

Ankle Spanning, Metaphyseal/Diaphyseal,  
Optional Cannulated and Hybrid





# JET-X<sup>◇</sup> BAR Unilateral Fixator

## Ankle Spanning, Metaphyseal/Diaphyseal, Optional Cannulated and Hybrid Surgical Technique

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### 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/Distracton 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:**

Materials	Stainless Steel
Overall Height	63.4mm
Overall Width	15.9mm
Wrench Needed	10mm Wrench 6mm Allen Wrench

**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:

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

## Used With:

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

# 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:

Materials	Carbon Fiber Composite High Strength Aluminum Stainless Steel
Total Angulation at the Ball	40°
Length	102.6mm
Diameter	37mm
Distance from Outer Pins to Center Pin	23mm
Distance Between Outer Pins	46mm
Wrench Needed	6mm Allen Wrench

## Used With:

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

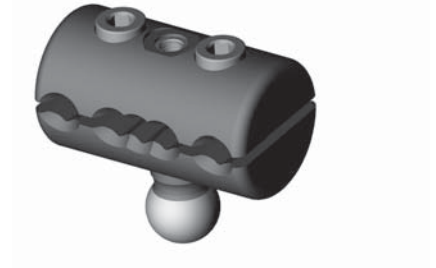
# T-Clamp

**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:

Materials	Carbon Fiber Composite High Strength Aluminum Stainless Steel
Total Angulation at the Ball	40°
Width	63.2mm
Distance from Outer Pins to Center Pin	23mm
Distance Between Outer Pins	46mm
Wrench Needed	6mm Allen Wrench

## Used With:

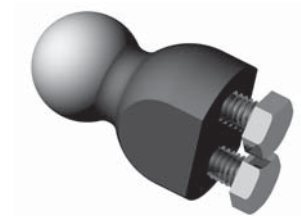
Central Body, Half Pin, Tissue Protector, Drill Sleeve, Trocar, 6mm Allen Wrench

# 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:

Materials	High Strength Aluminum Stainless Steel
Wrench Needed	10mm Wrench (Ring) 6mm Allen Wrench (Central Body)

## 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**

Materials	High Strength Aluminum Stainless Steel
Total Telescoping Movement	57.2mm
Wrench Needed	10mm Wrench 6mm Allen Wrench

**Long Hybrid Strut**

Materials	High Strength Aluminum Stainless Steel
Total Telescoping Movement	108mm
Wrench Needed	10mm Wrench 6mm Allen Wrench

**Used With:**

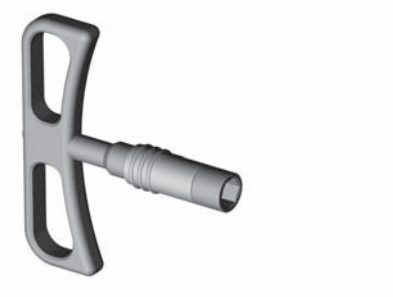
Straight Clamp, ILIZAROV™ Ring, TAYLOR SPATIAL FRAME° Ring, 10mm Wrench, 6mm Allen Wrench

# 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:**

Material	Stainless Steel
Overall Size (Top of Handle to End of Socket)	91.4mm
Handle Size	101.6mm x 31.2 mm
Connection 10mm Socket	AO Connection

**Used With:**

Ring Adaptor, 5mm Half Pin, 10mm Connector

# Compression/Distraktion Device

**Part Number:** 7105-1051 Short Central Body  
7105-1052 Standard Central Body  
7105-1053 Long Central Body



## Description:

The Compression/Distraktion 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

Materials	Stainless Steel
Teflon®	
Overall Distracted Length	110mm
Overall Compressed Length	90mm
Total Distraction	20mm
Wrench Needed	6mm Allen Wrench

### Long C/D Device

Materials	Stainless Steel
Teflon	
Overall Distracted Length	219.5mm
Overall Compressed Length	144.5mm
Total Distraction	75mm
Wrench Needed	6mm Allen Wrench

### Standard C/D Device

Materials	Stainless Steel
Teflon	
Overall Distracted Length	149.5mm
Overall Compressed Length	109.5mm
Total Distraction	40mm
Wrench Needed	6mm Allen Wrench

## 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:

Material	Stainless Steel
Overall Length	190mm

## Used With:

Central Body, Straight Clamp, T-Clamp, Trauma Ankle Clamp, Pin Tower  
Compression/Distraktion 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:

