Thoracolumbar posterior fixation system

USS Low Profile

Surgical Technique
This description alone does not provide sufficient background for direct use of DePuy Synthes products. Instruction by a surgeon experienced in handling these products is highly recommended.

**Processing, Reprocessing, Care and Maintenance**
For general guidelines, function control and dismantling of multi-part instruments, as well as processing guidelines for implants, please contact your local sales representative or refer to:
http://emea.depuy.synthes.com/hcp/reprocessing-care-maintenance
For general information about reprocessing, care and maintenance of Synthes reusable devices, instrument trays and cases, as well as processing of Synthes non-sterile implants, please consult the Important Information leaflet (SE_023827) or refer to:
http://emea.depuy.synthes.com/hcp/reprocessing-care-maintenance
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The four principles to be considered as the foundation for proper spine patient management underpin the design and delivery of the Curriculum: Stability – Alignment – Biology – Function.\textsuperscript{1,2}

### Stability
Stabilization to achieve a specific therapeutic outcome

### Alignment
Balancing the spine in three dimensions

### Biology
Etiology, pathogenesis, neural protection, and tissue healing

### Function
Preservations and restoration of function to prevent disability

\textsuperscript{1} Aebi et al (1998)  
\textsuperscript{2} Aebi et al (2007)
Indications and Contraindications

**Intended use**

The USS System is a posterior pedicle screw and hook fixation system (T1-S2) designed to provide precise and segmental stabilization of the spine skeletally mature patients.

**Indications**

The USS Low Profile system covers the following indications for posterior instrumentation and fusion/arthrodesis of the thoracolumbar spine:

- Thoracolumbar scoliosis and other deformities (1)
- Tumours (2)
- Degenerative diseases (3)
- Fractures with anterior support and multisegmental fractures with segmental fixation (4)
- Infections

**Contraindications**

Contraindications as stand-alone procedures are:

- Spondylolisthesis Grades IV & V
- Fractures with loss of anterior column support
- Tumours with loss of anterior column support
USS Low Profile implants

All implants are made of titanium alloy (TAN).

**USS Low Profile single-side-opening Pedicle Screws**
- Ø 4.2 mm, length 25–40 mm (499.150–156)
- Ø 5.0 mm, length 25–55 mm (499.119–125)
- Ø 6.0 mm, length 30–65 mm (499.130–137)
- Ø 7.0 mm, length 30–65 mm (499.140–147)
- Blunt tip
- Self-tapping thread design and threaded screw tip
- Dual core for grip in bone

**USS Low Profile Pedicle Hooks**
- Left, right and front-opening hooks with colour coding (499.880–882)
- One size
- Secured with USS Screw for Pedicle Hooks

**USS Screws for Pedicle Hooks**
- Ø 3.2 mm, length 20–30 mm (498.024–498.028)
- Screw core Ø 2.1 mm
- To be inserted after applying the drill bit Ø 2.0 mm

**USS Low Profile Lamina Hooks**
- Left, right and front-opening hooks with colour coding
- Small size (499.871–873)
- Medium size (499.874–876)
- Large size (499.877–879)
- Size labelled on implant

**USS Low Profile Lamina Hooks, angled**
- Left, right and front-opening with colour coding (499.883–886)
- One size

**USS Low Profile Sleeve (499.888)**
- Grooved design, fits rods Ø 6 mm
**USS Low Profile Nut (499.887)**

- 12-Point Nut
- Crank on lower side to fit Sleeve

**USS Rods Ø 6 mm**

- Hard rods, TiCP, length 50–500 mm (498.102–119) for fractures and deformities
- Extra hard rods, TAN, 200–500 mm (498.290–296)
- Soft rods, TiCP, length 50–150 mm (498.150–154) for lumbar degenerative diseases

**USS Transverse Connector for Rods Ø 6 mm**

Transverse connector, open, length 15–25 mm (499.295–297)

