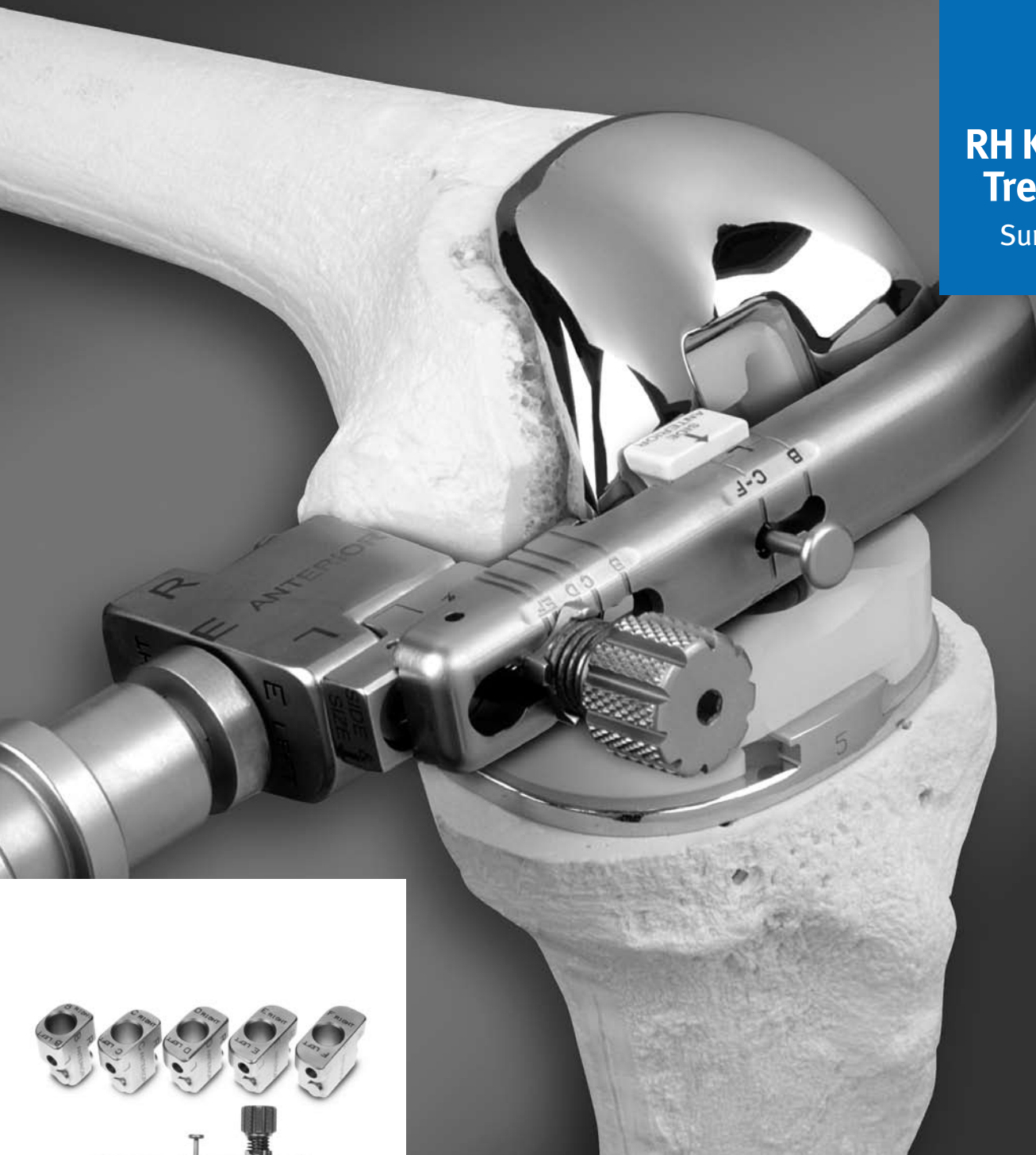




Zimmer®
NexGen®
RH Knee Condylar
Trepine Guide

Surgical Technique
Addendum



Servicing the hinge mechanism for an RH knee distal femur

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RH Knee Condylar
Trepine Guide
Surgical Technique
Addendum**

**Servicing the Hinge
Mechanism for an RH
Knee Distal Femur**

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Servicing the Intercondylar components of an RH Knee Distal Femur – General Information

With the *NexGen*® Rotating Hinge (RH) Knee, there are two hinge configurations available. The first hinge configuration includes the RH Knee Modular Hinge-Post design (Fig. 1). This is the standard configuration for the RH Knee Femoral Component, meaning, it is pre-packaged with these components.

