post help attain accurate insertion depth of the implant.

Compression Screws are available in different lengths. A short Advanced Compression Screw to enable the Advanced Locking Mode and longer Compression Screws from Standard to +15mm provide a "best fit" for every indication. An End Cap can only be inserted when using the Advanced Compression Screw or when not using compression.

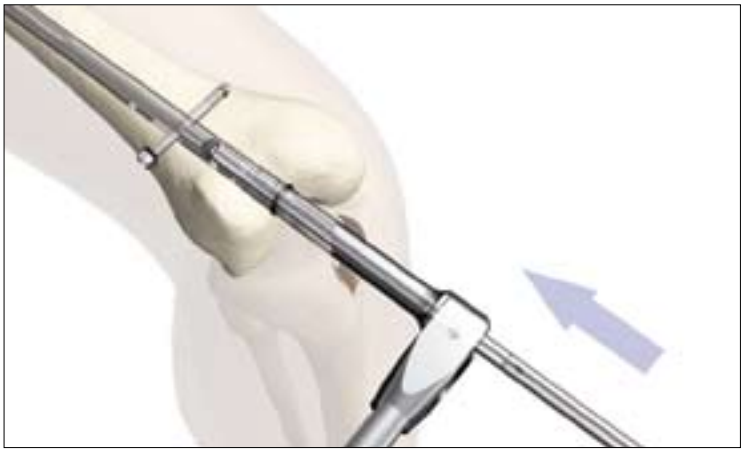


Fig. 31

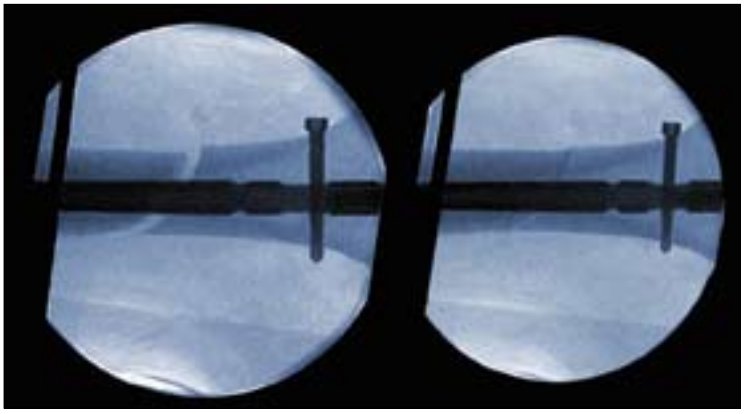


Fig. 32

Retrograde Technique

5.14. Advanced Locking Mode

In order to achieve additional fixation and to reduce the load on the Partially Threaded Locking Screw (Shaft Screw), the design of the T2™ Femoral Nail provides the opportunity to insert an additional Fully Threaded Locking Screw into the hole nearest the driving end of the nail after apposition/compression is utilized. An additional Fully Threaded Locking Screw should be inserted in either the more proximal or more distal of the static holes depending on the fracture stability.

Affix the Compression Screw on the self-retaining Compression Screwdriver Shaft. Remove the Nail Holding Screw leaving the Target Device in place (Fig. 33). Advance the Compression Screw through the Target Device until the ring marked with an "F" on the Compression Screwdriver Shaft is close to the Target Device (Fig. 34).

To insert the Advanced Compression Screw, follow the OP-Technique under Apposition/Compression Locking Mode section (5.13) on the previous page.

Note:
As previously described, it may be easier to insert the Compression Screw prior to fully seating the nail.

To reattach the Target Device to the nail, detach the Teardrop Handle from the Compression Screwdriver Shaft and screw the Nail Holding Screw over the Compression Screwdriver Shaft into its required position.

Prior to guided locking via the Target Device, the Nail Holding Screw must be tightened using the Universal Joint Socket Wrench.

To insert the most distal Screw, follow the locking procedure for static locking (Fig. 35–37).

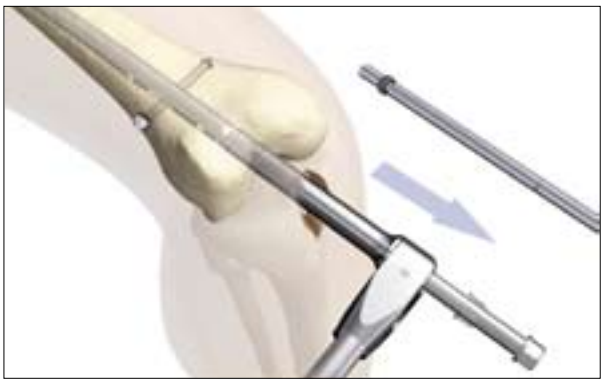


Fig. 33

Fig. 34

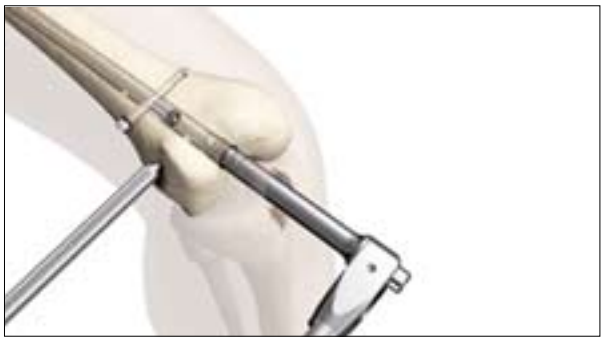


Fig. 35

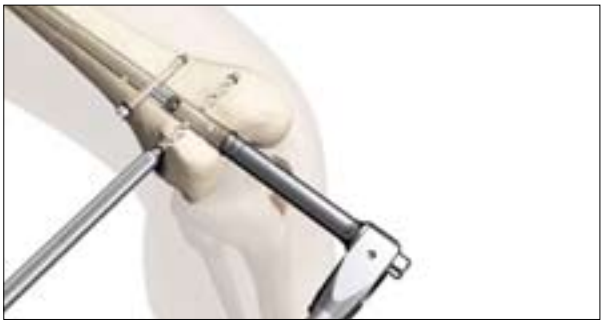


Fig. 36

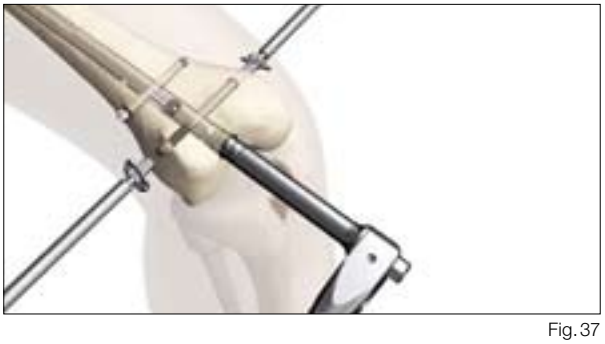


Fig. 37

5.15. Nail Removal

Nail removal is an elective procedure. If needed, the End Cap and Compression Screw (if Advanced Locking Mode was utilized after the most distal screw is extracted) are removed with the Long Screwdriver Shaft and Teardrop Handle (Fig. 38).

Note:
As an alternative to removing the Advanced Compression Screw (if used), it can be just disengaged from the Partially Threaded Locking Screw (Shaft Screw) by turning the Compression Screwdriver one full turn in a counter-clockwise direction. There is no need to remove it from the nail.

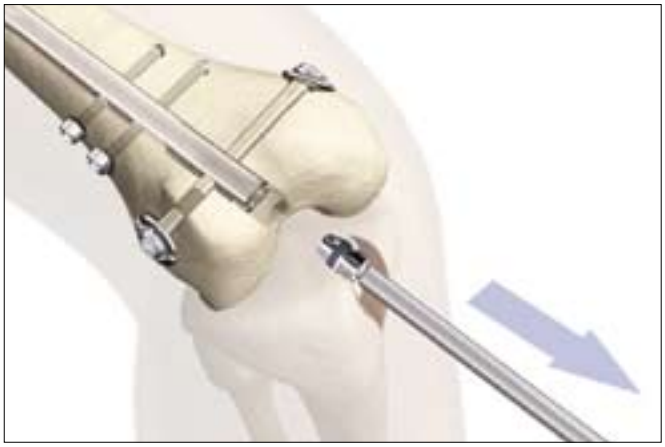


Fig. 38

The Universal Rod is inserted into the driving end of the nail. All Locking Screws are removed with the Long Screwdriver Shaft and Teardrop Handle (Fig. 39). The "optional" Long Screw Capture Sleeve (1806-0240) may be used on the Screwdriver.

