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Fitmore® Hip Stem

Surgical Technique

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Introduction

The Fitmore Hip Stem is a curved uncemented stem with a trapezoidal cross section, which is coated proximally with Ti-VPS (Titanium Vacuum Plasma Spray) and rough-blasted distally.

The Fitmore Hip stem system comprises 56* sizes, consisting of 3 stem families A, B and C (family B with two offsets), designed to cover different morphologies.

The fixation is mainly metaphyseal, in the intertrochanteric region. The rasps and the corresponding implants are not inserted straight into the femoral canal, but follow its natural curve. This is designed to help preserve the area of the greater trochanter and the insertion of the gluteal muscles.

The Offset Options

The Fitmore Hip Stem offers a wide range of offset options to address a wide variety of anatomic offsets among individuals. The design allows to restore biomechanical characteristics, such as the femoral offset and the leg length, while achieving soft tissue balance around the hip joint.

The same surgical technique is used for implantation of the Fitmore Hip Stem family A, family B, family B-Extended and family C.

In most cases, the B families might be the appropriate choice because they fit in most femora and offer the possibility to accommodate a bigger offset (B and B-Extended options). The A family might be more suitable for hips with a small offset, whereas varus hips with long necks may be better treated with C family stems.

* The size A1 is not available for commercial use in the U.S. market

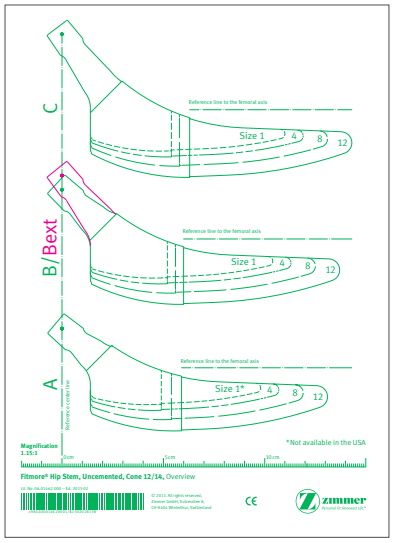


Figure 1

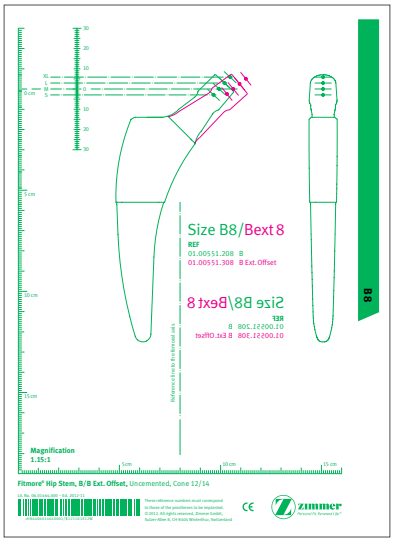


Figure 2

Pre-operative Planning

Accurate preoperative planning is important with the use of the Fitmore hip stem.

The Primary Objectives of Preoperative Planning are to

1. Determine preoperative leg length
2. Determine acetabular component size and position
3. Choose the family of the Fitmore Hip Stem that may best restore offset, center of rotation and match the medial contour
4. Determine the size, the position and fit of the stem

In addition, preoperative planning will assist in identifying bone deformities and potential problems that might require special instrumentation during surgery. In the event that adverse bone conditions are present, it is recommended to have a C-arm ready in the operating room in order to assess the implant position intraoperatively.

Manual Pre-operative Planning

The Fitmore Hip Stem provides a comprehensive selection of femoral X-ray templates in 115% and 120% magnifications (Figure 1). It is recommended to use a radiographic marker **to** assess the X-ray magnification and select the appropriate template. Templates are positioned over the Anterior/Posterior (A/P) X-rays to best decide the correct implant size and center of rotation.

Digital Pre-operative Planning

The Fitmore Hip Stem digital templates are available through various digital template providers. Zimmer Biomet's Orthosize® software can also be used and accessed via orthosize.com.

When using digital templating for a primary Total Hip Replacement (THR), it is necessary to use a magnification marker with a known dimension. This is required to calculate the correct magnification.

Once the appropriate magnification has been determined, the system maybe used to decide the correct implant size and center of rotation (Figure 2).