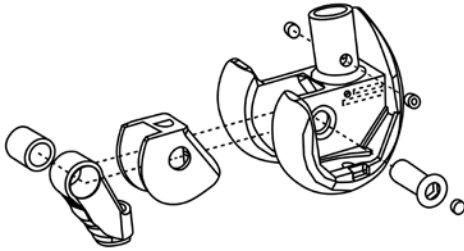


Fig 1. RH Knee Modular Hinge-Post Assembly Configuration

The second hinge configuration uses the Segmental One-Piece Hinge-Post design (Fig. 2). This configuration can be substituted for the modular hinge-post design (Fig. 1) prior to implanting the RH Knee Femoral Component in either a primary or revision TKA or by servicing the modular hinge post and components with a Segmental One-Piece Hinge-Post design.



Fig 2. RH Knee Segmental One-Piece Hinge-Post Assembly Configuration

The modular hinge post assembly (Fig. 1) is packaged with the RH Knee Femoral Component upon removal from the packaging or in the RH Knee Hinge Servicing Kit. The one-piece hinge-post and articular surface are packaged together (Fig. 3), while the polyethylene insert is packaged in the RH Knee Cement Shield Hinge Service Kit.

If hyperextension is encountered, it is recommended that the surgeon should first consider replacement of only the articular surface. If desired, however, the hinge mechanism may also be replaced.

The hinge mechanism of the RH Knee implant can be replaced or serviced without disrupting the fixation of the femoral and tibial components. A sterile kit (RH Knee Cement Shield Hinge Servicing Kit for replacement with the Segmental Articular Surface and the One-Piece Hinge Post, or the RH Knee Hinge Servicing Kit for replacement with the RH Knee Articular Surface or Segmental Articular Surface and the modular hinge post) is available for each femur size that contains the hinge components required to facilitate the exchange.

NOTE: If the RH Knee Hinge Servicing Kit (Fig. 3, top) is used to service the RH Knee implant, the RH Knee Modular Hinge Post can be used with either the RH Knee Articular Surface or the Segmental Articular Surface. If the RH Knee Cement Shield Hinge Servicing Kit (Fig. 3, bottom) is used to service the RH Knee implant, the Segmental One-Piece Hinge Post must be used with the Segmental Articular Surface. See Fig. 3 for an illustration of the compatibility of the servicing kits.

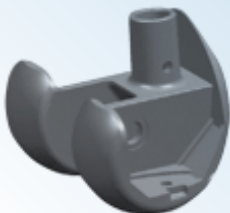





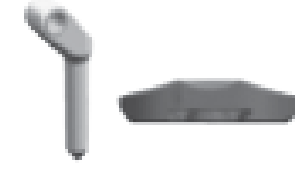
RH Knee	Hinge Servicing Kit Used	Compatible Articular Surfaces and Hinge Components	
			Segmental Articular Surface (with the Hinge Post Extension)
			 DISCARD
			

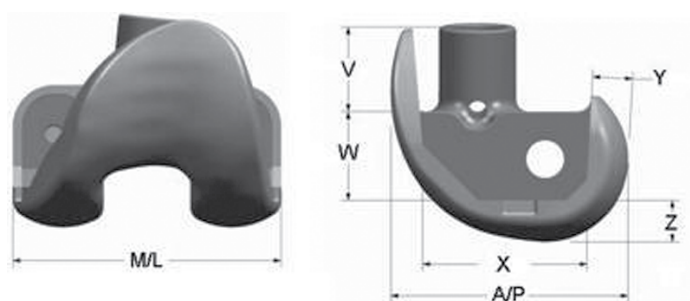
Fig 3. Servicing Kit Compatibility Chart

**Hinge Post Extension packaged with the RH Knee Articular Surface

Determine the femur size that has been implanted into the patient. Markings on the articular surface, top of the polyethylene box insert and on the back of the hinge post can assist in this identification.

