

Smith+Nephew

TITAN

Reverse Shoulder System-S

Surgical Technique



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Introduction

The TITAN Reverse Shoulder System and the following technique guide was prepared under the guidance and close collaboration with physicians. It contains a summary of medical techniques and opinions based upon their training and expertise in the field, along with their knowledge of Smith & Nephew products. It is provided for educational and informational purposes only. Smith & Nephew does not provide medical advice and it is not intended to serve as such. It is the responsibility of the treating physician to determine and utilize the appropriate products and techniques according to their own clinical judgment for each of their patients. For more information on the products in this surgical technique, including indications for use, contraindications, effects, precautions and warnings, please consult the products' Instructions for Use (IFU).

Note Bena

The following technique is for informational and educational purposes only. It is not intended to serve as medical advice. It is the responsibility of treating physicians to determine and utilize the appropriate products and techniques according to their own clinical judgment for each of their patients. For more information on the product, including its indications for use, contraindications, and product safety information, please refer to the product's label and the Instructions for Use packaged with the product.

Prior to performing this technique, please consult the Instructions for Use documentation provided with each device for additional health and safety information, including indications, contraindications, warnings and precautions.



Design Rationale

Redefining Modularity

A complete total shoulder system with the intraoperative flexibility to address total shoulder and reverse shoulder arthroplasty from a single stem platform.

Humeral Body

- Reverse Humeral Body made of Titanium
- 142° inclination angle
 - Potential for increased ROM and minimized scapular notching versus a 155° inclination^{1,2}
 - Designed for increased exposure of glenoid for preparation due to larger humeral head resection
- 3 body height options to address varying anatomy. Ability to tension deltoid without over lateralizing the humerus with spacers
 - Small, Standard, Large
 - Porous coating designed to allow an all press fit humeral component and secondary fixation
- Polished neck to allow for tuberosity and soft tissue suture retention



Baseplate and Screws

Porous coated Glenoid Baseplates made of Titanium

- 10.6 x 13mm length Post
- Anatomic shape to minimize reaming and aid in resistance to shear forces
- Porous coating designed to aid in long term fixation³⁻⁶

Central Compression Screw

- 4.5mm x (15-55mm) length in 5mm increments
- Independent compression screw for centralized compression of baseplate into glenoid

Peripheral Polyaxial Compression/Locking Screws

- Same screw as central screw
- Anterior and Posterior compression screws
- Superior and Inferior compression with subsequent locking option



Warnings

The following conditions tend to adversely affect shoulder replacement implants:

- Excessive patient weight
- High levels of patient activity
- Likelihood of falls
- Poor bone stock
- Metabolic disorders
- Disabilities of other joints

Precautions

- Do not reuse this device. Reuse of this product may result in infection or other systemic complication that may affect the patient's overall health. Additionally, the reuse of this product could adversely affect the function of the device. Any implant that has been damaged, mishandled, or removed from the sterile field may have surface damage that could result in implant fracture and/or particulate and should be discarded.
- The TITAN Reverse Shoulder System has not been evaluated for safety and compatibility in the magnetic resonance (MR) environment. It has not been tested for heating, migration, or image artifact in the MR environment. The safety of the TITAN Reverse Shoulder System-S in the MR environment is unknown. Scanning a patient who has this device may result in patient injury.



Humeral Liners

Standard and Retentive Polyethylene Humeral Liner options in four thicknesses designed to optimize soft tissue tensioning.

- Standard: +0mm, +3mm, +6mm, +9mm
- Retentive: +0mm, +3mm, +6mm, +9mm



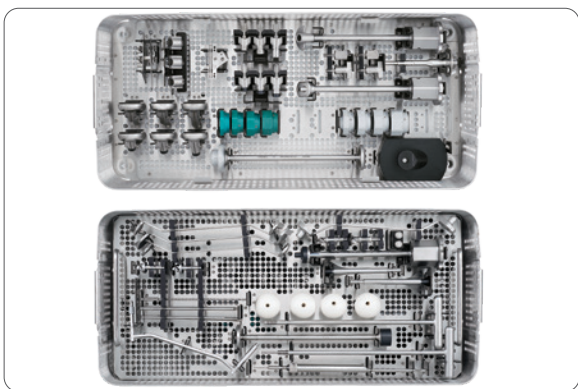
Humeral Stems

- Humeral Stems made from Titanium for press fit applications
 - 11 sizes (6-16mm) 1mm increments
- Humeral Stems made from Cobalt Chrome for cemented applications
 - 5 sizes (6-14mm) 2mm increments



Glenosphere

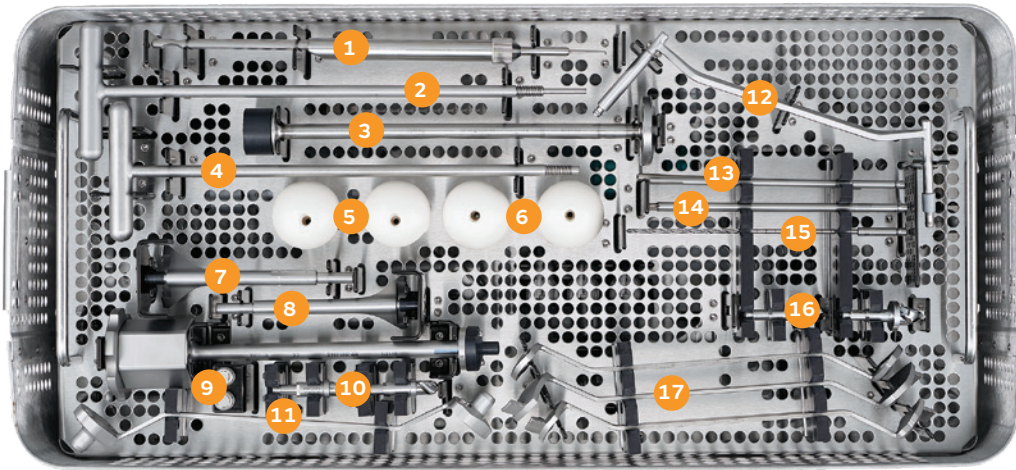
- 38mm diameter Glenospheres made of Cobalt Chrome
- 4 Glenosphere options to fine-tune soft tissue tensioning, stability, and range of motion to patient anatomy while minimizing scapular notching
 - Concentric Glenosphere, 2mm & 5mm Lateralized
 - 4mm Eccentric Glenosphere, 2mm & 5mm Lateralized



Instrumentation

- 3 systems in one
 - Total Shoulder Arthroplasty
 - Hemiarthroplasty for Proximal Humeral Fracture
 - Reverse Total Shoulder Arthroplasty
- All with one set of instruments (4 trays)

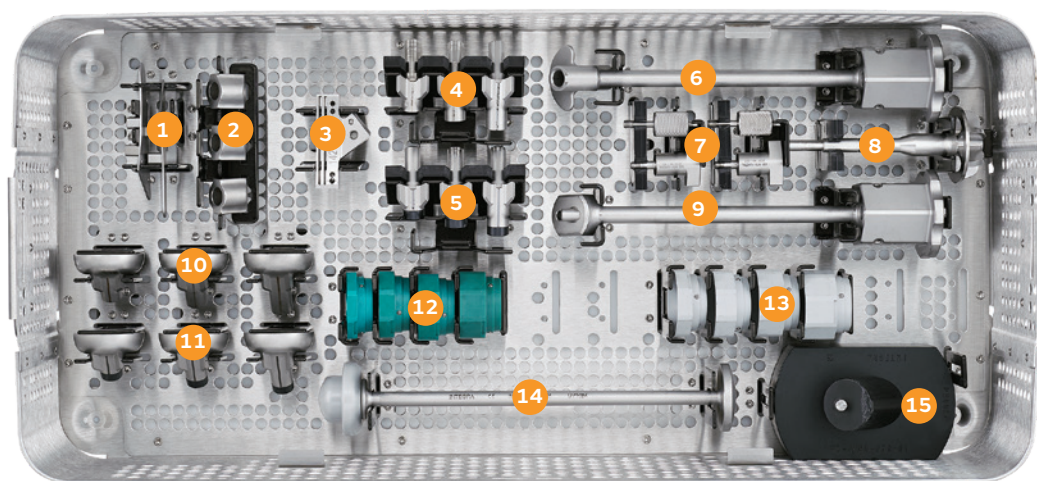
Reverse Shoulder System-S Glenoid Instruments (Top Tray)



- | | | |
|------------------------------------|----------------------------------|--|
| 1. RSS Drill Depth Gauge-S | 7. Peripheral Reamers-S | 13. Slotted T-15 Star Driver for Screw Locking Cap |
| 2. Glenosphere Removal Handle-S | 8. Glenoid Baseplate Impactor-S | 14. TX-15 Star Driver for 4.5mm Screws |
| 3. Glenosphere Impactor | 9. Anti-Rotation Baseplate Peg | 15. 2.5 Drill for 4.5mm Screws |
| 4. Glenosphere Inserter | 10. Baseplate Boss Drills | 16. Baseplate Central Drill-S |
| 5. Glenosphere Eccentric Trials-S | 11. Baseplate Boss Drill Guide-S | 17. Cannulated Drills for 13mm Central Peg |
| 6. Glenosphere Concentric Trials-S | 12. Double Drill Guide-S | |

No.	Reference	Description	Qty
1	RDG-0961-078	RSS 4.5mm Depth Gage	1
2	HDL-0961-067-S	RSS Glenosphere Removal Handle-S	1
3	IMP096006601	Glenosphere Impactor	1
4	HDL096006501	Glenosphere Inserter	1
5	TRL-0961-05E-S	RSS Glenosphere Trial, Eccentric-S	1
5	TRL-0961-02E-S	RSS Glenosphere Trial, Eccentric-S	1
6	TRL-0961-05C-S	RSS Glenosphere Trial, Concentric-S	1
6	TRL-0961-02C-S	RSS Glenosphere Trial, Concentric-S	1
7	RMR-0961-075-S	RSS Baseplate Peripheral Reamer, Eccentric-S	1
7	RMR-0961-076-S	RSS Baseplate Peripheral Reamer, Concentric-S	1
8	IMP-0961-064-S	RSS Glenoid Baseplate Impactor-S	1
9	PEG096007301	Anti-Rotation Baseplate Peg	2
10	DRL096007501	Baseplate Boss Drill	2
11	BDG-0961-074-S	RSS Baseplate Boss Drill Guide-S	1
12	DDG-0961-077-S	RSS Double Drill Guide-S	1
13	SCR096006301	Slotted T-15 Star Driver for Screw Locking Cap	2
14	SCR-0961-065-01	T-15 Star Driver for 4.5mm screws	2
15	DRL096006101	2.5 Drill Bit for 4.5 screws	2
16	DRL-0961-054-S	BASEPLATE CENTRAL DRILL-S	2
17	GWG096005301	Glenoid Wire Guide	1
17	GWG0960050EL	Glenoid Wire Guide Eccentric w. inf lip	1
17	GWG0960050CL	Glenoid Wire Guide Concentric w. inf lip	1

Reverse Shoulder System-S Humeral Instruments (Bottom Tray)

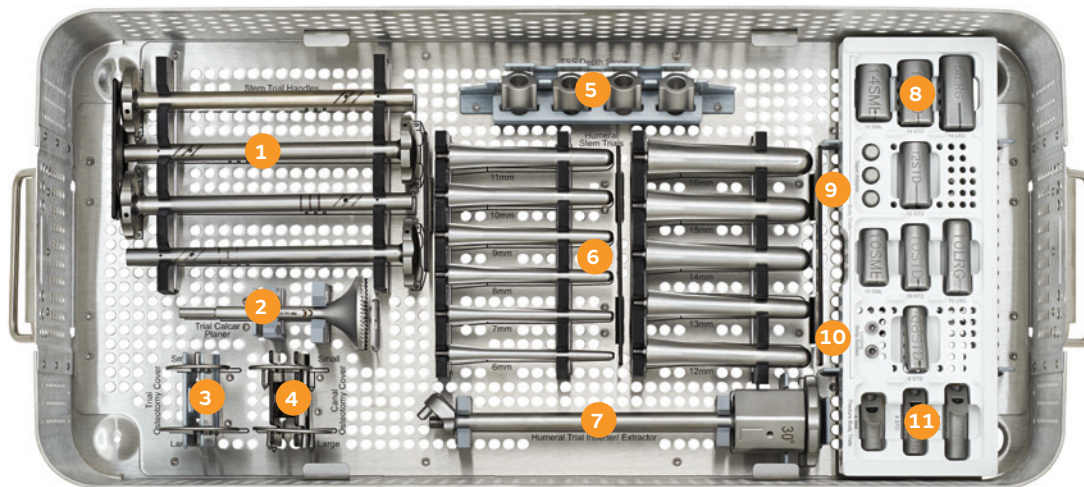


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|--|--|---|
| 1. Head cutting template, 142° | 6. Reamer Guide Body Inserter/Extractor | 11. Definitive Stem Humeral Body Trials |
| 2. RSS Stem Depth Stops | 7. Inserter/Extractor Knobs | 12. Standard Poly Trial Liners |
| 3. IM Head Cutting Guide, 142°4. | 8. Humeral Reamer | 13. Retentive Poly Trial Liners |
| 4. RSS Reamer Guide Bodies | 9. Reverse Humeral Body Inserter/Extractor | 14. Liner Impactor |
| 5. Definitive Stem RSS Reamer Guide Bodies | 10. Humeral Body Trials | 15. RSS Stem Impaction Stand |

No.	Reference	Description	Qty
1	TMP-0961-01R	RSS Head Cutting Template 142.5 Right	1
2	DEP096006901	Depth Stop	3
3	IMC096004301	RSS IM Cut Block	1
4	RGB096008LRG	Humeral Reamer Guide Body LRG	1
4	RGB096008SML	Humeral Reamer Guide Body SML	1
4	RGB096008STD	Humeral Reamer Guide Body STD	1
5	DGB096008LRG	Humeral Reamer Guide Body with definitive LRG	1
5	DGB096008SML	Humeral Reamer Guide Body with definitive SML	1
5	DGB096008STD	Humeral Reamer Guide Body with definitive STD	1
6	INS-0961-049-01	RSS Reamer Guide Body Inserter/Extractor	1
7	INS096004902	Reamer Guide Body Inserter/Extractor Knob	2
7	INS-0960-094-01	Humeral Body Inserter/Extractor Knob	2
8	RMR096004701	Humeral Reamer	1
9	INS-0961-048-01	Humeral Body Inserter/Extractor	1