**Connectors for Rods Ø 6 mm**

- USS parallel connector for rods Ø 6.0/6.0 mm (498.160)
- USS parallel connector for rods Ø 3.5/6.0 mm (498.960)
- USS extension connector for rods Ø 6.0/6.0 mm (498.165)

**Fixation Ring for Compression/Distraction (498.911)**

For rods Ø 6 mm

**Cross-Link**

- Cross-link rod Ø 3.5 mm, length 30–100 mm (496.920–999)
- USS cross-link clamp for rods Ø 6 mm, pre-assembled (498.813)

**Note:** All the implants are single-use products. They must not be reused once they have been in contact with the patient.
Handling implants with stick

Required instruments

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.640</td>
<td>USS Universal Handle</td>
</tr>
<tr>
<td>388.641</td>
<td>Sleeve for USS LP</td>
</tr>
<tr>
<td>388.616</td>
<td>USS LP Hook and Screw Holder</td>
</tr>
<tr>
<td>314.070</td>
<td>Screwdriver, hexagonal, small, length 200 mm</td>
</tr>
</tbody>
</table>

Attaching handle to Stick

Press the button on top of the USS Universal Handle (1) and simultaneously insert the Stick from below into the handle (2).

Picking-up of implants

Insert the tip of the Stick into the head of the implant (1). Carefully tighten the Stick to the implant by rotating the knurled knob of the USS Universal Handle (2). This firmly tightens the threaded bar of the Stick to the implant.

Release of Stick

After implant insertion, simultaneously press the button and remove the handle to release the Stick.

Note: If the Stick is required for subsequent manipulations, make sure that the Stick is firmly tightened to the implant. To do this, use the small hexagonal screwdriver to tighten the stick-implant-thread connection.
## Pedicle screw positioning

### Required instruments

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.551</td>
<td>USS pedicle awl, Ø 3.0 mm, length 230 mm, for Ø 4.2 mm screws</td>
</tr>
<tr>
<td>388.550</td>
<td>USS pedicle awl, length 230 mm, for Ø 5.0, 6.0 and 7.0 mm screws</td>
</tr>
<tr>
<td>388.538</td>
<td>Pedicle probe, Ø 2.8 mm, length 230 mm, for Ø 4.2 mm screws</td>
</tr>
<tr>
<td>388.540</td>
<td>Pedicle probe, Ø 3.8 mm, length 230 mm, for Ø 5.0 and Ø 6.0 mm screws</td>
</tr>
<tr>
<td>388.539</td>
<td>Pedicle probe, Ø 4.8 mm, length 230 mm, for Ø 7.0 mm screws</td>
</tr>
<tr>
<td>357.789</td>
<td>Length indicator for Pedicle Screws</td>
</tr>
<tr>
<td>388.545</td>
<td>Feeler for screw channel, straight, Ø 2.3 mm, length 275 mm</td>
</tr>
<tr>
<td>388.546</td>
<td>Feeler for screw channel, curved, Ø 2.3 mm, length 275 mm</td>
</tr>
</tbody>
</table>

### 1. Determine entry point and position of pedicle screws

a. **Thoracic spine**

Entry points are just below the rim of the upper facet joint (1). The screws should be inserted at an angle of 7–10° towards the midline (2) and 10–20° caudally (3).

b. **Lumbar spine**

Entry points are at the intersection of a vertical line tangential to the lateral border of the superior articular process and the horizontal line bisecting the transverse processes (4). The screws should be inserted at an angle of 5–10° towards the midline at the thoracolumbar junction (5). They should converge by 10° at L2 and increase to 15° at L5 (6).

c. **Sacrum**

Entry points for S1 are located at the intersection of the vertical line tangential to the lateral border of the superior articular process and the horizontal line tangential to its inferior border (7). The screws should converge towards the midline (8) so that they aim towards the anterior corner of the promontorium (9).
2. Open pedicle

Use the appropriate pedicle awl to perforate the cortex of the pedicle.

Continue opening the pedicle canal using one of the USS Pedicle Probes.

