

**CORAIL<sup>®</sup>**  
HIP SYSTEM

# CORAIL<sup>®</sup> Upgrade Kit

Surgical Technique





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# Surgical Technique

## Step 1: Pre-Operative Planning

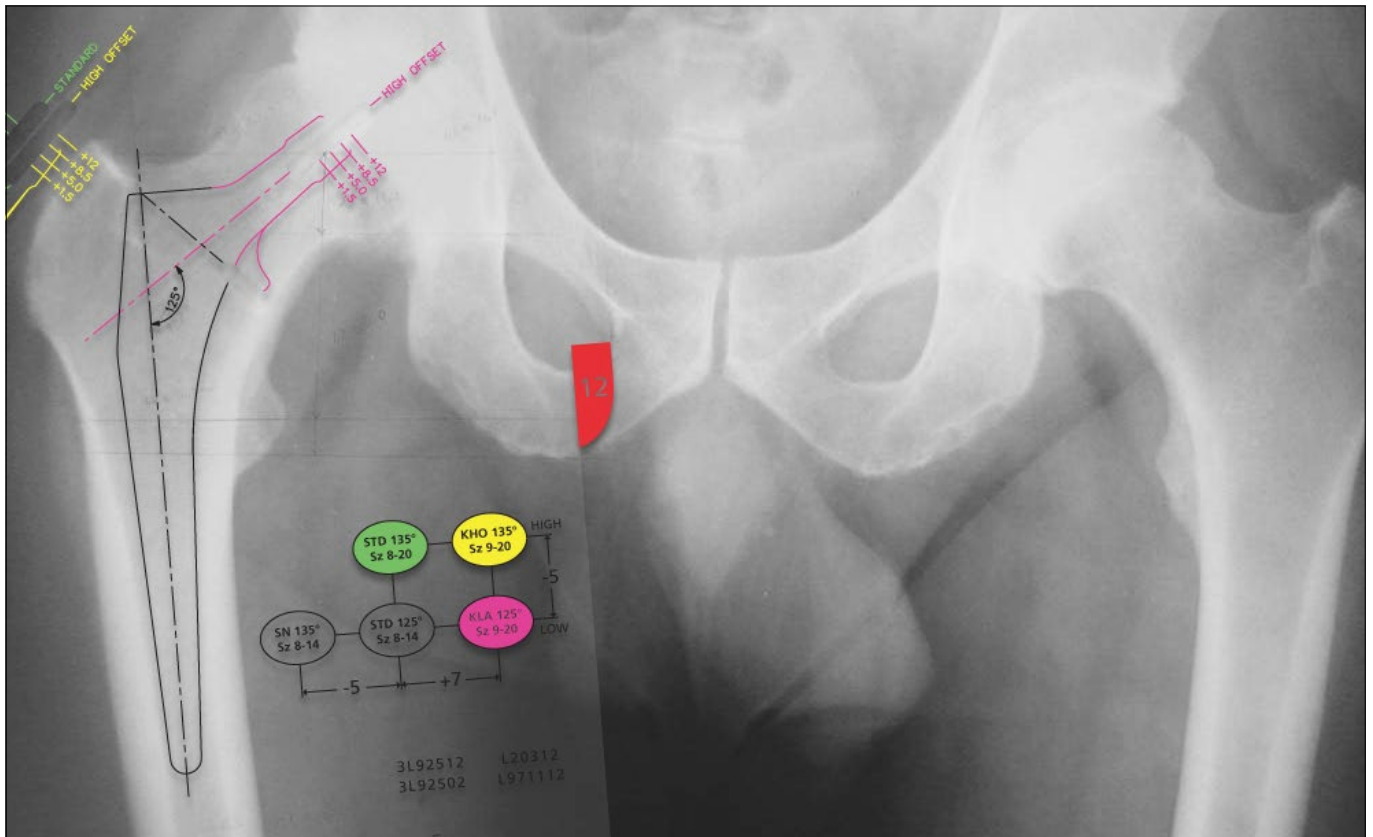


Figure 1 – Pelvis X-ray for templating.

The CORAIL Hip System provides pre-operative templates at three different magnifications (100%, 115% and 120%). The templates are placed over the AP and lateral radiographs to help determine the implant size in order to restore the patient's natural anatomy.