No.	Reference	Description	Qty
10	TRL096008LRG	Humeral Body Trial LRG	1
10	TRL096008SML	Humeral Body Trial SML	1
10	TRL096008STD	Humeral Body Trial STD	1
11	DTL096008LRG	Humeral Body Trial with definitive LRG	1
11	DTL096008SML	Humeral Body Trial with definitive SML	1
11	DTL096008STD	Humeral Body Trial with definitive STD	1
12	TRL096000S	Liner Trial Standard 0	1
12	TRL096003S	Liner Trial Standard 3	1
12	TRL096006S	Liner Trial Standard 6	1
12	TRL096009S	Liner Trial Standard 9	1
13	TRL096000R	Liner Trial Retentive 0	1
13	TRL096003R	Liner Trial Retentive 3	1
13	TRL096006R	Liner Trial Retentive 6	1
13	TRL096009R	Liner Trial Retentive 9	1
14	IMP096007101	Liner Impactor	1
15	IMS096007001	Stem Impaction Stand	1

Humeral Tray 1: Base

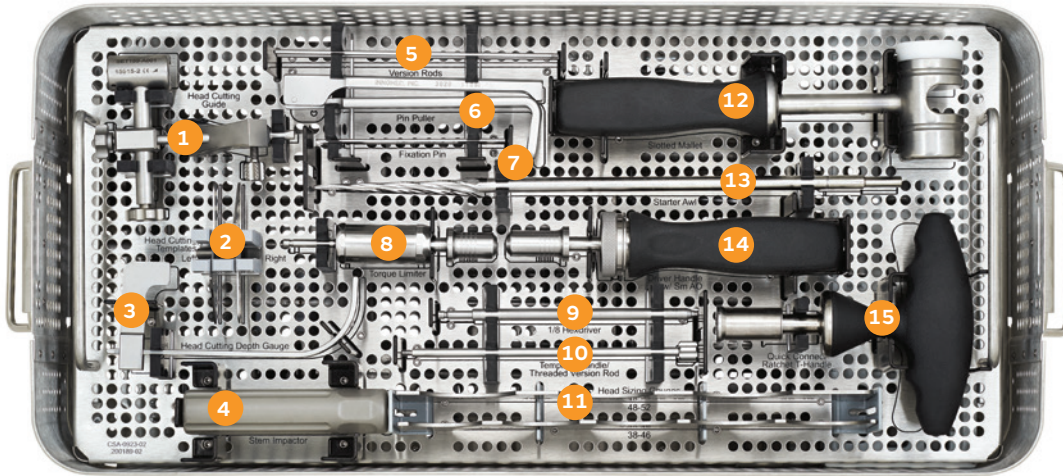


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|--------------------------|-------------------------------------|--------------------------|
| 1. Stem Trial Handles | 5. Total Shoulder Depth Stops | 9. Taper Adaptors |
| 2. Trial Calcar Planer | 6. Humeral Stem Trials | 10. Locking Body Screws |
| 3. Trial Osteotomy Cover | 7. Humeral Trial Inserter/Extractor | 11. Fracture Body Trials |
| 4. Canal Osteotomy Cover | 8. Humeral Body Trials | |

No.	Reference	Description	Qty
1	HDL-0920-043-001	Stem Trial Handle	4
2	RMR-0923-050-002	TSS Trial Calcar Planer, 2.5	1
3	CVR-0920-076L	Trial Osteotomy Cover, Large	1
3	CVR-0920-076S	Trial Osteotomy Cover, Small	1
4	CVR-0920-077L	Canal Osteotomy Cover, Large	1
4	CVR-0920-077S	Canal Osteotomy Cover, Small	1
6	HDS-0920-069-001	Depth Stop	4
6	TRL-0920-026-06	Humeral Stem Trial, 6mm	1
6	TRL-0920-026-07	Humeral Stem Trial, 7mm	1
6	TRL-0920-026-08	Humeral Stem Trial, 8mm	1
6	TRL-0920-026-09	Humeral Stem Trial, 9mm	1
6	TRL-0920-026-10	Humeral Stem Trial, 10mm	1
6	TRL-0920-026-11	Humeral Stem Trial, 11mm	1
6	TRL-0920-026-12	Humeral Stem Trial, 12mm	1
6	TRL-0920-026-13	Humeral Stem Trial, 13mm	1
6	TRL-0920-026-14	Humeral Stem Trial, 14mm	1
6	TRL-0920-026-15	Humeral Stem Trial, 15mm	1
6	TRL-0920-026-16	Humeral Stem Trial, 16mm	1

No.	Reference	Description	Qty
7	INS-0923-046-001	TSS Trial Inserter/Extractor, 2.5	4
8	TRL-0920-020-08STD	Body Trial, 8 Standard	1
8	TRL-0920-020-10LRG	Body Trial, 10 Large	1
8	TRL-0920-020-10SML	Body Trial, 10 Small	1
8	TRL-0920-020-10STD	Body Trial, 10 Standard	1
8	TRL-0920-020-12STD	Body Trial, 12 Standard	1
8	TRL-0920-020-14LRG	Body Trial, 14 Large	4
8	TRL-0920-020-14SML	Body Trial, 14 Small	1
8	TRL-0920-020-14STD	Body Trial, 14 Standard	1
9	ADT-0923-065-001	TSS Taper Adapter, 2.5	1
10	BSW-0920-01NS	Locking Body Screw	1
11	TRL-0923-021-08LRG	TSS Fracture Body Trial Lrg, 2.5	1

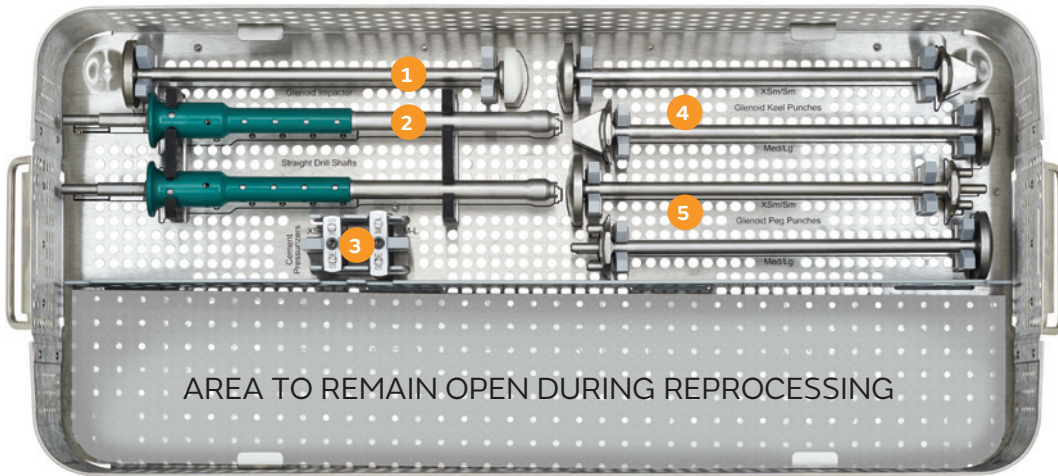
Humeral Tray 1: Insert



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|-----------------------------|----------------------------------|----------------------------|
| 1. Head Cutting Guide | 6. Pin Puller | 11. Head Sizing Gauges |
| 2. Head Cutting Templates | 7. Fixation Pin | 12. Slotted Mallet |
| 3. Head Cutting Depth Gauge | 8. Torque Limiter | 13. Starter Awl |
| 4. Stem Impactor | 9. 1/8 Hexdriver | 14. Driver Handle w/ Sm AO |
| 5. Version Rods | 10. Head Cutting Template Handle | 15. Quick Connect T-Handle |

No.	Reference	Description	Qty
1	SET189-A001	Head Cutting Guide	1
2	TMP-0920-040-001L	Head Cutting Template, Left	1
2	TMP-0920-040-001R	Head Cutting Template, Right	1
3	GAU-0920-058-001	Head Cutting Depth Gauge	1
4	IMP-0920-055-001	Stem Impactor	1
5	SET189-D007	Version Rod	1
6	PUL-0920-087-01	Pin Puller	1
7	PIN-0920-051-001	Fixation Pin	2
8	TRQ-0920-086-01	Torque Limiter	1
9	SCR-0920-060-001	1/8 Hexdriver	1
10	ROD-0923-040-001	Head Cutting Template Handle	1
11	HSG-0920-041-001	Head Sizing Gauge 38-46	1
11	HSG-0920-041-002	Head Sizing Gauge 48-52	1
12	MAL-0920-085-01	Slotted Mallet	1
13	AWL-0920-042-001	Starter Awl	1
14	G107992_B	Driver Handle w/ Sm AO	1
15	NR135004-J-004	Quick Connect T-Handle	1

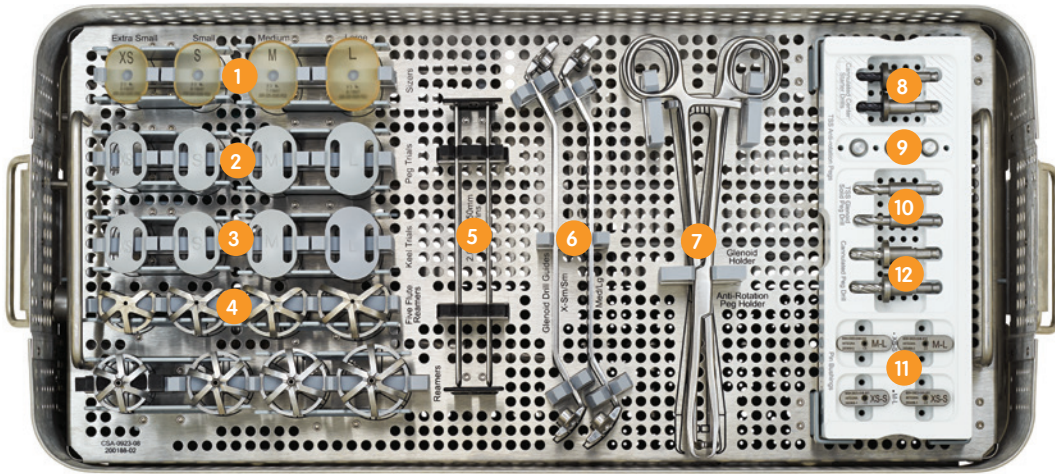
Pegged/Keeled Glenoid Tray: Base



1. Glenoid Impactor
2. Straight Drill Shaft
3. Cement Pressurizer
4. Glenoid Keeled Punches
5. Glenoid Peg Punches

No.	Reference	Description	Qty
1	IMP-0920-064-001	Glenoid Impactor	1
2	HDL-0922-082-01	Glenoid Drill Shaft	2
3	PRS-0923-073-001	Pressurizer XSm/Sm	1
3	PRS-0923-073-002	Pressurizer Med/Lg	1
4	PUN-0920-062-001	Glenoid Keel Punch, XSm/Sm	1
4	PUN-0920-062-002	Glenoid Keel Punch, Med/Lg	1
5	PUN-0920-072-001	Glenoid Peg Punch, XSm/Sm	1
5	PUN-0920-072-002	Glenoid Peg Punch, Med/Lg	1

Glenoid Tray: Insert

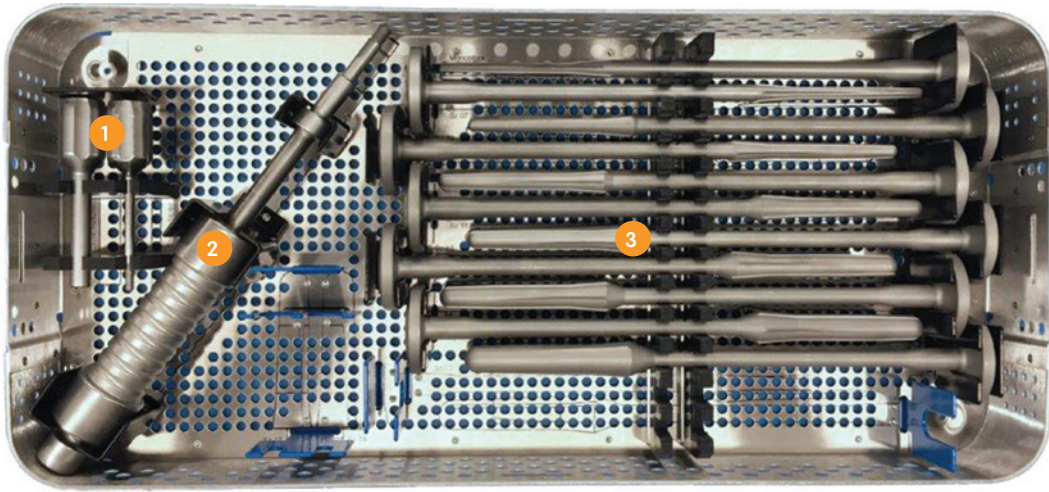


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|--------------------------|--|---------------------------------|
| 1. Glenoid Sizers | 5. Guide Pins | 9. Anti-Rotation Pegs |
| 2. Glenoid Peg Trials | 6. Glenoid Drill Guides | 10. TSS Glenoid Solid Peg Drill |
| 3. Glenoid Keeled Trials | 7. Glenoid Trial Holder/Anti-Rotation Peg Holder | 11. Pin Bushings |
| 4. Glenoid Reamers | 8. Cannulated Center Starter Drill | 12. Cannulated Peg Drills |

