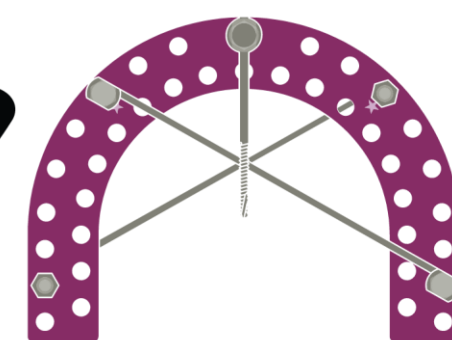


Revolution

EXTERNAL PLATING SYSTEM



SURGICAL TECHNIQUE

Product by

meta|ogix

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This technique offers recommendations for the use of the Revolution External Plating System.

The surgeon user must consider the needs of each patient and make adjustments when required.

All devices must be sterilized before surgery. Sterilization instructions can be seen in the Instructions for Use.

Please Contact your local Metalogix representative for further questions.

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1. Indications and Contraindications

INDICATIONS

The Revolution External Plating System is indicated for treatment of a variety of broken or deformed bones:

- Stabilizes open and/or unstable fracture of complex proximal and/or distal tibial fractures
- Fusions of the joints and bone (hand, foot, long-bone)
- Correction of bone or soft tissue deformities
- Correction of segmental or non-segmental bone, soft tissue defects or bone loss
- Neutralization of fractures stabilized with limited internal fixation
- Adult and Pediatric subgroups except newborns

CONTRAINDICATIONS

The Revolution External Plating System is NOT designed or sold for any use except as indicated. Use of the system is contradicted in the following situations:

- Patient with compromised immune system
- Non-compliant patient who would not be able to ensure proper frame adjustment or wire and pin care
- Any fracture, where rigid fixation or reduction cannot be achieved by means of external fixation

MRI SAFETY INFORMATION

The Revolution External Plating System has not been evaluated for safety and compatibility in the MR environment. It has not been tested for heating, migration, or image artifact in the MR environment. The safety of the Revolution External Plating System in the MR environment is unknown. Scanning a patient who has this device may result in patient injury.

LOAD-BEARING INFORMATION

It is recommended to use a total of four (4) struts and 5mm or 6mm Half Pins for weight bearing.

PEDIATRIC WARNING

Particular care should be taken that wires and half pins do not enter the joints or damage the growth plates in children.

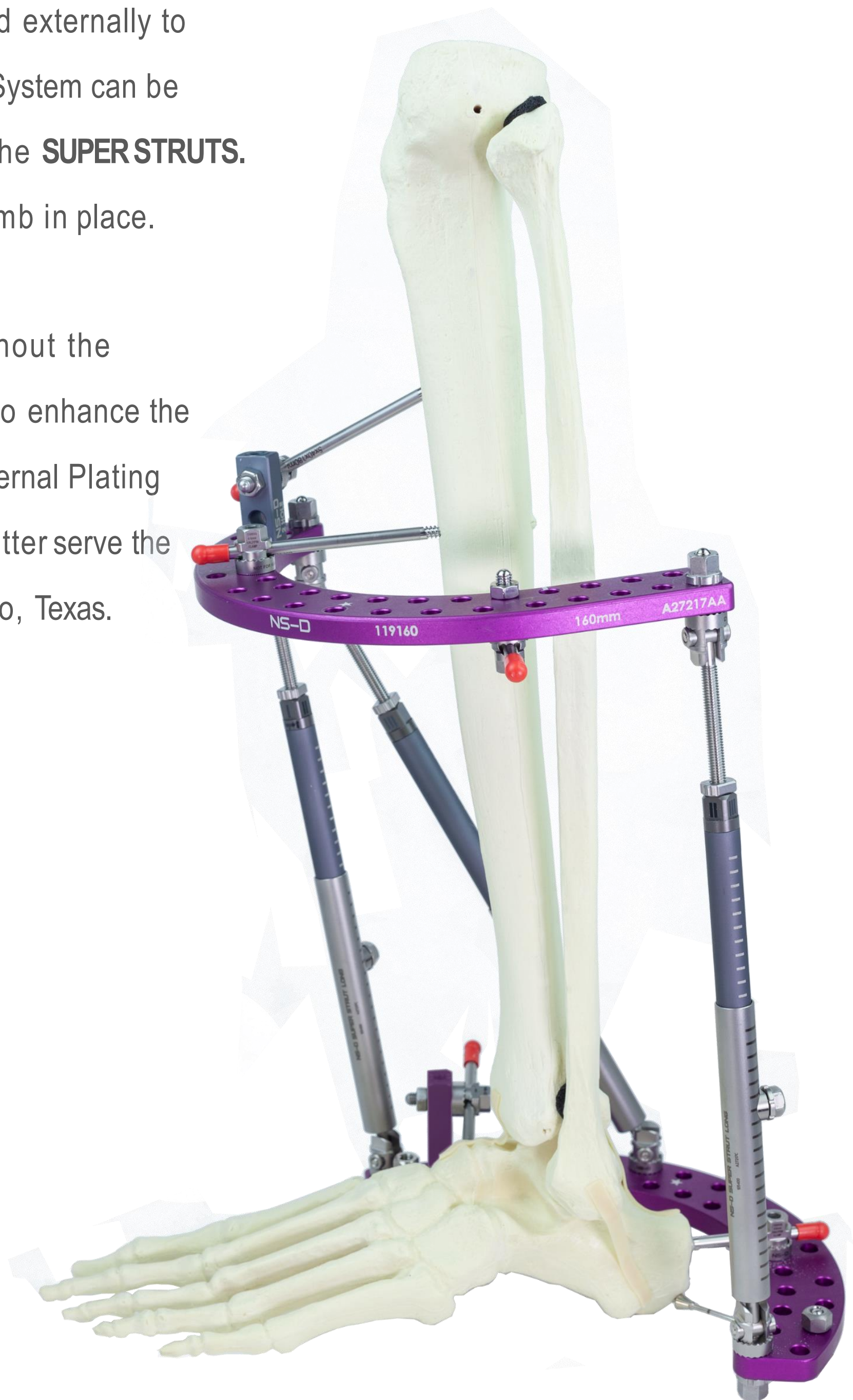
NOTE:

- Please refer to product Instructions For Use (IFU) for more information. IFU can be downloaded through www.metalogix.life
- All products are single-use except for instruments (Trocars & Sheath, Wire Tensioner, T-Handle, and all Wrenches)

2. Introduction

The Revolution External Plating System provides configurations for placement around the patient's limb. The plates are secured to the bone by tension wires or various sizes of **HALF-PINS**. Other plate configurations can be placed below or above the fracture and can be connected with the other plates by **THREADED RODS** or the **SUPER STRUTS**. The plates are connected externally to provide stability in the bone. The Revolution System can be manipulated in multiple angles by unlocking the **SUPER STRUTS**. The struts can be micro adjusted to lock the limb in place.

The principles of Ilizarov are preserved throughout the Revolution System, but have been fine tuned to enhance the surgeon's and patient use. The Revolution External Plating System is a modern revolutionary system to better serve the industry. The system was created in San Antonio, Texas.



3. Advantages

SIMPLICITY

- All plates are marked with an anterior, medial, and lateral symbol. All plates are marked with stars to indicate the positions are 45 degrees from the anterior.
- Revolution offers pre-assembled frames specified by the user.
- Revolution **SUPER STRUTS** only require one bolt manipulation for quick adjustments.
- Revolution **SUPER STRUTS** offer **SPEED NUTS** to increase the simplification of attaching the strut to the plate or other mounting devices.
- Revolution **WIRES** are cold forged and hold a cutting edge advantage, potentially lessening the risk of necrosis.
- Revolution **HALF-PIN FIXATION BOLTS** hold the **TROCAR & SHEATH** for all half-pin sizes.
- Revolution **WIRE FIXATION BOLTS** have machined serrations to clamp onto the wire. Markings allow the surgeon to see which side of the bolt to place the wire .
- Revolution **FOOT-PLATES** come with marked dedicated holes for the **WALKER RAILS**.
- **WALKER RAILS** are one size fits all.

STABILITY

- Plates are anodized and made out of Aluminum 6061 T6.
- Half-Pins and wires are made out of biocompatible 316 LVM Stainless Steel.
- The locking nut on the **SUPER STRUT** will lock the fine adjustment in its location.
- **WIRE FIXATION BOLTS** will have reduced bending when wire is being tensioned. Stress on the bolt will be reduced when used in combination with the **SPHERICAL NUT**.

PATIENT COMFORT

- All plates are open to allow comfort for the patient when laying down. This will allow the injured anatomy to swell in an open space.
- Less plate sizes are needed because the plates are open. Revolution Plates come in 120, 140, 160, 180, 200, and 220mm inner diameter sizes.
- Different plate shapes allow for the best treatment. Revolution Plates come in **n-PLATE, C-PLATE, J-PLATE, I-PLATE**, and **FOOT PLATE**.
- **SUPER STRUTS** can be angled up to 90 degrees which will allow versatility for the patient. However, it is recommended for the user to NOT go past 65 degrees.
- **SUPER STRUTS** have simplified identification markings on the fine adjustment to allow the user to easily adjust by hand or with a 10mm Wrench.
- **WALKER RAIL** is designed to have the same arch as the human foot.

4. Device Description

NOTE: ALL PRODUCTS CAN BE SEEN IN REVOLUTION PRODUCT POCKET BOOK

PLATES:

n-Plate

Sizes available in 120, 140, 160, 180, 200, 220mm InnerDiameter

J-Plate

Sizes available in 120, 140, 160, 180, 200mm InnerDiameter

C-Plate

Sizes available in 120, 140, 160, 180, 200mm InnerDiameter

I-Plate

Sizes available in 135mm and 195mm long and 30mm wide.

NOTE: NOT in Trays and should be specifically ordered

Foot-Plate

Sizes available in 120, 140, 160, 180, 200mm InnerDiameter

NOTE: 200mm NOT in Trays and should be specifically ordered

Revolution External Plates are made from high strength anodized Aluminum 6061 T6. All plates are open to provide patient comfort. All plates will eliminate the minimum spacing between itself and limb when post-op swelling occurs.

Double row holes allow freedom of hardware placement and extra strength. The plates are marked on the side with the inner diameter size. There are medial and lateral line markings, as well as star markings to symbolize 45 degrees from the anterior.



n-Plate

C-Plate

J-Plate

I-Plate

4. Device Description

FOOT PLATES:

Revolution Foot Plates are made from high strength anodized Aluminum 6061 T6. All Foot Plates have triple row holes to allow the doctors freedom of hardware placement. The posterior marking is in the shape of a triangle. The Foot Plates are marked on the side with the inner diameter size. There are also star markings to symbolize 45 degrees from the posterior. The white circular holes in the corners are dedicated holes for the Walker Rail. The ends are tapered to accept a standard 6mm threaded element.



NOTE:

The **WHITE CIRCLE**
Holes are for mounting
the Walker Rail, nothing
should occupy these
holes.

Sizes available in **120, 140, 160, 180, 200MM INTERNAL DIAMETER**

NOTE: 200mm NOT in Trays and should be specifically ordered

4. Device Description

WELDED **STACKED** PLATE TIBIAL BLOCK

THE REVOLUTION EXTERNAL FIXATION SYSTEM FEATURES PREASSEMBLED FRAME OPTIONS.

Welded Stacked Plate Tibial Block x 120mm

- Proximal Plate- C-Plate x 120mm
- Distal Tibial Plate- n-Plate x 120mm
- Foot Plate x 120mm

Welded Stacked Plate Tibial Block x 160mm

- Proximal Plate- C-Plate x 160mm
- Distal Tibial Plate- n-Plate x 160mm
- Foot Plate x 160mm

Welded Stacked Plate Tibial Block x 200mm

- Proximal Plate- C-Plate x 200mm
- Distal Tibial Plate- n-Plate x 200mm
- Foot Plate x 200mm

Welded Stacked Plate Tibial Block x 140mm

- Proximal Plate- C-Plate x 140mm
- Distal Tibial Plate- n-Plate x 140mm
- Foot Plate x 140mm

Welded Stacked Plate Tibial Block x 180mm

- Proximal Plate- C-Plate x 180mm
- Distal Tibial Plate- n-Plate x 180mm
- Foot Plate x 180mm

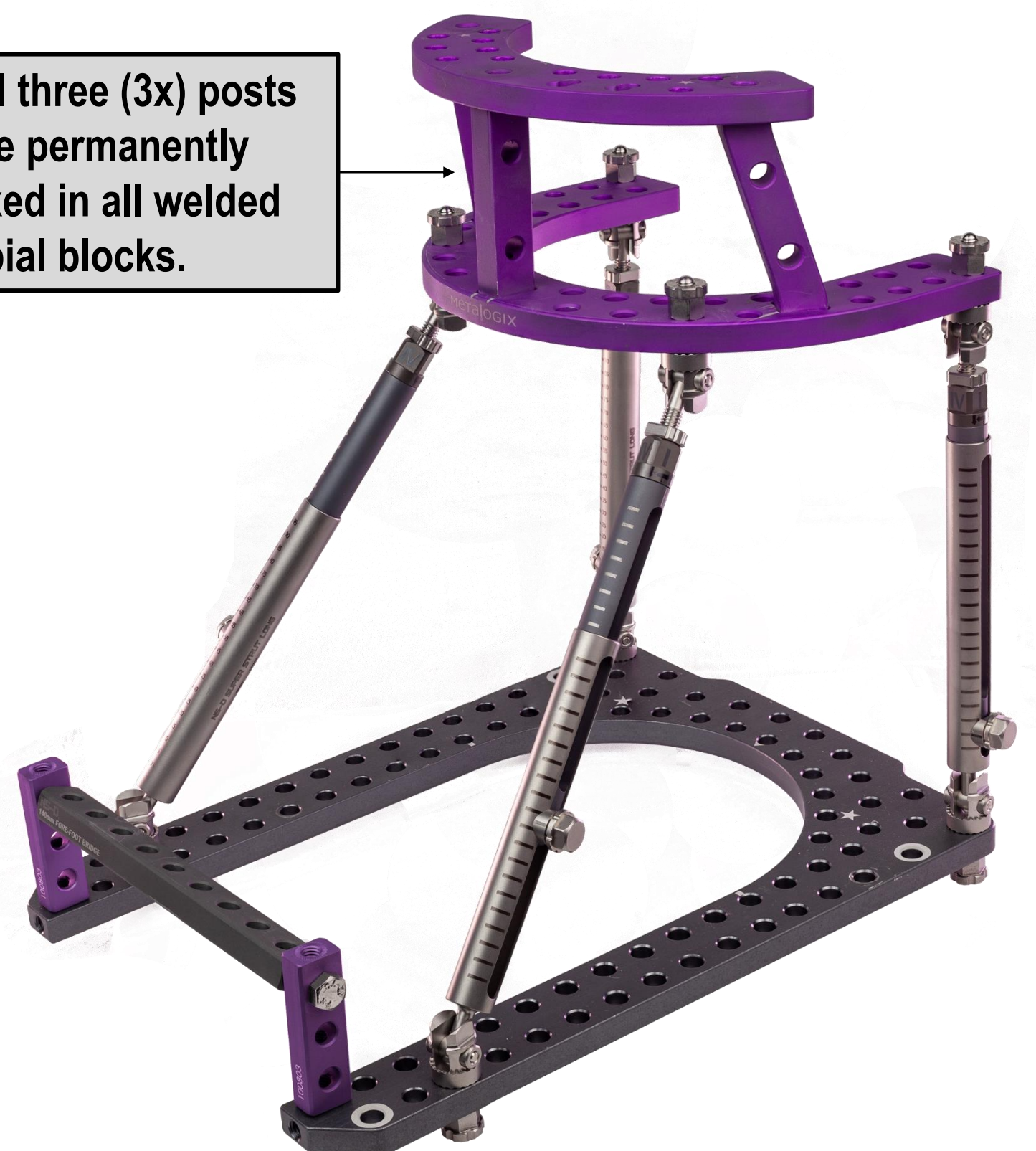
Tibial block height is **60mm**.

The frame can be configured by moving the **SUPER STRUTS** around.

The **FORE-FOOT BRIDGE** height can be adjusted to allow better visibility when using fluoroscopy and better facilitate fixation option.

The **WALKER RAIL** will be shipped in a separate box.

All three (3x) posts are permanently fixed in all welded tibial blocks.



NOTE: The **STACKED TIBIAL BLOCK** post placements are permanent and cannot be moved. These were strategically placed to achieve the highest stability possible. See above figure.

4. Device Description

WELDED **CASCADE** PLATE TIBIAL BLOCK

THE REVOLUTION EXTERNAL FIXATION SYSTEM FEATURES PREASSEMBLED FRAME OPTIONS.

Welded Cascade Plate Tibial Block x 120/140mm

- Proximal Plate- C-Plate x 140mm
- Distal Tibial Plate- n-Plate x 120mm
- Foot Plate x 120mm

Welded Cascade Plate Tibial Block x 160/180mm

- Proximal Plate- C-Plate x 180mm
- Distal Tibial Plate- n-Plate x 160mm
- Foot Plate x 160mm

Welded Cascade Plate Tibial Block x 200/220mm

- Proximal Plate- C-Plate x 220mm
- Distal Tibial Plate- n-Plate x 200mm
- Foot Plate x 200mm

Welded Cascade Plate Tibial Block x 140/160mm

- Proximal Plate- C-Plate x 160mm
- Distal Tibial Plate- n-Plate x 140mm
- Foot Plate x 140mm

Welded Cascade Plate Tibial Block x 180/200mm

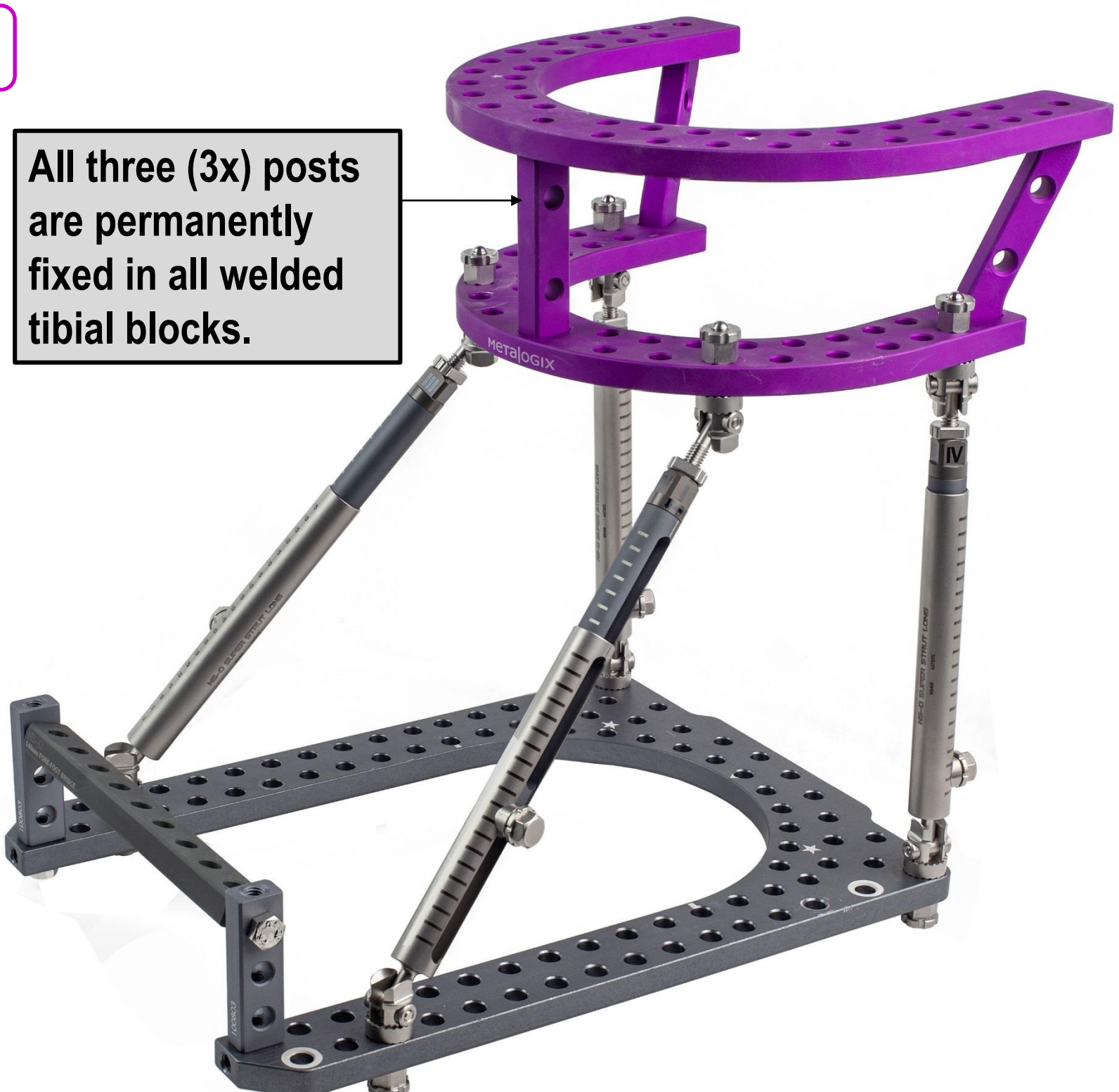
- Proximal Plate- C-Plate x 200mm
- Distal Tibial Plate- n-Plate x 180mm
- Foot Plate x 180mm

Tibial block height is **60mm**.