Material	Stainless Steel
Overall Length	165.1mm
Diameter	3.5mm
Cannulation	1.6mm
Connection	AO Connection

### 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:

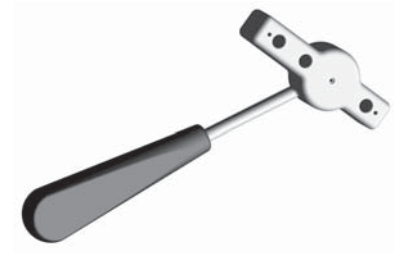
The Trauma Ankle Guide assists in pin placement for talar and calcaneal pins.

### Engineering Data:

Materials	Stainless Steel Aluminum Ultem®
Distance Between Outer Pins	58.4mm
Diameter of Pin Hole at Center of Rotation of Guide	1.6mm

### 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:

Material	Stainless Steel
Overall Length	175mm
Thread Length	40mm
Diameter	5mm
Cannulation	1.6mm
Connection	AO Connection

### 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).

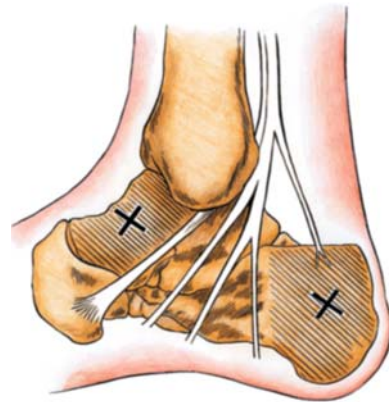


## JET-X Central Fixator Modular Quick Assembly

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.

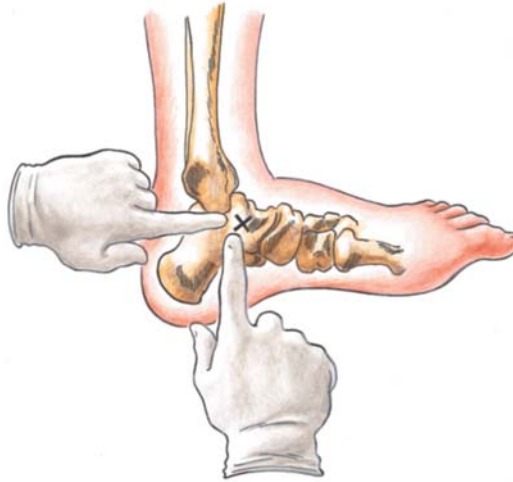


# JET-X<sup>◇</sup> Bar Unilateral Fixator Ankle Spanning Surgical Technique

## Placement of Ankle Pins

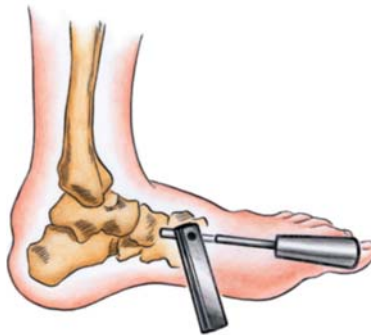
### Step One

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.

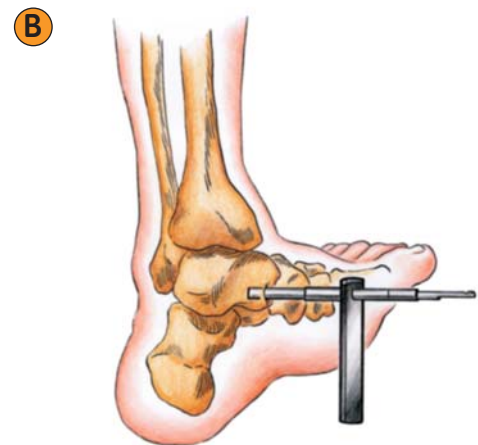


### Step Four

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.

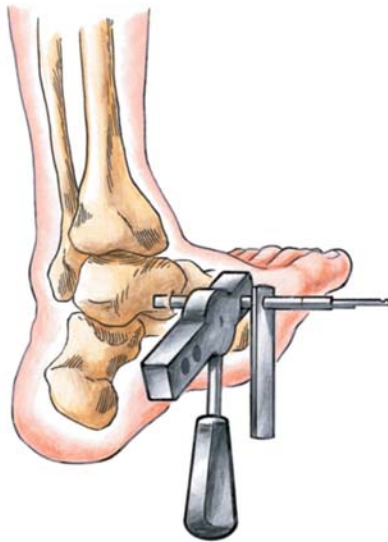
**Note:** JET-X Half Pins are self-drilling and self-tapping, and may be inserted under power without pre-drilling.)



