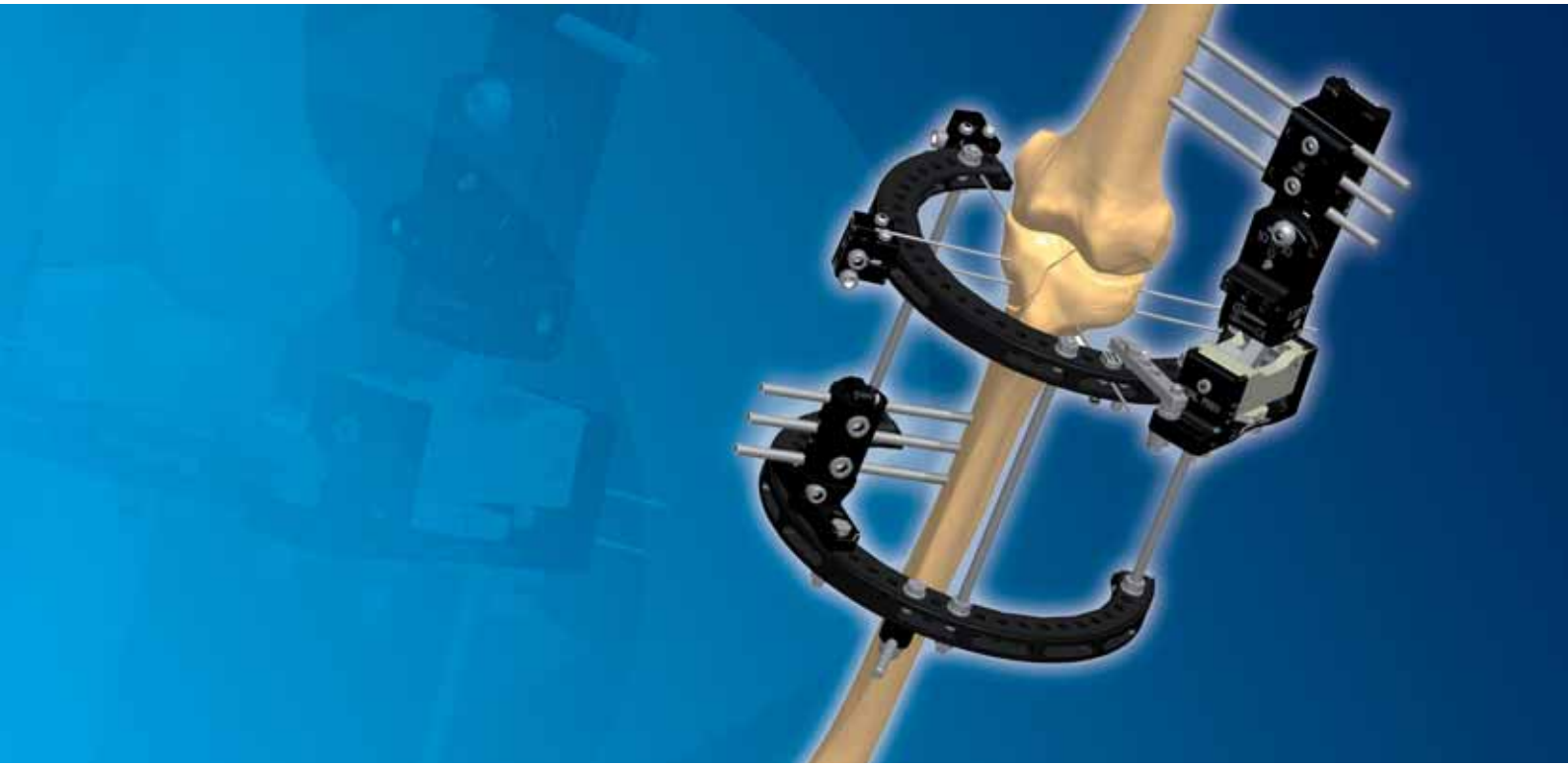
OPERATIVE TECHNIQUE



Knee Hinge
(LRS Advanced System)

ORTHOFIX®

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

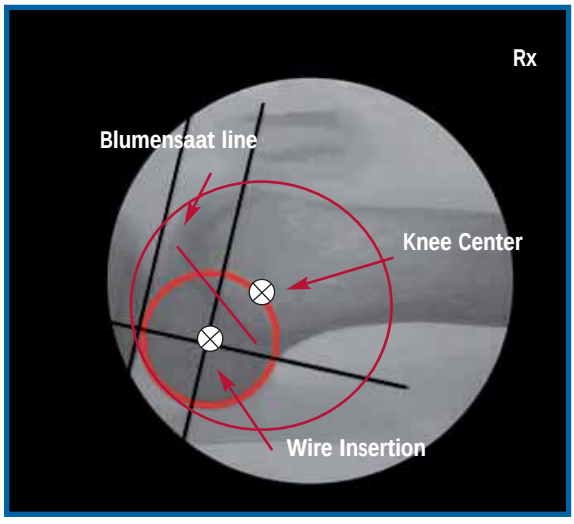
Milan Oleksak, MD
Marco De Peppo, MD

INTRODUCTION

The rotation centre of the knee joint appears to change relative to the position of knee flexion.
The femoral condyle in sagittal section is composed of the arcs of two circular facets, a small posterior arc (flexion facet), and a larger anterior arc (extension facet). The knee moves from an extended position along the larger anterior arc of the femoral condyle towards a smaller posterior arc of the flexion facet when flexion occurs.

Hence the rotational axis seems to be situated between the centers of the respective arcs of rotation, and migrates from a position above Blumensaat line towards a spot below this line with flexion of the knee joint.

The Knee Hinge aims to mimic the cruciate function of the knee and its moving rotational axis in the sagittal plane. The main purpose of the hinge is to permit anatomical rotation of the knee joint between a monolateral femoral external fixator (LRS) and a circular tibial device (SRF/TrueIok).



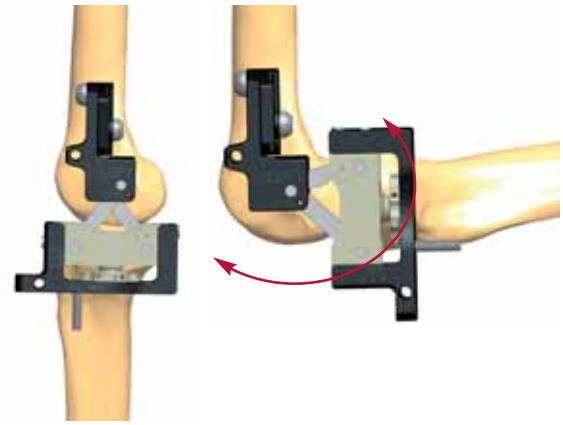
INDICATIONS

The knee hinge is indicated for bone stabilization in:
- Knee dislocation
- Ligamentous disruption and instability
- Severe Tibial plateau injuries
- Articular Reconstruction of the knee joint with osteochondral grafting
- Temporary cross knee fixation following removal of infected knee implants

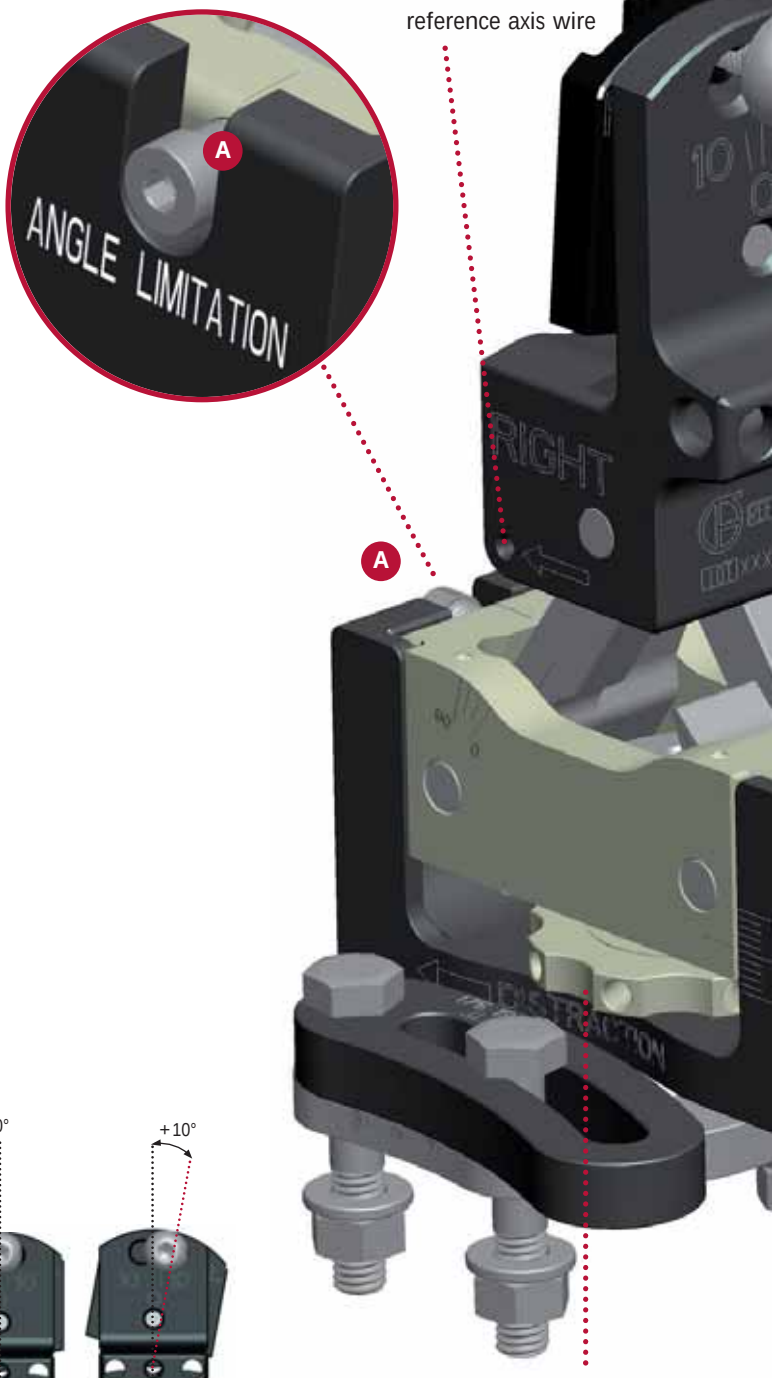
- **In articular fractures limit weightbearing as clinically indicated and tolerated.**
  The surgeon should decide the amount of weightbearing according to the stability of the repair and the rigidity required to ensure congruent healing.