The frame can be configured by moving the **SUPER STRUTS** around.

The **FORE-FOOT BRIDGE** height can be adjusted to allow better visibility when using fluoroscopy and better facilitate fixation option.

The **WALKER RAIL** will be shipped in a separate box.



NOTE: The **CASCADE TIBIAL BLOCK** post placements are permanent and cannot be moved. These were strategically placed to achieve the highest stability possible. See above figure.

4. Device Description

WALKER RAIL:

The **WALKER RAIL** has a profile following the gate to achieve the best walking motion for the patient. As a result, the anterior and posterior shoe ends feature different angled slopes. One **WALKER RAIL** fits all **FOOT PLATE** sizes. There are dedicated **WALKER RAIL** mounting holes on the **FOOT PLATES** which are identified by a white circle around the dedicated holes. Either a 14mm or 20mm **STANDARD BOLT** can be used to attach the **WALKERRAIL** to the **FOOT PLATE**.



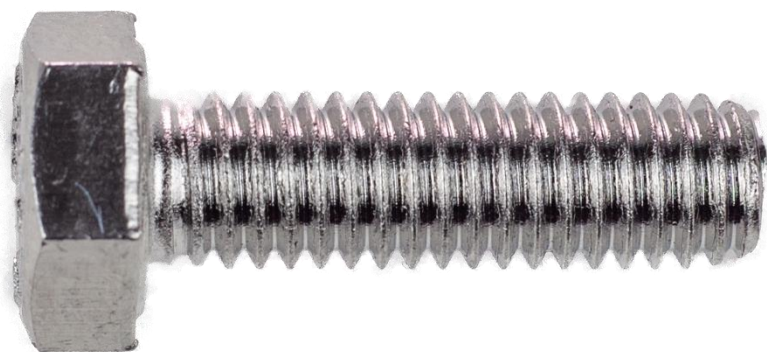
NOTE: Do NOT heat sterilize Walker Rail. They're NOT offered sterile and must be applied post-operatively. Use caution when walking on wet surfaces.

NOTE: NOT IN TRAY. Must order separately.

NOTE: Two (2) Walker Rails must be used with the frame construct.

4. Device Description

BOLTS:



Revolution Bolts are made from stainless steel, and feature a standard M6 thread and a 10mm hex head. Sizes available in 14, 20, and 30mm lengths

THREADED RODS:



Revolution M6 **THREADED RODS** are made from stainless steel. They have rounded ends to achieve better esthetics and to eliminate any risk of sharp burrs.

Sizes available in 40, 60, 80, 120, 160, 200, 220, 240, 300, and 400mm overall length.

NOTE: 200-400mm lengths are NOT in tray and should be ordered separately.

POSTS:



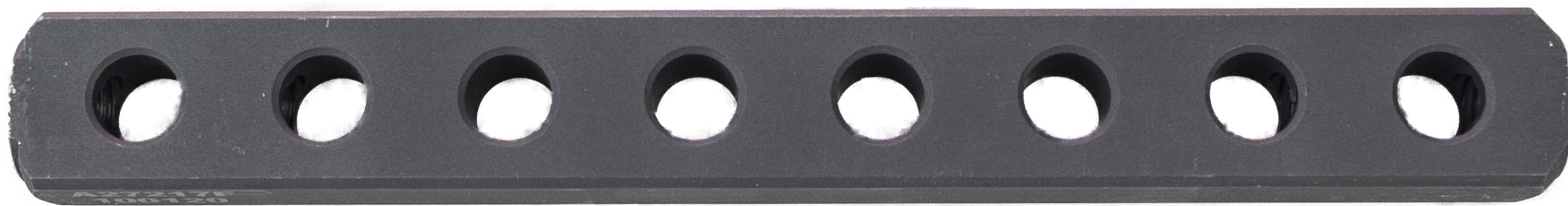
Revolution **POSTS** are made from lightweight aluminum. They have a 10mm by 15mm cross-section. The 15mm surface allows for maximum area for mounting the pins or bolts. All posts contain serrations at the base to prevent screw loosening. When fixed to any of the plates, a 14mm or 20mm **STANDARD BOLT** can be used.

Sizes available in 1, 2, 3, 4, and 5 holes

4. Device Description

FORE-FOOT BRIDGE:

Revolution **FORE-FOOT BRIDGES** are made from lightweight aluminum. They have a 10mm by 15mm cross-section. Every **FOOT PLATE** size will have a dedicated **FORE-FOOT BRIDGE** size. All bridges contain serrations at the ends to prevent screw loosening.



Sizes available for fitting to a 120, 140, 160, 180, and 200mm **FOOT PLATE**.

PLATE EXTENDERS:

Revolution **PLATE EXTENDERS** are made from stainless steel. A 10mm Wrench can fit on the plate to achieve counter-torque.



Sizes available in 30mm and 50mm Lengths

NOTE: Recommended to use washer when either a wire or Half-Pin will be placed in the slotted area.

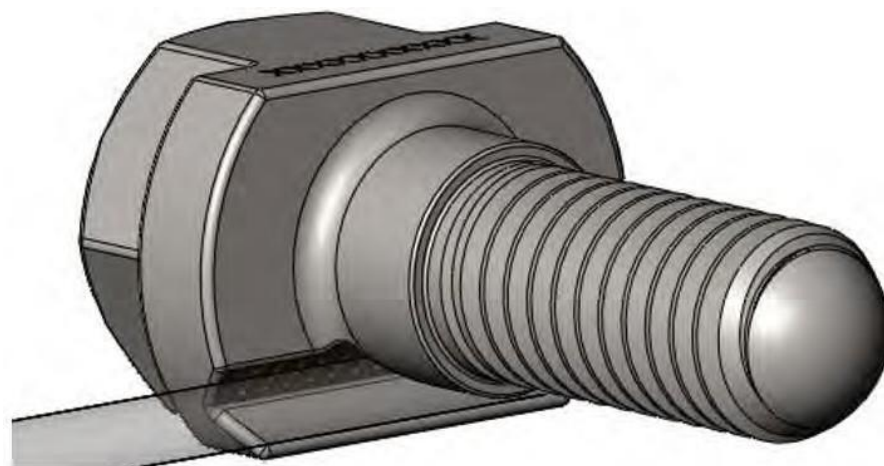
4. Device Description

WIRE FIXATION BOLT:



The Revolution **WIRE FIXATION BOLT** is made from stainless steel. A tight tolerance shoulder is designed to distribute the bending load of the bolt when being tensioned. The bolt offers a serrated 1.8mm wire v-slot to keep the wire from loosening. The top of the bolt is marked with a black line across the top indicating the location of the wire slot. The bolt has a 10mm hex head allowing more wrench placement for counter-torque.

NOTE: Recommended to use with the Spherical Nut



HALF-PIN FIXATION BOLT:



The Revolution **HALF-PIN FIXATION BOLT** is made from stainless steel. **10mm WRENCH** can fit the hex head for counter-torque. The bolt allows for a 4, 5, or 6mm **HALF-PIN** to be used along with the **TROCAR & SHEATH**. The bolt comes preassembled with a clamping washer. The washer has teeth on both sides to add grip strength.

NOTE: Do NOT fully tighten the bolt when using the Trocar & Sheath. The bolt could possibly impinge into the Trocar & Sheath if too much torque is applied. Only fully tighten bolt after Trocar & Sheath is removed.

4. Device Description

STANDARD NUT X 10MM:

Revolution **STANDARD NUT** (10mm -M6X1) is made from stainless steel.



SPHERICAL NUT X 10MM:

Revolution **SPHERICAL NUT** (10mm - M6X1) is made from stainless steel. The radius will distribute the bending forces on the **WIRE FIXATION BOLTS** when being tensioned. The **SPHERICAL NUT** can also be combined with a **SPHERICAL WASHER** to allow a maximum of 12 degree angulation on **THREADED RODS**.



NOTE: To take advantage of the **SPHERICAL NUT X 10mm**, the user should use this with the **WIRE FIXATION BOLTS**.

4. Device Description

SPEED NUT:

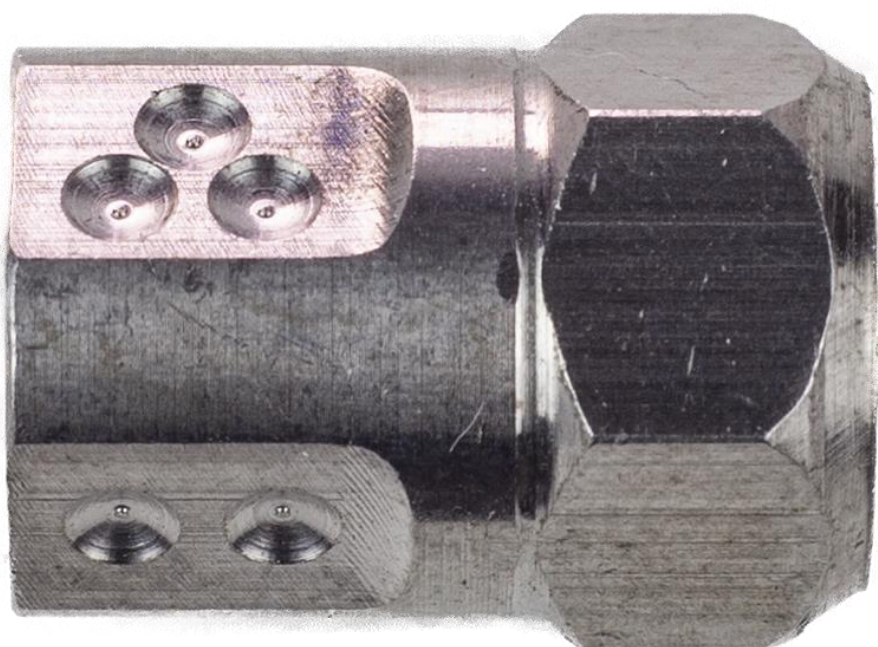
Revolution **SPEED NUT** (10mm - M6x1) is made from stainless steel. The flanged portion is meant for the user's fingers to quickly tighten the nut. **SPEED NUTS** are meant for the **SUPER STRUTS**, but can be used for other purposes.



NOTE: To take advantage of the Speed Nut, the user must have the hex towards the mating object.

COUNTER NUT:

Revolution Counter Nut (10mm-M6x1) is made from stainless steel. This is useful for attaching elements placed in adjacent holes. It can be used for a compression/distraction nut as it has four flats with sequential dots.



4. Device Description

HINGES:

- MALE HINGE
- FEMALE HINGE
- 90 DEGREE HINGE

Revolution **HINGES** are made from stainless steel. Can be combined together to create hinge movements in space. Can also be connected to **THREADED RODS** and **POSTS** to create a wide range of simple hinged assemblies.



NOTE: It is recommended to reinforce the **HINGES** with **STANDARD NUTS** when attaching to **THREADED RODS** or **POSTS**.

4. Device Description

SUPER STRUTS:

- **SUPER STRUT SHORT**
- **SUPER STRUT MEDIUM**
- **SUPER STRUT LONG**

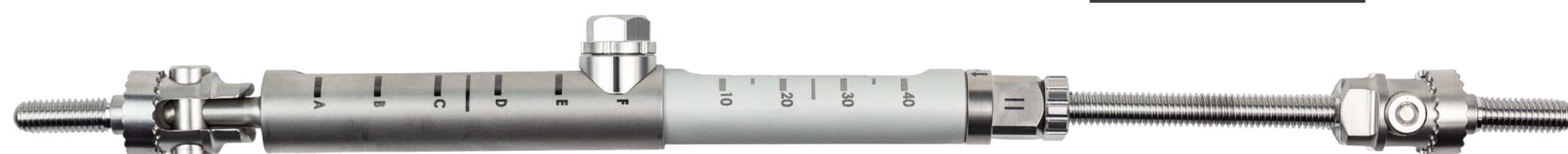
Revolution **SUPER STRUTS** will allow the surgeon to simplify the frame assembly. The struts can be micro adjusted by distraction or compression. Each adjustment can be seen with Roman numerals. Each turn to the next Roman numeral is $\frac{1}{4}$ mm of compression or distraction. One full turn equals 1mm of movement. The hinge movement on the ends are able to move to any desired angulation and can be locked.



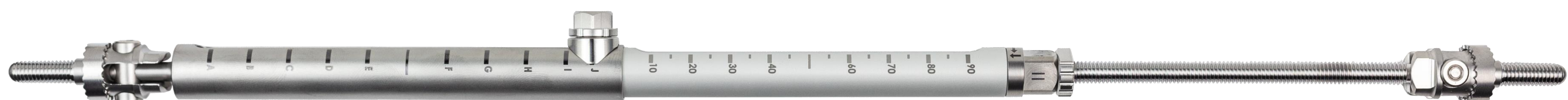
SHORT
98-128mm



MEDIUM
128-207mm



LONG
172-350mm



NOTE: For maximum stability, it is recommended to NOT angle the struts at a complete 90 degrees.

NOTE: SUPERSTRUTS are attached to the plates using the SPEED NUTS for quick locking. Have the hex towards the plate.

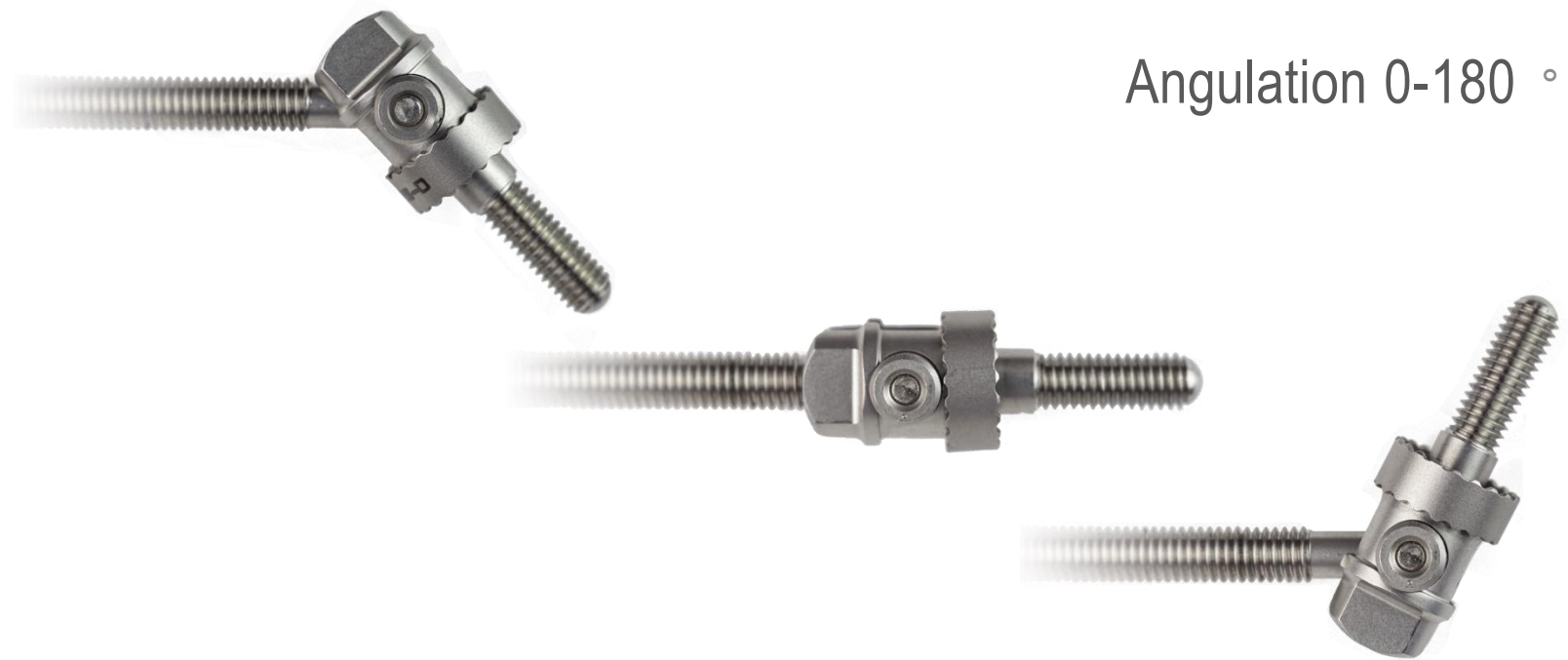
NOTE: Tighten sequence should be nut, nut, then bolt.

NOTE: Quick adjust bolt should face out when assembled to construct for easy access.

4. Device Description

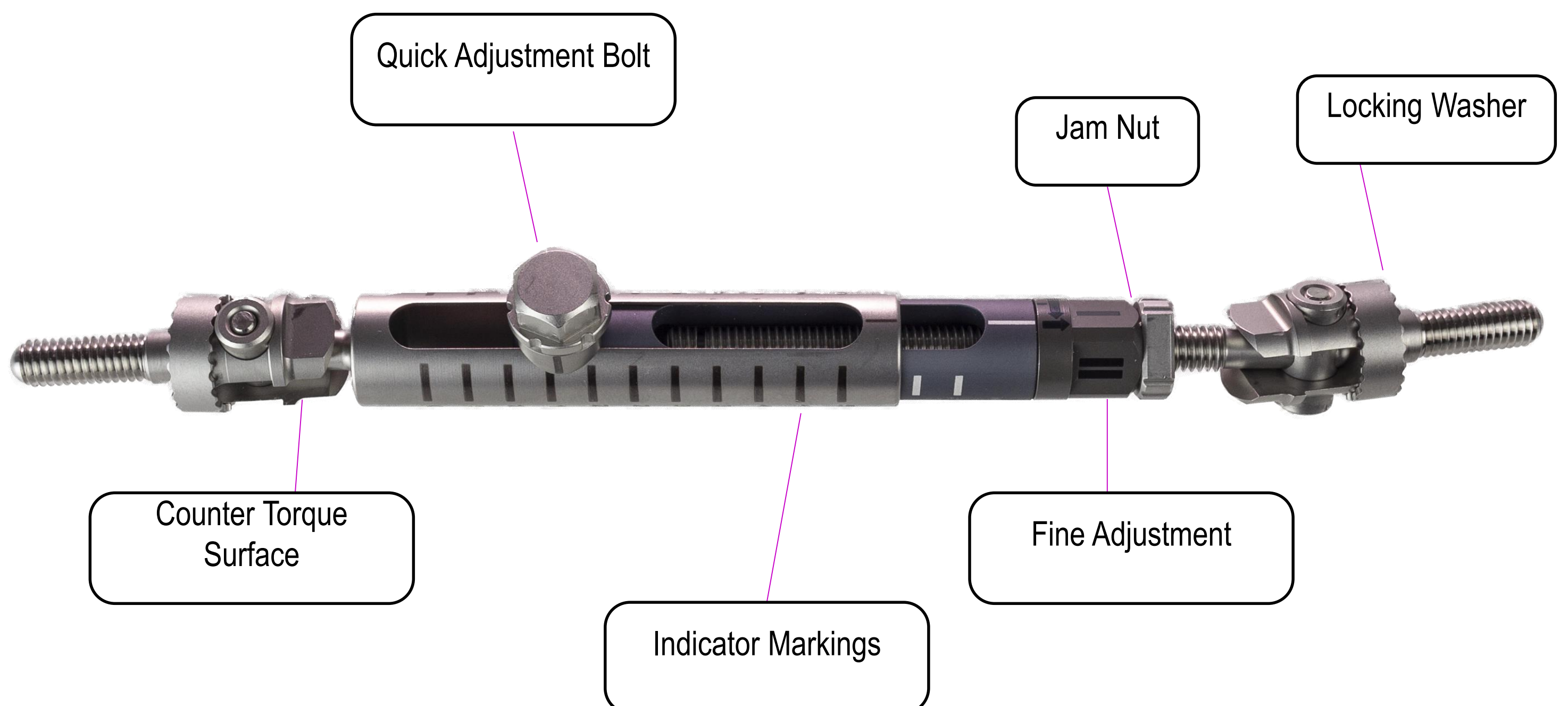
SUPER STRUTS:

- SUPER STRUT SHORT
- SUPER STRUT MEDIUM
- SUPER STRUT LONG



Angulation 0-180 °

NOTE: For maximum stability, it is recommended to NOT angle the struts at a complete 90 degrees.