## Placment of Ankle Pins (Cont.)

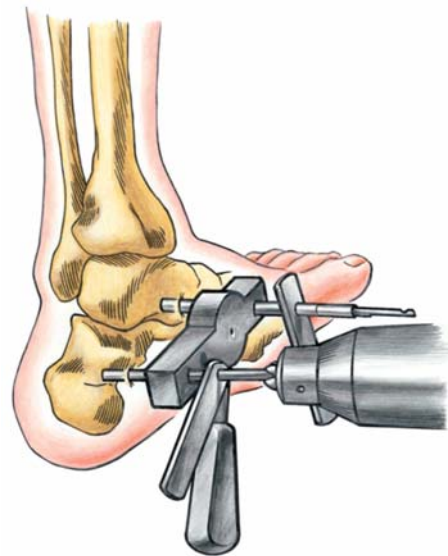
### Step Five

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<sup>®</sup> 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.



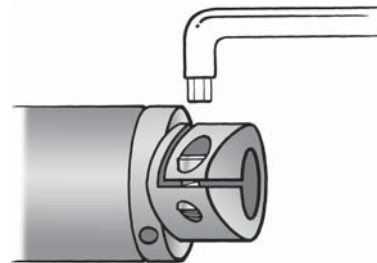
Place the fixator over the talar and calcaneal pins. Tighten the anterior and posterior bolts on the ankle clamp with the 6mm Allen Wrench.



## Insertion of Proximal Pins

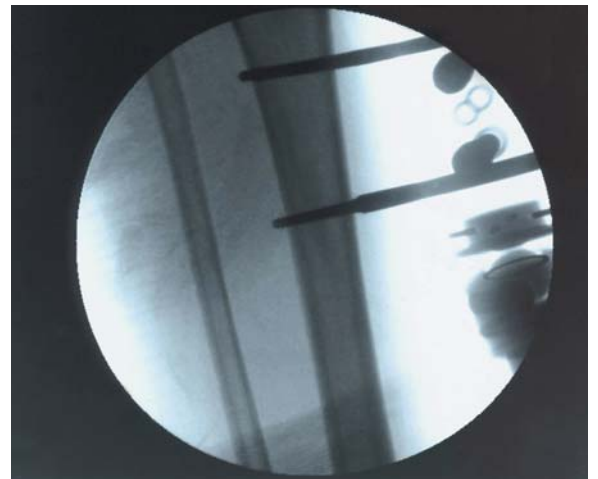
### Step Eight

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<sup>®</sup> 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.

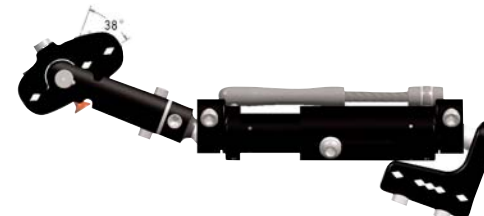
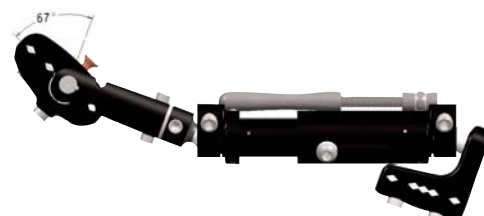
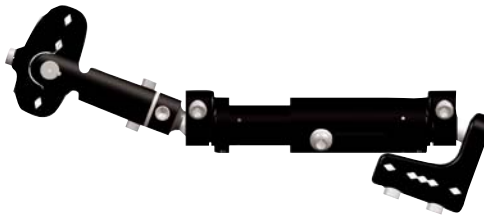
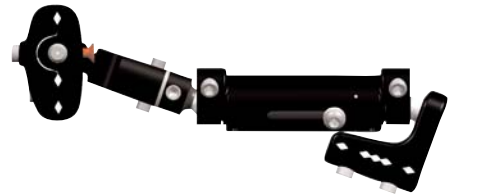


40° of total angulation



360° of rotation about the axis of the fixator

Articulating ankle hinge provides up to 38° of plantar flexion and 67° of dorsiflexion. Once positioned, tighten the center hinge bolt on the trauma ankle clamp.



