



General Principles of TL-HEX Frame Assembly

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Orthofix wishes to thank the following surgeons for their contribution to the development of this technique:

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INTRODUCTION

In 1951, Professor Gavril Ilizarov of Kurgan, Russia introduced a new external fixation apparatus and technique for fracture reduction, limb lengthening and deformity correction. The technique revolutionized the management of many previously unsolvable reconstructive problems. The Ilizarov apparatus experienced many modifications over the last sixty years. One of those modifications is TrueLok Ring Fixation System, developed at Texas Scottish Rite Hospital for Children (TSRHC) in Dallas, Texas. Although significantly improved when compared to the original Ilizarov apparatus, TrueLok Ring Fixation System preserves most of the original principles and methodology of Professor Ilizarov.

The TL-HEX is a hexapod-based system designed at TSRHC as a three-dimensional bone segment reposition module to augment the previously developed TrueLok frame. In essence, the system consists of circular and semi-circular external supports secured to the bones by wires and half pins and interconnected by six struts. This allows multi-planar adjustment of the external supports. The rings position is adjusted either rapidly or gradually in precise increments to perform bone segment repositioning in three-dimensional space.

All components of the TL-HEX are compatible with the TrueLok Ring Fixation System; therefore external supports from both systems can be connected to each other when building fixation blocks. All the basic components from the TrueLok Ring Fixation System (wire and half pin fixation bolts, posts, threaded rods, plates as well as other assembly components and instrumentation) should be utilized with the TL-HEX. As with any other hexapod-type external fixator, for successful application of the TL-HEX is available an associated software (see TL-HEX Software User Guide).

ADVANTAGES OF THE TL-HEX

Simple

TL-HEX offers pre-assembled and universal components, which are easy to connect, align and operate.

Stable

TL-HEX provides exceptional stability due to its unique aluminum-stainless steel and patented metal-plastic interface.

Versatile

The distinctive strut design allows for independent rapid and gradual adjustments resulting in a greater overall adjustment range.

INDICATIONS FOR USE

The TL-HEX system is intended for limb lengthening by metaphyseal or epiphyseal distractions, fixation of open and closed fractures, treatment of non-union or pseudoarthrosis of long bones and correction of bony or soft tissue defects or deformities.

Warnings

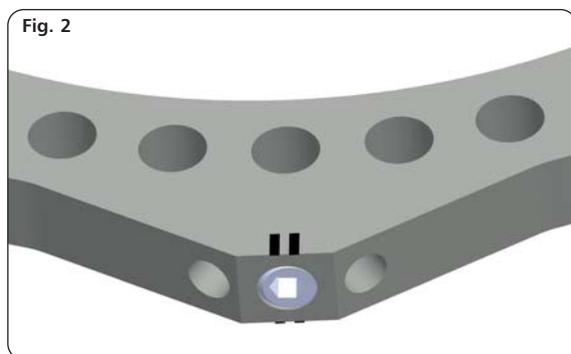
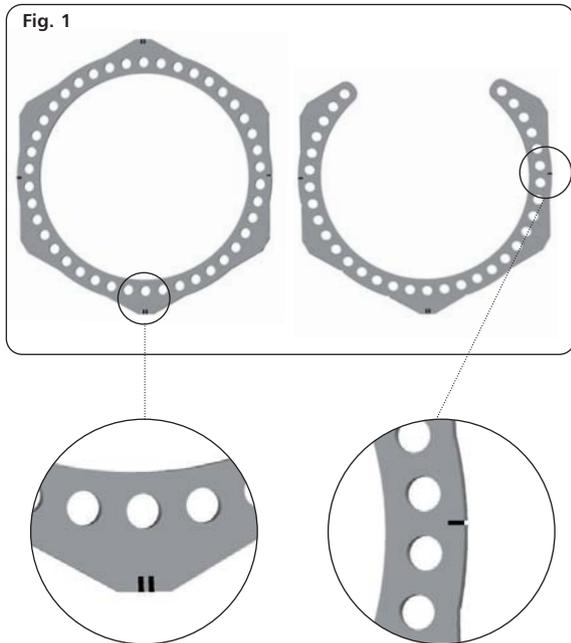
Particular care should be taken that wires and half pins do not enter the joints or damage the growth plates in children.

Precautions

Use of TL-HEX for specific patients is at the discretion of the treating surgeon. In general, application of a circular external fixator and post-operative management require appreciable experience and skill in the technique. In addition, building a specific frame to treat an individual case is of fundamental importance to the successful outcome of the procedure, and beyond the scope of this discussion. The reader is referred to manuals, textbooks, and skills laboratories for appropriate training in all aspects of the application of circular external fixation. A list of reference material for further exploration is provided at the end of this guide to further enhance the reader's understanding of circular external fixation.

A software program is available for preoperative planning in TL-HEX application (see TL-HEX Software User Guide). Accurate input of data is critical for correct calculations.





TL-HEX EXTERNAL SUPPORTS

TL-HEX external supports are 9 mm thick and made of anodized high-strength aircraft grade aluminum. They are offered in two shapes (full ring and 5/8 ring) and a variety of sizes to allow custom constructs to suit the particular clinical situation (Fig. 1). TL-HEX full rings and 5/8 rings have similar design features and match the hole pattern of the TrueLok external supports.

All TL-HEX external supports are light, strong and very stable. They have two sets of quadrant markings (double-line and single-line) to simplify alignment and frame assembly.

Full Rings

TL-HEX full rings are available in 5 sizes with internal diameters of 140 mm, 160 mm, 180 mm, 200 mm and 220 mm. Each full ring has six angulated tabs to accommodate up to 12 struts. Each tab has 2 mounting holes on the sides to accept the struts and a single retained locking screw to secure the struts in place (Fig. 2).

Two opposing tabs on each full ring are marked with double line indicating the anterior and posterior tabs. The exact orientation of the anterior tab is very important (see TL-HEX Frame Assembly) and is referenced in the Software User Guide. In addition, each full ring has 2 single-line marks oriented 90° relative to anterior and posterior tabs to simplify external support alignment and frame assembly (Fig. 1).

5/8 Rings

5/8 rings are also offered in 5 sizes with internal diameter of 140 mm, 160 mm, 180 mm, 200 mm and 220 mm. Each 5/8 ring has five tabs (Fig. 1). Similar to full ring tabs, each tab has 2 mounting holes on the sides to accommodate the struts and a single retained locking screw to secure the struts in place (Fig. 2)

The central tab on each 5/8 ring is marked with a double line to facilitate its orientation. The exact orientation of this tab is very important (see TL-HEX Frame Assembly) and is referenced in the Software User Guide. In addition, each 5/8 ring has 2 single-line marks oriented 90° relative to the central tab to simplify external support alignment and frame assembly (Fig. 1).

Warning: The locking screws on the rings are retained and should never be removed for any reason. Rings must be cleaned and sterilized in the assembled state with the locking screw only untightened.