4. Device Description

SUPER STRUTS:

SUPER STRUTS can come loosely pre- assembled giving the surgeon the ability to mount the frame to the limb. Once proper alignment is achieved, lock the two end nuts and then the quick adjust bolt.



NOTE: The middle strut will not be pre-assembled. The surgeon will place it once they find it's proper alignment.



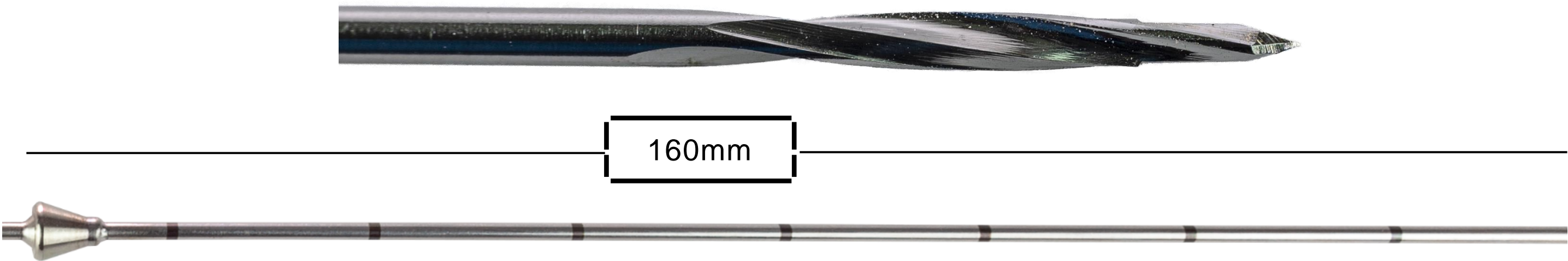
4. Device Description

WIRES:

- TRUSS WIRE
- SMOOTH WIRE

Revolution **WIRES** are made from 316 LVM surgical stainless steel with a diameter of 1.8mm x 400mm long. The cold forged tip is specifically designed to efficiently drill through both cortical and cancellous bone.

The **TRUSS WIRE** has markings with a spacing of 20mm behind the bead.

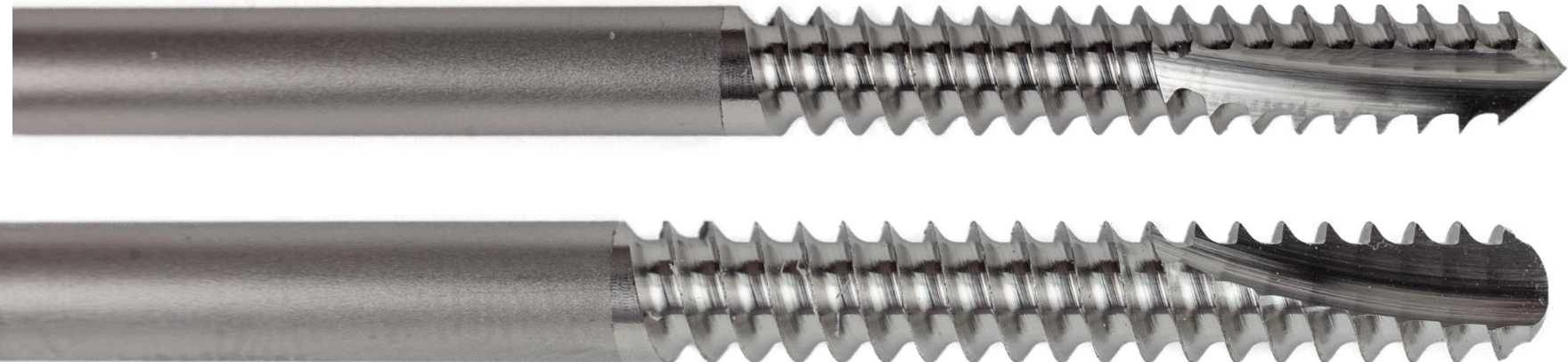
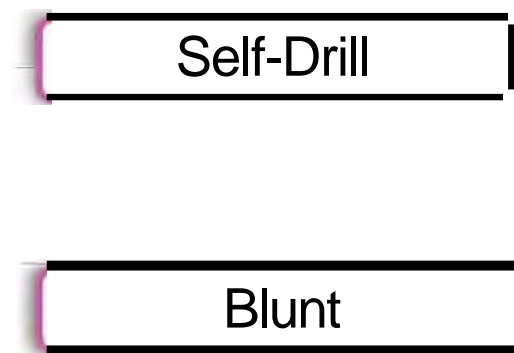


HALF-PINS:

- SELF-DRILL HALF-PIN
- BLUNT HALF-PIN

Revolution Half-Pins are made from 316 LVM surgical stainless steel with diameters of 4, 5, and 6mm each having a total length of 215mm. The ends of the Half-Pins have AO connections. There are two different types of Half-Pins; Self-Drill and Blunt.

Thread Lengths:
4mm- 15, 30, and 50mm
5mm- 30, 40, 60, 80mm
6mm- 40, 50, 60, 70, 80mm
(70 and 80mm are NOT in the trays and should be ordered separately.)



NOTE: The **BLUNT HALF-PINS** are offered in the Implant Tray. The **SELF-DRILL HALF-PINS** are offered in the Implant Modular Tray.

NOTE: There is a designated drill and sheath tube for each **HALF-PIN** diameter. The drill bits and sheath are marked with either 4, 5, or 6mm.

NOTE: When using **BLUNT HALF-PINS**, pre-drilling is necessary.

5. Surgical Technique

PREOPERATIVE PLANNING:

The proper size plate should be ordered after viewing patient anatomy. Plate Sizing Templates can be used to determine appropriate plate diameters.

The diameter should allow 2 cm of clearance between the limb and template.



NOTE: Plate Sizing Templates are NOT in the tray and should be ordered separately.

5. Surgical Technique

PRE-ASSEMBLED FRAME:

The Revolution External Plating System offers pre-assembled frames in 120mm, 140mm, 160mm, 180mm, and 200mm. The frames come in **STACKED** and **CASCADE** style.

The tibial block has a static height of 60mm. The frame height can be adjusted through the struts by releasing the quick adjustment bolt.



STACKED FRAME



CASCADE FRAME

5. Surgical Technique

HALF-PIN INSERTION:

1. When using the **HALF-PIN** off the plates, identify the proper insertion location hole on the plate and insert the **HALF-PIN FIXATION BOLT**.
2. Slightly secure bolt/nut to allow proper **TROCAR & SHEATH** fit.

NOTE: To allow the **TROCAR & SHEATH** to fit, user must not fully tighten the nut on bolt.

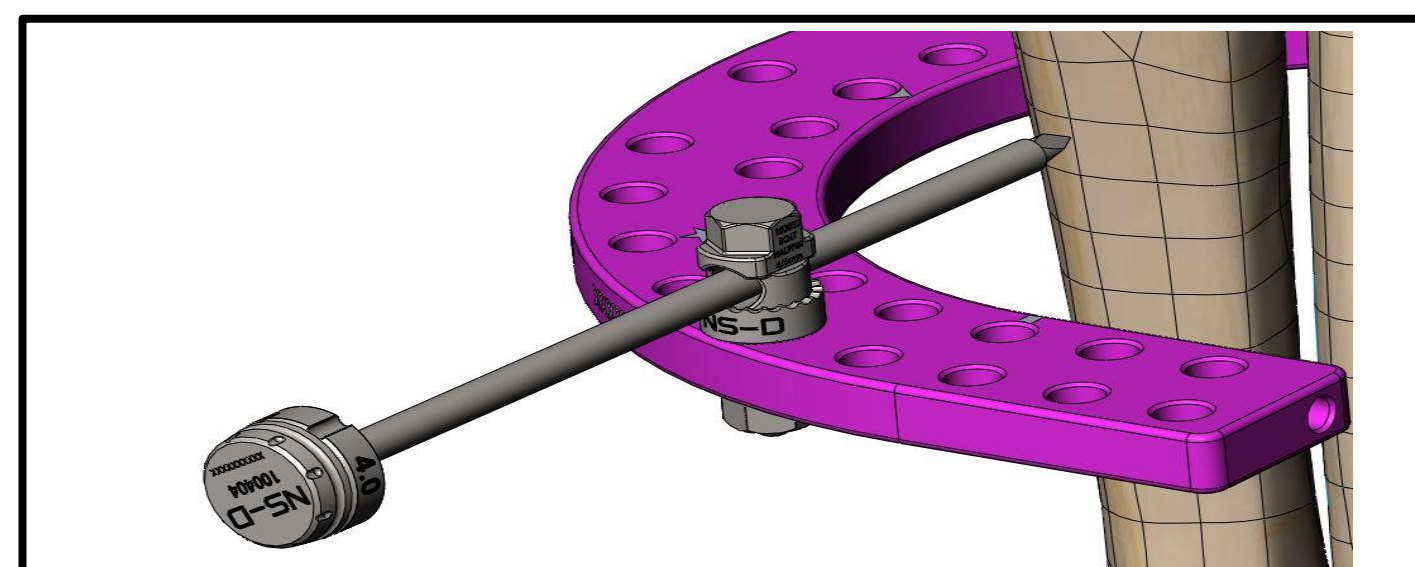
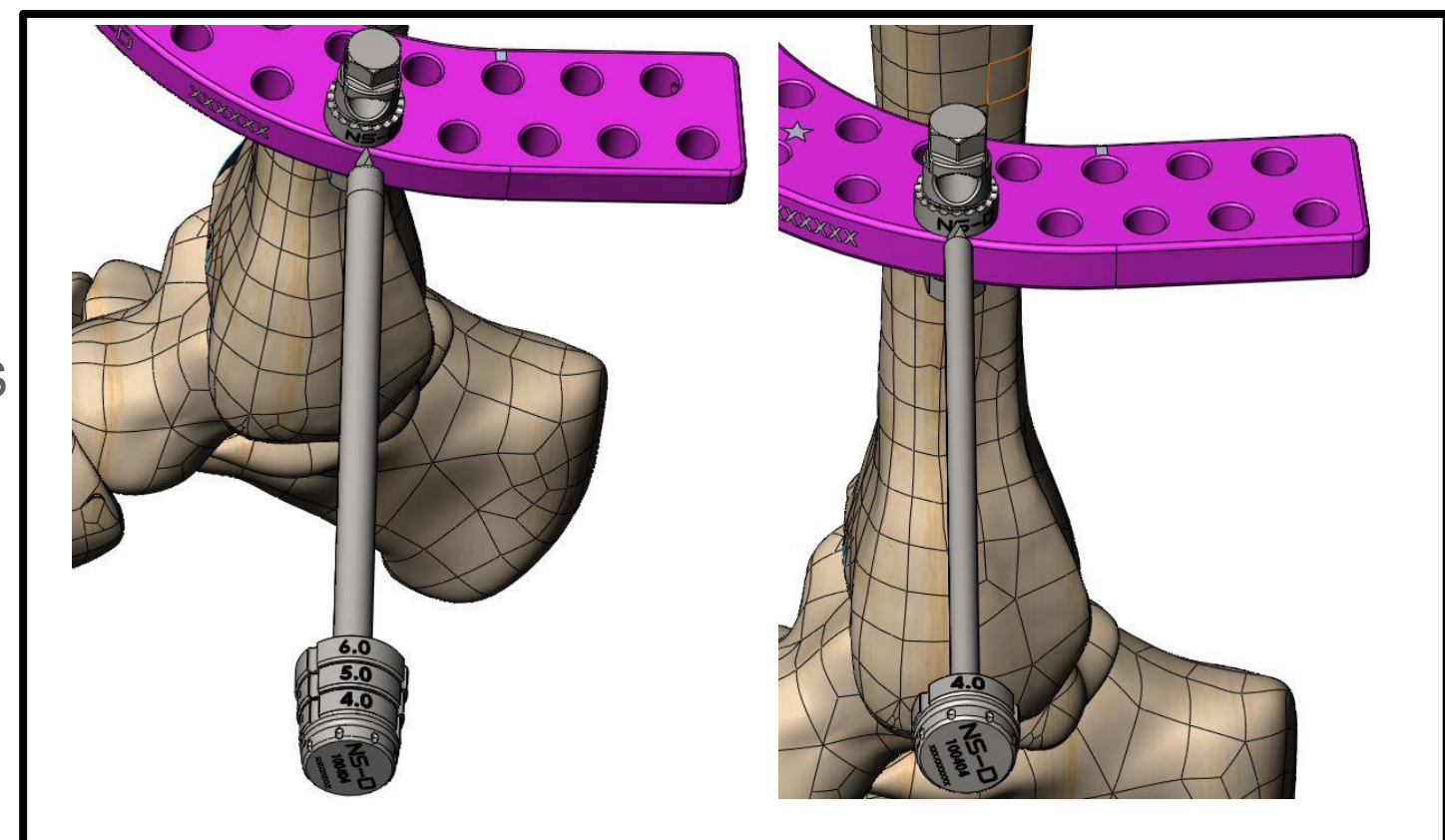
NOTE: Do not fully tighten the nut to the bolt when using the **TROCAR & SHEATH**. The bolt could possibly impinge into the **TROCAR & SHEATH** if too much torque is applied.

3. The **TROCAR & SHEATH** will be packaged with all sleeves together. The sleeves will be retained when inverted to ensure nothing drops.

NOTE: Remove the **SHEATH** sleeves that aren't related to the desired pin. For example, a 4mm **HALF-PIN** will be used and the 5 and 6mm sheath sleeve will be removed for this procedure.

NOTE: When cleaning, have all **SHEATH** sleeves and Trocar disassembled.

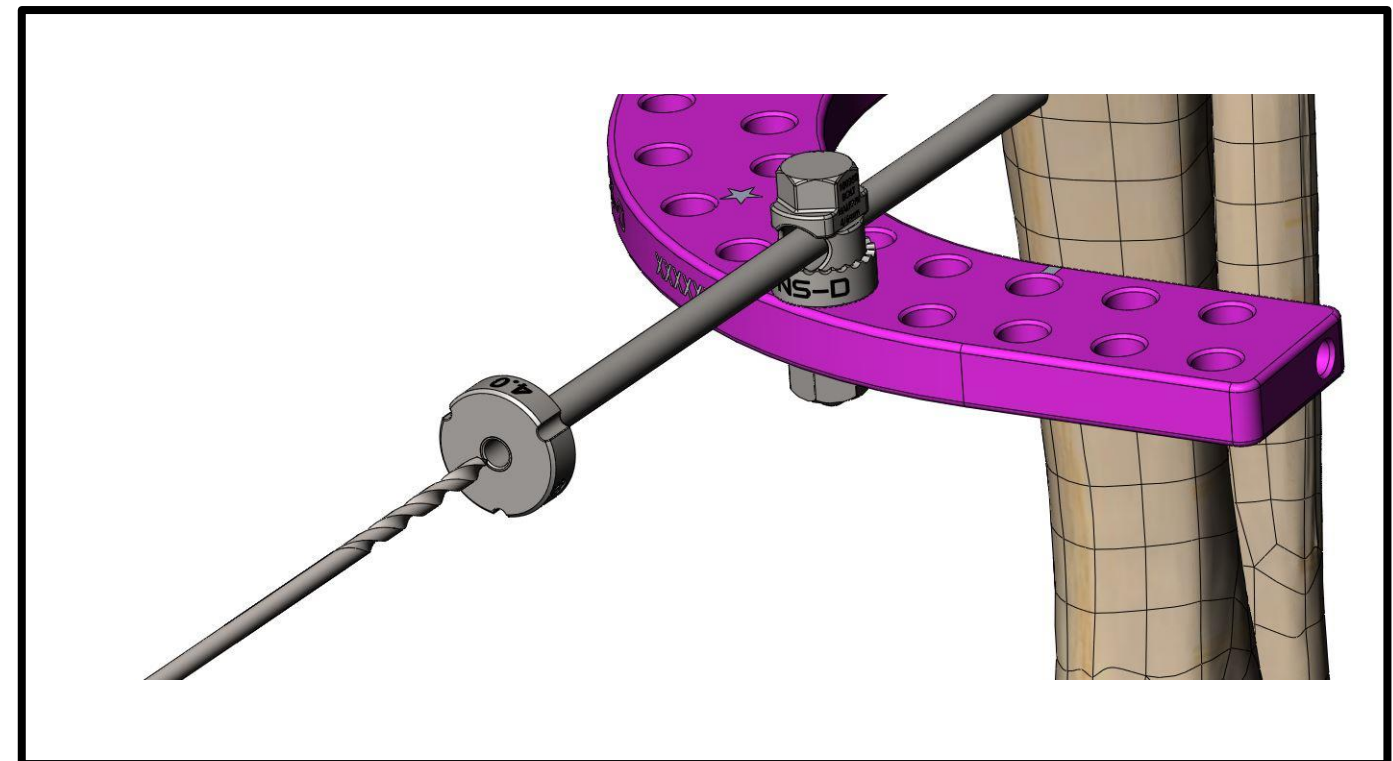
4. Use **TROCAR & SHEATH** to go through the soft tissue and stop once the **TROCAR** touches the bone. If using **SELF-DRILL HALF-PINS**, the **TROCAR** can be removed and designated **HALF-PIN** can be inserted instead.



5. Surgical Technique

HALF PIN INSERTION:

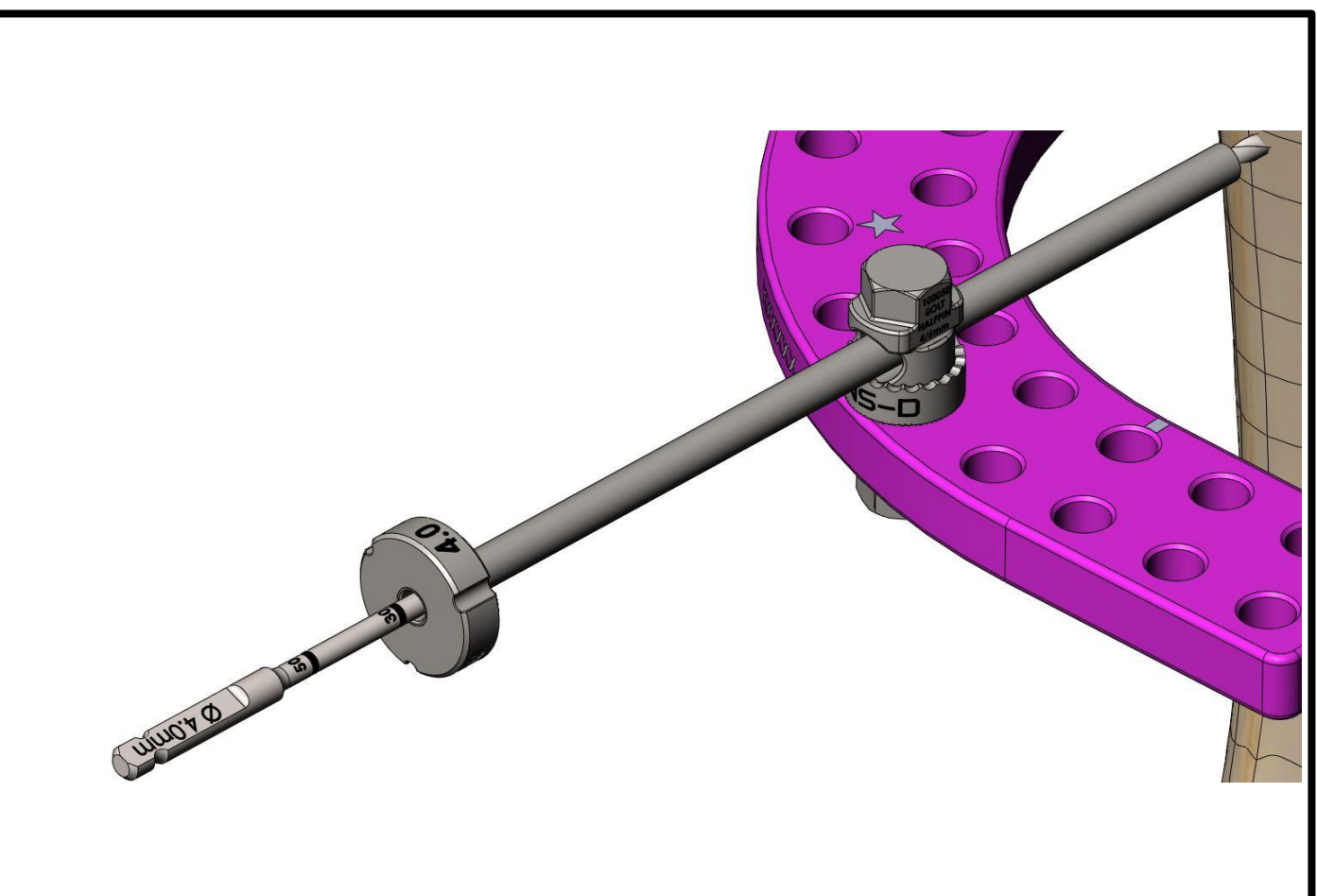
5. If using the **BLUNT HALF-PINS**, remove the **TROCAR** from assembly and insert required drill bit through the **SHEATH**.



