Ankle Spanning, Metaphyseal/Diaphyseal, Optional Cannulated and Hybrid
Nota Bene

The technique description herein is made available to the healthcare professional to illustrate the author’s suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the specific patient.
Design Features

Central Body

**Part Number:** 7105-1041 Short Central Body  
7105-1042 Standard Central Body  
7105-1043 Long Central Body

**Description:**
The Central Body is the main component of the fixator. Complete frames can be easily constructed by snapping a module onto the ball joint connectors on either end. Each Central Body can be compressed or distracted, either acutely or gradually, using the snap-on Compression/Distraction Device. One Allen Wrench tightens the Central Body bolt and each ball joint bolt.

**Engineering Data:**

**Short Central Body**
- **Materials**
  - Carbon Fiber Composite
  - High Strength Aluminum
  - Stainless Steel
- **Overall Distracted Length** 139mm
- **Overall Compressed Length** 119mm
- **Total Distraction** 20mm
- **Wrench Needed** 6mm Allen Wrench

**Standard Central Body**
- **Materials**
  - Carbon Fiber Composite
  - High Strength Aluminum
  - Stainless Steel
- **Overall Distracted Length** 179mm
- **Overall Compressed Length** 139mm
- **Total Distraction** 40mm
- **Wrench Needed** 6mm Allen Wrench

**Long Central Body**
- **Materials**
  - Carbon Fiber Composite
  - High Strength Aluminum
  - Stainless Steel
- **Overall Distracted Length** 249mm
- **Overall Compressed Length** 174mm
- **Total Distraction** 75mm
- **Wrench Needed** 6mm Allen Wrench

**Used With:**
10.5mm Bar, 10mm Wrench
Pin Tower
Part Number: 7105-1018

Description:
The Pin Tower allows an additional half pin to be placed oblique to the pin clamps. It will attach to either the T-Clamp or the Straight Clamp.

Engineering Data:
<table>
<thead>
<tr>
<th>Materials</th>
<th>Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Height</td>
<td>63.4mm</td>
</tr>
<tr>
<td>Overall Width</td>
<td>15.9mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>10mm Wrench</td>
</tr>
</tbody>
</table>

Used With:
Straight Clamp, T-Clamp, Half Pin, Tissue Protector, Drill Sleeve, Trocar, 10mm Wrench, 6mm Allen Wrench

Offset Clamp
Part Number: 7105-1722

Description:
The Offset Clamp allows placement of half pins anterior-medial in the tibia. There are five pin placement options, which hold 5mm or 6mm half pins. A minimum of two half pins per Offset Clamp is required. Each clamp is spring-loaded to provisionally grip instruments and pins.

Engineering Data:
| Materials: High Strength Aluminum Stainless Steel |
|----------------------|-----------------|
| Total Angulation at the Ball | 40°            |
| Distance Between Outer Pins | 46mm          |
| Distance From Outer Pins to Center Pin | 23mm          |
| Distance From Ball to 5mm Half Pins | 39.5mm        |
| Distance From Ball to 6mm Half Pin | 40.0mm        |

Wrench Needed: 6mm Allen Wrench

Used with:
Central Body, 5mm or 6mm Half Pin, Tissue Protector, Drill Sleeve, Trocar, 6mm Allen Wrench
Ankle Clamp
Part Number: 7105-1054

Description:
The Trauma Ankle Clamp is designed to span the ankle for fixation of pilon fractures. The Ankle Clamp offers two options for calcaneal pin placement to best fit a patient’s anatomy. It offers independent coronal and sagittal plane adjustment of the fracture. The removable swivel clamp is lockable and can be switched from left to right ankle configurations. The stem’s radiolucent carbon fiber composite material allows clear visualization of the ankle joint. For stabilization, tightening the center bolt on the hinge clamp prevents plantar flexion and dorsiflexion.

Engineering Data:

<table>
<thead>
<tr>
<th>Materials</th>
<th>Carbon Fiber Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Strength Aluminum</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel</td>
<td></td>
</tr>
<tr>
<td>Distance Between Outer Pins</td>
<td>58.4mm</td>
</tr>
<tr>
<td>Total Angulation at the Ball</td>
<td>40°</td>
</tr>
<tr>
<td>Diameter of Pin Hole at Center of Rotation of Hinge</td>
<td>1.6mm</td>
</tr>
<tr>
<td>Plantar Flexion</td>
<td>37°</td>
</tr>
<tr>
<td>Dorsiflexion</td>
<td>67°</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>6mm Allen Wrench</td>
</tr>
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</table>

Straight Clamp
Part Number: 7105-1045

Description:
The Straight Clamp allows placement of half pins in-line with the Central Body. There are five pin placement options, and the clamp holds 5mm or 6mm half pins. A minimum of two half pins per Straight Clamp is required. Each clamp is spring-loaded to provisionally grip instruments and pins.

Engineering Data:

<table>
<thead>
<tr>
<th>Materials</th>
<th>Carbon Fiber Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Strength Aluminum</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel</td>
<td></td>
</tr>
<tr>
<td>Total Angulation at the Ball</td>
<td>40°</td>
</tr>
<tr>
<td>Length</td>
<td>102.6mm</td>
</tr>
<tr>
<td>Diameter</td>
<td>37mm</td>
</tr>
<tr>
<td>Distance from Outer Pins to Center Pin</td>
<td>23mm</td>
</tr>
<tr>
<td>Distance Between Outer Pins</td>
<td>46mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>6mm Allen Wrench</td>
</tr>
</tbody>
</table>

Used With:
Central Body, Half Pin, Tissue Protector, Drill Sleeve, Trocar, 6mm Allen Wrench
**T-Clamp**  
**Part Number: 7105-1046**

**Description:**  
The T-Clamp allows half pins to be placed transverse to the Central Body. There are five pin placement options, and the clamp will hold 5mm or 6mm half pins. A minimum of two half pins per T-Clamp is required. Each clamp is spring-loaded to provisionally grip instruments and pins.

