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Guía de **Técnica Quirúrgica** | **Surgical Technique** Guide

Reverse® and **Reverse®** Monoblock

Shoulder Prosthesis

djosurgical®

Reverse® and Reverse® Monoblock Shoulder Prosthesis

SURGICAL TECHNIQUE

djosurgical®

REVERSE® AND REVERSE® MONOBLOCK SHOULDER PROSTHESIS SURGICAL TECHNIQUE

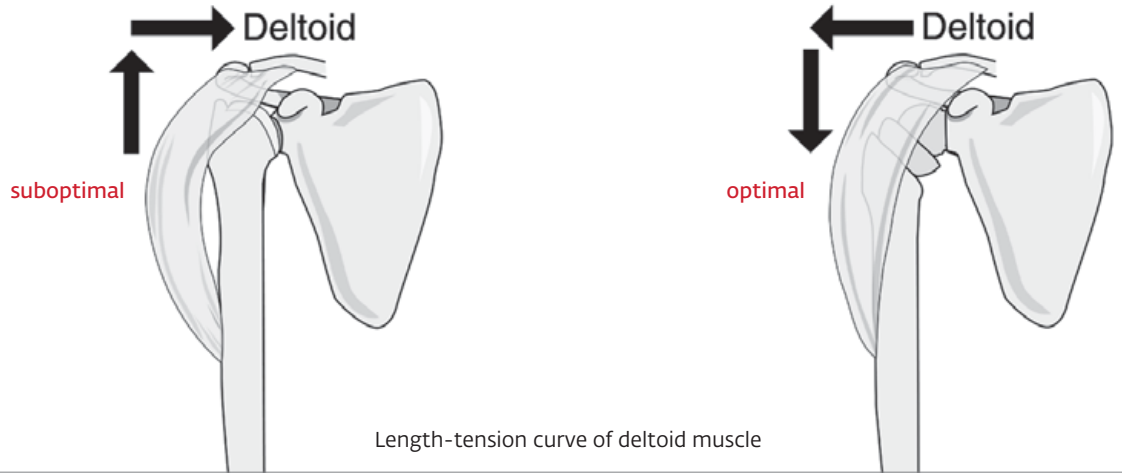
DJO Surgical® is a manufacturer of orthopedic implants and does not practice medicine. This surgical technique was prepared in conjunction with licensed health care professionals. The treating surgeon is responsible for determining the appropriate treatment, technique(s), and product(s) for each individual patient.

Contents

DJO®

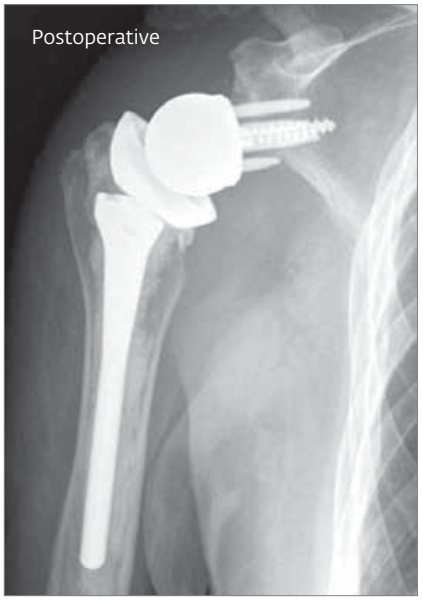
Background

FIGURE 1



Length-tension curve of deltoid muscle

The prosthetic humeral head "rides high" and/ or subluxes antero-superiorly with respect to the glenoid and leads to an unstable joint. The length–tension curve of the deltoid muscle is suboptimal and cannot provide a stable fulcrum for elevation (**FIGURE 1**). As a result, the patient may experience pain, joint instability, and reduced range of motion. The goal of the Reverse® Shoulder Prosthesis (RSP®) is to provide a surgical solution which enables orthopedic surgeons to address the shoulder joint in these disabled patients.



Design Rationale – Reverse® Shoulder Prosthesis

The rotator cuff deficient shoulder will have a variety of pathology related to the rotator cuff muscles, rotator cuff tendons, joint capsule, articular cartilage, joint congruity, and periarticular bone. A spectrum of clinical problems arises from the altered biomechanics and resultant pathophysiology. The progression of symptoms may not be linear. In fact, at some point, loss of sufficient rotator cuff function will lead to joint instability, synergistically causing greater dysfunction than muscle loss alone. The unopposed vertical pull of the deltoid further destabilizes the joint resulting in glenohumeral subluxation, which can lead to progressive articular cartilage breakdown, periarticular bone loss and loss of shoulder function.

The Reverse Shoulder Prosthesis is a total shoulder prosthesis designed specifically for use in patients with non-functional rotator cuffs. The articulation of this design is "inverted" compared to traditional total shoulder prosthesis. Unlike traditional total shoulders, the Reverse Shoulder is designed so that the "ball" of the articulation fits into the glenoid baseplate, and the "cup" of the articulation fits into a metal cup attached to the humeral stem.

A reverse ball and socket is selected because it provides the most mechanically efficient method to neutralize the vertical forces of the unopposed deltoid and maintain joint stability. The RSP® is designed to provide enhanced stability of the glenohumeral joint by increasing constraint of the artificial articulation. Fixation of the glenoid baseplate is achieved by using a fixed central screw and four peripheral screws. The central screw is attached to the baseplate at a fixed angle, providing significant compression at the prosthesis bone interface. The central screw is attached to the baseplate at a fixed angle, which, along with the natural contour of the baseplate ingrowth surface, provides significant compression at the prosthesis bone interface. Additional fixation is achieved through the insertion of up to four peripheral screws. 5.0mm locking and 3.5mm non-locking bone screws are available in variable lengths. Non-locking screws should only be used when perpendicular insertion will not allow for adequate bone purchase. The design of the four peripheral baseplate holes provides additional resistance to shear and torsional forces.

The RSP system has two cemented humeral stem options: the modular RSP Humeral Stem and the RSP Monoblock Humeral Stem. Both stems are indicated for both primary and revision surgeries, and the RSP Monoblock Humeral Stem has the added indication for use in the case of a proximal humeral fracture.

The variability in the degree of soft tissue deficiency, periarticular bone loss and quality, instability, and overall pathoanatomy experienced in rotator cuff deficient shoulders requires an array of reconstructive options to optimize surgical outcomes. The breadth of implant sizes and configurations offered within the RSP system provides the surgeon with this needed versatility. For example, there are four different glenosphere diameters available: 32mm, 36mm, 40mm, and 44mm. For each diameter (with the exception of the 44mm), there are two offsets available, neutral and -4mm. The humeral socket is available in two different levels of constraint depending on the depth of the socket chosen. Note that the inner diameter of the semi-constrained humeral socket insert has 10 degrees more articular arc than does the inner diameter of the standard humeral socket, providing more articular contact with the glenosphere for additional stability. Finally, the different glenospheres provide the ability to select a center of rotation that optimizes muscular function and enhances impingement-free range of motion[1,2,3].

1 Gutierrez S, Comiskey CAt, Luo ZP, Pupello DR, Frankle MA. Range of impingement-free abduction and adduction deficit after reverse shoulder arthroplasty. Hierarchy of surgical and implant-design-related factors. J Bone Joint Surg Am 2008;90:2606-15.
2 Gutierrez S, Levy JC, Frankle MA, Cuff D, Keller TS, Pupello DR, Lee WE, 3rd. Evaluation of abduction range of motion and avoidance of inferior scapular impingement in a reverse shoulder model. J Shoulder Elbow Surg 2008;17:608-15.
3 Virani NA, Cabezas A, Gutiérrez S, Santoni BG, Otto R, Frankle M. Reverse shoulder arthroplasty components and surgical techniques that restore glenohumeral motion. J Shoulder Elbow Surg. 2012 May 22.

Indications and Contraindications

INDICATIONS

The Reverse® Shoulder Prosthesis (RSP®) is indicated for use in patients with:

- Grossly deficient rotator cuff shoulder joints with severe arthropathy
- Failed joint replacement with a grossly deficient rotator cuff shoulder joint.

