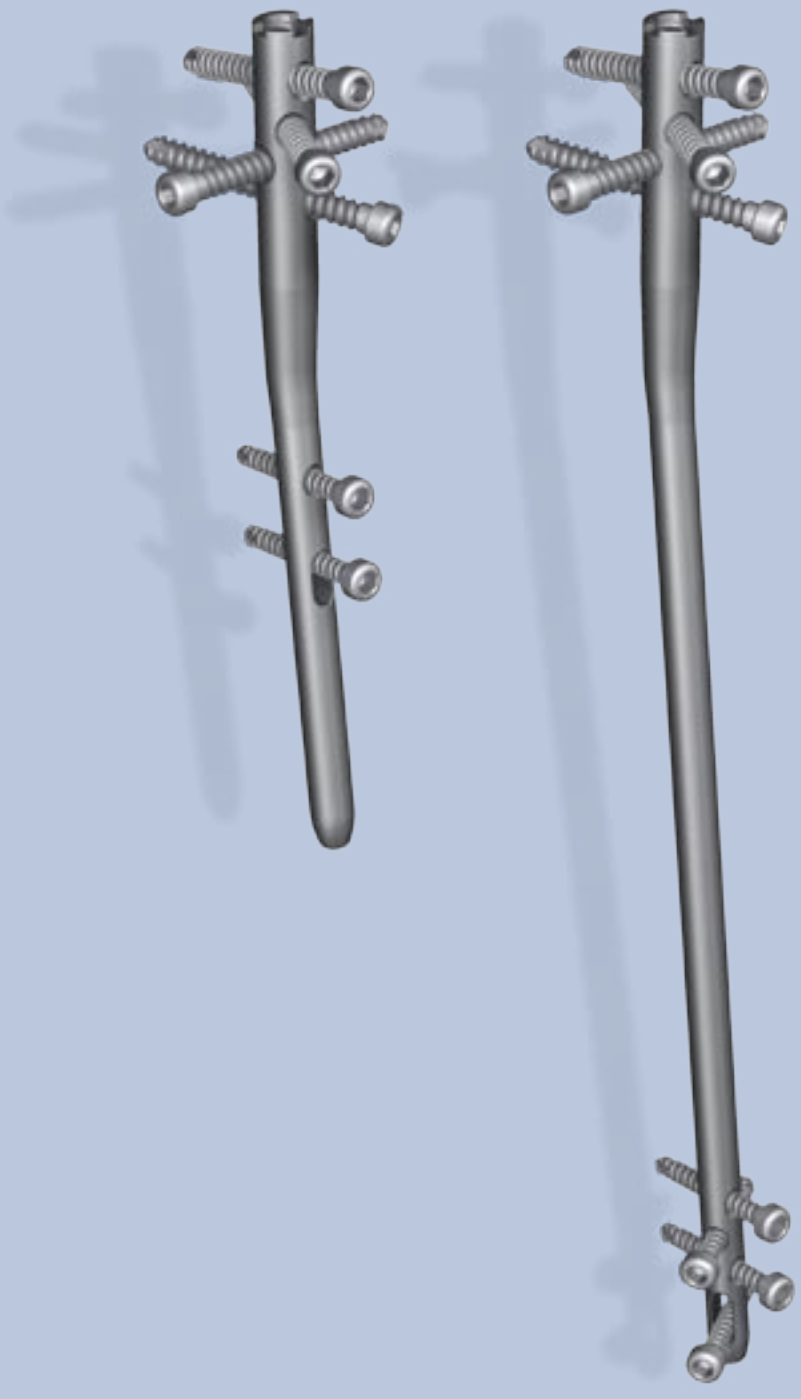
stryker®

Trauma

T2™
Proximal Humeral Nailing System

Operative Technique



Introduction

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

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

A workshop training is required prior to first surgery.

Contents

Introduction

1. Introduction

Proximal humeral fractures can be difficult to treat, particularly multifragmented fractures in osteopenic bone. A large number of treatment modalities have been developed over the years.

Treatments range from conservative measures such as swathe, to percutanous procedures using pins, wires and screws onwards to open procedures with plate fixation and even joint replacement.

Problems lie in the difficulty of obtaining fixation of one or several fragments and achieving rotator cuff stability to allow early motion. **Reduction and fixation must be performed without disturbing** the blood supply to the fracture fragments.
Finally, the **implants** used should be low profile so as not interfere with surrounding soft tissue or the acromion. Additionally, the risk of implant migration should be minimized.

1.1. Implant Features

To complement the **T2™ Nailing System**, Stryker Trauma has created a "new generation" humeral implant: the T2™ Proximal Humeral Nail for the treatment of complex proximal humeral fractures, and those with diaphyseal extension.

Although based on the well-known **T2™** platform, the **T2™** Proximal Humeral Nail design incorporates a number of unique features:

- **Small diameter** intramedullary implant that requires only a 10mm entrance hole and minimal canal preparation.
- **Left and right versions**, designed to reduce possible interference with the axillary nerve.
- **End Caps, of three different heights** in 2mm increments, allow fine adjustment to the length of the nail and optimize the purchase of the nail in the entrance hole.
- **Four Proximal Locking Holes** strategically placed to enable locking of separate fragments of the Lesser Tuberosity, the Greater Tuberosity and the Humeral Head.
- The **Proximal Locking Holes in the nail are threaded.** Thus, the holding strength of the Locking Screws will not depend on purchase in the often poor cancellous bone. The Locking Screws can also provide firm anchoring for suture augmentation of the Tuberosity fragment.
- The Proximal Locking Holes in the nail have a **nylon bushing**. This will further improve the holding strength of the screws and helps avoid screw back out. It also stops screw toggle, thereby minimizing mechanical destruction of osteopenic bone.
- **Washers** may be used in conjunction with the screws for fixing fragmented tuberosities. However, they can also stabilize the nail, allowing compression of the surrounding bone against the nail.
- The Distal Locking Hole configuration allows for either **Static or Dynamic Locking Modes.** In the Dynamic Locking mode, the pull of muscles spanning the fracture may be used for secondary dynamization.
- **The bend** of the nail allows insertion at the standard insertion point, i.e. lateral entry just inside the Greater Tuberosity, or central insertion, i.e. through the articular surface at the top of the humeral head. Central insertion improves fixation through interference between the subchondral bone at the entry point and the proximal end of the nail.
- **The 6° lateral bend** allows insertion of the nail along an almost straight path. The risk of losing reduction of fragments during insertion is thereby minimized.
  The nail may be used for percutanous reduction and insertion, or open insertion through a deltopectoral approach when indicated.
- **The long nails** (220mm–300mm) are **cannulated** and allow reaming of the medullary canal over the 2.5×800mm Ball Tip Guide Wire (1806-0083S). **The solid nail** design of **the short nail** (150mm) should not require additional reaming for nail insertion.

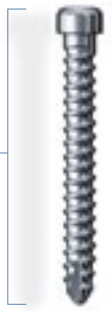
All implants of the **T2™** Proximal Humeral System are made from **Type II Anodized Titanium Alloy (Ti6Al4V) to maximize mechanical strength and biocompatibility.**

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

Technical Details

Nails (left & right)
Distal Diameter 8mm*
Sizes 150mm (Short Nail)
220–300mm (Long Nail)

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



Fully Threaded Locking Screw**
Length 25–60mm
Diameter 5mm

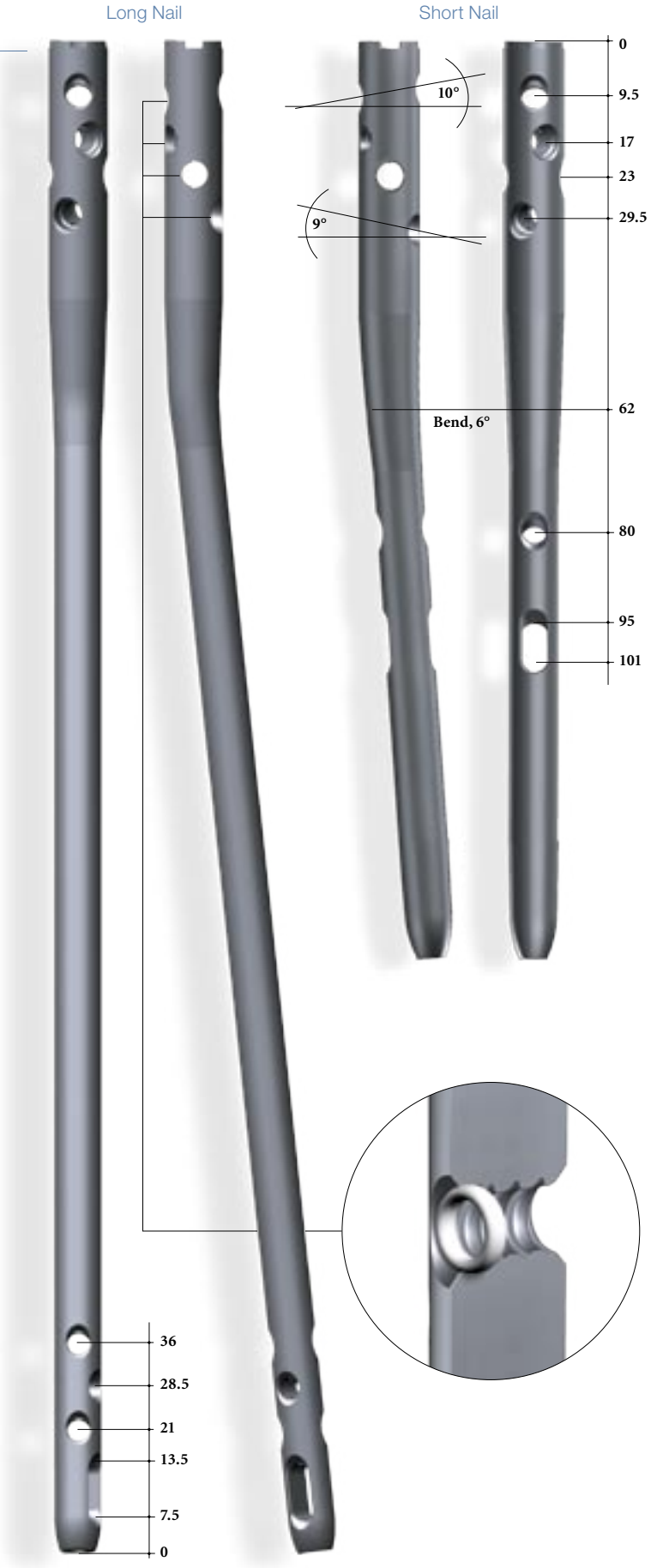
Fully Threaded Locking Screw***
Length 20–60mm
Diameter 4mm

