The Solid Nail Extraction System

TECHNIQUE GUIDE
Extractor Head Selection

Solid Titanium Femoral Nail

(Diameters: 9, 10, 11, or 12 mm)

If broken at the proximal end of the femoral nail, use the extractor head for 12 mm nail.

For Solid Nails

If broken at the distal end of the femoral or tibial nail, use the extractor head equal to the nail diameter.

Solid Titanium Tibial Nail

(Diameters: 8, 9, or 10 mm)

If broken at the proximal end of the tibial nail, use the extractor head for 12 mm nail.

Note:
If the correct extractor head is not available, use the next larger extractor head.
Assemble the Solid Nail Extractor (SNE)

1. **Select extractor head** (as shown on opposite page)
   
   For stainless steel solid tibial nails and titanium solid or cannulated femoral or tibial nails broken at the proximal end, select a 12 mm extractor head.

   *Note: If the correct extractor head is unavailable, use the next larger extractor head.*

2. **Insert drive shaft**
   
   Insert the threaded end of the drive shaft into the extractor head. Engage the hexagonal head of the drive shaft with the hexagonal recess in the extractor head.

   ![Drive Shaft](drive_shaft.png)  
   ![Extractor Head](extractor_head.png)  
   ![Flexible Shaft](flexible_shaft.png)

3. **Engage flexible shaft**
   
   Pass the threaded end of the drive shaft through the flexible shaft until the extractor head slot engages the flexible shaft tongue.

   ![Flexible Shaft Assembly](flexible_shaft_assembly.png)
Assemble the Solid Nail Extractor (SNE)—continued

4 Open ratchet grip
Open the ratchet grip at the hinge to form an “L” shape.

5 Connect ratchet grip
Slide the shaft assembly through the quick-coupling end of the ratchet grip until the flexible shaft locks (clicks) into the ratchet grip.

6 Close hinge
Align the flats of the drive shaft with the slot by rotating the ratchet grip. Close the hinge over the shaft.

Note:
If the flats on the drive shaft are aligned with the hinge slot but will not enter the hinge, the drive shaft may not be fully engaged in the extractor head—to correct this, pull again on the threaded end of the drive shaft and rotate it until the hinge can close over the flats.

Note: Hex head on drive shaft must be fully seated in hex recess of extractor head.
7 **Tighten connecting screw**

Turn the connecting screw at the base of the ratchet grip clockwise onto the drive shaft until tight.

**Note:** *Hex head on drive shaft must be fully seated in hex recess of extractor head.*

8 **Connect inserter-extractor**

Thread an Inserter-Extractor [356.49] onto the connecting screw to complete assembly of the SNE.

**WARNING:**

DO NOT advance the ratchet unless a nail fragment is in the extractor head—this will destroy the extractor head.

**Note:** *If the ratchet is accidentally advanced, extractor function may be restored by simultaneously retracting the ratchet release and rotating the rear of the SNE counterclockwise until the extractor jaw is fully open.*
Remove the Proximal Nail Fragment

1. **Remove the locking bolts**
   
   Remove the locking bolts from the proximal nail fragment only. The most distal bolt must be left in the distal fragment until the extractor head is locked onto the distal nail fragment. (FIG. 1)

2. **Expose nail**
   
   Expose the proximal end of the nail. Remove the nail end cap, if present. If no end cap was used, use a sharp hook to clean out the connecting thread in the proximal end of the nail.

3. **Extract proximal fragment**
   
   Attach the appropriate extraction or connecting screw to the nail, and extract the proximal fragment. (FIG. 2)
   
   - For AO Solid Tibial Nails, use Connecting Screw [356.54] and Extraction Block [356.56]
   
   - For AO Solid Femoral Nails use the Extraction Screw [357.36].

   **Note:**
   If there is no locking bolt in the most distal hole, insert a locking bolt, Schanz screw or K-wire to secure the nail fragment until the extractor head is locked onto it.
Prepare the Medullary Canal

1. **Ream canal**
   Using the ComPact Air Drive, ream the medullary canal to just above the proximal end of the distal nail fragment. Ream in 0.5 mm increments until the canal is 4 mm larger than the nominal nail diameter. (FIG. 3)

2. **Clear tissue from nail fragment**
   In the presence of dense hypertrophic tissue around the distal fragment, the use of a trephine is recommended. Select the trephine appropriate for the nail and attach it to the reamer shaft. Pass it down the medullary canal to the top of the nail fragment. Align the trephine with the nail and run it over the nail until it bottoms out on the nail fragment (20 mm). (FIG. 4)

3. **Remove reamer**
   Remove the reamer assembly from the medullary canal under continuous power.
Remove the Distal Nail Fragment

**WARNING:**
Do not tighten the ratchet unless a nail fragment is in the extractor head—this will destroy the extractor head.

1. **Advance extractor into canal**

   Pass the assembled solid nail extractor into the medullary canal and guide it to the level of the nail fragment. Continue to advance it until the extractor head is at the level of the nail. (FIG. 5)

   **Note:**
   *If passage is difficult, withdraw the extractor from the canal and clean any accumulated debris from the mouth of the extractor head.*

2. **Pass extractor head over nail fragment**

   Using image intensification, align the extractor head and pass it 20 mm over the proximal end of the nail fragment.

3. **Lock extractor onto nail**

   Lock the extractor onto the nail by rotating the ratchet grip clockwise (up to 90°) until tight.

   **WARNING:**
   Do not tighten the ratchet beyond 90°—this will destroy the extractor head.

   In the event the ratchet is accidentally advanced, extractor function may often be restored by simultaneously retracting the ratchet release (black ring) and rotating the rear of the SNE counterclockwise until the extractor jaw is fully open.
4. **Remove last locking bolt**

   Remove the remaining locking bolt(s) from the distal nail fragment.

5. **Extract distal fragment**

   Use controlled blows with the slotted hammer to extract the nail fragment.
Disassemble the Extractor

1. **Remove inserter-extractor**
   Unscrew the inserter-extractor from the connecting screw.

2. **Release nail**
   To release the nail from the SNE place the end of the connecting screw against a hard surface and press down firmly on the black ratchet release.

3. **Remove nail fragment**
   Remove the nail fragment from the SNE.

4. **Release drive shaft**
   Loosen the connecting screw at the back end of the ratchet grip to release the drive shaft. Pull back the quick coupling to release the shaft assembly.

Clean the Solid Nail Extractor

**Remove debris and clean parts**
Remove all debris from cannulations and surfaces.
Clean all parts with a brush and a mild cleaning solution before sterilization.

CAUTION:
Do not attempt to disassemble the ratchet grip.
AO ASIF Broken Solid Nail Extractor System

Product Information

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<td>Slotted Hammer</td>
<td>356.308</td>
<td>Trephine for 8 mm Nail</td>
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<td>351.43</td>
<td>8.0 mm Flexible Shaft, 360 mm</td>
<td>356.309</td>
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<td>356.350</td>
<td>Ratchet Grip</td>
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<td>Extractor Head for 12 mm Nail</td>
<td>356.49</td>
<td>Inserter/Extractor</td>
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<tr>
<td>356.340</td>
<td>Drive Shaft</td>
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Additionally Required Instruments

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<tbody>
<tr>
<td>105.570</td>
<td>Titanium Tibial Nail Insertion and Locking Set</td>
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<tr>
<td>105.655</td>
<td>Titanium Femoral Nail Standard Insertion and Locking Set</td>
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<tr>
<td>115.50</td>
<td>Universal Nail Reaming Instrument Set</td>
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<td>150.16</td>
<td>ComPact Air Drive Set</td>
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