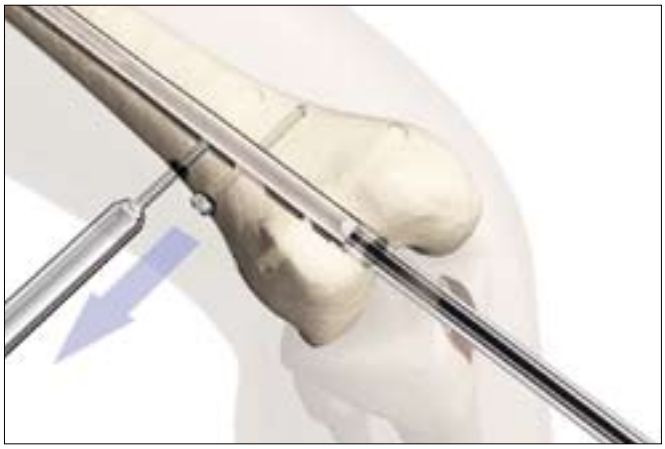


Fig. 39

The Slotted Hammer is used to extract the nail in a controlled manner (Fig. 40). A captured Sliding Hammer (1806-0175) is available as an "optional" addition to the basic instrument set.

Fig. 40

Antegrade Technique

6. Antegrade Technique

6.1. Patient Positioning and Fracture Reduction

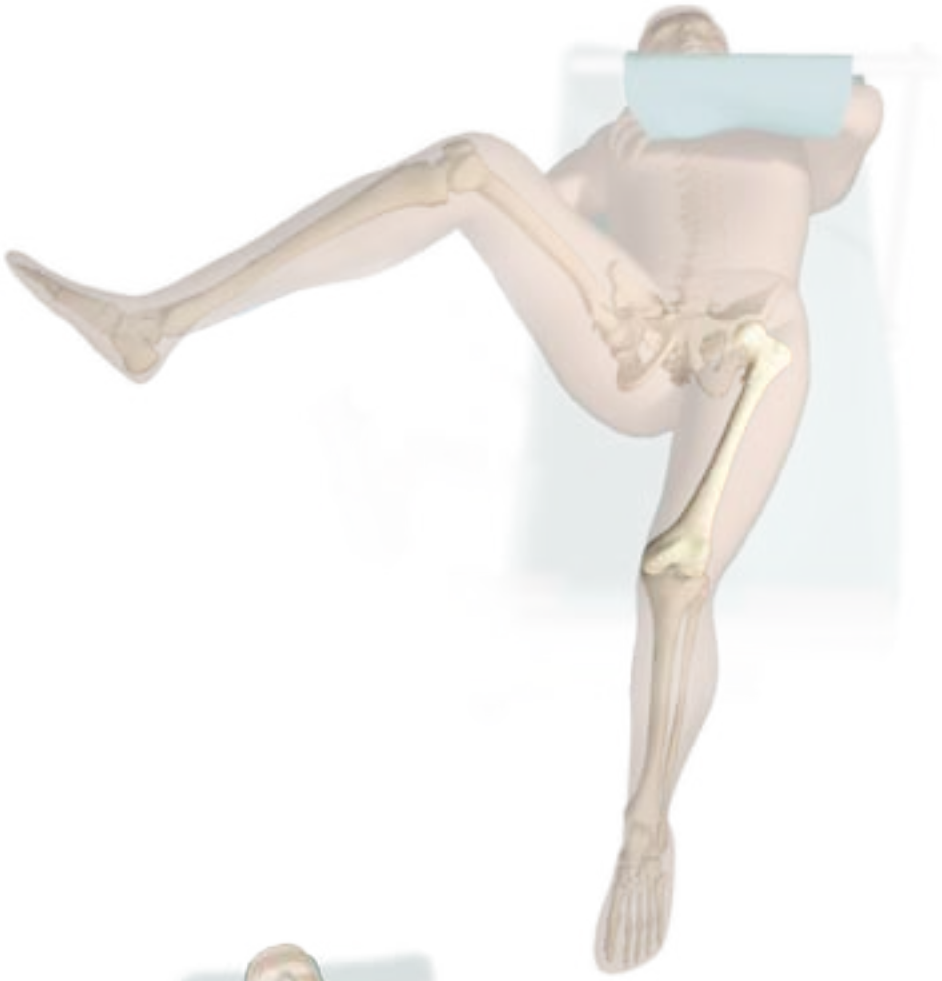
Patient positioning for antegrade femoral nail insertion is surgeon dependent. The patient may be positioned supine or lateral on a fracture table, or simply supine on a radiolucent table.

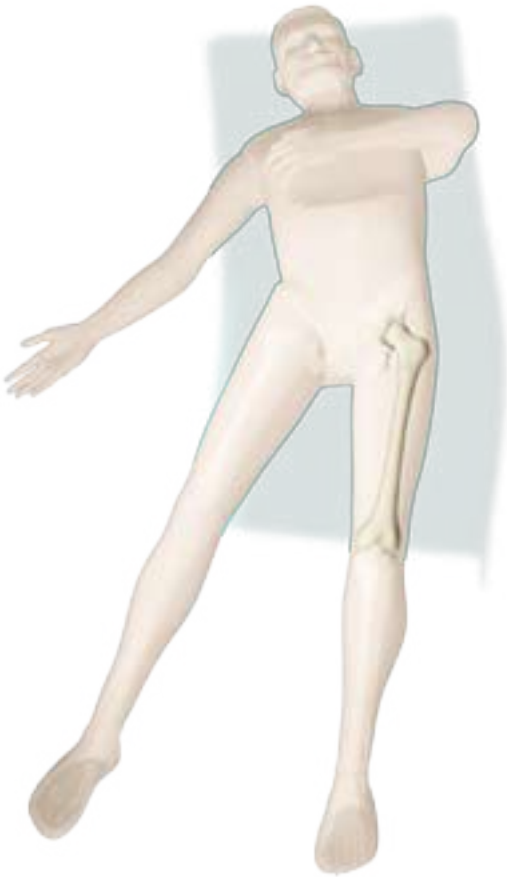
6.2. Incision

The design of the implant allows for insertion either through the Piriformis Fossa or the Tip of the Greater Trochanter.

Piriformis Fossa
A skin incision is made beginning at the level of the Greater Trochanter extending proximal and slightly posterior, in line with the Gluteus Muscle, exposing the Piriformis Fossa for antegrade femoral nail insertion.

Tip of the Greater Trochanter
With experience, the Tip of the Greater Trochanter can be located by palpation, and a horizontal skin incision is made from the Greater Trochanter to the Iliac Crest.





Antegrade Technique

6.3. Entry Point

The Tip (Medial Edge) of the Greater Trochanter (A)
The medullary canal is opened with the Curved Awl (1806-0040) at the junction of the anterior third and posterior two-thirds of the Greater Trochanter, on the medial edge of the tip itself (Fig. 41). Image intensification (A/P and Lateral) is used for confirmation.

Piriformis Fossa (B)
Alternatively, the implant may be introduced in the Piriformis Fossa, with a starting point just medial to the Greater Trochanter and slightly posterior to the central axis of the femoral neck.

Once the Tip of the Greater Trochanter or the Piriformis Fossa (Fig. 42) has been penetrated, the 3×1000mm Ball Tip Guide Wire (1806-0085S) may be advanced through the cannulation of the Curved Awl with the Guide Wire Handle (1806-0095 and 1806-0096) (Fig. 43).

Note:
During opening the entry portal with the Awl, dense cortex may block the tip of the Awl. An Awl Plug (1806-0032) can be inserted through the Awl to avoid penetration of bone debris into the cannulation of the Awl shaft.

6.4. Unreamed Technique

If an unreamed technique is preferred, the nail may be inserted with or without the Ball Tip Guide Wire.