Washers
Round:
Diameter 17mm

Square:
Size 10×18mm

Proximal Humerus End Cap

standard**** +2mm +4mm



* Nail driving end has a diameter of 10mm.
** For Proximal Locking Only
*** For Distal Locking Only
**** standard End Cap is flush with the nail

Features

1.2. Instrument Features

The majority of the instruments come from the existing T2™ platform. A new Targeting Device* has been designed, unique for the T2™ Proximal Humeral Nail.

The instrumentation is characterized as follows:

- **A unique carbonfiber, radiolucent Targeting Device (Fig. 1)** that allows exact placement of all Proximal Screws, and Distal Locking Screws of the short nail.
- **A K-Wire** inserted through the Targeting Device and aligned with the forearm indicates the **correct rotational alignment** of the Targeting Device and Nail. Alignment is based on the assumption that anatomical **retroversion of the humeral head is 30°.**
- **A second K-Wire** inserted through the Targeting Device indicates the exact top end of the nail to aid achieving the **correct insertion depth**.
- **A Friction Locking Mechanism** firmly holds the Drill Sleeves in their required position. The Drill Sleeves, when locked into the targeting device, will also help to stabilize the nail and may temporarily stabilize fragments during fixation.
- **Calibrated Drill** bits give correct measurements of screw length.
- **Proximal screw holes are manually drilled**. This improves the surgeons **"feel"** of the bone.
- Two sets of Tissue Protection Sleeves and Drill Sleeves provide the **opportunity to temporarily fix the nail** with one set, while the other set can be used for placing the first screw.

Fig. 1

* reddot design award winner 2004

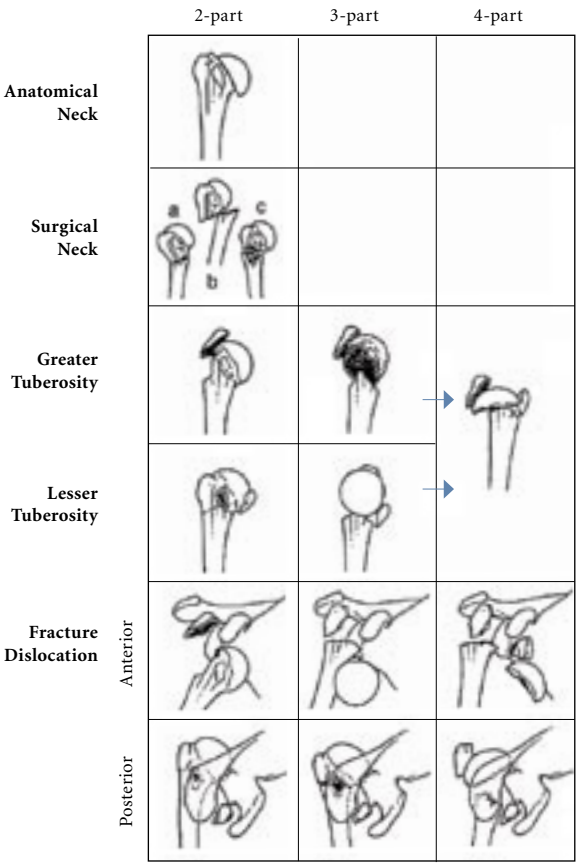
Indications

2. Indications

The **T2™ Proximal Humeral Nail** is indicated for:

- Two-part fractures of the proximal humerus
- Three-part fractures of the proximal humerus
- Four-part fractures of the proximal humerus
- Proximal Humeral Fractures with diaphyseal extension (Long PHN only).

Note:
The most important step before surgery remains a proper analysis of the fracture type.



NEER Classification

3. Pre-operative Planning

X-Ray Templates are available for pre-operative planning (Fig. 2 & 3).

- X-Ray Template, Short PHN (1806-2008)
- X-Ray Template, Long PHN (1806-2007)

Thorough evaluation of pre-operative radiographs of the affected Upper Arm and Shoulder is critical. Careful radiographic examination of the Humeral head region may prevent intra-operative complications.

The proper nail length when inserting long nails should extend from subchondral bone proximally, to 1cm above the olecranon fossa distally.

Fig. 2

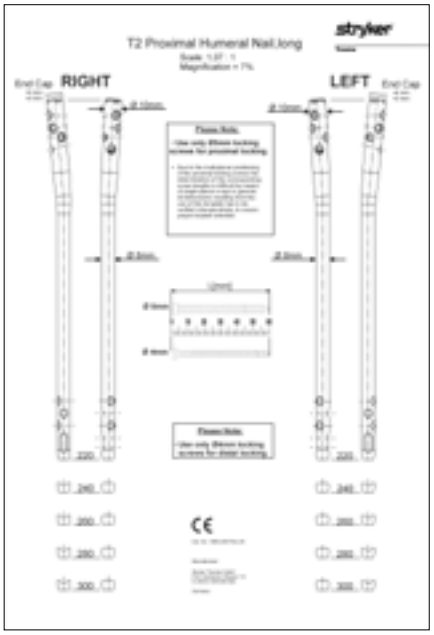


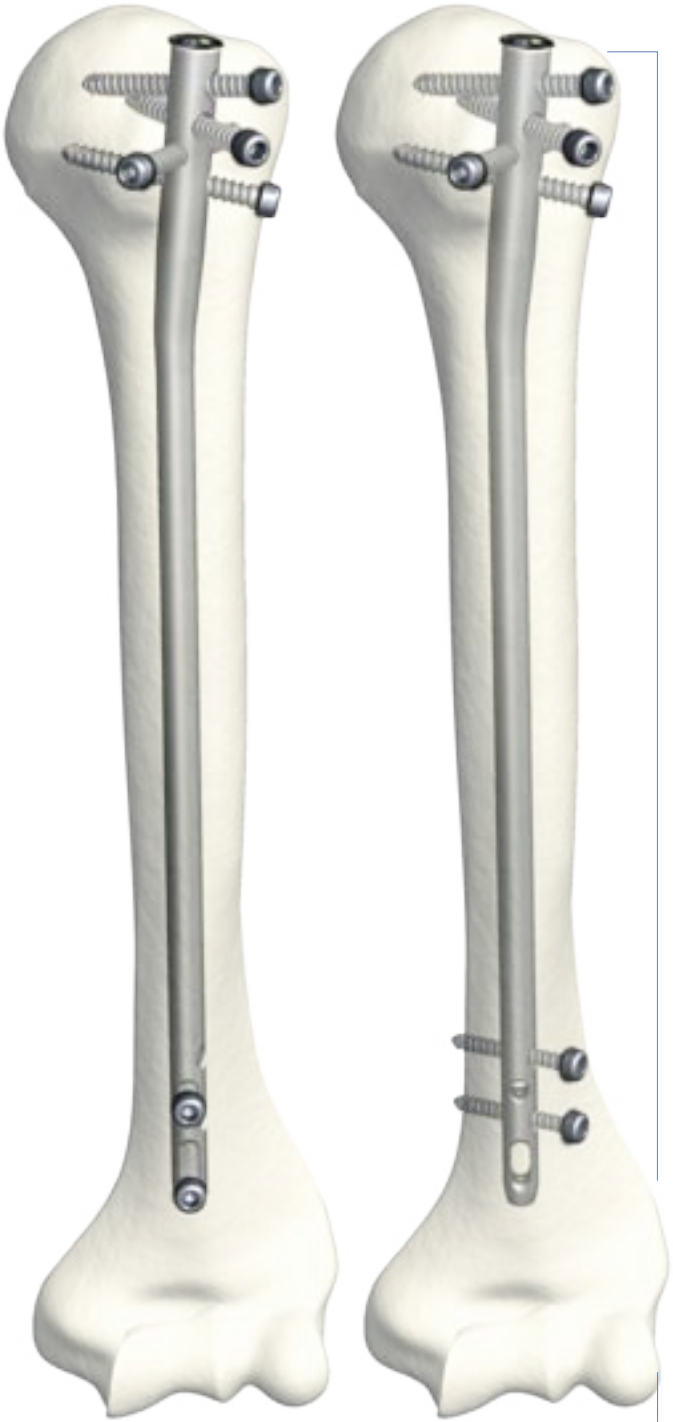
Fig. 3

Indications

4. Locking Option Examples:

T2™ Proximal Humeral Nail

Short Nail



Long Nail

5. Operative Technique

5.1. Patient Positioning and Fracture Reduction

The patient is placed semi-reclined in the "beach chair position" or supine on a radiolucent table. Patient positioning should be checked to ensure that imaging and access to the entry site are possible without excessive manipulation of the affected extremity (Fig. 4).

