stryker

Osteosynthesis

S2

Femoral Nail A/R

Operative Technique

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This publication sets forth detailed recommended procedures for using Stryker Osteosynthesis 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.

See package insert (L22000007) for a complete list of potential adverse effects, contraindications, warnings and precautions. The surgeon must discuss all relevant risks, including the finite lifetime of the device, with the patient, when necessary.

Warning:

All bone screws referenced in this document here are not approved for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic or lumbar spine.

Contents

		Page
1.	**Introduction & Features**	**4**
	Implant Features	4
	Instrument Features	6
	References	6
3.	**Indications and Contraindications**	**7**
	Indications	7
	Contraindications	7
	Pre-operative Planning	7
4.	**Locking Options**	**8**
5.	**Operative Technique - Antegrade Technique**	**9**
	Patient Positioning and Fracture Reduction	9
	Incision	9
	Entry Point	10
	Unreamed Technique	10
	Reamed Technique	11
	Nail Selection	12
	Distal Targeting Device Calibration	13
	Nail Insertion	13
	Distal Guided Locking Mode (via Distal Target Device)	15
	Proximal Guided Locking Mode - Oblique	15
	Freehand Distal Locking	17
	Set Screw Insertion	18
	Nail Removal	19
6.	**Operative Technique - Retrograde Technique**	**20**
	Patient Positioning and Fracture Reduction	20
	Incision	20
	Entry Point	21
	Unreamed Technique	22
	Reamed Technique	22
	Nail Selection	23
	Nail Insertion	24
	Distal Guided Locking Mode (via Target Device)	26
	Static Locking Mode - Fully Threaded Locking Screw	27
	Static Locking Mode - Condyle Screw	29
	Freehand Proximal Locking	31
	End Cap Insertion	32
	Nail Removal	33
	Ordering Information – Implants	**34**
	Ordering Information – Instruments	**36**

Introduction & Features

Implant Features

Over the past 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).

Stryker Osteosynthesis has created a **new generation locking nail system**, the **S2 Femoral Nail A/R,** bringing together all the capabilities and benefits of separate antegrade and retrograde nailing systems to create a single, integrated surgical resource for fixation of femoral fractures.

The S2 Femoral Nail A/R is designed as **One Implant** for Left or Right side **and Two Approaches**: antegrade and retrograde.

Furthermore, the development of the S2 Femoral A/R Nailing System offers the competitive advantages of:

- **Not limiting the approach to a certain nailing technique**
- **Accommodating reamed or unreamed procedures**
- **Providing a Distal Guided Locking option (with the S2 Distal Targeting Device)**

Through the development of a common, streamlined and intuitive surgical approach, both in principle and in detail, the S2 Femoral A/R Nailing System offers **significantly increased speed and functionality** for the treatment of fractures as well as simplifying the training requirements for all personnel involved.

The **S2 Femoral A/R Nailing System** is the realization of superior biomechanical intramedullary stabilization using small caliber, strong, cannulated implants for internal fixation of the femur.

According to the fracture type, the S2 Femoral A/R Nailing System offers an option for either an **antegrade or a retrograde** approach.

Common 5mm cortical screws simplify the surgical procedure and promote a minimally invasive approach.

- **Fully Threaded Locking Screws** are available for regular locking procedures.

Special Condyle Screws with adjustable washers for improved fit are designed to provide a better fixation in the condyle area (retrograde approach).

End Caps are available in various sizes to provide an improved fit for every indication and prevent bony or soft tissue ingrowth into the proximal part of the nail.
The End Cap will also block the most distal locking Screw (retrograde approach), thus avoiding lateral sliding of the nail.

A special **Set Screw** is designed to tighten down on the oblique Locking Screw (antegrade approach).

All implants of the **S2 Femoral A/R Nailing System** are made of **Stainless Steel (316LVM).**

The **S2 Femoral Nails, A/R** are **cannulated**, **not slotted** and have a **fluted** profile for an optimal bending stiffness.

In addition, **two longitudinal grooves** (one on each side of the nail), between the 2 M/L Distal Locking Holes, are designed for the Distal Guided Locking Mode technique (via S2 Distal Targeting Device). The main principle of this technique is based on easy nail detection with a Probe inserted into this groove. The groove is used to further guide the Probe into the Locking Hole. For detailed information about Distal Guided Locking Mode technique, please refer to the **S2 Distal Targeting Device-OP Technique**, REF B1000012.

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

Introduction & Features

S2 Femoral Nail A/R

Diameter 9–14mm
Sizes 260–480mm
(in 20mm increments)

Locking Screws

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

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

5.0mm Condyle Screws

L = 40–120mm

Condyle Nut

S2 Set Screw, proximal

S2 End Caps

Introduction & Features

Instrument Features

The major advantage of the instrument system is a break-through in the integration of the instrument platform which can be used not only for the complete **S2 Nailing System**, but will be the platform for future Stryker Trauma nailing systems, 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 number coded to indicate the step during the surgical procedure in which the instrument is used.

Drills

Step	Number
Opening	①
Reduction	②
Nail Introduction	③
Guided Locking	④
Freehand Locking	⑤

Drills feature color coded rings:

4.2mm = Green
For 5.0mm Fully Threaded Locking Screws.

5.0mm = Black
For both cortices when using Condyle Screws.

Unique to the **S2 Nailing System** is a special Distal Targeting Device designed for Distal Guided Locking Technique.

The **S2 Distal Targeting Device** offers the competitive advantage of:

- Minimizing fluoroscopy time
- Helping to avoid misdrilling
- Reducing the operative time.

For detailed information about the Distal Targeting Device please refer to the **S2 Distal Targeting Device-Operative Technique**, REF B1000012.

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 Non-union: 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., DiCicco, J., Retrograde Intramedullary Nailing of Femoral Diaphyseal Fractures, Journal of orthopaedic Trauma, Vol. 12, N¡ 7, pp. 464–468, 1998

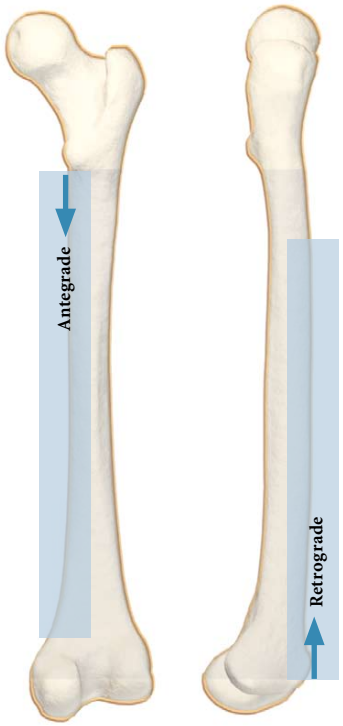
7. Lucas, SE et al.:
Intramedullary Supracondylar Nailing of Femoral Fractures. A Preliminary Report of the GSH Supracondylar Nail. Clinical Orthopaedics and Related Research 296 200–206, 1993

Indications & Contraindications

Indication

The S2 Femoral A/R Nail is indicated for:

- Open and closed shaft fractures
- Ipsilateral shaft fractures
- Segmental fractures
- 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
- Corrective osteotomies/Mal-unions
- Non-unions
- Supracondylar fractures including those with intra-articular extension



Relative Contraindications

The physician's education, training and professional judgement must be relied upon to choose the most appropriate device and treatment. Conditions presenting an increased risk of failure include:

- Any active or suspected latent infection or marked local inflammation in or about the affected area.
- Compromised vascularity that would inhibit adequate blood supply to the fracture or the operative site.
- Bone stock compromised by disease, infection or prior implantation that can not provide adequate support and/or fixation of the devices.
- Material sensitivity, documented or suspected.
- Obesity. An overweight or obese patient can produce loads on the implant that can lead to failure of the fixation of the device or to failure of the device itself.
- Patients having inadequate tissue coverage over the operative site.
- Implant utilization that would interfere with anatomical structures or physiological performance.
- Any mental or neuromuscular disorder which would create an unaccep table risk of fixation failure or complications in postoperative care.
- Other medical or surgical conditions which would preclude the potential benefit of surgery.

Pre-operative Planning

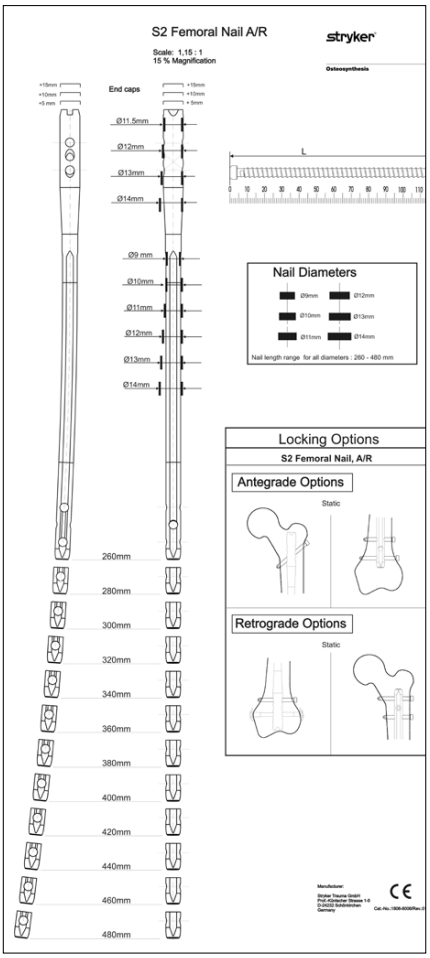
An X-Ray Template, Femur, A/R (1806-8006) is available for pre-operative planning (Fig. 1). Thorough evaluation of pre-operative radiographs of the affected extremity is critical. Careful radiographic examination of the trochanteric region and intercondylar regions can prevent intra-operative complications.

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 the level of the Lesser Trochanter.

Note:

Check with local representative regarding availability of nail sizes.



Locking Options

S2 Femoral Nail, A/R

Antegrade Approach
Static Locking Mode

Retrograde Approach
Static Locking Mode

Operative Technique - Antegrade Technique

Patient Positioning and Fracture Reduction

The **S2** Femoral Nail A/R may be used for antegrade insertion.

Patient positioning for antegrade femoral nail insertion is surgeon dependent. It is highly recommended to position the patient supine on a fracture table. The trunk should be bent to the opposite side to simplify the access to the entry point (Fig. 2).

To facilitate reduction of mid-shaft or distal femur fractures, the lower limb should be adducted. For more proximal fractures, the position should be neutral.

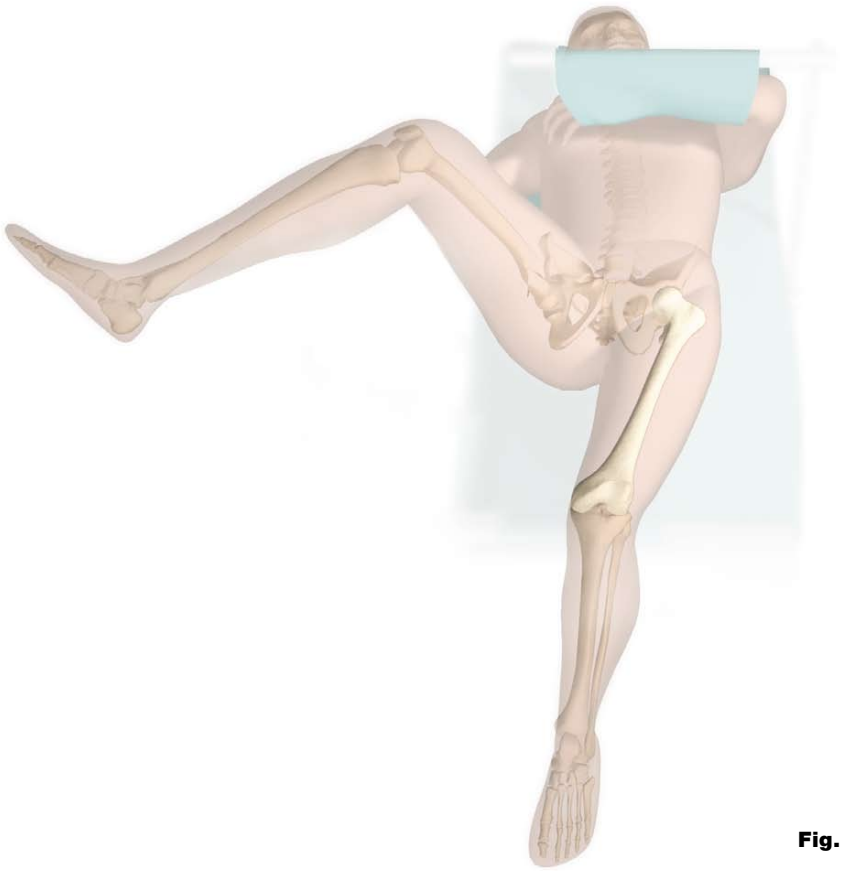


Fig. 2

Incision

The design of the implant allows for insertion either through the Tip of the Greater Trochanter (A) or the Piriformis Fossa (B) (Fig. 3).

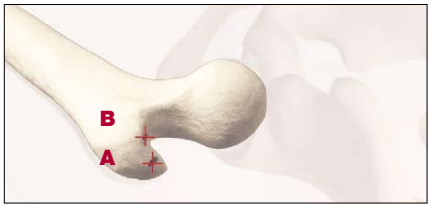


Fig. 3

Tip of the Greater Trochanter (A)
With experience, the Tip of the Greater Trochanter can be located by palpation. A skin incision is made beginning at the level of the Greater Trochanter, extending proximal and slightly posterior to the Iliac Crest (Fig. 4.a).

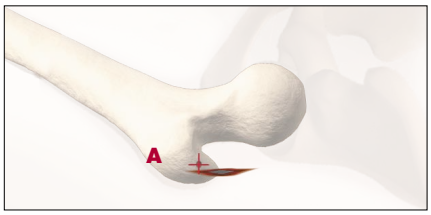


Fig. 4.a

Piriformis Fossa (B)
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 (Fig. 4.b).

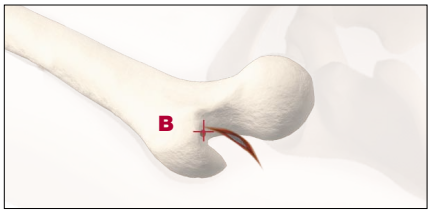


Fig. 4.b

Operative Technique - Antegrade Technique

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 Tip, on the medial edge of the tip itself. Image intensification (A/P and M/L) is used for confirmation (Fig. 5).

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. 6) 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 (1806-1095) (Fig. 7).

Note:

During opening of 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.

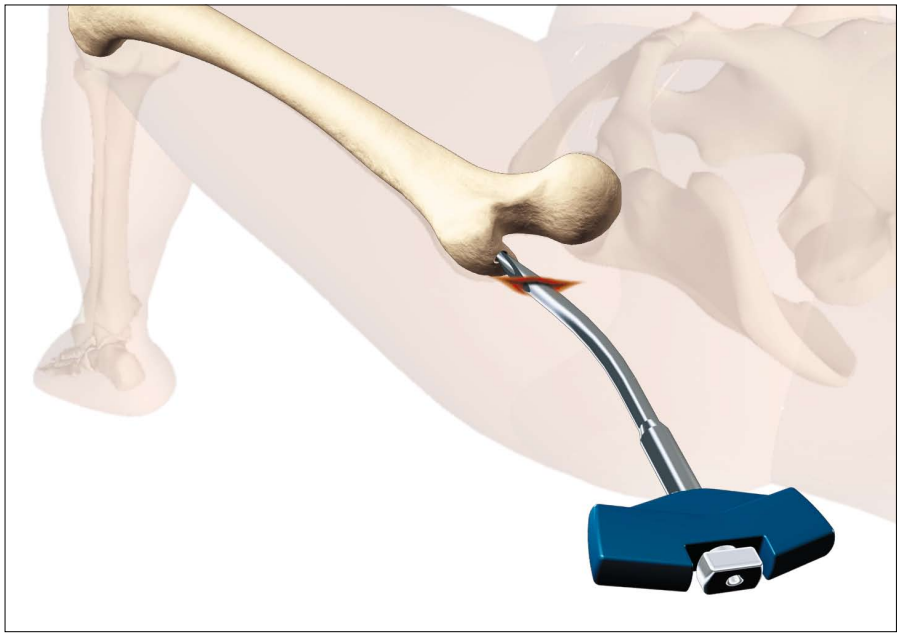


Fig. 5

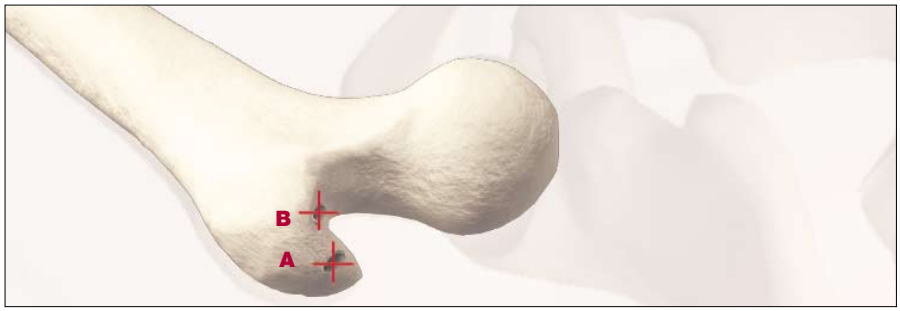


Fig. 6

Fig. 7

Unreamed Technique

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

Operative Technique - Antegrade Technique

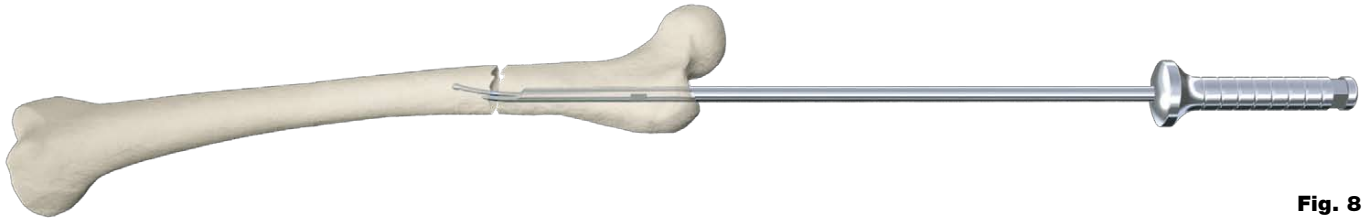


Fig. 8

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.