When templating ensure that the prosthesis does not make cortical contact. Understand the difference between fit and fill and optimum fit.

The surgical objective is a 1-2 mm gap between the cortices and the implant. If in doubt template a size that contacts the cortex and then go down a size.

Templating should be done with a neutral +5 head centre so that the possibility to change to a short or a long neck still remains in order to adjust leg length. The pre-operative templating will indicate the level of neck resection.

In Dorr Type A ('champagne flute') femurs (Figure 2) proper metaphyseal fit may require a larger size than the femoral canal can accommodate distally.

In these cases consideration should be given to distal reaming to enlarge the canal to accommodate a broach of the appropriate size.

### Pre-operative Planning Serves Two Purposes:

#### 1. Implant selection

The ideal implant size should allow adequate femoral shaft filling while providing about 1 mm of space between the implant and the cortical walls. There must be no implant-cortical wall contact.

Templating should be done with a medium neck so that the possibility to change to a short or a long neck still remains in order to adjust leg length.

#### 2. Reconstructing the Femoral Architecture

The purpose of the architectural reconstruction is to restore the length of the lower limb and the abductors' lever arm. These parameters are achieved by means of the type and offset of implant (STD 125/135, KHO, KLA or SN) and the femoral neck cutting level.

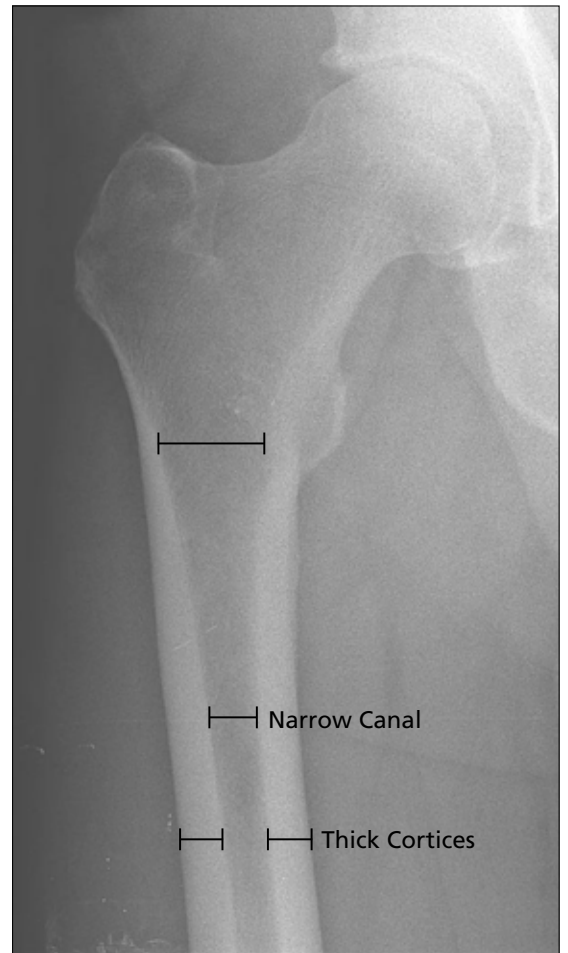


Figure 2 – Example of a DORR Type A femur.

## Step 2: Femoral Neck Resection

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The level of the neck cut, defined during the pre-op planning, is achieved using anatomical landmarks (lesser trochanter, trochanteric fossa, greater trochanter) and a graduated ruler. A broach aligned with the femoral diaphyseal axis can enable the 45° slanting of the cutting plane to be visualised. If the resection is too high, it may result in a varus positioned stem.



Figure 3

**Note: 2.1**

The osteotomy can be performed in one or two steps depending on the surgeon's preference.

## Step 3: Femoral Canal Preparation

### Preparation of the entry point

It is important to select a point of entry posterolaterally to the Piriformis Fossa to avoid varus positioning. Use a curette or general instrument to indicate the direction of the canal.

To prevent under-sizing or varus positioning, the greater trochanter may be prepared with a Modular Box Osteotome (2598-07-530) to allow better insertion of the broaches.



Figure 4

### Visualisation of the medullary canal axis

The medullary canal axis is determined using the femoral canal explorer. Its entry point must be postero-lateral, near the trochanteric fossa. The canal explorer comprises an 8 mm “bullet” end piece that enables the width of the distal femoral canal to be assessed. The tip of the canal explorer is larger than the distal AP part of the size 8 stems.

