BPK-S INTEGRATION

REVISION KNEE SYSTEM

SURGICAL TECHNIQUE

PETER BREHM
Die Präzision in Titan
für den Menschen

BPK-S Integration

The addition of new implant components has expanded the BPK-S Integration knee system into a comprehensive full system that provides solutions for nearly every initial setting in total knee arthroplasty. The use of stems is required for the fixation of the components of the Semi-Constrained (SC), Rotating Hinge (RH), and Total Hinge (TH) systems. This surgical technique describes the intramedullary guided implantation technique for the Semi-Constrained (SC) components and for the Rotating Hinge and Total Hinge (RH and TH) components.

The existing Unconstrained (UC) version with the Fix, Mobile, and Deep Dish insert options has been expended to include the Semi-Constrained (SC) design. The intercondylar cam and spine mechanism provides varus/valgus stabilization in the presence of mediolateral instability.

Rotating or Total Hinge (RH/TH) designs are also available as two axis guided versions to address high-grade instability. The yoke of these variants has a modular design to avoid the need to distract the joint during implantation as well as removal should it become necessary. It is securely tightened to a defined torque of 25 Nm during implantation.

The appropriate degree of constraint is selected according to the initial ligament situation and joint stability.

Due to the uniform osteotomy and uniform outer contour of the implants, primary and revision components can be combined rather freely as to adapt the system intraoperatively to match the specific soft-tissue and bone situation.

A number of augment options are available for filling bone defects. Femoral defects of up to 20 mm (distally) and up to 10 mm (posteriorly) can be managed with augments. Tibial augmentation up to a height of 15 mm is possible. Augments of different sizes can be freely combined. This makes it possible to adapt the cortical contact area with a tapered, proximally widening structure.

A broad selection of different stem designs is available to ensure bone fixation:

- Cemented stems (Co28Cr6Mo) are available in diameters 10-22 mm (2 mm increments), each in the lengths 40, 80, and 140 mm.
- Cementless stems (Ti6Al4V) are available in diameters 13-22 mm (1 mm increments) in the lengths 40, 80, and 140 mm as well as in diameters 23-30 mm, each in the lengths 40 and 80 mm.
- All stems can be combined with both the tibial and femoral components.

The stems are connected with the aid of an adapter. 4 mm and 6 mm offset variants are available in addition to the straight 0 mm adapter to enable individual adaptions to the patient's anatomical condition. The alignment is continuously adjustable through 360°.

The screw connections between the femoral- and tibial components and the adapter and stem are tightened to a defined torque of 25 Nm.

Table of Contents

5 Trial Femoral Component

6 Assembling the Tibial Implant

7 Assembling the Femoral Implant

8 Placing the Implants

Table of Contents

I Preoperative Planning

Preoperative Planning

The most important goals in revision total knee arthroplasty are restoration of the desired alignment with the components in correct rotation, functional stability of the knee, preservation of the function of the knee extenders, permanent stable fixation of the implant components, and restoration of the joint line.

As in all arthroplasties, preoperative planning is essential. This is done using A/P- and M/L-radiographs supplemented by a full-length standard view of the lower limb. Preoperative radiographs as well as radiographs of the contralateral side, which may not have had previous surgery, should also be consulted.

Allowing for correct axial alignment of the stem within the medullary canal, one can use the lateral radiographs to estimate the size of the femoral component for the reconstruction of the posterior femoral offset and to determine whether posterior augments are indicated for this size of component. Selecting a shorter stem and choosing a posterior point of entry into the medullary canal can shift the femoral component back from an overly anterior position and correct an excessively wide joint space in flexion. Planning the correct position of the femoral joint line is often difficult. The measurements relative to the various landmarks that are discussed in the literature have the obvious disadvantage of varying greatly depending on size and gender. Therefore, certain groups of authors have proposed formulas for calculating the distance from various landmarks to the joint line. These have the advantage of allowing for size and gender-specific differences among patients[1,2]. The goal for restoring the joint line for the best possible functional results is specified in the literature as a range of ±4 mm[3]. Appropriate distal augments are available for restoring the joint line.

Similar information applies to planning the tibial component. Allowing for the axis of the stem, one can estimate the required component size and any required offset in both planes. The osteotomy planes can be planned and the necessity of medial and lateral augments to restore the tibial joint line can be estimated.

NOTE: The thickness of the plateau (4.5 mm) and the minimum height of the insert (7 mm) must be taken into account at the Tibial Component.

The distal resection level for the BPK-S Integration femoral components (UC, SC, and RH/TH) is 9 mm. Therefore, a minimal resection of about 9 mm is required in the distal femur when using an intramedullary technique in a primary procedure.

[1] Maderbacher G. et al.: Accuracy of bony landmarks for restoring the natural joint line in Revision Knee Surgery: an MRI Study. Int Orthop. 2014 Jun; 38(6): 1173-81
[2] Servien E et al. Reliability of bony landmarks for restoration of the joint line in revision knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2008 Mar; 16(3):263-9
[3] Hofmann AA et al.: Clinical and Radiographic Analysis of Accurate Restoration of the Joint Line in Revision Total Knee Arthroplasty. The Journal of Arthroplasty, Volume 21, Issue 8, December 2006, Pages 1154-1162

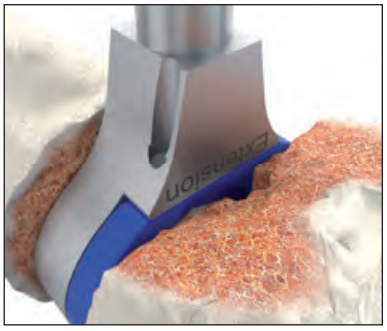
1 Determining the Joint Line

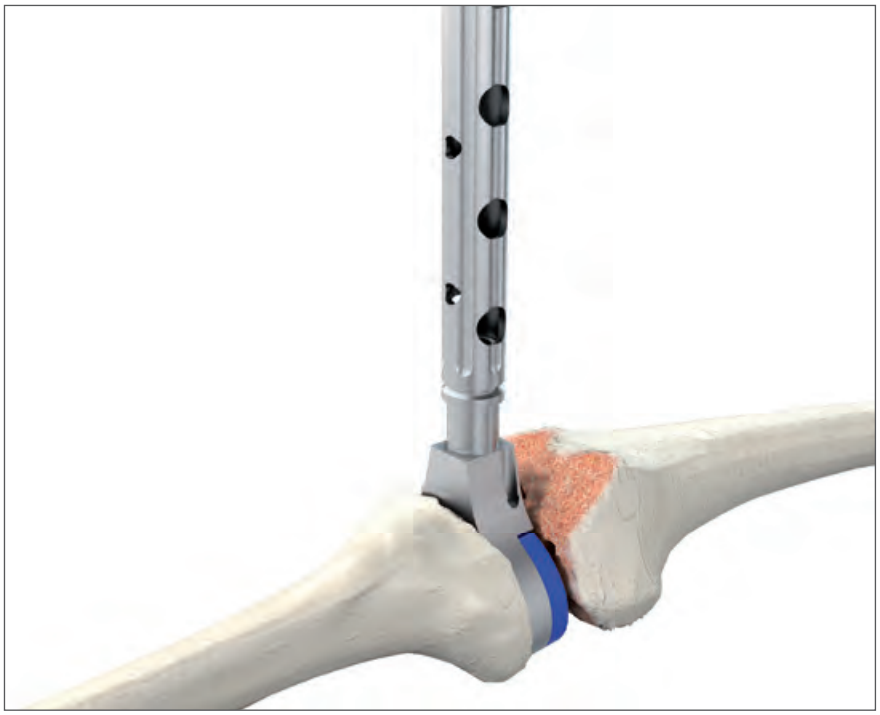
Evaluating Joint Space in Extension and Flexion during Revision Surgeries

Before the implant components requiring revision are removed, a comparison can be made with the *Femoral Sizing Templates* or the *TRIAL Femoral Components SC/RH/TH* to determine the femoral size.

01

After the primary components have been removed, the surgeon estimates the required height of the entire implant construct (TIBIA Component, FEMUR Component, and PE-INSERT) with the aid of *TRIAL Spacers* and determines whether joint space in extension and flexion is poorly balanced.

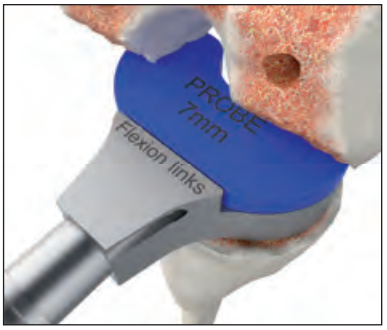


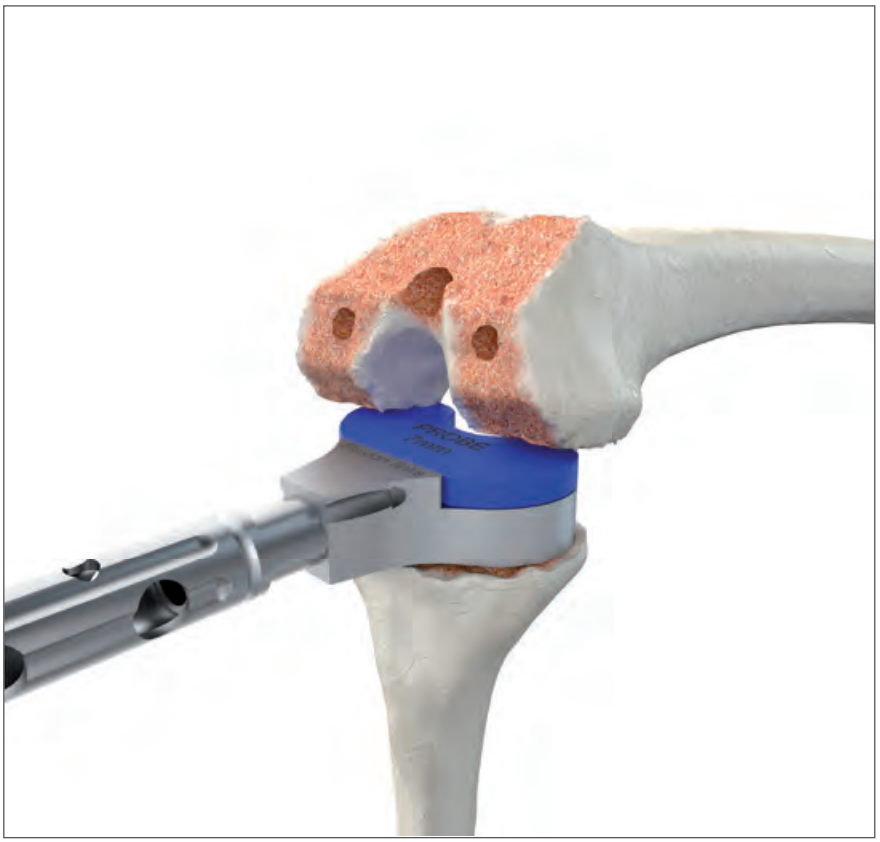


! NOTE

Be sure to use the proper right or left version of the *Spacer Handle Flexion*.

Verify that you are using the correct *Spacer Handle* labeled "Flexion" or "Extension".





1 **Determining the Joint Line**

Opening the Tibia and Preparing the Reamers with Guide Rod

02

Assembling the *Reamer with Guide Rod* and *Joint Line Plate*

1. *Reamer with Guide Rod*
2. *Drive Shaft for Reamer with Guide Rod*
3. *Handle with AO Coupling short*
4. *Tibial Joint Line Plate, primary*
5. *Caliper for Tibial Joint Line Plate (10)*
6. *Caliper for Tibial Joint Line Plate (2)*
7. *Tibial Joint Line Plate*

The tibial medullary canal is opened in accordance with preoperative planning and reamed with successively larger *Reamers with Guide Rods* until cortical bone is reached.

! NOTE

In primary procedures, the medullary canal is opened with the *Drill for Intramedullary Access.*

03

The medullary canal is machined to the desired depth. The markings on the *Drive Shaft for Reamer with Guide Rod* represent the joint line (JL). The first marking below (JL) indicates possible bone loss of 10 mm. Each additional marking represents augment heights of 5 mm each.

Precise alignment of the implant requires stable seating of the Drive Shaft for *Reamer with Guide Rod.*

! NOTE

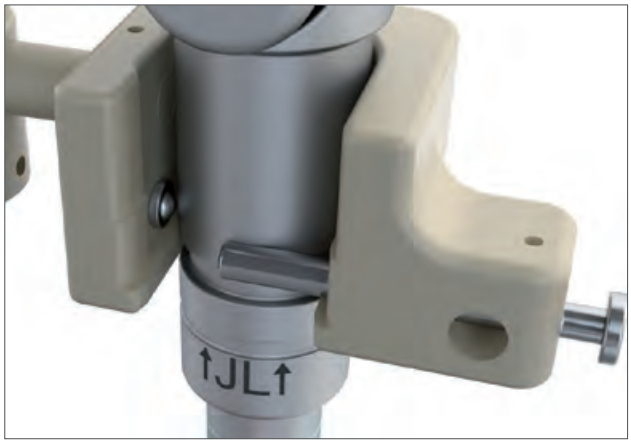
The maximum height of the tibial construct with augments is 15 mm.

1 Determining the Joint Line

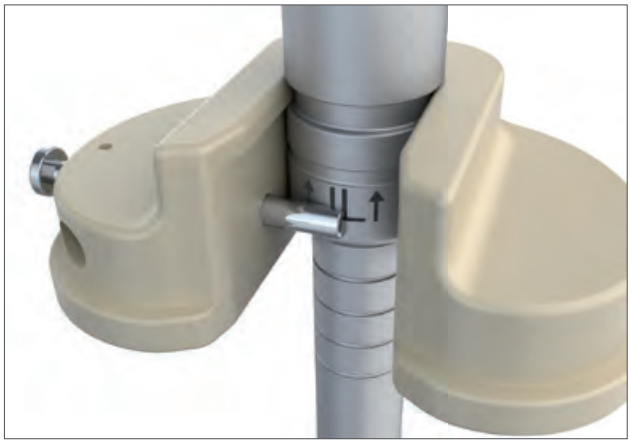
Opening the Tibia and Preparing the Reamers with Guide Rod

04

The respective *Tibial Joint Line Plate* can be used to identify the joint line in primary procedures or in the presence of bone defects. The *Tibial Joint Line Plate, primary* indicates an insert height of 7 mm. The *Tibial Joint Line Plate* for bone defects indicates an insert height of 9 mm.



Tibial Joint Line Plate, primary secured



Tibial Joint Line Plate secured

Where stable seating of the construct cannot be achieved with the *Reamers with Guide Rod*, using the *Reference Stem straight* (item 5) is recommended.

! NOTE

If it is not possible to remove the *Reamer with Guide Rod* by hand, then disconnect the *Drive Shaft for Reamer with Guide Rod* and remove the *Reamer with Guide Rod* with aid of the *Knurled Screw S* on the rod by lightly tapping it with a hammer.

Referencing in a primary procedure

Referencing in a revision procedure (correcting a defect of about 13.5 mm with an insert height of 9 mm)

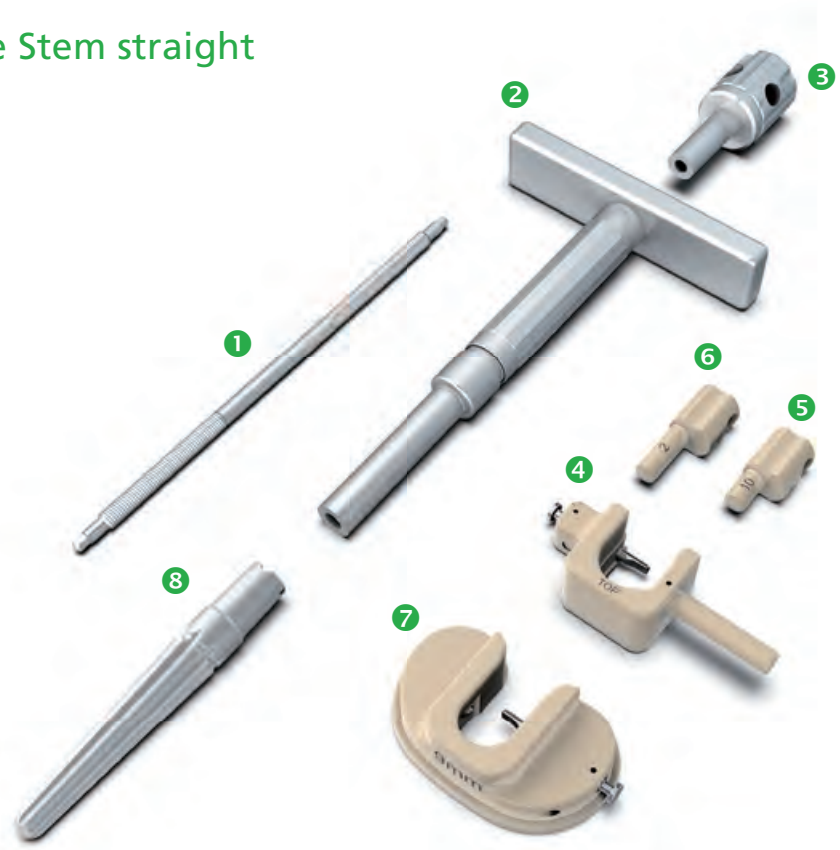
1 **Determining the Joint Line**

Preparing the Reference Stem straight

05

Assembling the *Reference Stem straight*

1. *Guide Rod*
2. *Handle Impactor/Extractor*
3. *Knurled Screw S*
4. *Tibial Joint Line Plate, primary*
5. *Caliper for Tibial Joint Line Plate (10))*
6. *Caliper for Tibial Joint Line Plate (2)*
7. *Tibial Joint Line Plate*
8. *Reference Stem straight*



Referencing in a primary procedure

Referencing in a revision procedure
(correcting a defect of about 13.5 mm
with an insert height of 9 mm)

1 **Determining the Joint Line**

Reconstruction of the Tibial Joint Line with the Tibial Joint Line Plates

06

Next the *Reference Stem straight* is impacted with the *Tibial Joint Line Plate* or the *Tibial Joint Line Plate, primary* and the *Caliper for Tibial Joint Line Plate (10)* or the *Caliper for Tibial Joint Line Plate (2)* so that the joint line is in the desired position.

In a primary procedure, the more heavily damaged side of the tibial plateau can be referenced with the *Caliper for Tibial Joint Line Plate (2)* to resect 2 mm of bone. The *Caliper for Tibial Joint Line Plate (10)* references a resection of 10 mm of bone and can be used on the less heavily damaged side of the tibial plateau.

Where larger bone defects are present, there may be a gap between the *Joint Line Plate* and the tibia.

In the presence of extensive bone defects the following reference points will aid in restoring the joint line:

- Approximately 15-20 mm proximal to the fibular head
- Plane of the tibial osteotomy for the previous prosthesis
- Level of the patella

Choosing a different reamer or stem diameter can change the position of the joint line.

! NOTE

A change of 1 mm in stem diameter corresponds to about a 1-2 cm change in position (height) depending on bone quality.

! NOTE

The *Reamer with Guide Rod* or *Reference Stem straight* must be securely seated.

Based on the natural anatomy, the implant system requires a minimum tibial resection of 11.5 mm (tibial plateau 4.5 mm, plus the insert height of 7 mm).

! NOTE

The figures show reconstruction of the joint line with the *Reference Stems straight*. The procedure for reconstructing the tibial joint line directly with the *Reamer with Guide Rod* is identical.

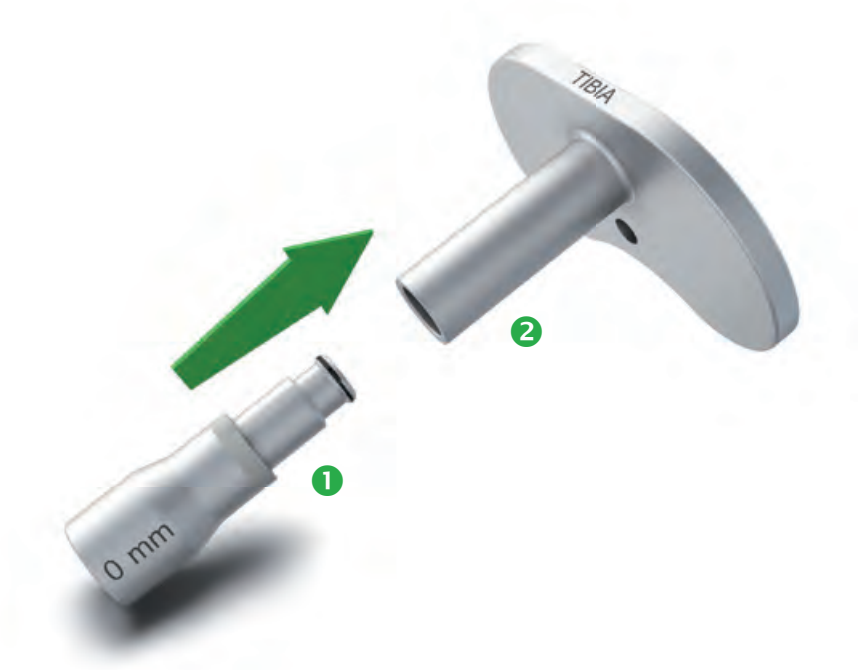
Once the desired joint level has been achieved, the *Handle Impactor/Extractor* and the respective *Joint Line Plate* are removed. Where *Reamers with Guide Rod* have been used, the *Drive Shaft* for *Reamer with Guide Rod* and *Handle with AO Coupling* short are removed.

1 **Determining the Joint Line**

Assembling and Placing the Tibial Joint Line Plate during Revision Surgeries and Use of the Reference Stems straight

07

The first step is to assemble the *Tibial reference plate*. To do this, the *Extension Sleeve 0 mm* (❶) is screwed all the way into the *Tibial reference plate* (❷). The end of the threading must allow for some clearance.



08

Next the assembled *Tibial reference plate* is slid over the *Guide Rod* onto the *Reference Stem straight,* and the *Guide Rod* is then unscrewed with the *Socket Wrench AF3,5*.

1 Determining the Joint Line

Assembling and Placing the Tibial Joint Line Plate during Revision Surgeries and Use of the Reference Stems straight

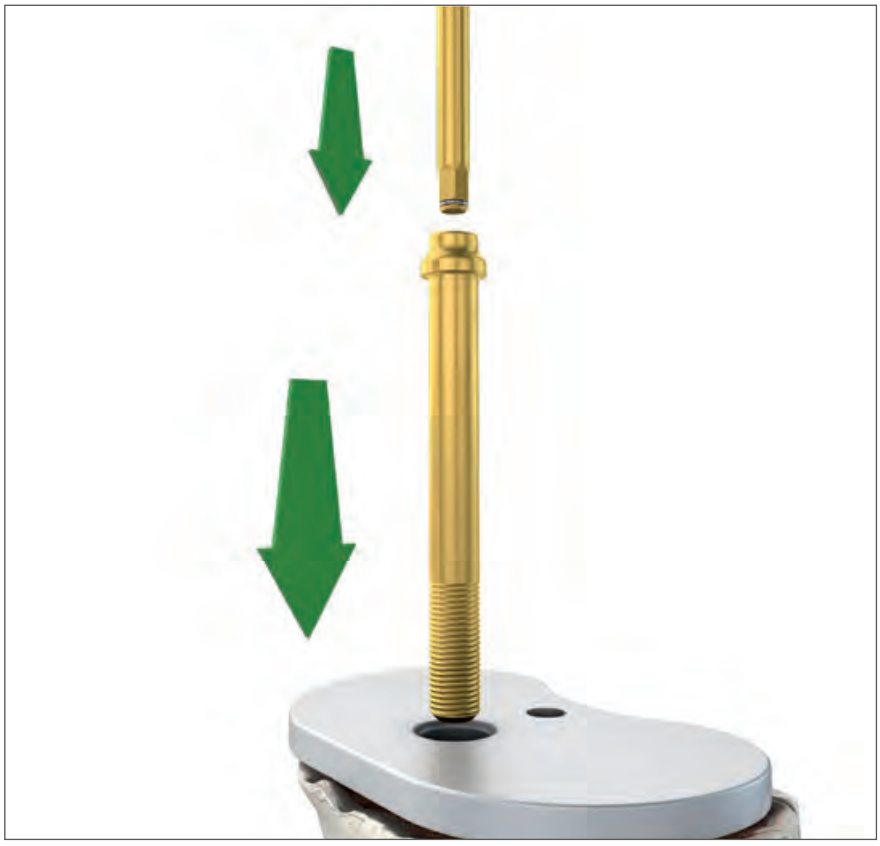
09

For correct position with respect to the joint line, the *Extension Sleeve 0 mm* must be seated on the taper of the *Reference Stem straight*.

10

The plateau is attached to the *Reference Stem straight* by hand tightening the gold *Clamp Screw M6 / 0 mm*.

The rotational alignment of the plateau is of no relevance at this stage.



1 **Determining the Joint Line**

Opening the Femur and Preparing the Reamers with Guide Rod

11

Assembling the *Reamer with Guide Rod* and *Femoral joint line plate*

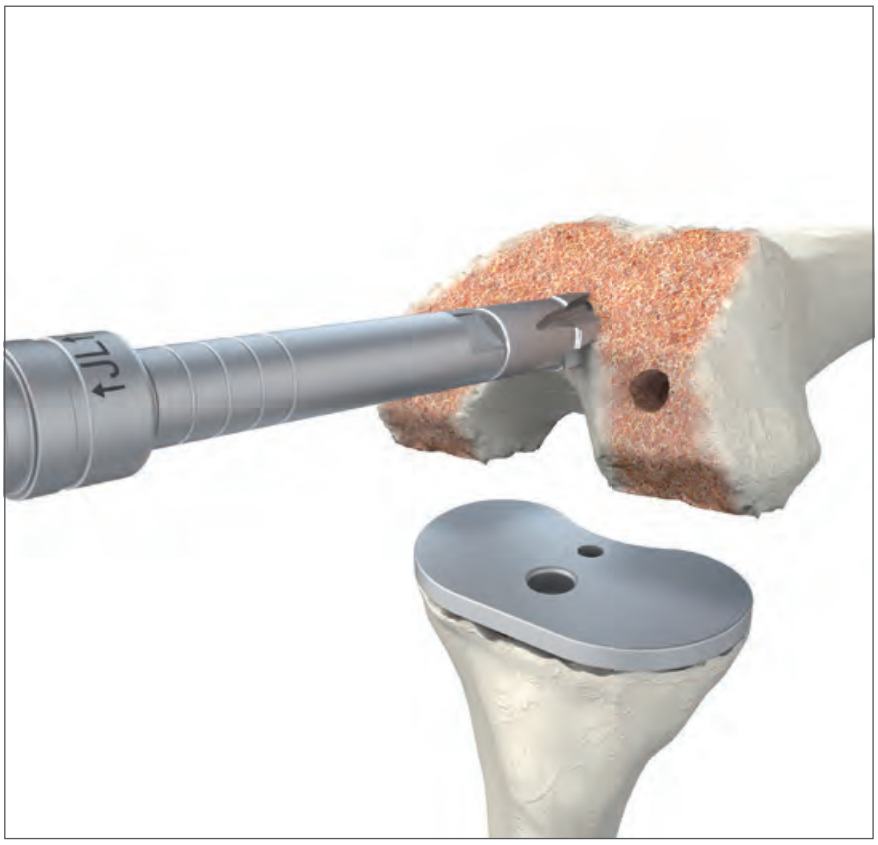
1. *Reamer with Guide Rod*
2. *Drive Shaft for Reamer with Guide Rod*
3. *Handle with AO Coupling short*
4. *Femoral joint line plate for bony Defects*
5. *Femoral joint line plate w/out bony Defects*

The distal femur is opened and reamed according to preoperative planning. Distinctive anatomic features such as the curvature of the femur must be taken into account.

! NOTE

In primary procedures, the medullary canal is opened with a *Drill for Intramedullary Access.*

The medullary canal is machined to the desired depth. The markings on the *Drive Shaft for Reamer with Guide Rod* represent the joint line (JL). The first marking below (JL) indicates possible bone loss of 10 mm. Each additional marking represents augment heights of 5 mm each. Precise alignment and positioning of the implant requires stable seating of the *Reamer with Guide Rod.*

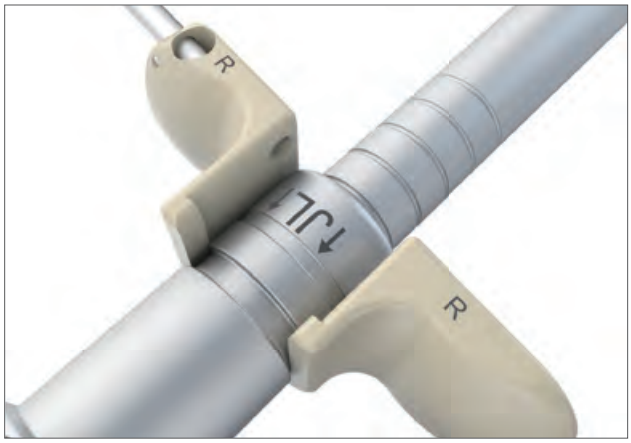


1 Determining the Joint Line

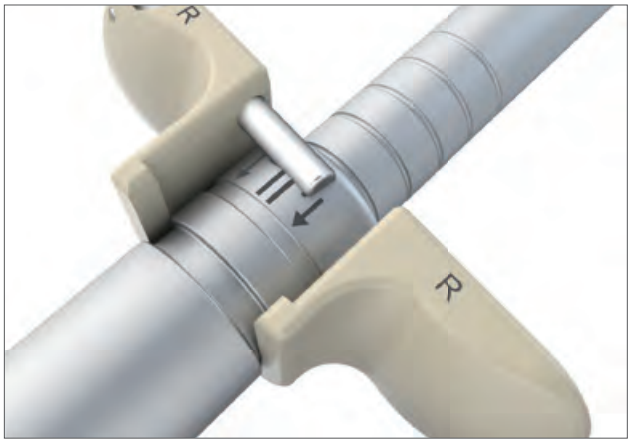
Opening the Femur and Preparing the Reamers with Guide Rod

13

After the *Femoral joint line plate w/out bony Defects* or the *Femoral joint line plate for bony Defects* has been attached to the *Drive Shaft for Reamer with Guide Rod*, it is secured with the pin.



Unsecured



Secured

12

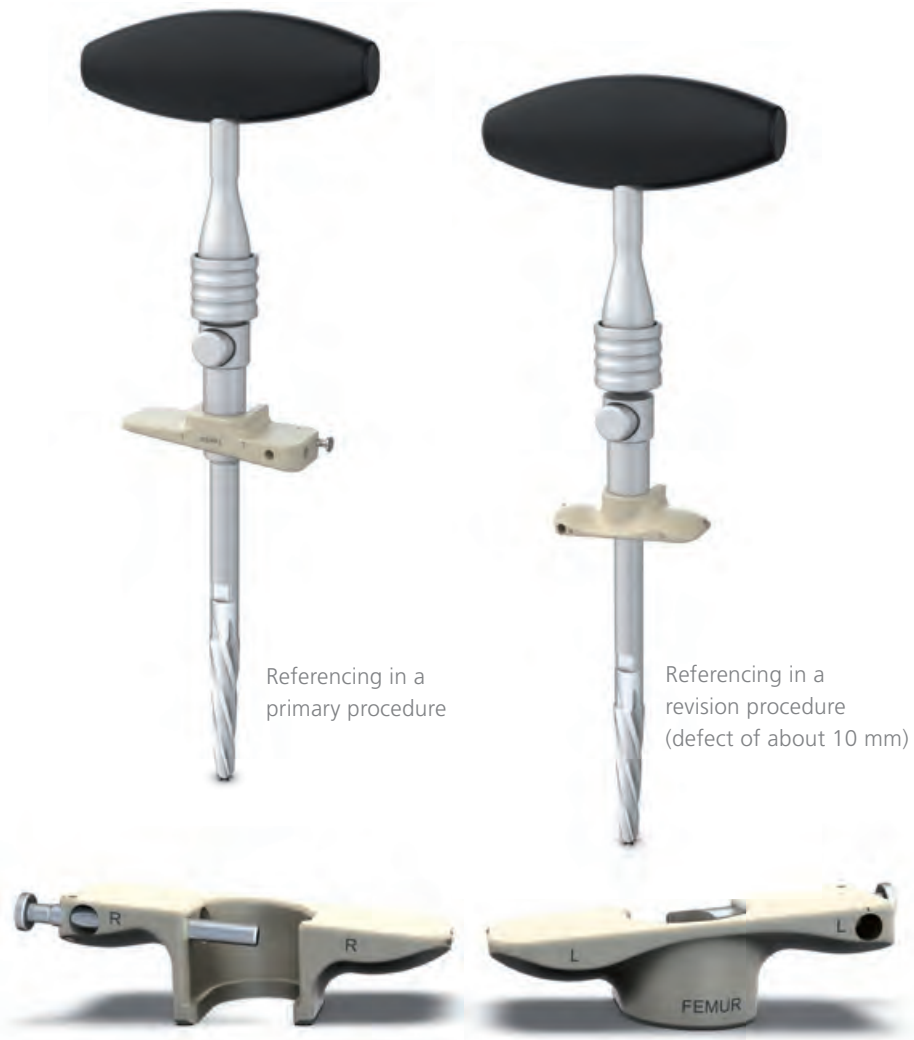
Depending on the initial situation, the *Femoral joint line plate for bony Defects* or the *Femoral joint line plate w/out bony Defects* can be used.