TL-HEX STRUTS

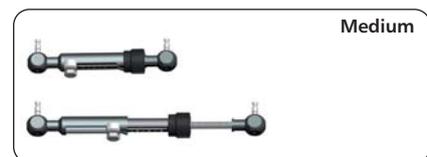
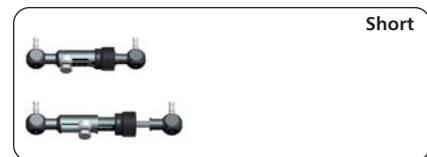
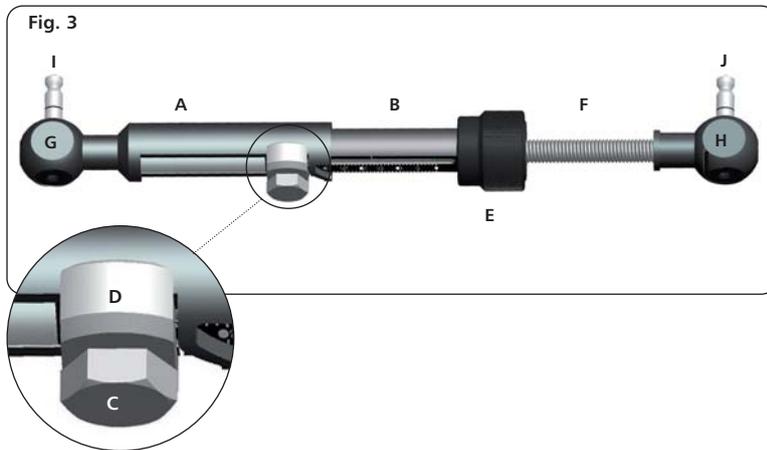
TL-HEX struts (Fig. 3) consist of two telescoping aluminum tubes, an outer tube (A) and an inner tube (B), which can be locked together at various lengths using the side locking bolt (C) and clamp washer (D).

Warning: The locking bolt on the strut is retained and should never be removed for any reason. Struts must be cleaned and sterilized in the assembled state with the locking bolt **only** untightened.

TL-HEX struts are available in three sizes (short, medium, long), providing adjustment range from 92 mm to a maximum extension of 318 mm (Table 1).

Table 1. Minimum and maximum lengths of the TL-HEX struts.

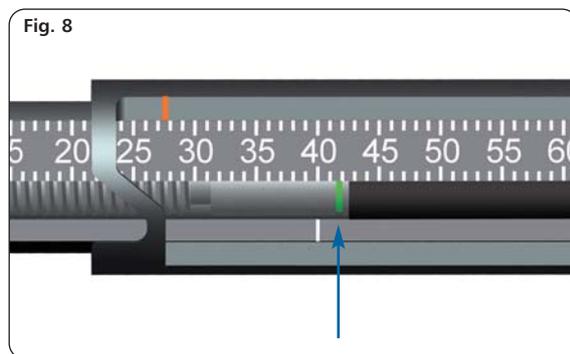
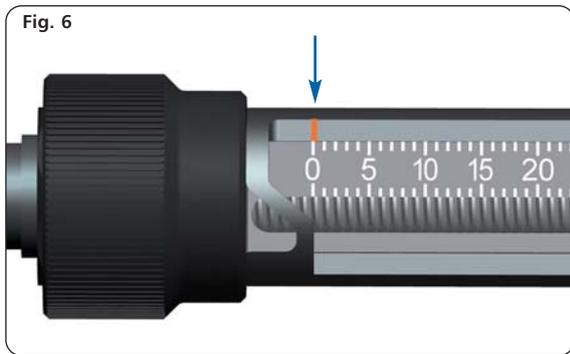
Part Number	Description	Minimum Length	Maximum Length
50-10200	Short	92 mm	122 mm
50-10300	Medium	114 mm	184 mm
50-10400	Long	158 mm	318 mm



The inner tube is attached to a spring-loaded, black knurled adjustment knob (E). The adjustment knob mates with the threaded rod (F) in a manner such that the rod translates relative to the inner tube when the knob is rotated. This will provide gradual changes of overall strut length in 0.5-mm increments. A reference arrow with (+) sign located on the base of the adjustment knob (Fig. 4) indicates the direction of turning to perform strut elongation (distraction).

Each strut has two special joints (Fig. 3, G-H), one at the base of the outer tube (tube end joint) and the other at the end of the threaded rod (rod end joint). Each joint has a mounting stud (Fig. 3, I-J), which can be inserted into the mounting holes on the ring tabs and held in place by the locking screw (Fig. 5, A-B).





The rapid adjustment of the strut length is achieved by untightening the side locking bolt, sliding the inner tube relative to the outer tube to the desired length and re-tightening the locking bolt. Rapid adjustment is indicated by the inner tube scale in 1-mm increments relative to the orange-line mark on the outer tube (Fig. 6).

The gradual adjustment is achieved by pulling and rotating the adjustment knob resulting in a noticeable detent (click) every 0.5 mm of adjustment (Fig 7).

Gradual adjustment is indicated by the same scale relative to the green-line mark on the end of the threaded rod (Fig. 8).

The struts are shipped with the outer tube locked to the inner tube at the zero rapid adjustment position. The threaded rod for gradual adjustment is set in the middle of the scale. This allows the surgeon to rapidly adjust the struts to the desired length followed by gradual compression or distraction.

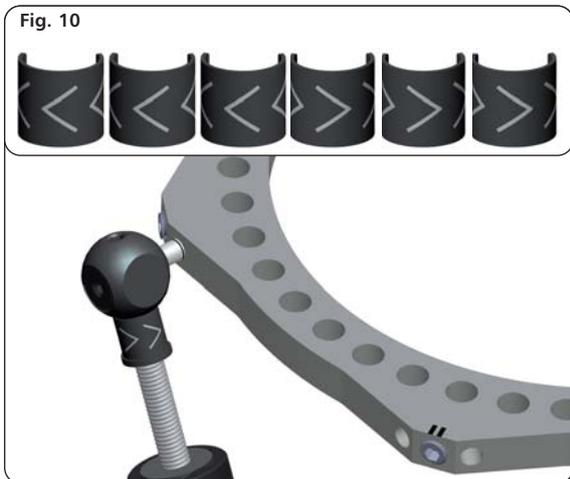
Fig. 9



There are two types of removable aluminum strut clips: number clips to indicate the strut number and direction clips to indicate the direction of gradual adjustment. The clips are snapped on to the struts and remain in place throughout the treatment.

The number clips are numbered from 1 to 6 and color coded as red (1), orange (2), yellow (3), green (4), blue (5), and purple (6). They are attached to the groove at the tube end joint (Fig. 9).

Fig. 10



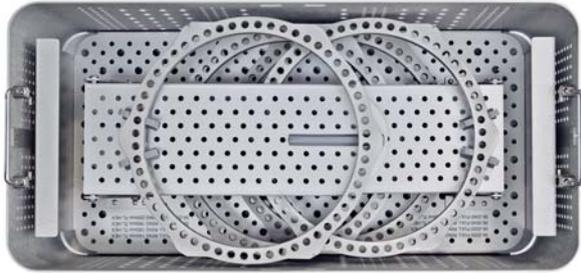
The direction clips are universal for all struts. They have an arrow indicating in which direction the adjustment knob should be turned to achieve the desired gradual adjustment. They are attached to the groove in the rod end joint of the strut (Fig. 10). The direction clip should be attached after surgery according to the prescription.

STERILIZATION TRAYS

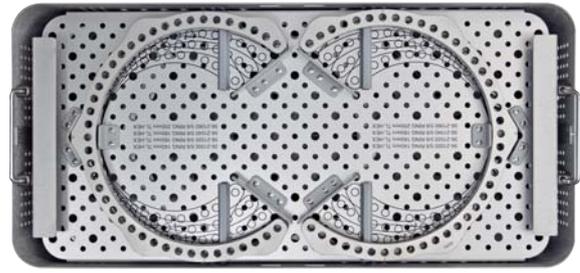
There are two TL-HEX sterilization trays: rings tray and struts tray. The rings tray includes two removable inserts (Fig. 11): a bottom full ring insert (A), which can hold four full rings and a top 5/8 ring insert (B), which can hold two 5/8 rings.