**At this stage, a Type A femur should be identified. In such cases, distal reaming could be carried out in principle followed by compaction broaching.**



Figure 5

### Cancellous Bone Compaction

Use the Modular Bone Impactor (L94013) to compact the cancellous bone proximally. This is an important step as the philosophy of the CORAIL stem is based on bone preservation.

### Compaction Broaching

The compaction of the cancellous bone is continued using specific atraumatic broaches. This process begins with the smallest size broach, along the axis provided by the femoral canal explorer. Ensure that broaching is started posterolaterally. The broach should run parallel to the posterior cortex following the natural anatomy of the femur. Begin with the smallest broach attached to the broach handle and increase the size of broach sequentially until longitudinal and rotational stability is achieved, broaching should then be stopped. Careful preoperative planning is key to help selection of the final broach size. The version will be determined by the natural version of the femur.

If concern around sizing still exists, intraoperative X-rays could be considered, where available.



Figure 6



Figure 7

**Note: 3.1**

In relation to the planned size, should vertical (subsiding) stability fail to be achieved, check for false route and/or calcar fracture.



## Step 4: Calcar Reaming

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Leave the last broach in place and use the Shielded Calcar Planer to achieve a flat resection surface. The calcar reaming should allow an optimised fit of the collar on the calcar.

The small shielded calcar reamer (940080007) is to be used for sizes from 8 to 12. The large shielded calcar reamer (L94010) is to be used for sizes 13 and above.



Figure 8

**Note: 4.1**

Ensure all soft tissue is clear before performing calcar reaming.

## Step 5: Trochometer (optional)

The trochometer is placed on the last broach inserted. Using the trochometer ruler, the level of the centre of head is checked relative to the apex of the greater trochanter. The grooves correspond to the various implant styles (STD 125/135, KHO, KLA or SN) with a neutral (+5) head.



Figure 9

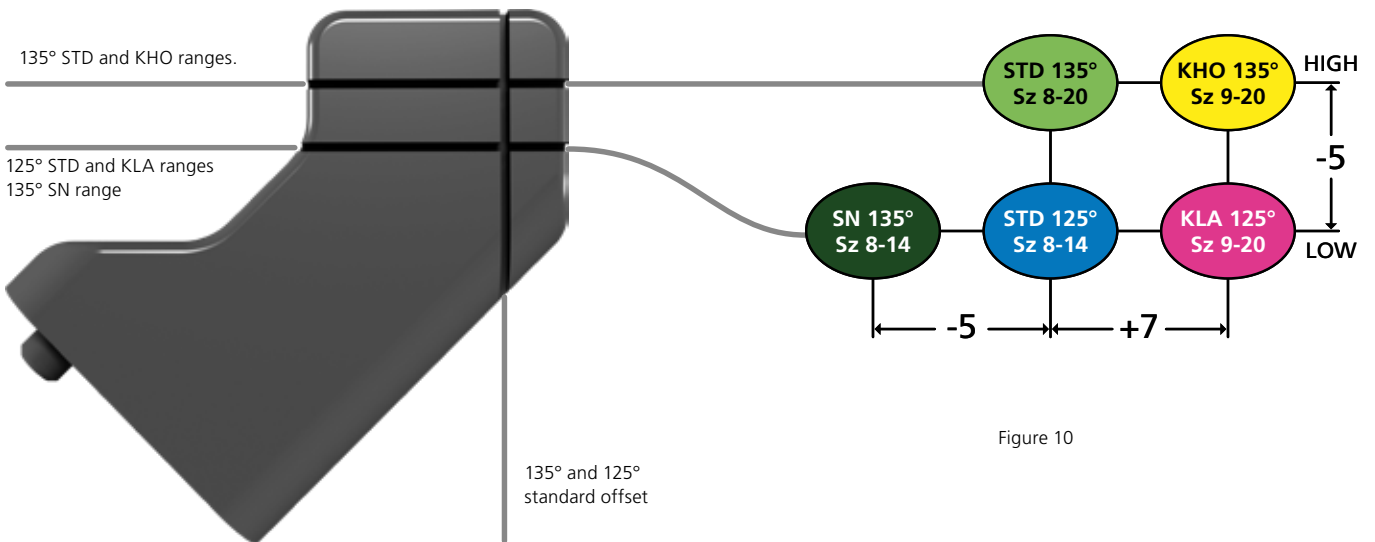


Figure 10

**Note: 5.1**

If broach is in varus or valgus position in accordance with pre-operative planning you must be aware that the head centre level indicated by the trochometer maybe affected.