NOTE: A drill bit can also be used for **SELF-DRILL HALF-PINS** if desired.

NOTE: If a 4mm **HALF-PIN** is used, the 4mm **DRILL BIT** will be used for pre-drill. Same concept with 5mm and 6mm.

6. Drill to desired depth and remove drill. The **DRILL BITS** have depth markings to allow the doctor to choose according **HALF-PIN** thread length.



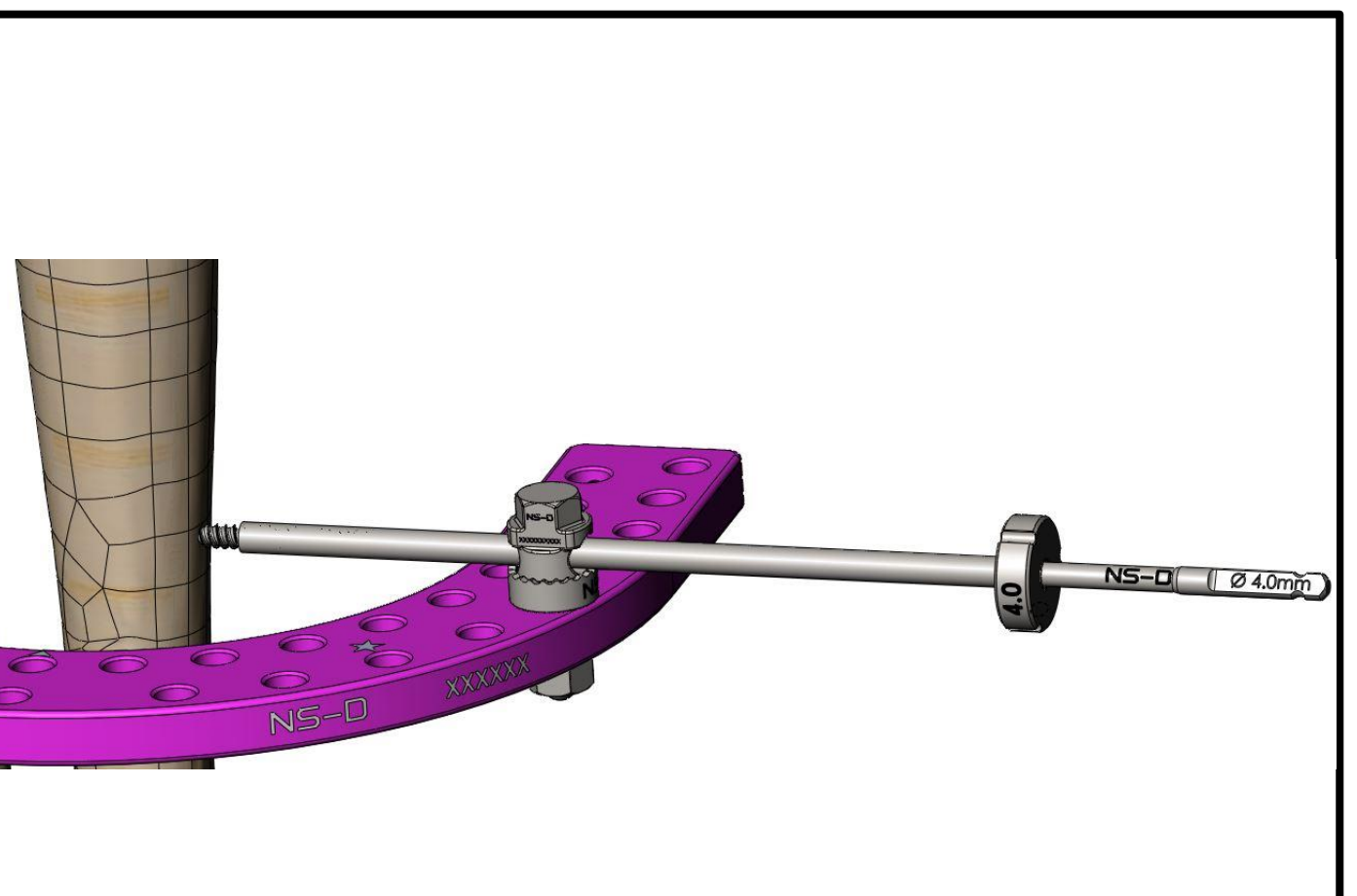
NOTE: Depth markings on each drill bit is dedicated to each **HALF-PIN** thread length.

NOTE: Efforts should be made to keep the **DRILL BIT** cool during insertion.

NOTE: Use an in-and-out pulse action to help clear flutes and drill guides of any bone debris. Drills should not be completely removed from guide during pulse action.

NOTE: Avoid applying lateral pressure on the sleeves or drill bit by ensuring the drill path is in line with the drill guide.

7. The **HALF-PIN** thread length is indicated on the **DRILL BIT**, lining up on the head of the appropriate **HALF-PIN** sheath and read on the outer edge of the head of the **SHEATH**.
8. Insert **HALF-PIN** through sheath sleeve. Manual **HALF-PIN** placement may be necessary when entering the second cortex.



NOTE: Efforts should be made to keep the **HALF-PIN** cool during insertion.

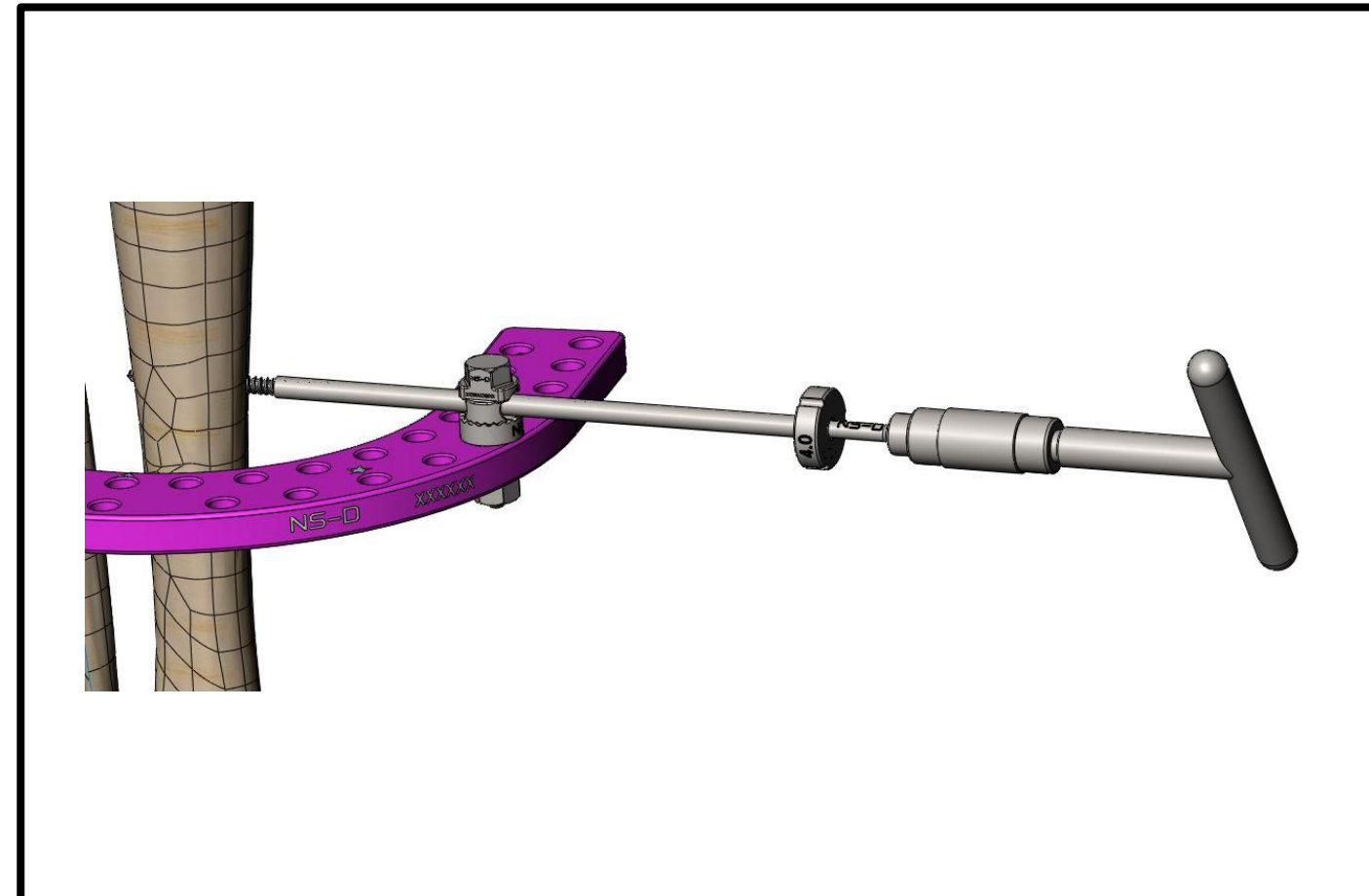
5. Surgical Technique

HALF-PIN INSERTION:

9. Use **AO T-HANDLE** to manually insert. Once placement is successful, loosen nut on **HALF-PIN FIXATION BOLT** and remove sheath.

NOTE: The weakest point of the pin is at the thread-shank junction. Sinking the shank of the pin into the proximal cortex will improve the stiffness.

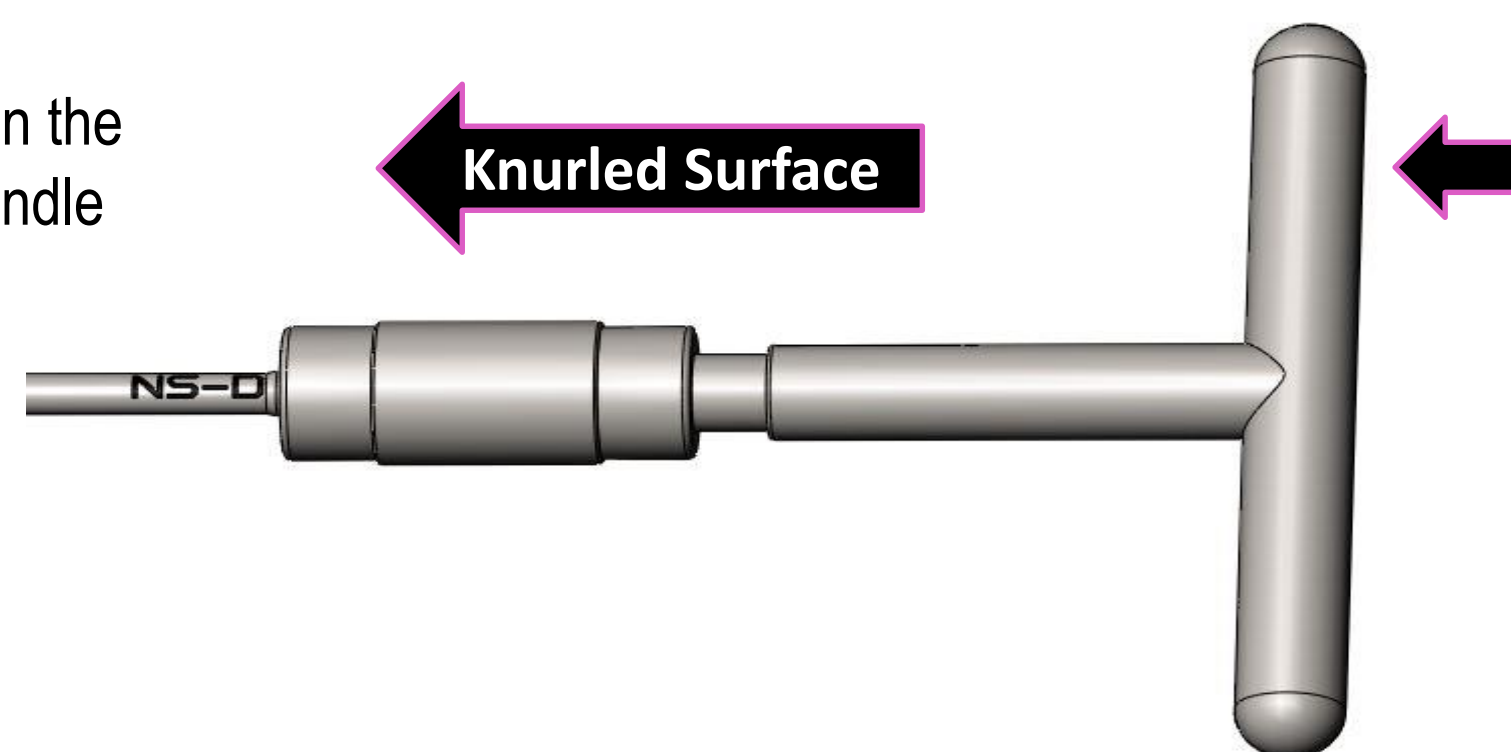
NOTE: The AO T-HANDLE has ball bearings to snap onto the HALF-PINS.



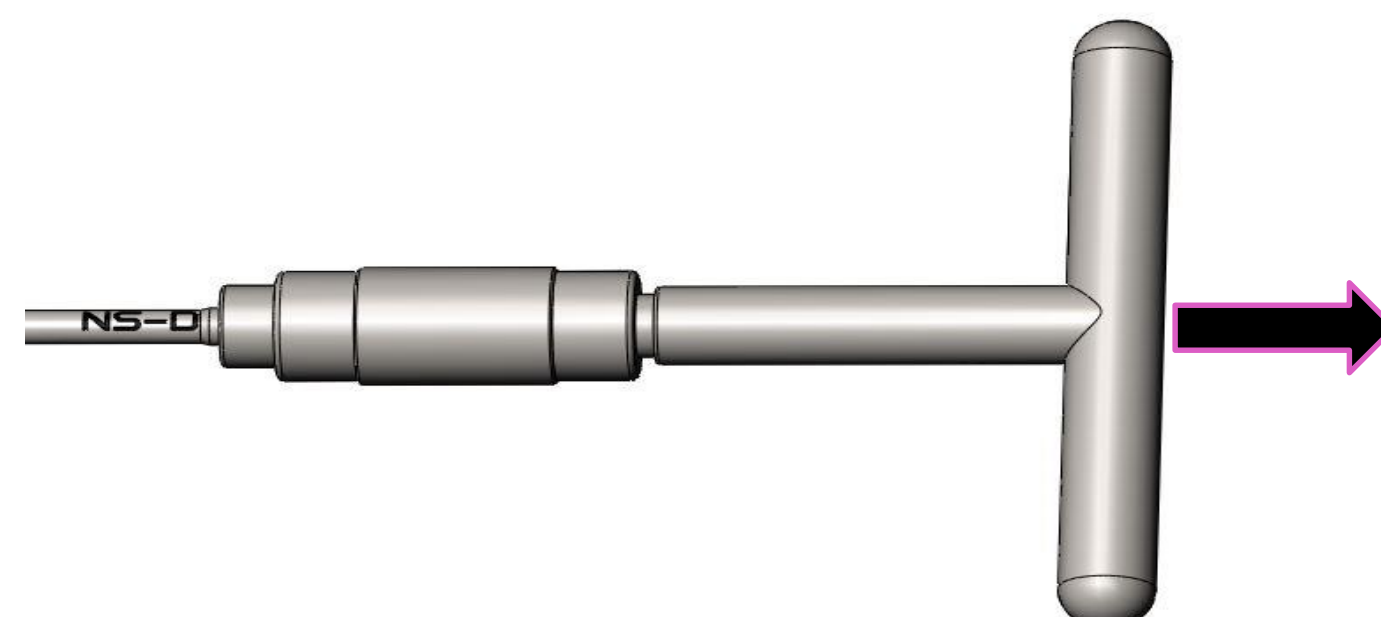
- a) First, insert the **T-HANDLE** on the AO end of the **HALF-PIN**.
Second, rotate the **T-HANDLE** to where the flat orientates with the flat on the AO end of the **HALF-PIN**.



- b) Once the flats are engaging, push up the knurled sleeve on the **T-HANDLE** to fully engage. At the same time, push the handle up against the **HALF-PIN**.



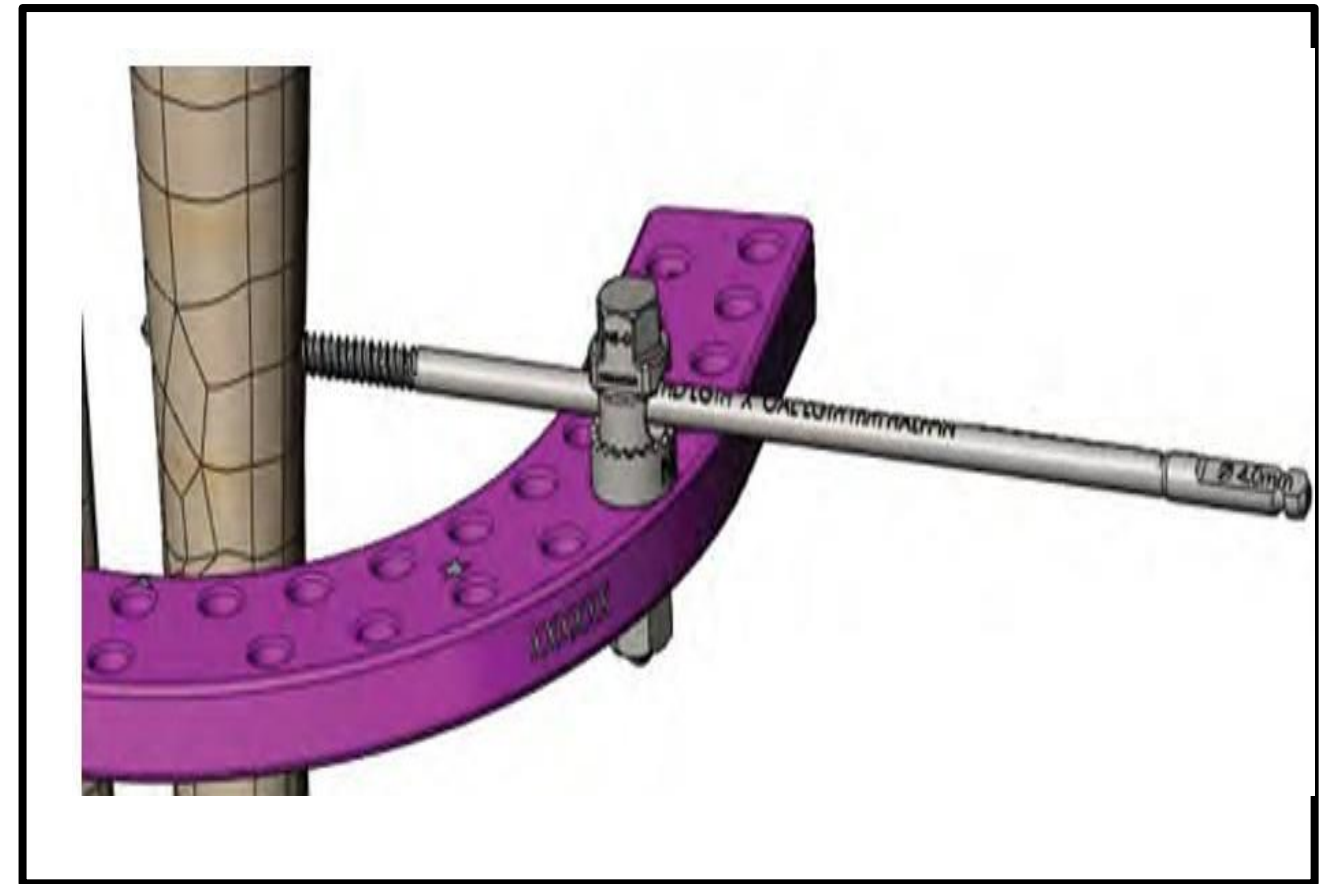
- c) Once the **T-HANDLE** can no longer be pushed, release the knurl and pull the **T-HANDLE** back.