NOTE: If the Segmental Articular Surface is used with the RH Knee Hinge Servicing Kit, discard the Segmental One-Piece Hinge Post from the Segmental Articular Surface package. An RH Knee Articular Surface package must also be opened to retrieve the hinge-post extension to be used with the RH Knee Hinge Servicing Kit and the Segmental Articular Surface.

NOTE: If a distal augment larger than 5mm has been used on the medial side, the augment will need to be removed to provide access to the hinge pin.



RH Knee Key Dimensions

	M/L	A/P	V	W	X	Y	Z
Size B	58mm	50mm	18mm	19mm	35mm	8.4mm	9mm
Size C	64mm	54.4mm	23.4mm	22.4mm	37mm	10mm	10.5mm
Size D	68mm	58mm	23.4mm	24mm	41mm	10mm	10.5mm
Size E	72mm	62mm	23.4mm	25.4mm	45mm	10mm	10.5mm
Size F	76mm	66mm	23.4mm	27.4mm	48.6mm	10mm	10.5mm

Fig 4. RH Knee Distal Femoral Implant Dimensions

NOTE: Make sure femur size is identified correctly (by reading markings or measuring M/L and/or A/P dimension of femoral implant) and that the correct Trepine Drill Bushing is chosen. Otherwise, hinge pin may not be accessed and additional bone loss could occur. See Fig. 4 for M/L, A/P, and other important dimensions of the RH Knee Distal Femoral Implant.

NOTE: The details of this surgical technique include terms used to describe components of the Trepine Guide instrument (Fig. 5).

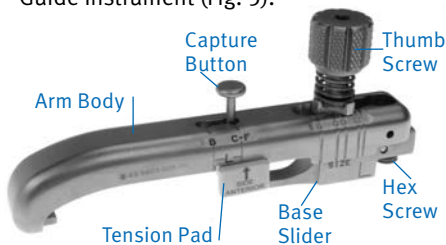


Fig 5. Trepine Guide with terms used in technique

If there is not sufficient clearance on the distal end of the RH Knee Femoral Component for the Trepine Guide instrumentation to be used properly due to biological obstructions, an alternate technique can be used to access the hinge pin. A freehand technique may be used to locate the hinge pin as follows.

Freehand Drilling using Trepine or 18mm Femoral Stem Drill**:

- Locate and mark the drilling center point on the medial side of the bone at a distance of 'X' from the anterior flange and a distance of 'Y' from the distal condyle surface (Fig. 6).
- Measure the additional bone on the medial side (not covered by the implant) and add to 'Z' depth (Fig. 7). This is the 'total depth' to be drilled.
- Mark the total depth on Trepine (00-5881-050-00) or 18mm Femoral Stem Drill (00-5987-010-01)** with a marking pen and drill through the bone to the required depth (taking care not to drill into the actual component) to access the hinge pin.
- Follow the steps as shown for servicing the hinge mechanism for a RH Knee Distal Femur with a Segmental One-Piece Hinge Post or servicing the hinge mechanism for a RH Knee Distal Femur with a RH Knee Modular Hinge Post, whichever applies.

'X', 'Y' and 'Z' dimensions for a given size of the femoral component are listed below:

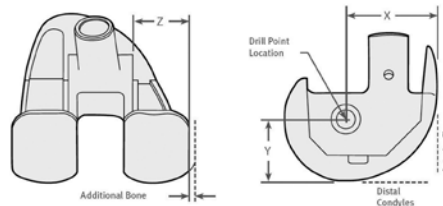


Fig 6.

