



# CPT<sup>®</sup> 12/14 Femoral System

Surgical Technique



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## Introduction

Collarless, polished tapered stems have been proven successful during more than 25 years of clinical use.<sup>1-4,8</sup>

The CPT Hip System has continued this tradition of success since its introduction in the early 1990s.<sup>1,4,5,8</sup> The CPT femoral system provides improved kinematic function by offering up to three offsets for each stem body size. Zimmer Biomet utilizes the strength of cobalt chromium to engineer offset designs that allow the surgeon to change from standard offset to extended offset to extra extended offset without the need to re-rasp. The collarless design also helps simplify leg length adjustments.

The CPT Hip System is a complete offering that encompasses two small stems, six primary sizes, and seven long stems. Two of the six primary stems are available with standard and extended offsets, and the other four primary stems are available with standard, extended, and extra-extended offsets. The 12/14 taper at the head/neck interface enables a wide selection of femoral head/stem combinations and the optimized neck geometry enhances range of motion.



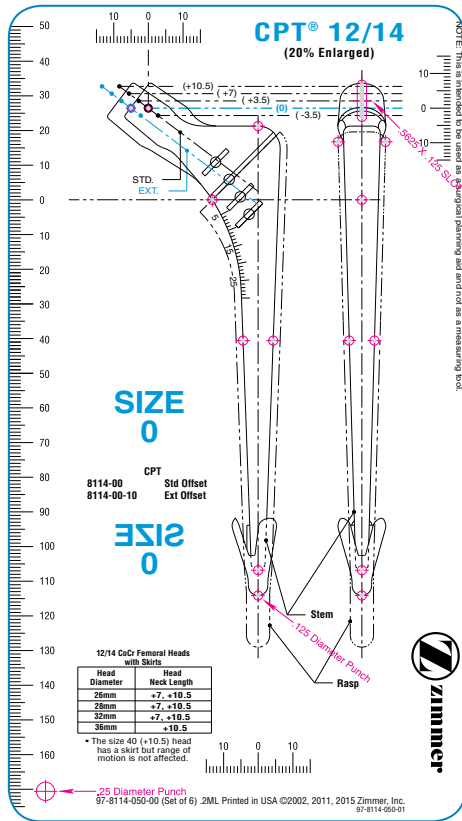


Figure 1

## Pre-Operative Planning

Selection of the appropriate femoral component is attained through careful pre-operative planning. This can be achieved manually using available X-ray templates (Figure 1).

Position the X-ray template onto the antero-posterior radiograph to best decide correct resection level, adequate implant size and cement mantle thickness. X-ray magnification, 120% or 150%, should be taken into consideration when selecting templates.



Figure 2



Figure 3

## Templating Procedure

The aim of templating is to plan for correct size and position of the implants, restore the hip center of rotation, femoral offset and leg length.

Templating typically begins on the contralateral hip with a true A/P radiograph (Figure 2). First choose the correct cup size and then the femoral head center of rotation.

On the operative side, mark the anatomic center of the femoral head. Using the appropriate template, align the midline of the implant with the anatomical axis of the femoral canal. Move the template vertically so the selected head level mark overlays the planned center of the femoral head. Select the stem size considering adequate cement mantle. The dotted line on the templates represents the width of about 2 mm cement mantle.

Stem oversizing should be avoided. It is recommended that a sufficient bed of proximal cancellous bone be preserved for bone cement interlock. Once the appropriate stem size has been chosen, note the resection level and corresponding stem depth mark.

## Surgical Exposure

The CPT stem can be implanted using most of the standard approaches for total hip arthroplasty. The goal is to gain adequate exposure of the proximal femur (Figure 3). This is essential for effective preparation of the endosteal surface of the bone, cementation and correct alignment of the prosthesis.