Ring sizes from 140 mm to 200 mm in any combination are accommodated by the sterilization tray. The 220 mm rings come sterile packaged.

Fig. 11



A



B

The struts tray contains three sets (6 of each) of struts: short, medium, and long (Fig. 12). The tray includes an ancillary clip caddy, which can hold up to 18 number clips (3 of each number) and 18 direction clips (Fig. 13).

Fig. 12

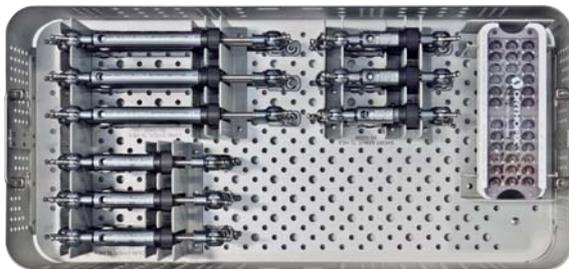


Fig. 13



Fig. 14 A



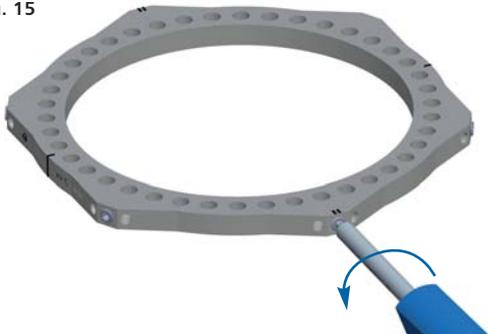
Fig. 14 B



TL-HEX FRAME ASSEMBLY

According to preoperative planning, select two rings, six struts and six number clips (Fig. 14, A-B).

Fig. 15



Confirm that the stud locking screws are backed out to the stops (Fig. 15).

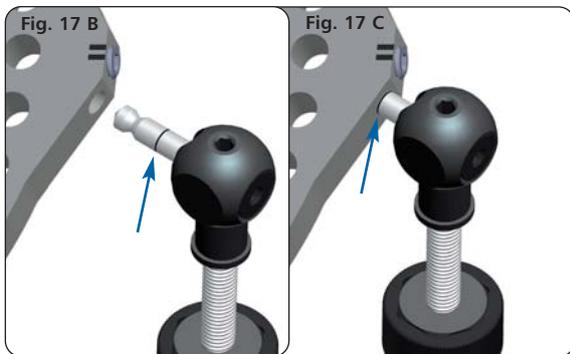
Fig. 16



Snap the number clips into the groove at the tube end joint (Fig 16).

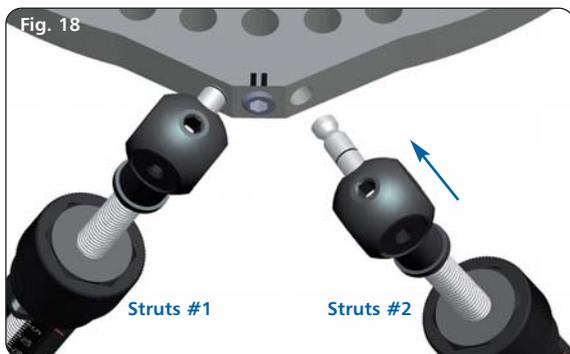


Position the proximal ring with the double-line marked tab facing the surgeon. Insert the mounting stud of strut #1 into the left mounting hole of the anterior tab (which becomes the master tab) of the ring (Fig. 17 A).



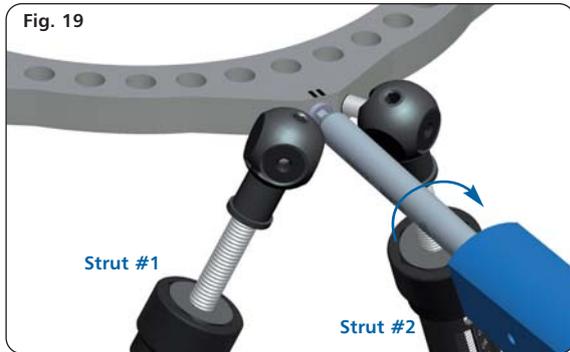
Confirm that the stud depth insertion line is fully hidden in the mounting hole (Fig. 17, B-C).

Note: If the strut stud does not fully seat in the mounting hole, back out the locking screw to the stop.



While holding strut #1 in place, insert the mounting stud of strut #2 into the right mounting hole of the same tab (Fig. 18).

Be sure that both adjustment knobs on the struts are pointing the same (preferably proximal) direction.



Using the 3.2-mm hex driver, firmly tighten the stud locking screw to hold the struts in place (Fig 19).

Note: Do not overtighten the stud locking screw to prevent stripping of the thread.

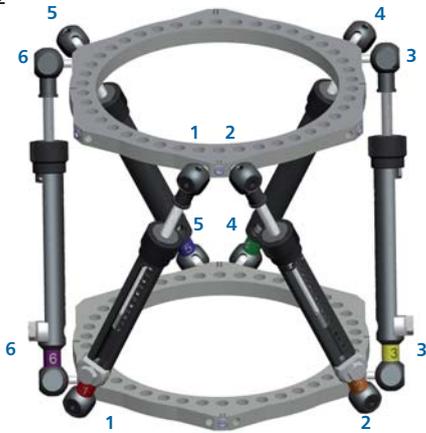


Moving to the right of the master tab, skip one tab and insert struts #3 and #4 following the same procedure. Continue moving to the right, skip one more tab and insert struts #5 and #6 (Fig 20). Confirm that all struts are sequentially positioned counterclockwise around the proximal ring.



Align the anterior tab of the distal ring (anti master tab) with the master tab of the proximal ring (Fig. 21). Insert the opposite end mounting studs of struts #2 and #3 into the mounting holes of the next tab to the right relative to anterior tab. Secure the struts in place as previously instructed.

Fig. 22



Moving to the right, skip one tab and insert struts #4 and #5 following the same procedure. Continue moving to the right, skip one more tab and insert struts #6 and #1 (Fig. 22). Confirm that all struts are sequentially positioned counterclockwise around the distal ring.

Fig. 23



Adjust the strut length according to preoperative planning. The rapid adjustment of the strut length is achieved by untightening the locking bolt, sliding the inner tube relative to the outer tube to the desired length and re-tightening the locking bolt (Fig. 23).

Note: Do not overtighten the strut locking bolt to prevent stripping of the thread.

Fig. 24

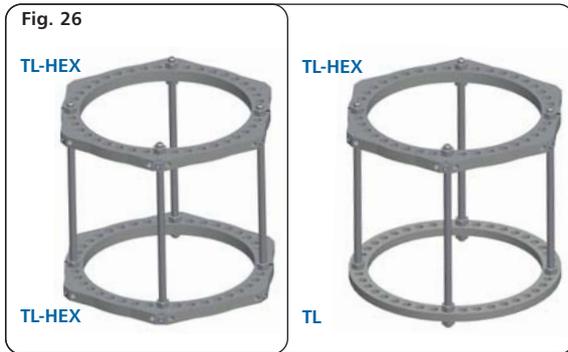


The gradual adjustment is achieved by pulling and rotating the adjustment knob (Fig. 24).

Fig. 25



To expedite the gradual adjustment, the rod end joint can be temporarily disconnected from the tab and rotated manually or rapidly using the TrueLok power adapter (Fig. 25).

