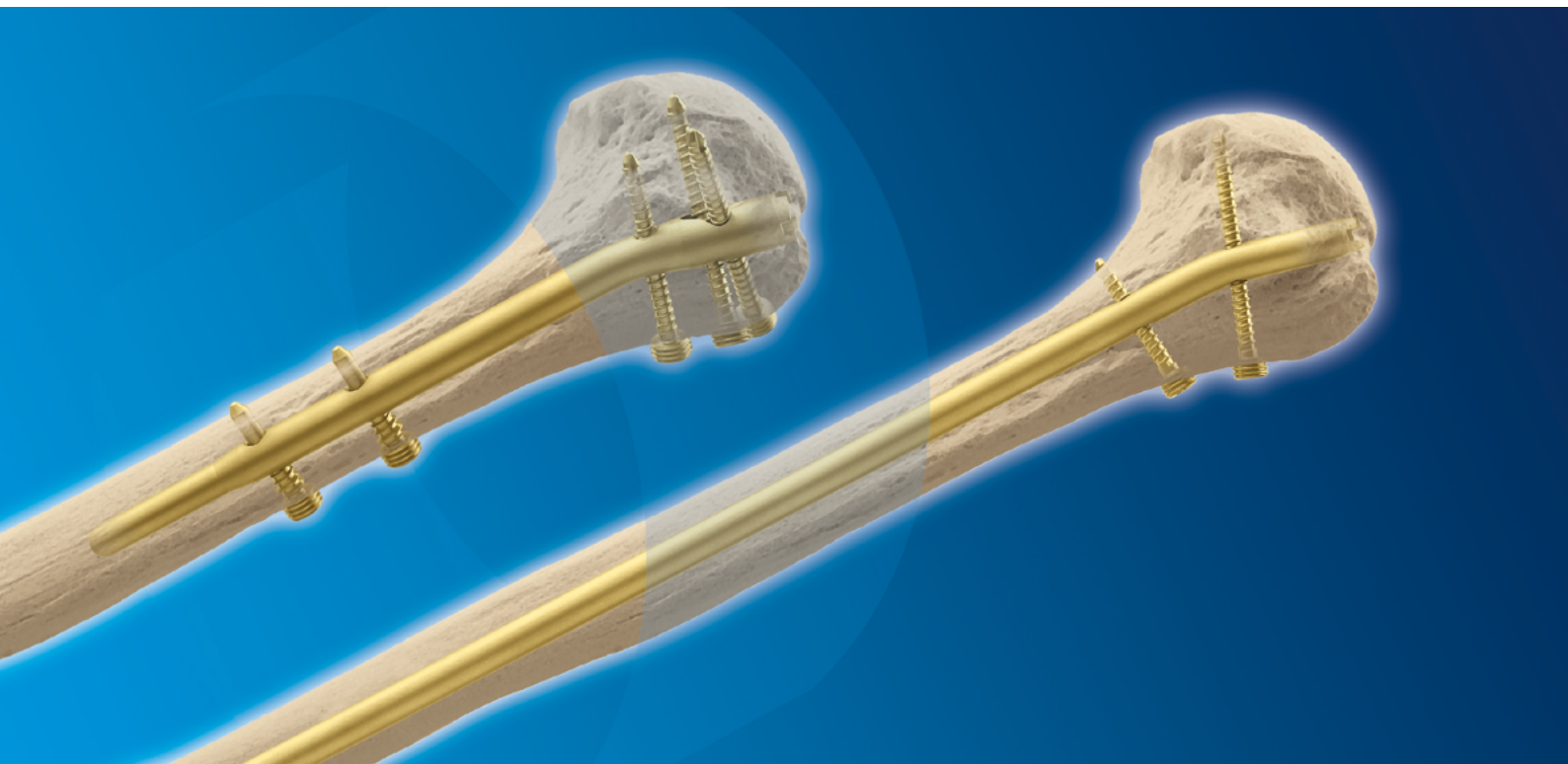




# CentroNail<sup>®</sup>

Titanium Humeral Nail



**The Centronail  
Titanium Humeral Nailing System**



## **1 FEATURES AND BENEFITS**

2 Proximal locking

3 Locking screws

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(by M. Manca, MD)

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(by M. Manca, MD)

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(by R. Giancola, MD)

## **37 NAIL REMOVAL**

Orthofix wishes to thank  
the following surgeons for their contribution  
to the development of the technique:

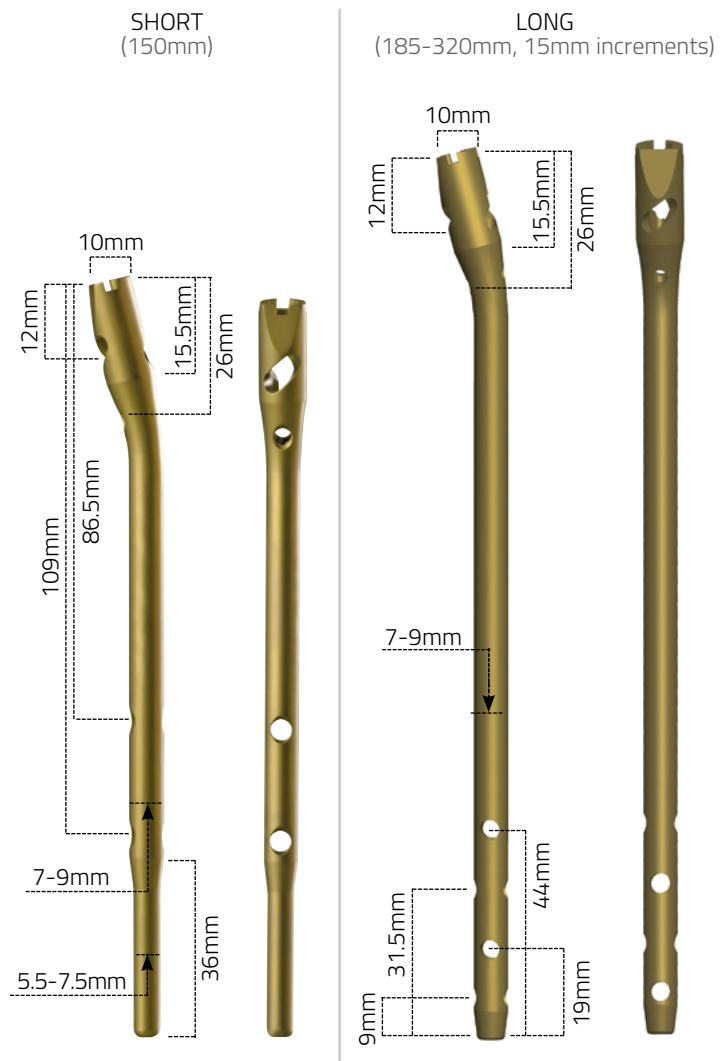
S. BERKI, MD  
Department of General, Trauma and Hand Surgery,  
University and County Hospital, Szentes, Hungary

DR. R. GIANCOLA  
Orthopaedics Department,  
San Carlo Hospital, Milan, Italy

M. MANCA, MD  
Department of Trauma and Orthopaedics, "Versilia"  
Hospital, Viareggio, Italy

## FEATURES AND BENEFITS

### PROXIMAL HUMERAL NAIL



Titanium nail and locking screws  
Allows MRI investigation, if necessary

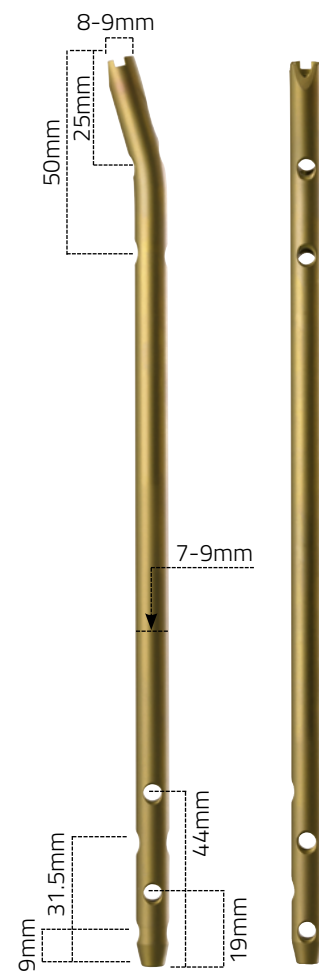
10mm proximal diameter

7-9mm distal diameter

One design for Left and Right humerus

Proximal bend 15°

### DIAPHYSEAL HUMERAL NAIL



Titanium nail and locking screws  
Allows MRI investigation, if necessary

7-9mm diameter

In the 7mm nail, the proximal 25mm is 8mm in diameter

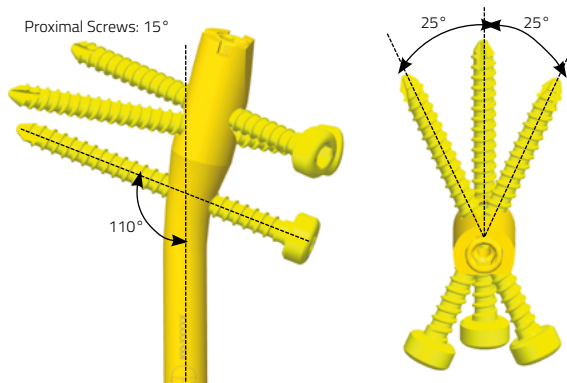
One design for Left and Right humerus  
Antegrade and retrograde insertion

185-320mm long (15mm increments)

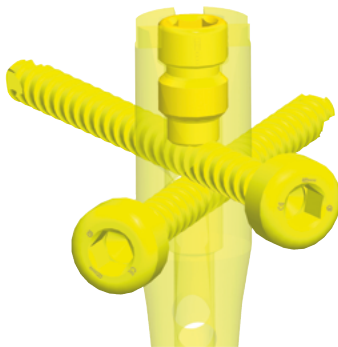
Proximal bend 15°

## Proximal locking

### PROXIMAL HUMERAL NAIL



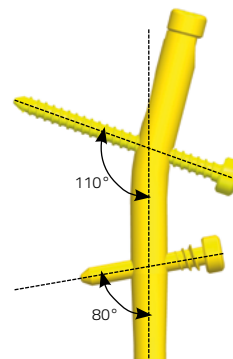
### End caps



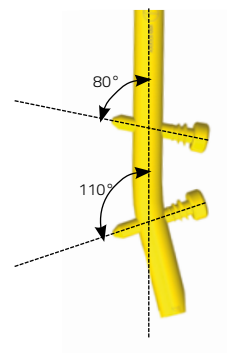
End caps function as set-screw to prevent proximal locking screw loosening.

### DIAPHYSEAL HUMERAL NAIL

#### Antegrade



#### Retrograde





## Locking screws

### TITANIUM STANDARD LOCKING SCREWS

6.0mm thread diameter  
4.0mm shaft diameter



Smooth diameter, unthreaded shaft: Maximises fatigue strength  
Reverse thread on screw head: Easy screw removal  
Conical tip: Helps insertion

### TITANIUM REVISION LOCKING SCREWS

8mm thread diameter  
Better purchase in poor quality bone  
4.0mm shaft diameter



### TITANIUM THREADED LOCKING SCREWS



Fully threaded shaft: Improves purchase in cancellous bone near articular surface.  
Reverse thread on screw head: Easy screw removal  
Conical tip: Helps insertion

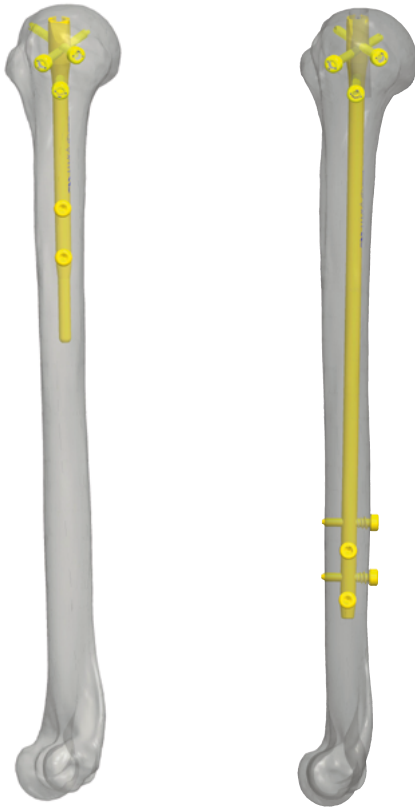
### TITANIUM PROXIMAL THREADED LOCKING SCREWS



To be used only in the humeral head.  
Improves purchase in osteoporotic bone.  
The low profile of the locking screw head reduces the risk of muscle impingement or interference.

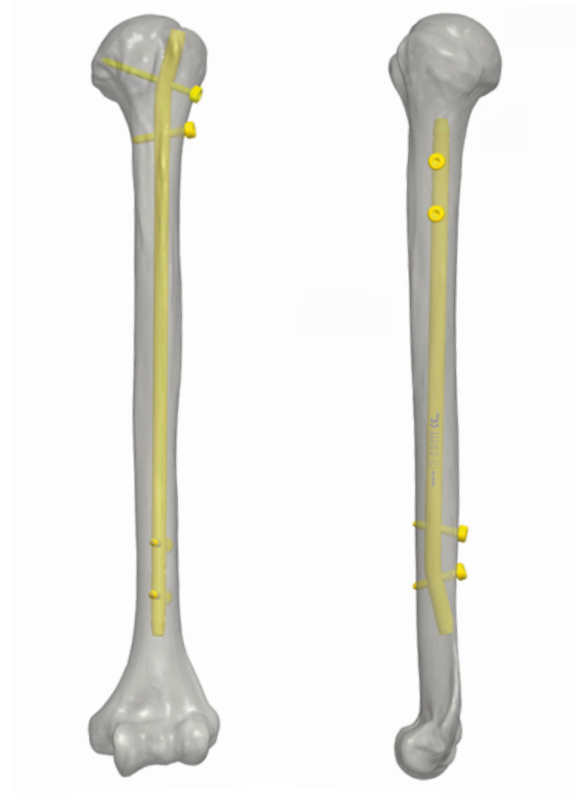
## INDICATIONS

### PROXIMAL HUMERAL NAIL



- Proximal Fractures
- Non-Union
- Mal-Union
- Pathological Fractures

### DIAPHYSEAL HUMERAL NAIL



- Diaphyseal Fractures
- Non-Union
- Mal-Union
- Pathological Fractures

## EQUIPMENT REQUIRED

Centronail Titanium Proximal Humeral Nail		
Ø 7 L 150mm	Cannulated	99-T787150
Ø 8 L 150mm	Cannulated	99-T788150
Ø 9 L 150mm	Cannulated	99-T789150

Ø 7 L 185mm	Cannulated	99-T787185PL
Ø 7 L 200mm	Cannulated	99-T787200PL
Ø 7 L 215mm	Cannulated	99-T787215PL
Ø 7 L 230mm	Cannulated	99-T787230PL
Ø 7 L 245mm	Cannulated	99-T787245PL
Ø 7 L 260mm	Cannulated	99-T787260PL
Ø 7 L 275mm	Cannulated	99-T787275PL
Ø 7 L 290mm	Cannulated	99-T787290PL
Ø 7 L 305mm	Cannulated	99-T787305PL
Ø 7 L 320mm	Cannulated	99-T787320PL
Ø 8 L 185mm	Cannulated	99-T788185PL
Ø 8 L 200mm	Cannulated	99-T788200PL
Ø 8 L 215mm	Cannulated	99-T788215PL
Ø 8 L 230mm	Cannulated	99-T788230PL
Ø 8 L 245mm	Cannulated	99-T788245PL
Ø 8 L 260mm	Cannulated	99-T788260PL
Ø 8 L 275mm	Cannulated	99-T788275PL
Ø 8 L 290mm	Cannulated	99-T788290PL
Ø 8 L 305mm	Cannulated	99-T788305PL
Ø 8 L 320mm	Cannulated	99-T788320PL
Ø 9 L 185mm	Cannulated	99-T789185PL
Ø 9 L 200mm	Cannulated	99-T789200PL
Ø 9 L 215mm	Cannulated	99-T789215PL
Ø 9 L 230mm	Cannulated	99-T789230PL
Ø 9 L 245mm	Cannulated	99-T789245PL
Ø 9 L 260mm	Cannulated	99-T789260PL
Ø 9 L 275mm	Cannulated	99-T789275PL
Ø 9 L 290mm	Cannulated	99-T789290PL
Ø 9 L 305mm	Cannulated	99-T789305PL
Ø 9 L 320mm	Cannulated	99-T789320PL

Centronail Titanium Humeral Nail	
Ø 7 L 185mm	Cannulated 99-T787185
Ø 7 L 200mm	Cannulated 99-T787200
Ø 7 L 215mm	Cannulated 99-T787215
Ø 7 L 230mm	Cannulated 99-T787230
Ø 7 L 245mm	Cannulated 99-T787245
Ø 7 L 260mm	Cannulated 99-T787260
Ø 7 L 275mm	Cannulated 99-T787275
Ø 7 L 290mm	Cannulated 99-T787290
Ø 7 L 305mm	Cannulated 99-T787305
Ø 7 L 320mm	Cannulated 99-T787320
Ø 8 L 185mm	Cannulated 99-T788185
Ø 8 L 200mm	Cannulated 99-T788200
Ø 8 L 215mm	Cannulated 99-T788215
Ø 8 L 230mm	Cannulated 99-T788230
Ø 8 L 245mm	Cannulated 99-T788245
Ø 8 L 260mm	Cannulated 99-T788260
Ø 8 L 275mm	Cannulated 99-T788275
Ø 8 L 290mm	Cannulated 99-T788290
Ø 8 L 305mm	Cannulated 99-T788305
Ø 8 L 320mm	Cannulated 99-T788320
Ø 9 L 185mm	Cannulated 99-T789185
Ø 9 L 200mm	Cannulated 99-T789200
Ø 9 L 215mm	Cannulated 99-T789215
Ø 9 L 230mm	Cannulated 99-T789230
Ø 9 L 245mm	Cannulated 99-T789245
Ø 9 L 260mm	Cannulated 99-T789260
Ø 9 L 275mm	Cannulated 99-T789275
Ø 9 L 290mm	Cannulated 99-T789290
Ø 9 L 305mm	Cannulated 99-T789305
Ø 9 L 320mm	Cannulated 99-T789320