ADDITIONAL INDICATIONS FOR THE RSP MONOBLOCK HUMERAL STEMS

The RSP Monoblock humeral stems have the following additional indications for use:

- In cases of fracture of the glenohumeral joint from trauma or pathologic conditions of the shoulder, including humeral head fracture or displaced 3- or 4-part fractures of the proximal humerus (for cemented implantation only)
- In cases of bone defects in the proximal humerus

ADDITIONAL INDICATIONS FOR THE RSP HUMERAL STEM ADAPTORS

The RSP humeral stem adaptors (Modular RSP Hemi-Adaptor and RSP Monoblock Hemi-Adaptor) are intended for use in the following intraoperative situations:

- During a primary surgery, after the humerus has been prepared and the glenoid bone stock appears "insufficient" to bear the load of the glenoid baseplate
- During a revision surgery, if the glenoid bone stock appears to be "insufficient" to bear the load of the glenoid baseplate.

NOTE: *The glenoid baseplate is intended for cementless application, in conjunction with screws for additional fixation.*

CONTRAINDICATIONS

Total joint replacement is contraindicated whenever there is:

- Nonfunctional deltoid muscle
- Infection or active sepsis
- Insufficient bone quality which may affect the stability of the implant, including excessive glenoid bone loss
- Muscular, neurological, or vascular deficiencies that compromise the affected extremity
- Conditions that place excessive demand on the implant (Charcot's joints, muscle deficiencies, refusal to modify postoperative physical activities, high levels of physical activity, skeletal immaturity)
- Known sensitivity to materials or metal allergy (e.g., jewelry)
- Pregnancy
- Alcoholism or other addictions.

NOTE: *The patient's joint must be anatomically and structurally suited to receive the selected implant(s), and a functional deltoid muscle is necessary to use the device.*

Preoperative Planning – Reverse® Shoulder Prosthesis

INITIAL EXAMINATION

It is suggested that the case history, examination, radiographs, and CT scans be performed as part of the preoperative plan.

CT scans will be used to determine the location of the baseplate by assessing glenoid version and bone loss. For primary cases, a detailed case history confirmed by A/P and lateral radiographs indicating shoulder arthritis and an irreparable rotator cuff tear must be present to perform a reverse shoulder surgery. A CT scan of the shoulder provides effective evaluation of glenoid version and quality of bone stock. An MRI is occasionally helpful in equivocal cases, and may be useful in determining the quality of the remaining rotator cuff (i.e., teres minor).

Preoperative planning also enables identification of any bone abnormalities and potential problems before surgery, which will help determine the proper selection of the prostheses, instrumentation required, and any variables that will need to be dealt with intraoperatively. Consideration of the degree of preoperative instability, glenoid bone loss, and humeral bone loss is essential in anticipating the glenoid head selection, choice of socket constraint and potential need for bone graft augmentation.

TEMPLATING THE HUMERUS

To determine the humeral implant size and appropriate position, select the humeral template size that best fits the proximal and distal humerus. Move the template proximally and distally until the axis of the neck of the humeral stem is in line with the axis of the patient's humeral neck. Locate the center of the humeral head using the humeral socket template. Center the geometry of the reverse shoulder humeral stem in the humeral canal, and fill the canal to the medial cortical wall. Verify that the stem size chosen in the A/P plane also fits the lateral plane.

Reverse® Shoulder Prosthesis templates include radiograph templates for the humeral stem, humeral socket, and glenoid head/baseplate. Note that the templates incorporate 10% magnification for greater accuracy when using A/P and lateral radiographs.

Instrumentation

RSP X-Ray Templates
[804-88-016, 804-88-019]

Humeral Preparation – Reverse® Shoulder Prosthesis

FIGURE 2

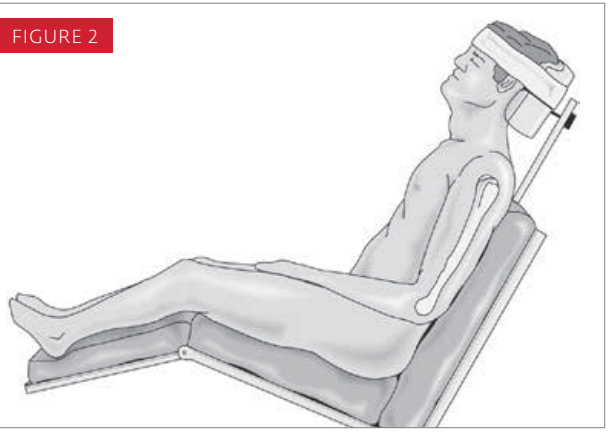
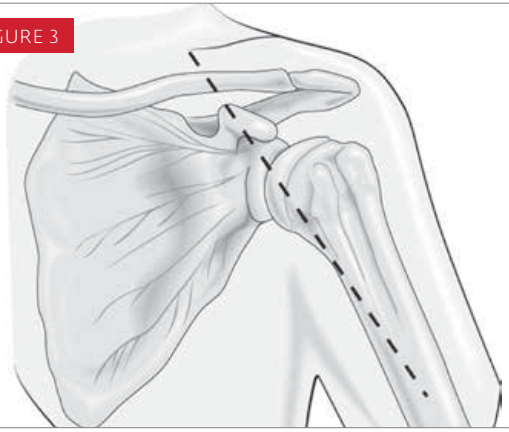


FIGURE 3



PATIENT PREPARATION AND POSITIONING

General endotracheal anesthesia combined with an interscalene nerve block is preferable prior to positioning.

Place the patient in an upright beach chair position with the head firmly secured with the arm draped free (**FIGURE 2**).

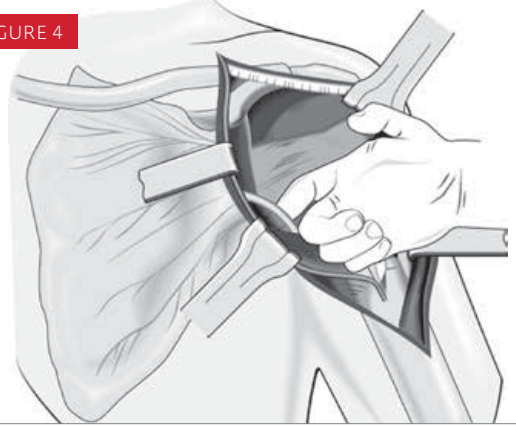
The operative arm must be sufficiently off to the side of the bed to allow for unobstructed movement of the shoulder in adduction and hyperextension.

DELTOPECTORAL SURGICAL APPROACH

An extended deltopectoral approach is used (**FIGURE 3**). In a primary case, prepare the incision 5 cm medial to the acromioclavicular joint and extend it down the anterior arm, distal and lateral to the axillary fold. Identify and preserve the cephalic vein. Free the deltoid muscle from the cephalic vein, ligating the lateral tributaries and leaving the vein medial with the pectoralis major muscle. Release a portion of the pectoralis major tendon insertion. Care should be taken to not damage the long head of the biceps tendon underneath.

Surgical Technique – Reverse® Shoulder Prosthesis

FIGURE 4

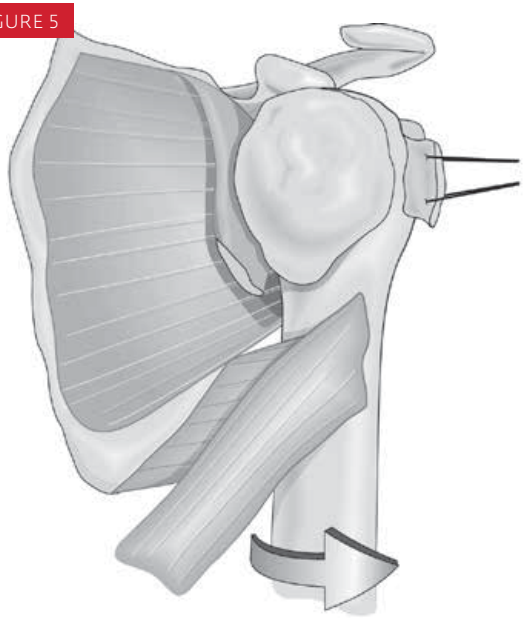


HUMERAL EXPOSURE

General endotracheal anesthesia combined with Expose the subdeltoid, subacromial, and subcoracoid spaces. Open the subdeltoid space using blunt and electrocautery dissection. Excise the subacromial bursa to allow placement of a deltoid retractor. Any remaining posterior rotator cuff insertion can be appreciated. Palpate the tip of the coracoid and identify the conjoined tendon. Incise the clavipectoral fascia superficially with electrocautery on the lateral border of the conjoined tendon. Avoid medial retractors on the conjoined tendon to prevent a musculocutaneous nerve traction injury.

