The Solid Nail Extraction System

TECHNIQUE GUIDE

SYNTHESES® Original Instruments and Implants of the Association for the Study of Internal Fixation—AO ASIF
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.

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 11 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.

**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 a nail broken at the proximal end, select the extractor head based on the nail type:
   
   - 11 mm for AO Solid Tibial Nails
   - 12 mm for AO Solid Femoral Nails

   For a distal break determine the nail diameter and select an extractor head of the same nominal diameter.

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.

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.

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

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**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.

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**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.

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8  **Connect inserter-extractor**

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

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**WARNING:**

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

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**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.

Note:
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.

CAUTION:
Do not attempt to disassemble the ratchet grip.

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.
AO ASIF Broken Solid Nail Extractor System

**Product Information**
- 332.20  Slotted Hammer
- 351.43  8.0 mm Flexible Shaft, 360 mm
- 356.328 Extractor Head for 8 mm Nail
- 356.329 Extractor Head for 9 mm Nail
- 356.330 Extractor Head for 10 mm Nail
- 356.331 Extractor Head for 11 mm Nail
- 356.332 Extractor Head for 12 mm Nail
- 356.340 Drive Shaft
- 356.308 Trephine for 8 mm Nail
- 356.309 Trephine for 9 mm Nail
- 356.310 Trephine for 10 mm Nail
- 356.311 Trephine for 11 mm Nail
- 356.312 Trephine for 12 mm Nail
- 356.350 Ratchet Grip
- 356.49  Inserter/Extractor

**Additionally Required Instruments**
- 105.570 Titanium Tibial Nail Insertion and Locking Set
- 105.655 Titanium Femoral Nail Standard Insertion and Locking Set
- 115.50 Universal Nail Reaming Instrument Set
- 150.16 ComPact Air Drive Set

**Also Available**
- 356.301 50° Tamp
- 356.302 30° Tamp
- 356.303 12° Tamp

*Also Available*