Note:
Closed reduction by "Joystick-technique" with K-wires to manipulate fragments can be used.

If closed reduction was not successful, open reduction should be performed.

Fig. 4

5.2. Incision

A small incision is made in line with the fibers of the deltoid muscle anterolateral to the acromion. The deltoid is split to expose the subdeltoid bursa (Fig. 5). The supraspinatus tendon is then incised in line with its fibers.

Fig. 5

5.3. Entry Point

To indicate the exact entry point before incising the supraspinatus tendon, a K-Wire (1806-0050S) can be placed through the tendon into the bone at the expected entry point (Fig. 6): Confirmation should be made with the image intensifier, in both lateral and A/P views.

The T2 Proximal Humeral Nail is designed to be inserted either through a lateral (A) or a central (B) entry point (Fig. 6).

The lateral entry point (A) is located just inside the Greater Tuberosity (as seen on the A/P view) and aligned with the humeral axis (as seen on the lateral view). Verify with the image intensifier.

The central entry point (B) is located at the very top of the humeral head, in the articular surface, in line with the humeral axis (in both A/P and lateral views).

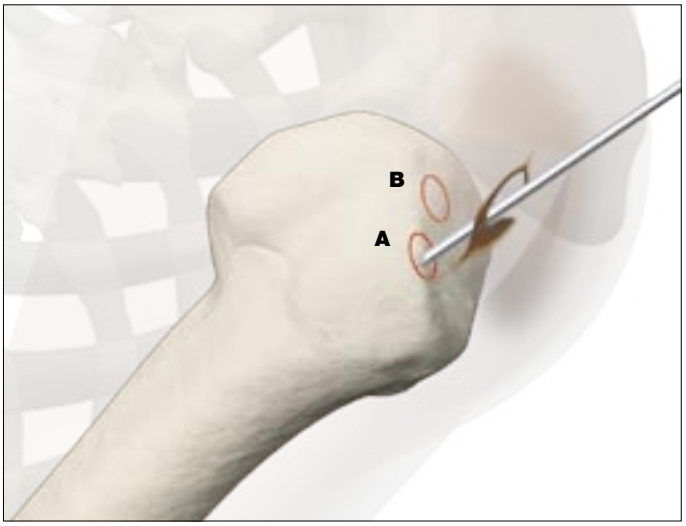


Fig. 6

5.3. Entry Point (continued)

Note:
If the greater tuberosity is fractured or compromised, the central entry point is recommended to achieve stability between the humeral head fragment and the proximal end of the nail.

The entry point is made with the cannulated 10mm Awl, Straight (1806-0045) or by using the Small K-Wire (1806-0050) with the Guide Wire Handle (1806-0095) (Fig. 7a, b, c). Image intensification is required to identify the correct entry point. The proximal metaphysis should be reamed with the Rigid Reamer, 10mm (1806-2010) through the Rigid Reamer Sleeve, 10mm (1806-0410).

Alternatively, the optional Crown Drill (1806-2020) may be used over the K-Wire for entry portal preparation. If the Rigid Reamer or Crown Drill cannot be used because of the fracture pattern or poor bone quality, use the 10mm Awl, Straight to prepare the proximal metaphysis.

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.

Further reaming is not necessary with the Short PHN. The nail may be inserted directly.

Fig. 7a

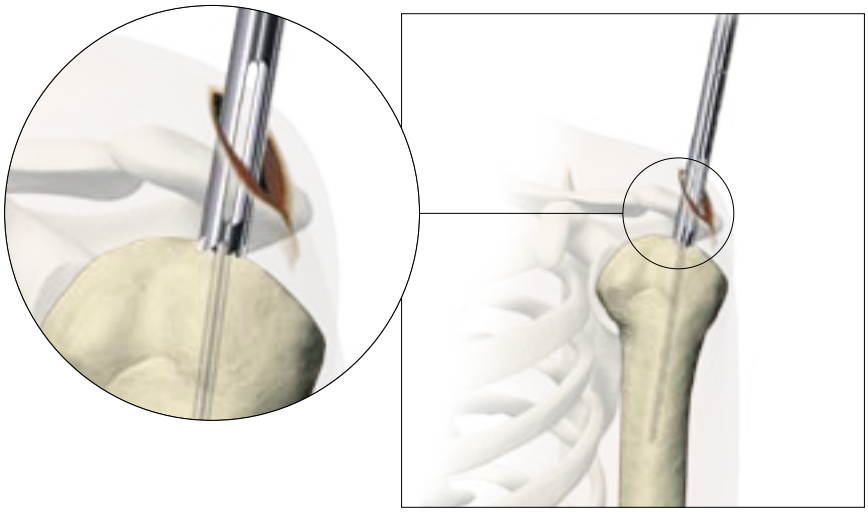


Fig. 7b

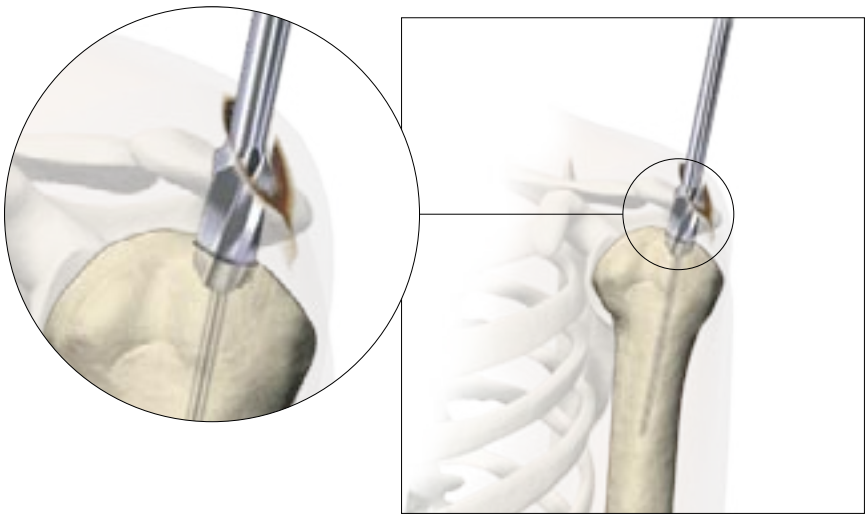


Fig. 7c

Operative Technique

Reamed Technique (Long PHN):

For insertion of the Long PHN, reaming of the medullary canal may be necessary.

For reamed techniques, the 2.5×800mm Ball Tip Guide Wire (1806-0083S) is inserted across the fracture site. The optional Reduction Rod (1806-0363), or the Universal Rod, Short with the optional Reduction Spoon (1806-0125), may be used as a fracture reduction tool to facilitate guide wire insertion across the fracture site (Fig. 8).

Reaming is commenced in 0.5mm increments. Final reaming should be 1mm–1.5mm larger than the diameter of the nail to be used (Fig. 9).

When reaming is completed, the Teflon Tube (1806-0073S) should be used to exchange the Ball Tip Guide Wire (1806-0083S) with the Smooth Tip Guide Wire (1806-0093S) for nail insertion (Fig. 10).

An unreamed technique can be considered in cases, where the medullary canal has the appropriate diameter. In these cases, the nail can be introduced over the 2.2×800mm Smooth Tip Guide Wire (1806-0093S).

Note:
X-Ray Templates should be used pre-operatively to determine the canal size radiographically.