The *Femoral joint line plate w/out bony Defects* or the *Femoral joint line plate for bony Defects* is turned on the handle of the *Drive Shaft for Reamer with Guide Rod* so that the correct side label (R or L) is visible anteriorly.

Where stable seating of the construct cannot be achieved with the *Reamers with Guide Rod*, using the *Reference Stem straight* (item 14) is recommended.

! NOTE

If it is not possible to remove the *Reamer with Guide Rod* by hand, then disconnect the *Drive Shaft for Reamer with Guide Rod* and remove the *Reamer with Guide Rod* with aid of the *Knurled Screw S* on the guide rod by lightly tapping it with a hammer.



Referencing in a primary procedure

Referencing in a revision procedure (defect of about 10 mm)

Left and right labeling on *Femoral joint line plate for bony Defects*

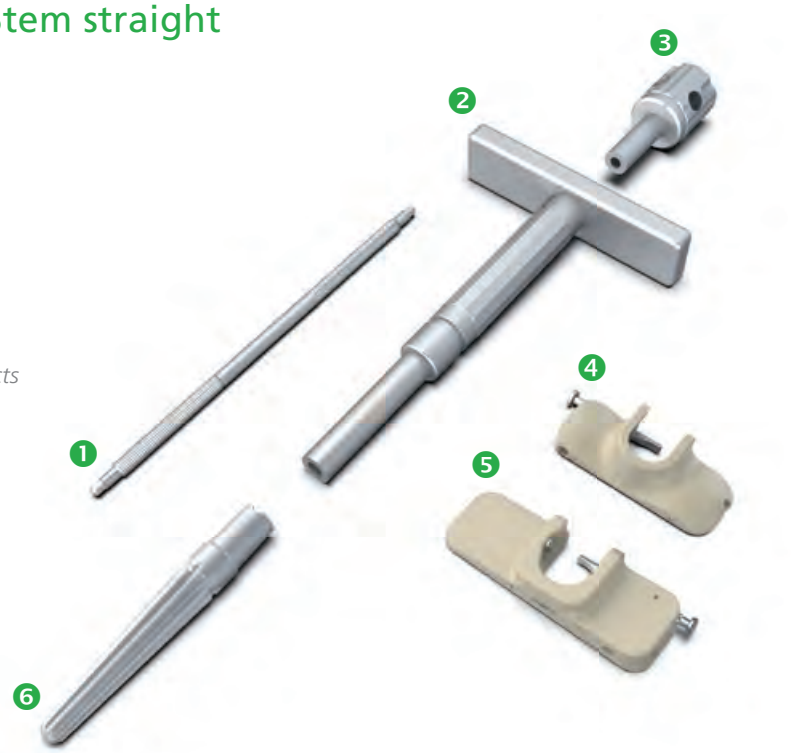
1 Determining the Joint Line

Preparing the Reference Stem straight

14

Assembling the *Reference Stem straight:*

1. *Guide Rod*
2. *Handle Impactor/Extractor*
3. *Knurled Screw S*
4. *Femoral joint line plate for bony Defects*
5. *Femoral joint line plate w/out bony Defects*
6. *Reference Stem straight*



Referencing in a primary procedure

Referencing in a revision procedure
(defect of about 10 mm)

1 **Determining the Joint Line**

Reconstruction of the Femoral Joint Line with the Femoral Joint Line Plates

15

Next the *Reference Stem straight* is seated with the *Femoral joint line plate w/out bony Defects* or the *Femoral joint line plate for bony Defects* so that the joint line is in the desired position.

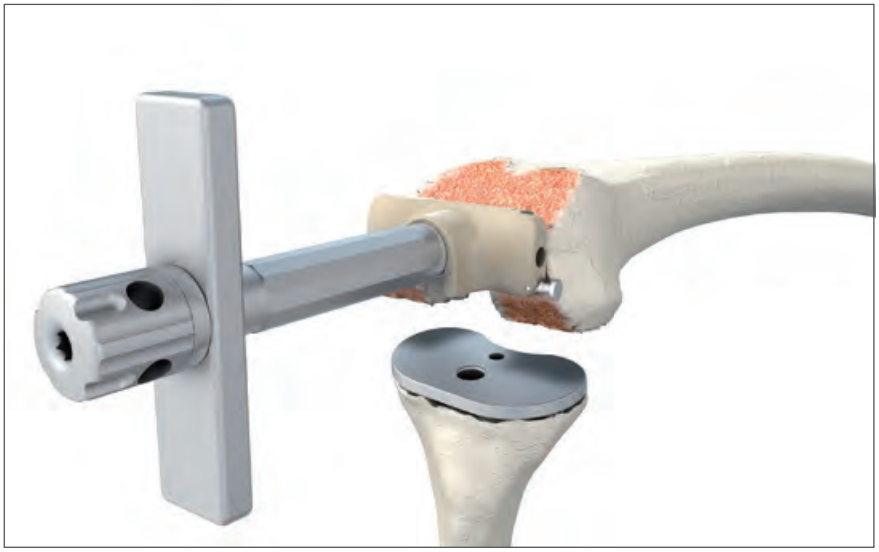
In primary procedures, the *Femoral joint line plate w/out bony Defects* is placed on the natural condyles to precisely restore the primary joint line.

The *Femoral joint line plate for Bony Defects* references a resection of 10 mm of bone. In revision procedures, there may be a gap between the *Femoral joint line plate for bony Defects* and the femur.

The following reference points will aid in restoring the joint line in the presence of extensive bone defects:

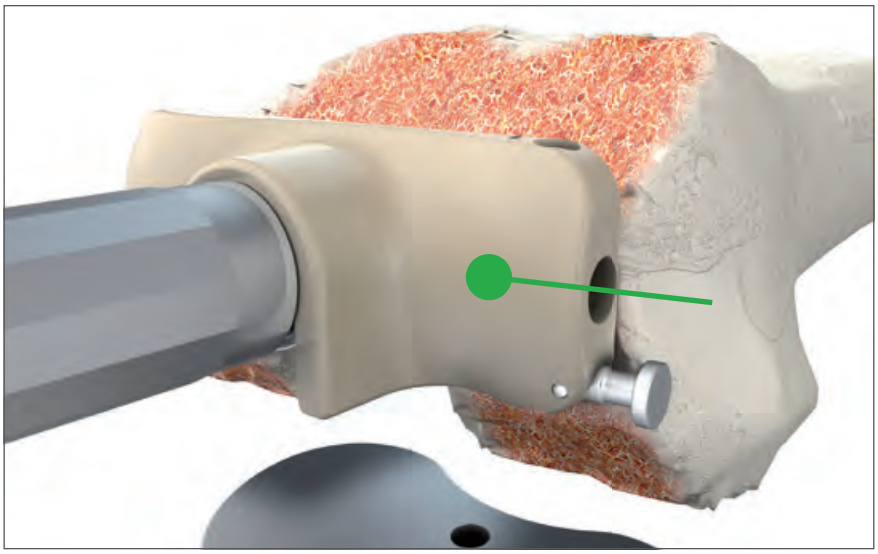
- Approximately 25-30 mm distal to the medial epicondyle
- Allow for the thickness of the revision implant
- Level of the patella

Choosing a different stem diameter can change the position of the joint line.



! NOTE

A change of 1 mm in stem diameter corresponds to about a 1-2 cm change in position (height) depending on bone quality.



! NOTE

The distal crest of the *Femoral joint line plate for bony Defects* corresponds to the femoral joint line.

! NOTE

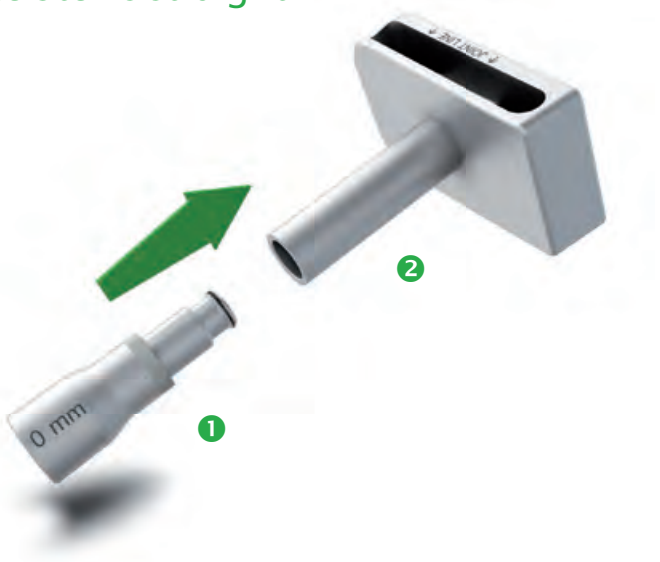
The procedure for reconstructing the femoral joint line directly with the *Reamer with the Guide Rod* is identical.

1 **Determining the Joint Line**

Assembling and Placing the Femoral Valgus Plate 6° during Revision Surgery and Use of the Reference Stems straight

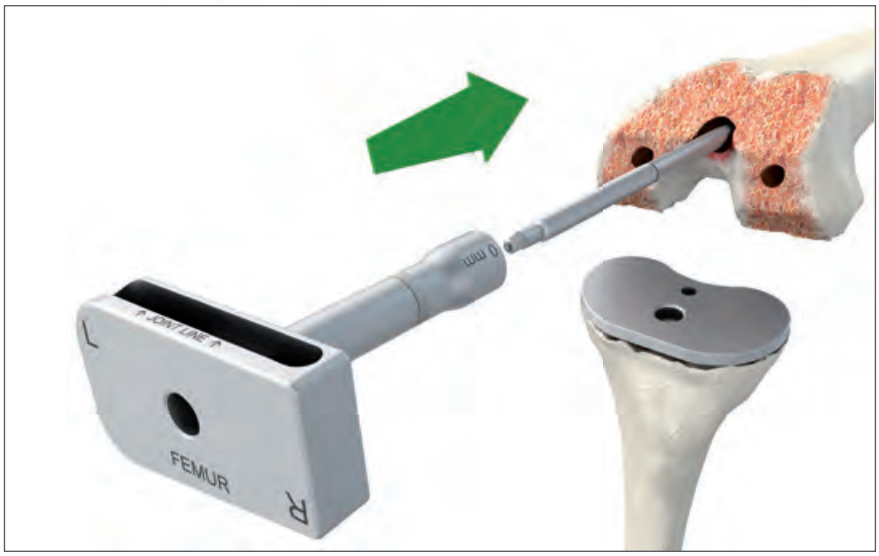
16

The *Femoral Valgus Plate 6°* is assembled in the same manner as the *Tibial reference plate*. To do this, the *Extension Sleeve 0 mm* (❶) is screwed all the way into the *Femoral Valgus Plate 6°* (❷. The end of the threading must allow for some clearance.



17

After the *Handle Impactor/Extractor* and the *Femoral joint line plate* have been removed, the assembled *Femoral Valgus Plate 6°* is slid over the *Guide Rod* onto the *Reference Stem straight*, and the *Guide Rod* is then unscrewed with the *Socket Wrench AF3,5*.



! NOTE

Verify proper right or left version.

For correct position with respect to the joint line, the *Extension Sleeve 0 mm* must be seated on the taper of the *Reference Stem straight*.

18

The *Femoral Valgus Plate 6°* is attached to the *Reference Stem straight* by hand tightening the *Clamp Screw M6 / 0 mm*.

1 Determining the Joint Line

Evaluating Extension Space during Revision Surgery and Use of the Reference Stems straight

19

Joint space in extension can be determined with the *Spacer, 7-17 mm (SC/RH/TH) or 19-25 mm (RH/TH only).*

! NOTE

If extension space is too narrow, the position of the femoral and tibial stems must be evaluated and changed if necessary.

The joint line is located at the level of the marked edge on the *Femoral Valgus Plate 6°*.

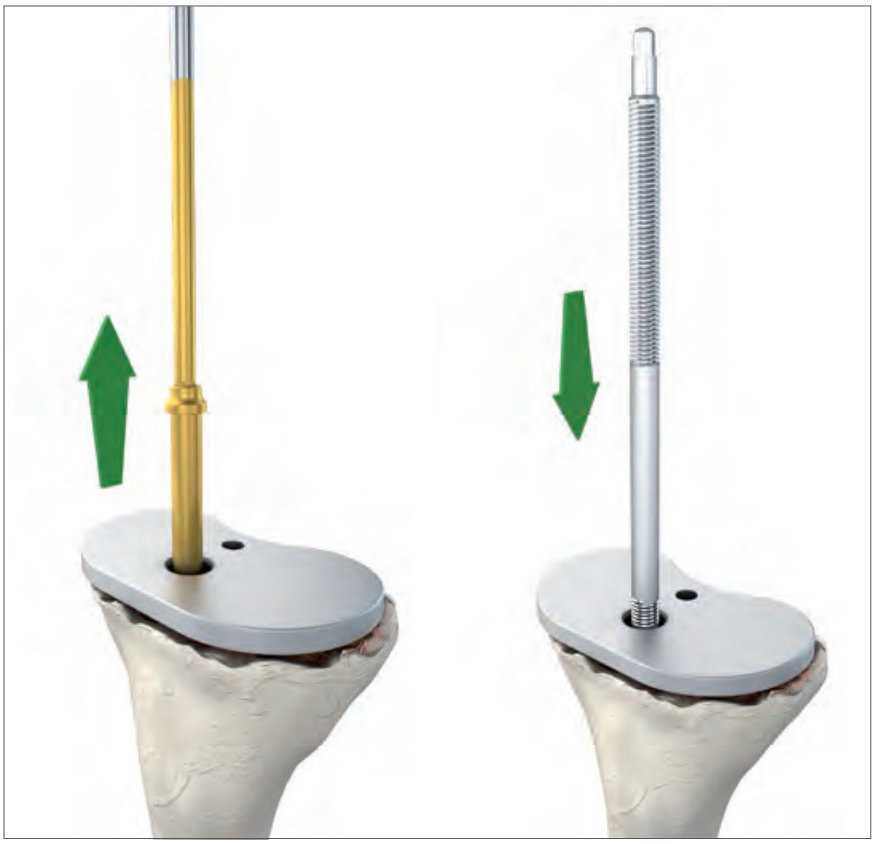
The *Femoral Valgus Plate 6°* is removed by unscrewing the *Clamp Screw M6 / 0 mm* with the *Socket Head Wrench AF5/AF3,5* and then removing the *Femoral Valgus Plate 6°*.

2 **Tibial Preparation**

Preparing the Tibial Resection

20

The *Tibial reference plate* must be removed before the *Tibial cutting block* can be placed, if applicable. This is done by unscrewing the gold *Clamp Screw M6 / 0 mm*. The *Guide Rod* is screwed into the *Reference Stem straight* and the *Handle* is screwed into the *Tibial reference plate*. Then the *Tibial reference plate* can be removed with the *Handle*.

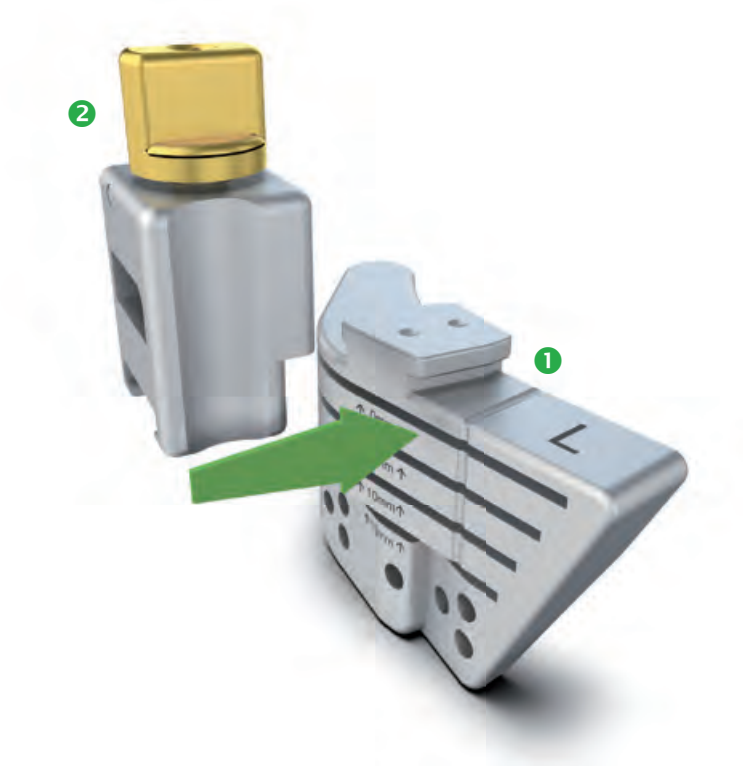


2 Tibial Preparation

Assembling the Tibial cutting block anatomic SC/RH/TH

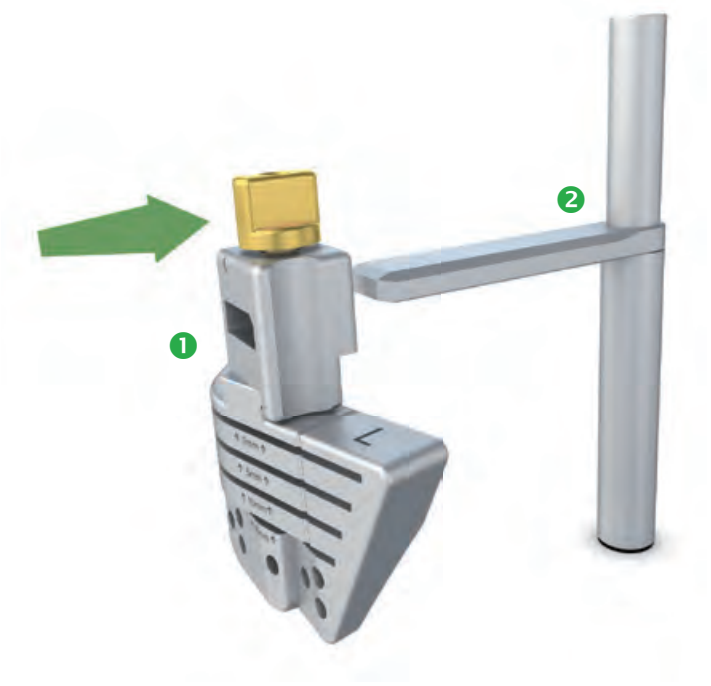
21

The *Tibial cutting block anatomic SC/RH/TH (right or left)* (❶) is then attached to the *Adapter for Tibial cutting block SC/RH/TH* (❷).



22

Next the assembled *Tibial cutting block anatomic SC/RH/TH (right or left)* (❶) is slid onto the *Outrigger for Tibial cutting block* (❷). The position of the *Tibial cutting block anatomic SC/RH/TH* is then secured with the gold screw.



2 Tibial Preparation

Placing the Tibial cutting block anatomic SC/RH/TH and Verifying the Osteotomies

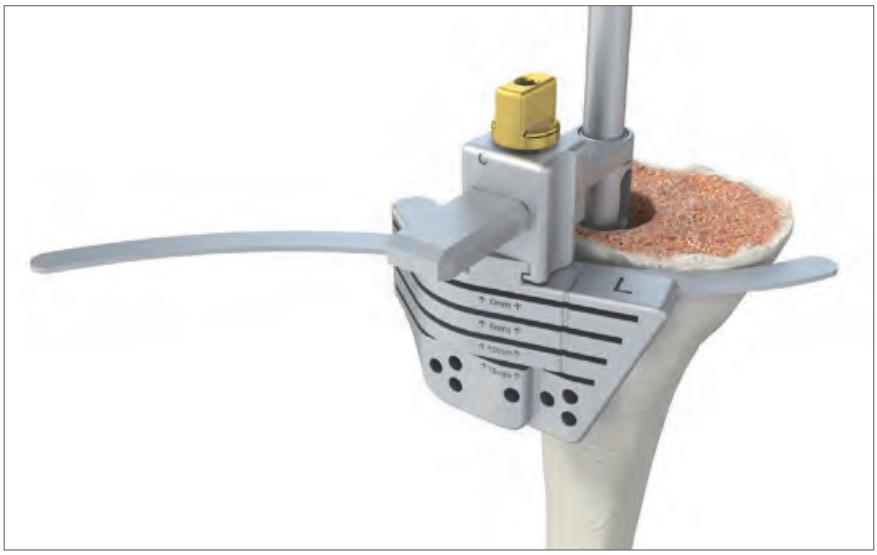
23

Next the assembled *Tibial cutting block anatomic SC/RH/TH* is positioned over the *Guide Rod* or the *Reamer with Guide Rod*. In primary procedures it may be necessary to remove some bone in the region of the intercondylar eminence of the tibia to allow the *Tibial cutting block* to rest on the *Reference Stem straight* or the *Reamer with Guide Rod*.

Then slide the *Tibial cutting block anatomic SC/RH/TH* onto the bone and secure it with the gold screw.

24

The tibial osteotomy including any necessary augments is then verified using the *Visualisation Guide S*. The tibial slope is 0°.



! NOTE

The maximum tibial augmentation height of 15 mm can be achieved using 5 mm medial and lateral augments. Augments of different sizes can be combined as needed.

2 Tibial Preparation

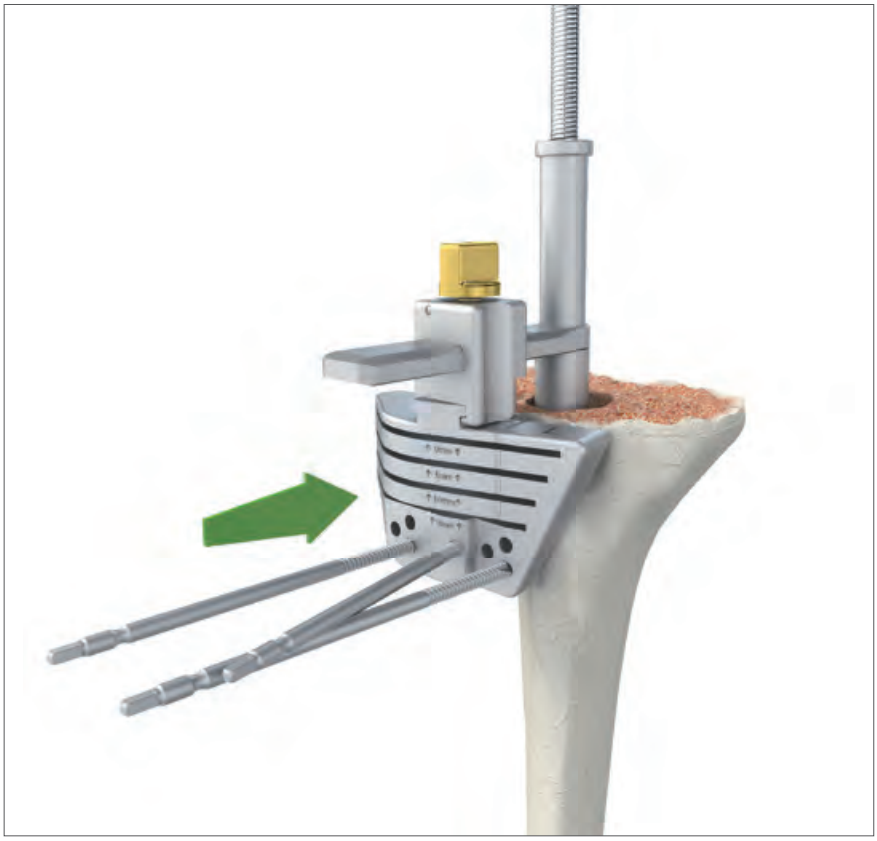
Securing the Tibial cutting block anatomic SC/RH/TH and Performing the Resection

25

The *Tibial cutting block anatomic SC/RH/TH (right or left)* is secured in the desired position by two parallel *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm* as well as by an oblique *Pin with Corticalis Thread Size: Ø 3,15 x 70 mm.*

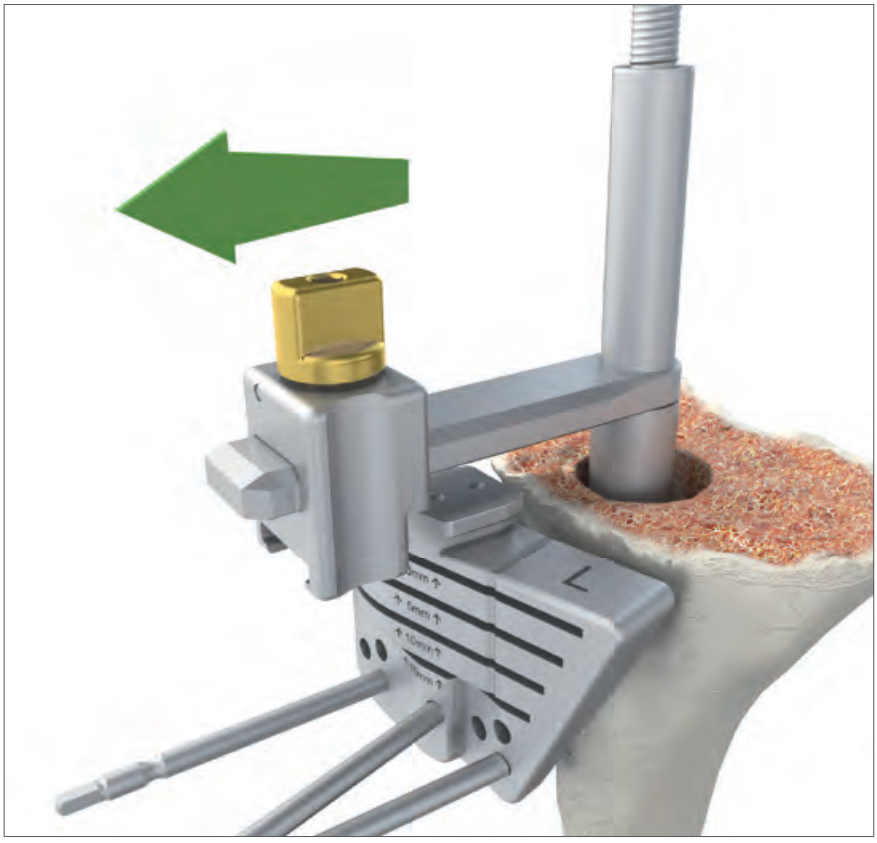
! NOTE

Using the lowest pair of holes will allow you to later change the position of the Tibial cutting block anatomic SC/RH/TH (right or left) by 2.5 or 5 mm.



26

Then the gold screw is unscrewed and only the *Adapter for Tibial cutting block SC/RH/TH* is removed.



2 **Tibial Preparation**

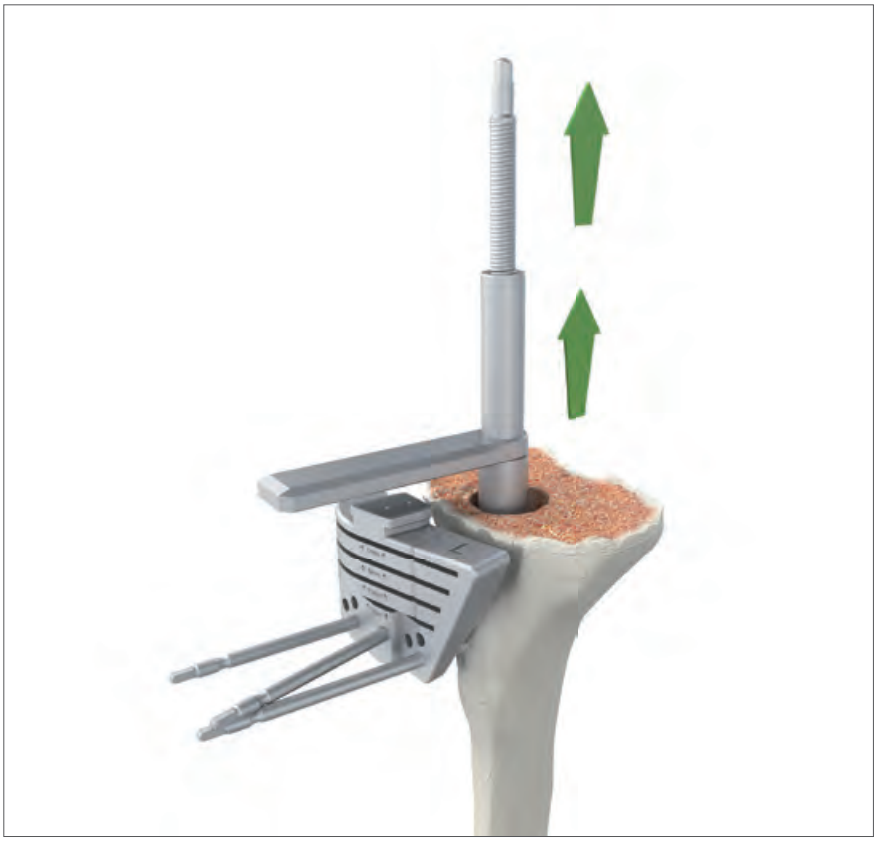
Securing the Tibial cutting block anatomic SC/RH/TH and Performing the Resection

27

The next step is to remove the *Outrigger for Tibial cutting block* and the *Guide Rod.*

! NOTE

The *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm* prevent removal of the *Reamer with Guide Rod.*



28

Now the osteotomy is performed and the oblique *Pin with Corticalis Thread Size: Ø 3,15 x 70 mm* and the *Tibial cutting block anatomic SC/RH/TH* is removed. The parallel *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm* may remain in place until the resection level is ensured.

! NOTE

Only saw blades from PETER BREHM GmbH with a thickness of 1.18 mm ±0.01 mm may be used for the osteotomy.

2 Tibial Preparation

Determining the Size of the TIBIA Component

29

The size of the TIBIA Component can be determined by placing the *Tibial base plate*. The goal is to maximize cortical contact. If the resection allowed for augments, then *TRIAL Tibial Augments* must be attached to the *Tibial base plate* and secured with *Locking Pin for Tibial Augment*.

! NOTE

TRIAL Tibial Augments can be freely combined as needed with all sizes (maximum 3 x 5 mm) of *TRIAL TIBIAL Components* to achieve optimal cortical contact.