Templating the Femur

Choose the appropriate family and size of the stem: Three different families (A, B, C) of the Fitmore Hip Stem are shown on the overview template (Figure 1). With this template the most suitable family is determined by restoring anatomical offset and by confirming that the medial curve of this stem follows closely the inner line of the cortex in the calcar region when the stem is in axis with the femoral canal. After choosing the correct stem family with the help of the overview template, the appropriate size is selected using the family-specific templates (Figure 2). The width of the medullary canal determines the body size.

Figure 3a

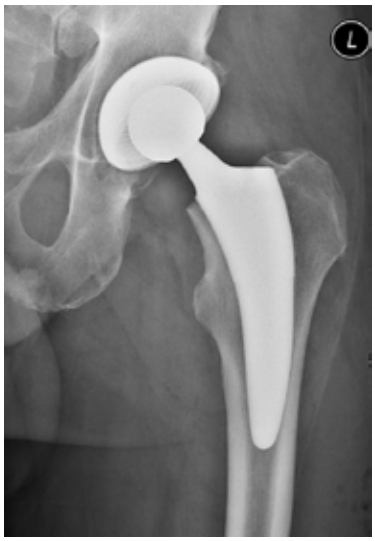


Figure 3b

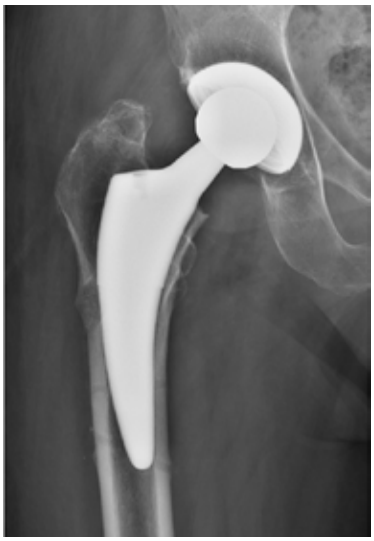


Figure 3c

Patient Positioning and Surgical Approach

The Fitmore Hip stem can be implanted using any of the standard and minimally invasive approaches for total hip replacement.

The aim of the approach selected is to provide optimal visualization of both the acetabulum and proximal femur and to spare as much bone and tissue as possible.

Osteotomy of the Femoral Neck

Once the femoral head has been dislocated from the acetabulum, proceed to the femoral neck resection according to the pre-operative planning, beginning near the lateral base of the femoral neck, with a 45° inclination (Figure 3a). Depending on the planning and the individual anatomy the osteotomy may vary in height: valgus hips are usually cut above and varus hips below the saddle (Figure 3b and 3c). The level of the osteotomy is also influenced by the antetorsion of the neck of the femur: the greater the antetorsion, the lower the level of the osteotomy.

Care needs to be taken that the height of the osteotomy allows the chosen stem to achieve sufficient proximal fixation. This is facilitated when the coating of the stem is well covered by bone (ideally the entire proximal coating is covered).

Preparation of the Acetabulum

When complete visualization of the acetabulum is achieved, prepare the acetabulum as instructed in the appropriate surgical technique. The correct positioning of the acetabulum is one of the most critical parts of a total hip arthroplasty.