** Use 18mm Femoral Stem Drill in place of Trepine if service kit is not available.

NOTE: If a distal augment larger than 5mm has been used on the medial side, the augment will need to be removed to provide access to the hinge pin.

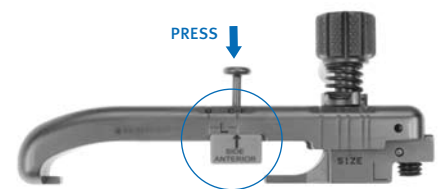
RH Knee Hinge Pin Location Dimensions

Femoral Size	X	Y	Z
B	32.5mm	17.5mm	16mm
C	32.5mm	22mm	19mm
D	35mm	23.5mm	21mm
E	37mm	25mm	23mm
F	38.5mm	27mm	25mm

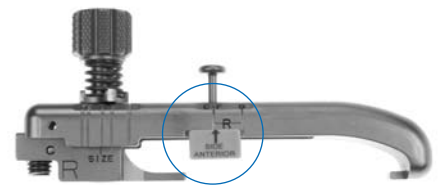
Fig 7.

Step 1: Preparing the Trepine Guide Instrumentation

Adjust the orientation of the tension pad by pressing the capture button so that the tension pad is disengaged and slide the capture button so that it is in the hole that corresponds to the size of the femoral component (Fig. 8).



Left Size C Femur



Right Size C Femur

Fig 8. Detail of proper Tension Pad alignment for different sides and sizes of femoral implants

The etching on the tension pad must match up with the etching on the arm body indicating which side femoral component ('L' for left or 'R' for right) is being serviced (Fig. 9).



Fig 9. Detail of proper orientation of the tension pad

Adjust the base slider by loosening the thumb screw of the Trepine Guide so that the recessed hex screw is accessible for attachment of the Trepine Drill Bushing (Fig. 10).

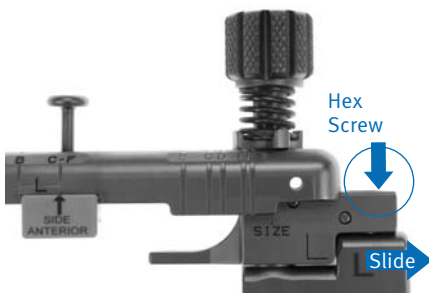


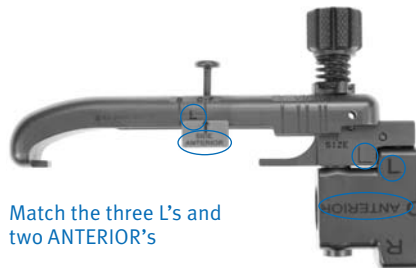
Fig 10. Detail of proper orientation of base slider to access hex screw

Secure the appropriate size Trepine Drill Bushing, corresponding to the size femoral component implanted in the patient, to the Trepine Guide by tightening the recessed hex screw with the 3.5mm Hex Driver (Fig. 11).



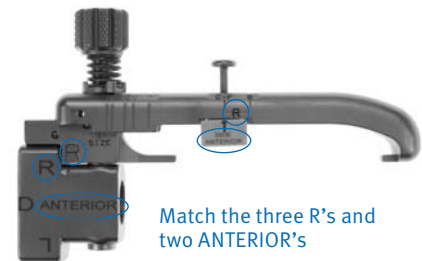
Fig 11. Detail showing the proper attachment of the Trepine Drill Bushing

NOTE: For a left femur, the 'L' on the Trepine Drill Bushing should be oriented the same as both 'L's on the Trepine Guide (Fig. 12). For a right femur, the 'R' on the Trepine Drill Bushing should be oriented the same as the 'R' on the Trepine Guide (Fig. 13). In both cases the bushing and guide should read 'ANTERIOR'.



Match the three L's and two ANTERIOR's

Fig 12. Proper orientation of Bushing and Trepine Guide for left femoral component



Match the three R's and two ANTERIOR's

Fig 13. Proper orientation of bushing and Trepine Guide for right femoral component

Attach the Trepine Guide to the notches on each side of the femoral component by sliding the base slider towards the femoral component (Fig. 14).



