



Surgical Technique

Amplitude is an internationally renowned orthopaedic company that has built a reputation for exceptional engineering, reliable clinical results, and cohesive collaboration with the world's leading surgeons.



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E²® Hip System

The E²® is a highly polished dual taper, cemented femoral stem based on biomechanical design principles with over 40 years' clinical history. The system was developed by Amplitude's team of internationally renowned engineers in collaboration with a leading group of Australian design surgeons.

The E²® femoral stem is manufactured from a high nitrogen stainless steel alloy (M30NW) with tapered geometry to enhance load transfer and minimise shear stress at the cement/bone interface.

The instrumentation features a slimline stem inserter for increased control and accurate alignment along with a PMMA distal centraliser to allow for subsidence of the stem, following the traditional loading philosophy.

The efficient instrument system allows for reproducible technique, enhancing the potential for long term clinical success.

Reliability

- The stem philosophy follows a proven design with over 40 years' clinical history.
- The stem is manufactured from high nitrogen stainless steel alloy (M30NW) conforming to ISO standard 5832-9.

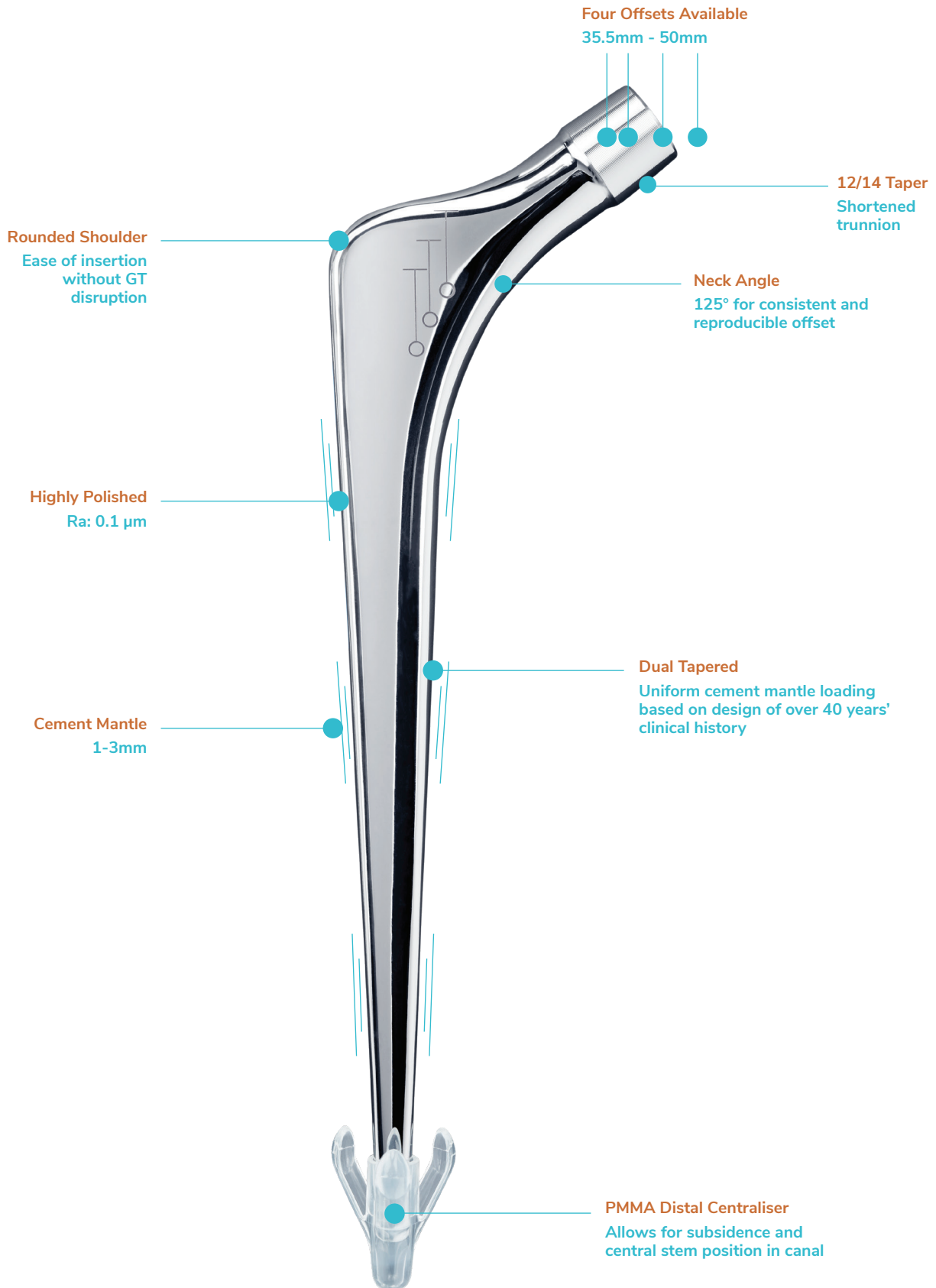
Choice

- Thirteen stem sizes available with offsets of 35.5mm, 37.5mm, 44mm and 50mm.