FEATURES AND BENEFITS

Knee Motion



- The hinge mechanism permits a similar range of knee motion to that of the Anterior and Posterior Cruciate Ligaments, from 0° to 90° in the sagittal plane
- Facility for limiting range of motion (locking screw A)



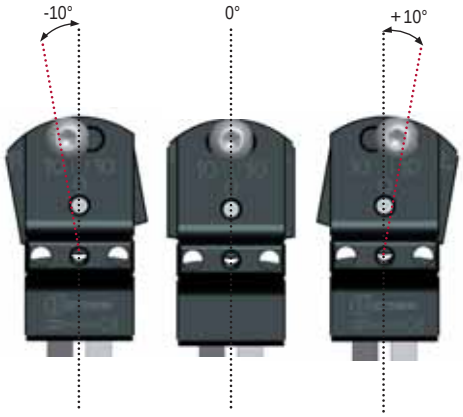
- 2 mm hole to allow insertion of the reference axis wire

Distraction Knob

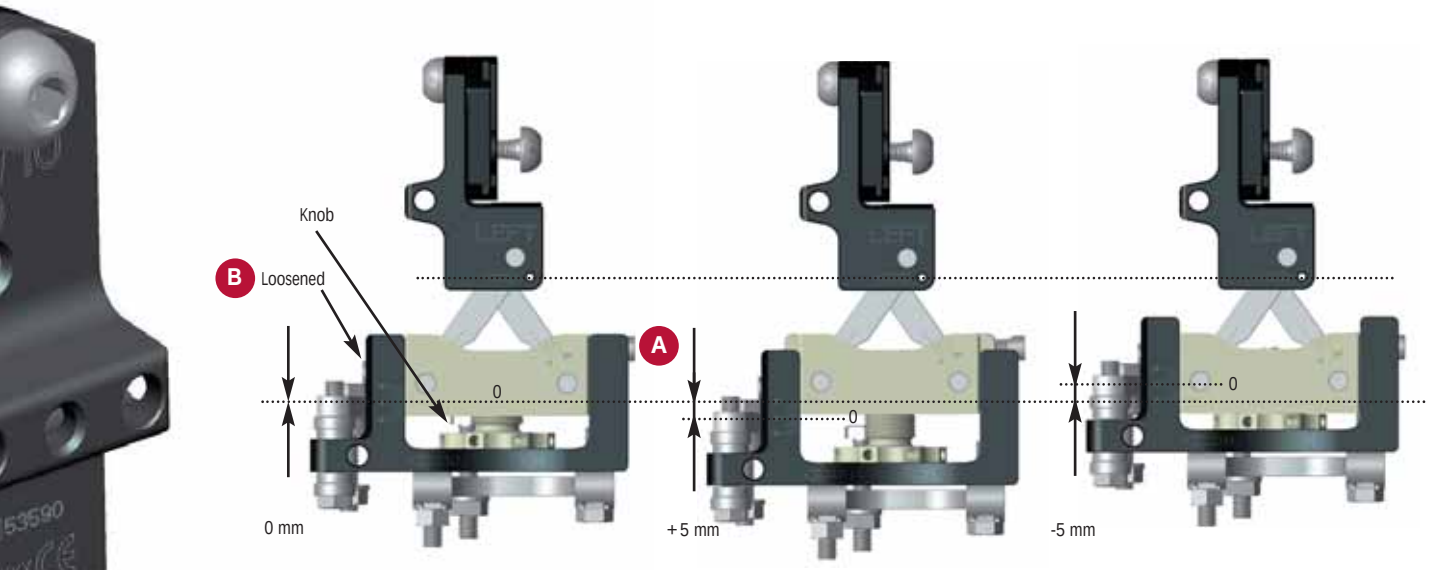
- Passive R.O.M. possible with additional use of compression-distraction unit.

Femoral alignment of the rotation axis:

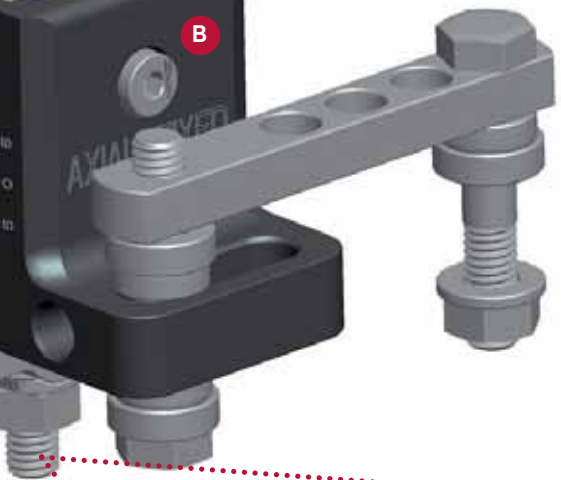
- Radiolucent central body
- The proximal part of the Knee Hinge can Is able to swivel ± 10° in the frontal plane to allow for positioning of the rail parallel to the femoral anatomical axis



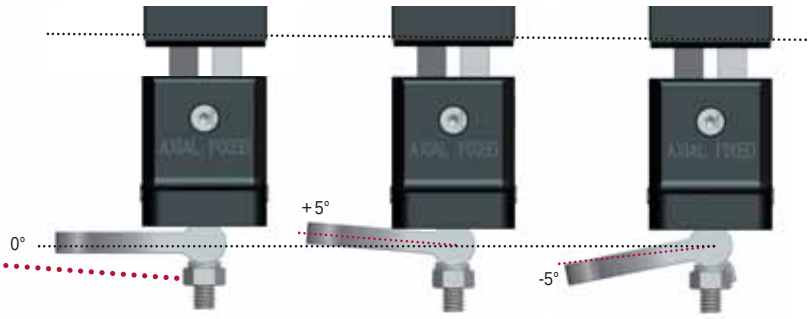
Knee Distraction

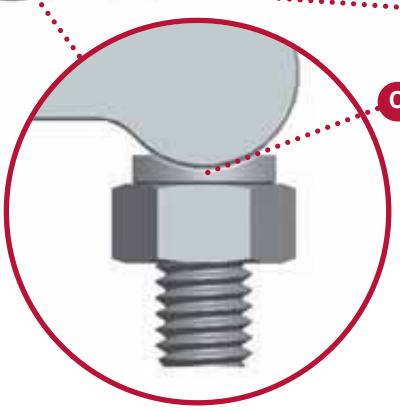


- ±5 mm tibial axial distraction-compression is possible from the tibial side by turning the distraction knob with locking screw B loosened



Tibial Alignment





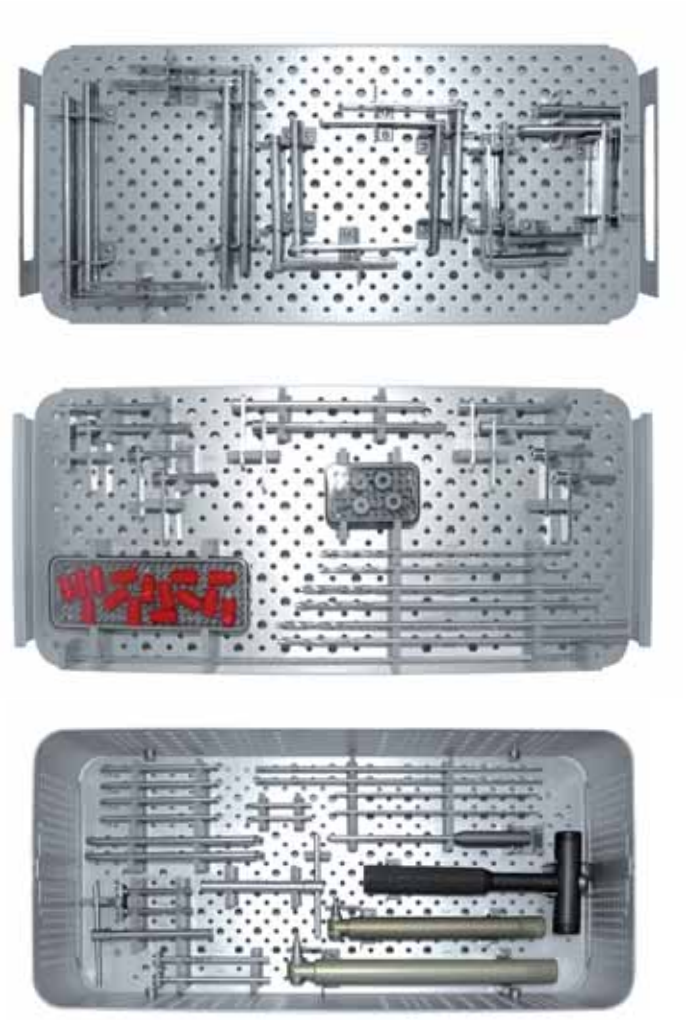
- The Ring Support with the 5-hole plate allows the Knee Hinge to be correctly aligned to the tibial ring

EQUIPMENT REQUIRED

53995 - ADV LRS Instruments Steri-Box Empty

Can accomodate:

Part No.	Component Description
Upper tray	
10x11102	Screw Guide, length 60 mm
10x11103	Screw Guide, length 100 mm
10x11124	Screw Guide, length 160 mm
Central tray	
2x11104	Drill Guide, Ø 4.8 mm, length 40 mm
2x11105	Drill Guide, Ø 4.8 mm, length 80 mm
2x11106	Drill Guide, Ø 3.2 mm, length 40 mm
2x11116	Drill Guide, Ø 3.2 mm, length 80 mm
2x11125	Drill Guide, Ø 4.8 mm, length 140 mm
5x80122	X-Wire without olive Ø 2 mm, length 400 mm
2x1100201	Drill Bit, Ø 4.8 mm, length 240 mm
2x1100301	Drill Bit, Ø 3.2 mm, length 200 mm
2x1100701	Drill Bit, Ø 4.8 mm, length 280 mm
1x10200	Sterilizable Screw Covers (pack of 20)
2x11005	Drill Bit Stop Unit, Ø 4.8 mm
2x11006	Drill Bit Stop Unit, Ø 3.2 mm
Lower Tray	
2x10012	Allen Wrench 3 mm
2x10017	Allen Wrench 6 mm
1x10025	Torque Wrench 6 mm
2x11000	T-Wrench or 2x91150 Universal T-Wrench
1x11004	Tapered Trocar
1x30025	Torque Wrench 5 mm (31000 Series)
2x1101101	Cannulated Drill Bit Ø 3.2 mm, length 200 mm
2x1101201	Cannulated Drill Bit Ø 4.8 mm, length 280 mm
2x11144	Ruland Pilot Wire Guide Ø 2 mm, length 75 mm
2x11145	Ruland Pilot Wire Guide Ø 2 mm, length 115 mm
2x30017	Allen Wrench 5 mm
2x36017	Allen Wrench 4 mm
1x11111	Hammer



