# ANKLE NAIL Surgical Technique





### **Design rationale**

The Ankle Fusion Nail (AFN) brings the simplified instrumentation of the Manyetix Nail System to the hindfoot. The AFN features an oblique locking configuration that allows surgeons to maximize thread purchase by locking into better bone. The AFN advantage allows surgeons to target screws through the calcaneus and into specific bones to attain the most stable construct while at the same time gaining fusion between the calcaneus and surrounding bones. Fusion is further aided by allowing screws to cross the articulating surfaces of the calcaneus and talus, as well as the calcaneus and cuboid bones.

The Manyetix AFN offers threaded distal screw holes for added stability and reduced risk of screw back out. In addition, the surgeon may select not to use specific holes or to use shorter screws that allow the joints to maintain mobility. Rotational stability is also achieved by either a proximal static locking hole or dynamic compression slot in the proximal end of the nail.

### Indications



### Design features



#### Advantages

- Simplified instrumentation and anatomically designed implants included as part of the line
- · Diverging screw angles allow the surgeon to target specific bones and joints
- Distal threaded screw holes help to reduce risk of screw back out while adding stability
- · Various screw sizes give the surgeon more options for patient care
- Rotational stability achieved with proximal static locking hole or dynamic compression slot
- Dynamic compression slot allows up to 5mm of late controlled compression
- Internal hex captured locking screws help to ease screw insertion

#### Patient positioning

The prone position is preferred, but lateral and supine positions are acceptable if needed. Patient positioning is determined based on the type of arthrodesis procedure performed and is therefore at the

surgeon's discretion.

#### C-Arm position

The C-arm should come in perpendicular to the leg, on the opposite side of the operating table. In the standard position this will provide an AP (supine), PA (prone), or lateral (lateral) radiograph. Turning the C-arm 90 degrees will afford a lateral view for the supine and prone positions while providing an AP view for the patient in the lateral position.

Note: For optimal viewing, the operating table should be radio translucent.





#### Surgical approach

The approach chosen for the debridement, preparation and alignment of the hindfoot joint surfaces is based on factors such as surgical preference, patient positioning, and anatomy. The simplest approach is usually through a lateral incision over the fibula and into the sinus tarsi. Full access to the joint surfaces requires a fibular osteotomy above the tibiotalar joint. This allows direct visualization and access to both the tibiotalar and sub-talar joints for debridement and subsequent alignment for fixation. This approach can be extended distally if access to the calcaneocuboid joint is needed.



#### Entry portal

Once all the joint surfaces have been prepared and aligned in the desired position of fusion, the C-arm is brought into position laterally, and the 3.2mm x 343mm Brad Point Tip Threaded Guide Pin is placed on the plantar surface of the foot in line with the tibia, talus, and calcaneus. The use of provisional guide pin fixation to maintain correct position of the respective arthrodesis is recommended. The Guide Pin will start slightly lateral to midline, in line with the tibial medullary canal axis.

Using this as the center of the planned insertion point, a 3cm longitudinal incision is made on the plantar aspect of the heel.



A hemostat is used to bluntly spread the soft tissues and open the plantar fascia down to bone. Assemble and place the Entry Tool through the incision to bone.



3.2mm x 343mm Brad Point Tip Threaded Guide Pin Entry Tool Cat. no. 571631114

Cat. no. 571674130

#### Guide pin placement

With the AFN in the position of desired fusion, the Guide Pin is powered in from the calcaneus to the tibia under fluoroscopic control. The C-arm is rotated into the AP/PA position to verify that the Guide Pin is positioned centrally within the tibia. If initial guide pin placement is not optimal, a second guide pin may be placed through the Entry Tool to ensure proper alignment.

Note: Any deviation from a central position can affect the final fusion position. With the Guide Pin along the anterior tibia, the nail will increase dorsiflexion and anterior position of the foot. However, along the posterior cortex, the Guide Pin will have the opposite effect. The Guide Pin contact with the medial or lateral walls of the tibia can cause increased varus or valgus position changes respectively in the foot.

Once the desired position is confirmed, advance the Guide Pin until it is 2-3cm proximal to the tibiotalar joint.



#### Entry reaming

Using the 12.5mm Entry Reamer, ream into the tibia, ideally stopping at the threads on the Guide Pin. This should ensure adequate reaming of the calcaneus, talus, and tibia to accommodate the distal, driving end of the nail.