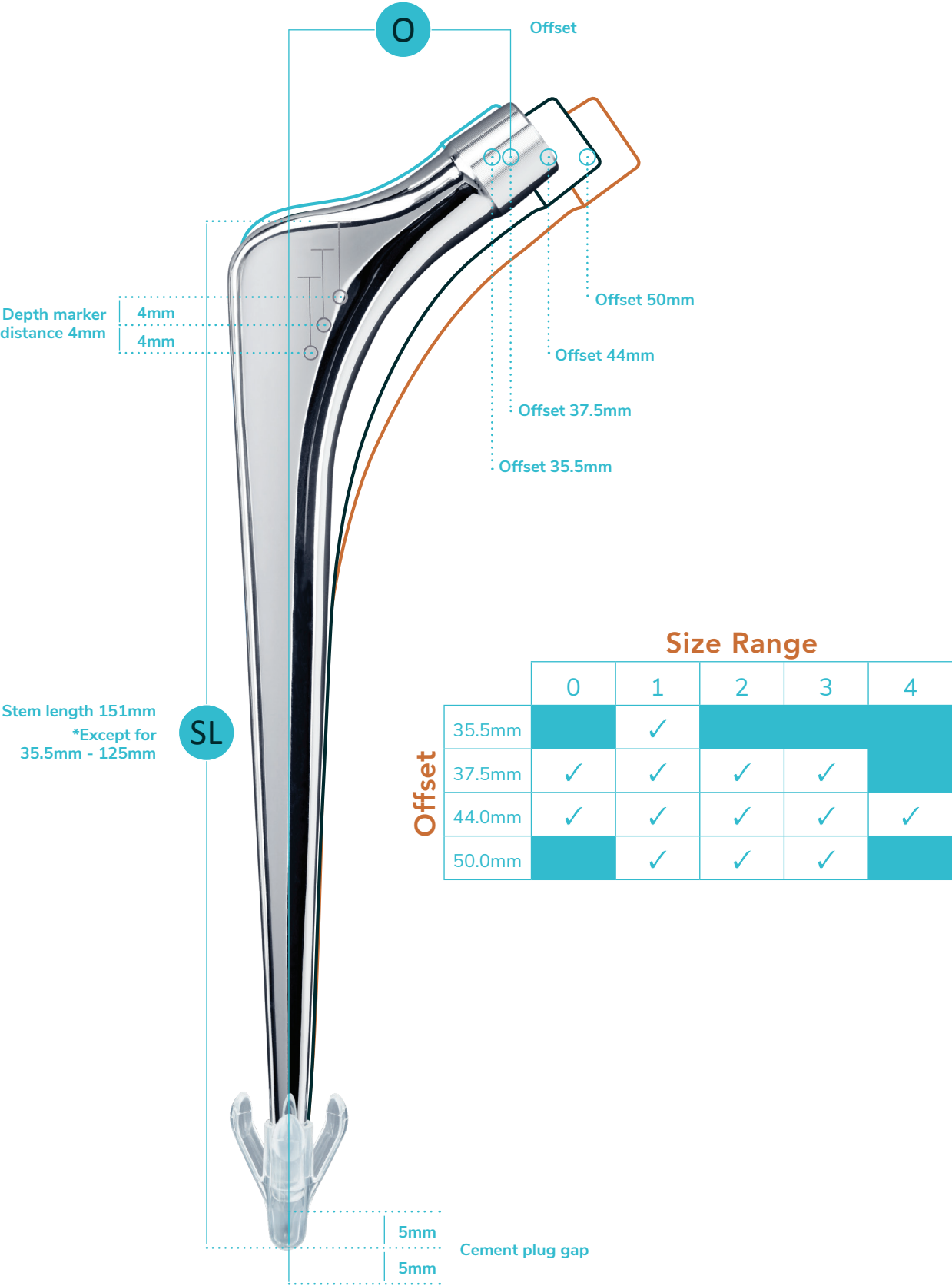
Efficiency

- Ergonomic instrumentation.
- Efficient tray design and layout.
- Streamlined instruments simplify setup and provide alignment assistance to the surgeon intra-operatively.

E² Features



Implant Information





Femoral Heads 12/14



Size	Neck length
Ø 28mm	SN -3.5mm
	MN 0mm
	LN +3.5mm
Ø 32mm	SN -4mm
	MN 0mm
	LN +4mm
	XLN +7mm
Ø 36mm	SN -4mm
	MN 0mm
	LN +4mm
	XLN +8mm

Size	Neck length
Ø 22.2mm	SN -2mm
	MN 0mm
	LN +2mm
Ø 28mm	SN -3.5mm
	MN 0mm
	LN +3.5mm
	XLN +7mm
Ø 32mm	SN -4mm
	MN 0mm
	LN +4mm
	XLN +7mm
Ø 36mm	SN -4mm
	MN 0mm
	LN +4mm
	XLN +8mm

Size	Neck length
Ø 28mm	SN -3mm
	MN 0mm
	LN +4mm
	XLN +7mm
Ø 32mm	SN -3mm
	MN 0mm
	LN +4mm
	XLN +7mm
Ø 36mm	SN -3mm
	MN 0mm
	LN +4mm
	XLN +7mm

Surgical Technique Overview

1

Femoral Neck Resection

- Identify anatomical landmarks (LT, PF, GT).
- Determine the neck cut level during pre-operative planning.
- Mark the cutting plane level onto the bone with reference to the anatomical landmarks.
- Take care to protect the soft tissues & greater trochanter during neck cut - In some cases, where the cut is lower, a second vertical cut can be made at the base of the neck and GT.

2

Femoral Canal Preparation

- Insert smallest T-handle reamer into centre of the femoral canal.
- Remove hard bone along the medial side of the greater trochanter with the box chisel.
- Leave cut bone within the proximal canal for compaction.



3

Metaphyseal Preparation

- Prepare the metaphyseal area by removing hard bone, passing the box chisel close to the medial side of the greater trochanter at its junction with the neck.



4

Broaching

- Start with the 35.5mm broach or the smallest size of the templated offset and sequentially increase until the templated offset and size is reached.




5

Trial on Broach

- Place the trial neck on the broach and then the templated head onto the neck.




6



Cement Restrictor Insertion

- Insert the femoral sounds into canal to the desired length. Insert the correctly sized PMMA cement restrictor into the femoral canal.


7



Femoral Cementing

- Place the suction catheter into the canal to remove blood and excess irrigation as cement is introduced using a modern cementing technique.