Fig. 41

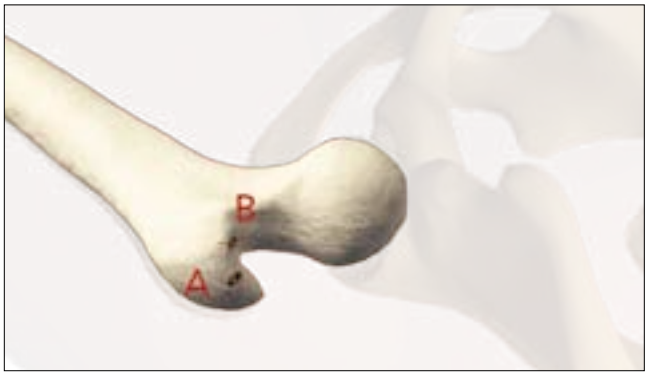


Fig. 42

Fig. 43

6.5. Reamed Technique

If the procedure will be performed using a reamed technique, the 3×1000mm Ball Tip Guide Wire is inserted with the Guide Wire Handle through the fracture site to the level of the Epiphyseal Scar or the mid-pole of the Patella and does not need a Guide Wire exchange. The Ø9mm Universal Rod (1806-0110) with Reduction Spoon (1806-0125), or the Reduction Tip (special order 1806-0120), may be used as a fracture reduction tool to facilitate Guide Wire insertion through the fracture site (Fig. 44), and in an unreamed technique, may be used as a "sound" to help determine the diameter of the medullary canal.

Fig. 44

Note:
The Ball Tip at the end of the Guide Wire will stop the reamer head.

Reaming is commenced in 0.5mm increments until cortical contact is appreciated (Fig. 45). Final reaming should be 1mm larger than the diameter of the nail to be used.

Note:
The proximal diameter (driving end) of the 9mm–11mm diameter nails is 11.5mm. Nail sizes 12–15mm have a constant diameter.

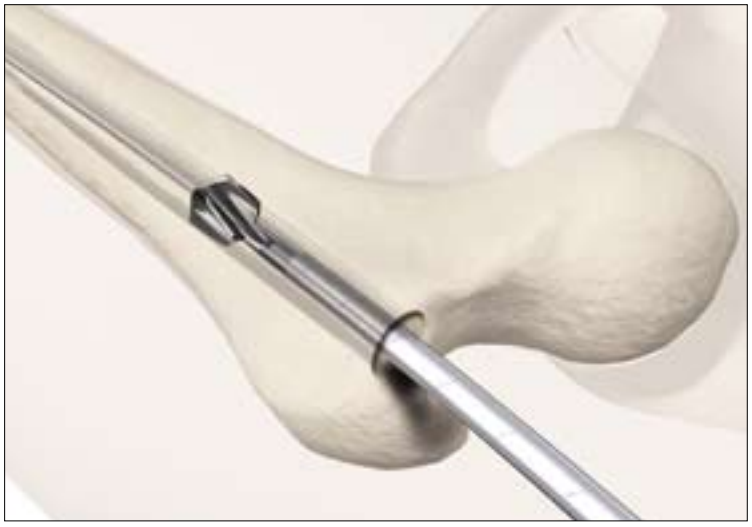


Fig. 45

6.6. Nail Selection

Diameter
The diameter of the selected nail should be 1mm smaller than that of the last reamer used. Alternatively, the diameter may be determined using the Femur X-ray Ruler (1806-0015) with the different diameters matching with the radiographs (see Fig. 7.1 on page 14).

Length
Nail length may be determined with the X-Ray Ruler or may be determined by measuring the remaining length of the Guide Wire. The Guide Wire Ruler (1806-0020) may be used by placing it on the Guide Wire reading the correct nail length at the end of the Guide Wire on the Guide Wire Ruler (Fig. 46 and 47).

Note:
X-Ray Ruler and Guide Wire Ruler can be used for nail length determination beginning from 240mm. Shorter nail length can be determined via the template.

Note:
If the fracture is suitable for apposition/compression, the implant selected should be 10–15mm shorter than measured, to help avoid migration of the nail beyond the insertion site.

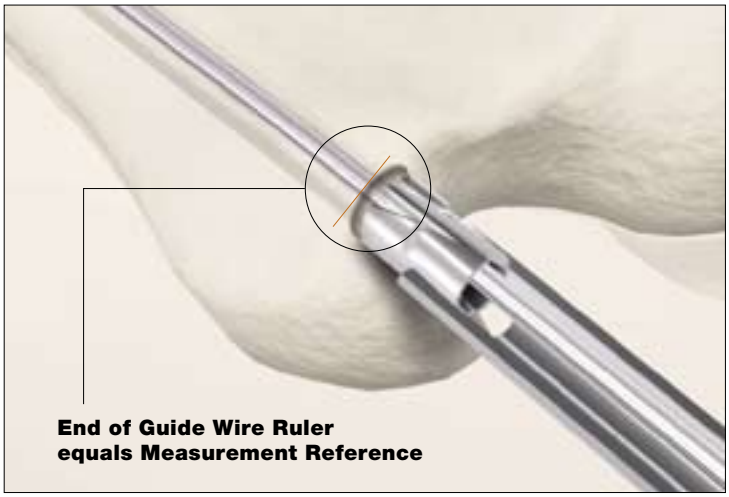


Fig. 46

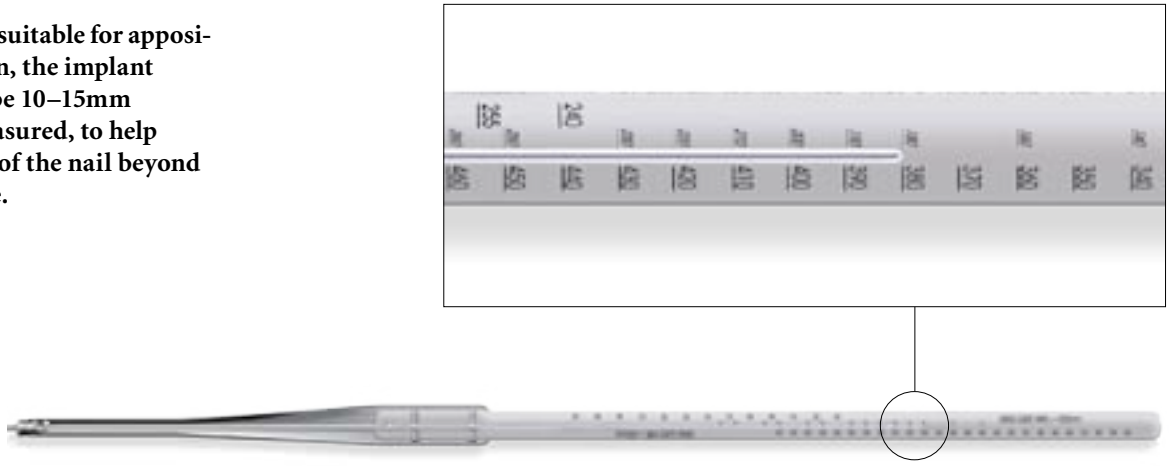


Fig. 47

Antegrade Technique

6.7. Nail Insertion

The selected nail is assembled onto the Target Device with the Nail Holding Screw (Fig. 48.1). Tighten the Nail Holding Screw with the Universal Joint Socket Wrench (1806-0400) securely so that it does not loosen during nail insertion.