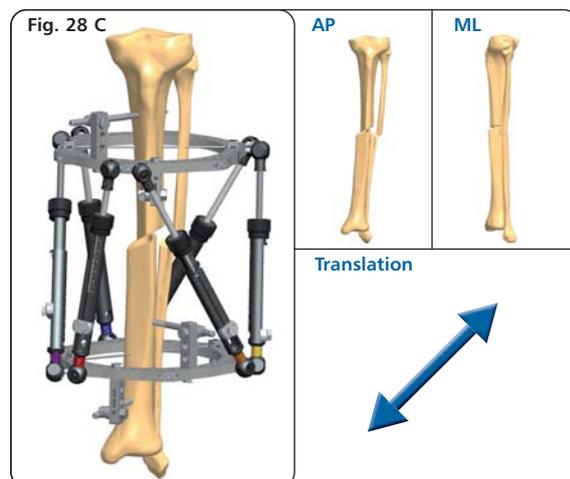
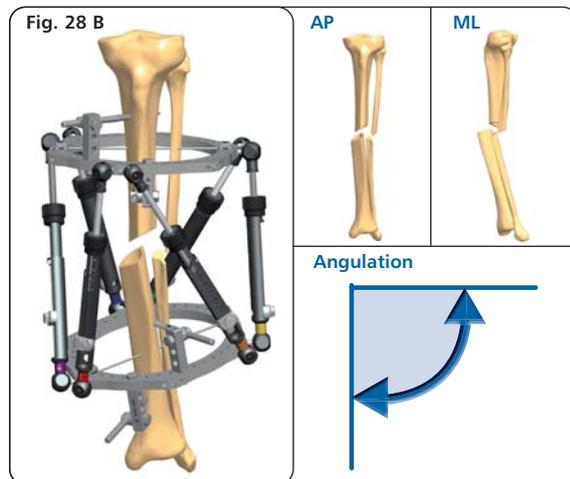
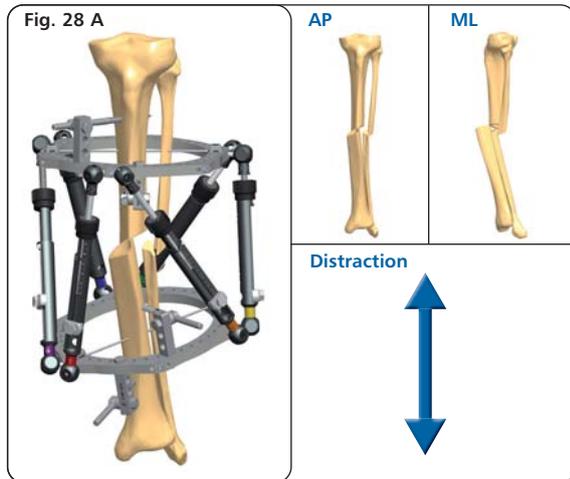


When additional stability is required, a second external support can be added to the proximal or distal rings. Since components of the TL-HEX are compatible with the TrueLok External Fixation System, external supports from the both systems can be connected to each other when building fixation blocks (Fig. 26).



The preassembled TL-HEX frame (Fig. 27) is now ready to be attached to the limb as defined by Ilizarov principles. All basic components from the TrueLok External Fixation System (wire and half pin fixation bolts, posts, threaded rods, plates as well as other assembly components and instrumentation) are required to perform the surgery with the TL-HEX (See General Principles: Limb Lengthening and Deformity Correction using TruLok Ring Fixation System).

In some cases, TL-HEX external supports (fixation blocks) are mounted to the limb first. TL-HEX struts are then applied in the proper sequence as described above. Surgeon should place external supports as orthogonal to bone axis as possible to minimize measurement errors and reduce the number of residual corrections. However, perfect orthogonal orientation of the TL-HEX external supports relative to the bone axis is not required. Deviation of ring alignment will be taken into consideration by the software.



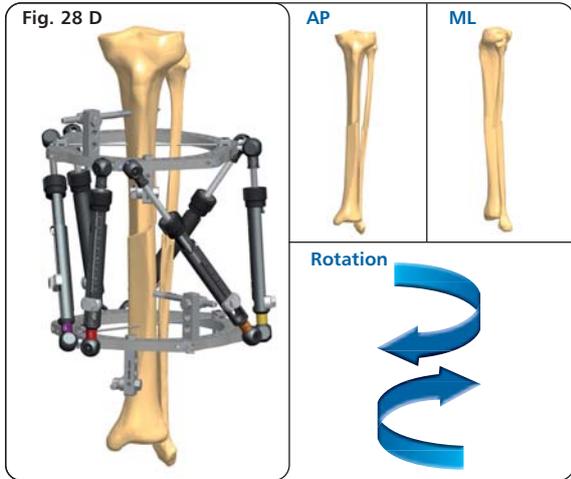
BASIC TL-HEX FRAME CONSTRUCTS

Presented below are some examples of the basic TL-HEX frame assemblies for reduction and stabilization of midshaft tibial fracture, correction of midshaft tibial malunion associated with complex deformity, correction of proximal tibial Blount's deformity and correction of distal femoral valgus.

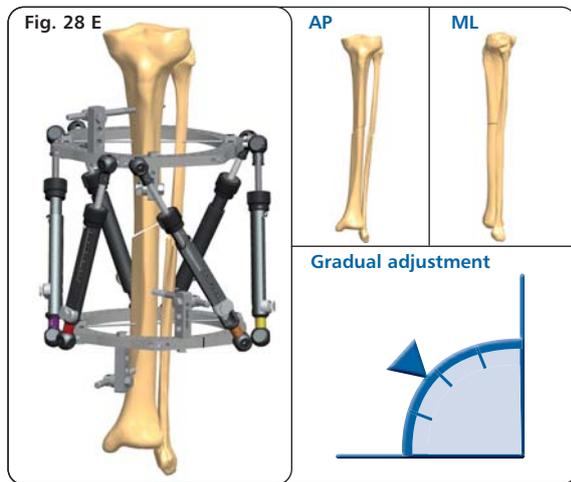
Midshaft Tibial Fracture

TL-HEX frame for reduction of midshaft tibial fracture with displacement (shortening, angulation, horizontal translation and rotation) consists of the proximal and distal TL-HEX full rings interconnected by six struts. Each ring is secured to the proximal and distal tibial fragments by one wire and two half-pins.

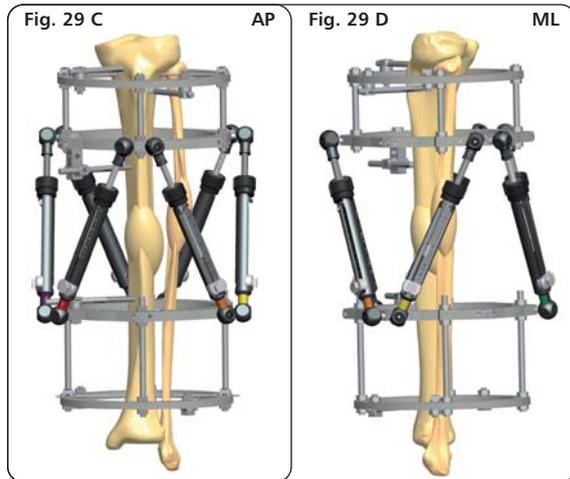
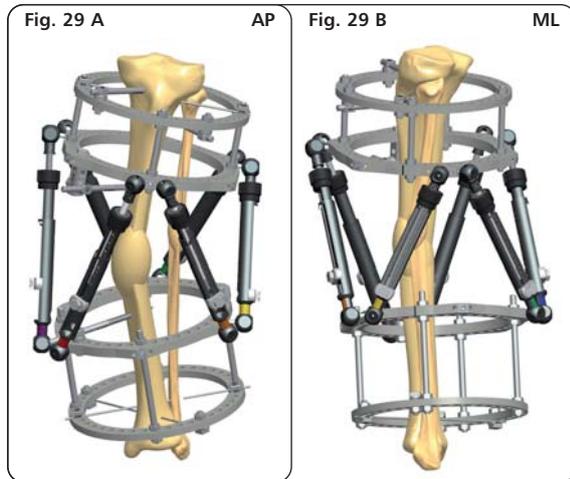
For fracture reduction, the side locking bolts are released on all struts to allow for rapid strut adjustments. Longitudinal traction to eliminate axial translation and bring the tibia up to length is performed first (Fig. 28, A), followed by angular deformity correction (Fig. 28, B) and reduction of the horizontal translation (Fig. 28, C).