The Ball Tip of the Guide Wire should be centered in the condylar region to ensure concentric reaming of the femur; care must be taken with flexible reamers to prevent lateral displacement and thus unequal resection of lateral bone which might result in an offset position of the nail.

For proximal fractures, the Ø9mm Universal Rod (1806-0110) with Reduction Spoon (1806-0125) may be used as a fracture reduction tool to facilitate Guide Wire insertion through the fracture site (Fig. 8 & 9).

Note:

The Ball Tip at the end of the Guide Wire will stop the Bixcut reamer head (Fig. 10.a).

Reaming is commenced in 0.5mm increments until cortical contact is appreciated (Fig. 10.b). Final reaming should be 1.5–2mm larger than the diameter of the nail to be used.

Caution:

The proximal diameter (driving end) of the 9mm–11mm diameter nails is 11.5mm. Additional reaming may be required for the trochanteric region in order to facilitate nail insertion. Nail sizes 12–14mm have a constant diameter.

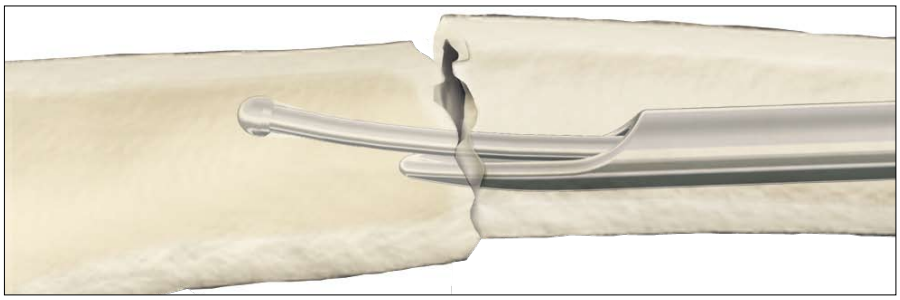


Fig. 9

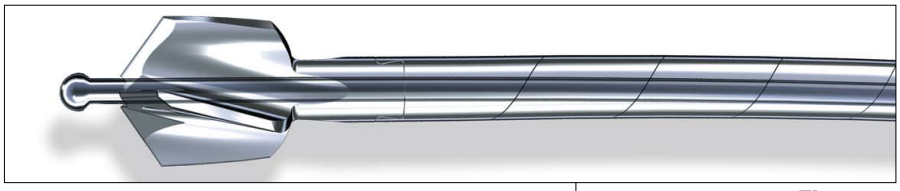


Fig. 10.a

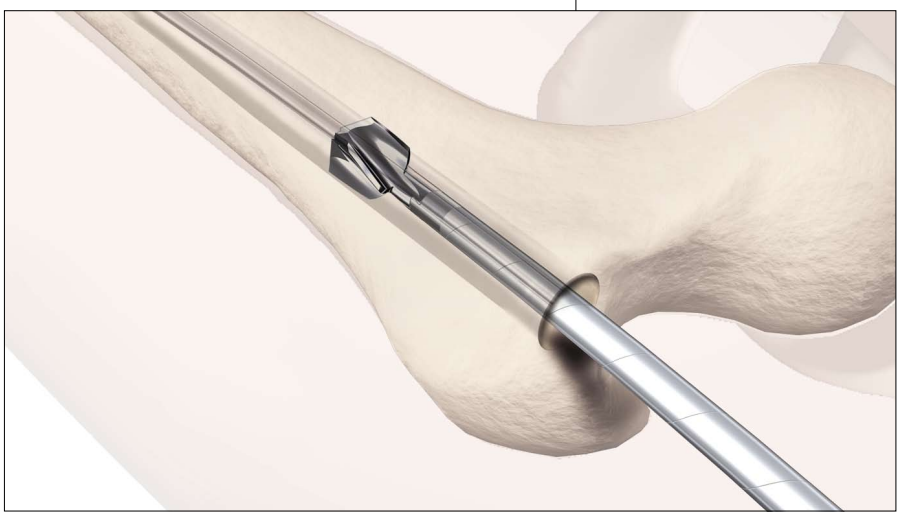


Fig. 10.b

Bixcut Reamer*

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

* see pages 38–39 for additional **Bixcut Reamer** system details.

Nail Selection

Diameter
The diameter of the selected nail should be 1.5–2mm smaller than that of the last reamer used. Alternatively, the diameter may be determined using the X-Ray Ruler, Femur, A/R (1806-8011) with the different diameters matching with the radiographs (Fig. 11.1).

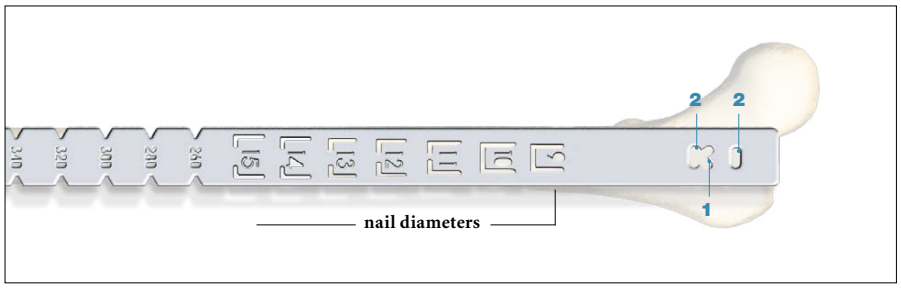


Fig. 11.1

In addition, the X-Ray Ruler, Femur, A/R can be used as a guidance for possible locking screw position.

Fig. 11.1: Hole positions (driving end)
1. Static Locking - Oblique hole (Antegrade)*
2. Static Locking - both M/L holes (Retrograde)*

Fig. 11.2

Fig. 11.2: Hole positions (non-driving end)
1. Static Locking - both M/L holes (Antegrade)*
2. Static Locking - A/P hole (Retrograde)*

Length
Nail length may be determined with the X-Ray Ruler (Fig. 11.2) or 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 and reading the correct nail length at the end of the Guide Wire on the Guide Wire Ruler (Fig. 12 & 13).

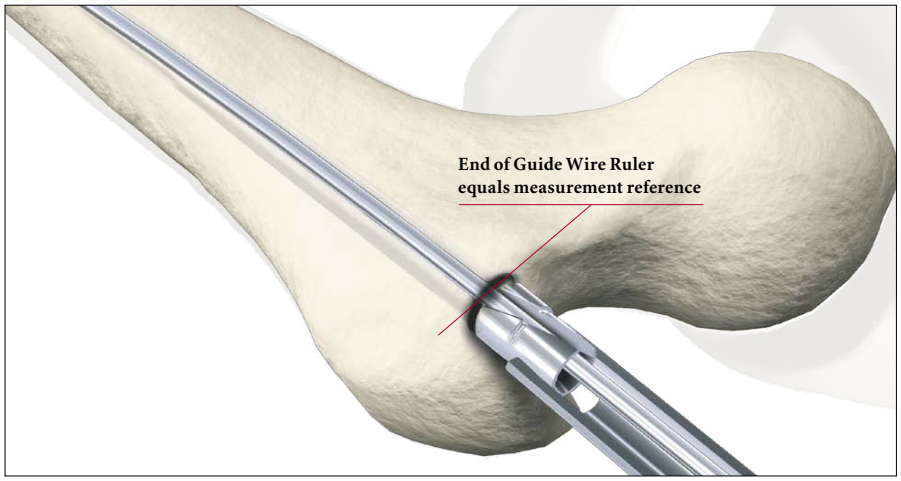


Fig. 12

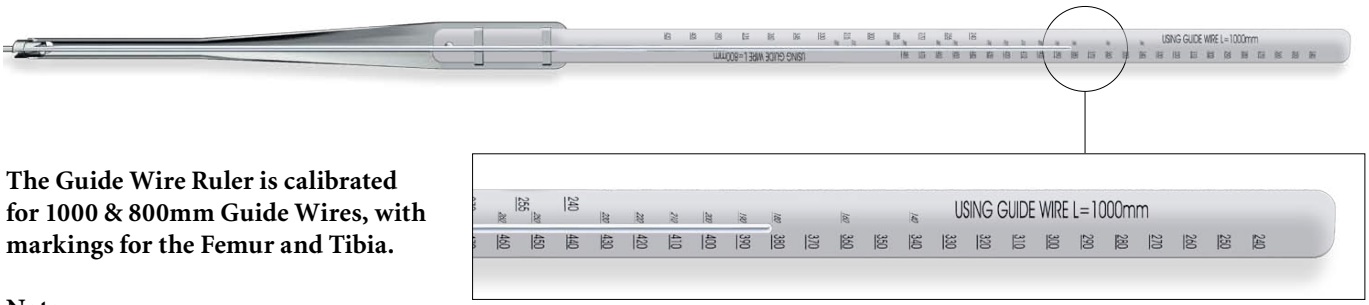


Fig. 13

The Guide Wire Ruler is calibrated for 1000 & 800mm Guide Wires, with markings for the Femur and Tibia.

Note:
Confirm the position of Guide Wire tip before measurement.

* see page 8 for detailed illustrations of Antegrade and Retrograde Locking Options.

Distal Targeting Device Calibration

Note:

Calibration of the S2 Distal Targeting Device must be performed prior to nail insertion, if decided to be used for Distal Guided Locking procedure.

For detailed information about Calibration technique, please refer to the Operative Technique for S2 Distal Targeting Device (REF B1000012).

Fig. 14

Nail Insertion

The selected nail is assembled onto the Nail Adapter (1806-8001) with the Nail Holding Screw (1806-8005). Tighten the Nail Holding Screw with the Universal Joint Socket Wrench (1806-0400) securely so that it does not loosen during nail insertion (Fig. 14).

Note:

If calibration of the S2 Distal Targeting Device was performed before Nail Insertion, the nail is already assembled on the Nail Adapter.

Upon completion of reaming and Distal Targeting Device calibration, the appropriate size nail is ready for insertion. Unique to the **S2 Femoral Nail A/R**, the 3×1000mm Ball Tip Guide Wire does not need to be exchanged.

Caution:

Curvature of the nail must match the curvature of the femur (Fig. 15).

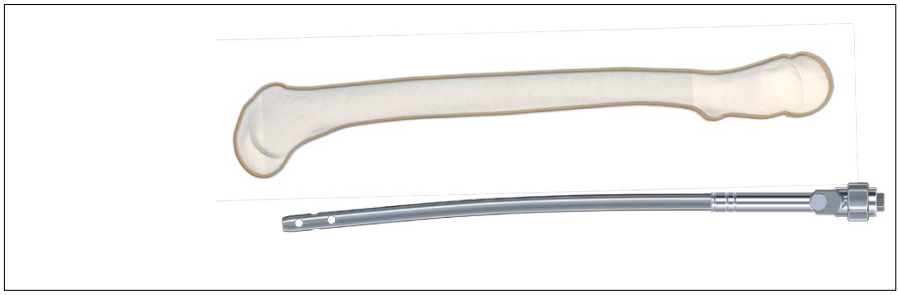


Fig. 15

Caution:

Prior to nail insertion please check correct alignment by inserting a Drill bit through the assembled Tissue Protection- and Drill Sleeve placed in the oblique hole of the Nail Adapter.

Fig. 16

The Strike Plate (1806-0150) is threaded into the Nail Adapter and the nail is advanced through the entry point past the fracture site to the appropriate level (Fig. 16).

Operative Technique - Antegrade Technique

The Slotted Hammer (1806-0170) may be used on the Strike plate (Fig. 17), if dense bone is encountered.

Note:

Do not hit the Target Device. Only hit the Strike Plate.

Repositioning should be carried out either by hand or by using the Strike Plate placed on top of the Nail Adapter. The Universal Rod (1806-0110) may then be attached to the Strike Plate and used in conjunction with the Slotted Hammer to carefully and smoothly extract the assembly (Fig. 18).

Note:

A chamfer is located on the driving end of the nail in order 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. 19). 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. 20).

Note:

If the S2 Distal Targeting Device will be used for Distal Guided Locking, the nail must be countersunk at least 15mm. The final insertion depth is reached after pulling back the nail 10mm, in a later step. Please refer to the S2 Distal Targeting Device - Operative Technique (REF. NO: B1000012) for detailed information.

Caution:

Remove the Guide Wire prior to drilling and insertion of the Locking Screws.

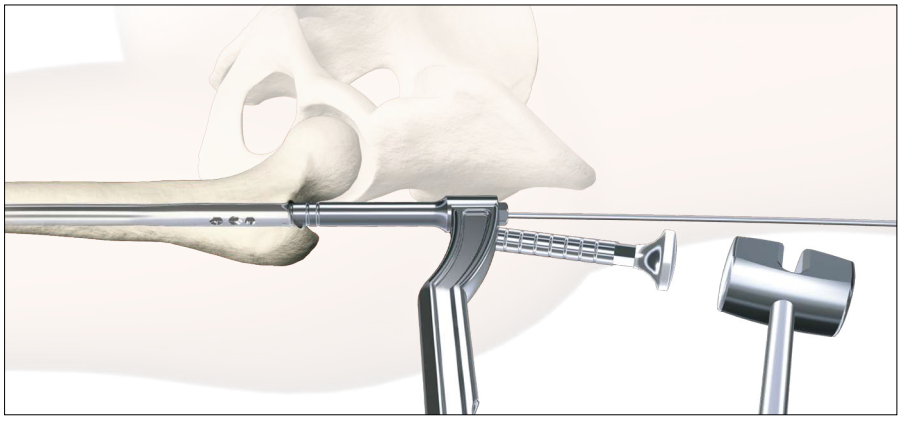


Fig. 17

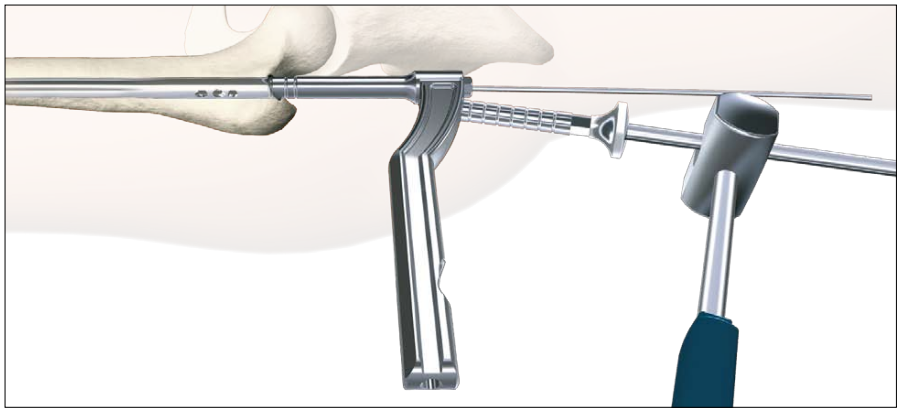


Fig. 18

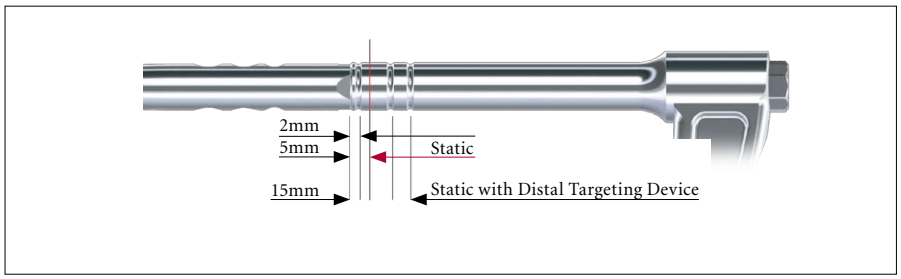


Fig. 19

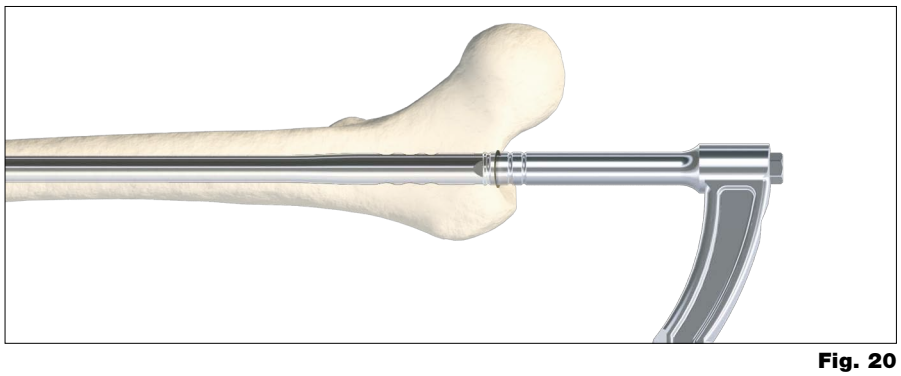


Fig. 20

Distal Guided Locking Mode (Via Distal Targeting Device)

Note:

If the S2 Distal Targeting Device is going to be used, Distal Guided Locking should always be performed before the Proximal Locking.
This is because of the Distal Guided Locking technique that requires free movements of the nail in the medullary canal.