**Engineering Data:**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Carbon Fiber Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Strength Aluminum</td>
</tr>
<tr>
<td></td>
<td>Stainless Steel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Angulation at the Ball</th>
<th>40°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>63.2mm</td>
</tr>
<tr>
<td>Distance from Outer Pins to Center Pin</td>
<td>23mm</td>
</tr>
<tr>
<td>Distance Between Outer Pins</td>
<td>46mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>6mm Allen Wrench</td>
</tr>
</tbody>
</table>

**Used With:**

Central Body, Half Pin, Tissue Protector, Drill Sleeve, Trocar, 6mm Allen Wrench

**Ring Adapter**  
**Part Number: 7105-1047**

**Description:**  
The Ring Adaptor connects a JET-X Central Body to an ILIZAROV... Ring or TAYLOR SPATIAL FRAME® Ring.

**Engineering Data:**

<table>
<thead>
<tr>
<th>Materials</th>
<th>High Strength Aluminum Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrench Needed</td>
<td>10mm Wrench (Ring) 6mm Allen Wrench (Central Body)</td>
</tr>
</tbody>
</table>

**Used With:**

Central Body, ILIZAROV Ring, TAYLOR SPATIAL FRAME Ring, 6mm Wrench, AO T-Handled Connector w/10mm Socket
Hybrid Strut

Part Number:  7105-1048 Short Hybrid Strut
              7105-1049 Long Hybrid Strut

Description:
The Hybrid Strut supports the ring on the fixator in a hybrid application. In a tibial plateau application, the Hybrid Strut attaches distally to the Straight Clamp and proximally to the ring.

Engineering Data:
Short Hybrid Strut

<table>
<thead>
<tr>
<th>Materials</th>
<th>High Strength Aluminum Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Telescoping Movement</td>
<td>57.2mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>10mm Wrench 6mm Allen Wrench</td>
</tr>
</tbody>
</table>

Used With:
Straight Clamp, ILIZAROV® Ring, TAYLOR SPATIAL FRAME® Ring, 10mm Wrench, 6mm Allen Wrench

Long Hybrid Strut

<table>
<thead>
<tr>
<th>Materials</th>
<th>High Strength Aluminum Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Telescoping Movement</td>
<td>108mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>10mm Wrench 6mm Allen Wrench</td>
</tr>
</tbody>
</table>

AO T-Handle Connector with 10mm Socket

Part Number:  7106-3001

Description:
The AO T-Handle Connector with 10mm Socket is a dual-purpose instrument. The AO Connector allows the manual insertion of half pins with the T-Handle, while the 10mm Socket provides compatibility with ILIZAROV® Composite Rings in hybrid applications.

Engineering Data:

<table>
<thead>
<tr>
<th>Material</th>
<th>Stainless Steel</th>
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<tbody>
<tr>
<td>Overall Size</td>
<td>91.4mm</td>
</tr>
<tr>
<td>(Top of Handle to End of Socket)</td>
<td></td>
</tr>
<tr>
<td>Handle Size</td>
<td>101.6mm x 31.2 mm</td>
</tr>
<tr>
<td>Connection</td>
<td>AO Connection</td>
</tr>
</tbody>
</table>

Used With:
Ring Adaptor, 5mm Half Pin, 10mm Connector
Compression/Distraction Device
Part Number: 7105-1051 Short Central Body
7105-1052 Standard Central Body
7105-1053 Long Central Body

Description:
The Compression/Distraction Device compresses or distracts the Central Body. It can be added to the fixator before, during or after surgery. Posts on both ends of the Device simply plug into the mounting holes on the end caps of the Central Body.

Engineering Data:

Short C/D Device

<table>
<thead>
<tr>
<th>Materials</th>
<th>Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teflon®</td>
<td></td>
</tr>
<tr>
<td>Overall Distracted Length</td>
<td>110mm</td>
</tr>
<tr>
<td>Overall Compressed Length</td>
<td>90mm</td>
</tr>
<tr>
<td>Total Distraction</td>
<td>20mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>6mm Allen Wrench</td>
</tr>
</tbody>
</table>

Long C/D Device

<table>
<thead>
<tr>
<th>Materials</th>
<th>Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teflon®</td>
<td></td>
</tr>
<tr>
<td>Overall Distracted Length</td>
<td>219.5mm</td>
</tr>
<tr>
<td>Overall Compressed Length</td>
<td>144.5mm</td>
</tr>
<tr>
<td>Total Distraction</td>
<td>75mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>6mm Allen Wrench</td>
</tr>
</tbody>
</table>

Standard C/D Device

<table>
<thead>
<tr>
<th>Materials</th>
<th>Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teflon®</td>
<td></td>
</tr>
<tr>
<td>Overall Distracted Length</td>
<td>149.5mm</td>
</tr>
<tr>
<td>Overall Compressed Length</td>
<td>109.5mm</td>
</tr>
<tr>
<td>Total Distraction</td>
<td>40mm</td>
</tr>
<tr>
<td>Wrench Needed</td>
<td>6mm Allen Wrench</td>
</tr>
</tbody>
</table>

Used With:
Central Body, 6mm Allen Wrench

6mm Allen Wrench
Part Number: 7105-3006

Description:
The 6mm Allen Wrench is the only instrument needed to tighten all JET-X Central modules.

Engineering Data:

<table>
<thead>
<tr>
<th>Material</th>
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<tbody>
<tr>
<td>Overall Length</td>
<td>190mm</td>
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Used With:
Central Body, Straight Clamp, T-Clamp, Trauma Ankle Clamp, Pin Tower
Compression/Distraction Device
10mm Ratchet Wrench
Part Number: 7106-3003

Description:
The 10mm Ratchet Wrench may be used with any 10mm connector.