Palpate the axillary nerve proximally between the conjoined tendon and the lower subscapularis muscle and distally on the undersurface of the lateral deltoid muscle. Confirm its location by performing the tug test (**FIGURE 4**).

FIGURE 5



Expose the long head of the biceps tendon and completely open the rotator interval to the superior rim of the glenoid. Ligate the anterior humeral circumflex vessels at the lower portion of the subscapularis. Release the remnant subscapularis tendon from the lesser tuberosity and proximal humerus. Externally rotating the arm will place tension on the muscle and facilitate its release from bone. Atraumatically dislocate the shoulder anteriorly using gentle external rotation and extension (**FIGURE 5**). The humerus is often osteopenic and can be fractured if overzealous force is used to dislocate the shoulder.

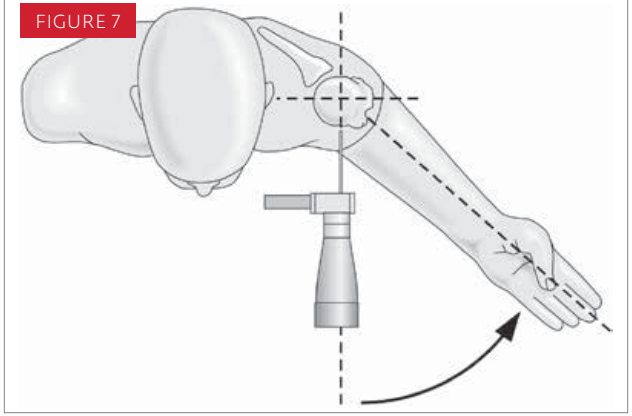
Surgical Technique – Reverse® Shoulder Prosthesis

FIGURE 6

HUMERAL HEAD OSTEOTOMY

Measure the level of the humeral head resection intraoperatively by reviewing the preoperative plan. Trim any osteophytes from the proximal humerus as needed using a straight rongeur to improve visualization of the anatomic neck of the humerus. Position the Osteotomy Guide onto the anterior humeral shaft to determine the varus-valgus angle of the humeral head osteotomy (**FIGURE 6**).

FIGURE 7



Humeral retroversion is determined by using the forearm as a reference point to the flexed elbow. Externally rotate the forearm, and align the Retroversion Alignment Rod parallel to the forearm to recreate a preferred humeral neck resection in 30 degrees of humeral retroversion (**FIGURE 7**). Note that the height of the osteotomy should be above the anatomic neck so that resection is no larger than a tablespoon (**FIGURE 8**). A minimal amount of bone should be removed.

FIGURE 8

Drill 2 holes through the Osteotomy Guide using a 3.2mm drill bit. Tap the bone pins into the prepared drill holes to secure the Osteotomy Guide to the anterior humeral shaft.

Instrumentation

Osteotomy Guide, Right/Left [804-00-046_047]	Bone Pins, 3-inch [800-01-338]	Retroversion Alignment Rod [803-01-057]	3.2mm Drill Bit [801-01-020]

Surgical Technique – Reverse® Shoulder Prosthesis

FIGURE 9

FIGURE 10

HUMERAL HEAD OSTEOTOMY

Place Hohmann retractors medially around the proximal humerus to protect the axillary nerve. Aim the oscillating saw parallel to the sagittal plane of the body through the proximal humerus. Begin the humeral head resection by cutting parallel to the top of the Osteotomy Guide until the humeral head is completely resected (**FIGURE 9**).

Pull out the bone pins using the Bone Pin Puller/ Extractor and remove the Osteotomy Guide (**FIGURE 10**).

Instrumentation

Bone Pin Puller/Extractor
[800-01-035]

Surgical Technique – Reverse® Shoulder Prosthesis

FIGURE 11

FIGURE 12

HUMERAL CANAL REAMING

The Humeral Reamers are cylindrical and self-centering, with blunt tips, proportionally sized in 6mm to 14mm diameters, in 2mm increments. It is recommended to always manually hand-ream the intramedullary humeral canal.

Extend and adduct the humerus to allow access to the medullary canal. Remove a small amount of lateral cortical bone to allow straight access down the humeral shaft and prevent varus reaming. Enter the intramedullary canal where the supraspinatus tendon normally would attach to the greater tuberosity lateral to the humeral head cut surface. Begin reaming with the small T-handle Starter Reamer and then advance with the 6mm Reamer (**FIGURE 11**).

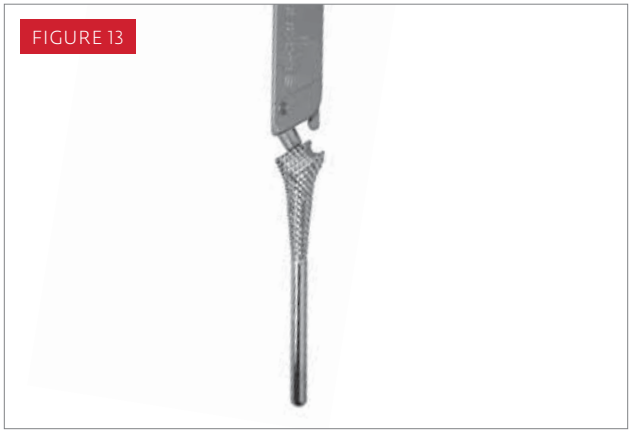
Attach the smallest size (6mm) Humeral Reamer to the detachable T-handle. Orient the Humeral Reamer laterally against the cortical bone to ensure proper alignment of the reamer along the long axis of the humeral shaft for correct component positioning. Use the proximal level of the humeral osteotomy as the point of reference, and sequentially ream the intramedullary canal to the size templated in the preoperative plan or until cortical bone chatter resistance is encountered (**FIGURE 12**).

Instrumentation

T-Handled Starter Reamer (6mm) [804-00-002]	Detachable T-Handle [803-05-257]	Humeral Reamers (6mm/8mm/10mm/12mm/14mm) [804-00-029_037]

Surgical Technique – Reverse® Shoulder Prosthesis

FIGURE 13



HUMERAL CANAL BROACHING

RSP Humeral Broaches are symmetrically designed and available from 6mm to 14mm diameters in 1mm increments. Each Broach precisely matches the entire length of the corresponding modular RSP® Humeral Stem. The diameter of each Broach also precisely matches the distal diameter of the corresponding RSP Monoblock Humeral Stem. The proximal portion of each RSP Monoblock Humeral Stem is slightly smaller than the proximal portion of the same-sized Humeral Broach. The modular RSP Humeral Stems are variable in overall length (primary stems range from 101-124mm), while the RSP Monoblock Humeral Stems are all one length (primary stems are 101mm). To allow for an adequate cement mantle, a stem smaller than the final broach size should be selected for both modular and Monoblock stems.

Attach the smallest size (6mm) RSP Humeral Broach to the Humeral Broach Handle (**FIGURE 13**).

FIGURE 14

As a guide for proper alignment and retroversion, attach the Retroversion Alignment Rod to the right or left hole in the Humeral Broach Handle. Externally rotate the forearm, and align the Retroversion Alignment Rod parallel to the patient's forearm to maintain approximately 30 degrees of humeral retroversion (**FIGURE 14**).

Gently impact the Humeral Broach Handle using a mallet until the depth indicator line on the lateral side of the Humeral Broach Handle lines up with the lateral humeral cortex to ensure that the RSP Humeral Broach has been countersunk into the metaphysis of the proximal humerus (**FIGURE 15**).

FIGURE 15

Continue to sequentially broach, increasing in size, until a firm and stable fit is achieved. The final RSP Broach size obtained is generally equivalent to, or is one size smaller than, the last Humeral Reamer size used.

Remove the Humeral Broach Handle, and leave the final countersunk RSP Humeral Broach in the humerus. Once the last broach is seated and left in the canal, visually confirm that the reaming process removed sufficient bone for the socket shell. Hand ream any additional bone necessary with the acetabular reamers or by using a rongeur to assemble the trial socket onto the broach.

Instrumentation

Humeral Broach Handle [804-02-055]	Retroversion Alignment Rod [803-01-057]	RSP Humeral Broach, (6mm-14mm) [804-02-006/010,016/019]

Surgical Technique – Reverse® Shoulder Prosthesis

FIGURE 16

FIGURE 17

PROXIMAL HUMERAL PREPARATION

RSP® Humeral Socket Reamers are designed with crosscut teeth to effectively prepare a proximal cup of bone support that will surround either the RSP Humeral Socket or the shell region of the RSP Monoblock Humeral stem. They are available in three sizes: small, medium, and large.

