PFNA. Leading the way to optimal stability.

Surgical Technique
Contents

PFNA blade 4
Case studies 5
PFNA nail 6
Indications 7

Quick Steps 8
1a Preparation 8
2a Insertion of the PFNA 9
3 Positioning of guide wire for the PFNA blade 10
4a Insertion of PFNA blade 11
5a Assembly 12
6a Insertion of locking bolt and end cap 13

Preparation 14
1 Patient positioning 14
2 Determination of CCD angle 14
3 Fracture reduction 14
4 Determination of PFNA diameter 15
5 Surgical approach 15

Surgical technique 16
1 Determination of PFNA entry point and guide wire insertion 16
2 Opening of the femur 17
3 Assembly of PFNA instruments 17
4 Insertion of the PFNA 18
5 Preparation of guide wire insertion 19
6 Guide wire insertion 20
7 Measuring of PFNA blade length 24
8 Removal of drill sleeve 24
9 Opening of lateral cortex for PFNA blade insertion 24
10 Drill hole for the PFNA blade 25
11 Assembly of PFNA blade and PFNA inserter 25
12 Insertion of PFNA blade 26
13 Locking of PFNA blade 27
14 Removal of protection sleeve 27
15 Static distal locking 28
16 Dynamic distal locking 28
17 Insertion of locking bolt 29
18 Instrument removal 29
19 Insertion of end cap 30
### Implant removal
1. Removal of PFNA blade
2. Removal of PFNA end cap, PFNA, and locking bolt

### Insertion depth of PFNA blade
- Insertion depth correction of PFNA blade

### Cleaning
- Intra- and postoperative cleaning

### Bibliography

### Instruments

### Alternative: aiming device

### Implants
PFNA blade

Rational and angular stability achieved with one single element

Compaction of cancellous bone
Inserting the PFNA blade compacts the cancellous bone. This provides additional anchoring to the PFNA blade, which is especially important in osteoporotic bone.

Bone structure before insertion of the PFNA blade.
Bone structure after PFNA blade insertion – cancellous bone is compacted providing additional anchoring to the PFNA blade.

The increased stability caused by bone compaction around the PFNA blade has been biomechanically proven to retard rotation and varus collapse. Such biomechanical tests demonstrated that the PFNA blade had a significantly higher cut-out resistance compared to commonly-used screw systems.

Lateral locking-fast and reliable insertion of the PFNA blade

- all surgical steps required to insert the PFNA blade are done through the lateral incision
- the PFNA blade is automatically locked to prevent rotation of the PFNA blade and the femoral head
x-rays

27 years, male, AO 31 A3
11 days post-op
11 weeks post-op

85 years, male, AO 31 A2
7 days post-op
17½ weeks post-op
**PFNA nail**

**Excellent fit**
The anatomical design guarantees an optimal fit in the femur.
The nail design has been well proven in over 200,000 cases performed with the PFN.

The PFNA has medial-lateral angle of 6°. This allows insertion at the tip of the greater trochanter.

**Optimal stress distribution**
The flexible PFNA tip eases insertion and avoids stress on the bone at the tip of the PFNA.
**Indications**

**PFNA**
- Petrochanteric fractures (31-A1 und 31-A2)
- Intertrochanteric fractures (31-A3)
- High subtrochanteric fractures

**PFNA long**
- Low and extended subtrochanteric fractures
- Ipsilateral trochanteric fractures
- Combination fractures (in the proximal femoral)
- Pathological fractures

**Product range**

The PFNA is available in 4 sizes:
- PFNA, length 240 mm
- PFNA small, length 200 mm
- PFNA xs, length 170 mm
- PFNA long, length 300, 340, 380, 420 mm with bending radius 1500 mm

**Several distal locking options**

Static dynamic locking can be performed via the aiming arm with PFNA standard, small and xs. The PFNA long allows in addition secondary dynamisation.
Quick Steps

1a
Preparation
Position the patient

1b
Preoperative planning

1c
Entry point
2a
Insertion of the guide wire
- Insertion the guide wire to open the femur
- AP and ML control

2b
Open the femur

2c
Insert the PFNA
3

Positioning of guide wire for the PFNA blade

- Mount the aiming arm for the PFNA blade
- Insert the guide wire for the PFNA blade
- Image intensifier control (AP)
- Image intensifier control (ML)
**4a**