No.	Reference	Description	Qty
1	SZR-0920-052-000	Glenoid Sizer, Extra Small	1
1	SZR-0920-052-001	Glenoid Sizer, Small	1
1	SZR-0920-052-002	Glenoid Sizer, Medium	1
1	SZR-0920-052-003	Glenoid Sizer, Large	1
2	TRL-0920-030-00P	Glenoid, Peg Trial, Extra Small	1
2	TRL-0920-030-01P	Glenoid, Peg Trial, Small	1
2	TRL-0920-030-02P	Glenoid, Peg Trial, Medium	1
2	TRL-0920-030-03P	Glenoid, Peg Trial, Large	1
3	TRL-0920-030-00K	Glenoid, Keel Trial, Extra Small	1
3	TRL-0920-030-01K	Glenoid, Keel Trial, Small	1
3	TRL-0920-030-02K	Glenoid, Keel Trial, Medium	1
3	TRL-0920-030-03K	Glenoid, Keel Trial, Large	1
4	RMR-0920-057-000	Glenoid Reamer, Extra Small	1
4	RMR-0920-057-001	Glenoid Reamer, Small	1
4	RMR-0920-057-002	Glenoid Reamer, Medium	1
4	RMR-0920-057-003	Glenoid Reamer, Large	1
4	RMR-0920-059-000	Glenoid Five Flute Reamer, XS	1
4	RMR-0920-059-001	Glenoid Five Flute Reamer, S	1
4	RMR-0920-059-002	Glenoid Five Flute Reamer, M	1
4	RMR-0920-059-003	Glenoid Five Flute Reamer, L	1
5	GDW-0920-061-501	2.0mm x 150mm Guide Pin	4

No.	Reference	Description	Qty
6	DRG-0922-067-01	Glenoid Drill Guide, X-Sm/Sm	1
6	DRG-0922-067-02	Glenoid Drill Guide, Med/Lg	1
7	HDL-0920-075-001	Anti-rotation Peg Holder	1
7	HDR-0920-063-001	Glenoid Holder	1
8	DRL-0920-047-001	Cannulated Center Starter Drill	2
9	PEG-0922-074-02	TSS Anti-rotation Peg	3
10	DRL-0922-080-01	TSS Glenoid Solid Peg Drill	2
11	BSH-0923-048-001	Pin Bushing XS/S	2
11	BSH-0923-048-002	Pin Bushing M/L	2
12	DRL-0923-047-001	Cannulated Peg Drill	2

Monoblock Sounder Tray



1. Adaptors
2. Slap Hammer
3. Monoblock Sounders

No.	Reference	Description	Qty
1	ADA-0950-040-501	Trial Adaptor	1
1	ADA-0950-040-502	Stem Adaptor	1
2	SLP-1002-519	Slap Hammer	1
3	MON-0927-026-06	Monoblock Humeral Sounder, 6 mm	1
3	MON-0927-026-07	Monoblock Humeral Sounder, 7 mm	1
3	MON-0927-026-08	Monoblock Humeral Sounder, 8 mm	1
3	MON-0927-026-09	Monoblock Humeral Sounder, 9 mm	1
3	MON-0927-026-10	Monoblock Humeral Sounder, 10 mm	1
3	MON-0927-026-11	Monoblock Humeral Sounder, 11 mm	1
3	MON-0927-026-12	Monoblock Humeral Sounder, 12 mm	1
3	MON-0927-026-13	Monoblock Humeral Sounder, 13 mm	1
3	MON-0927-026-14	Monoblock Humeral Sounder, 14 mm	1
3	MON-0927-026-15	Monoblock Humeral Sounder, 15 mm	1
3	MON-0927-026-16	Monoblock Humeral Sounder, 16 mm	1

Surgical Technique



Smith & Nephew does not practice medicine and does not recommend this or any other surgical technique for use on a specific patient. The surgeon who performs any implant procedure is responsible for determining and using the appropriate techniques for implanting the device in each patient.

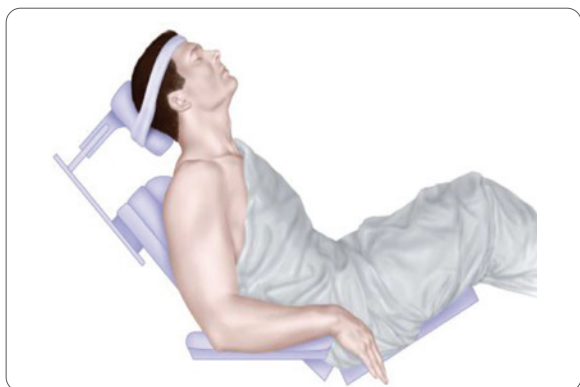


Figure 1

Step 1: Preoperative Templating and Patient Positioning

Preoperative evaluation of the humerus using the Reverse Shoulder System X-ray Templates helps determine the size of the prosthesis and level of the humeral head resection. The goal is to remove the humeral head at the neck shaft inclination angle of 142° , and humeral version indicated by the patient's natural version.

Reverse total shoulder arthroplasty can be performed using general anesthesia, regional anesthesia (i.e., interscalene block), or a combination. Place the patient in beach chair position. This position would have the patient supine with the hips flexed approximately 30° , knees bent approximately 30° and back elevated approximately 30° . Specialized headrests, arm mounts or operating tables with breakaway side panels can facilitate further access to the top and back of shoulder.

(Figure 1)

Step 2: Exposure

A deltopectoral approach is used to provide exposure to the anterior aspect of the glenohumeral joint, the upper humeral shaft and the humeral head. The initial incision line runs from the mid-clavicle, over the top of the coracoid and extends in a straight line down the anterior aspect of the arm. It should follow the path of the cephalic vein along the interval between the deltoid and the pectoralis major. The length of the initial incision along this line can vary, depending on the exposure needed to provide adequate access and visualization of the joint, and is determined by patient body habitus. **(Figure 2)**

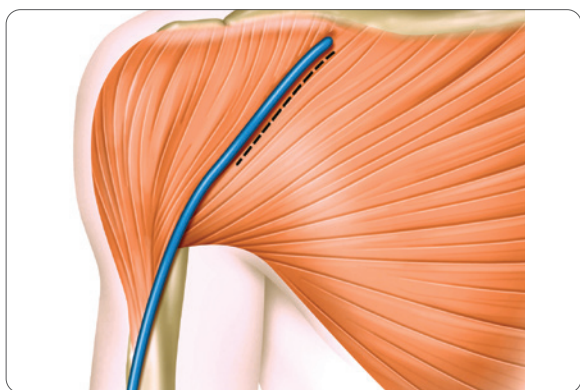


Figure 2

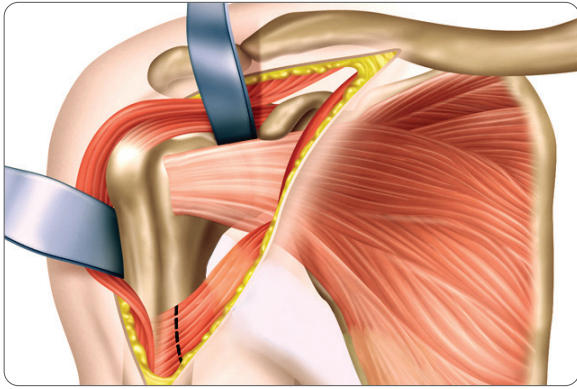


Figure 3

Once the initial incision is made, expose, incise and release the fascia. Locate the cephalic vein at the deltopectoral interval. Separate the deltoid and pectoralis major muscles so that the deltoid muscle is completely free from its origin to its insertion, especially along its deep surface. Abduct and externally rotate the arm. Gently retract the cephalic vein medially or laterally along with the deltoid and pectoralis muscle. **(Figure 3)**

Incise the clavicular head of the pectoralis major tendon from its insertion on the humerus, using an electrocautery cutting blade. Place a Hohmann retractor over the top of the humeral head, pulling the upper part of the deltoid posteriorly. Introduce self-retaining Weitlander and Kobel retractors underneath the conjoined tendon and underneath the middle deltoid.

Release the biceps tendon from the bicipital groove and along the rotator interval down to its glenoid attachment. Resect the long head of the biceps at the origin of the superior glenoid. Open the rotator interval along the line of the biceps to define the superior margin of the subscapularis. Isolate, clamp and ligate or coagulate the anterior humeral circumflex vessels lying across the anterior/inferior third of the subscapularis tendon. It is important to be aware of the musculocutaneous nerve, which penetrates the coracobrachialis muscle 1-2" distally from the coracoid. The nerve may not be palpable within the surgical field, but remember its proximity to the conjoined tendon. Digitally locate the axillary nerve. This is especially important as it will protect the axillary nerve, define and expose the inferior capsule.

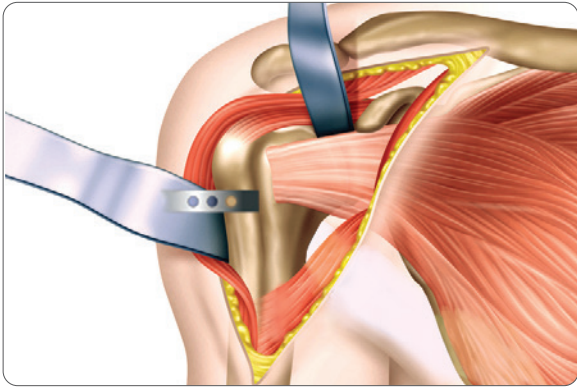


Figure 4

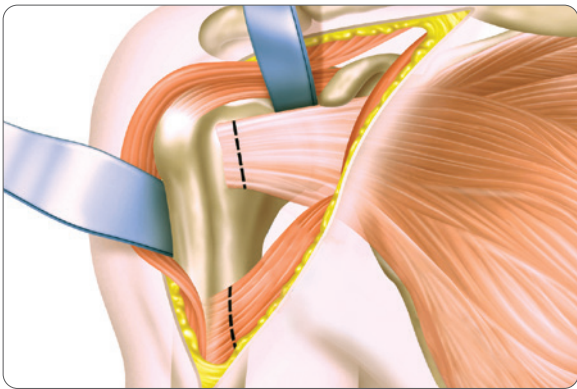


Figure 5

Step 3: Subscapularis Tendon Management

Lesser Tuberosity Osteotomy

Locate the insertion of the subscapularis tendon onto the lesser tuberosity. Place the saw blade or osteotome just lateral to the subscapularis insertion point and resect approximately 4-5mm of the lesser tuberosity. **(Figure 4)**

Subscapularis Tenotomy

Alternatively the tendon can be removed from its insertion with sharp dissection about 1cm medial to the lesser tuberosity. This will allow for tendon to tendon reattachment of the subscapularis. **(Figure 5)**

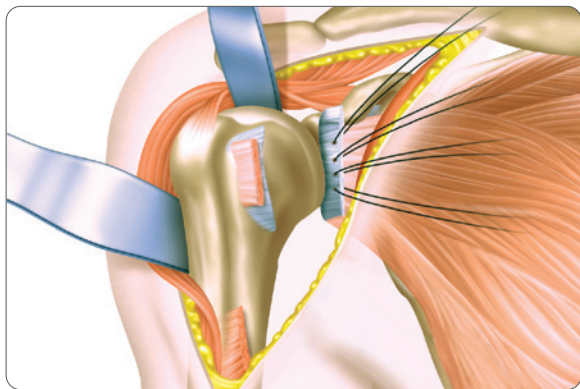


Figure 6

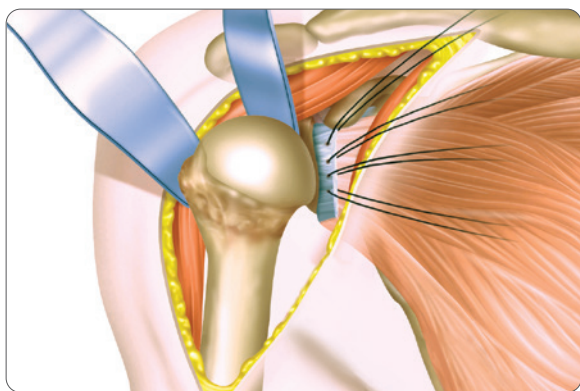


Figure 7

Step 4: Capsule Release and Humeral Head Dislocation

Using blunt dissection, separate the capsule from the subscapularis, inferiorly and medially. Release the rest of the anterior capsule from the subscapularis to the glenoid rim. Release the coracohumeral ligament from the base of the coracoid. Place traction sutures in the subscapularis tendon to control and mobilize it from the anterior glenoid neck. The subscapularis traction sutures will be utilized as a “shoe horn” to control the humeral head dislocation and relocation.

(Figure 6)

The ‘subscapularis tendon-capsule complex’ is dissected and elevated as one unit from the humerus at the medial aspect of the bicipital groove. If this complex is contracted, a superior 180° release of the subscapularis must be performed to mobilize the tendon to gain eventual external rotation. (Figure 7)

Further humeral neck joint capsule release may be performed medially, anteriorly or inferiorly as needed. The posterior capsule is maintained to facilitate centralization and prevent posterior subluxation. Take care to protect the axillary nerve as it passes inferior to the subscapularis and capsule. The location of the axillary nerve should be kept in mind at all times during capsular release.

Note: If the capsule is tented over large inferior osteophytes, it may be safer to remove the osteophytes with an osteotome, moving away from the articular surface in an inferior direction.

Once the osteophyte has been separated from the bone, it may be peeled off the capsule, and the capsular release can then be completed adjacent to the capsular attachment to the humerus. This decreases the risk of inadvertently damaging the axillary nerve when attempting to mobilize the capsule out from beneath large inferior osteophytes.