End Caps	
L 0mm	99-T780000
L 5mm	99-T780005
L 10mm	99-T780010

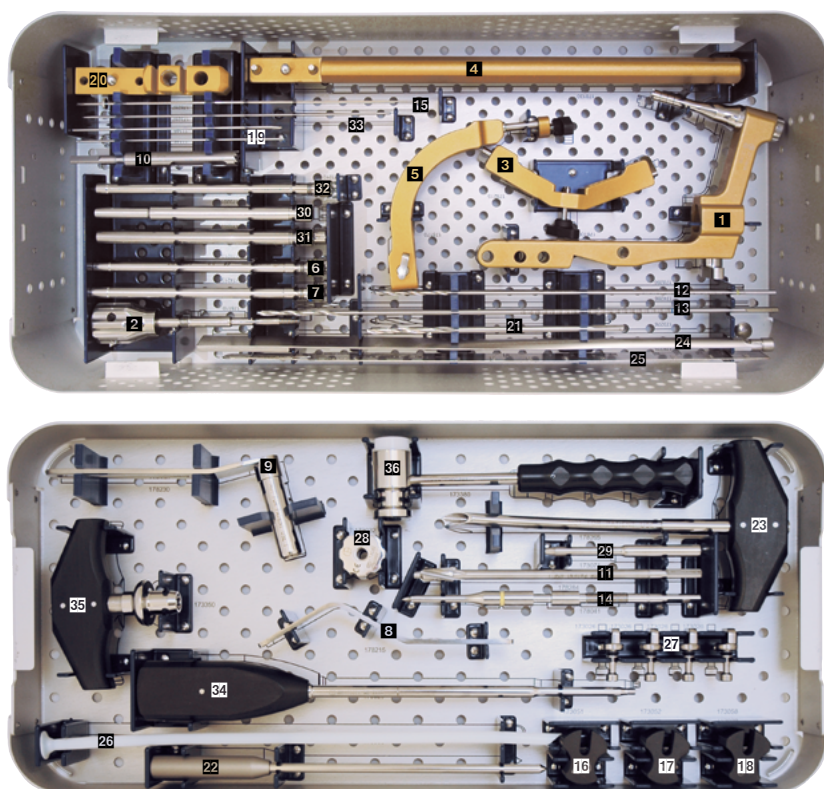
4.0mm Titanium Threaded Locking Screws	
99-T786020	20mm
99-T786025	25mm
99-T786030	30mm
99-T786035	35mm
99-T786040	40mm
99-T786045	45mm
99-T786050	50mm
99-T786055	55mm
99-T786060	60mm
99-T786065	65mm
99-T786070	70mm
99-T786075	75mm
99-T786080	80mm

4.0mm Titanium Proximal Threaded Locking Screws*	
99-T784030	30mm
99-T784035	35mm
99-T784040	40mm
99-T784045	45mm
99-T784050	50mm
99-T784055	55mm
99-T784060	60mm
99-T784065	65mm

\*not available in all markets

4.0mm Titanium Locking Screw	
99-T74420	20mm
99-T74425	25mm
99-T74430	30mm
99-T74435	35mm
99-T74440	40mm
99-T74445	45mm
99-T74450	50mm
99-T74455	55mm
99-T74460	60mm
99-T74465	65mm
99-T74470	70mm
99-T74475	75mm
99-T74480	80mm

4.0mm Titanium Revision Locking Screw	
99-T785020	20mm
99-T785025	25mm
99-T785030	30mm
99-T785035	35mm
99-T785040	40mm
99-T785045	45mm
99-T785050	50mm
99-T785055	55mm
99-T785060	60mm
99-T785065	65mm
99-T785070	70mm
99-T785075	75mm
99-T785080	80mm



#### HUMERAL SPECIFIC INSTRUMENTS BOX, EMPTY (178991) can accommodate:

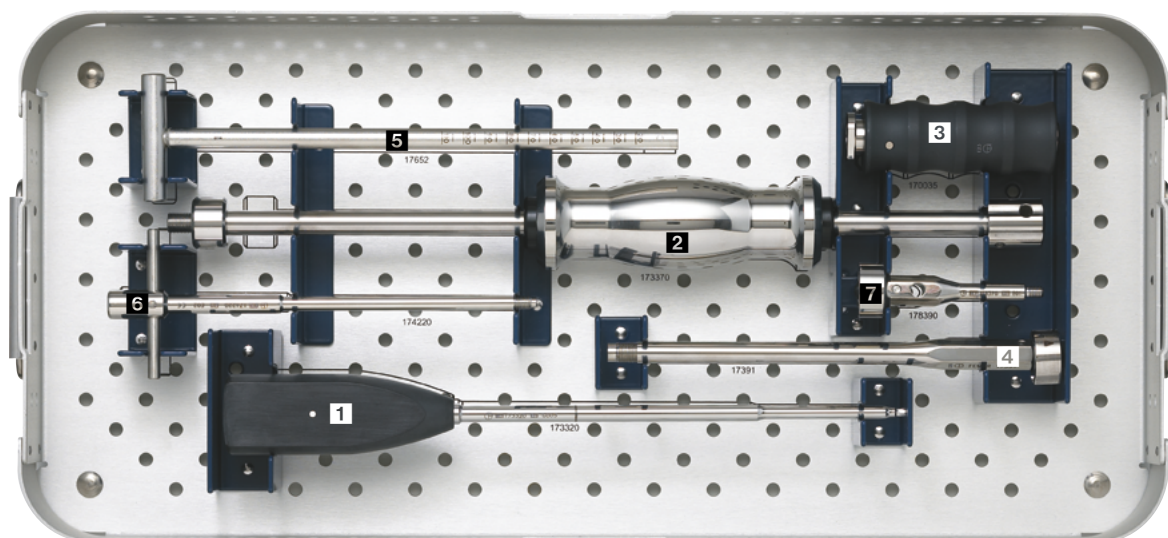
Part #	Description	Qty
178100	1 HANDLE	1
178110	2 LOCKING ROD	1
178120	3 PROXIMAL HUMERAL OUTRIGGER	1
178130	4 GUIDE BAR	1
178170	5 TARGETING ARM	1
178213	6 DRILL GUIDE 3.2 MM	2
174213	7 DRILL GUIDE 4.0 MM	1
178215	8 RETROGRADE INSERTION TEMPLATE	1
178230	9 HUMERAL REAMING SLEEVE	1
178261	10 ANTEROGRADE CANNULATED REAMER	1
178284	11 RETROGRADE INSERTION DRILL	1
178286	12 DRILL BIT D. 3,2X280 MM	2
174286	13 DRILL BIT D. 4X365 MM	1
178041	14 STABILIZING ROD	1
178287	15 ANTEGRADE INSERTION WIRE D. 2X250 MM	1

#### Sterile Packaged Instruments

Part #	Description
99-178285	CANNULATED DRILL BIT KIT 6 MM STERILE
99-178283	GUIDE WIRE WITH OLIVE D.2X780 MM STERILE
99-178282	GUIDE WIRE WITHOUT OLIVE D.2.5X780 MM STERILE

#### HUMERAL SPECIFIC INSTRUMENTS BOX, EMPTY (178991) can accommodate:

Part #	Description	Qty
173058	16 SPACER NAIL 7 MM	1
173051	17 SPACER NAIL 8 MM	1
173052	18 SPACER NAIL 9 MM	1
11146	19 X-WIRE WITHOUT OLIVE DIAMETER 2 MM LENGTH 150 MM	3
178160	20 DISTAL ADAPTER	1
1100101	21 DRILL BIT DIAMETER 4.8 MM LENGTH 180 MM	1
11129	22 TROCAR D 6 MM LENGTH 240 MM	1
178265	23 BENDED AWL SMALL	1
173276	24 RULER SUPPORT	1
178275	25 HUMERAL RULER	1
178353	26 HUMERAL WIRE EXCHANGE TUBE	1
173026	27 LOCKING CAM	4
173032	28 LOCKING NUT	1
173071	29 IMPACTOR	1
173201	30 STABILIZING SLEEVE	1
173211	31 SCREW GUIDE	2
173212	32 TROCAR	1
173287	33 K-WIRE 2 MM	1
173320	34 CANNULATED SCREW DRIVER	1
173350	35 T HANDLE	1
173380	36 HAMMER	1



**EXTRACTION INSTRUMENTS BOX, EMPTY (173998)  
can accommodate:**

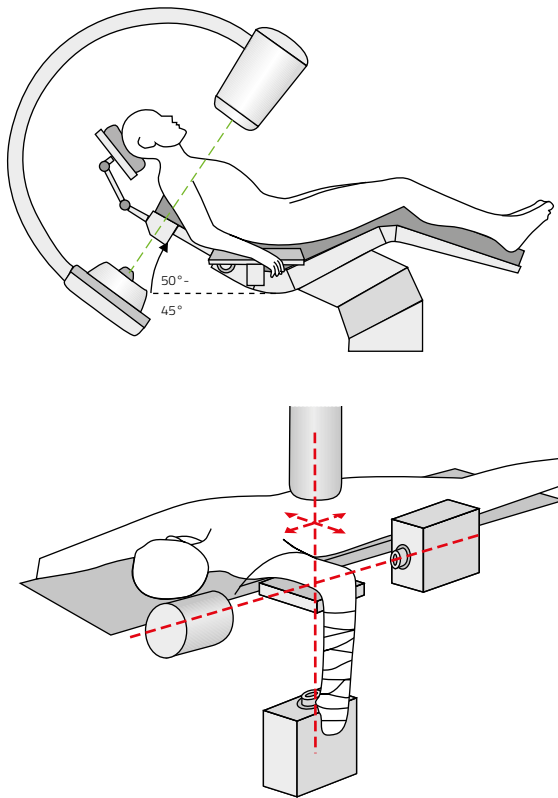
Part #	Description	Qty
173320	1 CANNULATED SCREW DRIVER	1
173370	2 SLIDING HAMMER	1
170035	3 BLACK HANDLE WITH BAYONET FITTING	1
17391	4 FEMORAL NAIL EXTRACTOR	1
17652	5 LOCKING SCREW EXTRACTOR	1
174220	6 TIBIAL EXTRACTOR	1
178390	7 HUMERAL NAIL EXTRACTOR	1

## Cleaning, disinfection, sterilisation and maintenance of instrumentation

Orthofix supplies the Centronail Titanium Universal Humeral Nail, locking screws and end caps in a STERILE package, while the instruments are supplied NON-STERILE. Please check the sterility of each device on the product label.

The surgeon must check that the package has not been damaged and has not expired. The instruments are supplied in a non-sterile state and therefore must be cleaned before use, as described for new products. The whole cleaning, disinfection and sterilisation cycle must be followed before each use, as described in the instructions for use PQ ISP.

N.B. Disassemble all instruments for thorough cleaning and disinfection prior to sterilization.



## OPERATIVE TECHNIQUE

### Patient Positioning

Standard X-rays should be taken. In proximal fractures, a CT-scan will help to identify the size and position of the fragments. Nail length and diameter are determined by assessing the extent of the fracture and by measuring the medullary canal. Positioning of the Nail Locking Screws should be included in the planning.

#### Antegrade Insertion

The patient should be positioned in a beach chair position. The humerus should be freely mobile on the side of the operating table with an unobstructed image intensifier view.

#### Retrograde Insertion

The patient is placed on a radiolucent table in the prone position. The arm is supported on an arm board or hand table. The shoulder is in 90° abduction, the elbow joint flexed in a 90° position. Make sure that the elbow can be flexed by 120° to avoid impingement at the level of the olecranon. Patient positioning should be checked to ensure that imaging of the entry point is possible in both planes. Good visualisation of the proximal humerus is also important for locking of the nail in the proximal end.





It is recommended that the distal targeting instrumentation is assembled before nail insertion to check for correct alignment with the nail.

## Proximal Humeral Nail

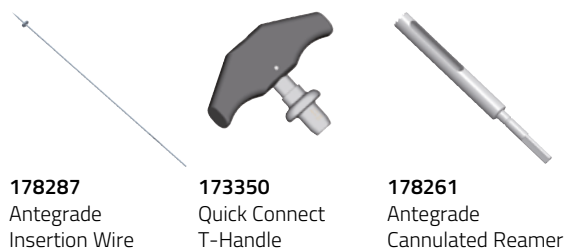
By M. Manca, MD

### Entry Point

A 3-4 cm skin incision is carried out at the anterior part of the acromion. The deltoid muscle should be separated in line with its fibres. The subacromial bursa is incised and removed since there is often an haematoma in it. If the rotator cuff is intact, a 1.5 cm split along the tendinous fibres is carried out medially to its insertion in the greater tuberosity to avoid damage to this critical insertion point. The rotator cuff must be protected throughout surgery. If the rotator cuff was damaged by the injury, it is possible to go through the defect that is repaired at the end of surgery. In three and four part fractures, the humeral head may be reconstructed using non-absorbable trans-osseous wires to suture the tuberosities or K-wires and cannulated screws to stabilise the fragments. The nail is inserted between the fragments, which are then sutured.

### Option 1: Antegrade Cannulated Reamer

The Antegrade Insertion Wire d. 2x250mm (178287) is inserted using a power drill, in line with the medullary canal in the lateral view 8-9mm medial to the cartilage-bone transitional zone at the sulcus between the head and the greater tuberosity. Attach the Quick Connect T-Handle (173350) to the Antegrade Cannulated Reamer (178261) and place over the antegrade insertion wire. Open up the entry point down to the medullary canal. Remove the antegrade insertion wire and the cannulated reamer.



**178287**  
Antegrade  
Insertion Wire

**173350**  
Quick Connect  
T-Handle

**178261**  
Antegrade  
Cannulated Reamer

**Option 2: Cannulated Awl**

Make the entry point with the Awl (178265). The Guide Wire with Olive (99-178283) is inserted through the awl down the medullary canal. Use image intensification when passing the fracture.

**INSTRUMENTATION**

**178265**  
Awl



**99-178283**  
Guide Wire  
with olive  
2x780mm



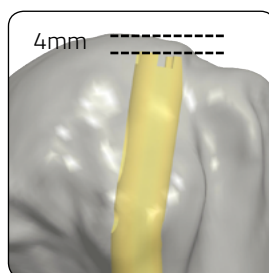
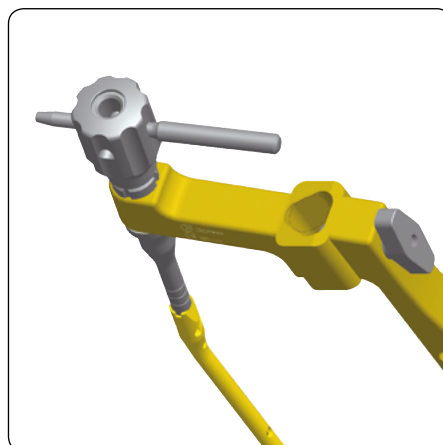


## Short Proximal Humeral Nail

### Nail Insertion

Insert the Locking Rod (178110) into the back of the Handle (178100) and the nail of correct diameter into the nail support. Tighten the locking rod using the Impactor (173071) inserted in the holes in the locking rod.

Under image intensification, insert the nail using gentle manoeuvres avoiding bending between the nail and the handle. Always ensure that the proximal end of the nail is at least 4mm below the bone surface.



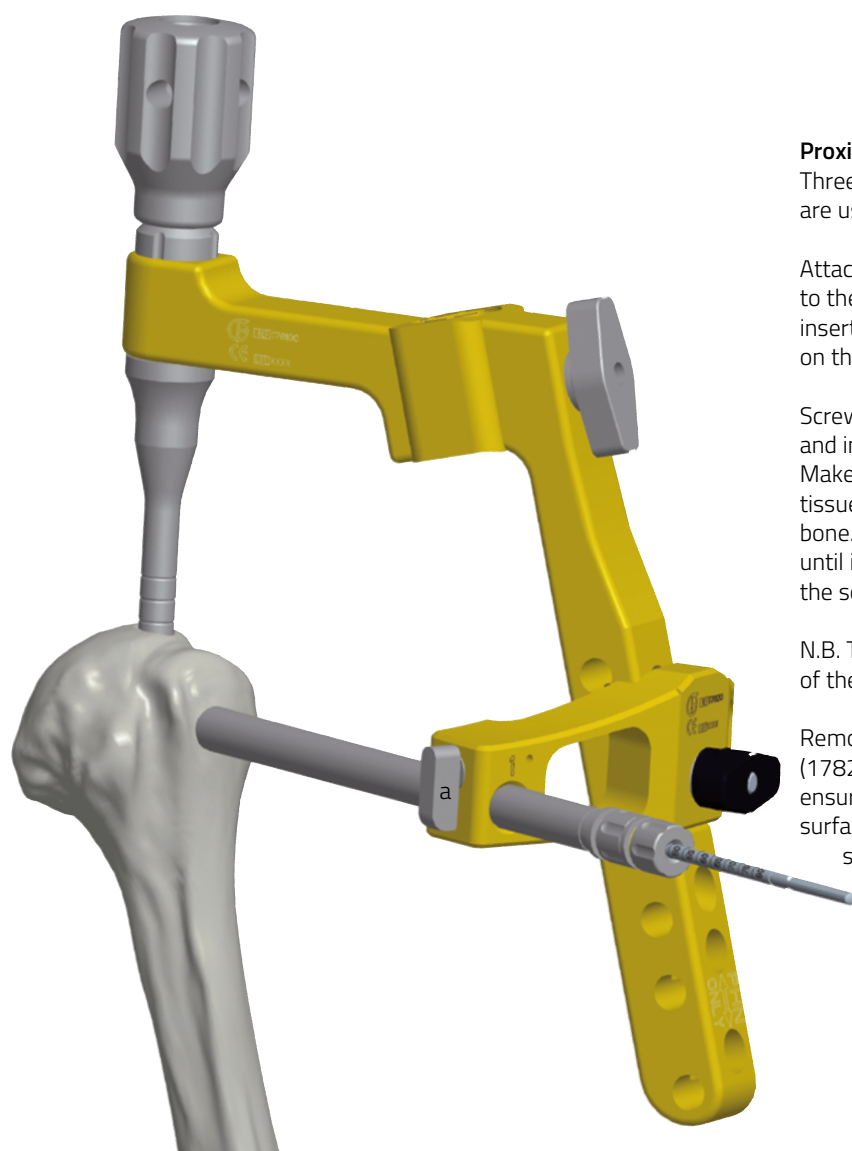
**178110**  
Locking Rod



**178100**  
Handle



**173071**  
Impactor



### Proximal Locking

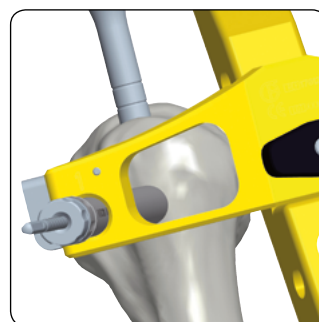
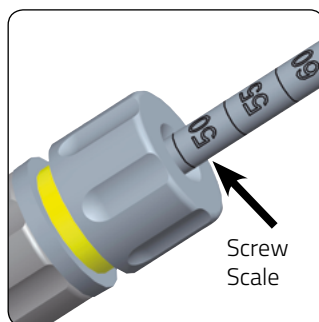
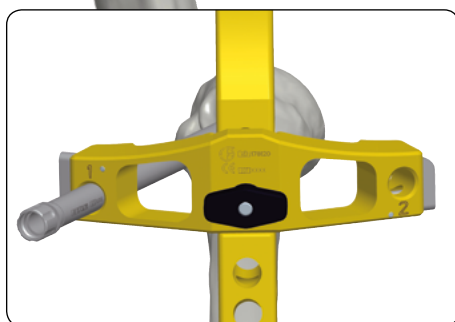
Three 4.0mm titanium fully threaded locking screws are used for proximal locking in the humeral head.