Note: After canal reaming the Guide Pin will most likely be extracted with removal of the Entry Reamer.



3.2mm x 343mm Entry Tool Brad Point Tip Cat. no. 571631114 Threaded Guide Pin Cat. no. 571674130 Reducing the hindfoot anatomy

In most cases, the 3.0mm x 600mm Ball Tip Guide Rod can now be easily inserted through the initial portal made by the Entry Reamer and placed into the center of the tibia. If needed, the hindfoot position can be realigned using the Reducer attached to the T-Handle. Check to ensure the Guide Pin has been removed prior to inserting the Reducer. The Reducer is used to accurately place the Guide Rod in the tibia to assure proper reaming and nail insertion.



Canal reaming

Additional reaming depth may be required. Prepare canal using sequential reamers until canal is 1 – 1.5mm larger than selected nail size.



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3.0mm x 600mm Ball Tip Guide Rod Cat. no. 571665026 Reducer Cat. no. 571751105 Gripper Cat. No. 571631100 Obturator Cat. No. 571674078

Reamer Heads Cat. No. 57111823X

Flexible Shaft Cat. No.571118200







Nail assembly and insertion

Assemble the nail to the Drill Guide using the Guide Bolt and Guide Bolt Wrench. The nail is keyed and can only be assembled to the Drill Guide in the correct way.

Attach the Drop (571700004) to the drill guide and verify targeting accuracy by inserting a gold 9.0mm Drill Sleeve (571631152) and 4.0mm Drill Sleeve (571674083) into the Drop and passing a 4.0mm Long Pilot Drill

(571631110) through the assembly. An incorrectly attached nail will not target.

Using hand force, insert the nail through the incision into the reamed canal and seat flush to the plantar surface of the calcaneus.

Note: Once proper entry depth is obtained, the Impactor may be attached to the Drill Guide. Initial manual compression may be achieved by flexing the knee and using the Slotted Hammer to tap the construct.

Position the C-arm to obtain an M-L view of the nail's driving end. Maintain the foot in the anatomical position and rotate the nail until the transverse hole can be visualized as a perfect circle. Under fluoroscopy, use the shadows of the cuboid and talus screw holes as alignment guides for screw placement.

Once proper alignment is established, the orientation can be fixed using a guide pin(s) through the provisional fixation holes in the Drill Guide.

Remove the Guide Rod prior to fully seating the nail.

Note: The Guide Rod will not pass through the Impactor.















Guide Bolt Wrench Cat. No. 571631140

Cannulated Impactor Cat. No. 571675081



Slotted Hammer Cat. No. 571674082

AFN Nail Cat. No.40741-XXX

Drill Guide Cat. No. 571700005

Guide Bolt Cat. No. 571631136

#### Screw insertion

Although screw placement sequence is at the surgeon's discretion, it is recommended that the locking screws be placed sequentially from calcaneus to tibia to allow impaction at each joint level.

Attach the Drop to the posterior side of the Drill Guide. Place the 4.0mm Inner Drill Sleeve into the Gold Outer Drill Sleeve and insert the sleeve assembly through the Drop's cuboid hole. The sleeve assembly end should sit on the lateral side of the calcaneal tuberosity and not on the lateral face of the calcaneus. Rotate the nail assembly if needed to keep the screws on the posterior surface. Make a stab incision to allow the sleeves to contact bone.

Note: For added stability and rotational control, advance the Long Pilot Drill through the drill sleeve assembly to the desired depth. Remove the Long Pilot Drill from power, leaving it in the cuboid hole as a provisional fixation tool for the talus screw insertion.





Drop Cat. No. 571700004 4.0mm Inner Drill Sleeve Cat. No. 571674083

9mm Drill Sleeve Cat. No. 571631152

#### Talus screw insertion

Screw length is determined from the calibrated markings on the Long Pilot Drill or by using the Screw Depth Gauge.

The talus screw should be inserted from posteriorinferior and lateral in the calcaneus to anterior-medial in the talar dome. This screw will sit approximately perpendicular to the subtalar joint.

Advance the Long Pilot Drill. Remove the Long Pilot Drill and the Inner Drill Sleeve. Attach the 5.0mm screw to the Medium Hex Driver. Attach the Medium Hex Driver to power or use the manual T-Handle to insert the screw. Insert the screw assembly through the Outer Drill Sleeve.