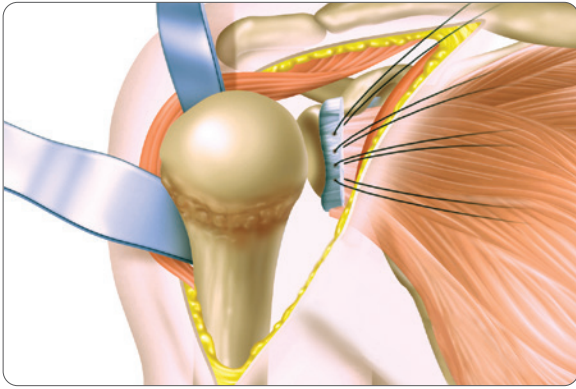


Figure 8

Place a large Darrach retractor underneath the upper part of the humeral head and dislocate the humerus. Put a medium size retractor on the inferior part of the humeral head and continue to bring the arm into full external rotation. The entire humeral head should now be in vision, with all capsular tissues removed from around the neck to provide excellent exposure. **(Figure 8)**

Release of the anterior, inferior and posterior gleno-humeral ligaments is vital to properly and concentrically centralize the humeral head as noted above. At this point, the humeral head should freely rotate into maximum external rotation, slight abduction and significant extension allowing the head to dislocate anteriorly for preparation of the humeral head.

Proper anterior and inferior capsular releases are needed for ease of dislocation and proper humeral head preparation as well as re-establishing concentricity of the gleno-humeral joint. Releasing the inferior capsule off the humerus past

6 o'clock position is essential in gaining exposure. Bone preparation is initiated by debridement of sufficient amount of anterior inferior osteophytes to properly identify the anatomic neck.



Figure 9

Step 5: Humeral Head Preparation and Resection

Assess the humeral head and remove any unwanted osteophytes to return the proximal humerus to near native anatomy.

Note: An optional Monoblock Sounder is offered which can replace the Stem Trial/Stem Handle construct. The Monoblock Sounder offers the same functionality as the Stem Trial/Stem Handle construct. The Monoblock Sounder or Stem Trial/Stem Handle construct are used in Step 5 and Step 6 to prepare the humerus.

Freehand Head Resection Technique

Place the 142° Head Cutting Template along the anterior aspect of the arm parallel to the shaft of the humerus and mark the angle at which the humeral head will be resected with an oscillating power saw or mallet and large osteotome. There are two proximal holes on the Head Cutting Template for 3.2 mm Fixation Pin placement, if preferred. 0, 10, 20 and 30 degree threaded version holes for the Template Handle are also available to assess retroversion. **(Figure 9)**

The saw or osteotome should enter the anterior surface of the humerus above the anatomic neck and exit 2-3 mm proximal to the posterior cuff attachment. Once complete, the resection will remove less humeral head than the primary total shoulder resection of 135°.

Head Resection with an Intramedullary Cutting Guide

Attach the T-Handle to the Starter Awl and create a pilot hole at the top of the humerus, in line with the long axis of the humerus just lateral to the articular surface of the head of the humerus and medial to the attachment of the rotator cuff. **(Figure 10)**

Note: This surgical step should not be performed with power reamers or drills.



Figure 10

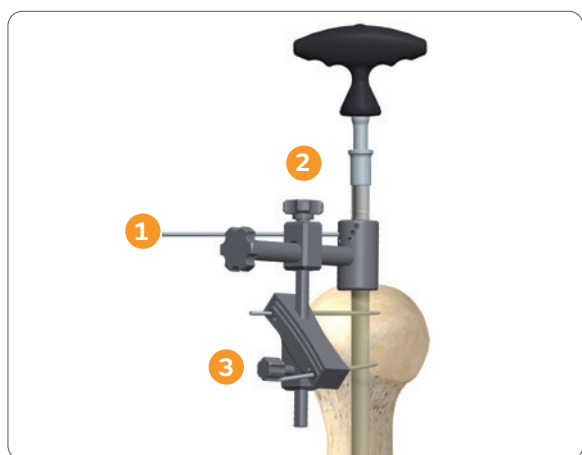


Figure 11

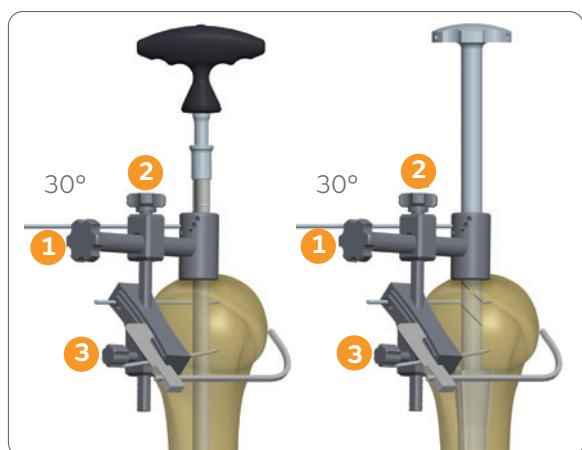


Figure 12

Leave the Starter Awl in place and clamp the IM Head Cutting Guide, 142° around the awl shank by tightening knob 1. The Version Rod is then passed through the holes in the resection guide and is rotated into the desired retroversion. The holes denote 20°, 30°, and 40° of retroversion, in reference to the forearm axis. A zero degree version hole is provided on the IM Head Cutting Guide, 142°. If more or less retroversion is required, use the orientation holes on the resection guide collar and rotate the forearm to desired angle accordingly. Slide the Reverse IM Head Cutting Guide, 142° against the humerus and tighten knob 2. Adjust the resection level by sliding the IM Head Cutting Guide, 142° up or down and tightening knob 3. **(Figure 11)**

The Head Cutting Depth Gauge can be used to assess the cutting plane. Before the oscillating saw blade (33 x 0.8 mm) is placed along the flat surface of the IM Head Cutting Guide, 142°, drill two 3.2 mm Fixation Pins through the Reverse IM Cut Block and into the underlying bone which will stabilize the guide. Remove the Head Resection Guide-Starter Awl assembly by loosening knob 3 on the IM Head Cutting Guide, 142° and removing the Starter Awl out of the humerus. Use an oscillating saw through the capture to remove the humeral head. If additional head resection is needed, lower the blade to the next slot. This will remove 3 mm of additional bone. After removing the humeral head, extract the Fixation Pins using the Pin Puller. **(Figure 12)**

Note: For larger canals, it may be preferable to start impacting up, using the Stem Trials (or the Monoblock Sounders), until a solid fit is achieved in the canal. The IM Cutting Guide, 142° can then be attached to the Stem Trial Handle (or the Monoblock Sounder handle) in the same manner as described in Step 5 **(Figure 11 and 12)**

Step 6: Humeral Canal Preparation

This system is a bone-preserving shoulder system. It utilizes a bone impaction technique vs. the traditional reaming systems. Bone impaction is achieved by using the stem trials and trial bodies to impact the cancellous bone in the humerus.

Note: Humeral canal preparation can be completed using either of the two methods identified below:

- A. Humeral Stem Trial and Stem Trial Handle
- B. Monoblock Sounder

A. Humeral Stem Trial and Stem Trial Handle

With the RSS Stem Depth Stop slid over the Stem Trial Handle, attach the Stem Trial Handle to the 6 mm Humeral Stem Trial. Place the tip of the stem trial at the most superior point on the resected humerus just behind the long head of the bicipital groove, so that it is aligned with and ready to pass directly down the intramedullary canal. Using the Stem Trial, create a pilot hole and then sequentially trial/impact the medullary canal in line with its long axis. If the 142° Head Cutting Template was used the Starter Awl can be used to create the pilot hole. Continue sequential trialing/impacting, following the path created through the intramedullary canal, increasing the Stem Trial diameter in 1 mm increments until a solid fit is achieved in the humerus. **(Figure 13)**



Figure 13



Figure 14

B. Monoblock Sounder

Place the tip of the Monoblock Sounder at the most superior point on the resected humerus just behind the long head of the bicipital groove, so that it is aligned with and ready to pass directly down the intramedullary canal. Using the Monoblock Sounder, create a pilot hole and then sequentially trial/impact the medullary canal in line with its long axis. If extramedullary cutting guide was used the Starter Awl can be used to create the pilot hole. Continue sequential trialing/impacting, following the path created through the intramedullary canal, increasing the Monoblock Sounder diameter in 1mm increments until a solid fit is achieved in the humerus. **(Figure 14)**

Note: The Monoblock Sounders have diagonal laser markings which correspond to the depth required for the Small, Standard, and Large Proximal Bodies.

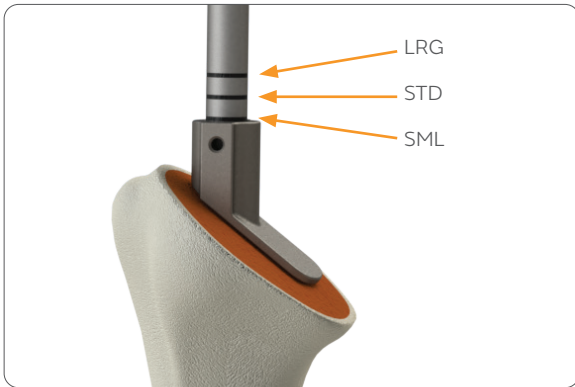


Figure 15

A. Humeral Stem Trial and Stem Trial Handle

Note: The horizontal laser lines and hole on the Stem Trial Handle. These correspond to the depth required for the Small, Standard, and Large Reverse Bodies. If using a Small body height, impact until the top of the sliding Depth Stop lines up with the most inferior laser etched horizontal line on the Stem Trial Handle. The Large body height will correspond with the most superior laser etched horizontal line on the Stem Trial Handle. It is recommended to size to the small body initially, thus allowing for additional up-sizing possibilities should additional soft tissue tensioning be needed. **(Figure 15)**

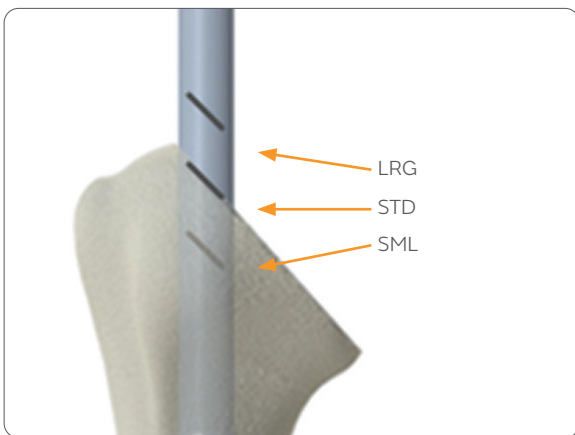


Figure 16

B. Monoblock Sounder

The laser etchings on the Monoblock Sounder correspond to the body height: LRG, STD, and SML **(Figure 16)**. Impact the Monoblock Sounder until the appropriate laser etching is parallel with the osteotomy. It is recommended to size to the small body initially, thus allowing for additional up-sizing possibilities should additional soft tissue tensioning be needed. **(Figure 16)**

Note: The TITAN Modular Shoulder System Monoblock Sounder Tray is equipped with a Slap Hammer and two adaptors: one adaptor attaches to the Humeral Stem Trial and the other can attach to the final stem implant. The Slap Hammer can attach directly to the top of the Monoblock Sounder.

Note: The final selected size of the Monoblock Sounder will correspond to the same sized Humeral Stem Trial which will be used through the remainder of the procedure prior to implanting the final implant. The final selected size of the Monoblock Sounder will also indicate the final distal stem implant.

Long Stem Option

The surgical technique for implanting a TITAN Long Stem differs slightly from the standard length stems.

Attach the T-Handle to the Starter Awl and create a 6mm pilot hole within the humerus. Continue progressively reaming using cylindrical reamers of increasing diameter to 8, 10, or 12mm in either the 125mm or 165mm stem length options. The canal is reamed until cortical chatter is present and inserted to the depth of the laser mark associated with the desired height of humeral body. It is important to prepare the medullary canal over its total length. The final reamer used will correlate to the proper trial stem selected. The reamer, trial, and implant are line to line; minimizing cement to the stem flutes and within the surrounding trabecular bone. If a greater cement mantle is desired, choose an implant smaller than the reamer and trial stem used for preparation.

Note: The long stems are for cemented use only.

Note: The long reamers are a special order item and do not come with the standard TSS and RSS instrumentation set.

Step 7: Proximal Humerus Preparation

With the selected Stem Trial from Step 6, attach it to the Humeral Reamer Guide Body corresponding to the humeral body height chosen in the previous step. Attach the Humeral Reamer Guide Body/Stem Trial construct to the Reamer Guide Body Inserter/Extractor by tightening the Humeral Reamer Guide Body Inserter/Extractor Knob at the base of the Reamer Guide Body Inserter/Extractor until secure.

(Figure 17)

Using the Slotted Mallet, carefully drive the Humeral Reamer Guide Body/Stem Trial into the humerus, keeping in line with the long axis of the humerus. Using the Version Rod on the Humeral Reamer Guide Body Inserter/Extractor impact the stem in the desired retroversion, which corresponds to the version set during the humeral head osteotomy. Seat the Humeral Reamer Guide Body/Stem Trial until the Reamer Guide Body Inserter/Extractor sits on the resected surface. Loosen the Humeral Reamer Guide Body Inserter/Extractor Knob to remove the Reamer Guide Body Inserter/Extractor.

(Figure 18)



Figure 17



Figure 18



Figure 19

Load the Humeral Reamer on the appropriate power tool. Power reaming should be carried out carefully and always starting the Humeral Reamer while not in contact with bone. The T-Handle may be utilized with the Humeral Reamer if a manual reaming technique is preferred. Place the Humeral Reamer over the Humeral Reamer Guide Body and ream the proximal humerus until the Humeral Reamer is in contact with the stop point of the Humeral Reamer Guide Body. **(Figure 19)**

Step 8: Reverse Body/Stem Trial Insertion

With the selected Stem Trial from Step 6, attach it to the corresponding height of Body Trial. Attach the Reverse Body/Stem Trial construct to the Humeral Body Inserter/Extractor by tightening the Humeral Body Inserter/Extractor Knob until the Reverse Body/Stem Trial is secure. **(Figure 20)**

Using the Slotted Mallet, carefully drive the Reverse Body/Stem Trial into the humerus, keeping in line with the long axis. Using the Version Rod on the Humeral Body Inserter/Extractor, impact the stem in the correct retroversion, which corresponds to the version set during the humeral head osteotomy. Seat the Reverse Body/Stem Trial until flush with the osteotomy/reamed metaphyseal area. Remove the Humeral Body Inserter/Extractor. **(Figure 21)**



Figure 20



Figure 21



Figure 22



Figure 23

Step 9: Glenoid Preparation

Place a standard Fukuda Retractor or Toothed Glenoid Retractor posterior to the glenoid, resting on the osteotomy and Body Trial, and a Bankart retractor anterior to the shoulder. Position the humerus to allow for the best access to the glenoid. Remove any remnants of soft tissue, such as the biceps tendon and the superior and posterior labrum, to ensure the entire glenoid is visualized.