Attach the Proximal Humeral Outrigger (178120) to the handle. The two most proximal screws are inserted first following the numerical order marked on the proximal humeral outrigger.

Screw a Trocar (173212) into a Screw Guide (173211) and insert them together into the hole marked "1". Make a stab incision where they touch the skin, split the tissues down to the bone, and push them down to the bone. Unscrew the trocar and advance the screw guide until it is sitting flush against the bone surface. Tighten the screw guide in place with the locking cam (a).

N.B. The surgeon should be aware of the position of the axillary nerve during this procedure.

Remove the trocar and screw in the 3.2mm Drill Guide (178213). Drill with the 3.2mm Drill Bit (178286), ensuring that the drill does not penetrate the articular surface. The screw length required is read from the scale on the drill bit immediately above the top of the drill guide (see inset). It is advisable to position the drill bit and drill guide exactly at right angles to the Image Intensifier.



## INSTRUMENTATION



**178120**  
Proximal Humeral  
Outrigger



**173212**  
Trocar



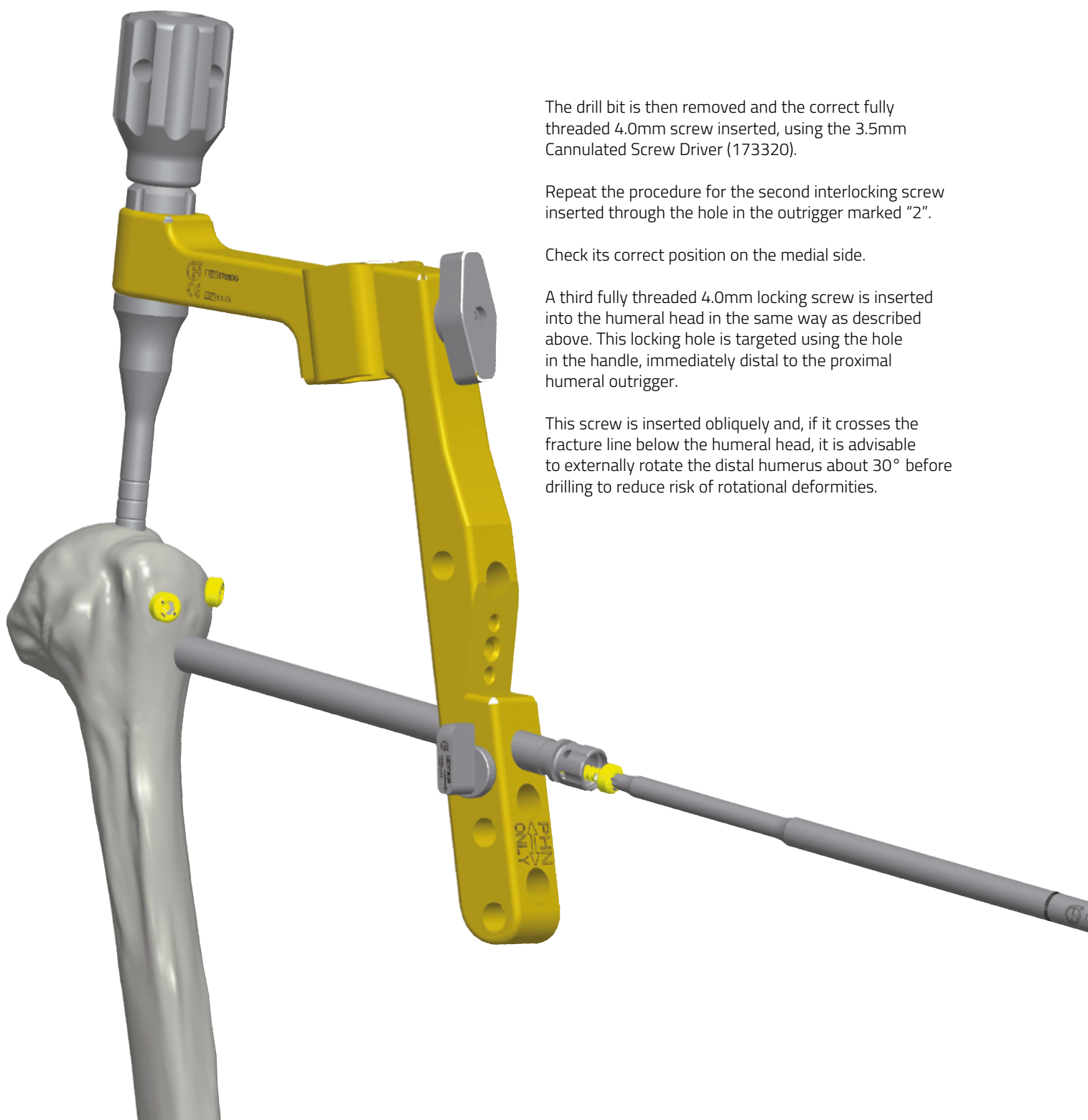
**173211**  
Screw Guide



**178213**  
3.2mm  
Drill Guide



**178286**  
3.2mm  
Drill Bit



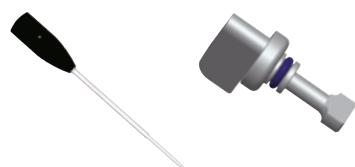
The drill bit is then removed and the correct fully threaded 4.0mm screw inserted, using the 3.5mm Cannulated Screw Driver (173320).

Repeat the procedure for the second interlocking screw inserted through the hole in the outrigger marked "2".

Check its correct position on the medial side.

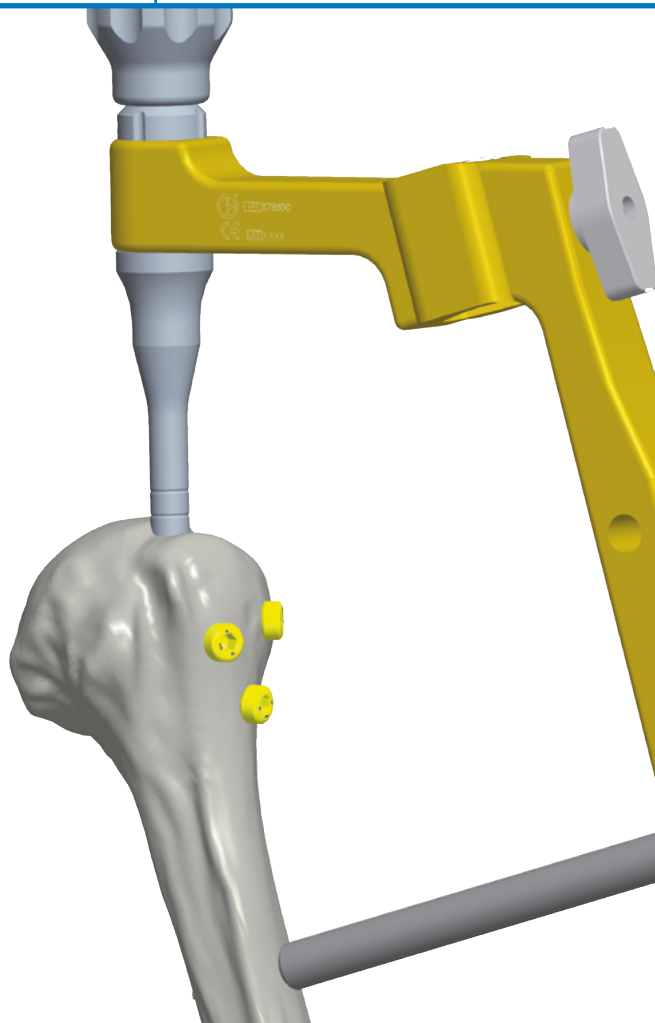
A third fully threaded 4.0mm locking screw is inserted into the humeral head in the same way as described above. This locking hole is targeted using the hole in the handle, immediately distal to the proximal humeral outrigger.

This screw is inserted obliquely and, if it crosses the fracture line below the humeral head, it is advisable to externally rotate the distal humerus about 30° before drilling to reduce risk of rotational deformities.



**173320**  
3.5mm  
Cannulated  
Screw Driver

**173026**  
Locking Cam



### Distal Locking

Check for any rotational deformity or distraction of the fracture site before carrying out distal locking.

Distal locking is carried out using 4.0mm standard (partially threaded) locking screws. Two locking screws are used distally if the bone quality is poor. The most proximal of the distal holes should always be filled. Screw the trocar (173212) into the screw guide (173211) and insert them both into the proximal of the two holes that are marked 'PHN ONLY'.

Make a stab incision where they touch the skin, split the tissues down to the bone, and push both down to the bone. Unscrew the trocar and push the screw guide until it is sitting flush against the bone surface. Tighten the screw guide in place with the locking cam.

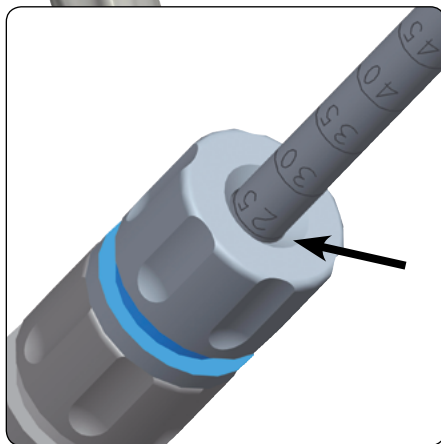
N.B. The surgeon should be aware of the position of the radial nerve during this procedure.

Remove the trocar and screw in the 4.0mm Drill Guide (174213). Drill with the 4.0mm Drill Bit (174286) until the drill tip is 2-3mm through the second cortex.

The screw length required is read from the scale on the drill bit immediately above the top of the drill guide (see inset). Insert the locking screw using the 3.5mm cannulated screw driver (173320).

Repeat the procedure for the most distal locking screw if required.

For "Removal of the Handle and Closure" see on page 22.



## INSTRUMENTATION



**174213**  
4.0mm  
Drill Guide



**174286**  
4.0mm  
Drill Bit

## Long Proximal Humeral Nail

### Reaming

It is necessary to ream the distal part of the humerus before nail insertion. The chosen nail should be as long as possible to prevent damage to the radial nerve during distal locking. This decision will depend on bone dimensions and quality. Over-reaming is not normally required, but an additional 0.5mm may be necessary to facilitate insertion. Reaming is always advisable in order to insert the nail easily without force. A guide wire with olive should be inserted and also used for initial fracture reduction. Fracture reduction should not be accomplished with the nail and the handle as leverage arm. Use the Humeral Reamer Sleeve (178230) to protect soft tissues when reaming. If power reaming is required, the olive-tipped guide wire should be used and exchanged for a plain guide wire before nail insertion.

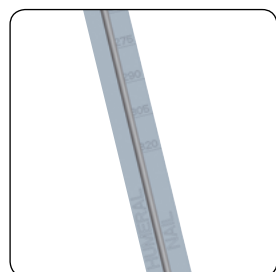
After reaming, replace the guide wire with olive with a plain guide wire, using the Guide Wire Exchange Tube (178353). Check the position of the radio opaque marker under image intensification. Confirm that the tip of the plain guide wire is in the correct position and remove the Plastic Exchange Tube.

**178353**  
Guide Wire Exchange  
Tube

**178230**  
Humeral Reaming  
Sleeve

**99-178283**  
Guide Wire  
with olive  
2x780mm

**99-178282**  
Guide Wire  
without olive  
2.5x780mm



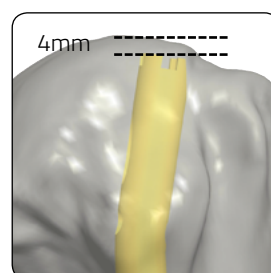
### Measurement of Nail Length

The ruler (178275) is mounted in the ruler support (173276), and positioned at the entry portal. The nail length is read from the position of the tip of the guide wire. N.B. The ruler is calibrated for a 780mm guide wire. The nail should be inserted as distally as possible.

### Nail Insertion

Insert the Locking Rod (178110) into the back of the Handle (178100) and the nail of correct diameter and length into the nail support. Tighten the locking rod using the Impactor (173071) inserted in the holes in the locking rod.

Under image intensification, insert the nail. Always ensure that the proximal end of the nail is about 4mm below the surface of the humeral head without protruding into the subacromial zone. Hammering is strongly not recommended during nail insertion, which should be performed by pushing and rotatory movements. The hammer (173380) should only be used when insertion of the nail is almost completed. Note: Hammer gently with the plastic surface until the nail is fully inserted.



## INSTRUMENTATION



**178275**  
Humeral Ruler



**173276**  
Ruler Support



**178110**  
Locking Rod



**178100**  
Handle

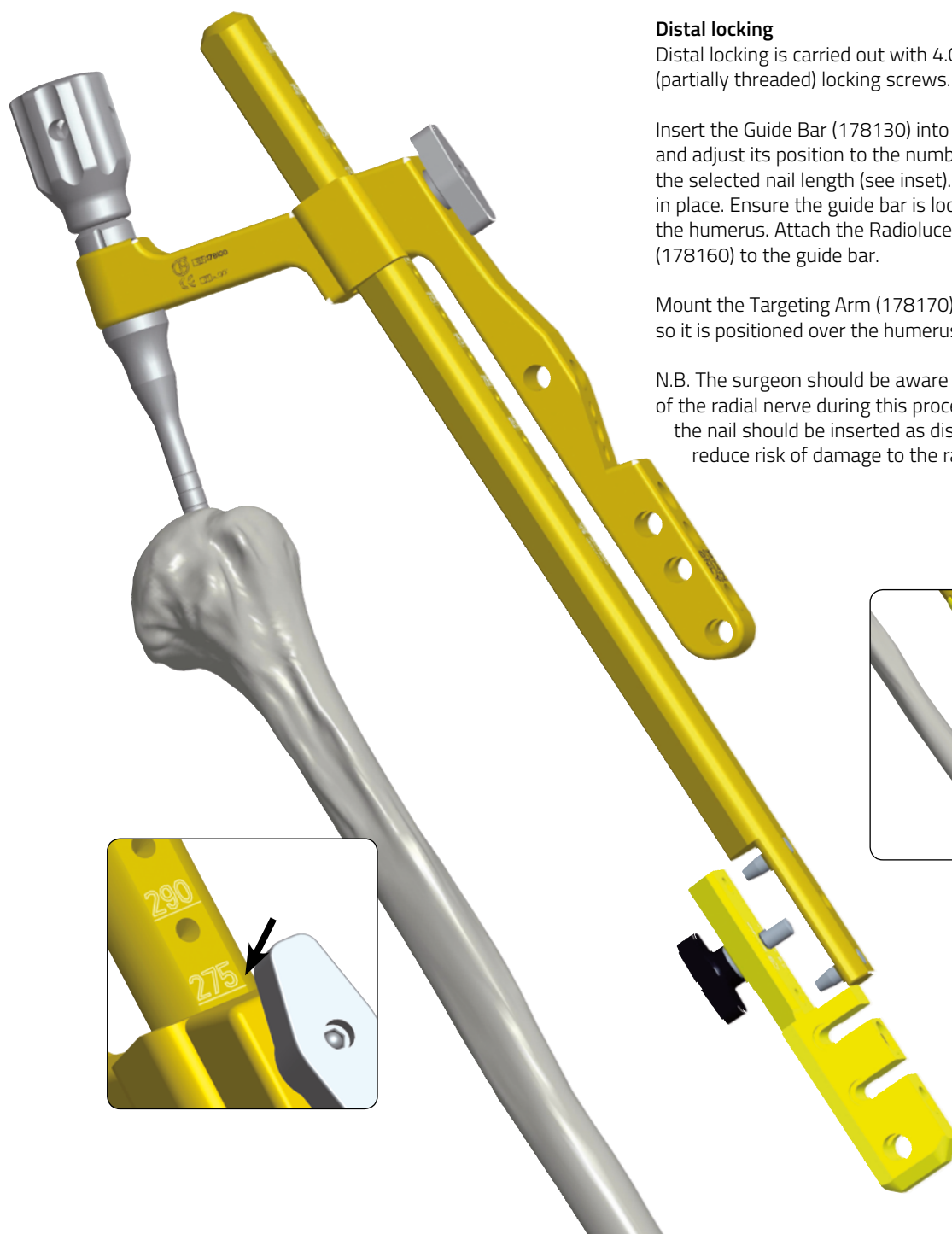


**173071**  
Impactor



**173380**  
Hammer





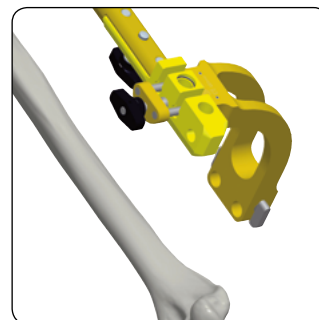
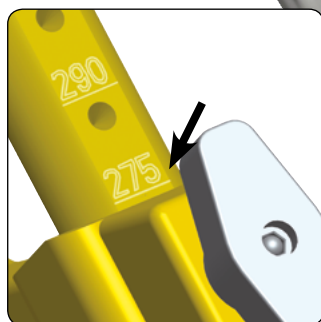
### Distal locking

Distal locking is carried out with 4.0mm standard (partially threaded) locking screws.