Fig. 48.2

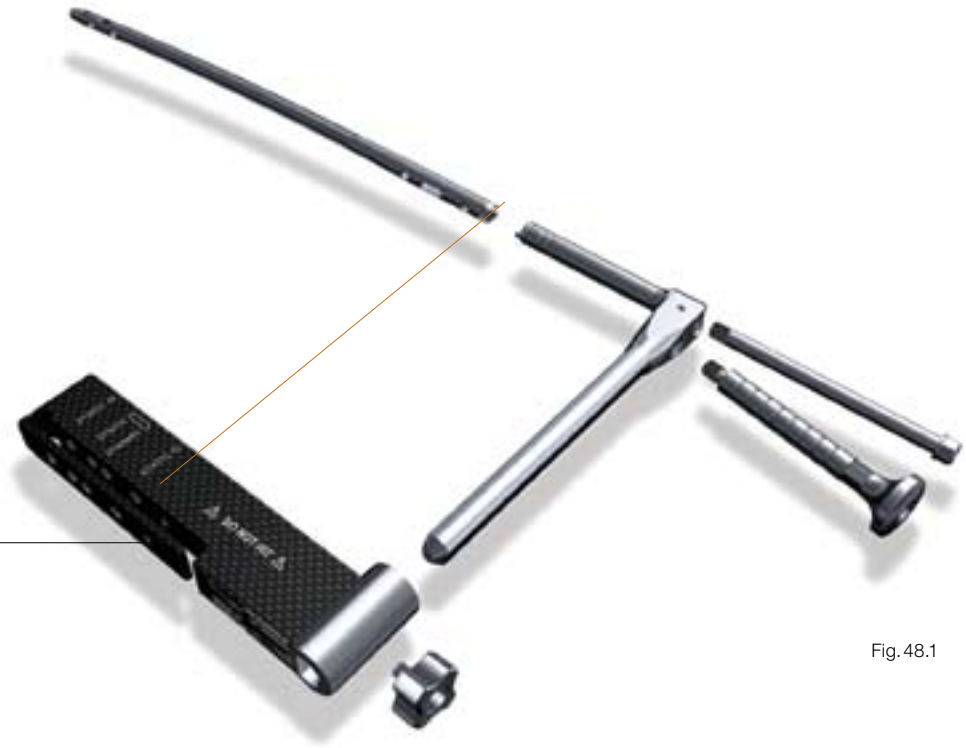


Fig. 48.1

Note:
Prior to nail insertion please check correct alignment by inserting a drill bit through the assembled Tissue Protection- and Drill Sleeve placed in the required holes of the targeting device.

Upon completion of reaming, the appropriate size nail is ready for insertion. Unique to the T2™ Femoral Nail the 3 × 1000mm Ball Tip Guide Wire does not need to be exchanged. The Strike Plate (1806-0150) is threaded into the Target Device and the nail is advanced through the entry point past the fracture site to the appropriate level.

Note:
Curvature of the nail must match the curvature of the femur.

The Slotted Hammer can be used on the Strike Plate (Fig. 49.1), or if dense bone is encountered, the Universal Rod may be attached to the Nail Holding Screw and used in conjunction with the Slotted Hammer to insert the nail (Fig. 49.2).

Note:
Prior to insertion, check for correct assembly by passing a drill bit through the Target Device and through the nail holes to help check alignment. DO NOT hit the Target Device. Only hit on the Strike Plate.

Fig. 49.1

Fig. 49.2

Antegrade Technique

Note:
A chamfer is located on the working end of the nail to denote the end under X-Ray. Three circumferential grooves are located on the insertion post at 2mm, 10mm, and 15mm from the driving end of the nail (Fig. 50). Depth of insertion may be visualized with the aid of fluoroscopy.

When locking the antegrade nail in the static mode, the nail is countersunk a minimum of 5mm (Fig. 51).

When the implant is inserted in the dynamic mode, without active apposition/compression, or when the implant is inserted with active apposition/compression, the recommended depth of insertion is 15mm (Fig. 52).

Additionally, the 3×285mm K-Wire may be inserted through the Target Device which indicates the junction of the nail and insertion post (see Fig. 48.2 on p. 31).

Insertion of the 3×285mm K-Wire into the lateral cortex may also help to lock the Target Device to the proximal femur and prevent rotation of the nail in cases where the Apposition/Compression Locking Mode is utilized.

Repositioning should be carried out either by hand or by using the Strike Plate on the top of the Target Device. The Universal Rod and Slotted Hammer may then be attached to the Strike Plate to carefully and smoothly extract the assembly.

Note:
Remove the Guide Wire prior to drilling and inserting the Locking Screws.

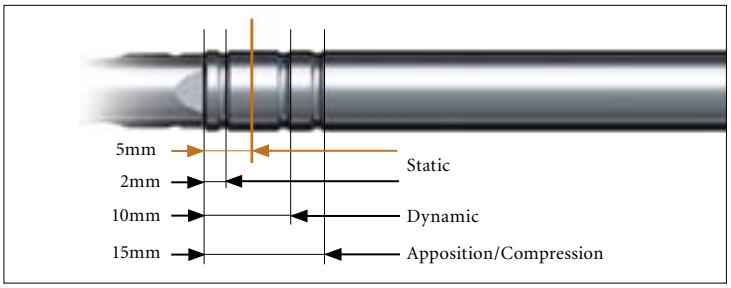


Fig. 50

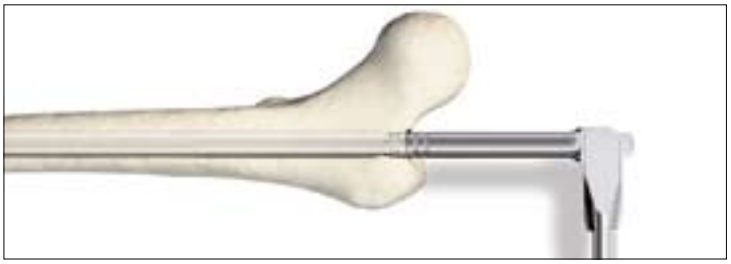


Fig. 51


Fig. 52

6.8. Guided Locking Mode (via Target Device)

Prior to guided locking via the Target Device the Nail Holding Screw must be firmly tightened using the Universal Joint Socket Wrench, to help ensure that the nail is in correct alignment with the Target Device (Fig. 53).

The Target Device is designed with four locking holes. According to the selected locking mode, the appropriate holes are used (see Fig. 14.1.–14.3 on p. 17).

The Long Tissue Protection Sleeve (1806-0185) together with the Long Drill Sleeve (1806-0215) and the Long Trocar (1806-0315) is inserted into the Target Device by pressing the safety clip (see Fig. 15 on p. 17). The mechanism will keep the sleeve in place and prevent it from falling out. It will also prevent the sleeve from sliding during screw measurement. To release the Tissue Protection Sleeve, the safety clip must be pressed again.


Fig. 53

6.9. Static Locking Mode

The Long Tissue Protection Sleeve together with the Long Drill Sleeve and the Long Trocar are positioned through the static locking hole on the Target Device. A small skin incision is made, and the assembly is pushed through until it is in contact with the lateral cortex of the femur (Fig. 54). The Trocar is removed while the Tissue Protection Sleeve and the Drill Sleeve remain in position.

Fig. 54

To help ensure accurate drilling, and easy determination of screw length, use the center tipped, calibrated Ø4.2×340 Drill (1806-4260S). The centered Drill is forwarded through the Drill Sleeve and pushed onto the cortex.

After drilling both cortices, the screw length may be read directly off of the calibrated Drill at the end of the Drill Sleeve (Fig. 55 and see Fig. 17 and 18 on p. 18).

Fig. 55

When the Drill Sleeve is removed, the correct Locking Screw is inserted through the Tissue Protection Sleeve using the Long Screwdriver Shaft (1806-0227) with Teardrop Handle (702429) (Fig. 56). The screw is advanced through both cortices. The screw is near its' proper seating position when the groove around the shaft of the screwdriver is approaching the end of the Tissue Protection Sleeve (see Fig. 19 on p. 18).

Fig. 56

Repeat the locking procedure for the other statically positioned Locking Screws (Fig. 57). The most proximal M/L hole (nearest the driving end of the nail) is not generally utilized in the antegrade mode.

Note:
In unstable fracture patterns, static locking should always be performed with at least two Locking Screws distal and two Locking Screws proximal.