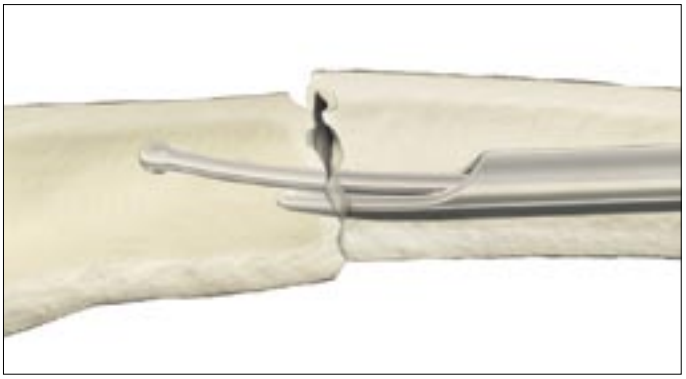


Fig. 8

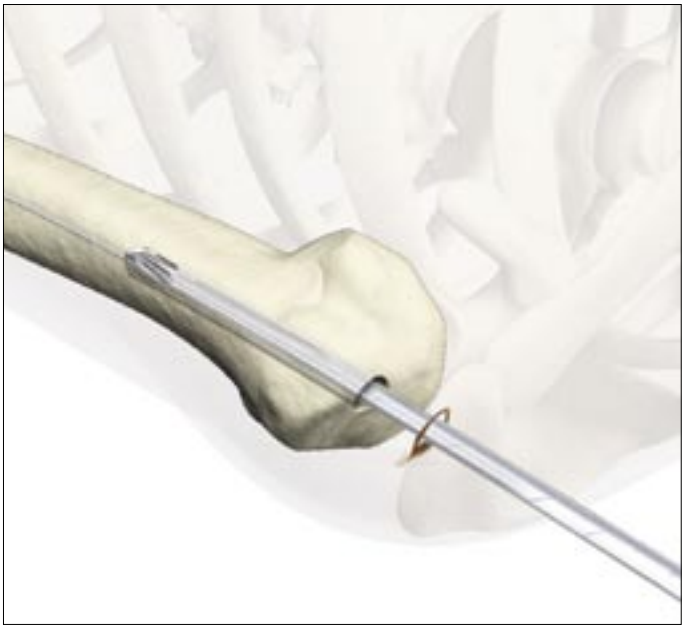


Fig. 9

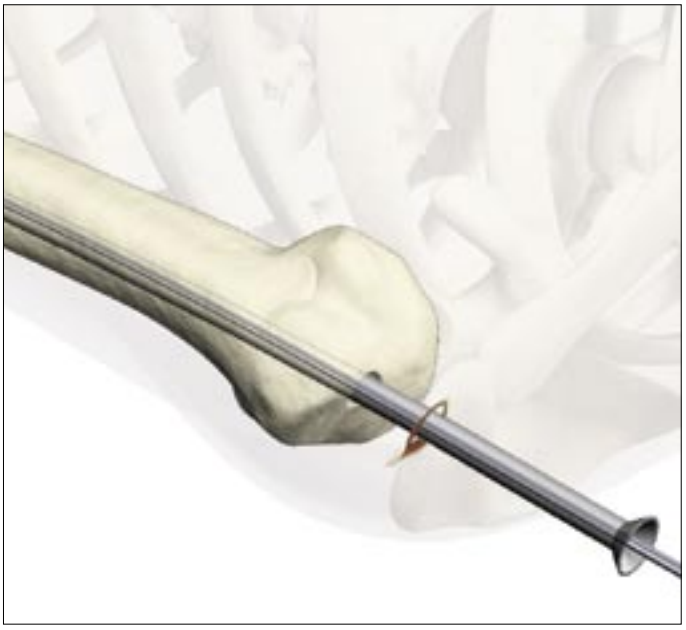


Fig. 10

Operative Technique

5.4. Nail Selection

The T2™ PHN is available in left and right, short and long.

Diameter
Both the Short and the Long version have a proximal diameter of 10mm and a shaft diameter of 8mm (Fig. 11).

Length
The Short PHN is available in 150mm length only. The Long PHN are available in five different lengths (220–300mm).

The proper nail length when inserting long nails should extend from subchondral bone proximally, to 1cm above the olecranon fossa distally.

Short Nail

Long Nail

Fig. 11

Operative Technique

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).

Confirm the position of the tip of the Guide Wire prior to measurement.

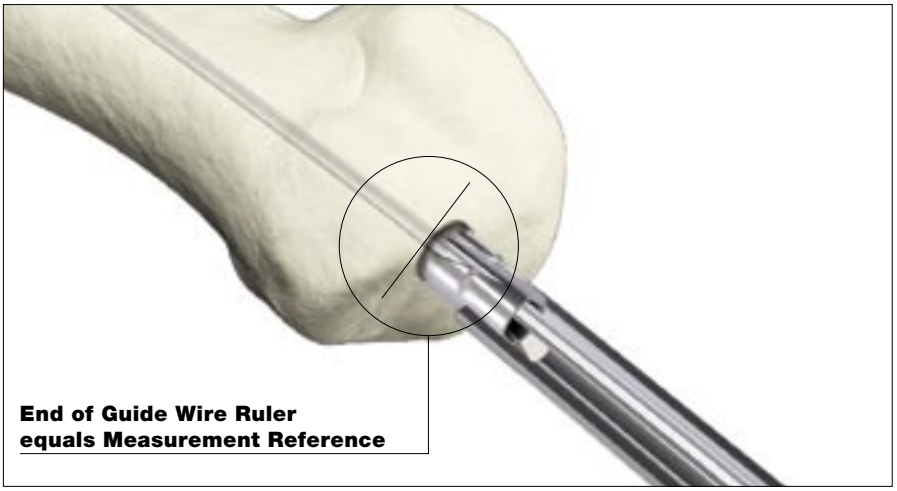


Fig. 12

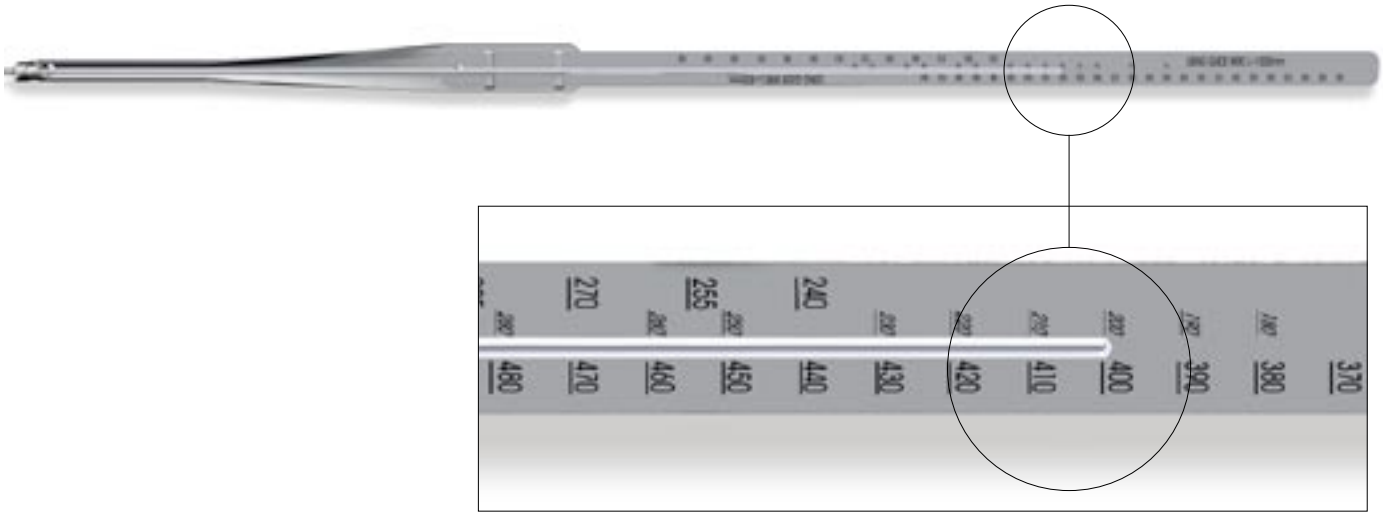


Fig. 13

Operative Technique

5.5. Nail Insertion

The selected nail is attached to the Nail Adapter (1806-2025) until its three connection teeth engage into the corresponding slots of the Nail (Fig. 14).

The Nail Holding Screw (1806-0163) is placed through the Nail Adapter, and tightened securely with the Insertion Wrench (1806-0135) or Wrench 8/10mm (1806-0130) to avoid loosening during Nail insertion. Engravings on the Nail Adapter will indicate lateral and medial direction (Fig. 15).

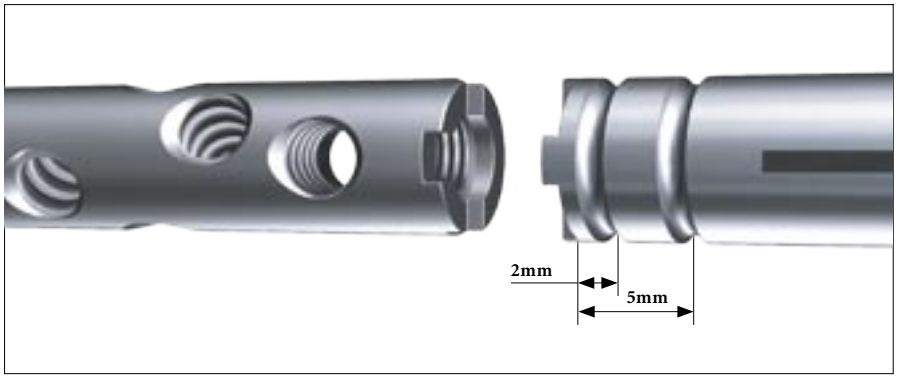


Fig. 14

Fig. 15

Fig. 16

Note:
Two circumferential grooves are located on the insertion post at 2mm and 5mm from the driving end of the nail (Fig. 14). Depth of insertion may be visualized with the aid of fluoroscopy.