Figure 4

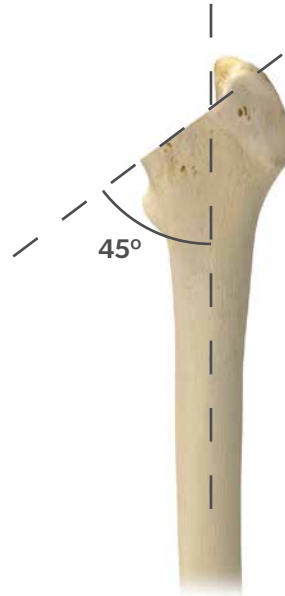


Figure 5

## Femoral Neck Resection

Exposing the femoral neck may be assisted by retractors placed superiorly and inferiorly. The neck osteotomy level will vary depending on the size of the patient, the neck angle, and preoperative templating. The versatility of the collarless CPT Stem allows a wide range of insertion levels.

Resection level may be determined in a number of ways, including the following:

1. Place a finger above the lesser trochanter, approximating 2 cm.
2. Use the osteotomy guide provided with the CPT System (Figure 4). If you choose to use the osteotomy guide, please note that one guide is provided for all stem sizes. Superimpose the guide on the proximal femur. The longitudinal axis of the guide should be parallel to the longitudinal axis of the femur. Position the appropriate slot on the osteotomy guide over the femoral head center of rotation.

If preferred, the osteotomy guide can also be positioned by using the scale on the medial edge of the guide to move the templated distance above the lesser trochanter, or by aligning the lateral slots with the tip of the greater trochanter.

3. Determine the midpoint between the lesser trochanter and the femoral head in relatively normal anatomical situations.

The level of osteotomy may be marked with either a saw or methylene blue. Note that the angle of the osteotomy cut is approximately 45 degrees to the long axis of the femur (Figure 5). Make the cut with a reciprocating saw in the neutral plane.

**Note:** The slot labeled “STD/EXT” is used for both the standard and extended offset stems, and the slot labeled “XEXT” is used for the extra-extended offset stems. Both refer to the neutral (+0 mm) head center.

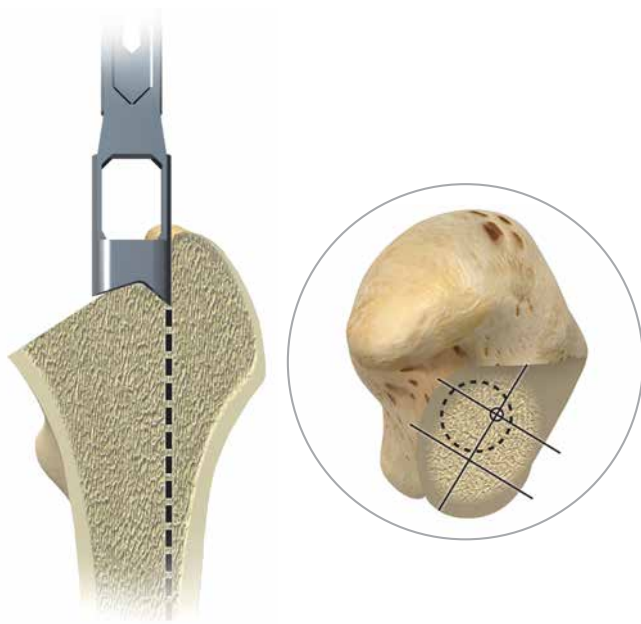


Figure 6



Figure 7

## Femoral Canal Opening

Open the proximal femur to the piriformis fossa by using the box osteotome (Figure 6) or a combination of a gauge, rongeurs or the starter awl. A burr may be helpful in sclerotic bone.

Locate and open the femoral canal using the blunt starter awl or a sharp T-handle reamer for sclerotic bone. Use the medium awl and large awl in progression to widen the femoral canal while working laterally and posteriorly into the greater trochanter. Ensure that the awls are aligned axially within the femoral canal (Figure 7), using femoral landmarks and the knee as guides. Caution should be exercised if using the larger T-handle awls in small diameter canals.

To help reduce the risk of varus positioning, it is important to remove medial bone in the area of the greater trochanter. This will allow the canal to be opened so that the rasps and femoral component may be inserted along the femoral axis.