For detailed information about the Distal Guided Locking procedure, please refer to the **S2 Distal Targeting Device - Operative Technique** (REF. NO: B1000012).

Fig. 21

Proximal Guided Locking Mode - Oblique

The S2 Femoral Nail A/R should be locked proximally with one oblique screw.

An Oblique Hole (Fig.21) is located in the Nail Adapter to allow guided targeting of the oblique locking hole.

When locking the S2 Femoral Nail, A/R with the Oblique screw, insert the Tissue Protection Sleeve, Long (1806-0185) together with the Drill Sleeve, Long (1806-0215) and the Trocar, Long (1806-0315) into the oblique hole of the Nail Adapter.

A small skin incision is made, and the assembly is pushed through until the Tissue Protection Sleeve is in contact with the lateral cortex of the femur. Insert the Sleeve Fixation Screw (1806-8003) and tighten it to fix the Tissue Protection Sleeve (Fig. 22).

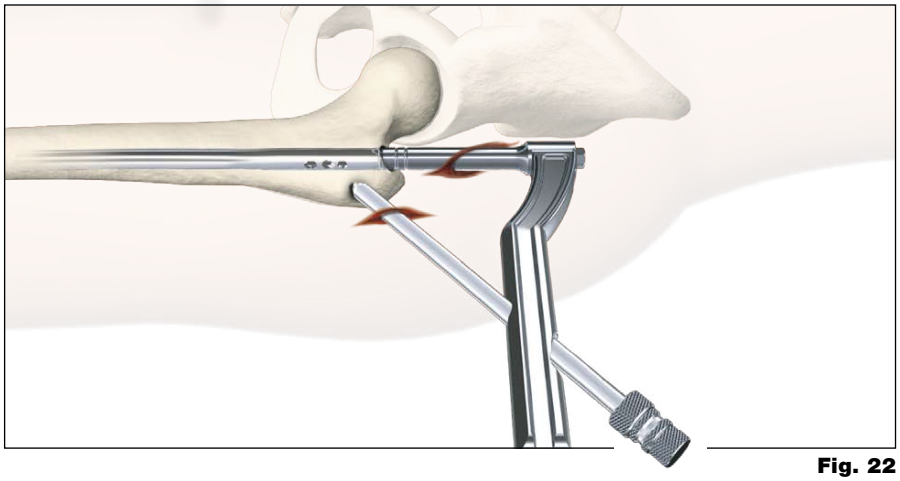


Fig. 22

Operative Technique - Antegrade Technique

The Long Trocar is removed while the Long Tissue Protection Sleeve and the Long Drill Sleeve remain in position.

Caution:

For optimal stability, the tip of the oblique screw should be positioned at the level of the Lesser Trochanter.

To help ensure accurate drilling for the oblique screw, use the Ø4.2×250 Drill (1806-8018S) to open the first cortex. The Drill is forwarded through the Drill Sleeve and pushed onto the cortex. After opening the first cortex, use the center tipped, calibrated Ø4.2×340 Drill (1806-4260S) and drill through both cortices.

The screw length may be read directly from the calibrated Drill (Fig. 23).

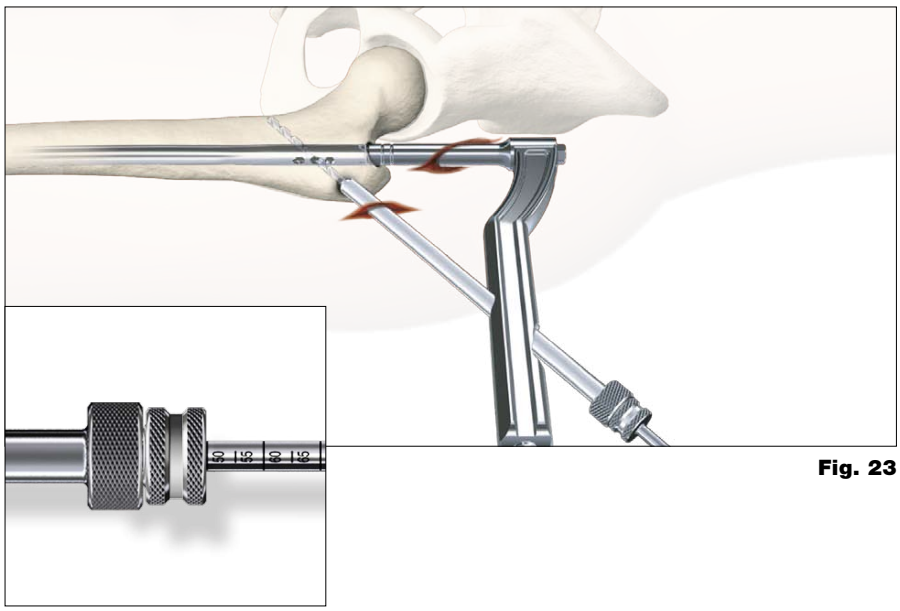


Fig. 23

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. Check the position of the end of Drill with image intensification before measuring the screw length.

If Screw measurement with the Screw Gauge, Long (1806-0325) is preferred, first remove the Drill Sleeve, Long and read the screw length directly at the end of the Tissue Protection Sleeve, Long.

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.

Alternatively, stop the drill when it engages the far cortex and measure the drill bit depth off of the calibrated drill. Add 5mm to this length to obtain the correct screw length.

Caution:

Make sure the Tissue Protection Sleeve/Drill Sleeve Assembly is seated on bone prior to selecting final screw length.

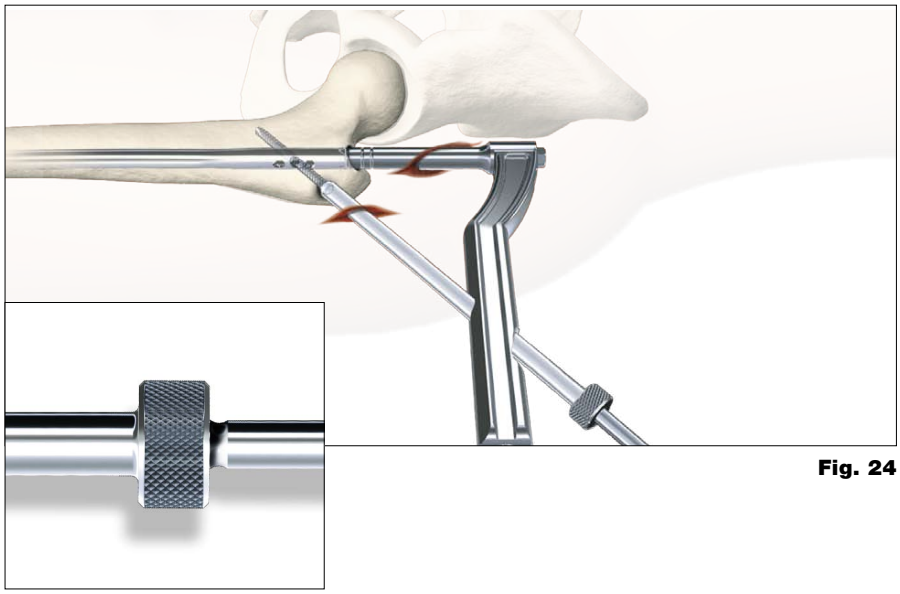


Fig. 24

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. 24).

Caution:

The coupling of Elastosil handles contains a mechanism with one or multiple ball bearings. In case of applied axial stress on the Elastosil handle, those components are pressed into the surrounding cylinder resulting in a complete blockage of the device and possible bending.

To avoid intra-operative complications and secure long-term functionality, we mandate that Elastosil handles be used only for their intended use. DO NOT HIT hit on them.

Freehand Distal Locking

The freehand technique is used to insert Fully Threaded Locking Screws into both distal M/L holes of 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 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. 25). Upon X-Ray verification, the Drill is placed perpendicular to the nail and drilled through the lateral and medial cortices. Confirm in both the A/P and M/L planes by X-Ray that the Drill passes through the hole in the nail (Fig. 26).

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 (Fig. 27).

Alternatively, the Screw Gauge (1806-0480) for Freehand technique can be used insted of the Screw Scale, Long to determine the screw length.

As with proximal locking, 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. Check the position of the end of Drill with image intensification before measuring the screw length.

Routine Locking Screw insertion is employed with the assembled Long Screwdriver Shaft and Teardrop Handle. Repeat the locking procedure for the other distal locking screw (Fig. 28).

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

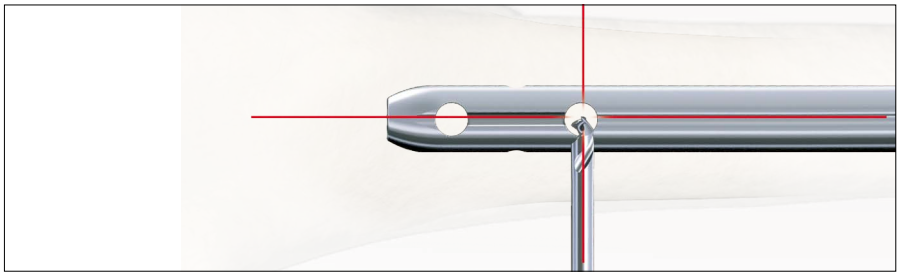


Fig. 25

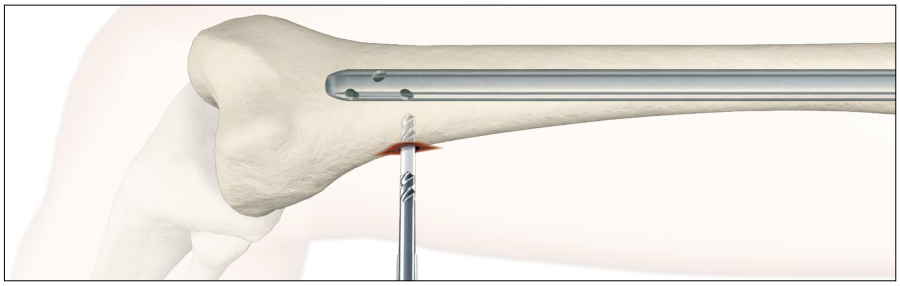


Fig. 26

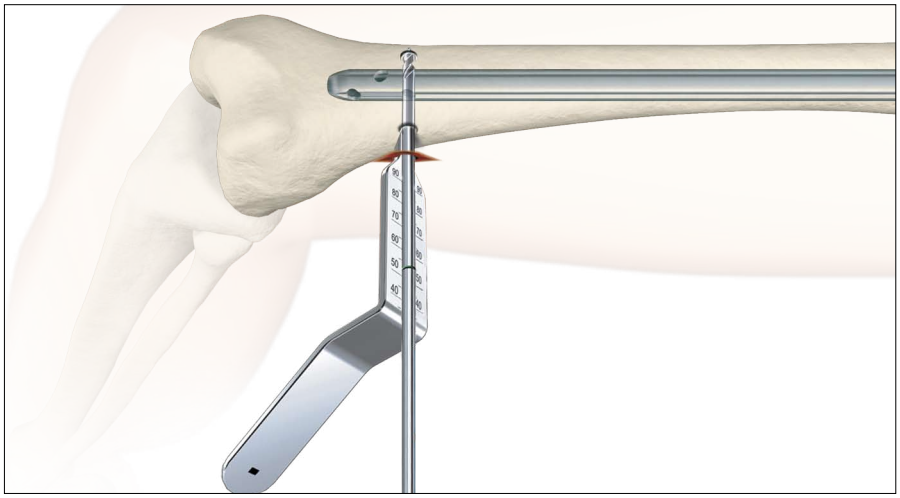


Fig. 27

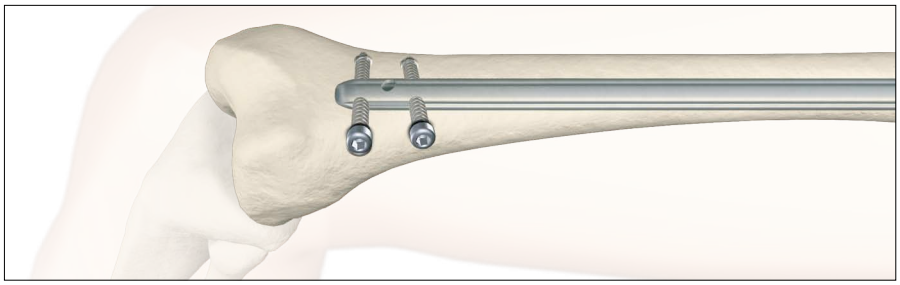


Fig. 28

Set Screw Insertion

After removal of the Nail Adapter, a Set Screw, proximal (Fig. 29) is used to reduce the potential for bony ingrowth into the thread of the nail driving end.

Fig. 29

Alternatively, the Nail Holding Screw securing the nail to the insertion post is removed, leaving the insertion post in contact with the nail. This will act as a guide for the insertion of the Set Screw, proximal.

Note:

The Set Screw is designed to tighten down on the oblique Locking Screw.

The Set Screw is inserted with the Long Screwdriver Shaft and Teardrop Handle after intra-operative radiographs show satisfactory reduction and hardware implantation (Fig. 30 & 31). Fully seat the Set Screw to minimize the potential for loosening (Fig. 32).

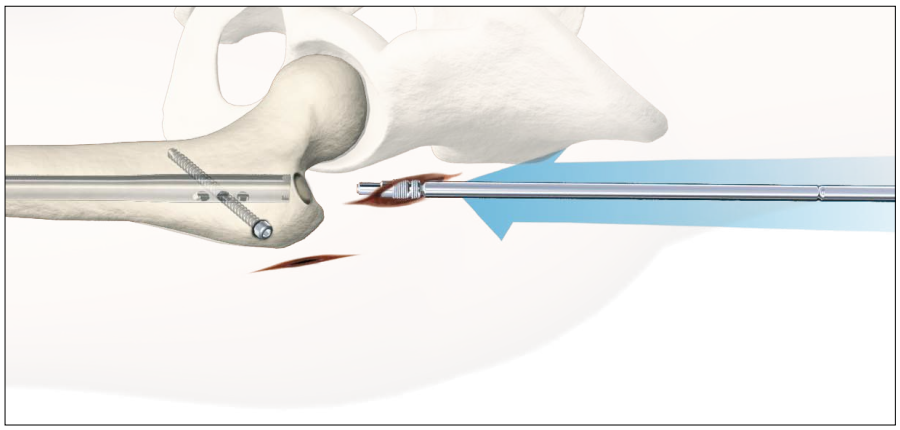


Fig. 30

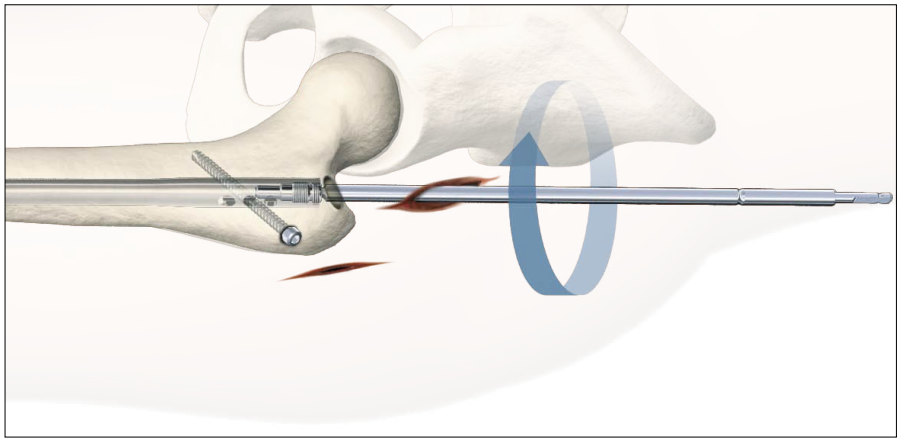


Fig. 31

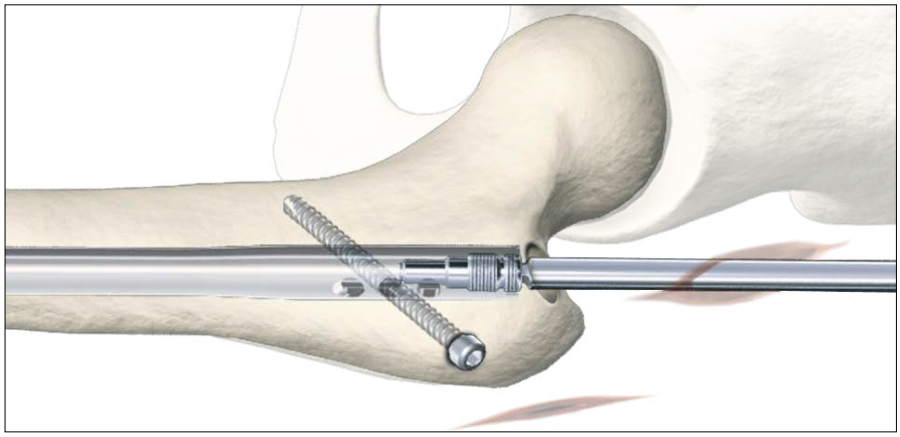


Fig. 32

Nail Removal

Nail removal is an elective procedure. If needed, the Set Screw is removed with the Long Screwdriver Shaft and Teardrop Handle (Fig. 33).