53995UEC - ADV LRS INSTRUMENTS STERI-BOX COMPLETE

Components out of the tray	
1x53592	ADV Knee Hinge Replacement Kit
1x54-1150	TrueLok conical washer couple
1x55-1171	TrueLok plate 5-hole

53990 - ADV LRS Components Steri-Box Empty A
Can accomodate:

Part No.	Component Description
Upper Tray	
6x53530	ADV Straight Clamp
1x53560R *or* 53560	ADV Radiolucent LRS rail 400mm *or* ADV LRS rail 400mm
1x53555R *or* 53555	ADV Radiolucent LRS rail 350mm *or* ADV LRS rail 350mm
1x53550R *or* 53550	ADV Radiolucent LRS rail 300mm *or* ADV LRS rail 300mm
1x53549R *or* 53549	ADV Radiolucent LRS rail 250mm *or* ADV LRS rail 250mm
1x53545R *or* 53545	ADV Radiolucent LRS rail 200mm *or* ADV LRS rail 200mm
1x53544R *or* 53544	ADV Radiolucent LRS rail 120mm *or* ADV LRS rail 120mm
2x50008	Compression Distraction Clicker-extends to 4cm
2x50009	Compression Distraction Clicker-extends to 8cm
1x53580	ADV Inclination Clamp
Lower Rray	
1x53115	ADV Micrometric Swivelling Clamp
1x53111	ADV Translation Clamp
1x53585	ADV Micrometric Translation-Angulation Clamp
1x53520	ADV Metaphyseal Clamp
1x53031	ADV T Garches Clamp
1x53004	ADV Garches CD Unit Standard extends 5,5cm
1x53005	ADV Garches CD Unit Long extends 10cm
1x53034	ADV TrueLok™ kit for Ring Connection
1x53581	ADV Multiplanar Clamp
1x53570	ADV Ring Hinge
2x53536	ADV Dyna-Ring
1x53590	ADV Knee Hinge

53990C - ADV LRS COMPONENTS STERI-BOX COMPLETE A *(Aluminium Rails)*
53990RC - ADV LRS COMPONENTS STERI-BOX RADIOLUCENT COMPLETE A *(Radiolucent Rails)*

To be positioned in the steri-box, the knee Hinge must be assembled as shown below.

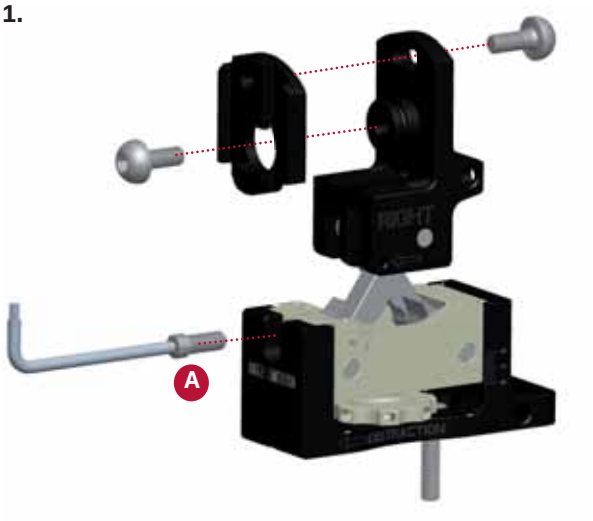
For Cleaning, Disinfection, Sterilisation and Maintenance of Instrumentation please refer to PQ ISP.

All bolts and locking screws should be loosened during sterilisation.

KNEE HINGE ASSEMBLY

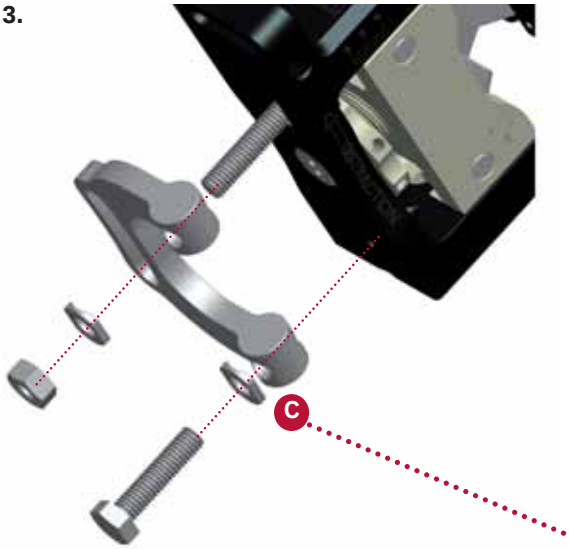
In case the Knee Hinge has been dismantled, please attend to the following instructions for reassembly.

1.



2.

3.



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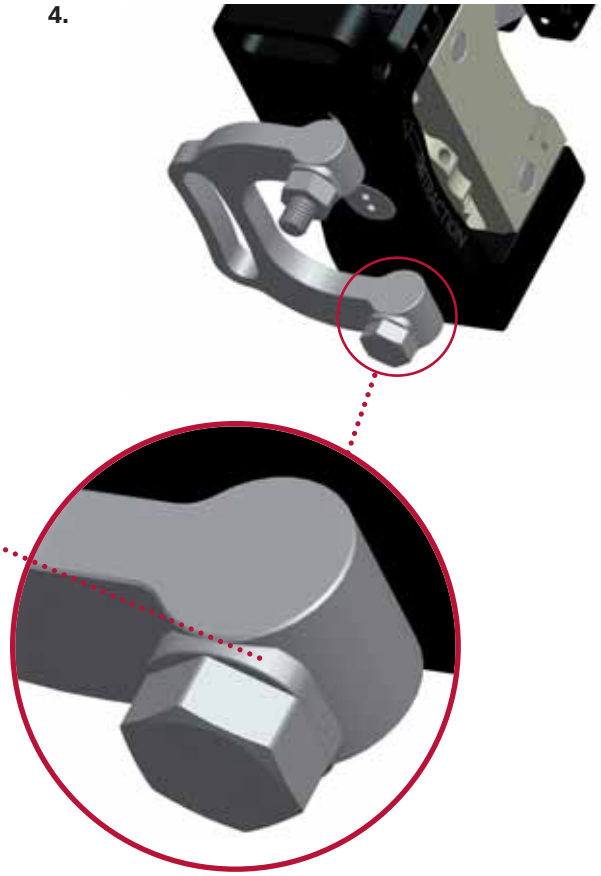
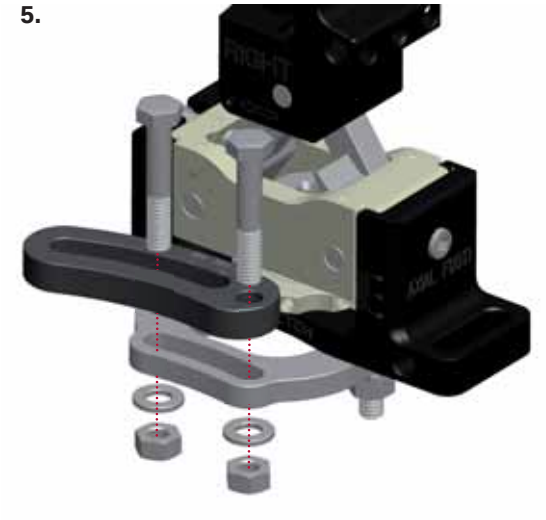
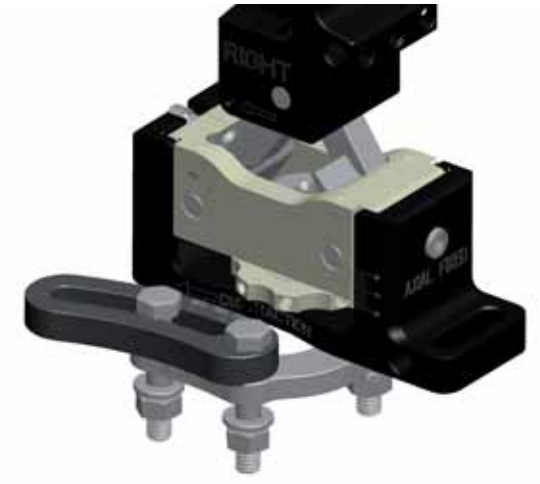


5.


RIGHT
AXIAL FIXED

6.


RIGHT
AXIAL FIXED

7.


RIGHT
AXIAL FIXED

8.


RIGHT

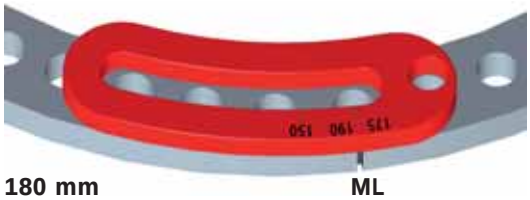
TRAUMA

1. Knee Hinge Preparation
Remove the template, the 5-hole plate with locking screws and washers.
Before applying the Knee Hinge to the ring, ensure that locking screw A is loosened (free hinge movement).

TrueLok™ Rings:

150 mm **ML**

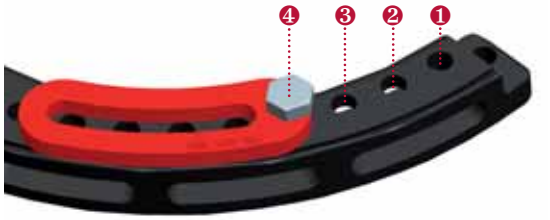
170 mm **ML**



180 mm **ML**

Sheffield Rings:

Ring 150 mm, hole 3



Ring 175 mm, hole 4

Ring 190 mm, hole 4

NB: in the pictures, the red color of the template is only for demonstration purposes and the actual component is grey, as all the other metal components.