Fig 14. Detail of Trepine Guide attached to a left femoral component

NOTE: The etching on the Trepine Drill Bushing 'ANTERIOR' as well as the etching on the tension pad 'ANTERIOR' should be facing the ANTERIOR side of the femoral component.

Tighten the thumb screw in the location on the arm body such that the appropriate size femur matches the size indicated by the Trepine Guide (Fig. 15). This will secure the Trepine Guide to the notches of the femoral component.

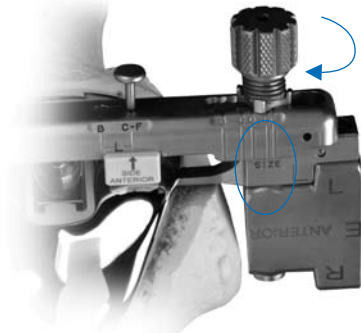


Fig 15. Detail of the femoral component size indication on the Trepine Guide for a size C distal femur

NOTE: Make sure the femur size implanted in the patient matches the femoral size marking on the Trepine Guide. Otherwise, hinge pin may not be accessed and additional bone loss could occur.

Step 2: Accessing the Currently Implanted Hinge Pin

Use the Trepine to drill an access hole into the medial side of the femur (Fig. 16). The Trepine has a built in stop to limit the depth of drilling. Use the Hand Rasp to remove any remaining bone or cement obstructing access to the hinge pin (Fig. 17).



Fig 16. Drilling the medial access hole with Trepine Drill

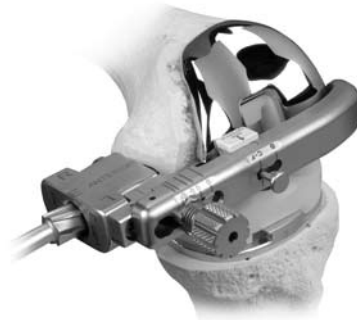


Fig 17. Clearing access to hinge pin using Hand Rasp

Remove the Trepine Guide from the femoral component by loosening the thumb screw. Use the Hinge Pin Plug Removal Tool to remove the polyethylene plug from the hex in the hinge pin by pressing the tip into the center of the hinge pin plug and turning (Fig. 19).



Fig 18. View of hinge pin



Fig 19. Detail of Hinge Pin Plug Removal Tool

Step 3: Removing the Currently Implanted Hinge Pin and Components

NOTE: This document assumes that there is a well-fixed distal femoral component and a well-fixed proximal tibia component.

Removing the Hinge Pin and Components

Remove the hinge pin using the 4.5mm Hex Driver Bit and RH Knee Removal Wrench. Once the hinge pin has been removed, the remaining internal hinge components are also removed (Fig. 20 and 21).



Fig 20. Removing hinge pin



Fig 21. Removal of internal components

Remove the articular surface. Remove tibial bushing from the tibial plate stem with the Tibial Bushing Removing Tool (Fig. 22). Be careful to avoid scratching the tibial plate surface.



Fig 22. Removal of the tibial bushing

Step 4: Implanting the New Hinge Mechanism and Articular Surface

Implanting the Hinge Mechanism using the RH Knee Hinge Servicing Kit with an RH Knee Modular Hinge Post

Insert the new tibial bushing from the RH Knee Hinge Servicing Kit for using a RH Knee Modular Hinge Post into the tibial plate stem and press into place (Fig. 23).



Fig 23. Insertion of the new tibial bushing

Insert the polyethylene box insert from the RH Knee Hinge Servicing Kit into the femur and slide the RH Knee Hinge Post with bushing into place (Fig. 24).



Fig 24. Detail of RH Knee Modular Hinge Post into the distal femoral component

Attach the new hinge pin from the RH Knee Hinge Servicing Kit to the 4.5mm Expandable Extractor (Fig. 25). The 4.5mm Expandable Extractor can be used to hold the hinge pin during insertion.



Fig 25. Detail of attaching the new hinge pin to the extractor

NOTE: Do not use this instrument to torque the hinge pin after it is fully inserted.