**Note:** The use of trochanteric power reamers should be confined to removing only lateral trochanteric bone.





Figure 8

## Femoral Canal Preparation

Begin femoral rasping with a rasp that is one to two sizes smaller than the templated size (Figure 8). Then use sequentially larger rasps until reaching the templated size, or until obtaining adequate resistance. Avoid over-rasping; leave an adequate bed of 3 mm to 4 mm of cancellous bone proximally. The entire procedure may be achieved through hand rasping only, using light taps with the mallet to dislodge the rasp. Alternatively, the mallet may be used gently to insert the rasps. The rasps should advance with each moderate mallet blows. Do not tap the rasp again once it has stopped advancing.

Rasp laterally and posteriorly in the femoral neck to aid in optimal placement of the Rasp and final component. Anteversion may be determined by choosing a standard degree of anteversion of approximately 10 degrees or by the patient's natural anteversion or at the surgeon's discretion based on the particular patient.

Soft cancellous bone may be removed with a curette from regions where the rasp did not reach, especially laterally and medially at the level of the lesser trochanter.

ⓘ **Note:** Power reamers should not be used to prepare the femoral canal as damage to the endosteal surface of the femur compromises cement interdigitation into cancellous bone.



Figure 9



Figure 10

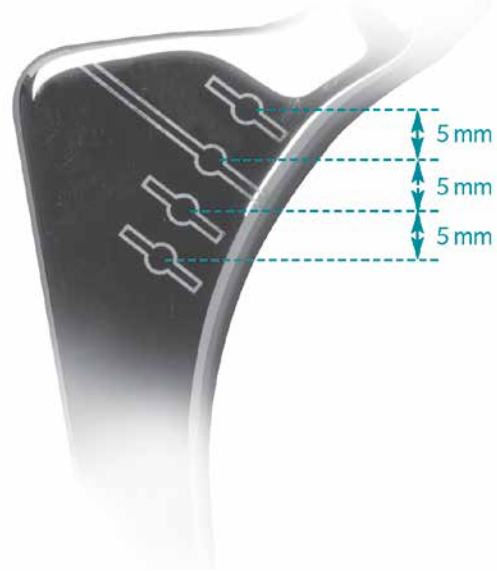


Figure 11

## Femoral Trial Reduction

The CPT femoral system offers up to three offset options for each stem body size to help re-establish the femoral head center. A rasp is available for each stem size; however, a cone provisional is provided for each offset (Figure 9). The Cone Provisionals are labeled “STD”, “EXT”, and “XEXT” for standard, extended, and extra-extended offsets, respectively. An etch mark on the Cone Provisional corresponds to the etch mark 5 mm above the osteotomy line on the stem.

**Note:** Stem Provisionals are only provided for the small and extra-small stems (Figure 10). Small and extra-small Stem Provisionals model the stem and the cement mantle, so there is an increase in cross section at the osteotomy line

CPT rasps have depth indicator holes that correspond to the depth indicator markings on the final implant (Figure 11). These indicators are 5 mm apart.

### Depth Indicators Below Osteotomy Line

Stem Size	STD	EXT	XEXT
Small	0	na	na
X-Small	0	na	na
0	2	0	na
1	2	1	na
2	2	2	1
3	2	2	2
4	2	2	2
5	2	2	2

*Small and X-small have no depth indicator above the osteotomy line. All other stems have one indicator above the osteotomy line.*

**Note:** In some instances there may be more depth indicators on the rasp than on the final implant. The number of depth indicators decreases with increased offset.



Figure 12



Figure 13

### Femoral Trial Reduction (cont.)

Perform a trial reduction using the head pusher (Figure 12). Aim for a neutral head center (+0 mm) to avoid the need for a skirted head (+7.0 mm and +10.5 mm). Assess range of motion, soft tissue tension, joint stability and leg length. Repeat trial reduction procedure with different neck and head offsets and, if needed, different broach implantation depths until joint stability and desired leg length have been achieved.

If good proximal bone is present and it is desired to seat the stem slightly proud, insert a trial locating pin into the appropriate hole to maintain the proud position during trial reduction (Figure 13).