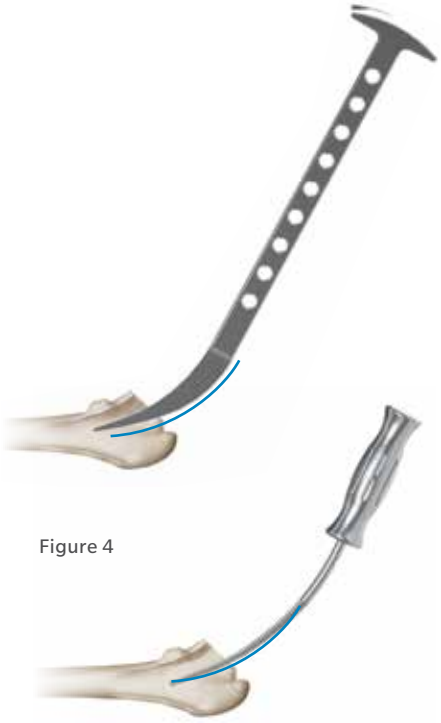


Figure 4

Figure 5

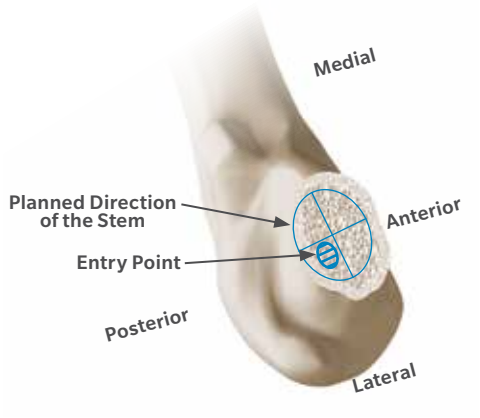


Figure 6

Femoral Canal Opening

The femoral canal is entered by opening the medullary canal with a starter instrument (curved chisel and/or curved hand rasp (Figure 4 and Figure 5) which enters into the resection surface slightly laterally to the femoral neck centre on the posterior side (Figure 6), and should be in line with the axis of the femur.

It is recommended to direct the entry point towards the medullary canal following the axis of the femur. This should ensure the correct introduction of the starter instrument (curved hand rasp and/or curved chisel) and the subsequent starter rasp. The starter instrument should only be inserted and not twisted in the cancellous bone in order to avoid the creation of a too large hole in the AP plane. Care must be taken to preserve as much bone as possible. In high resections of the neck the lateral neck cortex may be opened to allow correct stem size and prevent varus position. The use of an awl is not recommended. The insertion of the starter instrument will determine the plane of antecurvation of the femur.

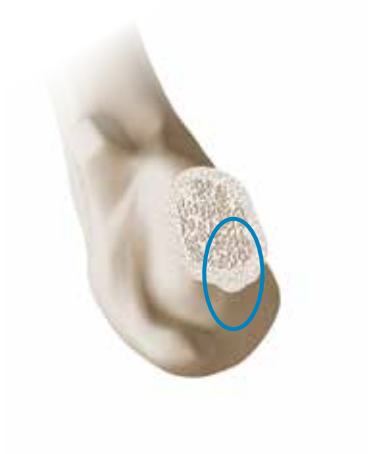


Figure 7

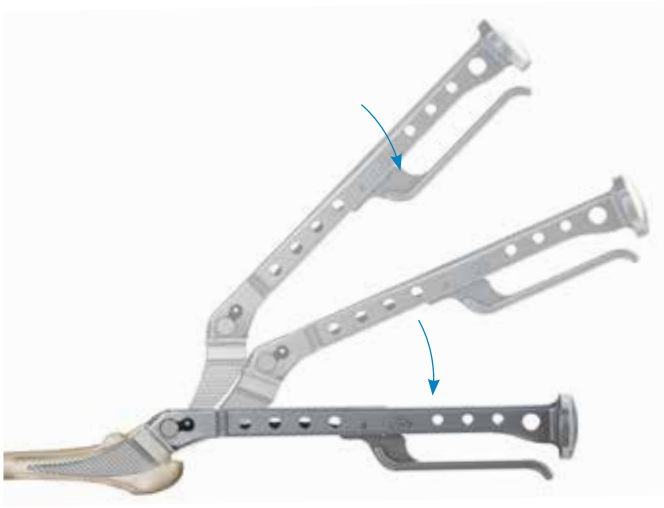


Figure 8

Femoral Canal Opening (cont.)

Initiate the femoral preparation with the starter rasp, following the femoral canal. Progress with the smallest rasp size of the stem family chosen in the preoperative planning. Rasps are always inserted in the entry point of the femoral canal. With mallet blows, the rasps are directed towards the medullary canal by giving the rasps a valgus moment (Figure 8), therefore allowing the rasps to follow the curvature and preventing a straight insertion. The femoral canal is prepared, using rasps of increasing size, until maximum stability without further rasp movement into the femur is obtained. The lateral cortex of the femoral neck can be a barrier to bring in the stem deeper, especially with high resections. It may prevent one from rasping up to planned stem size. Therefore it is important to provide enough mediolateral space by opening part of the postero-lateral cortex. (Figure 7). If the medial fit of the rasp is not adequate, i.e. there is no cortical contact in the calcar region, one should consider switching from stem family A to B or from stem family B to C. In this case it is recommended to start rasping two sizes smaller than the last rasp size used. Example: If the last rasp used was A8, start again with rasp B6.