Align the holes of the femoral component and of the RH Knee Modular Hinge Post/RH Knee Polyethylene Box Insert assembly to accept the hinge pin by first confirming alignment visually through the medial access hole, then insert the Segmental/RH Knee Hinge Pin Aligner through the medial access hole.

Hold the knee steady, and remove the Segmental/RH Knee Hinge Pin Aligner. Then insert and thread the new hinge pin (attached to the 4.5mm Expandable Extractor). Remove the 4.5mm Expandable Extractor.

Torque the hinge pin to 95 in.-lb. using the LCCK Torque Wrench (black handle) and the 4.5mm Hex Driver (Fig. 26). Press the new hinge pin plug from the RH Knee Hinge Servicing Kit into the hex of the hinge pin or cover the hex with bone wax. Replace the bone removed during drilling if desired.



Fig 26. LCCK Torque Wrench

Distraction Method

Place the tibial articular surface onto the tibial base plate and slide it forward until it engages the tab (Fig. 27). While distracting the joint, rotate the hinge post posteriorly until it drops into the hole in the middle of the articular surface (Fig. 28).



Fig 27.



Fig 28.

The Locking Mechanism of the Rotating Hinge Knee

Tightening of the taper on the Hinge Post Extension is critical to achieving security of the locking mechanism of the implant. Use of the Spanner Wrench to counteract the opposing forces of the Rotating Hinge Knee Torque Wrench ensures minimal forces are transmitted to the fixation surfaces, and reduces the potential of binding. Tightening to the level indicated on the Torque Wrench is the most important step in the surgical technique because it “locks” the Hinge Post Extension into position. The Hinge Post Extension is designed with a 4 degree Morse-type taper below the threads (Fig. 29). This 4 degree taper mates with a taper in the hinge post to provide the “lock” between the components. If the hinge post assembly is not properly tightened, **postoperative disassembly could potentially occur.**

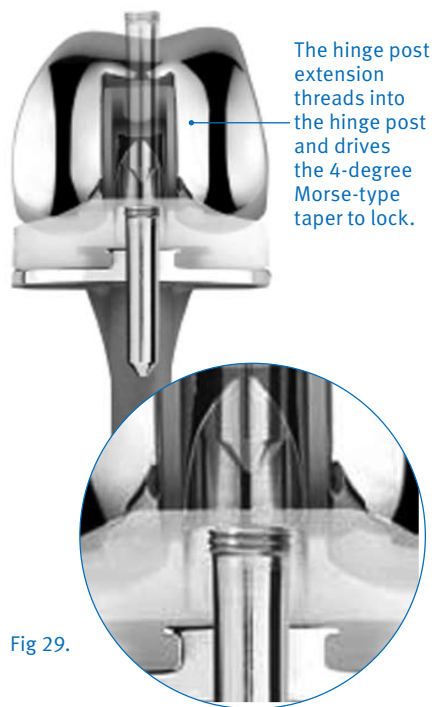


Fig 29.

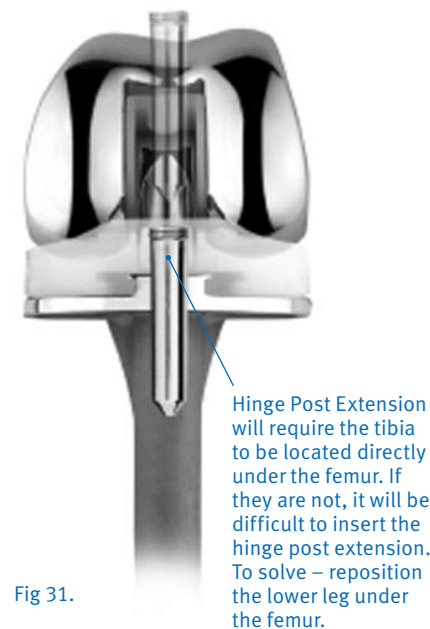
Freedom of the hinge post extension to rotate within the hinge may be compromised (reduced) by binding between the threads of the hinge post and hinge post extension. This binding is created when the tibia is not aligned directly under the femoral component (Fig. 30).