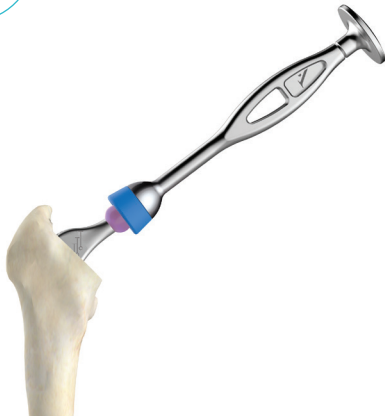
8



Final Stem Insertion

- Once bone cement is of sufficient viscosity to resist extrusion from the canal, the stem can be implanted.
- Attach the stem to the inserter gun and, with the distal centraliser attached, insert the stem into canal to the desired depth marking corresponding with the trial.

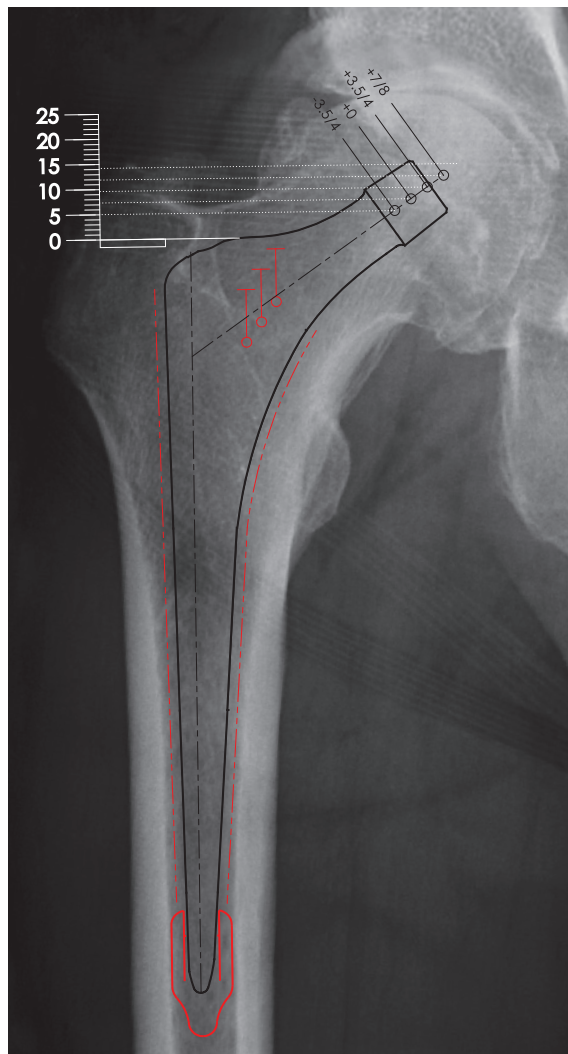
9



Head Impaction & Final Reduction

- Once the excess cement has been cleared away and the cement polymerises, a secondary trial reduction can be performed on the definitive stem.
- Once the correct head is chosen, the implant is placed by hand onto the clean, dry taper and impacted.
- The joint is reduced.

Pre-Operative Planning



NOTE

- Templates are provided at 115% scale. Other magnifications are available upon request.

1: Assess quality of radiograph

Obtain an adequate AP pelvis X-ray centred on the pubis with attention to the following:

- Pelvic rotation – The symphysis should project centrally through the middle of the sacrum. You should be able to see both of the obturator foramen equally sized and shaped.
- Pelvic flexion – Sacrococcygeal joint to upper symphysis should be approximately 30-50mm. It will be increased if the pelvis was tilted forward, or decreased if the pelvis was tilted back, at the time of X-ray.
- Femoral rotation – Both femora should be internally rotated by 15-20 degrees. You should be able to see more than 2mm but less than 3mm of the lower trochanter.
- The image quality is acceptable and is at the expected magnification~115%.

2: Identify anatomical landmarks

You should be able to identify the following landmarks on the radiograph:

- Femoral head centres for both femora – centre of rotation.
- Femoral shaft axis.
- Teardrops.

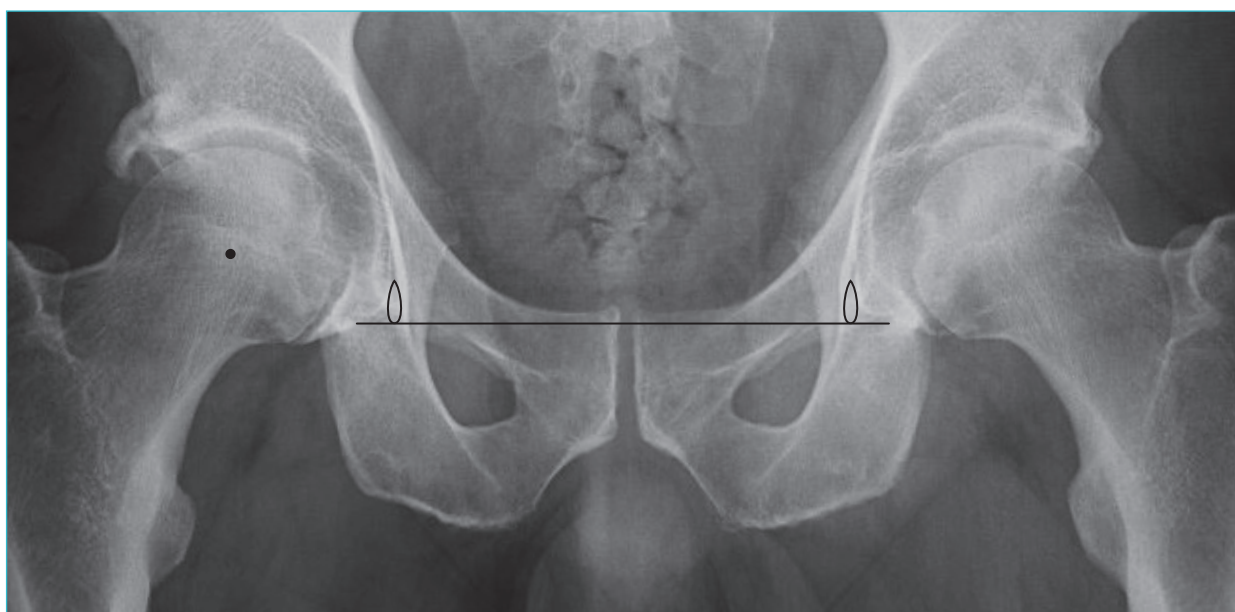
3: Identify acetabular and femoral biomechanical points and optimise implant positioning¹