Assembling *TRIAL Tibial Augment*

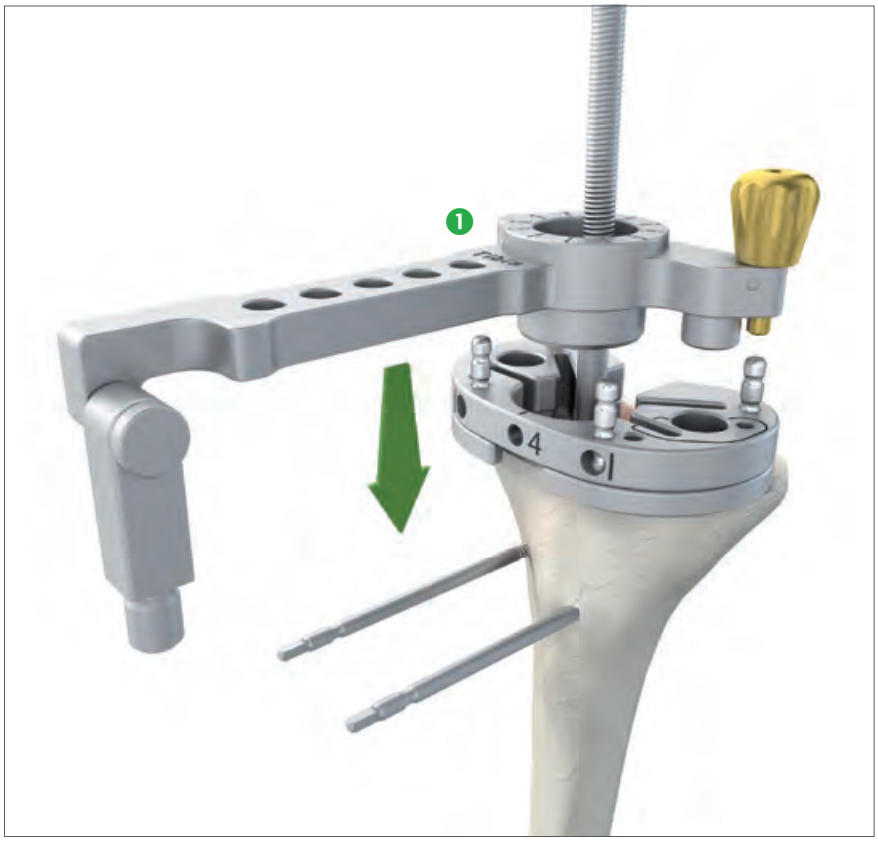
Assembled *TRIAL Tibial Augments*

2 Tibial Preparation

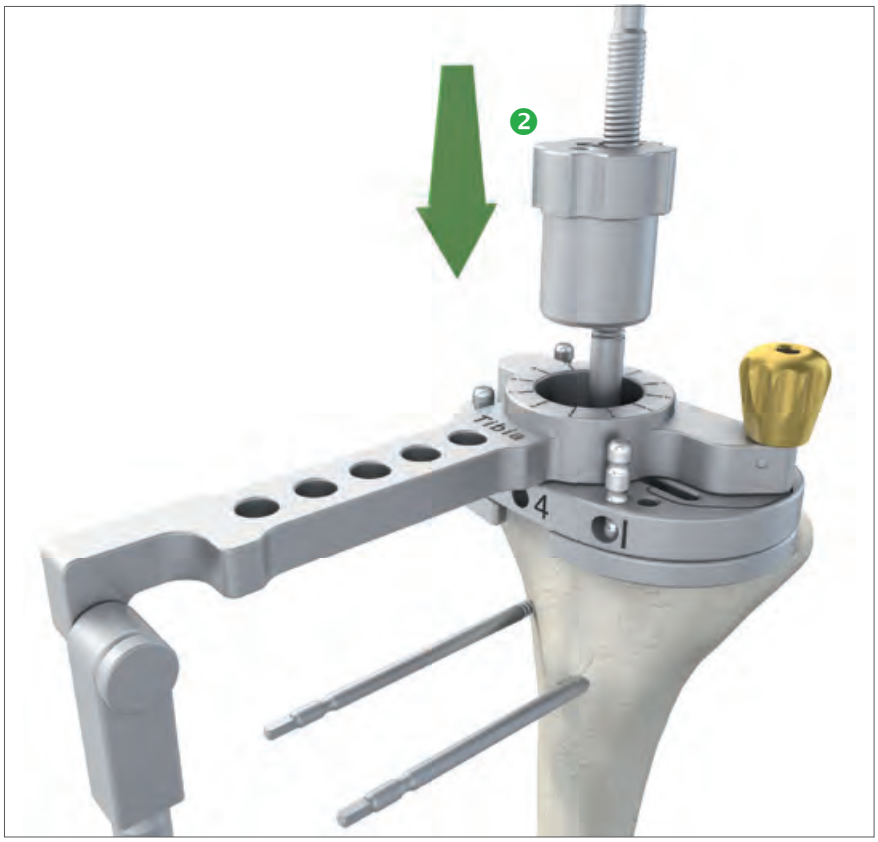
Assembling the Tibial base plate and Adjusting the Offset

30

After the *Guide Rod* has been inserted again if necessary, the *Tibial alignment guide* (❶) is secured to the top of the *Tibial base plate*.



In order to achieve the best cortical coverage, a *Centralizer Bushing* (❷) (0, 4, or 6 mm offset) is inserted over the *Guide Rod* or the *Reamer with Guide Rod* into the *Tibial alignment guide*.



2 Tibial Preparation

Assembling the Tibial base plate and Adjusting the Offset

The alignment guide consisting of the *Alignment Rod* and the *Alignment Sleeve* is attached to the *Tibial alignment guide*. The pendulum pointer provides a means of verifying rotation against the ankle.

2 Tibial Preparation

Assembling the Tibial base plate and Adjusting the Offset

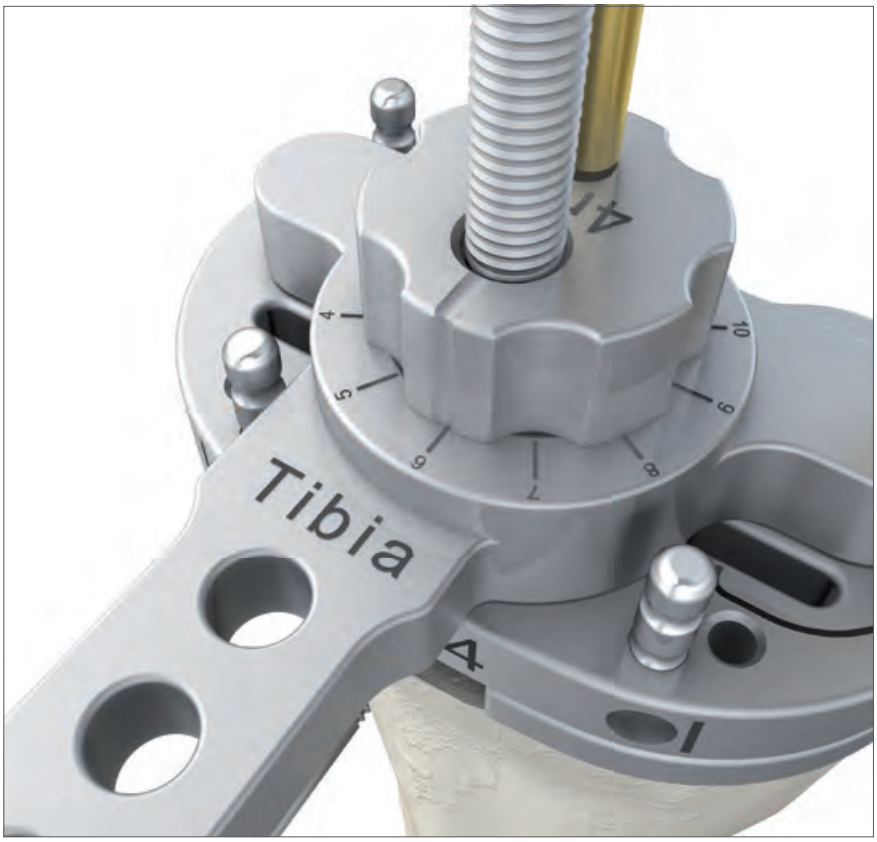
31

Centralizer Bushings with Offset are rotated on the *Guide Rod* or the *Reamer with Guide Rod* with the *Socket Wrench AF3,5* until the best possible cortical coverage with satisfactory rotational alignment has been achieved.

! NOTE

Should the *Centralizer Bushing* that is being used fail to achieve satisfactory cortical contact, it has to be checked whether a different offset option might be more suitable.

The offset adjustment is noted to ensure it is correctly transferred to the implant.

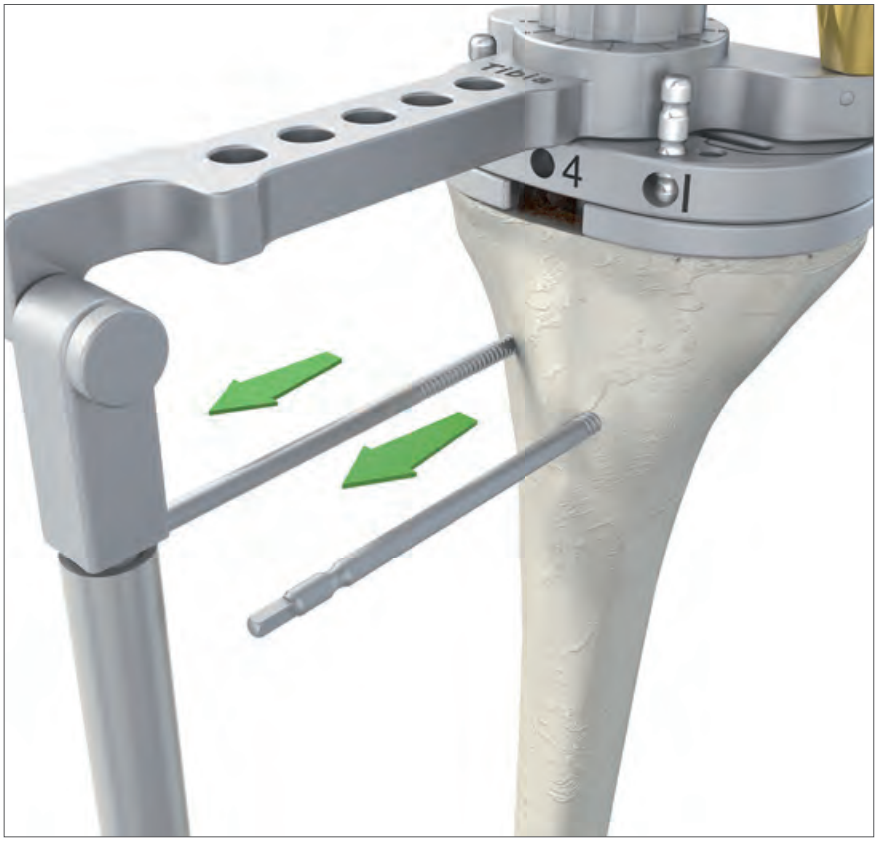


2 Tibial Preparation

Securing the Tibial base plate

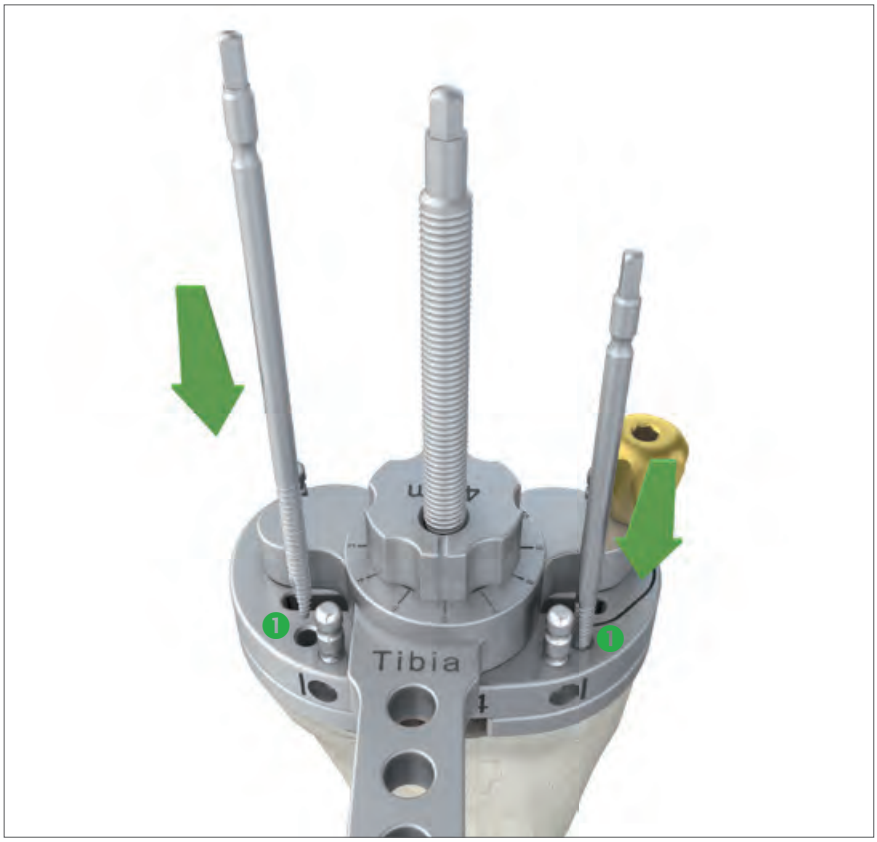
32

To secure the *Tibial base plate*, first the *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm* of the *Tibial cutting block anatomic SC/RH/TH* must be removed.



33

Then two *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm* are screwed into the drill holes (❶) of the *Tibial base plate* for fixation.



2 Tibial Preparation

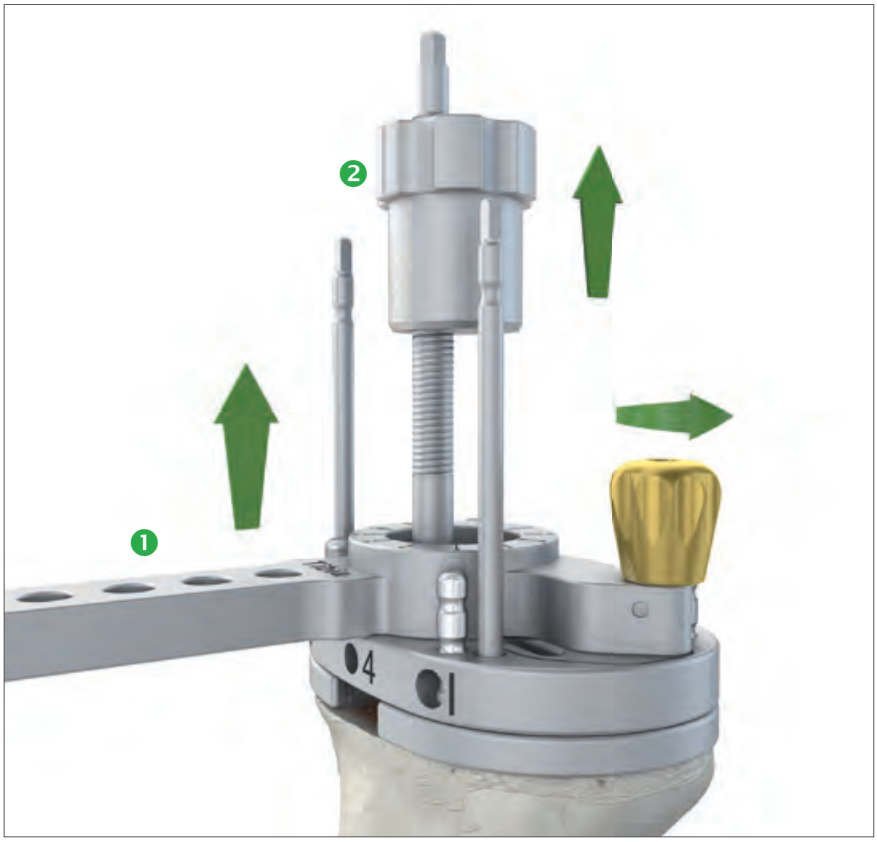
Disassembling the Tibial alignment guide

34

After the *Tibial base plate* has been attached, the *Tibial alignment guide* (❶) must be removed. This is done by removing the *Centralizer Bushing* (❷), unscrewing the screw on the *Tibial alignment guide* and removing it from the *Tibial base plate*. Then the *Guide Rod* or the *Reamer with Guide Rod* is removed.

! NOTE

If it is not possible to remove the *Reamer with Guide Rod* through the opening of the *Tibial base plate*, then the *Tibial base plate* must be removed with the *Tibial alignment guide* attached and then placed back in position using the remaining pins.



2 Tibial Preparation

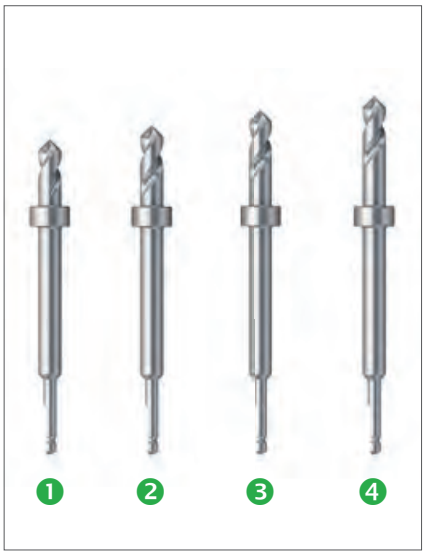
Preparing the tibial implant site

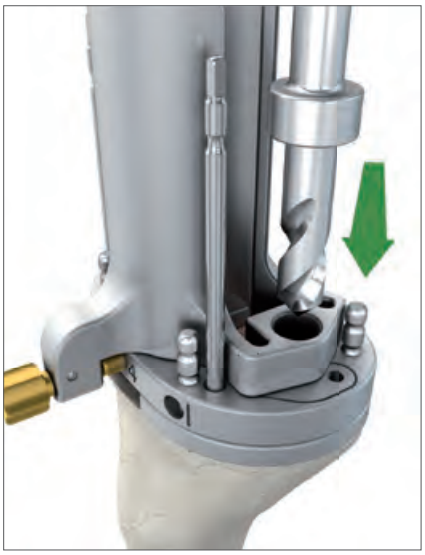
35

Precision preparation of the Tibial implant site begins with attaching the *Tibial reaming guide SC/RH/TH* to the *Tibial base plate*. Then the *Tibial reaming guide SC/RH/TH* is secured with the gold screw.

36

Medial and lateral recesses of the proper depth are drilled using *Drill for Tibial Augment* that match the total height of the augments (without tibial augments (❶), 5 mm (❷), 10 mm (❸), 15 mm (❹) augments). The recesses are necessary to countersink the projecting heads of the augment screws into the bone.





37

The tibia is reamed to an inner taper up to the stop with the *Tibial Reamer SC/RH/TH*.

2 Tibial Preparation

Preparing the tibial implant site

38

The *Tibial punch SC/RH/TH* is used to punch the keel and determine the rotational alignment.

Make sure that the *Tibial punch SC/RH/TH* is driven in until the stop on the *Tibial base plate* to allow for the depth of the ribs.

39

Subsequently all instruments are removed. If necessary, the *Guide Rod* is screwed into the *Reference Stem straight*, and the *Handle Impactor/Extractor* is slid over it and secured with the *Knurled Screw S*. Then the *Reference Stem straight* can be extracted.

3 Tibial Trial Component

Overview of the TRIAL Components

40

The tibial trial component is assembled from the *TRIAL TIBIAL Component, TRIAL Tibial Adapter (0, 4 and 6 mm, 3°) SC/RH/TH, TRIAL Counter Nut for Adapter,* and a *TRIAL Stem Straight* of the desired length.

41

The *TRIAL Tibial Adapter (0, 4, and 6 mm, 3°) SC/RH/TH* is universal and does not depend on the size of the *TRIAL TIBIAL Component*.

The *TRIAL Tibial Adapter 4 or 6 mm* allows the position of the offset to be continuously adjusted through 360° in both the femur and the tibia.

! NOTE

With the SC and RH/TH versions of the BPK-S Integration system, both femoral and tibial ANCHORING STEMS straight must be used.

3 Tibial Trial Component

Assembling the TRIAL TIBIAL Component SC - Assembly Block (SC)

42

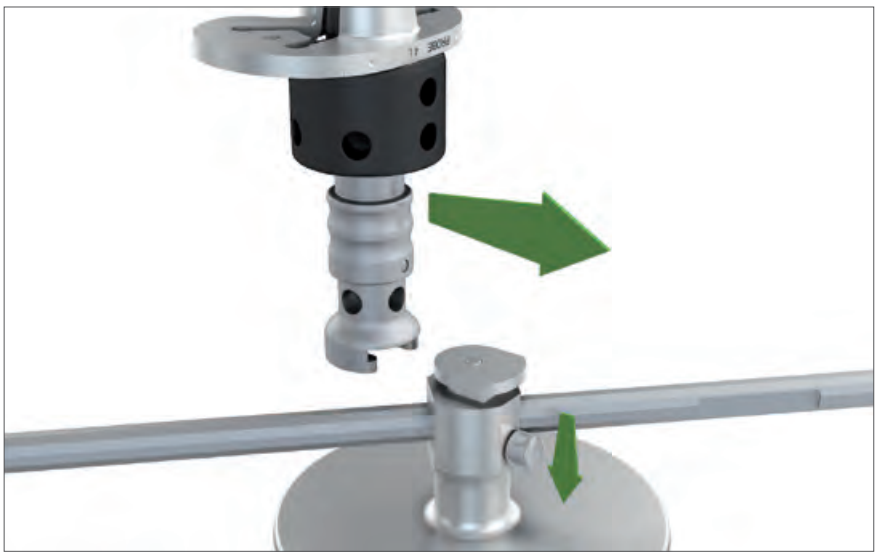
Two *Handles* can be screwed onto the sides of the *Assembling base plate* to stabilize the Assembly Block (SC) for later tightening the components.

43

The Assembly Block (SC) consists of the *Assembling base plate* and the *Tibial Impactor/Extractor SC.* To secure the *TRIAL TIBIAL Component SC* on the *Tibial Impactor/Extractor SC*, the locking sleeve (❶) is pushed forward and the *TRIAL TIBIAL Component SC* is pressed onto the *Tibial Impactor/ Extractor SC*.

44

Pulling down the locking button allows to slide the *Tibial Impactor/ Extractor SC* onto the *Assembling base plate* and secure it.

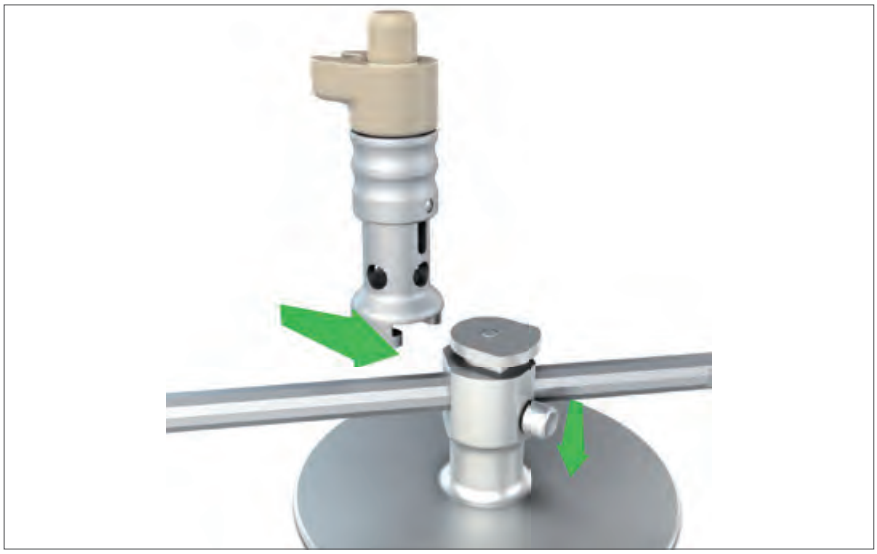


3 Tibial Trial Component

Assembling the TRIAL TIBIAL Component RH/TH - Assembly Block (RH/TH)

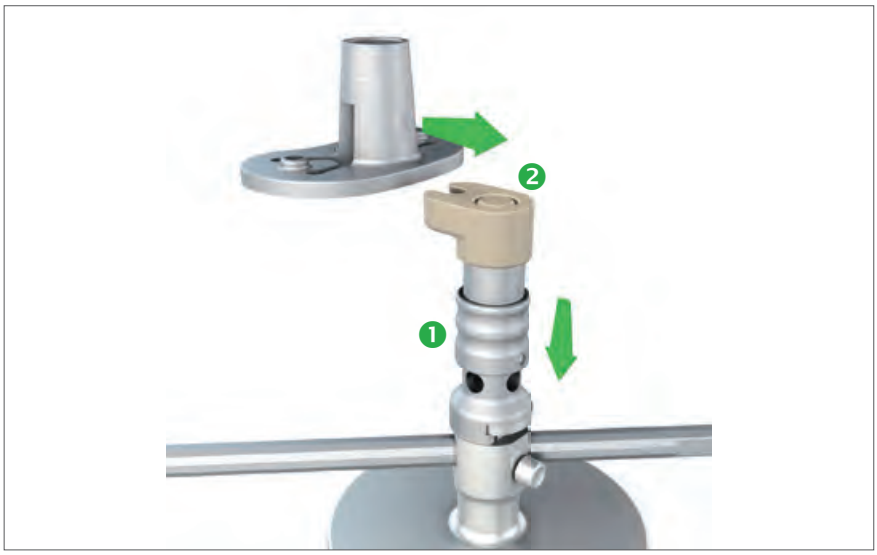
45

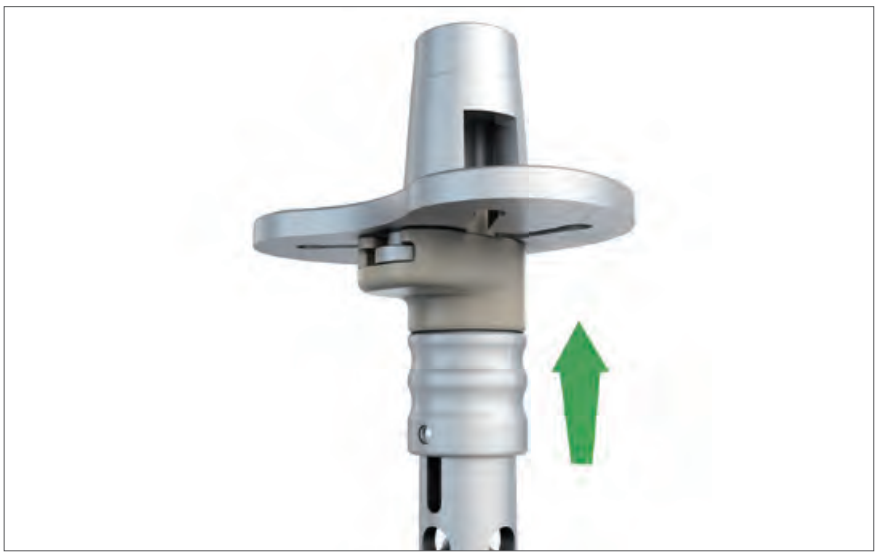
The Assembly Block RH/TH consists of the *Assembling base plate* and the *Impactor/Extractor Tibia RH/TH.*



46

To secure the *TRIAL TIBIAL Component RH/TH* on the I*mpactor/Extractor Tibia RH/TH,* the locking bolt (❶) is drawn back and the *TRIAL TIBIAL Component RH/TH* is slid onto the *Impactor/Extractor Tibia RH/TH* (❷). The *TRIAL TIBIAL Component RH/TH* is secured on the *Impactor/Extractor Tibia RH/TH* with the locking bolt.





3 **Tibial Trial Component**

Final Assembly of the Tibial Trial Component

47

If the resection considered augments, then the *TRIAL Tibial Augments* must be screwed on with the *TRIAL Clamp Screw for Tibial Augment* of the appropriate length before attaching the *TRIAL Stem Straight*.

The maximum augmentation height of 15 mm can be achieved by using multiple medial and lateral *TRIAL Tibial Augments* stacked one on top of each other. *TRIAL Tibial Augments* of different sizes can be combined as needed.

! NOTE

The length of the T*RIAL Clamp Screw for Tibial Augment* depends on the overall height of the *TRIAL Tibial Augments*.

3 Tibial Trial Component

Assembling the TRIAL Stem Straight and TRIAL Tibial Adapter

48

A *TRIAL Counter Nut for Adapter* is screwed onto the preselected *TRIAL Tibial Adapter (0, 4 or 6 mm, 3°)* all the way to the end of the threading.

49

Then the *TRIAL Stem Straight* of the appropriate length is screwed into the *TRIAL Tibial Adapter (0, 4 or 6 mm, 3°)* hand tight.

50

The gold *Socket Wrench AF3,5* is used to screw it in.

3 Tibial Trial Component

Assembling the TRIAL Stem Straight and TRIAL Tibial Adapter

51

The *TRIAL Stem Straight* together with the *TRIAL Tibial Adapter (0, 4, or 6 mm, 3°)* is screwed all the way into the *TRIAL TIBIAL Component* with the gold *Socket Wrench AF3,5* and secured with the *TRIAL Counter Nut for Adapter.*

The *TRIAL Tibial Adapter* does not depend on the size of the *TRIAL TIBIAL Component used.*

3 Tibial Trial Component

Assembling the TRIAL Tibial Adapter 4 or 6 mm

52

If a *Centralizer Bushing 4 or 6 mm* Offset was used in positioning the *Tibial base plate*, then an *TRIAL Tibial Adapter* with the offset determined under item 31 must also be used with the *TRIAL TIBIAL Component.*

Observe the following instructions when assembling the *TRIAL TIBIAL Component:*

- All threaded connections must be screwed tight.
- When using a *TRIAL Tibial Adapter 4 or 6 mm,* the predetermined offset position must be set (within one backward turn) and secured with a hand tightened *TRIAL Counter Nut for Adapter.*
- Verify proper offset position.

3 **Tibial Trial Component**

Placing the Tibial Trail Component

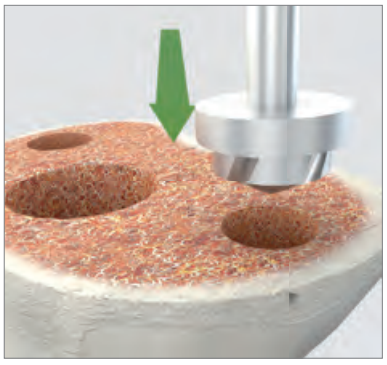
53

To place the trial component, the Assembling base plate is removed and the *Handle for Impactor/Extractor* is connected.

54

When placing the *TRIAL TIBIAL Components*, a sufficient cortical coverage and a secure seating have to be verified. If necessary, different sizes of trial components can be used.

If the *TRIAL TIBIAL Component* is not completely in contact with the osteotomy surface, then the recesses for the heads of the *TRIAL Clamp Screw for Tibial Augments* should be enlarged with the *Extension Drill Ø 11 mm for Augment Screws Tibia*.