Engineering Data:
Material: Stainless Steel
Length: 159mm
Connection: 10mm Open-end, 10mm Closed-end

Used With:
Ring Adaptor, Hybrid Strut, Pin Tower

3.5mm Graduated Drill with AO Connector
Part Number: 7106-3006

Description:
The 3.5mm Drill is used to pre-drill for 5mm half pins.

Engineering Data:
Material: Stainless Steel
Length: 260.4mm
Diameter: 3.5mm
Connection: AO Connection

Used With:
Straight Clamp, T-Clamp, Ankle Clamp, Pin Tower, Tissue Protector, Drill Sleeve, Half Pin
3.5mm/1.6mm Graduated Cannulated Drill with AO Connector
Part Number: 7106-3013

Description:
The 3.5mm/1.6mm Drill is used to pre-drill over a 1.6 mm wire for 5mm Cannulated Half Pins.

Engineering Data:
<table>
<thead>
<tr>
<th>Material</th>
<th>Stainless Steel</th>
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<tbody>
<tr>
<td>Overall Length</td>
<td>165.1mm</td>
</tr>
<tr>
<td>Diameter</td>
<td>3.5mm</td>
</tr>
<tr>
<td>Cannulation</td>
<td>1.6mm</td>
</tr>
<tr>
<td>Connection</td>
<td>AO Connection</td>
</tr>
</tbody>
</table>

Used With:
Ankle Clamp, 1.6mm Wire, 1.6mm Wire Guide, Cannulated Pin Tissue Protector, Cannulated Pin Drill Sleeve, Cannulated Half Pin

Trauma Ankle Drill Guide
Part Number: 7106-3014

Description:
The Trauma Ankle Guide assists in pin placement for talar and calcaneal pins.

Engineering Data:
<table>
<thead>
<tr>
<th>Materials</th>
<th>Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aluminum</td>
</tr>
<tr>
<td></td>
<td>Ultem®</td>
</tr>
<tr>
<td>Distance Between Outer Pins</td>
<td>58.4mm</td>
</tr>
<tr>
<td>Diameter of Pin Hole at Center of Rotation of Guide</td>
<td>1.6mm</td>
</tr>
</tbody>
</table>

Used With:
1.6mm Wire, 5mm Tissue Protector, Trocar, 3.5mm Drill Sleeve, 5mm Half Pin, Trauma Ankle Clamp
5mm X 40mm X 1.6mm
Cannulated Half Pin
Part Number: 7106-5405

Description:
The 5mm Cannulated Half Pin is used in conjunction with a 1.6mm Wire for precise placement in the talar neck.

Engineering Data:

<table>
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<th>Material</th>
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</tr>
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<tbody>
<tr>
<td>Overall Length</td>
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<tr>
<td>Thread Length</td>
<td>40mm</td>
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<tr>
<td>Diameter</td>
<td>5mm</td>
</tr>
<tr>
<td>Cannulation</td>
<td>1.6mm</td>
</tr>
<tr>
<td>Connection</td>
<td>AO Connection</td>
</tr>
</tbody>
</table>

Used With:
Ankle Clamp, 1.6mm Wire, 1.6mm Wire Guide,
Cannulated Pin Tissue Protector, Cannulated Pin
Drill Sleeve, Cannulated Drill
Ankle Spanning Surgical Technique
Rationale

The JET-X® Central Unilateral Fixator is used to rapidly stabilize open and/or unstable fractures, to secure osteotomies and for fracture fixation (open and closed). It is especially useful in cases where the soft tissue damage prevents incisions and soft tissue recovery is needed.

Indications for the JET-X Central Ankle Fixator

1. The first part of a two-stage treatment protocol for complex pilon fractures (open reduction and internal fixation [ORIF] of the fibula and placement of an external fixation until soft tissue healing occurs to allow ORIF of the distal tibia).

2. The definitive treatment of ankle and plafond fractures that cannot be treated by ORIF (i.e. severely damaged soft tissue or open fractures).

JET-X Central Fixator Modular Quick Assembly

The modular components of the JET-X Central external fixation system can be quickly combined to construct a simple yet versatile ankle fixation frame. Simply snap-click the Offset Clamp and Ankle Clamp modules into the connecting ports at each end of a Central Body (short, standard or long).

Relevant Anatomy

Care must be taken to avoid neurovascular structures and intraarticular penetration. Shaded areas: Medial talar and medial calcaneal safe pin zones.
Placement of Ankle Pins

Step One
Make a stab wound in the skin one finger breadth inferior and one finger breadth anterior to the medial malleolus parallel to the talus.

Step Two
Bluntly dissect down to the neck of the talus. Place 3.5mm drill guide into 5mm tissue protector, insert trocar and push to bone to find center of talar neck.
Placement of Ankle Pins (Cont.)

Step Three
Insert the 3.5mm graduated drill through the 3.5mm drill guide and tissue protector. With the C-arm coming from the ipsilateral side of the injury in the Mortise view (15° internal rotation from the AP) drill across the talus parallel to the dome.

Step Four
Verify drill placement on lateral C-arm (A). Remove 3.5mm drill and drill guide. Insert 5mm half pin through the 5mm tissue protector into the talus achieving bicortical purchase (B).

Option: Manually insert JET-X™ Half Pins using the T-handle connector. Attach half pin to the T-handle connector by pulling back on the gold locking collar.

Note: JET-X Half Pins are self-drilling and self-tapping, and may be inserted under power without pre-drilling.)
Placment of Ankle Pins (Cont.)

**Step Five**
Place the ankle clamp drill guide over the talar half pin, and then place the 5mm tissue protector over the talar half pin.