**Note:** If the probe resists advancement, use image intensifier control to check the position and orientation.

3. Probe pedicle channel

Palpate the inner walls of the pedicle screw channel using the straight or curved probe in order to check for intact screw channel walls.
4. Insert pedicle screw into pedicle

Determine the length of the pedicle screws using the length indicator. Confirm the position and orientation with image intensifier control. Pick up the appropriate pedicle screw from the tray as described on page 6.

Insert the screw into the prepared pedicle until the screw head is well seated, i.e., the side opening of the implant head should point in the desired direction and the horizontal position should be aligned with the rod trajectory (1). In order to disconnect the handle from the Stick, press the release button (2).

**Note:** If a rod connector is used, the opening of the screw must be oriented perpendicular to the rod trajectory. Use of \( \varnothing 4.2 \) mm screws in the thoracic spine only.
# Pedicle hook positioning

**Required instruments**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.510</td>
<td>USS Pedicle Feeler, length 260 mm</td>
</tr>
<tr>
<td>388.642</td>
<td>USS LP Hook Positioner, length 273 mm</td>
</tr>
<tr>
<td>310.190</td>
<td>Drill Bit, Ø 2.0 mm, length 102/75 mm</td>
</tr>
<tr>
<td>319.060</td>
<td>Depth Gauge for 1.5 to 2 mm screws</td>
</tr>
<tr>
<td>314.070</td>
<td>Screwdriver, hexagonal, small, length 200 mm</td>
</tr>
<tr>
<td>388.381</td>
<td>Holding Sleeve for Fillister Head Screws</td>
</tr>
<tr>
<td>388.581</td>
<td>USS Drill Sleeve 2.0</td>
</tr>
<tr>
<td>499.880–</td>
<td>USS LP Pedicle Hooks</td>
</tr>
<tr>
<td>499.882</td>
<td></td>
</tr>
<tr>
<td>498.024–</td>
<td>USS Screws Ø 3.2 mm for USS Pedicle Hooks</td>
</tr>
<tr>
<td>498.026</td>
<td></td>
</tr>
</tbody>
</table>

The 3.2 mm screws guarantee that the USS LP Pedicle Hooks stay securely in place during and after surgery.

## 1. Prepare seat for pedicle hook

Prepare the pedicle using the USS Pedicle Feeler. Place the pedicle feeler between the inferior and superior facet joints.

**Note:** Carefully check that the instrument is placed in the articular joint space and not in the bone of the inferior facet.

To facilitate insertion of the pedicle hook, remove a small portion of the inferior facet with an osteotome (1). The pedicle feeler has marks. When the last mark in direction of the tip is reached, sufficient bone has been removed to accommodate the hook around the pedicle (2).

**Note:** Check the optimal position of the pedicle feeler by moving it laterally and cranially. Do not push medially. The correct position has been reached as soon as the pedicle feeler no longer moves.

Remove the pedicle feeler.
2. Position pedicle hook

Pick up a pedicle hook from the tray with the stick as described on page 6.

**Note:** Use a front-opening hook if a rod connector is mounted on the hook.

Insert the hook positioner into the screw hole of the pedicle hook and ease the hook into the previously prepared seat. Check that the pedicle hook is snug around the pedicle by axial loading of the hook positioner and also by pushing laterally.

**Note:** The pedicle hook is correctly placed when it can no longer be moved.

Gently tap the hook positioner with a hammer to firmly seat the hook. Remove the hook positioner and the handle. The Stick remains attached to the hook.

3. Drill hole for screw Ø 3.2 mm

Drill the screw hole with the three-fluted drill bit together with the USS Drill Sleeve and an oscillating device. The two components of the drill sleeve (sleeve and handle) must be screwed together before use.

**Note:** Do not start the power drill if the bit does not hit bone after passing through the drill sleeve.

4. Determine screw length

Remove the drill sleeve and determine the depth with the length indicator.
5. Insert screw Ø 3.2 mm

Select an appropriate screw length and insert it into the previously prepared drill hole using the hexagonal screw-driver and the holding sleeve.