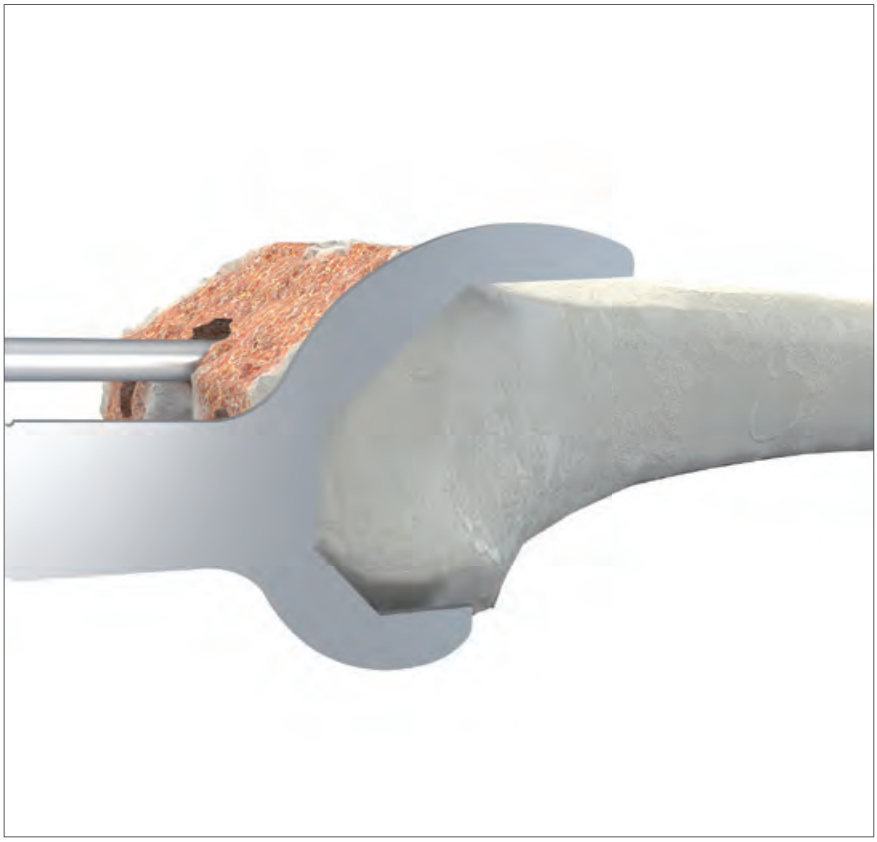


4 Femoral Preparation

Determining the Size of the FEMUR Component

55

The femoral osteotomies and the size of the FEMUR Component should be determined using the *Femoral Sizing Templates.*



56

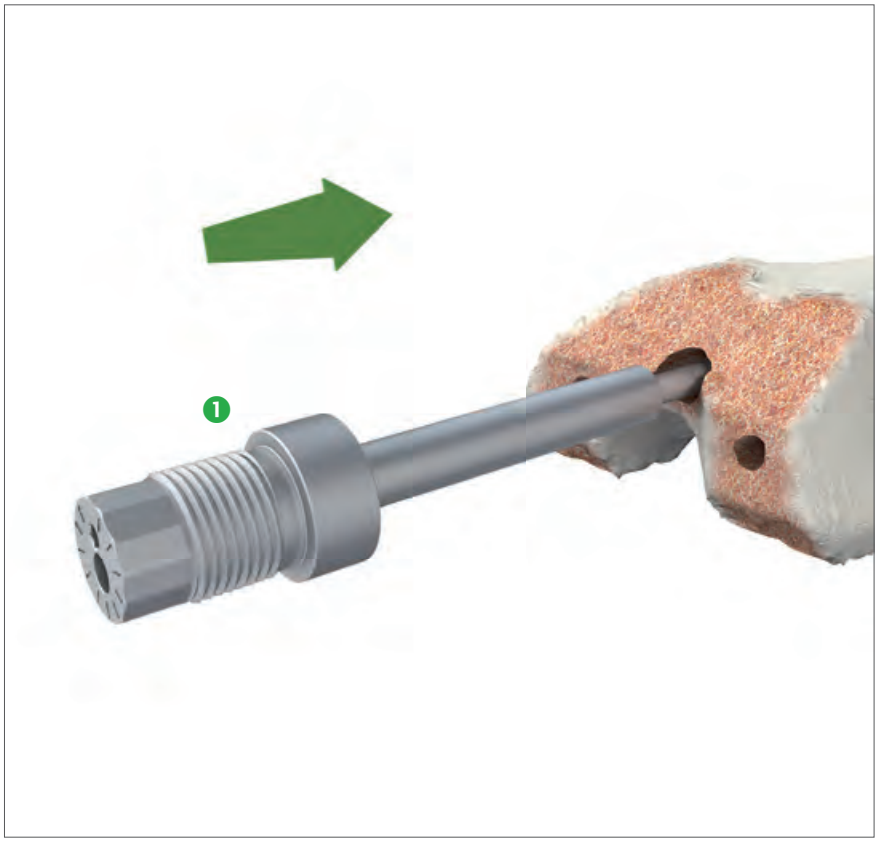
The dimensions of any previously removed implant will also be helpful in determining component size. They can be compared with the contralateral *TRIAL FEMORAL Components SC/RH/TH.*

4 Femoral Preparation

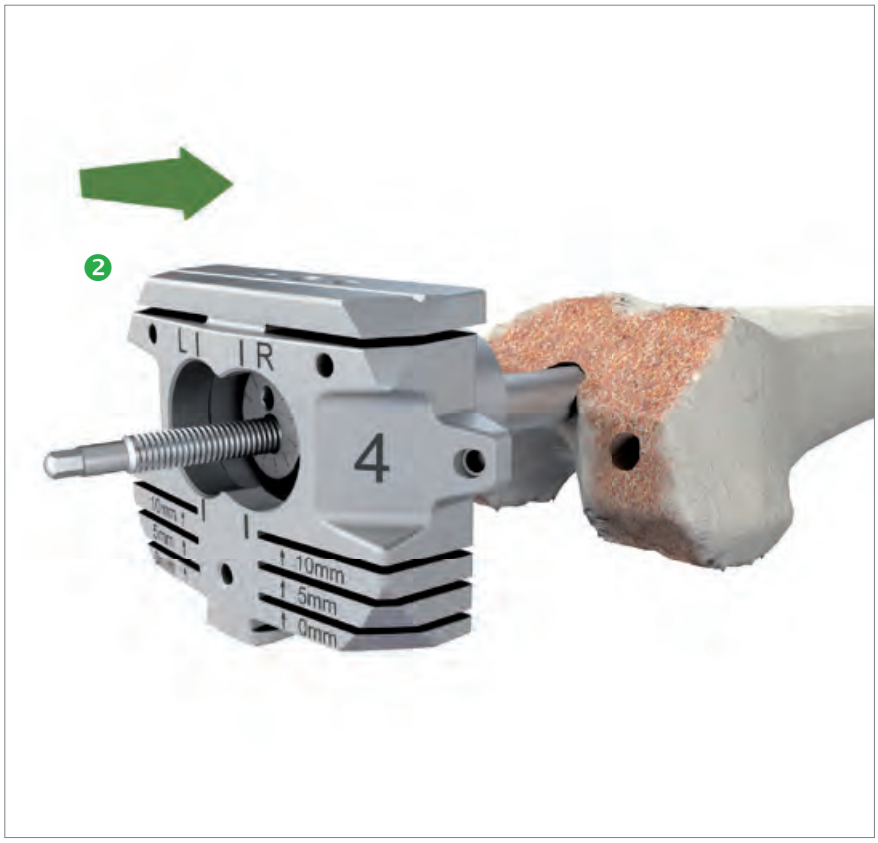
Assembly for the Femoral Dissection

57

First the *Adapter Femur* with the desired offset (❶) (0, 4, or 6 mm) is advanced over the *Guide Rod* or the *Reamer with Guide Rod* into the medullary canal until it is in contact with the *Reference Stem straight* or the *Reamer with Guide Rod*.



Then the *Femoral cutting block A/P* (❷) of the preselected size (see items 55 and 56) is placed on the *Adapter Femur*. Be sure to use the proper right or left option on the *Femoral cutting block A/P*.



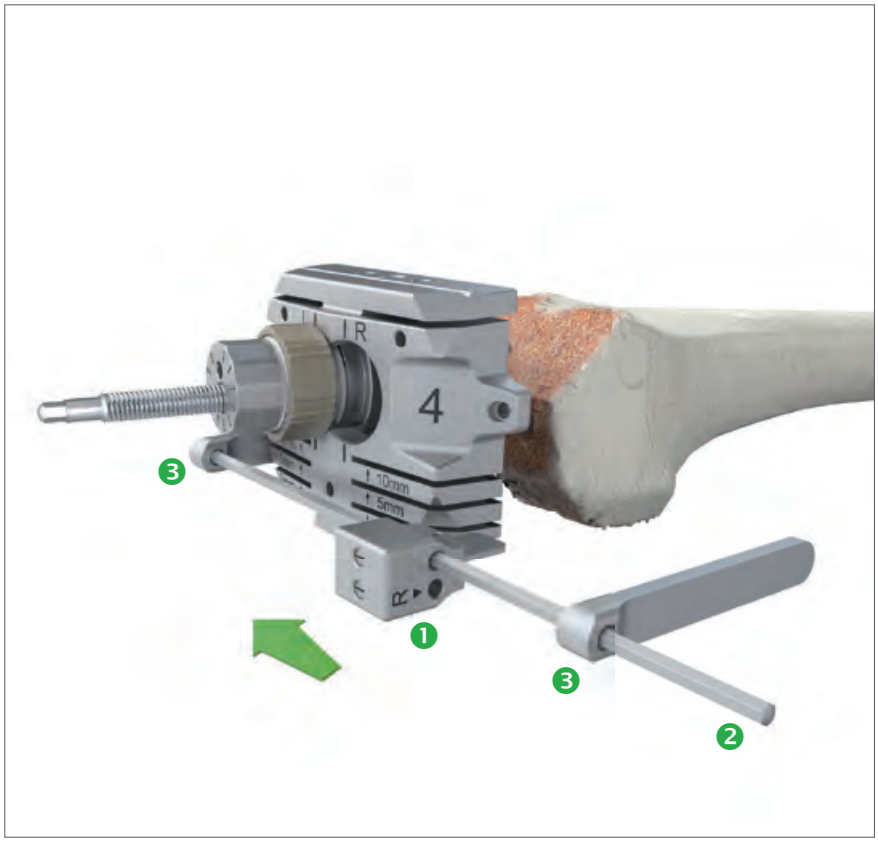
4 Femoral Preparation

Assembly for the Femoral Dissection

The construct is stabilized by hand tightening the *Hexagonal clamping nut PEEK* (❸).

58

To verify proper rotational alignment, the *Adapter Epicondyle Feeler* (❶) with the *Guide Epicondyle Feeler* (❷) and the *Epicondyle Feeler* (❸) is attached to one of the posterior osteotomy guides on the *Femoral cutting block AIP.*



4 Femoral Preparation

Assembly for the Femoral Dissection

The *Femoral stylus* is set to the size of the *Femoral cutting block AIP* and attached to the anterior osteotomy guide.

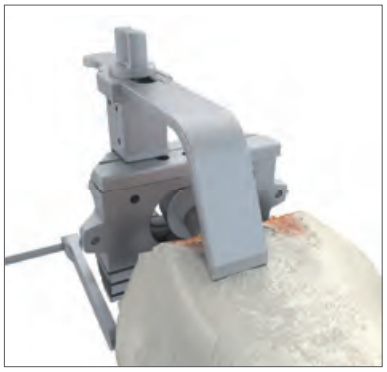
4 Femoral Preparation

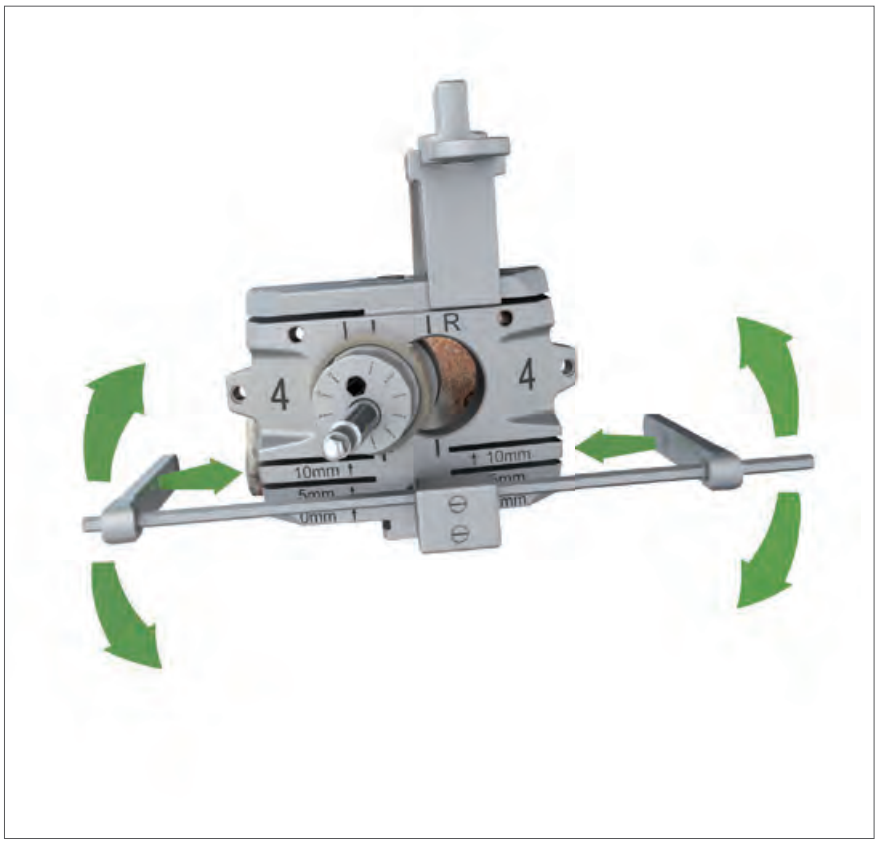
Adjusting and Securing Rotational Alignment and Offset

59

M/L alignment can be estimated from the width of the *Femoral cutting block A/P*, as the M/L dimension of the *Femoral cutting block A/P* corresponds to the respective implant size.

When aligning the *Femoral cutting block A/P,* make sure the femoral resection depth guide is in contact with the anterior lateral cortex of the femur.





The Epicondyle Feeler Gauge is used to verify rotational alignment with respect to the femoral epicondyles.

4 **Femoral Preparation**

Adjusting and Securing Rotational Alignment and Offset

60

Should the *Adapter Femur* that is being used fail to achieve satisfactory alignment, then check whether a better result can be achieved using other offset options (reassemble the construct starting with item 57).

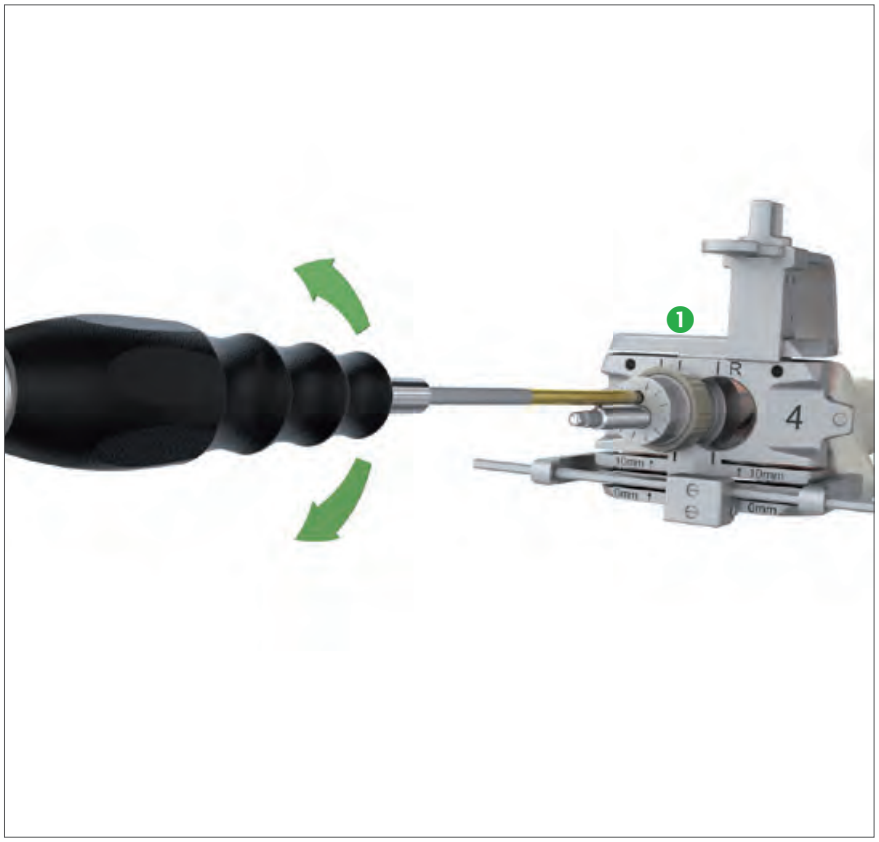
Offset options

Adapters Femur 4 or 6 mm are rotated with the *Socket Wrench AF3,5* until the best possible A/P and M/L alignment with satisfactory rotational alignment and anterior position of the *Femoral stylus* have been achieved.

The offset adjustment is noted to ensure it is correctly transferred to the implant.

! NOTE

The anterior vertical marking (❶) on the *Femoral cutting block A/P* indicates the offset on the *Adapter Femur.*

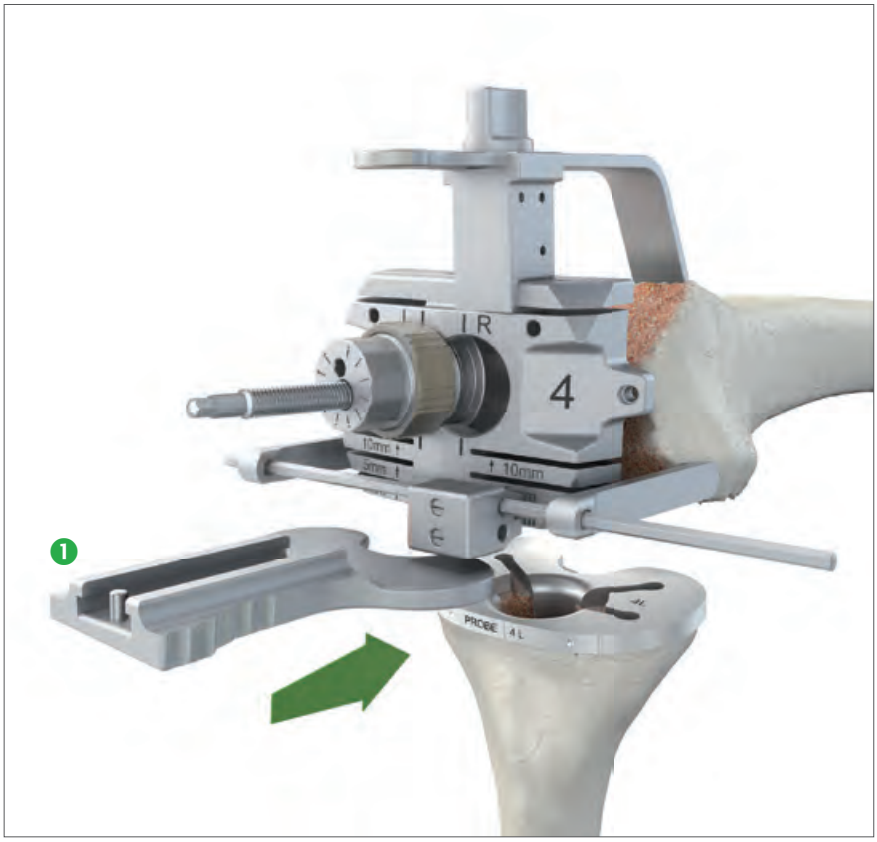


4 **Femoral Preparation**

Evaluating Flexion Space

61

The *Shoe* (❶) for the respective side (right or left) is inserted to evaluate the flexion space. *Spacers* measuring 7-17 mm (SC and RH/TH), and 19-25 mm only with RH/TH (❷) are available for this purpose.



62

Now it is checked whether the lowest insert height of 7 mm can be used, respectively how much the extension space differs from the flexion space.

Differences between extension space and flexion space can be corrected by changing the position of the *Reference Stem straight* or the *Reamer with Guide Rod*, or by using a FEMUR Component of a different size.

! NOTE

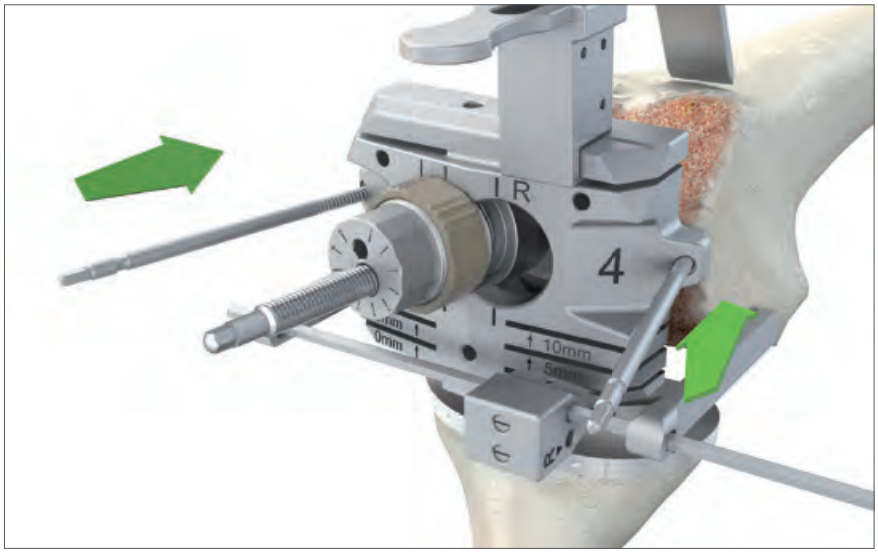
If a *TRIAL TIBIAL Component RH/TH* has been used, make sure when placing the *Shoe* that it is not in contact with the rotation pin of the *TRIAL TIBIAL Component RH/TH.*

4 **Femoral Preparation**

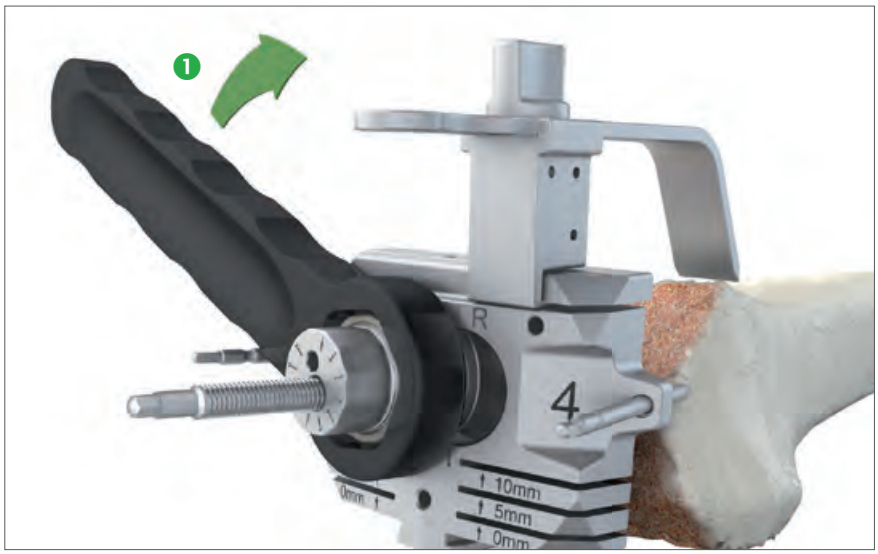
Verifying the AP Resections, Securing, and Performing the Osteotomies

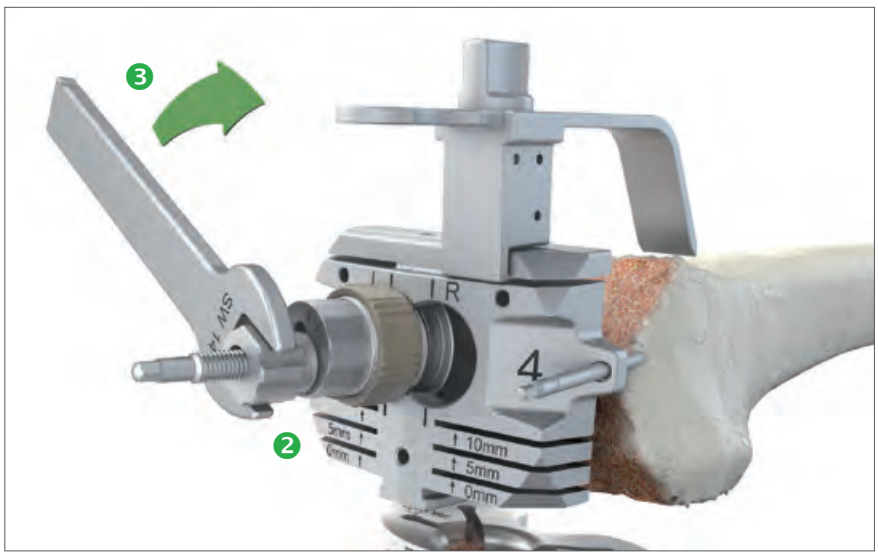
63

After the construct has been aligned, it is secured by oblique *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm* and the Epicondylar Feeler Gauge is removed.



Additionally, the *Hexagonal clamping nut PEEK* can be secured with the *Ring-Wrench for Hexagonal Clamping Nut* (❶), and the *Clamping nut* (❷) can be secured with the *Flat Wrench AF14* (❸).



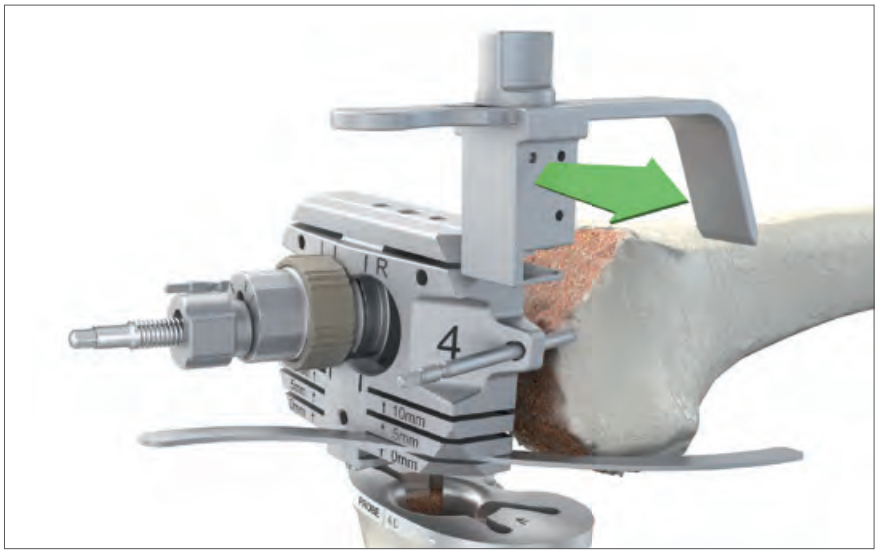


4 Femoral Preparation

Verifying the A/P Resections, Securing, and Performing the Osteotomies

64

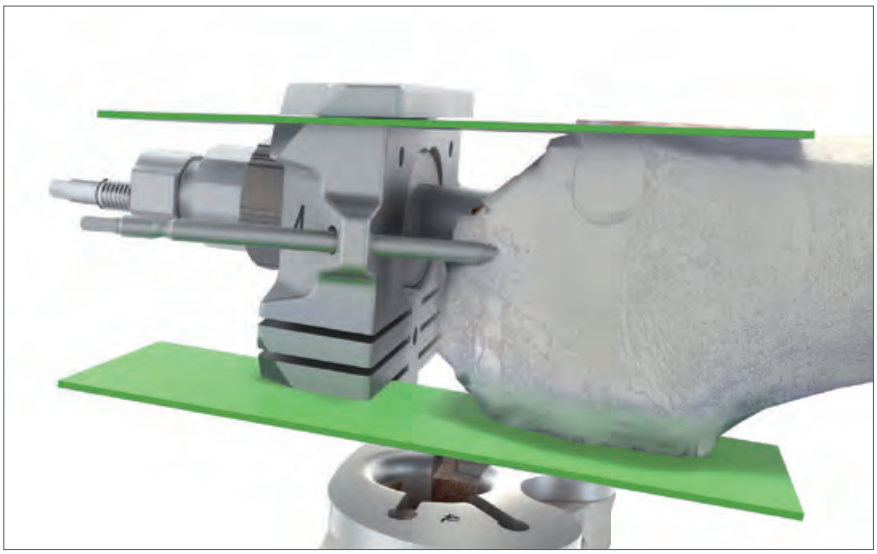
Then the A/P osteotomies are verified with the *Visualisation Guide S* and the instruments for adjusting rotational alignment as well as the *Femoral stylus* is removed.



Now the A/P osteotomies are performed.

! NOTE

Only saw blades from PETER BREHM GmbH with a thickness of 1.18 mm ±0.01 mm may be used for the osteotomy.



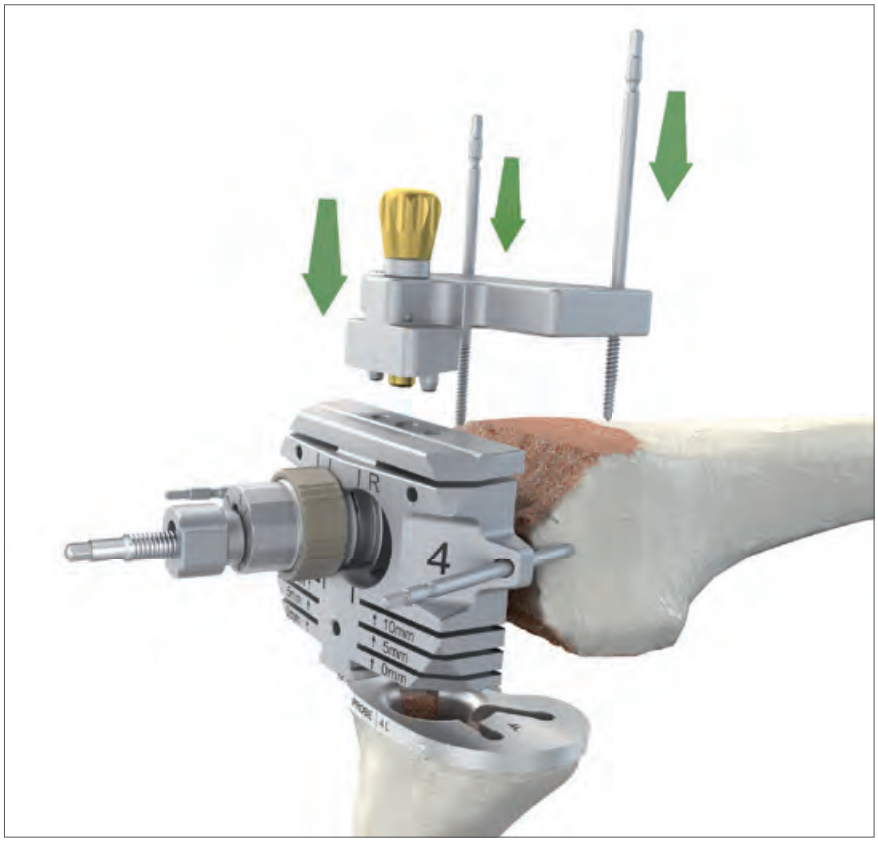
Posterior resection guide 0 mm, and for augments 5 mm and 10 mm.

4 **Femoral Preparation**

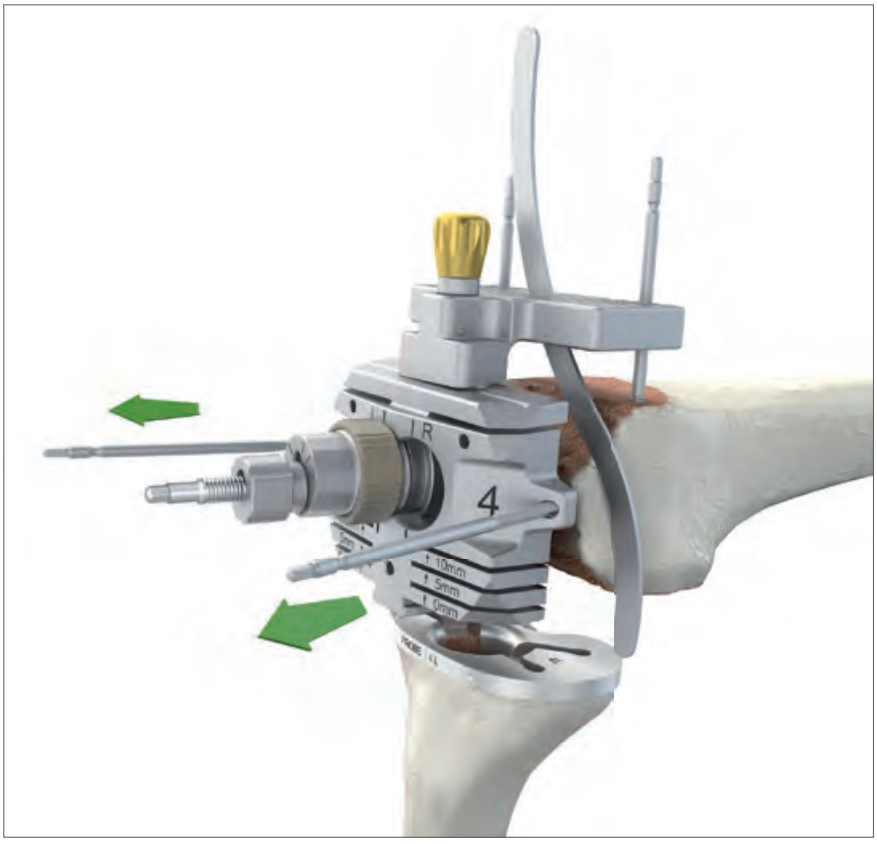
Assembling and Securing the Femoral cutting block distal

65

Then the *Femoral cutting block distal* is attached to the *Femoral cutting block A/P* and secured with 2 *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm.*



The pins on the *Femoral cutting block A/P* are removed and the distal osteotomy is checked with the *Visualisation Guide S.*



4 **Femoral Preparation**

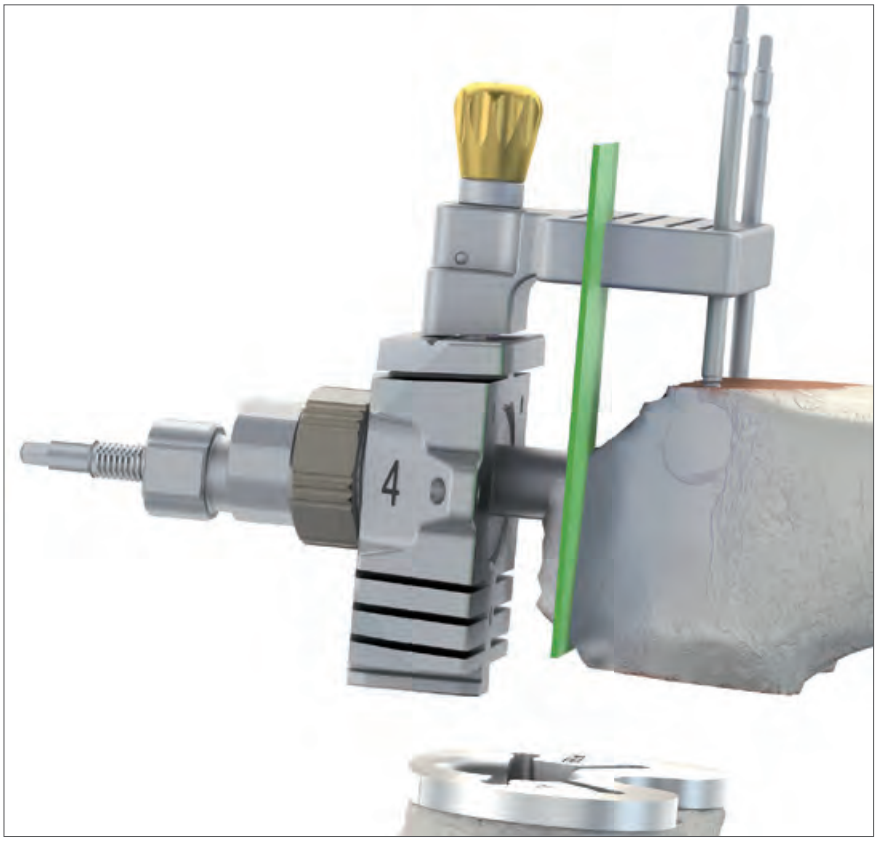
Assembling and Securing the Femoral cutting block distal

66

Now the distal osteotomy is performed.