- **Note 1:** Never switch from C to B, or C to A, or B to A.
- **Note 2:** Do NOT switch directly from family A to C, as an intermediate step is required.

It must be taken into consideration that by changing the stem family, the offset is also changed. Therefore, the new stem family and the preoperatively planned stem height need to be reassessed in order to avoid lengthening the leg. In most cases switching families means downsizing one to two sizes within the new stem family.

- **Note 3:** In small femora with hard bone it is recommended to use the 0 mm Fitmore Rasps, available in sizes 1 to 5 as in these cases the built-in press-fit resulting from the Titanium Vacuum Plasma-Spray coating may inhibit the full seating of the final stem implant to the planned level. The standard rasps have a 0.4 mm – 0.6 mm press-fit per side whereas the 0 mm rasps are slightly sharper and have no built in press-fit.
- **Note 4:** Care must be taken to stabilize the rasp handle in A/P during the whole rasping procedure in order to avoid the creation of a gap on the anterior or posterior metaphyseal side, which could compromise the proximal fit.

Design Coding and Labeling

Figure 9

Design Coding

Figure 10

Trial Reduction

Remove the rasp handle and leave the rasp in the femoral canal. Choose the appropriate trial neck following the stem family concept, i.e. A, B, B-Ext. or C. The stem families are indicated on the top of the trial necks (Figure 9). Each family has a specific design coding feature (Figure 10) to prevent incorrect rasp body and trial neck mating. Once the trial neck is inserted, check the distance between lesser trochanter and taper compared with your preoperative planning. If the distance is consistent with the preoperative plan, apply the appropriate trial head to the trial neck and proceed with the trial reduction.

Joint stability and soft-tissue tension are assessed. This procedure is repeated as necessary, using trial heads of different lengths, until optimal offset, leg length and stability are achieved. A trial reduction should not allow significant push-pull of the joint in full extension. The range of motion is checked to avoid bony and implant impingement as well as instability.

Figure 11

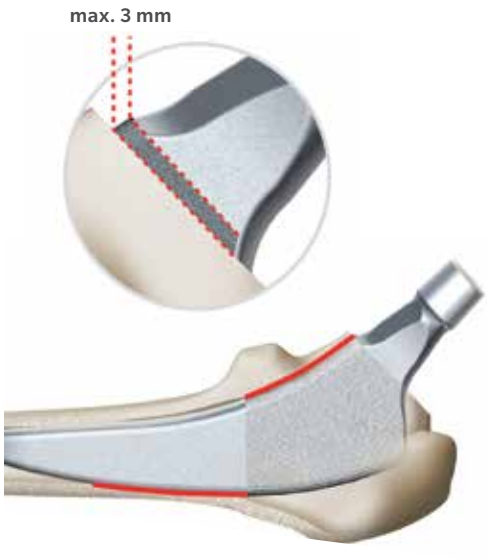


Figure 12

Femoral Implant Insertion

After removal of the rasp, the selected stem is inserted and driven in until cortical contact stabilizes the stem. It is recommended to hold the straight stem driver in at least 30° angle to the stem axis (Figure 11), in order to give a valgus moment and prevent straight insertion of the stem and risking fractures of the calcar.

It is important to adjust the force of the mallet blows to the quality of the bone and to stop hammering immediately when the dull sound (cancellous bone) changes to the sharp sound (cortical bone).

The level of osteotomy and proximal coating should match closely. The uncovered proximal coating should ideally not exceed 3 mm (Figure 12).

Note 5: In small femora with hard bone it is recommended to use the 0 mm Fitmore rasps, available in Sizes 1 to 5, as in these cases the built-in press-fit resulting from the Titanium Vacuum Plasma-Spray coating may inhibit the full seating of the final stem implant to the planned level.

Also make sure that no bony structures around the postero-lateral cortical ring are preventing the stem to get fully seated.