Using the small-sized RSP Humeral Socket Reamer, position the guide pin for the RSP Humeral Socket Reamer into the opening of the countersunk RSP Humeral Broach in the humeral metaphysis. Place the reamer over the guide pin and ream the humeral metaphysis using power (**FIGURE 16**).

Remove excess bone from the medial margin of the humeral metaphysis using a burr or curved rongeur (**FIGURE 17**).

Leave the final countersunk RSP Humeral Broach in the humeral canal while preparing the glenoid to minimize the risk of deforming or fracturing the proximal humerus. Final preparation of the proximal humerus will be performed after glenoid baseplate insertion.

Instrumentation

RSP Humeral Socket Reamer (Small) [804-02-083]

RSP Humeral Socket Reamer Guide Pin [804-02-089]

Glenoid Preparation – Reverse® Shoulder Prosthesis

GLENOID EXPOSURE

Abduct the arm on a free-standing Mayo stand or arm holder to relax the deltoid, and allow the humerus to retract posteriorly. Extensive soft tissue releases may be necessary to gain optimal visualization and access to the glenoid.

Place a glenoid retractor on the posterior-inferior rim of the glenoid to displace the humerus posteriorly. Release the coracohumeral ligament from the lateral coracoid to free the subscapularis and visualize the lateral coracoid base.

Release the glenohumeral ligaments, capsule, and labrum, and excise them from the glenoid beginning at the 12 o'clock position and ending between the 6 and 7 o'clock positions (for the right side shoulder). Excise the inferior capsule to ensure excellent visualization of inferior glenoid. Note that the axillary nerve is at risk for injury near the posterior-inferior resection of the capsule. When using electrocautery, care must be taken to remain on the bone of the glenoid neck while performing these releases to help minimize this risk.

Place a Meyerding or blunt Hohmann retractor on the anterior glenoid neck to retract the subscapularis and facilitate releases around the glenoid to minimize traction on the anterior structures to avoid brachial plexus traction injuries.

Instrumentation

RSP Humeral Socket Reamer (Small) [804-02-083]

RSP Humeral Socket Reamer Guide Pin [804-02-089]

Glenoid Preparation – Reverse® Shoulder Prosthesis

FIGURE 18

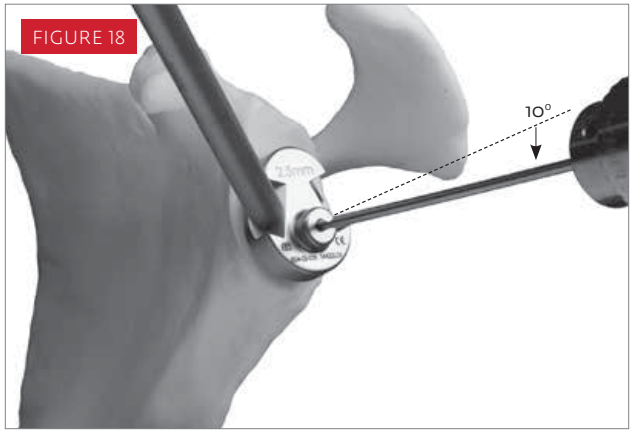


FIGURE 19

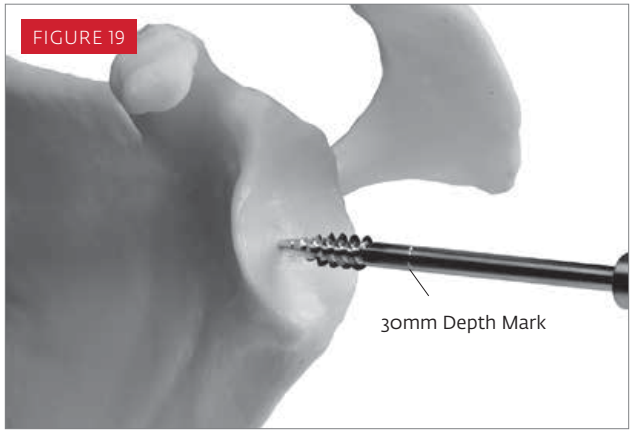
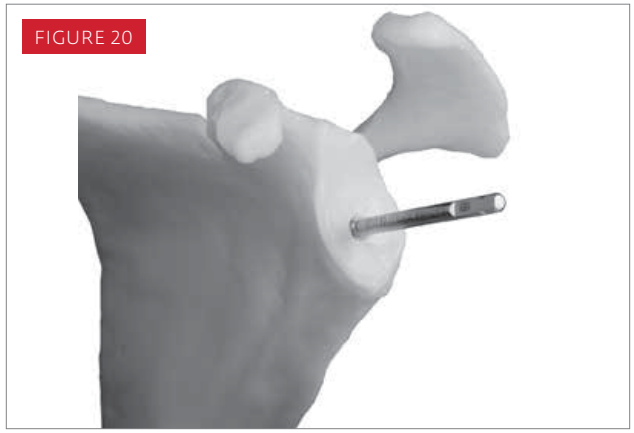


FIGURE 20



GLENOID DRILL GUIDE PLACEMENT

Assemble the Central Drill Guide Handle to the Central Drill Guide such that the handle will be held anteriorly when the drill guide is placed on the glenoid. Place the inferior edge of the drill guide on the inferior edge of the glenoid (**FIGURE 18**). The Central Drill Guide has a built-in 10 degree inferior tilt to ensure accurate placement of the RSP® baseplate.

Preoperative planning helps to anticipate the tilt of the glenoid baseplate. As is common in cases of cuff tear arthropathy, superior wear of the glenoid may be present. In those cases, the 10 degree built-in inferior tilt of the drill guide may not be sufficient in ensuring the appropriate tilt of the baseplate.

Drill the hole and exit the anterior scapula using the 2.5mm drill bit. Measure the depth of the drill hole using the Depth Gauge to ensure that the depth of the drill hole is approximately 30mm.

It is important to note that the length of the central screw on the baseplate is 30mm. Therefore, the length of the drilled hole should be of the appropriate length to achieve bicortical fixation after the face of the glenoid has been reamed.

Seat the RSP 6.5mm Guide Tap in the same direction and angle as that used for the 2.5mm drill hole until it engages the anterior cortex of the scapula. The RSP 6.5mm Guide Tap has a 30mm depth mark to provide guidance for achieving the appropriate depth (**FIGURE 19**). Manual placement of the RSP 6.5mm Guide Tap is achieved by connecting the manual Tap Driver Adaptor to the Ratchet Handle. Power placement of the RSP 6.5mm Guide Tap is achieved by using the Power Tap Driver Adaptor. Significant resistance should be felt when the anterior cortex is engaged.

Leave the 6.5 mm Guide Tap in the glenoid (**FIGURE 20**).

Instrumentation

2.5mm Drill Bit [1395-1025]	Central Drill Guide Handle [804-03-037]	RSP 6.5mm Guide Tap [804-03-008]	Manual Tap Driver Adaptor [804-03-016]
2.5mm Central Drill Guide [804-03-036]	Depth Gauge [804-03-003]	Ratchet Handle (black) [803-05-163]	Power Driver Adaptor [804-03-020]

Glenoid Preparation – Reverse® Shoulder Prosthesis

FIGURE 21

GLENOID REAMING

RSP® Glenoid Reamers are cannulated and designed to create a concave glenoid surface that is congruent with the RSP Glenoid Baseplate. They are designed for power use and are available in 4 sizes: starter, small, medium, and large.

Connect the smallest-sized Starter RSP Glenoid Reamer to the RSP Glenoid Reamer Driver for power use. Place the hole of the cannulated Starter RSP Glenoid Reamer onto the RSP 6.5mm Guide Tap and begin to ream the glenoid surface using power. Ream the glenoid surface using the Small RSP Glenoid Reamer (**FIGURE 21**). Medium and Large RSP Glenoid Reamers are available based on surgeon preference.