Insert the Guide Bar (178130) into the handle, and adjust its position to the number corresponding to the selected nail length (see inset). Lock the arm firmly in place. Ensure the guide bar is located laterally over the humerus. Attach the Radiolucent Distal Adapter (178160) to the guide bar.

Mount the Targeting Arm (178170) on the distal adapter so it is positioned over the humerus posteriorly.

N.B. The surgeon should be aware of the position of the radial nerve during this procedure. For this reason the nail should be inserted as distally as possible to reduce risk of damage to the radial nerve.



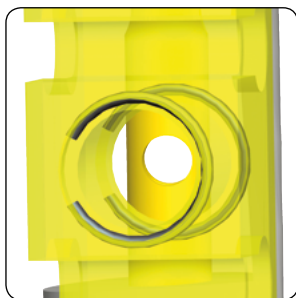
**178130**  
Guide Bar



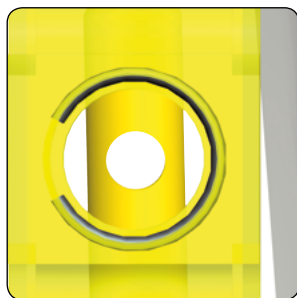
**178160**  
Radiolucent  
Distal Adapter



**178170**  
Targeting Arm



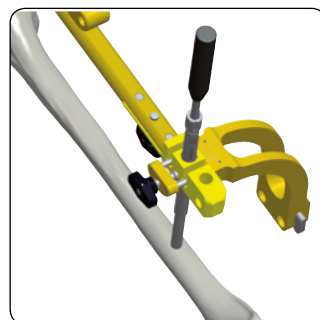
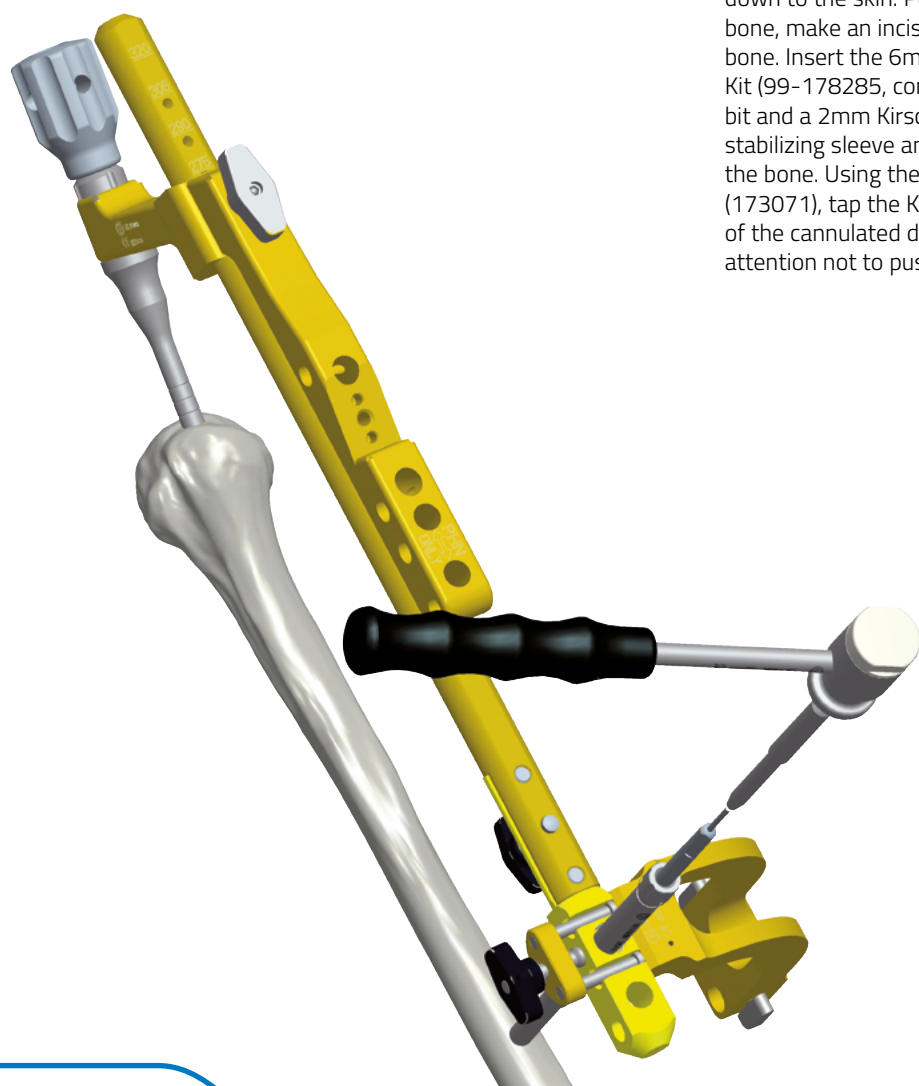
Not aligned



Aligned

The proximal hole in the Radiolucent Distal Adapter (178160) has two targeting rings to enable it to be centred over the nail. After having carefully rotated the arm externally, the Image Intensifier is positioned over the distal adapter so that the two rings appear as one ring. If the rings are not central over the nail hole the guide bar is moved anteriorly or posteriorly until they are centered.

Insert the Stabilizing Sleeve (173201) and trocar (11129) through the proximal hole in the distal adapter down to the skin. Position it over the centre of the bone, make an incision and advance it down to the bone. Insert the 6mm Single-Use Cannulated Drill Bit Kit (99-178285, consisting of a 6mm cannulated drill bit and a 2mm Kirschner Wire 220mm long) into the stabilizing sleeve and push the two together down to the bone. Using the Hammer (173380) and the Impactor (173071), tap the K-wire until it is flush with the end of the cannulated drill. Drill the first cortex only, paying attention not to push against the nail.



## INSTRUMENTATION



**173201**  
Stabilizing Sleeve



**11129**  
Trocar

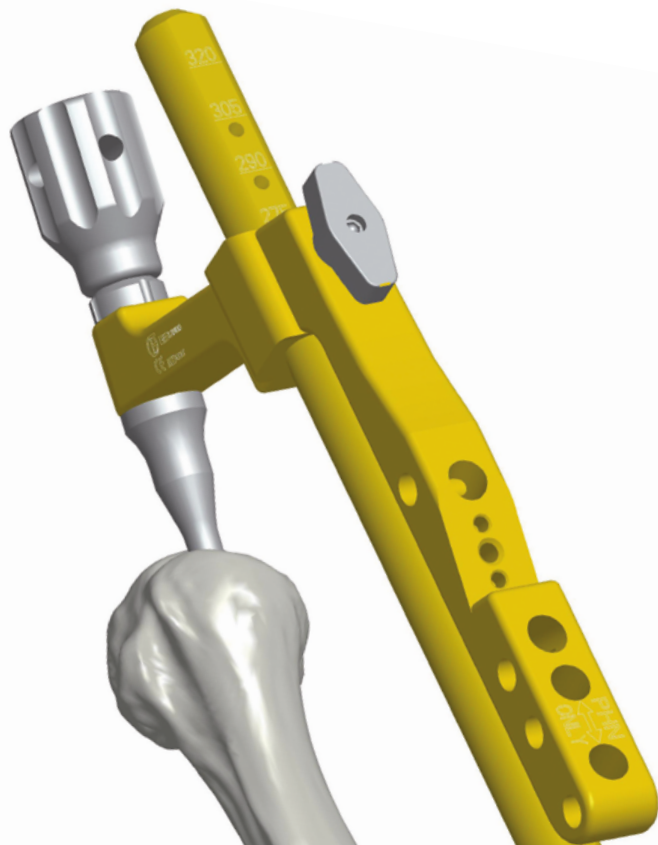


**99-178285**  
6mm  
Cannulated  
Drill Bit Kit



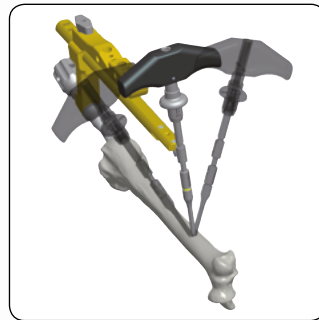
**173380**  
Hammer





Remove the cannulated drill, K-wire and stabilizing sleeve. Attach the Quick Connect T-Handle (173350) to the Stabilizing Rod (178041) and insert it into the proximal hole in the distal adapter down to the corresponding threaded hole in the nail. Screw it in fully.

If there is difficulty in finding the threaded hole in the nail with the guide bar in place, the targeting arm and distal adapter can be removed together so that the stabilizing rod (178041) may be used to find the hole in the nail with a probing technique. Once this hole has been found, remove the quick connect T-handle and insert the targeting arm and distal adapter over the stabilizing rod.



Screw the Locking Nut (173032) to the rod. Attach the correct Spacer (173051, 173052, 173058) for the diameter (7-9mm) of the nail and tighten the nut fully.

NB. The spacer must be attached to the stabilizing rod with the number (7,8, or 9) facing outwards.

173051 / 2 / 8



**178041**  
Stabilizing Rod



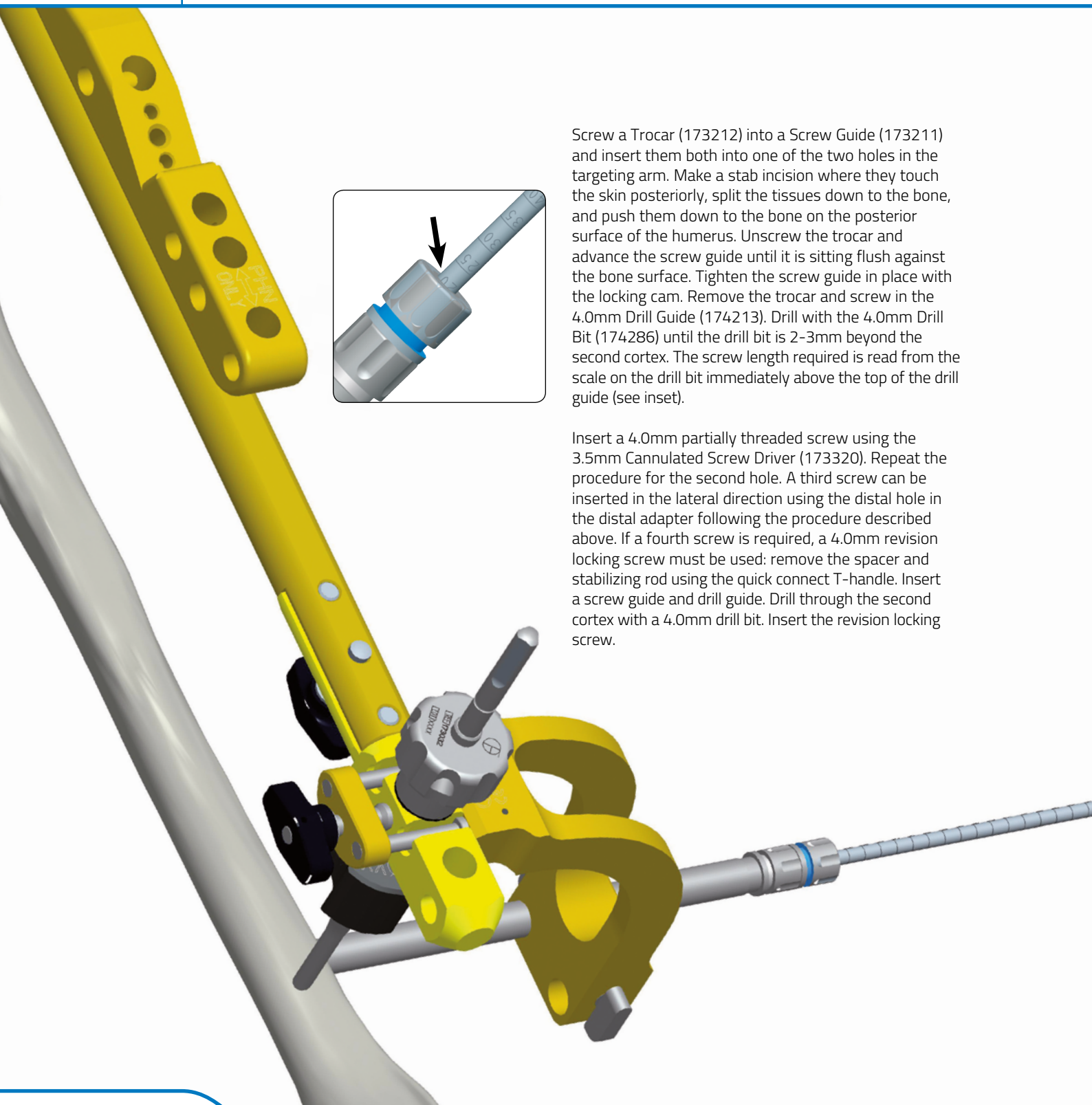
**173032**  
Locking Nut



**173051 / 2 / 8**  
Spacer



**173350**  
T Handle



Screw a Trocar (173212) into a Screw Guide (173211) and insert them both into one of the two holes in the targeting arm. Make a stab incision where they touch the skin posteriorly, split the tissues down to the bone, and push them down to the bone on the posterior surface of the humerus. Unscrew the trocar and advance the screw guide until it is sitting flush against the bone surface. Tighten the screw guide in place with the locking cam. Remove the trocar and screw in the 4.0mm Drill Guide (174213). Drill with the 4.0mm Drill Bit (174286) until the drill bit is 2-3mm beyond the second cortex. The screw length required is read from the scale on the drill bit immediately above the top of the drill guide (see inset).

Insert a 4.0mm partially threaded screw using the 3.5mm Cannulated Screw Driver (173320). Repeat the procedure for the second hole. A third screw can be inserted in the lateral direction using the distal hole in the distal adapter following the procedure described above. If a fourth screw is required, a 4.0mm revision locking screw must be used: remove the spacer and stabilizing rod using the quick connect T-handle. Insert a screw guide and drill guide. Drill through the second cortex with a 4.0mm drill bit. Insert the revision locking screw.

## INSTRUMENTATION



**173212**  
Trocar



**173211**  
Screw Guide



**174213**  
4.0mm  
Drill Guide



**174286**  
4.0mm  
Drill Bit



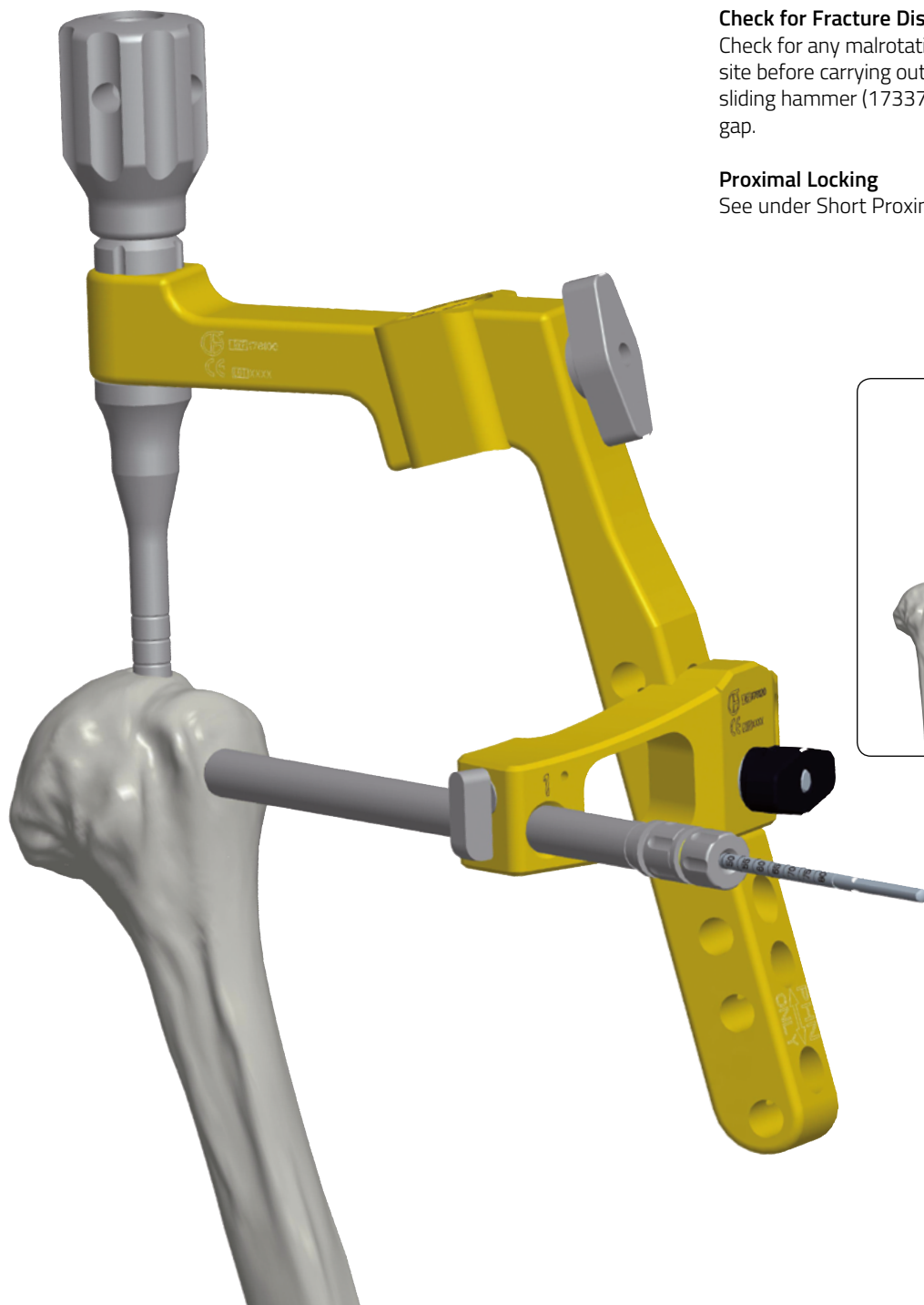
**173320**  
3.5mm  
Cannulated  
Screw Driver

**Check for Fracture Distraction**

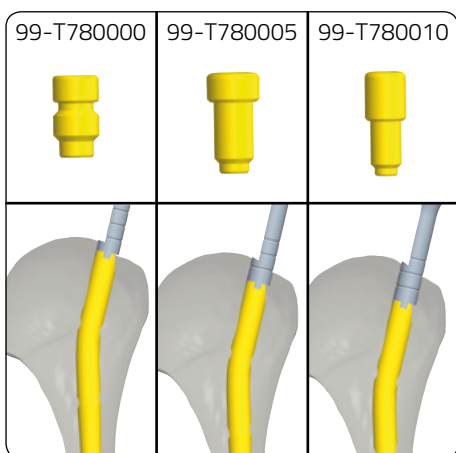
Check for any malrotation or distraction of the fracture site before carrying out proximal locking. If necessary the sliding hammer (173370) can be used to close a fracture gap.