! NOTE

Only saw blades from PETER BREHM GmbH with a thickness of 1.18 mm ±0.01 mm may be used for the osteotomy.



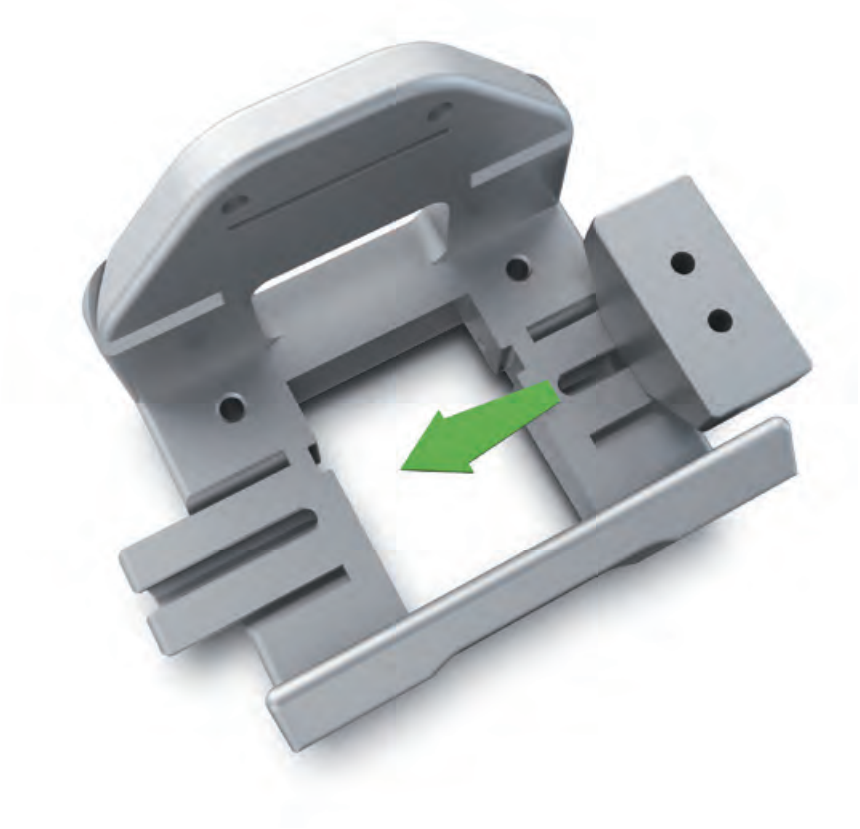
Distal resection guide 0 mm, and for augments 5, 10, 15 and 20 mm

4 **Femoral Preparation**

Assembling and Placing the Box preparation

67

If the resection considered augments, then the appropriate *Box-Augment distal* and posterior must be inserted into the *Box preparation*.



68

The following box augments are available:

- Posterior: 5 mm, 10 mm
- Distal: 5 mm, 10 mm, 15 mm, 20 mm

Box-Augments distal

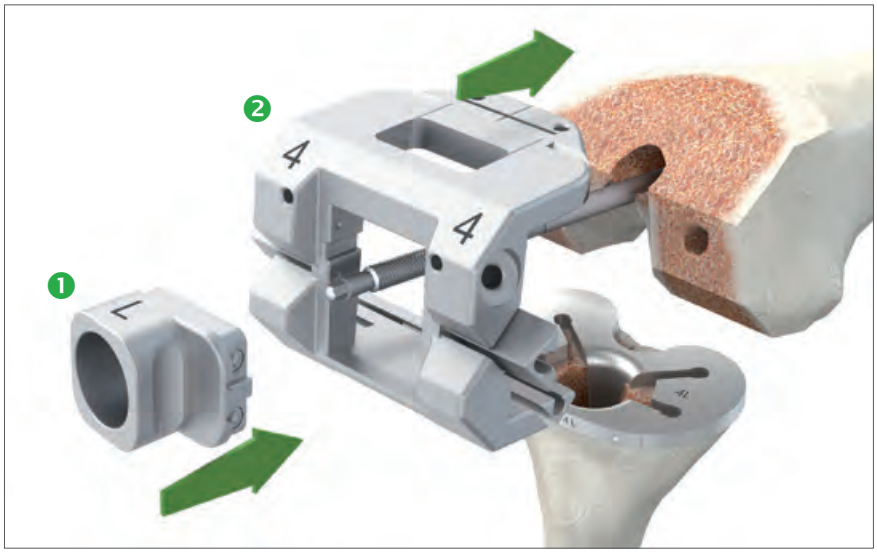
Box-Augments posterior

4 Femoral Preparation

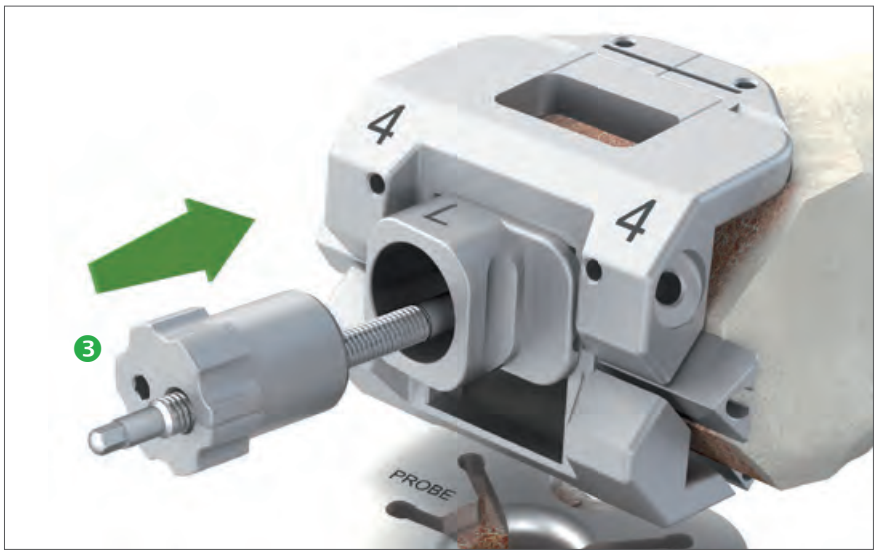
Assembling and Placing the Box preparation

69

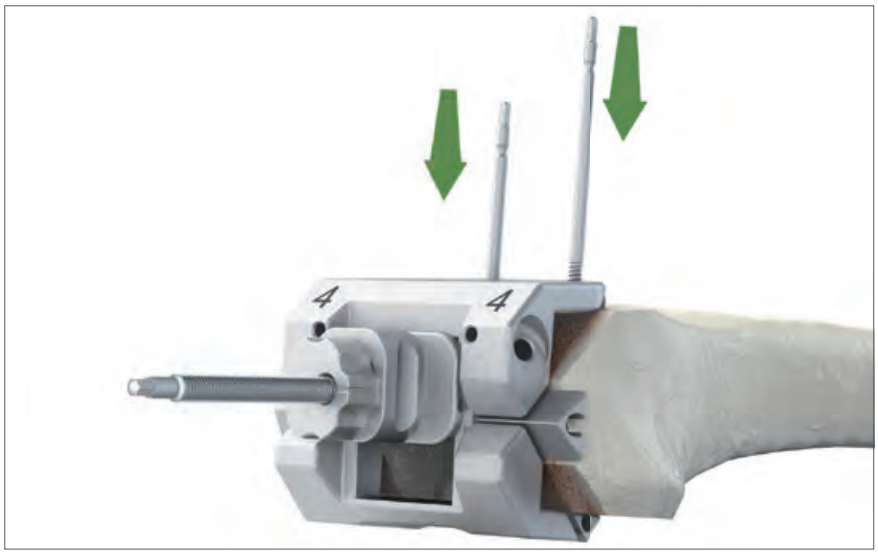
The *Drill Guide Ø 19 mm for Box preparation* (❶) is inserted into the *Box preparation* (❷) of the appropriate size and mounted on the distal femur guided by the *Guide Rod* or the *Reamer with Guide Rod*. Ensure to use the proper right "R" or left "L" position marked on the *Drill Guide Ø 19 mm for Box preparation*. The label on the instrument indicating the position must be visible anteriorly.



Then the *Centralizer bushing* (❸) with the offset determined in item 60 is slid over the *Guide Rod* or the *Reamer with Guide Rod* into the *Drill Guide Ø 19 mm for Box preparation* to obtain the desired M/L alignment.



The *Box preparation* is secured with 2 *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm*. Then the *Centralizer bushing*, the *Drill Guide Ø 19 mm for Box preparation,* and the *Guide Rod* or the *Reamer with Guide Rod* are removed.



! NOTE

If it is not possible to remove the *Reamer with Guide Rod* through the opening of the *Box preparation*, then the *Box preparation* must be removed with it. Distally inserted *Pins with Corticalis Thread Size: Ø 3,15 x 70 mm* or an anterior marking can be used to ensure reliable repositioning.

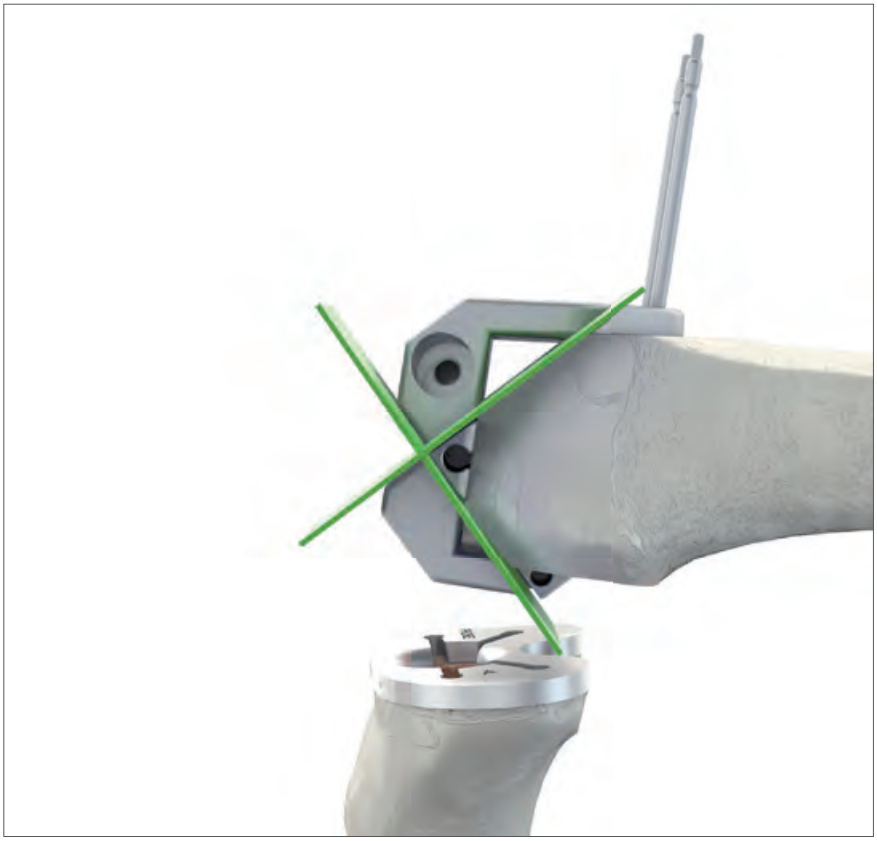
4 **Femoral Preparation**

Diagonal Osteotomies and Preparing the Femoral Box

70

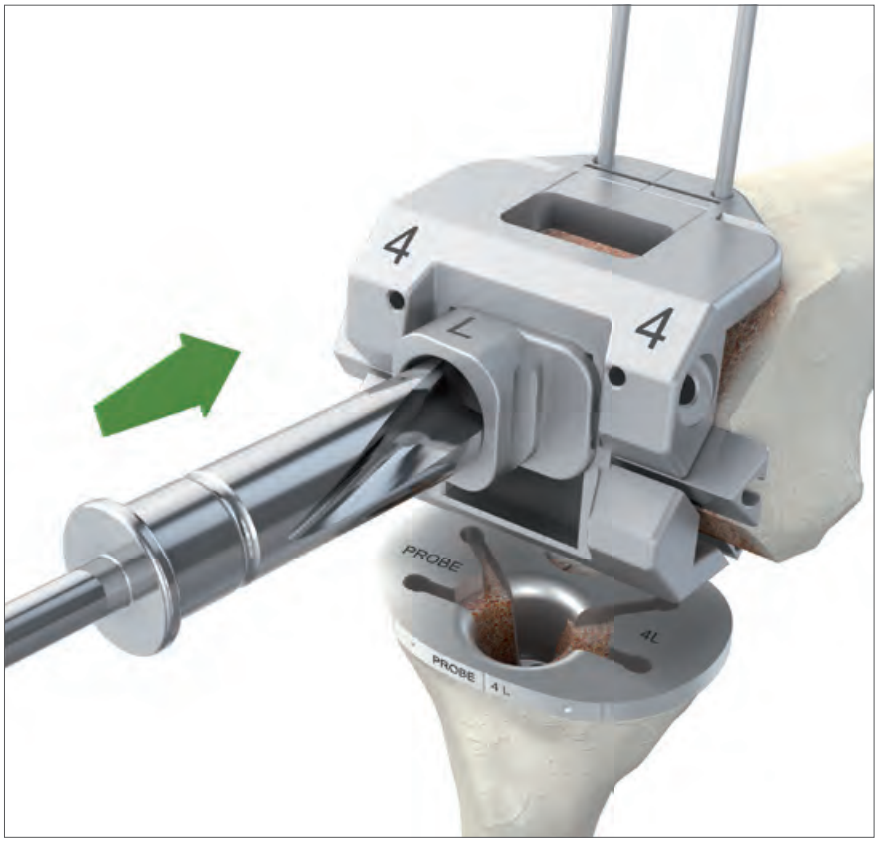
Now the oblique osteotomies are performed.

Only saw blades from PETER BREHM GmbH with a thickness of 1.18 mm ±0.01 mm may be used for the osteotomy..



71

After the *Drill Guide Ø 19 mm for Box preparation* has been reinserted, the femur is drilled with the *Drill Size: Ø 19 mm.*

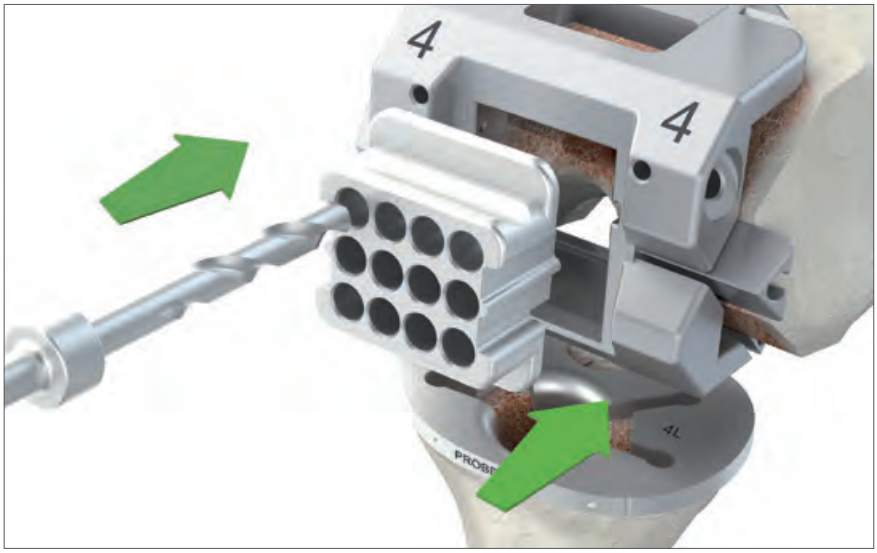


4 Femoral Preparation

Preparing the Femoral Box (Alternative 1)

72

The *Drill Guide Ø 6 mm* and the *Drill AO Coupling Size: Ø 6 mm* can be used to remove excess bone in the box.



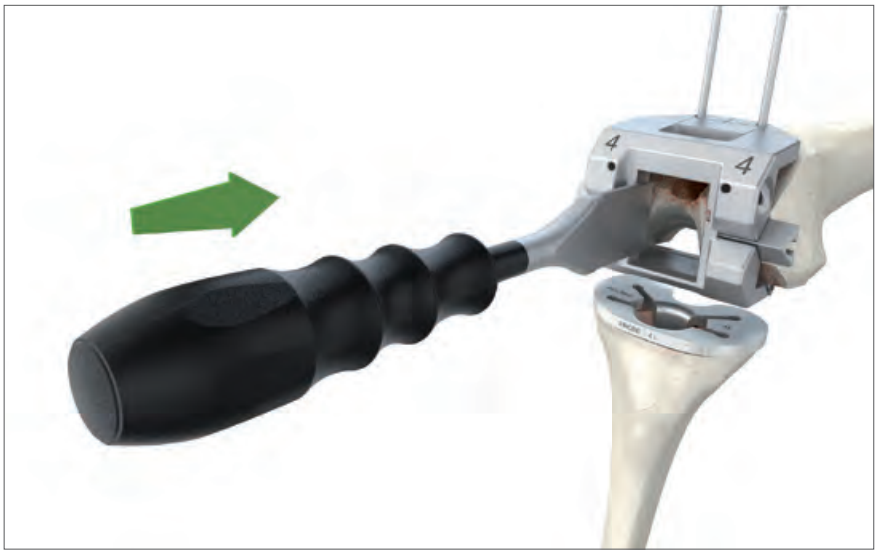
73

The edges of the box can be created with the *Box Chisel*. The *Handle for Impactor/Extractor* is attached to the *Box Chisel* for this purpose.

! NOTE

Make sure the "anterior" marking on the *Box Chisel* is visible from above in order to protect posterior and intercondylar structures.

The *Cutting chisel* is used to remove any remaining structures. The inner wall of the *Box preparation* acts as a guide whereas the stop on the *Cutting chisel* ensures the necessary dissection depth. The posterior structures must hereby also be taken into account.

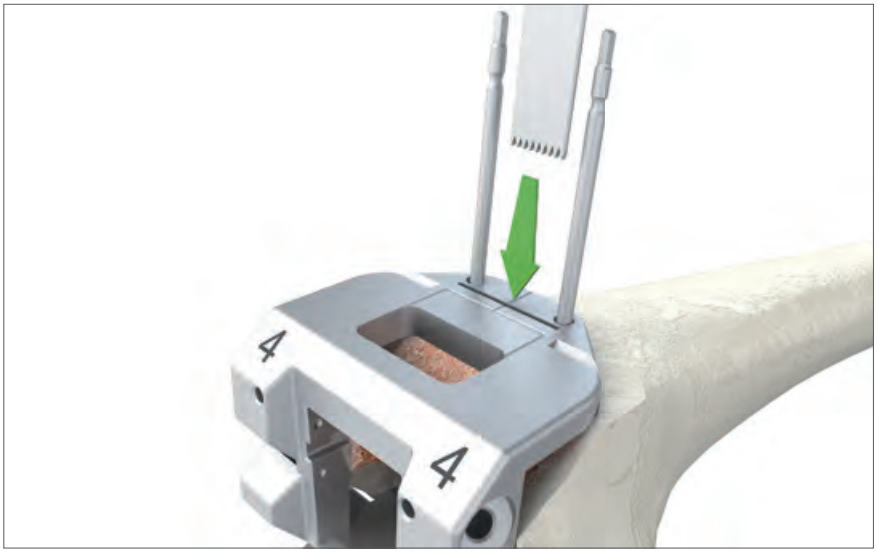


4 **Femoral Preparation**

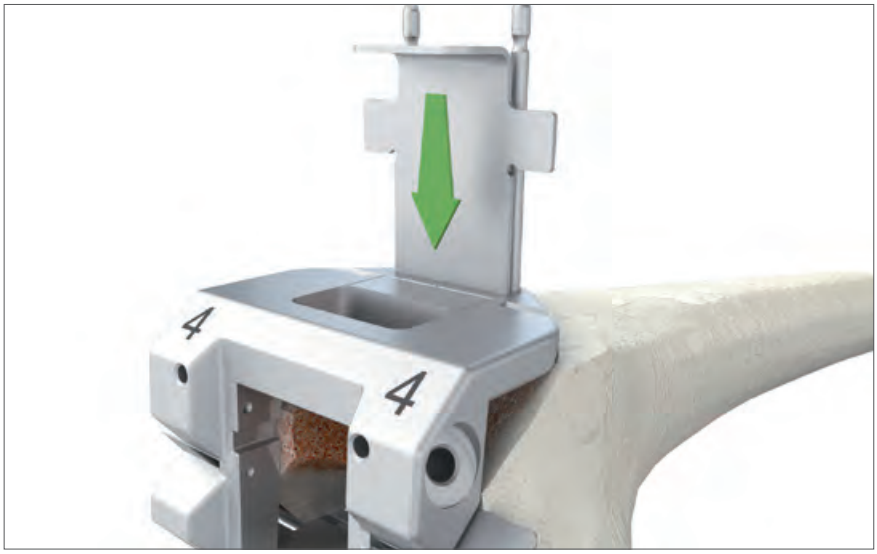
Preparing the Femoral Box (Alternative 2)

74

Alternatively, the box can be dissected with an oscillating saw. First the distal resection is performed through the anterior slot in the *Box preparation*. Be careful to maintain proper axial alignment during the resection.



After the *Depth Stop for Box Preparation* has been inserted, a distal osteotomy is carried as far as the *Depth Stop for Box preparation* to mobilize the block of bone. The inner wall of the *Box preparation* acts as a guide for the saw blade.



! NOTE

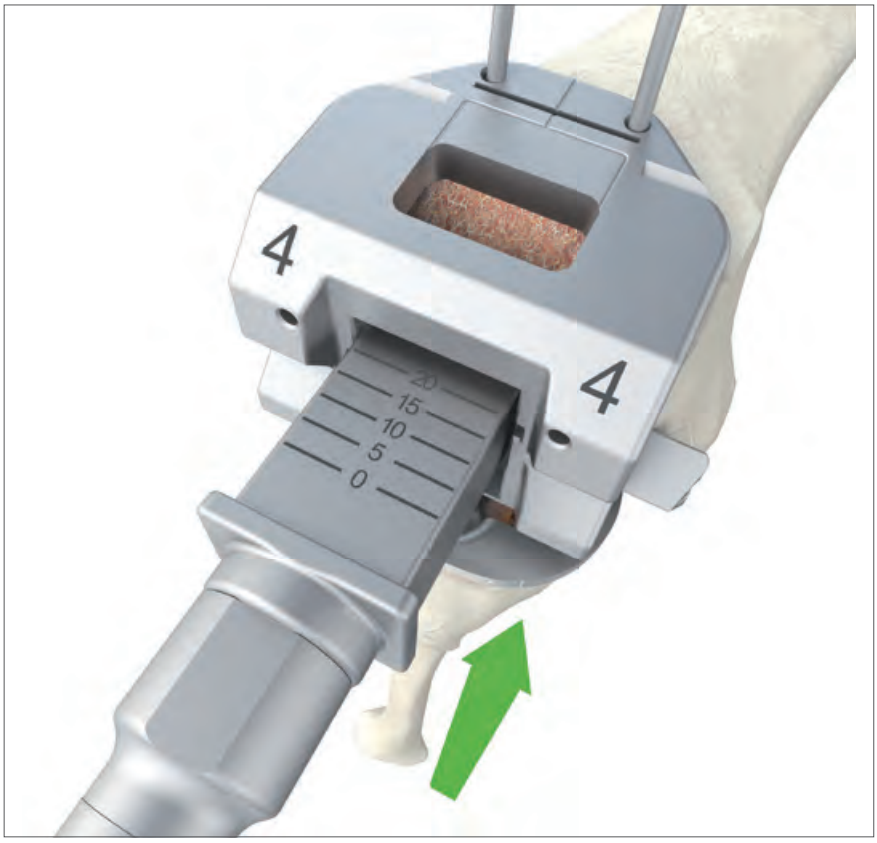
Only saw blades from PETER BREHM GmbH with a thickness of 1.18 mm ±0.01 mm may be used for the osteotomy.

4 **Femoral Preparation**

Evaluating the Box Resection

75

The *Depth gauge for Box preparation* is used to determine the width and depth of the box osteotomy.



4 **Femoral Preparation**

Evaluating the Femoral Resection

76

All instruments are removed except for the *Reference Stem Straight*, if applicable. The *TRIAL Femoral Component SC/RH/TH* can then be placed to evaluate the osteotomies and the femoral box.

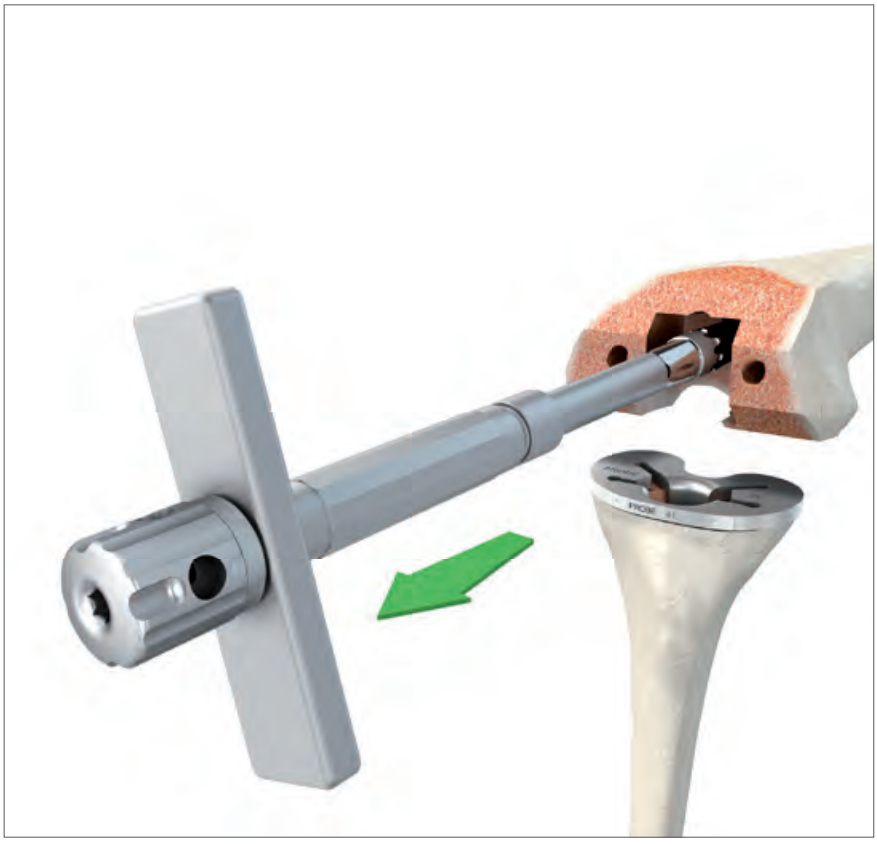
If the resection considered *Trial AUGMENTS Femur SC/RH/TH,* then they must first be inserted into the *TRIAL Femoral Component SC/RH/TH.*

! NOTE

The size of the augment depends on the size of the femur.

77

If necessary, the *Guide Rod* is screwed into the *Reference Stem straight*, and the *Handle Impactor/Extractor* is slid over it and secured with the *Knurled Screw S.* Then the *Reference Stem straight* can be extracted.



5 Trial Femoral Component

Assembling the TRIAL Femoral Component RH/TH

78

The *TRIAL Femoral Component SC/RH/TH* is assembled by inserting the *TRIAL Yoke Neck for Femur RH/TH* into the intercondylar box.

The axis holes on the *TRIAL Femoral Component SC/RH/TH* and *TRIAL Yoke Neck for Femur RH/TH* are aligned and the *Trial Hinge* is inserted.

! NOTE

The size of the *TRIAL Yoke Neck for Femur RH/TH* depends on the size of the *TRIAL Femoral Component SC/RH/TH.*

5 **Trial Femoral Component**

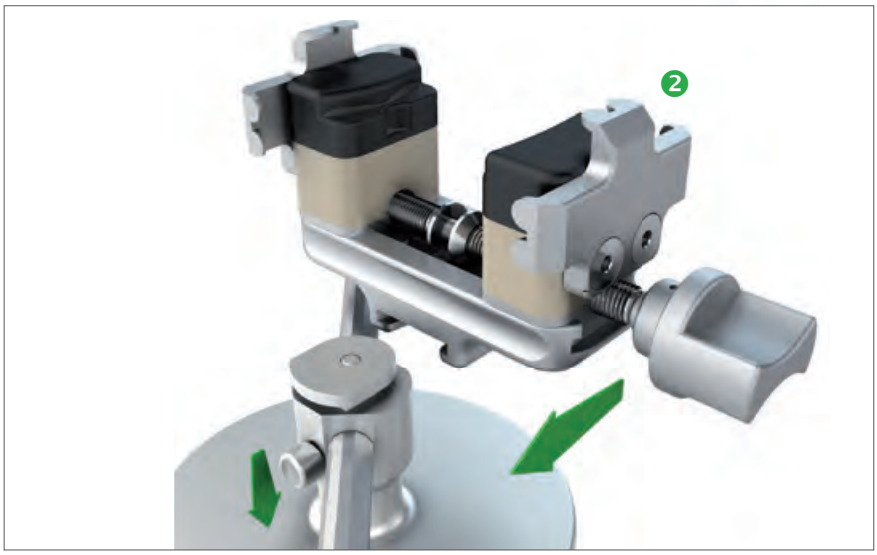
Attaching the TRIAL Femoral Components SC and RH/TH to the Assembling base plate and placing TRIAL Augments

79

Two *Handles* can be screwed onto the sides of the *Assembling base plate* to stabilize the Femoral Assembly Block for later tightening the components.

80

The Femoral Assembly Block consists of the *Assembling base plate* (1) and the *Femoral Impactor/Extractor* (2). Pressing down the locking button allows to slide the *Femoral Impactor/Extractor* onto the *Assembling base plate* and to secure it.



81

The *TRIAL Femoral Component SC/RH/TH* is mounted on the *Femoral Impactor/Extractor* for assembly.

! NOTE

If the resection considered augments, then the *Trial AUGMENTS Femur* must be inserted into the *TRIAL Femoral Component SC/RH/TH*.

5 Trial Femoral Component

Assembling the TRIAL Stem Straight and TRIAL Adapter Femur

82

To assemble the *TRIAL Stem Straight*, a *TRIAL Counter Nut for Adapter* is screwed onto the preselected *TRIAL femoral adapter SC/RH/TH (0, 4, or 6 mm offset)* all the way to the end of the threading.

! NOTE

The size of the *TRIAL Adapter Femur* depends on the size of the *TRIAL Femoral Component SC/RH/TH*.

83

Now the *TRIAL Stem Straight* of the selected length is screwed into the *TRIAL Adapter Femur* hand tight.

5 Trial Femoral Component

Assembling the TRIAL Stem Straight and TRIAL Adapter Femur

84

For screwing in the gold *Socket Wrench AF3,5* can be used.

85

The *TRIAL Stem Straight* together with the *TRIAL Adapter Femur* is screwed all the way into the *TRIAL Femoral Component SC/RH/TH* and secured with the *TRIAL Counter Nut for Adapter.*

5 Trial Femoral Component

TRIAL Adapter Femur 4 mm and 6 mm Offset for TRIAL Femoral Components SC and RH/TH

86

If an offset was used when adjusting the *Femoral cutting block A/P*, then the corresponding sizes of the *TRIAL Femoral Component SC/RH/TH* and *TRIAL Adapter Offset Femur* must also be used.