## Step 6: Trial Reduction

With the final broach in situ, attach the appropriate trial neck and trial head. Reduce the hip and assess what adjustments, if any, are required to ensure stability through a full range of motion.

### Trial Implant Removal

The trial neck should then be removed. The broach stability including subsidence or rotation should be checked again using the handle to prove that it has not been affected by the previous test. This also confirms the reliability of the compacted cancellous bed. Should the broach seem to have lost its stability, the broach that is the next size up should be inserted.

The last femoral broach is then removed. The femoral canal **should not** be irrigated or dried in order to preserve the quality of the compacted cancellous bone and promote osteointegration of the stem. The surgeon can then request the selected implant size. The CORAIL stem can then be implanted.



Figure 11

## Step 7: Femoral Component Insertion

**Important Note:** The protective covers should be left on until the components are ready to be implanted. Before implanting a femoral head, the male taper on the femoral stem must be wiped clean of any blood, bone chips or other foreign materials. When implanting the definitive stem (that has the same size as the final broach) in the femoral canal, ensure that it is directed in by hand. It must be held by the taper protection sleeve. This will help avoid changing the version as a precautionary measure. You should not have more than a thumb's breadth between the resection line and the top of the HA coating on the stem. If the stem does not readily go down this far, the surgeon should broach again. If the HA level of the stem sinks below the resection line, the surgeon should consider a larger stem or using a collar. Then lightly tap the stem impactor to fully seat the stem so the HA coating sits level with the milled femoral neck cut.

Once the femoral stem has been implanted, the calcar should be checked for possible damage such as cracks. If a crack is discovered, this should be wired into place.

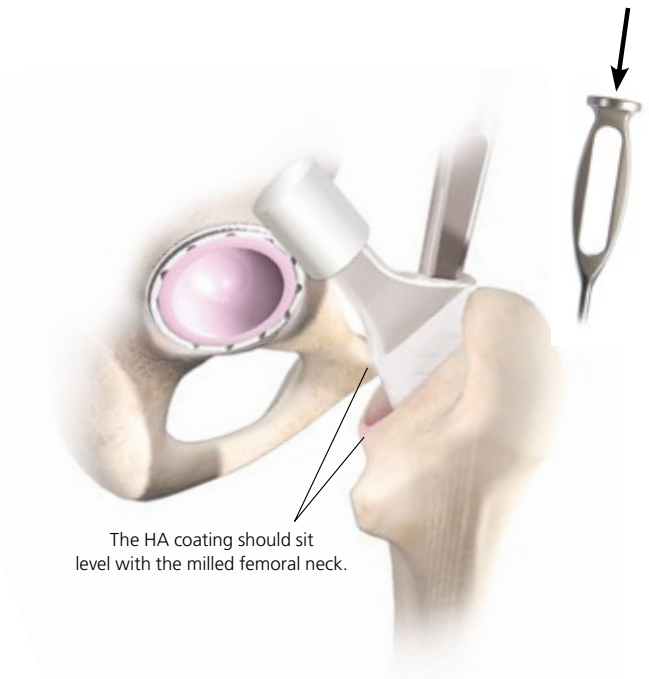


Figure 12

### Note: 7.1

The stem is slightly larger than the broach in order to ensure the press-fit function. This volume difference corresponds to the thickness of the HA coating, 155  $\mu\text{m}$  on either face of the implant.

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### Bone Grafting (Optional)

Once the CORAIL stem is fully seated, cancellous bone from the resected femoral head is added around the proximal part of the stem using the bone tamp to seal the femoral canal and to reduce the time for osteointegration which provides definitive stability.



Figure 13

### Femoral Head Impaction

A final trial reduction is carried out to confirm joint stability and range of motion. A DePuy Synthes 12/14 head must be used. Clean and dry the stem taper carefully to remove any particulate debris. Place the femoral head onto the taper and lightly tap it (especially if a ceramic head is used) using the head impactor. Ensure bearing surfaces are clean and dry and finally reduce the hip.