**Proximal Locking**

See under Short Proximal Humeral Nail on page 12



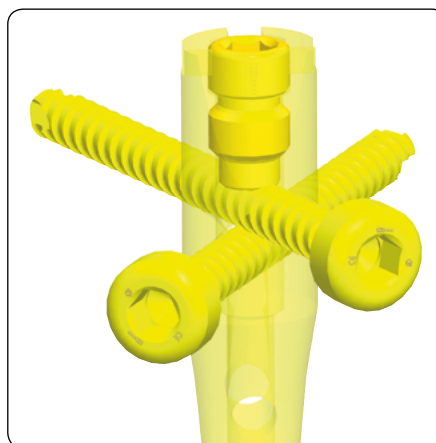
**173370**  
Sliding Hammer



### Removal of the Handle and Closure

Before removing the handle from the nail, check correct insertion of locking screws both in the AP and lateral planes. Remove the handle and the locking rod and, using the 3.5mm cannulated screw driver (173320), insert the nail end cap (99-T780000, 99-T780005, 99-T780010) over a K-wire, choosing the correct length (0, 5, 10) and avoiding protrusion above the bone surface.

N.B. At the end of surgery, remove the deltoid fibres from the locking screw heads and mobilise the arm in all directions, including internal and external rotation.



## INSTRUMENTATION

## Diaphyseal Humeral Nail

### Antegrade Insertion

By M. Manca, MD

#### Entry point

See under Short Proximal Humeral Nail on page 9.

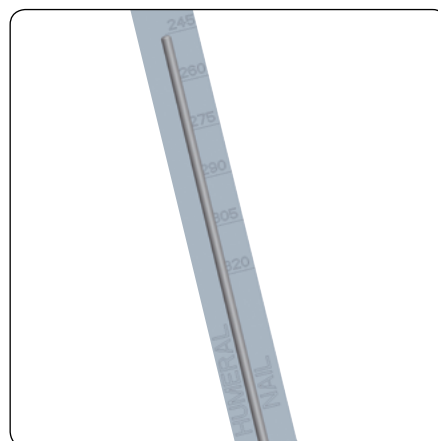
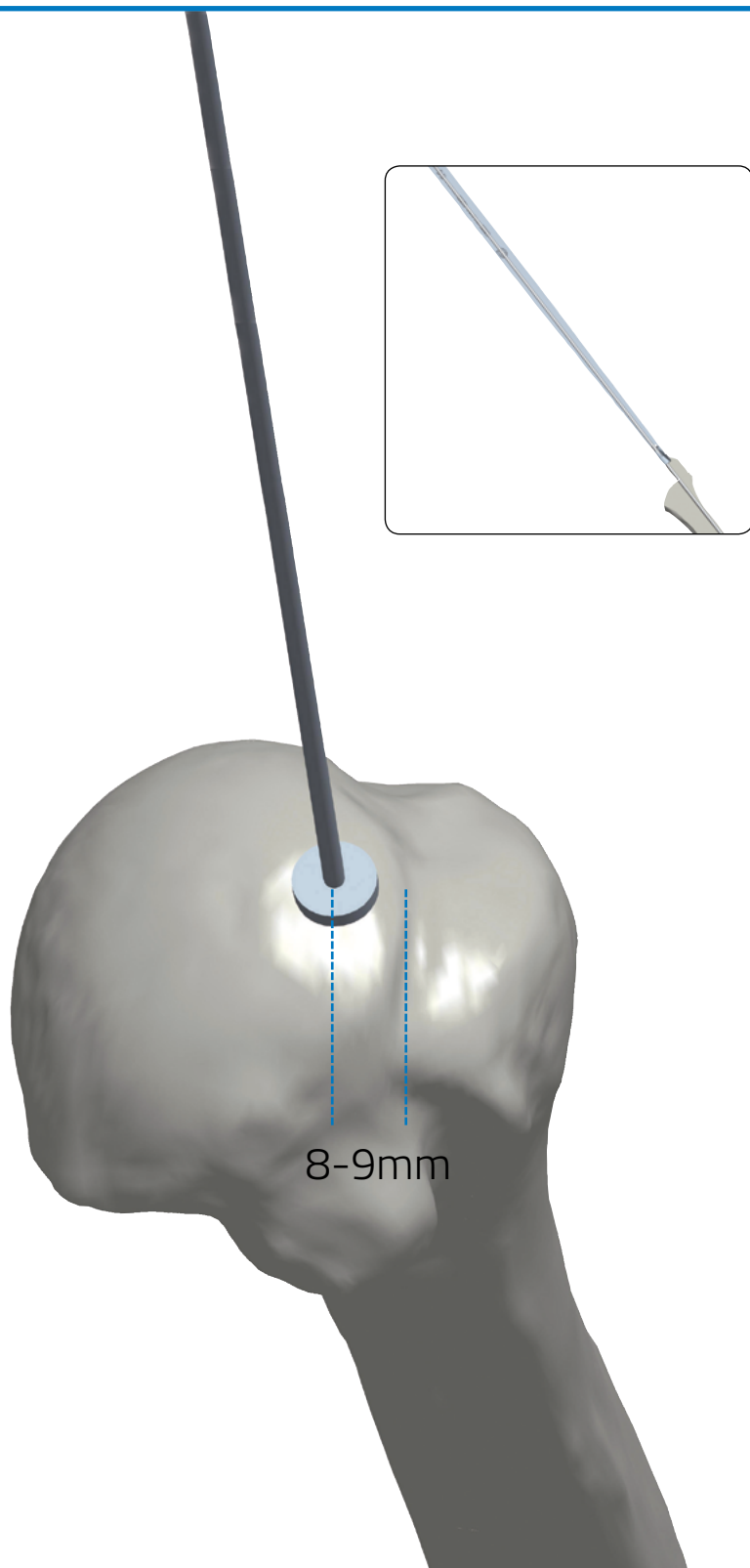
#### Reaming

See under Long Proximal Humeral Nail on page 15.

#### Measurement of Nail Length

The ruler (178275) is mounted in the ruler support (173276), and positioned at the entry portal. The nail length is read from the position of the tip of the guide wire.

N.B. The ruler is calibrated for a 780mm guide wire. The nail should be inserted as distally as possible.



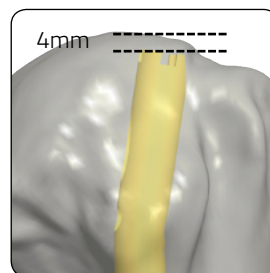
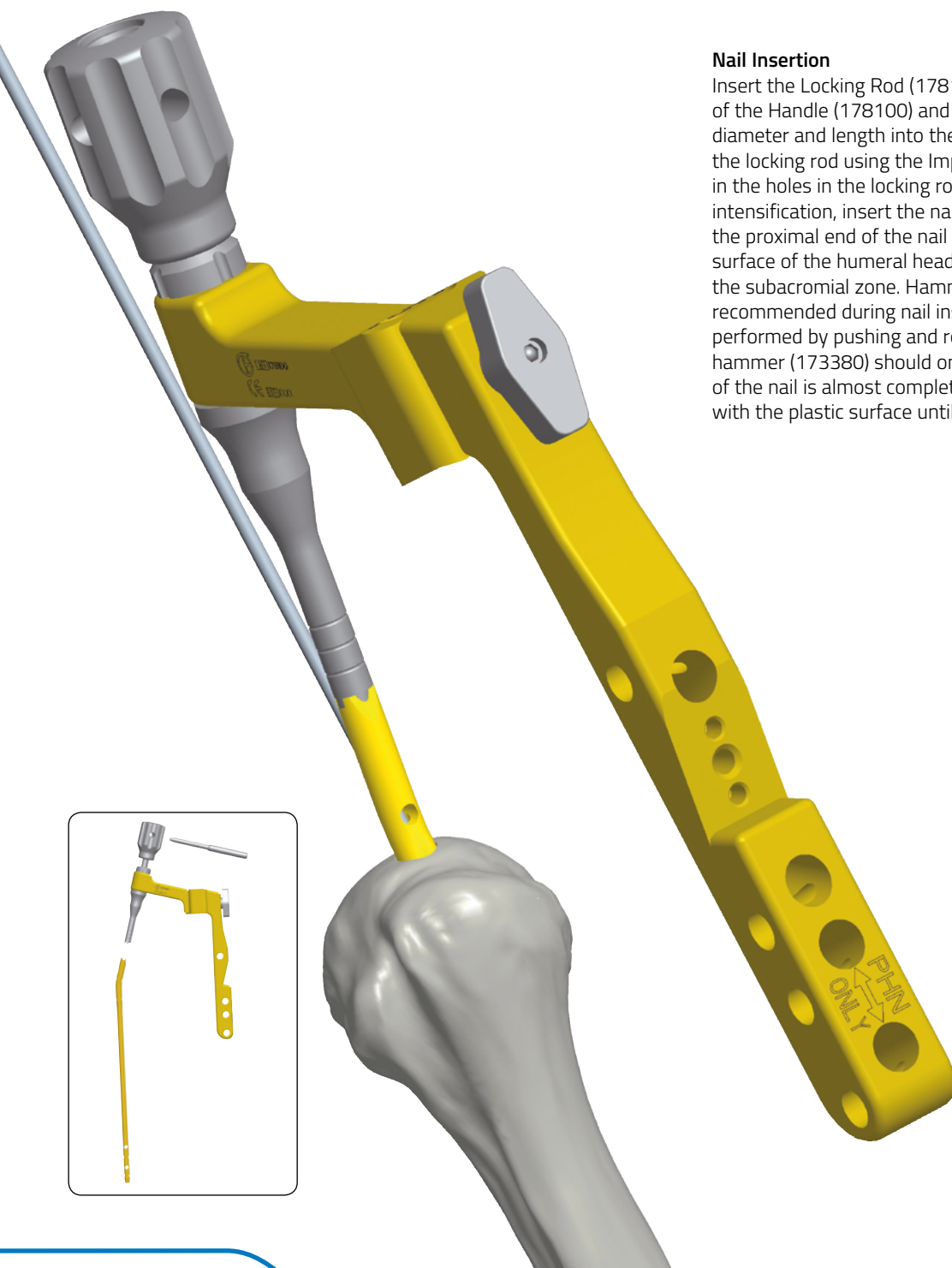
**99-178282**  
Guide Wire  
without olive  
2.5x780mm

**178275**  
Humeral Ruler

**173276**  
Ruler Support

### Nail Insertion

Insert the Locking Rod (178110) into the back of the Handle (178100) and the nail of correct diameter and length into the nail support. Tighten the locking rod using the Impactor (173071) inserted in the holes in the locking rod. Under image intensification, insert the nail. Always ensure that the proximal end of the nail is about 4mm below the surface of the humeral head without protruding into the subacromial zone. Hammering is strongly not recommended during nail insertion, which should be performed by pushing and rotatory movements. The hammer (173380) should only be used when insertion of the nail is almost completed. Note: Hammer gently with the plastic surface until the nail is fully inserted.



### INSTRUMENTATION



**178110**  
Locking Rod



**178100**  
Handle



**173071**  
Impactor

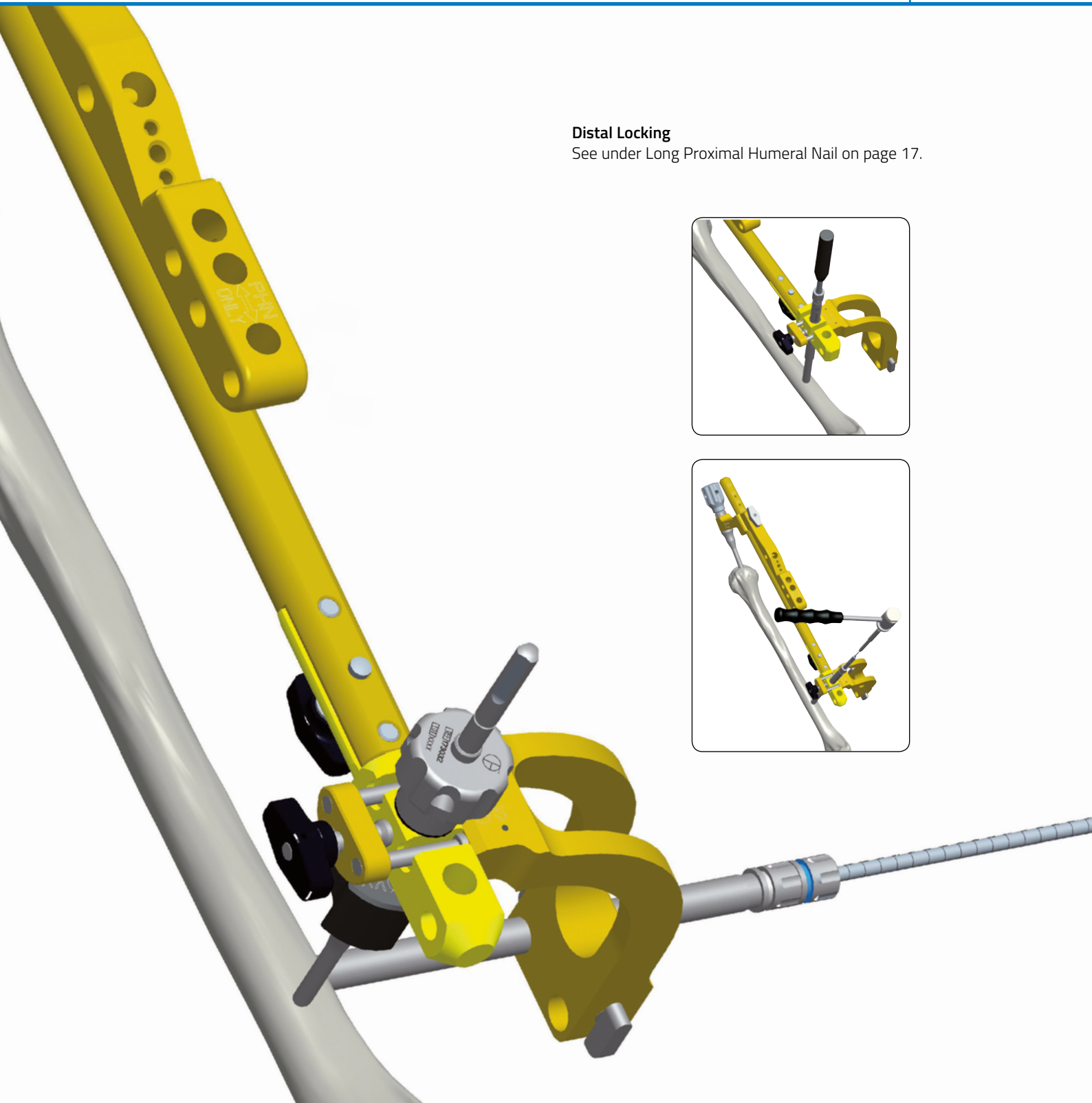
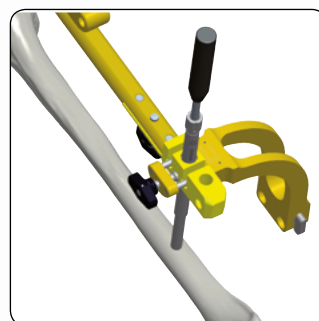


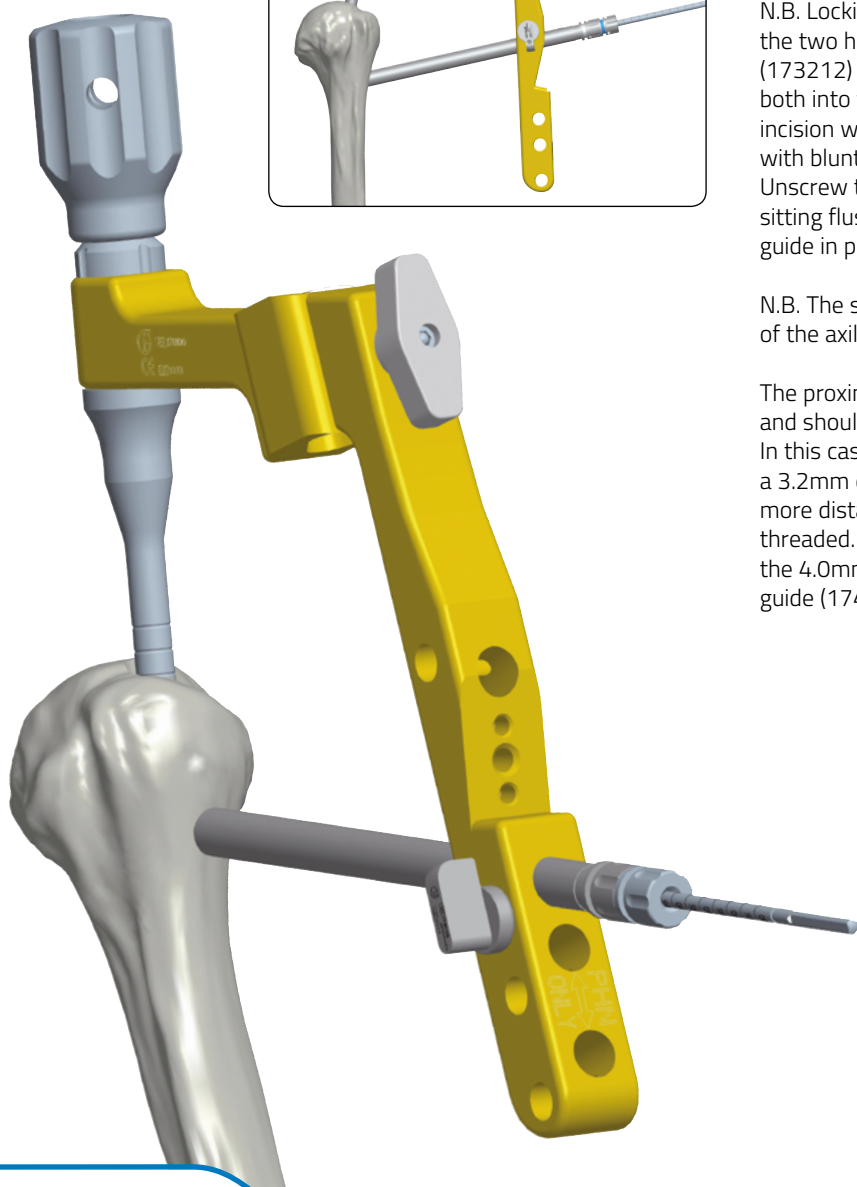
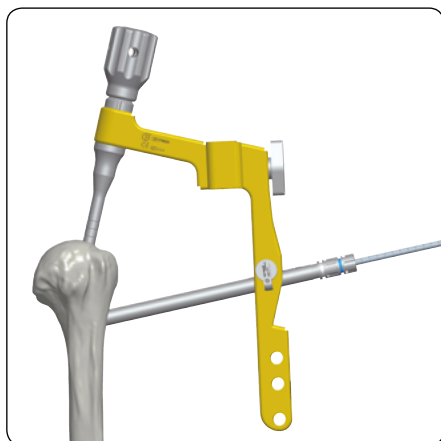
**173380**  
Hammer



**Distal Locking**

See under Long Proximal Humeral Nail on page 17.