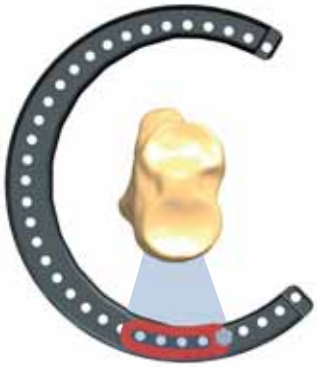
2. Template Positioning

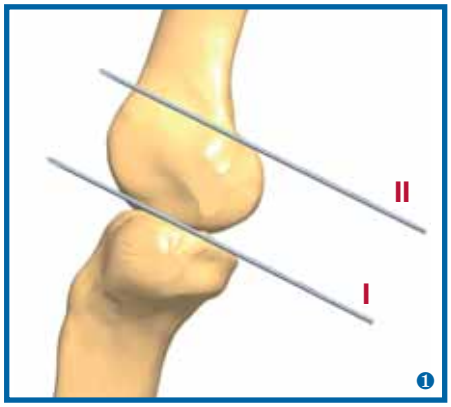
The template is designed to be used with 150, 175 (170 mm TrueLok™ ring), 190 mm diameter rings. The markings on the template help the surgeon to position it correctly on to the ring:

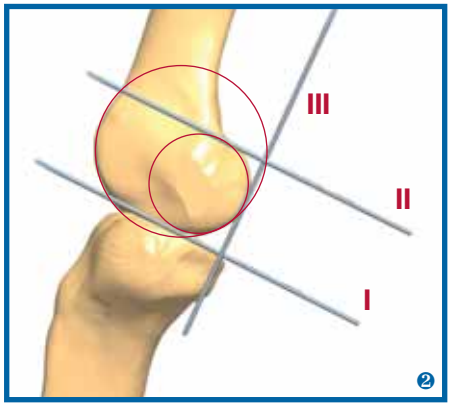
- TrueLok™ Ring: Align the template marking corresponding to the ring diameter used with the ring Medial Line (ML).

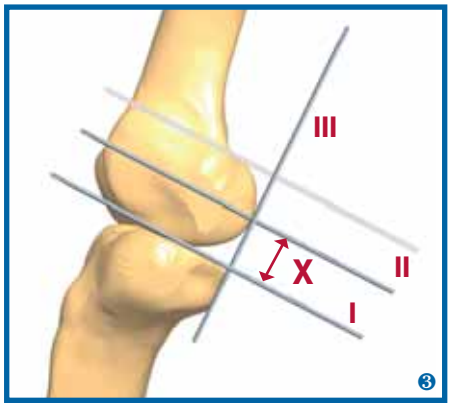
- Sheffield Ring: When locking the template, use the 3th hole of a 150 mm diameter ring or the 4th hole of a 175 or 190 mm diameter ring.

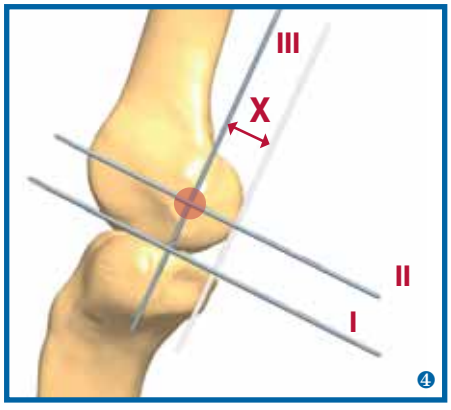
The template ensures that bone screws or wires are not inserted in the area where the Knee Hinge is positioned.







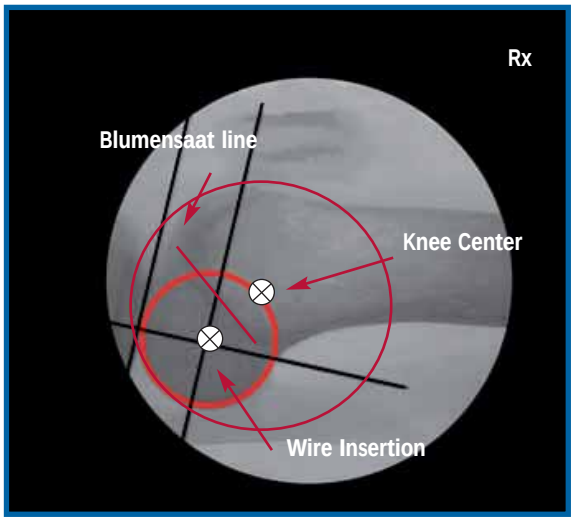


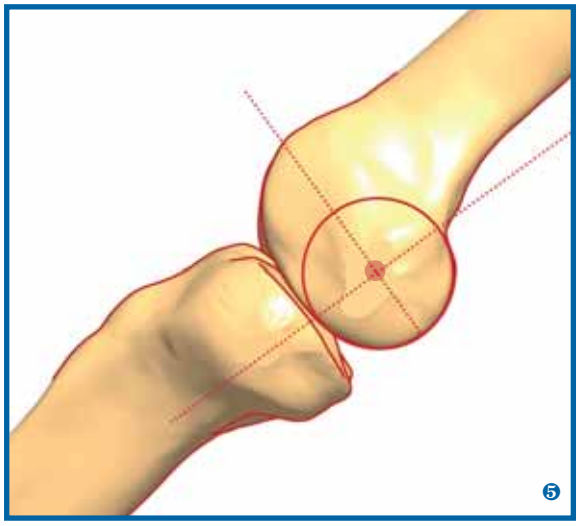


3. Reference Wire Placement

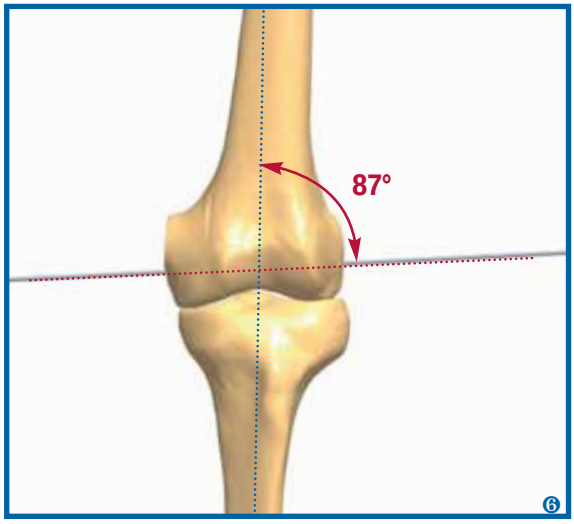
❶ Place a K-wire (I) on the skin at the level of the knee joint and parallel to the tibial plateau. Place a second (II) wire parallel to the first (I), at the level of the proximal end of the condyles.
❷ A third (III) wire is placed at right angles, at the level of the posterior part of the femoral condyles.
❸ Move the proximal parallel wire (II) down to the centre of the condyles. Measure the distance “X” between the parallel wires.
❹ Move the posterior wire (III) anteriorly of a distance equal to “X”.

The point where wires two (II) and three (III) meet will be the reference axis of the Knee Hinge (Rx image).

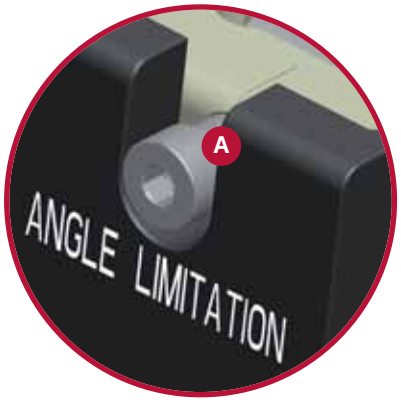




❺ Insert a K-wire in the centre of the flexion arc.



❻ The wire needs to be parallel to the knee joint (87° to the mechanical axis)

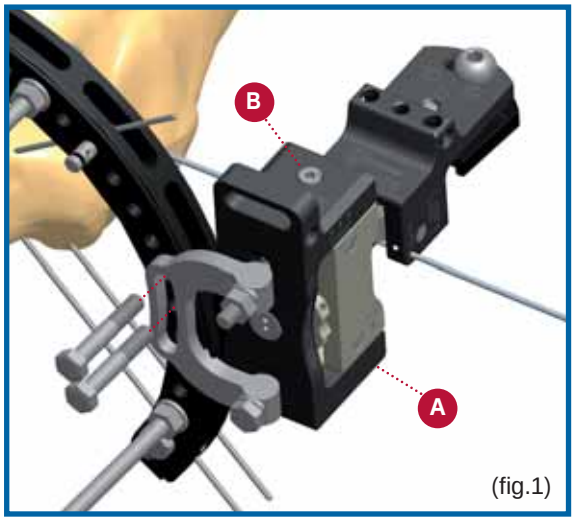


4. Sheffield ring

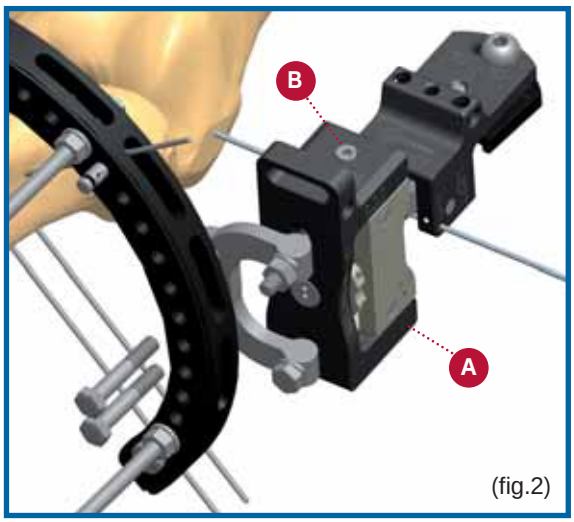
4a. Apply the Sheffield Ring Fixator

4b. Knee Hinge Positioning

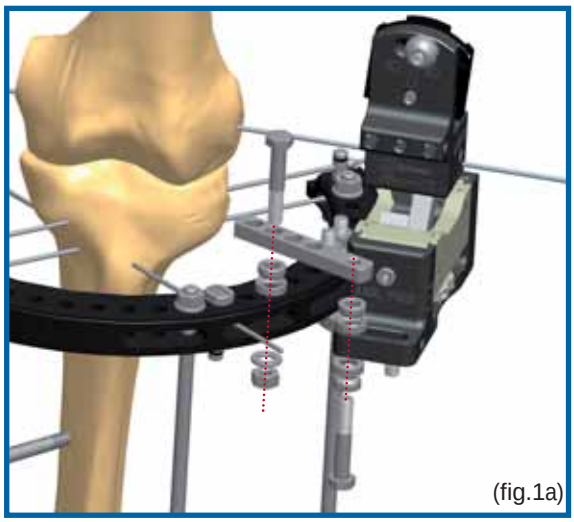
- Remove the template before applying the Knee Hinge.
- Depending upon which leg is treated (L or R), the corresponding mark should face the surgeon.
- Apply the Knee Hinge over the reference axis wire, making sure that locking screw A and locking screw B are loosened. If necessary, turn the distraction knob in order to adjust the distance between the ring support and the ring.
- The ring support can be attached above or below the proximal ring.