This malalignment creates friction between the threads of the hinge post and hinge post extension as the extension is inserted and turned. The friction in the hinge post extension can lead to a reduction in the tightening torque being applied to threads just above the 4 degree Morse Taper. As bending forces (binding) increase, the rotational torque that is applied to the hinge post extension decreases. This could directly affect locking of the 4 degree locking taper. In cases where this malalignment is significant, it is possible for bending forces to increase to the point where even though the torque wrench reads to the proper level, only a fraction of tightening force is being exerted to the screw threads and Morse Taper. **In this case, the 4-degree Morse**

Taper may not be fully locked. As earlier discussed, **adequate taper locking is critical to maintaining assembly.**

It is possible to address this concern at the time of implant assembly by following these recommendations. If difficulty is encountered in assembling or disassembling the provisional hinge post components, it is necessary to reposition the lower leg (tibia) under the femur until the hinge post extension pin slips easily into place. The same is true for the implant assembly. The hinge post extension should easily slide through the hole in the top of the hinge post and into the tibial base plate (Fig. 31).



The surgeon should be able to easily turn (thread) the hinge post extension until it is flush with the top of the hinge using only two fingers on the hex head screwdriver. If significant resistance to turning is encountered, the tibial/femoral alignment must be altered to remove the binding force.

Proper alignment must be maintained during the entire assembly process. It is critical to continue to maintain this orientation during the time that the spanner wrench is assembled, and the torque wrench is tightened. Remember, if resistance to turning is encountered, a malalignment is creating a bending force (binding) and reducing the locking torque on the 4-degree Morse Taper.

To confirm that the femur and tibia are in alignment during the tightening process, **use the Knurled Driver to finger tighten and loosen the hinge post extension a half turn immediately prior to use of the Torque Wrench.** The proper upper/lower leg alignment position must then be maintained throughout the tightening process.

Hinge Post Extension Insertion

Make sure that the hinge post and hinge post extension tapers are clean and dry prior to assembly of the components. The appropriate length hinge post extension is packaged with each articular surface. Align the hinge post with the hole in the top of the tibial base plate, and insert the hinge post extension in the hinge post through the articular surface and into the hole on the tibial base plate (Fig. 32). Thread the hinge post extension into the hinge post, by hand, using the driver (Fig. 33).



Fig 32.

Leave the driver in the hinge post extension. Attach the Spanner Wrench to the two tabs on the outside of the medial and lateral femoral component. Thumb tighten the knurled wheel to snug the wrench to the distal femoral condyles. Attach the Rotating Hinge Knee Deflection Beam Torque Wrench to the driver, and apply 130 in.-lbs. (15n-m) of torque until the needle on the wrench reaches the appropriate mark on the torque wrench (Fig. 34, 35 & 36). While torque is being applied, counter rotation is applied using the Spanner Wrench.

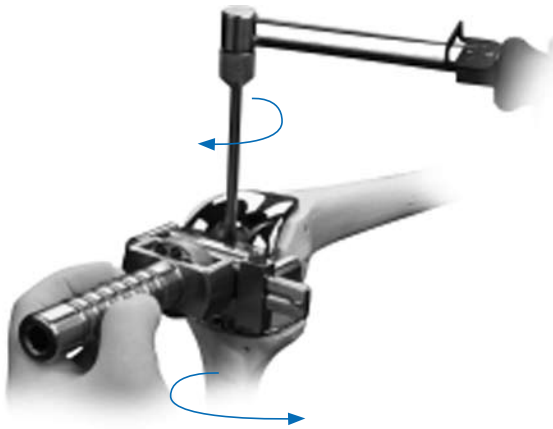


Fig 34.



Fig 33.



Fig 35.



Fig 36.

NOTE: Do not over- or under-torque. Undertightening of the hinge post extension may allow it to loosen over time. Overtightening is not necessary.