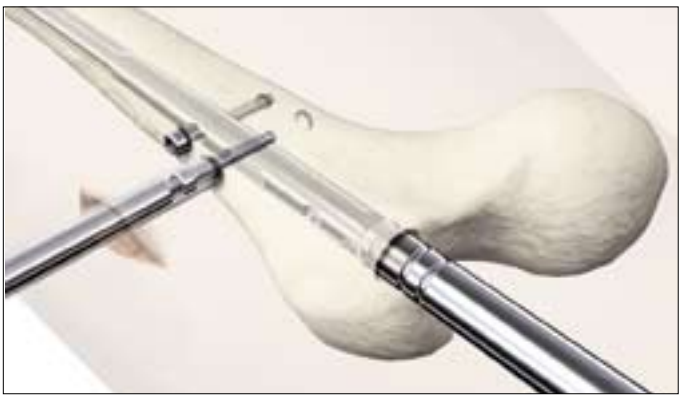


Fig. 57

6.10. Freehand Distal Locking

The freehand technique is used to insert Fully Threaded Locking Screws into both distal M/L holes in the nail. Rotational alignment must be checked prior to locking the nail statically.

Multiple locking techniques and radiolucent drill devices are available for freehand locking. The critical step with any freehand locking technique, proximal or distal, is to visualize a perfectly round locking hole or perfectly oblong locking hole with the C-Arm.

The center-tipped Ø4.2 × 180 Drill (1806-4270S) is held at an oblique angle to the center of the locking hole (Fig. 58 and 59). Upon X-Ray verification, the Drill is placed perpendicular to the nail and drilled through the lateral and medial cortex. Confirm in both the A/P and M/L planes by X-Ray that the Drill passes through the hole in the nail.

After drilling both cortices, the screw length may be read directly off of the Long Screw Scale (1806-0365) at the green ring on the center tipped Drill (see Fig. 25 on p. 20). Alternatively, the optional Depth Gauge, Standard Style for Freehand Locking (1806-0390), may be used after drilling to determine the length of screw needed.

Routine Locking Screw insertion is employed with the assembled Long Screwdriver Shaft and Teardrop Handle (Fig. 60).

Note:
The Screwdriver Shaft may be used in conjunction with the Long Screw Capture Sleeve (1806-0240).

Fig. 58

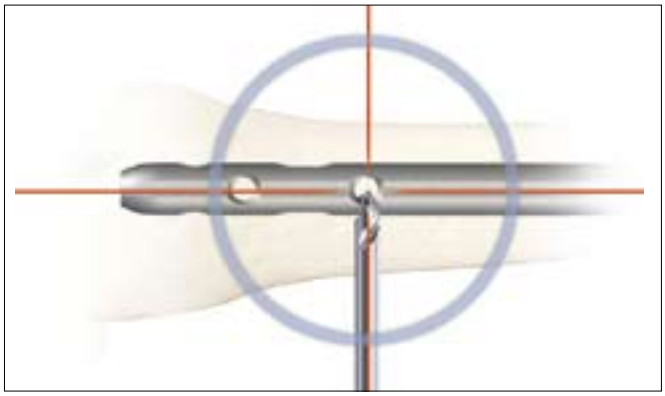


Fig. 59

Fig. 60

Antegrade Technique

6.11. End Cap Insertion

After removal of the Target Device, an End Cap is used. Eight different sizes of End Caps are available to adjust nail length and to reduce the potential for bony ingrowth into the proximal thread of the nail. (see Fig. 27 on p. 22)

Note:
All End Caps are designed to tighten down onto the Locking or Condyle Screw at the driving end of the nail. This will help prevent the nail from M/L sliding.

The End Cap is inserted with the Long Screwdriver Shaft and Teardrop Handle after intra-operative radiographs show satisfactory reduction and hardware implantation (Fig. 61). Fully seat the End Cap to minimize the potential for loosening.

Note:
Final verification of implants should be confirmed by X-Ray at this time.

Thoroughly irrigate the wound to prevent debris from remaining. Close the wound using the standard technique.

Fig. 61

6.12. Dynamic Locking Mode

When the fracture profile permits, dynamic locking may be utilized for transverse, axially stable fractures. While dynamic locking can be performed at either end of the nail, routine antegrade dynamic locking should utilize the M/L oblong hole at the Target Device.

The Partially Threaded Locking Screw is placed in the dynamic position of the oblong hole via the Target Device. This allows the nail to move and the fracture to settle while providing torsional stability (Fig. 62).

Antegrade dynamization is performed by statically locking the nail distally with two M/L Fully Threaded Locking Screws in a freehand technique.

Fig. 62

6.13. Apposition/Compression Locking Mode

In transverse, axially stable fracture patterns, active apposition/compression increases fracture stability, may enhance fracture healing, and allow for early weight bearing. The T2™ Femoral Nail gives the option to treat a femur fracture with active mechanical apposition/compression prior to leaving the operating room.

Note:
Distal freehand static locking with at least two Fully Threaded Locking Screws must be performed prior to applying active, controlled apposition/compression to the fracture site.

If active apposition/compression is required, a Partially Threaded Locking Screw (Shaft Screw) is inserted via the Target Device in the dynamic position of the oblong hole. This will allow for a maximum of 10mm of active, controlled apposition/compression. In order to insert the Shaft Screw, drill both cortices with the Ø4.2×340 Drill (1806-4260S). Next, drill the near cortex, ONLY, with the Ø5×230mm Drill (1806-5000S).

Note:
As previously described, it may be easier to insert the Compression Screw prior to fully seating the nail.

Note:
After the opposite cortex is drilled with the Ø4.2×340mm Drill, the correct screw length can be read directly off of the calibrated Drill at the end of the Drill Sleeve.

After the Shaft Screw is inserted, the Nail Holding Screw securing the nail to the insertion post is removed, leaving the insertion post intact with the nail (Fig. 63). This will act as a guide for the Compression Screw. The Compression Screw is inserted with the Compression Screwdriver Shaft (1806-0268) and Teardrop Handle through the insertion post (Fig. 64).

When the ring marked with an "F" on the Compression Screwdriver Shaft is close to the Target Device, it indicates the engagement of the apposition/compression feature of the nail.

Note:
The ring marked with a "T" is for the Tibial Compression Screw.

The Long Tissue Protection Screw is removed and the Compression Screw is gently tightened utilizing the two-finger technique. As the Compression Screw is advanced against the 5.0mm Partially Threaded Locking Screw (Shaft Screw), it draws the distal fracture segment towards the fracture site, employing active apposition/compression (Fig. 65). Image intensification will enable the surgeon to visualize active apposition/compression. Some bending of the transverse Shaft Screw may be seen.

Note:
Apposition/compression must be carried out under X-Ray control. Over compression may cause the nail or the Shaft Screw to fail.

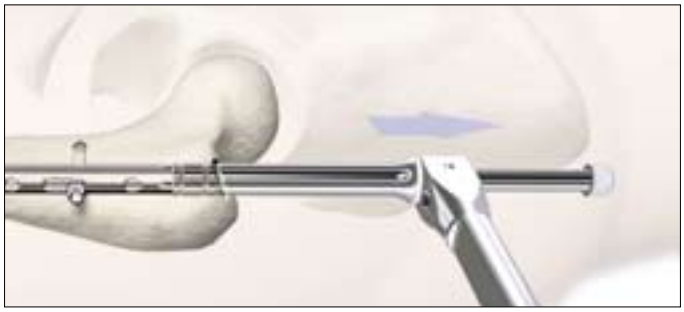


Fig. 63

Fig. 64

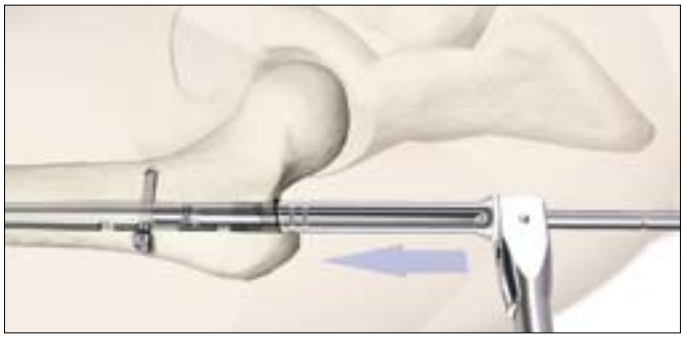


Fig. 65

Note:
When compressing the nail, the implant must be inserted a safe distance from the entry point to accommodate for the 10mm of active compression. The three grooves on the insertion post help attain accurate insertion depth of the implant.