Where proximal femoral bone stock is missing or insufficient, the stem should not be seated proud. Note the insertion depth.

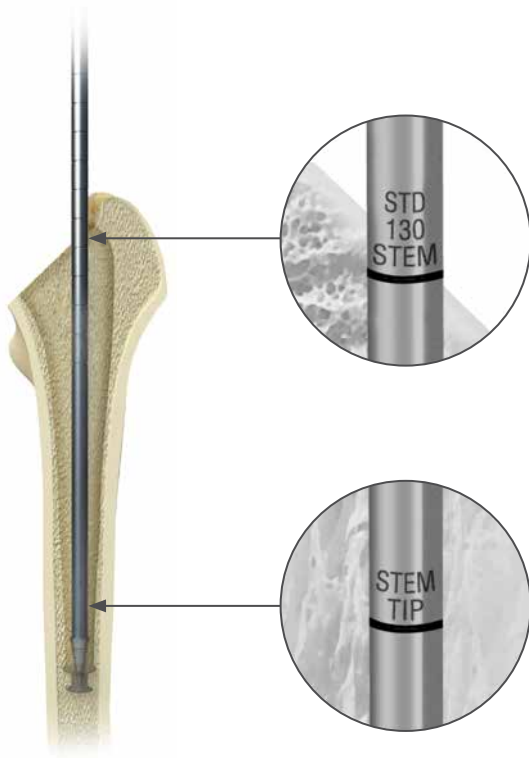


Figure 14



Figure 15

## Femoral Canal Final Preparation

### Bone Bed Preparation

Use the medullary canal sizers to determine the appropriate size of the Allen Medullary Bone Plug. One technique is to use the plug with the core size that corresponds to the last sizer that passed through the isthmus.

Use the disposable Allen Medullary Bone Plug Inserter to insert the bone plug to the mark on the inserter which corresponds to approximately 2.5 cm below the tip of the stem. If preferred, use the Allen Plug Metal Inserter.

This instrument has marks on one side which indicate the depth of insertion of the plug for different stems (Figure 14). The other side of the inserter has marks every centimeter.

Thoroughly clean the femoral shaft using pulse lavage, and dry the femoral shaft to remove any loose debris from the cancellous surface (Figure 15). This final preparation is essential for cement penetration into cancellous bone and strong bone/cement micro-interlock. Utilising pulse lavage may also help reduce the risk of embolism during cement insertion.

For cementing guidance, please refer to Zimmer Biomet's Modern Cementing Technique for Hip Arthroplasty.



Figure 16



Figure 17

## Femoral Canal Final Preparation (cont.)

### Cement Delivery

Introduce cement into the plugged femoral canal in a retrograde fashion, moving the cement gun nozzle out as the canal fills with cement (Figure 16). This technique has been reported to reduce the risk of air entrapment, prevent porosity in the cement mantle and reduce risk of revision for aseptic loosening by 20%.<sup>9</sup>

ⓘ **Note:** Delivery of cement to the bone, should never be done when the cement is in low viscosity stage.

### Pressurisation

Once the femoral canal is filled with cement, snap off the redundant nozzle and apply the proximal pressuriser and support plate against the resected femoral neck to pressurise cement (Figure 17). A positive sign of pressurisation is marrow extrusion from the proximal femur. Cement pressurisation has been shown to achieve greater penetration into the cancellous bone, thereby improving the bone cement interlock and enhancing cement strength.<sup>2</sup>

Pressure needs to be maintained until cement is sufficiently doughy to withstand bleeding from the endosteal surface of the femoral canal. The cement polymerisation time varies depending on the type of cement used, temperature and humidity.