Finally, rotational deformity correction is performed (Fig. 28, D) and side locking bolts are re-tightened to lock the length on all struts.

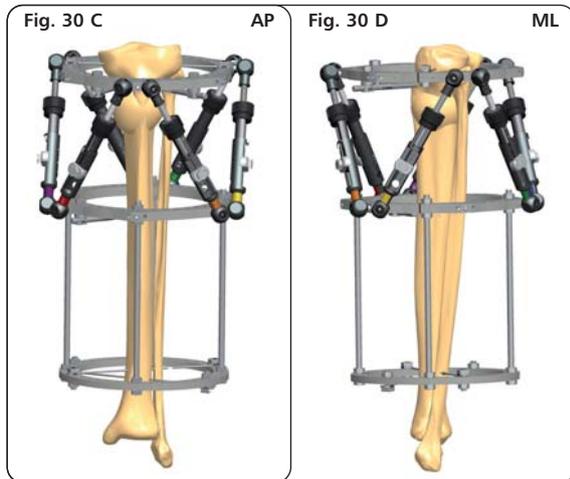
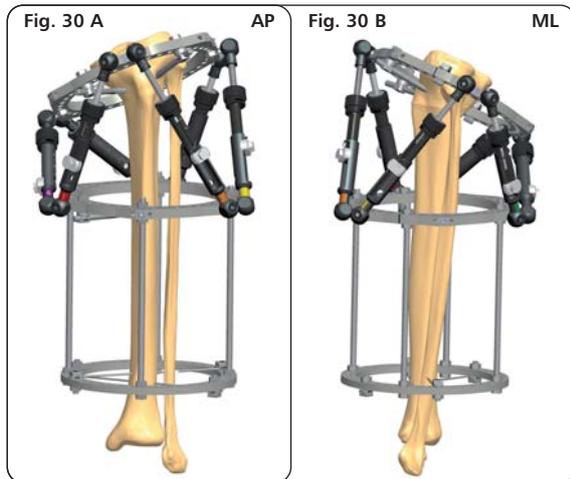


If necessary, incremental compression can be performed using gradual adjustment of the struts (Fig. 28, E).



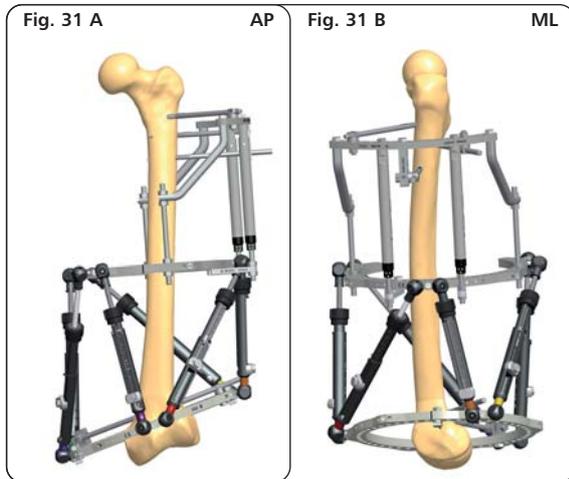
Midshaft Tibial Malunion

TL-HEX construct for midshaft tibial malunion (e.g., valgus, procurvatum, lateral & posterior translation) correction consists of a proximal and distal TL-HEX full ring interconnected by six struts. To increase stability of bone segment fixation, both proximal and distal TL-HEX rings are connected to TrueLok rings creating proximal and distal double-ring blocks. The proximal double ring block is secured to the proximal tibial fragment by one horizontal wire and three half pins. Two of those half pins are inserted from antero-lateral and antero-medial towards postero-medial and postero-lateral, respectively, and attached to the most proximal ring. The third proximal segment half pin is a diaphyseal medial face pin attached to the TL-HEX proximal ring. The distal double-ring block is secured to the distal tibial fragment by two cross wires (including at least one fibular-tibial olive wire) and at least one medial face half pin attached to the distal TL-HEX ring (Fig. 29).



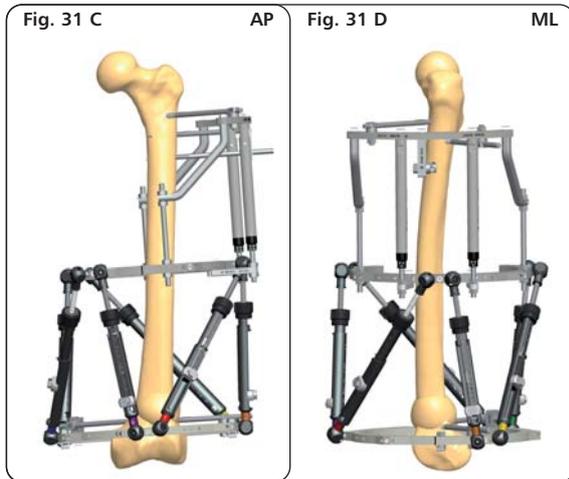
Blount's Deformity

TL-HEX construct for proximal tibial Blount's deformity correction consists of a proximal TL-HEX 5/8 ring with an anterior orientation of the central tab and a distal TL-HEX full ring interconnected by six struts. To increase stability of bone segment fixation, the distal TL-HEX ring is connected to one TrueLok ring creating a double-ring block. The proximal TL-Hex 5/8 ring is secured to the proximal tibial fragment by one horizontal olive wire and two half pins, which inserted from antero-lateral and antero-medial towards postero-medial and postero-lateral, respectively. The TL-HEX double-ring block is attached to the distal tibial fragment by two cross wires (including at least one fibular-tibial olive wire) and at least one medial face half pin (Fig. 30).

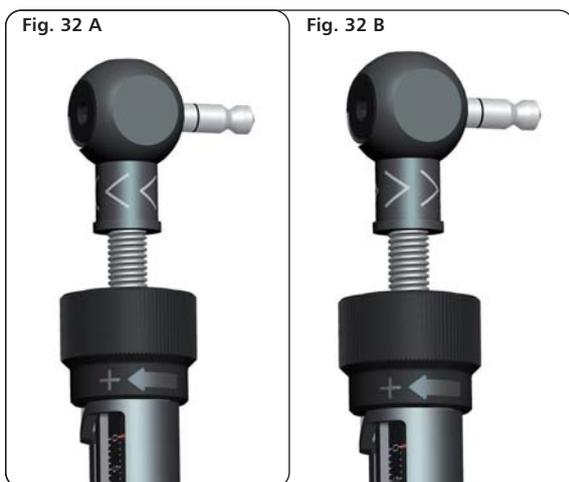


Distal Femoral Valgus

TL-HEX construct for distal femoral valgus deformity correction consists of two TL-HEX 5/8 rings interconnected by six struts. The central tab of the proximal 5/8 ring is oriented laterally while the orientation of the distal 5/8 ring central tab is anterior. To increase stability of bone segment fixation, the proximal 5/8 ring is connected to TrueLok femoral arch, secured to the proximal femoral fragment by three half pins. The distal TL-HEX 5/8 ring is attached to the distal femoral fragment by one horizontal olive wire and two half pins, inserted from postero-lateral and postero-medial towards antero-medial and antero-lateral, respectively (Fig. 31).