When using power, stop advancing the screw when the laser marked ring on the Medium Hex Driver approaches the top of the Outer Drill Sleeve. It is recommended that final tightening of the screw should always be under manual control.

Note: Sinking the distal screw heads into the calcaneus helps prevent soft tissue irritation.

The Screw Driver Release Handle may be used to detach the Medium Hex Driver from the screw. Once the talus screw is placed, the tibiotalar joint can be manually compressed and aligned by attaching the Impactor to the Drill Guide and using the Slotted Hammer to tap the construct.







4.0mm Long Pilot Drill Cat. No. 571631110 Screw Depth Gauge Cat. No. 571631189

5.0mm Internal Hex I Captured Locking ( Screw

Cat. No. 5716422XX

Medium Hex Driver Cat. No. 571631066 Screw Driver Release Handle Cat. No. 571631208



T-Handle Cat. No. 571631172

#### Cuboid screw insertion

Repeat this procedure for the cuboid screw which should be oriented posterior-medial in the calcaneus to anterior-lateral in the cuboid.

Advance the Long Pilot Drill through to the anterior process of the calcaneus. If cuboid fixation is desired, continue advancing the Long Pilot Drill through to the distal aspect of the cuboid.

#### Transverse screw insertion

Pilot Drill

Cat. No. 571631110

Once these screws are in place, a third transverse distal locking option can be used at the surgeon's discretion.

Remove the Drop and attach it on the lateral aspect of the Drill Guide. Markings on the Drill Guide will help ensure proper orientation.

Insert the drill sleeve assembly into the transverse hole on the Drop and repeat the above procedure.

Cat. No. 571631189



Release Handle

Cat. No. 571631208



Cat. No. 571631066

Captured Locking

Cat. No. 5716422XX

Screw

T-Handle Cat. No. 571631172

#### Proximal locking screw insertion

To lock the nail proximally, remove the Drop and attach it on the medial aspect of the Drill Guide. Markings on the Drill Guide will help ensure proper Drop orientation.

Dynamic or static proximal locking options are available to the surgeon. Both options provide a locking screw to prevent rotation of the implant. The dynamic option allows for up to 5mm of late settling of the nail. If this option is chosen it is important to ream beyond the desired nail length to minimize binding. Markings on the Drop dictate the proximal static or dynamic locking options available.

Note: The 25cm nail can not be targeted proximally and must be done freehand. The same screw drilling and insertion procedure used distally is then repeated.

When presented with hard cortical bone, the 4.7mm Diaphyseal Starter Drill can be used to perforate the near cortex.

Note: The Silver Inner Drill Sleeve must be removed from the Gold Outer Sleeve prior to using the Diaphyseal Drill. The Gold Outer Drill Sleeve must be touching bone as the Diaphyseal Drill will bottom out on the Gold Outer Drill Sleeve.



4.7mm Diaphyseal Starter Drill Cat. no. 571700006 Implantation complete

Note: Bone graft or bone graft substitutes should be used to fill in gaps around the bones to enhance bony union.

Follow standardized procedures for closure.



#### Nail removal

It is not recommended to remove the nail unless deep infection occurs or if the patient is symptomatic.

However if removal is required, then dissect the plantar soft tissue to expose the distal end of the nail. Clear away any tissue or bone that may have grown into the threads in the end of the nail. Thread the Large Nail Extractor tool into the distal end of the nail before screw removal to restrict nail movement. The Impactor may also be threaded into the Large Nail Extractor to aid in the nail extraction.





Make stab wounds over the original incisions and remove the screws with the Medium Hex Driver and T-Handle.

Once all the screws have been removed, extract the nail from the foot. The Slotted Hammer may be used with the Impactor to aid in removal.

Close in the usual manner.





Large Nail Extractor Cat. no. 571631278

### Catalog information – Implants (Set No. 571700000)

### 5.0mm Internal Hex Captured Locking Screws

Cat Na	l anath
Cal. NO.	Length
2001015025	25mm
2001015030	30mm
2001015035	35mm
2001015040	40mm
2001015045	45mm
2001015050	50mm
2001015055	55mm
2001015060	60mm
2001015065	65mm
2001015070	70mm
2001015075	75mm
2001015080	80mm
2001015085	85mm
2001015090	90mm
2001015095	95mm
2001015100	100mm
2001015105	105mm
2001015110	110mm