Glenosphere Options

There are four Glenosphere options to choose from to account for varying patient anatomy. **(Figure 22)**

- Concentric Glenosphere, 2mm Lateralized
- Concentric Glenosphere, 5mm Lateralized
- Eccentric Glenosphere, 2mm Lateralized
- Eccentric Glenosphere, 5mm Lateralized

Guide Pin Placement

When exposure is deemed adequate, choose either the Glenoid Wire Guide or the Glenoid Wire Guide (Concentric or Eccentric) With Lip to determine proper 2.0mm x 150mm Guide Pin positioning. **(Figure 23)**

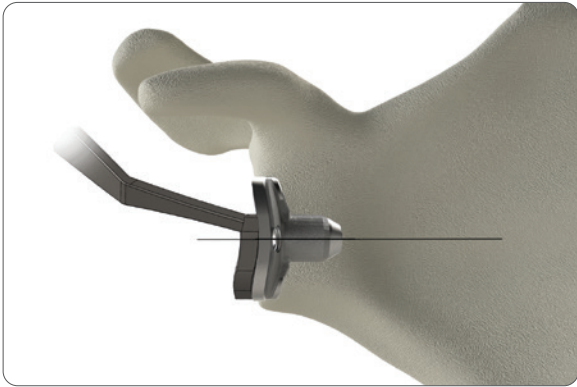


Figure 24

Note: The Glenoid Wire Guide without the lip references the inferior edge of the Baseplate. **(Figure 24)**

Placement of the Glenoid Wire Guide should take into consideration the 5mm eccentric Glenosphere as well as the inherent 18° inferior screw trajectory built in to the baseplate design. There is an additional 21° of total convergence/divergence allowable with each superior and inferior screw. These design features should be considered to allow for a more centrally placed baseplate. **(Figure 25)**

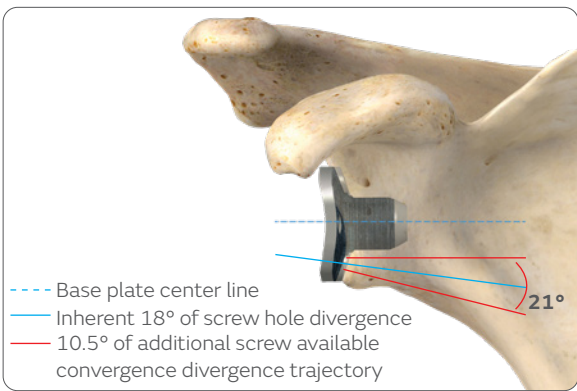


Figure 25

Note: The Glenoid Wire Guide (Concentric or Eccentric) With Lip both reference the inferior rim of the Glenosphere. **(Figure 26)**

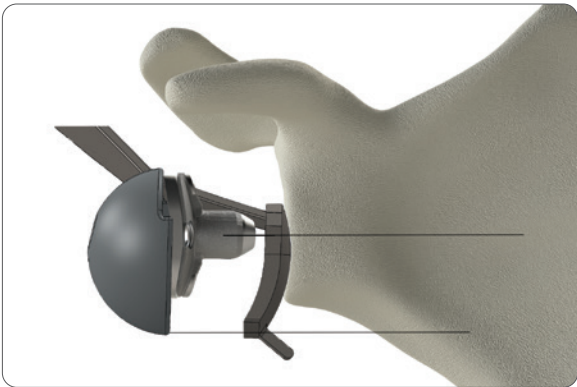


Figure 26



Figure 27

Placing the guide too low and diverging the inferior screw could allow for inadequate inferior screw fixation. **(Figure 27)**



Figure 28

The Glenoid Wire Guide chosen should allow for the post of the Baseplate to be positioned for adequate fixation of peripheral Baseplate screws. Positioning should also allow for enough Glenosphere overhang the inferior glenoid rim to minimize or eliminate contact between the humeral Poly Liner and the lateral scapula border during glenohumeral adduction. **(Figure 28)**

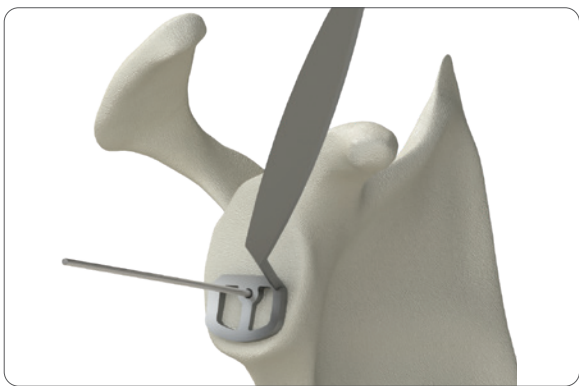


Figure 29

Drive the Guide Pin through the Glenoid Wire Guide until adequate purchase is achieved into the glenoid. If increased retroversion is noted on preoperative imaging studies, then orient the Glenoid Wire Guide to correct this retroversion by placing the Glenoid Wire Guide in a plane that is anteverted from the native glenoid plane prior to Guide Pin insertion. **(Figure 29)**

Place the Black Cannulated Center Starter Drill onto the Straight Drill Shaft and drill over the Guide Pin until drill stop reaches the glenoid.

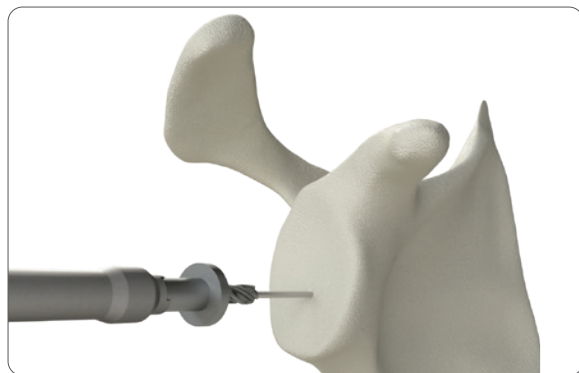


Figure 30

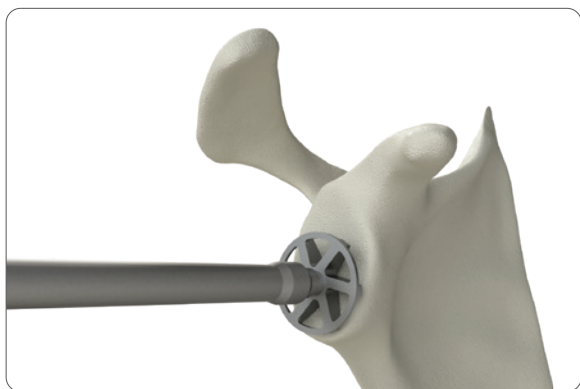


Figure 31

Attach the Extra Small Glenoid Reamer to the Straight Drill Shaft and ream accordingly until proper concavity has been achieved and cartilage has been removed. The spherical radius of the Reamer matches the backside of the Baseplate and sufficient reaming will allow the Baseplate to fully seat in the glenoid. It is important to remember that over-reaming will both decrease the surface area of the glenoid face and reduce the depth of the glenoid vault. Excessive glenoid reaming should be avoided. **(Figure 31)**



Figure 32

With the Guide Pin still in place, connect the Center Drill to the power source and drill over the Guide Pin until full contact between the drill and bone is obtained. Remove the Center Drill and the Guide Pin. **(Figure 32)**

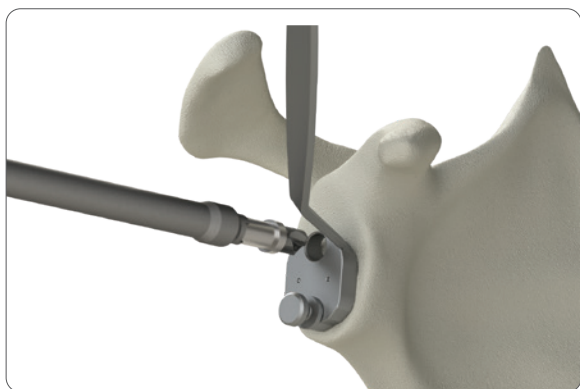


Figure 33

Center the Baseplate Boss Drill Guide over the glenoid with the post within the center hole. Orient the Boss Drill Guide so the superior screw hole is positioned to allow the superior screw to be directed toward the base of the coracoid process which should also allow trajectory of the inferior screw toward the scapular neck. Using the Baseplate Boss Drill, drill the inferior hole until the Baseplate Boss Drill is in full contact with the Baseplate Boss Drill Guide. After removing the drill, a RSS Anti-Rotation Baseplate Peg should be placed through the Baseplate Boss Drill Guide in the inferiorly drilled hole to maintain baseplate orientation. The superior hole may now be drilled. Remove the Drill, RSS Anti-Rotation Baseplate Peg, and Baseplate Boss Drill Guide. **(Figure 33)**

Using a rongeur, remove the bone remaining between the superior and inferior holes and the central screw hole to create space for the baseplate to seat.

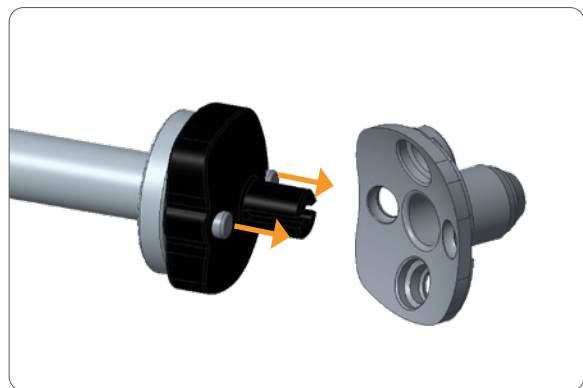


Figure 34

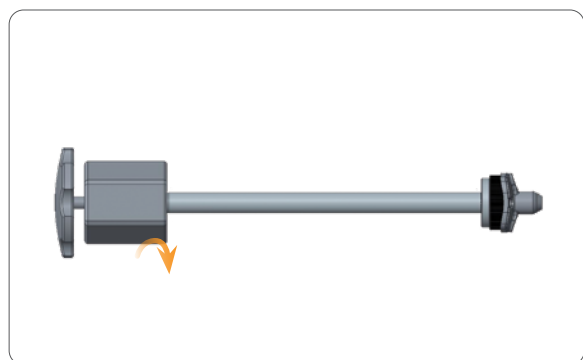


Figure 35

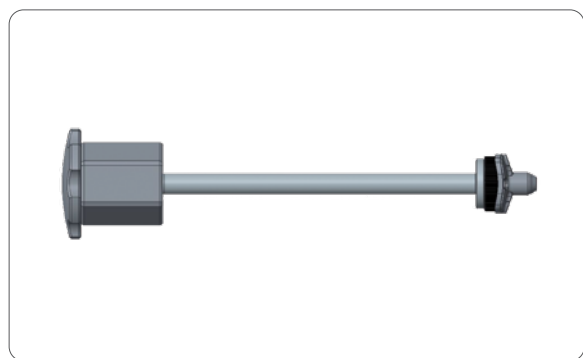


Figure 36



Figure 37

Step 10: Baseplate Insertion

With the internal rod of the Glenoid Baseplate Impactor unscrewed, place the Baseplate on the Glenoid Baseplate Impactor taking care to orient the Baseplate so the antirotation tabs are seated within the anterior/posterior screw holes of the Baseplate. **(Figure 34)** With the Baseplate sitting flush against the Glenoid Baseplate Impactor; fully tighten the internal rod of the Glenoid Baseplate Impactor to secure the Baseplate. **(Figure 35 and 36)**

The laser lines on the Baseplate Impactor align with the superior and inferior screw holes and should be referenced to help orient the Baseplate into desired position on the glenoid. Use the Slotted Mallet to impact the Baseplate Impactor until the backside of the Baseplate is fully seated on the glenoid. Unscrew the top of the Baseplate Impactor to back out the internal rod and remove the Baseplate Impactor. **(Figure 37)**

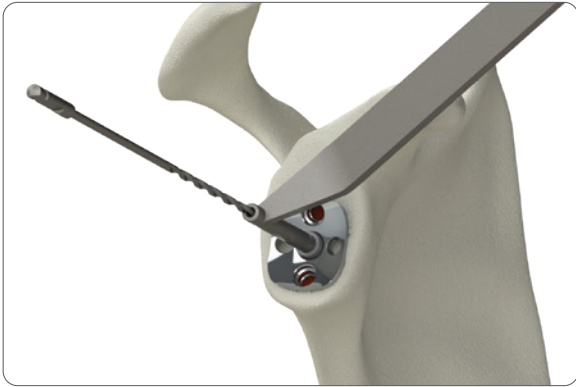


Figure 38

Screw Placement

Place the central side of the Double Drill Guide within the center post hole of the Baseplate. Using the 2.5mm Drill Bit on power, drill and push until the anterior cortex of the scapula has been perforated. **(Figure 38)**



Figure 39

The length of the screw is indicated on the drill bit by laser markings. The RSS Depth Gauge can also be used to assess optimal screw length. **(Figure 39)**

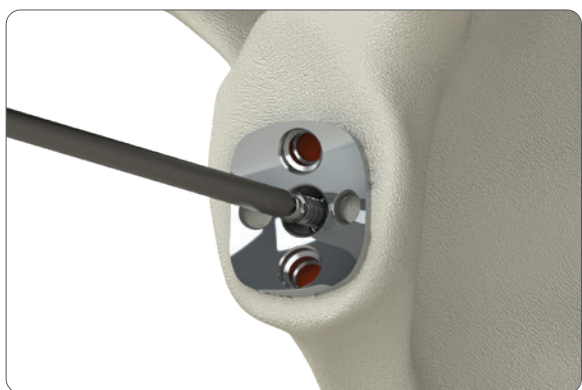


Figure 40

Select the appropriate length screw and insert into the Baseplate center hole with the Ratcheting Screwdriver Handle and the TX-15 Star Driver for 4.5mm screws, advancing the screw just before it is fully seated.