## Fracture Reduction and Adjustment (Cont.)

Each ball joint on the JET-X<sup>®</sup> 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.

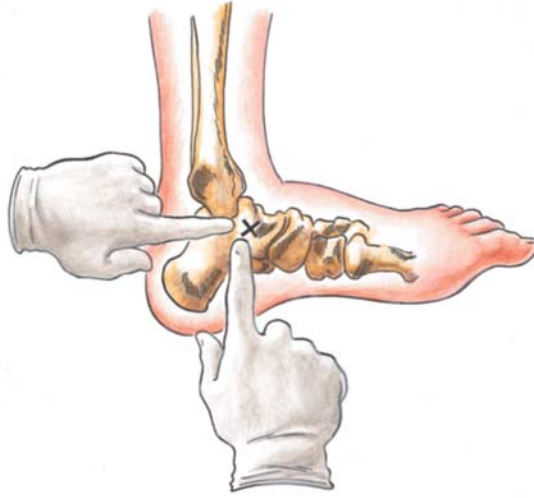
Tighten the base of the Pin Tower with a 10mm wrench. Tighten the hinge joint and pin clamp bolts using the hex wrench.



# Optional Cannulated Technique for Talar Pin Placement

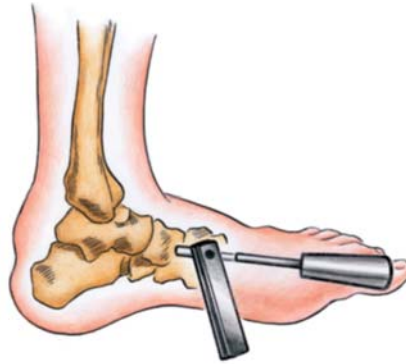
## Step One

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.

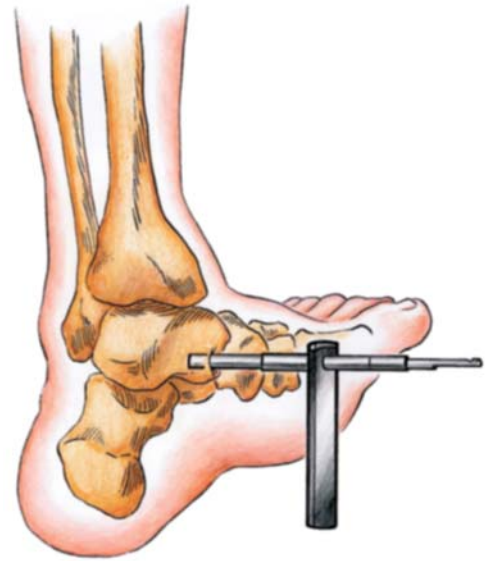


## Optional Cannulated Technique for Talar Pin Placement (Cont.)

### 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.

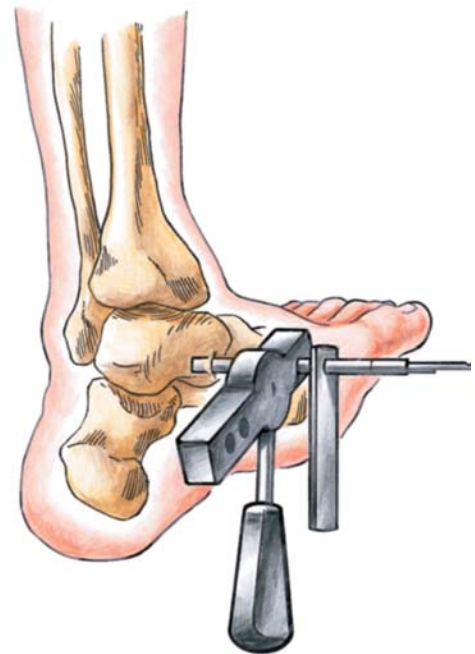
**Option:** The talar pin placement may be pre-drilled using the 3.5/1.6mm graduated cannulated drill.)