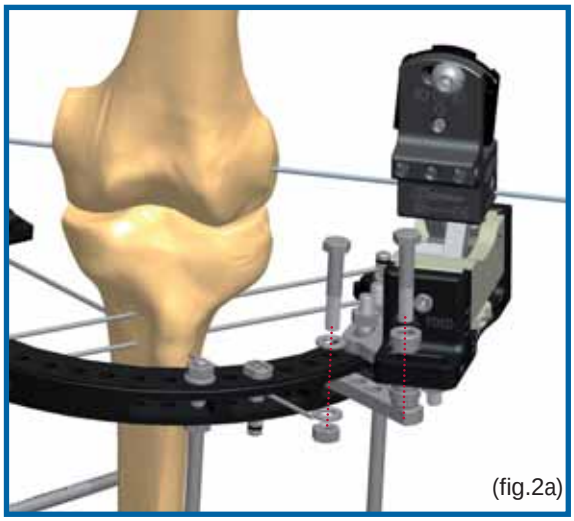


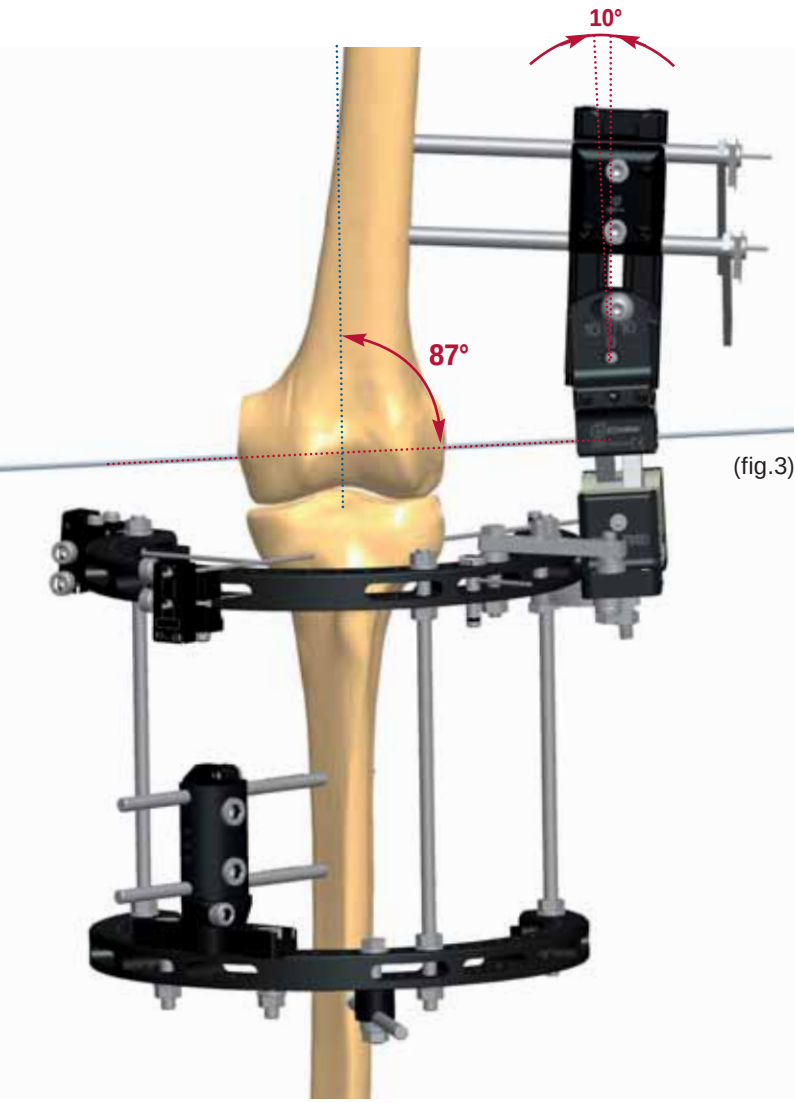
(fig.1)



(fig.2)


(fig.1a)


(fig.2a)

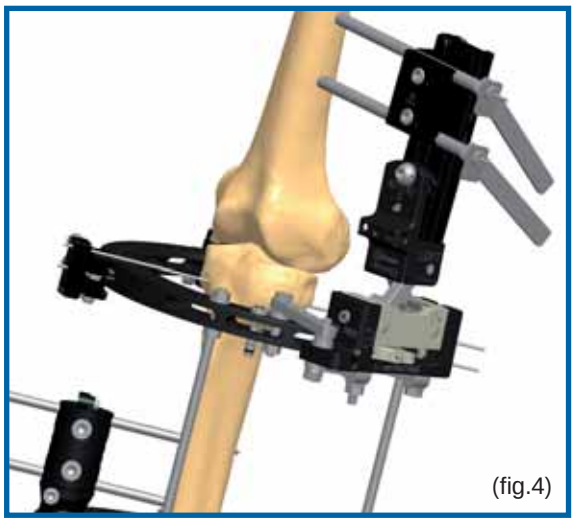


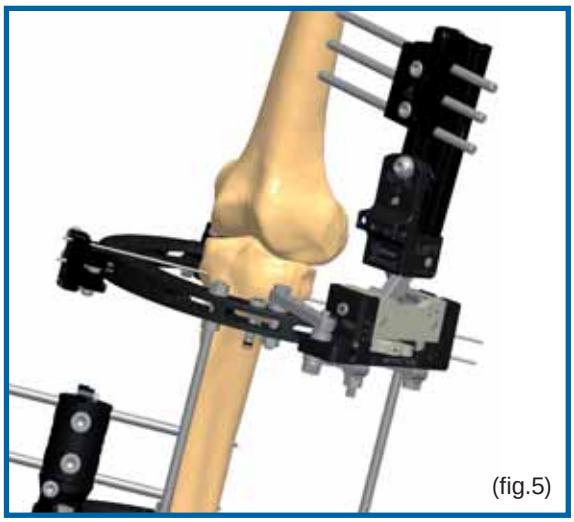
(fig.3)

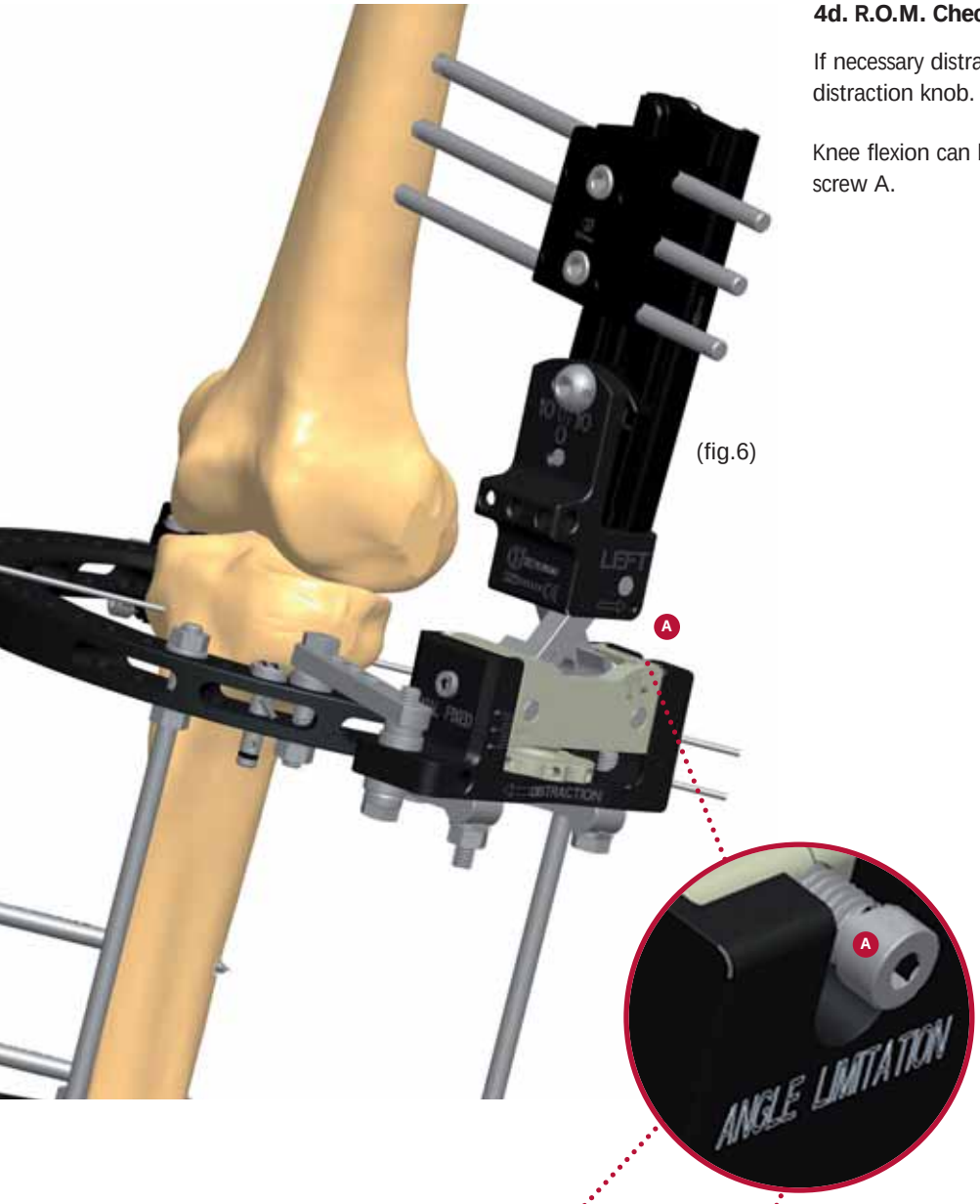
4c. Insertion of Femoral Screws

- Insert the rail with a straight clamp on the hinge. Position the straight clamp 15-20 mm from the hinge.
- Ensure that the rail is in line with the anatomical axis of the femur. If necessary, swivel the proximal part of the hinge in the frontal plane to allow perpendicular placement of bone screws (see page 2).
- Insert 2 wire guides into the screw guides positioned in the screw seats 1 and 5 of the straight clamp. Insert the wires (fig.3).
- Remove the reference wire (fig.4).
- It is advisable to check flexion-extension of the knee in both planes under image intensification (fig.4a). If necessary, replace the reference wire correctly (see page 10).
- Remove the wires and wire guides. Insert the screws after drilling with 4.8 mm drill guide and drill bit (fig.5).