(Figure 40)

Note: The screws should not be tightened using a power driver.

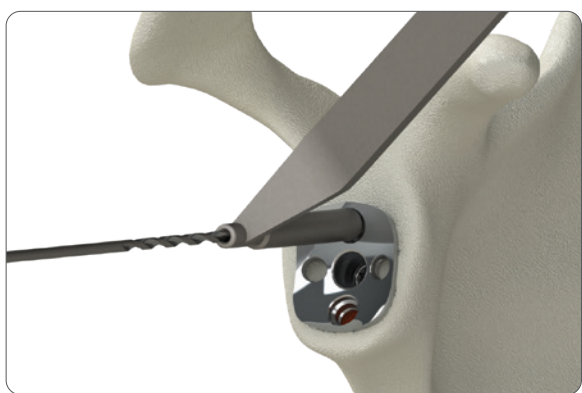


Figure 41

The peripheral side of the Double Drill Guide is placed in the inferior peripheral screw hole of the Baseplate and angled inferiorly targeting the pillar of the scapula. The system is designed to allow screws to lock +/- 10.5 degrees; further angulation may prevent the locking caps from seating. Use the 2.5mm Drill Bit on power and drill trans-cortically. The length of the screw is indicated on the drill bit by laser markings. The RSS Depth Gauge can also be used to assess optimal screw length directly through the Baseplate. The appropriate 4.5mm Screw is introduced into the inferior hole and fully tightened using the TX-15 Star Driver and Ratcheting Screw Driver Handle. **(Figure 41)**



Figure 42

The superior, anterior, and posterior screw holes are filled in a similar manner taking care to drill and place screws in the optimal bone stock and obtaining trans-cortical purchase when possible. In the event of poor screw fixation, the orientation of the drill guide should be reoriented and the hole drilled again into sufficient bone stock. The anterior and posterior screws will not sit as flush in the baseplate as the superior and inferior screws. **(Figure 42)**

Once peripheral screws have been placed, retighten the central screw as additional compression may have occurred during peripheral screw placement.

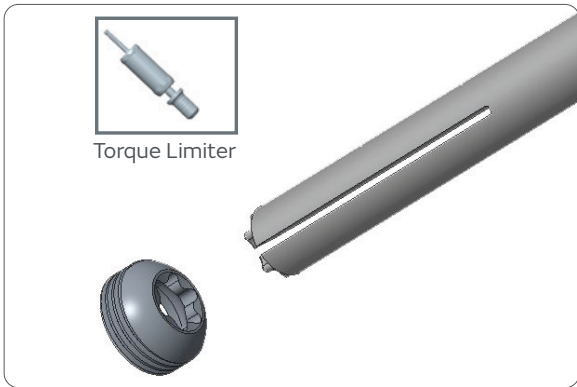


Figure 43

Locking Screw Caps

Secure the superior and inferior screws by placing Locking Caps over the previously placed screws. The Torque Limiter, Ratcheting Screwdriver Handle and Slotted T-15 Star Driver for Screw Locking Cap are used to thread and tighten the Locking Caps directly over the superior and inferior screw heads. **(Figure 43)**



Figure 44

Tighten the Locking Caps until they are fully seated within the Baseplate securing the 4.5mm screws in place. The Torque Limiter will click when the Cap is fully seated. **(Figure 44)**

Note: The torque limiter is designed to tighten the Locking Caps to 2 Nm. The Locking Caps should not be tightened using a power driver.



Figure 45

Step 11: Humeral and Glenoid Component Trialing

Varying Glenosphere Trial options are available for determining optimal Glenosphere offset and positioning through a series of trial reductions.

The Glenosphere Trials have a snap feature when fully seated in the Baseplate to assess bone and soft tissue clearance, as well as provide stability during trial reduction. **(Figure 45)**



Figure 46

Use the associated Peripheral Reamer - Concentric or Eccentric - to manually clear any remaining bone around the periphery of the Baseplate. **(Figure 46)**

Failure to perform this step can prevent the Glenosphere from seating.

.....
Note: This surgical step should not be performed using a powered reamer.

Glenosphere trialing should begin with the Concentric 2mm Glenosphere Trial and progress to the more lateralized and eccentric options if additional soft tissue tensioning and/or inferior orientation on the glenoid be necessary. **(Figure 47)**

The Standard Poly Trial Liner, +0 is attached to the RSS Humeral Body Trial. A trial reduction is performed and stability of the implant assessed. The shoulder should be placed through a range of motion to assess the stability of the construct and that the components do not impinge on bony structures. If tension is inadequate, additional thickness options are available, up to 9mm. If additional stability is required, Retentive Poly Liner options are available in the same thickness as the Standard Poly Liners. Additional trial reductions should be performed to confirm adequate stability if the trial components are changed.

Varying Glenosphere Trial options are available for determining optimal Glenosphere offset and positioning through a series of trial reductions.

The Glenosphere Trials have a snap feature when fully seated in the Baseplate to assess bone and soft tissue clearance, as well as provide stability during trial reduction.

.....
Note: When possible the Reverse Humeral Body should be positioned within the metaphyseal bone to maximize implant construct support.



Figure 47

Glenosphere Placement

After selection of the appropriate Glenosphere utilizing the Glenosphere Trials, clear any soft tissue around the circumference of the Baseplate using the Concentric or Eccentric Peripheral

Reamer and ensure that the Baseplate surface, including the Morse taper, is clean and dry.

Note: Peripheral Reaming and cleaning the Morse Taper are critical to promote Glenosphere engagement. Ensure that both the male and female components of the taper are dry before engaging the taper.

Thread the Glenosphere Inserter into the Glenosphere and place the Glenosphere into the Morse taper of the Baseplate by lightly tapping the top of the Glenosphere Inserter with a mallet. Unthread the Glenosphere Inserter to remove from the Glenosphere. **(Figure 48)**

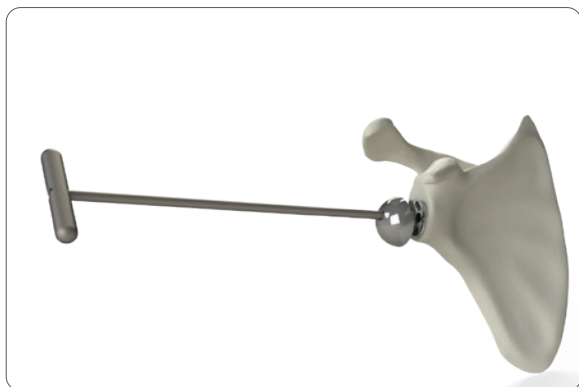


Figure 48

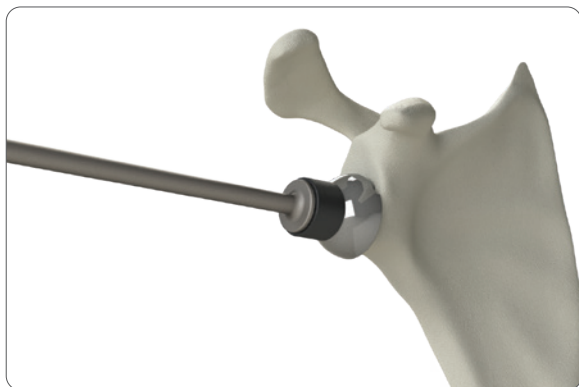


Figure 49

Use the Glenosphere Impactor and Slotted Mallet to impact the Glenosphere on-axis onto the Baseplate with three to four controlled firm strikes. **(Figure 49)**

To confirm taper engagement:

1. Fully thread the Glenosphere Inserter into Glenosphere
2. Pull axially
3. Twist the T-Handle of the Glenosphere Inserter clockwise

If the Glenosphere separates from the Baseplate, check for soft tissue impingement or screw head prominence. Repeat this page to reinsert the Glenosphere.



Figure 50

Step 12: Humeral Implant Assembly

The Reverse Humeral Body Inserter/Extractor is attached to the Reverse Body Trial and the humeral stem trial construct. Using the Slotted Mallet, remove the humeral trial construct. Select the Reverse Body and Humeral Stem that corresponds to the final trials used during humeral preparation. Seat and secure the Reverse Body implant onto the RSS Stem Impaction Stand. Place the Humeral Stem implant into the Reverse Body with finger pressure. Place the Stem Impactor over the tip of the humeral stem and engage the tapers with a few mallet strikes. **(Figure 50)**



Figure 51

Step 13: Stem/Body Implantation

Insert the assembled Body/Stem implant into the prepared humerus using the Reverse Humeral Body Inserter/Extractor. Use the Version Rod on the Reverse Humeral Body Inserter/Extractor to set the stem in the desired version which should match the version set at the time of the humeral osteotomy and trialing. Slowly impact the implant and stop once the stem is firmly seated and the Reverse Body is flush with the level of the humeral osteotomy. Remove the Reverse Humeral Body Inserter/Extractor. **(Figure 51)**

Note: Following the definitive stem/body insertion and prior to definitive poly liner insertion, a secondary poly liner trial reduction may be performed to reaffirm proper soft tissue tensioning for stability.

Remove the Reverse Humeral Body Screw from its packaging and insert into the in-situ Reverse Body with the Driver Handle, Body Screw Torque Limiter, and 1/8 Hex Driver. Tighten the screw until the torque limiter clicks. **(Figure 52)**

Note: The torque limiter is designed to tighten the screw to 2 Nm. This surgical step should not be performed using a powered driver.

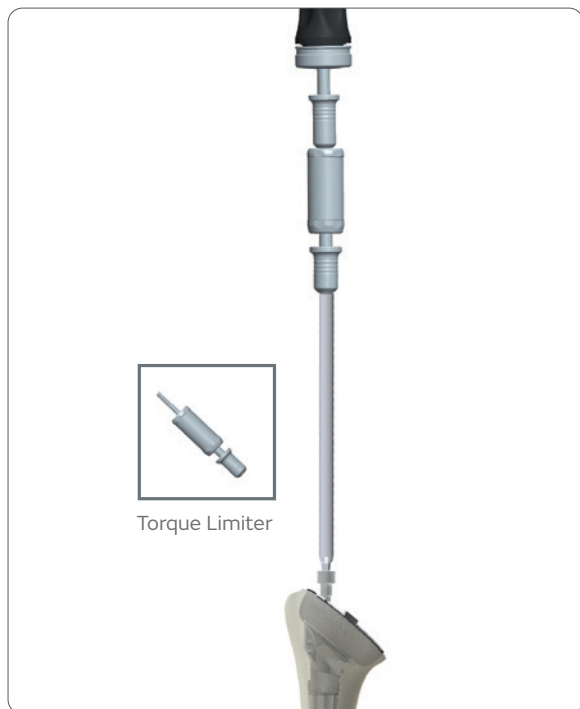


Figure 52



Figure 53

Humeral Poly Liner Insertion

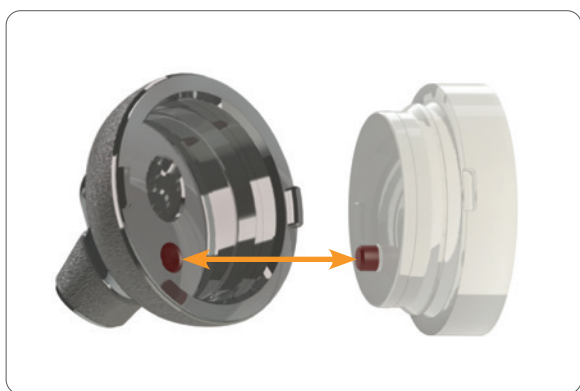
Place the definitive Standard or Retentive Poly Liner in the implanted Reverse Body taking care to orient the pilot tip on the underside of the Poly Liner with the inferior/medial hole in the Reverse Body (**Figure 53**). Using the Liner Impactor and light taps with the Slotted Mallet, fully seat the Poly Liner making sure to maintain a 90 degree angle to the osteotomy. There may be up to a 1mm gap circumferentially between the Poly Liner and the lip of the Reverse body. (Figure 53)

Reduce the joint and perform a final assessment of joint stability and range of motion.

Step 14: Wound Closure

Once final implant is in place, the subscapularis tendon repair can be completed with the sutures placed prior to implant seating. Tenodesis the biceps tendon to the humeral shaft prior to wound closure.

Thoroughly irrigate the wound with antibiotic solution. If a regional anesthetic is not used then infiltrate the soft tissue with a local anesthetic that will last 6-8 hours. A wound drainage system is recommended to prevent formations of postoperative hematoma. The wound may be closed according to surgeon preference. Careful attention to wound closure will result in a cosmetically acceptable incision. After the dressing and shoulder immobilizer are in place, the use of a cold wrap is recommended. This pre-frozen wrap can be placed on the shoulder in the operating room and replaced with another unit every three hours. The combination of regional anesthetic or local anesthetic and the immediate cooling seems to decrease the amount of postoperative pain.



Pilot tip on poly liner needs to be oriented towards the hole in the reverse body. The red color of the pin and hole are indicated here for reference only and are not reflected in the actual product.