5. Surgical Technique

HALF PIN INSERTION:

10. Tighten **HALF-PIN FIXATION BOLT** with two (2) wrenches. One wrench on the nut and the other on the **HALF-PIN FIXATION BOLT** hex.



11. Cut the excess **HALF-PIN** length and attach desired pin guards.

NOTE: Pin guards come in three (3) different colors.

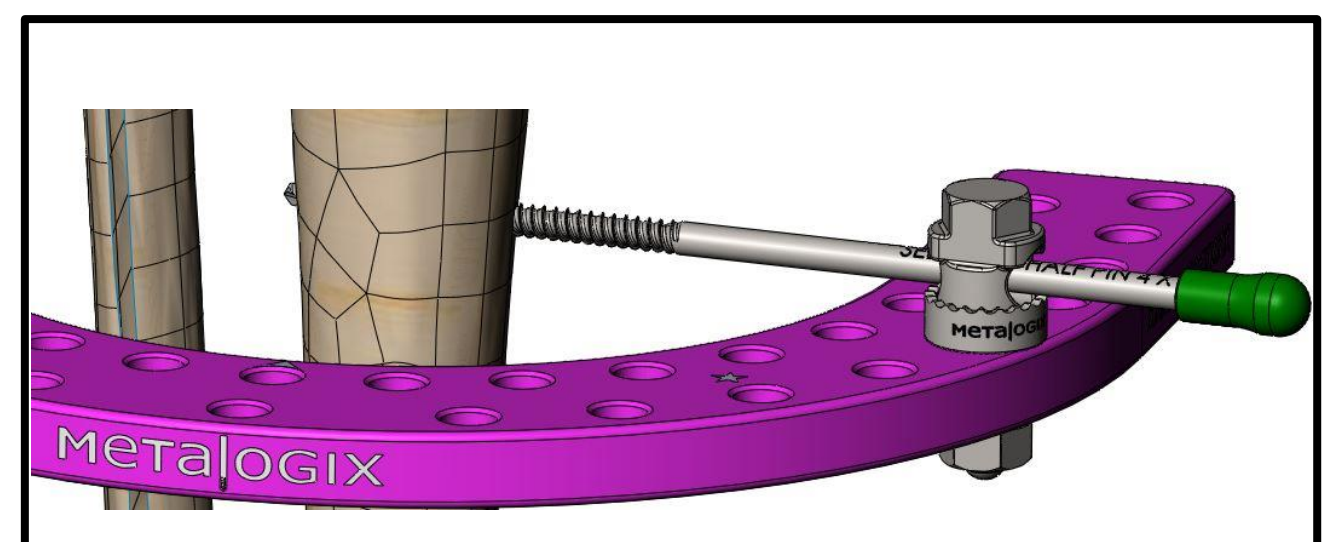
4MM-GREEN

5MM-RED

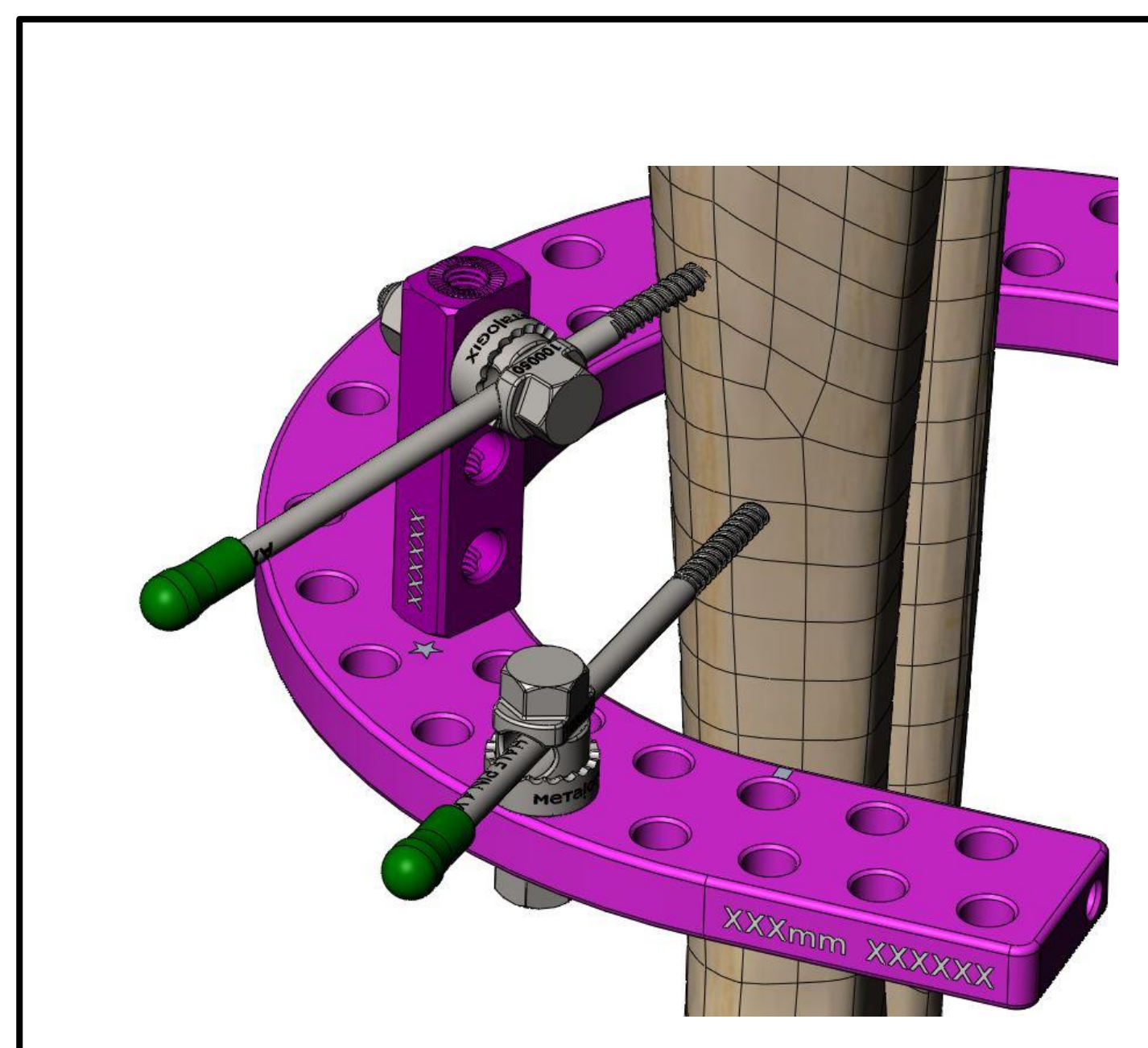
6MM-BLACK



NOTE: HALF-PIN cutters are provided by hospitals.



12. **HALF-PINS** can be placed on any posts instead of the plate. Loosely attach the post to desired hole with either a **14mm** or **20mm bolt**. A **20mm bolt** will block the first hole.
13. Attach the **HALF-PIN FIXATION BOLT**. Repeat steps 2-8.
14. Fully tighten the posts to the plate by having the wrench on the bolt hex and post.
15. Sequence of tightening should be: tighten **HALF-PIN FIXATION BOLT** to post, then tighten post to plate.



5. Surgical Technique

WIRE INSERTION:

1. Insert the wire through the soft tissue and drill through the bone to the opposite soft tissue edge. Ensure the wire is beyond the plate's outside diameter. The Ilizarov principle for wire insertion should be observed: Insert the wire through the soft tissue to the bone, slowly drill the wire through the bone (in a pulsing action), once past the second cortex, tap the wire through the soft tissue, pull the wire through to the appropriate length to attach to the hardware.

NOTE: Keep the wire straight. Avoid excessive pressure. **DO NOT BEND THE WIRE.**

NOTE: Efforts should be made to keep the wire cool during insertion. Can use in-and-out pulse action.

NOTE: It is also viable to use the **WIRE FIXATION BOLT** as a guide.

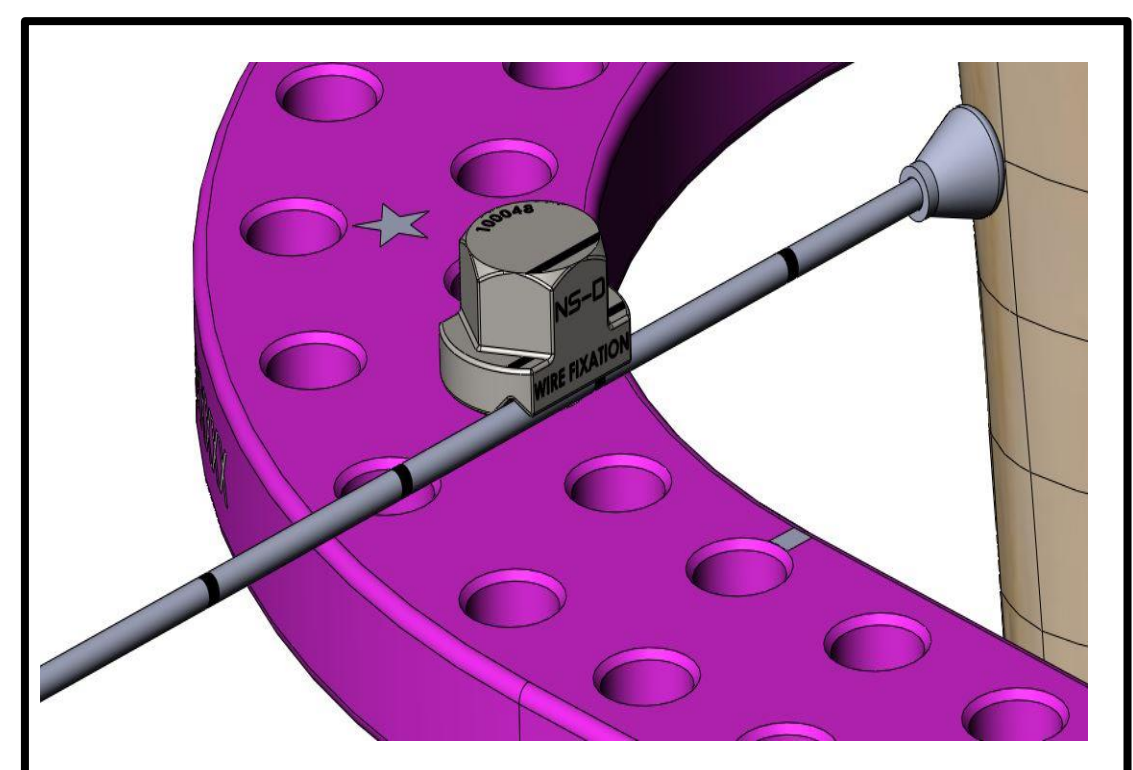
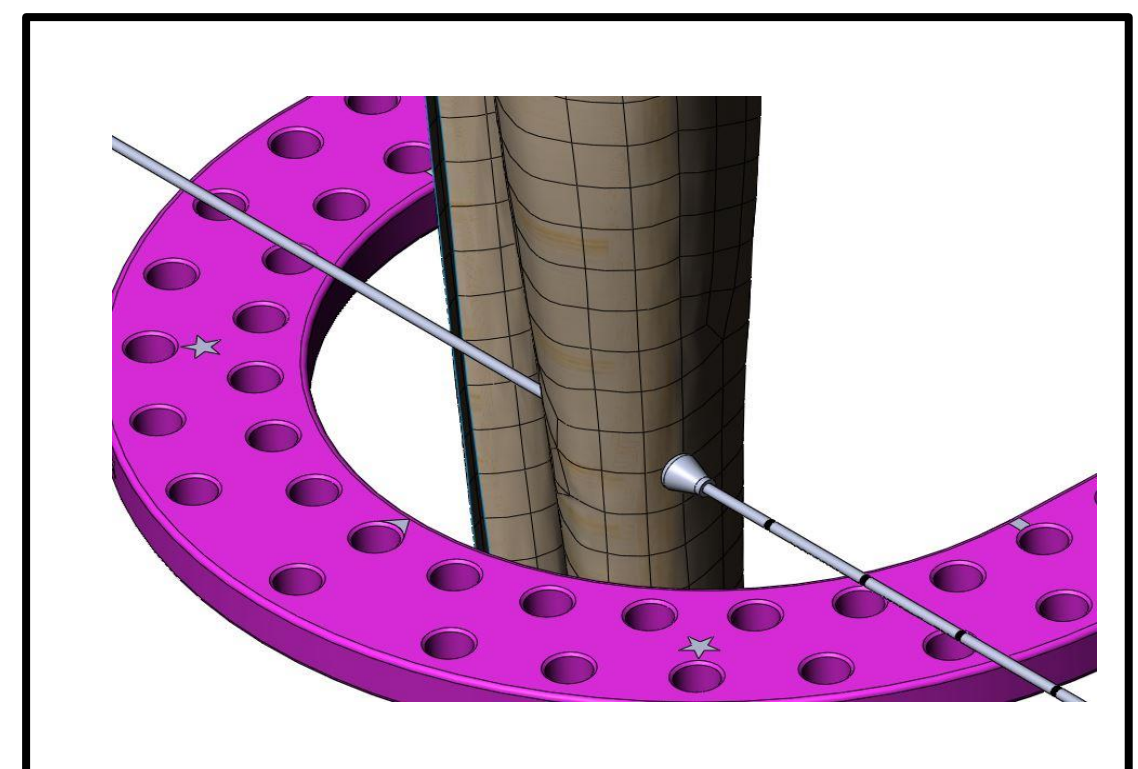
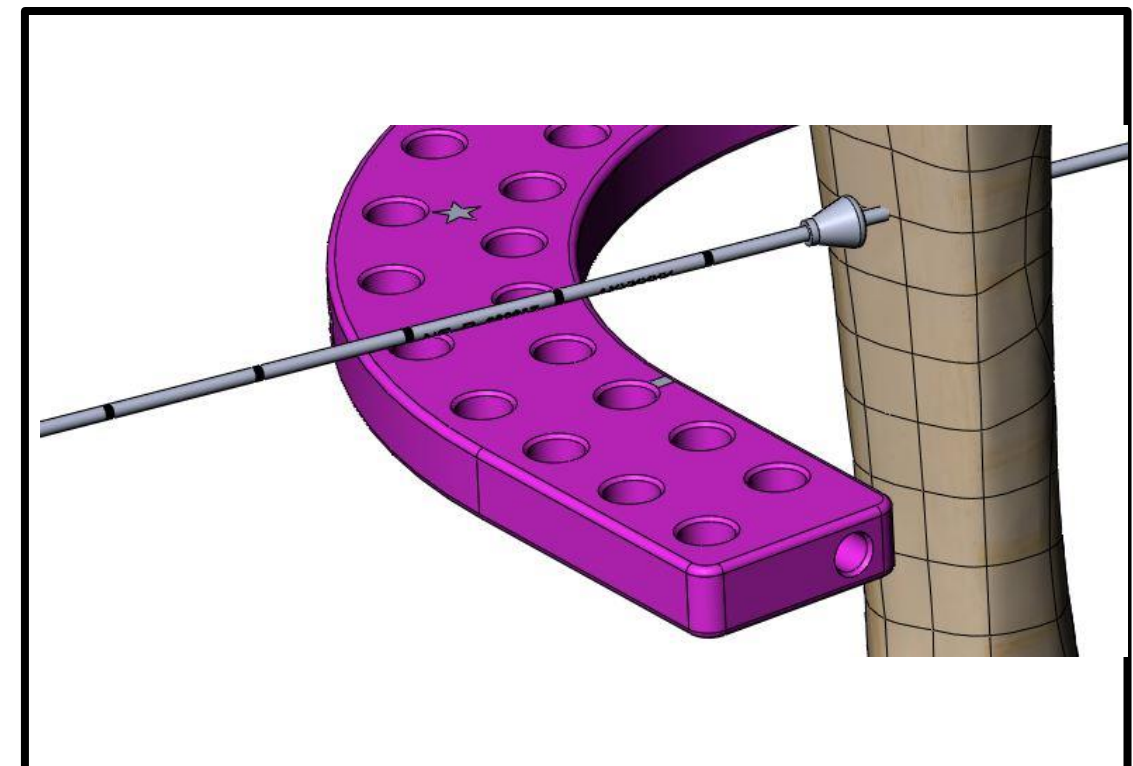
NOTE: Wires should rest directly on the plates. If one does not, then build the plate up to the wire. **Do NOT** bend a wire down to the frame.

2. If a **TRUSS WIRE** is used, make a small incision along the axis of the wire to allow the bead to pass through the skin. The bead on the wire will come in contact with the bone cortex.

NOTE: **TRUSS WIRES** have depth markings behind the bead. 20mm spacing. **SMOOTH WIRES** have no markings.

NOTE: The **WIRE FIXATION BOLT** has a side slot only.

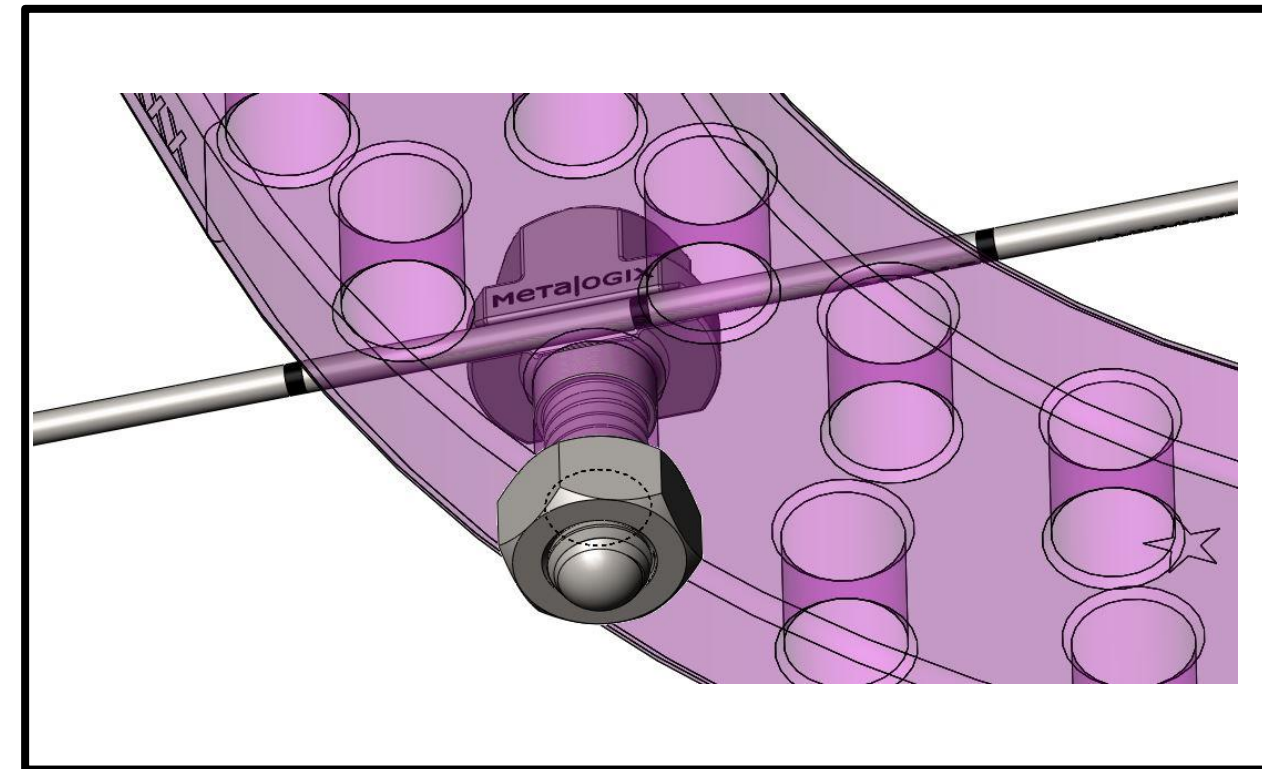
3. Secure the wire by using **WIRE FIXATION BOLT**. A black line can be seen on the top face to indicate slot fixation feature. The black will be parallel with axis of the wire. Secure bolt by using a **SPHERICAL NUT x 10mm**. Use a 10mm wrench to hold the hex head of the bolt.



