

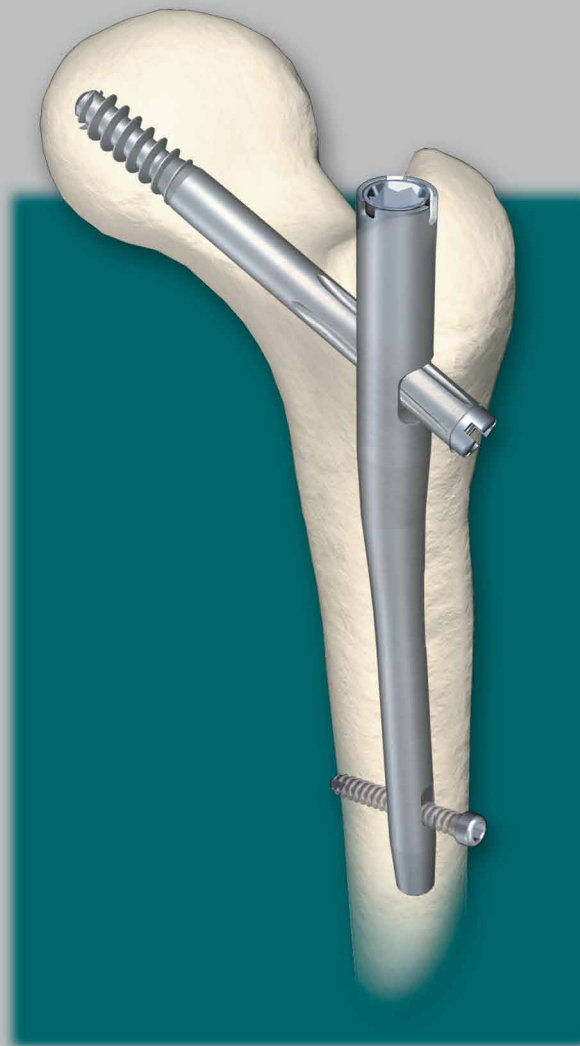
stryker®

# Gamma3

## Trochanteric Nail 180

Operative Technique

Hip Fractures



# Trochanteric Nail 180

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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 recommended prior to first surgery.

All non-sterile devices must be cleaned and sterilized before use. Follow the instructions provided in our reprocessing guide (L24002000). Multi-component instruments must be disassembled for cleaning. Please refer to the corresponding assembly/disassembly instructions.

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:**

##### **Fixation Screws:**

**Stryker Osteosynthesis bone screws are not approved or intended for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic or lumbar spine.**

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# Introduction

The Gamma3 Locking Nail System was developed based on more than 15 years of Gamma Nail experience. This is the third generation of Gamma intramedullary short and long fixation nails.

The evolution of the successful Trochanteric and Long Gamma Nails as well as the Asia Pacific and Japanese versions followed strictly a step-by-step enhancement based on the clinical experience of the clinical outcome from surgeons all over the world.

The newest generation nail, Gamma3, is designed to facilitate minimally invasive surgery and to help reduce the OR time to a minimum with the aid of using the state-of-the-art instrumentation and an optimized surgical technique.

The nails have a proximal diameter of 15.5mm to help minimize the incision length required for minimally invasive surgery. Nevertheless, they offer the same biomechanical strength and cut-out resistance as the well established Trochanteric and Long Gamma Nails.

The Lag Screw shape has been improved, especially in the area of the thread and the cutting flutes at the tip of the screw. This design offers superior cutting behavior during Lag Screw insertion, providing very low insertion torque.

The thread design also offers excellent grip in the cancellous bone of the femoral head and strong resistance against cut-out.

The 5mm distal locking screws are also used in the T2 intramedullary nailing system.

A major advantage of the system is the state-of-the-art instrument platform. The instruments are designed for a minimally invasive surgical technique and may reduce OR time to a minimum. The instruments are easy to use and easy to clean, and they share the same platform as the Stryker intramedullary T2 and S2 nails.

## Acknowledgements:

Our thanks are due to the many surgeons who supported the development of the Gamma3 System, with their feedback and ideas during worldwide panel meetings. They have helped the Gamma3 System to be what it is today.

Special thanks to the Asian Pacific Technical Committee, who supported very early the idea of smaller implants for the treatment of proximal femur fractures.



# Features

## Design Features of the Gamma3 System

Gamma3 Locking Nails come in 3 neck-shaft angles of 120, 125 and 130°.

- In the following, the Trochanteric Nail 180 is called: Gamma3 Nail 180

All nails\* use the same Lag Screws, Set Screw, distal Locking Screws and End Caps (see Fig. 3).

### Gamma3 Nail 180

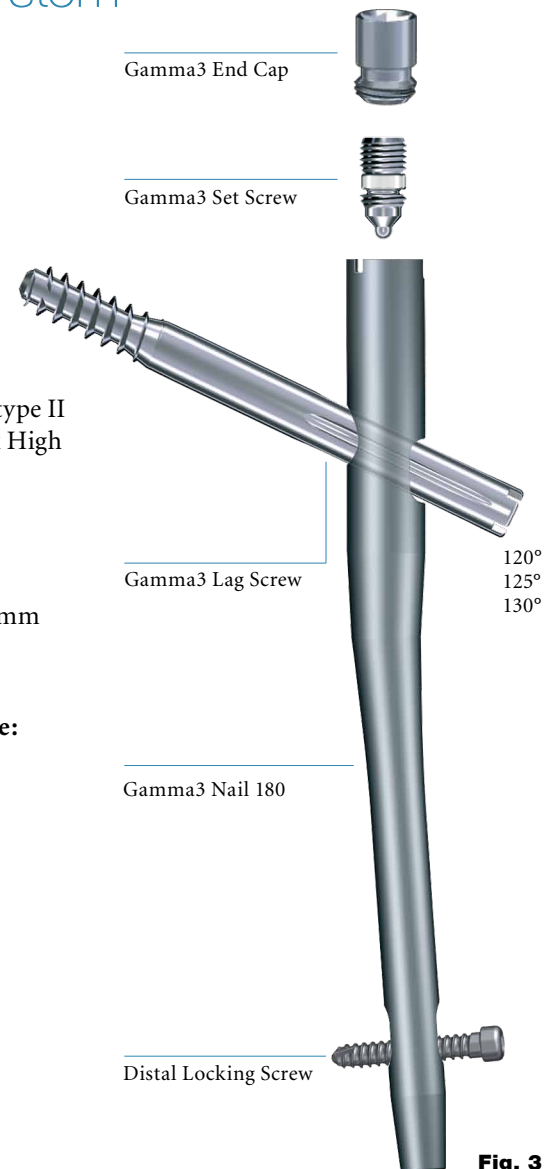
The anatomical shape of the nail is universal for all indications involving the treatment of trochanteric fractures. The nail is cannulated for Guide-Wire-controlled insertion and features a conical tip for optimal alignment with the inner part of the cortical bone.

A range of three different neck-shaft angles are available for Lag Screw entry to accommodate variations in femoral neck anatomy.

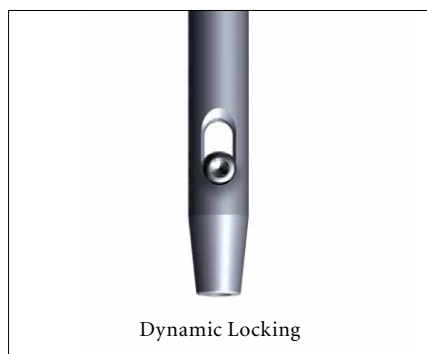
A single distal Locking Screw is provided to stabilize the nail in the medullary canal and to help to prevent rotation in complex fractures. The oblong hole allows for static or dynamic locking.

### Technical Specifications:

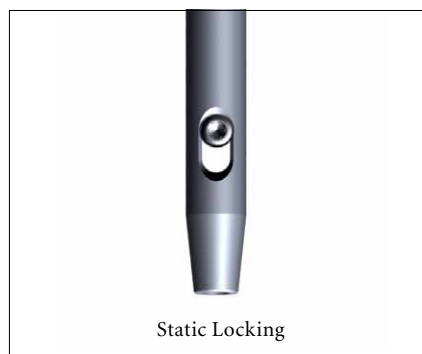
- **Material:**  
Titanium alloy with anodized type II surface treatment or Orthinox High Strength Stainless Steel
- **Nail length:**  
180mm
- **Nail diameter:**  
proximal 15.5mm, distal: 11.0mm
- **Proximal Nail angle range:**  
120°, 125°, 130°
- **M-L bend for valgus curvature:**  
4 degrees
- **End Caps** in lengths of  
0mm, +5mm and +10mm
- **Distal oblong hole** for  
5mm screws; up to 5mm dynamization is possible



**Fig. 3**



**Fig. 1**



**Fig. 2**

### Distal Locking Options

- Locking in the distal part of the oblong hole creates a dynamic locking mechanism (see Fig. 1).
- Locking in the proximal part of the oblong hole allows static locking of the nail (see Fig. 2).

\* Each nail is supplied sterile packaged together with a Set Screw in one box.

# Features

## Lag Screw and Set Screw Function

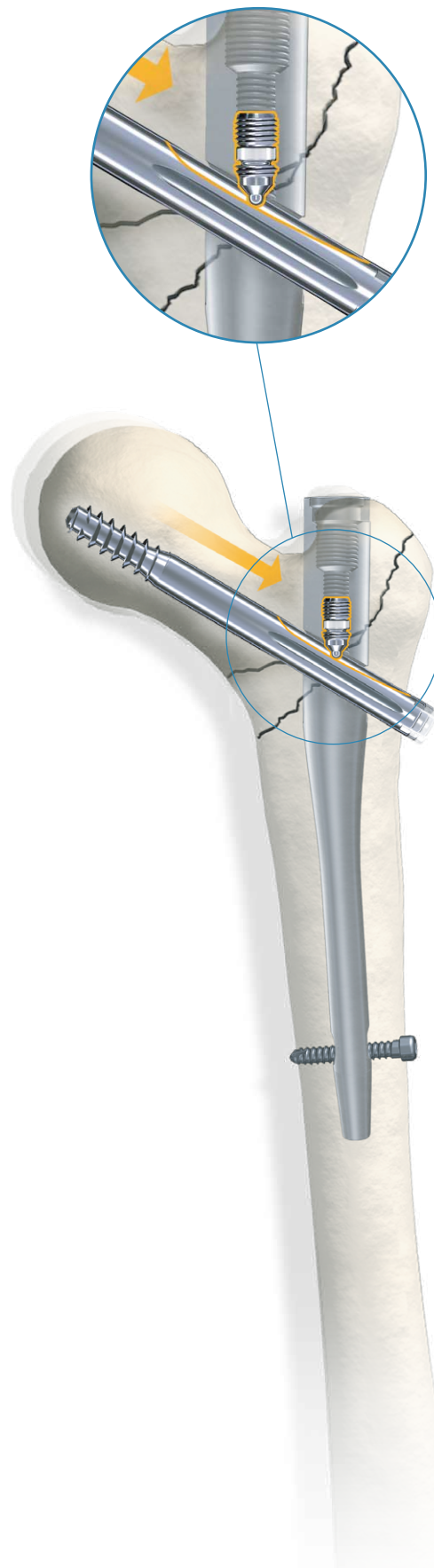
The Lag Screws are designed to transfer the load of the femoral head into the nail shaft by bridging the fracture line to allow faster and more secure fracture healing. The load carrying thread design of the Gamma3 Lag Screw allows for large surface contact to the cancellous bone. This provides high resistance against cut out. The Gamma3 Lag Screw has a self-tapping thread and it is designed for easy insertion.

The Set Screw is designed to fit into one of the four grooves of the shaft of the Lag Screw. This prevents both rotation and medial migration of the Lag Screw.

The nail allows sliding of the Lag Screw to the lateral side for dynamic bone compression at the fracture site to enhance fracture healing.

### Technical Specifications

- Lag Screw diameter: 10.5mm
- Lag Screw lengths: 70–120mm in 5mm increments.
- Lag Screw design for high load absorption and easy insertion.
- Asymmetrical depth profile to allow the Lag Screw to slide in the lateral direction only (see orange arrow on Fig. 4).
- Self retaining Set Screw to protect the Lag Screw against rotation and simultaneously allowing sliding of the Lag Screw laterally.

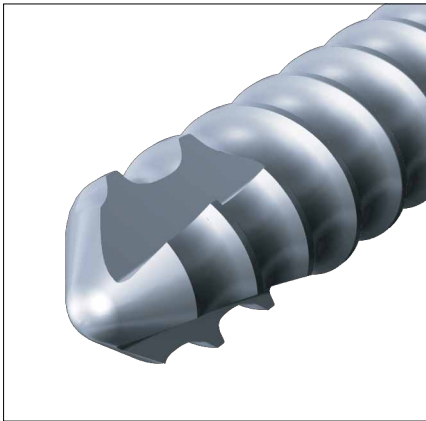


**Fig. 4**  
**Lag Screw Stabilization System**

# Features

## Distal Locking Screws

The distal Locking Screw has a short self-tapping tip which facilitates a faster and easier start as well as easy screw insertion. It helps to promote excellent surface to bone contact (Fig. 5).



**Fig. 5**

The screw has an external diameter of 5mm, and provides an even higher fatigue strength than the clinically successful 6.28mm Locking Screw of the former generation of Gamma systems (data on file).

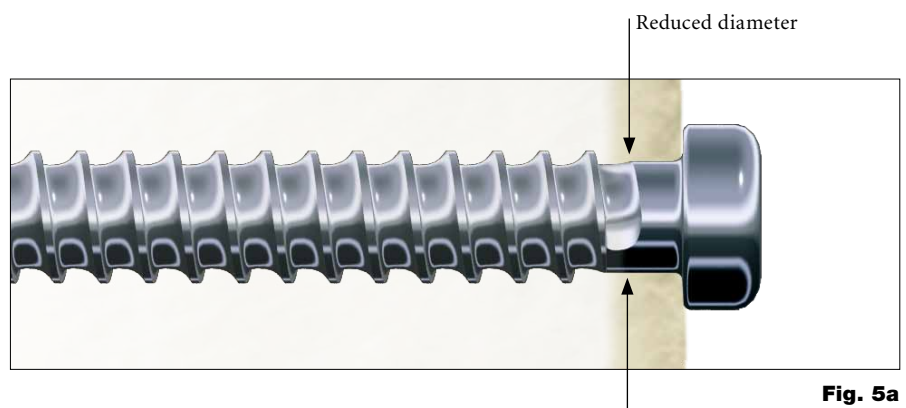
The screw diameter directly under the screw head has been reduced to prevent radial pressure that may cause micro-fractures during screw insertion when the screw head reaches its final position. This reduction in diameter also improves the feel on the final tightening of the screw (Fig. 5a).

### Length Definition of the Distal Locking Screw

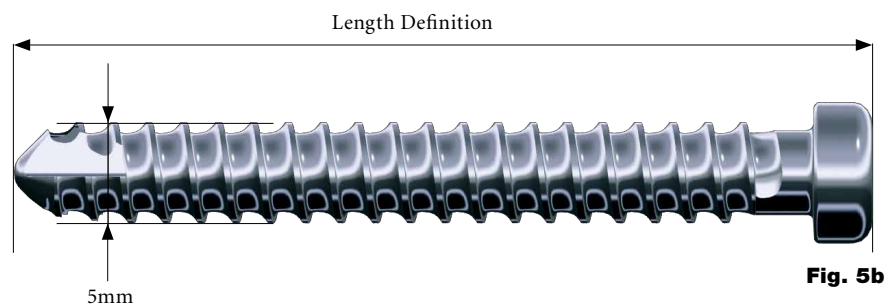
The distal Locking Screw is measured from head to tip (Fig. 5b).

### Technical Specifications

- Distal Locking Screw Diameter: 5mm.
- Distal Locking Screw lengths ranging from 25–50mm, in 2.5 and 5mm increments. Longer screws up to 120mm are available on request.
- Fully threaded screw design. Partially threaded screws are available on request.
- Self-tapping screw tip with optimized short cutting flutes.
- Optimized diameter under the head helps to prevent micro – fractures during insertion.



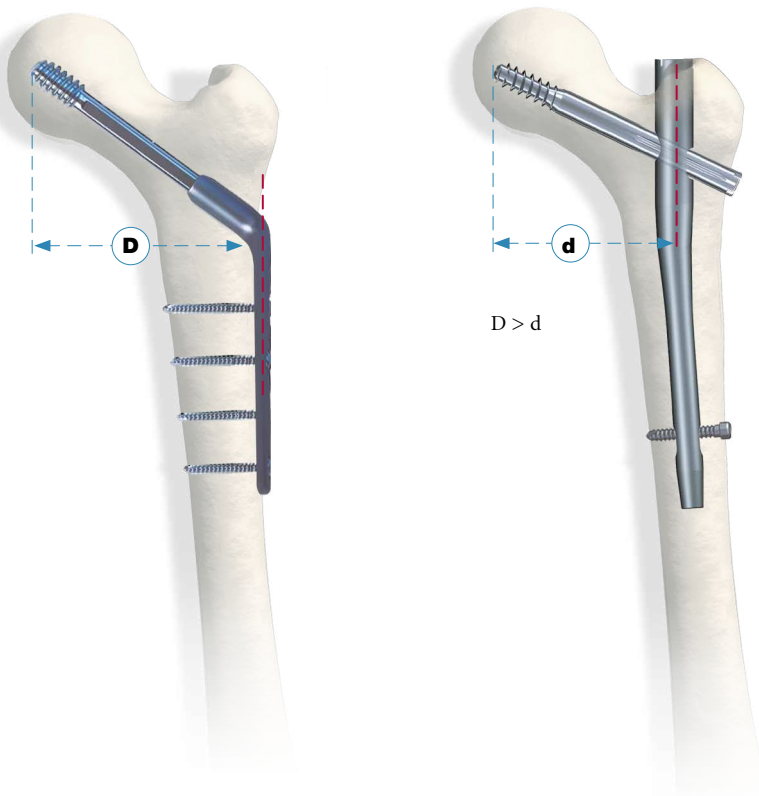
**Fig. 5a**



**Fig. 5b**



# Features



**Fig. 6**

## Gamma3 System Benefits

### Strength and Stability

The biomechanical features of the intramedullary system offer significantly greater strength and stability compared with the side plate, in clinical use[1]. The Gamma3 system offers the same strength as the well-established Gamma Locking Nail System.

### The Biomechanical Advantage over Side-Plate Systems

Since the load-bearing axis of the Gamma3 Nail is closer to the hip joint fulcrum, the effective lever arm on the implant and femur is significantly shorter than with an extramedullary plate. The reduction factor is equivalent to  $d/D$  as shown in Figure 6 (approximately 25% [1]).

The resultant force is transmitted directly down the femur using a nail system. If a side-plate system is used, the femur shaft may be weakened through a high number of screws. The Gamma3 Nail increases both the strength and reliability of the biomechanical repair. The distal dynamic locking option additionally allows the use of dynamic compression.

### Rehabilitation Benefits

The extra strength effectively gained through the biomechanics of the Gamma3 System combined with improved control of axial telescoping and rotational instability may allow earlier weight-bearing. Early mobilization, dynamic compression, and a less traumatic operative technique help to increase the chance for rapid recovery and reliable bone union.

[1] K.S.Leung et al, Multicenter Trial of the Modified Gamma Nail in East Asia CORR323: 146-154, 1996



# Indications, Precautions & Contraindications

## Indications

The indications for the Gamma3 Nail 180 are the same of those for the Gamma Trochanteric Locking Nail (Fig. 7).

- Intertrochanteric fractures
- Pertrochanteric fractures
- Nonunion and malunion

## Contraindications

Contraindications are medial neck fractures and sub-trochanteric fractures.

### Caution:

**The Gamma Nail is designed for temporary implantation until the bone consolidation occurs.**

**Therefore, if no bone consolidation occurs or if consolidation is not sufficient, the system may break. The aim of post-operative care must be to ensure the promotion of bone consolidation. The Gamma Nail is not intended for full weight bearing in patients with complex unstable fractures until sufficient bone consolidation is confirmed in the follow up X-rays.**

The aim of this operative technique manual is to provide the surgeon with a simple step-by-step operating guide to aid in successful addition of the Gamma3 System into their standard trauma care. Once the technique has been learned, the surgeon should find the operative procedure simple to implement. In fact, many of the basic principles for the Gamma3 System are those employed for all closed intramedullary nailing procedures.

## Precautions

Stryker Osteosynthesis systems have not been evaluated for safety and use in MR environment and have not been tested for heating or migration in the MR environment, unless specified otherwise in the product labeling or respective operative technique.

This operative technique has been devised in consultation with leading surgeons in many countries to be a basic guide, particularly for less experienced users of the Gamma3 System. It is acknowledged that several alternative approaches to certain elements of the procedure are available, and may have advantages for particular situations or surgeons.



**Fig. 7**

# Operative Technique

## Pre-operative Planning

The Gamma3 Nail with a 125° nail angle may be used in the majority of patients. The 120° nail may be needed in patients with coxa vara, and the 130° nail for coxa valga.

Where such variations in femoral anatomy require an alternative, the following chapter describes how to select the optimum implant size.

## Implant Selection

X-Ray templates are very helpful during pre-operative planning. Use the X-Ray Templates for short and long nails to select the correct implant and the optimal nail angle.