Note:
The Strike Plate (1806-0150) (Fig. 16) or the Short Universal Rod (1806-0113) may be used to improve handling during insertion. These are screwed into the Nail Holding Screw and have to be removed if the Targeting Arm (1806-2035) is to be mounted after introduction of the nail.

Operative Technique

Alternatively, the Targeting Arm is assembled onto the Nail Adapter with the Nut (1806-2030) (Fig. 17a). Hand tighten the Nut so that it does not loosen during nail insertion.

Note:
Before inserting the nail, verify that the assembly is locked in the appropriate position: the smaller peg of the Nail Adapter engaged into the smaller slot of the Targeting Arm indicated by the "LATERAL Locking" sign (Fig. 17a) and the larger peg into the larger slot on the opposite side (Fig. 17b).

Fig. 17a

Fig. 17b

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 (Fig. 18).

The nail is ready for insertion. The Long PHN is cannulated and can be inserted over the 2.2×800mm Smooth Tip Guide Wire. The Short PHN is solid and can be inserted directly. Advance it through the entry point (Fig. 19).
The nail should be advanced with manual pressure. Aggressiveness can result in additional fractures or fragment displacements. If the nail does not advance easily, use the image intensifier to identify the problem.

Note:
Do not hit the Targeting Device and/or the Nail Holding Screw.

Note:
The nail should be inserted at least up to the first circumferential groove on the Nail Adapter but not deeper than the second groove.


Fig. 18


Fig. 19

Operative Technique

5.6. Proximal Guided Locking

Fig. 20

Fig. 21

Prior to guided locking via the Target Device, the Nail Holding Screw and the Nut must be firmly tightened to ensure that the nail is in correct alignment with the Targeting Device (Fig. 20).

Remove the Strike Plate if used. Withdraw the guide wire if used (Long PHN).

Two sets of Tissue Protection Sleeves, Drill Sleeves and Trocars can be used at the same time. The tight fit of the friction lock mechanism provides the opportunity to temporarily stabilize the nail and the fragment with one set, while using the second to perform locking.

Note:
A K-Wire placed through the Targeting Device and aligned with the forearm indicates anatomical 30° retroversion of the humeral head (Fig. 21).

Note:
Prior to proximal locking of the Long PHN, ensure correct alignment of the distal holes as these are locked by freehand technique. The K-Wire placed through the targeting device is in the same plane as the AP locking holes at the nail tip whereas the plane of the targeting arm is the same for the distal Oblique holes (Fig. 22).

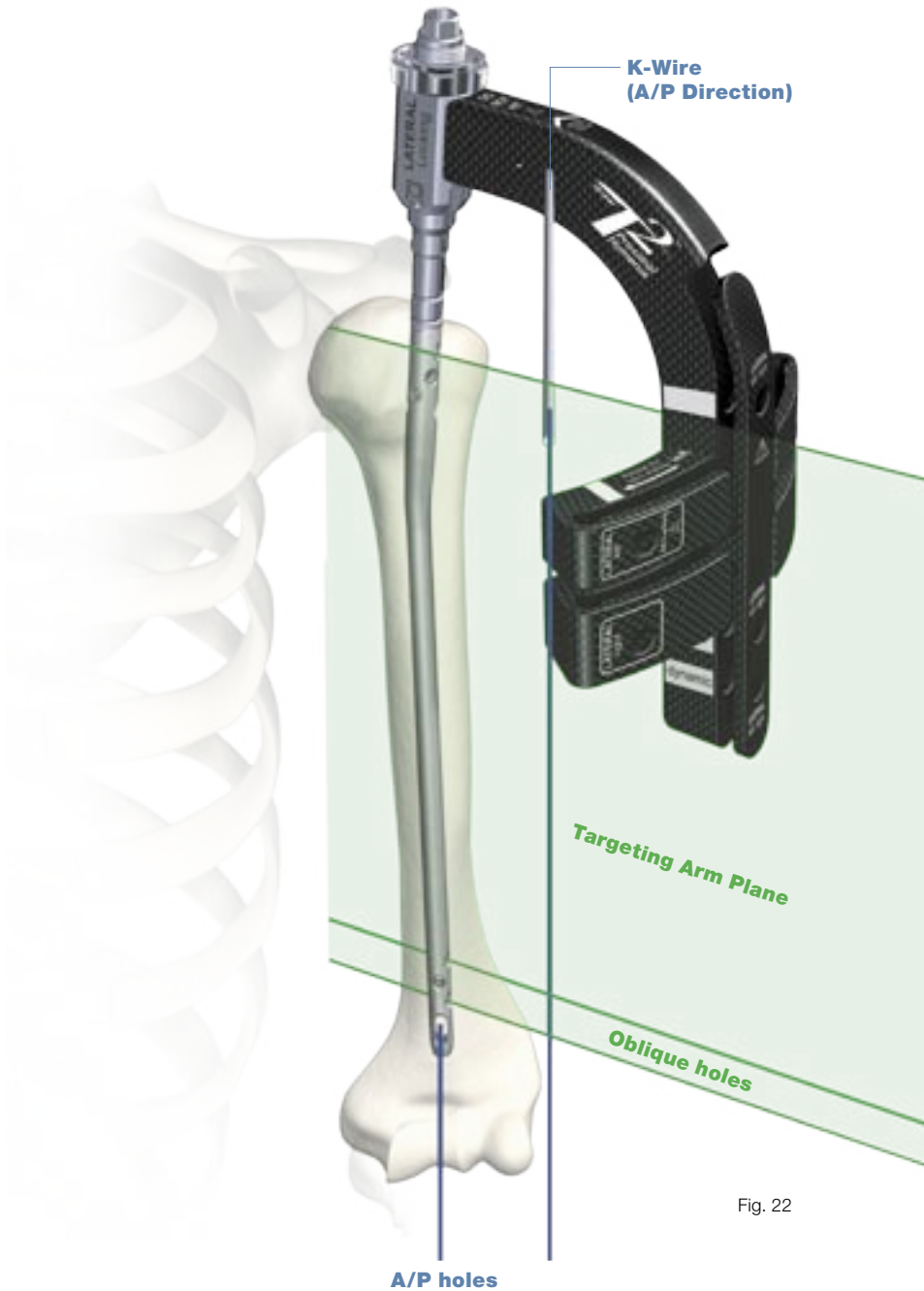


Fig. 22

Operative Technique

Except for the A/P Proximal Locking Screw, all of the Proximal and Distal Locking procedure (Short PHN only) can be performed without changing position of the Targeting Arm.

Note:
For the use of an A/P Locking Screw see Chapter 5.7.

Note:
Ensure correct rotational alignment of the nail prior to proximal locking, to avoid penetration of the biceps tendon with the proximal anterior screw.

The Short Tissue Protection Sleeve (1806-0180) together with the Short Drill Sleeve (1806-0210) and the Short Trocar (1806-0310) are inserted into the Targeting Arm by pressing the Safety Clip (Fig. 23a & b).

The friction locking mechanism is designed to keep the sleeve in place. It will also stop the sleeve from sliding during screw measurement. To release the Tissue Protection Sleeve, the Safety Clip must be pressed again.