5. Surgical Technique

WIRE INSERTION:

4. Tighten Wire Fixation Bolt on the side away from where the tension will be applied. For Truss Wires, completely tighten down the bolt on the truss side and then tension the wire on the opposite side. Bending the tightened end 90° before tensioning, confirms the wire is tight and if it doesn't move/straighten.



NOTE: Recommended to use SPHERICAL NUT X 10mm. However, any other nut will be acceptable.

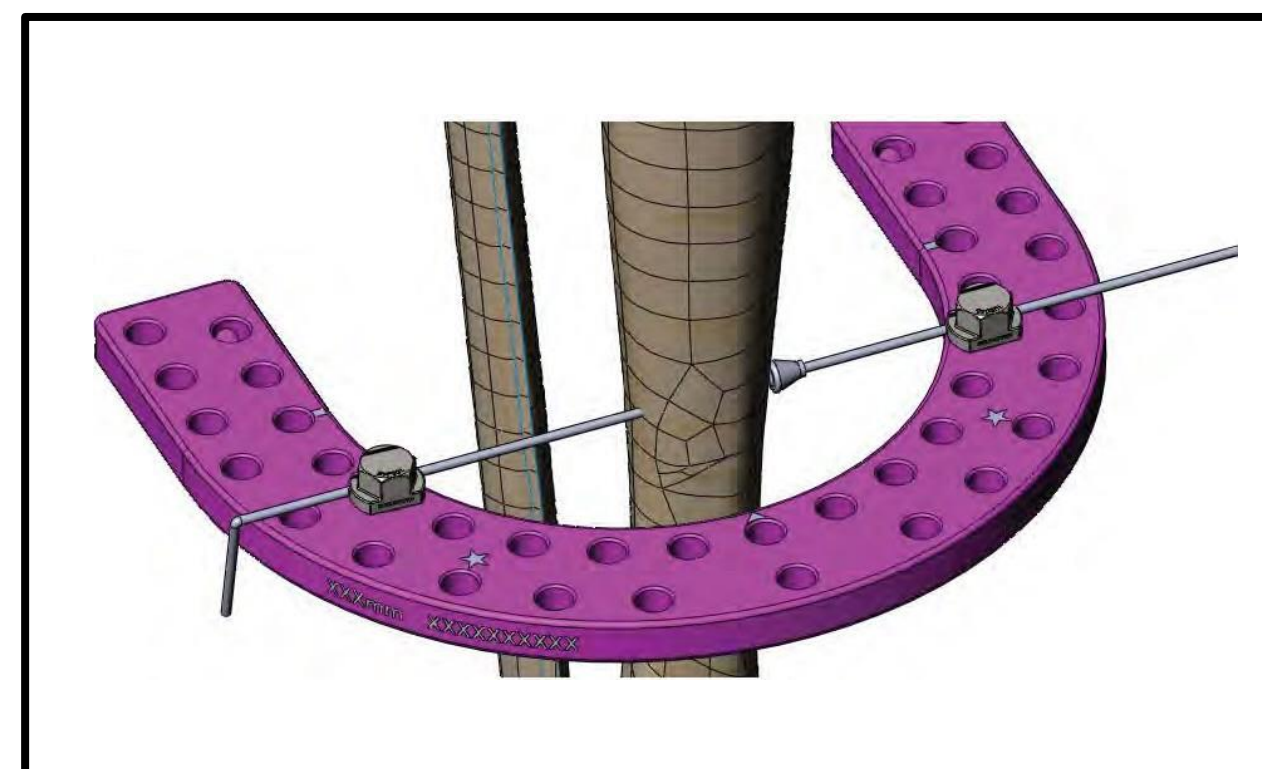
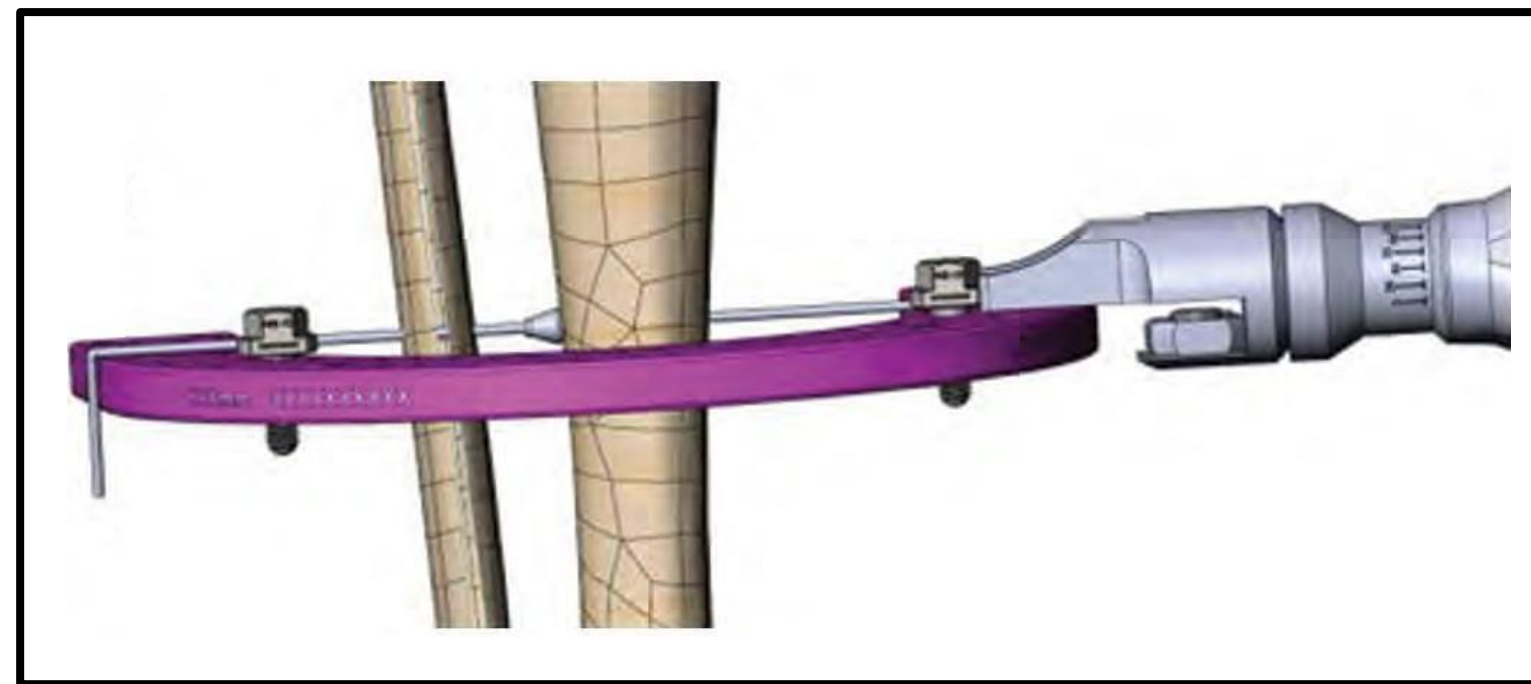
NOTE: Recommended to tension anywhere between 50kg-125kg, as per surgeon's preference.

NOTE: After tensioning, go back and re-tighten WIRE FIXATION BOLTS.

NOTE: Simultaneously tensioning two (2) wires on the same plate is highly advisable.

NOTE: When placing two (2) wires, it is advised to spread wires to as close to 90° as anatomically possible. Use at least two (2) planes of wires/half pins in each major bone segment.

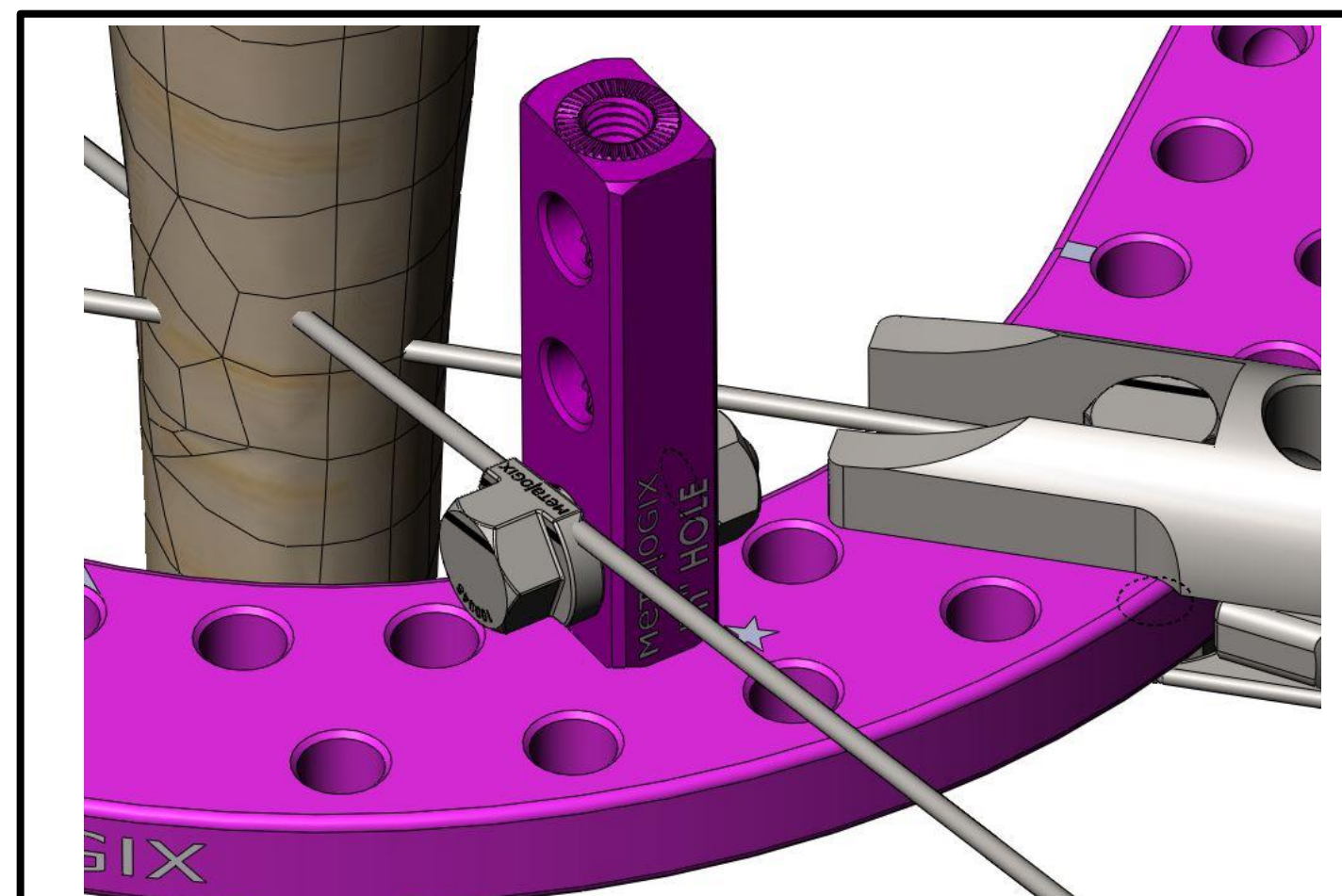
NOTE: The sequence of tensioning will be dependent of frame application and surgeon preference.



5. The same wire attachment concept can be used on a post if the wire needs to be higher from the plane of the plate.

NOTE: The height of the wire can also be achieved by adding washers below the WIRE FIXATION BOLT.

NOTE: Use a 14 MM BOLT to attach a post on a plate.



5. Surgical Technique

FORE-FOOT BRIDGE ASSEMBLY:

1. It is always recommended to close off the **FOOT PLATE** with the **FORE-FOOT BRIDGE** construct.
2. The **FORE-FOOT BRIDGE** should be attached and in place before any wires are tightened to the **FOOT PLATE**.
3. Place a **5 HOLE POST** on the end of the **FOOT PLATE** legs. Turn the posts, so that the long side is parallel to the inside wall. Place either a **14mm or 20mm BOLT** to hold the posts in place. Do not fully tighten the posts.

NOTE: Depending upon the surgeon's desired height of the bridge, any post can be used.

4. When the height and angulation of the **FORE-FOOT BRIDGE** is determined, use the **20mm BOLTS** to lock the bridge in place.

NOTE: It is important to use the 20mm BOLTS length when locking the **FORE-FOOT BRIDGE** on the posts.

NOTE: The **FORE-FOOT BRIDGE** angle can be adjusted by loosening up the 20mm BOLTS. The **FORE-FOOT BRIDGE** has a 10mm flat for the wrench to hold for counter torque.

5. Fully tighten the **FORE-FOOT BRIDGE** first before tightening the posts to the plate.



5. Surgical Technique

WIRE TENSIONER:

1. The **WIRE TENSIONER** is a spring-loaded, forceps style instrument. The tensioner head has a unique swivel head to capture wire and **WIRE FIXATION BOLTS** at difficult angles. The head is also extended to reach inside holes on **FOOT PLATES**. The tensioner has tensioning forces from 0kg- 125kg.

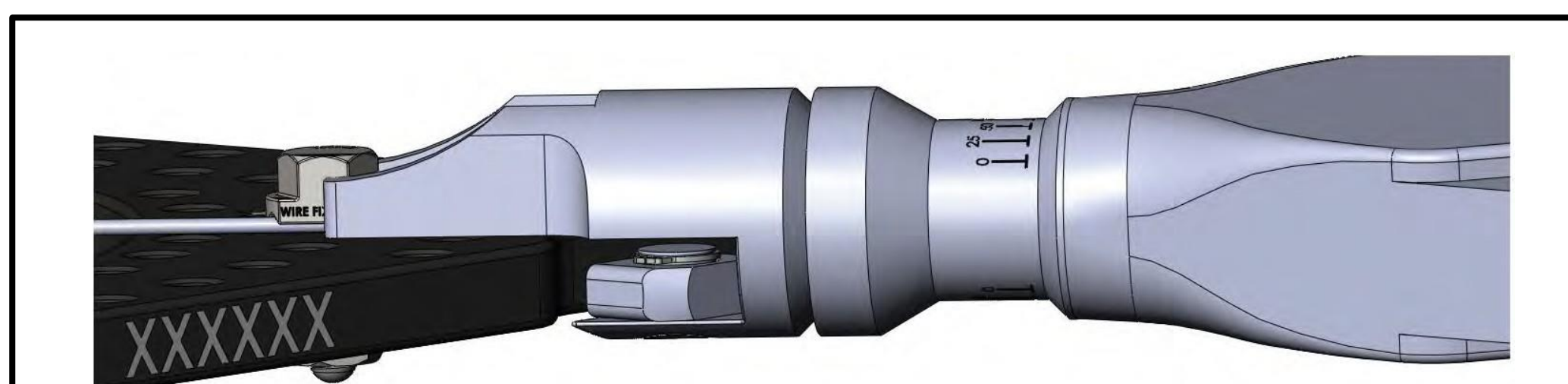
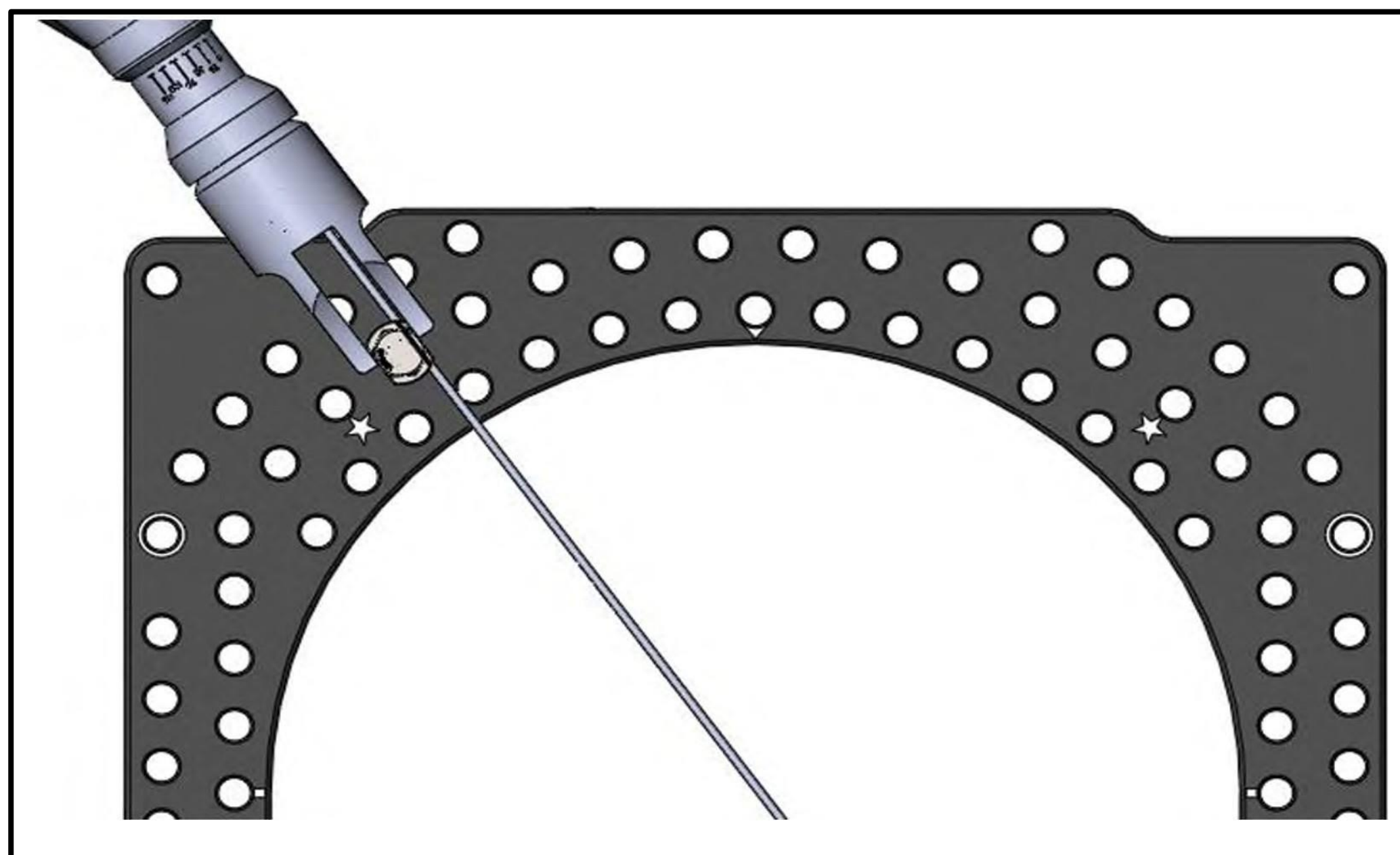
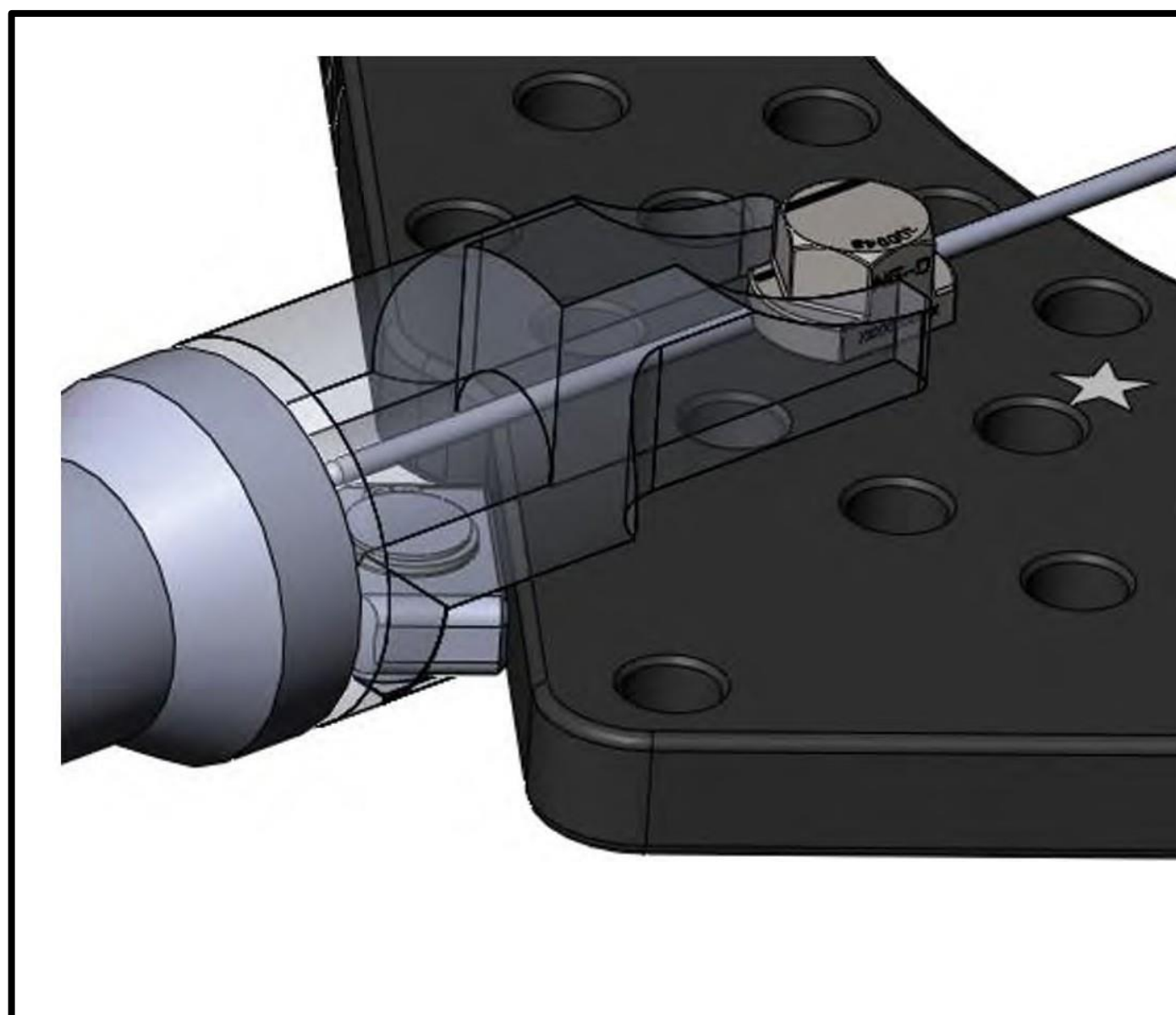
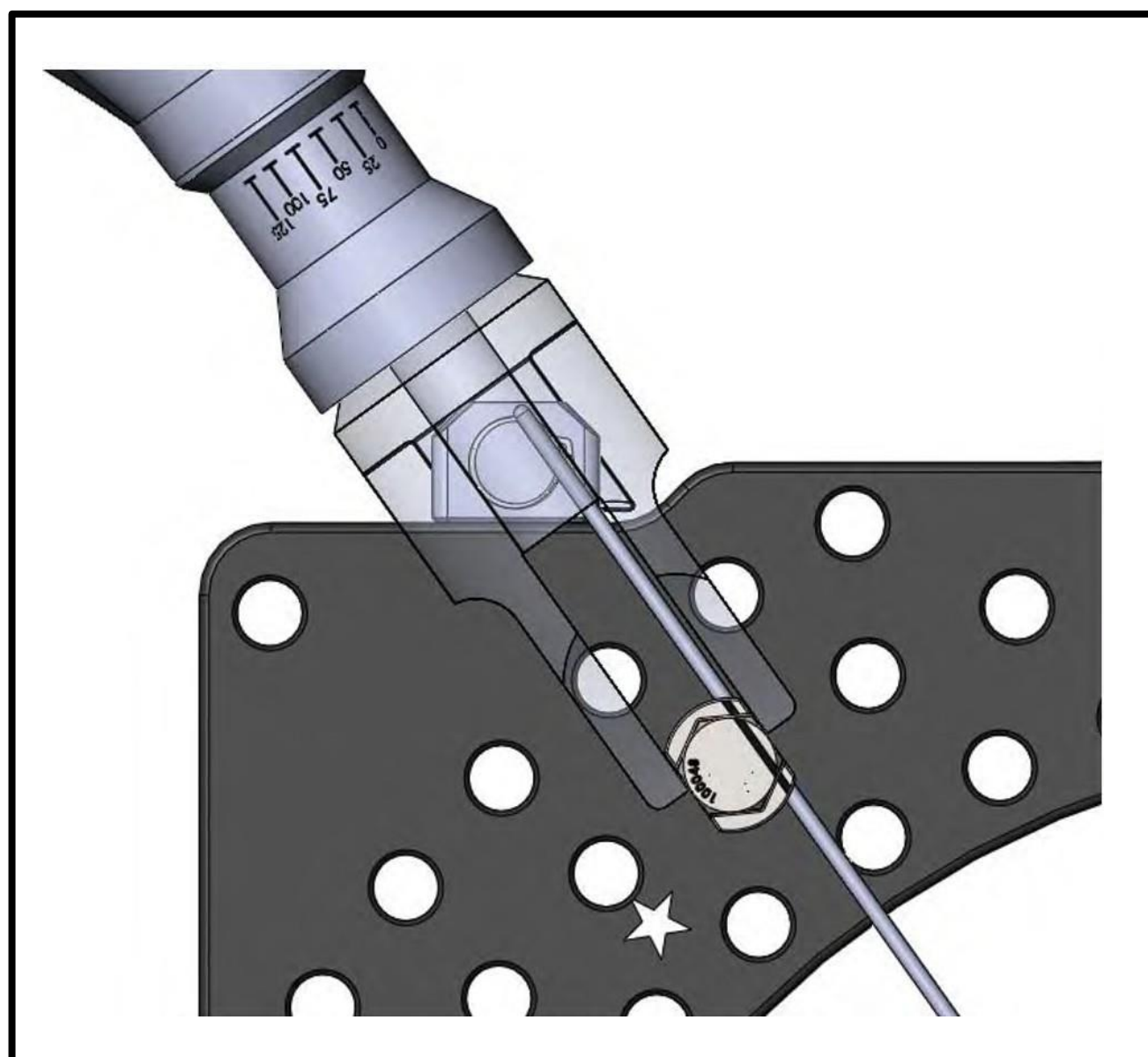
NOTE: Reading is done after the collar/tube interface.