fig. 4a


(fig.4)


(fig.5)

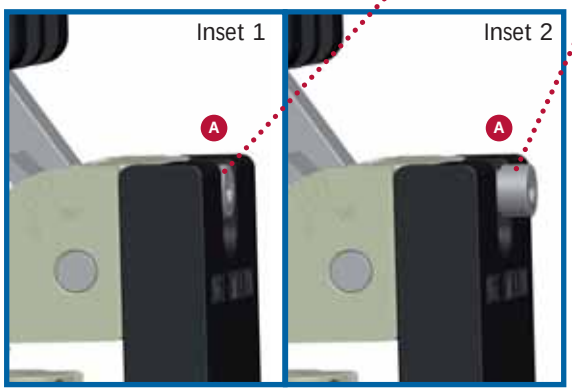


(fig.6)

4d. R.O.M. Check

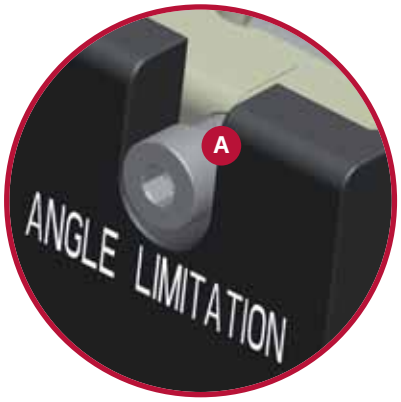
If necessary distract the knee joint by turning the distraction knob.

Knee flexion can be limited by tightening the locking screw A.



Hinge movement limited in extension (0°)

Complete free hinge movement (0°-90°)



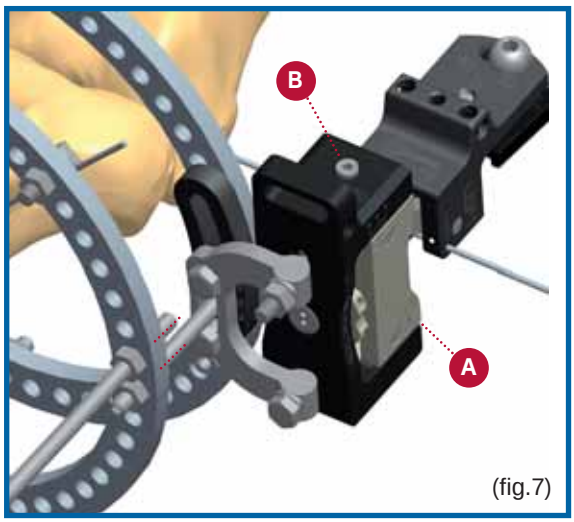
5. TrueLok™ ring

5a. Apply the TrueLok™ Fixator

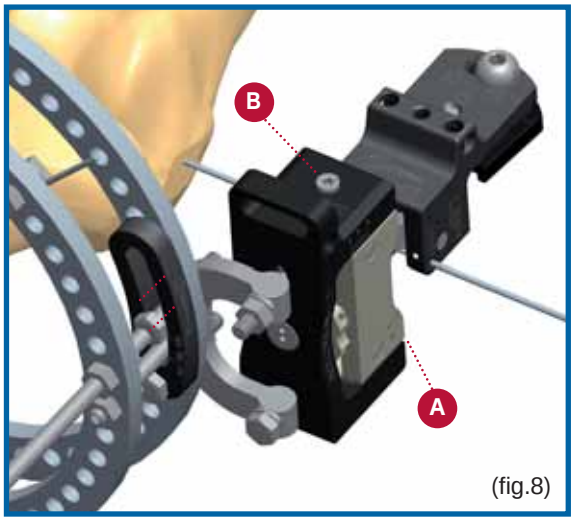
5b. Knee Hinge Positioning

The distraction knob can be used to adjust the distance between the Knee Hinge and the ring.

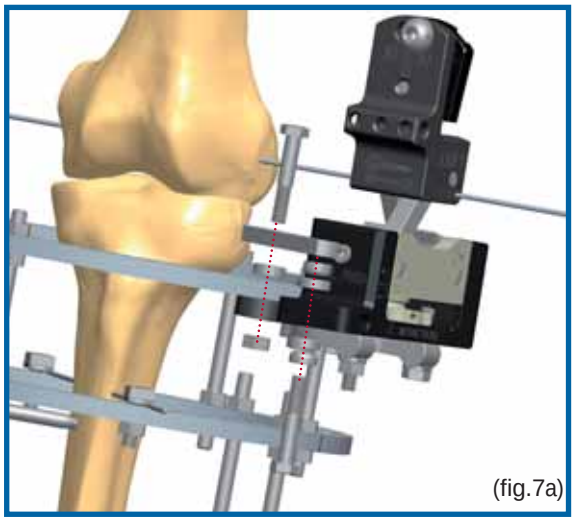
The template needs to be used to apply the hinge on the TrueLok ring.

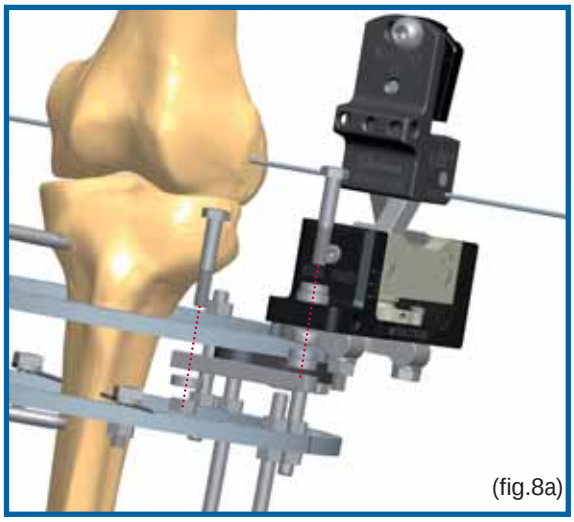


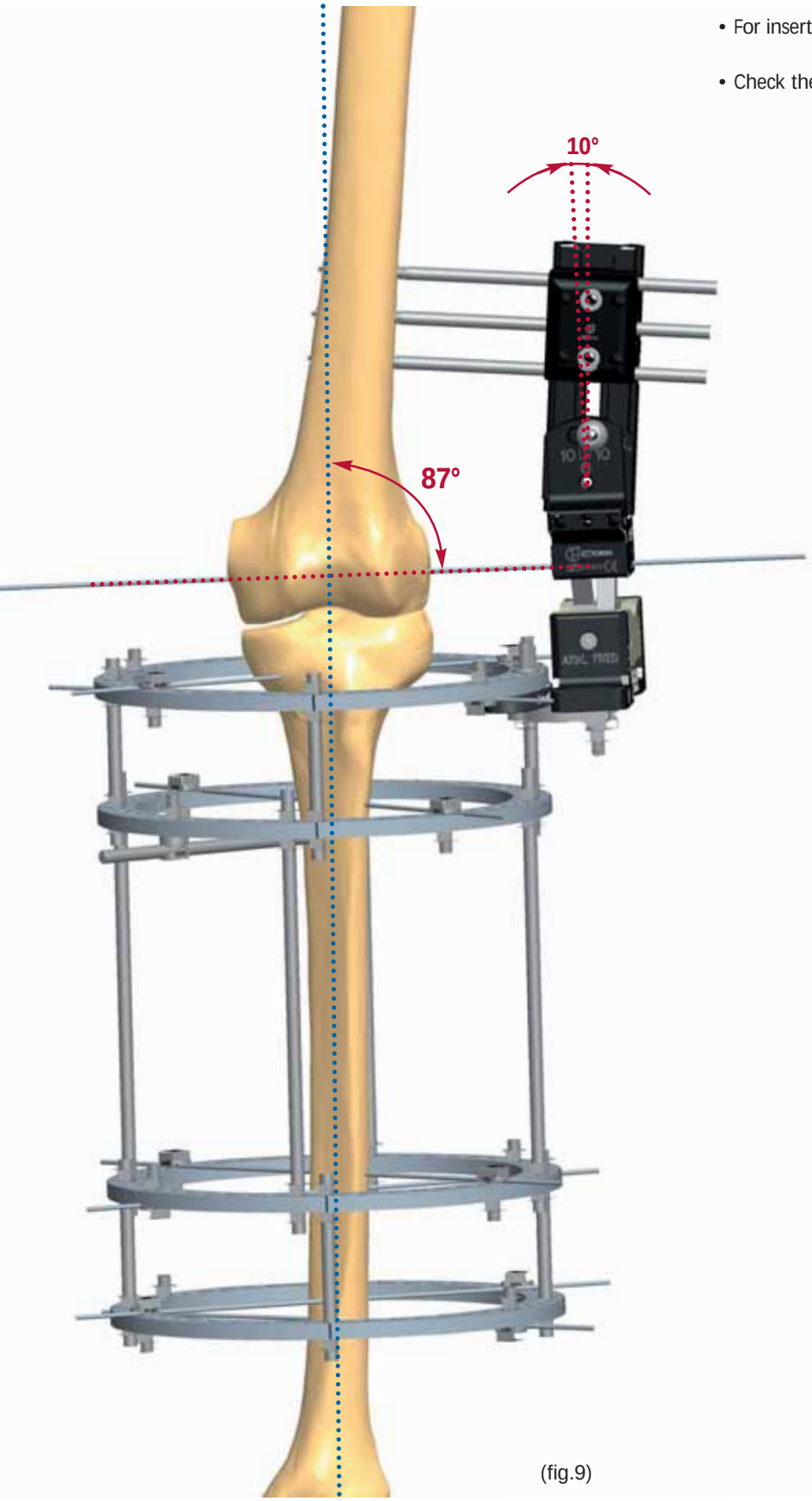
(fig.7)



(fig.8)


(fig.7a)


(fig.8a)



(fig.9)

- For insertion of Femoral Screws (see page 13).
- Check the R.OM (see page 14).