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. 34). The optional Screw Capture Sleeve, Long (1806-0240) may be used on the Screwdriver.

The Slotted Hammer is used to extract the nail in a controlled manner (Fig. 35). A captured Sliding Hammer (1806-0175) is available as an optional addition to the standard instrument set.

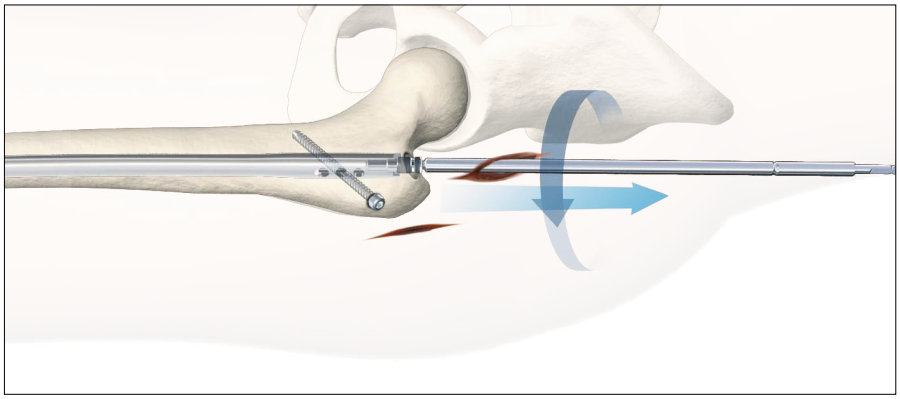


Fig. 33

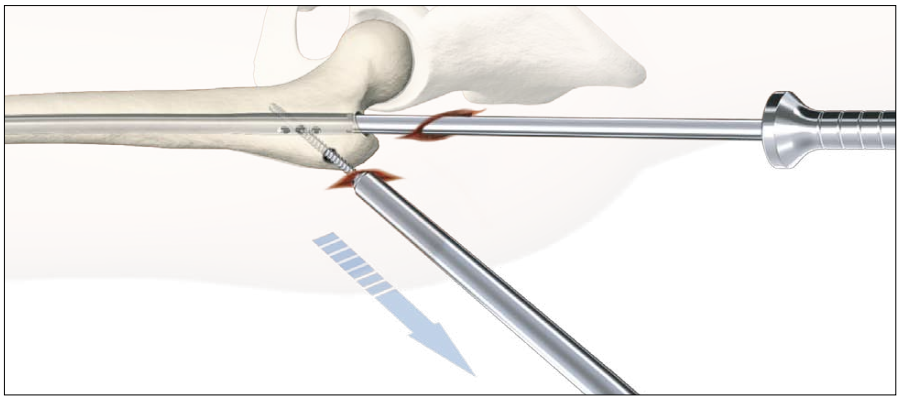


Fig. 34

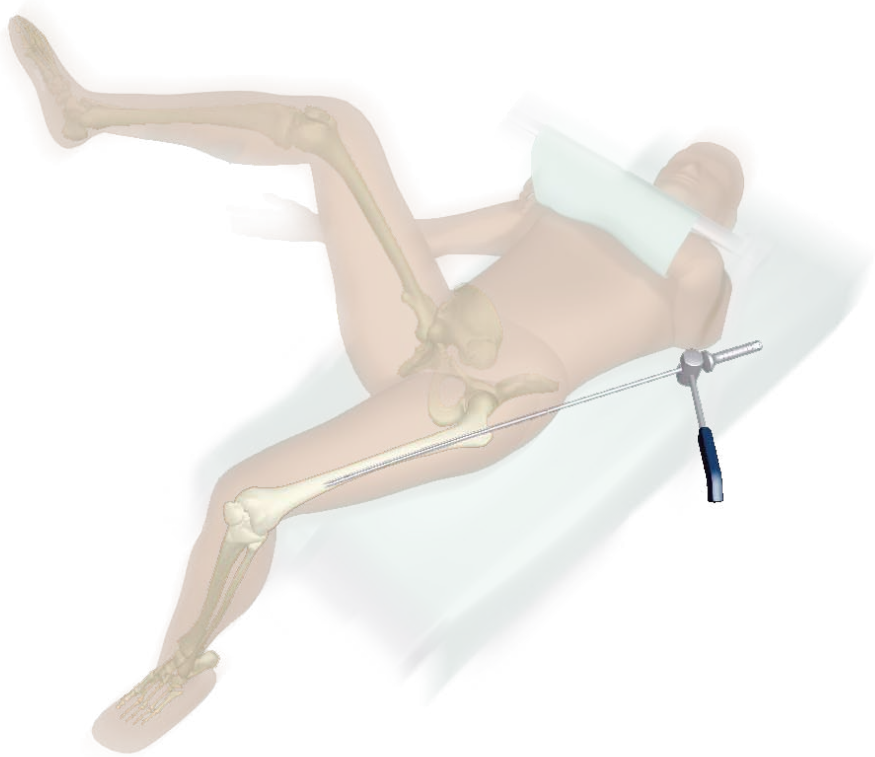


Fig. 35

Operative Technique - Retrograde Technique

The **S2** Femoral Nail A/R can be used for retrograde insertion.

Patient Positioning and Fracture Reduction

Retrograde nail insertion is performed with the patient supine on a radio-lucent 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 (Fig. 36). Manual traction through a flexed knee or a distraction device may be used to facilitate reduction for most acute femoral shaft fractures.

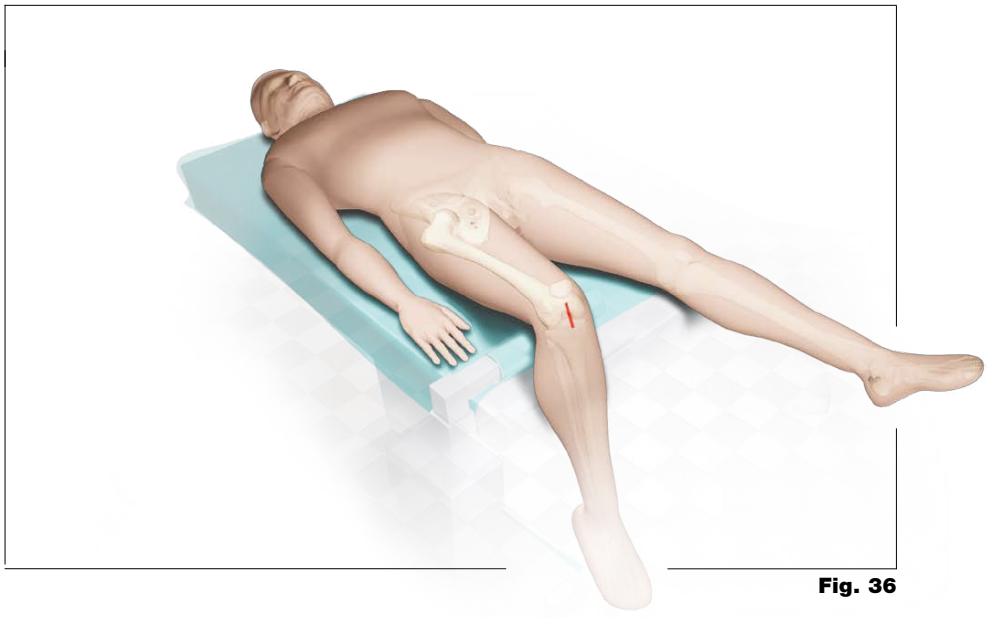


Fig. 36

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 (Fig. 37). 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 StSt 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 during the insertion of the retrograde nail and place cannulated screws after the nail is inserted.

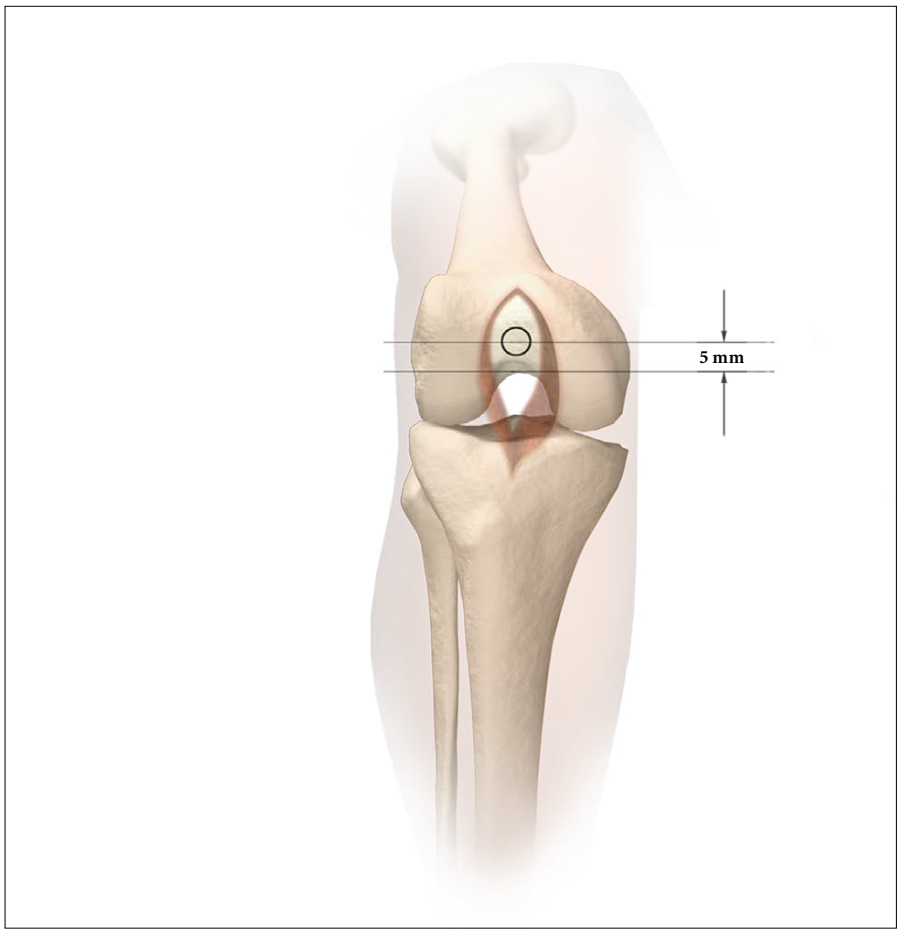


Fig. 37

Entry Point

The 3×285mm K-Wire (1806-0050S) can easily be fixed to the Guide Wire Handle (1806-1095) (Fig. 38.1). 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. 38.2).

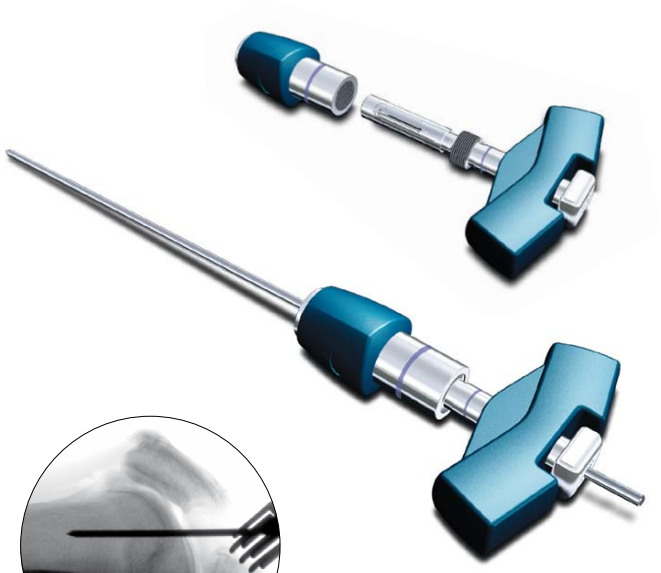


Fig. 38.1

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

Fig. 38.2

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 M/L radiograph.

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. 39).

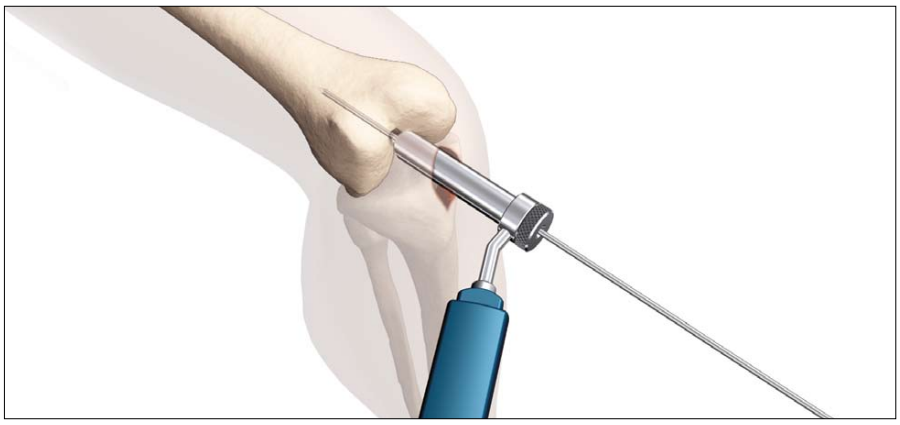


Fig. 39

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 most distal 8cm of the femur is reamed (Fig. 40).

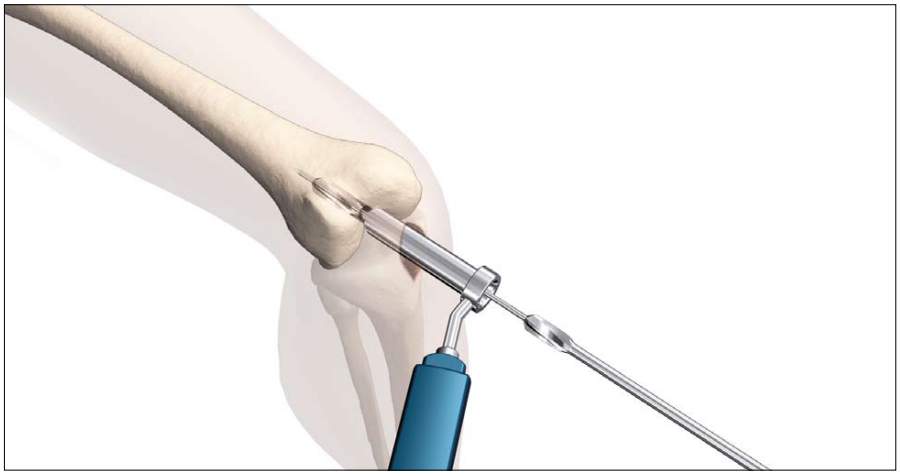


Fig. 40

The Ø12mm Rigid Reamer is used for nails 9mm–11mm in diameter. Larger nail diameters may be reamed with a flexible reamer 1.5–2mm larger than the nail.

Caution:

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.