After the frame is mounted to the limb, AP and ML radiographs are taken with the reference ring positioned perpendicular to the x-ray cassette (see Software User Guide). Deformity and frame mounting parameters are then obtained from the radiographs and entered into the software. The software generates a prescription, for surgeon review and approval, that indicates the turning direction and amount that each strut should be adjusted per day.



The direction clips are then applied to the rod end joints according to the prescription. If strut elongation is required (positive numbers in the prescription), the arrow on the clip should point in the same direction as the reference arrow on the adjustment knob (Fig. 32, A). If strut shortening is required (negative numbers in the prescription), the clip should be applied with the arrow pointing in the opposite direction of the arrow on the adjustment knob (Fig. 32, B).

POST-OPERATIVE MANAGEMENT OF THE TL-HEX

Gradual Deformity Correction

The correction of limb deformity is performed by gradual strut adjustment according to the prescription. Each full turn of the adjustment knob produces 1 mm of strut length increase/decrease. The amount of gradual strut adjustment is monitored by a noticeable detent (click) every 0.5 mm (half turn) of adjustment or using the position of green-line mark at the end of the threaded rod relative to the scale at the inner tube of the strut. The direction of strut length change (increase or decrease) depends on the type of deformity corrected and is outlined in the Table 2.

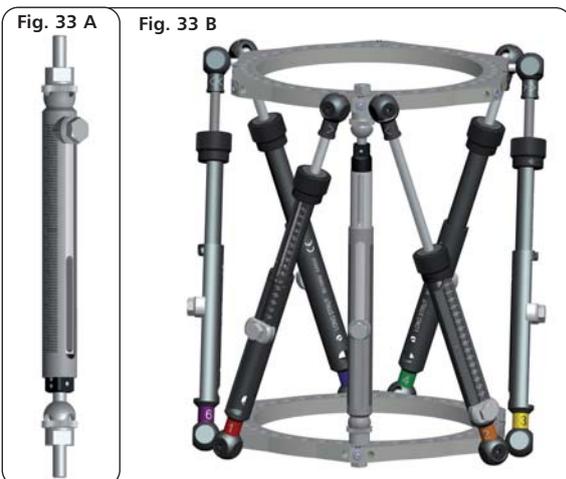
Note: The patient/caregiver must be instructed by the physician to:

- Make the adjustments or get help in making the adjustments as needed
- Identify on the prescription when to return for a strut change and for follow up visits
- Report if adjustment schedule cannot be met
- Report any adverse or unexpected effects (strut breakage or disengagement, component damage, clip dislodgement, lost prescription)

Table 2. Direction of strut length adjustment depending on the deformity type

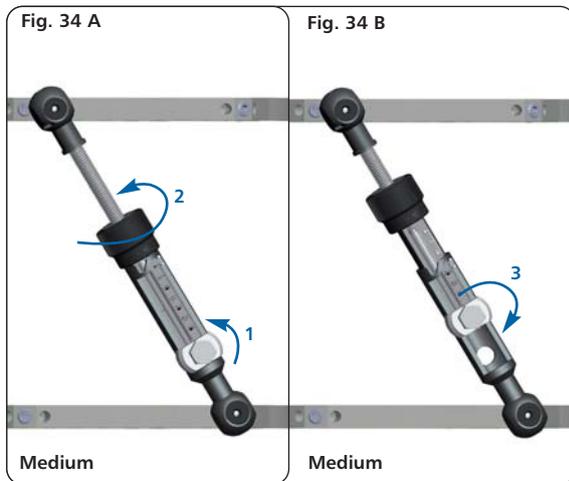
Deformity Type	Left Limb		Right Limb	
	Strut Length Increased	Strut Length Decreased	Strut Length Increased	Strut Length Decreased
Shortening	1, 2, 3, 4, 5, 6		1, 2, 3, 4, 5, 6	
Medial Translation	2, 5	1, 4	1, 4	2, 5
Lateral Translation	1, 4	2, 5	2, 5	1, 4
Anterior Translation	1, 2, 4, 5	3, 6	1, 2, 4, 5	3, 6
Posterior Translation	3, 6	1, 2, 4, 5	3, 6	1, 2, 4, 5
Varus	6 (1, 5)	3 (2, 4)	3 (2, 4)	6 (1, 5)
Valgus	3 (2, 4)	6 (1, 5)	6 (1, 5)	2, (3, 4)
Procurvatum	4, 5	1, 2	4, 5	1, 2
Recurvatum	1, 2	4, 5	1, 2	4, 5
Internal Rotation	2, 4, 6	1, 3, 5	1, 3, 5	2, 4, 6
External Rotation	1, 3, 5	2, 4, 6	2, 4, 6	1, 3, 5

In extreme cases of external/internal rotation, these directions may change during the correction to the opposite of what is indicated in Table 2.

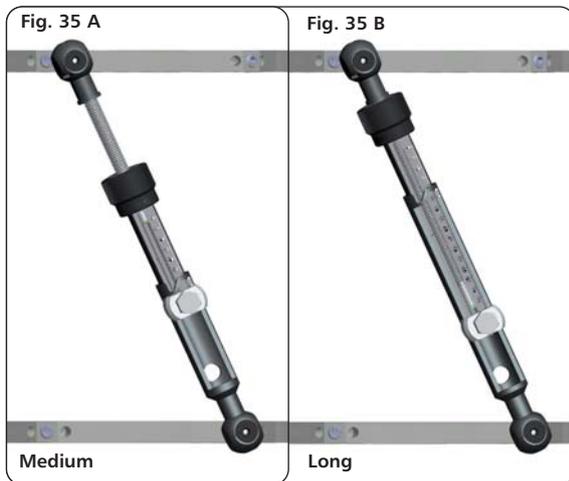


Strut Readjustment and Exchange

Strut readjustment and exchange are utilized to increase the gradual adjustment range (distraction or compression). For either strut readjustment or exchange, external supports must be stabilized using a temporary “brace” (e.g. TrueLok Rapid Adjust Struts) (Fig. 33).



For strut readjustment, untighten the side locking bolt (1) and turn the adjustment knob (2) until the gradual and rapid adjustment indicators align with the new prescribed values on the scale (Fig. 34, A-B). Retighten the side locking bolt (3) and remove the temporary brace.



For strut exchange (Fig. 35, A-B), loosen the side locking bolt on the strut, untighten the stud locking screws on the appropriate proximal and distal tabs and remove the strut. Prepare the new strut according to prescription, insert the mounting studs into appropriate mounting holes and retighten the stud locking screws confirming that the stud depth insertion line is fully hidden in the mounting hole. Replace the number and direction clips to the new strut and remove the temporary ring stabilizing brace.

GENERAL PRINCIPLES OF SOFTWARE USAGE

Please refer to TL-HEX Software User Guide.
Registration page can be accessed through www.tlhex.com.