**Step Six**
Place a 5mm tissue protector and 3.5mm drill guide in the desired calcaneal slot, and line up the center of the ankle clamp drill guide at the subtalar joint. Make a stab wound and bluntly dissect to bone. Place the 5mm tissue protector and 3.5mm drill guide to bone. Insert self-drilling half pin or pre-drilled half pin. Remove ankle clamp drill guide.
Apply Fixator

Step Seven
Ensure the JET-X™ Central Body is extended at least 1cm to allow compression or distraction. Adjust fixator to appropriate length via telescoping Central Body. Lock Central Body telescoping lock using 6mm Allen Wrench.

Place the fixator over the talar and calcaneal pins. Tighten the anterior and posterior bolts on the ankle clamp with the 6mm Allen Wrench.

Insertion of Proximal Pins

Step Eight
Provisionally tighten the ball joints of the fixator using a 6mm Allen Wrench for added stability in placing the tibial half pins.

Use the pin clamp as a template. The spring-loaded pin clamp will provisionally hold 5mm tissue protectors in place. Make a stab incision and bluntly dissect to the anteromedial face of the tibia. Insert self-drilling or pre-drilled half pins through the 5mm tissue protector. (See Step 3 for pre-drilling technique.) Remove the tissue protectors and tighten the pin clamps around the half pins. Leave 2cm between fixator and skin for swelling. Pins can be cut at the fixator level and pin caps applied.

Supplementary half pins can be used for additional stability. (See Pin Tower on Page 22.)
Fracture Reduction and Adjustment

Ball joints allow adjustment in multiple planes.

Step Nine

The JET-X® Central Ankle Fixator is designed to facilitate obtaining anatomical reduction. Manual traction and closed manipulation of the fracture to achieve the best possible reduction prior to placing half pins is recommended. Adjustments can be made in multiple planes:
(a) 360° of reduction capability by rotating the ball joints.
(b) Gross distraction by loosening the locking bolt in the telescoping Central Body.
(c) Flexion/Extension by articulating the Trauma Ankle Clamp.
(d) Gradual compression/distraction by using the snap-on Compression/Distraction Device.

Central Body telescoping lock allows gross distraction/compression.

The Compression/Distraction Device can be used for gradual distraction or compression – either intra- or post-operatively. Snap the C/D Device into ports on end caps of Central Body. Ensure the Central Body telescoping lock is loosened. Using the 6mm Allen Wrench, turn clockwise for compression and counterclockwise for distraction. Once the desired compression/distraction is obtained, lock the Central Body telescoping bolt. One revolution corresponds to 1mm of compression or distraction.
Fracture Reduction and Adjustment (Cont.)

Each ball joint on the JET-X™ Central Unilateral Fixator provides 360° of rotation about the axis of the fixator, within 40° of angulation, for smooth anatomical reduction.

Final Fixator Tightening

Step Ten
After reduction is achieved, ensure the pin clamp bolts, ball joint bolts, telescoping lock bolt and hinge bolt are all securely tightened with the 6mm Allen Wrench. No torque wrench is necessary. Tighten the ball joint bolt until the gap in the housing is completely closed.

Pin Tower
The Pin Tower allows placement of a half pin convergent to those placed through a Straight or T-clamp. Attach the Pin Tower to a clamp by threading the base of the Pin Tower into the threaded hole located on top of the T-clamp or on the side of the Straight Clamp. The Pin Tower base should not be tightened at this point, and the hinge bolt on the Pin Tower should be loose. Place the 5 mm tissue protector through the Pin Tower clamp, verify location of pin insertion and insert the half pin.

Note: JET-X Half Pins are self-drilling, but could be pre-drilled if desired.

Tighten the base of the Pin Tower with a 10mm wrench. Tighten the hinge joint and pin clamp bolts using the hex wrench.
Optional Cannulated Technique for Talar Pin Placement

Step One
Make a stab wound in the skin one finger breadth inferior and one finger breadth anterior to the medial malleolus parallel to the talus.

Step Two
Bluntly dissect down to the neck of the talus. Use the 5mm cannulated pin tissue protector, insert the 3.5mm cannulated pin drill sleeve with the inserted trocar to find the center of the talar neck. Remove the trocar. Insert the 1.6mm wire guide.

Step Three
With the C-arm coming from the ipsilateral side of the injury in the Mortise view (15° internal rotation from the AP view) drill the 1.6mm guide wire across the talus parallel to the dome.
Optional Cannulated Technique for Talar Pin Placement (Cont.)

Step Four
Verify guide wire placement on lateral C-arm. Remove 1.6mm wire guide and the 3.5mm cannulated pin drill sleeve. Drill the 5mm cannulated half pin over the guide wire into the talus achieving bicortical purchase.

Option: The talar pin placement may be pre-drilled using the 3.5/1.6mm graduated cannulated drill.)

Step Five
Place the ankle clamp drill guide over the talar half pin, and then place the 5mm tissue protector over the talar half pin. (See Step Six, Ankle Spanning Technique page 19.)

Note: JET-X® Half Pins have a tapered minor diameter and a constant major diameter which maintains excellent cortical contact even when pin is backed out to achieve optimal position.
Metaphyseal/Diaphyseal Technique
Rationale

Preoperative planning helps to ensure that the optimal fixator will be constructed for each case as dictated by the soft tissue injury and fracture pattern. It is important to first obtain gross manual alignment of the fracture.
JET-X° Bar Unilateral Fixator
Metaphyseal/Diaphyseal Technique

General Half Pin Application

Step One
With any diaphyseal fracture, prior reduction—especially rotation—is preferred. Place two half pins on one side of the fracture, preferably the shorter segment. Use the spring-loaded pin clamps to hold the 5mm tissue protectors in position.

Step Two
Make a stab skin incision, bluntly dissect to bone, and place the 5mm tissue protector to bone.