Fig. 23a

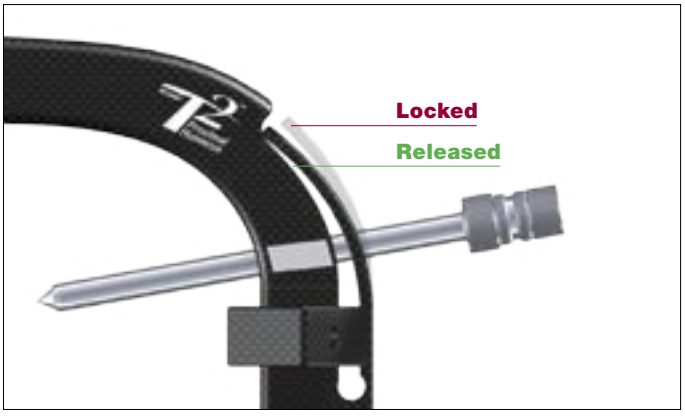


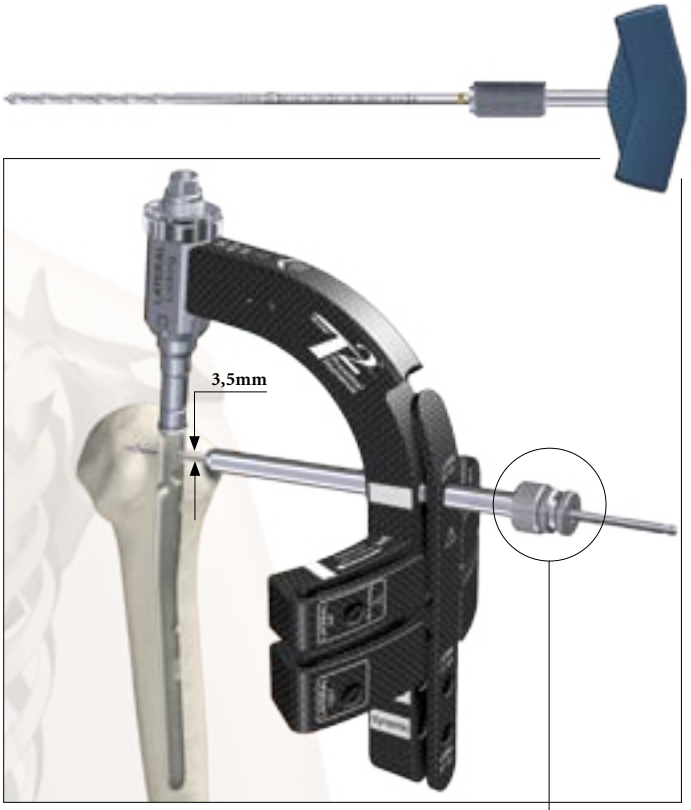
Fig. 23b

Operative Technique

5.6. Proximal Guided Locking (continued)

The Trocar is removed, while the Tissue Protection Sleeve and the Drill Sleeve remain in position. The T-Handle (702427) is assembled with the 3.5×230mm Drill (1806-3540S). Drilling is preferably done manually to improve feel of resistance in soft bone. The Drill is forwarded through the Drill Sleeve and pushed onto the cortex (Fig. 24).

Advance the Drill until it is in contact with the subchondral bone. The appropriate screw length may be read directly off of the Drill at the end of the Drill Sleeve (Fig. 24).



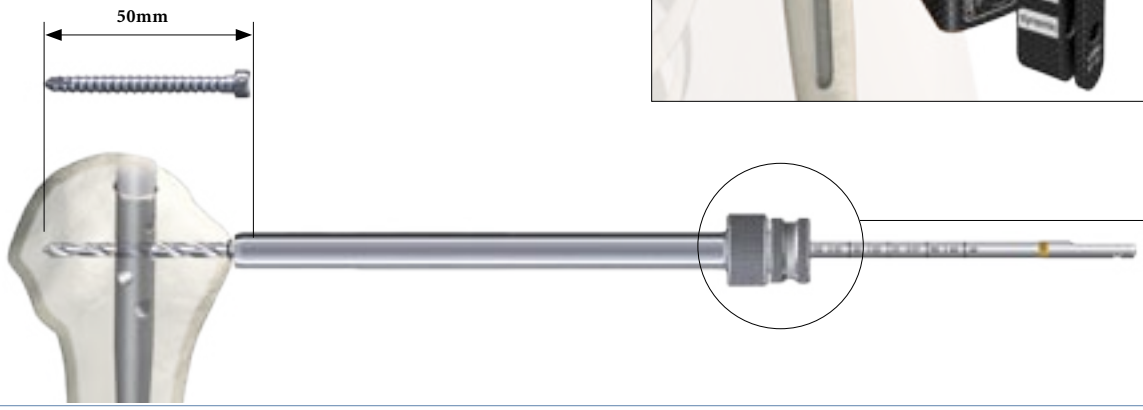


Fig. 24

Note:
Do not drill through the far cortex as this will penetrate the joint.
The position of the Drill tip placed in the subchondral bone is equal to where the end of the screw will be.

Note:
The Locking Screw length determination is very important and must be carried out carefully.

In cases with dense bone, the cortex of the proximal locking holes may be opened with the 5.0×180mm Drill (1806-5010S).

Note:
Drill the lateral cortex only. In cases where the nail is inserted close to the lateral cortex, manual drilling will help to avoid nail contact.

Fig. 25

Operative Technique

When the Drill Sleeve is removed, the correct 5.0mm Fully Threaded Locking Screw is inserted through the Tissue Protection Sleeve using the Screwdriver Shaft Short (1806-0224) with the Teardrop Handle (702429) (Fig. 26).

Note:
In order to optimize screw insertion in the threaded screw hole, push the Locking Screw without turning through the first cortex until it is in contact with the nail. Then start turning the Locking Screw with gentle axial pressure to engage the internal thread of the nail. In cases with dense bone where the screw cannot be pushed forward, the lateral cortex may be opened with the 5.0×180mm Drill to ease screw insertion as described above.

Note:
To avoid loss of reduction or position of the nail when the Drill is removed, you may leave the first Drill in the bone. Then, using the second set of Sleeves, drill the second hole and insert this screw while the nail is stabilized by the first Drill.

The Locking 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. 27).

Note:
Fluoroscopic visualisation during Locking Screw insertion is absolutely necessary to place the tip of the Locking Screw in the subchondral bone, to stabilize the head fragment and avoid penetration of the Locking Screw into the articular surface.

Note:
In four-part fractures, the role of the first Proximal Screw is to obtain fixation of the Head Fragment and not of the Greater Tuberosity.

Repeat the locking procedure for all lateral Proximal Locking Screws (Fig. 28).

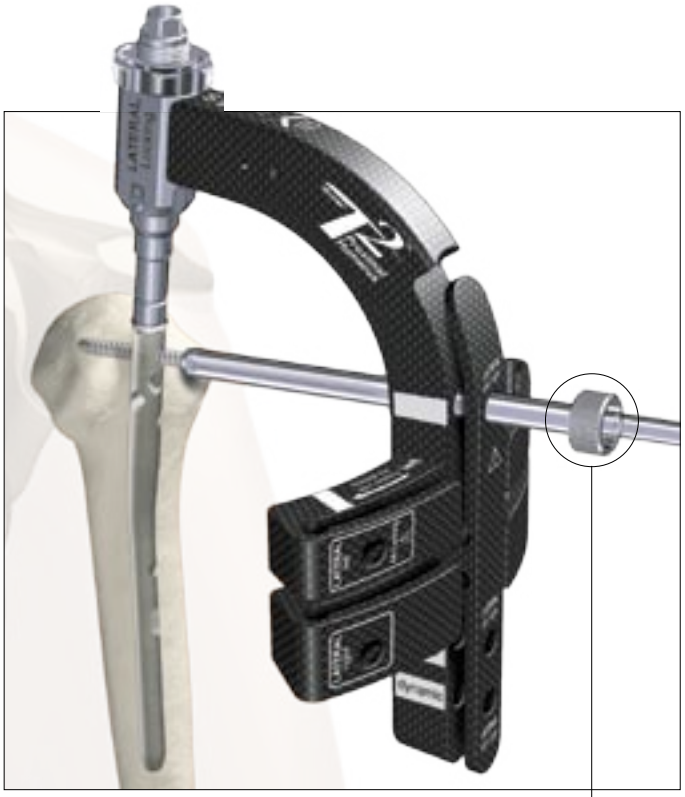


Fig. 26

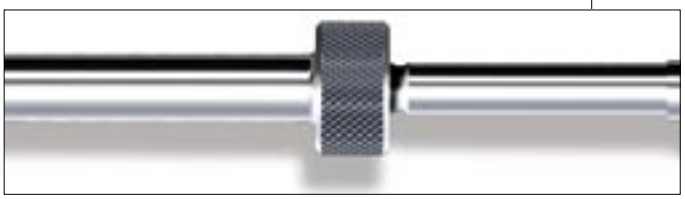


Fig. 27

Fig. 28

5.6. Proximal Guided Locking (continued)

A Washer, either Rectangular or Round, is available for patients with osteoporotic bones. They can be used in conjunction with a screw for fixing fragmented tuberosities. However, they can also be used to stabilize the nail, allowing compression of the surrounding bone against the nail.

Note:
Do not use a Washer with the most Proximal Locking Screw as it may cause Acromial impingement.

Fig. 29

5.7. Proximal A/P Locking

Note:
The A/P Screw is designed to fix the Lesser Tuberosity. If an A/P Screw is inserted, it is recommended to perform the A/P Screw locking after all other required screws are inserted.

To place the A/P Locking Screw, the Targeting Arm must be rotated. The Nut must be released with four complete turns. Pull-up the Targeting Arm and turn it anteriorly around the Nail Adapter (Fig. 29). Push down the Targeting Arm and lock the system in the appropriate position indicated on the Targeting Arm (Fig. 30a).

For the left nail, the larger peg of the Nail Adapter engages into the larger slot indicated by the "AP locking left" sign (Fig. 30a) and the smaller peg into the opposite smaller slot (Fig. 30b).

(**For the right nail**, the smaller peg must be engaged into the smaller slot, indicated by the "AP Locking right" sign and the larger peg into the opposite larger slot.)

Hand tighten the Nut to ensure it does not loosen during locking procedure.

Routine locking procedure is performed as described in Chapter 5.6.

Fig. 30a

Fig. 30b

5.8 Distal Locking

5.8.1. Distal Guided Locking (Short PHN only)

The Targeting Device is designed to provide two Distal Locking Options; Static Mode or Dynamic Mode.

For Static Locking Mode, two Distal Locking Screws should be used (round and oblong hole).