Operative Technique - Retrograde Technique

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. 41). 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. 41

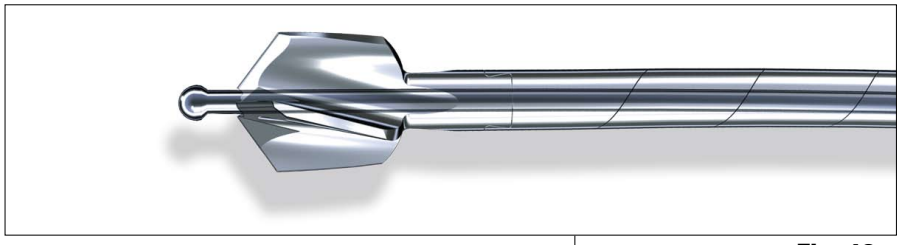


Fig. 42.a

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. 41).

Note:

The Ball Tip at the end of the Guide Wire will stop the Bixcut reamer head (Fig. 42.a).

Reaming (Fig. 42.b) is commenced in 0.5mm increments until cortical contact is estimated. Final reaming should be 1.5–2mm larger than the diameter of the nail to be used.

Caution:

The diameter of the driving end of the 9–11mm diameter nails is 11.5mm. Additional metaphyseal reaming may be required to facilitate nail insertion. Nail sizes 12–14mm have a constant diameter.

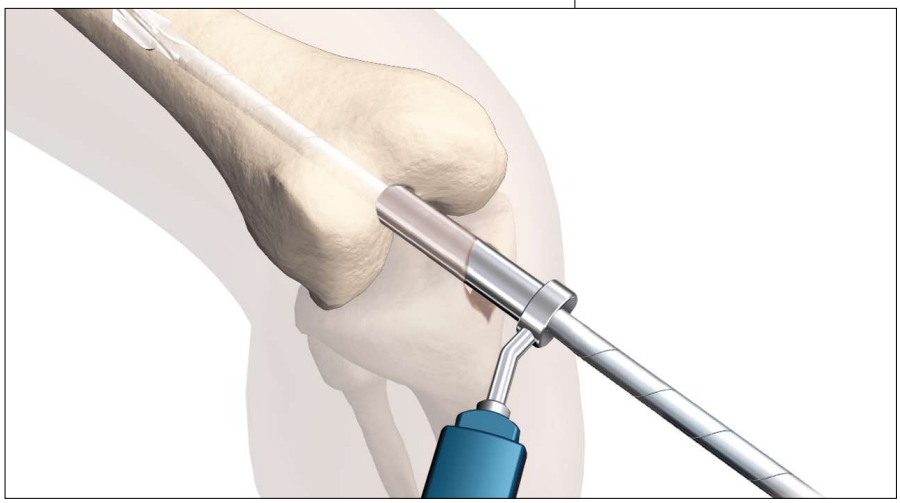


Fig. 42.b

Thoroughly irrigate the knee joint to remove any debris.

Bixcut Reamer*

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

The optimized cutting flute geometry is designed to largely reduce intramedullary 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 38–39 for additional **Bixcut Reamer** system details.

Nail Selection

Diameter
The diameter of the selected nail should be 1.5–2mm smaller than that of the last reamer used. Alternatively, the nail diameter may be determined using the X-Ray Ruler, Femur, A/R (1806-8011) (Fig. 43.1).

In addition, the X-Ray Ruler, Femur, A/R can be used as guidance for possible locking screw position.

Fig. 43.1: Hole positions (driving end)
1. Static Locking - Oblique hole (Antegrade)
2. Static Locking - both M/L holes (Retrograde)

Fig. 43.2: Hole positions (non driving end)
1. Static Locking - both M/L holes (Antegrade)
2. Static Locking - A/P hole (Retrograde)

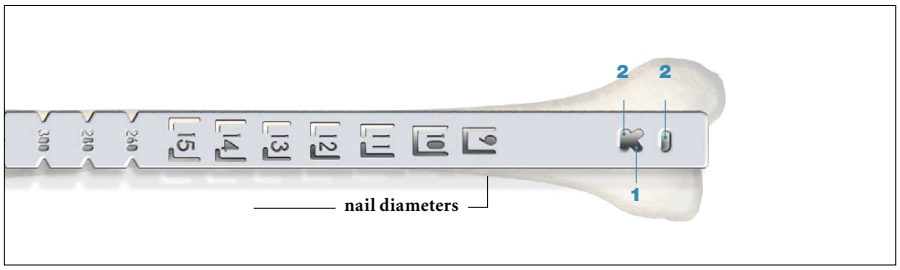


Fig. 43.1

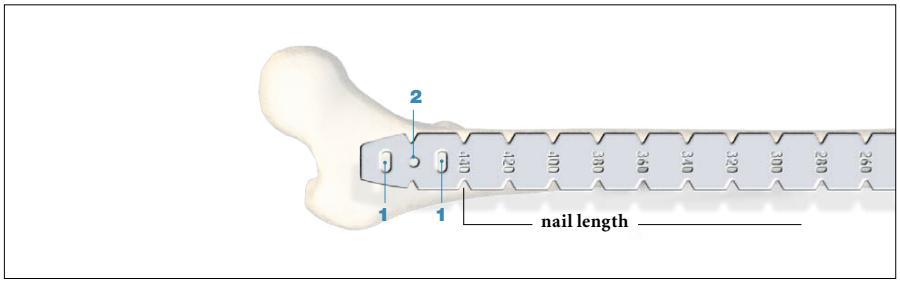


Fig. 43.2

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 and reading the correct nail length at the end of the Guide Wire on the Guide Wire Ruler (Fig. 44 & 45).

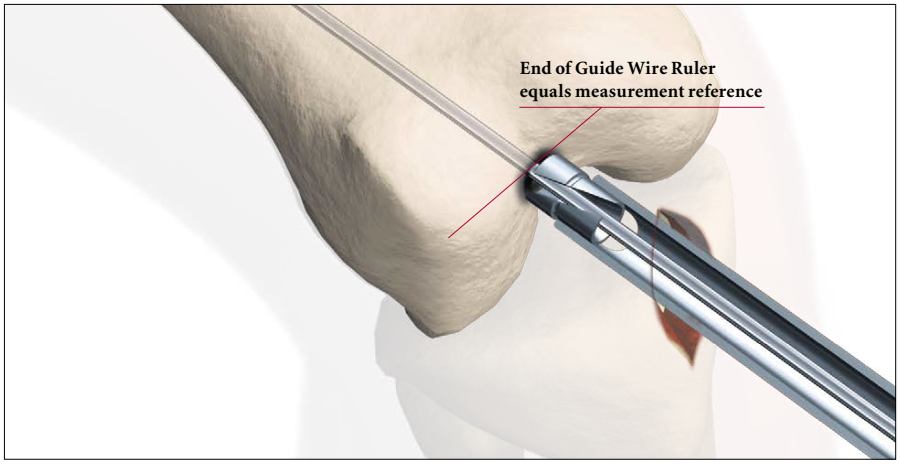
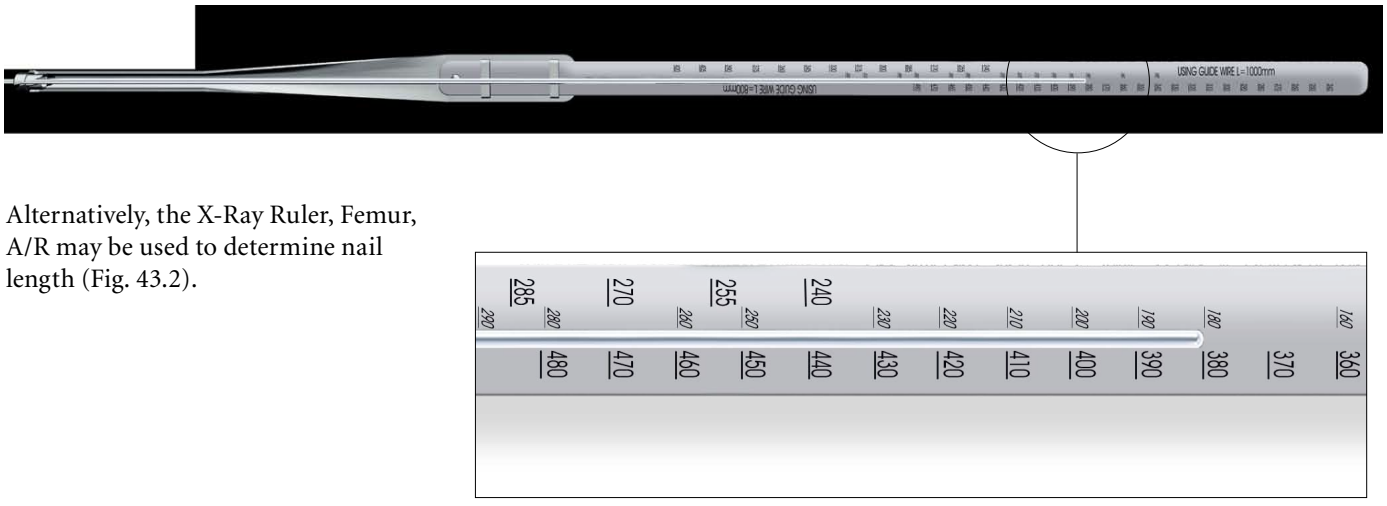


Fig. 44



Alternatively, the X-Ray Ruler, Femur, A/R may be used to determine nail length (Fig. 43.2).

Fig. 45

Nail Insertion

The selected nail is assembled onto the Targeting Device (1806-8000) with the Nail Holding Screw (1806-8005). Tighten the Nail Holding Screw with the Universal Joint Socket Wrench (1806-0400) securely so that it does not loosen during nail insertion
(Fig. 46).

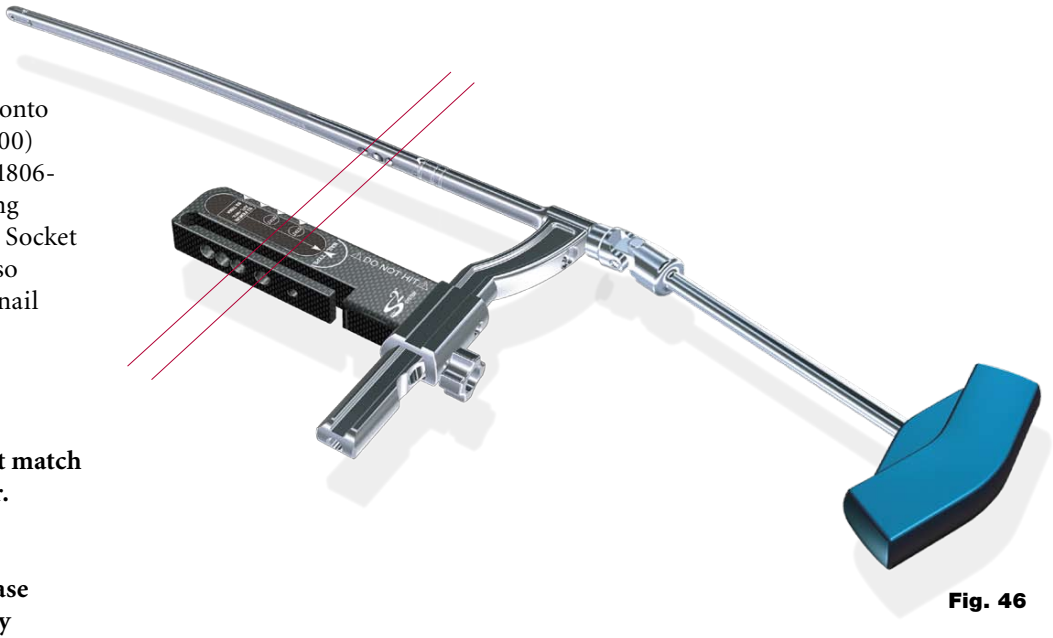


Fig. 46

Caution:

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

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 **S2** Femoral Nail A/R, 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 (Fig. 47).

Fig. 47

Additionally, a 3×285mm K-Wire may be inserted through the Targeting Device which identifies the junction of the nail and insertion post (Fig. 48).

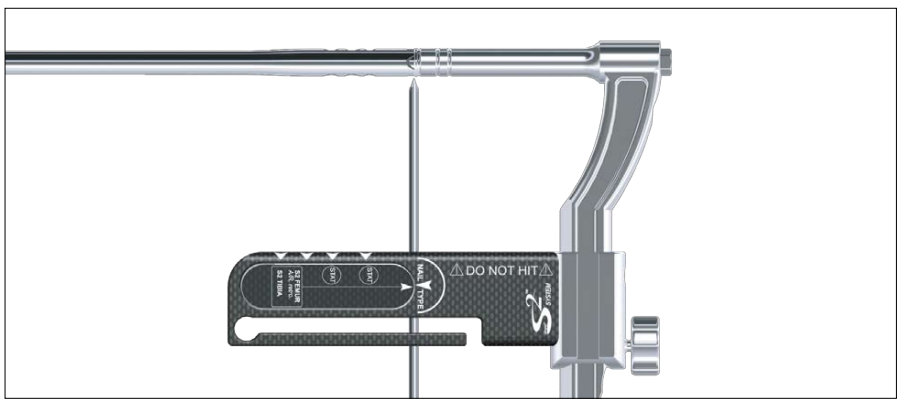


Fig. 48

Operative Technique - Retrograde Technique

The Slotted Hammer can be used on the Strike Plate or on the Insertion Wrench (1806-0135), that is placed on the Nail Holding Screw to insert the nail over the Guide Wire (Fig. 49).

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. Depth of insertion may be visualized with the aid of fluoroscopy (Fig. 50).

When inserting the S2™ Femoral Nail A/R in a retrograde approach, the nail is countersunk a minimum of 5mm to the chondral surface (Fig. 50 and 51).

The grooves on the insertion post situated at 10 and 15mm are used for visualisation of insertion depth in the antegrade approach.

Repositioning should be carried out either by hand or by using the Strike Plate attached to the hole next to the Nail Holding Screw. The Universal Rod and Slotted Hammer may then be attached to the Strike Plate to carefully and smoothly extract the assembly (Fig. 52).

Note:

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

Fig. 49

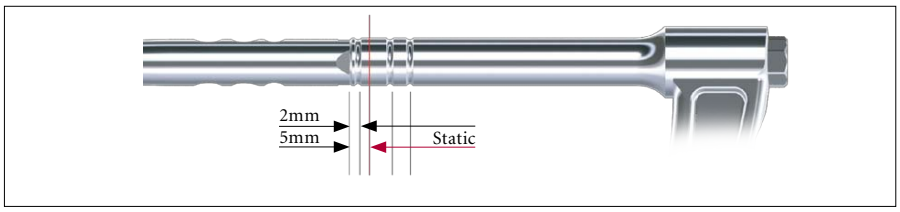


Fig. 50

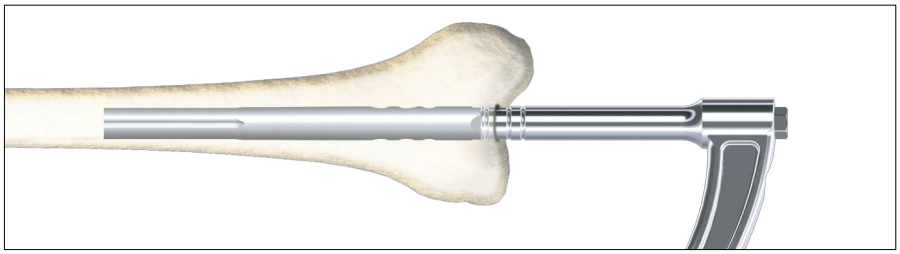


Fig. 51

Fig. 52

Distal Guided Locking Mode (via Target Device)

Before 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.

The Target Device consists of three main parts (Fig. 53):
1 Nail Adapter (1806-8001),
2 Targeting Adapter (1806-8002),
3 Fixation Screw (1806-1007),

The Fixation Screw will fix the Targeting Adapter on the Nail Adapter.

The Sleeve Fixation Screw is only used for antegrade oblique locking mode.

The Target Device with the Target Template placed into the Targeting Adapter is designed to provide distal M/L Locking Options in the retrograde approach (Fig. 54).

Note:
The Target Template (1806-8016) can be placed into the Targeting Adapter in one direction only. The arrow on the Target Template has to line up with the arrow on the Targeting Adapter.

Note:
The Target Template will block all locking holes in the Targeting Adapter that cannot be used with the selected nail.

Caution:
Do not use the Target Device without Target Template!

The Long Tissue Protection Sleeve (1806-0185) together with the Long Drill Sleeve (1806-0215) and the Long Trocar (1806-0315) are inserted into the Target Device by pressing the Safety Clip (Fig. 55). The Friction Locking 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.