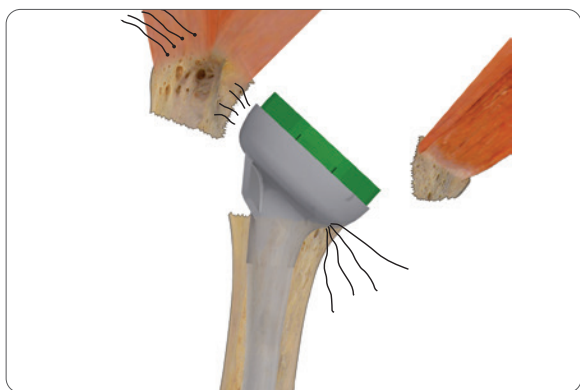


Figure 54

Step 15: Fracture Procedures

Tuberosity Reconstruction

Prior to sizing and trialing the humeral components, sutures are placed in the appropriate rotator cuff tendons for use in the anatomic reconstruction of the tuberosities. Pass two horizontal sutures through the infraspinatus tendon and two horizontal sutures through the teres minor tendon just medial to their insertion on the greater tuberosity from outside to inside. These four sutures will be passed around the inferior neck of the final implant to secure the fracture. **(Figure 54)**

The Reverse Body/Stem Trial should be positioned at the correct height to preserve the anatomic reconstruction of the tuberosities. If the Reverse Body Trial is too short, the prosthesis will not allow space for the anatomic reconstruction of the tuberosities. If this happens remove the Standard Reverse Body Trial and replace with the Large Reverse Body Trial. This will increase the overall prosthesis height and allow for consolidation of the tuberosities. If the overall prosthesis is too proud with the Standard Reverse Body Trial, replace it with the Small Reverse Body Trial. If more height is desired after increasing to a Large Reverse Body Trial, increasing stem diameter will result in a higher seated prosthesis.

A slight overlap of the tuberosities on the prosthesis is desirable. Reduce the tuberosities to ensure they will fit around the prosthesis and can be attached to one another. A towel clip or reduction forceps can be utilized to hold the tuberosities around the prosthesis. Check soft tissue tensioning by performing a gentle range of motion test.

After completing the range of motion test, remove the Reverse Body/Stem Trial. Drill two suture holes, one on each side of the bicipital groove, into the humeral shaft to assist in repair of the tuberosities. Place two heavy, non-absorbable sutures through the drill holes before proceeding with prosthesis implantation. **(Figure 55)**



Figure 55



Figure 56

Once the assembled Body/Stem implant is placed to the correct height, pass the four sutures previously placed in the rotator cuff around the inferior neck of the prosthesis posterior to anterior. **(Figure 56)**

Select one superior and one inferior suture and tie off their corresponding tails creating a cerclage to reduce the greater tuberosity to the prosthesis. The two remaining sutures (inferior and superior) are pushed through the subscapularis tendon from inside to outside and then tied off to their corresponding tails creating a cerclage to reduce the lesser tuberosity.

The diaphyseal placed sutures are used to reduce the tuberosities in the vertical plane. Pass one suture through the subscapularis and supraspinatus tendons and tie off to its corresponding tail. The other suture is passed through the infraspinatus and supraspinatus and tied off to its corresponding tail.

Step 16: Revision Procedures

Removing Reverse Components

Prior to performing a revision case, verify the post diameter of the baseplate used. This technique and associated instrumentation is only valid for GBP-0961-094-S (RSS GLENOID BASEPLATE-S). If a different baseplate was used, please reference the TITAN Reverse Shoulder System Surgical Technique for the appropriate technique and instrumentation.

To remove the in-situ Glenosphere, the Glenosphere Removal Handle is fully threaded into the in situ Glenosphere to release the taper lock of the Glenosphere from the Baseplate. If a central screw is in the Baseplate, the tip of the Glenosphere Removal Handle will push the two components apart with advancement. If no central screw is in the Baseplate use the slotted mallet on the Glenosphere Removal Handle to disengage the Glenosphere from the Baseplate with gentle strikes. **(Figure 57)**

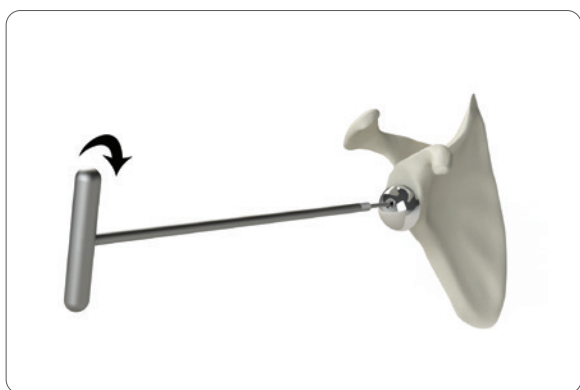


Figure 57

Note: The Glenosphere Removal Handle will not work to remove the Glenosphere from the Baseplate without use of the slotted mallet, if the central screw was not previously placed in the Baseplate.

The Humeral Poly Liner is removed using an osteotome. The 1/8 Hex Driver is used to remove the body screw. The Body Separator is threaded into the Reverse Body and threaded until the Reverse Body is disengaged from the in-situ stem. The Humeral Body Inserter/Extractor may be attached to the Reverse Body to help remove the Reverse Body from the proximal humerus.

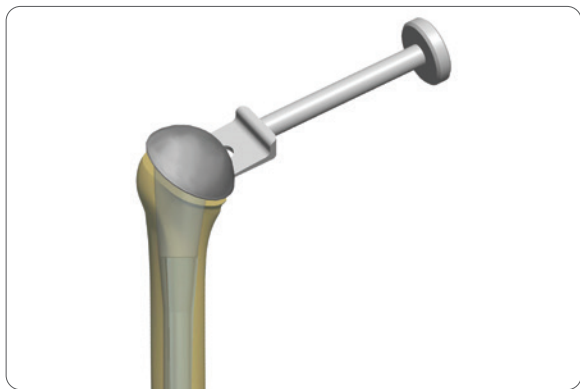


Figure 58

Converting Anatomic Shoulder to Reverse Shoulder

Removal of the humeral head and/or proximal humeral body during revision surgery can be achieved without disturbing a well-fixed distal stem.

Removing the Humeral Head

The Humeral Head can be removed using the Humeral Head Extractor. Place the two prongs of the extractor between the humeral head and the osteotomy surface so that the prongs will advance in each side of the linking component. Lift the head off the proximal humeral body taper by impacting the end of the extractor with the slotted mallet. **(Figure 58)**

Removing the Proximal Humeral Body

The Humeral Body can be removed using the Body Separator and the final Implant Inserter/Extractor. Disengage the Humeral Body Screw and remove using the 1/8 Hex Driver. Unthread the inner rod from the Implant Inserter/Extractor and replace with the Body Separator. Place the Inserter/Extractor over the taper, and thread the Body Separator into the Humeral Body until resistance is felt. Grip the Inserter/Extractor firmly to control rotation of implant and continue to tighten the Body Separator to disengage the Morse taper between the Humeral Body and Distal Stem. Remove the Humeral Body, which will be threaded onto the Body Separator. **(Figure 59)**



Figure 59

Removing the Stem

The stem is designed to remain in the humeral canal. After the Humeral Body has been removed and it is determined that the stem should be removed also, the TITAN Modular Shoulder system Long Stem tray or the TITAN Modular Shoulder System Monoblock Shoulder tray include a Slap Hammer and Stem Adaptor that can attach to the implanted stem for removal.

The 142° Head Cutting Template is used to determine desired version and removal of superior aspect of the greater tuberosity. This osteotomy will allow for easier alignment of the Humeral Reamer Guide Body and RSS Humeral Body Trials with the in-situ stem. **(Figure 60)**



Figure 60



Figure 61



Figure 62

Humeral Preparation for Reverse Body

When converting from an anatomic shoulder to reverse shoulder the specific Reamer Guide Bodies (**Figure 61**) and RSS Humeral Body Trials that are dedicated for use with definitive stems in place must be utilized to protect the in-situ stem taper during humeral preparation. Place the Definitive Stem RSS Reamer Guide Body that correlates to the same height of humeral body that was just explanted. Use X-ray/fluoroscopy to confirm in-situ positioning of the Definitive Stem RSS Reamer Guide Body. (**Figure 62**) The reaming of the humerus is performed as per the technique described in the Proximal Humerus Preparation section. The corresponding sized Definitive Stem RSS Body Trial can now be placed in-situ on the well-fixed stem and the remainder of humeral and glenoid preparation resumed as in standard fashion.

Postoperative Therapy Protocol*

The patient is placed in a comfortable immobilizer with arm at their side and regional block analgesia as preferred. Active pendulum exercises are not encouraged in order to prevent stretch of the anterior repair. However, supine passive range of motion within 24-72 hours of surgery is of the utmost importance. The limits to the extent of passive range of motion performed should not exceed the safe zone of rotation observed at surgery after subscapularis closure.

Supervised physical therapy program is recommended after 24-48 hours. Supervised active assisted and passive range of motion mobilization is suggested for the first 72 hours. Active assisted and passive assistance is recommended for 6 weeks after which terminal stretching and active range of motion is initiated. Home pulley system is initiated at 72 hours.

The sling immobilizer may be abandoned at approximately 6 weeks to protect the subscapularis repair. Most patients are able to perform all their exercises at home in a physician supervised therapy program. Supervision of all post-operative therapy is recommended. **Therapy should be individualized and based on the status of the repaired tissues and muscle strength.** Most importantly, protection of the subscapularis repair and/or rotator cuff repair will dictate the amount of stretching or resistance as well as the duration of immobilization. Progressive resistance for the rotator cuff including the subscapularis is initiated at 10-12 weeks depending on the quality of rotator cuff tissue and of the repair. Guarded loading of the shoulder should be observed for the first 4-6 months post-operatively. Complete recovery from surgery generally occurs at 9-12 months.

*Postoperative care is individualized and is determined by the physician based on the patient's injury pattern, unique patient anatomy, and pathologic kinematics. Not all patients will have the same surgical procedure or timelines for rehabilitation. The views and opinions expressed for postoperative care are for informational and educational purposes only. Smith & Nephew, Inc. does not provide medical advice. In no event shall Smith & Nephew, Inc., be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising out of the use of or inability to use the expressed views.

Essential Product Information

Important: The information presented below is also provided in the product package insert. This information was current at the time of surgical technique printing, but may have been revised after that date.

Device Description

The TITAN Reverse Shoulder System is a semi-constrained total shoulder construct. The humeral components consist of humeral stems, varying heights of reverse bodies, and humeral poly liners. The Poly Liners are available in varying thicknesses and constraints to achieve stability of the glenohumeral joint. The variable length and proximally-filling shape are designed to accommodate the natural humeral geometry and provide stable fixation as well as proximal bone loading. The glenoid components are composed of a Baseplate secured by 4 peripheral screws, two of which can be locked, as well as a central compression screw. The Baseplate is covered with a Glenosphere which is available in varying offsets to minimize scapula notching.

Sterility

The Highly Cross-Linked Poly Liners have been sterilized by Ethylene Oxide (EO) and are sterile in the unopened, undamaged package. All other implants have been sterilized by gamma radiation and are sterile in the unopened, undamaged package. If either the implant or the package appears damaged or has been opened, or if sterility is questioned for any reason, the implant should not be used. Do not resterilize this product.

Adverse Events

- Potential adverse events include early or late postoperative infection, allergic reaction, intraoperative or postoperative bone fracture and/or postoperative pain. In case of arthroplasty after fracture: malunion or nonunion.
- Intraoperative bone perforation or fracture may occur, particularly in the presence of poor bone stock caused by osteoporosis, bone defects from previous surgery, bone resorption, or while inserting the device.
- Loosening or migration of the implants can occur due to loss of fixation, trauma, malalignment, bone resorption, and/or excessive activity.
- Surgical intervention may be required to treat adverse effects.
- MDR Reporting Reminder: Medical device manufacturers and users are required by law and regulation to report serious injuries and death.

Surgical Procedure

A Surgical Technique brochure is available which outlines the basic procedure for device implantation and use of the specialized surgical instrumentation. It is the responsibility of the surgeon to be familiar with the procedure before use of these products. Each surgeon must evaluate the appropriateness of the surgical technique used based on personal medical training and experience.

Meticulous preparation of the implant site and selection of the proper size implant increase the potential for successful reconstruction. A complete set of instruments for each type of implant is available to aid bone preparation and reduce the operative time. It is suggested that the proper size implant be removed from its sterile package only after the implant site has been prepared and properly sized.

Training

Surgeons may obtain training from a qualified instructor prior to implanting the TITAN Reverse Shoulder System to ensure thorough understanding of the implantation techniques and the instrumentation.