Acetabulum

- Mark the teardrops and draw a straight line between them.
- Measure the distance from the inter teardrop line to the lesser trochanter or other fixed landmark on each side. Note the difference between the indicated and contra-indicated side in order to assess leg length inequality.
- Rest the dome line of the acetabular template on the medial wall. The inferior cup should sit just below the tear drop at the inferior acetabulum.
- Mark the new acetabular centre - make the inclination 40 degrees and note the component size.

Femur

- Compare the normal and abnormal sides.
- Template the normal side first. This is of particular importance if the femoral head is deformed.
- Template the indicated side and note the neck osteotomy level, stem size and new femoral head centre.
- The implant should allow for 1-3mm of cement mantle.
- The offset of the stem and neck cut level should allow a proper restoration of lower limb length and abductor's lever arm (femoral offset).
- Mark and measure neck resection level to use as a reference intra-operatively.
- Check and adjust neck length to restore offset.



1. Scheerlinck T., Primary hip arthroplasty templating on standard radiographs - A stepwise approach, Acta Orthop. Belg., 2010

Surgical Approach

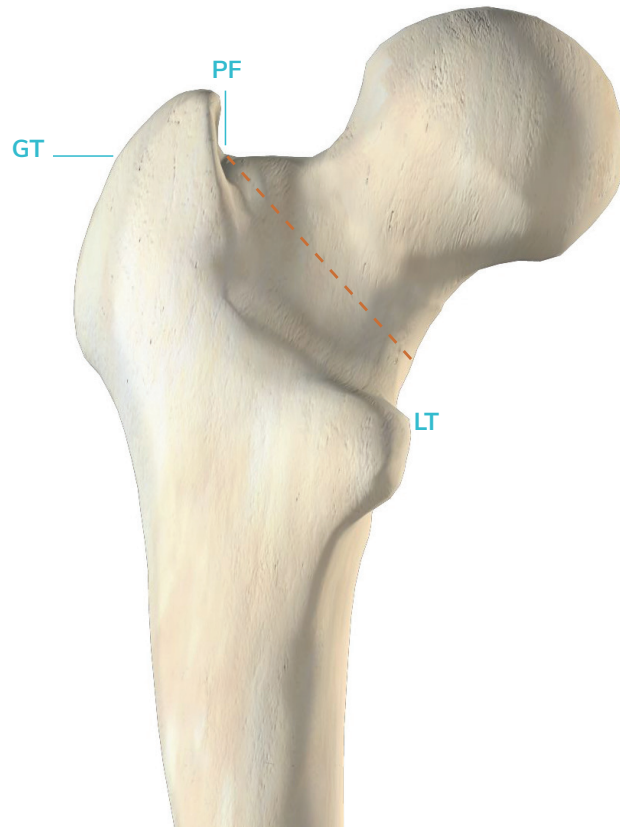
The E²® stem may be implanted using any of the traditional surgical approaches and any of the contemporary, less-invasive approaches including direct anterior (on or off table).

The requirement of any approach is adequate visualisation of the acetabulum and proximal femur.

- 360 (degree) view of the rim, floor, transverse acetabular ligament and other landmarks for correct cup positioning.
- Direct view down the femoral canal and the calcar in order to prepare the canal correctly and minimise/identify intra-operative fractures.
- Clear view of the greater and lesser trochanters to reduce the incidence of fracture and measure leg length.



1 Femoral Neck Resection



1. Identify anatomical landmarks: Lesser Trochanter (LT), Piriformis Fossa (PF), Greater Trochanter (GT).
2. Determine the neck cut level during pre-operative planning.
3. Mark the cutting plane level onto the bone with reference to the anatomical landmarks.
4. Take care to protect the soft tissues and greater trochanter during neck cut. In some cases where the cut is lower, a second vertical step-cut is made at the base of the neck and GT.

NOTE

The E²[®] femoral stem can accept multiple neck cut angles including a vertical step cut where necessary.

2 Femoral Canal Preparation



Canal Identification

1. Identify the femoral entry point which is normally found in the piriformis fossa on the posterior and lateral quadrant of the cut neck surface. You may need to remove a small part of the posterior cortex at the neck junction.
2. Use the smallest T-handle reamer to find the centre of the canal.
3. Push into the femoral canal to prepare it for broaching, making sure to stay in the femoral shaft axis.
4. Use the larger diameter reamer to open the canal. Metaphyseal reamers are available on request.

3 Metaphyseal Preparation



Canal Opening

1. Prepare the metaphyseal area by removing hard bone, passing close to the medial side of the greater trochanter at its junction with the neck.
2. Keep the box chisel in line with the centre of the canal and the planned anteversion of the stem.
3. Avoid removing any additional bone and leave cut bone within the proximal canal for compaction.

*Canal Identification and Canal Opening are interchangeable steps.