Insertion of PFNA blade

Measure the length for the PFNA blade

**4b**

Open the lateral cortex for PFNA blade insertion

**4c**

Drill hole for the PFNA blade
5a
Attach the PFNA blade
Attach the PFNA blade to the inserter (turn the inserter anticlockwise to the «attach» marking)

5b
Insert the PFNA blade

5c
Lock the PFNA blade
(turn the inserter clockwise to the «lock» marking)
6a
Insertion of locking bolt and end cap
Drill hole and measure for distal locking

6b
Insert the locking bolt

6c
Insert the end cap
Preparation

1
Patient positioning
Position the patient supine on an extension table or a radiolucent operating table. Abduct the unaffected leg as far as possible and place it on a leg support, so that it does allow free fluoroscopic examinations. This should be tested preoperatively.
For an unimpeded access to the medullary cavity, abduct the upper body by about 10–15° to the unaffected side (or adduct the affected leg by 10–15°).

2
Determination of CCD angle
Take a preoperative AP radiography of the unaffected leg. Determine the CCD angle using a goniometer or the preoperative planning template.

3
Fracture reduction
Perform closed reduction of the fracture under image intensifier control. Carry out open reduction, if the result is not satisfactory.

Note: Exact anatomical reduction and secure fixation of the patient to the operating table are essential for easy handling and a good surgical result.
4

Determination of PFNA diameter

Determine the distal PFNA diameter by placing the preoperative planning template over the isthmus on an AP radiography.

Alternative:

Use image intensifier control to place the Radiographic Ruler (309.602) on the femur and position the square marking over the isthmus. If the transition of medullary space/cortex is still visible on both sides of the marking, the corresponding PFNA diameter may be used.

If the intramedullary canal is too narrow, select a smaller size PFNA diameter or ream to a diameter that is at least 1 mm larger than that of the planned PFNA.

Note: The use of a too large PFNA can provoke loss of reduction or an iatrogenic fracture.

5

Surgical approach

Palpate the trochanter major.

Make a 5 cm incision approximately 5 to 10 cm proximal from the tip of the greater trochanter. Make a parallel incision of the fasciae of the gluteus medius and split the glutaeus medius in line with the fibres. When using the Insertion Handle for PFN (357.020), extend the incision distally.
**Surgical Technique**

1

**Determination of PFNA entry point and guide wire insertion**

In AP view, the PFNA entry point is usually **on** the tip or **slightly lateral** to the tip of the greater trochanter in the 6° curved extension of the medullary cavity, as the ML angle of the PFNA is 6°. This means that the 3.2 mm Guide Wire (356.830) must be inserted on the tip or slightly laterally of the greater trochanter at an angle of 6° to the intended extension of the medullary. Insert the guide wire into the medullary cavity to a depth of 15 cm.

In lateral view, verify whether the position of the guide wire is **straight and in the centre of the medullary cavity**. It should not appear bent in lateral view, as this would subsequently position the PFNA too ventrally or too dorsally and impede correct positioning of PFNA blade in the femoral neck. Use the Universal Chuck with T-handle (393.100) or the COMPACT AIR DRIVE (511.701) and the Quick Coupling for Kirschner wires (511.790) for the manual insertion of the guide wire.

**Percutaneous technique:**

Position both 20.0/17.0 mm Protection Sleeve (357.001) and 17.0/3.2 mm Drill Sleeve (309.603) at the insertion point. Insert the guide wire through the protection sleeve and the drill sleeve. Then remove the drill sleeve.

**Note:** The correct entry point and angle are essential for a successful result. To ensure the correct position of the guide wire, position a guide wire ventrally on the femur and check radiographically.
2

Opening of the femur

Guide the cannulated 17.0 mm Drill Bit (309.600) through the 20.0/17.0 mm Protection Sleeve (357.001) over the 3.2 mm Guide Wire (356.830) and drill with the Universal Chuck with T-handle (393.100) as far as the stop on the protection sleeve. Remove the protection sleeve and the guide wire.

Note: It is recommended to open the femur by power tool at high speed or carefully by hand. To prevent dislocating the fracture fragments, avoid lateral movements or excessive compression forces.