Step Three
Insert the 5mm self-drilling half pins. (Optionally, pre-drill with a 3.5mm drill.) Once the first pin is placed, leave the tissue protector guide in place and insert the second half pin in a similar fashion.

Step Four
Once the second half pin is placed, remove the two 5mm tissue protectors, and tighten the pin clamp.

Assemble the fixator: Snap lock selected pin clamps into selected Central Body ensuring that the Central Body of the fixator is lengthened at least 1cm for compression or distraction.

Step Five
Slightly tightening the ball joint using a 6mm Allen Wrench gives stability to the frame for placement of the second set of half pins.
General Half Pin Application
(Cont.)

Step Six
Use the second pin clamp as a template for pin placement. Insert the two half pins through the pin clamp on the opposite side of the fracture.

Step Seven
Tighten the second pin clamp using the 6mm Allen Wrench. Make final adjustments using ball joints and Central Body translation. Usually leave 2cm between skin and fixator for swelling.

Step Eight
Tighten all bolts using the 6mm Allen Wrench. Ball joints are sufficiently tightened when the gap in the housing is completely closed.

Step Nine
The JET-X™ Central Unilateral Fixator is designed to facilitate obtaining anatomical reduction. Manual traction and closed manipulation of the fracture to achieve the best possible reduction prior to placing half pins is recommended. Adjustments can be made in multiple planes:
(a) 360° of reduction capability by rotating the ball joints.
(b) Gross distraction by loosening the locking bolt in the telescoping Central Body.
(c) Gradual compression/distraction by using the snap-on Compression/Distraction Device.
(See Page 10 for diagram.)
JET-X™ Central External Fixator Applications

Tibial Shaft Frame
Fixator is usually placed along the medial face of the tibia avoiding the muscles of the tibia.

Additional half pins may be used for stability.

Proximal or Distal Tibia Metaphyseal Fracture
Placement of the T-clamp proximally anteromedially.
JET-X° Central External Fixator Applications (Cont.)

**Femoral Shaft Fracture**
Reduce the fracture, especially rotation. Apply the clamp laterally. If possible, the half pin should be at least 3cm from the fracture.

**Distal Femur Metaphyseal Fracture**
Place the T-clamp fixator distally with the anterior pin 1cm posterior to the anterior cortex and 1cm proximal to the distal condyle.

**Humerus**
Unilateral fixator placed laterally. The radial nerve crosses the potential half pin position so open placement at distal half pins is recommended.
Hybrid Surgical Technique
Rationale

The JET-X® Central Unilateral Fixator can easily accommodate either ILIZAROV® or TAYLOR SPATIAL FRAME® rings using the snap-fit Hybrid Ring Adaptor.

Indications

Metaphyseal and articular fractures in proximal and distal tibia and distal femur.
General Technique

Step One
Selection of either a full ring (distal tibia) and/or 5/8 ring (distal femur; proximal tibia) is preferred. The transfixing wire closest to the joint is inserted first, parallel to the joint surface. Olive wires or smooth wires can be placed. (Olive wires allow translation correction along the axis of the wire). The initial reference wire is tensioned using the dynametric wire tensioner to the full ring (130 kg) or 5/8 ring (110 kg).

The proper wire insertion technique is to push the wire through the soft tissue and drill through the bone using a moist lap to hold the wire during insertion. Use the C-arm to ensure the wire is parallel to the joint. Avoid the joint capsule (in the knee, 14mm below the joint laterally and 9mm below the joint medially).

Insert a second transfixing wire on the opposite side of the ring ensuring the ring remains parallel to the joint. Additional wires and half pins (using Rancho cubes) may be added for stability.
Fixator Quick Assembly

Step Two
Select a Central Body (short, standard or long). Snap Hybrid Ring Adaptor into one end of the Central Body and Straight Clamp into the other end.

Step Three
Using a 10mm wrench, attach the Hybrid Adaptor to the ring with the 2 bolts. The ball joint in the Hybrid Adaptor facilitates reduction and optimal pin placement by providing 20° of adjustment in any direction. Connect the 5/8 ring to the other ring using threaded rods and nuts.

Step Four
Select short or long Hybrid Struts. Insert the two mounting pins located on the hybrid strut-mounting bar into the central pin slots of the Straight Clamp.
Fixator Quick Assembly (Cont.)

Step Five
Attach the arms of the Hybrid Strut to the ring using 10mm bolts and a 10mm wrench. Note that strut arm telescopes for length adjustment.

Step Six
Manual traction and closed manipulation of the fracture to achieve the best possible reduction prior to placing half pins is recommended. The JET-X® Central fixator ball joint and telescoping Central Body provide 360° of rotation for adjustments. Provisionally tighten ball joints for stability while placing half pins. Adjustments can be made by: rotating the ball joints, gross distraction by loosening the locking bolt in the telescoping Central Body and by gradual compression/distraction by using the snap-on Compression/Distraction Device. (See Page 10 for diagram.)

Step Seven
Use the spring-loaded straight pin clamp as a template to hold the 5mm tissue protectors in place. Make a stab incision, bluntly dissect to bone and place tissue protector to bone.

Step Eight
Insert the 5mm half pins. (JET-X Half Pins are self-drilling, self-tapping and may be inserted under power. Each pin end is AO quick connect for faster technique.) (Option: pre-drill with 3.5mm drill.)

Step Nine
Tighten the pin clamp using 6mm Allen Wrench. Make final adjustments using ball joints and Central Body. The snap-on Compression/Distraction Device may be used intra- or post-operatively.