4 Broaching

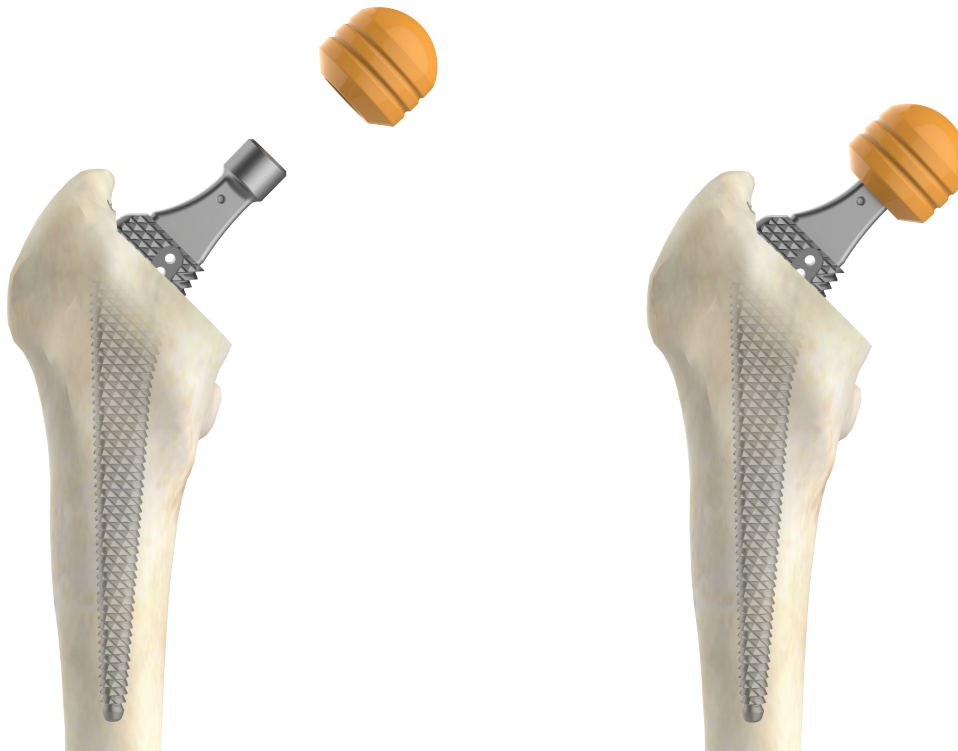
1. Assemble the broach to the broach handle. Start with the 35.5mm or smallest size of the templated offset.
2. Keep the broach lateral to maintain neutral positioning and take note of the depth marker templated pre-operatively to ensure correct leg length recreation.
3. If introduction of the broach requires excessive force, you may be broaching into a varus position. Remove the broach and reintroduce the T-handle reamer to ensure lateralisation then repeat broaching to the desired size.
4. Confirm the broach is placed correctly, then disengage the broach from the broach handle.
5. Impact to the templated level.

NOTE

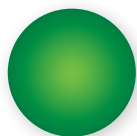
- The broach depth markings correspond exactly to the depth markings on the implant.
- All broaches are slightly longer (3mm) than the corresponding stem size to accommodate placement of the stem distal centraliser.



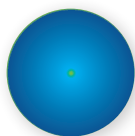
5 Trial on Broach



1. Place the trial neck onto the broach then select and place the trial head onto the neck.
2. Reduce the hip using the head impactor or by hand under control.
3. Test the range of motion and joint stability as well as leg length, offset and impingement to confirm adjustments.
4. If required, change the trial head until desired results are achieved.
5. Remove the trial head and extract the broach from the femoral canal using the broach handle.



Ø22.2mm



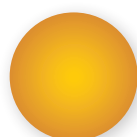
Ø28mm



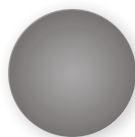
short neck



medium neck



Ø32mm



Ø36mm

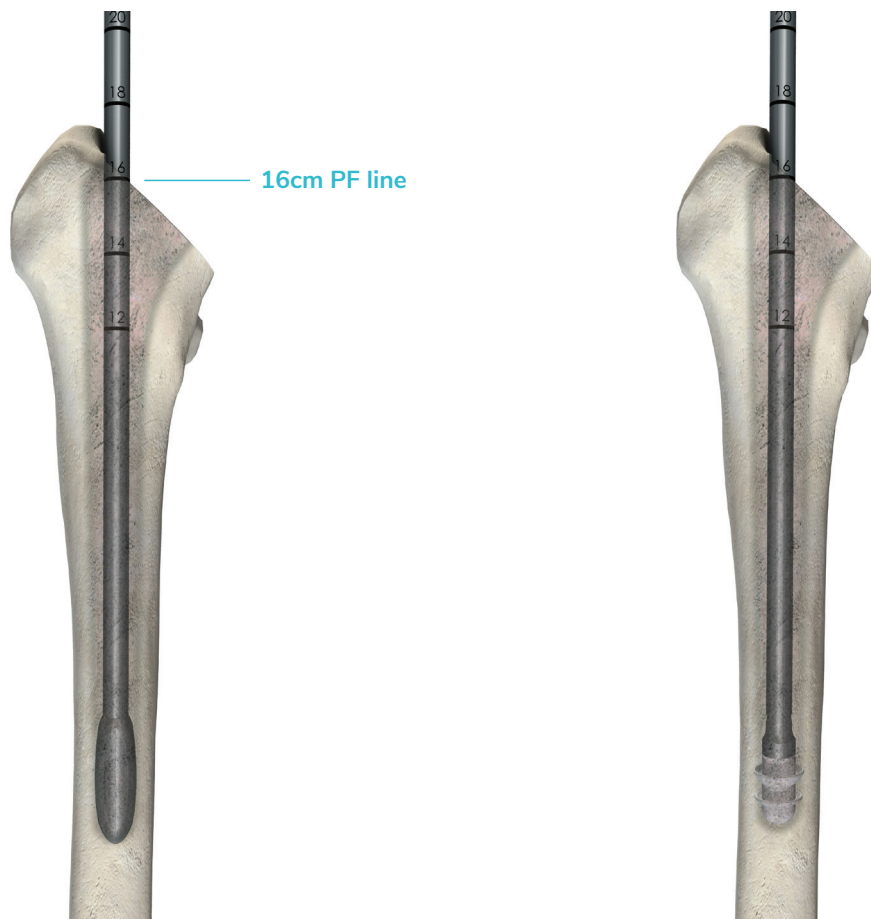


long neck



extra-long neck

6 Cement Restrictor Insertion



1. Start by inserting the smallest femoral sound into the canal until it wedges. If this is a depth less than or equal to 16cm below the piriformis fossa then this is the correct cement size plug. If it descends more than 16cm below the piriformis fossa select the next size up.
2. Thread the chosen cement restrictor clockwise onto the inserter rod and insert the cement restrictor to 16cm (or 14cm if using a 35.5mm stem). Disengage the inserter by twisting it anticlockwise once the restrictor is in position.