5. Surgical Technique

WIRE TENSIONER:

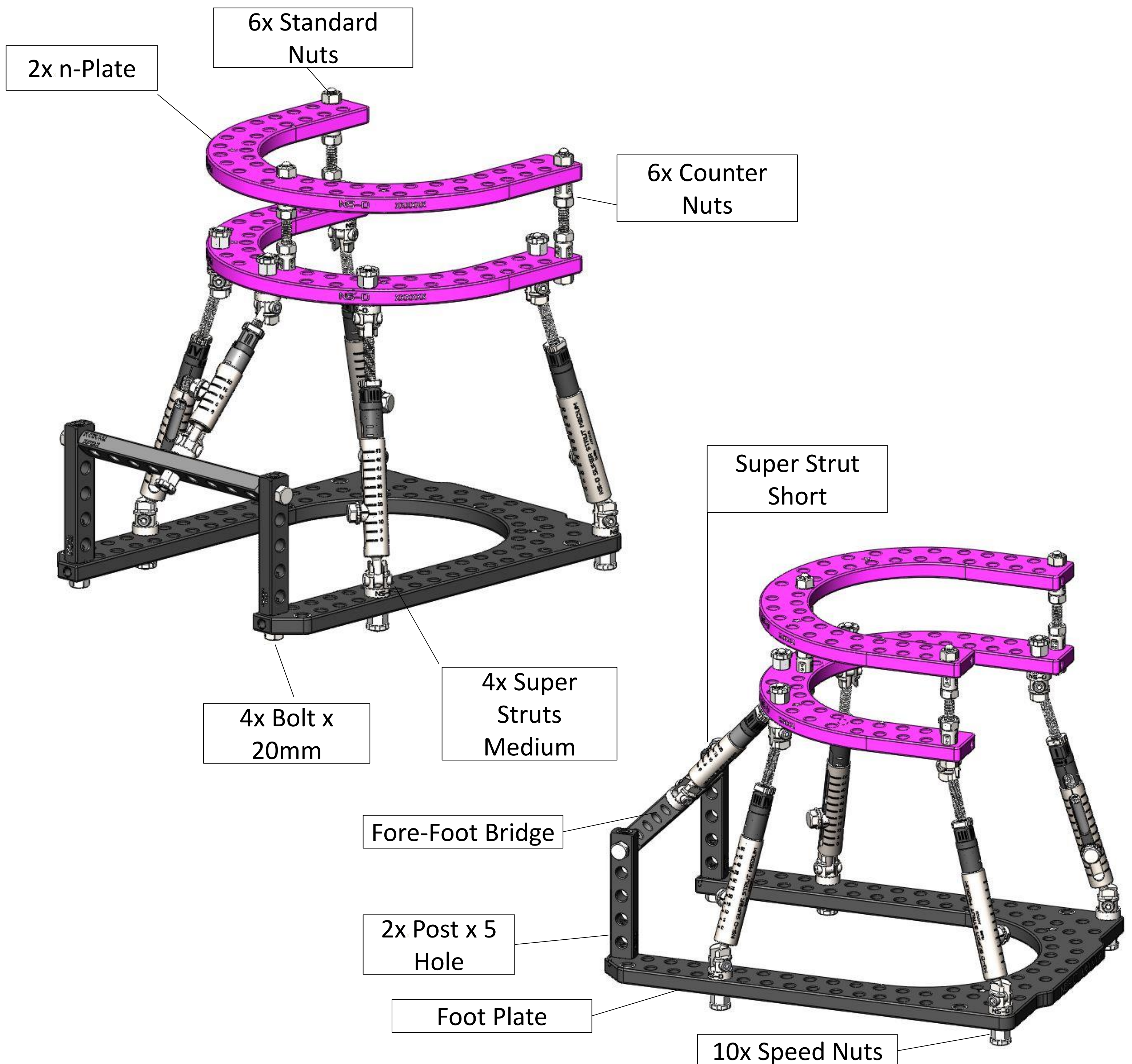
Examples of the Wire Tensioner being used on a Foot Plate:



6. Frame Examples

STATIC FOOT & ANKLE FRAME ASSEMBLY:

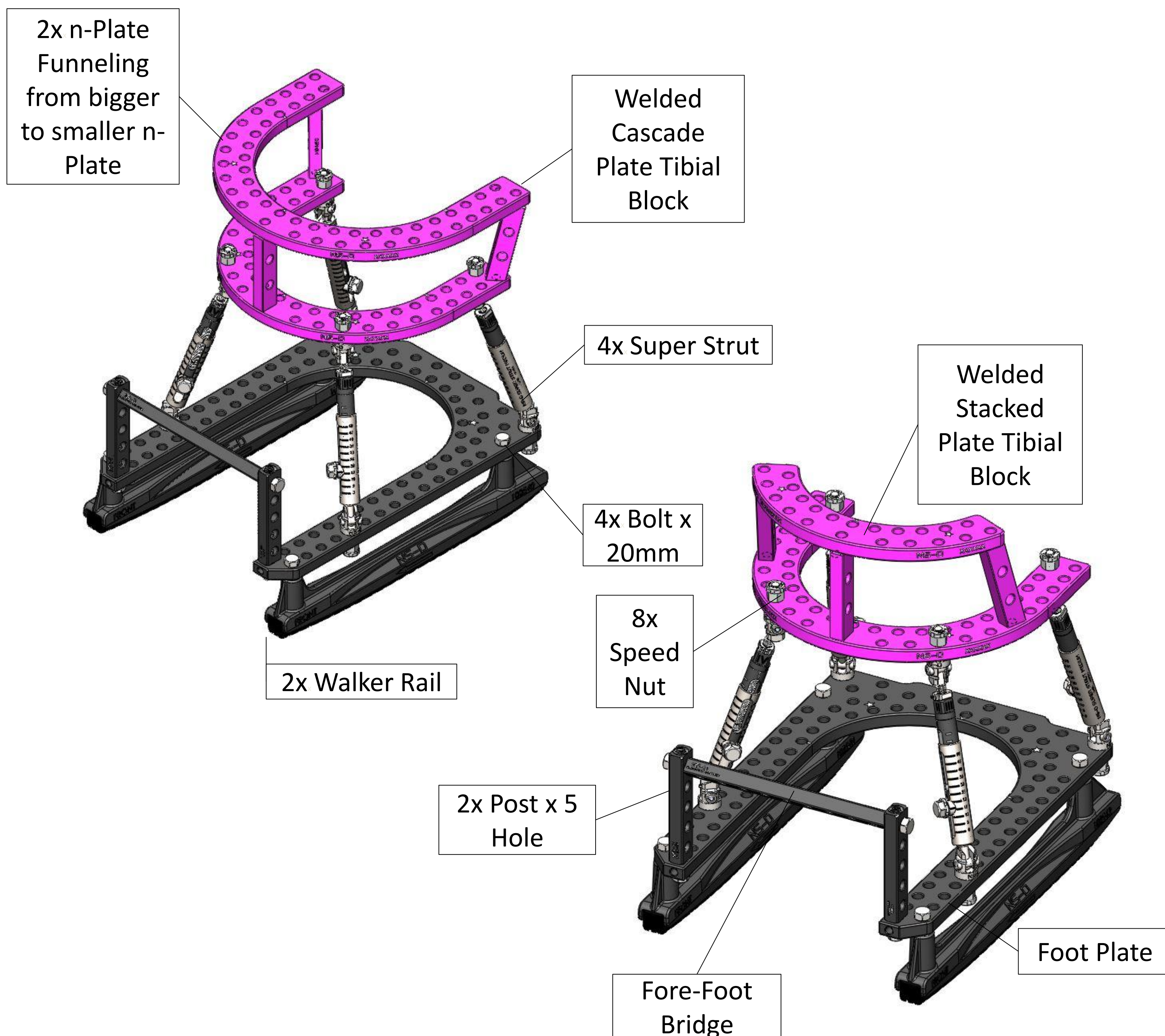
If the surgeon wants to build the frame, it is recommended to have a minimum of three points of fixation per **TIBIAL BLOCK PLATE** and four points of fixation per **FOOT PLATE**. Additional frame stability can be gained by attaching a **SUPER STRUT** to the **FORE-FOOT BRIDGE** as shown below.



6. Frame Examples

CASCADE/STACKED FOOT & ANKLE FRAME ASSEMBLY:

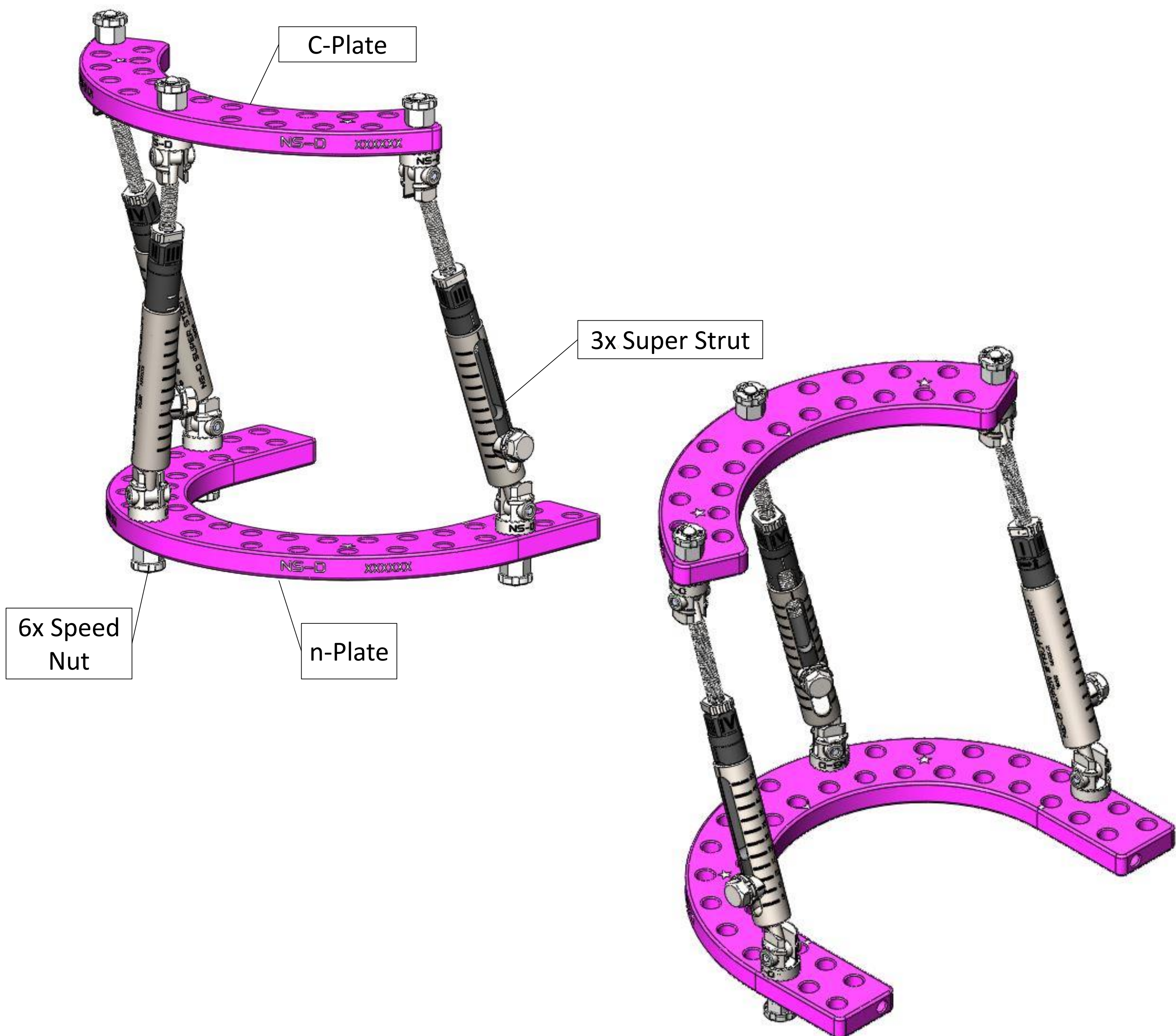
The **CASCADE FRAME** consists of a welded Tibial Block with 2x **n-PLATES** (Image on left). The **n-PLATES** are funneling from a bigger size **n-PLATE** down to a smaller size. The **STACKED FRAME** (Image on right) consists of a welded stacked Tibial Block with 1x **C-PLATE** and same size **n-PLATE**. The angulated posts in the Tibial Block are welded and can not be moved. However, wires or **HALF-PINS** can be attached to them.