Compression Screws are available in different lengths. A short Advanced Compression Screw to enable the Advanced Locking Mode and longer Compression Screws from Standard to +15mm provide a "best fit" for every indication. An End Cap can only be inserted when using the Advanced Compression Screw or when not using compression.

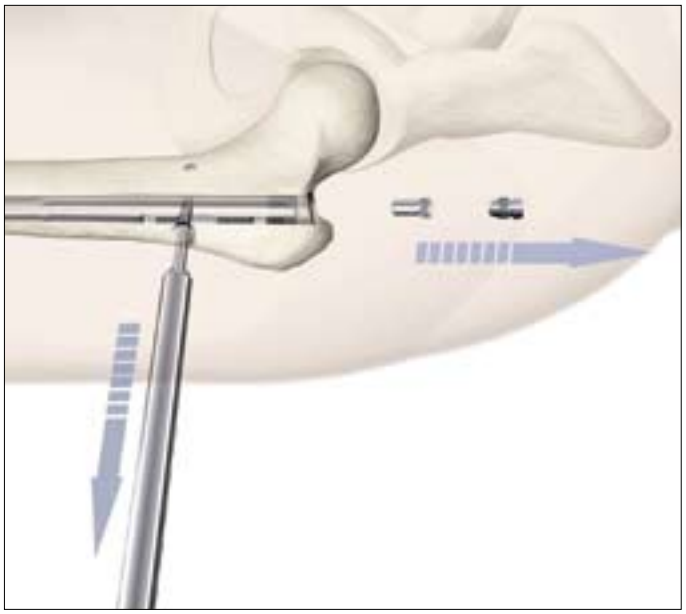


Fig. 66

6.14. Advanced Locking Mode

In order to achieve additional fixation and to reduce the load on the Partially Threaded Locking Screw (Shaft Screw), an additional Locking Screw should also be inserted in the more distal or more proximal of the proximal locking holes depending on the fracture stability.

Note:
Using the most proximal locking hole to reduce the load on the Partially Threaded Locking Screw requires appropriate positioning of the nail. Ensure secure screw placement below the calcar region. End Caps in eight different lengths allow for intra-operative length adjustment.

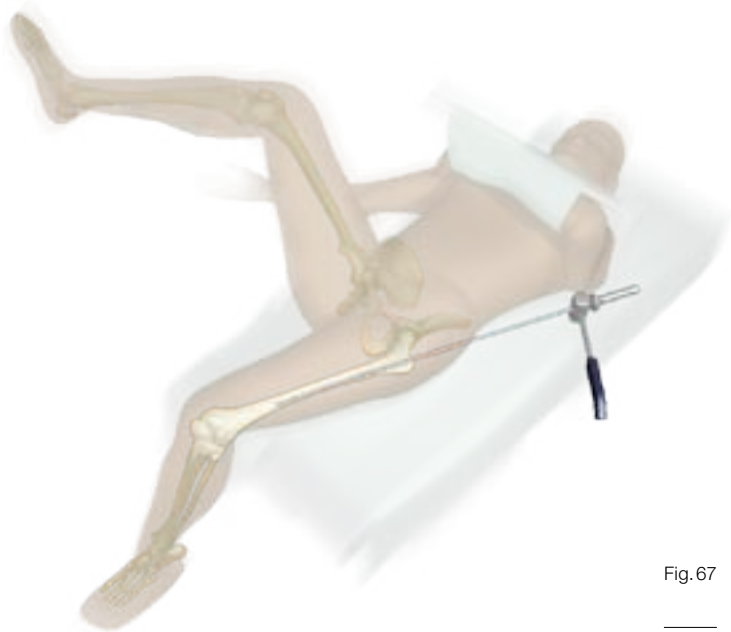


Fig. 67

6.15. Nail Removal

Nail removal is an elective procedure. If needed, the End Cap and Compression Screw are removed with the Long Screwdriver Shaft and Teardrop Handle (Fig. 66).

Note:
As an alternative to removing the Advanced Compression Screw (if used), it can be just disengaged from the Partially Threaded Locking Screw (Shaft Screw) by turning the Compression Screwdriver one full turn in a counter-clockwise direction. There is no need to remove it from the nail.

The Universal Rod is inserted into the driving end of the nail. All Locking Screws are removed with the Long Screwdriver Shaft and Teardrop Handle. The "optional" Long Screw Capture Sleeve may be used on the Screwdriver Shaft.

The Slotted Hammer is used to extract the nail in a controlled manner (Fig. 67). A captured Sliding Hammer (1806-0175) is available as an "optional" addition to the basic instrument set.

Ordering Information - Implants

T2™ Femoral Locking Nail

REF	Diameter mm	Length mm
1825-0914S	9.0	140
1825-0916S	9.0	160
1825-0918S	9.0	180
1825-0920S	9.0	200
1825-0922S	9.0	220
1825-0924S	9.0	240
1825-0926S	9.0	260
1825-0928S	9.0	280
1825-0930S	9.0	300
1825-0932S	9.0	320
1825-0934S	9.0	340
1825-0936S	9.0	360
1825-0938S	9.0	380
1825-0940S	9.0	400
1825-0942S	9.0	420
1825-0944S	9.0	440
1825-0946S	9.0	460
1825-0948S	9.0	480
1825-1014S	10.0	140
1825-1016S	10.0	160
1825-1018S	10.0	180
1825-1020S	10.0	200
1825-1022S	10.0	220
1825-1024S	10.0	240
1825-1026S	10.0	260
1825-1028S	10.0	280
1825-1030S	10.0	300
1825-1032S	10.0	320
1825-1034S	10.0	340
1825-1036S	10.0	360
1825-1038S	10.0	380
1825-1040S	10.0	400
1825-1042S	10.0	420
1825-1044S	10.0	440
1825-1046S	10.0	460
1825-1048S	10.0	480
1825-1114S	11.0	140
1825-1116S	11.0	160
1825-1118S	11.0	180
1825-1120S	11.0	200
1825-1122S	11.0	220
1825-1124S	11.0	240
1825-1126S	11.0	260
1825-1128S	11.0	280
1825-1130S	11.0	300
1825-1132S	11.0	320
1825-1134S	11.0	340
1825-1136S	11.0	360
1825-1138S	11.0	380
1825-1140S	11.0	400
1825-1142S	11.0	420
1825-1144S	11.0	440
1825-1146S	11.0	460
1825-1148S	11.0	480
1825-1214S	12.0	140
1825-1216S	12.0	160
1825-1218S	12.0	180
1825-1220S	12.0	200
1825-1222S	12.0	220
1825-1224S	12.0	240
1825-1226S	12.0	260
1825-1228S	12.0	280
1825-1230S	12.0	300
1825-1232S	12.0	320
1825-1234S	12.0	340
1825-1236S	12.0	360
1825-1238S	12.0	380
1825-1240S	12.0	400
1825-1242S	12.0	420
1825-1244S	12.0	440
1825-1246S	12.0	460
1825-1248S	12.0	480

REF	Diameter mm	Length mm
1825-1314S	13.0	140
1825-1316S	13.0	160
1825-1318S	13.0	180
1825-1320S	13.0	200
1825-1322S	13.0	220
1825-1324S	13.0	240
1825-1326S	13.0	260
1825-1328S	13.0	280
1825-1330S	13.0	300
1825-1332S	13.0	320
1825-1334S	13.0	340
1825-1336S	13.0	360
1825-1338S	13.0	380
1825-1340S	13.0	400
1825-1342S	13.0	420
1825-1344S	13.0	440
1825-1346S	13.0	460
1825-1348S	13.0	480
1825-1414S	14.0	140
1825-1416S	14.0	160
1825-1418S	14.0	180
1825-1420S	14.0	200
1825-1422S	14.0	220
1825-1424S	14.0	240
1825-1426S	14.0	260
1825-1428S	14.0	280
1825-1430S	14.0	300
1825-1432S	14.0	320
1825-1434S	14.0	340
1825-1436S	14.0	360
1825-1438S	14.0	380
1825-1440S	14.0	400
1825-1442S	14.0	420
1825-1444S	14.0	440
1825-1446S	14.0	460
1825-1448S	14.0	480
1825-1514S	15.0	140
1825-1516S	15.0	160
1825-1518S	15.0	180
1825-1520S	15.0	200
1825-1522S	15.0	220
1825-1524S	15.0	240
1825-1526S	15.0	260
1825-1528S	15.0	280
1825-1530S	15.0	300
1825-1532S	15.0	320
1825-1534S	15.0	340
1825-1536S	15.0	360
1825-1538S	15.0	380
1825-1540S	15.0	400
1825-1542S	15.0	420
1825-1544S	15.0	440
1825-1546S	15.0	460
1825-1548S	15.0	480

Implants in sterile packaging.