NOTE

If using a 35.5mm stem, the target depth should be approximately 14cm below the piriformis fossa.

NOTE

There are three femoral sounds - small, medium and large - but there are four femoral plug sizes available. If the large sound does not wedge into the canal, use the extra large plug.

7 Femoral Cementing



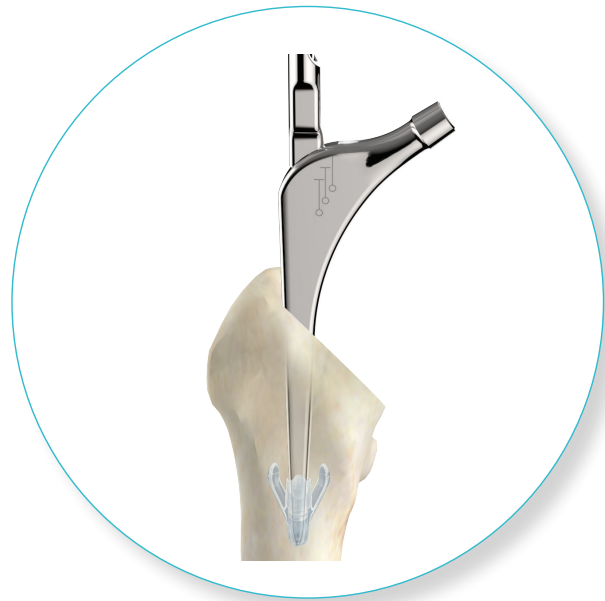
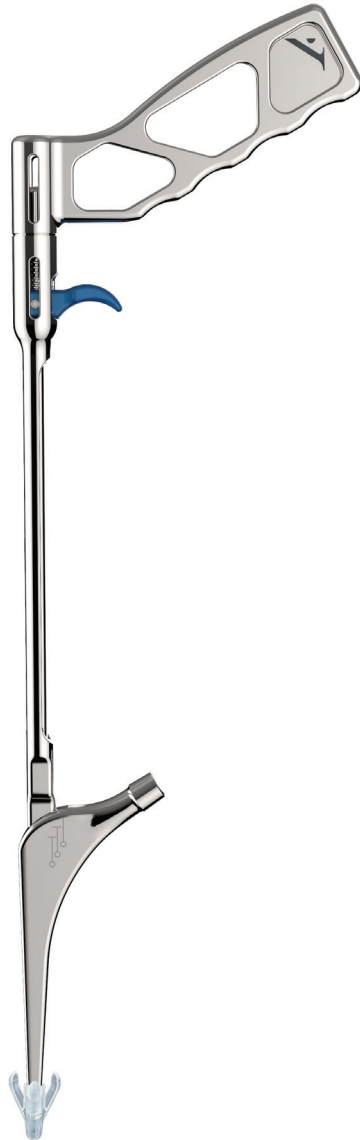
Preparing the Femoral Canal

1. Irrigate the canal using saline solution and thoroughly clean the canal with pulsed lavage.
2. Assess the condition of the canal to ensure it is free of any extraneous material and bone debris.
3. Drain canal with suction tubing.
4. Thoroughly dry the canal by packing with a suitable absorbent material which may be left in place until cement injection to minimise bleeding. **Note: Gauze can be soaked with Hydrogen Peroxide to assist this process.**
5. Open the implants and prepare for cementing, following instructions of the cement manufacturer.

Femoral Cementing

1. Ideally, a low viscosity cement is used to allow cement penetration into the prepared canal.
2. Insert the nozzle of the cement gun adjacent to the restrictor to allow retrograde filling (ie from distal to proximal) until the canal is completely full.
3. Pressurise the cement into the canal by applying steady force to half moon, occluding canal opening.
4. Once the bone cement is of sufficient viscosity to resist extrusion from the canal, withdraw the pressuriser and remove any residual cement from around the canal periphery using the cement curettes.