### 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<sup>®</sup> 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<sup>◇</sup> Bar Unilateral Fixator Metaphyseal/Diaphyseal Technique

## General Half Pin Application

### Step One

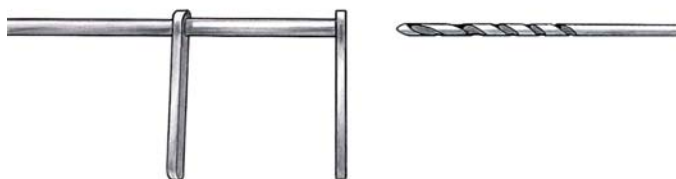
With any diaphyseal fracture, prior reduction—especially rotation—is preferred. Place two half pins on one side of the fracture, preferably the shorter segment. Use the spring-loaded pin clamps to hold the 5mm tissue protectors in position.

### 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

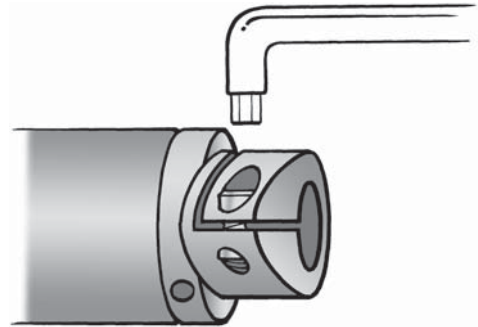
Tighten all bolts using the 6mm Allen Wrench. Ball joints are sufficiently tightened when the gap in the housing is completely closed.

## Step Nine

The JET-X<sup>®</sup> 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/Distractor Device.

(See Page 10 for diagram.)

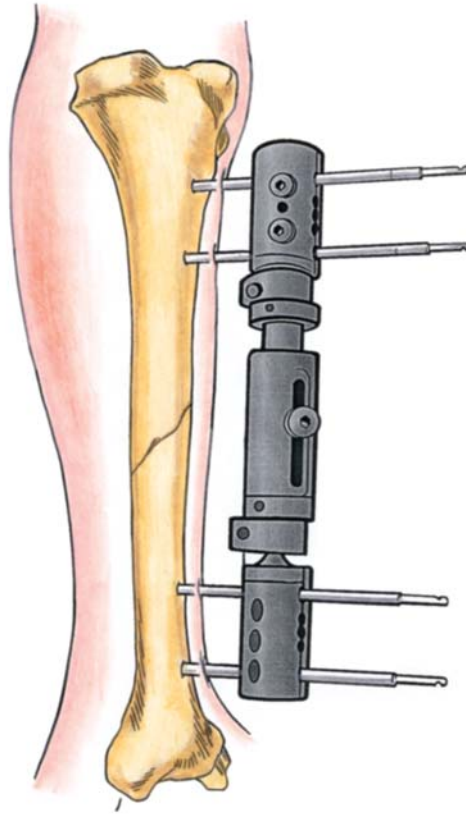


# JET-X<sup>®</sup> Central External Fixator Applications

## Tibial Shaft Frame

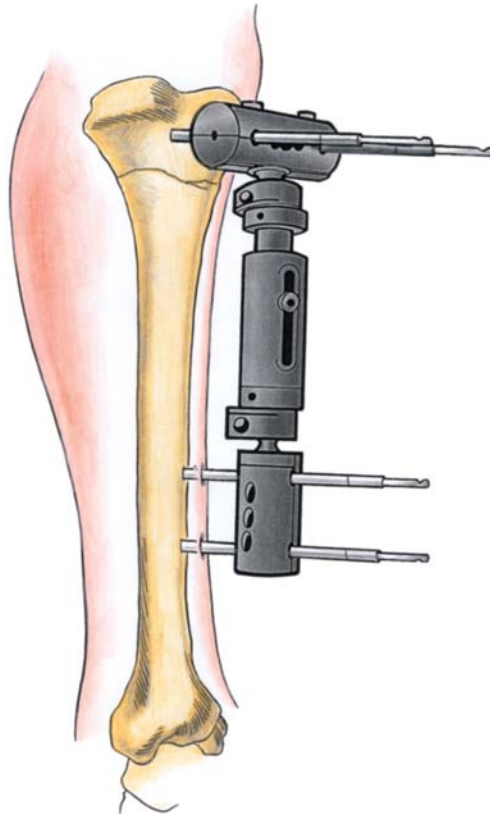
Fixator is usually placed along the medial face of the tibia avoiding the muscles of the tibia.