Note:
Check with local representative regarding availability of nail sizes.

Ordering Information - Implants

5mm Fully Threaded Locking Screws

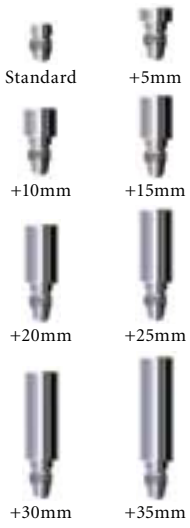
REF	Diameter mm	Length mm
1896-5025S	5.0	25.0
1896-5027S	5.0	27.5
1896-5030S	5.0	30.0
1896-5032S	5.0	32.5
1896-5035S	5.0	35.0
1896-5037S	5.0	37.5
1896-5040S	5.0	40.0
1896-5042S	5.0	42.5
1896-5045S	5.0	45.0
1896-5047S	5.0	47.5
1896-5050S	5.0	50.0
1896-5052S	5.0	52.5
1896-5055S	5.0	55.0
1896-5057S	5.0	57.5
1896-5060S	5.0	60.0
1896-5065S	5.0	65.0
1896-5070S	5.0	70.0
1896-5075S	5.0	75.0
1896-5080S	5.0	80.0
1896-5085S	5.0	85.0
1896-5090S	5.0	90.0
1896-5095S	5.0	95.0
1896-5100S	5.0	100.0
1896-5105S	5.0	105.0
1896-5110S	5.0	110.0
1896-5115S	5.0	115.0
1896-5120S	5.0	120.0

5mm Partially Threaded Locking Screws

(Shaft Screws)

REF	Diameter mm	Length mm
1891-5025S	5.0	25
1891-5030S	5.0	30
1891-5035S	5.0	35
1891-5040S	5.0	40
1891-5045S	5.0	45
1891-5050S	5.0	50
1891-5055S	5.0	55
1891-5060S	5.0	60
1891-5065S	5.0	65
1891-5070S	5.0	70
1891-5075S	5.0	75
1891-5080S	5.0	80
1891-5085S	5.0	85
1891-5090S	5.0	90
1891-5095S	5.0	95
1891-5100S	5.0	100
1891-5105S	5.0	105
1891-5110S	5.0	110
1891-5115S	5.0	115
1891-5120S	5.0	120

End Caps



REF	Diameter mm	Length mm
1822-0003S	8.0	Standard
1822-0005S	11.5	+ 5mm
1822-0010S	11.5	+10mm
1822-0015S	11.5	+15mm
1822-0020S	11.5	+20mm
1822-0025S	11.5	+25mm
1822-0030S	11.5	+30mm
1822-0035S	11.5	+35mm

Condyle Screws

REF	Diameter mm	Length mm
1895-5040S	5.0	40
1895-5045S	5.0	45
1895-5050S	5.0	50
1895-5055S	5.0	55
1895-5060S	5.0	60
1895-5065S	5.0	65
1895-5070S	5.0	70
1895-5075S	5.0	75
1895-5080S	5.0	80
1895-5085S	5.0	85
1895-5090S	5.0	90
1895-5095S	5.0	95
1895-5100S	5.0	100
1895-5105S	5.0	105
1895-5110S	5.0	110
1895-5115S	5.0	115
1895-5120S	5.0	120

Compression Screws

REF	Diameter mm	Length mm
1825-0000S	8.0	
1825-0005S	8.0	5
1825-0010S	8.0	10
1825-0015S	8.0	15

Nut for Condyle Screws

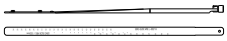
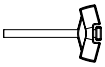
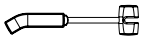
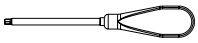
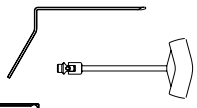
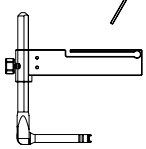
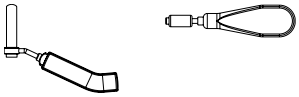
REF	Diameter mm	Length mm
1895-5001S	5.0	

Advanced Compression Screw, Femur

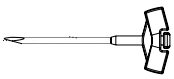
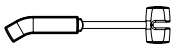
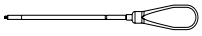
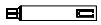
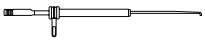
REF	Diameter mm	Length mm
1825-0001S	8.0	

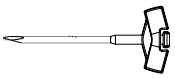
Note:
Outside of the U.S., Locking Screws and other specific products may be ordered non-sterile without the "S" at the end of the corresponding Catalogue Number.

Ordering Information - Instruments

	REF	Description
	Standard Instruments	
	1806-6005	T2™ Femur Instrument Set, Basic
	1806-0015	X-Ray Ruler, Femur
	1806-0020	Guide Wire Ruler
	1806-0040	Awl, Curved, Ø10mm
	1806-0050	K-Wire 3×285mm (outside of U.S.)
	1806-0095	Guide Wire Handle
	1806-0096	Guide Wire Handle Chuck
	1806-0110	Universal Rod
	1806-0125	Reduction Spoon
	1806-0130	Wrench 8mm/10mm
	1806-0135	Insertion Wrench, 10mm
	1806-0150	Strike Plate
	1806-0165	Nail Holding Screw, Femur (2 each)
	1806-0170	Slotted Hammer
	1806-0185	Tissue Protection Sleeve, Long
	1806-0215	Drill Sleeve, Long
	1806-0227	Screwdriver Shaft AO, Long
	1806-0255	Screwdriver, Condyle Screw (2 each)
	1806-0268	Screwdriver Shaft, Compression
	1806-0292	Screw Driver Shaft, 3.5×85mm
	1806-0315	Trocar, Long
	1806-0325	Screw Gauge, Long
	1806-0365	Screw Scale, Long
	1806-0400	Socket Wrench, Universal Joint 10mm
	1806-1005	Target Device, Femur (2 components)
	1806-2012	Rigid Reamer Ø12mm
	1806-4270	Drill Ø4.2×180, AO, (outside of U.S.)
	1806-4260	Drill Ø4.2×340, AO, (outside of U.S.)
	1806-4290	Drill Ø4.2×230, AO, (outside of U.S.)
	1806-5000	Drill Ø5.0×230, AO, (outside of U.S.)
	1806-5020	Drill Ø5.0×340, AO, (outside of U.S.)
	702429	Teardrop Handle, AO coupling
	703165	Protection Sleeve, Retrograde
	0152-0218	K-Wire for Condyle Screw, (outside of U.S.)
	1806-9025	Femur Instrument Tray

Ordering Information - Instruments

	REF	Description
	Optional	
	0152-0218S	K-Wire for Condyle Screw, sterile (U.S.)
	1806-0005	X-Ray Template, Femur
	1806-0032	Awl Plug
	1806-0045	Awl, Straight, Ø10mm
	1806-0050S	K-Wire 3×285mm, sterile
	1806-0085	Guide Wire, Ball Tip, 3×1000mm (outside of U.S.)
	1806-0085S	Guide Wire, Ball Tip, 3×1000mm, sterile (U.S.)
	1806-0175	Sliding Hammer
	1806-0232	Screwdriver, Long
	1806-0237	Screwdriver, Short
	1806-0240	Screw Capture Sleeve, Long
	1806-0257	Revision Screwdriver bit, Condyle Screw
	1806-0270	Ratchet T-Handle AO
	1806-0300	Screw Driver Shaft, Ball Tip
	1806-0350	Extraction Rod, Conical, Ø8mm
	1806-0480	Long Screw Gauge (20mm–80mm)
	1806-4260S	Drill Ø4.2×340, AO, sterile (U.S.)
	1806-4270S	Drill Ø4.2×180, AO, sterile (U.S.)
	1806-4290S	Drill Ø4.2×230, AO, sterile (U.S.)
	1806-5000S	Drill Ø5.0×230, AO, sterile (U.S.)
	1806-5020S	Drill Ø5.0×340, AO, sterile (U.S.)
	1806-9010	Screw Tray

	REF	Description
	Special Order Items	
	702427	T-Handle, AO Coupling
	703166	Freehand Drill Sleeve
	0140-0002	Reaming Protector
	1806-0047	Awl, Straight Ø11.5mm
	1806-0120	Reduction Tip
	1806-0202	Screwdriver, Extra Short
	1806-0340	Extraction Adapter
	1806-0450	Long Freehand Tissue Protection Sleeve
	1806-0460	Long Drill Sleeve Ø 4.2mm
	1806-1007	Target Device Locking Nut, Spare
	1806-2011	Rigid Reamer, Ø11.5mm

* Instruments designated "Outside of the U.S." may not be ordered for the U.S. market.