8 Final Stem Insertion

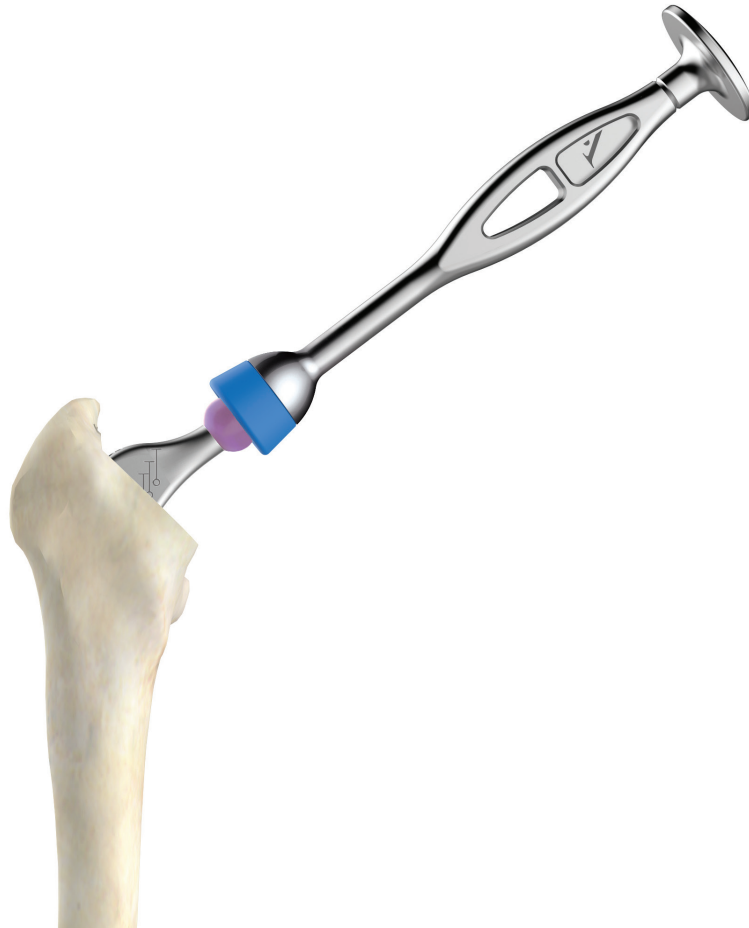


NOTE

The distal centraliser is critical to the insitu behaviour of the E²® implant. As well as ensuring neutral stem alignment, the distal centraliser prevents the stem from becoming end-bearing directly in the cement.

1. Attach the E²® femoral stem inserter to the stem by pulling back the trigger on the handle and inserting the tip into the hole in the proximal end of the prosthesis.
2. Place the distal centraliser (narrow or wide) on the distal extremity of the stem and hold in place (centraliser is not retentive).
3. Place a thumb or finger medial to the stem to occlude the medial exit, thereby pressurising the cement and assisting correct alignment.
4. Maintain desired anteversion throughout stem insertion.
5. Insert the stem to the trialled depth marker.
6. Disengage the inserter from the stem by pulling back the trigger, taking care not to move the stem within the cement mantle.
7. Use the cement curettes to trim away excess cement.
8. Apply the stem seal and hold in position until the cement polymerises.

9 Head Impaction & Final Reduction



Trial Reduction

1. Place the trial head onto the definitive stem and reduce the hip.
2. Check that the leg length, offset, stability and impingement are reproduced.
3. Put the hip through its range of motion to check any potential for dislocation.

Head Assembly

1. Before placing the definitive femoral head on the stem, meticulously inspect the stem taper and head taper and remove any foreign bodies.
2. Manually place the head on the stem taper.
3. Finalise fixation of the head with the head impactor by giving it a slight hammer tap along the axis, and reduce articulation with the head pusher.

IMPORTANT

- Never strike the femoral head directly with the hammer so as to avoid damage.
- During the final reduction of the femoral head into the acetabular liner, contact between the femoral head and any metal (cup or instruments) must be avoided.

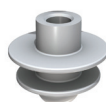
Implant Information



PRIMARY FEMORAL COMPONENTS		
PART NO	OFFSET	SIZE
111-042-002	35.5mm	1
111-042-005	37.5mm	0
111-042-006	37.5mm	1
111-042-007	37.5mm	2
111-042-008	37.5mm	3
111-042-009	44.0mm	0
111-042-010	44.0mm	1
111-042-011	44.0mm	2
111-042-012	44.0mm	3
111-042-013	44.0mm	4
111-042-014	50.0mm	1
111-042-015	50.0mm	2
111-042-016	50.0mm	3



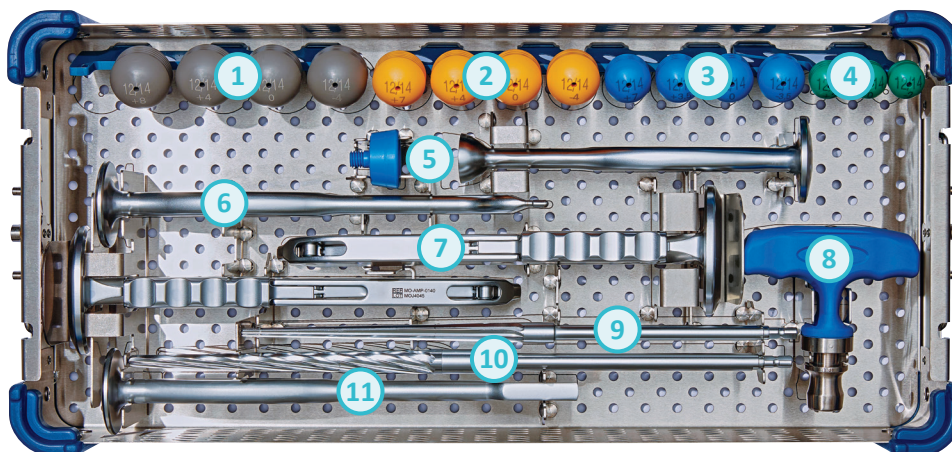
DISTAL CENTRALISER	
PART NO	DESCRIPTION
111-162-002	Winged
111-162-003	Wingless