After driving in the stem, the taper protector is removed from the taper and a trial head may be mounted for a final trial reduction. Once the final range of motion and "shuck" tests are completed and the appropriate femoral head implant is confirmed, remove the Femoral Head Provisional. Ensure that the 12/14 taper is clean and dry. Place the selected femoral head on the taper by hand and twist with downward force. Impact the head with at least one hard mallet strike on the Head Impactor. Test the security of the head fixation by trying to remove it by hand. After reduction of the joint, the range of motion and the stability of the joint are re-assessed throughout the whole range of motion.

Wound closure is carried out according to the specific technique and approach used.

Figure 13

Figure 14

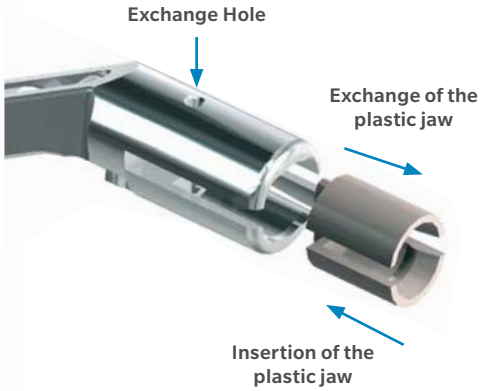


Figure 15

Intraoperative Extraction of the Fitmore Hip Stem

If the stem needs to be removed intraoperatively, only the specific extraction instrument, which protects the taper of the stem, may be used. Slide the extraction instrument over the stem taper (Figure 13). Tighten the exchangeable plastic jaws by closing the lever. Make sure that the instrument is firmly fixed. Remove the stem by hammering back on the extraction instrument (Figure 14).

Note 6: The extraction instrument must be used exclusively for intraoperative stem extraction. It is not suitable for revision cases. The plastic jaws should be exchanged if damaged, deformed or if they do not firmly fix the stem taper.

In case of intraoperative repositioning of the stem the surgeon must verify the integrity of the stem.

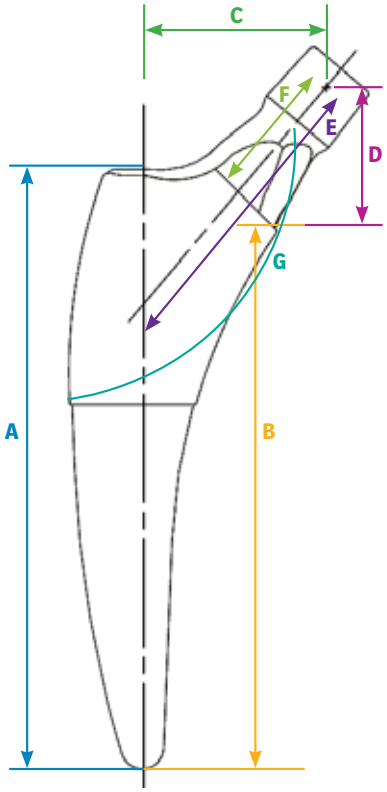
Exchange of the Plastic Jaw

A pin is used through the hole to release the plastic jaws (Figure 15).

Insertion of the Plastic Jaw

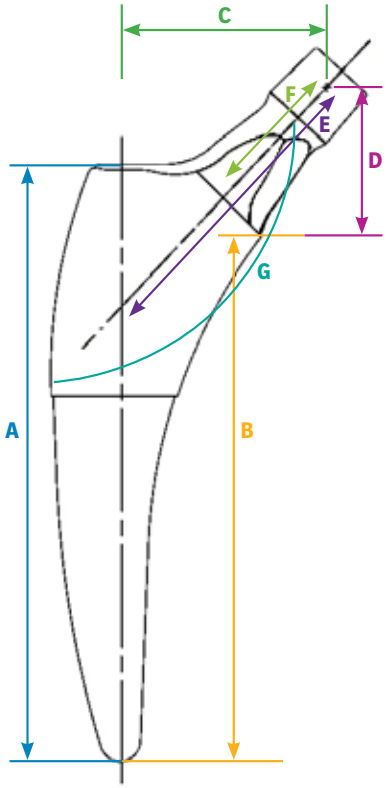
Each plastic jaw is aligned with the slot and snapped into place inside the housing (Figure 15).