3

Assembly of PFNA instruments

Guide the Connecting Screw (357.021) through the Insertion Handle (357.012) and secure the PFNA to the insertion handle using the Hexagonal Wrench with T-handle (357.023). The diameter of the PFNA has already been determined during surgical preparation.

Note: Ensure that the connection between PFNA and insertion handle is tight (retighten, if necessary) to avoid deviations when inserting the PFNA blade through the insertion handle. Do not attach the aiming arm yet.
4
Insertion of the PFNA

Use image intensifier control to insert the PFNA.

Carefully insert the PFNA manually as far as possible into the femoral opening. Slight twisting hand movements help insertion. If the PFNA cannot be inserted, select a smaller size PFNA diameter or ream the medullary cavity to a diameter that is at least 1 mm larger than that of the selected nail.

If necessary, light blows with the Hammer (399.420) on the protection shield of the insertion handle can support the insertion of the PFNA.

The correct PFNA insertion depth is reached, as soon as the projected PFNA blade is positioned in the lower half of the femoral neck. Placing a ruler on the AP view allows checking the position of the PFNA blade. A too cranial or too caudal PFNA position should be avoided as it can lead to malposition of the PFNA blade.

The anteversion can be determined by inserting a guide wire ventral to the femoral neck in the femoral head. In the mediolateral view, place the insertion guide parallel to the guide wire to align the correct rotation of the PFNA.

Remove all guide wires. Do not reuse, but dispose of the guide wires.

Note:
- Always ensure that the PFNA is firmly attached to the insertion handle.
- Use only light blows on the protection shield of the insertion handle.
  Avoid unnecessary use of force to prevent loss of reduction or an iatrogenic fracture.
Preparation of guide wire insertion

Mount the appropriate 130° Aiming Arm (356.811) and fix it firmly to the insertion handle.

Firmly secure the golden 16.0/11.0 mm Buttress Nut (356.817) to the Protection Sleeve for PFNA Blade (356.818). Make sure the «Lateral side» marking points towards the head of the sleeve. For the insertion, insert the buttress nut through the aiming arm as far as the marking 1.

Insert the golden 11.0/3.2 mm Drill Sleeve (356.819) and the golden 3.2 mm Trocar (356.820) through the protection sleeve.
6

Guide wire insertion

Advance the entire sleeve assembly for PFNA blade through the aiming arm to the skin. See marking on the 130° Aiming Arm (356.811). Make a stab incision in the area of the trocar tip. Advance the sleeve assembly through the soft tissues in direction of the lateral cortex until it clicks into the aiming arm.

**Note:** Ensure that the sleeve assembly clicks into the aiming arm. Otherwise it does not guarantee the exact position of the PFNA blade.
Insert the sleeve assembly as far as the lateral cortex. Advance the Protection Sleeve (356.818) to the lateral cortex using slight clockwise turns of the Buttress Nut (356.817). Prepare the passage of the protection sleeve by turning the internal golden 11.0/3.2 mm Drill Sleeve (356.819).

Note: The sleeve assembly must be in contact with the bone during the entire blade implantation. Do not tighten the buttress nut too firmly as this could impair the precision of the insertion handle and sleeve assembly.
Remove the trocar. Insert a new 3.2 mm Guide Wire (356.830) through the golden 11.0/3.2 mm Drill Sleeve (356.819) into the bone. Verify both direction and position under image intensifier in AP and lateral view. In the AP view, the position of the guide wire should be in the lower half of the femoral neck. In lateral view, the wire should be positioned in the in the centre of the femoral neck. Insert the guide wire subchondrally into the femoral head, but at a distance of least 5 mm from the joint.

**Note**: If the PFNA or the guide wire has to be repositioned, remove the guide wire, release the sleeve assembly with buttress nut from the aiming arm by pressing the button on the clamp device and remove it. The PFNA can be repositioned only by rotation, deeper insertion or partial retraction. Reinsert the sleeve assembly and turn the buttress nut clockwise to position the assembly on the bone. Reinsert the guide wire.
Optional technique for antirotation wires:

In very unstable fractures, insert an additional guide wire to prevent rotation. Leave the golden 11.0/3.2 mm Drill Sleeve (356.819) in place in the golden 16.0/11.0 mm Protection Sleeve (356.818) when applying this technique. After having inserted the guide wire into the femoral head, secure the Aiming Jig for antirotation wire (356.826) either anterior or posterior to the aiming arm. Secure the position of the antirotation wire by tightening the hexagonal nut. Insert the 5.6/3.2 mm Drill Sleeve (356.827) into the Aiming Jig for antirotation wire (356.826). Make a stab incision and insert the drill sleeve to the bone.