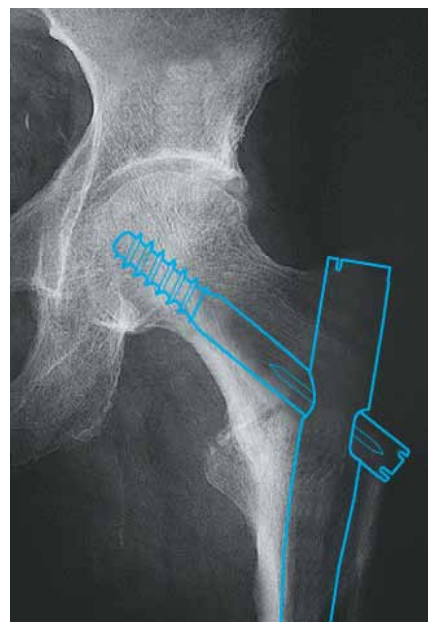
These templates show the true implant size at a magnification of 15% in anterior-posterior view. The X-Rays should be taken at this magnification (15%) for an optimum surgical outcome (see Fig. 9). If accurate anatomical reduction has been achieved, the X-Ray can be taken from the fractured hip or from the contralateral side.

Alternatively the femoral neck angle, i.e. the angle between the femoral shaft mid-axis and the femoral neck mid-axis, could be measured using a goniometer.

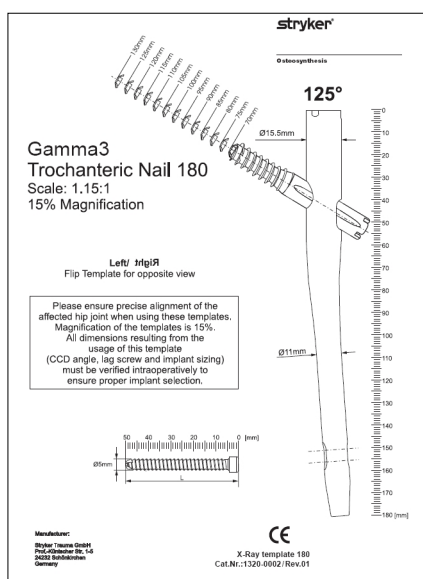
In case the X-Ray Templates do not show an anatomical fit with the bone, a different implant solution should be considered.

### Note:

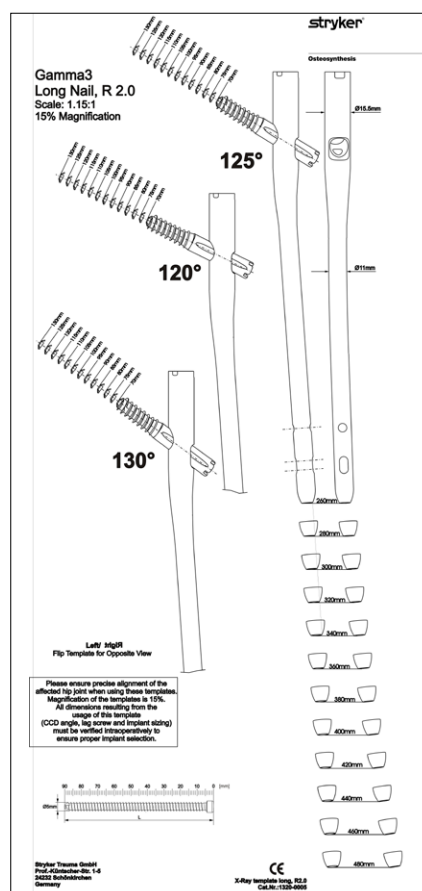
- Please ensure precise alignment of the affected hip joint when using these templates. Template magnification is 15%. All dimensions (nail angle and implant sizing) resulting from using these templates must be verified intraoperatively to ensure proper implant selection.
- Stryker Imaging offers also the Advanced Case Plan including digital template for Gamma3 System as an alternative.



**Fig. 9**  
**X-Ray in a-p**  
**view, showing**  
**implant**



**Fig. 9a**  
**Gamma3 Nail 180 X-Ray Template**  
**(Ref. No 1320-0002)**



**Fig. 9b**  
**Gamma3 Long Nail X-Ray Template**  
**(Ref. No 1320-0005)**

# Operative Technique

## Patient Positioning

The patient is placed in a supine position on the fracture table and closed reduction of the fracture is recommended. Reduction should be achieved as anatomically as possible. If this is not achievable in a closed procedure, open reduction may be necessary.

Traction is applied to the fracture, keeping the leg straight. The unaffected leg is abducted as far as possible to make room for the image intensifier (Fig. 10).

Maintaining traction, the leg is internally rotated 10–15 degrees to complete fracture reduction; the patella should have an either horizontally or slightly inward position (Fig. 11).

Position the image intensifier so that anterior-posterior and mediolateral views of the trochanteric region of the affected femur can be easily obtained. This position is best achieved if the image intensifier is positioned so that the axis of rotation of the intensifier is centered on the femoral neck of the affected femur (Fig. 12).

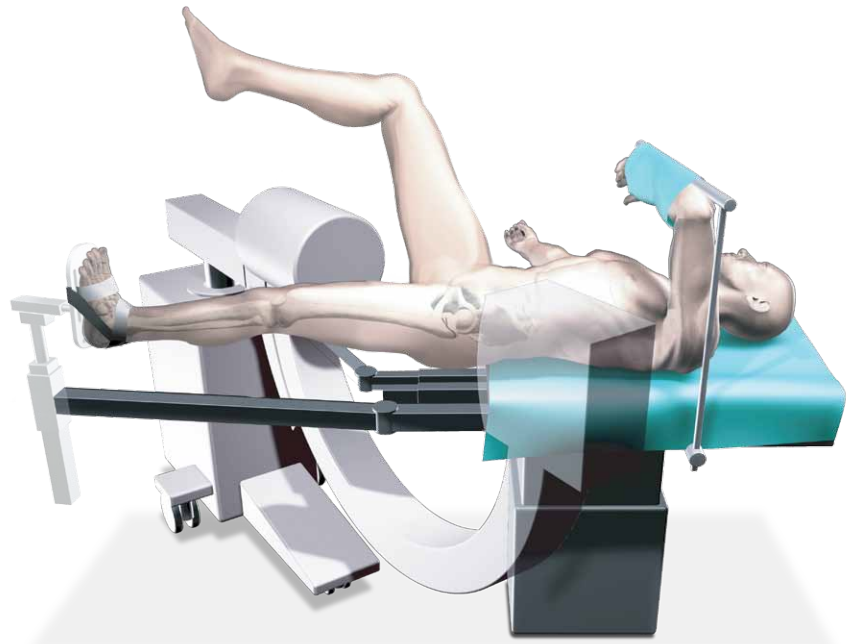
It is important to ensure that a view of both the distal and proximal ends of the nail can be obtained during the procedure without obstruction by the traction table.

The patient is then prepared and draped as for standard femoral nailing procedures. When positioning the drapes, bear in mind that the incision will be proximal.

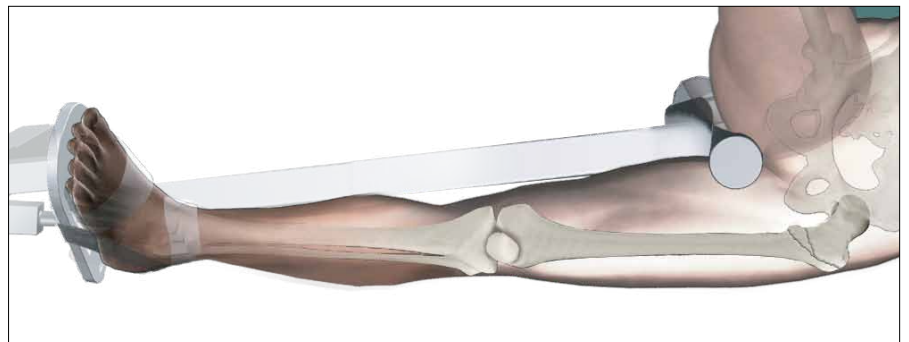
## Fracture Reduction

### Note:

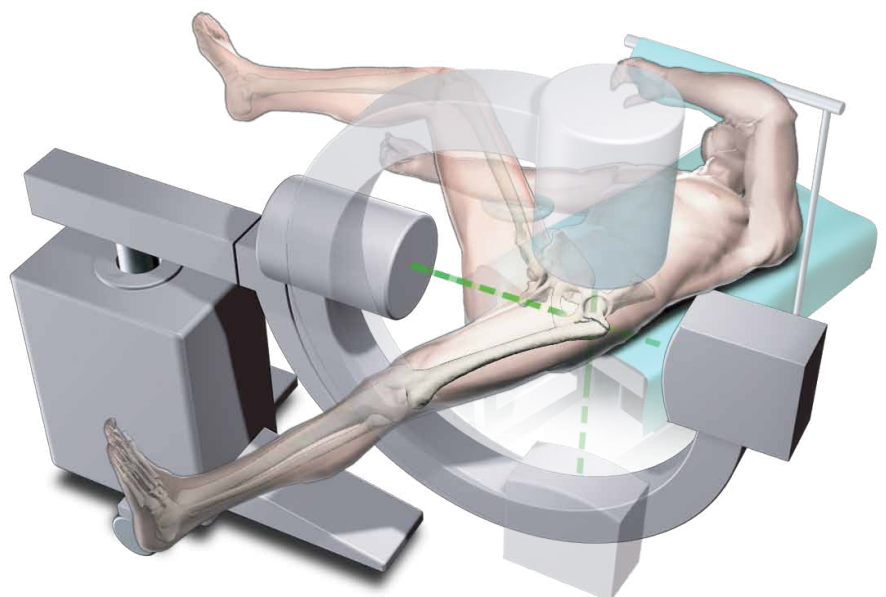
**Reduction should be achieved as anatomically as possible. If this is not achievable, reduction should be achieved at least in one plane. Reduction in the other plane may be achieved with the Gamma3 Nail during insertion.**



**Fig. 10**



**Fig. 11**



**Fig. 12**

# Operative Technique

## Incision

Incisions may be developed in different manners. Two alternatives will be described below.

### Alternative 1:

The tip of the greater trochanter may be located by palpation (Fig. 13) and a horizontal skin incision of approximately 2–3cm is made from the greater trochanter in the direction of the iliac crest (Fig. 14). In larger patients the incision length may need to be longer, depending on BMI of the patient.

A small incision is deepened through the fascia lata, splitting the gluteal muscle approximately 1–2cm immediately above the tip of the greater trochanter, thus exposing its tip. A self-retaining retractor, or tissue protection sleeve is put in place.

### Alternative 2:

A long and thin metal rod (e.g. Screw Scale, Long) is placed on the lateral side of the leg. Check with the image intensifier, using M-L view, that the metal rod is positioned parallel to the bone in the center of the proximal part of the femoral canal (Fig. 16a). A line is drawn on the skin (Fig. 16).



Fig. 13

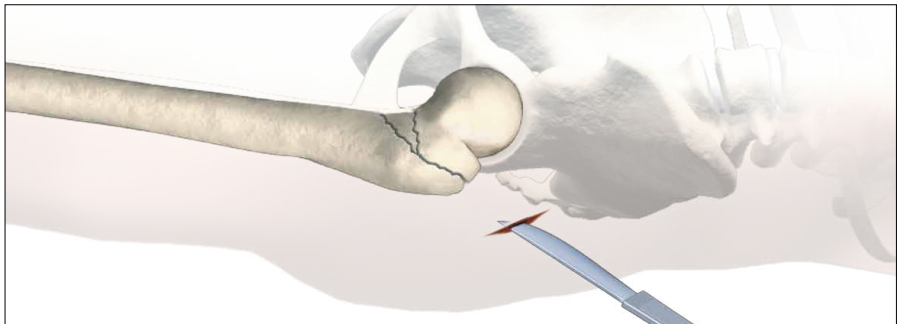


Fig. 14

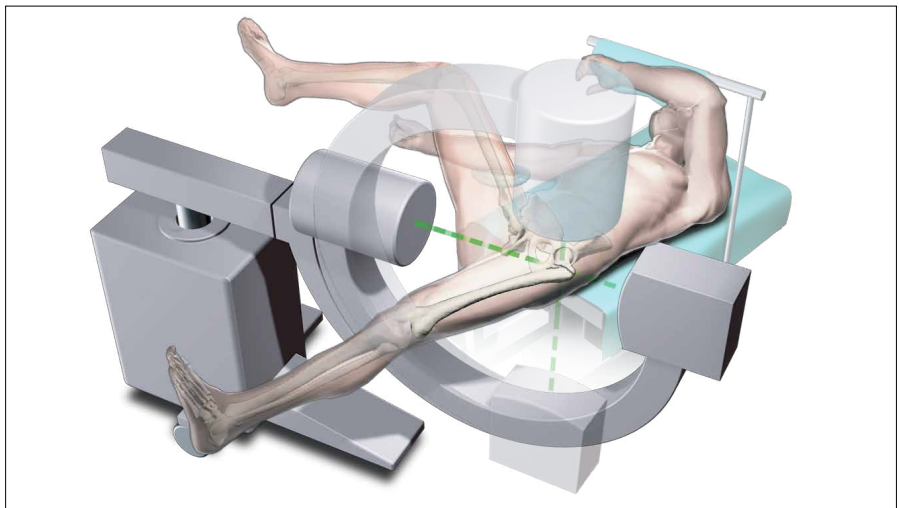


Fig. 15

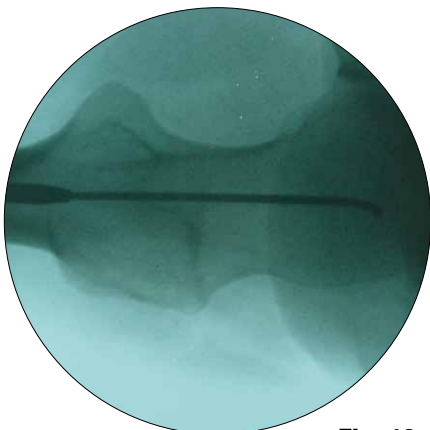


Fig. 16a

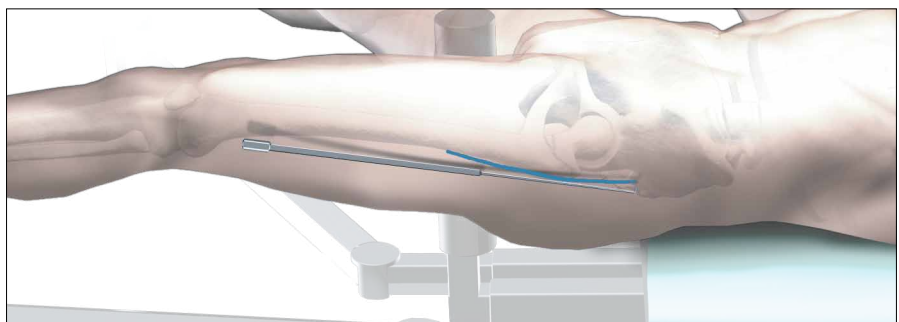
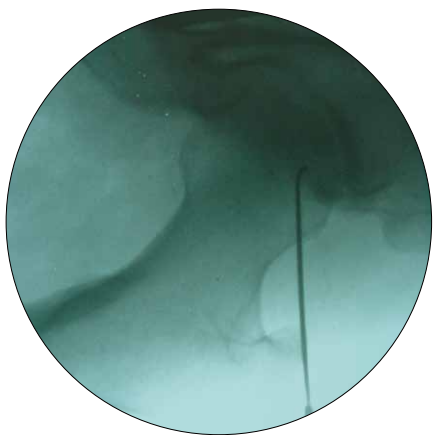


Fig. 16

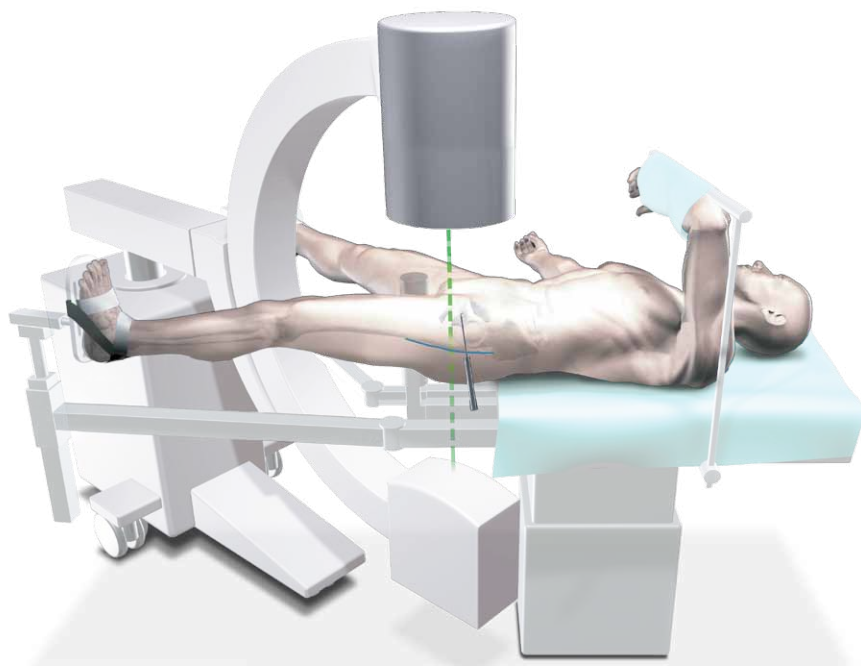


# Operative Technique

The C-Arm is turned approx 90° to provide an A/P image of the tip of the trochanter using the metal rod as shown in Figure 17 and 17a.



**Fig. 17a**

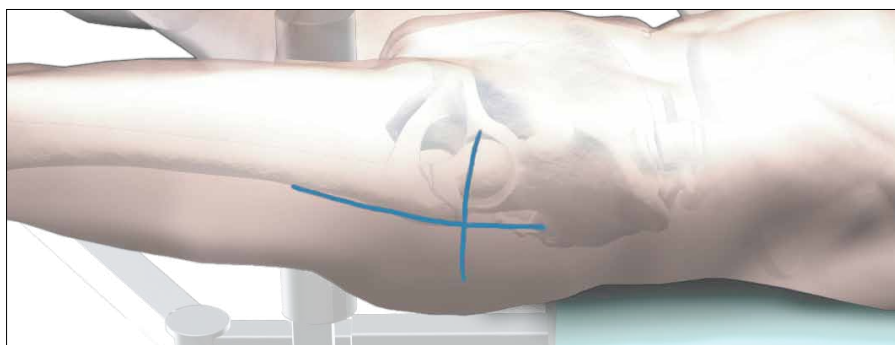


**Fig. 17**

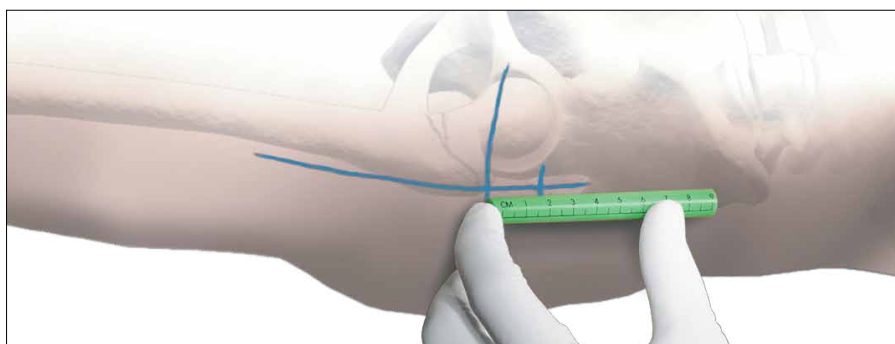
A vertical line is drawn onto the skin (Fig. 18). The intersection of the lines indicates the position for the entry point of the nail. This is usually the anterior third of the tip of the greater trochanter as shown in Fig. 19.

The skin incision is made cranially to the indicated intersection, following the sagittal line in cranial direction. The distance between the intersection and the starting point for the incision differs, depending on the amount of soft tissue of the patient. Under normal conditions it is a distance of approximately 2cm's.

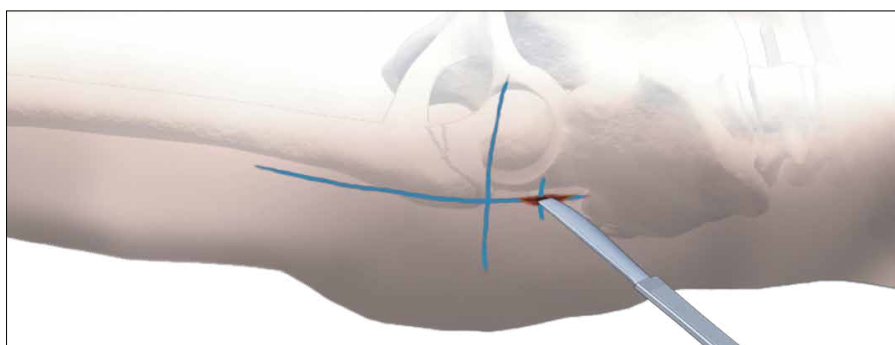
A small skin incision is made as described in Alternative 1 and shown in Fig. 20.



**Fig. 18**



**Fig. 19**



**Fig. 20**

# Operative Technique

## Incision

Using a finger, the tip of the trochanter should be felt easily (Fig. 21).

## Entry Point

The correct entry point is located at the junction of the anterior third and posterior two-thirds of the tip of the greater trochanter and on the tip itself (Fig. 22).