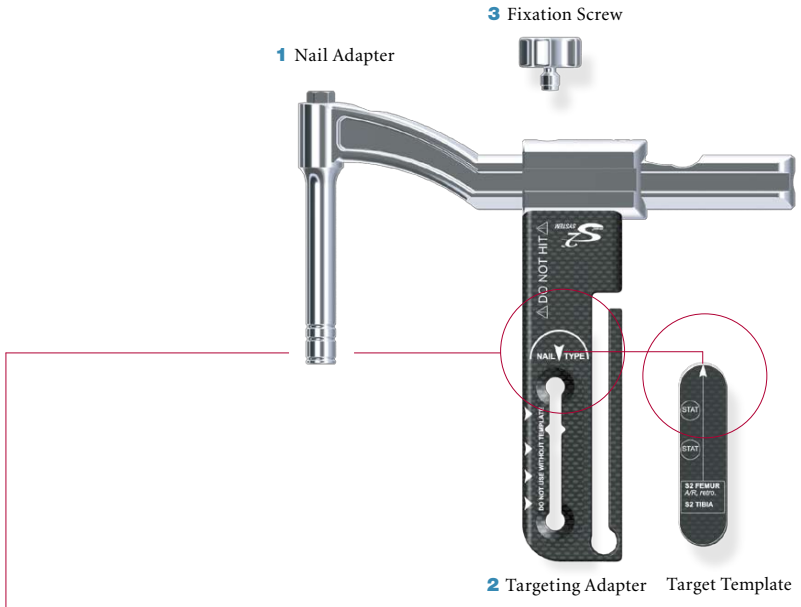


Fig. 53

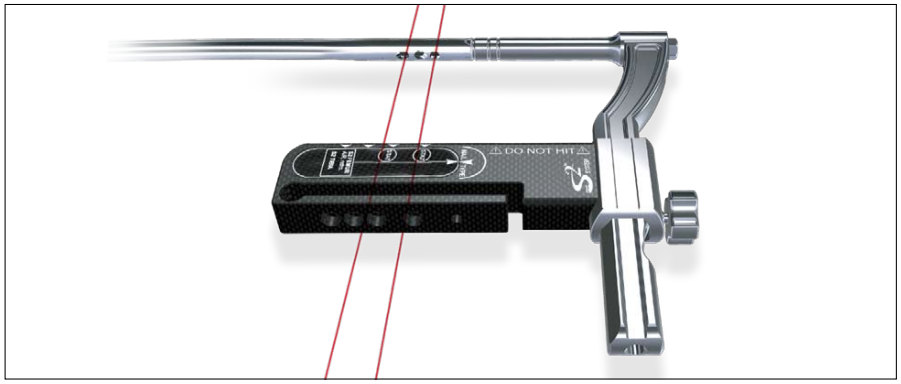


Fig. 54

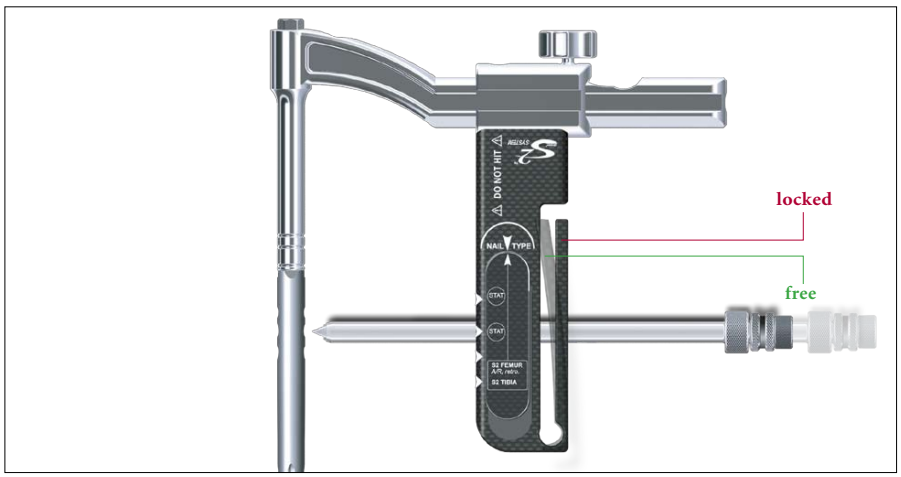


Fig. 55

Static Locking Mode - Fully Threaded Locking Screw

When treating supracondylar fractures, two M/L screws should be used whenever possible. Always start with the most proximal screw.

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 Template. A small skin incision is made, and the assembly is pushed through until the Tissue Protection Sleeve is in contact with the lateral cortex of the femur (Fig. 56).

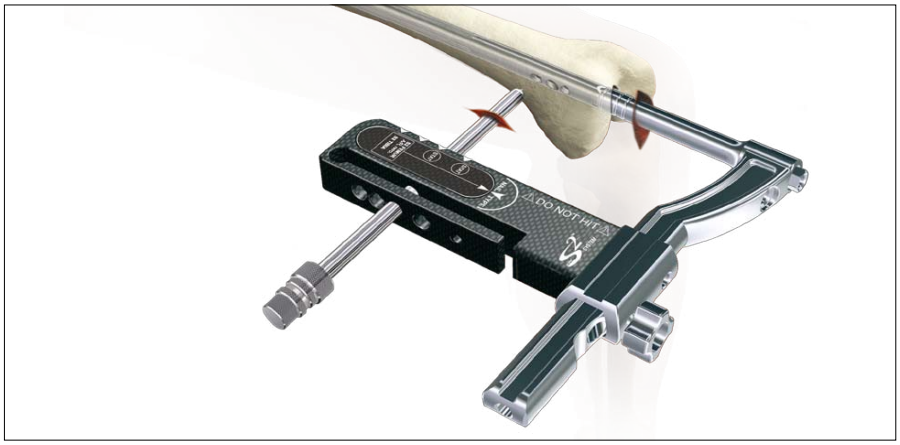


Fig. 56

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.

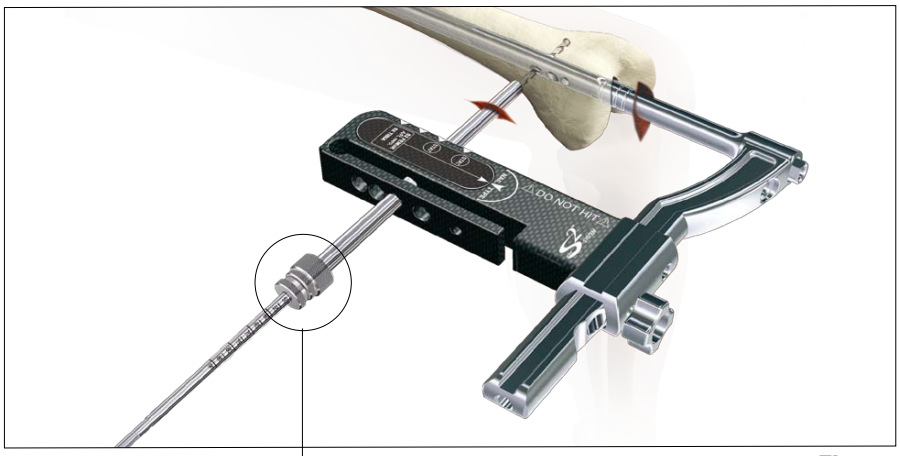


Fig. 57

After drilling both cortices, the screw length may be read directly from the calibrated Drill at the end of the Drill Sleeve (Fig. 57). If measurement with the Long Screw Gauge (1806-0325) is preferred, first remove the Drill Sleeve, Long and read the screw length directly at the end of the Tissue Protection Sleeve, Long.

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.

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. 58).

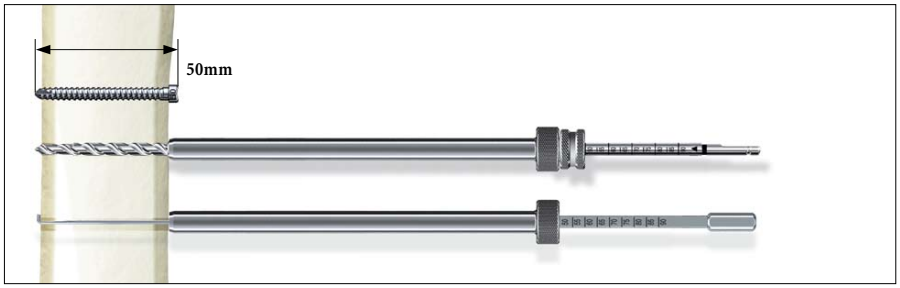


Fig. 58

Caution:

Make sure the Tissue Protection Sleeve/Drill Sleeve Assembly is seated on bone prior to selecting final screw length.

Alternatively, stop the drill when it engages the far cortex and measure the drill bit depth off of the calibrated drill. Add 5 mm to this length to obtain the correct screw length.

Operative Technique - Retrograde Technique

When the Drill Sleeve is removed, the correct Fully Threaded Locking Screw is inserted through the Tissue Protection Sleeve using the Long Screwdriver Shaft (1806-0227) with Teardrop Handle (702429) (Fig. 59).

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. 60).

Repeat the locking procedure for the other statically positioned Locking Screw (Fig. 61).

For locking the distal most hole, either a Fully Threaded Locking Screw or a Condyle Screw may be used.
Please refer to Chapter 6.8.2 for the Condyle Screw Locking Technique.

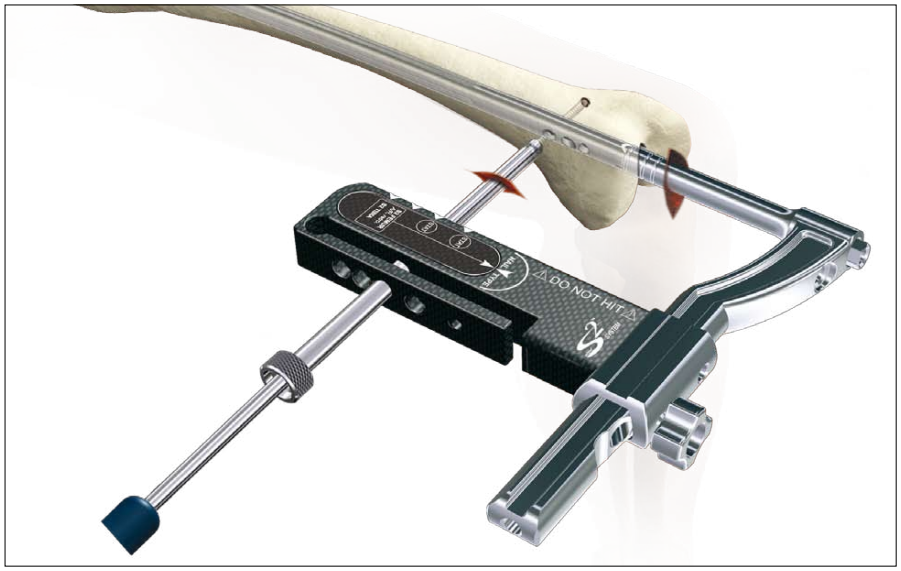


Fig. 59

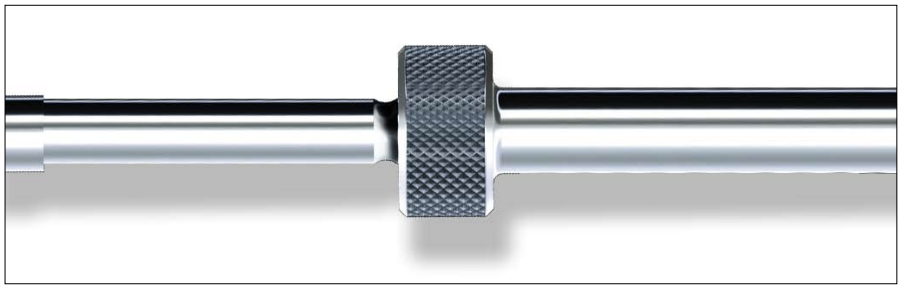


Fig. 60

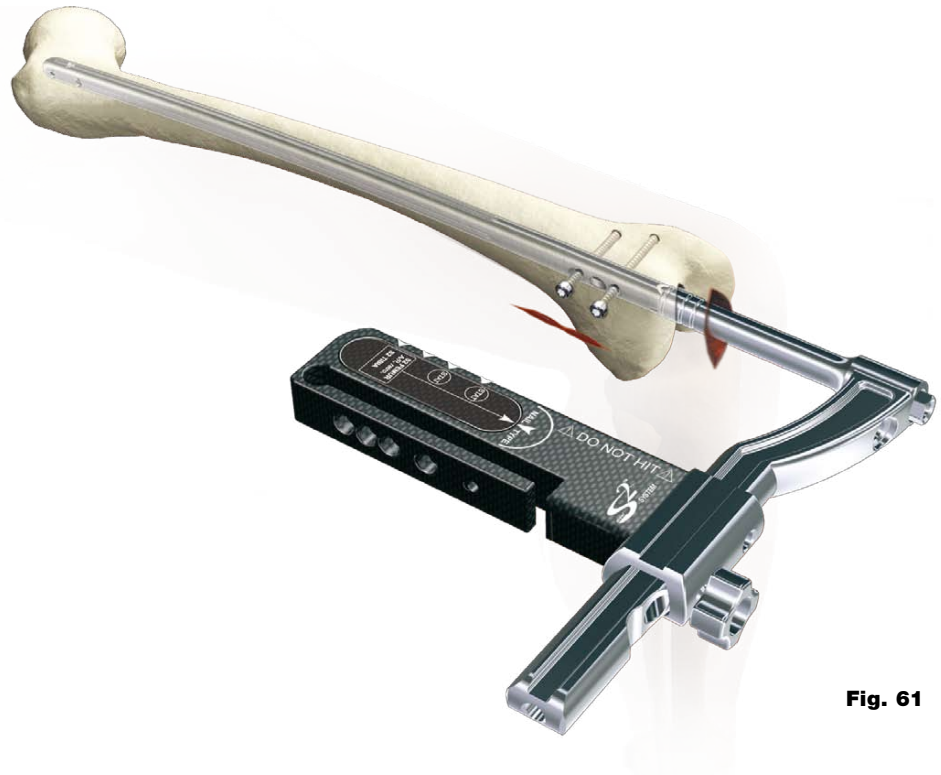


Fig. 61

Static Locking Mode - Condyle Screw

If a Condyle Screw is to be inserted, both cortices are drilled with the Ø5×340mm Drill (1806-5020S).

After drilling both cortices, the screw length may be read directly off of the calibrated Drill at the end of the Drill Sleeve.

Confirm the measurement with the Screw Gauge, Long. First remove the Drill Sleeve, Long and read the screw length directly at the end of the Tissue Protection Sleeve, Long (Fig. 62).

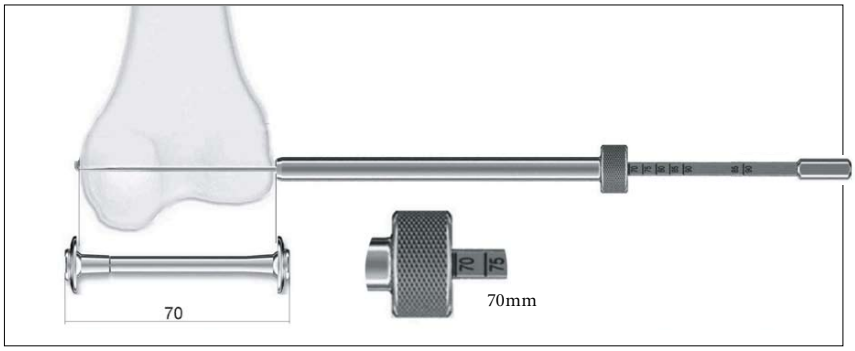


Fig. 62

Note:

The measurement equals Condyle Screw fixation length (from top of the Condyle Screw head to the top of Condyle Nut head, as shown in Fig. 62). The Condyle Screw length is defined with the Condyle Screw tip flush to the Condyle Nut head.

The possible fixation length can be 2mm longer than the Condyle Screw length or 5mm shorter.

Fig. 63

Caution:

Please ensure that the Condyle Nut is tightened a minimum of 5 turns on the Condyle Screw!

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 (Fig. 63).

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. 64a).

Condyle Screw - introduced M-L **Fig. 64a**

Operative Technique - Retrograde Technique

Alternatively, if patient anatomy allows, the Condyle Screw may be introduced from Lateral to Medial in a similar manner as described above (Fig. 64b).

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

Condyle Screw - introduced L-M **Fig. 64b**

The adjustable screw washers of the Condyle Screw and the Condyle Nut adapt to the surface of the bone eliminating the need to countersink both (Fig. 65).