SUGGESTED READING

G.A. Ilizarov. *Transosseous Osteosynthesis. Theoretical and Clinical Aspects of the Regeneration and Growth of Tissue*. 800 pages, SpRinger-Verlag, New York-Berlin-Heidelberg, 1992

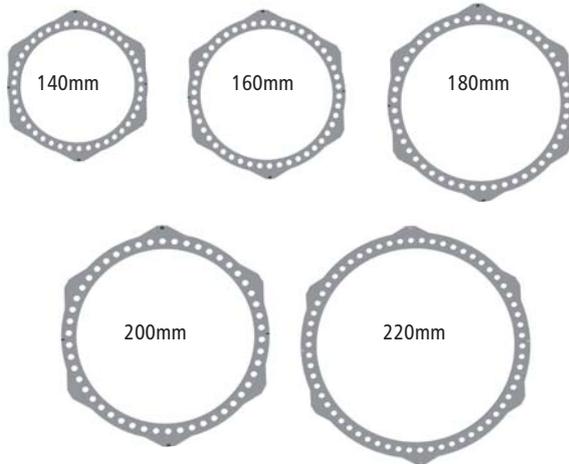
S.R. Rozbruch, S. Ilizarova. *Limb Lengthening and Reconstruction Surgery*. 695 pages, Informa Healthcare, New York, 2007

D. Paley. *Principles of Deformity Correction*. 806 pages, Springer-Verlag, New York-Berlin-Heidelberg, 2002

TL-HEX COMPONENTS

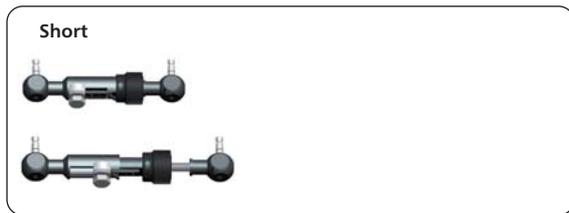
Full Rings

Part Number	Description	Quantity
56-20000	Full Ring, 140mm, TL-HEX	1
56-20020	Full Ring, 160mm, TL-HEX	1
56-20040	Full Ring, 180mm, TL-HEX	1
56-20060	Full Ring, 200mm, TL-HEX	1
99-56-20080	Full Ring, 220mm, TL-HEX (Sterile)	1



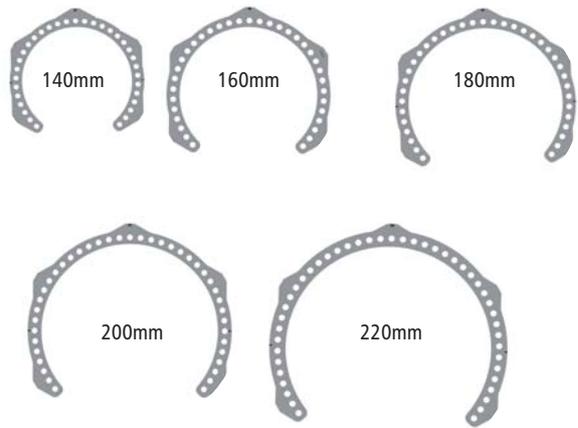
Struts

Part Number	Length
50-10200	Short Strut TL-HEX - 92mm-122mm
50-10300	Medium Strut TL-HEX - 114mm-184mm
50-10400	Long Strut TL-HEX - 158mm-318mm



5/8 Rings

Part Number	Description	Quantity
56-21000	5/8 Ring, 140mm, TL-HEX	1
56-21020	5/8 Ring, 160mm, TL-HEX	1
56-21040	5/8 Ring, 180mm, TL-HEX	1
56-21060	5/8 Ring, 200mm, TL-HEX	1
99-56-21080	5/8 Ring, 220mm, TL-HEX (Sterile)	1



Number Clips

Part Number	Description
50-10215	Strut Number Clip Kit, TL-HEX (6 pcs) <i>Consisting of:</i> Strut Number Clip, #1, TL-HEX Strut Number Clip, #2, TL-HEX Strut Number Clip, #3, TL-HEX Strut Number Clip, #4, TL-HEX Strut Number Clip, #5, TL-HEX Strut Number Clip, #6, TL-HEX



Direction Clips

Part Number	Description
50-10214	Strut Direction Clip Kit, TL-HEX (6 pcs)



TL-HEX Strut Exchange Kit cod. 50-10500

Part Number	Description	Quantity
50-10180	TL Plus Medium Quick Adjust Strut	1
50-10190	TL Plus Long Quick Adjust Strut	1
52-10210	TL+ AO 1/8' Hex Power Driver Attachment	1
52-1018	TL - 1/8' Hex Driver	1
54-1154	TL - Wrench, Combo, 10mm	1
54-2226	TL - 90 Degree Tubular Wrench	1
50-13020	TL+ Extended Nut M6 X 1	2
50-10214	Strut Direction Clip Kit, TL-HEX (6 pcs)	1

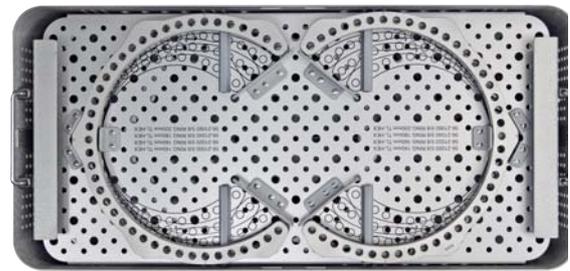
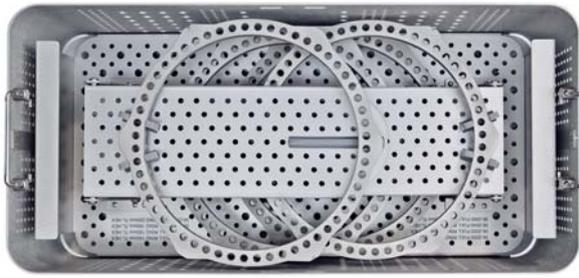
Rings Tray cod. 30110086 (empty)

The Ring Tray can accommodate a combination of the TL-HEX rings for sterilization.
The maximum number of rings that the tray can hold is four full rings and two 5/8 rings.

Part Number	Description
56-20000	Full Ring, 140mm, TL-HEX
56-20020	Full Ring, 160mm, TL-HEX
56-20040	Full Ring, 180mm, TL-HEX
56-20060	Full Ring, 200mm, TL-HEX
56-21000	5/8 Ring, 140mm, TL-HEX
56-21020	5/8 Ring, 160mm, TL-HEX
56-21040	5/8 Ring, 180mm, TL-HEX
56-21060	5/8 Ring, 200mm, TL-HEX
30110086	Ring Tray, TL-HEX, empty

Material out of the tray

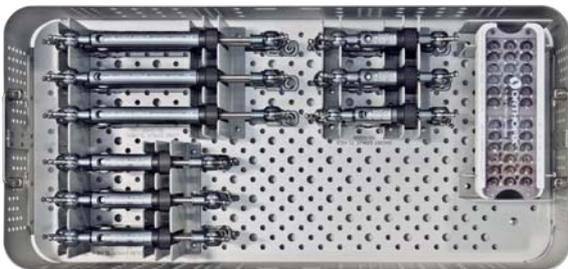
99-56-20080	Full Ring, 220mm, TL-HEX (Sterile)
99-56-21080	5/8 Ring, 220mm, TL-HEX (Sterile)



Struts Tray cod. 30110085 (empty)

Can accommodate:

Part Number	Description	Quantity
50-10214	Strut Direction Clip Kit, TL-HEX	3 Kits (18 Strut Direction Clips)
50-10215	Strut Number Clip Kit, TL-HEX	3 Kits (3 of each Strut Number Clip)
50-10200	Short Strut, TL-HEX- 92mm-122mm	6
50-10300	Medium Strut, TL-HEX - 114mm-184mm	6
50-10400	Long Strut, TL-HEX - 158mm-318mm	6
30110085	Strut Tray, TL-HEX, empty	