### Check for Fracture Distraction

Check for any malrotation or distraction of the fracture site before carrying out proximal locking. If necessary the sliding hammer (173370) can be used to close a fracture gap.

### Proximal Locking

One or two locking screws are used proximally. N.B. Locking screws should not be inserted through the two holes labelled "PHN ONLY". Screw a Trocar (173212) into a Screw Guide (173211) and insert them both into the proximal hole in the handle. Make a stab incision where they touch the skin, split the tissues with blunt dissection, and push them down to the bone. Unscrew the trocar and push the screw guide until it is sitting flush against the bone surface. Tighten the screw guide in place with the locking cam.

N.B. The surgeon should be aware of the position of the axillary nerve during proximal locking.

The proximal screw is inserted in the humeral head and should therefore be unicortical and fully threaded. In this case it is necessary to drill the bone with a 3.2mm drill bit in a 3.2mm drill guide. The second, more distal, proximal screw is bicortical and partially threaded. In this case the pilot hole must be drilled with the 4.0mm Drill Bit (174286) through a 4.0mm drill guide (174213).

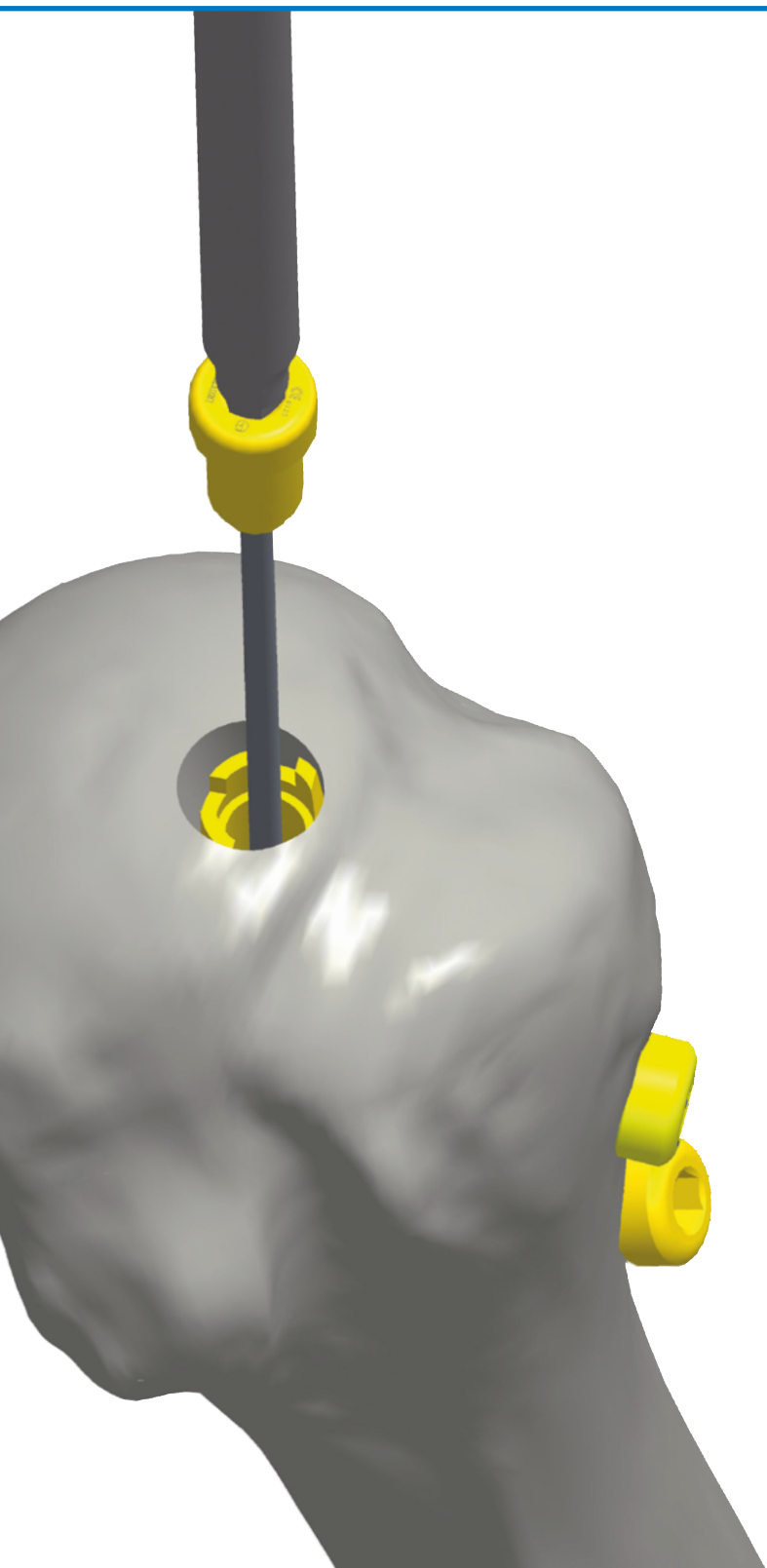
## INSTRUMENTATION



173370

Sliding Hammer

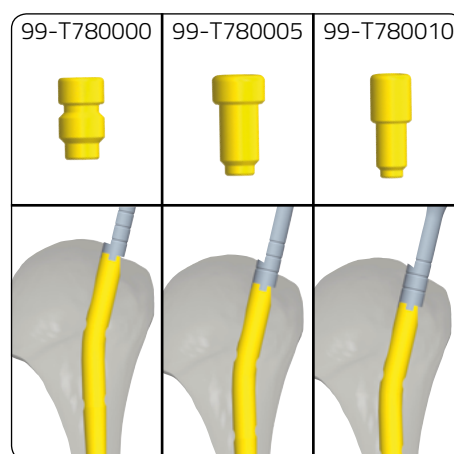




#### Removal of the Handle and Closure

Before removing the handle from the nail, check correct insertion of locking screws both in the AP and lateral planes. Remove the handle and the locking rod and, using the 3.5mm cannulated screw driver (173320), insert the nail end cap (99-T780000, 99-T780005, 99-T780010) over a K-wire, choosing the correct length (0, 5, 10) and avoiding protrusion above the bone surface.

N.B. At the end of surgery, remove the deltoid fibres from the locking screw heads and mobilise the arm in all directions, including internal and external rotation.



11146

K-Wire without olive  
d. 2x150mm

## Retrograde Insertion

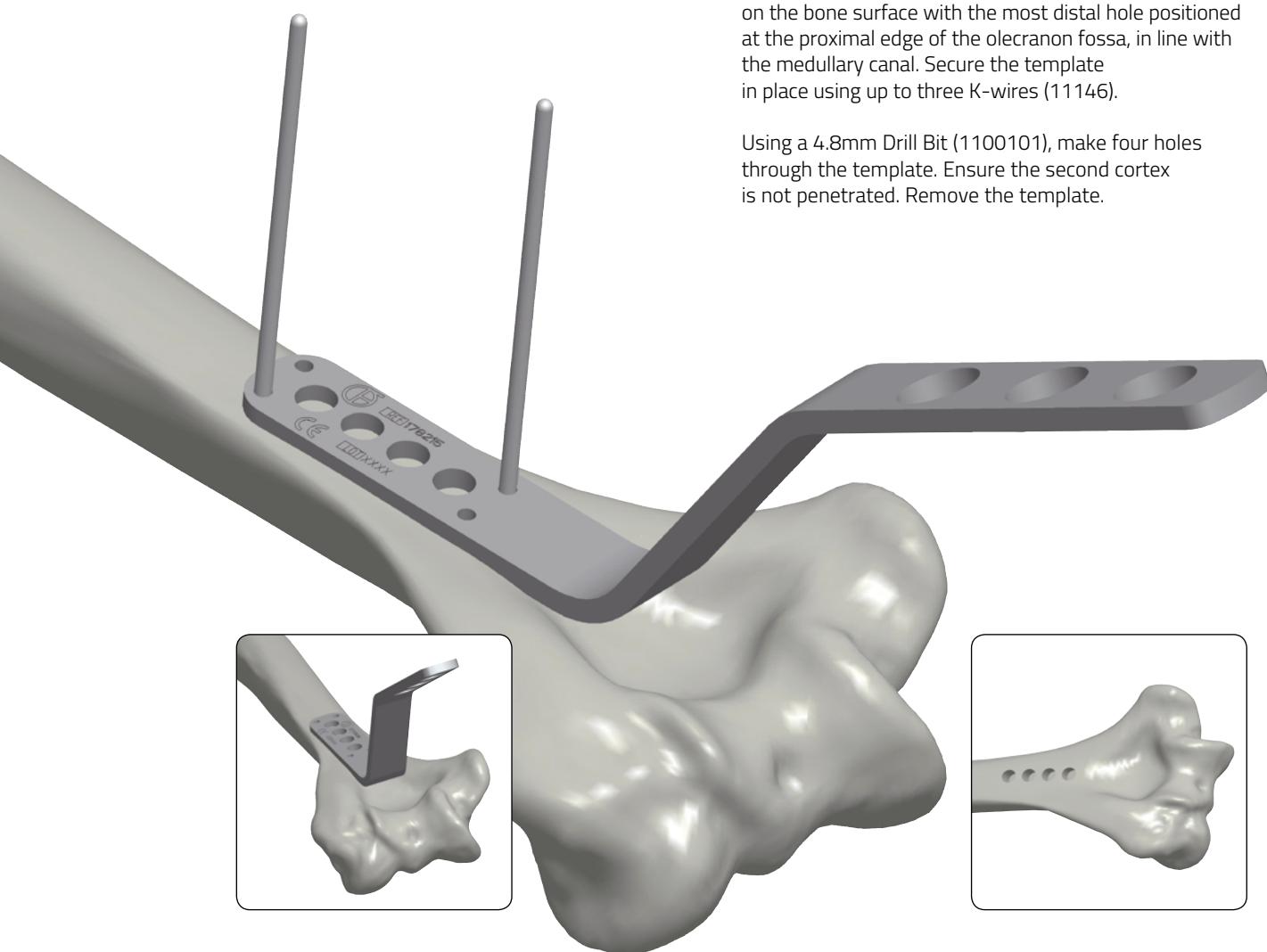
By R. Giancola, MD

### Entry Point

Using a triceps-splitting incision, expose the dorsal side of the humerus 8-10 cm proximal from the tip of the olecranon. Retract the triceps.

Place the Retrograde Insertion Template (178215) on the bone surface with the most distal hole positioned at the proximal edge of the olecranon fossa, in line with the medullary canal. Secure the template in place using up to three K-wires (11146).

Using a 4.8mm Drill Bit (1100101), make four holes through the template. Ensure the second cortex is not penetrated. Remove the template.



## INSTRUMENTATION



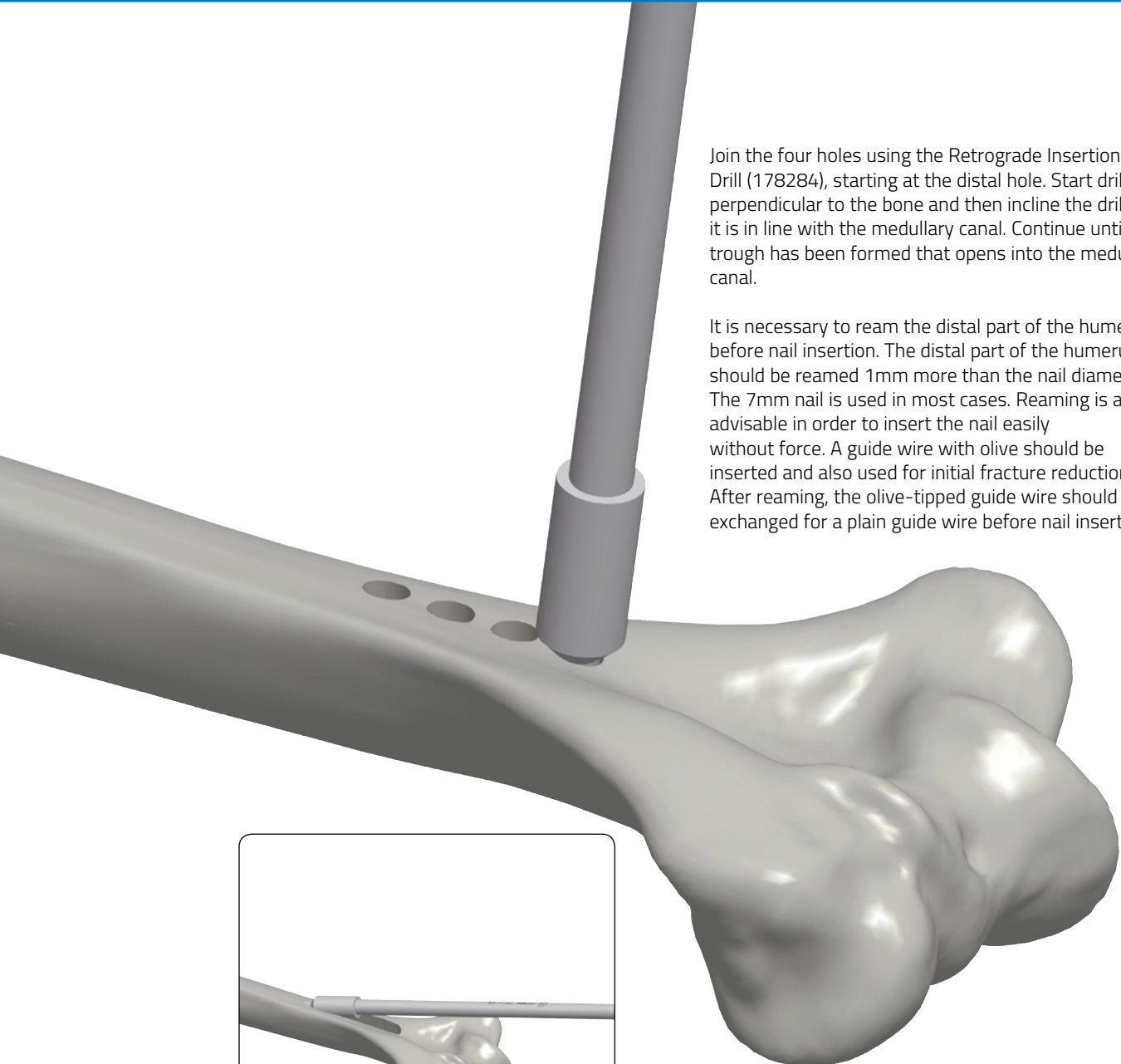
**178215**  
Retrograde  
Insertion  
Template



**11146**  
2mm K-wire

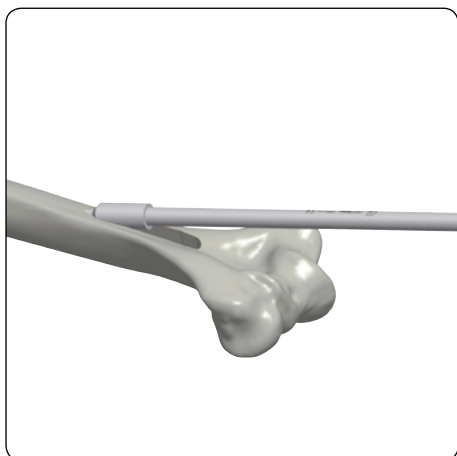


**1100101**  
Drill Bit  
4.8mm



Join the four holes using the Retrograde Insertion Drill (178284), starting at the distal hole. Start drilling perpendicular to the bone and then incline the drill until it is in line with the medullary canal. Continue until a trough has been formed that opens into the medullary canal.

It is necessary to ream the distal part of the humerus before nail insertion. The distal part of the humerus should be reamed 1mm more than the nail diameter. The 7mm nail is used in most cases. Reaming is always advisable in order to insert the nail easily without force. A guide wire with olive should be inserted and also used for initial fracture reduction. After reaming, the olive-tipped guide wire should be exchanged for a plain guide wire before nail insertion.



Guide wire exchange is facilitated using the Guide Wire Exchange Tube (178353).