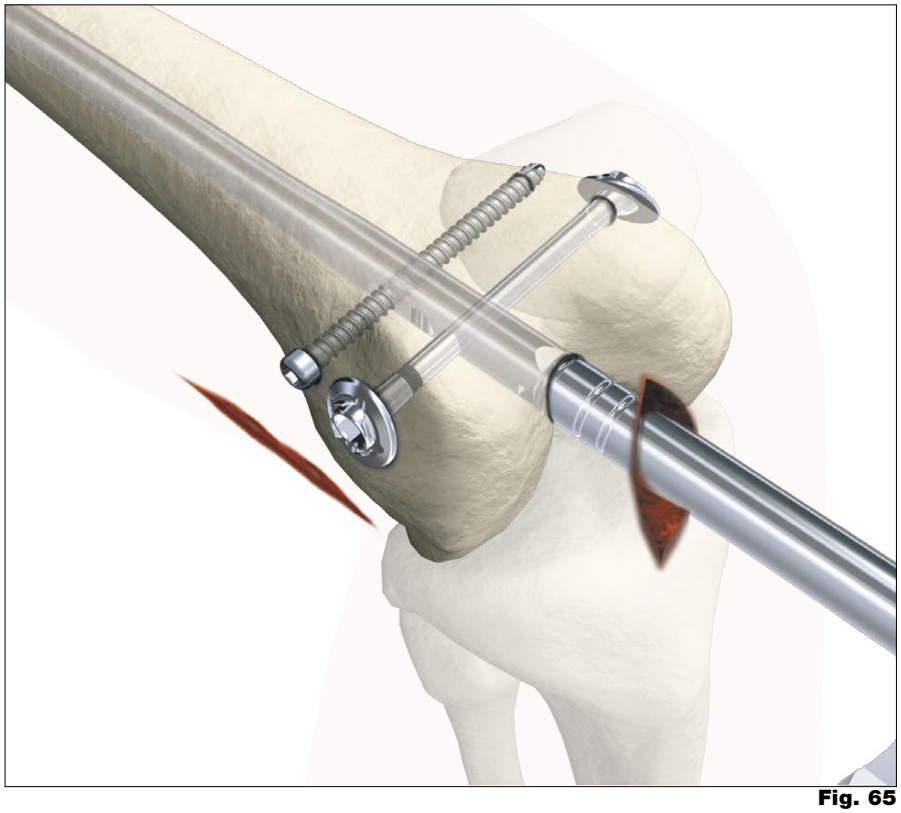


Fig. 65

Freehand Proximal Locking

The freehand technique is used to insert Locking Screws into the A/P round hole in the nail. Rotational alignment must be checked prior to locking the nail statically.

The M/L holes may also be used alternatively or in addition to the A/P Locking Screw 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 with the C-Arm.

The center-tipped Ø4.2×180 Drill (1806-4270S) or, optional Ø4.2×230 Drill (1806-4290S) is held at an oblique angle to the center of the locking hole (Fig. 66). Upon X-Ray verification, the Drill is placed perpendicular to the nail and drilled through the anterior and posterior cortices. Confirm that the Drill passes through the hole in the nail in both the A/P and M/L planes by X-Ray (Fig. 67).

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. 68).

Alternatively, the Screw Gauge (1806-0480) for Freehand technique can be used insted of the Screw Scale, Long to determine the screw length.

As with distal guided locking, 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. 69).

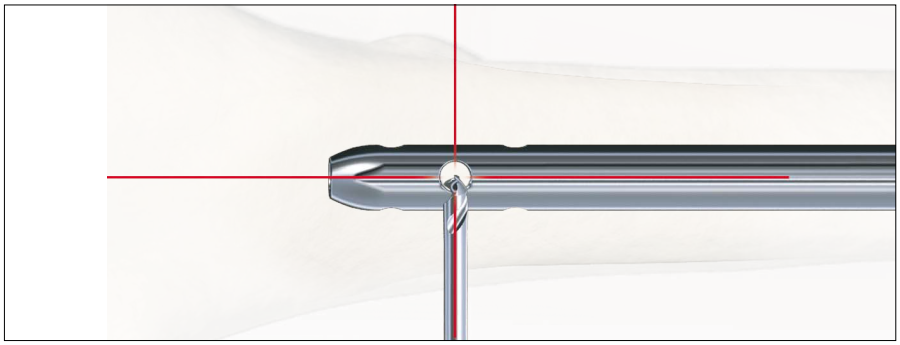


Fig. 66

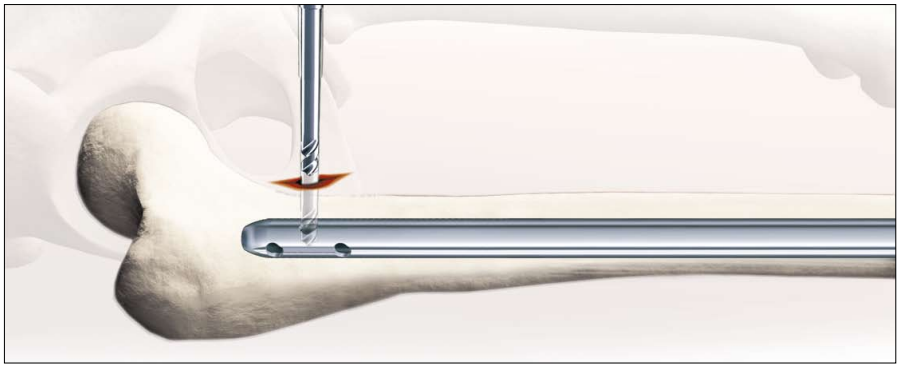


Fig. 67

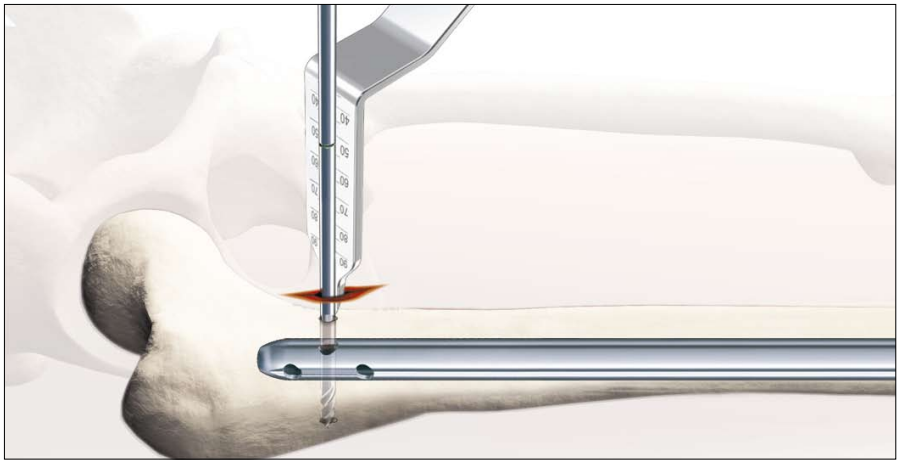


Fig. 68

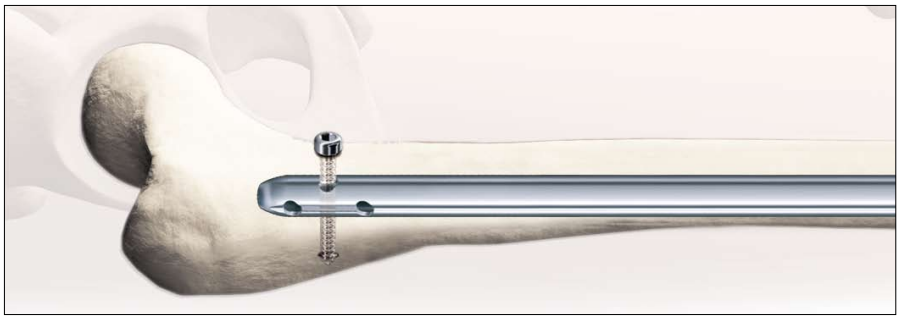


Fig. 69

End Cap Insertion

After removal of the Target Device, an End Cap is used. Four different sizes of End Caps are available to adjust nail length and to reduce the potential for bony ingrowth into the thread of the nail driving end (Fig. 70).

Note:

All End Caps are designed to tighten down on the first Locking Screw at the driving end of the nail. This will help prevent the nail from M/L sliding.

Fig. 70

The End Cap is inserted with the Long Screwdriver Shaft and Teardrop Handle after intra-operative radiographs show satisfactory reduction and hardware implantation (Fig. 71). Fully seat the End Cap to minimize the potential for loosening (Fig. 72).

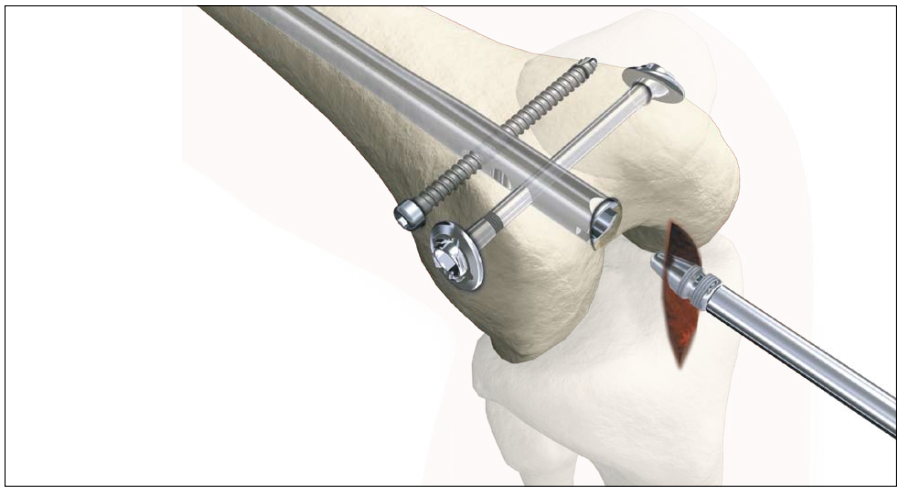


Fig. 71

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

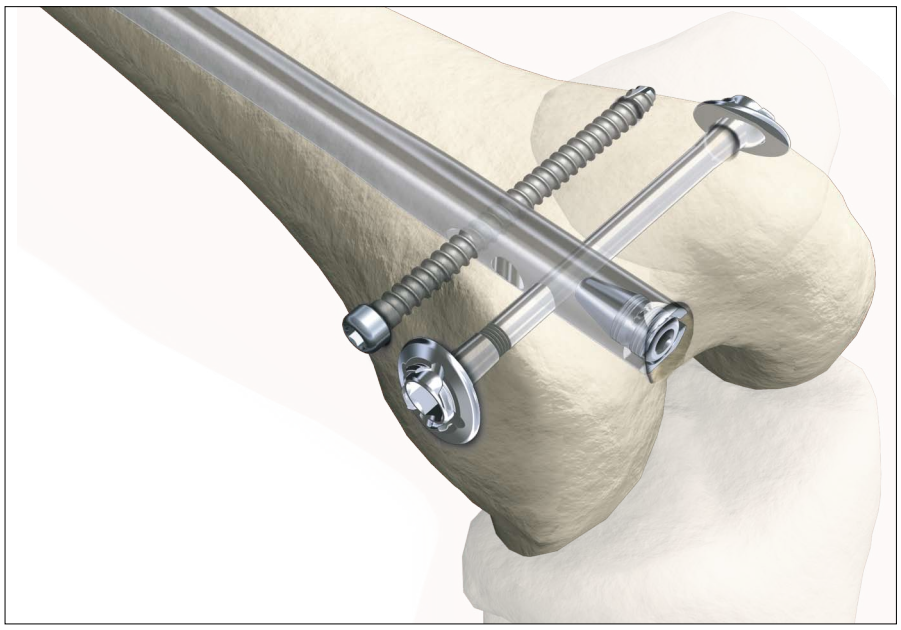


Fig. 72

Nail Removal

Nail removal is an elective procedure. If needed, the End Cap is removed with the Long Screwdriver Shaft and Teardrop Handle (Fig. 73).

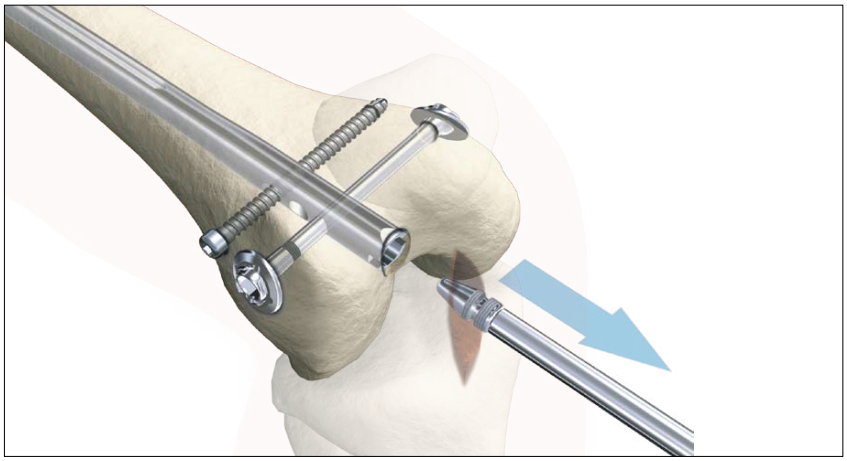


Fig. 73

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. 74). The optional Screw Capture Sleeve, Long (1806-0240) may be used on the Screwdriver.

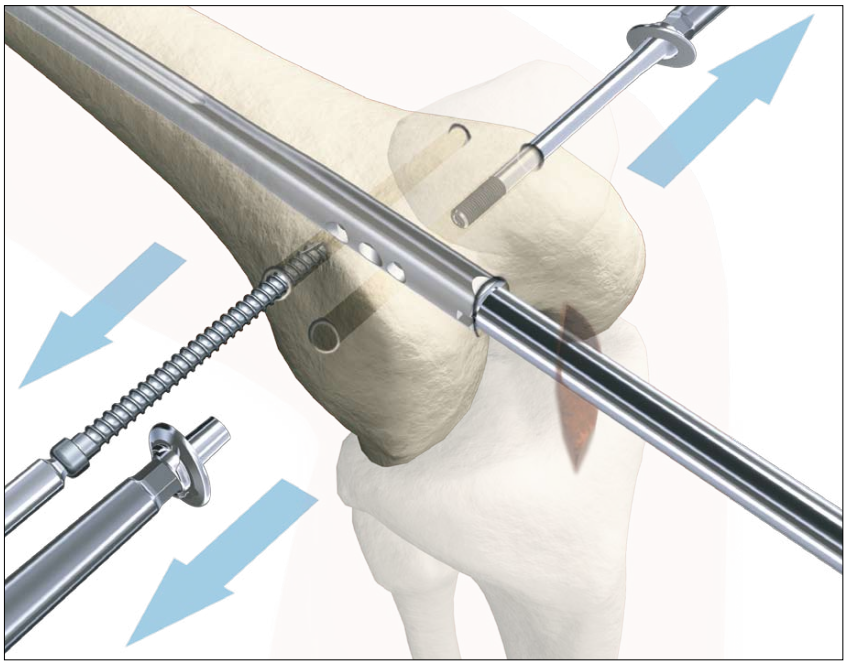


Fig. 74

The Slotted Hammer is used to extract the nail in a controlled manner (Fig. 75). A captured Sliding Hammer (1806-0175) is available as an optional addition to the standard instrument set.