The Short Tissue Protection Sleeve together with the Short Drill Sleeve and the Short Trocar are inserted into the Targeting Arm in the static hole.

A small skin incision is made and the assembly is pushed through until it is in contact with the lateral cortex.

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

After drilling both cortices with the calibrated 3.5×230mm Drill (1806-3540S), the screw length may be read directly off of the calibrated Drill at the end of the Drill Sleeve.

Alternatively, after removal of the Drill Sleeve, the Screw Gauge, Short (1806-0330) can be used for screw length measurement.

A 4mm Locking Screw is inserted with the assembled Short Screwdriver Shaft and the Teardrop Handle.

For the second distal Locking Screw, routine Screw insertion is employed using the dynamic hole on the Targeting Arm.

Note:
The dynamic hole on the Targeting Arm will allow placement of the Locking Screw in a Dynamic Locking Mode (at the bottom of the oblong hole) (Fig. 31).

Depending on the fracture type, secondary dynamization can be achieved by extracting the static distal Locking Screw (round hole) (Fig. 32).

Fig. 31

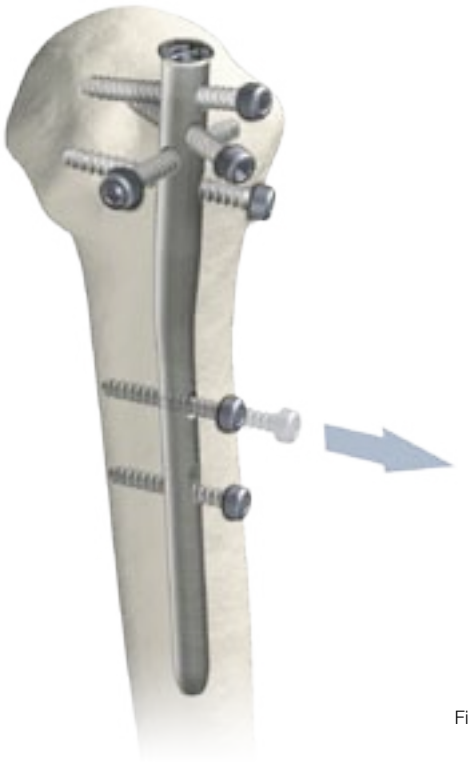


Fig. 32

5.8.2. Distal Freehand Locking (Long PHN only)

Note:
Never use the the distal holes (Static/ Dynamic) of the Targeting Device. There are no corresponding holes in the Long PHN.

The freehand technique is used to insert Locking Screws into both the A/P and Oblique holes in the nail. Rotational alignment must be checked prior to distal locking.

Multiple locking techniques and radio-lucent 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.

Note:
In order to avoid damage to the neurovascular structure, a limited open approach should be considered.

Note:
Leaving the targeting device attached can facilitate the freehand locking procedure. The K-Wire placed through the targeting device is in the same plane as the AP locking holes at the nail tip whereas the plane of the targeting arm is the same for the distal Oblique holes (Fig. 22, p. 16).

The Ø3.5×130mm Drill (1806-3550S) is held at an oblique angle to the center of the locking hole (Fig. 33, 34). Upon X-Ray verification, the Drill is placed perpendicular to the nail and drilled through the anterior cortex. Confirm these views in both the A/P and M/L planes by X-Ray.

After drilling both cortices, the screw length may be read directly off of the Screw Scale, Short (1806-0360) at the orange color coded ring on the center-tipped Drill (Fig. 35a & b). As with proximal 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 Short Screwdriver Shaft and the Teardrop Handle.

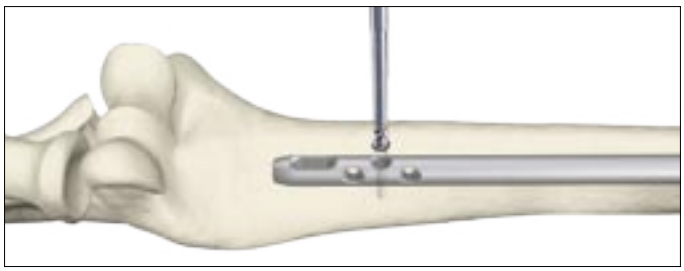


Fig. 33

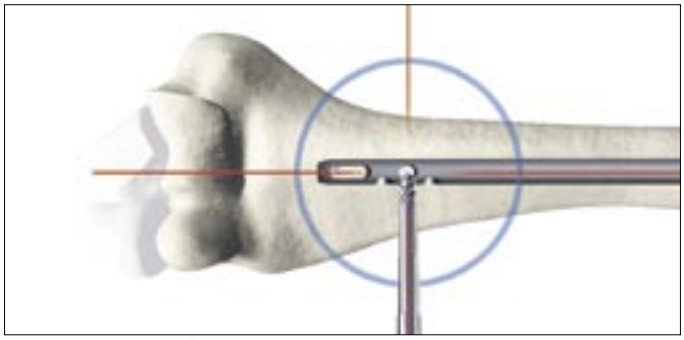


Fig. 34

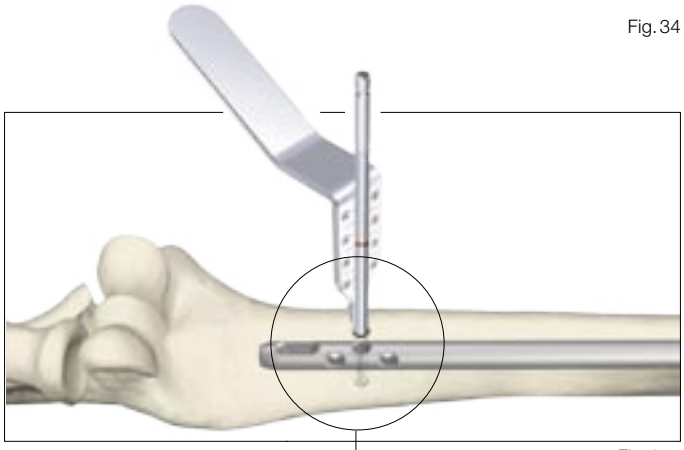


Fig. 35a

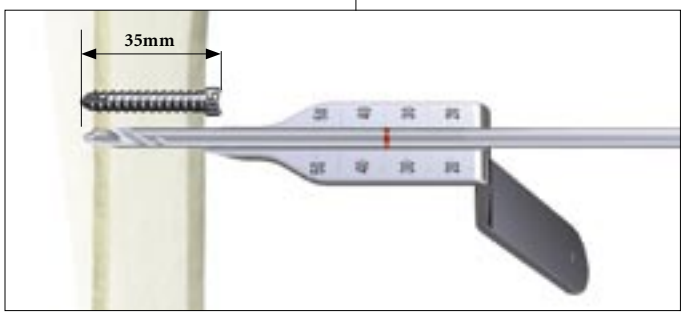


Fig. 35b

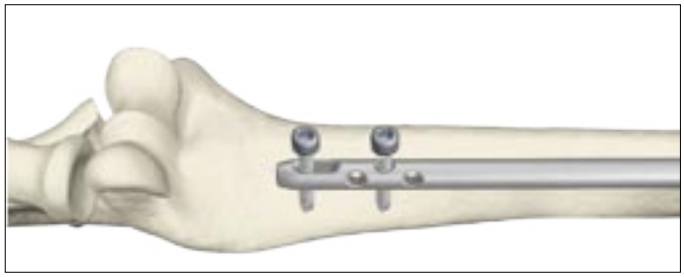


Fig. 36

Note:
The A/P oblong hole (Long PHN) in the nail tip will allow placement of the Locking Screw in a Dynamic Locking Mode (at the bottom of the oblong hole).

If possible, the Long PHN should be locked distally with two Fully Threaded Locking Screws. Additional locking of the Oblique hole(s) is possible if the image intensifier can be adjusted (Fig. 36).

Note:
Use image intensification to confirm screw position through the nail as well as screw length.


Fig. 37


Fig. 38

5.9. End Cap Insertion

After removal of the Targeting Device, an End Cap may be inserted. End Caps are available in three sizes.

The End Cap is inserted with the Screwdriver Shaft, Short assembled on the Teardrop Handle (Fig. 37). Fully seat the End Cap to minimize the risk of loosening.

The End Cap may be used to:
- Lock and stabilize the Proximal Locking Screw.
- Adjust the height of the nail for optimal purchase of the nail at the entry point.

Note:
To avoid impingement, carefully select the length of the End Cap.

Close the wound using standard technique.

5.10. Nail Removal

Nail removal is an elective procedure. The End Cap, if used, and the most proximal Locking Screw are removed with the Screwdriver Shaft, Short and the Teardrop Handle.

Note:
Attaching the Universal Rod, Short to the nail before removal of all other Locking Screws, will prevent nail migration.

The Short Universal Rod is inserted into the driving end of the nail. All Locking Screws are removed with the Short Screwdriver Shaft and the Teardrop Handle (Fig. 38).

The nail may then be removed with the Slotted Hammer (Fig. 39).