6. Frame Examples

TRAUMA FRAME ASSEMBLY:

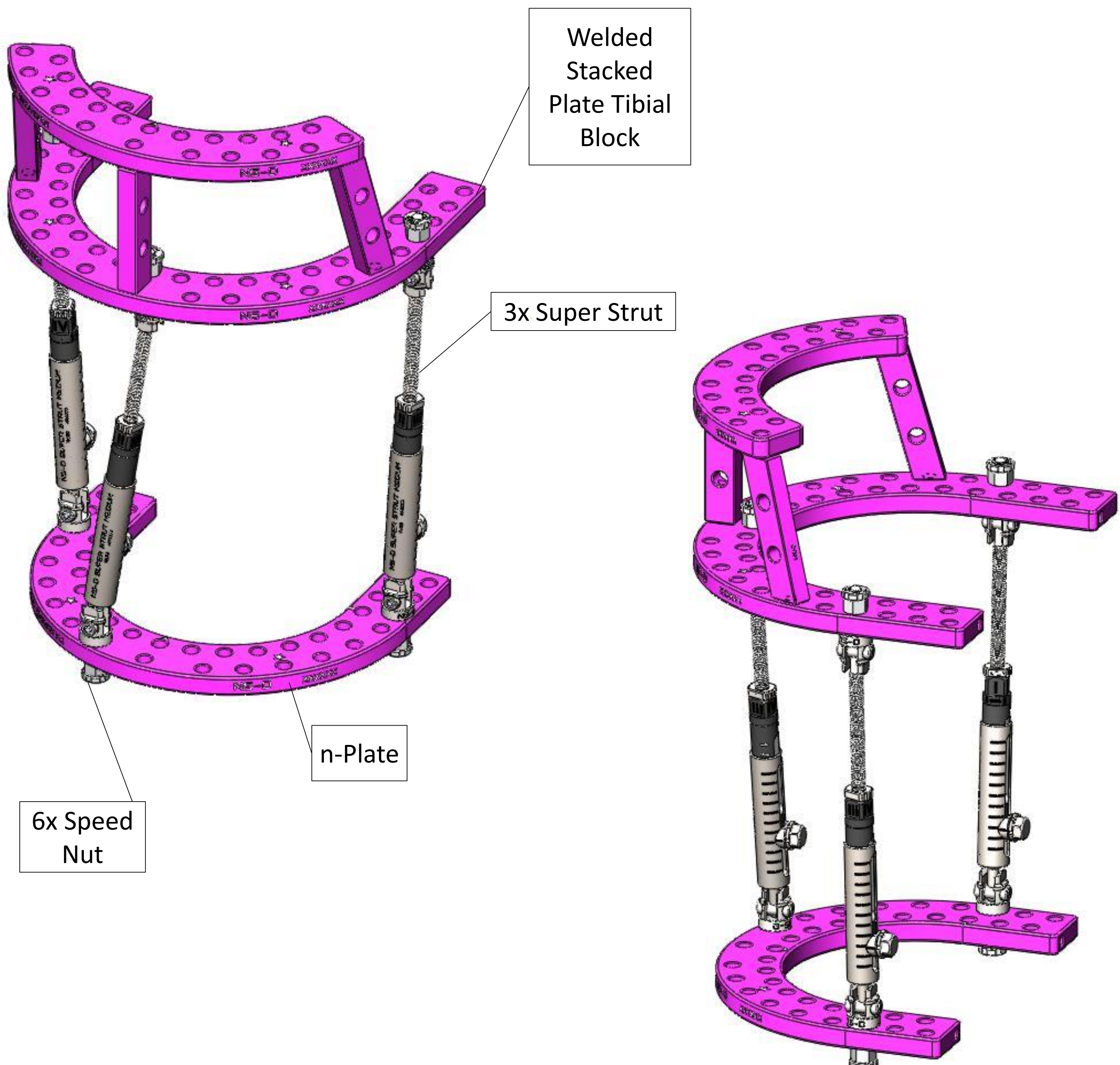
The **TRAUMA FRAME ASSEMBLY** can be used to support the distal/proximal/mid-tibial shaft fractures. It is recommended to have a minimum of three (3) **SUPER STRUTS**. A **C-PLATE** and **n-PLATE** can be used for this construct.



6. Frame Examples

TRAUMA FRAME ASSEMBLY:

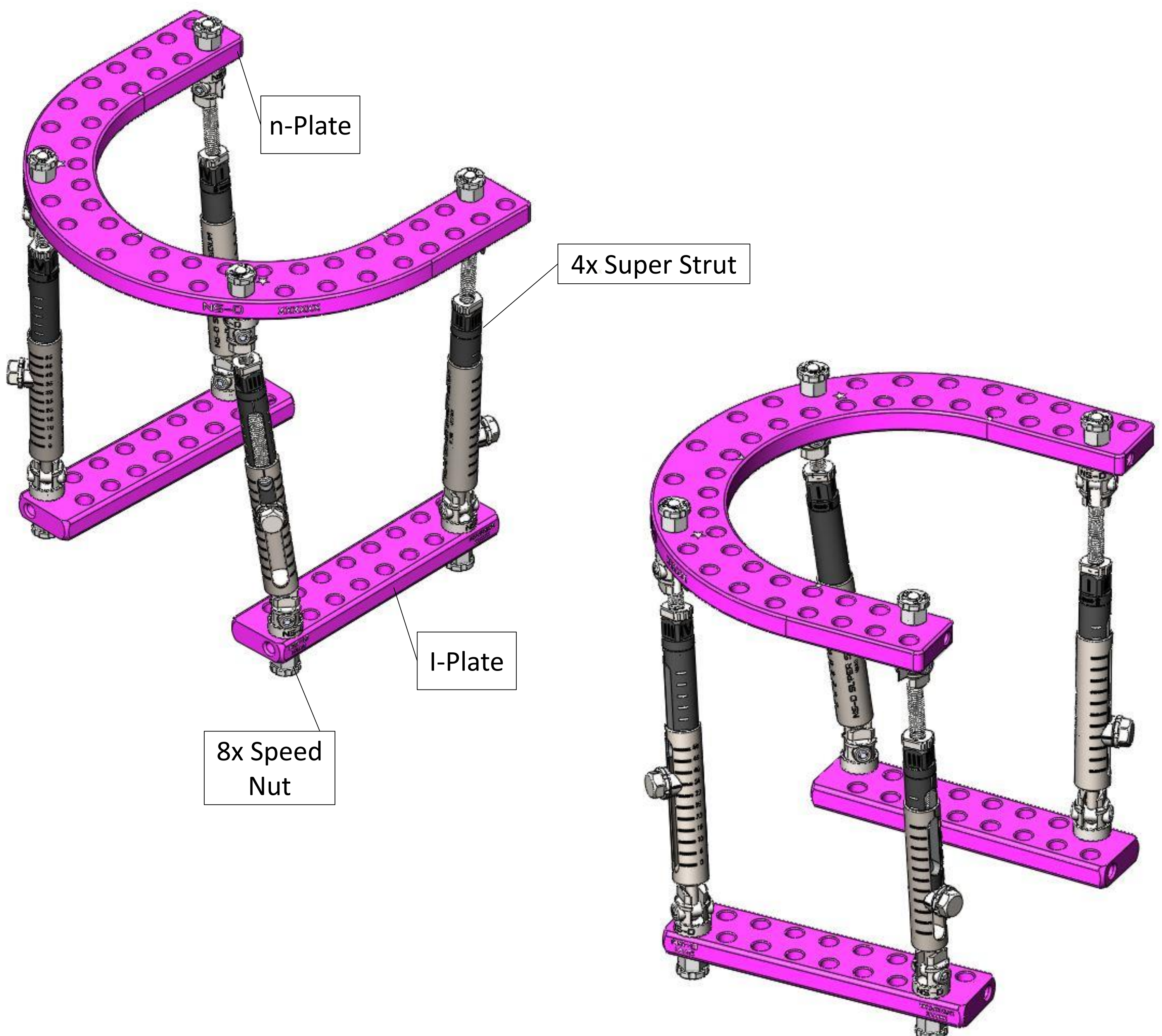
The **TRAUMA FRAME ASSEMBLY** can be used to support the distal/proximal/mid-tibial shaft. For extra support, a welded **STACKED TIBIAL BLOCK** can be added. It is recommended to have a minimum of three (3) **SUPER STRUTS**.



6. Frame Examples

TRAUMA FRAME ASSEMBLY:

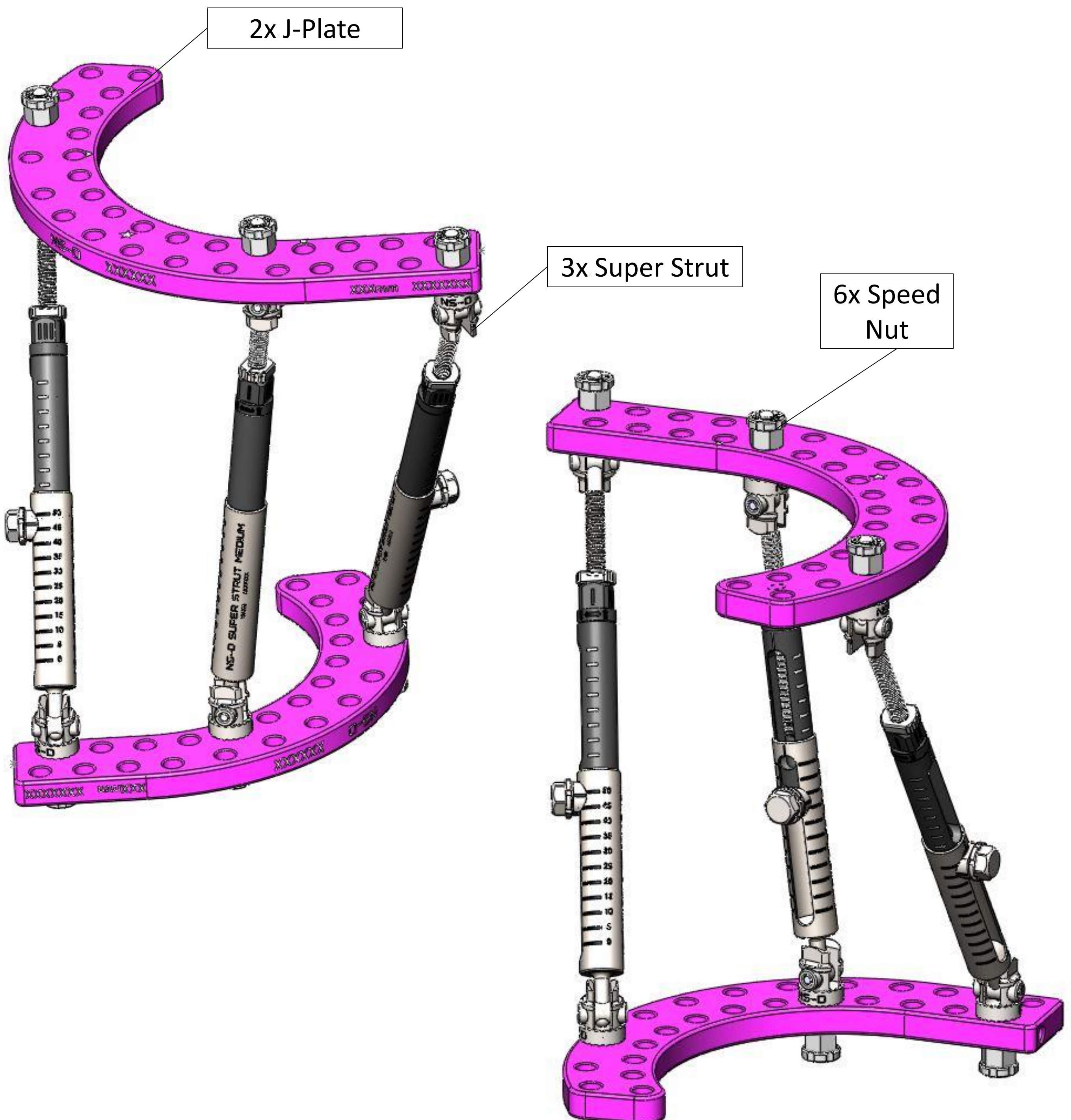
The **TRAUMA FRAME ASSEMBLY** can be used to support the distal tibial fractures. It is recommended to have a minimum of four (4) **SUPER STRUTS**, attached through calcaneus with a full **STEINMANN PIN**.



6. Frame Examples

TRAUMA FRAME ASSEMBLY:

The **FLAP** or **TRAUMA FRAME ASSEMBLY** can be used to support the tibial shaft and foot, but allowing more of an open for swelling by using **J-PLATES**. It is recommended to have a minimum of three (3) **SUPER STRUTS**.



7. Ordering Information

REVOLUTION TRAYS

PART#	TRAY DESC.	GTIN-12	CASE Identifier #
900123	Implant Tray	854641008051	IMP-XXX
900124	C/Footplate Tray	854641008068	CFP-XXX
900125	J/N-Plate Tray	854641008075	JNP-XXX
900126	Instrument + Hardware Tray	854641008082	IHT-XXX
900127	General Tray	854641008099	GEN-XXX
900128	Implant Modular Tray	854641008105	IMT-XXX
900129	Nut and Bolt Caddy Tray	854641008129	NBT-XXX

NOTE: To order trays or parts, use Sales/Restock Order Form.



7. Ordering Information

IMPLANT TRAY

PART #	DESCRIPTION	PREDETERMINED QTY.
900123-F	Implant Tray	1
900117	Smooth Wire x 1.8mm SS	16
900217	Truss Wire x 1.8mm SS	16
624004	Steinmann Pin x 4mm	2
624005	Steinmann Pin x 5mm	2
624006	Steinmann Pin x 6mm	2
618015	Blunt Half-Pin 4x20x215mm	4
618030	Blunt Half-Pin 4x30x215mm	4
618050	Blunt Half-Pin 4x50x215mm	4
621030	Blunt Half-Pin 5x30x215mm	4
621040	Blunt Half-Pin 5x40x215mm	4
621060	Blunt Half-Pin 5x60x215mm	4
621080	Blunt Half-Pin 5x80x215mm	4
623040	Blunt Half-Pin 6x40x215mm	4
623050	Blunt Half-Pin 6x50x215mm	4
623060	Blunt Half-Pin 6x60x215mm	4
100504	2.9mm Drill	3
100505	3.5mm Drill	3
100506	4.7mm Drill	3
100048	Wire Fixation Bolt	25
100050	Half-Pin Bolt x 4/6mm	10
900026	Speed Nut	20
900039	Spherical Nut x 10mm	40
900060	Wing Bolt x 14mm	8
900061	Wing Bolt x 20mm	8
900030	Wing Nut	12
900043	Large Pin Stopper	6
900044	Large Wire Stopper	6
900045	Small Pin Stopper	12
900046	Small Wire Stopper	12
900035	Standard Nut x 10mm	50

7. Ordering Information

IMPLANT MODULAR TRAY

PART #	DESCRIPTION	PREDETERMINED QTY.
900128-F	Implant Modular Tray	1
617015	Self-Drill Half-Pin 4x20x215mm	4
617030	Self-Drill Half-Pin 4x30x215mm	4
617050	Self-Drill Half-Pin 4x50x215mm	4
620030	Self-Drill Half-Pin 5x30x215mm	4
620040	Self-Drill Half-Pin 5x40x215mm	4
620060	Self-Drill Half-Pin 5x60x215mm	4
620080	Self Drill Half Pin 5x80x215mm	4
622040	Self-Drill Half-Pin 6x40x215mm	4
622050	Self-Drill Half-Pin 6x50x215mm	4
622060	Self-Drill Half-Pin 6x60x215mm	4
100504	2.9mm Drill	3
100505	3.5mm Drill	3
100506	4.7mm Drill	3

7. Ordering Information

NUT AND BOLT CADDY TRAY

PART #	DESCRIPTION	PREDETERMINED QTY.
900129-F	Nut & Bolt Caddy Tray	1
100049	Wire Fixation Bolt-Long	12
94007A000	Spherical Washer Coupling	16
100065	Standard Bolt 10mm x 14mm	10
100070	Standard Bolt 10mm x 20mm	8
100080	Standard Bolt 10mm x 30mm	8
100719	Counter Nut	8
900032	Washer 1mm	20
900110	Pin Caps 4mm	10
900111	Pin Caps 5mm	10
900112	Pin Caps 6mm	10
900029	Slotted Washer	25

7. Ordering Information

C & FOOTPLATE TRAY

PART #	DESCRIPTION	PREDETERMINED QTY.
900124-F	C & Foot Plate Tray	1
116120	C-Plate x 120mm	2
116140	C-Plate x 140mm	2
116160	C-Plate x 160mm	2
116180	C-Plate x 180mm	2
116200	C-Plate x 200mm	2
114120	Foot Plate x 120mm	2
114140	Foot Plate x 140mm	2
114160	Foot Plate x 160mm	2
114180	Foot Plate x 180mm	2

7. Ordering Information

J & n-PLATE TRAY

PART #	DESCRIPTION	PREDETERMINED QTY.
900125-F	J & n-Plate Tray	1
115120	n-Plate x 120mm	2
115140	n-Plate x 140mm	2
115160	n-Plate x 160mm	2
115180	n-Plate x 180mm	2
115200	n-Plate x 200mm	2
115220	n-Plate x 220mm	2
119120	J-Plate x 120mm	2
119140	J-Plate x 140mm	2
119160	J-Plate x 160mm	2
119180	J-Plate x 180mm	2
119200	J-Plate x 200mm	2

7. Ordering Information

INSTRUMENT & HARDWARE TRAY

PART #	DESCRIPTION	PREDETERMINE D QTY.
900126-F	Instrument + Hardware Tray	1
901040	Threaded Rod x 40mm	4
901060	Threaded Rod x 60mm	4
901080	Threaded Rod x 80mm	4
901120	Threaded Rod x 120mm	4
901160	Threaded Rod x 160mm	4
100720	Male Hinge	4
100722	Female Hinge	4
100790	90° Hinge	2
100830	Plate Extender 30mm	4
100850	Plate Extender 50mm	4
100801	Post x 1 Hole	6
100802	Post x 2 Holes	6
100803	Post x 3 Holes	6
100804	Post x 4 Holes	6
100805	Post x 5 Holes	6
100120	Fore-Foot Bridge 120mm	2
100140	Fore-Foot Bridge 140mm	2
100160	Fore-Foot Bridge 160mm	2
100180	Fore-Foot Bridge 180mm	2
100201	Fore-Foot Bridge 200mm	2
105300	Super Strut - Short	4
105200	Super Strut - Medium	4
105400	Super Strut - Long	4
100404	Trocar & Sheath 4-6mm	2
900101	Wire Tensioner x Ratcheting	2
900103	T-Handle Wrench x AO	2
900104	Slotted 90 Deg Tubular Wrench x 10mm	2
900105	Open End/Swivel End Wrench x 10mm	2
900106	Standard Wrench x 10mm	2

7. Ordering Information

EMPTY TRAYS

PART #	DESCRIPTION	PREDETERMINED QTY.
900127-F	General Tray	1

NOTE: These are empty trays that can be ordered and filled to however the reps feels is necessary per surgery.

7. Ordering Information

PRE-ASSEMBLED FRAMES

Description
Pre-Assembled Welded Stacked Frame x 120mm
Pre-Assembled Welded Stacked Frame x 140mm
Pre-Assembled Welded Stacked Frame x 160mm
Pre-Assembled Welded Stacked Frame x 180mm
Pre-Assembled Welded Stacked Frame x 200mm
Pre-Assembled Welded Cascade Frame x 120/140mm
Pre-Assembled Welded Cascade Frame x 140/160mm
Pre-Assembled Welded Cascade Frame x 160/180mm
Pre-Assembled Welded Cascade Frame x 180/200mm
Pre-Assembled Welded Cascade Frame x 200/220mm

NOTE: For Pre-Assembled Frames, use Pre-Assembled Frame order form. The form will allow the user to specifically customize the frame.

7. Ordering Information

PARTS NOT INCLUDED IN TRAYS

Part #	Description
114200	Foot Plate x 200mm
135120	Welded Stacked Plate Tibial Block 120mm
135140	Welded Stacked Plate Tibial Block 140mm
135160	Welded Stacked Plate Tibial Block 160mm
135180	Welded Stacked Plate Tibial Block 180mm
135200	Welded Stacked Plate Tibial Block 200mm
137120	Welded Cascade Plate Tibial Block 120/140mm
137140	Welded Cascade Plate Tibial Block 140/160mm
137160	Welded Cascade Plate Tibial Block 160/180mm
137180	Welded Cascade Plate Tibial Block 180/200mm
137200	Welded Cascade Plate Tibial Block 200/220mm
100540	Walker Rail
901200	Threaded Rod x 200mm
901220	Threaded Rod x 220mm
901240	Threaded Rod x 240mm
901300	Threaded Rod x 300mm
901400	Threaded Rod x 400mm
100806	I-Plate
100807	I-Plate Long
104000	Plate Sizing Template Set
900025	Nut with Nylon Insert
900040	T-Block n-Plate
900041	T-Block Footplate
622070	Self-Drill Half-Pin 6x70x215mm
622080	Self-Drill Half-Pin 6x80x215mm
623070	Blunt Half-Pin 6x70x215mm
623080	Blunt Half-Pin 6x80x215mm

NOTE: To order trays or parts, use Sales/Restock Order Form.

References

Basic Ilizarov techniques (1990). Techniques in Orthopaedics, 5(4).

Catagni, M.A. (2003). Atlas for the insertion of transosseous wires and half-pins: Ilizarov method (2nd ed.). A. Bianchi-Maiocchi (Ed.). Milan, Italy: Medi Surgical Video.

Gubin, A. V., Borzunov, D. Y., & Malkova, T. A. (2013). The Ilizarov paradigm: thirty years with the Ilizarov method, current concerns and future research. International Orthopaedics, 37(8), 1533-1539.

<http://doi.org/10.1007/s00264-013-1935-0>

Hamdy. MB. ChB, MSc. FRCSC, R. C., McCarthy. MD, J. J., & Clarke. MD, H. D. (Eds.). (2011). Management of limb-length discrepancies (45th ed.). Rosemont, IL: American Academy of Orthopaedic Surgeons.

Notes

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Blanchard D.P.M Ravi
Karia M.D

This document is intended for the use of an medical professional. It is there responsibility to evaluate the suitability of a technique based on their experience.

The surgical technique is presented to demonstrate the Revolution system. Pertain to the instructions for use before the use of the product.

Please contact your Metalogix representative for any questions.

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