## Opening the Cortex

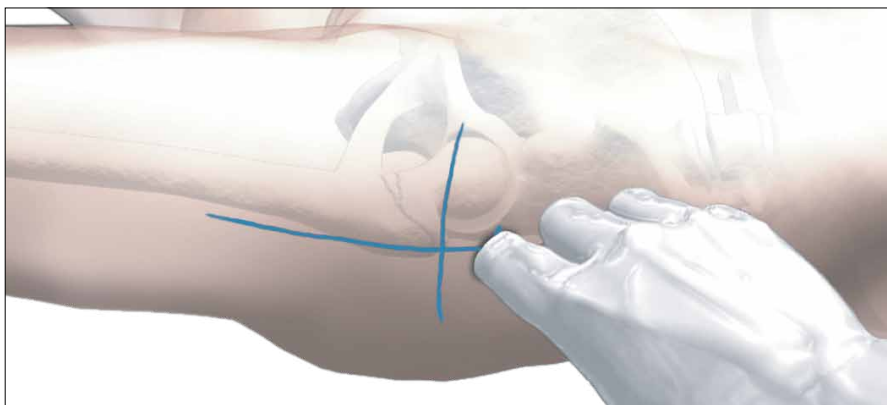
The medullary canal has to be opened under image intensification. The use of the cannulated Curved Awl (Fig. 23) is recommended if conventional reaming or the One Step Conical Reamer will be used to prepare the canal for the nail.

### Caution:

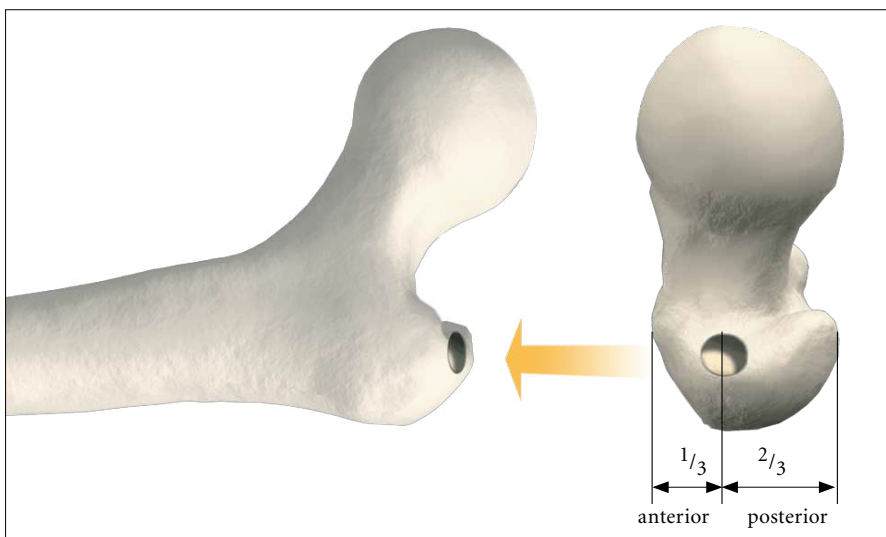
**During opening the entry point with the Awl, dense cortex may block the tip of the Awl.**

**An Awl Plug (1806-0032) can be inserted through the Awl to avoid penetration of bone debris into the cannulation of the Awl Shaft.**

The optional Rasp Awl combines the feature of the Rasp and Awl to prepare the proximal femur for the Gamma3 Nail. It may provide an option to open the proximal femur cavity without further reaming (Fig.24).



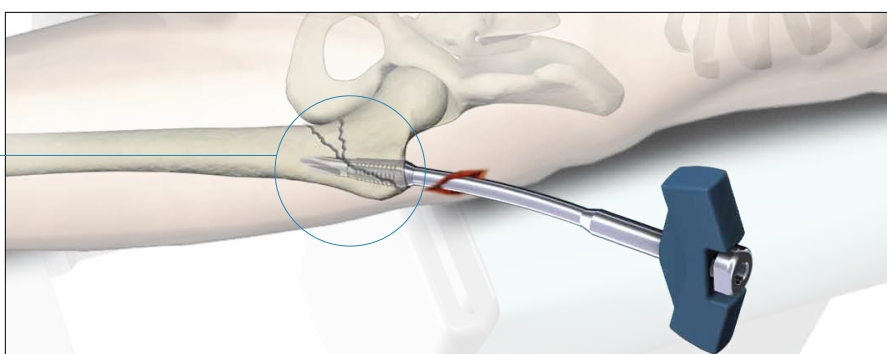
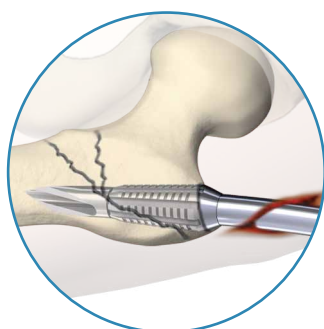
**Fig. 21**



**Fig. 22**



**Fig. 23**



**Fig. 24**

# Operative Technique

## Preparation of the Medullary Canal

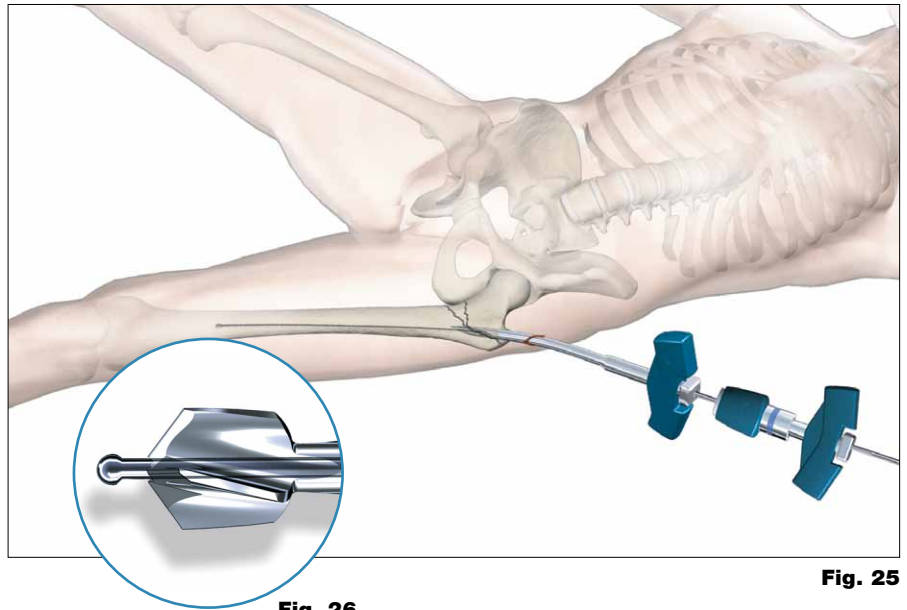
The Gamma3 System includes four options to prepare the medullary canal. These options are described below.

### **Alternative 1: Reaming the Medullary Canal**

A 3mm ball-tipped Guide Wire is recommended as a reamer guide. Pass the reamer Guide Wire through the cannulated curved awl into the shaft of the femur as shown, using the Guide Wire Handle (Fig. 25).

Rotating the Guide Wire during insertion makes it easier to achieve the desired position in the middle of the medullary canal.

Flexible reamers are used to ream the shaft of the femur in stages starting from 9mm diameter and increasing in 0.5mm increments (Fig. 26). The canal should be reamed at least 2mm larger than the distal diameter of the nail, 13mm for the Gamma3 Nail 180. In some narrow medullary canals, reaming may be necessary to achieve this (Fig. 27).



**Fig. 26**

**Fig. 25**



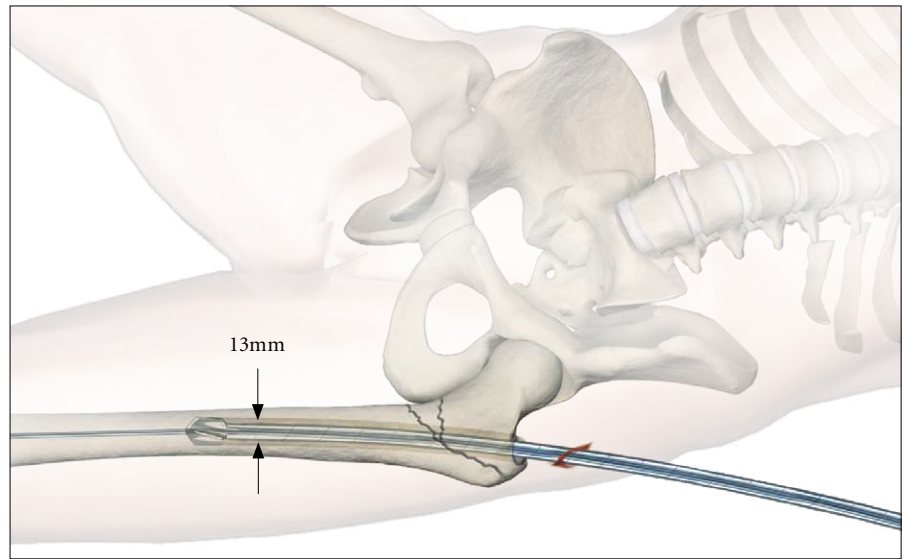
# Operative Technique

When reaming is performed, the entire femoral canal should be over-reamed down through the isthmus, in order to avoid stress riser in the bone.

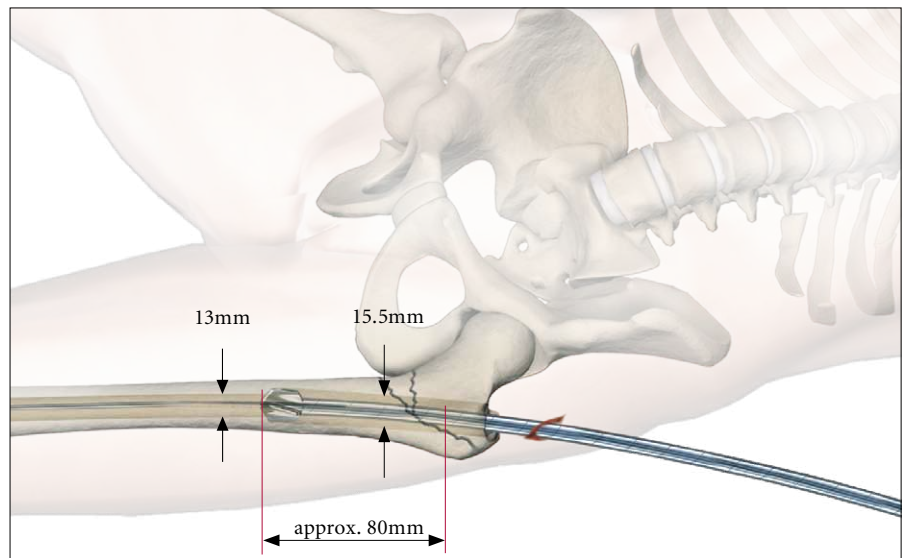
In order to accommodate the proximal part of the Gamma3 Nail, the subtrochanteric region must be opened up to 15.5mm (Fig. 28). This can be done either by reaming with the Stryker Bixcut Reaming System (Fig. 26) or, alternatively, with the One Step Conical Reamer. For soft tissue protection, the Conical Reamer Sleeve should be used during reaming.

**Warning:**

Care must be taken with flexible reamers to ensure that the Guide Wire is not displaced laterally during reaming. This could lead to resection of more bone on the lateral side, which in turn would lead to an offset position for the nail and a risk of shaft fracture.



**Fig. 27**



**Fig. 28**

# Operative Technique

## Alternative 2: One Step Conical Reamer

The One Step Conical Reamer is an optional instrument and has been developed to provide surgeons with another option to prepare the proximal canal of the trochanter using only one drilling step.

When the Gamma3 Nail 180 is used, reaming of the subtrochanteric and diaphyseal region of the femoral cavity may not be required, particularly in elderly patients with wide medullary canals.

After skin incision, opening the Entry Point with the Curved Awl, and positioning of the Guide Wire as described above, the Trocar or Multi Hole Trocar is inserted into the Reamer Sleeve to protect the soft tissue during insertion. Push the Trocar (use center hole, if Multi Hole Trocar is used) and Sleeve Assembly down over the 3mm Guide Wire to the tip of the trochanter (Fig. 29 and 30).

### Entry Point Optimization

The Entry Point can also be made without using the awl. A 3.2mm K-Wire is placed through the tip of the trochanter.

If you find that the K-Wire is not positioned in the optimal position, it may easily be corrected using a second K-Wire in combination with the Multi Hole Trocar.

The Multi Hole Trocar has a special design for more precise insertion. In addition to the central hole, 4 other holes are located eccentrically at different distances from the center (Fig. 29) to easily revise insertion of the guiding K-Wire in the proper position (Entry Point).

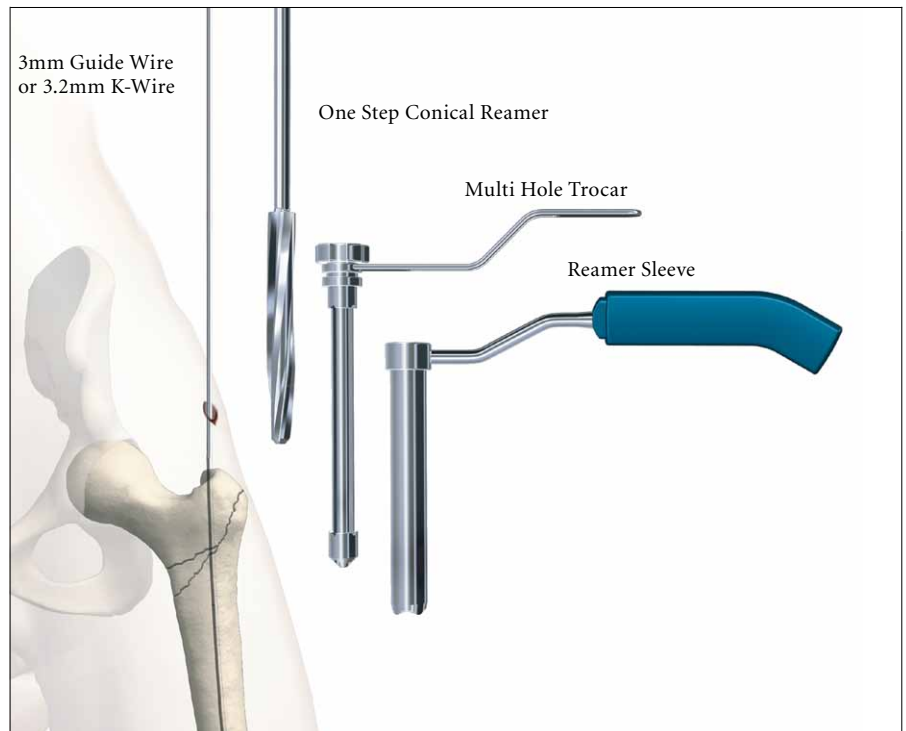


Fig. 29

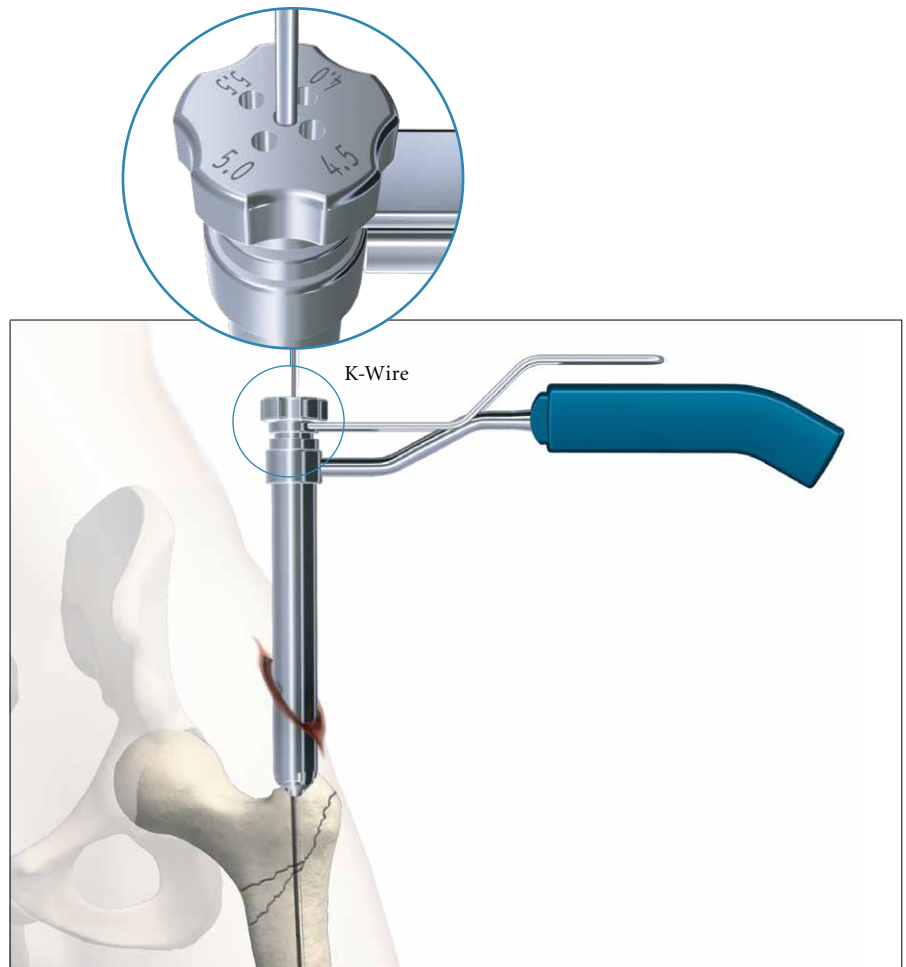


Fig. 30

# Operative Technique

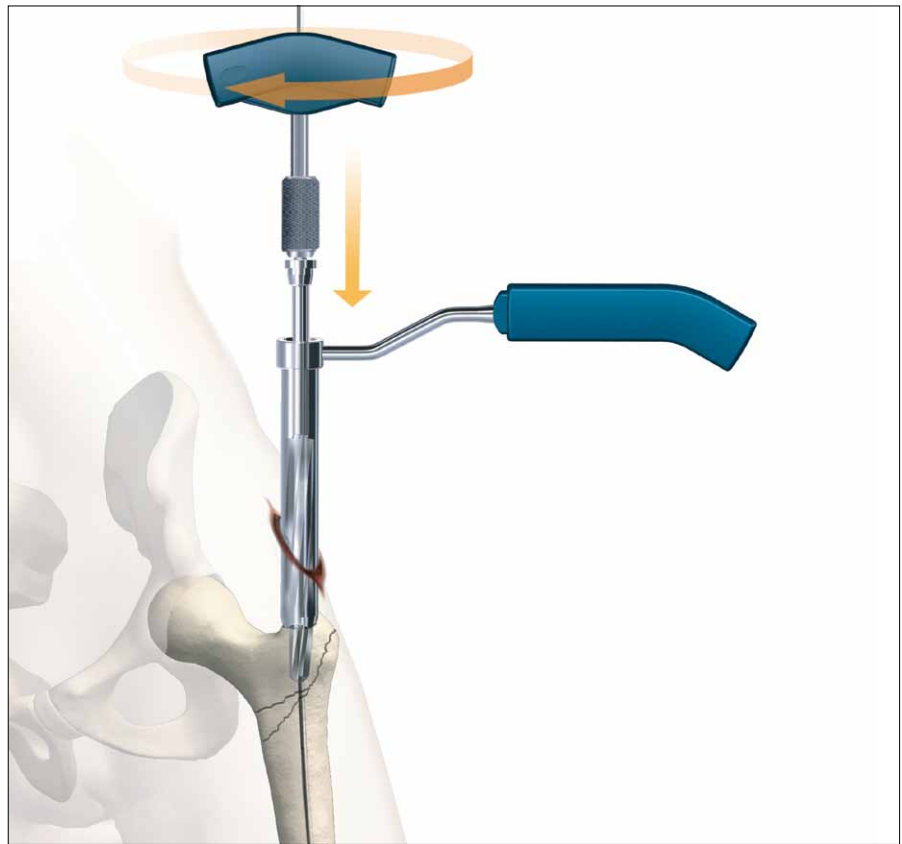
The Trocar is then removed and the One Step Conical Reamer is connected to the T-Handle and slid over the Guide or K-Wire to the tip of the trochanter. With gentle clockwise turning and pushing movements, the Conical Reamer will drill into the proximal part of the trochanter (Fig. 31 and 32) and prepare the canal for the proximal part of the Gamma3 Nail. The One Step Conical Reamer stops when the correct depth is reached. If a 3.2mm K-Wire was used it should be replaced by a Guide Wire now.