Figure 14

# Primary Intra-Operative

## Non Osteointegrated Stem Extraction

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**Warning:** Please be aware that the Modular Non Osteo-Integrated Extractor is not in the CORAIL upgrade kit. Components which make up the Modular Non Osteo-Integrated Extractor can be ordered separately.

If the stem becomes blocked in an incorrect position, sits proud or subsides, it must be removed. This is carried out using a threaded pin screwed into the CORAIL stem and linked to the modular handle. The strike plate is screwed into the other side of the modular handle (Figure 13).

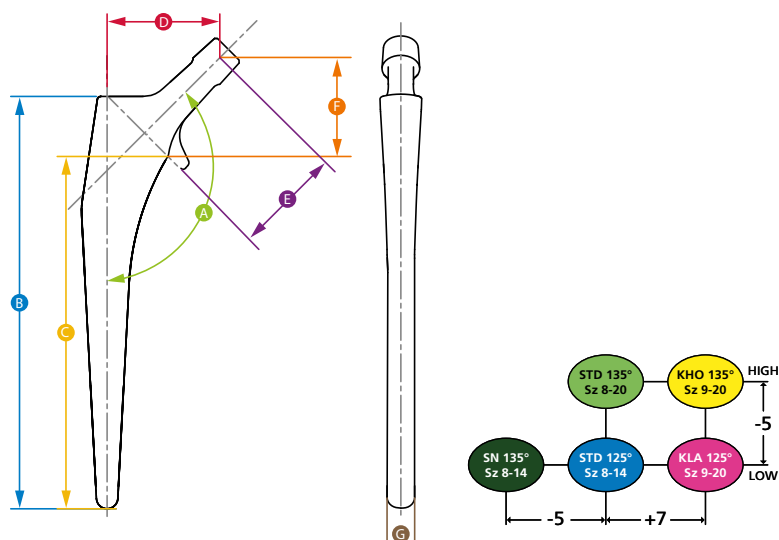
**In order to optimise the use of the instrument, it is essential to ensure that the threaded rod is fully screwed into the CORAIL stem during the extraction.**

Once the stem is removed, broaching should be resumed with the last used broach to remove the blockage. The extractor is not to be used to extract osteo-integrated stems.

### **Note: 8.1**

The extractor screw (the one locking the plate to the handle) must be tightened regularly when extracting a stem (to prevent any loosening of the plate or the screw itself).

# CORAIL Hip System Size offerings



## 135° STANDARD (STD) – COLLARLESS

Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
8	135°	115	93	38.3	39	36	7
9	135°	130	108	38.8	39	36	8
10	135°	140	118	39.5	39	36	8
11	135°	145	123	40.3	39	36	9
12	135°	150	128	41.0	39	36	10
13	135°	155	133	41.7	39	36	10
14	135°	160	138	42.3	39	36	10
15	135°	165	143	43.0	39	36	10
16	135°	170	148	43.8	39	36	10
18	135°	180	158	44.8	39	36	11
20	135°	190	168	45.8	39	36	11

## 135° STANDARD (STD) – COLLARED

Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
8	135°	115	93	38.3	39	36	7
9	135°	130	108	38.8	39	36	8
10	135°	140	118	39.5	39	36	8
11	135°	145	123	40.3	39	36	9
12	135°	150	128	41.0	39	36	10
13	135°	155	133	41.7	39	36	10
14	135°	160	138	42.3	39	36	10
15	135°	165	143	43.0	39	36	10
16	135°	170	148	43.8	39	36	10
18	135°	180	158	44.8	39	36	11
20	135°	190	168	45.8	39	36	11

135° HIGH OFFSET (KHO) – COLLARLESS							
Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
9	135°	130	108	45.7	43	35	8
10	135°	140	118	46.4	43	35	8
11	135°	145	123	47.2	43	35	9
12	135°	150	128	47.9	43	35	10
13	135°	155	133	48.5	43	35	10
14	135°	160	138	49.2	43	35	10
15	135°	165	143	49.9	43	35	10
16	135°	170	148	50.7	43	35	10
18	135°	180	158	51.8	43	36	11
20	135°	190	168	52.9	43	36	11