Use image intensifier control to insert a 3.2 mm Guide Wire (356.830) into the femoral head. If a second antirotation wire is necessary, use the same procedure to insert it into the femoral head.

Note: In axial view, the antirotation wire will approach, but not touch the blade tip. This antirotation wire fixes the femoral head only temporarily and will be removed after the insertion of the blade.
7

**Measuring of PFNA blade length**

Verify the position of the guide wire in AP and lateral view before measuring the length.

Guide the Measuring Device for 3.2 mm Guide Wire (356.829) over the guide wire, advance it to the protection sleeve and determine the length of the required blade. The measuring device indicates the exact length of the guide wire in the bone ensuring that the position of the PFNA blade will be flush with the tip of the guide wire. The correct position of the PFNA blade is approximately 5–10 mm below the joint level. If the guide wire’s position is subchondral, subtract 5–10 mm, as in the DHS system, to position the PFNA blade correctly.

8

**Removal of drill sleeve**

Carefully remove the golden 11.0/3.2 mm Drill Sleeve (356.819) without changing the position of the guide wire.

9

**Opening of lateral cortex for PFNA blade insertion**

Push the cannulated 11.0 mm Drill Bit (356.822) over the 3.2 mm Guide Wire (356.830). Drill to the stop. This opens the lateral cortex.

**Note:** if the guide wire has been bent slightly during insertion, guide the drill bit over it using carefully forward and backward movements. However, if the wire has been bent to a greater extent, reinsert it or replace it by a new guide wire. Otherwise, the tip of the drill bit risks to break off.
10
Drill hole for PFNA blade
Set the measured length of the blade on the cannulated 11.0 mm Reamer (356.821) by fixing the Fixation Sleeve (357.046) in the corresponding position. Read off the correct length on the side of the fixation sleeve pointing towards the tip of the drill bit. Push the reamer over the 3.2 mm Guide Wire (356.830). Drill to the stop. The fixed fixation sleeve prevents further drilling. Use the reamer only after drilling the lateral cortex with the drill bit.

11
Assembly of PFNA blade and PFNA inserter
The PFNA blade is supplied in a locked state. Use slight anti-clockwise pressure («attach» marking on the handle) to insert the Inserter (356.823) into the selected PFNA blade to the stop. Ensure its firm fit. This procedure unlocks the PFNA blade. Now the blade rotates freely. This is essential for the implantation of the PFNA blade.
12

Insertion of PFNA blade

Insert both blade and Inserter (356.823) over the 3.2 mm Guide Wire (356.830) through the protection sleeve. In view of the particular shape of the PFNA blade, align it with the protection sleeve for insertion (see marking on the protection sleeve), pressing at the same time the button on the protection sleeve.

Hold the golden handle of the inserter and manually insert the blade over the guide wire as far as possible into the femoral head. Insert the PFNA blade to the stop by hammering lightly with the Hammer (399.420).

Use image intensification to check the position of the PFNA blade.

**Note:** Inserting the blade to the stop is important, as the inserter has to click into the protection sleeve. Do not use unnecessary force when inserting the PFNA blade.
13

Locking of PFNA blade

Turn the inserter clockwise to the stop (see «lock» marking on the handle). The PFNA blade is now locked. Verify PFNA blade locking intraoperatively. The PFNA blade is locked if all gaps are closed. If the PFNA blade cannot be locked, remove it and replace it by a new PFNA blade (see implant removal, point 1, p. 28).

Note: Gliding of the PFNA blade is guaranteed.

Press the button on the protection sleeve to remove the inserter. Remove and dispose of the guide wire.