## Warning:

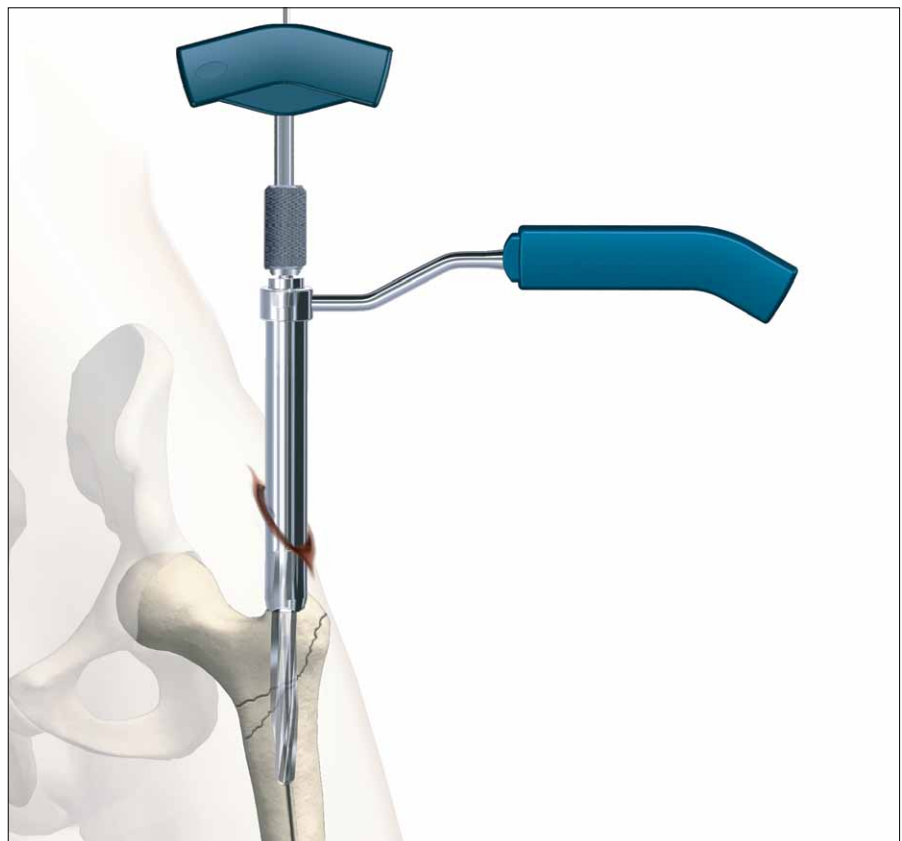
**The One Step Conical Reamer is a front and side cutting instrument and should be used with great care to ensure that the sharp edges of the reamer do not damage intact bone inadvertently.**

## Caution:

**3.2mm K-Wires are not intended for re-use. They are single use only. K-Wires may be damaged or be bent during surgical procedures. Therefore, please do NOT use the same K-Wire for Lag Screw insertion.**



**Fig. 31**



**Fig. 32**

# Operative Technique

## Alternative 3: Cannulated Cutter

The Cannulated Cutter is a front cutting device used to prepare the proximal part of the femur for the Gamma3 Nail 180.

It provides surgeons with an advanced option to open the proximal femur cavity without reaming. Especially in older patients, it may reduce the requirement for reaming of the femoral cavity.

It is guided over a solid 4mm Guide Pin. The fixation of this Guide Pin in the bone allows for an optimal placement for the Cannulated Cutter. This device is designed to allow for easy collection of bone graft material which might be helpful in difficult healing conditions.

### Caution:

**When the Cannulated Cutter is used, do not open the cortex with the Awl, because the Awl usually creates larger holes than 4mm. The 4mm Guide Pin needs bony stability to provide optimal cutting performance of the Cannulated Cutter.**



**Fig. 33**



**Fig. 34**

# Operative Technique

## Alternative 4: Crown Drill

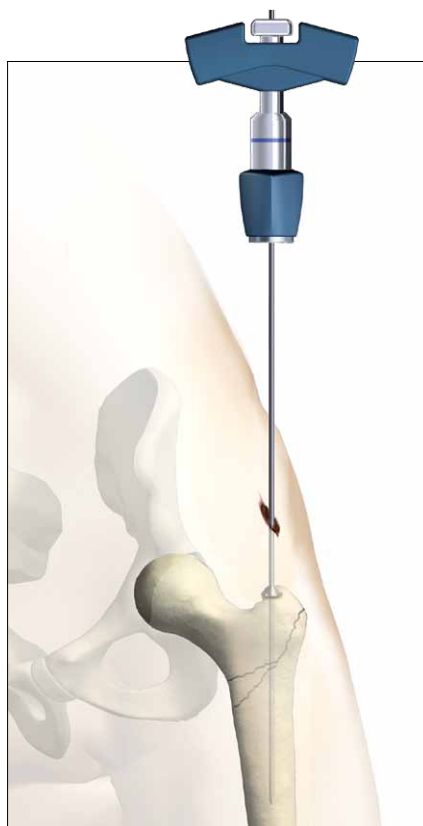
The Crown Drill is a front cutting device used to prepare the proximal part of the femur for the Gamma3 Nail 180. It may provide an option to open the proximal femur cavity without reaming. Especially in older patients, the Crown Drill may reduce the requirement for reaming of the femoral cavity.

Insert the K-Wire with Washer through a small incision using the Guide Wire Handle until the washer reaches the surface of the greater trochanter (Fig. 35).

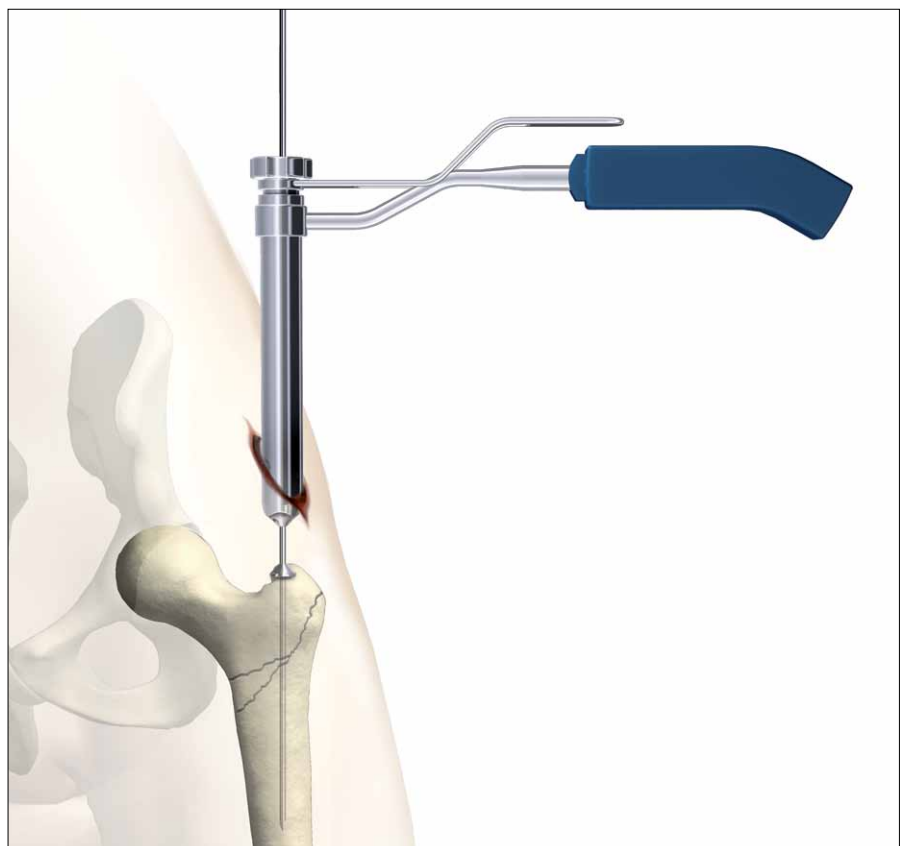
Then insert the assembled Trocar and the Reamer Sleeve over the K-wire until the tip of the Trocar reaches the Greater Trochanter (Fig. 36).

### Caution:

**Do not open the cortex with the Awl when using the Crown Drill, as the Awl creates a hole larger than 3.2mm. The 3.2mm K-Wire needs bony stability to provide optimal Crown Drill cutting performance.**



**Fig. 35**



**Fig. 36**

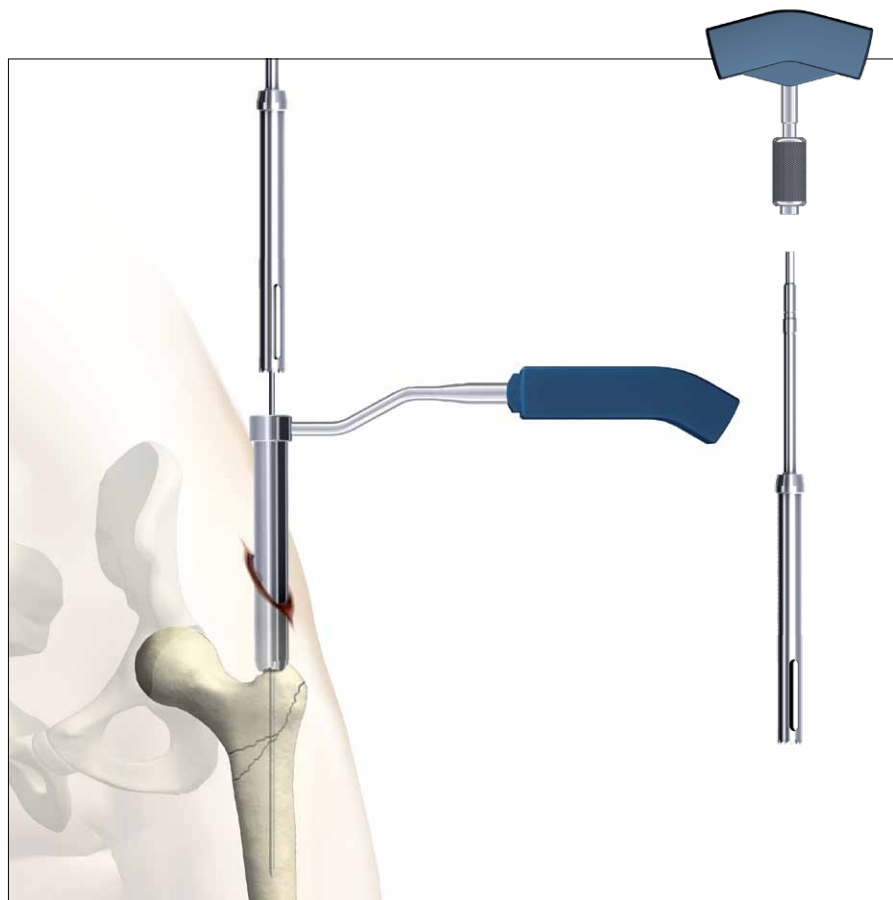


# Operative Technique

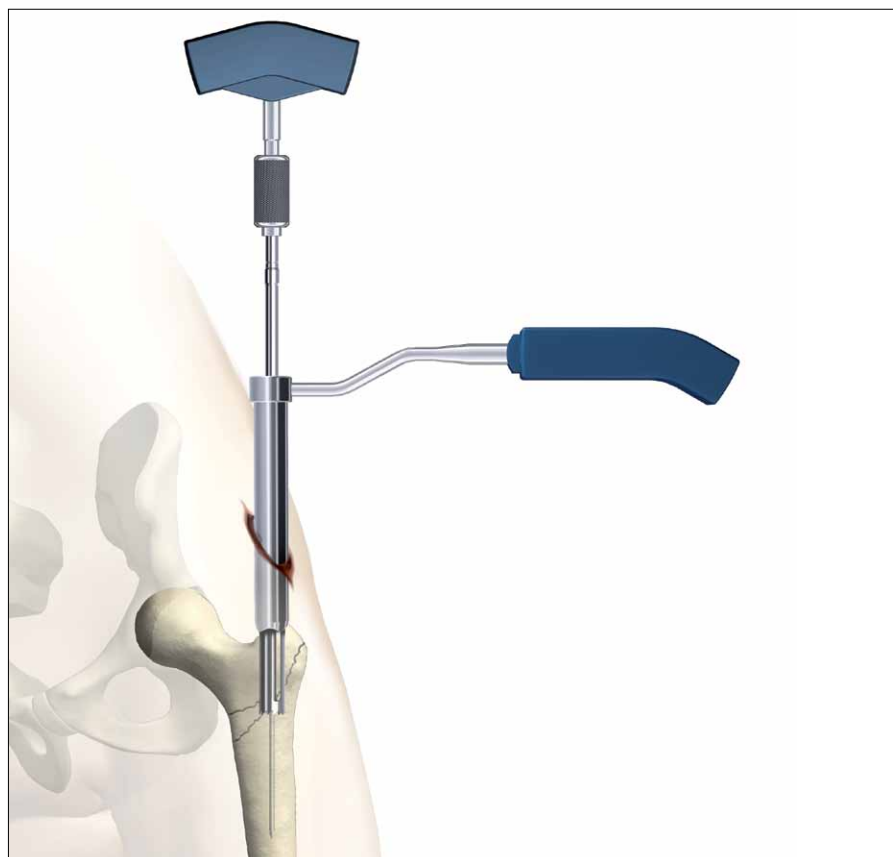
Remove the Trocar and then connect the Crown Drill to the T-Handle and slide it over the K-Wire to the tip of the greater trochanter. With gentle clockwise turning and pushing movements, the Crown Drill will drill into the proximal part of the trochanter and prepare the canal for the proximal part of the Gamma3 Nail. The Crown Drill stops when the correct depth is reached (Fig. 37 and 38).

**Warning:**

**If using a power tool to drive the Crown Drill, particular attention must be paid to the position of the K-Wire. The Crown Drill is a front and side cutting instrument and should be used with great care to ensure that the sharp edges of the reamer do not inadvertently ream intact bone.**



**Fig. 37**



**Fig. 38**

# Operative Technique

## Assembly of Targeting Device

### 1. Targeting Sleeve and Knob Assembly

First assemble the Knob to the Targeting Sleeve (Fig. 34a) and adjust the point on the Knob to be in line with the arrow on the Target Sleeve. Push the knob hard against the sleeve. The Knob moves approximately 5mm to the sleeve and has to be turned clockwise by approximately 30 degrees. Now release the Knob and it will slip back the same distance. Now the Knob is assembled to the Targeting Sleeve and has to be connected to the Target Arm (Fig. 34c).

As an alternative, the Speedlock Sleeve is newly available and allows for assembly of the sleeve directly to the Targeting Arm without going through above mentioned step. The Speedlock Sleeve has the same functions as the assembled Targeting Sleeve and Knob. This Operative Technique describes the use with the Speedlock Sleeve (Fig. 34d) in the following chapters.

### 2. Targeting Arm and Speedlock Sleeve Assembly

Push the Speedlock Sleeve assembly over the Targeting Arm along the line until it stops (arrow line to arrow line).

Rotate the Speedlock Sleeve around to the required nail angle position for the Lag Screw, e.g. 125° (point to point) or distal locking positions, either "Dynamic" or "Static". Now the Targeting Sleeve must be fixed in this position by pushing it strongly against the Targeting Arm. You will feel and hear as the sleeve snaps into position.

By turning the Speedlock Sleeve Knob into the "lock" position, the Speedlock Sleeve can be locked to the Targeting Arm. It also locks either the Lag Screw Guide Sleeve or the Tissue Protection Sleeve.



Fig. 34d



# Operative Technique

## 3. Assembly of the Targeting Device and the Gamma3 Nail 180

The selected Gamma3 Nail is now assembled to the Carbon Fiber Target Device as shown in Fig. 35. The nail connecting part of the Targeting Device is designed with an easy assembly function for fast and secure nail fixation. Ensure that the locating pegs fit into the corresponding notches of the proximal part of the nail.

Fully tighten the Nail Holding Screw with the Ball Tip Screwdriver, so that it does not loosen during nail insertion.

Before starting surgery the following functions of the Targeting Device have to be checked:

1. Secure fixation between Nail and Target Device.
2. Lag Screw Guide Sleeve matches the selected nail angle.
3. Distal locking position of the Tissue Protection Sleeve, for required "Static" or "Dynamic" locking.



**Fig. 35**  
**Gamma3 Nail Assembly**

# Operative Technique

Before checking the function of the Lag Screw Guide Sleeve or Tissue Protection Sleeve for the distal locking, the Speedlock Sleeve Knob must be positioned in the counter clockwise position. Pass the Lag Screw Guide Sleeve gently through the hole of the Speedlock Sleeve and tighten it gently in its final position by turning the Knob clockwise. Check correct nail angle using the K-Wire, 4.2mm Drill or Lag Screw Step Drill (Fig. 36).

Remove the Lag Screw Guide Sleeve in the opposite order; turn the Speedlock Sleeve Knob counter-clockwise and remove the Lag Screw Guide Sleeve by pulling it back.

Before the distal locking function can be checked, the Speedlock Sleeve has to be positioned in either the “Static” or “Dynamic” mode.

Pull the Speedlock Sleeve back and turn the sleeve until the required distal locking position is reached. Now push the sleeve against the Target Arm until a “snap in” is felt.

The distal Tissue Protection Sleeve is passed through the Speedlock Sleeve until its final position is achieved. Lock the distal Tissue Protection Sleeve by gently turning the Speedlock Sleeve Knob clockwise. Check position with the Drill Sleeve and 4.2mm Drill (Fig. 36a).

## Note:

**Before starting surgery, the implant and instrument assembly must be checked. Ensure that the Sleeve angle matches the corresponding nail angle chosen, e.g. a 125° position in Speedlock Sleeve for a 125° nail, and the distal Sleeve matches either for “Dynamic” or “Static” locking as required (Fig. 36 and 36a).**



**Fig. 36**



**Fig. 36a**  
**Checking of Lag Screw Sleeve and**  
**Distal Locking Sleeve positioning and**  
**function.**

# Operative Technique

## Nail Insertion

Insert the Gamma3 Nail by hand (Fig. 37)

### Note:

It is recommended to lock the Speedlock Sleeve Knob while introducing the nail. This can help to prevent the sleeve from sliding out intraoperatively.

### Warning:

Even if some resistance is felt during nail insertion, never use high forces and/or a hammer to insert the nail, because these high forces will create stress to both bone and to the nail. It may create micro fractures in the bone or deform the nail, which may lead to a reduced targeting accuracy when drilling. Consider that titanium alloy is a more flexible material than stainless steel. In order to avoid stress in the bone and/or possible deformation of the nail shaft, appropriate reaming of the intramedullary canal or adjustment of the proximal entry point may be necessary.

The final Nail depth position is monitored with the image intensifier C-Arm; the projected axis of the Lag Screw may be projected with a ruler on the monitor screen to ensure that the Lag Screw is placed in the optimal position.

Proceed until the axis of the Lag Screw hole (visible as a crescent shape on the screen) is aligned with the lower half of the femoral neck (Fig. 38). The objective of this is to ultimately position the Lag Screw centrally or slightly inferior in femoral head in the frontal plane.

### Note:

Remove Guide Wire for the flexible reamer and nail insertion using Guide Wire Handle. (Fig. 39a).



Fig. 37

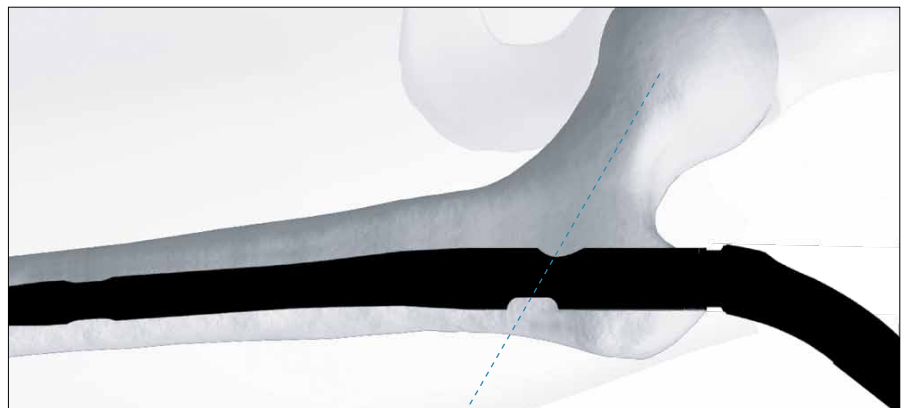


Fig. 38



Fig. 39a

# Operative Technique

When the Gamma3 Nail has been inserted to its final depth, check the anteversion of the nail. By using the K-Wire Clip or Closed Tube Clip with K-Wires (Fig. 39). As an alternative the Gamma3 U-Wire can be used with the K-Wire Clip or Closed Tube Clip. The K-Wire Clip or Closed Tube Clip is mounted into the slots of the Target Arm by pressing the Clip flanges together.

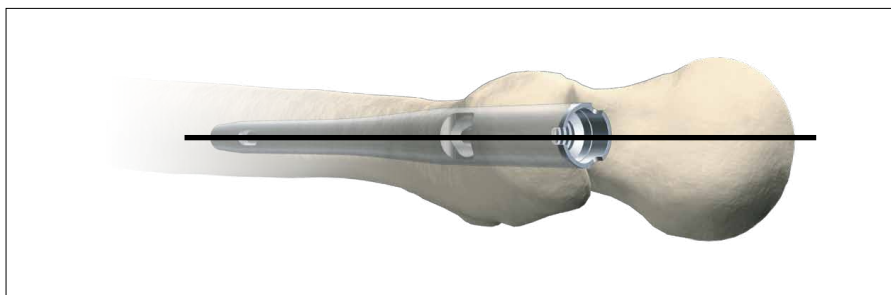
**Note:**

**Before proceeding ensure that the Nail Holding Screw is still fully tightened.**

The Lag Screw should be placed in the central position of the femoral head in the lateral view (Fig. 40).