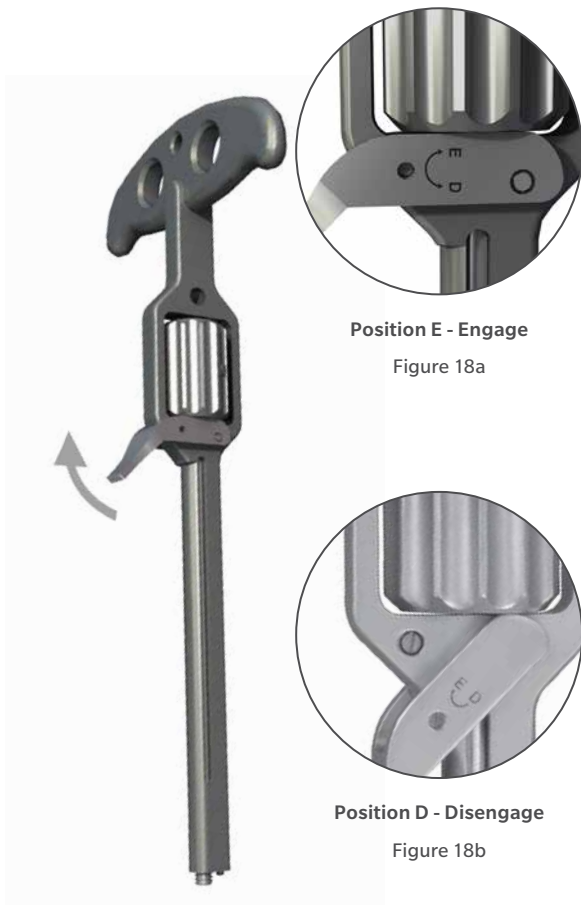


Figure 18

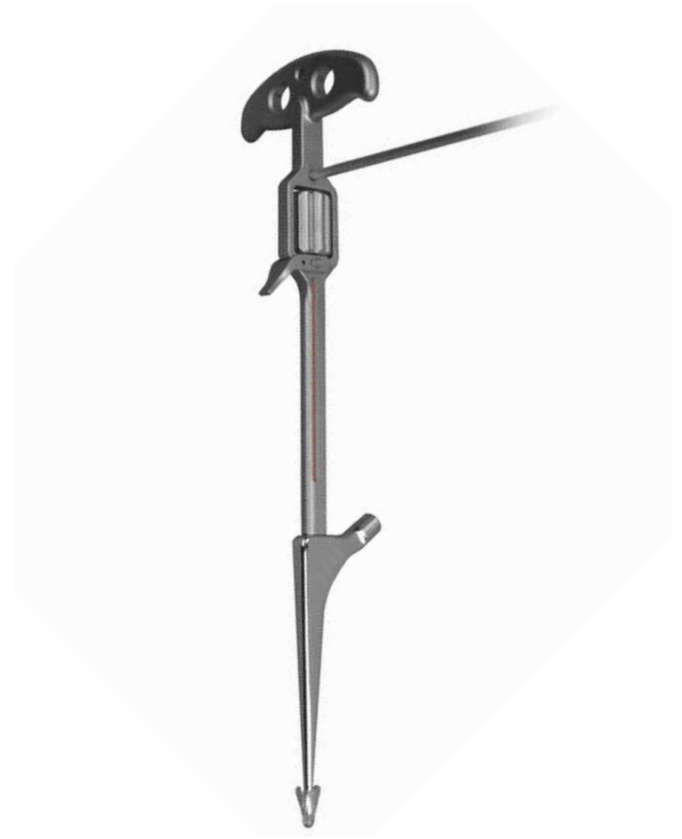


Figure 19

## Femoral Stem Insertion

Attach the distal centralizer to the femoral stem by pushing it on with a twisting motion. Two distal centralizers are available. The standard distal centralizer has wings and is recommended for use with sizes 1 through 5, as well as long stems. The revision distal centralizer has no wings and is used with sizes extra-small, small and 0, as well as during impaction grafting procedures. The recommended centralizer is packaged with the stem.

Attach the femoral component to the stem inserter by placing the release lever in the engage position, marked “E” (Figure 18a), and turning the barrel to loosely thread the inserter onto the stem (Figure 19). Do not overtighten. A small protuberance on the inserter adjacent to the screw attachment engages the dimple on the stem shoulder to control component anteversion during insertion.