The pedicle hook is now firmly attached to the pedicle.
Lamina hook positioning

Required instruments

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.520</td>
<td>USS Lamina Feeler, length 260 mm</td>
</tr>
<tr>
<td>388.642</td>
<td>USS LP Hook Positioner, length 273 mm</td>
</tr>
<tr>
<td>499.871–</td>
<td>USS LP Lamina Hooks</td>
</tr>
<tr>
<td>499.879</td>
<td></td>
</tr>
</tbody>
</table>

1. Prepare seat for lamina hook

The lamina hook can be placed around the superior or inferior portion of the lamina. Carefully remove the ligamentum flavum with a rongeur to ensure a snug fit of the hook on the lamina. Remove a small portion of the lamina with a bone rongeur. Check the seat for the lamina hook using the USS Lamina Feeler.

Remove the lamina feeler.

2. Position lamina hook

Pick up an appropriate lamina hook from the tray with the Stick as described on page 6.

Note: Use a front-opening hook if a rod connector is mounted on the hook.

Insert the hook positioner into the positioning hole of the hook and ease the lamina hook into the previously prepared seat.

Remove the hook positioner. The Stick remains attached to the hook until the hook is connected to the rod.
Angled Lamina Hook positioning at the transverse process

Required instruments

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.520</td>
<td>USS Lamina Feeler, length 260 mm</td>
</tr>
<tr>
<td>388.521</td>
<td>USS-ss Lamina Feeler</td>
</tr>
<tr>
<td>388.642</td>
<td>USS LP Hook Positionier, length 273 mm</td>
</tr>
<tr>
<td>499.883–</td>
<td>USS LP Lamina Hook, angled</td>
</tr>
<tr>
<td>499.886</td>
<td></td>
</tr>
</tbody>
</table>

1. Prepare seat for angled lamina hook

Remove the soft tissue from the transverse process. Place the USS Lamina Feeler around the transverse process in order to elevate the soft tissue attachments from the anterior portion of the transverse process.

Remove the lamina feeler.

Note: Aim for a hook position as medially as possible in order to limit stress on transverse process.

2. Position angled lamina hook

Pick up an appropriate angled lamina hook from the tray with the Stick as described on page 6.

Note: Use a front-opening hook if a rod connector is mounted on the hook.

Insert the hook positioner into the positioning hole of the hook and ease the angled lamina hook into the previously prepared seat. Remove the hook positioner. The Stick remains attached to the hook until the hook is connected to the rod.
**Rod contouring**

**Required instruments**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.870/388.880</td>
<td>Trial Rod for USS Rods, length 150 or 400 mm</td>
</tr>
<tr>
<td>388.960</td>
<td>Bending Pliers with Rolls for USS Rods</td>
</tr>
<tr>
<td>388.910/388.920</td>
<td>USS Bending Irons, left/right</td>
</tr>
<tr>
<td>498.150–498.154</td>
<td>TiCP Rods</td>
</tr>
<tr>
<td>498.290–498.296</td>
<td>TAN Rods</td>
</tr>
</tbody>
</table>

Use the trial rod to determine proper rod contour and length. Contour the rod using either the bending pliers with rolls (1) or the USS Bending Irons.

**Note:** Once bent, titanium rods should not be bent back again. Do not bend titanium rods more than 45°.
Tightening of construct

### Required instruments

- 388.616 USS LP Screw and Hook Holder
- 388.640 USS Universal Handle
- 388.641 Sleeve for USS LP
- 388.663 USS LP Socket Wrench 12 point, 11 mm, straight
- 388.130 USS Socket Wrench 11 mm, with L-handle
- 388.140 USS Socket Wrench 6 mm
- 499.887 USS LP Nut
- 499.888 USS LP Sleeve, grooved

### Optional instruments

- 388.643 USS LP Counter torque instrument with L-handle

### 1. Pick up and place Sleeve with the universal handle

The Sleeve and Nut are picked up with the universal handle from the tray. Make sure that the upper side of the Nut is correctly oriented; i.e., the crank of the Nut faces downward and fits the Sleeve correctly (1). Safely release the Sleeve and Nut over the stick by pushing on the release button (2).