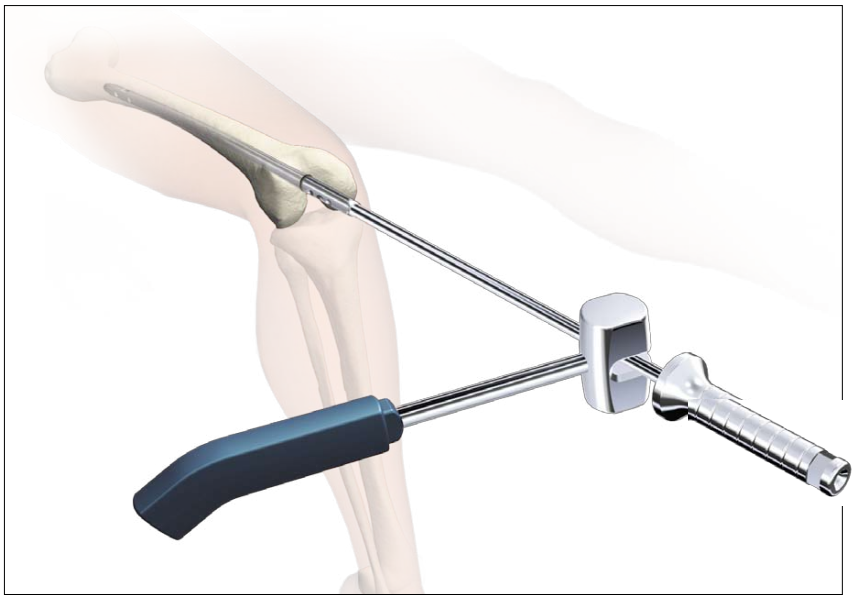


Fig. 75

Ordering Information - Implants

S2 Femoral Nail A/R

StSt REF	Diameter mm	Length mm
1732-0926S	9.0	260
1732-0928S	9.0	280
1732-0930S	9.0	300
1732-0932S	9.0	320
1732-0934S	9.0	340
1732-0936S	9.0	360
1732-0938S	9.0	380
1732-0940S	9.0	400
1732-0942S	9.0	420
1732-0944S	9.0	440
1732-0946S	9.0	460
1732-0948S	9.0	480
1732-1026S	10.0	260
1732-1028S	10.0	280
1732-1030S	10.0	300
1732-1032S	10.0	320
1732-1034S	10.0	340
1732-1036S	10.0	360
1732-1038S	10.0	380
1732-1040S	10.0	400
1732-1042S	10.0	420
1732-1044S	10.0	440
1732-1046S	10.0	460
1732-1048S	10.0	480
1732-1126S	11.0	260
1732-1128S	11.0	280
1732-1130S	11.0	300
1732-1132S	11.0	320
1732-1134S	11.0	340
1732-1136S	11.0	360
1732-1138S	11.0	380
1732-1140S	11.0	400
1732-1142S	11.0	420
1732-1144S	11.0	440
1732-1146S	11.0	460
1732-1148S	11.0	480
1732-1226S	12.0	260
1732-1228S	12.0	280
1732-1230S	12.0	300
1732-1232S	12.0	320
1732-1234S	12.0	340
1732-1236S	12.0	360
1732-1238S	12.0	380
1732-1240S	12.0	400
1732-1242S	12.0	420
1732-1244S	12.0	440
1732-1246S	12.0	460
1732-1248S	12.0	480

S2 Femoral Nail A/R

StSt REF	Diameter mm	Length mm
1732-1326S	13.0	260
1732-1328S	13.0	280
1732-1330S	13.0	300
1732-1332S	13.0	320
1732-1334S	13.0	340
1732-1336S	13.0	360
1732-1338S	13.0	380
1732-1340S	13.0	400
1732-1342S	13.0	420
1732-1344S	13.0	440
1732-1346S	13.0	460
1732-1348S	13.0	480
1732-1426S	14.0	260
1732-1428S	14.0	280
1732-1430S	14.0	300
1732-1432S	14.0	320
1732-1434S	14.0	340
1732-1436S	14.0	360
1732-1438S	14.0	380
1732-1440S	14.0	400
1732-1442S	14.0	420
1732-1444S	14.0	440
1732-1446S	14.0	460
1732-1448S	14.0	480

* Implants are packed sterile.

Ordering Information - Implants

5mm Fully Threaded Locking Screws

StSt REF	Diameter mm	Length mm
1796-5025S	5.0	25.0
1796-5027S	5.0	27.5
1796-5030S	5.0	30.0
1796-5032S	5.0	32.5
1796-5035S	5.0	35.0
1796-5037S	5.0	37.5
1796-5040S	5.0	40.0
1796-5042S	5.0	42.5
1796-5045S	5.0	45.0
1796-5047S	5.0	47.5
1796-5050S	5.0	50.0
1796-5052S	5.0	52.5
1796-5055S	5.0	55.0
1796-5057S	5.0	57.5
1796-5060S	5.0	60.0
1796-5065S	5.0	65.0
1796-5070S	5.0	70.0
1796-5075S	5.0	75.0
1796-5080S	5.0	80.0
1796-5085S	5.0	85.0
1796-5090S	5.0	90.0
1796-5095S	5.0	95.0
1796-5100S	5.0	100.0
1796-5105S	5.0	105.0
1796-5110S	5.0	110.0
1796-5115S	5.0	115.0
1796-5120S	5.0	120.0

Condyle Screws

StSt REF	Diameter mm	Length mm
1795-5040S	5.0	40
1795-5045S	5.0	45
1795-5050S	5.0	50
1795-5055S	5.0	55
1795-5060S	5.0	60
1795-5065S	5.0	65
1795-5070S	5.0	70
1795-5075S	5.0	75
1795-5080S	5.0	80
1795-5085S	5.0	85
1795-5090S	5.0	90
1795-5095S	5.0	95
1795-5100S	5.0	100
1795-5105S	5.0	105
1795-5110S	5.0	110
1795-5115S	5.0	115
1795-5120S	5.0	120

End Caps

StSt REF	Diameter mm	Length mm
1722-0003S	8.0	0
1722-0005S	11.5	+5
1722-0010S	11.5	+10
1722-0015S	11.5	+15

Nut for Condyle Screws

StSt REF	Diameter mm	Length mm
1795-5001S	5.0	

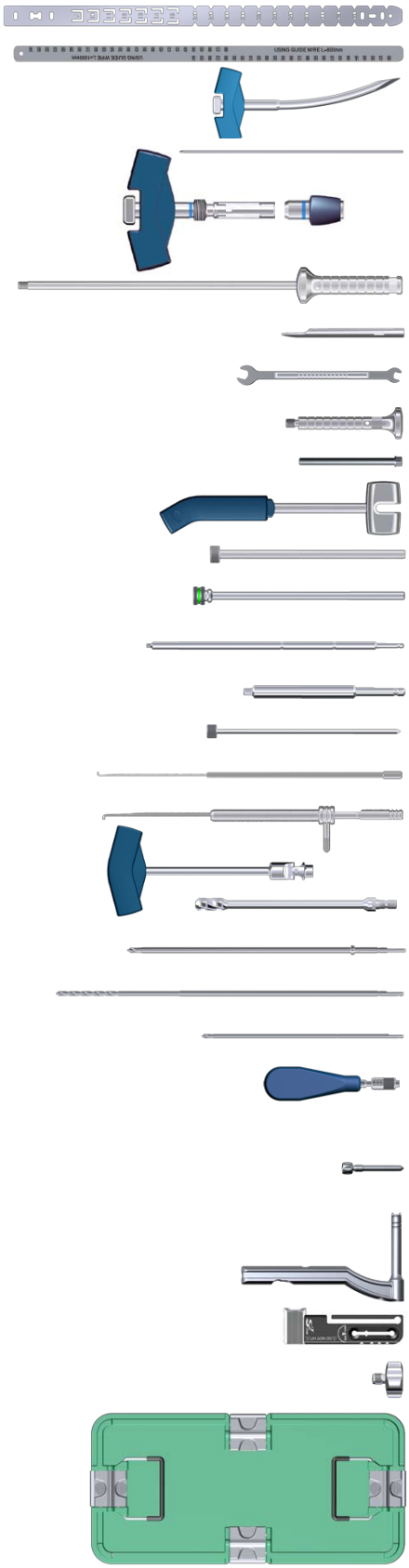
Set Screw – Proximal

StSt REF	Diameter mm	Length mm
1722-0002S	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 REF. Number.

Ordering Information - Instruments

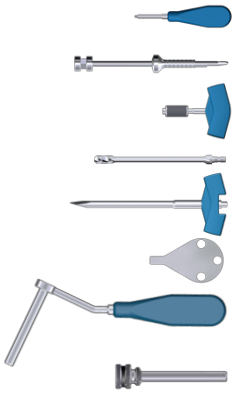


REF	Description
S2 Femur A/R – Standard Instruments	
1806-8011	X-Ray Ruler, Femur, A/R
1806-0020	Guide Wire Ruler
1806-0040	Awl, Curved, Ø10mm
1806-0050	K-Wire 3×285mm (outside of U.S.)*
1806-1095	Guide Wire Handle
1806-1096	Guide Wire Handle Chuck Ø2-3,5 mm
1806-0110	Universal Rod
1806-0125	Reduction Spoon
1806-0130	Wrench 8mm/10mm
1806-0150	Strike Plate
1806-8005	S2 Nail Holding Screw (2 each)
1806-0170	Slotted Hammer
1806-0185	Tissue Protection Sleeve, Long
1806-0215	Drill Sleeve, Long
1806-0227	Screwdriver Shaft AO, Long
1806-0292	Screw Driver Shaft, 3.5×85mm
1806-0315	Trocar, Long
1806-0325	Screw Gauge, Long
1806-0480	Long Screw Gauge (20mm-80mm)
1806-0400	Socket Wrench, Universal Joint 10mm
1806-2012	Rigid Reamer Ø12mm
1806-8018	Drill Ø4.2×250, AO, (outside of U.S.)*
1806-4260	Drill Ø4.2×340, AO, (outside of U.S.)*
1806-4270	Drill Ø4.2×180, AO, (outside of U.S.)*
702429	Teardrop Handle, AO coupling
1806-8016	Target Template
1806-8003	Sleeve Fixation Screw
1806-8000	Target Device, S2 (3 components)
1806-8001	S2 Nail Adapter
1806-8002	S2 Targeting Adapter
1806-1007	Fixation Screw
1806-8022	Dedicated Instrument Box, S2

* Outside of the U.S., instruments with an „S“ may be ordered non-sterile without the „S“ at the end of the corresponding REF. NO.

Ordering Information - Instruments

REF	Description
Optional Insrtuments	
1806-8006	X-Ray Template, Femur, A/R
1806-0045	Awl, Straight, Ø10mm
1806-0032	Awl Plug
0152-0218S	K-Wire for Condyle Screw, sterile (U.S.)
1806-0050S	K-Wire 3×285mm, sterile (U.S.)
1806-0135	Insertion Wrench, 10mm
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
1806-0240	Screw Capture Sleeve, Long
1806-0255	Screwdriver, Condyle Screw (2 each)
1806-0365	Screw Scale, Long
0152-0218	K-Wire for Condyle Screw, (outside of U.S.)*
703165	Protection Sleeve, Retrograde
1806-0270	Ratchet T-Handle AO
1806-0041	Awl, Curved, 90° Handle
1806-0350	Extraction Rod, Conical, Ø8mm
1806-8018S	Drill Ø4.2×250, AO, sterile (U.S.)*
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.)*
1806-4290	Drill Ø4.2×230, AO, (outside of U.S.)*
1806-5000S	Drill Ø5.0×230, AO, sterile (U.S.)*
1806-5000	Drill Ø5.0×230, AO, (outside of U.S.)*
1806-5020S	Drill Ø5.0×340, AO, sterile (U.S.)*
1806-5020	Drill Ø5.0×340, AO, (outside of U.S.)*
1806-0257	Revision Screwdriver Bit, Condyle Screw
1806-0203	Screwdriver, Self-Holding, Extra Short 3.5 mm
1806-0233	Screwdriver, Self-Holding, Long 3.5 mm
1806-0238	Screwdriver, Self-Holding, Short 3.5 mm
1806-9035	**S2 Combined Instrument Box (5 Components)**
1806-9051	Opening/Insertion Universal Insert
1806-9052	Locking Insert, long sleeves
1806-9055	S2 Targeting Insert
1806-9059	Metal Base Box
1806-9061	Lid Stryker IM Instruments
1806-9036	**S2 Combined Instrument Set (U.S.)**



REF	Description
Special Order Items	
1806-0202	Srewdriver, Extra Short
1806-0340	Extraction Adapter
702427	T-Handle, AO Coupling
1806-2011	Rigid Reamer, Ø11.5mm
1806-0047	Awl, Straight Ø11.5mm
0140-0002	Reaming Protector
1806-0450	Long Freehand Tissue Protection Sleeve
1806-0460	Long Drill Sleeve Ø 4.2mm

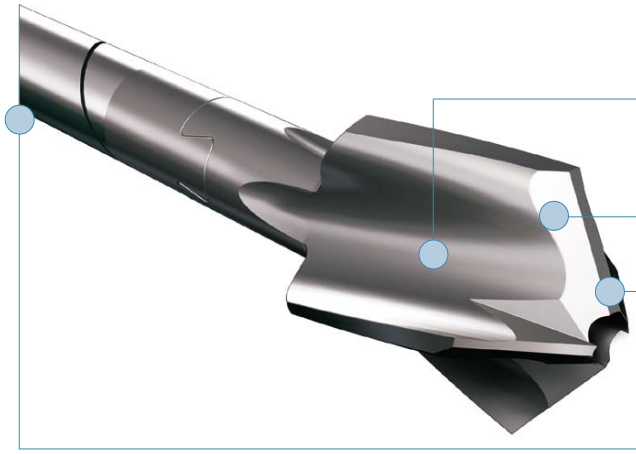
REF	Description
Spare Parts	
1806-1097	Handle
1806-0098	Cage
1806-0099	Clamping Sleeve

* Outside of the U.S., instruments with an „S“ may be ordered non-sterile without the „S“ at the end of the corresponding REF. NO.

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.

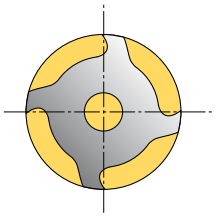
Cutting flute geometry optimized to lower pressure generation.

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.

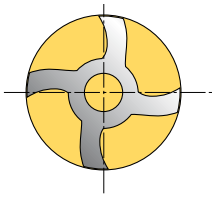
Smaller, 6 and 8mm shaft diameters significantly reduce IM pressure.

Typical Standard
Reamer Ø14mm

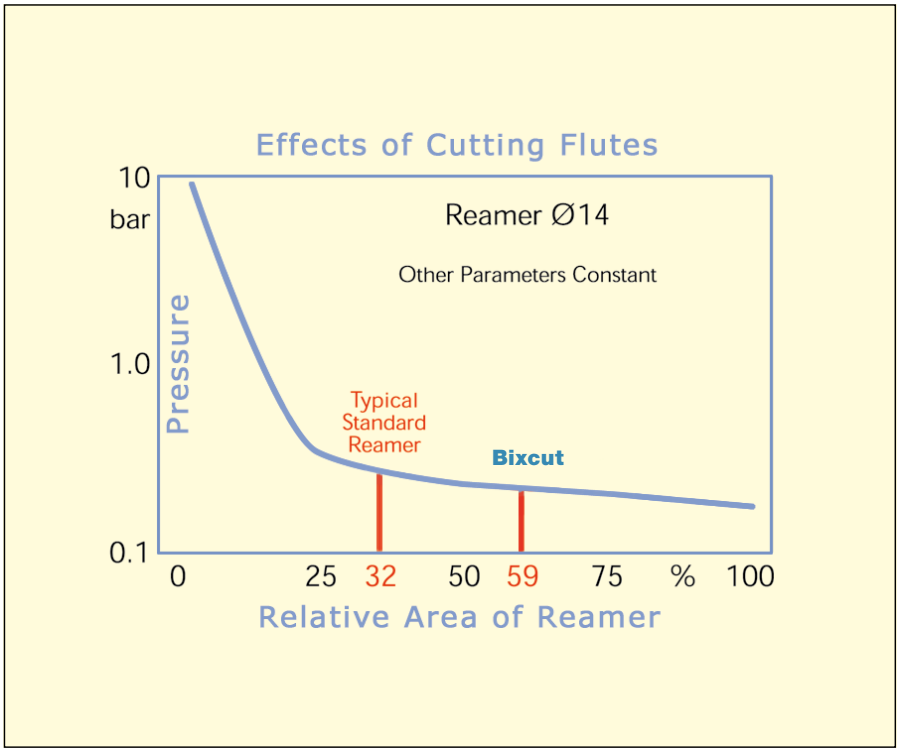


Clearance area:
32% of cross section

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] 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

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 Shafts (Sterile)[1,2,3,4]

REF	Description	Length mm
0227-8240S	Mod. Trinkle	284
0227-3000S	Mod. Trinkle	448
0227-8510S	Mod. Trinkle	510
0227-8885S	Mod. Trinkle	885
0226-8240S	AO	284
0226-3000S	AO	448

Shaft Accessories

REF	Description
3212-0-210	Grommet (pack of 25)
3212-0-220	Grommet inserter/extractor
0225-6010	Grommet Case

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

Optional Instruments

REF	Description
5235-6-606	Hand Reamer 6 mm w/T-Handle
5235-6-607	Hand Reamer 7 mm w/T-Handle
5235-6-608	Hand Reamer 8 mm w/T-Handle
5235-6-609	Hand Reamer 9 mm w/T-Handle
0227-0060	Hand Reamer 6 mm w/Mod Trinkle connection
0227-0070	Hand Reamer 7 mm w/Mod Trinkle connection
0227-0080	Hand Reamer 8 mm w/Mod Trinkle connection
0227-0090	Hand Reamer 9 mm w/Mod Trinkle connection
1806-6520	Curved Reduction Rod 8.5 mm w/Mod Trinkle connection
1806-6500	T-Handle w/Mod Trinkle connection

Bixcut Trays empty

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)
0225-6040	Mini Trauma Tray (for modular heads 9-18)
0225-6050	Mini Revision Tray (for modular heads 9-28)

Note:

Bixcut Fixed Head – Modified Trinkle fitting+ available in same diameters and length as the AO Fitting (REF No: 1227-xxxx)

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

** Use with Stryker Power Equipment

1. Non-Sterile shafts supplied without grommet. Use new grommet for each surgery. See Shaft Accessories.
2. Sterile shafts supplied with grommet pre-assembled.
3. For Non-Sterile leave "S" off the REF Number when ordering (510 and 885mm available only sterile Modified Trinkle Fitting).
4. Non-Sterile, AO Fitting Shafts in 510 and 885mm are available as build to order items:

- CM810921 AO Fitting Shaft, length 510mm
- CM810923 AO Fitting Shaft, length 885mm

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Germany

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