The following rules should be observed when assembling the trial implants:

- All threaded connections must be screwed tight.
- When using a *TRIAL Adapter Offset Femur,* the predetermined offset position must be set (within one backward turn) and secured with the hand tightened *TRIAL Counter Nut for Adapter.*
- Ensure proper offset position.

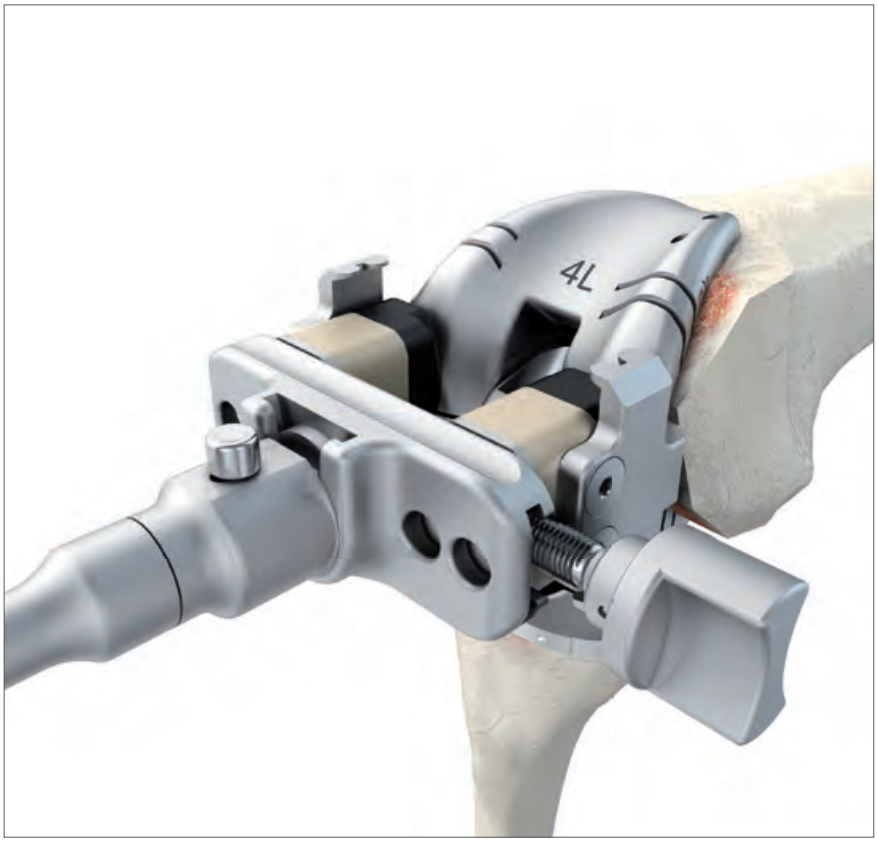
5 Trial Femoral Component

Placing the TRIAL Femoral Component

87

To place the *TRIAL Femoral Component SC/RH/TH*, the *Assembling base plate* is removed and the *Handle for Impactor/Extractor* is connected.

Place the *TRIAL Femoral component SC/RH/TH.* If necessary, different sizes of trial components can be used.



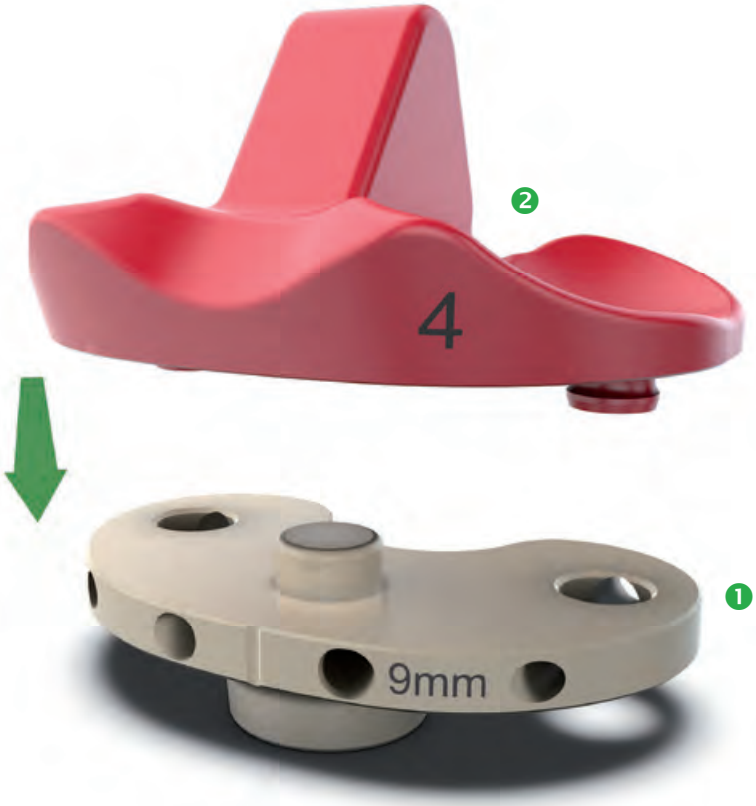
5 Trial Femoral Component

Assembling the TRIAL Insert

88

The trial insert consists of the *TRIAL INSERT Adapter UC/SC* or *TRIAL TIBIAL Base Plate RH/TH* (❶) and the *TRIAL Insert SC or RH/TH* (❷).

The size of the *TRIAL Insert SC or RH/TH* should be selected according to the size of the FEMUR Component. The *TRIAL INSERT Adapter UC/SC* or *TRIAL TIBIAL Base Plate RH/TH* is selected according to the insert height determined by evaluating joint space in flexion and extension. The two components are pressed together for the trial reduction.



Assembling the *TRIAL Insert SC*

89

The *TRIAL INSERT Adapter UC/SC* or *TRIAL TIBIAL Base Plate RH/TH* is independent of the size of the FEMUR Component. The following heights are available: 7-17 mm (SC/RH/TH) and 19-25 mm (RH/TH only).

Assembling the *TRIAL Insert RH/TH*

5 Trial Femoral Component

Placing the TRIAL Insert SC

90

The T*rial Insert Holder* is used to place the assembled T*RIAL Insert SC* into the joint space.

91

The joint should now be moved through its range of motion to evaluate stability and function. If necessary, different heights of PE-INSERTS can be used.

! NOTE

Use *TRIAL Components* exclusively to select the appropriate implant and make sure that *TRIAL Components* are never implanted permanently.

5 Trial Femoral Component

Placing the TRIAL Insert RH/TH and TRIAL YOKE RH

92

The *TRIAL Insert RH/TH* is slid over the pin of the *TRIAL TIBIAL Component RH/TH.*

93

The *Yoke sling* (❶) is screwed into the *TRIAL YOKE RH* (❷) of the appropriate height. The *Yoke assembling device* (❸) can be used for this purpose.

94

When placing the *TRIAL YOKE RH,* make sure that the loop of the *Yoke sling* faces forward.

! NOTE

The *Yoke sling* must not be bent or damaged.

The *TRIAL YOKE RH* should be selected according to the height of the *TRIAL Insert RH/TH.*

5 **Trial Femoral Component**

Connecting the TRIAL YOKE RH

95

The loop of the Yoke sling is now visible through the *TRIAL Yoke Neck for Femur RH/TH*.

Moving the knee through its range of motion makes it easier to center the *TRIAL Yoke Neck for Femur RH/TH* over the *TRIAL YOKE RH*.

96

The hook of the Y*oke assembling device* is hooked into the loop of the *Yoke sling*.

5 Trial Femoral Component

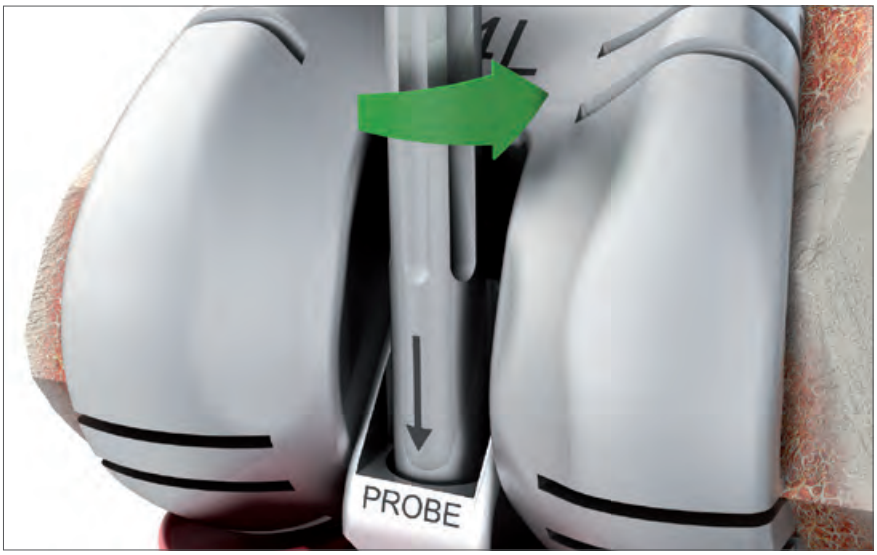
Coupling the TRIAL Component RH/TH

97

To pull the *TRIAL YOKE RH* into the *TRIAL Yoke Neck for Femur RH/TH* you must now use the Y*oke assembling device* as a lever to pry the *Yoke sling* upwards.

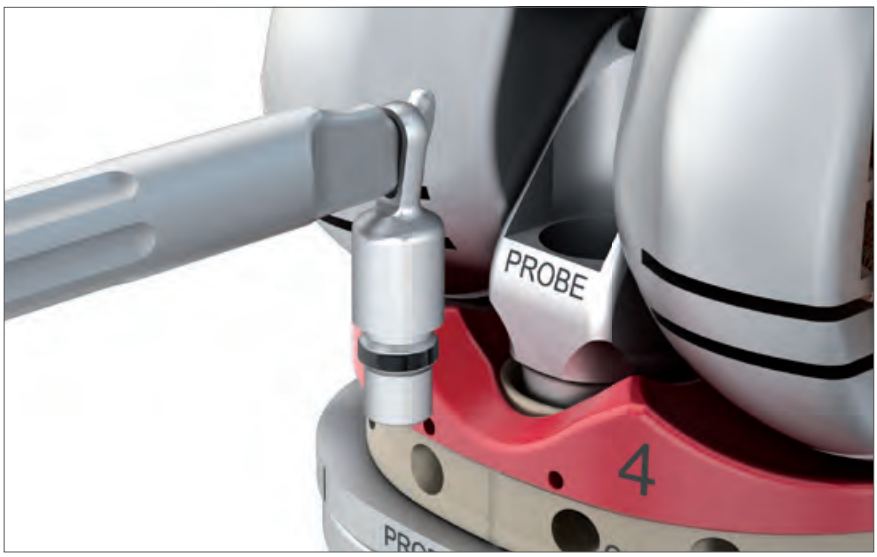
98

The *Yoke sling* is then unscrewed with the *Yoke assembling device.*



99

The last step is to remove the *Yoke sling.*



5 **Trial Femoral Component**

Coupling the TRIAL Component RH/TH

100

The *TRIAL YOKE RH* is secured in the *TRIAL Yoke Neck for Femur RH/TH* with an additional *TRIAL Clamp Screw M6 x 0,5* which is tightened with the *Socket Head Wrench AF5*.

! NOTE

Use *TRIAL Components* exclusively to select the appropriate implant and make sure that *TRIAL Components* are never implanted permanently.

101

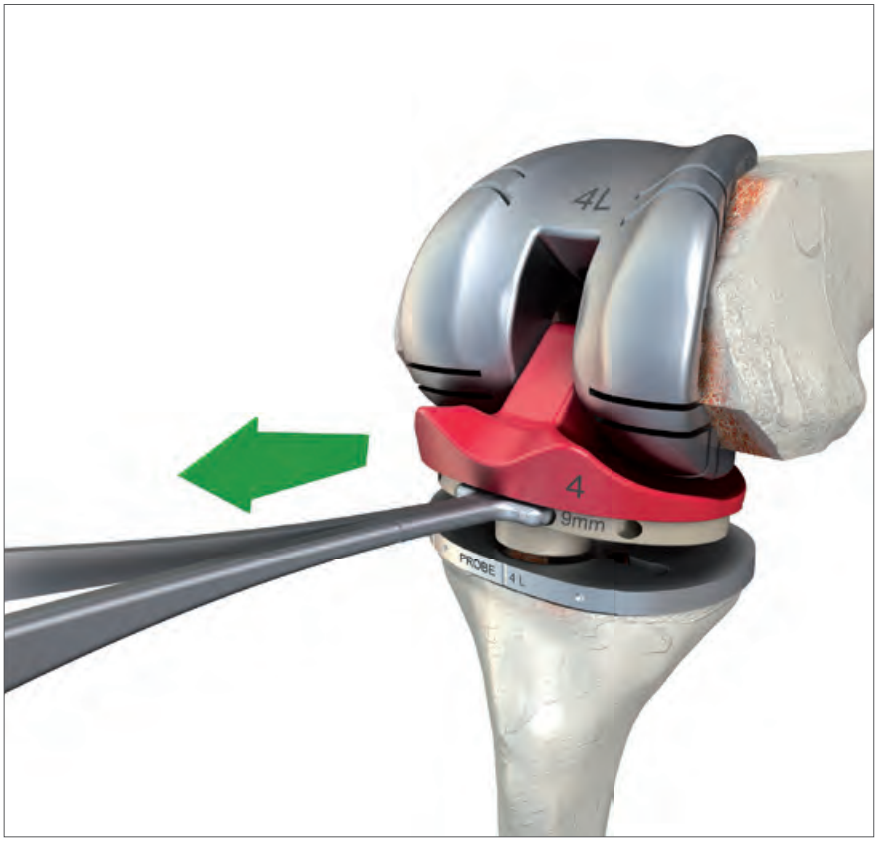
The joint is now moved through its range of motion to evaluate the stability and function of the complete trial construct. If necessary, different heights of inserts can be used.

5 **Trial Femoral Component**

Removing the TRIAL Component SC

102

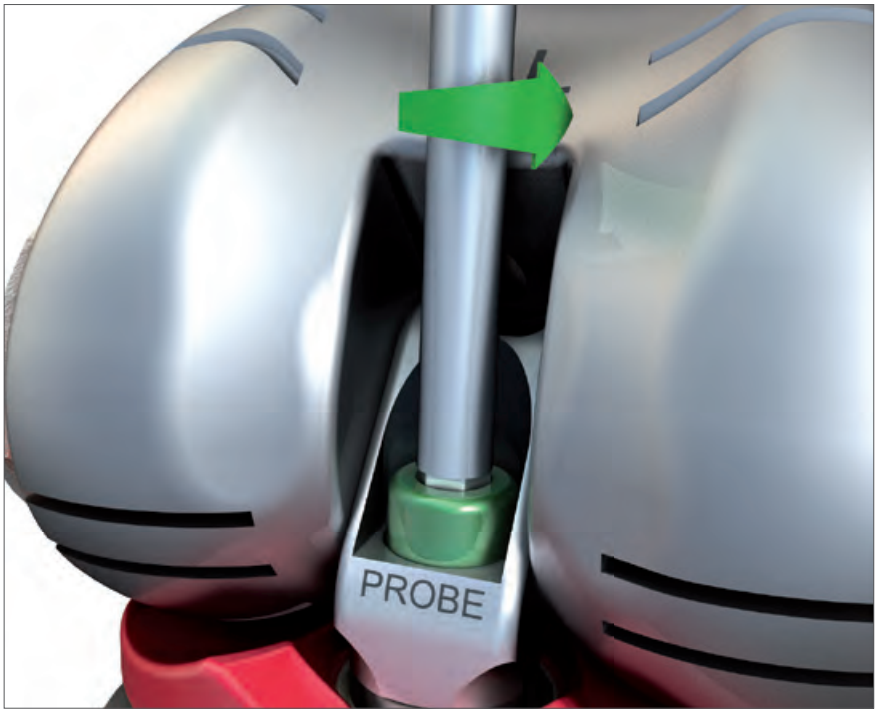
The *TRIAL Insert SC* is lifted with the *Trial Insert Holder* so that it can be pulled out anteriorly.



Disconnecting the TRIAL YOKE RH

103

The TRIAL assembly is disconnected by unscrewing the *TRIAL Clamp Screw M6 x 0,5* with the *Socket Head Wrench AF5*.



5 **Trial Femoral Component**

Disconnecting the TRIAL YOKE RH

104

Next the *Removing Handle* (❶) is screwed into the *TRIAL Yoke Neck for Femur RH/TH* and the *Removing Rod* (❷) is inserted from above. Then the *Removing Mandril* (❸) is screwed into the *Removing Handle* and turned clockwise until the taper connection separates.

5 Trial Femoral Component

Removing the TRIAL YOKE RH

105

To remove the *TRIAL Yoke Neck RH/TH*, screw in the *Yoke sling* using the *Yoke assembling device* and remove it together with the *TRIAL Yoke Neck for Femur RH/TH*.

106

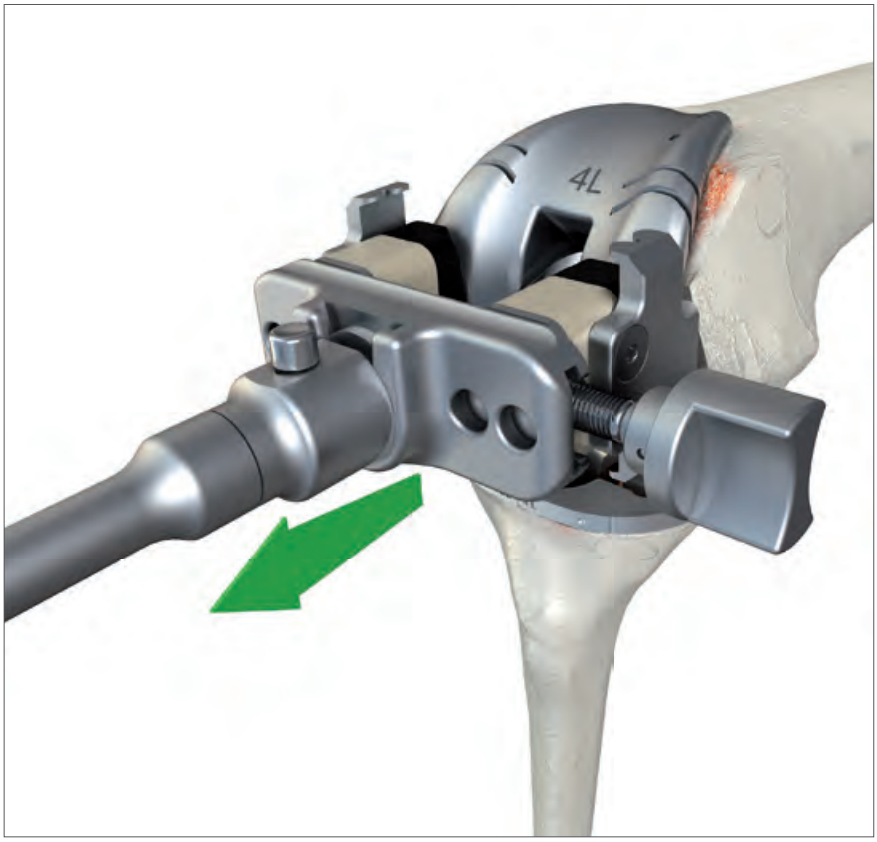
The *TIRAL Insert* is removed anteriorly.

5 Trial Femoral Component

Removing the TRIAL Femoral and Tibial Components

107

The *Femoral Impactor/Extractor* and *Impactor/Extractor Tibia* (see items 53 and 54) are attached to the *TRIAL Components* and the *TRIAL Components* are then extracted.



108

The *TRIAL TIBIAL Component SC or RH/TH* can usually be extracted with the *Handle for Impactor/Extractor*, the *Tibial Impactor/Extractor SC*, or *Tibial Impactor/Extractor RH/TH* (see items 53 and 54).

In the case of a tightly pressed *TRIAL Stem Straight*, the *TRIAL TIBIAL Component SC* should be extracted with *Mandril Extractor TRIAL Tibia SC* (❶) and the *Handle Extractor TRIAL Tibia SC* (❷).

For the *TRIAL TIBIAL Component RH/TH,* the *Extractor RH/TH Tibia* (❸) can be used.

6 Assembling the Tibial Implant

Assembling the AUGMENTS Tibia

109

The TIBIA Component is clamped in the *Assembling base plate* in the same manner as the *TRIAL TIBIAL Component* (items 42-47). If AUGMENTS Tibia are used, they are then attached to the TIBIAL Component with the appropriate CLAMP SCREW for Augments and hand tightened with the *Socket Head Wrench AF3,5.*

The maximum augmentation height of 15 mm can be achieved using multiple medial and lateral AUGMENTS Tibia stacked one on top of the other. AUGMENTS Tibia of different sizes can be combined as needed.

! NOTE

The length of the CLAMP SCREW depends on the height of the respective compartment.

Stacking AUGMENTS Tibia

6 **Assembling the Tibial Implant**

Assembling the ADAPTER Tibia and ANCHORING STEM Straight

110

The ANCHORING STEM Straight and the ADAPTER Tibia are assembled in the same way as *TRIAL Stem Straight* and the *TRIAL Tibial Adapter* (items 48-51).

Assembling the OFFSET ADAPTER Tibia

111

When an OFFSET ADAPTER Tibia is used, the offset is adjusted in the same manner as for the *TRIAL Tibial Adapter* (item 52).

! NOTE

Make sure that the position of the *TRIAL Tibial Adapter* is correctly transferred to the OFFSET ADAPTER Tibia.

6 Assembling the Tibial Implant

Tightening the Tibial Implants

112

For tightening the ANCHORING STEM Straight and the ADAPTER Tibia, insert the *Flat Wrench AF14 for Torque Key* into the *Torque Key 25 ± 1 Nm* and place it on the ANCHORING STEM Straight.
A *Flat Wrench AF14* placed on the ADAPTER Tibia acts as a brace. Then the two implants are tightened until you hear an audible click.

! NOTE

When tightening the connection, be sure to hold the *Torque Key 25 ± 1 Nm* in your right hand so that the torque scale is visible from above.

113

To tighten the LOCK NUT for Adapter, insert the *Flat Wrench AF14 for Torque Key* into the *Torque Key 25 Nm* and place it on the LOCK NUT for Adapter. A *Flat Wrench AF14 for Torque Key* placed on the ADAPTER Tibia acts as a brace. The offset position is again verified. Then the LOCK NUT for Adapter is tightened until you hear an audible click. The final step is to verify the correct stem position again.

6 **Assembling the Tibial Implant**

Tightening the Tibial Implants

! NOTE

Make sure there is an audible click when you tighten the construct. Do not use the *Torque Key 25 ± 1 Nm* to remove screws.

Using the *Torque Key 25 ± 1 Nm* to remove screws can damage the instrument and prevent it from achieving the required torque during subsequent use.

6 Assembling the Tibial Implant

Assembling the Tibial Impactor

114

After the assembled TIBIA Component has been removed from the *Assembling base plate*, the *Handle for Impactor/ Extractor* is connected.

7 Assembling the Femoral Implant

Placing the CEMENT PROTECTION for Femur Component SC

115

The *CEMENT PROTECTION for Femur Component SC* must now be placed. The *Trial Insert Holder* (1) can be used for this purpose.

! NOTE

Make sure that the *CEMENT PROTECTION for Femur Component SC* completely seals the open femoral box.

Correctly positioned *CEMENT PROTECTION for Femur Component SC*

Incorrectly positioned *CEMENT PROTECTION for Femur Component SC*

7 Assembling the Femoral Implant

Placing the CEMENT PROTECTION for Femur Component RH/TH

116

The *CEMENT PROTECTION for Femur Component RH/TH* must now be placed to protect the femoral box. The *Trial Insert Holder* (❶) can be used for this purpose. The *CEMENT PROTECTION for Femur Component RH/TH* is pulled down and over the *YOKE Neck RH/TH*, which is in extension, with the T*rial Insert Holder*.

! NOTE

Make sure that the *CEMENT PROTECTION for Femur Component RH/TH* completely seals the open femoral box.

Correctly positioned *CEMENT PROTECTION for Femur Component RH/TH*.

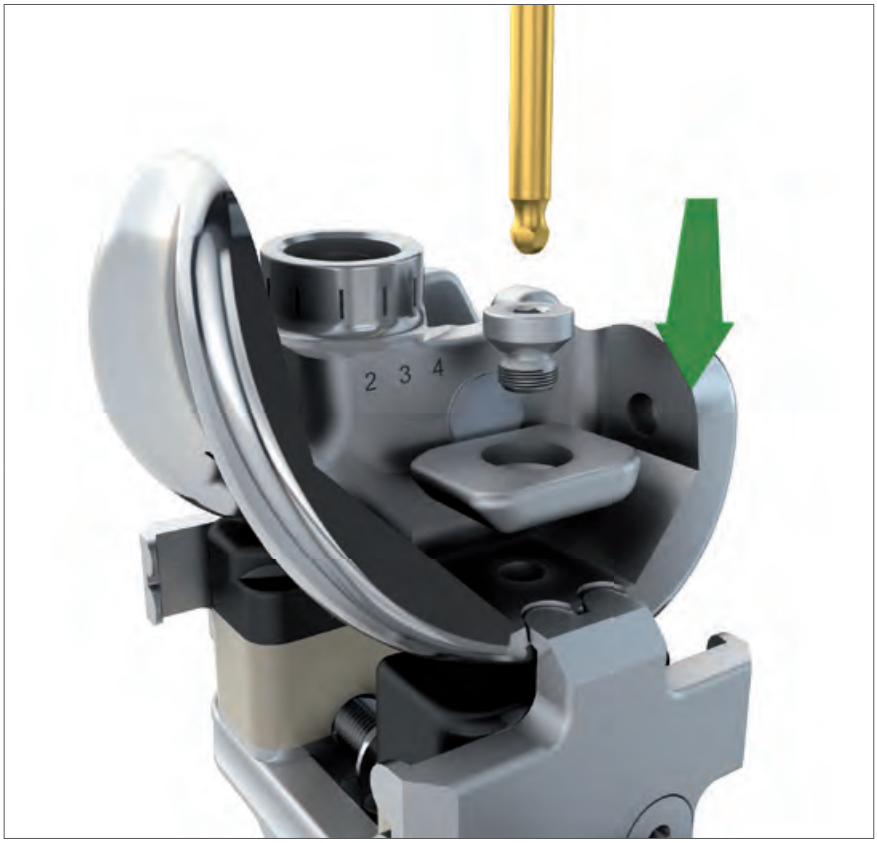
Incorrectly positioned *CEMENT PROTECTION for Femur Component RH/TH*.

7 **Assembling the Femoral Implant**

Assembling the AUGMENTS Femur

117

The FEMUR Components are assembled in the *Assembling base plate* in the same manner as the T*RIAL FEMORAL Components* (items 79-81). The appropriate AUGMENTS Femur are screwed onto the FEMUR Component with the *Cardan Screw Driver AF3,5* or the *Socket Head Wrench AF 3,5* and hand tightened.



! NOTE

The size of the AUGMENT Femur depends on the size of the FEMUR Component.

Assembling the ANCHORING STEM Straight and ADAPTER Femur

118

The ANCHORING STEM Straight and the ADAPTER Femur are assembled in the same way as *TRIAL Stem Straight* and the *TRIAL Adapter Femur* (items 82-85).

7 Assembling the Femoral Implant

Assembling the OFFSET ADAPTER Femur SC/RH/TH

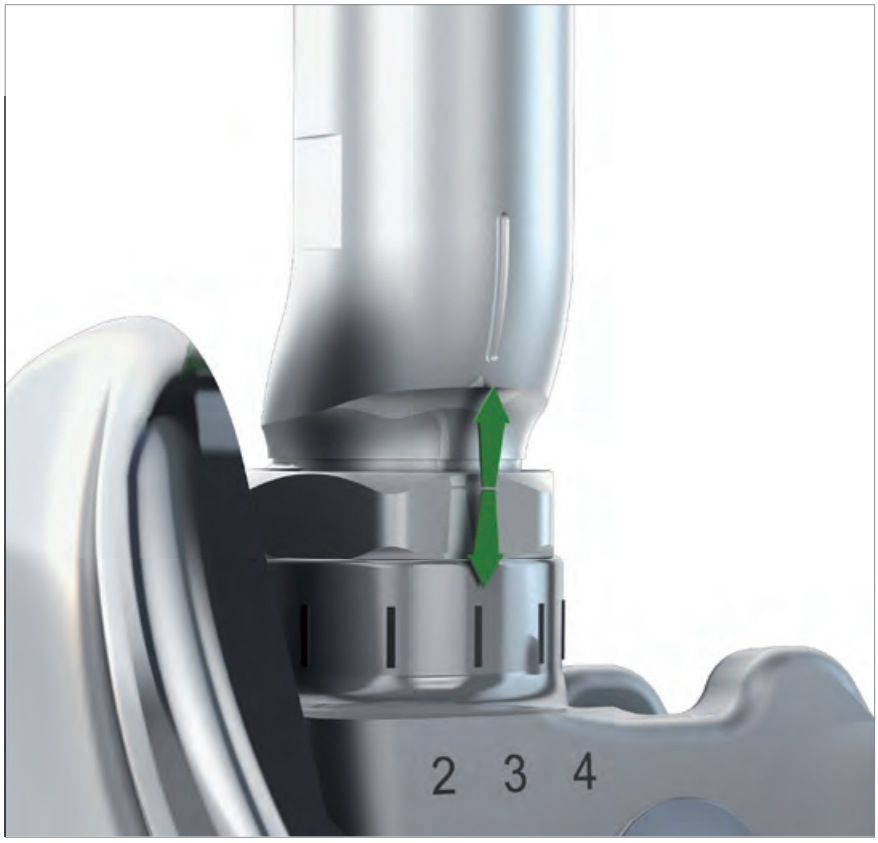
119

When the OFFSET ADAPTER Femur SC/RH/TH is used, the offset is adjusted in the same manner as for the *TRIAL Adapter Offset for Femur* (see item 86).

If a *TRIAL Adapter Offset for Femur* was used, then a OFFSET ADAPTER Femur SC/RH/TH must also be used with the implant. The setting is read off the *TRIAL Adapter Offset for Femur* and transferred.

! NOTE

The size of the OFFSET ADAPTER Femur SC/RH/TH depends on the size of the FEMUR Component.



7 **Assembling the Femoral Implant**

Tightening the FEMUR Component

120

The FEMUR Component is tightened in the same manner as the TIBIA Components (see items 112-113). Both the ANCHORING STEM Straight and the FEMUR Component must be tightened with the ADAPTER Femur.

7 Assembling the Femoral Implant

Assembling the Femoral Impactor

121

Then the *Femoral Impactor/Extractor* is disconnected from the *Assembling base plate* and connected to the *Handle for Impactor/Extractor.*

8 **Placing the Implant**

Placing the medullary cement lock

The BPK-S Integration system does not provide standard equipment for placing medullary cement lock. When third-party systems are used, it is important to compare the length of the seating instrument to the length of the implant.

Follow the instructions in the manufacturer's manual.

Those portions of the bone where cement will be used to fix implants are carefully cleaned of contaminants such as residues from reaming, blood, and medullary fat using suitable irrigation instruments (brush, jet lavage) and then dried. The cleaner the surface is, the farther the bone cement can penetrate into the cancellous bone. Drying prevents formation of a parting layer of liquid between the cement and cancellous bone.

After preparation of the bone cement, the medullary canal is filled in retrograde fashion with the aid of a cement syringe.