Step Ten
Leave 2cm between fixator and skin to allow for swelling. Tighten all bolts using 6mm Allen Wrench and 10mm wrench.
External Fixation Systems

**Important Medical Information**

**External Fixation Systems**

**Special Notes**
External fixation should be used only under the directions of physicians who have a thorough knowledge of the anatomy, physiology and surgical principles involved. Physicians are strongly encouraged to obtain instruction from experienced clinicians or to observe surgical application of the apparatus prior to its initial use.

**Description**
External Fixation Systems consist of various components used to build constructs to treat the indications listed below. External Fixation Systems are modular, therefore, different frame configurations are possible. An individualized configuration should be designed for each case to suit the specific application. Refer to supporting instruction information provided by Smith & Nephew or component information assembly instructions and surgical techniques for each individual external fixation system. All External Fixation System components are designed for SINGLE USE ONLY.

Unless outlined in supporting instructional information, each External Fixation System is designed as a system and does not allow the substitution of components from other systems or manufacturers.

External Fixation Systems are made from various types of metal, plastic, and composite materials. The component material is provided on the outside carton label.

The Compass™ Universal Hinge is used with the LIZAROV External Fixator to control distraction and rotation of an injured joint to regain, maintain or increase the range of motion of the joint. It utilizes circular frame and half-pin fixation techniques and procedures for placement of the device. The device is intended to be centered on the axis of rotation. The device allows some adjustability to permit adjustment on the axis. Please refer to the surgical technique for complete details of the recommended procedures.

THE TAYLOR SPATIAL FRAME utilizes computer software to recommend adjustments to the fixation frame based on surgeon-derived measurements and examination.

**Indications**
1. Post-Traumatic joint contracture which has resulted in loss of range of motion (not applicable for Hex-Fix)
2. Fractures and disease which generally may result in joint contractures or loss of range of motion and fractures requiring distraction
3. Open and closed fracture fixation
4. Pseudarthrosis of long bones
5. Limb lengthening by epiphysial or metaphysial distraction (not applicable for Compass Universal Hinge)
6. Correction of bony or soft tissue deformities (not applicable for Compass Universal Hinge)
7. Correction of segmental bony or soft tissue defects
8. Joint arthrodesis
9. Infected fractures or nonunions
10. The Distal Radius and Colles Fracture Frame are indicated for the management of comminuted intra-articular fractures of the distal radius
11. Calandruccio devices are indicated for arthrodesis of the ankle or subtal joints, as well as some select fractures, nonunion or osteotomy of the distal tibia and acute transverse fractures or nonunion of the distal tibia.

**Contraindications**
External fixation devices are contraindicated for use in uncooperative or mentally incompetent patients who are unable to follow the postoperative regimen.

Calandruccio devices are also contraindicated for fractures that will most likely heal satisfactorily with noninvasive conservative management, either casting or cast bracing without loss of joint function. Other contraindications include fractures or nonunions which do not permit multiple pin fixation in the coronal plane and patients with medical problems that require weight-bearing on the extremity.

**Warnings**
1. The correct selection of device components is extremely important. The appropriate type and size should be selected for the patient based on injury, weight, compliance, etc.
2. Preliminary frame assembly is recommended to reduce operative times and to assure an adequate supply of components prior to surgery.
3. Intraoperative fracture or instrument breakage can occur. Instruments which have been used extensively or with excessive force are susceptible to fracture. Examine all instruments for wear and damage prior to surgery. Replace where necessary.
4. Correction of varus, valgus, procurvatum and recurvatum movement of limb segments during distraction should be planned preoperatively by selecting an appropriate prophyllactic ring and strategically positioning wires with stoppers, fulcrums, half pins and hinges.
5. Wire and pin placement requires strict anatomical consideration to avoid damage to nerves, muscles, tendons and vessels. Wires should be gently pushed through soft tissue, not drilled, to reduce the possibility of injury.
6. Wire drilling through the bone should be done slowly to avoid heat necrosis of surrounding tissues and bone.
7. Use caution when handling the sharp tips of wires. The tip of the wire should be held when clamped. Eye protection is recommended for operating room personnel.
8. Pin/wire site care is crucial in reducing infections.
9. Periodic postoperative follow-up and radiographs are recommended during the distraction phase.

**Precautions**
1. Use extreme care in handling and storing components. Cutting, bending or scratching the surface of components can reduce the strength and fatigue life of the device. Any components damaged during the course of the treatment should be replaced. Wire bending can be avoided by using various types of washers to build the ring to the wire.
2. Surgical technique information is available upon request. The surgeon should be familiar with the devices, instruments and surgical technique prior to surgery.
3. Unless specified, only components from the same system should be used together. Refer to supporting instruction information for details on each external system.
4. Proper fixation and assembly of components are essential. All wires and miscellaneous parts should be securely fastened with the appropriate instrument. Wires should be tensioned as specified in product literature.
5. The proper wire diameter should be used to ensure sufficient wire strength and to maintain appropriate axial stiffness of the apparatus. The 1.8 mm wires are usually recommended for the tibia and femur in normal adults, while the 1.5 mm wires are usually recommended for the upper limbs and pediatric lower limb applications.
6. The diameter of the rings, assembled half rings or frames, are recommended to be about 4 cm larger than the maximum diameter of the operated limb segment to accommodate swelling
7. Wire security, wire tension, and device frame integrity should be routinely checked. The gap at a fracture site should be reassessed during healing. Adjustments should be made as necessary.
8. The patient should be instructed to report any adverse or unanticipated effects to the physician as soon as possible and should also be advised of the distraction and adjustment requirement.
9. Preoperative planning for the Taylor Spatial Frame requires special software and programs. Accurate inputs are critical for accurate results. Verify and double check all input parameters. The computer program should be run twice to verify that the parameters have been correctly entered into the software. The Taylor Spatial Frame can be used as a template to compare the adjusted frame to the deformity to verify fit. Output of strut lengths from the program can exceed any strut length for a particular preassembled frame. If this occurs, refer to Surgical Technique and Instruction Manuals.
10. Intraoperative placement of the Taylor Spatial Frame according to preoperative plans is imperative to achieve predetermined results. If intraoperative conditions require a change to frame placement (eccentricity) or size (parameters), new strut lengths should be calculated by entering the new inputs into the program. Small changes may affect accuracy of outcome.
11. Touch down weight bearing may be allowed postoperatively. Weight bearing may be increased as the callus thickens.
12. For patients with Calandruccio devices, postoperative care and physical therapy should be structured to prevent weight bearing on the operated leg until sufficient healing is evident on the x-ray.