Fig. 39

Ordering Information - Implants

T2 Proximal Humerus Nail

short version

long version

REF	Description
1832-1025S	T2™ Proximal Humeral Nail, left (8×150mm)
1832-1015S	T2™ Proximal Humeral Nail, right (8×150mm)
1832-3822S	T2 Proximal Humerus Nail long, right (8×220mm)
1832-3824S	T2 Proximal Humerus Nail long, right (8×240mm)
1832-3826S	T2 Proximal Humerus Nail long, right (8×260mm)
1832-3828S	T2 Proximal Humerus Nail long, right (8×280mm)
1832-3830S	T2 Proximal Humerus Nail long, right (8×300mm)
1832-2822S	T2 Proximal Humerus Nail long, left (8×220mm)
1832-2824S	T2 Proximal Humerus Nail long, left (8×240mm)
1832-2826S	T2 Proximal Humerus Nail long, left (8×260mm)
1832-2828S	T2 Proximal Humerus Nail long, left (8×280mm)
1832-2830S	T2 Proximal Humerus Nail long, left (8×300mm)

End Caps

standard

+2mm

+4mm

REF	Diameter mm	Length mm
1832-0003S	ø6	standard
1832-0002S	ø10	+2
1832-0004S	ø10	+4

Washer

round

square

REF	Description	Diameter× Length mm
1830-0008S	Washer, round	ø17.0
1830-0009S	Washer, square	10×18

4mm Fully Threaded Locking Screws*

REF	Diameter mm	Length mm
1896-4020S	4.0	20
1896-4022S	4.0	22
1896-4024S	4.0	24
1896-4025S	4.0	25
1896-4026S	4.0	26
1896-4028S	4.0	28
1896-4030S	4.0	30
1896-4032S	4.0	32
1896-4034S	4.0	34
1896-4035S	4.0	35
1896-4036S	4.0	36
1896-4038S	4.0	38
1896-4040S	4.0	40
1896-4045S	4.0	45
1896-4050S	4.0	50
1896-4055S	4.0	55
1896-4060S	4.0	60

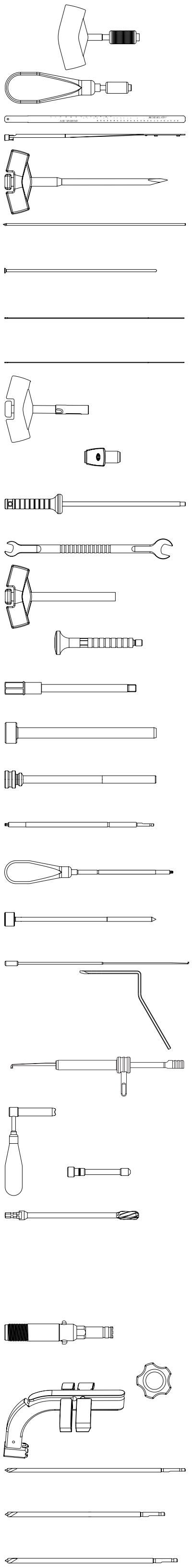
5mm Fully Threaded Locking Screws*

REF	Diameter mm	Length mm
1896-5025S	5.0	25.0
1896-5027S	5.0	27.5
1896-5030S	5.0	30.0
1896-5032S	5.0	32.5
1896-5035S	5.0	35.0
1896-5037S	5.0	37.5
1896-5040S	5.0	40.0
1896-5042S	5.0	42.5
1896-5045S	5.0	45.0
1896-5047S	5.0	47.5
1896-5050S	5.0	50.0
1896-5052S	5.0	52.5
1896-5055S	5.0	55.0
1896-5057S	5.0	57.5
1896-5060S	5.0	60.0

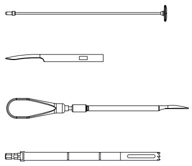
Note:
Implants in sterile packaging

* Outside of the U.S., Locking Screws may be ordered non-sterile without the "S" at the end of the corresponding Reference Number.

Ordering Information - Instruments



REF	Description
Standard Instruments	
702427	T-Handle, AO Coupling
702429	Teardrop Handle, AO Coupling
1806-0020	Guide Wire Ruler
1806-0045	Awl, Straight
1806-0050S	K-Wire, ø3×285mm (2×)
1806-0073S	Teflon Tube
1806-0083S	Guide Wire, Ball Tip, ø2.5×800mm
1806-0093S	Guide Wire, Smooth Tip, ø2.2×800mm
1806-0095	Guide Wire Handle
1806-0096	Guide Wire Handle Chuck
1806-0113	Universal Rod, Short
1806-0130	Wrench, 8mm/10mm
1806-0135	Insertion Wrench, 10mm
1806-0150	Strike Plate
1806-0163	Nail Holding Screw, Humerus
1806-0180	Tissue Protection Sleeve, Short (2×)
1806-0210	Drill Sleeve, Short (2×)
1806-0224	Screwdriver Shaft AO, Short
1806-0237	Screwdriver Short
1806-0310	Trocar, Short (2×)
1806-0330	Screw Gauge, Short
1806-0360	Screw Scale, Short
1806-0390	Depth Gauge, Standard Style for freehand locking (20–60mm)
1806-0410	Rigid Reamer Sleeve, 10mm
1806-0411	Rigid Reamer Trocar, 10mm
1806-2010	Rigid Reamer, 10mm
1806-2000	Targeting Device, Proximal Humerus, complete
1806-2025	Nail Adapter, Proximal Humerus
1806-2030	Nut, Proximal Humerus
1806-2035	Targeting Arm, Proximal Humerus
1806-3540S	Drill ø3.5×230mm, AO (2×)
1806-3550S	Drill ø3.5×130mm, AO (2×)
1806-5010S	Drill ø5×180mm, AO (2×)
1806-2007	X-Ray Template (Long PHN)
1806-2008	X-Ray Template (Short PHN)
1806-9300	T2 PHN Dedicated Instrument Tray
1806-9310	T2 PHN Add-On Instrument Tray



REF	Description
Optional Instruments	
1806-0032	Awl Plug
1806-0125	Reduction Spoon
1806-0363	Reduction Rod, ø7mm
1806-2020	Crown Drill

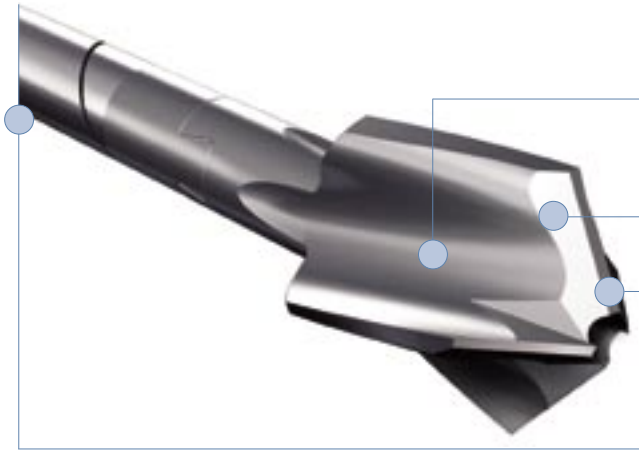
Note:
Federal law (U.S.A) restricts this device to sale by or on the order of a licensed physician.

Note:
Outside of the U.S., instruments may be ordered non-sterile without the "S" at the end of the corresponding Reference Number.

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.

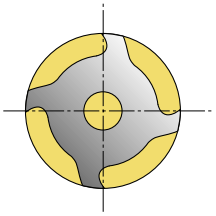
Cutting flute geometry optimized to lower pressure generation.

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.

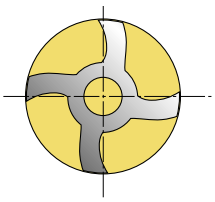
Smaller, 6 and 8mm shaft diameters significantly reduce IM pressure.

Typical Standard
Reamer Ø14mm

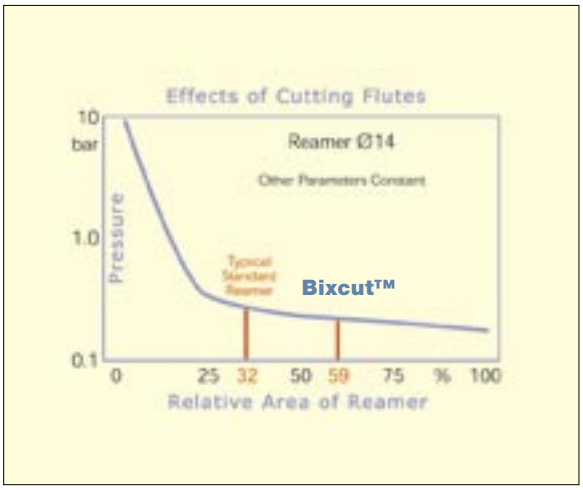


Clearance area:
32% of cross section

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™ Shaft – AO fitting

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

Bixcut™ Shaft – Modified Trinkle fitting (sterile)

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

Bixcut™ Trays

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

Bixcut™ Fixed Head – AO fitting

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

Bixcut™ Fixed Head – Modified Trinkle fitting⁺

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

⁺ Use with Stryker Power Equipment

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

Note:
Federal law (U.S.A) restricts this device to sale by or on the order of a licensed physician.

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Literature Number: **B1000009**
LOT **D5004**