CEMENT RESTRICTOR		
PART NO	DIAMETER	SIZE
112-012-116	16mm	S
112-012-120	20mm	M
112-012-125	25mm	L
112-012-132	32mm	XL

Instrumentation

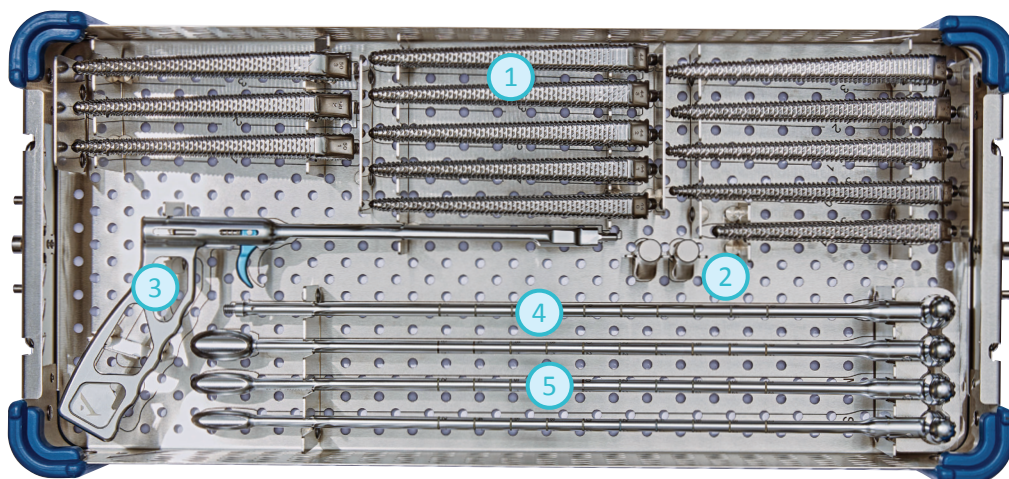
Universal Set



KEY	DESCRIPTION	REFERENCE	QTY
1	Trial femoral head 12/14 on stem Ø36 Extra-Long neck +8	2-0196115	1
1	Trial femoral head 12/14 on stem Ø36 Long neck +4	2-0196112	1
1	Trial femoral head 12/14 on stem Ø36 Medium neck	2-0196111	1
1	Trial femoral head 12/14 on stem Ø36 Short neck -4	2-0196110	1
2	Trial femoral head 12/14 on stem Ø32 Extra-Long neck	2-0196114	1
2	Trial femoral head 12/14 on stem Ø32 Long neck +4	2-0196109	1
2	Trial femoral head 12/14 on stem Ø32 Medium neck	2-0196108	1
2	Trial femoral head 12/14 on stem Ø32 Short neck -4	2-0196107	1
3	Trial femoral head 12/14 on stem Ø28 Extra-Long neck	2-0196113	1
3	Trial femoral head 12/14 on stem Ø28 Long neck +3.5	2-0196103	1
3	Trial femoral head 12/14 on stem Ø28 Medium neck	2-0196102	1
3	Trial femoral head 12/14 on stem Ø28 Short neck	2-0196101	1
4	Trial femoral head 12/14 on stem Ø22.2 Long neck	2-0196106	1
4	Trial femoral head 12/14 on stem Ø22.2 Medium neck	2-0196105	1
4	Trial femoral head 12/14 on stem Ø22.2 Short neck	2-0196104	1
5	Head Impactor Ø22.2, Ø28, Ø32, Ø36	112-042-045	1
6	Offset Stem Impactor	2-0194200	1
7	Straight Male Broach Handle Conventional	2-0194500	2
8	T handle - Zimmer-Hall Connection	2-0192300	1
9	Tapered Pin Reamer 4/11mm - Zimmer/Hall	2-0193200	1
10	Tapered Pin Reamer 7/14mm - Zimmer/Hall	2-0193300	1
11	Box Chisel Medium	112-042-038	1



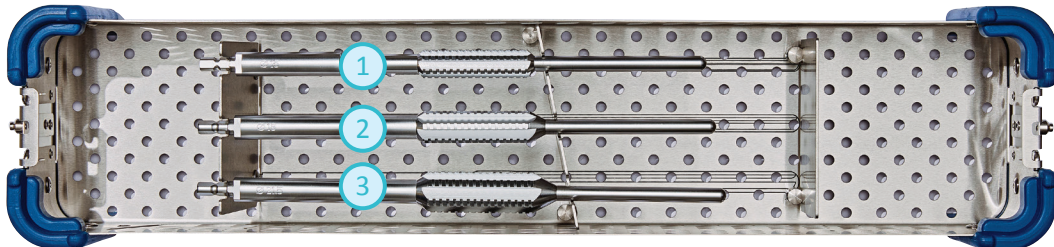
E² Broach Tray



KEY	DESCRIPTION	REFERENCE	QTY
1	E ² Broach Offset 35.5 Size 1	2-0192001	1
1	E ² Broach Offset 37.5 Size 0	2-0192002	1
1	E ² Broach Offset 37.5 Size 1	2-0192003	1
1	E ² Broach Offset 37.5 Size 2	2-0192004	1
1	E ² Broach Offset 37.5 Size 3	2-0192005	1
1	E ² Broach Offset 44 Size 0	2-0192006	1
1	E ² Broach Offset 44 Size 1	2-0192007	1
1	E ² Broach Offset 44 Size 2	2-0192008	1
1	E ² Broach Offset 44 Size 3	2-0192009	1
1	E ² Broach Offset 44 Size 4	2-01920010	1
1	E ² Broach Offset 50 Size 1	2-01920011	1
1	E ² Broach Offset 50 Size 2	2-01920012	1
1	E ² Broach Offset 50 Size 3	2-01920013	1
2	E ² Trial Neck	2-0180700	2
3	E ² Stem Inserter	2-0107900	1
4	E ² Cement Restrictor Introducer	2-0180800	1
5	E ² Intramedullary Sound Size S (13mm)	2-0107213	1
5	E ² Intramedullary Sound Size M (15mm)	2-0107215	1
5	E ² Intramedullary Sound Size L (20mm)	2-0107220	1

Instrumentation - Optional

Proximal Reamer Tray



KEY	DESCRIPTION	REFERENCE	QTY
1	Connection Zimmer/Hall Proximal Straight Reamer Ø15	2-0194415	1
2	Connection Zimmer/Hall Proximal Straight Reamer Ø18	2-0194418	1
3	Connection Zimmer/Hall Proximal Straight Reamer Ø21.5	2-0194421	1



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