135° HIGH OFFSET (KHO) – COLLARED							
Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
9	135°	130	108	45.7	43	35	8
10	135°	140	118	46.4	43	35	8
11	135°	145	123	47.2	43	35	9
12	135°	150	128	47.9	43	35	10
13	135°	155	133	48.5	43	35	10
14	135°	160	138	49.2	43	35	10
15	135°	165	143	49.9	43	35	10
16	135°	170	148	50.7	43	35	10
18	135°	180	158	51.7	43	35	11
20	135°	190	168	52.7	43	35	11

125° HIGH OFFSET (KLA)							
Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
9	125	130	108	45.6	40	30	8
10	125	140	118	46.3	40	30	8
11	125	145	123	47.1	40	30	9
12	125	150	128	47.8	40	30	10
13	125	155	133	48.5	40	30	10
14	125	160	138	49.1	40	30	10
15	125	165	143	49.8	40	30	10
16	125	170	148	50.6	40	30	10
18	125	180	158	51.8	40	31	11
20	125	190	168	52.8	40	31	11



125° STANDARD (STD) – COLLARLESS							
Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
8	125	115	93	38.4	35	31	7
9	125	130	108	38.9	35	31	8
10	125	140	118	39.6	35	31	8

125° STANDARD (STD) – COLLARED							
Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
8	125	115	93	38.4	35	31	7
9	125	130	108	38.9	35	31	8
10	125	140	118	39.6	35	31	8
11	125	145	123	40.4	35	31	9
12	125	150	128	41.1	35	31	10
13	125	155	133	41.7	35	31	10
14	125	160	138	42.4	35	31	10

135° SHORT NECK (SN) – COLLARLESS							
Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
8	135	115	93	33.0	32	31	7
9	135	130	108	33.5	32	31	8
10	135	140	118	34.2	32	31	8

135° SHORT NECK (SN) – COLLARED							
Size	Neck Shaft Angle (A)	Stem Length (mm) (B)	Stem Length (mm) (C)	Offset (mm) (D)	Neck Length (mm) (E)	Neck height (mm) (F)	Width (mm) (G)
8	135	115	93	33.0	32	31	7
9	135	130	108	33.5	32	31	8
10	135	140	118	34.2	32	31	8
11	135	145	123	35.0	32	31	9
12	135	150	128	35.7	32	31	10
13	135	155	133	36.4	32	31	10
14	135	160	138	37.0	32	31	10

# Ordering Information

## Implants



### 135° Standard STD (KS No Collar)

3L92507	Size 8
3L92509	Size 9
3L92510	Size 10
3L92511	Size 11
3L92512	Size 12
3L92513	Size 13
3L92514	Size 14
3L92515	Size 15
3L92516	Size 16
3L92518	Size 18
3L92520	Size 20



### 135° Standard STD (KA Collar)

3L92498	Size 8
3L92499	Size 9
3L92500	Size 10
3L92501	Size 11
3L92502	Size 12
3L92503	Size 13
3L92504	Size 14
3L92505	Size 15
3L92506	Size 16
3L92508	Size 18
3L92521	Size 20



### 135° High Offset KHO (No Collar)

L20309	Size 9
L20310	Size 10
L20311	Size 11
L20312	Size 12
L20313	Size 13
L20314	Size 14
L20315	Size 15
L20316	Size 16
L20318	Size 18
L20320	Size 20



### 135° High Offset KHO (Collar)

L971109	Size 9
L971110	Size 10
L971111	Size 11
L971112	Size 12
L971113	Size 13
L971114	Size 14
L971115	Size 15
L971116	Size 16
L971118	Size 18
L971120	Size 20



### 125° High Offset KLA (KLA Collar)

3L93709	Size 9
3L93710	Size 10
3L93711	Size 11
3L93712	Size 12
3L93713	Size 13
3L93714	Size 14
3L93715	Size 15
3L93716	Size 16
3L93718	Size 18
3L93720	Size 20



### 125° Standard STD (No Collar)

L981208	Size 8
L981209	Size 9
L981210	Size 10



### 125° Standard STD (Collar)

L971208	Size 8
L971209	Size 9
L971210	Size 10
L971211	Size 11
L971212	Size 12
L971213	Size 13
L971214	Size 14



### 135° Short Neck SN (No Collar)

L981308	Size 8
L981309	Size 9
L981310	Size 10



### 135° Short Neck SN (Collar)

L971308	Size 8
L971309	Size 9
L971310	Size 10
L971311	Size 11
L971312	Size 12
L971313	Size 13
L971314	Size 14

To select the correct DePuy Synthes Femoral Head to be used with CORAIL AMT HA-coated stem in case of hemiarthroplasty, refer to algorithm presented in document ref. DPEM/JRC/1213/0002.