#### Fusion Nails - 10mm

Cat. No.	Description
4007410150	10mm x 16cm Left
4007412150	10mm x 16cm Right
4007410180	10mm x 20cm Left
4007412180	10mm x 20cm Right
4007410210	10mm x 25cm Left
4007412210	10mm x 25cm Right

#### Fusion Nails – 11.5mm

Cat. No.	Description
4007411150	11.5mm x 16cm Left
4007410240	11.5mm x 16cm Right
4007411180	11.5mm x 20cm Left
4007411240	11.5mm x 20cm Right
4007411210	11.5mm x 25cm Left
4007412240	11.5mm x 25cm Right



### Catalog information – Instruments (Set No. 571700001)

Screw Length Sleeve Cat. No. 571674085



SCULPTOR Flexible Shaft with Circular Connector Cat. No. 571118200

Medium Hexdriver Cat. No. 571631066

Short Hexdriver Cat. No. 571631068

Gripper Cat. No. 571674080





No.571674075

Entry Portal Tube Cat. No.571674060

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12.5mm Entry Reamer Cat. No. 571631116

Obturator Cat. No. 571674078

Guide Bolt Cat. No. 571631136

Guide Bolt Wrench Cat. No. 571631140

### Catalog information – Instruments (Set No. 571700001)

Hammer Cat. No. 571674082



9mm Drill Sleeve Cat. No. 571631152

4.0mm Inner Drill Sleeve Cat. No. 571674083

T-Handle Cat. No. 571631172

Screw Depth Gauge Cat. No. 571631189

Screw Driver Release Handle Cat. No. 571631208

Nail Extractor Cat. No. 571631321

Cannulated Impactor Cat. No. 571675081









### Catalog information – Instruments (Set No. 571700001)

Fusion Nail Drop Cat. No. 571700004

Fusion Nail Drill Guide Cat. No. 571700005

4.7mm Diaphyseal Starter Drill Cat. No. 571700006

Straight Reducer 4.2mm ID/6.6mm OD Cat. No. 571751105

Modular Reamer Box Kit Cat. No. 571631218

#### Reamer Heads

Cat No.	Description		
571118231	9.0mm	Endcutting	
571118233	9.5mm	Pilot Nose	
571118234	10.0mm	Pilot Nose	
571118235	10.5mm	Pilot Nose	
571118236	11.0mm	Pilot Nose	
571118237	11.5mm	Pilot Nose	
571118238	12.0mm	Pilot Nose	

4.0mm Short Drill Cat. No. 571631117

3.0mm x 600mm Ball Tip Guide Rod Cat. No. 571665026

3.2mm x 343mm Brad Tip Threaded Guide Pin Cat. No. 571674130

4.0mm Long Pilot Drill Cat. No. 571631110









## Instrument Reference Guide



# Ankle Fusion Nail Instrument Set Set No. 571700001

Cat. Item	Description	Qty	Reference
110238	Screw Length Sleeve	1	А
571118200	SCULPTOR™ Flexible Shaft with Circular Connector	1	В
571631066	Medium Hexdriver	1	С
571631068	Short Hexdriver	1	D
571631100	Gripper	1	E
571631114	Entry Tool	1	F
571631116	12.5mm Entry Reamer	1	G
571674078	Obturator	1	Н
571631136	Guide Bolt	2	1
571631140	Guide Bolt Wrench	1	J
571631150	Hammer	1	К
571631152	9mm Gold Outer Drill Sleeve	2	L
571674083	4.0mm Silver Inner Drill Sleeve	2	Μ
571631172	T-Handle	1	Ν
571631186	Mini Connector	1	0
571631187	Mini Connector with Trinkle End	1	Р
571631189	Screw Depth Gauge	1	Q
571631208	Screw Driver Release Handle	1	R
571631278	Large Nail Extractor	1	S
571675081	Cannulated Impactor	1	Т
571700004	Hindfoot Fusion Nail Drop	1	U
571700005	Hindfoot Fusion Nail Drill Guide	1	V
571700006	4.7mm Diaphyseal Starter Drill	1	W
571751105	Straight Reducer 4.2mm ID/6.6m OD	1	Х
571751105	AO Mini Connector	1	Y
571631218	Modular Reamer Box Kit	1	Z
571631110	4.0mm Long Pilot Drill	2	AA
571631117	4.0mm Short Drill	2	BB
571674130	3.2mm x 343 mm Brad Tip Threaded Guide Pin	2	CC