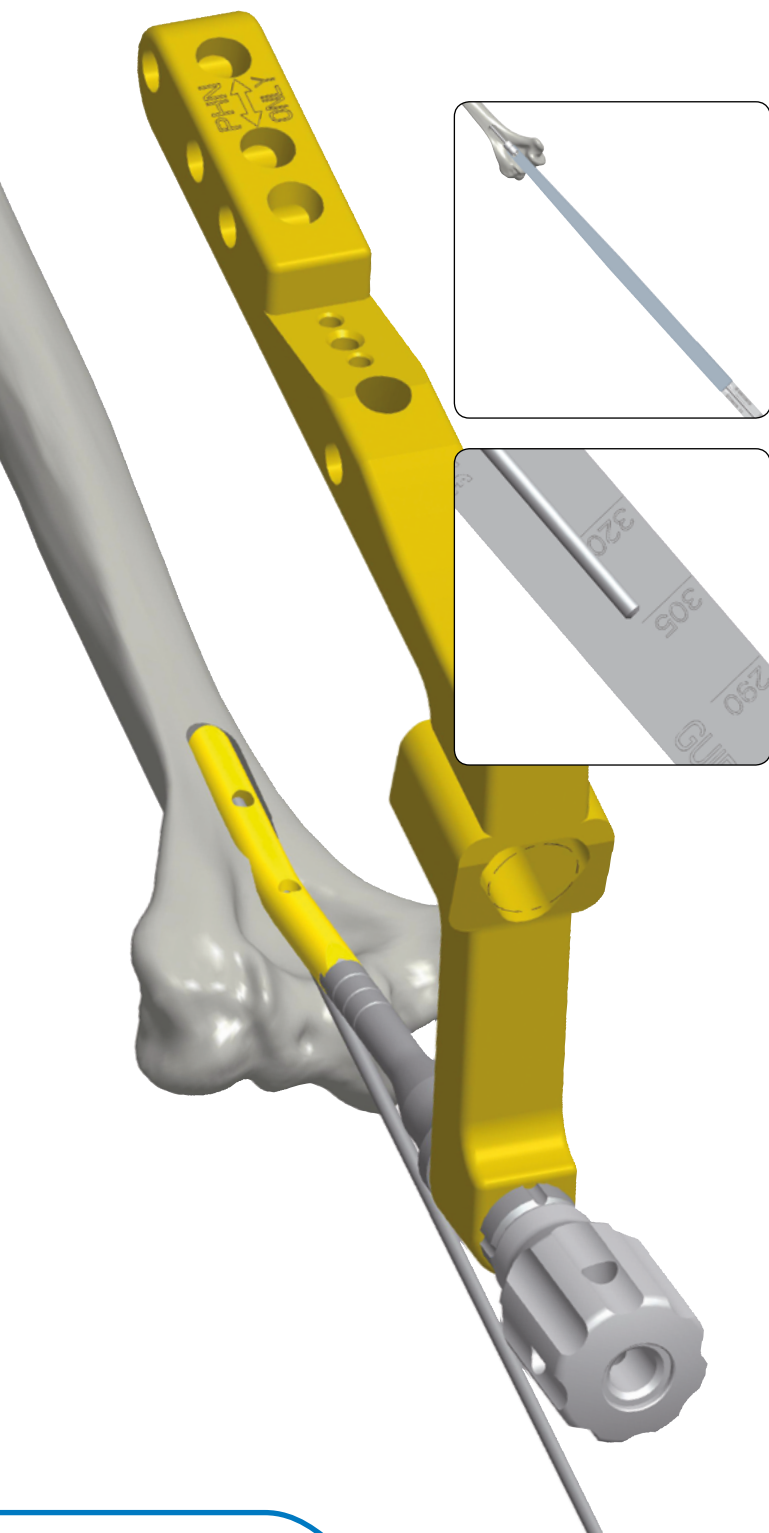
## INSTRUMENTATION



**178284**  
Retrograde  
Insertion Drill



**178353**  
Guide Wire  
Exchange Tube



### Measurement of Nail Length

The ruler (178275) is mounted in the ruler support (173276), and positioned at the entry portal. The nail length is read from the position of the tip of the guide wire.

N.B. The ruler is calibrated for a 780mm guide wire.

### Nail Insertion

Insert the Locking Rod (178110) into the back of the Handle (178100) and the nail of correct diameter and length into the nail support. Tighten the locking rod using the Impactor (173071) inserted in the holes in the locking rod.

Insert the nail gently over the guide wire, using rotatory movements if necessary. If insertion is difficult, do not hammer but ream again the medullary canal. Alternatively, use a smaller diameter nail.

Under image intensification, insert the nail until it is beneath the insertion site and not protruding.

IF USED, THE GUIDE WIRE MUST NOW BE REMOVED.

## INSTRUMENTATION



**178275**  
Humeral Ruler



**173276**  
Ruler Support



**178110**  
Locking Rod



**178100**  
Handle



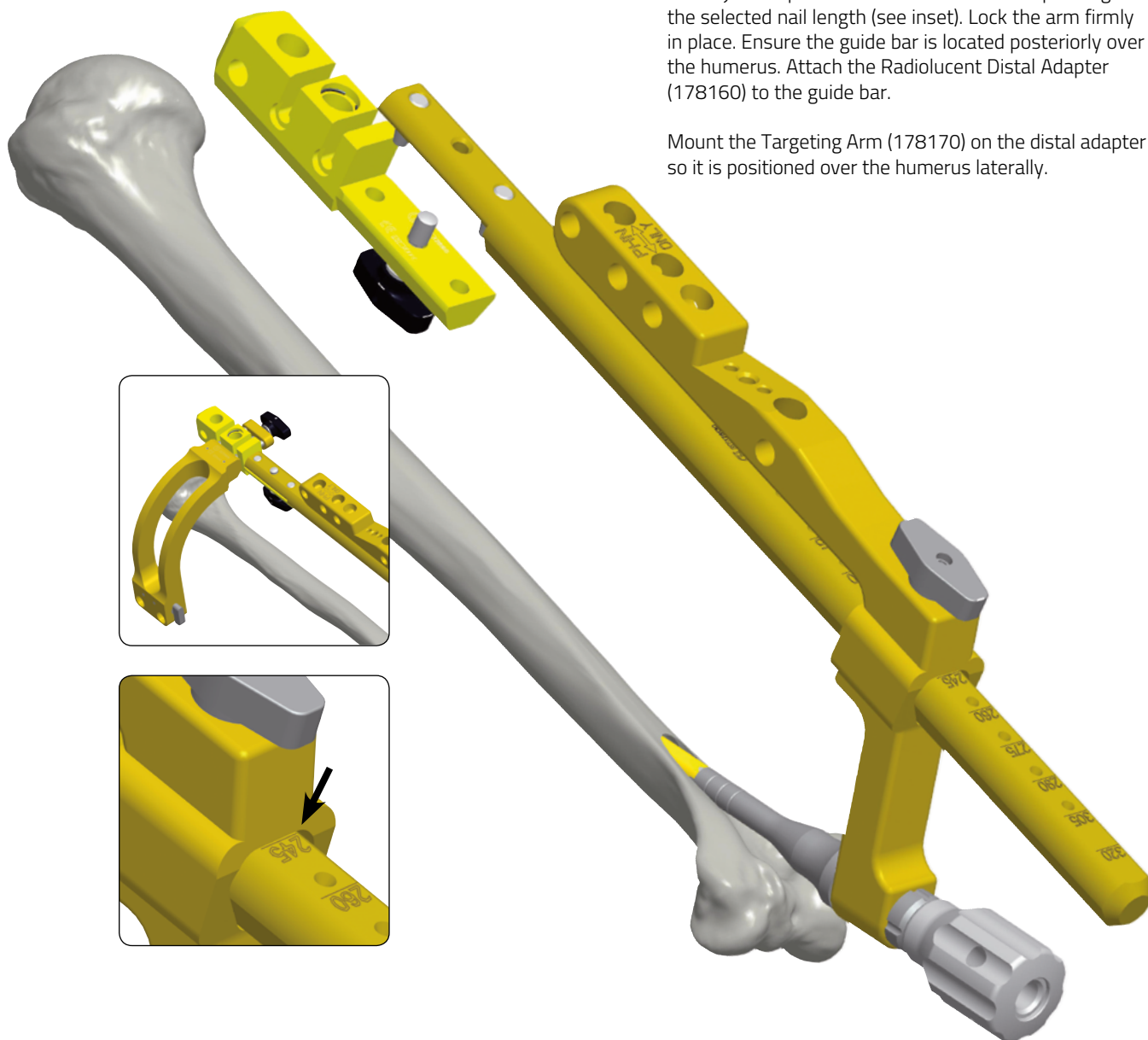
**173071**  
Impactor

**Proximal locking**

Proximal locking is carried out with 4.0mm standard (partially threaded) locking screws.

Insert the Guide Bar (178130) into the handle, and adjust its position to the number corresponding to the selected nail length (see inset). Lock the arm firmly in place. Ensure the guide bar is located posteriorly over the humerus. Attach the Radiolucent Distal Adapter (178160) to the guide bar.

Mount the Targeting Arm (178170) on the distal adapter so it is positioned over the humerus laterally.



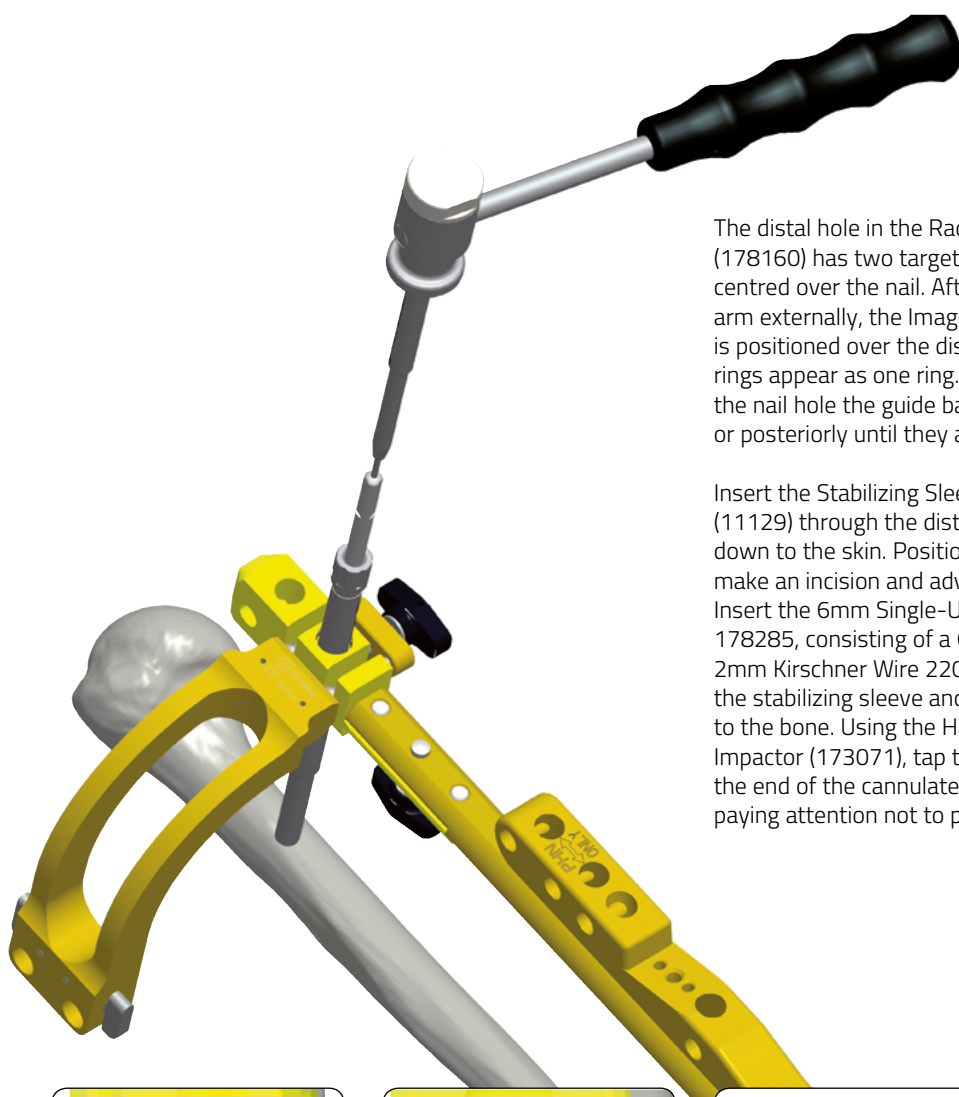
**178130**  
Guide Bar



**178160**  
Radiolucent  
Distal Adapter

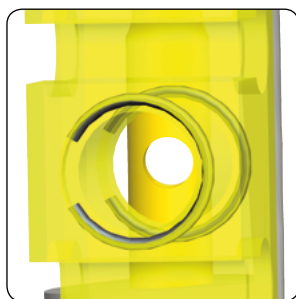


**178170**  
Targeting Arm

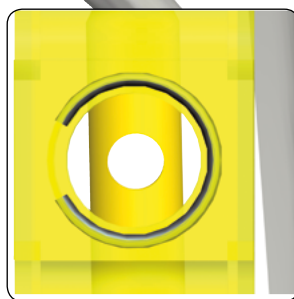


The distal hole in the Radiolucent Distal Adapter (178160) has two targeting rings to enable it to be centred over the nail. After having carefully rotated the arm externally, the Image Intensifier is positioned over the distal adapter so that the two rings appear as one ring. If the rings are not central over the nail hole the guide bar is moved anteriorly or posteriorly until they are centered.

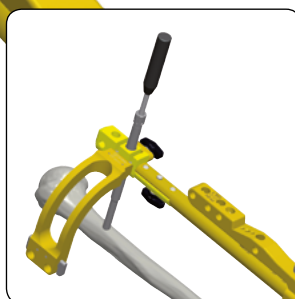
Insert the Stabilizing Sleeve (173201) and trocar (11129) through the distal hole in the distal adapter down to the skin. Position it over the centre of the bone, make an incision and advance it down to the bone. Insert the 6mm Single-Use Cannulated Drill Bit Kit (99-178285, consisting of a 6mm cannulated drill bit and a 2mm Kirschner Wire 220mm long) into the stabilizing sleeve and push the two together down to the bone. Using the Hammer (173380) and the Impactor (173071), tap the K-wire until it is flush with the end of the cannulated drill. Drill the first cortex only, paying attention not to push against the nail.



Not aligned



Aligned



## INSTRUMENTATION



**173201**  
Stabilizing Sleeve



**11129**  
Trocar

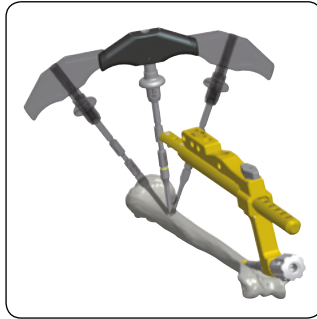


**99-178285**  
6mm Single-Use  
Cannulated  
Drill Bit Kit



**173380**  
Hammer



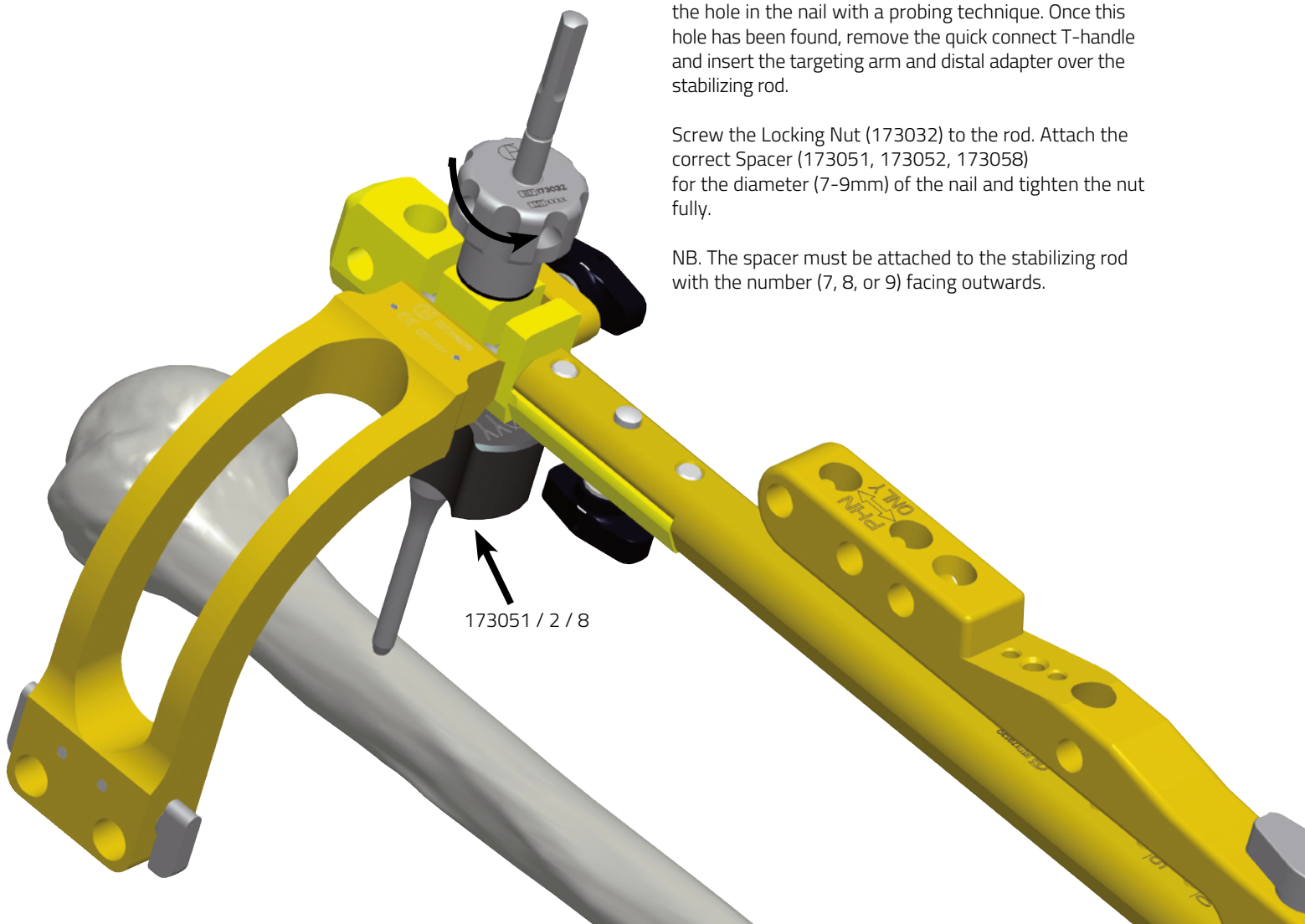


Remove the cannulated drill, K-wire and stabilizing sleeve. Attach the Quick Connect T-Handle (173350) to the Stabilizing Rod (178041) and insert it into the proximal hole in the distal adapter down to the corresponding threaded hole in the nail. Screw it in fully.