**Fig. 39**

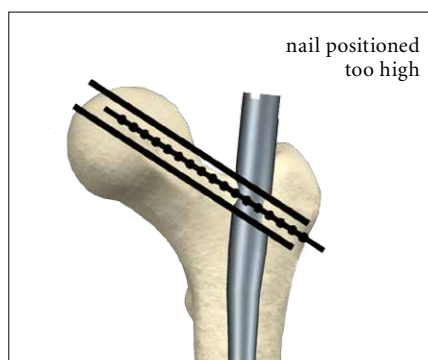
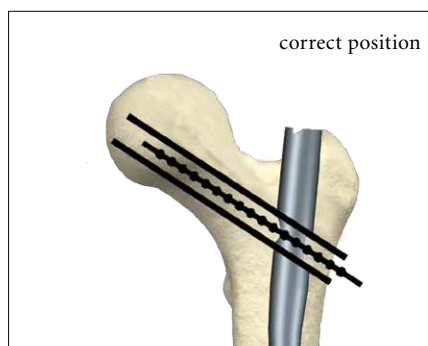
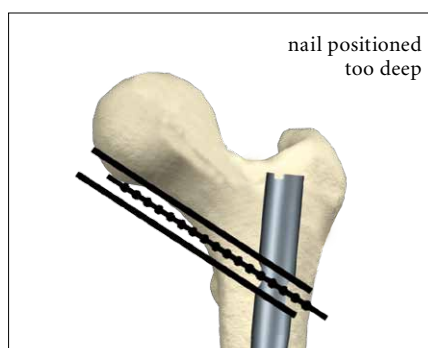


**Fig. 40**

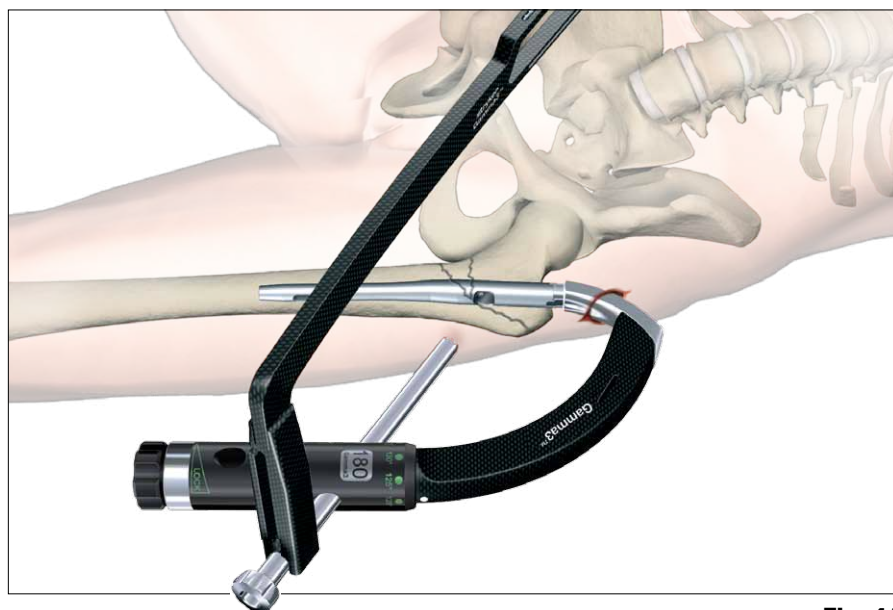
# Operative Technique

## Lag Screw Positioning using the One Shot Device

The One Shot Device is recommended for establishing whether the Lag Screw is in the optimum position. This device is designed to enable correct positioning of the K-Wire for Lag Screw placement before performing lateral skin incision and opening of the lateral cortex (see Fig. 41–42a).



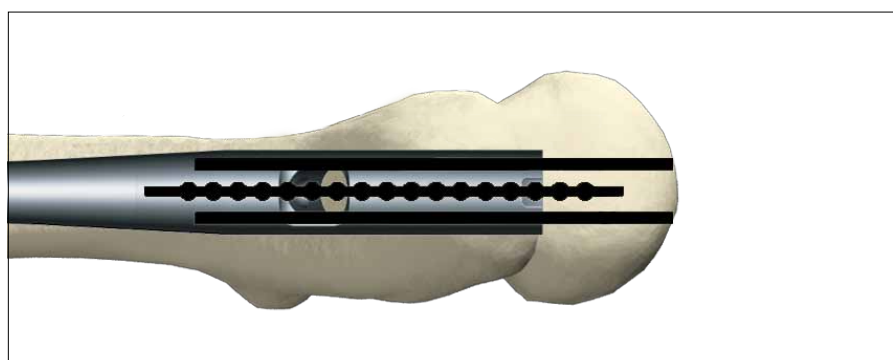
**Fig. 41a**  
A/P view



**Fig. 41**



**Fig. 42**



**Fig. 42a**  
Lateral view



# Operative Technique

## Lag Screw Insertion

The Targeting Device may be held by an assistant to prevent its weight from externally rotating the nail until the next stage is completed.

Next, assemble the Lag Screw Guide Sleeve with the green coded 4.2mm Lag Screw Drill Guide Sleeve and pass them through the Targeting Sleeve to the level of the skin. This indicates the position for a small incision down to the bone (Fig. 43). The Guide Sleeve assembly is now advanced through the incision. If the guide catches the fascia lata, twisting it will usually allow it to pass through to the bone.

In order to facilitate the smooth insertion of the sleeve assembly, the Paddle Tip Trocar can optionally be used prior to the use of the Lag Screw Drill Guide Sleeve. Assemble the Lag Screw Guide Sleeve with the Paddle Tip Trocar and pass them through the Targeting Sleeve to the level of the skin. Make the skin incision down to the bone (Fig 43a). When the tip of the Paddle Trocar catches the fascia lata, twist it manually. There is a mark at the head of the Paddle Tip Trocar provides the direction of the Trocar Tip. When the tip reaches the bone, replace the Paddle Tip Trocar to the green coded 4.2mm Lag Screw Guide Sleeve and prepare for the next pre-drilling step.

For an accurate Lag Screw length measurement, the outer Guide Sleeve must be in good contact to the lateral cortex of the femur. The Knob of the Target Sleeve must be turned gently **clockwise** to lock the Guide Sleeve in place and further stabilize the targeting assembly (Fig. 44 and 44a).

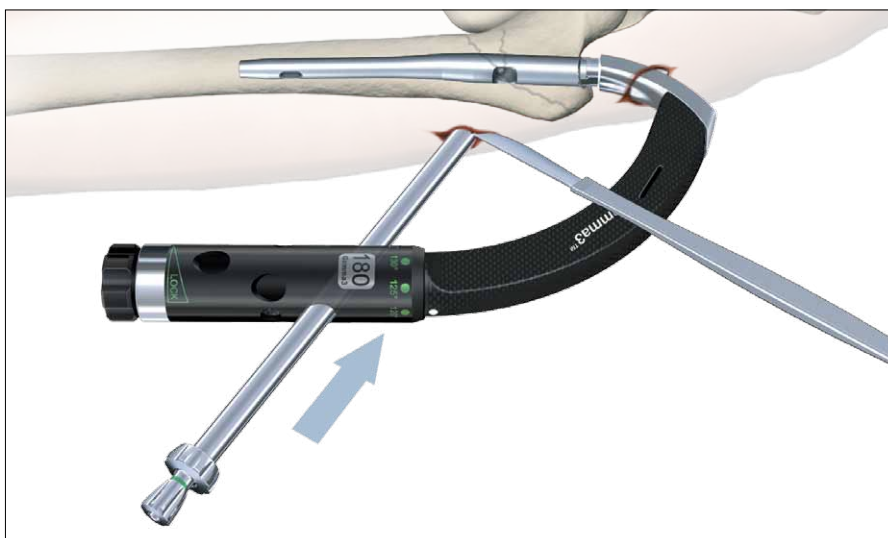


Fig. 43

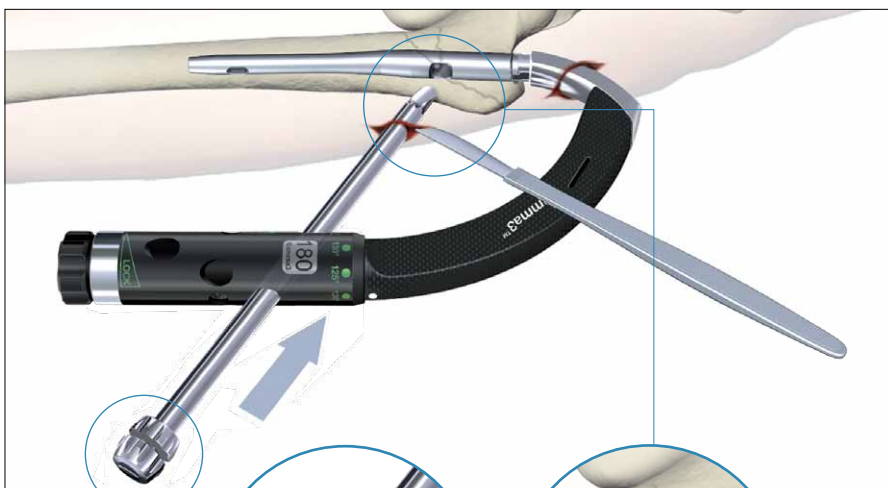


Fig. 43a

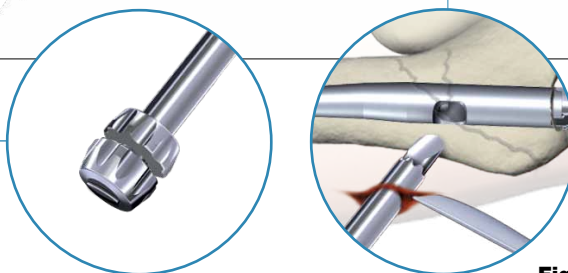


Fig. 43b

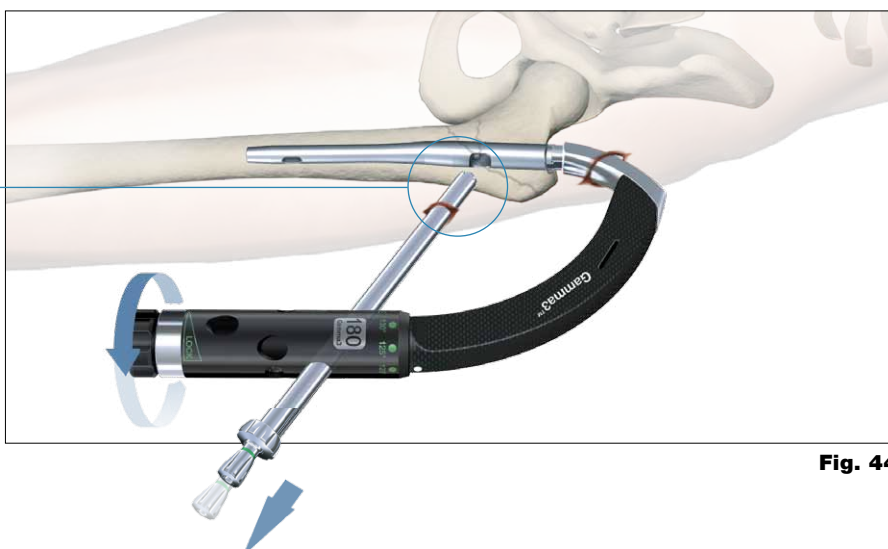


Fig. 44

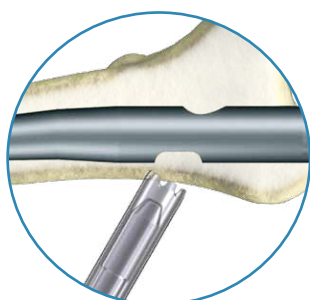


Fig. 44a

# Operative Technique

## Pre-Drilling the lateral cortex

With the Lag Screw Guide Sleeve firmly engaged in the cortex, the green coded 4.2mm Lag Screw Drill Guide Sleeve should be pushed gently against the cortex. Using the green coded 4.2mm x 300mm center tipped drill, the lateral cortex should be opened by power tool or by hand. A longer 4.2mm x 360mm drill is also available as an alternative for deeper pre-drilling possibility, allowing for a longer guidance for the K-Wire (Fig. 45).

The green coded 4.2mm Lag Screw Drill Guide Sleeve is then replaced by the K-Wire Sleeve. (Both sleeves look similar, but have different inner hole diameters. The K-Wire Sleeve has no colored ring).

### Note:

**Before proceeding, check that the Guide Wire for the flexible reamer and nail insertion used earlier has been removed.**

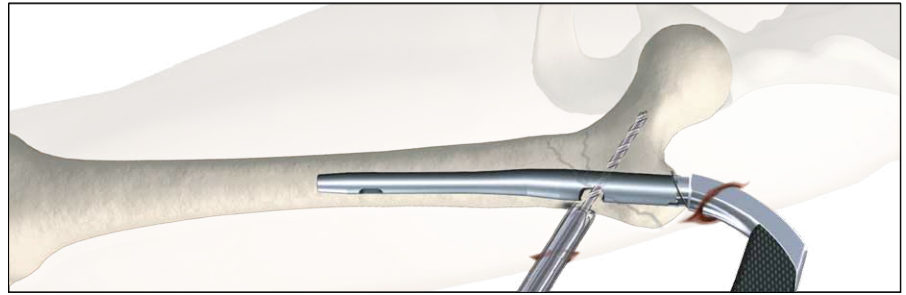
The single use K-Wire inserted through the K-Wire Sleeve should be advanced up to the subchondral bone (Fig. 46), using the Guide Wire Handle or using power tool. Check that the K-Wire is placed either central or in the lower half of the femoral head in the frontal plane and on the midline in the lateral plane (Fig. 46a).

### Note:

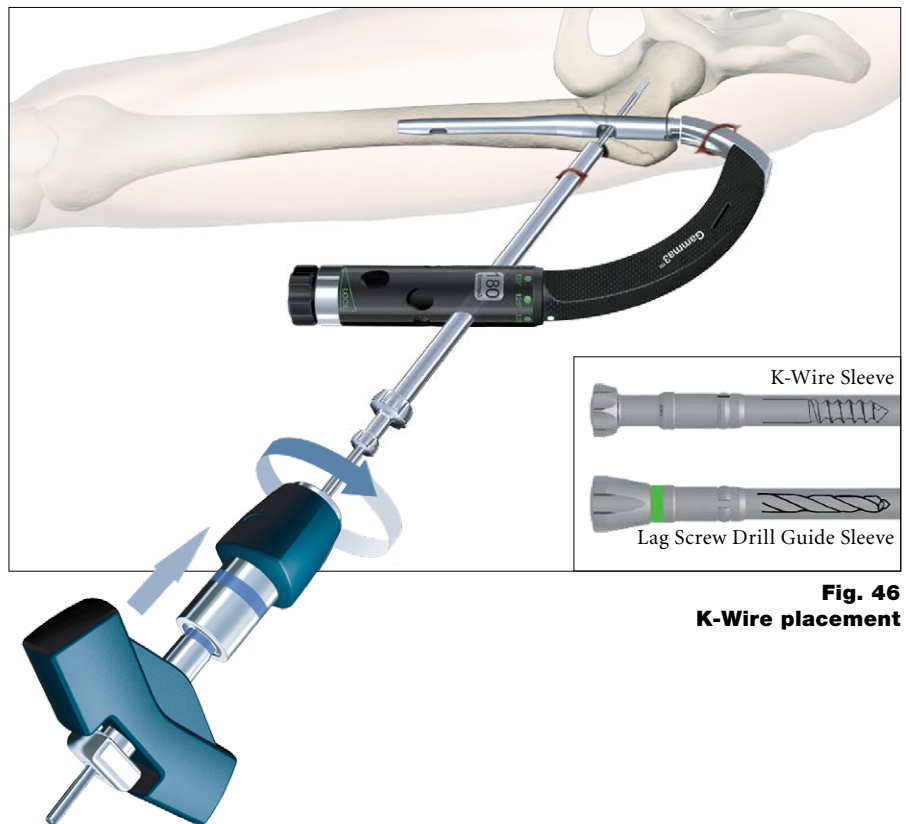
**Pre-drilling offers a possibility to open the lateral cortex for the K-Wire entry. Pre-drilling helps to prevent a possible slipping of the K-Wire on the cortex and may avoid deflection within the femoral head. This helps to perform the Lag Screw reaming without nail contact. Therefore check the proper K-Wire position with the image intensifier in both the anterior-posterior and mediolateral views as shown in Fig. 38 and 40 to ensure that K-Wire deflection did not occur.**

### Warning:

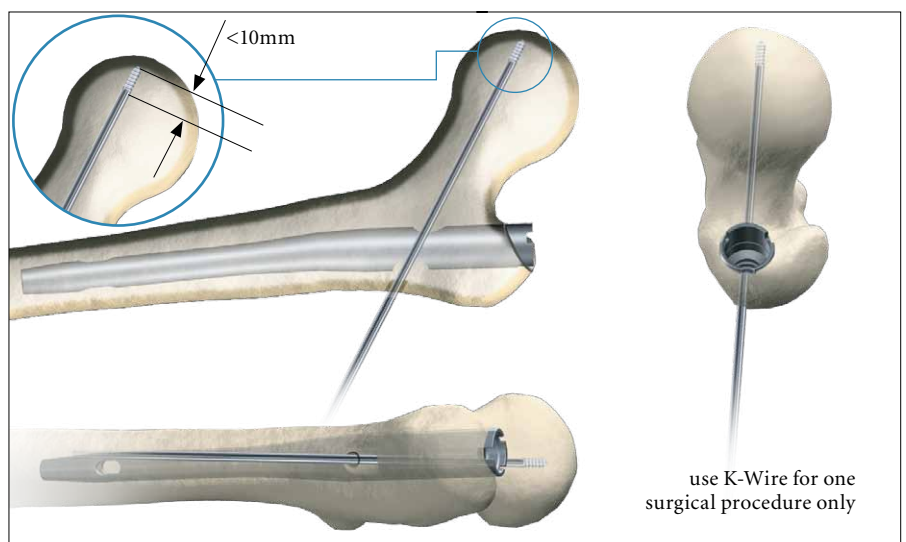
**In the event the nail is damaged during Lag Screw reaming, the fatigue strength of the implant may be reduced which may cause nail to fracture.**



**Fig. 45**  
**Opening of the lateral cortex**



**Fig. 46**  
**K-Wire placement**



**Fig. 46a**  
**K-Wire placement**



# Operative Technique

The objective is to position the Lag Screw either in the center or below the center of the femoral head in the anterior-posterior view and centrally in the lateral view, to provide the best load transfer to the Lag Screw (Fig. 47).

After satisfactorily positioning the K-Wire, the required Lag Screw length is measured using the Lag Screw Ruler.

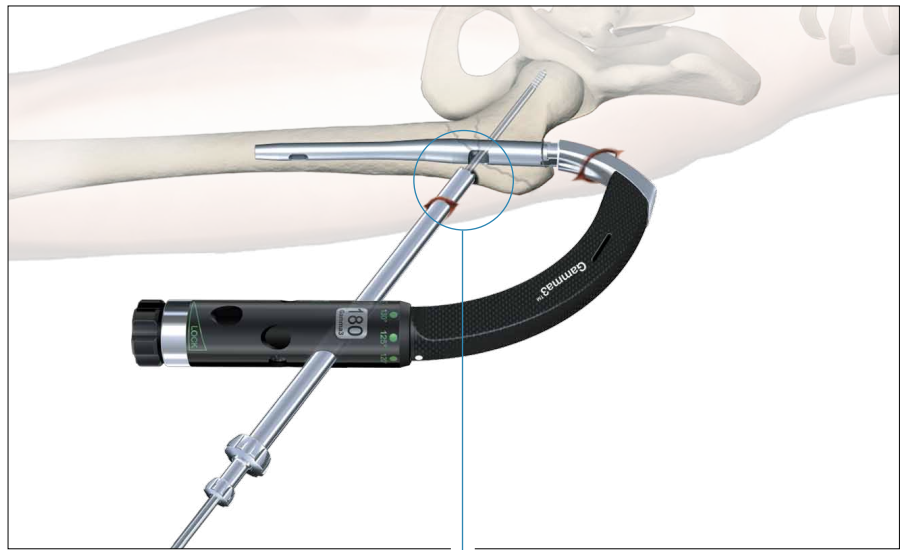
Before starting to measure, ensure that the Lag Screw Guide Sleeve is still pressed firmly against the lateral cortex of the femur (Fig. 47a).

Place the Lag Screw Ruler directly under the K-Wire (Fig. 48).

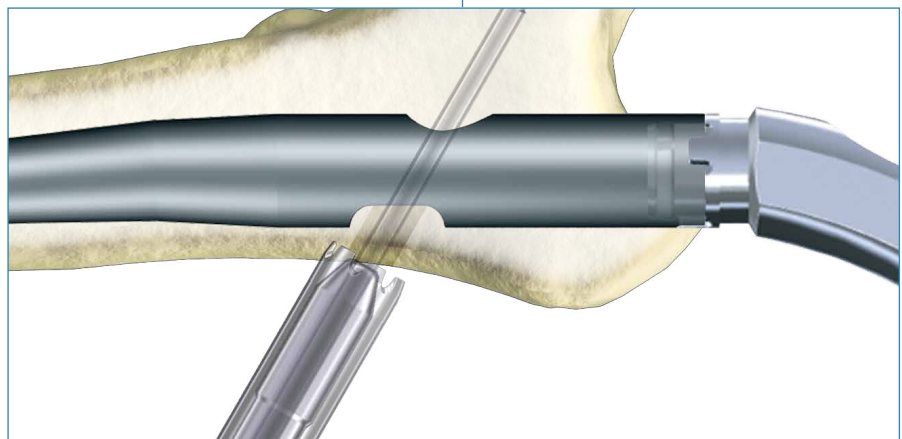
The recommended value for the Step Drill depth and the Lag Screw length can be read directly from the Lag Screw Ruler. If the value is between markings on the scale, e.g. 97mm, it should always be rounded up to the next higher value, e.g. 100mm.