**Note:** Be sure to use USS Low Profile Sleeves and Nuts only. Do not use Sleeves and Nuts from other USS systems.

### 2. Loosely tighten the Nut

Use the straight socket wrench to loosely tighten the Nut. The screw-rod connection is now loosely fixed and allows for further manipulations along the construct.
3. Firmly tighten the Nut

Use the Counter torque instrument with L-handle, which acts directly on the rod. As before, the Socket Wrench with L-Handle is used to tighten the Nuts.

Notes:
- At the end of the surgery, it is necessary to check with the Socket Wrench with L-handle if every single implant is firmly tightened to the rod. The counter torque instrument is used simultaneously.
- Also check carefully that the rods clearly overlap the screws at the respective ends (min. 5 mm).

Options:
- Use the Straight Socket Wrench to tighten the nut and provide counter torque with the USS LP Counter Torque Instrument with L-handle.
- Use the Socket Wrench 11 mm with L-handle to firmly tighten the Nut while providing counter torque with the USS Socket Wrench 6 mm applied on the Stick.
Introduction of rods into side openings

Required instruments

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.500</td>
<td>USS Rod Introduction Pliers (Persuader), length 250 mm</td>
</tr>
<tr>
<td>388.502</td>
<td>USS Sleeve Pusher for 388.500</td>
</tr>
<tr>
<td>388.501</td>
<td>Support for No. 388.500</td>
</tr>
<tr>
<td>388.410</td>
<td>USS Spreader Forceps, length 330 mm</td>
</tr>
<tr>
<td>388.642</td>
<td>USS LP Hook Positioner, length 273 mm</td>
</tr>
<tr>
<td>388.140</td>
<td>USS Socket Wrench ⌀ 6 mm</td>
</tr>
</tbody>
</table>

Optional Instruments

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.490</td>
<td>Rod Crimping Pliers for USS Implants</td>
</tr>
</tbody>
</table>

Using the Rod Introduction Pliers (Persuader)

The Persuader is a key element of the USS system. It is used in situations when the distance between implant and rod is significant. The Persuader permits easy introduction of the 6 mm rod into the side opening of the implant.

The Persuader is equally important when applying the segmental derotation technique for scoliosis correction, which is unique to the side-opening USS systems.

Option:

Alternative method without Persuader

If the rod is correctly aligned horizontally to the side opening, the rod crimping pliers can be used to simply push the rod into the implant opening.
1. Mount Sleeve Pusher onto Persuader

Place the USS Sleeve Pusher onto the cylinder of the Persuader. The handle of the Sleeve Pusher must be located on the side of the Persuader with the arrow pointing to the outer side (1). Pick up a Sleeve from the tray (2).

2. Locate Persuader on implants

Slide the cylinder of the Persuader over the Stick and orient the limb of the pliers towards the rod. Engage the rod with the opposite jaw of the Persuader and slightly squeeze the handle to push the rod towards the implant.
3. Attach support for rod introduction pliers

The support serves as a locking device when lifting the implant towards the rod.

Slide the support over the protruding end of the Stick in the configuration with the persuader mounted over the Stick (1). The forked opening of the support must face upwards. The lever must be pulled and then released so that the fork of the support engages in the hexagon of the Stick.

4. Bring rod towards side opening of implant

Place the spreader forceps on the Stick between the Distraction Clip and the Persuader (1). Slowly open the spreader to bring the implant up towards the rod (2). When the opening is opposite to the rod, close the Persuader to fully engage the rod (3).

**Note:** Carefully apply force to the anchorage to prevent pull-out from the bone.
5. Place Sleeve over implant and rod

Push the Sleeve Pusher down the cylinder to place the Sleeve over the rod and implant (1). When retracting the Sleeve Pusher (2) it is important to leave the Sleeve on the implant and rod

**Note:** If the Sleeve cannot be positioned easily

a. either try to align the screw to the rod by slightly turning the Stick using the USS Socket Wrench 6 mm

b. or gently tap the sleeve pusher to position the Sleeve on the implant using the USS Low Profile Hook Positioner by placing it in the round dent on the handle of the sleeve pusher.