Stem A Sizing Chart



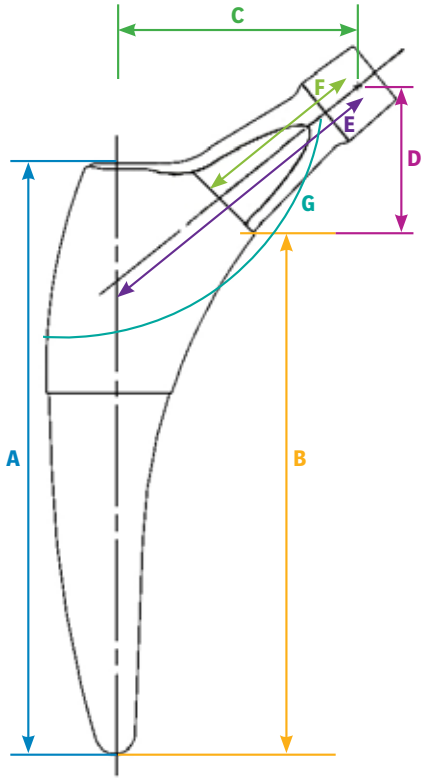
Part Number	Size	A	B	C	D	E	F	G
		Stem Length Lateral Shoulder	Stem Length Medial Calcar	Horizontal Offset +0 mm Head	Vertical Offset +0 mm Head	Neck Length To Center Line	Neck Length To Resection	Neck Angle
01.00551.101	A 1	84.0	68.0	31.0	24.2	52.2	23.2	140.0
01.00551.102	A 2	87.0	71.0	31.5	24.2	53.0	23.2	140.0
01.00551.103	A 3	90.0	74.0	32.0	24.2	53.8	23.2	140.0
01.00551.104	A 4	93.0	77.0	32.5	24.2	54.6	23.2	140.0
01.00551.105	A 5	96.0	80.0	33.0	24.2	55.3	23.2	140.0
01.00551.106	A 6	99.0	83.0	33.6	24.2	56.3	23.2	140.0
01.00551.107	A 7	102.0	86.0	34.2	24.2	57.3	23.2	140.0
01.00551.108	A 8	105.0	89.0	34.8	24.2	58.3	23.2	140.0
01.00551.109	A 9	108.0	92.0	35.5	24.2	59.2	23.2	140.0
01.00551.110	A 10	111.0	95.0	36.3	24.2	60.4	23.2	140.0
01.00551.111	A 11	114.0	98.0	37.0	24.2	61.6	23.2	140.0
01.00551.112	A 12	117.0	101.0	37.8	24.2	62.7	23.2	140.0
01.00551.113	A 13	120.0	104.0	38.5	24.2	63.9	23.2	140.0
01.00551.114	A 14	123.0	107.0	39.3	24.2	70.4	23.2	140.0

Stem B Sizing Chart



Part Number	Size	A Stem Length Lateral Shoulder	B Stem Length Medial Calcar	C Horizontal Offset +0 mm Head	D Vertical Offset +0 mm Head	E Neck Length To Center Line	F Neck Length To Resection	G Neck Angle
01.00551.201	B1	90.0	74.0	37.0	26.7	60.6	27.4	137.0
01.00551.202	B2	93.0	77.0	37.5	26.7	61.3	27.4	137.0
01.00551.203	B3	96.0	80.0	38.0	26.7	61.9	27.4	137.0
01.00551.204	B4	99.0	83.0	38.5	26.7	62.6	27.4	137.0
01.00551.205	B5	102.0	86.0	39.0	26.7	63.2	27.4	137.0
01.00551.206	B6	105.0	89.0	39.6	26.7	64.0	27.4	137.0
01.00551.207	B7	108.0	92.0	40.3	26.7	64.8	27.4	137.0
01.00551.208	B8	111.0	95.0	40.9	26.7	65.6	27.4	137.0
01.00551.209	B9	114.0	98.0	41.5	26.7	66.4	27.4	137.0
01.00551.210	B10	117.0	101.0	42.3	26.7	67.4	27.4	137.0
01.00551.211	B11	120.0	104.0	43.0	26.7	68.3	27.4	137.0
01.00551.212	B12	123.0	107.0	43.8	26.7	69.3	27.4	137.0
01.00551.213	B13	126.0	110.0	44.5	26.7	70.3	27.4	137.0
01.00551.214	B14	129.0	113.0	45.3	26.7	71.2	27.4	137.0