**Note:** Extra-small stem does not have a threaded hole or a dimple for insertion and should be inserted by hand.

The stem inserter has a mark along the stem center line to aid in insertion. The stem inserter also has a threaded hole between the handle and barrel to assemble the anteversion rod which may be assembled on either side and represents a reference for zero degrees of anteversion (Figure 19).



Figure 20

Insert the stem tending towards valgus.

Place the thumb or finger over the medial anterior femoral neck while inserting the stem to maintain cement pressure (Figure 20).

This will help maintain the stem aligned axially, without moving into varus or shifting anteriorly. There should be 4 mm of cement on the medial side of the stem.

Slowly advance the stem into the cement mantle.

Pause approximately a centimeter proud to make sure the cement is viscous enough to support the stem. Insert the stem to the final position as determined by the depth /alignment marks on the stem and the mark on the femoral neck.

It is recommended to gently push a small amount of lateral cement over the lateral shoulder of the stem with a curette or finger. This helps prevent the remote possibility of the stem backing out



Figure 21

inadvertently should a postoperative dislocation require reduction.

Continue to support the inserter while flipping the release lever to the disengage position marked “D” (Figure 18b), unscrewing the barrel and removing the inserter.

## Final Reduction

If desired, once cement has cured, complete a further trial reduction using the appropriate trial heads. Check range of motion, joint stability, soft tissue tension and leg length.

After fully seating the femoral component, position the modular head onto the dry and clean surface of the trunnion (Figure 21). Fully seat the modular head by means of firm axial impaction, utilizing the modular head impactor and mallet.

Once the definitive modular femoral head has been attached to the femoral stem, reduce the hip joint.



Figure 22

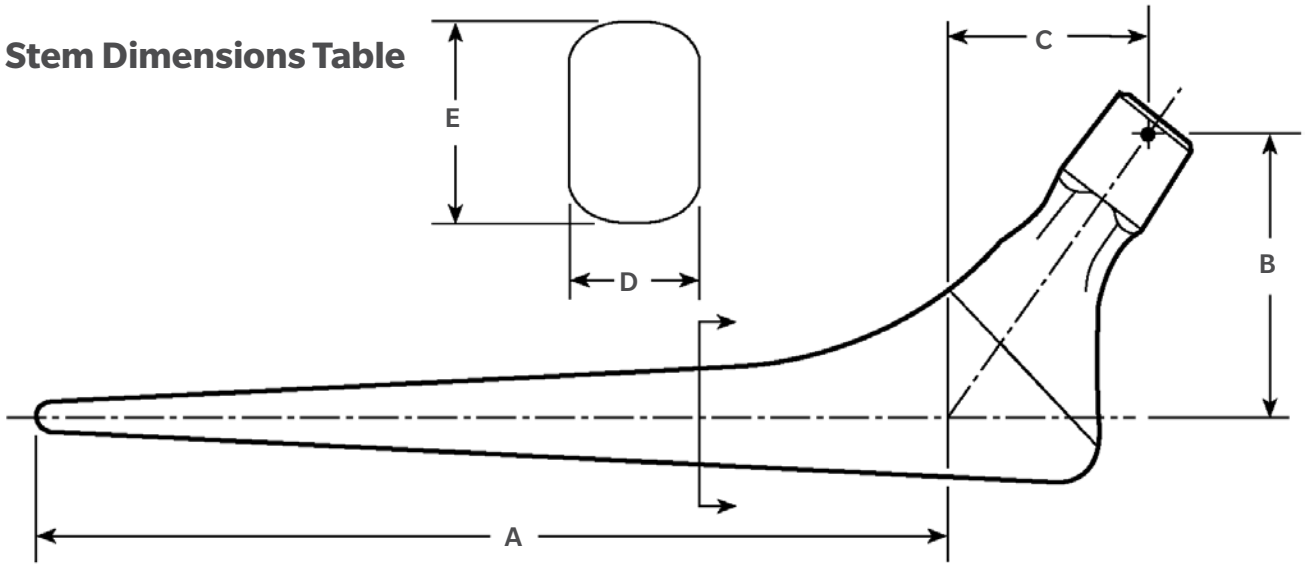
## Implant Removal

Should a CPT femoral component ever require removal, a stem extractor adapter is included in the General Instrument Set (Figure 22).