Placing the TIBIA Component SC

Order of implantation
1. TIBIA Component
2. PE-INSERT
3. FEMUR Component
4. Secure PE-INSERT with Locking Pin

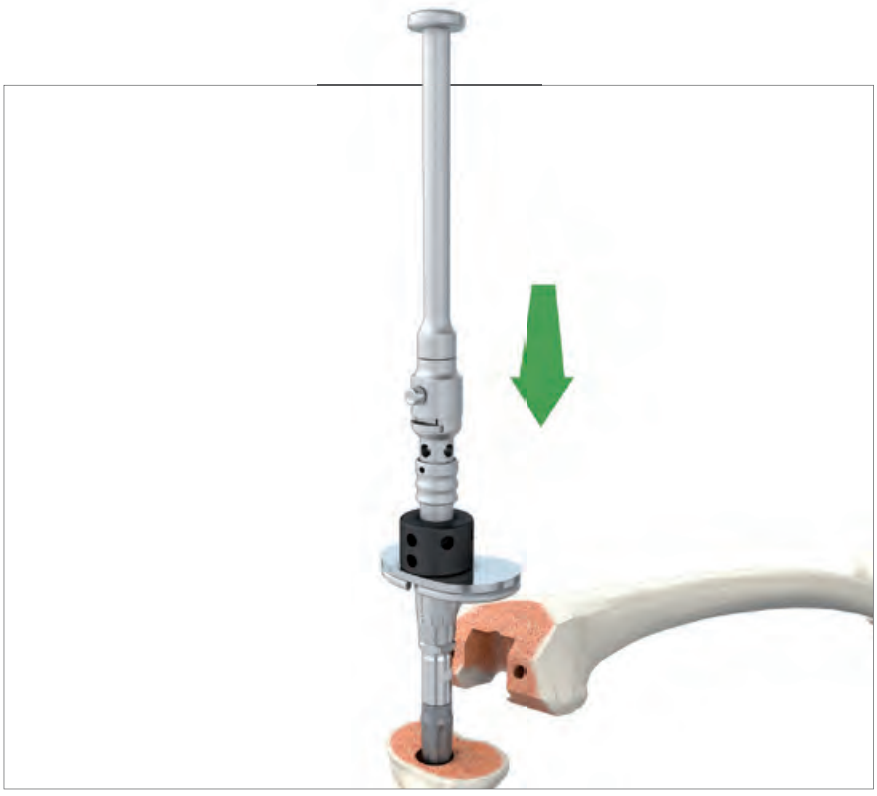
All bone interfering components of the implant system must be cemented except the ANCHORING STEMS Straight cementless. They must be dry and clean when placed.

122

The TIBIAL Component SC is inserted with the *Tibial Impactor/Extractor SC*.

! NOTE

For greater clarity, the following figures do not show the bone cement.

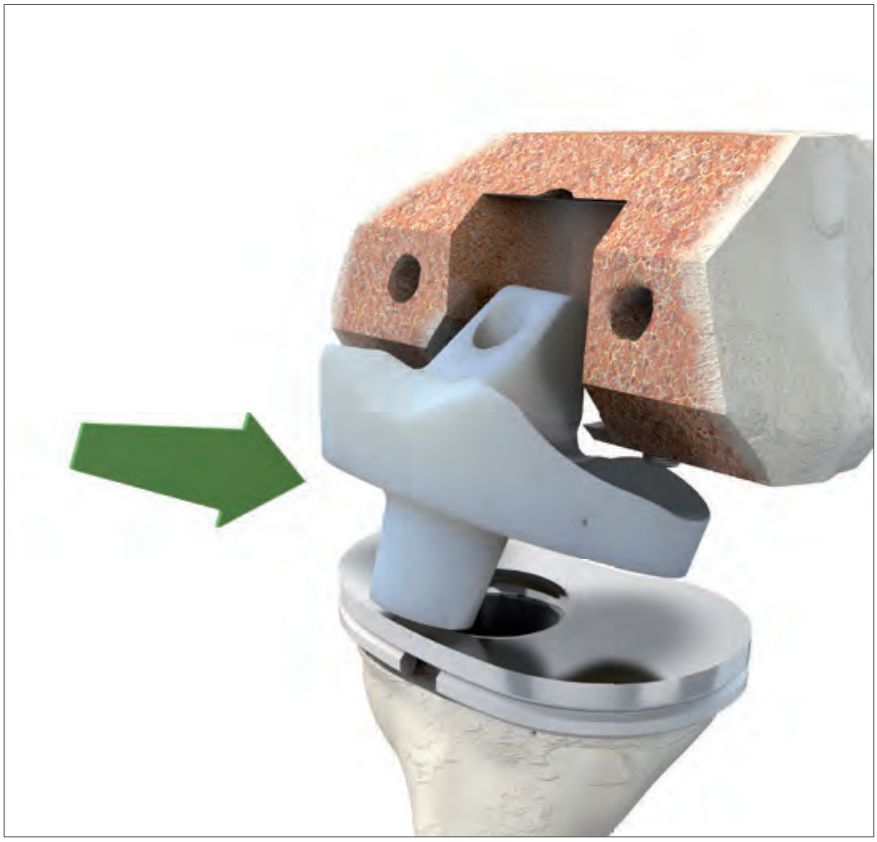


8 **Placing the Implant**

Placing the PE-INSERT SC Mobil

123

Once the cement has hardened, the PE-INSERT is placed.



8 Placing the Implant

Placing the FEMUR Component SC

124

Placing the FEMUR Component SC.

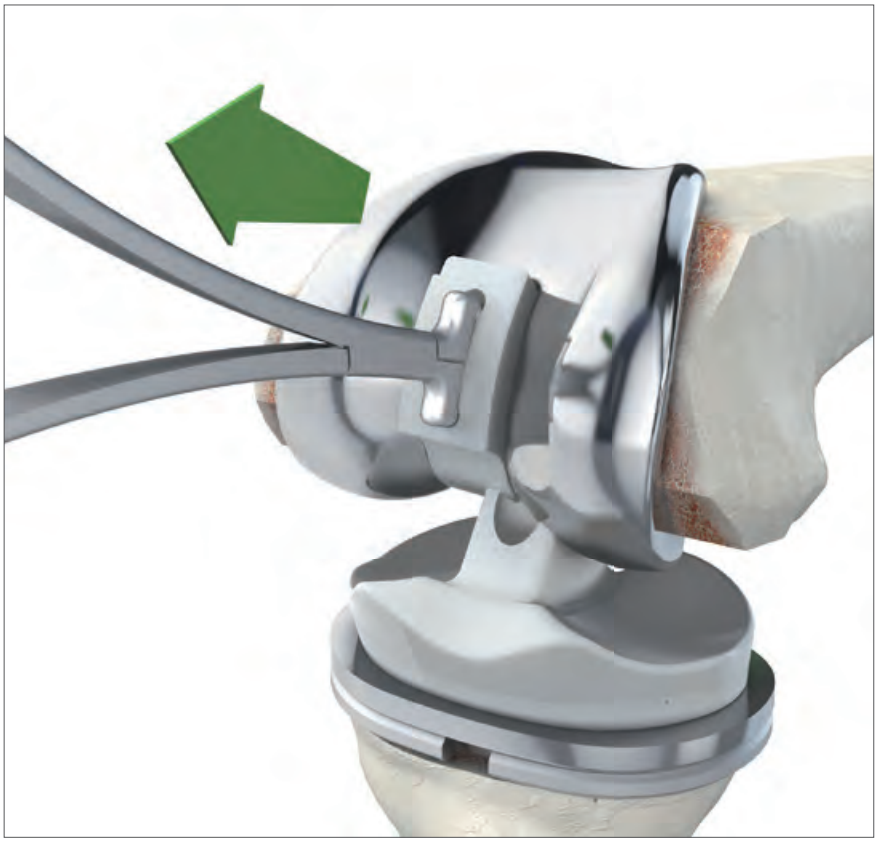
! NOTE

For greater clarity, the following figures do not show the bone cement.

125

After the FEMUR Component SC has been placed, the *CEMENT PROTECTION for Femur Component SC* and any residual cement must be removed. Particular attention should be paid to the open femoral box.

Thoroughly clean the implant components to remove any foreign bodies (such as residual cement, tissue, bone) from the implants.

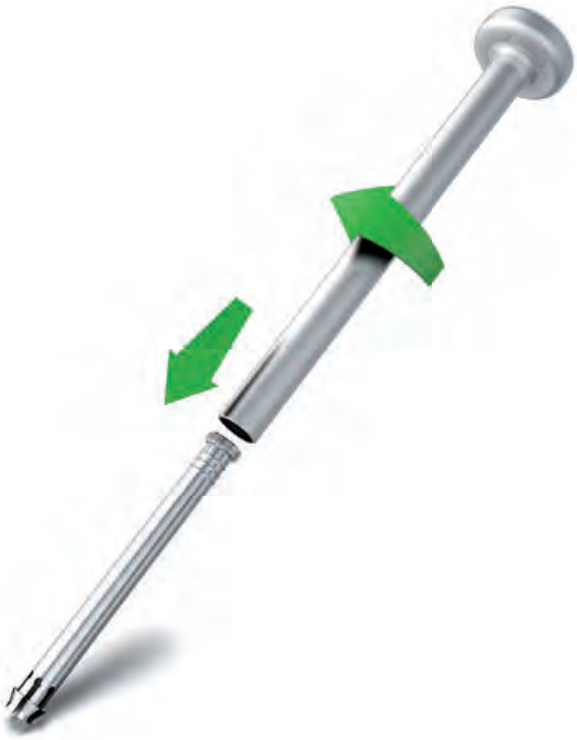


8 Placing the Implant

Securing PE-INSERT SC Mobil

126

The *Impactor for Locking Bolt* is screwed onto the Locking Pin.



127

The *Impactor for Locking Bolt* is driven in with the *Hammer 700g* to secure the PE-INSERT.

Make sure that the Locking Pin snaps into place within the TIBIA Component SC.

Finally, the wound closure of the knee joint is carried out in the usual manner.

8 **Placing the Implant**

Placing the Implant Components RH/TH

The TIBIA and FEMUR Components RH/TH are implanted in the same manner as the TIBIA and FEMUR Components SC (see items 122 and 124).

All bone interfering components of the implant system must be cemented except the ANCHORING STEMS Straight cementless. They must be dry and clean when placed.

128

After the FEMUR Component RH/TH has been placed, the *CEMENT PROTECTION for Femur Component RH/TH* and any residual cement are removed. Particular attention should be paid to the open femoral box.

When removing residual cement, take care to ensure that no cement interferes with or blocks the YOKE Neck RH/TH.

Thoroughly clean the implants to remove any foreign bodies (such as residual cement, tissue, bone) from them.

8 Placing the Implant

Placing the PE-INSERT RH/TH and the YOKE

129

The PE-INSERT RH/TH of the selected height is slid over the pin of the TIBIA Component RH/TH.

130

The *Yoke sling* is screwed into the YOKE, which is then inserted into the TIBIA Component RH/TH.

! NOTE

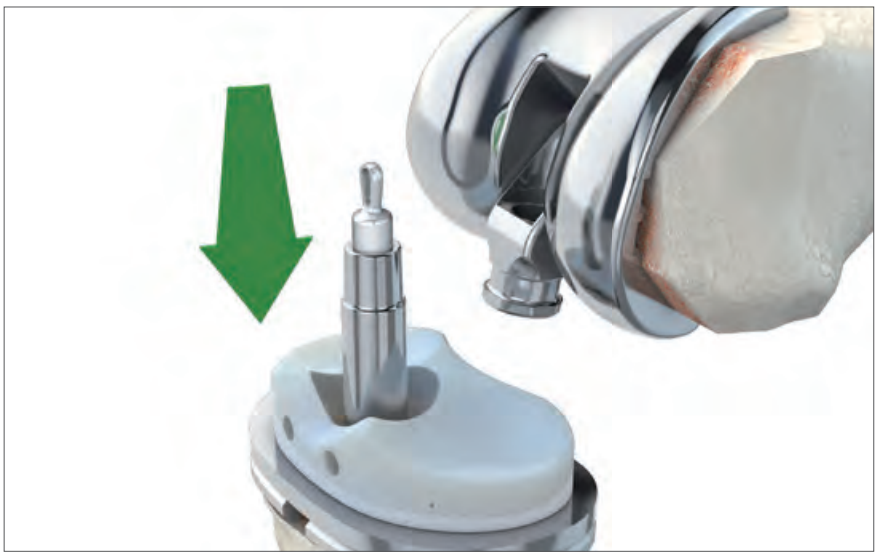
The YOKE should be selected according to the height of the PE-INSERT.

131

When placing the YOKE, make sure that the loop of the *Yoke sling* faces forward.

! NOTE

The *Yoke sling* may not be bent or damaged.



8 **Placing the Implant**

Disassembling the AXIS LOCK

132

Before the YOKE Neck RH/TH and YOKE can be connected, the AXIS LOCK must be temporarily removed from the preassembled FEMUR Component RH/TH. This is done with the aid of the *Socket Head Wrench AF5 / AF3,5*.

133

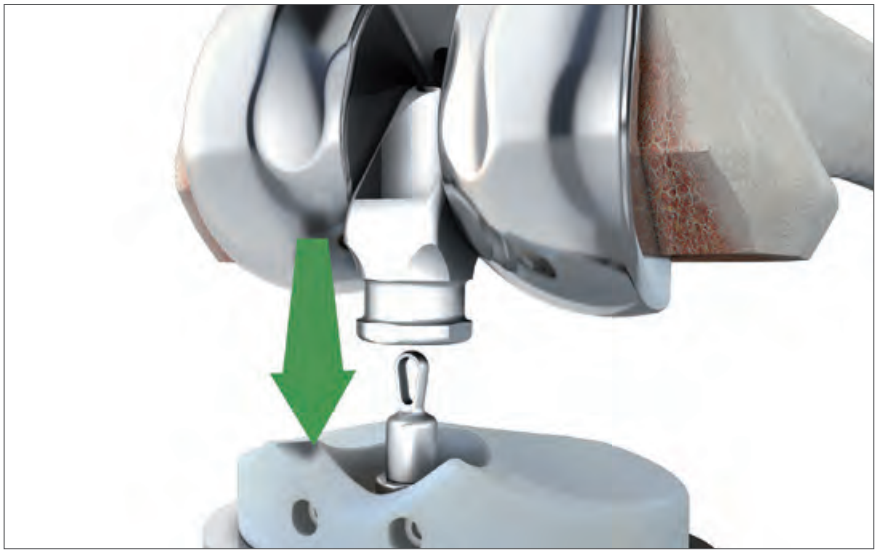
The AXIS LOCK is reinserted once the components have been joined together and tightened (see item 140).

8 Placing the Implant

Connecting the YOKE

134

The FEMUR Component RH/TH is positioned on the PE-INSERT so that the YOKE Neck RH/TH is centered over the YOKE. Moving the knee through its range of motion makes it easier to center the YOKE Neck RH/TH above the YOKE.

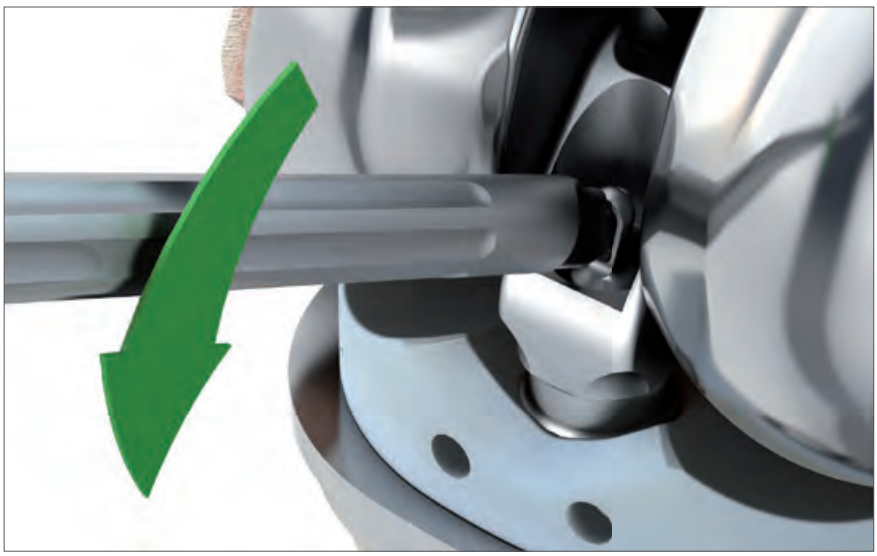


135

The loop of the *Yoke sling* will now be visible.

136

To pull the YOKE RH/TH into the YOKE Neck RH/TH the *Yoke assembling device* has to be used as a lever to pry the *Yoke sling* upwards.

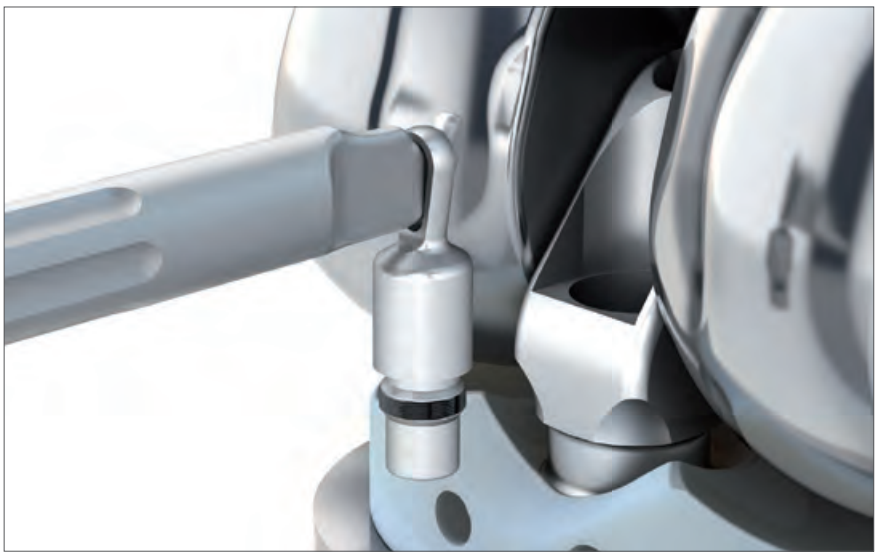


8 **Placing the Implant**

Removing the Yoke Sling

137

After the connection is made, the *Yoke Sling* is unscrewed with the *Yoke assembling device* and removed.

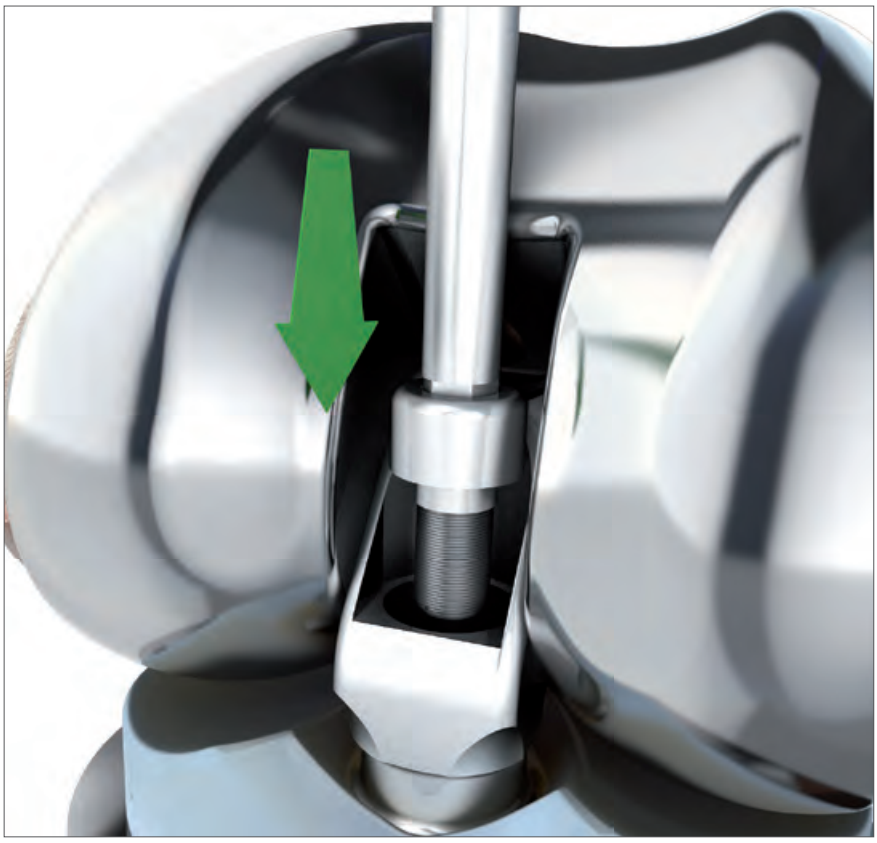


8 Placing the Implant

Securing and Tightening the YOKE

138

The YOKE is secured in the YOKE Neck RH/TH by the CLAMPING SCREW which is screwed in and tightened with the *Socket Head Wrench AF5*.



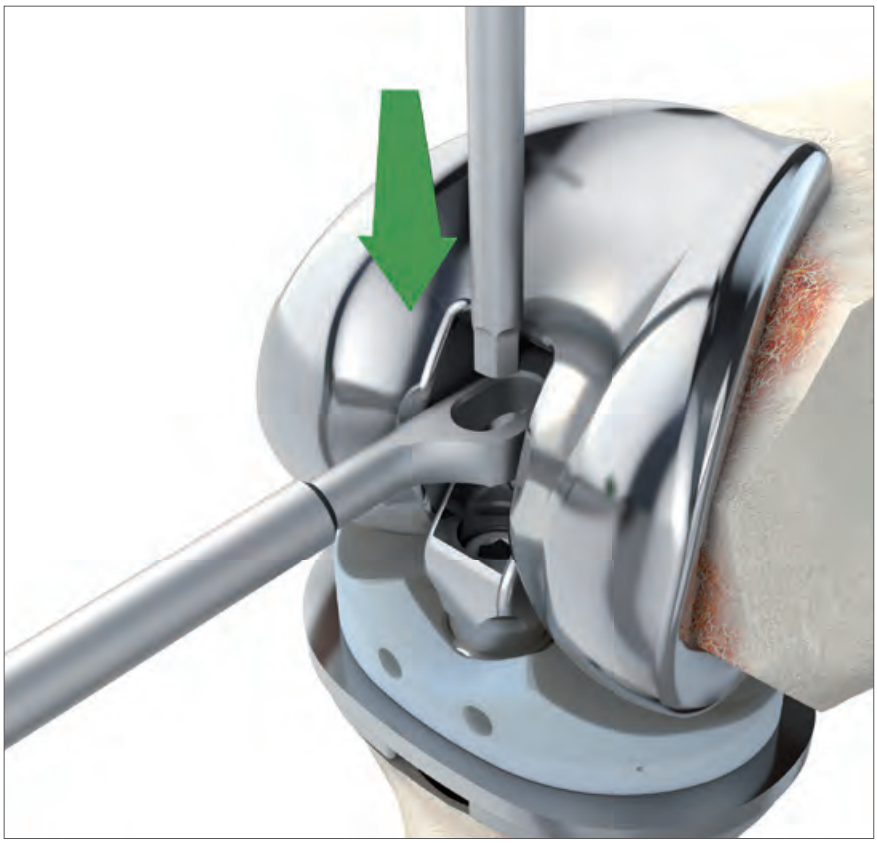
139

To tighten the CLAMPING SCREW, the *Counter Holder* is placed on the FEMUR Component RH/TH.

8 **Placing the Implant**

Securing and Tightening the YOKE

The *Socket Head Wrench AF5* (with the socket head wrench connection) is placed in the CLAMP SCREW. Then the *Torque Key 25 ± 1 Nm* and the *Tommy Bar for Socket Head Wrench AF 6* are attached.



! NOTE

Always use the *Torque Key 25 ± 1 Nm* exclusively with the *Counter Holder* in order to avoid inducing rotational stresses in the bone.

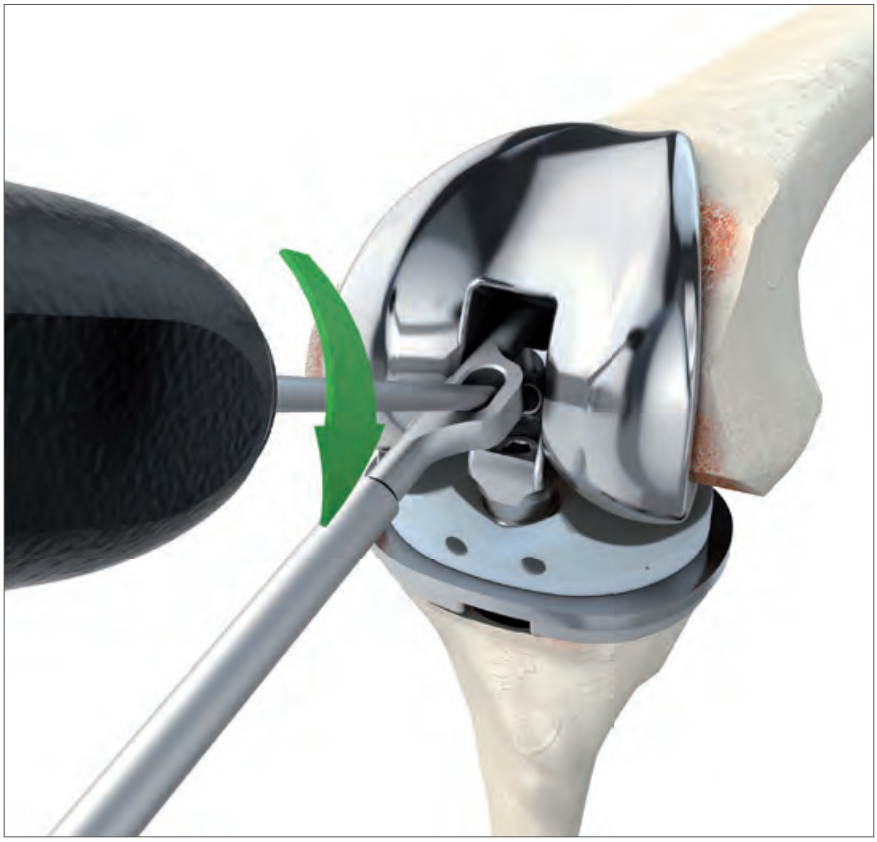
Then the CLAMP SCREW is tightened to a defined torque with the *Torque Key 25 ± 1 Nm.*

8 Placing the Implant

Assembling the AXIS LOCK

140

The AXIS LOCK, which had been temporarily removed, is reinserted once the implants have been joined together and tightened (see item 133). The *Socket Head Wrench AF5 / AF3,5 with snap ring* can be used for this purpose. The screw is hand tightened. Then the *Counter Holder* can be withdrawn again.

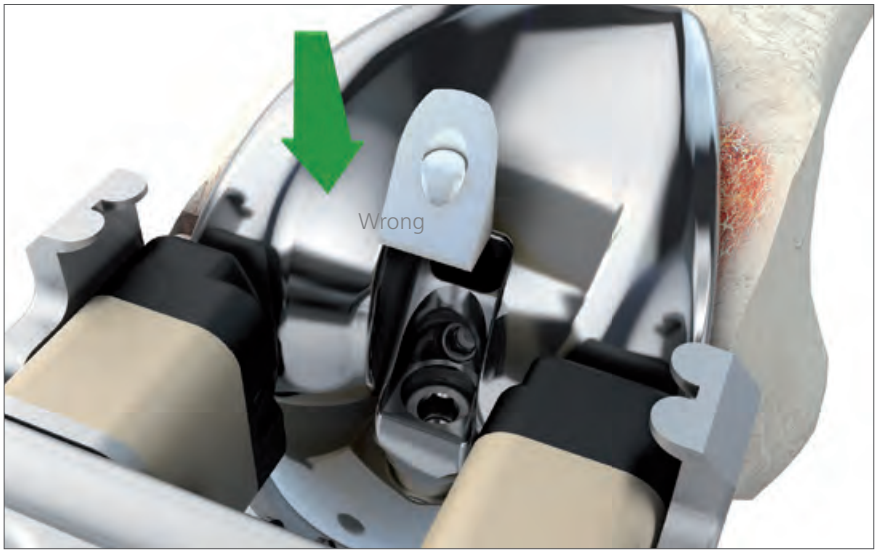


8 Placing the Implant

Placing and Securing the BUMPER for Femur

141

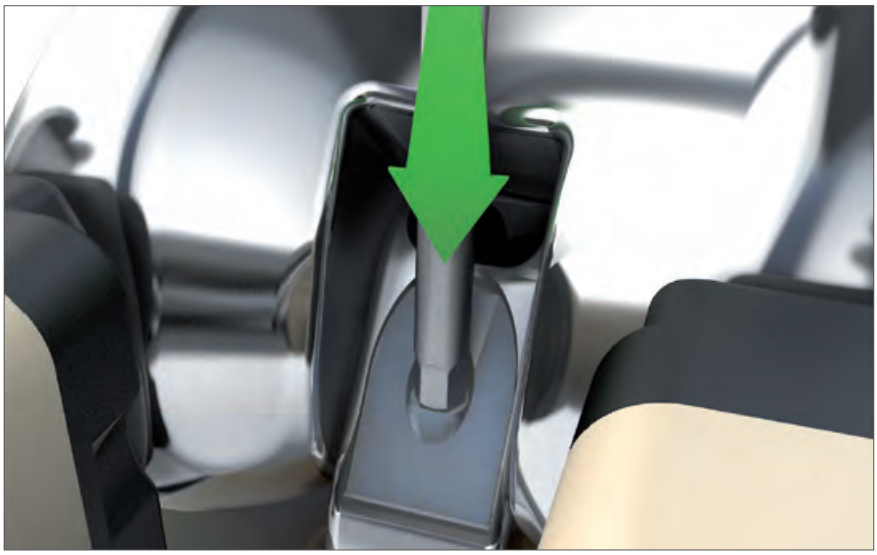
Finally, the *BUMPER for Femur RH/TH* is placed by hand.



The *BUMPER for Femur RH/TH* is pressed in and locked with the narrow side of the *Socket Head Wrench AF5 / AF3,5*.

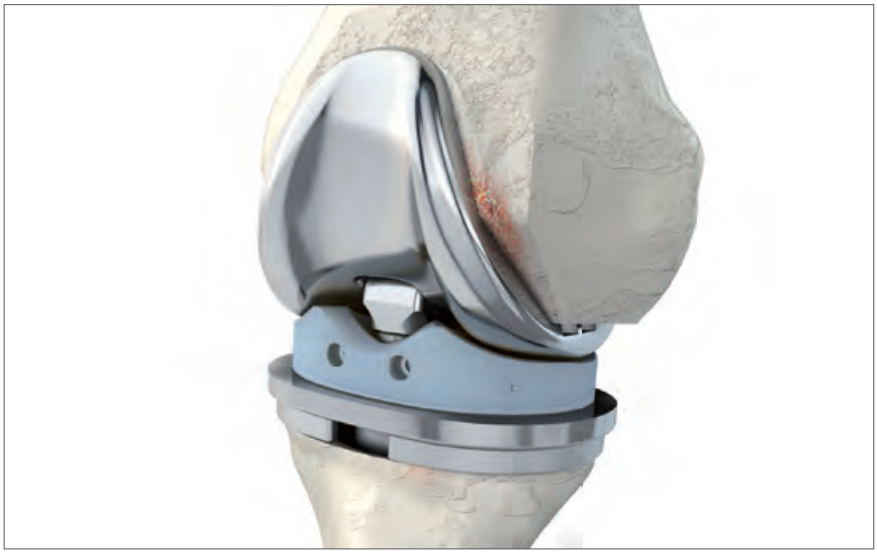
Wrong

Right



142

Finally, the wound closure of the knee joint is carried out in the usual manner.