14

Removal of protection sleeve

Release and remove the protection sleeve and the buttress nut by pressing the button on the clamp device of the aiming arm.
15

Static distal locking

Perform a stab incision and insert the drill sleeve assembly for distal locking, consisting of the green 11.0/8.0 mm Protection Sleeve (356.831), the green 8.0/4.0 mm Drill Sleeve (356.828) and the green 8.0 mm Trocar (356.833), through the «static» locking hole on the aiming arm to the bone.

Remove the green Trocar (356.833) and use the 4.0 mm Drill Bit (356.834) to drill through both cortices. The tip of the drill bit should protrude by 2 to 4 mm, and the protection sleeve should be in direct contact with the bone.

Read the length of the required locking bolt directly off the marking on the drill bit.

Note:
– Always make sure that no diastasis has occurred intraoperatively before beginning distal locking. Diastasis can cause delayed healing.
– Always ensure that the connection between PFNA, insertion handle and aiming arm is good, otherwise reaming for the distal locking bolt can damage the PFNA.

Alternative length measuring:
Determine the length of the bolt with the Depth Gauge for Locking Bolts (356.835). Advance the depth gauge to the cortex. Then draw back the hook until it engages in the opposite cortex. Add 2 to 4 mm to the measured length to ensure good engagement of the locking bolt in the opposite cortex.

16

Dynamic distal locking

Mount the PFNA Aiming Arm for dynamic locking (356.824). Proceed as described in point 15.
17

Insertion of locking bolt

Insert the locking bolt through the protection sleeve using the large Hexagonal Screwdriver (314.260).

18

Removal of instruments

Remove the protection sleeve and the aiming arm. Use the hexagonal socket to loosen the connecting screw and remove the insertion handle.
19

Insertion of end cap

Use the end cap with 0 mm extension if the nail end is flush with the upper edge of the trochanter major.

Insert the hook of the Guide Wire with Hook (356.717) through the selected end cap. Then guide the 4/11 mm Hexagonal Screwdriver Shaft (356.714) over the guide wire to the end cap. The end cap is retained automatically as soon as this connection is established.

Guide the cannulated end cap to the proximal end of the nail. Use the 11 mm Ratchet Wrench (321.200) to secure the end cap. Fully insert the end cap into the nail. The last turns of the end cap in the nail will offer increased resistance. Continue to turn until the stop of the end cap touches the proximal nail end. This prevents the end cap from slipping out. Remove the hexagonal screwdriver shaft, the ratchet wrench and the guide wire.
Implant removal

1

Removal of PFNA blade

After an incision through the old scars, locate the PFNA blade by palpation or under image intensification. Insert the 3.2 mm Guide Wire (356.830). Push the Extraction Screw (356.825) over the guide wire and use gentle pressure to turn it anti-clockwise into the PFNA blade (see «unlock» marking).

Use light hammer blows with the Slotted Hammer (357.026) to remove and dispose of the PFNA blade.

2

Removal of PFNA end cap, PFNA, and locking bolt

First remove the PFNA End Cap (473.1555). Insert the hook of the Guide Wire with Hook (356.717) through the end cap. Then guide the 4/11 mm Hexagonal Screwdriver Shaft (356.714) over the guide wire to the end cap. As soon as this connection is established, remove the end cap using the 11 mm Ratchet Wrench (321.200). Remove the PFNA. Attach the Guide Rod for PFN* (357.071) to the PFNA, and only then use the Hexagonal Screwdriver (314.260) to remove the distal locking bolt. Mount the large Holding Sleeve (314.280) onto the hexagonal screwdriver to facilitate removal of the locking bolt.
Note: Remove the locking bolt only after attaching the guide rod to the PFNA. This prevents the PFNA from rotating in the bone.

Attach the Slotted Hammer (357.026) to the guide rod to remove the PFNA. Ensure that the guide rod fits firmly into the PFNA. Tighten with the 4.5 mm Pin Wrench (321.170). Use gentle hammer blows to extract the PFNA from the femur.
**Insertion depth of the PFNA blade**

**Correct the insertion depth of the PFNA blade**

Remove the inserter, the sleeve assembly and the aiming arm. Use gentle anticlockwise pressure to insert the Extraction Screw (356.825) over the guide wire into the PFNA blade (see «unlock» marking). Advance the now unlocked PFNA blade to the desired insertion depth by applying gentle blows with the Slotted Hammer (357.026). Turning it clockwise to the stop allows relocking of the PFNA blade.
Cleaning

Intra- and postoperative cleaning

Use the 2.8 mm Stylet (319.460) or the long 2.8 mm Cleaning Stylet (357.009, length 450 mm) for intraoperative cleaning of the instrument cannulations.
Clean the instruments postoperatively with the 2.8 mm Stylet (319.460) and the 2.9 mm Cleaning Brush for cannulated instruments (319.240).