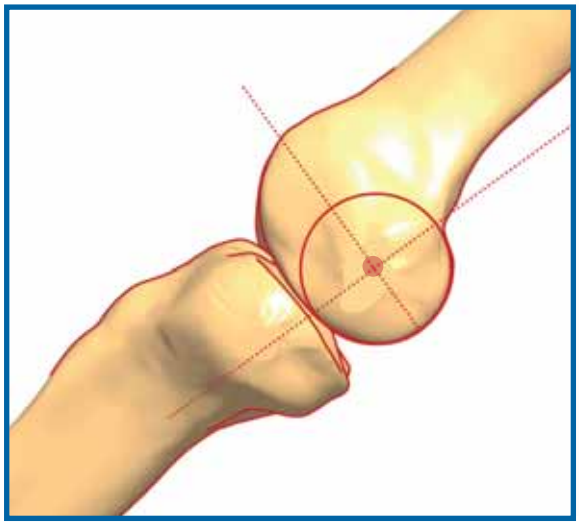
KNEE DISLOCATION

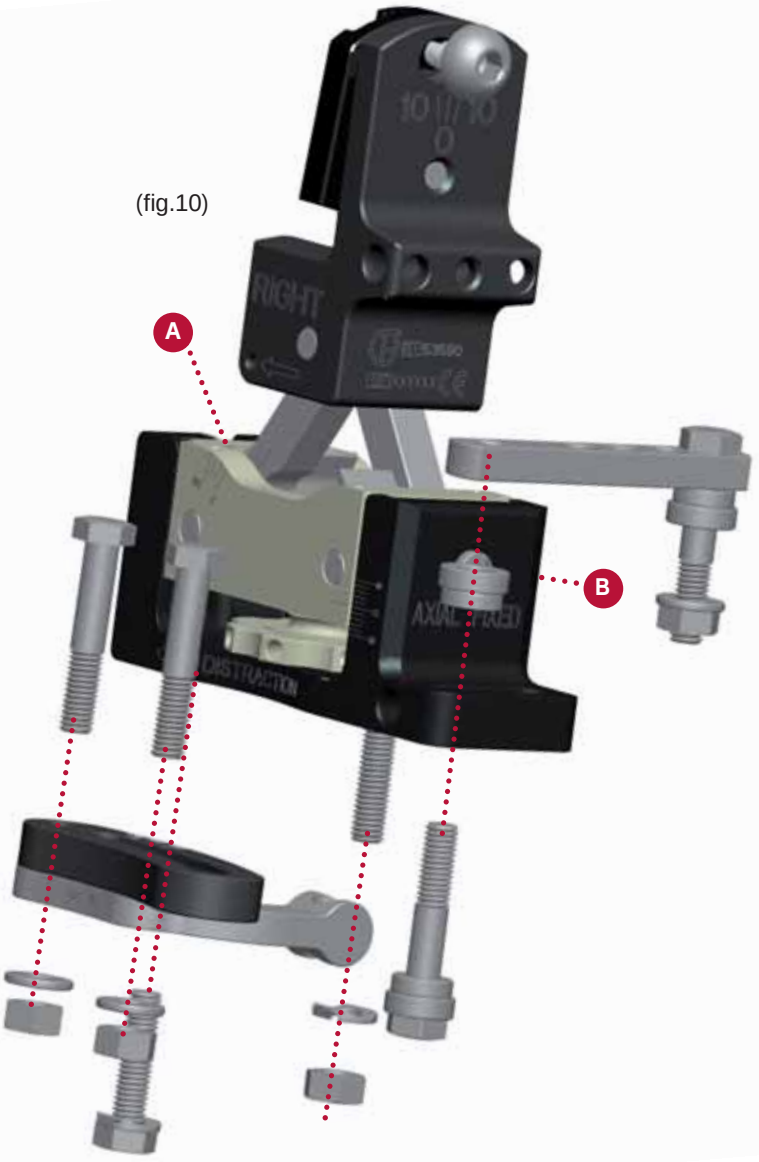
- Disassemble the Knee Hinge completely (fig.10).
- Insert the reference axis wire (see page 10) and apply the Knee Hinge over it, making sure that locking screw A and locking screw B are loosened. Depending upon which leg is treated (L or R), the corresponding mark should face the surgeon.

Sheffield Ring System

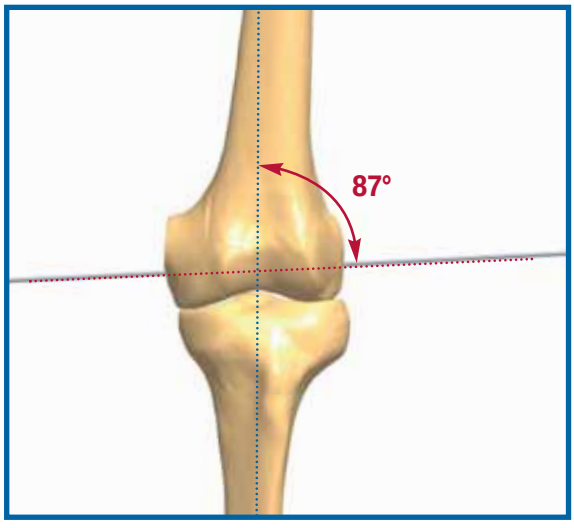
- Attach the Knee Hinge directly to the ring, without using the ring support or 5-hole plate (fig.11).

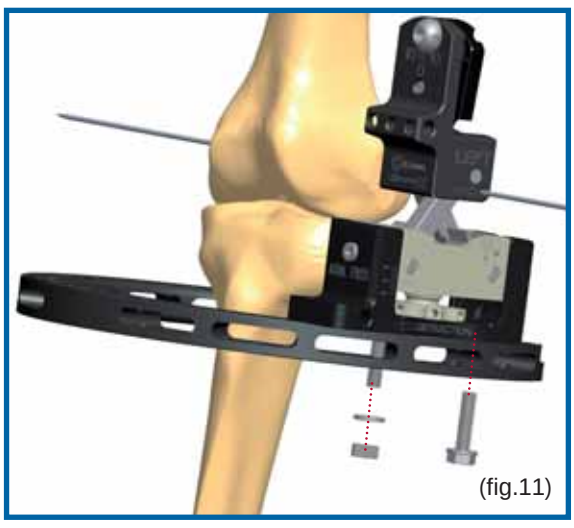
NB: use flat washers with the bolt and nut.





(fig.10)

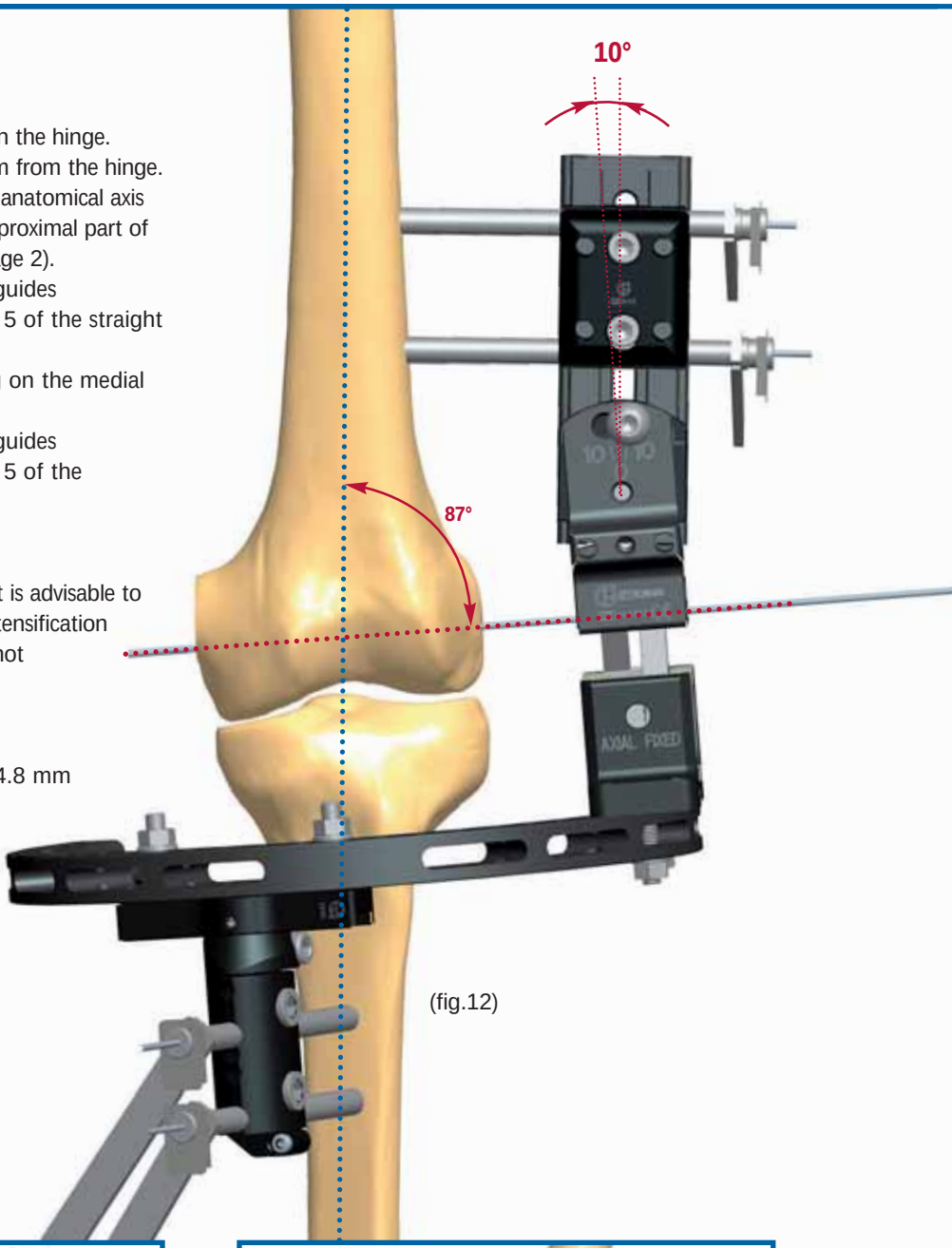




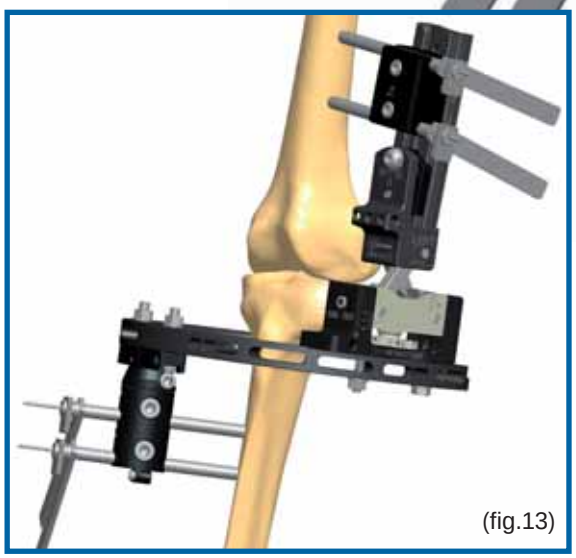
(fig.11)