## Warning:

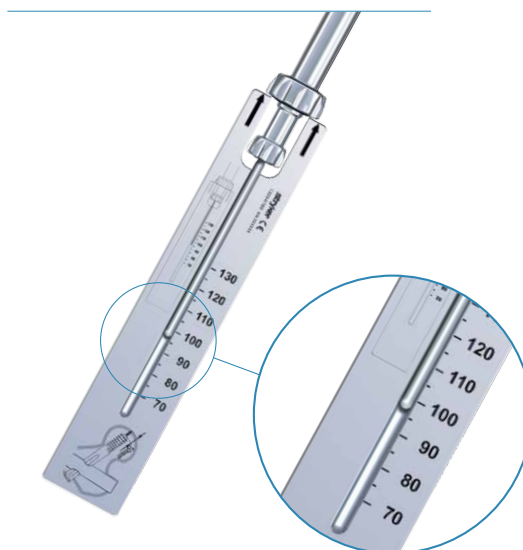
**K-Wires are not intended for re-use. They are single use only. K-Wires may be damaged or bent during surgical procedures. If a K-Wire is re-used, it may get stuck in the drill and could be advanced into the pelvis, and may damage large blood vessels or cause other serious injuries.**



**Fig. 47**  
**Lag Screw length measurement**



**Fig. 47a**



**Fig. 48**  
**Lag Screw Length Measurement**

# Operative Technique



**Fig. 49**

The value of the measurement (Fig. 48) is now transferred to the adjustable stop on the Lag Screw Step Drill (Fig. 49). The value e.g. 100 must be visible in the window (Fig. 49a)

The K-Wire Sleeve is now removed and the adjusted Lag Screw Step Drill is passed over the K-Wire (Fig. 50), through the Lag Screw Guide Sleeve.

The channel for the Lag Screw is prepared using the T-Handle connected to the Lag Screw Step Drill. A power tool may be used with great care paying specific attention to the K-Wire position.

Drilling should continue until the stop of the Step Drill comes into contact with the Lag Screw Guide Sleeve (Fig. 51). Ensure that the Targeting Device is well supported to prevent it from slipping back or rotating.

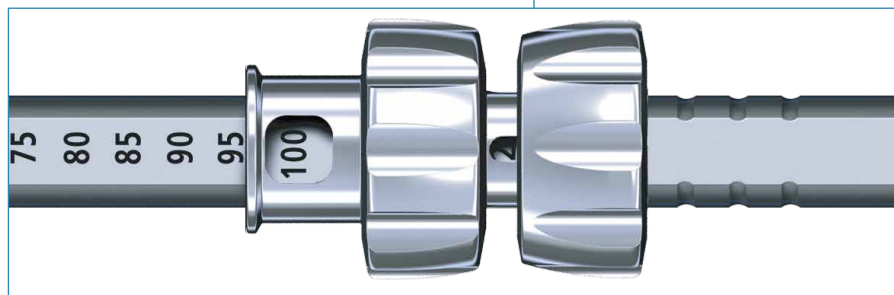
The drilling process, especially when the tip of the drill comes close to its final position in the femur head, should be controlled under an image intensifier to avoid hip joint penetration. The K-Wire also may be observed in the K-Wire window of the Step Drill.

## Note:

It is important to observe the K-Wire tip during drilling on the intensifier. The K-Wire window provides an additional possibility to double check the K-Wire end position.

## Warning:

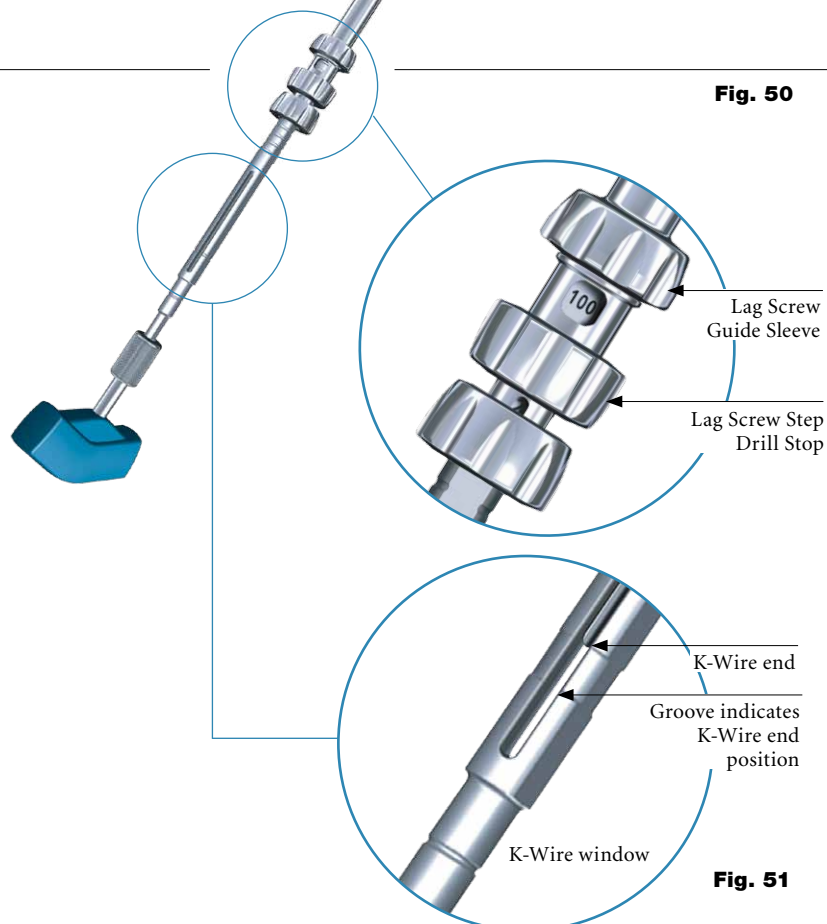
Ensure that under no circumstances the K-Wire is advanced into the pelvis. In case a deflection of the K-Wire is observed, it is strongly recommended to remove the K-Wire and replace it by a new one. If the Stepdrill does not pass through the Lag Screw hole with ease, check by image intensifier whether the K-Wire is deflected or not. Never drive the Stepdrill with force through the nail, since this may cause severe damage to the nail resulting in increased risk of implant failure.



**Fig. 49a**



**Fig. 50**



**Fig. 51**

# Operative Technique

## Lag Screw Insertion

Check on the image intensifier during drilling to monitor the depth of the drill near the subchondral bone. At this stage, you should see the tip of the K-Wire protruding about 6 to 10mm out of the step drill. This is because the threaded portion of the K-Wire was intentionally not included in the drill measurement. This is to prevent the drill from penetrating the joint (Fig. 52) and to ensure that the K-Wire remains anchored in the subchondral bone after reaming. Remove the Step Drill by turning it clockwise and pulling it backwards.

In case of hard bone, the Lag Screw Tap is available as an option.

Transfer the value of the measurement (Fig. 48) to the adjustable stop on the Lag Screw Tap (Fig. 52a). Make sure that the value (e. g. 100) is visible in the window (Fig. 52b). The selected length of the Step Drill, the Lag Screw Tap and the Lag Screw should all be the same (in this example 100mm).

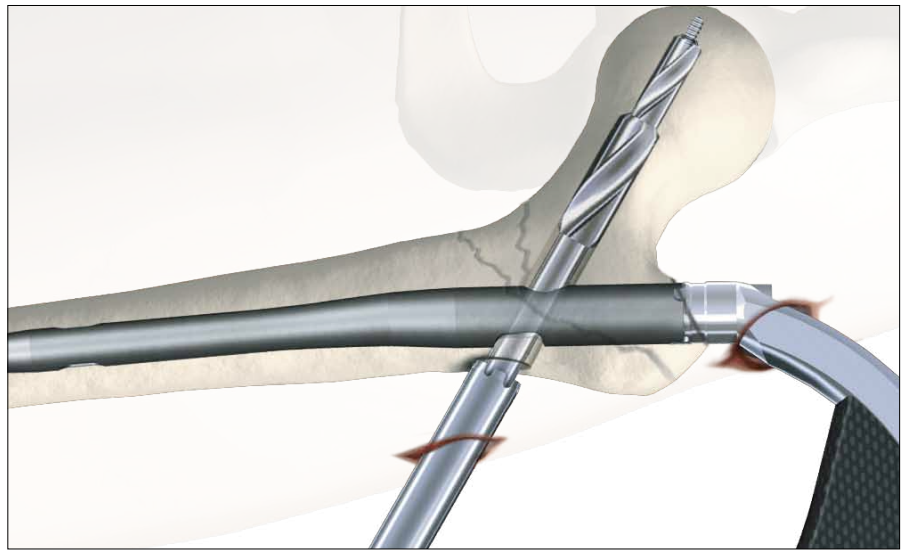


Fig. 52



Fig. 52a

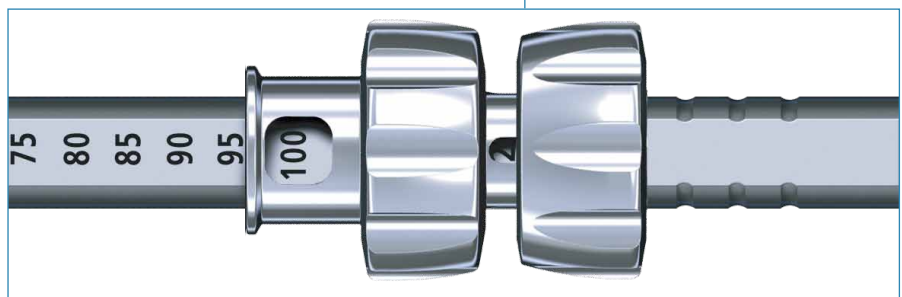


Fig. 52b

The screw is then assembled to the Lag Screwdriver (Fig. 53).

In a case where compression is to be applied, a shorter Lag Screw length should be chosen to avoid the excessive lateral Lag Screw protrusion (see chapter Compression/ Apposition below). Ensure that the pins of the Lag Screwdriver are in the slots of the Lag Screw. The end thumbwheel must be turned clockwise and tightened using the Ball Tip Screwdriver.

The Lag Screw assembly is now passed over the K-Wire, through the Lag Screw Guide Sleeve, and threaded up to the end of the pre-drilled hole of the femur head. Check the end position of the Lag Screw on the image intensifier. A double check of the end position is also possible with the indicator ring on the Lag Screw

Screwdriver when it reaches the end of the Lag Screw Guide Sleeve.

### Warning:

**Make sure that the K-Wire does not get protrude into the pelvis during the Lag Screw insertion.**

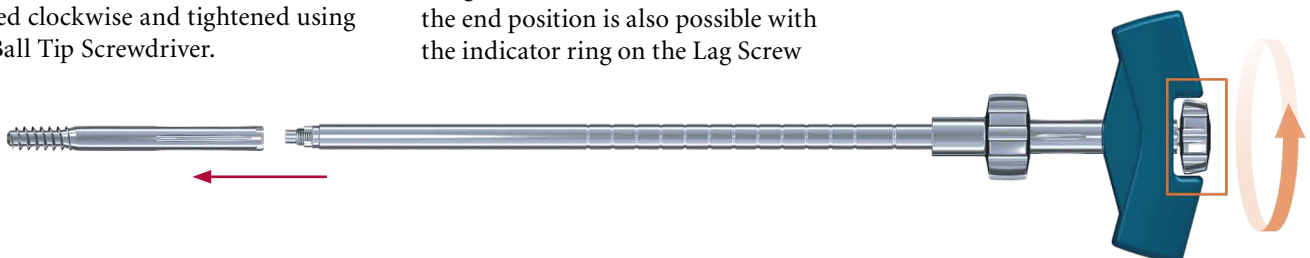


Fig. 53

Lag Screw and Lag Screwdriver assembly

# Operative Technique

## Lag Screw Fixation

The handle of the Lag Screwdriver must be either parallel or perpendicular (90°) to the Target Arm (Fig. 55 and 55a) to ensure that the Set Screw is able to fit into one of the 4 Grooves of the Lag Screw shaft. The Set Screw alignment indicator will help to find the right position of the handle.

If the T-Handle is not perpendicular or parallel to the Target Arm, turn it clockwise until it reaches this position. NEVER TURN THE LAG SCREW COUNTER CLOCKWISE.

If the K-Wire is inadvertently removed, then the screw may still be inserted without it, provided that the Guide Sleeve is still in contact with the cortex.

### Warning:

**It is strongly recommended to place the Lag Screw at the end of pre-drilled hole in order to provide maximal resistance against cut-out. Never turn the Lag Screw counterclockwise after the final position is reached, because otherwise the Lag Screw may lose full bony surface contact to its tip.**

### Compression / Apposition

If compression or apposition of the fracture gap is required, this can be achieved by gently turning the thumb-wheel of the Lag Screwdriver clockwise against the Guide Sleeve (Fig. 54). In osteoporotic bone care must be taken to prevent Lag Screw pullout in the femoral head. The Lag Screw should be chosen shorter depending on the expected amount of compression.



Fig. 54

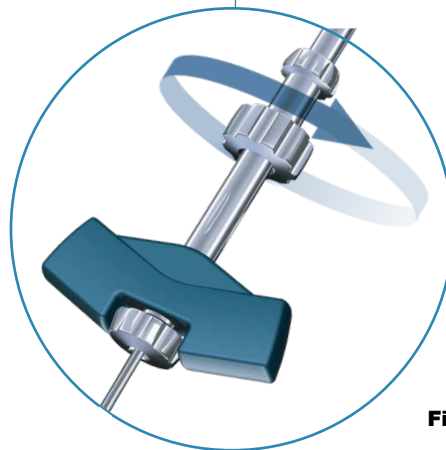


Fig. 54a



# Operative Technique

## Lag Screw Fixation

### Note:

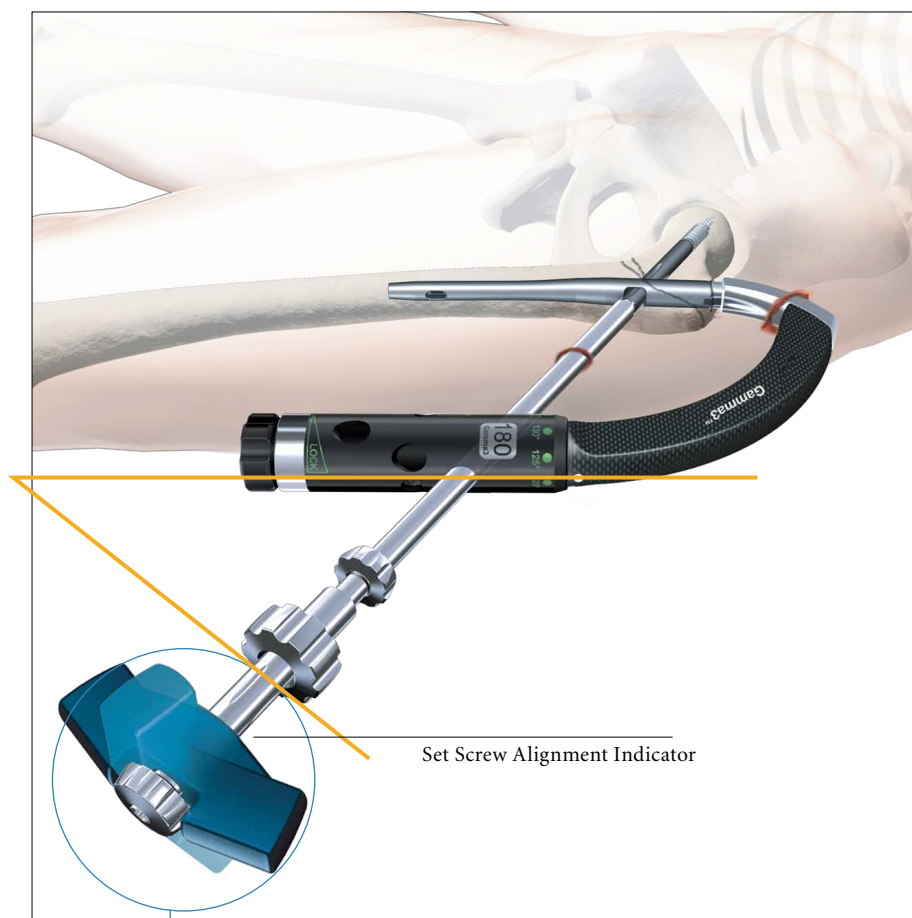
**The Set Screw must be used.  
The use of the Set Screw is not  
an option.**

Assemble the Set Screw to the Set Screw Driver. Insert the Set Screw as shown in Figure 56 along the opening of the post of the Targeting Device and advance it through the Nail Holding Screw pushing the Set Screwdriver.

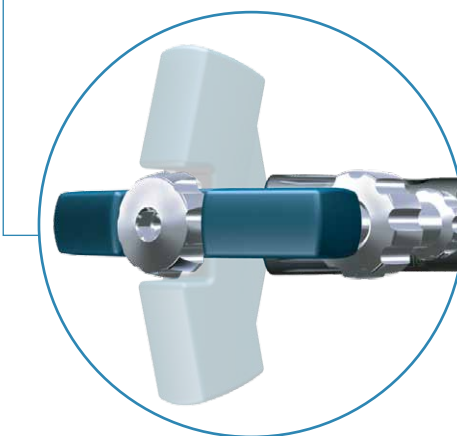
**Push the Set Screw Driver down until you are sure, that the Set Screw engages the corresponding thread in the nail. During pushing down the assembly, you may feel a slight resistance.**

Turn the Screwdriver handle clockwise under continuous pressure. You may notice a resistance when turning the Set Screw. This is because the Set Screw thread is equipped with the “Nylstop” system to prevent spontaneous loosening.

This is not the final position for the Set Screw.  
Keep on turning the Set Screw until you feel contact in one of the grooves of the Lag Screw.



**Fig. 55**  
**T-Handle end position**



**Fig. 55a**

# Operative Technique

To verify the correct position of the Set Screw, try to turn the Lag Screwdriver gently clockwise and counterclockwise. If it is not possible to turn the Lag Screwdriver, the Set Screw is engaged in one of the grooves. If the Lag Screw Driver still moves, recorrect the handle position and tighten the Set Screw again until it engages in one of the four grooves.

After slightly tightening the Set Screw it should then be unscrewed by one quarter ( $\frac{1}{4}$ ) of a turn, until a small play can be felt at the Lag Screwdriver. This ensures a free sliding of the Lag Screw.

Make sure that the Set Screw is still engaged in the groove by checking that it is still not possible to turn the Lag Screw with the Lag Screwdriver.

**Note:**

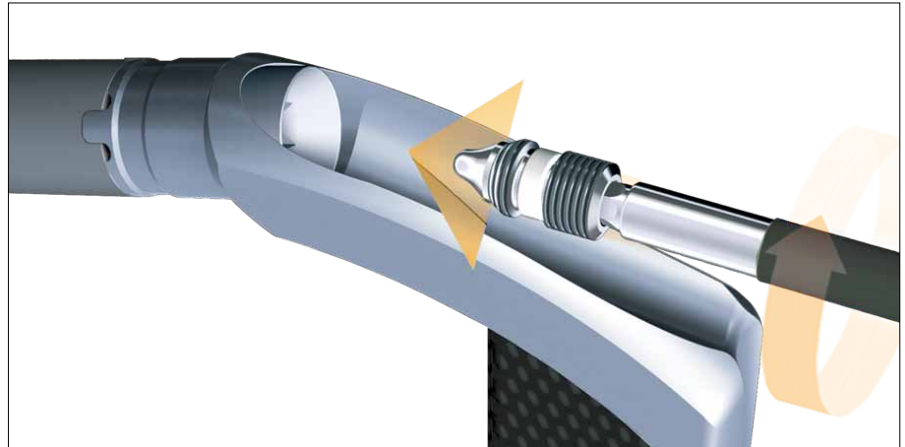
**Do not unscrew the Set Screw more than  $\frac{1}{4}$  of a turn.**

As an alternative, the Set Screw can be inserted using Gamma3 Closed Tube Clip (see next page).

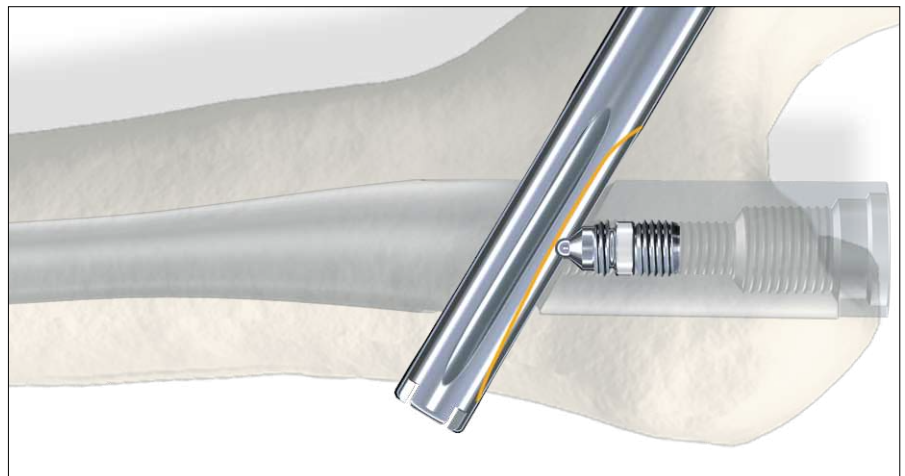
If distal locking is not indicated, the End Cap should be assembled to the nail end to prevent bone ingrowth. Leaving the Lag Screwdriver in place, the Nail Holding Screw is now removed using the ball tip Screw Driver or Universal Socket Wrench and turning it counter clockwise. Insert the End Cap (size 0) using the Socket Wrench or the Ball Tip Screwdriver. The End Cap should be tightened slightly.

Please see chapter “End Cap Insertion”.

Alternatively the End Cap could also be inserted free hand after removal of the Target Device.