Additional half pins may be used for stability.



## Proximal or Distal Tibia Metaphyseal Fracture

Placement of the T-clamp proximally anteromedially.



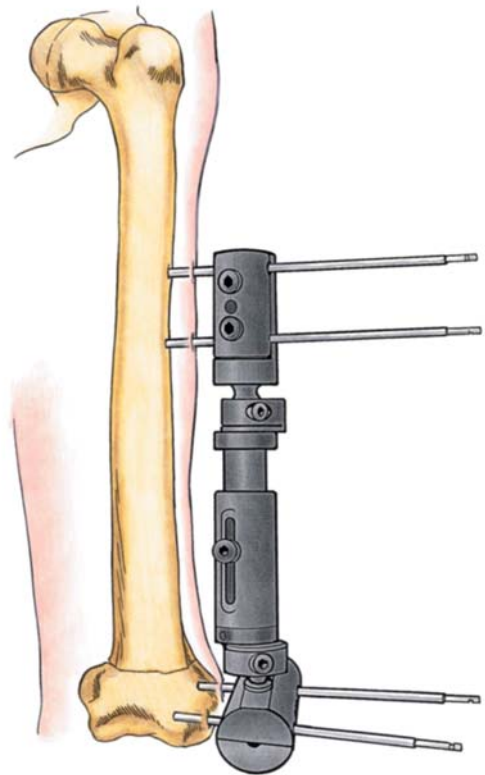
## JET-X<sup>o</sup> Central External Fixator Applications (Cont.)

### 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.

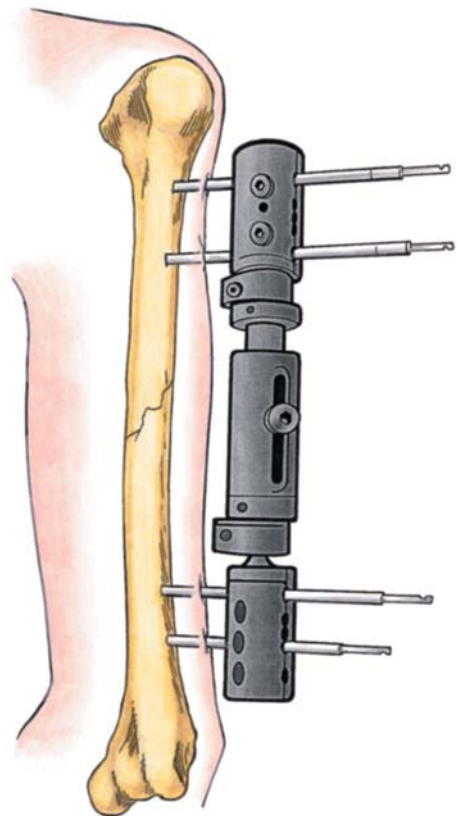
### Distal Femur Metaphyseal Fracture

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.

# JET-X<sup>◇</sup> Bar Unilateral Fixator Hybrid Technique

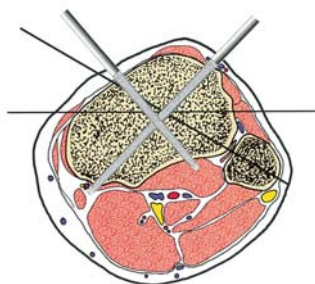
## General Technique

### Step One

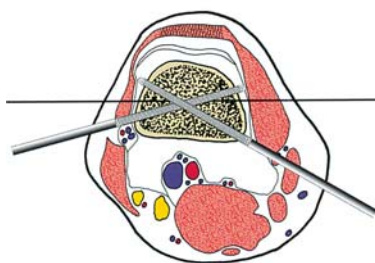
Selection of either a full ring (distal tibia) and/or 5/8 ring (distal femur; proximal tibia) is preferred. The transfixing wire closest to the joint is inserted first, parallel to the joint surface. Olive wires or smooth wires can be placed. (Olive wires allow translation correction along the axis of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

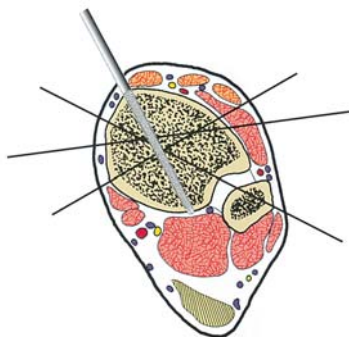
Insert a second transfixing wire on the opposite side of the ring ensuring the ring remains parallel to the joint. Additional wires and half pins (using Rancho cubes) may be added for stability.