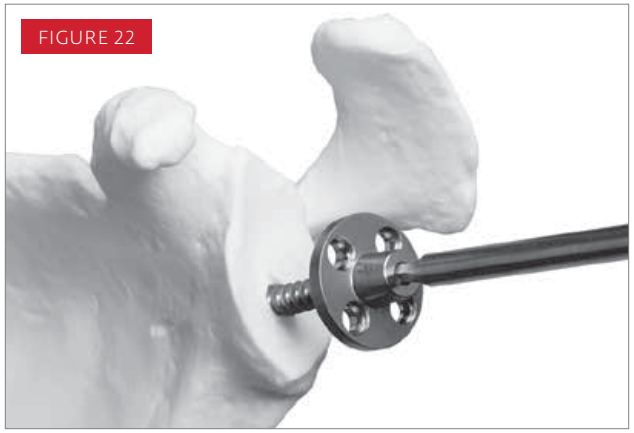
Ream to expose subchondral bone. Continue reaming to violate the subchondral bone on the inferior 50% of the prepared glenoid until bleeding bone is exposed. Remove the RSP 6.5mm Guide Tap upon completion. Manual removal of the RSP 6.5mm Guide Tap is achieved either by connecting the Quick-Coupling T-handle directly to the 6.5mm Guide Tap or by connecting the Manual Tap Driver Adaptor to the Ratchet Handle.

Instrumentation

RSP Glenoid Reamer Driver [804-03-011]	RSP Glenoid Reamer [804-03-012, Starter] [804-03-013, Small] [804-03-014, Medium] [804-03-015, Large]	RSP Glenoid Half Moon Reamer [804-06-012, Starter] [804-06-013, Small] [804-06-014, Medium]	Ratchet Handle (Black) [803-05-163]	Manual Tap Driver Adaptor [804-03-016]	Quick-Coupling T-Handle [804-03-019]

Glenoid Preparation – Reverse® Shoulder Prosthesis

FIGURE 22



RSP® GLENOID BASEPLATE IMPLANT

The RSP® Glenoid Baseplate implant is designed with a 6.5mm centralized bone screw that is 30mm long and 4 peripheral holes for bone screws. The baseplate is manufactured using a titanium alloy to promote biological fixation.

GLENOID BASEPLATE INSERTION

Implant the RSP Glenoid Baseplate into the prepared glenoid by purchasing the tip of the 6.5mm central bone screw into the pre-drilled hole on the anterior cortex of the scapula for secure fixation (**FIGURE 22**). Manual placement of the RSP Glenoid Baseplate is achieved by connecting the Ratchet Handle to the 3.5mm Hex Driver, which mates with a hex feature on the Morse taper of the RSP Glenoid Baseplate.

FIGURE 23

When fully seated, the RSP Glenoid Baseplate should sit flush with the glenoid, and the scapula should rotate slightly when attempting to tighten it down onto the glenoid surface (**FIGURE 23**). The purchase of the central screw when the baseplate is fully seated must be very secure so that the attempted further advancement of the screw will cause the entire scapula to rotate.

PERIPHERAL BONE SCREW IMPLANTS

Four peripherally mounted bone screws are used to provide additional fixation of the RSP Glenoid Baseplate to the glenoid surface. For perpendicular placement, 5.0mm locking bone screw implants are indicated and are available in 7 lengths (14mm to 38mm, in 4mm increments). For angled placement in any direction up to 12 degrees, 3.5mm non-locking bone screw implants are indicated and are available in 13 lengths (14mm to 38mm, in 2mm increments). Selection of bone screws is at the discretion of the surgeon, however, it is preferable to use 5.0mm locking screws. A variable angle 3.5mm non-locking screw should only be used in the event that a perpendicular 5.0mm locking screw is unable to achieve adequate bone purchase

Instrumentation

Ratchet Handle (Black) [803-05-163]	3.5mm Hex Driver [803-05-167]

Glenoid Preparation – Reverse® Shoulder Prosthesis

FIGURE 24

FIGURE 25

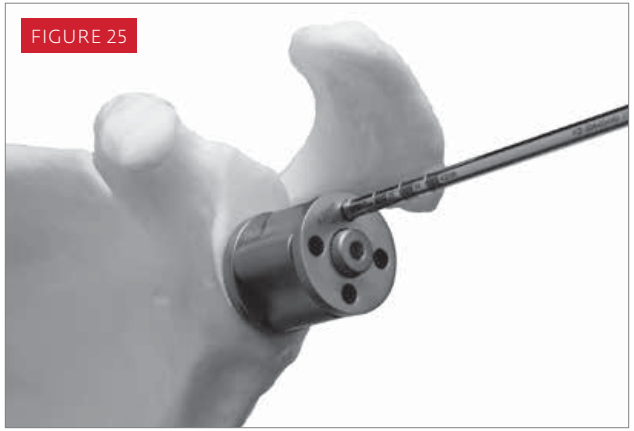
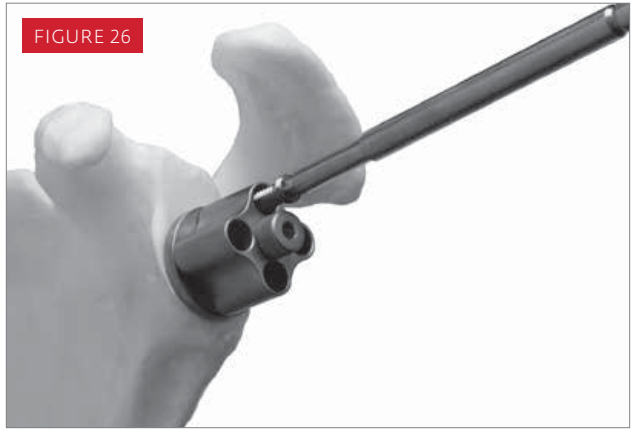


FIGURE 26



PERIPHERAL BONE SCREW INSERTION

For placement of the 5.0mm locking bone screws, attach the RSP® Two-Piece Drill Guide onto the RSP Glenoid Baseplate (**FIGURE 24**). Using the 4.0mm drill bit, drill all 4 screw holes through the assembled RSP Two-Piece Drill Guide (**FIGURE 25**). When the rear cortex is penetrated by the drill bit, the depth line on the drill bit should be noted to determine the appropriate screw length. The 4.0mm drill bit is calibrated in 4mm increments, starting at 14mm up to 42mm.

To measure the depth of each pre-drilled screw hole using the Depth Gauge, subtract 25mm (i.e., the assembled height of the drill guide) from the Depth Gauge reading to obtain screw length. Remove the inner drill guide tube section, leaving the outer screw guide. The outer screw guide provides guidance for the locking screws. Implant the appropriate 5.0mm locking bone screw into the RSP Glenoid Baseplate (**FIGURE 26**).

Manual placement of the 5.0mm locking bone screw is achieved using the 3.5mm Hex Driver connected to the Ratchet Handle. Power placement of the 5.0mm locking bone screw is achieved by connecting the Power Tap Driver Adaptor to the 3.5mm Power Hex Driver.

Care should be taken when using power for insertion of the 5.0mm locking screws with the screw guide. A low/slow setting must be applied when drilling. Do not engage the head of the screw to the baseplate under power.

Obtain final seating of the bone screws manually using the 3.5mm Hex Screwdriver. Screw heads should be tightened completely to prevent impingement with the RSP Glenoid Head.

Instrumentation

4.0mm Drill Bit [804-03-049]	5.0mm Bone Screw Tap [804-03-017]	Ratchet Handle (Black) [803-05-163]	Power Driver Adaptor [804-03-020]	Large 3.5mm Hex Screwdriver [801-01-042]
RSP Two-Piece Drill Guide [804-03-048]	Depth Gauge [804-03-003]	3.5mm Hex Driver [803-05-167]	3.5mm Power Hex Driver [804-03-022]	

Glenoid Preparation – Reverse® Shoulder Prosthesis

FIGURE 27

FIGURE 28

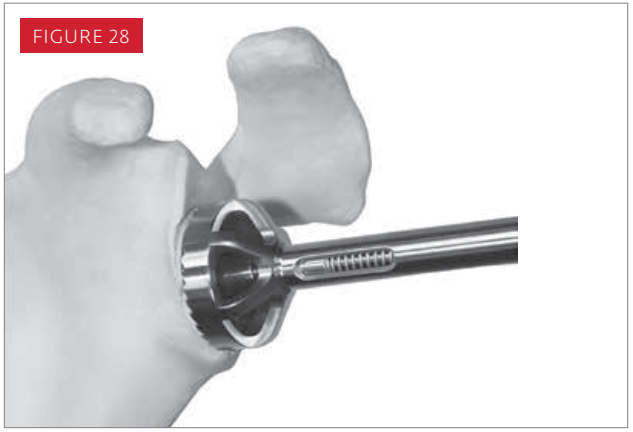


FIGURE 29

PERIPHERAL BONE SCREW INSERTION/NON-LOCKING SCREWS

Occasionally, there may be an inadequate amount of bone stock and/or too poor quality of bone for perpendicular placement of the 5.0mm locking bone screws. Under these circumstances, the 3.5mm non-locking bone screws can be used to angle the bone screw placement using the 2.5mm drill bit and the 2.5mm/3.2mm angled drill guide for improved bone purchase (**FIGURE 27**). Measure the depth of each pre-drilled screw hole using the Depth Gauge.