Subject to modifications.
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Entry point soft tissue damage in antegrade femoral nailing: a cadaver study
### Instruments

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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356.714  Screwdriver Shaft, hexagonal, 4.0/11.0 mm

356.715  Screwdriver Shaft, hexagonal 11.0/11.0 mm

356.717  Guide Wire 2.8 mm dia., with Hook, length 460 mm

356.810*  Aiming Arm for PFNA Blade, 125°
356.811*  Aiming Arm for PFNA Blade, 130°
356.812*  Aiming Arm for PFNA Blade, 135°
356.813**  Aiming Arm for PFNA Blade, 125°
356.814**  Aiming Arm for PFNA Blade, 130°

356.817  Buttress Nut for PFNA Blade

356.818  Protection Sleeve 16.0 /11.0 mm for PFNA Blade (golden)

356.819  Drill Sleeve 11.0 /3.2 mm for PFNA Blade (golden)

356.820  Trocar 3.2 mm dia., for PFNA Blade (golden)

356.821  Reamer 11.0 mm dia., cannulated, for PFNA Blade

*for PFNA standard and PFNA long  **for PFNA small, XS and long
356.822 Drill Bit 11.0 mm dia., cannulated, for PFNA Blade

356.823 Inserter for PFNA Blade

356.824 PFNA Aiming Arm for dynamic locking

356.825 Extraction Screw for PFNA Blade

356.826 Aiming Jig for antirotation wire

356.827 Drill Sleeve 5.6/3.2 mm for no. 356.826

356.828 Drill Sleeve 8.0/4.0 mm (green)

356.829 Measuring Device for 3.2 mm Guide Wire

356.830 Guide Wire 3.2 mm dia., for PFNA Blade
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*Fits also PFNA

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**Synthes PFNA Surgical Technique**
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<td>Socket, hexagonal, with T-handle</td>
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<td>357.021</td>
<td>Connecting Screw for PFN*, for no. 357.012</td>
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<td>357.026</td>
<td>Slotted Hammer 400g, detachable</td>
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<td>357.046</td>
<td>Fixation Sleeve for no. 357.045</td>
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<td>357.071</td>
<td>Guide Rod for PFN*</td>
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<td>393.100</td>
<td>Universal Chuck with T-handle</td>
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<td>399.420</td>
<td>Hammer</td>
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<td>185.280</td>
<td>PFNA Instrument Set in VARIO Case</td>
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<tr>
<td>385.222</td>
<td>Screw Rack for 4.9 mm locking bolts</td>
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*Fits also PFNA
685.280  Vario Case PFNA Instruments 1

685.282  Vario Case PFNA Instruments 2

689.530  Lid for Vario Case

**Alternative: aiming device**

357.020  Insertion Handle for PFN*, stainless steel

357.029  Connecting Screw for PFN*, for no. 357.020

357.028  Driving Cap to no. 357.020

*Fits also PFNA*
**Implants**

**PFNA standard, sterile**

<table>
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<tr>
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<th>Length</th>
<th>CCD angle</th>
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**PFNA small, sterile**

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<td>472.376S</td>
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<td>472.377S</td>
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<td>472.430S</td>
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<tr>
<td>472.431S</td>
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<td>130°</td>
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**PFNA XS, sterile**

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<td>472.437S</td>
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### PFNA long, sterile

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<td>125° droite</td>
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<td>130° droite</td>
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<td>472.320S</td>
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<td>472.340S</td>
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<td>472.350S</td>
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### PFNA End Cap, titanium alloy, sterile

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<td>473.158S</td>
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### PFNA Blade, titanium alloy, sterile

<table>
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### 4.9 mm Locking Bolt, self-tapping

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<th>TAN Sterile</th>
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