Catalog Numbers

Implants

Part Number	Description
BBS-0960-21SML	Reverse Body Small and Reverse Body Screw
BBS-0960-21STD	Reverse Body Standard and Reverse Body Screw
BBS-0960-21LRG	Reverse Body Large and Reverse Body Screw
LNR-0960-191-0S	RSS HXL Liner Standard, +0S
LNR-0960-191-3S	RSS HXL Liner Standard, +3S
LNR-0960-191-6S	RSS HXL Liner Standard, +6S
LNR-0960-191-9S	RSS HXL Liner Standard, +9S
LNR-0960-192-0R	RSS HXL Liner Retentive, +0R
LNR-0960-192-3R	RSS HXL Liner Retentive, +3R
LNR-0960-192-6R	RSS HXL Liner Retentive, +6R
LNR-0960-192-9R	RSS HXL Liner Retentive, +9R
LNR-0960-00R	Retentive Poly Liner, +0
LNR-0960-03R	Retentive Poly Liner, +3
LNR-0960-06R	Retentive Poly Liner, +6
LNR-0960-09R	Retentive Poly Liner, +9
LNR-0960-00S	Standard Poly Liner, +0
LNR-0960-03S	Standard Poly Liner, +3
LNR-0960-06S	Standard Poly Liner, +6
LNR-0960-09S	Standard Poly Liner, +9
GLS-0961-02C-S	RSS Glenosphere, Concentric-S, 2mm
GLS-0961-05C-S	RSS Glenosphere, Concentric-S, 5mm
GLS-0961-02E-S	RSS Glenosphere, Eccentric-S, 2mm
GLS-0961-05E-S	RSS Glenosphere, Eccentric-S, 5mm
GBP-0961-094-S	RSS Glenoid Baseplate-S
SCW-0961-046-15	RSS 4.5mm Star Screw and Cap; 15mm Length
SCW-0961-046-20	RSS 4.5mm Star Screw and Cap; 20mm Length
SCW-0961-046-25	RSS 4.5mm Star Screw and Cap; 25mm Length
SCW-0961-046-30	RSS 4.5mm Star Screw and Cap; 30mm Length
SCW-0961-046-35	RSS 4.5mm Star Screw and Cap; 35mm Length
SCW-0961-046-40	RSS 4.5mm Star Screw and Cap; 40mm Length
SCW-0961-046-45	RSS 4.5mm Star Screw and Cap; 45mm Length
SCW-0961-046-50	RSS 4.5mm Star Screw and Cap; 50mm Length
SCW-0961-046-55	RSS 4.5mm Star Screw and Cap; 55mm Length
BSC-0960-21-01	Reverse Body Screw

Single Use

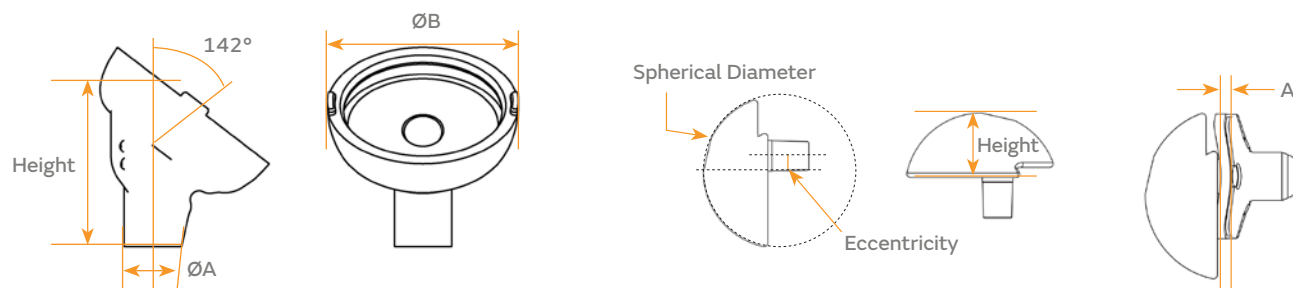
Part Number	Description
DRL-0960-061-01	2.5mm Drill Bit for 4.5mm Screw

Instruments

Part Number	Description
DRL-0960-075-01	Baseplate Boss Drill
DRL-0961-054-S	Baseplate Central Drill -S
TRL-0960-00S	Standard Poly Trial Liner, +0
TRL-0960-03S	Standard Poly Trial Liner, +3
TRL-0960-06S	Standard Poly Trial Liner, +6
TRL-0960-09S	Standard Poly Trial Liner, +9
TRL-0960-00R	Retentive Poly Trial Liner, +0
TRL-0960-03R	Retentive Poly Trial Liner, +3
TRL-0960-06R	Retentive Poly Trial Liner, +6
TRL-0960-09R	Retentive Poly Trial Liner, +9
TRL-0960-08SML	RSS Humeral Body Trial, Small
TRL-0960-08STD	RSS Humeral Body Trial, Standard
TRL-0960-08LRG	RSS Humeral Body Trial, Large
DTL-0960-08SML	Definitive Stem RSS Body Trial, Small
DTL-0960-08STD	Definitive Stem RSS Body Trial, Standard
DTL-0960-08LRG	Definitive Stem RSS Body Trial, Large
TRL-0961-02C-S	Glenosphere Trial, 2mm Concentric -S
TRL-0961-05C-S	Glenosphere Trial, 5mm Concentric -S
TRL-0961-02E-S	Glenosphere Trial, 2mm Eccentric -S
TRL-0961-05E-S	Glenosphere Trial, 5mm Eccentric -S
TMP-0961-01L	RSS Head Cutting Template, 142° Left
TMP-0961-01R	RSS Head Cutting Template, 142° Right
RGB-0960-08SML	Humeral Reamer Guide Body, Small
RGB-0960-08STD	Humeral Reamer Guide Body, Standard
RGB-0960-08LRG	Humeral Reamer Guide Body, Large
DGB-0960-08SML	Definitive Stem RSS Reamer Guide Body, Small
DGB-0960-08STD	Definitive Stem RSS Reamer Guide Body, Standard
DGB-0960-08LRG	Definitive Stem RSS Reamer Guide Body, Large

Part Number	Description
RMR-0960-047-01	Humeral Reamer
INS-0961-048-01	RSS Humeral Body Inserter/Extractor
INS-0961-049-01	RSS Reamer Guide Body Inserter/Extractor
INS-0960-094-01	Humeral Body Inserter/Extractor Knob
INS-0960-049-02	Reamer Guide Body Inserter/Extractor Knob
GWG-0960-050-CL	Glenoid Wire Guide Concentric With Lip
GWG-0960-050-EL	Glenoid Wire Guide Eccentric With Lip
GWG-0960-053-01	Glenoid Wire Guide
SCR-0960-063-01	Slotted T-15 Star Driver for Screw Locking Cap
IMP-0961-064-S	Glenoid Baseplate Impactor -S
HDL-0960-065-01	Glenosphere Inserter
IMP-0960-066-01	Glenosphere Impactor
HDL-0961-067-01	RSS Glenosphere Removal Handle-S
DEP-0960-069-01	RSS Stem Depth Stop
IMS-0960-070-01	RSS Stem Impaction Stand
IMP-0960-071-01	Liner Impactor
PEG-0960-073-01	RSS Anti-Rotation Baseplate Peg
BDG-0961-074-S	Baseplate Boss Drill Guide-S
RMR-0961-076-S	Peripheral Reamer, Concentric-S
RMR-0961-075-S	Peripheral Reamer, Eccentric-S
DDG-0961-077-S	Double Drill Guide -S
RDG-0961-078	RSS Depth Gauge-S
IMC-0960-043-01	IM Head Cutting Guide, 142°
CSA-0961-02	Instrument Set Insert
CSA-000-14	Generic Case Lid
CSA-0961-01	Instrument Set Base
SCR-0961-065-01	TX-15 Star Driver for 4.5mm Screws

Body, Glenosphere and Liner Dimensions



Body Dimensions (mm), Ti

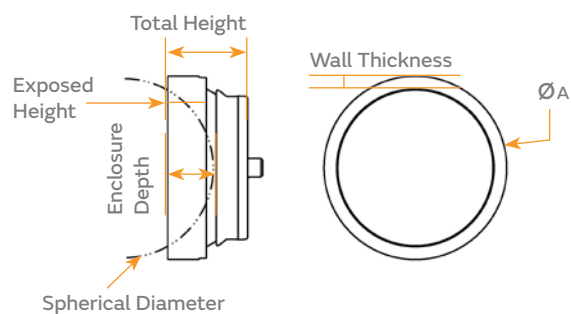
Body Catalog Number	Height	Diameter A	Diameter B
BBS-0960-21SML	30	12.1	38.7
BBS-0960-21STD	35	12.1	38.7
BBS-0960-21LRG	40	12.1	38.7

Concentric Glenosphere Dimensions (mm), CoCr

Concentric Glenosphere Catalog Number	Spherical Diameter	A	Height
GLS-0961-02C-S	38	2	16
GLS-0961-05C-S	38	5	19

Eccentric Glenosphere Dimensions (mm), CoCr

Eccentric Glenosphere Catalog Number	Spherical Diameter	A	Height	Eccentricity
GLS-0961-02E-S	38	2	16	4
GLS-0961-05E-S	38	5	19	4

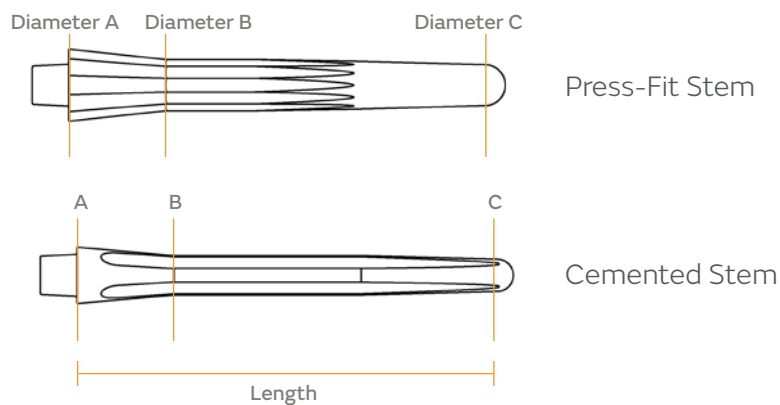


Liner Dimensions (mm), UHMWPE

Standard HXL Poly Liner Catalog Number	Standard UHMWPE Liner Catalog Number	Height	Enclosure depth	Exposed Height	Diameter A	Wall thickness	Spherical Diameter
LNR-0960-191-0S	LNR-0960-00S	14	9.6	5.2	38.7	2.7	38
LNR-0960-191-3S	LNR-0960-03S	17	9.6	8.2	38.7	2.7	38
LNR-0960-191-6S	LNR-0960-06S	20	9.6	11.2	38.7	2.7	38
LNR-0960-191-9S	LNR-0960-09S	23	9.6	14.2	38.7	2.7	38

Retentive HXL Poly Liner Catalog Number	Retentive UHMWPE Liner Catalog Number	Height	Enclosure depth	Exposed Height	Diameter A	Wall thickness	Spherical Diameter
LNR-0960-192-0R	LNR-0960-00R	17	12.6	8.2	38.7	1.25	38
LNR-0960-192-3R	LNR-0960-03R	20	12.6	11.2	38.7	1.25	38
LNR-0960-192-6R	LNR-0960-06R	23	12.6	14.2	38.7	1.25	38
LNR-0960-192-9R	LNR-0960-09R	26	12.6	17.2	38.7	1.25	38

Stem Dimensions



Press-Fit Stem Dimensions (mm), Ti

Press-Fit Stem Catalog Number	Length	Diameter A	Diameter B	Diameter C	Spline Depth	No. of Splines
STEM-0920-025-06	90.4	11.6	6.8	4.6	1	12
STEM-0920-025-07	90.4	12.4	7.6	5.3	1	12
STEM-0920-025-08	90.4	13.7	9	6.6	1	12
STEM-0920-025-09	90.4	14.4	9.9	7.4	1	12
STEM-0920-025-10	90.4	15.4	10.9	8.5	1	12
STEM-0920-025-11	90.4	16.5	12.1	9.5	1	12
STEM-0920-025-12	90.4	17.5	13.2	10.6	1	12
STEM-0920-025-13	90.4	18.5	14.2	11.6	1	12
STEM-0920-025-14	90.4	19.5	15.3	12.6	1	12
STEM-0920-025-15	90.4	20.5	16.4	13.5	1	12
STEM-0920-025-16	90.4	21.5	17.4	14.7	1	12

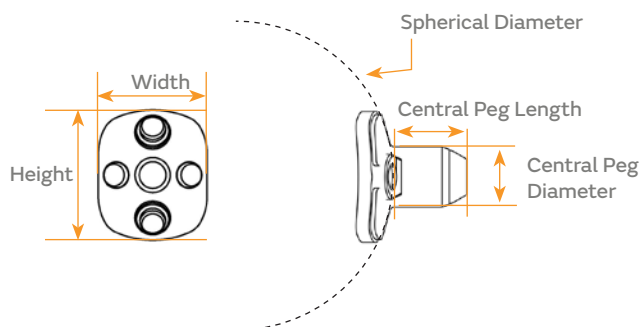
Cemented Stem Dimensions (mm), CoCr

Cemented Stem Catalog Number	Length	Diameter A	Diameter B	Diameter C	No. of Flutes
STEM-0950-025-06	90.4	9.6	6.1	4.6	4
STEM-0950-025-08	90.4	11.6	8.1	6.7	4
STEM-0950-025-10	90.4	13.4	9.9	8.5	4
STEM-0950-025-12	90.4	15.4	11.9	10.6	4
STEM-0950-025-14	90.4	17.5	14	12.6	4

Cemented Long Stem Dimensions (mm), CoCr

Cemented Long Ste Catalog Number	Length	Diameter A	Diameter B	Diameter C	No. of Flutes
STEM-0950-025-08125	125	11.5	8	6	4
STEM-0950-025-08165	165	11.5	8	6	4
STEM-0950-025-10125	125	13.5	10	8	4
STEM-0950-025-10165	165	13.5	10	8	4
STEM-0950-025-12125	125	15.5	12	10	4
STEM-0950-025-12165	165	15.5	12	10	4
STEM-0950-025-14125	125	17.5	14	12	4
STEM-0950-025-14165	165	17.5	14	12	4

Baseplate, Screw and Locking Screw Cap Dimensions

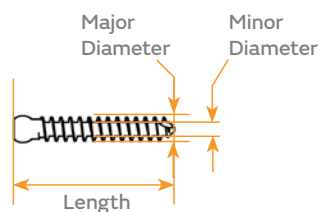


Baseplate Dimensions (mm), Ti

Glenoid Baseplate Catalog Number	Height	Width	Thickness	Spherical Diameter	Central Peg Length	Central Peg Diameter
GBP-0961-094-S	27.3	22.8	2	62	13	10.6

4.5 Star Screw Dimensions (mm), Ti

4.5mm Star Screw Catalog Number	Length	Major Diameter	Minor Diameter
SCW-0961-046-15	15	4.5	2.5
SCW-0961-046-20	20	4.5	2.5
SCW-0961-046-25	25	4.5	2.5
SCW-0961-046-30	30	4.5	2.5
SCW-0961-046-35	35	4.5	2.5
SCW-0961-046-40	40	4.5	2.5
SCW-0961-046-45	45	4.5	2.5
SCW-0961-046-50	50	4.5	2.5
SCW-0961-046-55	55	4.5	2.5



Locking Screw Cap Dimensions (mm), Ti

Locking Screw Cap Catalog Number	Height	Diameter
SLC-0961-045-01	3	6



Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your Smith+Nephew representative or distributor if you have questions about the availability of Smith+Nephew products in your area.

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29643 V2 LC-04-0961-0001 REV F 11/22

Manufacturer:



Ascension Orthopedics, Inc
11101 Metric Blvd
Austin, TX 78758 • USA

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