Proximal Tibia<sup>†</sup>



Femur Anterior<sup>†</sup>



Distal Tibia<sup>†</sup>

## Fixator Quick Assembly

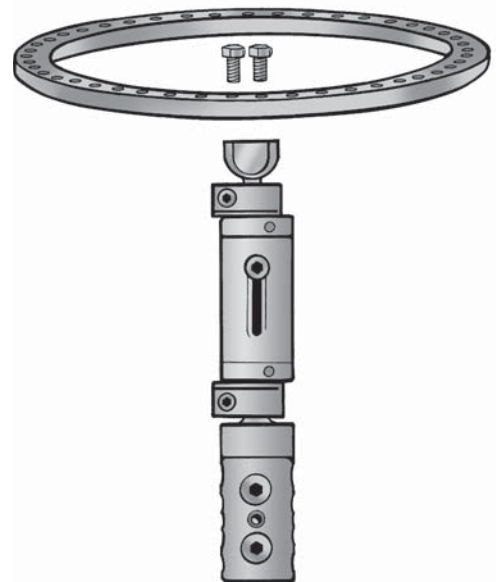
### Step Two

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.



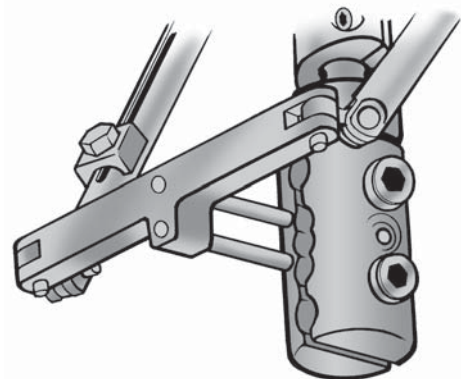
### Step Three

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

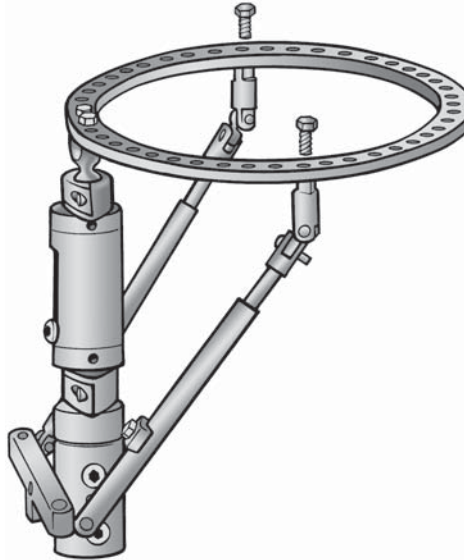
Select short or long Hybrid Struts. Insert the two mounting pins located on the hybrid strut-mounting bar into the central pin slots of the Straight Clamp.



## 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<sup>®</sup> 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/Distractor 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/Distractor 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.



# 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 ILIZAROV 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. Pseudoarthrosis of long bones
5. Limb lengthening by epiphyseal or metaphyseal 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 subtalar 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 prophylactic ring tilt 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 clipped. 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/pin security in bone, 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. projective 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. Reoperation 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 impalement
13. Skin pressure problems caused by external components
14. The intrinsic risks associated with anesthesia
15. Premature consolidation during bone elongation
16. Secondary equinus contracture
17. Failure of bone to regenerate satisfactorily; development or persistence of nonunion or pseudo-arthrosis
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 transfixion 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:

Sterilant	Temp.	Humidity Pressure	Maximum	Concentration Time	Exposure
10% EtO 90% HCFC	130°F (55°C)	40-60%	28 PSIA (1930 millibar)	550-650 mg/L	120 minutes
10% EtO 90% HCFC	100°F (38°C)	40-60%	28 PSIA (1930 millibar)	550-650 mg/L	6 hours
100% EtO	131°F (55°C)	30-60%	10 PSIA (689 millibar)	736 mg/L	30 minutes

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.**

<sup>1</sup> Dickson, KF; Montgomery, S; Field, J "High Energy Plafond Fractures Treated by a Spanning External Fixator Initially and Followed by a Second Stage Open Reduction Internal Fixation of the Articular Surface Preliminary Report." *Injury*. Dec 2001; 32 Suppl 4:92-8.