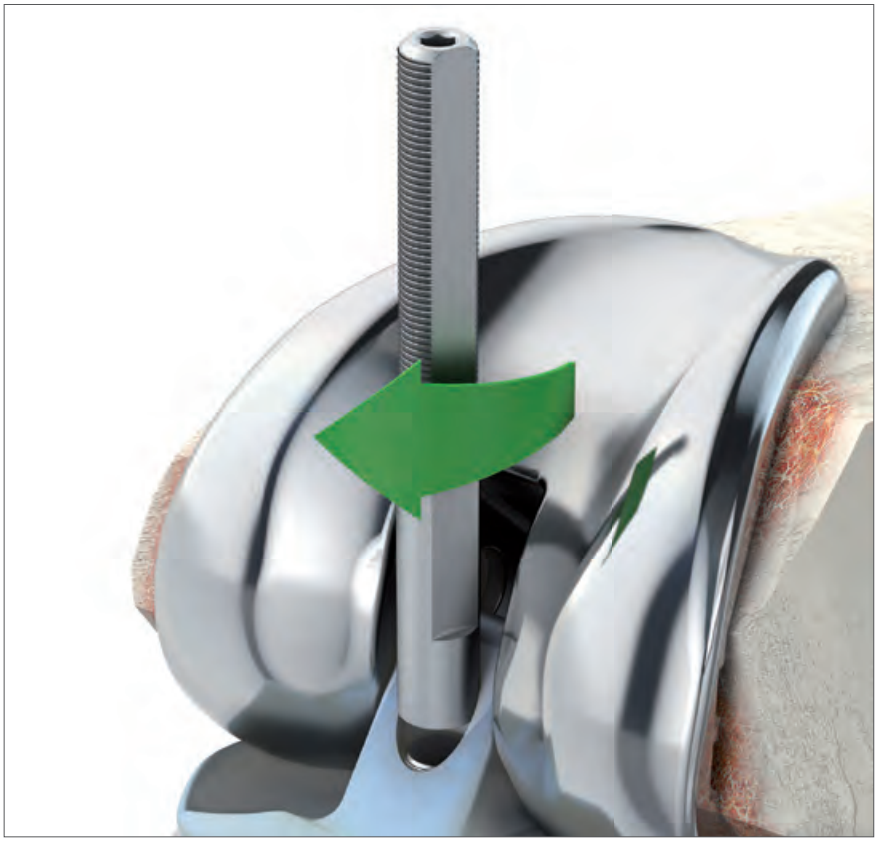
9 **Appendix**

Replacing the PE-INSERT SC Mobil

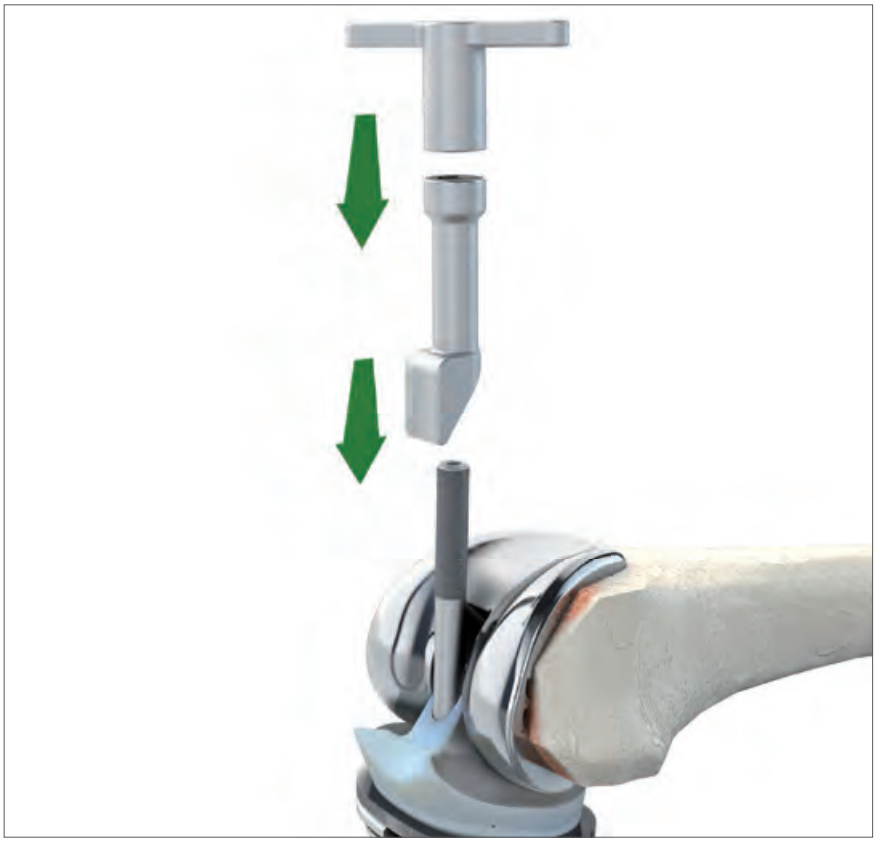
143

In order to replace the PE-INSERT SC Mobil, the Locking Bolt must be removed with the removal device.

To do this, the inner section of the *Extractor for Locking Bolt (inner)* is first screwed onto the Locking Bolt.



The *Extractor for Locking Bolt (outer)* is slid over it. Then the *Extractor for Locking Bolt (Knob)* is attached.

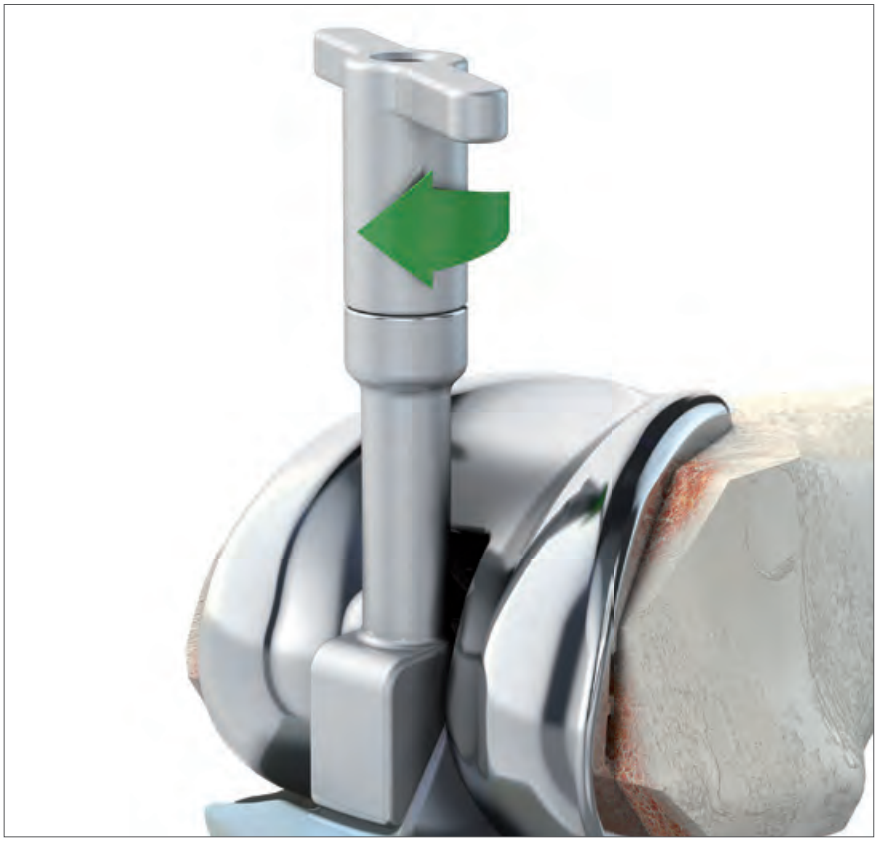


9 Appendix

Replacing the PE-INSERT SC Mobil

144

The Locking Bolt can then be removed by turning it clockwise.



145

A new Locking Bolt must be used whenever the PE-INSERT is replaced.

! NOTE

The implants are approved for one-time use only; do not reuse them.

9 **Appendix**

Disconnecting the YOKE

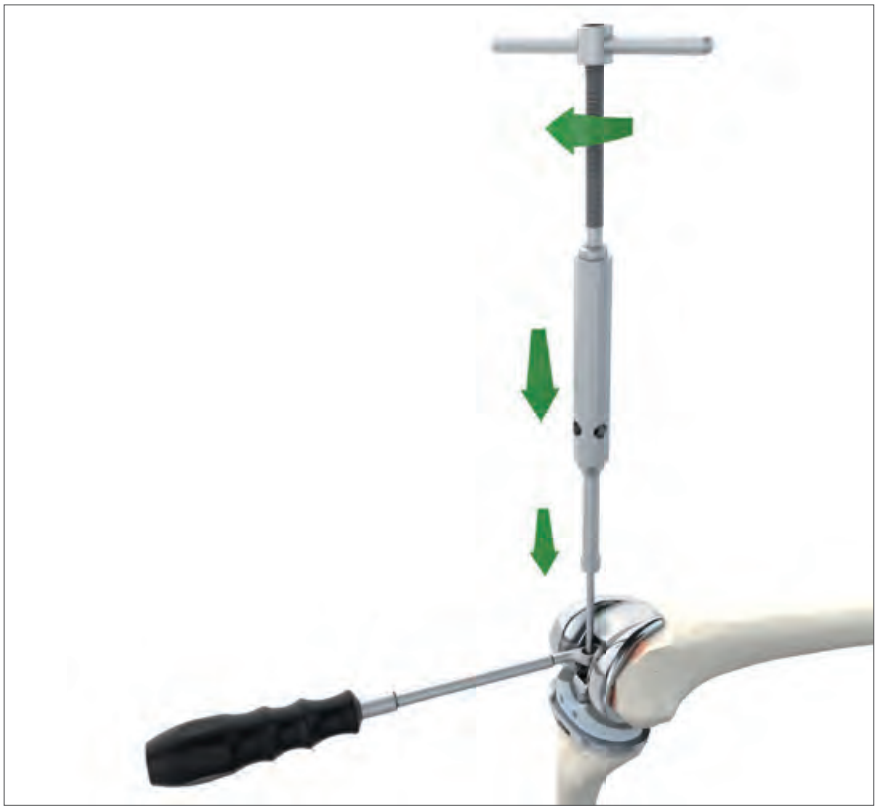
To disconnect the YOKE, first remove the *BUMPER for Femur* using a flat instrument like an osteotome. Then the AXIS LOCK is unscrewed using the *Socket Head Wrench AF5 / AF3,5*.

146

To remove the CLAMP SCREW, attach the *Socket Head Wrench AF5* and the *Tommy Bar for Socket Head Wrench AF 6* and unscrew the CLAMP SCREW. To remove the CLAMP SCREW, the *Counter Holder* is placed on the FEMUR Component RH/TH.

147

To release the YOKE from the taper connection, the *Removing Handle* is screwed into the YOKE Neck RH/TH, the *Removing Rod* is inserted, and the *Removing Mandril RH/TH* is screwed in until the taper connection separates. The *Counter Holder* is also used for separating the taper connection.



9 **Appendix**

Removing the YOKE and PE-INSERT

148

After the separating instrument has been removed, the YOKE can be removed from the TIBIA Component RH/TH with the aid of a clamp and the PE-INSERT RH/TH can be pushed off anteriorly.

! NOTE

The implants are approved for one-time use only; do not reuse them.

A new CLAMP SCREW and a new YOKE must be used whenever the PE-INSERT is replaced.

9 **Appendix**

Size Combinations for FEMUR and TIBIA Components (Revision)

		Tibia size					
		3	4	5	6	7[1]	8[1]
Femur size	3	■	■	■			
	4	■	■	■	■		
	5		■	■	■	■	
	6				■	■	■

[1] The TIBIA Components in sizes 7 and 8 are only available as UC/SC versions (not augmentable, 3° tibial slope) and SC versions.

The length of the Locking Bolt (SC) or the YOKE depends on the height of the PE-INSERT used.

The size of the following implants depends on the size of the FEMUR Component:

- PATELLA
- PE-INSERT
- CEMENT PROTECTION
- ADAPTER Femur
- AXIS LOCK Screw
- BUMPER Femur
- YOKE
- AUGMENTS Femur

Size Combinations for FEMUR Components and PATELLA (Revision)

	Patella	Diameter			
		24	28	32	36
Femur size	3	■	■	■	
	4	■	■	■	■
	5		■	■	■
	6		■	■	■

The patellar dissection is described in the primary surgical technique.

9 **Appendix**

UC/SC and SC Components

1 FEMUR Component SC cemented
- Size 3, 4, 5, 6 left and right

2 AUGMENT Femur SC, RH/TH
- Distal 5 mm, 10 mm, 15 mm, 20 mm
- Posterior 5 mm, 10 mm
- Distal/posterior 5 mm, 10 mm

3 ADAPTER Femur
- 0 mm, 4mm, 6 mm Offset

4 ANCHORING STEM Straight
- Cementless
  - Ø 13 …. Ø 22 mm (1 mm increments); Length 40, 80, 140 mm
  - Ø 23 …. Ø 30 mm (1 mm increments); Length 40, 80 mm
- Cemented
  - Ø 10 …. Ø 22 mm (2 mm increments); Length 40, 80, 140 mm

5 PE-INSERTS SC Mobil
- Height 7-17 mm (2 mm increments)

6 TIBIA Component UC/SC cemented
- Size 3, 4, 5, 6, 7, 8 left/ right
- Asymmetrical tibial component
- 3° posterior slope
- NOT augmentable

7 ADAPTER Tibia
- 0 mm, 4 mm, 6 mm Offset, 3°

8 PATELLA
- Size 3, 4, 5, 6
- Ø 24 / 8 mm, 28 / 8 mm, 32 / 8 mm, 36 / 8 mm

9 Appendix

SC Components

1 FEMUR Component SC cemented
- Size 3, 4, 5, 6 left /right

2 AUGMENT FEMUR SC, RH/TH
- Distal 5 mm, 10 mm, 15 mm, 20 mm
- Posterior 5 mm, 10 mm
- Distal/posterior 5 mm, 10 mm

3 ADAPTER Femur
- 0 mm, 4 mm, 6mm Offset

4 ANCHORING STEM Straight
- Cementless
  - Ø 13 …. Ø 22 mm (1 mm increments); Length 40, 80, 140 mm
  - Ø 23 …. Ø 30 mm (1 mm increments); Length 40, 80 mm
- Cemented
  - Ø 10 …. Ø 22 mm (2 mm increments); Length 40, 80, 140 mm

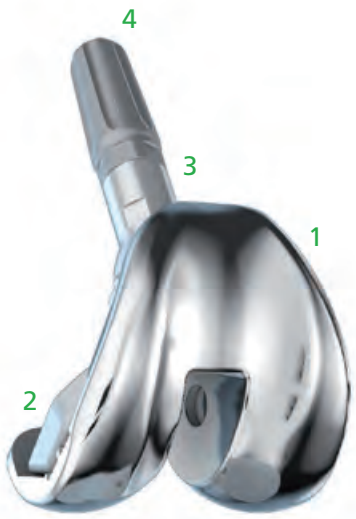
5 PE-INSERT SC Mobil
- Height 7-17 mm (2 mm increments)

6 TIBIA Component SC cemented
- Size 3, 4, 5, 6, 7, 8 left / right
- Symmetrical tibial component
- 0° posterior slope
- Augmentable

7 AUGMENT Tibia SC
- Medial 5 mm, 10 mm, 15 mm
- Lateral 5 mm, 10 mm, 15 mm

8 ADAPTER Tibia
- 0 mm, 4 mm, 6 mm offset, 3°

9 PATELLA
- Size 3, 4, 5, 6
- Dia. 24 / 8 mm, 28 / 8 mm, 32 / 8 mm, 36 / 8 mm



9 **Appendix**

RH/TH Components

1 FEMUR Component RH/TH cemented
- Size 3, 4, 5, 6 left / right

2 AUGMENT Femur SC/RH/TH
- Distal: 5 mm, 10 mm, 15 mm, 20 mm
- Posterior 5 mm, 10 mm
- Distal/posterior 5 mm, 10 mm

3 ADAPTER Femur
- 0 mm, 4 mm, 6mm Offset

4 ANCHORING STEM Straight
- Cementless
  - Ø. 13 …. Ø 22 mm (1 mm increments); length 40, 80, 140 mm
  - Ø. 23 …. Ø 30 mm (1 mm increments); length 40, 80 mm
- Cemented
  - Ø 10 …. Ø 22 mm (2 mm increments); length 40, 80, 140 mm

5 PE-INSERT RH/TH
- Height 7-25 mm (2 mm increments)

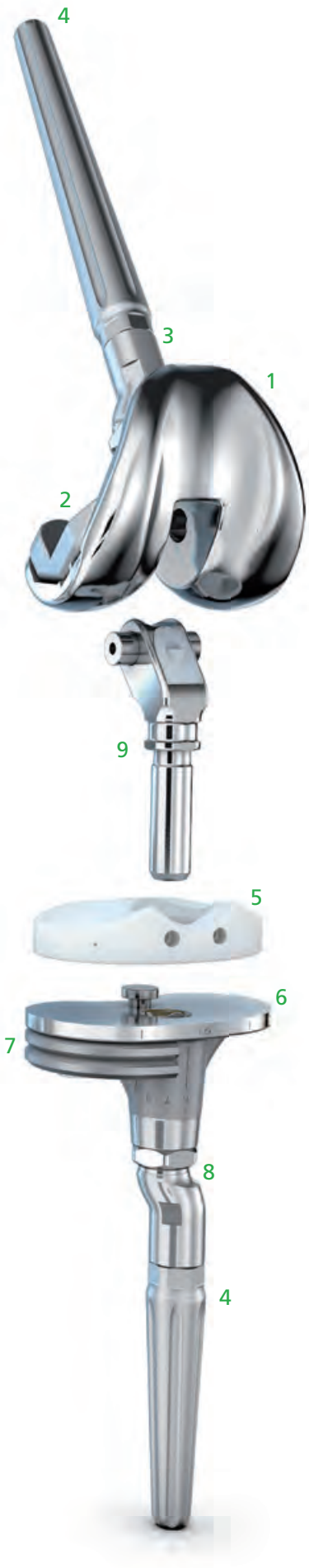
6 TIBIA Component RH/TH cemented
- Size 3, 4, 5, 6 left / right
- Symmetrical tibial component
- 0° posterior slope
- Augmentable

7 AUGMENT Tibia SC/RH/TH
- Medial 5 mm, 10 mm, 15 mm
- Lateral 5 mm, 10 mm, 15 mm

8 ADAPTER Tibia
- 0 mm, 4 mm, 6 mm offset, 3°

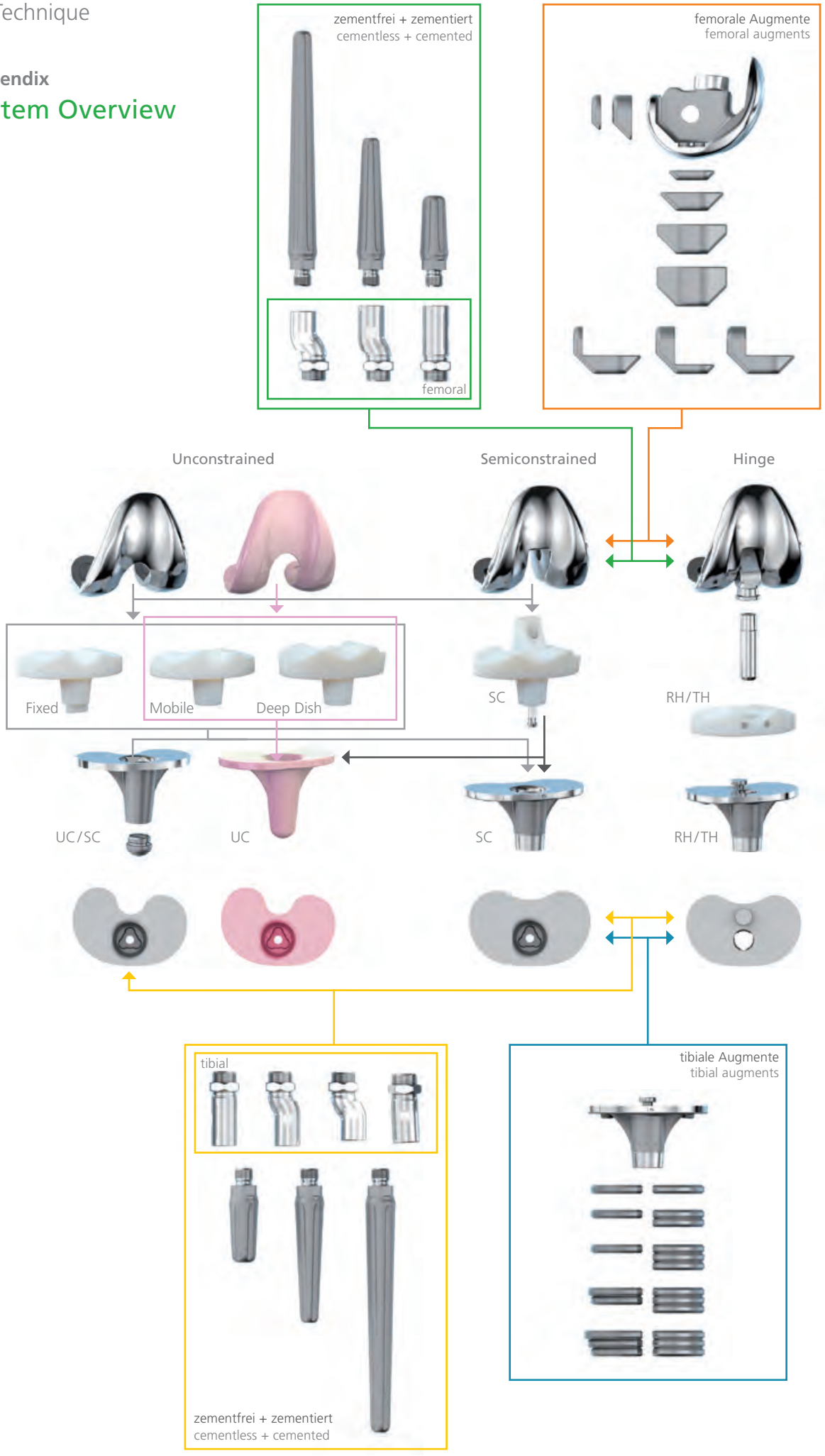
9 YOKE for PE Insert
- Height 7-25 mm (2 mm increments)

10 PATELLA
- Size 3, 4, 5, 6
- Ø 24 / 8 mm, 28 / 8 mm, 32 / 8 mm, 36 / 8 mm



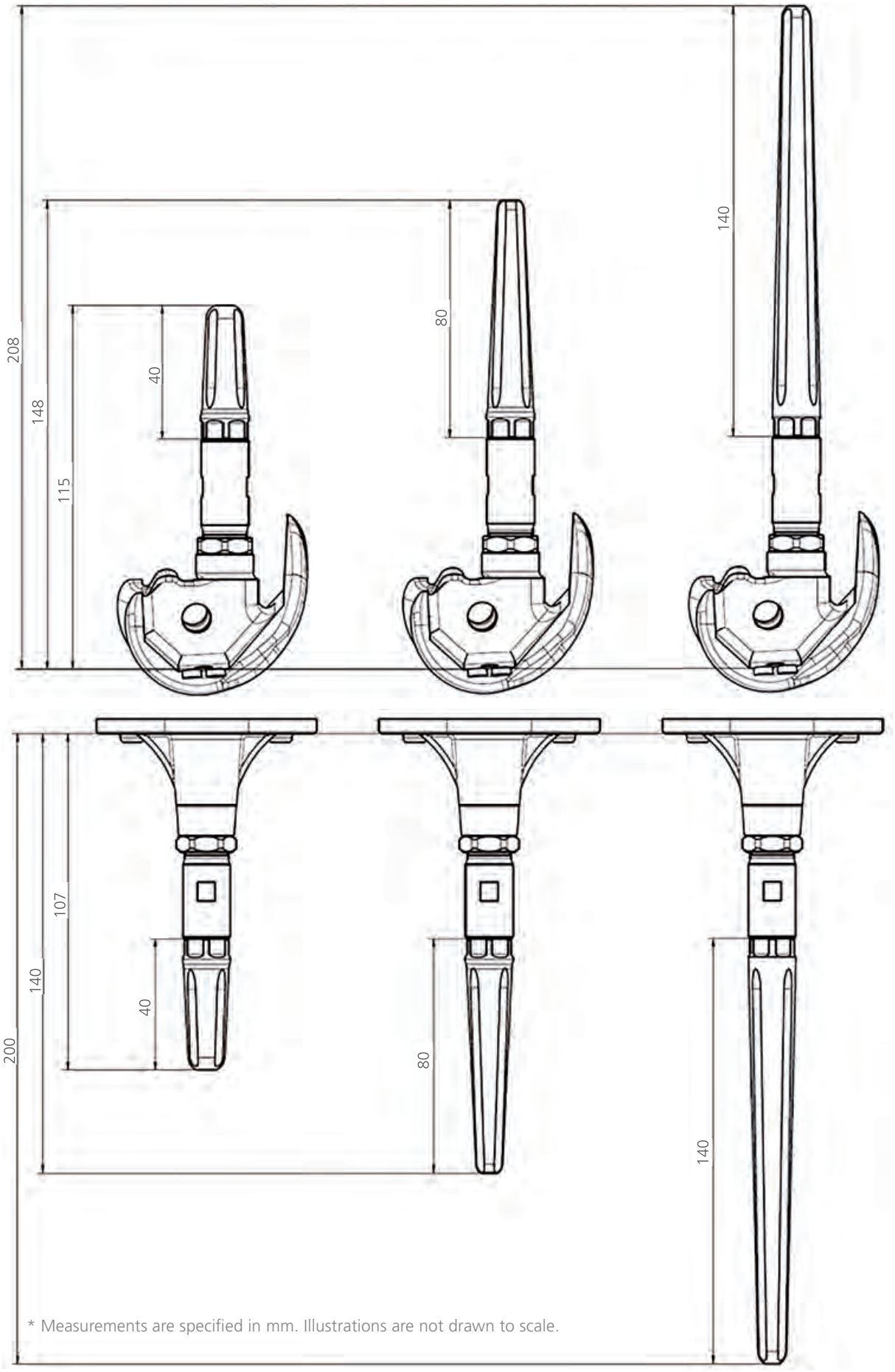
9 Appendix

System Overview



9 Appendix

Construct Lengths (All Measurements Rounded)

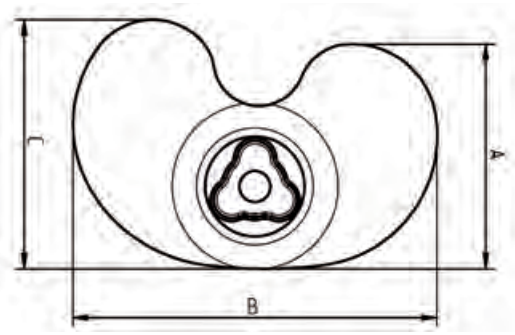


* Measurements are specified in mm. Illustrations are not drawn to scale.

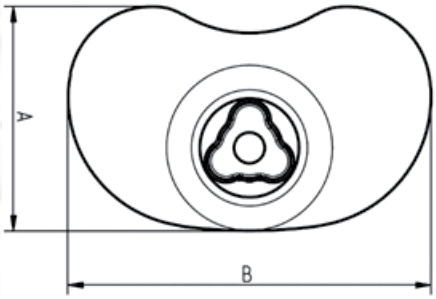
9 Appendix

Dimensions – TIBIA Components (All Measurements Rounded)

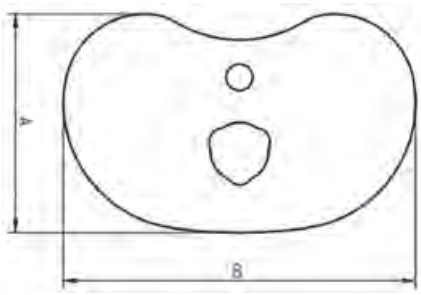
UC/SC



SC



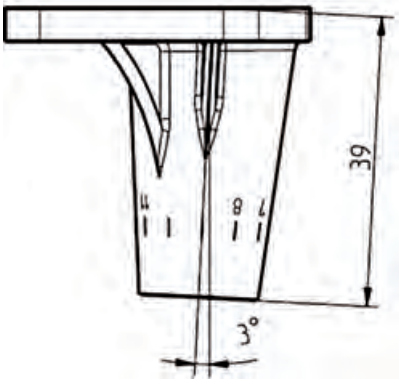
RH/TH

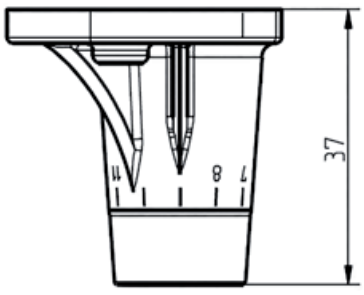


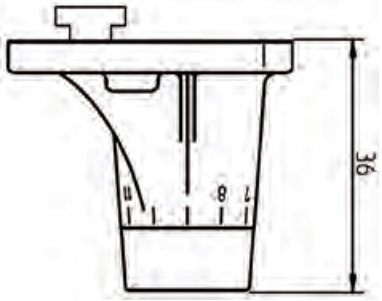
Size	A [mm]	B [mm]	C [mm]
1	36,9	60	40,9
2	38,8	63,2	43
3	41,1	66,5	45,3
4	43,3	70	47,7
5	45,9	74,2	50,5
6	48,6	78,7	53,5
7	51,6	83,4	56,8
8	54,7	88,4	60,2

Size	A [mm]	B [mm]
3	41,1	66,5
4	43,3	70
5	45,9	74,2
6	48,6	78,7
7	51,6	83,4
8	54,7	88,4

Size	A [mm]	B [mm]
3	41,1	66,5
4	43,3	70
5	45,9	74,2
6	48,6	78,7



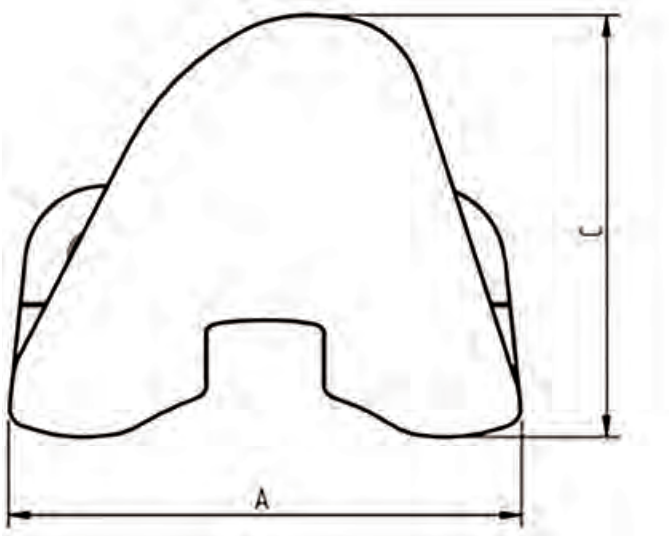


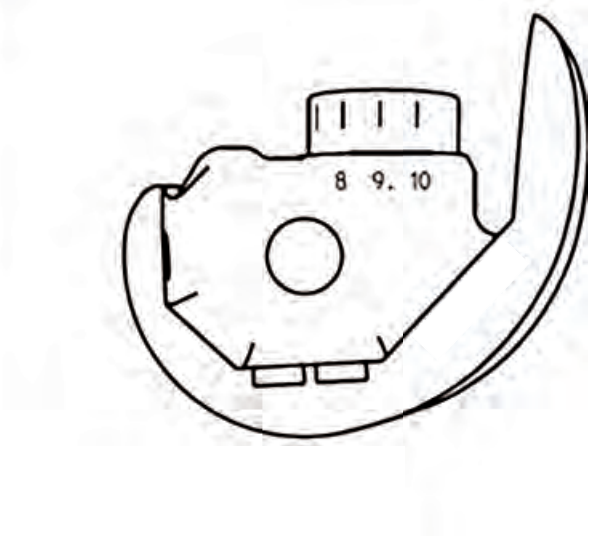


* Measurements are specified in mm. Illustrations are not drawn to scale.

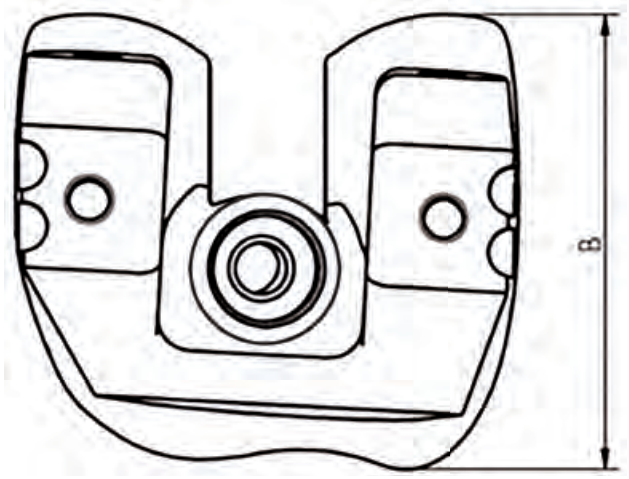
9 Appendix

Dimensions - FEMUR Components SC and RH/TH (All Measurements Rounded)





Size	A [mm]	B [mm]	C [mm]
3	61,5	55,4	50,4
4	65,5	59,4	53,6
5	70,8	64,2	57,9
6	77,2	70,2	63



* Measurements are specified in mm. Illustrations are not drawn to scale.

! NOTE

This brochure is intended for physicians only and is not suitable as a source of information for lay persons. The information about the products and/or procedures described in this brochure is of a general nature and does not represent the advice or recommendation of a physician. The information provided here does not in any way represent an opinion on the diagnosis or treatment of any specific medical case. The respective patient must be examined individually and advised accordingly. This brochure can neither completely nor partially substitute these measures.

The information contained in this brochure has been produced and compiled by medical experts and qualified PETER BREHM employees to the best of their knowledge. The greatest possible care has been taken to ensure that the information provided is correct and comprehensible.

PETER BREHM
Die Präzision in Titan
für den Menschen

PETER BREHM GmbH
Am Mühlberg 30
91085 Weisendorf

Telefon + 49 9135 7103-0
Fax + 49 9135 7103-16

peter-brehm.de

pb-bpks-rev-op-LBL 427-21-20190711-ENG-tc