Tap the pre-drilled 2.5mm screw holes using the 3.5mm Bone Screw Tap. Manual placement of the 3.5mm non-locking bone screw is achieved using the small 2.5mm Hex Screwdriver. Power placement of the 3.5mm locking bone screw is achieved by connecting the Power Tap Driver Adaptor to the 2.5mm Power Hex Driver.

Obtain final seating of the bone screws using the 2.5mm Hex Screwdriver. Screw heads should be tightened completely to prevent impingement with the RSP Glenoid Head.

GLENOID BASEPLATE RIM PLANNING

Position the RSP® Baseplate Rim Planer over the RSP Glenoid Baseplate. Manually ream around the rim of the Glenoid Baseplate to remove any bone or soft tissue (**FIGURE 28**). This will help to prevent impingement when implanting the RSP Glenoid Head onto the RSP Glenoid Baseplate.

ALTERNATIVE GLENOID PLANNING TECHNIQUE UTILIZING A BURR INSTEAD OF GLENOID RIM PLANER

Remove any observed soft tissue or bony prominence around the baseplate that might prevent the head from seating fully using rongeurs or a burr, being careful to avoid damaging the rim of the baseplate. If the trial glenoid head is seated fully and the taper is engaged, then sufficient bone was removed.

FINAL HUMERAL PREPARATION

Sequentially ream the proximal humerus using the Medium and Large RSP Humeral Socket Reamers. Position the guide pin for the RSP Humeral Socket Reamer into the opening of the countersunk RSP Humeral Broach in the humeral metaphysis. Place the reamer over the guide pin and ream the humeral metaphysis using power (**FIGURE 29**). Both the Medium and Large Humeral Socket Reamers should be used to adequately prepare for the trial and implant. Leave the final countersunk RSP Humeral Broach in the humeral canal for trial reduction.

Instrumentation

Ratchet Handle (Black) [803-05-163]	RSP 32mm Baseplate Rim Planer [804-03-056]	2.5mm Power Hex Driver [804-03-021]	3.5mm Bone Screw Tap 804-03-018]	RSP Humeral Socket Reamers Guide Pin [803-02-089]
2.5mm / 3.5mm Angled Drill Guide [804-.03-007]	Small 2.5mm Hex Screwdriver [1395-1030]	Depth Gauge [804-03-003}	RSP Humeral Socket Reamers (Medium/Large) [804-02-084_085]	

Shoulder Trial Reduction

FIGURE 30

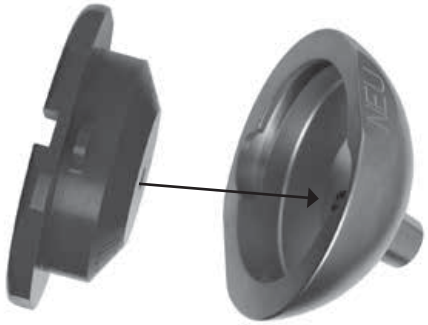


FIGURE 31

USING HUMERAL BROACH, SOCKET SHELL TRIALS, AND SOCKET INSERT TRIALS

RSP® Humeral Socket Shell Trials are available in three sizes: neutral, +4mm thickness, and +8mm thickness. Socket Insert Trials are available in sixteen sizes that are defined according to diameter, constraint level, and thickness (see table below). Available diameters include 32mm (blue), 36mm (yellow), 40mm (green), and 44mm (gray). Each diameter is available in a standard and a semi-constrained configuration, as well a neutral and +4mm thickness.

Socket Insert Trial Sizes (16 Total)

DIAMETERS	32MM, 36MM, 40MM, 44MM			
THICKNESSES	NEUTRAL		+4MM	
CONSTRAINT LEVELS	STANDARD	SEMI-CONSTRAINED	STANDARD	SEMI-CONSTRAINED

Note that the inner diameter of the Semi-Constrained Humeral Socket Inserts has 10 degrees more articular arc than the inner diameter of the Standard Humeral Sockets, providing more articular contact with the glenoid head for additional stability.

The broach and any of the three Humeral Socket Shell Trial sizes should be used to trial for the modular RSP Humeral Stem implants. The broach and neutral Humeral Socket Shell Trial should be used to replicate the Monoblock stem. If a +8mm build-up is needed in a Monoblock case, the neutral Humeral Socket Shell Trial should be used in conjunction with the 8mm Spacer Trial. All Humeral Socket Shell Trials and the 8mm Spacer Trial can be used with any Humeral Socket Liner Trial. See the Humeral Build-Up Options section of this surgical technique for specific information regarding final implant thicknesses and compatibility.

The Socket Insert Trials assemble to the Socket Shell Trials by lining up the tabs of the Insert Trial with the scallops of the Shell Trial (**FIGURE 30**). A clockwise ¼ turn of the Insert Trial will lock it into the Shell Trial.

USING THE MONOBLOCK IMPLANT AND SOCKET INSERT TRIALS

In an RSP Monoblock case it is recommended that trial reduction first be performed using the Humeral Broach, Socket Shell Trials, and Socket Insert Trials. In certain cases, however, it may be desirable to cement the Monoblock Humeral Stem implant prior to performing the initial trial reduction. Refer to the RSP Monoblock Stem Cementation section of this surgical technique for instructions on cementing the Monoblock implant into the humerus. In these instances, the Socket Insert Trials may be assembled to the Monoblock Stem implant by lining up the tabs of the Insert Trial with the scallops of the Monoblock Stem implant (**FIGURE 31**). A clockwise ¼ turn of the Insert Trial will lock it into the Monoblock Stem implant.

Instrumentation

RSP Humeral Socket Shell Trials [804-02-057_059]

RSP Humeral Socket Insert Trials [804-02-066_067, 460_473]

RSP Monoblock 8mm Spacer Trial [804-02_071]

Shoulder Trial Reduction

FIGURE 32

FIGURE 33

FIGURE 34

FIGURE 35

The 8mm Spacer Trial can also be used to further increase tensioning in the shoulder joint as required in an RSP® Monoblock case. It assembles to the Monoblock implant by aligning the 8mm Spacer Trial tabs to the mating scallops on the implant (**FIGURE 32**), followed by a clockwise ¼ turn of the 8mm Spacer Trial (assembled construct shown in (**FIGURE 33**).

Note: Size 44mm instruments and implants are not part of the standard instrument set and implant bank and need to be ordered separately.

HUMERAL BUILD-UP OPTIONS

The tables below describe the final implant options available for introducing humeral build-up (i.e., additional thickness). The Humeral Socket Shell and Socket Insert Trials are designed to simulate these build-up options, allowing intraoperative assessment and optimization of joint tensioning.

Modular RSP Humeral Build-Up Options

	NEUTRAL SHELL	+4MM SOCKET SHELL	+8MM SOCKET SHELL
NEUTRAL SOCKET INSERTS	0MM	+4MM*	+8MM*
+4MM SOCKET INSERTS	+4MM	+8MM	+12MM
***Preferred implant combination for given amount of build-up**			

RSP Monoblock Humeral Build-Up Options

	MONOBLOCK STEM ONLY	MONOBLOCK STEM + 8MM SPACER
NEUTRAL SOCKET INSERTS	0MM	+8MM
+4MM SOCKET INSERTS	+4MM	+12MM
***The 8mm spacer is ONLY compatible with the Monoblock Humeral Stem**		

GLENOID HEAD SELECTION AND FINAL REDUCTION

RSP Glenoid Head Trials are available in seven sizes: 32mm blue (neutral and -4mm offset), 36mm yellow (neutral and -4mm offset), 40mm green (neutral and -4mm offset), and 44mm gray (+8mm offset).

NOTE: *Size 44mm instruments and implants are not part of the standard instrument set and implant bank and need to be ordered separately.*

Select the appropriate RSP Glenoid Head Trial with the correct offset. Assemble the Glenoid Head Trial to the Glenoid Head Inserter by placing the RSP Glenoid Head Inserter into the outer central hole of the Trial and rotating clockwise until tight. Position the Glenoid Head Trial onto a clean, dry Morse taper of the RSP Glenoid Baseplate using the RSP Glenoid Head Inserter (**FIGURE 34**). Using the Glenoid Head Impactor, impact the Glenoid Head Trial onto the Glenoid Baseplate using three to four taps (**FIGURE 35**).