# Ordering Information

## Instruments

Core Tray		Expansion Tray	
2001-65-000	Femoral/Humeral Head Impactor	L20415	Broach CORAIL AMT 15
2530-81-000	ARTICUL/EZE™ Trial Head Grooved 28 mm +1.5	L20416	Broach CORAIL AMT 16
2530-82-000	ARTICUL/EZE™ Trial Head Grooved 28 mm +5	L20418	Broach CORAIL AMT 18
2530-83-000	ARTICUL/EZE™ Trial Head Grooved 28 mm +8.5	L20420	Broach CORAIL AMT 20
2530-84-000	ARTICUL/EZE™ Trial Head Grooved 28 mm +12	L94010	Large Shielded Calcar Planer
2530-91-000	ARTICUL/EZE™ Trial Head Grooved 32 mm +1	2001-42-000	T Handle
2530-92-000	ARTICUL/EZE™ Trial Head Grooved 32 mm +5	2105-11-000	Canal Reamer 9.0
2530-93-000	ARTICUL/EZE™ Trial Head Grooved 32 mm +9	2105-12-000	Canal Reamer 10.0
2530-94-000	ARTICUL/EZE™ Trial Head Grooved 32 mm +13	2105-14-000	Canal Reamer 11.0
2545-01-700	DePuy Synthes Lid	2105-15000	Canal Reamer 12.0
2570-05-100	SUMMIT® Standard Imp. Inserter	L95058	CORAIL Expansion Tray Sizes 15-20
2598-07-530	Modular Osteotome	2545-01-700	DePuy Synthes Lid
9400-80-007	Proxima Calcar Planer		
9522-12-500F	CORAIL AMT Extra Curved Handle		
L20408	Broach CORAIL AMT 8		
L20409	Broach CORAIL AMT 9		
L20410	Broach CORAIL AMT 10		
L20411	Broach CORAIL AMT 11		
L20412	Broach CORAIL AMT 12		
L20413	Broach CORAIL AMT 13		
L20414	Broach CORAIL AMT 14		
L94003	Neck Trial 125 STD		
L94004	Neck Trial 125 HO		
L94005	Neck Trial 135 STD		
L94006	Neck Trial 135 HO		
L94007	Neck Trial 135 SN		
L94013	Modular Bone Compactor		
L94018	Canal Explorer		
L95057	CORAIL Femoral Tray Sizes 8-14		

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## Modular Non Osteo-Integrated Extractor

L94026	Modular Handle
L94027	Extractor Strike Plate
L94028	Extractor Screw
L94029	Extractor Threaded Rod

## Templating

### Pre-operative Templates

L94041	CORAIL X-ray Templates 100% STD HO 8-20
L94042	CORAIL X-ray Templates 115% STD HO 8-20
L94043	CORAIL X-ray Templates 120% STD HO 8-20
L96041	CORAIL X-ray Templates 100% STD HO LE 2
L96042	CORAIL X-ray Templates 115% STD HO LE 2
L96043	CORAIL X-ray Templates 120% STD HO LE 2
L94044	CORAIL X-ray Templates 100% SN 8-10 & Dysplasia 6
L94045	CORAIL X-ray Templates 115% SN 8-10 & Dysplasia 6
L94046	CORAIL X-ray Templates 120% SN 8-10 & Dysplasia 6
L96044	CORAIL X-ray Templates 100% SN 8-14 & Dysplasia 6 LE 2
L96045	CORAIL X-ray Templates 115% SN 8-14 & Dysplasia 6 LE 2
L96046	CORAIL X-ray Templates 120% SN 8-14 & Dysplasia 6 LE 2

### Digital Templates

The availability of digital templates depends on DePuy International's agreement with the vendors

Please contact DePuy International for more information

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