**Fig. 56**  
**Set Screw insertion**



**Fig. 57**

# Operative Technique

## **Alternative: Set Screw Insertion with Gamma3 Closed Tube Clip**

Taking the Gamma3 Closed Tube Clip and clipping it onto the Gamma3 Targeting Arm, it is possible to create a guided path for the Set Screwdriver. With this new feature, by pushing down the flexible Set Screwdriver into the nail axis, the Set Screw can be easily guided into the cannulation of the nail. It is possible to assemble the Closed Tube Clip either prior to the Nail insertion or prior to the Set Screw insertion as shown in Fig. 58a.

### **Step 1**

Assemble the Gamma3 Closed Tube Clip to the Targeting Arm by pressing the grip together and releasing it. At this stage, you should assemble it slightly behind the groove of the Targeting Arm (Fig. 58a).

### **Step 2 and Step 3**

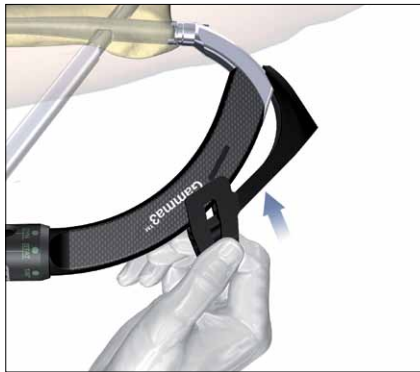
Hold the Targeting Device and Closed Tube Clip together, then push Closed Tube Clip with your thumb in the direction shown in arrow until it clicks onto the final position (Fig 58b and 58c).

### **Step 4**

Insert the Set Screw according to the normal procedure (Fig. 58d).

### **Caution:**

**The Gamma3 Closed Tube Clip is designed for the Flexible Set Screwdriver (1320-0233) only and NOT for the Straight Screw Driver (1320-0210) or (1320-0230).**



**Fig. 58a**



**Fig. 58b**



**Fig. 58c**



**Fig. 58d**



# Operative Technique

## Distal Screw Locking

Disconnect the Lag Screwdriver by loosening the end thumbwheel, remove the Lag Screwdriver, Lag Screw Guide Sleeve and the K-Wire. The nature of the fracture determines whether the distal Locking Screw is used.

It should be used:

- If the fracture is unstable
- If rotational stability is required
- When there is a wide disparity between the diameter of the nail and the femoral cavity

Gamma3 nails offer the possibility to be locked distally either dynamically or statically. The fracture pattern determines the method of distal locking.

### Note:

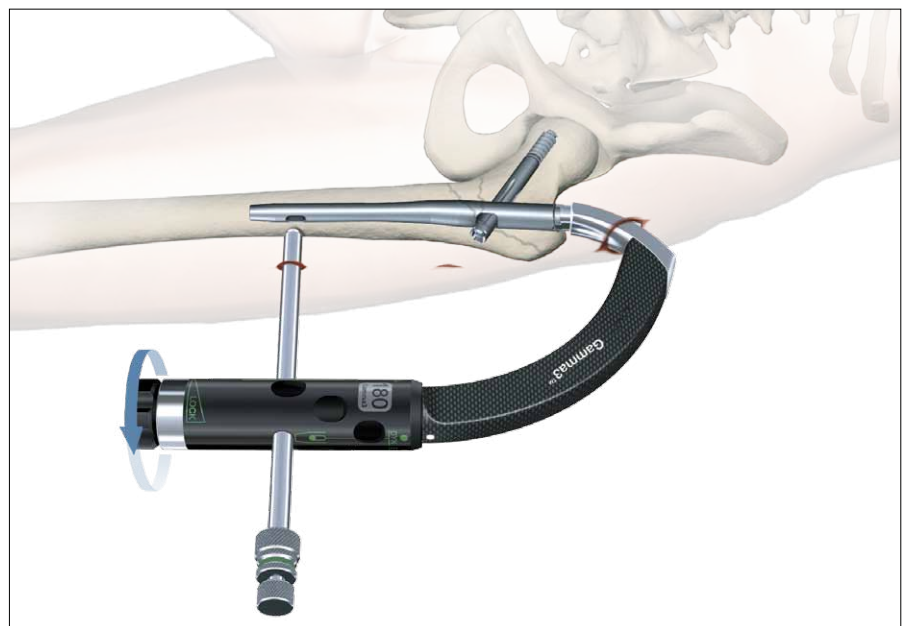
**These following points must be considered in order to perform a proper distal locking procedure:**

- Ensure that the Nail Holding Bolt is still fully tightened
- Avoid soft tissue pressure on the distal locking sleeve assembly- therefore the skin incision would be made (co-linear) in direction of the sleeve assembly
- Check that the distal locking sleeve assembly with the trocar removed is in contact with the lateral cortex of the Femur and is locked securely with the Speedlock Sleeve Knob. Confirm final locking screw placement with A/P and Lateral fluoroscopic X-Ray.
- Neutralize the power tool weight during drilling procedure and do not apply force to the Targeting Arm
- Start the power tool before having bone contact with the drill
- Use sharp and center tipped drills only

The Carbon Fiber Targeting Device offers the options of guided distal locking in a dynamic or static position of the nail. The green coded Targeting Sleeve of the Target Arm has to be adjusted in the required position. In the following description, a dynamic locking will be described. Turn the Targeting Sleeve until you reach the dynamic position with the point on



**Fig. 59**



**Fig. 60**

the Target Sleeve is in line where the arrow on the target arm. Push the sleeve up in the cranial direction. Now assemble the Tissue Protection Sleeve, Gamma3 Drill Sleeve and Gamma3 Trocar and advance it through the hole of the Target Arm down to the skin.

A small incision is started at the tip of the Trocar, and is extended down

to the lateral cortex (Fig. 59). The Trocar will extend beyond the sleeve by approx. 3mm when the Tissue Protection Sleeve has reached the lateral cortex (Fig. 60).

Before locking the sleeve, gently turn the Speedlock Sleeve Knob clockwise, making sure that the Tissue Protection Sleeve is in good contact with the bone (Fig. 60).

# Operative Technique

The Trocar is now removed and replaced by the calibrated green coded 4.2mm x 300mm drill. Drill through the first cortex and as the second cortex is reached read off the measurement on the drill scale. Add the thickness of the cortex, which is approximately 5mm, to this measurement to select the correct screw length (Fig. 61a). Proceed to drill the second cortex.

Alternatively, the drill can be drilled through the second cortex and monitored by X-Ray or image intensifier. The screw length can then be read directly from the scale on the drill (Fig. 61b). Proceed to drill the second cortex.

It is also possible to measure the correct screw length using the Screw Gauge after drilling through the second cortex. The Drill Guide Sleeve must be removed and the Screw Gauge may be advanced through the Tissue Protection Sleeve. Put the small hook behind the medial cortex and read the required locking screw length from the scale.

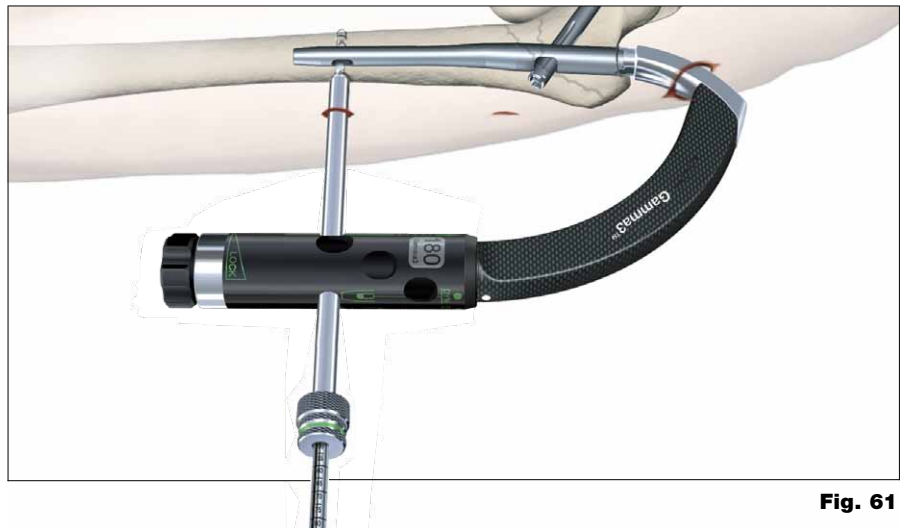
## Caution:

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

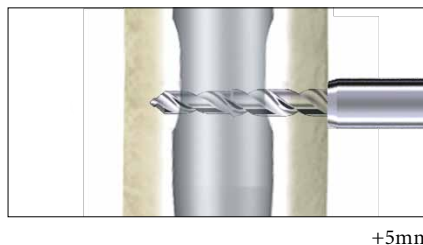
Insert the 5mm distal Locking Screw (Fig. 62) through the Distal Tissue Protector by using the 3.5mm Screwdriver until the mark on the Screwdriver shaft approaches the Protector; advance the screw head carefully until it is slightly in direct contact with the cortex.

## Note:

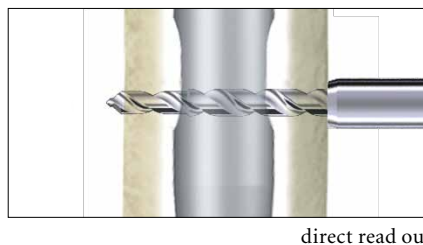
**When the mark on the Screwdriver shaft reaches the Tissue Protection Sleeve, this indicates that the screw head is near the cortex (Fig. 62a). Take care not to overscrew. The screw head should come just into contact with the cortex and resistance should be felt.**



**Fig. 61**



**Fig. 61a**



**Fig. 61b**



**Fig. 62**

**Fig. 62a**

# Operative Technique

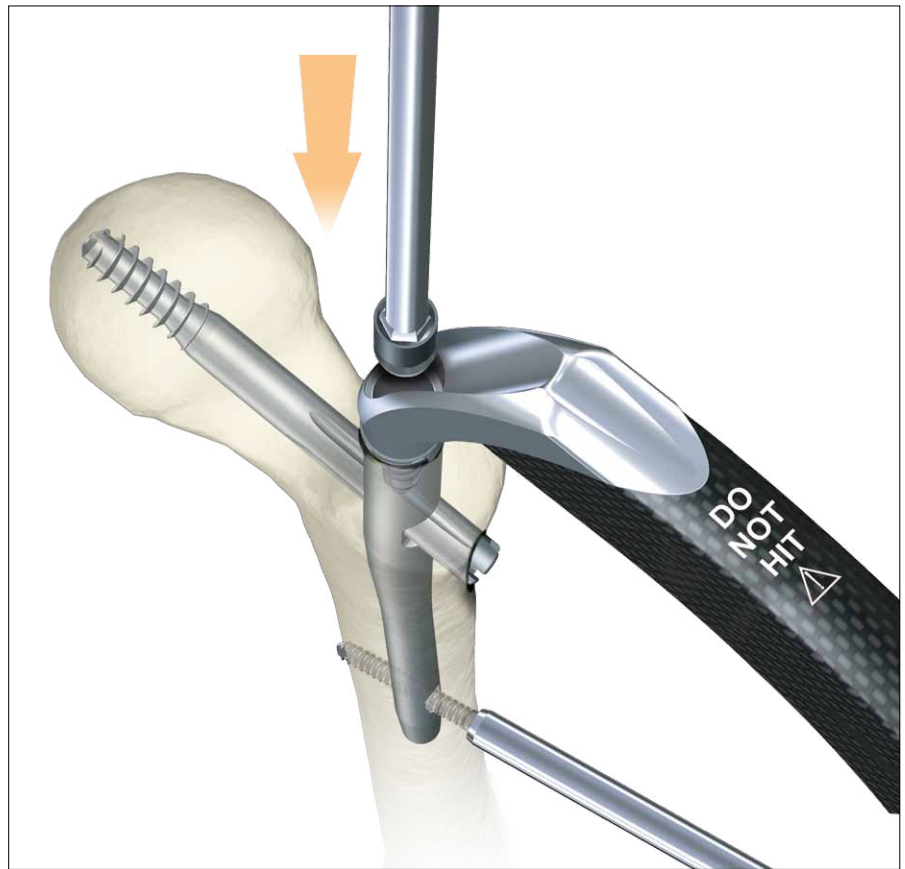
## End Cap Insertion

It is recommended to use an End Cap to close the proximal part of the nail to prevent bone ingrowth.

Leave the Screwdriver for the distal locking in place and remove the Nail Holding Screw using the Ball Tip Screwdriver, Spreading Screwdriver or Screwdriver Strike Plate. Load the End Cap (size 0) to one of the Screwdrivers and pass the assembly through the top of the Targeting Device down into the nail.

Turn the handle clockwise until it stops mechanically. Remove the Screwdriver, the distal Screwdriver and the distal sleeves and remove the Targeting Device in cranial direction.

Alternatively the End Cap could also be inserted free hand after removal of the Target Device.



**Fig. 63**  
**End Cap assembly**



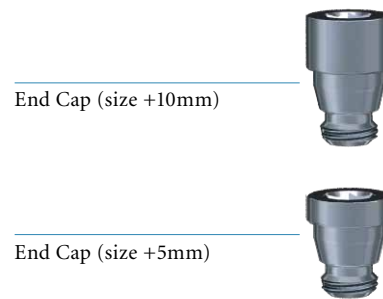
**Fig. 64**  
**Final Nail assembly**

# Operative Technique

## Nail Extension End Caps

If the proximal end of the nail is completely in the trochanter and cortical bone support is required at the end of the nail, End Caps in size +5mm and +10mm are available and can be assembled to the nail instead of the End Cap size 0. The proximal part of the nail will be elongated by 5mm or 10mm.

The elongation End Caps are assembled using the Screwdriver Strike Plate with the self retaining ring, Spreading Screwdriver or Ball Tip Screwdriver. This can only be done if the Target Device is already removed from the nail.



## Post-operative Care and Rehabilitation

Active and passive mobilization of the lower limbs may be started immediately. The injured limb should be kept elevated.

For stable fractures with dynamic locking, full weight-bearing walking may be started immediately. For unstable fractures with static locking, immediate full weight-bearing walking is allowed in fractures with good bone contact.

For fractures with poor bone contact due to comminution, partial weight-bearing walking is allowed for the first 6 to 8 weeks. Full weight-bearing walking can be commenced when there is a bridging callus formed as evident on the follow up X-Ray.

**Fig. 65**



# Operative Technique

## Extraction of the Gamma3 Implants

Where implant extraction is indicated, please proceed as follows:

### Step I (Fig. 66)

Remove the distal screw using the 3.5mm Screwdriver after making an incision through the old scar.

### Step II (Fig. 67)

Make a small incision through the old scar below the greater trochanter to expose the outer end of the Lag Screw. Remove any bony ingrowth which may be obstructing the outer end or internal thread of the Lag Screw as necessary to enable the Lag Screwdriver to engage fully.

The K-Wire is then introduced via the Lag Screw into the head of the femur. The Lag Screwdriver is passed over the K-Wire, using the Lag Screw Guide Sleeve as a Tissue Protector, and engaged with the distal end of the Lag Screw.

Check that ingrowth does not obstruct secure engagement of the Lag Screwdriver, otherwise the Lag Screw or Screwdriver may be damaged and extraction will be much more difficult. Tighten the thumbwheel clockwise.

### Step III (Fig. 68)

An incision is made over the proximal end of the nail, the proximal End Cap if used is removed using the Ball Tip Screwdriver, Spreading Screwdriver or Screwdriver Strike Plate, and the Set Screwdriver is engaged with the Set Screw. The screw is rotated anticlockwise until it is removed.

#### Note:

As the targeting device is not connected to the nail, we recommend using the Straight Set Screwdriver (1320-0210) for better guidance through the soft tissue to get access to the Set Screw.

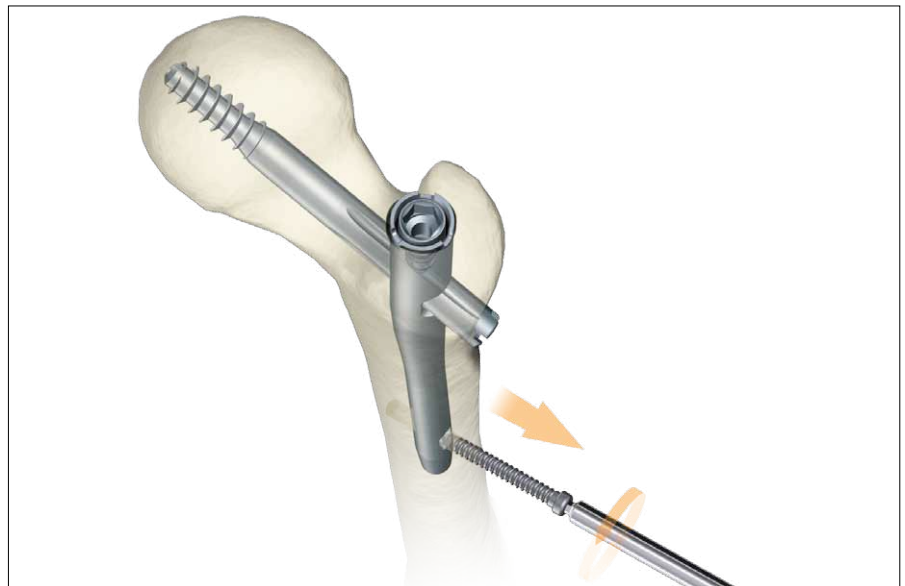


Fig. 66

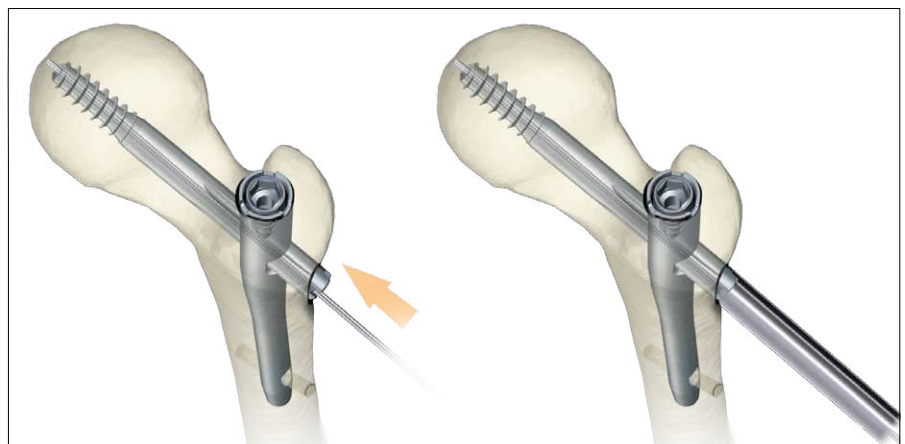


Fig. 67

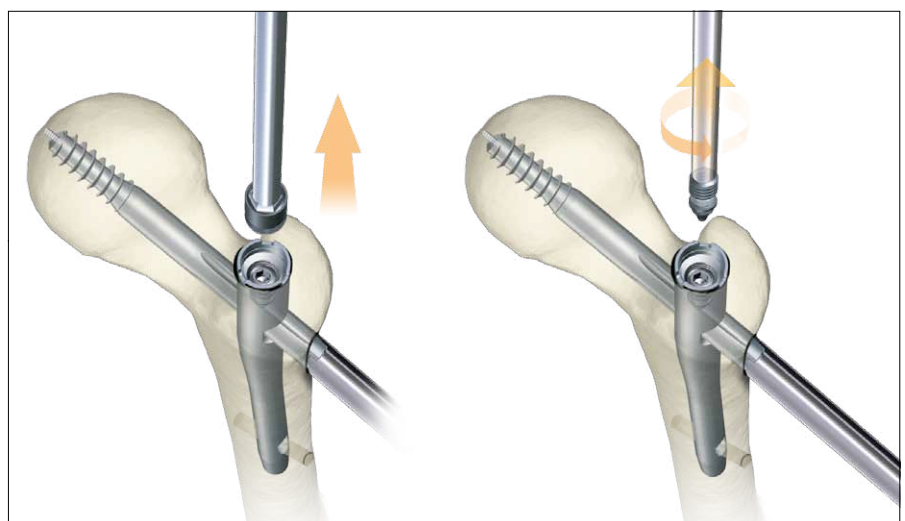


Fig. 68



# Operative Technique

## Step IV (Fig. 69)

The Nail Extraction Adapter is then threaded and tightened into the proximal end of the nail. The Lag Screw is extracted by anti-clockwise rotation and pulling of the Lag Screwdriver. The K-Wire must then be removed.

## Step V (Fig. 70a & b)

An appropriate sliding hammer assembly is attached to the Nail Extraction Adapter and the nail is extracted.

### Note:

- It is useful to turn the Lag Screw Screwdriver clockwise slightly first to loosen the possibly bony ingrowth into the screw threads before turning it counter clockwise.
- As an alternative for implant extraction and even in rare case of broken implants the Stryker Implant Extraction System can be used.

For details, please refer to the "Implant Extraction Set" Guide or ask Stryker Representative for further assistance.