**Adverse Effects**
1. Damage to nerves or vessels resulting from insertion of wires and pins
2. Infection including persistent drainage of the pin tracts or after wire removal, chronic pin/wire site osteomyelitis
3. Edema or swelling, possible compartment syndrome
4. Joint contracture, loss of range of motion or reduction, joint subluxation or dislocation
5. Septic arthritis and osteomyelitis
6. Loosening or breakage of the pins, wires or other components including inadvertent injury to the patient or operating room personnel caused by the wire (e.g. projectile wire from tip cutting during surgery)
7. Intractable pain or delayed unions or both
8. Persistence or recurrence of the initial condition requiring treatment
9. Recuperation to replace a component or the entire apparatus
10. Foreign body reaction to pins, wires or other components
11. Tissue necrosis occurring during pin or wire insertion or at the pin/wire tissue junction
12. Excessive operative bleeding or muscle tendon impairment
13. Skin pressure problems caused by external components
14. The intrinsic risks associated with anesthesia
15. Premature consolidation during bone elongation
16. Secondary equines contracture
17. Failure of bone to regenerate satisfactorily, development or persistence of nonunion or pseudo-arthritis
18. Fracture of regenerated bone or fracture through a hole after removal of the device
19. Abnormal growth plate development in patients who are not skeletally mature, including premature fusion and slowed or accelerated growth
20. Loss of bone mass due to “stress shielding”
21. Limb length discrepancy
22. Bone sequestration secondary to rapid drilling of the bony cortex, with heat build-up and bone necrosis
23. Excessive motion at the fracture site due to failure to tighten the component parts of the device; improper tensioning of wires, flexion from use of too few pins or pins that are too small
24. Ankle stiffness if multiple transfusion pins are used in tibial fractures
25. Thrombosis, late erosion or arteriovenous fistulas
26. Persistent drainage after wire removal, chronic wire site osteomyelitis
27. Bone deformity
28. Inability to compress the bone surface if the pins are not securely seated in bone
PACKAGING
Components should only be accepted if received by the hospital or surgeon with the factory packaging and labeling intact.

STERILIZATION/RESTERILIZATION
Unless specifically labeled sterile, the implants and instruments are supplied non-sterile and must be sterilized prior to use. “In-a-Box” components (Hex-in-a-Box, Universal-in-a-Box, Pelvic-in-a-Box, etc.) are supplied sterile and have been sterilized by ethylene oxide gas. All radiation sterilized components have been exposed to a minimum of 25 kiloGrays of gamma radiation. The method of sterilization is noted on the package label.

Metal components may be initially sterilized or resterilized, if necessary, by steam autoclaving in appropriate protective wrapping, after removal of all original packaging and labeling. Protect the devices, particularly mating surfaces, from contact with metal or other hard objects which could damage the product. The following process parameters are recommended for these devices:

• Prevacuum Cycle: 4 pulses (Maximum = 26.0 psig (2.8 bars) & Minimum = 10.0 inHg (339 millibars)) with a minimum dwell time of 4 minutes at 270°F to 275°F (132°C to 135°C), followed by a 1 minute purge and at least 15 minutes of vacuum drying at 10 inHg (339 millibars) minimum.

Smith & Nephew does not recommend the use of gravity cycles or flash sterilization.

If the “In-a-Box” components are to be resterilized in their packaged containers, they should be resterilized by ethylene oxide gas. Plastic components may also be sterilized by ethylene oxide gas. The following parameters are recommended as starting points for cycle validation by the health care facility:

<table>
<thead>
<tr>
<th>Sterilant</th>
<th>Temp.</th>
<th>Humidity</th>
<th>Maximum Pressure</th>
<th>Concentration</th>
<th>Exposure</th>
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<tbody>
<tr>
<td>10% EtO</td>
<td>130°F (55°C)</td>
<td>40-60%</td>
<td>28 PSIA (1930 millibar)</td>
<td>550-650 mg/L</td>
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<td>90% HFC/</td>
<td>100°F (38°C)</td>
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<td>28 PSIA (1930 millibar)</td>
<td>550-650 mg/L</td>
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<td>10% EtO</td>
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<td>30-60%</td>
<td>10 PSIA (689 millibar)</td>
<td>736 mg/L</td>
<td>30 minutes</td>
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Suggested initial aeration starting point for aeration validation is 12 hours at 122°F (50°C) with power aeration. Consult aerator manufacturer for more specific instructions.

INFORMATION
For further information, please contact Customer Service at (800) 238-7538 for calls within the continental USA and (901) 396-2121 for all international calls.

Caution: Federal Law (USA) restricts this device to sale by or on the order of a physician.