If there is difficulty in finding the threaded hole in the nail with the guide bar in place, the targeting arm and distal adapter can be removed together so that the stabilizing rod (178041) may be used to find the hole in the nail with a probing technique. Once this hole has been found, remove the quick connect T-handle and insert the targeting arm and distal adapter over the stabilizing rod.

Screw the Locking Nut (173032) to the rod. Attach the correct Spacer (173051, 173052, 173058) for the diameter (7-9mm) of the nail and tighten the nut fully.

NB. The spacer must be attached to the stabilizing rod with the number (7, 8, or 9) facing outwards.



**173350**  
Quick Connect  
T-Handle



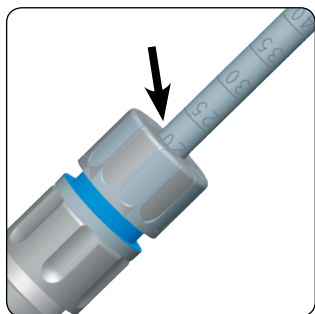
**178041**  
Stabilizing Rod



**173032**  
Locking Nut



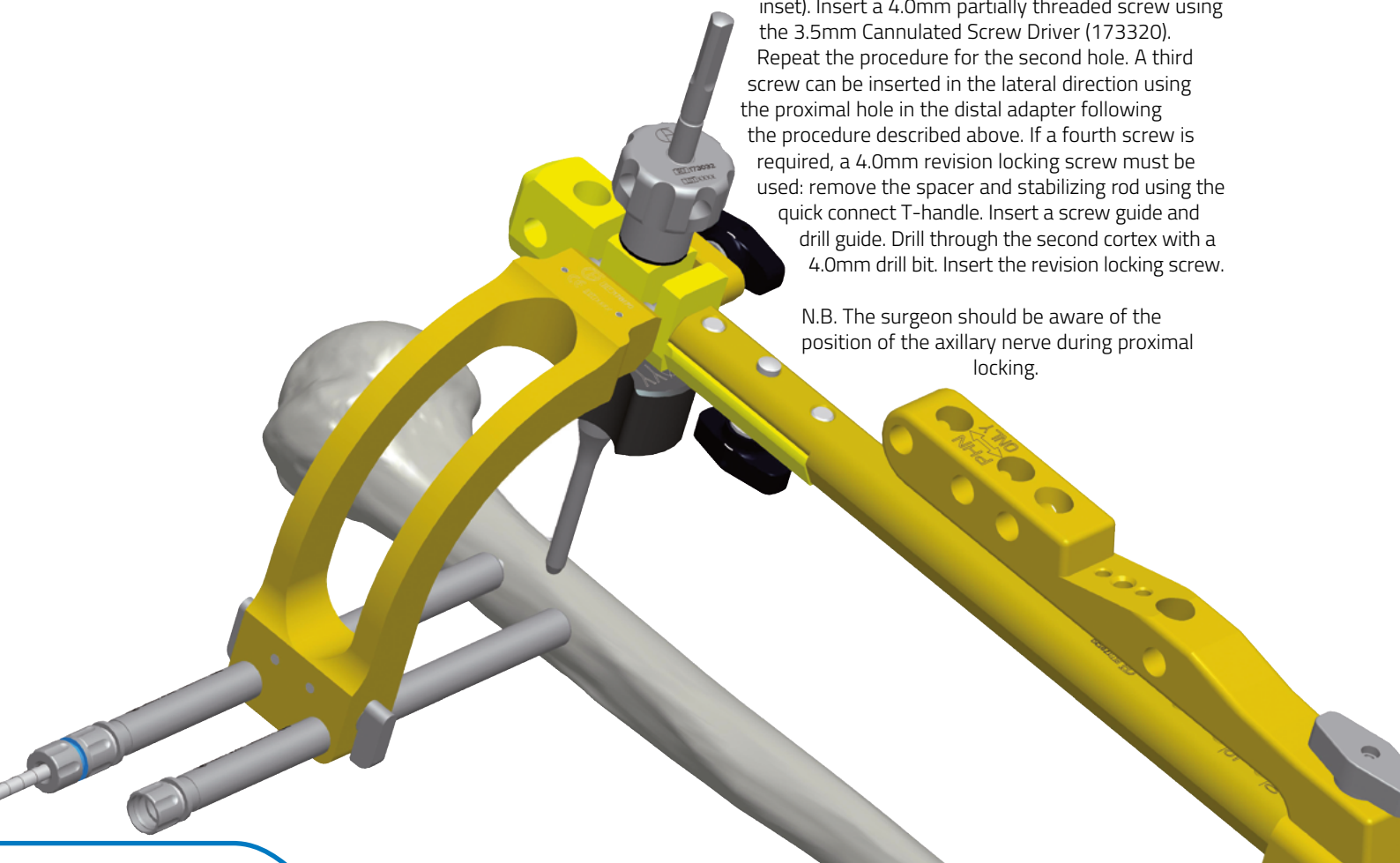
**173051 / 2 / 8**  
Spacer



Screw a Trocar (173212) into a Screw Guide (173211) and insert them both into one of the two holes in the targeting arm. Make a stab incision where they touch the skin posteriorly, split the tissues down to the bone, and push them down to the bone on the posterior surface of the humerus. Unscrew the trocar and advance the screw guide until it is sitting flush against the bone surface. Tighten the screw guide in place with the locking cam.

Remove the trocar and screw in the 4.0mm Drill Guide (174213). Drill with the 4.0mm Drill Bit (174286) until the drill bit is 2-3mm beyond the second cortex. The screw length required is read from the scale on the drill bit immediately above the top of the drill guide (see inset). Insert a 4.0mm partially threaded screw using the 3.5mm Cannulated Screw Driver (173320). Repeat the procedure for the second hole. A third screw can be inserted in the lateral direction using the proximal hole in the distal adapter following the procedure described above. If a fourth screw is required, a 4.0mm revision locking screw must be used: remove the spacer and stabilizing rod using the quick connect T-handle. Insert a screw guide and drill guide. Drill through the second cortex with a 4.0mm drill bit. Insert the revision locking screw.

N.B. The surgeon should be aware of the position of the axillary nerve during proximal locking.



## INSTRUMENTATION



**173212**  
Trocar



**173211**  
Screw Guide

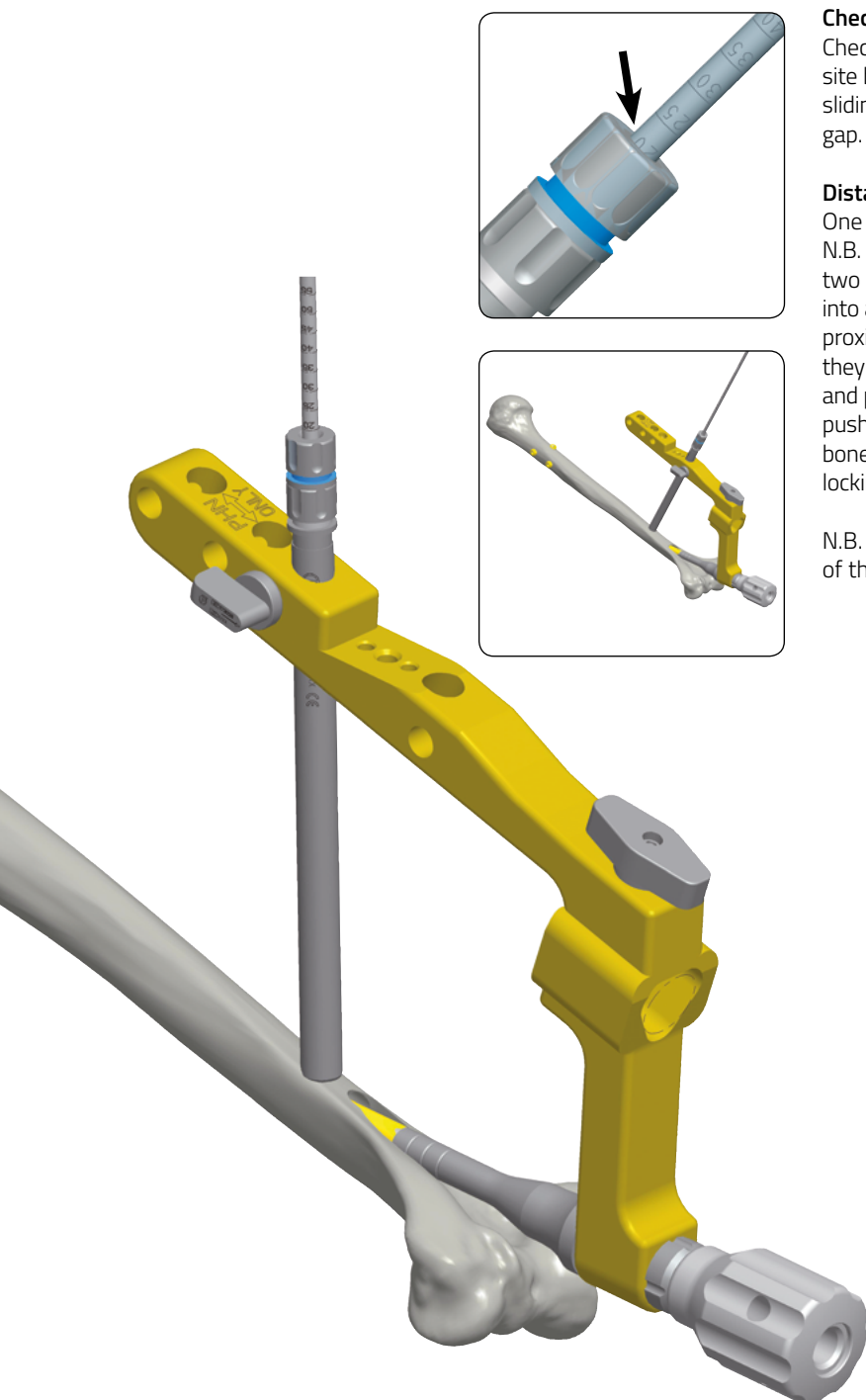


**174213**  
4.0mm  
Drill Guide



**174286**  
4.0mm  
Drill Bit





#### Check for Fracture Distraction

Check for any malrotation or distraction of the fracture site before carrying out distal locking. If necessary the sliding hammer (173370) can be used to close a fracture gap.

#### Distal Locking

One or two locking screws are used distally. N.B. Locking screws should not be inserted through the two holes labelled "PHN ONLY". Screw a Trocar (173212) into a Screw Guide (173211) and insert them both into the proximal hole in the handle. Make a stab incision where they touch the skin, split the tissues with blunt dissection, and push them down to the bone. Unscrew the trocar and push the screw guide until it is sitting flush against the bone surface. Tighten the screw guide in place with the locking cam.

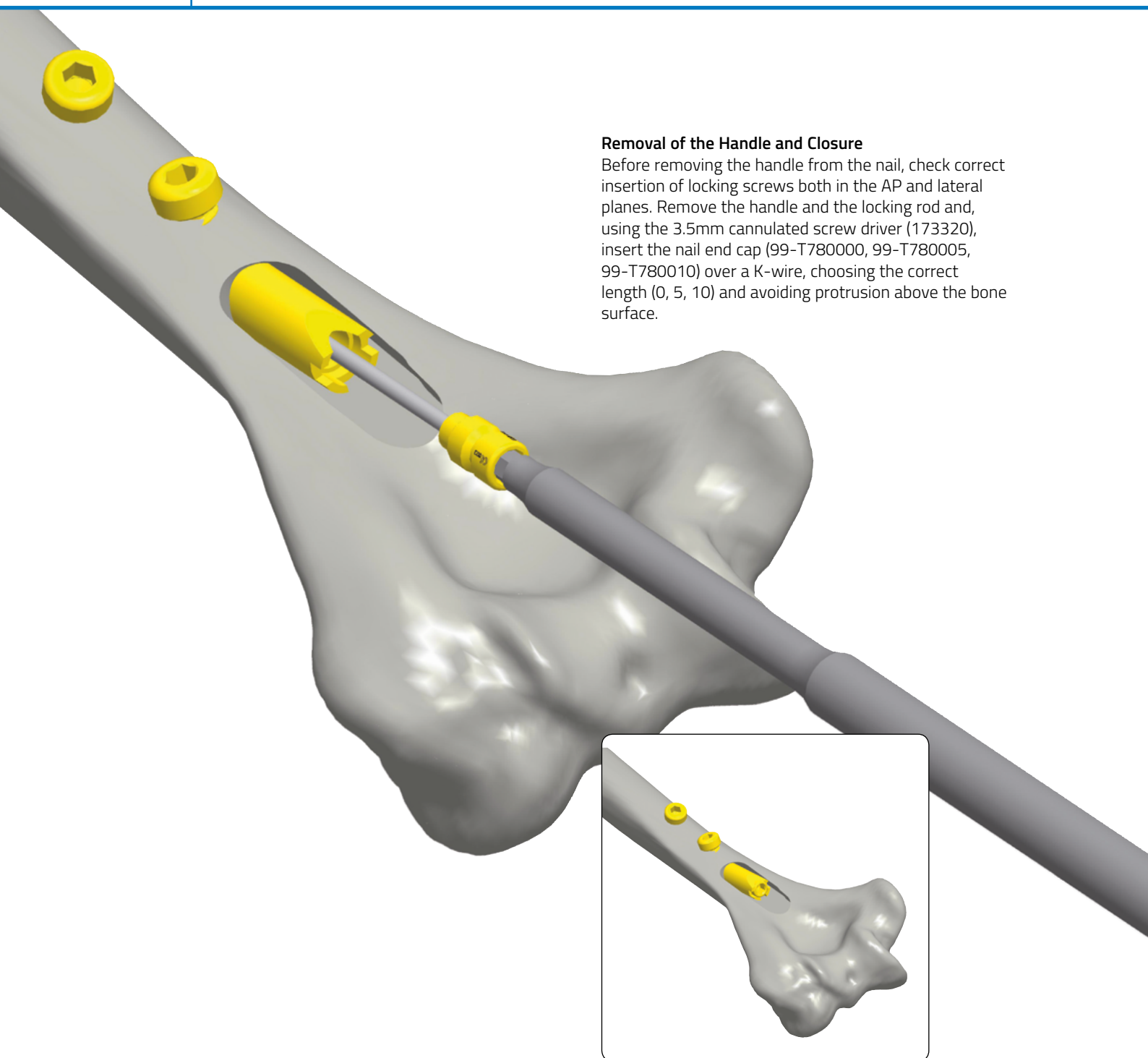
N.B. The surgeon should be aware of the position of the radial nerve during proximal locking.



**173370**  
Sliding Hammer



**173320**  
3.5mm Cannulated  
Screw Driver

**Removal of the Handle and Closure**

Before removing the handle from the nail, check correct insertion of locking screws both in the AP and lateral planes. Remove the handle and the locking rod and, using the 3.5mm cannulated screw driver (173320), insert the nail end cap (99-T780000, 99-T780005, 99-T780010) over a K-wire, choosing the correct length (0, 5, 10) and avoiding protrusion above the bone surface.

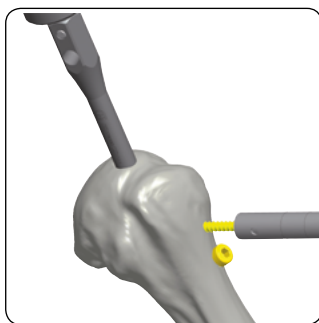
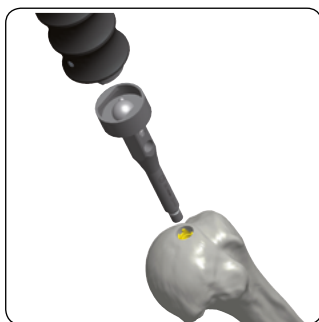
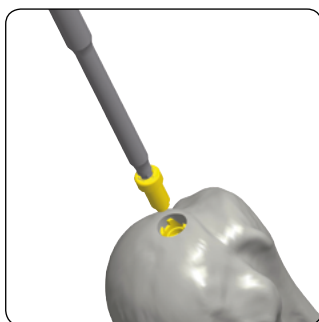
**INSTRUMENTATION**

11146  
2mm K-wire

## NAIL REMOVAL

The Extraction Instruments Box is needed for nail removal. The nail end cap is removed with the 3.5mm Cannulated Screw Driver (173320). The Humeral Extractor (178390) is screwed fully into the nail. The locking screws are now all removed using the Locking Screw Extractor (17652). The Extractor Handle (170035) is screwed onto the Sliding Hammer (173370) and attached to the screw adapter. The nail is then removed by reverse hammering.

When removing a retrograde nail, the pulling force must be exerted along the diaphyseal axis.



**173320**  
3.5mm  
Cannulated  
Screw Driver



**178390**  
Humeral  
Extractor



**17652**  
Locking  
Screw Extractor



**170035**  
Extractor Handle



**173370**  
Sliding Hammer





CN-0701-OPT The Centronail Titanium Universal Femoral Nailing System

CN-0702-OPT The Centronail Titanium Tibial Nailing System

CN-0703-OPT The Centronail Titanium Supracondylar and Retrograde Nailing System

CN-0704-OPT The Centronail Titanium Humeral Nailing System





Please refer to the “Instructions for Use” supplied with the product for specific information on indications for use, contraindications, warnings, precautions, adverse reactions and sterilization.

Electronic Instructions for use available at the website <http://ifu.orthofix.it>

Electronic Instructions for use - Minimum requirements for consultation:

- Internet connection (56 Kbit/s)
- Device capable to visualize PDF (ISO/IEC 32000-1) files
- Disk space: 50 Mbytes

Free paper copy can be requested from customer service (delivery within 7 days):

tel +39 045 6719301, fax +39 045 6719370,

e-mail: [customerservice@orthofix.it](mailto:customerservice@orthofix.it)

Caution: Federal law (USA) restricts this device to sale by or on the order of a physician. Proper surgical procedure is the responsibility of the medical professional. Operative techniques are furnished as an informative guideline. Each surgeon must evaluate the appropriateness of a technique based on his or her personal medical credentials and experience.



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