<sup>2</sup> M Sirkin et al. "A staged protocol for soft tissue management in the treatment of complex pilon fractures." *Journal of Orthopaedic Trauma*. 1999; 13,2. 78-84.

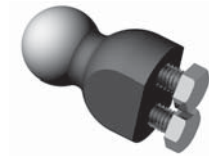
<sup>3</sup> Mark D Santi and Michael J Botte. "External Fixation of the Calcaneus and Talus: An Anatomical Study for Safe Pin Insertion." *Journal of Orthopaedic Trauma*. 1996; 10:487-491. Illustration modified with permission of the publisher.

<sup>4</sup> Maurizio A Catagni, MD. Atlas for the insertion of transosseous wires and half-pins, Ilizarov Method. 2002, 22 & 33.

# 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<sup>®</sup> 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



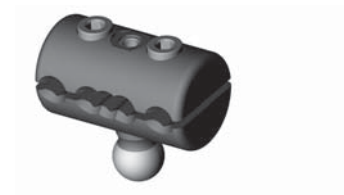
Offset Clamp  
Cat. No. 7105-1722



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



## JET-X<sup>o</sup> Central Trauma Sterilization Case

(Not Shown)

Cat. No. 7105-1040

## 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<sup>®</sup> 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



## JET-X<sup>®</sup> Central Trauma Hybrid Set

Cat. No. 7105-9004

### Implants

Cat. No.	Description
10-0700	Slotted Wire Fixation Bolt
10-2107	1.8mm Olive Wire
10-3203	20mm Connection Bolt
10-3300	10mm Nut
10-3405	5mm Centering Sleeve
10-3451	1-Hole Rancho Cube
10-3443	3-Hole Rancho Cube
7105-1047	Ring Adaptor
7105-1048	Short Hybrid Support Strut
7105-1049	Long Hybrid Support Strut

### Instruments

Cat. No.	Description
10-3101	Dynametric Wire Tensioner
7105-3060	JET-X Central Hybrid Case
7112-9401	Small Outer Case
7112-9402	Lid for Outer Case

### Replacement Parts

Cat. No.	Description
7105-3030	8mm Central Body Bolt
7105-3031	8mm Cap Pin Clamp Locking Bolt
7105-3032	8mm Pin Clamp Spring
7105-3033	8mm Central Body Lock Bolt Washer
7105-3038	8mm Ball Joint Locking Bolt

# JET-X<sup>o</sup> Central Trauma Implant/

## Instrument Set

Cat. No. 7105-9005

### Implants

Cat. No.	Description
7105-1018	Pin Tower
7105-1040	JET-X Central Trauma Sterilization Case
7105-1041	Short Central Body
7105-1042	Standard Central Body
7105-1043	Long Central Body
7105-1045	Straight Clamp
7105-1046	T-Clamp
7105-1051	Short Compression/Distracton Module
7105-1052	Standard Compression/Distracton Module
7105-1053	Long Compression/Distracton Module
7105-1054	Ankle Clamp
7106-5301	5mm x 30mm Short Half Pin
7106-5401	5mm x 40mm Short Half Pin
7106-5701	5mm x 70mm Short Half Pin

### Instruments

Cat. No.	Description
7105-3006	6mm Allen Wrench
7105-3050	JET-X Central Trauma Instrument Case
7105-1039	1.6mm x 240mm Wire
7106-3001	AO T-Handle Connector with 10mm Socket
7106-3003	10mm Ratchet
7106-3006	3.5mm Graduated Drill with AO Connector
7106-3007	5mm Tissue Protector
7106-3008	3.5mm Drill Sleeve
7106-3012	5mm Trocar
7106-3014	Trauma Ankle Clamp Drill Sleeve
7106-3011	1.6mm Wire Guide
7106-3013	3.5mm/1.6mm Cannulated Drill
7106-3016	5mm Short Tissue Protector
7106-3017	5mm Cannulated Pin Tissue Protector
7106-3018	3.5mm Cannulated Pin Drill Sleeve
7106-5405	5mm x 40mm x 175mm, 1.6mm Cannulated
7112-9400	Small Outer Case
7112-9402	Lid for Outer Case



**Orthopaedics**  
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