Instrumentation

RSP Glenoid Head Trials
[804-03-042_047, 804-04-048]

RSP Glenoid Head Inserter
[804-03-051]

RSP Humeral Socket Insert Trials
[804-02-066_067, 460_473]

RSP Monoblock 8mm Spacer Trial
[804-02-071]

RSP Glenoid Head Impactor
[804-03-001, 800-01-018]

Shoulder Trial Reduction

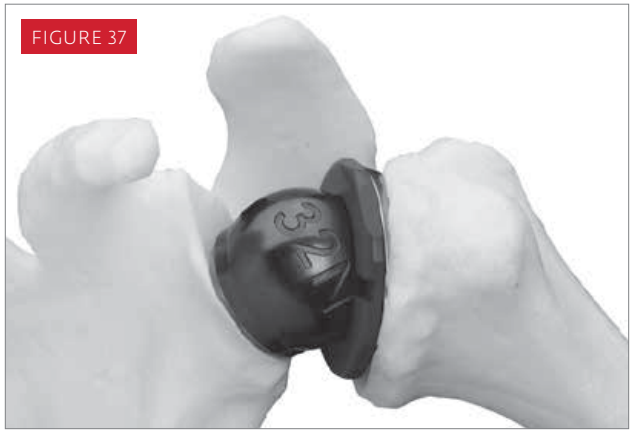
FIGURE 36

As the 36mm -4mm offset, 40mm neutral, and 40mm -4mm offset glenoid heads are hooded on the inferior portion, excess bone from the medial, inferior margin of the glenoid should be removed using a high speed burr or curved rongeur to ensure that the hooded glenoid head sits flush on the prepared glenoid without impingement.

Pull the proximal humerus laterally while extending and externally rotating the arm to deliver the proximal humerus anteriorly.

Position the taper of the RSP® Humeral Socket Trial into the opening of the countersunk RSP Humeral Broach to ensure that it sits flush against the prepared metaphysis without any impingement from osteophytes, labrum, or soft tissue. Use the Humeral Socket Impactor to seat the Humeral Socket Trial onto the Morse taper of the Humeral Broach (**FIGURE 36**).

FIGURE 37



Reduce the shoulder by pulling laterally on the Humeral Socket Trial and proximal humerus to clear it from the Glenoid Head Trial, while flexing and internally rotating the arm, until a gentle, but appreciable, "clunk" occurs (**FIGURE 37**). If the shoulder reduces too easily, soft tissue tension is inadequate and may be addressed by incorporating greater humeral build-up and/or using a different glenoid head. In a modular RSP (modular shell and stem) case, an RSP Humeral Socket Shell Trial with additional thickness (+4mm or +8mm) should be considered as well as an a + 4mm Socket Insert Trial or an alternate glenoid head. To address inadequate soft tissue tension in an RSP Monoblock case, a +4mm Socket Insert Trial or an 8mm Spacer Trial should be considered as well as an alternate glenoid head. If the shoulder cannot be reduced, there may be soft tissue impingement, the patient may not be completely relaxed, or additional reaming of the proximal humerus may be required.

ASSESMENT OF MOBILITY

In primary cases, ideal soft tissue tension of the shoulder will allow for "near" full elevation. In revision cases, elevation is dependent on several variables due to the altered native anatomy. However, 120 degrees of elevation is often achieved.

ASSESMENT OF JOINT STABILITY

Initial assessment of stability is performed with the arm at the side. If there is excessive laxity, additional humeral build-up may be introduced or an alternate glenoid head may be considered. The positions most associated with instability are internal rotation, adduction, and extension of the humerus. In revision cases with proximal bone loss, bone grafting and/or use of a Humeral Socket with greater thickness will help achieve adequate soft tissue tension. In addition, a semi-constrained socket insert will improve stability.

Instrumentation

RSP Humeral Socket Shell Trials [804-02-057_059]	RSP Humeral Socket Insert Trials [804-02-066_067, 460_473]	RSP Humeral Socket Impactor [804-02-002, 804-02-036_037, 800-01-018]

› Trial Removal

FIGURE 38

FIGURE 39

REMOVAL OF TRIAL COMPONENT

Once shoulder mobility and joint stability are sufficient, dislocate the shoulder to remove all RSP trial components. Rotate the RSP® Socket Insert Trial counter-clockwise, and remove it from the Shell Trial. If the Shell Trial cannot be removed by hand, insert the RSP Glenoid Head Distractor into the hole through the taper of the Shell Trial, and rotate clockwise until the trial disengages from the Humeral Broach (**FIGURE 38**). The RSP Glenoid Head Distractor is also used to remove the Glenoid Head Trial. Position the RSP Glenoid Head Distractor into the central hole of the RSP Glenoid Head Trial and rotate clockwise until the Glenoid Head Trial disengages from the Glenoid Baseplate (**FIGURE 39**). After the trial components and the broach have been removed, clear any remaining debris from the humeral canal.

RSP GLENOID HEAD IMPLANT

RSP Glenoid Head Implants are manufactured with a wrought cobalt chrome articulating glenoid head surface and reverse Morse taper for fixation to the Glenoid Baseplate. RSP Glenoid Heads are available in diameters of 32mm, 36mm, and 40mm, in either a neutral or -4mm offset. A 44mm Glenoid Head with a +8mm offset is also available. The 36mm -4mm offset, 40mm neutral, and 40mm -4mm offset Glenoid Heads are hoooded on the inferior portion. All Glenoid Heads have a 5.4mm diameter hole in the center of the glenosphere to accept a 3.5mm titanium alloy Retaining Screw that is 16mm long. Although the Glenoid Head is attached to the Glenoid Baseplate via a Morse taper connection, the Retaining Screw is designed to be tightened into the central part of the Glenoid Baseplate to provide an additional measure of security.

Instrumentation

RSP Glenoid Head Distractor
[804-02-035]

› Final Implantation

FIGURE 40

FIGURE 41

GLENOID HEAD INSERTION

Clear any soft tissue around the circumference of the RSP® Glenoid Baseplate. Irrigate the Glenoid Baseplate surface including the Morse taper and dry thoroughly. As the 36mm -4mm offset, 40mm neutral, and 40mm -4mm offset Glenoid Heads are hooded on the inferior portion, excess bone from the medial, inferior margin of the glenoid should be removed using a high speed burr or curved rongeur to ensure that the hooded Glenoid Head sits flush within the prepared glenoid without impingement.

Select the appropriate cobalt-chrome RSP Glenoid Head implant with the correct offset. Assemble the Glenoid Head to the Glenoid Head Inserter by placing the RSP Glenoid Head Inserter into the outer central hole of the Glenoid Head and rotate clockwise until tight. Position the Glenoid Head onto a clean, dry Morse taper of the RSP Glenoid Baseplate using the RSP Glenoid Head Inserter (**FIGURE 40**). Remove the Glenoid Head Inserter and, using the Glenoid Head Impactor, impact the cobalt-chrome Glenoid Head implant onto the Glenoid Baseplate implant using three to four firm taps (**FIGURE 41**).

Instrumentation

Glenoid Head Inserter [804-03-051]	Glenoid Head Impactor [804-03-001, 800-01-018]

› Final Implantation

FIGURE 42

FIGURE 43

Thread the Glenoid Head Inserter onto the Glenoid Head implant and pull on the Glenoid Head Inserter to ensure the Glenoid Head is fully seated onto the Morse taper of the Glenoid Baseplate (**FIGURE 42**). A fully seated Glenoid Head implant will not move. If the Glenoid Head implant is not fully seated, soft tissue impingement may be present. Insert the 3.5mm titanium alloy Retaining Screw into the outer central hole of the Glenoid Head. Tighten the Retaining Screw using the RSP® Torque Limiting Driver (**FIGURE 43**).

Instrumentation

Glenoid Head Inserter [804-03-051]	RSP Torque Limiting Driver [804-03-038]

› Final Implantation

SUBCAPULARIS MANAGEMENT

Using a 2mm drill bit, drill transosseous holes into the proximal humerus. Pass No. 1 braided sutures through the pre-drilled holes for reattaching any remaining subscapularis after final humeral implantation.