Ordering Information - Instruments

Bixcut™

Complete range of modular and fixed-head reamers to match surgeon preference and optimize O. R. efficiency, presented in fully sterilizable cases.

Large clearance rate resulting from reduced number of reamer blades coupled with reduced length of reamer head to give effective relief of pressure and efficient removal of material.

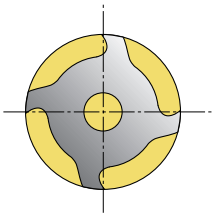
Cutting flute geometry optimized to lower pressure generation.

Forward- and side-cutting face combination produces efficient material removal and rapid clearance.

Double-wound shaft transmits torque effectively and with high reliability. Low-friction surface finish aids rapid debris clearance.

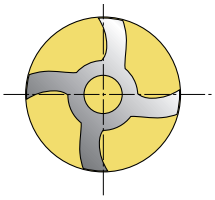
Smaller, 6 and 8mm shaft diameters significantly reduce IM pressure.

Typical Standard
Reamer Ø14mm

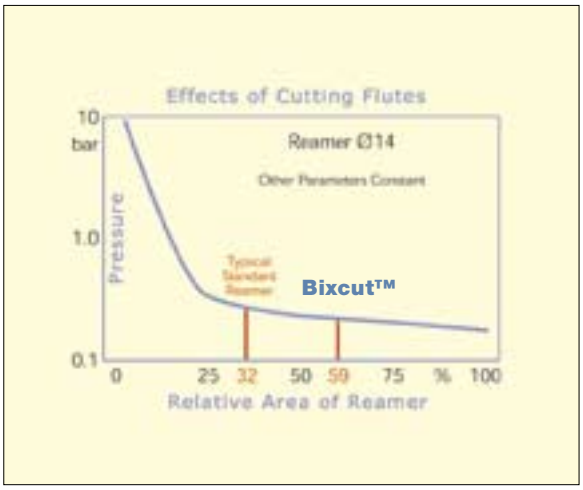


Clearance area:
32% of cross section

Bixcut™
Reamer Ø14mm



Clearance area:
59% of cross section



Recent studies[1] have demonstrated that the pressures developed within the medullary cavity through the introduction of unreamed IMnails can be far greater than those developed during reaming – but this depends very much upon the design of the reamer.

After a three year development study[2] involving several universities, the factors that determine the pressures and temperatures developed during reaming were clearly established. These factors were applied to the development of advanced reamers that demonstrate significantly better performance than the best of previous designs.

[1] Jan Paul M. Frolke, et al.;
Intramedullary Pressure in Reamed Femoral Nailing with Two Different Reamer Designs.,
Eur. J. of Trauma, 2001 #5

[2] Medhi Massau, et al.;
Pressure Changes During Reaming with Different Parameters and Reamer Designs,
Clinical Orthopaedics and Related Research Number 373, pp. 295-303, 2000

Ordering Information - Instruments

Bixcut™ Modular Head

REF	Description	Diameter mm
0226-3090	Bixcut Head	9.0
0226-3095	Bixcut Head	9.5
0226-3100	Bixcut Head	10.0
0226-3105	Bixcut Head	10.5
0226-3110	Bixcut Head	11.0
0226-3115	Bixcut Head	11.5
0226-3120	Bixcut Head	12.0
0226-3125	Bixcut Head	12.5
0226-3130	Bixcut Head	13.0
0226-3135	Bixcut Head	13.5
0226-3140	Bixcut Head	14.0
0226-3145	Bixcut Head	14.5
0226-3150	Bixcut Head	15.0
0226-3155	Bixcut Head	15.5
0226-3160	Bixcut Head	16.0
0226-3165	Bixcut Head	16.5
0226-3170	Bixcut Head	17.0
0226-3175	Bixcut Head	17.5
0226-3180	Bixcut Head	18.0
0226-4185	Bixcut Head	18.5
0226-4190	Bixcut Head	19.0
0226-4195	Bixcut Head	19.5
0226-4200	Bixcut Head	20.0
0226-4205	Bixcut Head	20.5
0226-4210	Bixcut Head	21.0
0226-4215	Bixcut Head	21.5
0226-4220	Bixcut Head	22.0
0226-4225	Bixcut Head	22.5
0226-4230	Bixcut Head	23.0
0226-4235	Bixcut Head	23.5
0226-4240	Bixcut Head	24.0
0226-4245	Bixcut Head	24.5
0226-4250	Bixcut Head	25.0
0226-4255	Bixcut Head	25.5
0226-4260	Bixcut Head	26.0
0226-4265	Bixcut Head	26.5
0226-4270	Bixcut Head	27.0
0226-4275	Bixcut Head	27.5
0226-4280	Bixcut Head	28.0

Bixcut™ Shaft – AO fitting

REF	Description	Length mm
0226-3000	Shaft, AO	450
0226-8240	Shaft, AO	240

Bixcut™ Shaft – Modified Trinkle fitting (sterile)+

REF	Description	Length mm
0227-3000(S)	Shaft, Mod. Trinkle	450
0227-8240(S)	Shaft, Mod. Trinkle	240

Bixcut™ Trays

REF	Description
0225-6000	Tray, Modular Head (up to size 22.0mm)
0225-6001	Tray, Modular Head (up to size 28.0mm)
0225-8000	Tray, Fixed Head (up to size 18.0mm)

Bixcut™ Fixed Head – AO fitting

REF	Diameter mm	Length mm
0225-5060	6.0*	400
0225-5065	6.5*	400
0225-5070	7.0*	400
0225-6075	7.5	480
0225-6080	8.0	480
0225-6085	8.5	480
0225-6090	9.0	480
0225-6095	9.5	480
0225-6100	10.0	480
0225-6105	10.5	480
0225-6110	11.0	480
0225-8115	11.5	480
0225-8120	12.0	480
0225-8125	12.5	480
0225-8130	13.0	480
0225-8135	13.5	480
0225-8140	14.0	480
0225-8145	14.5	480
0225-8150	15.0	480
0225-8155	15.5	480
0225-8160	16.0	480
0225-8165	16.5	480
0225-8170	17.0	480
0225-8175	17.5	480
0225-8180	18.0	480

Bixcut™ Fixed Head – Modified Trinkle fitting+

REF	Diameter mm	Length mm
0227-5060	6.0*	400
0227-5065	6.5*	400
0227-5070	7.0*	400
0227-6075	7.5	480
0227-6080	8.0	480
0227-6085	8.5	480
0227-6090	9.0	480
0227-6095	9.5	480
0227-6100	10.0	480
0227-6105	10.5	480
0227-6110	11.0	480
0227-8115	11.5	480
0227-8120	12.0	480
0227-8125	12.5	480
0227-8130	13.0	480
0227-8135	13.5	480
0227-8140	14.0	480
0227-8145	14.5	480
0227-8150	15.0	480
0227-8155	15.5	480
0227-8160	16.0	480
0227-8165	16.5	480
0227-8170	17.0	480
0227-8175	17.5	480
0227-8180	18.0	480

+ Use with Stryker Power Equipment

* Use with 2.2mm×800mm Smooth Tip and 2.5mm×800mm Ball Tip Guide wires only.

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Germany

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