Implanting the Hinge Mechanism using the RH Knee Cement Shield Servicing Kit with a Segmental One-Piece Hinge Post

Insert the new tibial bushing from the RH Knee Cement Shield Hinge Servicing Kit for using a Segmental One-Piece Hinge Post into the tibial plate stem and press into place (Fig. 37).



Fig 37. Insertion of the new tibial bushing

Attach the proper size RH Knee Cement Shield Polyethylene Insert to the Segmental Hinge Post by spreading out the sides of the insert slightly and pressing it over the hinge post so the holes in the insert engage the bosses of the Segmental Hinge Pin Bushing. The holes in the polyethylene insert must match the bosses on the hinge pin bushing to assure proper orientation (Fig. 38).



Fig 38. Detail of Segmental One-Piece Hinge Post Fit with the RH Knee Cement Shield Polyethylene Insert

NOTE: If attached backwards, the insert will not sit flush against the lateral side of the hinge post due to a “no-fit” condition with the hinge pin bushing. This will cause the hinge post/polyethylene insert assembly to not fit without interference within the intercondylar notch of the femoral component upon assembly. Therefore, if the hinge post/polyethylene insert assembly does not fit easily within the intercondylar notch, pull the assembly out, spread the sides of the polyethylene insert to remove it from the hinge post, reverse the polyethylene insert orientation, and reattach it. The polyethylene insert should then be flush against the lateral sides of the hinge post.

Place the Segmental Articular Surface onto the Tibial Base Plate and slide it forward until it engages the tab.

Insert the cylindrical portion of the Segmental One-Piece Hinge Post through the Segmental Articular Surface and into the implanted tibial component

Attach the new hinge pin from the RH Knee Cement Shield Hinge Servicing Kit to the 4.5mm Expandable Extractor (Fig. 39). The 4.5mm Expandable Extractor can be used to hold the hinge pin during insertion.



Fig 39. Detail of attaching the new hinge pin to the extractor

NOTE: Do not use this instrument to torque the hinge pin after it is fully inserted.

Insert the proximal end of the Segmental One-Piece Hinge Post/RH Knee Cement Shield Polyethylene Insert assembly into the intercondylar notch of the distal femur. Anteroposterior rotation of the Segmental One-Piece Hinge Post/RH Knee Cement Shield Polyethylene Insert assembly, from flexion into extension, may facilitate seating of the assembly into the intercondylar notch.

Align the holes of the femoral component and the Segmental One-Piece Hinge Post/RH Knee Cement Shield Polyethylene Insert assembly to accept the hinge pin by first confirming alignment visually through the medial access hole, then insert the Segmental/RH Knee Hinge Pin Aligner through the medial access hole.

Hold the knee steady, and remove the Segmental/RH Knee Hinge Pin Aligner. Then insert and thread the new hinge pin (attached to the 4.5mm Expandable Extractor). Remove the 4.5mm Expandable Extractor.

Torque the hinge pin to 95 in.-lb. using the LCCK Torque Wrench (black handle) and the 4.5mm Hex Driver (Fig. 40). Press the new hinge pin plug from the RH Knee Hinge Servicing Kit into the hex of the hinge pin or cover the hex with bone wax. Replace the bone removed during drilling if desired.



Fig 40. LCCK Torque Wrench

**RH Knee Size Compatibility Chart
When Using An RH Knee Articular Surface**

Tibial Base Plate	Femoral Size				
	B	C	D	E	F
1	B				
2	B	C			
3	B	C	D		
4	B	C	D	E	
5	B	C	D	E	F
6	B	C	D	E	F

Articulating Surface Size

**RH Knee Size Compatibility Chart
When Using A Segmental Articular Surface**

RH Knee Tibial Size	RH Knee Femoral Size				
	B	C	D	E	F
1	B/123456	C/123456	D/123456		
2	B/123456	C/123456	D/123456	E/23456	
3	B/123456	C/123456	D/123456	E/23456	F/3456
4	B/123456	C/123456	D/123456	E/23456	F/3456
5	B/123456	C/123456	D/123456	E/23456	F/3456
6	B/123456	C/123456	D/123456	E/23456	F/3456

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