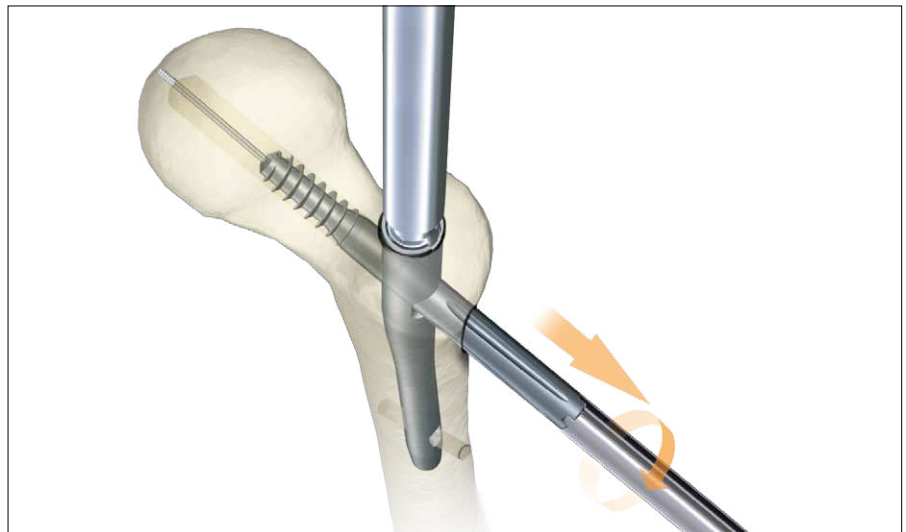


Fig. 69

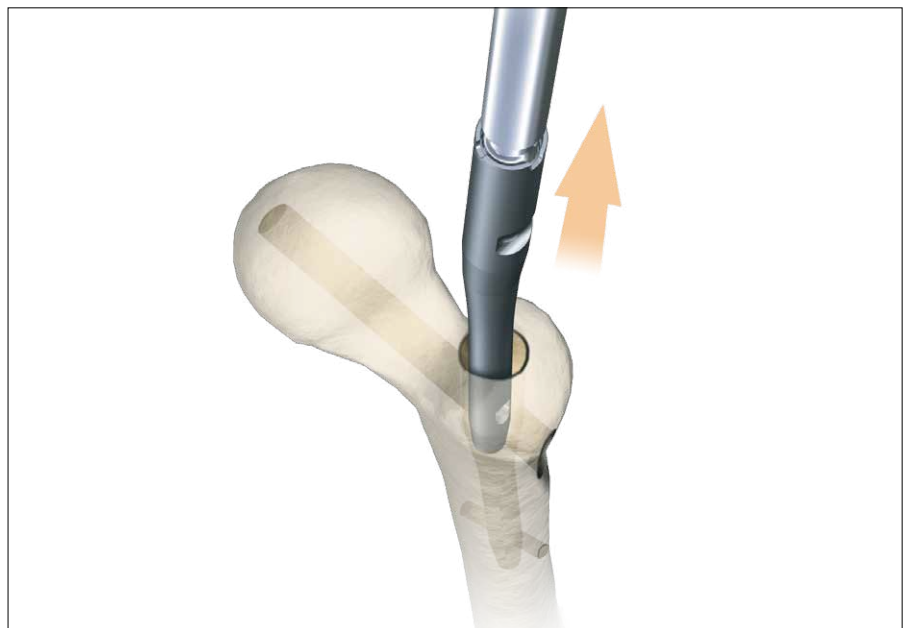
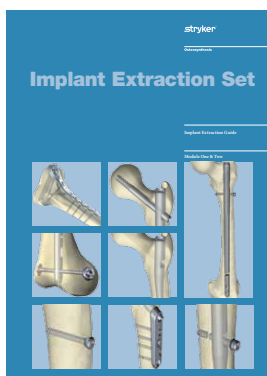


Fig. 70a



Implant Extraction Set:

- Quick Reference Guide
- Implant Extraction Guide

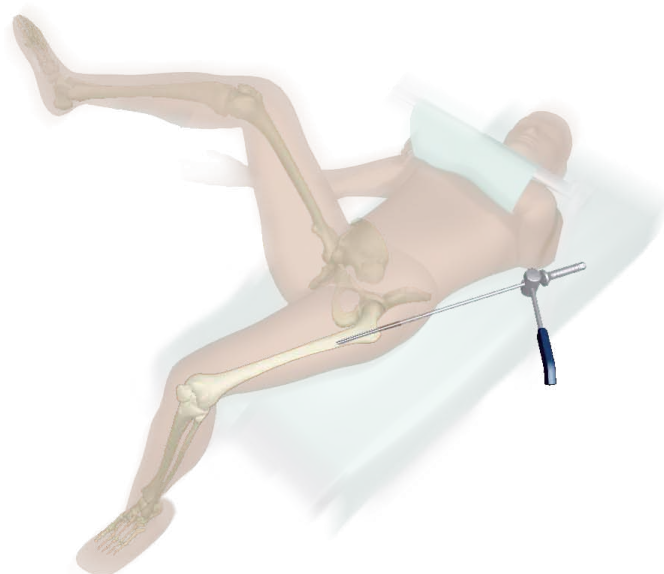


Fig. 70b

# Operative Technique

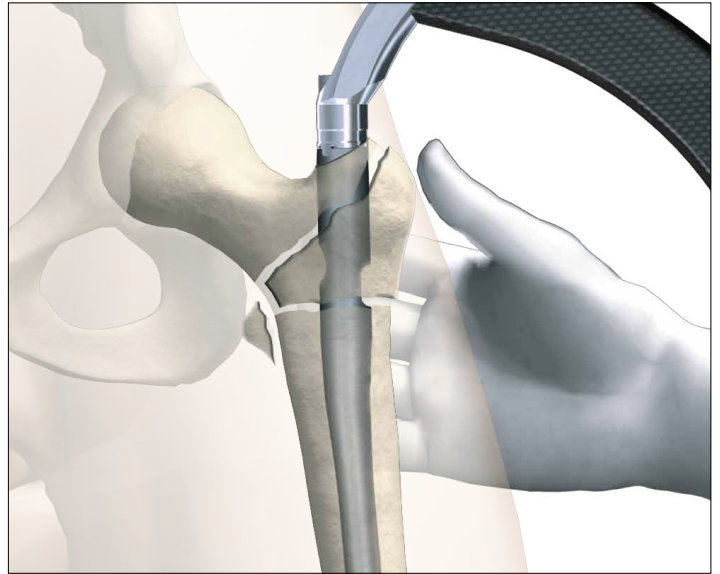
## Dealing with Special Cases

In the case of a comminuted fracture, there is a tendency for the fracture to become displaced posterior, making it difficult to place the K-Wire into the center of the neck and head. This can be solved by lifting the nail insertion Targeting Device (Fig. 71).

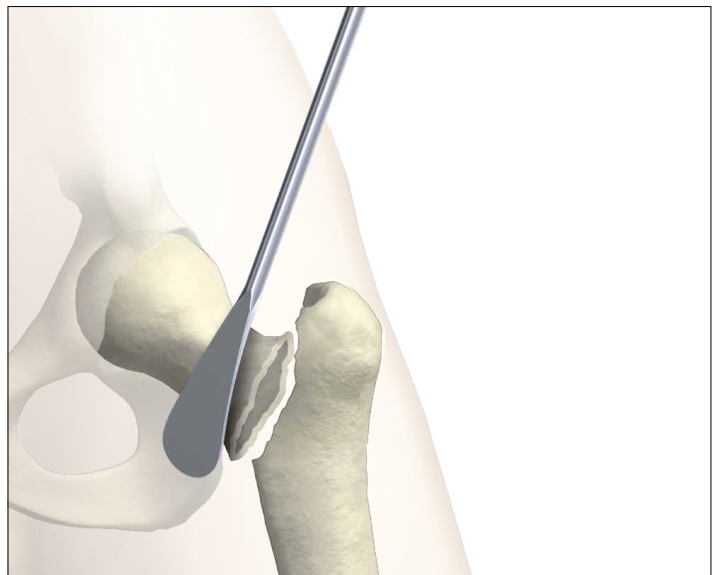
Alternatively, an assistant can lift up the greater trochanter manually or with a reduction spoon; or support it with a sandbag. This will help maintain the neck and the femur in almost the same axis, facilitating passage of the K-Wire through the center of the neck and head.

In a case when the proximal fragment is split and making it difficult to place the K-Wire into the center of the femoral neck and head, the Reduction Spatula can be utilized as an option. Enter with the Reduction Spatula from the same incision for the nail entry. Then slide the Reduction Spatula along the surface of the trochanter (Fig. 72a). Gently lift the lever to manipulate the region of the displaced fragment. It is important to continue holding the Reduction Spatula until the Lag Screw insertion is completed (Fig. 72b).

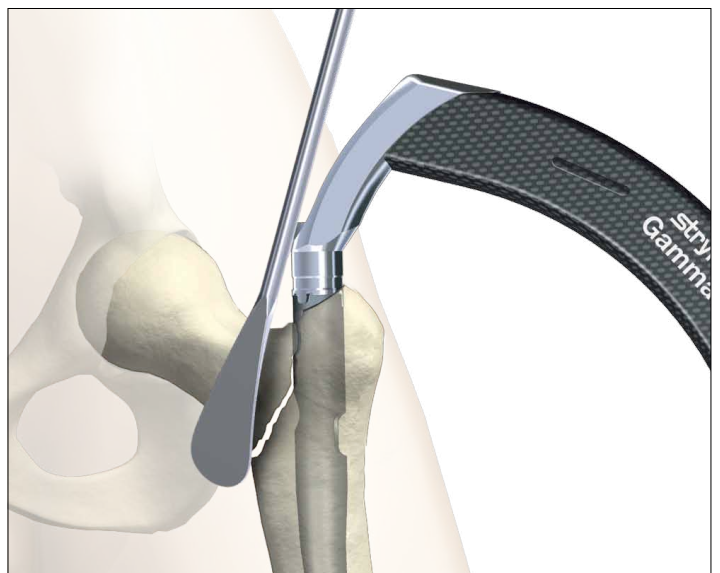
The position should then be checked in both the anterior-posterior and lateral views using the image intensifier.



**Fig. 71**



**Fig. 72a**



**Fig. 72b**



## Packaging

**All implants are packed sterile only.**

The Nail and Lag Screw Implant have to be secured using the Set Screw in every surgical operation, without exception (see also page 34).

**The Nail and the Set Screw are therefore supplied together in the same blister pack (see Fig. 73).**

The blister is packed in a white carton and wrapped to protect the contents during transportation and storage.

Only two package sizes are used for all the nails (Fig. 74).

The long nails are packed in a longer box and the short nails in a shorter box.

This facilitates identification in the storage area.

The package carries also the date of sealing and a sterility expiration date.

**Fig. 73**



Long Nail, packaging example



Trochanteric Nail, packaging example

**Fig. 74**

# Ordering Information – Implants

## TROCHANTERIC NAIL KIT 180, TI \*



| Titanium<br>REF | Diameter<br>mm | Length<br>mm |
|-----------------|----------------|--------------|
| 3120-1180S      | 15.5/11        | 180 x 120°   |
| 3125-1180S      | 15.5/11        | 180 x 125°   |
| 3130-1180S      | 15.5/11        | 180 x 130°   |

## 5MM FULLY THREADED LOCKING SCREW, TI \*\*



| Titanium<br>REF | Diameter<br>mm | Length<br>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         |
| 1896-5050S      | 5.0            | 50.0         |

## LAG SCREW, TI



| Titanium<br>REF | Diameter<br>mm | Length<br>mm |
|-----------------|----------------|--------------|
| 3060-0070S      | 10.5           | 70           |
| 3060-0075S      | 10.5           | 75           |
| 3060-0080S      | 10.5           | 80           |
| 3060-0085S      | 10.5           | 85           |
| 3060-0090S      | 10.5           | 90           |
| 3060-0095S      | 10.5           | 95           |
| 3060-0100S      | 10.5           | 100          |
| 3060-0105S      | 10.5           | 105          |
| 3060-0110S      | 10.5           | 110          |
| 3060-0115S      | 10.5           | 115          |
| 3060-0120S      | 10.5           | 120          |
| 3060-0125S      | 10.5           | 125          |
| 3060-0130S      | 10.5           | 130          |

## END CAPS, TI



| Titanium<br>REF | Diameter<br>mm | Length<br>mm |
|-----------------|----------------|--------------|
| 3005-1100S      | 11.0           | 0            |
| 3005-1105S      | 15.5           | + 5          |
| 3005-1110S      | 15.5           | + 10         |

## SET SCREW, TI (AVAILABLE SEPARATELY)



| Titanium<br>REF | Diameter<br>mm | Length<br>mm |
|-----------------|----------------|--------------|
| 3003-0822S      | 8              | 17.5         |

\* Nails are packed together with the Set Screw, sterile.

\*\* Longer Locking Screws as well as partially threaded screws are available on request.

# Ordering Information – Implants

## TROCHANTERIC NAIL KIT 180, STST \*



| Stainless Steel<br>REF | Diameter<br>mm | Length<br>mm |
|------------------------|----------------|--------------|
| 4120-1180S             | 15.5/11        | 180 x 120°   |
| 4125-1180S             | 15.5/11        | 180 x 125°   |
| 4130-1180S             | 15.5/11        | 180 x 130°   |

## 5MM FULLY THREADED LOCKING SCREWS, STST \*\*



| Stainless Steel<br>REF | Diameter<br>mm | Length<br>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         |
| 1796-5050S             | 5.0            | 50.0         |

## LAG SCREW, STST



| Stainless Steel<br>REF | Diameter<br>mm | Length<br>mm |
|------------------------|----------------|--------------|
| 4060-0070S             | 10.5           | 70           |
| 4060-0075S             | 10.5           | 75           |
| 4060-0080S             | 10.5           | 80           |
| 4060-0085S             | 10.5           | 85           |
| 4060-0090S             | 10.5           | 90           |
| 4060-0095S             | 10.5           | 95           |
| 4060-0100S             | 10.5           | 100          |
| 4060-0105S             | 10.5           | 105          |
| 4060-0110S             | 10.5           | 110          |
| 4060-0115S             | 10.5           | 115          |
| 4060-0120S             | 10.5           | 120          |

## END CAPS, STST



| Stainless Steel<br>REF | Diameter<br>mm | Length<br>mm |
|------------------------|----------------|--------------|
| 4005-1100S             | 11.0           | 0            |
| 4005-1105S             | 15.5           | +5           |
| 4005-1110S             | 15.5           | +10          |

## SET SCREW, STST



| Stainless Steel<br>REF | Diameter<br>mm | Length<br>mm |
|------------------------|----------------|--------------|
| 4003-0822S             | 8              | 17.5         |

\* Nails are packed together with the Set Screw, sterile.

\*\* Longer Locking Screws as well as partially threaded screws are available on request.



# Ordering Information – Instruments

|  | REF        | Description  |
|--|------------|--|
| <b>Basic Instruments</b>   |            |  |
|  | 702628     | T-Handle, Quicklock  |
|  | 1210-6450S | Kirschner Wire, sterile*   |
|  | 1320-0011  | One Step Conical Reamer, working with Conical Reamer Sleeve short and long |
|  | 1320-0026  | Multihole Trocar, short  |
|  | 1320-0065  | Screwdriver 8mm, Ball-Tip, T-Handle  |
|  | 1320-0031  | Conical Reamer Sleeve, short   |
|  | 1320-0066  | Spreading Screwdriver  |
|  | 1320-0090  | Nail Holding Screw   |
|  | 1320-0100  | Gamma3 Targeting Arm   |
|  | 1320-1118  | Speedlock Sleeve 180   |
|  | 1320-0130  | Lag Screw Guide Sleeve   |
|  | 1320-0140  | Drill Guide Sleeve 4.2mm for Lag Screw, green                              |
|  | 1320-0150  | Guide Wire Sleeve  |
|  | 1320-0180  | Lag Screw Ruler  |
|  | 1320-0190  | Lag Screw Step Drill   |
|  | 1320-0200  | Lag Screw Driver   |
|  | 1320-0233  | Flexible Set Screwdriver, 4mm  |
|  | 1320-3010  | One Shot Device, Gamma3  |
|  | 1320-3042S | Drill 4.2 x 300mm, AO small, green, sterile*                               |
|  | 1806-0041  | Awl, Curved  |
|  | 1806-1095  | Guide Wire Handle, blue coded (combined only with 1806-1096)               |
|  | 1806-1096  | Guide Wire Handle Chuck, blue coded (combined only with 1806-1095)         |
|  | 1806-0185  | Tissue Protection Sleeve, Long   |
|  | 1320-0215  | Gamma3 Drill Sleeve, green coded   |
|  | 1806-0232  | Screwdriver, Long  |
|  | 1320-0315  | Gamma3 Trocar, green coded   |
|  | 1806-0325  | Screw Gauge, Long  |
|  | 1806-0365  | Screw Scale, Long (for Long Nail)  |
|  | 1806-0480  | Screw Gauge (for Long Nail)  |
|  | 1806-4270S | Drill Ø4.2 x 180mm, AO small, green, sterile (for Long Nail)*              |

\* For non-sterile, leave "S" off the REF number when ordering.

# Ordering Information – Instruments



| REF                | Description  |
|--------------------|--|
| <b>Basic Trays</b> |  |
| 1320-9100          | Instrument Metal Tray, Basic, empty                  |
| 1320-6100          | Instrument Set, Metal Tray, Basic, completely filled |

| REF | Description |
|-----|-------------|
|-----|-------------|

## Optional Instruments



|            |   |
|------------|---|
| 702634     | Large AO Coupling Hall Fitting  |
| 0152-0218S | K-Wire 1.8 x 310mm, for Condyle Screws*                                 |
| 1213-9091S | Guide Pin 4 x 400mm*  |
| 1320-0021  | Conical Reamer Trocar, short  |
| 1320-0022  | Conical Reamer Sleeve, long   |
| 1320-0027  | Multihole Trocar, long  |
| 1320-0032  | Conical Reamer Sleeve, long   |
| 1320-0041  | Cannulated Cutter, use with 4mm Guide Pin only                          |
| 1320-0042  | Sleeve for Cannulated Cutter  |
| 1320-0070  | Screwdriver Strike Plate  |
| 1320-0110  | Clip for K-Wire   |
| 1320-0112  | Gamma3 U-Wire   |
| 1320-0125S | Closed Tube Clip*   |
| 1320-0131  | Lag Screw Guide Sleeve, navigated                                       |
| 1320-0160  | Rotational Control Clip   |
| 1320-0170  | Rotational Control Sleeve   |
| 1320-0210  | Straight Screwdriver, 4mm for Set Screw                                 |
| 1320-3030S | Drill 3.0 x 300mm, AO small, sterile, white (for Fragment Control Clip) |
| 1320-3035  | Drill 3.0 x 300mm, Tri-Flat Fitting, white (for Fragment Control Clip)* |
| 1320-3045S | Drill 4.2 x 300mm, Tri-Flat Fitting*                                    |
| 1320-3642S | Drill 4.2 x 360mm, AO small, green*                                     |
| 1320-3645S | Drill 4.2 x 360mm, Tri-Flat Fitting*                                    |
| 1320-9002  | Insert for Bixcut Reamer Heads for Diameter 11, 12, 13, 14, 15.5mm      |
| 1407-4006  | Nail Extraction Adapter   |
| 1806-0020  | Guide Wire Ruler (for Long Nail)  |
| 1806-0032  | Trocar for Curved Awl, (Awl Plug)                                       |
| 1806-0085S | Guide Wire, Ball Tip, Ø3 x 1000mm, Sterile*                             |
| 1806-0110  | Universal Rod   |
| 1806-0125  | Reduction Spoon   |

\* For non-sterile, leave "S" off the REF number when ordering.

# Ordering Information – Instruments

|   | REF        | Description   |
|---|------------|---|
| <b>Optional Instruments</b>   |            |   |
|    | 1320-0133  | Paddle Trocar   |
|    | 1320-0195  | Tap   |
|    | 1320-0045  | Rasp Awl  |
|    | 1320-0015  | Crown Drill   |
|    | 1320-0016S | K-Wire 3.2mm with Washer  |
|    | 1320-0225  | Reduction Spatula   |
|    | 1320-0085  | Cleaning Stylet   |
|    | 1320-9105  | Instrument Metal Tray, Optional, empty                                    |
|    | 1806-0130  | Wrench, 8mm/ 10mm   |
|    | 1806-0170  | Slotted Hammer  |
|   | 1806-0203  | Selfholding Screwdriver, extrashort                                       |
|  | 1806-0233  | Selfholding Screwdriver, long   |
|  | 1806-0238  | Selfholding Screwdriver, short  |
|  | 1806-0255  | Condyle Screwdriver (for Condyle Screws)                                  |
|  | 1806-0450  | Tissue Protection Sleeve  |
|  | 1806-0460  | Drill Sleeve Ø4.2mm   |
|  | 1806-4290S | Drill, 4.2 x 230mm, AO small, green (Long Nail)*                          |
|  | 1806-5020S | Drill, 5 x 340mm, AO small, sterile, black (for Condyle or Shaft Screws)* |

## 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 Elastosil handles.
- Care should be taken to utilize the Cleaning Stylet for intra- and post-operative cleaning of cannulated instruments. Rinsing with saline solution can help prevent accumulation of debris.

## X-Ray Template

|           |   |
|-----------|---|
| 1320-0002 | X-Ray Template, Gamma3 Nail 180         |
| 1320-0005 | X-Ray Template, Gamma3 Long Nail, R 2.0 |

\* For non-sterile, leave "S" off the REF number when ordering.

# References

## Publications

More than 1.500.000 Gamma Nail implantations have been performed world wide over the last 22 years. Extensive clinical experience has been published with the Gamma Locking Nail.

## We recommend the following publications:

- The Gamma Locking Nail, Ten Years Surgical Experience Gahr, R. H.; Leung, K.-S.; Rosenwasser, M. P.; Roth, W. (eds.), Einhorn-Press Verlag, ISBN 3-88756-808-7
- Patients treated with the Long Gamma Nail, R. van Doorn, Bedrijfsnaam: Castellum Drukwerk Vof.

These books contain almost 300 clinical reports available on request.





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