TRUELOK™ COMPONENTS

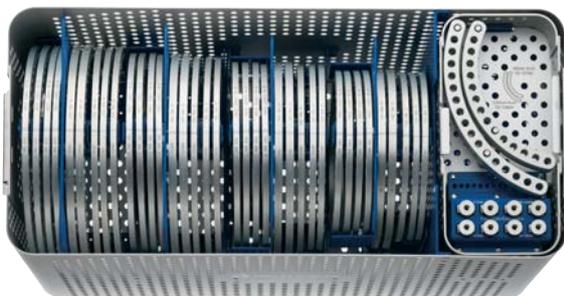
Instruments 450178C

Part Number	Description	Quantity
52-1018	TL - 1/8" Hex Driver	1
52-1020	TL - 1/8, 90° Hex Driver	1
52-10210	TL+ AO 1/8" Hex Power Driver attachment	1
W1003	Wire Cutter	1
54-1139	Wire Tensioner (*)	2
54-1154	TL- Wrench, Combo, 10 mm	2
54-1155	TL - Wrench Hinged	2
54-2226	TL - 90 Degree Tubular Wrench	2
54-2227	Needle Nose Pliers	2
52-1137	T-Wrench	1
52-10.61	Double Wrench (Must be ordered separately)	

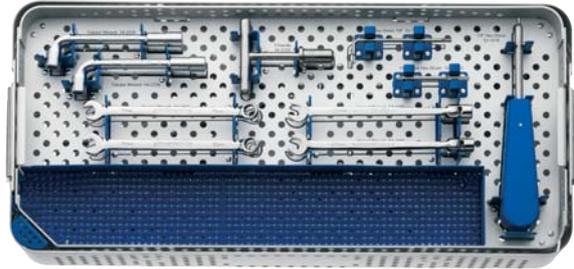
(*) Please contact Orthofix for availability

External Supports 450179C

Part Number	Description	Quantity
56-10910	140 mm Full Ring	4
56-11610	140 mm Half Ring	2
56-12610	140 mm 5/8 Ring	1
56-13610	140 mm Foot Plate	2
56-10930	160 mm Full Ring	4
56-11630	160 mm Half Ring	2
56-12630	160 mm 5/8 Ring	1
56-13630	160 mm Foot Plate	2
56-10950	180 mm Full Ring	4
56-11650	180 mm Half Ring	2
56-12650	180 mm 5/8 Ring	1
56-13650	180 mm Foot Plate	2
56-11660	200 mm Half Ring	2
56-10960	200 mm Full Ring	4
56-12660	200 mm 5/8 Ring	1
56-13660	200 mm Foot Plate	2
56-14580	Three Hole Foot Plate Extension	4
56-14590	Five Hole Foot Plate Extension	4
55-10760	90 mm Arch	2
55-10800	120 mm Arch	2



450179C



450178C

Additional External Supports

Must be ordered separately

Part Number	Description
56-10840	80 mm Full Ring
56-11570	80 mm Half Ring
56-10860	100 mm Full Ring
56-11580	100 mm Half Ring
56-12580	100 mm 5/8 Ring
56-13580	100 mm Foot Plate
56-10890	120 mm Full Ring
56-11590	120 mm Half Ring
56-12590	120 mm 5/8 Ring
56-13590	120 mm Foot Plate
56-10900	130 mm Full Ring
56-11600	130 mm Half Ring
56-12600	130 mm 5/8 Ring
56-13600	130 mm Foot Plate
56-10920	150 mm Full Ring
56-11620	150 mm Half Ring
56-12620	150 mm 5/8 Ring
56-13620	150 mm Foot Plate
56-13625	150 mm Double Row Foot Plate (*)
56-13635	160 mm Double Row Foot Plate (*)
56-10940	170 mm Full Ring
56-11640	170 mm Half Ring
56-12640	170 mm 5/8 Ring
56-13640	170 mm Foot Plate
56-13655	180 mm Double Row Foot Plate (*)
56-13665	200 mm Double Row Foot Plate (*)
56-10970	220 mm Full Ring
56-11670	220 mm Half Ring
56-10980	240 mm Full Ring
56-11680	240 mm Half Ring

(*) Please contact Orthofix for availability

Fixation Elements 450180C

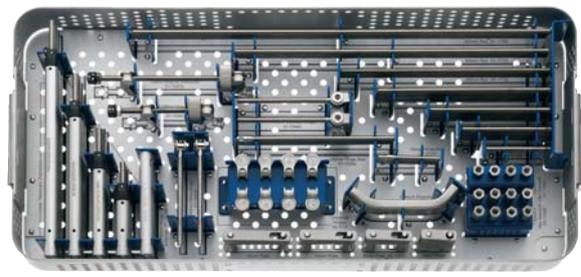
Part Number	Description	Quantity
50-1008	10 mm Nut	120
50-13010	Distraction Nut	16
50-13020	Extended Nut	10
54-10.50	12 mm Bolt	24
54-1010	16 mm Bolt	24
54-1018	20 mm Bolt	12
54-1064	Slotted Washer	8
54-11230	4 mm Half Pin	6
54-11240	5 mm Half Pin	12
54-11250	6 mm Half Pin	6
54-1133	Wire Stopper (Red)	36
54-1136	Half Pin Stopper (Grey)	12
54-11530	Universal Half Pin Fixation Bolt	12
54-11600	One Hole Post	4
54-11610	Two Hole Post	4
54-11620	Three Hole Post	4
54-11630	Four Hole Post	2
54-11640	Five Hole Post	2
54-1215	Bayonet Wire with Stopper	12
54-1216	Bayonet Wire	12
54-1134	Rubber Stopper Applicator	2
54-1142	Spacing Washer	12
54-1150	Conical Washer Couple	16
54-1152	Universal Wire Fixation Bolt	36



450180C

Hinges and Distractors 450181C

Part Number	Description	Quantity
50-11010	70 mm Telescopic Linear Distractor	4
50-10140	100 mm Telescopic Linear Distractor	4
50-10150	150 mm Telescopic Linear Distractor	4
50-10160	200 mm Telescopic Linear Distractor	4
51-10430	Inline Hinge	2
51-10440	Outboard Hinge	2
51-10300	60 mm Hinge Rod	4
51-10550	150 mm Hinge Rod	4
51-10220	Hinge Extender	2
51-10460	100 mm Angular Distractor	1
51-10470	150 mm Angular Distractor	1
55-11720	60 mm Threaded Rod	8
55-10530	85 mm Threaded Rod	8
55-10060	115 mm Threaded Rod	8
55-10070	165 mm Threaded Rod	8
55-11730	200 mm Threaded Rod	4
55-11740	300 mm Threaded Rod	4
55-11750	400 mm Threaded Rod	4
55-10.99	Oblique Support	4
55-10340	20 mm Plate	8
55-11670	30 mm Plate	4
55-11671	40 mm Plate	4
55-11680	50 mm Plate	4
54-11650	15 mm Spacer	8
54-11660	30 mm Spacer	4
55-1176	Universal Hinge	8



450181C

Proper surgical procedure is the responsibility of the medical professional. This Manual is furnished as an informative guideline. Each surgeon must evaluate the appropriateness of a technique based on his or her personal medical credentials and experience. Please refer to the TL-HEX Instructions for Use (PQ TLH) and TrueLok™ Instructions for Use (PQ TLK) supplied with the products for specific information on indications for use, contraindications, warnings, precautions, adverse effects and sterilization.

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