Stem B Extended Offset Sizing Chart



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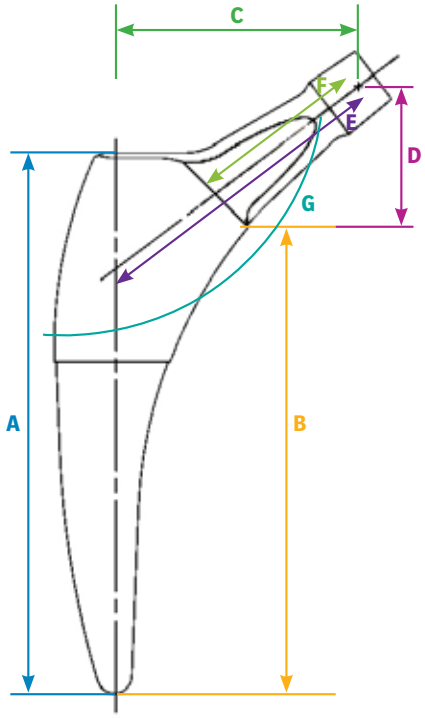
01.00551.301	B Ext.Offs. 1	90.0	74.0	44.0	26.5	67.9	32.4	129.0
01.00551.302	B Ext.Offs. 2	93.0	77.0	44.5	26.5	68.5	32.4	129.0
01.00551.303	B Ext.Offs. 3	96.0	80.0	45.0	26.5	69.1	32.4	129.0
01.00551.304	B Ext.Offs. 4	99.0	83.0	45.5	26.4	69.7	32.4	129.0
01.00551.305	B Ext.Offs. 5	102.0	86.0	46.0	26.4	70.4	32.4	129.0
01.00551.306	B Ext.Offs. 6	105.0	89.0	46.6	26.4	71.2	32.4	129.0
01.00551.307	B Ext.Offs. 7	108.0	92.0	47.3	26.4	71.9	32.4	129.0
01.00551.308	B Ext.Offs. 8	111.0	95.0	47.9	26.4	72.7	32.4	129.0
01.00551.309	B Ext.Offs. 9	114.0	98.0	48.5	26.4	73.5	32.4	129.0
01.00551.310	B Ext.Offs. 10	117.0	101.0	49.3	26.4	74.4	32.4	129.0
01.00551.311	B Ext.Offs. 11	120.0	104.0	50.0	26.4	75.4	32.4	129.0
01.00551.312	B Ext.Offs. 12	123.0	107.0	50.0	26.4	76.3	32.4	129.0
01.00551.313	B Ext.Offs. 13	126.0	110.0	51.5	26.4	77.3	32.4	129.0
01.00551.314	B Ext.Offs. 14	129.0	113.0	52.3	26.4	78.2	32.4	129.0

Stem C Sizing Chart



Part Number	Size	A	B	C	D	E	F	G
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01.00551.401	C 1	96.0	80.0	51.0	29.3	67.9	37.3	127.0
01.00551.402	C 2	99.0	83.0	51.5	29.3	68.5	37.3	127.0
01.00551.403	C 3	102.0	86.0	52.0	29.3	69.1	37.3	127.0
01.00551.404	C 4	105.0	89.0	52.5	29.3	69.7	37.3	127.0
01.00551.405	C 5	108.0	92.0	53.0	29.3	70.4	37.3	127.0
01.00551.406	C 6	111.0	95.0	53.6	29.3	71.2	37.3	127.0
01.00551.407	C 7	114.0	98.0	54.3	29.3	71.9	37.3	127.0
01.00551.408	C 8	117.0	101.0	54.9	29.3	72.7	37.3	127.0
01.00551.409	C 9	120.0	104.0	55.5	29.3	73.5	37.3	127.0
01.00551.410	C 10	123.0	107.0	56.3	29.3	74.4	37.3	127.0
01.00551.411	C 11	126.0	110.0	57.0	29.3	75.4	37.3	127.0
01.00551.412	C 12	129.0	113.0	57.8	29.3	76.3	37.3	127.0
01.00551.413	C 13	132.0	116.0	58.5	29.3	77.3	37.3	127.0
01.00551.414	C 14	135.0	119.0	59.3	29.3	78.2	37.3	127.0

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