- Insert the rail with a straight clamp on the hinge. Position the straight clamp 15-20 mm from the hinge.
- Ensure that the rail is in line with the anatomical axis of the femur. If necessary, swivel the proximal part of the hinge in the frontal plane (see page 2).
- Insert 2 wire guides into the screw guides positioned in the screw seats 1 and 5 of the straight clamp. Insert the wires.
- Attach a Sheffield Clamp to the ring on the medial aspect of the tibia.
- Insert 2 wire guides into the screw guides positioned in the screw seats 2 and 5 of the Sheffield Clamp (fig.12). Insert the wires.
- Remove the reference wire (fig.13).
- Before inserting the femoral screws, it is advisable to check in both planes under image intensification that flexion-extension of the knee is not impeded. If necessary, replace the reference axis wire correctly.
- Remove the wires and wire guides. Insert the screws after drilling with 4.8 mm drill guide and drill bit (fig.14).

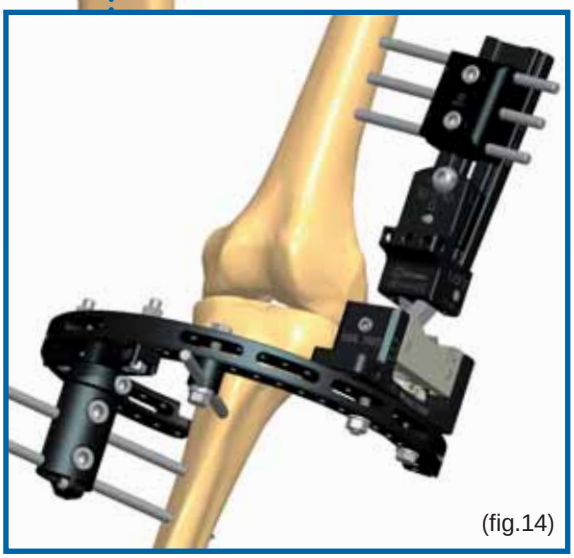
- Check the R.O.M. (see page 14).



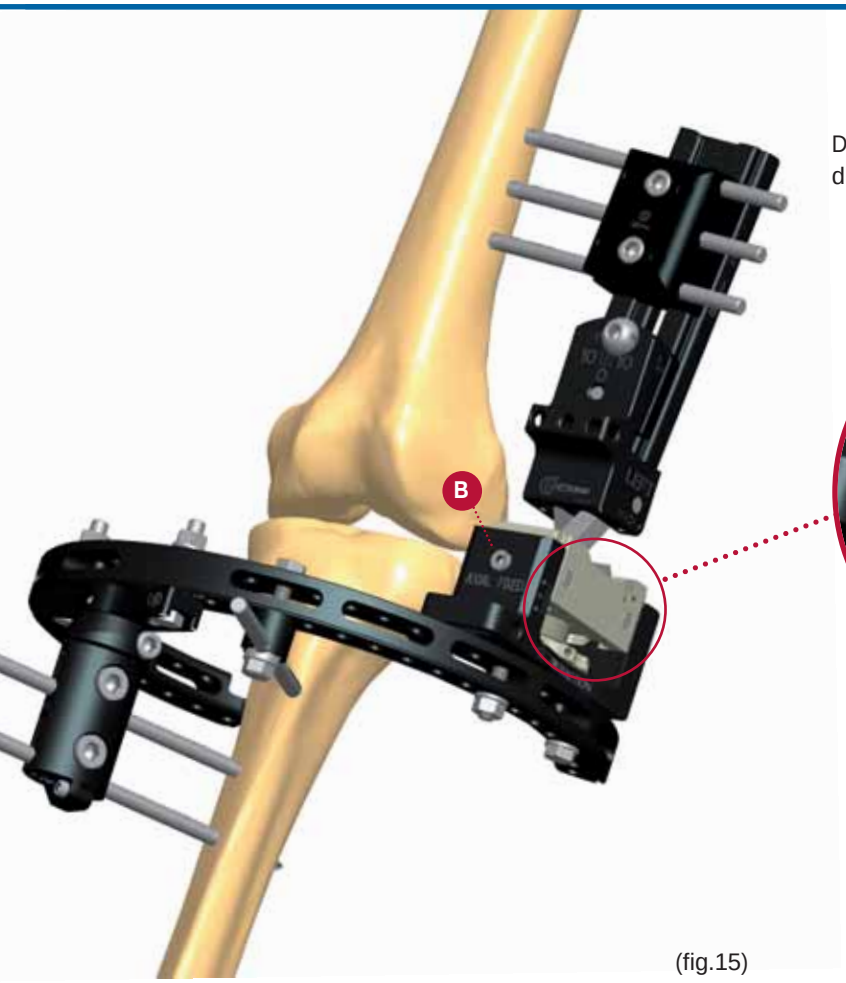
(fig.12)



(fig.13)

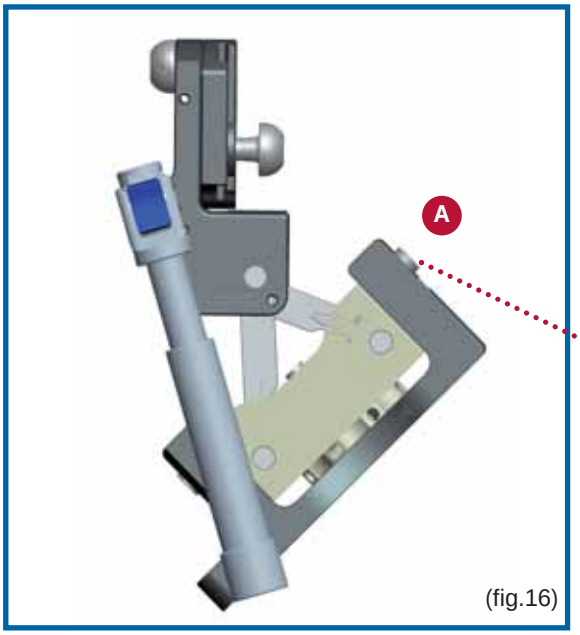


(fig.14)



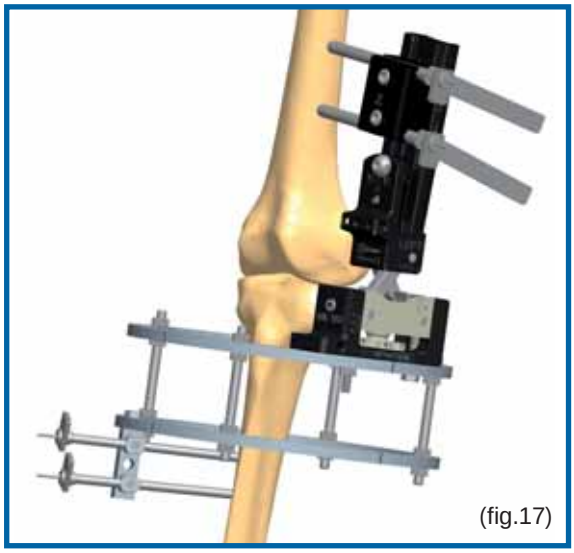
(fig.15)

Distraction of the knee joint is possible by turning the distraction knob. Tighten locking screw B.

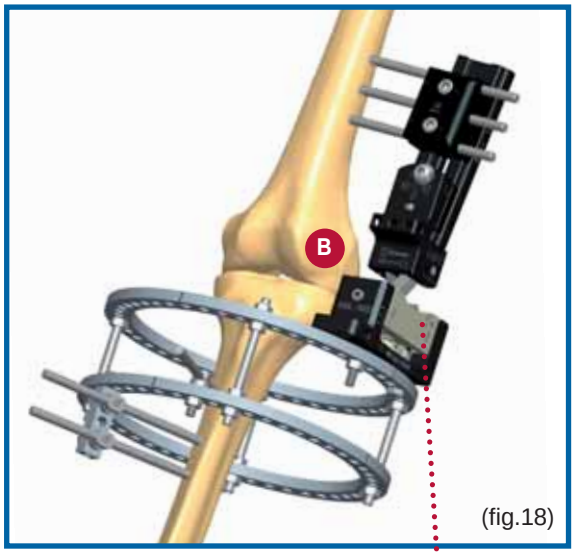


(fig.16)

The range of motion of the knee can be increased by using the compression-distraction unit (see fig.16).



(fig.17)



(fig.18)

TrueLok™ System

- Attach the Knee Hinge directly to the ring using ADV TrueLok™ Kit for ring connection (53034), without the ring support or 5-hole plate.
- Insert the rail with a straight clamp on the hinge. Position the straight clamp 15-20 mm from the hinge.
- If necessary, rotate the proximal part of the hinge in the sagittal plane (see page 2).
- Insert 2 wire guides into the screw guides positioned in the screw seats 1 and 5 of the straight clamp. Insert the wires.
- Attach a post to the distal ring and using half pin fixation bolts secure two wire guides. Insert two wires into the wire guides.
- Remove the reference wire (fig.17).
- Before inserting the femoral screws, it is advisable to check in both planes under image intensification that flexion-extension of the knee is not impeded. If necessary, reposition the reference wire correctly.
- Remove the wires and wire guides. Insert the screws after drilling with 4.8 mm drill guide and drill bit (fig.18).

- Check the R.O.M. (see page 14).

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