ⓘ **Note:** The stem inserter is not intended for use to remove the stem. A stem extractor adapter is included in the general instrument set for this purpose.



### Stem Dimensions Table



Product No.	Stem Size (mm)	A Stem Length (mm)	B Offset (mm) When Head/Neck Component Selected is:					C Offset (mm) When Head/Neck Component Selected is:					D A/P Width	E M/L Width
			-3.5	0	+3.5	+7	+10.5	-3.5	0	+3.5	+7	+10.5		
<b>Small</b>														
00-8114-040-00	X-Small	85	25	28	31	34	37	21	23	25	27	29	7.0	8.0
00-8114-050-00	Small	95	27	30	33	36	39	22	24	26	28	30	7.5	9.0
	<b>Standard Offset</b>		<b>-3.5</b>	<b>0</b>	<b>+3.5</b>	<b>+7</b>	<b>+10.5</b>	<b>-3.5</b>	<b>0</b>	<b>+3.5</b>	<b>+7</b>	<b>+10.5</b>		
00-8114-000-00	0-STD	105	29	32	35	37	40	24	26	28	30	32	7.5	9.0
00-8114-001-00	1-STD	130	31	34	37	39	42	24	26	28	30	32	9.0	10.5
00-8114-002-00	2-STD	130	33	36	38	41	44	24	26	28	30	32	9.0	13.0
00-8114-003-00	3-STD	130	35	37	40	43	46	24	26	28	30	32	9.0	15.5
00-8114-004-00	4-STD	130	35	38	41	44	46	24	26	28	30	32	10.0	17.5
00-8114-005-00	5-STD	130	37	40	43	45	48	24	26	28	30	32	10.0	20.0
<b>Extended Offset</b>														
00-8114-000-10	0-EXT	105	34	37	40	42	45	24	26	28	30	32	7.5	9.0
00-8114-001-10	1-EXT	130	36	39	42	44	47	24	26	28	30	32	9.0	10.5
00-8114-002-10	2-EXT	130	38	41	43	46	49	24	26	28	30	32	9.0	13.0
00-8114-003-10	3-EXT	130	40	42	45	48	51	24	26	28	30	32	9.0	15.5
00-8114-004-10	4-EXT	130	40	43	46	48	51	24	26	28	30	32	10.0	17.5
00-8114-005-10	5-EXT	130	42	45	47	50	53	24	26	28	30	32	10.0	20.0
<b>Extra Extended Offset</b>														
00-8114-002-30	2-XEXT	130	43	46	48	51	54	29	31	33	35	37	9.0	13.0
00-8114-003-30	3-XEXT	130	45	47	50	53	56	29	31	33	35	37	9.0	15.5
00-8114-004-30	4-XEXT	130	45	48	51	53	56	29	31	33	35	37	10.0	17.5
00-8114-005-30	5-XEXT	130	47	50	52	55	58	29	31	33	35	37	10.0	20.0
<b>Revision-Long</b>														
00-8114-002-18	2, 180 mm	180	33	36	38	41	44	24	26	28	30	32	9.5	13.0
00-8114-012-18	2, 180 mm VN	180	33	36	38	41	44	39	41	43	45	47	9.5	13.0
00-8114-003-18	3, 180 mm	180	40	42	45	48	51	24	26	28	30	32	9.5	16.0
00-8114-013-18	3, 180 mm VN	180	40	42	45	48	51	39	41	43	45	47	9.5	16.0
00-8114-004-20	4, 200 mm	200	40	43	46	49	51	24	26	28	30	32	11.0	16.0
00-8114-004-23	4, 230 mm	230	40	43	46	49	51	24	26	28	30	32	11.0	16.0
00-8114-004-26	4, 260 mm	260	40	43	46	49	51	24	26	28	30	32	11.0	16.0

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