6. Attach implant to rod

Remove the Persuader. The implant is now loosely fixed by the Sleeve. In order to secure the assembly, add a Nut over the implant and tighten it as described on page 16/17.
Distraction or compression of two adjacent implants

**Required instruments**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>388.410</td>
<td>USS Spreader Forceps, length 330 mm</td>
</tr>
<tr>
<td>388.422</td>
<td>Compression Forceps for USS and Click’X</td>
</tr>
</tbody>
</table>

**Optional instruments**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>314.070</td>
<td>Screwdriver, hexagonal, small, length 200 mm</td>
</tr>
<tr>
<td>388.360</td>
<td>USS Holding Sleeve, length 80 mm, for 314.070</td>
</tr>
<tr>
<td>388.440</td>
<td>USS Holding Forceps for USS Rods</td>
</tr>
<tr>
<td>498.911</td>
<td>Fixation ring</td>
</tr>
</tbody>
</table>

**Distraction or compression**

Once the rod has been introduced and attached to the implants, distraction or compression can be carried out. This is usually performed with two neighbouring implants with one implant firmly tightened and the other loose. Distraction is carried out with the spreader forceps and compression with the compression forceps. The tip of the instrument is placed on the sleeve of the implants.

**Options**

Alternative methods when forceps cannot be applied directly to the implants because the neighbouring implants are too far apart.

a. Additional use of holding forceps for rods

Instead of using the fixation ring, secure the holding forceps next to the dedicated implant and carry out distraction or compression.

b. Additional use of fixation ring

A fixation ring is placed adjacent to the implant where compression or distraction is to be performed. The ring is placed onto the rod using the hexagonal screwdriver and the holding sleeve. The distraction or compression is now carried out over the implant and the fixation ring. The implant must be loose during this procedure. Remove the fixation ring after tightening the Nut of the implant.
Connecting a rod to an implant with a Rod Connector

**Required instruments**

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<tbody>
<tr>
<td>314.070</td>
<td>Screwdriver, hexagonal, small, length 200 mm</td>
</tr>
<tr>
<td>499.888</td>
<td>USS LP Sleeve, grooved</td>
</tr>
<tr>
<td>499.887</td>
<td>USS LP Nut</td>
</tr>
<tr>
<td>388.130</td>
<td>USS Socket Wrench 11 mm, with L-handle</td>
</tr>
<tr>
<td>388.140</td>
<td>USS Socket Wrench 6 mm</td>
</tr>
<tr>
<td>388.643</td>
<td>USS LP Counter torque instrument with L-handle</td>
</tr>
<tr>
<td>499.295–</td>
<td>USS-II Rod Connector, length 15–25 mm, golden</td>
</tr>
<tr>
<td></td>
<td>499.297</td>
</tr>
</tbody>
</table>

Rod connectors allow the bridging of lateral distances in cases where the rod is offset from the implant. The Rod Connector can be easily attached to the rod at any point during the surgery. To accommodate the Rod Connector, the side opening of the pedicle screws is to be oriented perpendicular to the rod whereas the front-opening models are to be selected for the hooks.
1. Fasten Rod Connector to rod

Position the Rod Connector on the rod and insert the ribbed part of the Rod Connector in the side opening of the implant (1). Tighten the set screw of the Rod Connector using the small hexagonal screwdriver (2).

2. Connect Rod Connector to implant

Add a Sleeve and Nut over the implant and secure the assembly as described on page 16/17.

Example of an instrumentation with a rod connector

15-year old female patient with idiopathic scoliosis. Posterior instrumentation with pedicle screws in T9 to L1 and pedicle and lamina hooks in T2 to T5 including two cross-connectors. Rod connector at T9.