Catalog Information

Ring Adaptor
Cat. No. 7106-1047

Short Hybrid Support Strut
Cat. No. 7105-1048

Long Hybrid Support Strut
(Not Shown)
Cat. No. 7105-1049

Slotted Wire Fixation Bolt
(Not Shown)
Cat. No. 10-0700

1.8mm Olive Wire
(Not Shown)
Cat. No. 10-2107

20mm Connection Bolt
(Not Shown)
Cat. No. 10-3203

10mm Nut
(Not Shown)
Cat. No. 10-3300
5mm Centering Sleeve  
Cat. No. 10-3405

1-Hole Rancho Cube  
Cat. No. 10-3451

3-Hole Rancho Cube  
Cat. No. 10-3453

Dynametric Wire Tensioner  
Cat. No. 10-3101

JET-X° Central Hybrid Case  
(Not Shown)  
Cat. No. 7105-3060

Small Outer Case  
(Not Shown)  
Cat. No. 7112-9401

Lid for Outer Case  
(Not Shown)  
Cat. No. 7112-9402

8mm Central Body Bolt  
Cat. No. 7105-3030
8mm Cap Pin Clamp Locking Bolt
Cat. No. 7105-3031

8mm Pin Clamp Spring
Cat. No. 7105-3032

8mm Central Body Lock Bolt Washer
Cat. No. 7105-3033

8mm Ball Joint Locking Bolt
Cat. No. 7105-3038

Short Central Body
Cat. No. 7105-1041

Standard Central Body
(Not Shown)
Cat. No. 7105-1042

Long Central Body
(Not Shown)
Cat. No. 7105-1043

Trauma Ankle Clamp
Cat. No. 7105-1054
Offset Clamp
Cat. No. 7105-1722

Straight Clamp
Cat. No. 7105-1045

T-Clamp
Cat. No. 7105-1046

Short Compression/ Distraction Module
Cat. No. 7105-1051

Standard Compression/ Distraction Module
(Not Shown)
Cat. No. 7105-1052

Long Compression/ Distraction Module
(Not Shown)
Cat. No. 7105-1053

Short Half Pins
Cat. No. Size
7106-5301 5mm X 30mm
7106-5401 5mm X 40mm
7106-5701 5mm X 70mm
Pin Tower
Cat. No. 7105-1018

6mm Allen Wrench
Cat. No. 7105-3006

A/O T-Handle Connector
with 10mm Socket
Cat. No. 7106-3001

10mm Ratchet
Cat. No. 7106-3003

3.5mm Graduated Drill
with AO Connector
Cat. No. 7106-3006

5mm Tissue Protector
Cat. No. 7106-3007

5mm Short Tissue Protector
(Not Shown)
Cat. No. 7106-3016
3.5mm Drill Sleeve
Cat. No. 7106-3008

5mm Trocar
Cat. No. 7106-3012

Trauma Ankle Clamp
Drill Guide
Cat. No. 7106-3014

JET-X® Central Trauma
Instrument Case
(Not Shown)
Cat. No. 7105-3050

Large Outer Case
(Not Shown)
Cat. No. 7112-9400

Lid for Outer Case
(Not Shown)
Cat. No. 7112-9402

5mm x 40mm x 1.6mm Cannulated
Half Pin
Cat. No. 7106-5405
3.5mm/1.6mm Graduated Cannulated Drill
Cat. No. 7106-3013

1.6mm x 240mm Wire
Cat. No. 7105-1039

1.6mm Wire Guide
Cat. No. 7106-3011

3.5mm/1.6mm Cannulated Drill
(Not Shown)
Cat. No. 7106-3013

5mm Cannulated Pin
Tissue Protector
(Not Shown)
Cat. No. 7106-3017

3.5mm Cannulated Pin
Drill Sleeve
(Not Shown)
Cat. No. 7106-3018

5 mm x 40 mm x 175,
1.6 mm Cannulated
Cat. No. 7106-5405
### Implants

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<th>Description</th>
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<td>10-2107</td>
<td>1.8mm Olive Wire</td>
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<td>10-3203</td>
<td>20mm Connection Bolt</td>
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<td>10-3300</td>
<td>10mm Nut</td>
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<td>10-3405</td>
<td>5mm Centering Sleeve</td>
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<tr>
<td>10-3451</td>
<td>1-Hole Rancho Cube</td>
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<tr>
<td>10-3443</td>
<td>3-Hole Rancho Cube</td>
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<td>7105-1047</td>
<td>Ring Adaptor</td>
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<td>7105-1048</td>
<td>Short Hybrid Support Strut</td>
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<td>Long Hybrid Support Strut</td>
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### Instruments

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### Replacement Parts

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<td>8mm Central Body Bolt</td>
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<td>8mm Cap Pin Clamp Locking Bolt</td>
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<tr>
<td>7105-3032</td>
<td>8mm Pin Clamp Spring</td>
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<tr>
<td>7105-3033</td>
<td>8mm Central Body Lock Bolt Washer</td>
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<tr>
<td>7105-3038</td>
<td>8mm Ball Joint Locking Bolt</td>
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</table>
# JET-X® Central Trauma Implant/Instrument Set
Cat. No. 7105-9005

## Implants
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<td>T-Clamp</td>
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<td>Short Compression/Distraction Module</td>
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<td>5mm x 70mm Short Half Pin</td>
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<td>7106-3001</td>
<td>AO T-Handle Connector with 10mm Socket</td>
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<tr>
<td>7106-3003</td>
<td>10mm Ratchet</td>
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<tr>
<td>7106-3006</td>
<td>3.5mm Graduated Drill with AO Connector</td>
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<td>7106-3007</td>
<td>5mm Tissue Protector</td>
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<td>3.5mm Drill Sleeve</td>
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<td>7106-3012</td>
<td>5mm Trocar</td>
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<td>Trauma Ankle Clamp Drill Sleeve</td>
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<tr>
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<td>1.6mm Wire Guide</td>
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<td>3.5mm/1.6mm Cannulated Drill</td>
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<td>7106-3017</td>
<td>5mm Cannulated Pin Tissue Protector</td>
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<td>3.5mm Cannulated Pin Drill Sleeve</td>
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<td>7106-5405</td>
<td>5mm x 40mm x 175mm, 1.6mm Cannulated</td>
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