MODULAR RSP® HUMERAL STEM IMPLANT

RSP® Humeral Stem implants are manufactured using a titanium alloy and designed with an anatomic-shaped proximal body, and cylindrical-shaped distal segment with cement flutes. The cemented RSP Humeral Stems are precisely matched with the RSP Humeral Reamers and Broaches, size for size, in all dimensions. To allow for an adequate cement mantle, a stem smaller than the final broach size should be selected. Humeral Stems are available in five primary sizes: 6mm x 101mm, 7mm x 105mm, 8mm x 109mm, 10mm x 116mm, and 12mm x 124mm; and 4 revision sizes: 6mm, 8mm, 10mm, and 12mm in one length of 175mm.

RSP HUMERAL SOCKET SHELL IMPLANT

RSP Humeral Socket Shell implants are manufactured using a titanium alloy. Connected to the humeral stem via Morse taper fixation, the lateralized humeral socket design stabilizes the superior pulling force of the deltoid muscle to help restore joint mobility and minimize the risk of bone erosion caused by impingement of the humeral socket against the inferior aspect of the glenoid. The neck/shaft angle of the Modular Stem/Socket Shell Construct is 135 degrees.

The RSP Humeral Socket Shells are available in neutral, +4mm, and +8mm thicknesses, and are designed to mate with the RSP Humeral Socket Inserts.

RSP MONOBLOCK HUMERAL STEM IMPLANT

The RSP Monoblock Stem implants are manufactured using a titanium alloy with titanium plasma spray applied to the distal surface of the shell for osteointegration. The Monoblock stems are designed with a 135-degree neck/shaft angle and contain anterior, posterior, and lateral fins with suture holes for stability and to aid in tuberosity reconstruction. The distal segment of each Monoblock stem is cylindrically shaped, with cement flutes. Monoblock stems are available in five primary sizes: 6mm, 7mm, 8mm, 10mm, and 12mm diameters, each having a length of 108mm. Revision Monoblock stems are also available in 4 different diameters: 6mm, 8mm, 10mm, and 12mm, each having a length of 175mm.

An 8mm Spacer implant is also available to further increase tensioning in the shoulder joint as required in an RSP Monoblock case. The 8mm Spacer is manufactured using a titanium alloy and is secured to the proximal shell of the Monoblock stem using a titanium retaining screw.

RSP HUMERAL SOCKET INSERT IMPLANT

A compression molded polyethylene Humeral Socket Insert snaps into either the Humeral Socket Shell (in a modular RSP case) or the proximal shell of the RSP Monoblock Humeral Stem. The Humeral Socket Inserts are available in sixteen sizes that are defined according to diameter, constraint level, and offset. Available diameters include 32mm, 36mm, 40mm, and 44mm. Each diameter is available in a standard and a semi-constrained configuration, as well as neutral and +4mm thickness. The inner diameter of the Semi-Constrained Humeral Socket Insert has 10 degrees more articular arc than the inner diameter of the Standard Humeral Socket, providing more articular contact with the Glenoid Head for additional stability. Any Humeral Socket Shell or Monoblock Stem can be combined with any Humeral Socket Insert, but the size of the insert must match the size of the Glenoid Head.

NOTE: *It is recommended that when increasing soft tissue tension through the use of thicker Humeral Socket Shells, the 8mm Spacer, and/or thicker Humeral Socket Inserts that the majority of the added thickness be comprised of metal componentry.*

Instrumentation

RSP X-Ray Templates
[804-88-016, 804-88-019]

Final Implantation

FIGURE 44

MODULAR RSP® HUMERAL SOCKET SHELL – SOCKET INSERT ASSEMBLY

Select the appropriately sized RSP® Humeral Socket Shell. Position the Socket Shell into the socket cavity of the RSP Impaction Fixture. Select the appropriately sized RSP Humeral Socket Insert based on the last trial reduction performed. Carefully align the Humeral Socket Insert into the opening of the Humeral Socket Shell.

Lightly impact the RSP Humeral Socket Insert into the RSP Humeral Socket Shell using three to four firm taps (**FIGURE 44**). Make sure that the Socket Insert is seated all the way around the circumference of the Socket Shell.

FIGURE 45

MODULAR RSP HUMERAL STEM – SOCKET ASSEMBLY

Select the appropriately sized RSP Humeral Stem implant. Note that the Humeral Stem implant should be smaller than the final RSP Humeral Broach size used. Position and lock the Humeral Stem into the Humeral Stem/Socket Impaction Fixture. Mate the Morse taper of the assembled RSP Humeral Socket implant into the opening of the RSP Humeral Stem implant using a light rotational movement until firmly seated. Determine the correct orientation of the two components by aligning the black-etched markings on the inferior aspect of the Humeral Socket to the medial aspect of the Humeral Stem. Lightly impact the Humeral Socket implant into the Humeral Stem implant using three to four firm taps (**FIGURE 45**). The mallet impacts should be directly downward, normal to the impaction fixture.

Instrumentation

RSP Impaction Fixture [804-03-054]	RSP Humeral Socket Impactor [804-02-002, 804-02-036_037}	RSP Impactor Handle [800-01-018]

Final Implantation

FIGURE 46

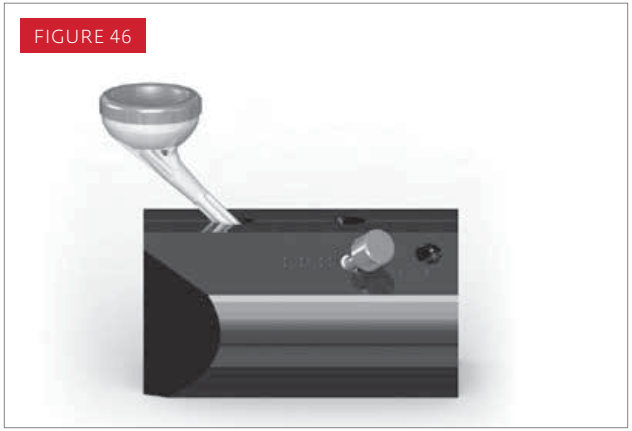


FIGURE 47

RSP® MONOBLOCK HUMERAL STEM – SOCKET INSERT ASSEMBLY

Select the appropriately sized RSP® Monoblock Stem implant. Note that the RSP Monoblock Humeral Stem implant should be smaller than the final RSP Humeral Broach size used to allow for an adequate cement mantle. Position the RSP Monoblock Stem implant into the RSP Modular Stem cavity and secure it with the thumb screw. Select the appropriately sized RSP Humeral Socket Insert based upon the last trial reduction performed. Carefully align the RSP Humeral Socket Insert into the opening of the humeral socket of the RSP Monoblock Stem. Lightly impact the RSP Humeral Socket Insert into the RSP Monoblock Stem using firm taps on the Humeral Socket Impactor (**FIGURE 46**). Ensure that the Socket Insert is fully seated around the entire circumference of the Socket Shell portion of the Monoblock Stem.

If required based upon trial reduction, the 8mm Spacer Implant should be assembled to the Monoblock Stem socket prior to insertion of the Socket Insert. Insert the 8mm Spacer implant into the RSP Monoblock Stem, ensuring that the alignment features are appropriately aligned with the mating pockets on the Monoblock socket shell (Figure 50). Insert and tighten the retaining screw using the 45 in-lb Torque Limiting Driver Handle and 5/16" Hex Socket Driver, and then proceed to assemble the appropriately sized Socket Insert into the Monoblock Stem – 8mm Spacer construct using the RSP Monoblock Impaction Fixture and RSP Humeral Socket Impactor.

Instrumentation

Humeral Socket Impactor [804-02-002, 804-02-036_037]	RSP Impactor Handle [800-01-018]	RSP Impaction Fixture [804-03-054]

NOTE: *It is recommended that the Socket Insert is assembled to the RSP Monoblock Stem using the RSP Monoblock Impaction Fixture whenever possible. In certain cases (such as a fracture case), it may be necessary to use the RSP Monoblock Inserter/Impactor in conjunction with a Retroversion Alignment Rod to insert the Monoblock Stem implant directly into the patient's humerus prior to assembling the Socket Insert and 8mm Spacer (if required). Refer to RSP Monoblock Stem Cementation section of this surgical technique for instructions on cementing the Monoblock implant into the humerus.*

NOTE: *The impaction fixtures are only for use with the primary Monoblock and Modular RSP stems. The longer stems must be assembled in situ.*

MODULAR RSP HUMERAL STEM CEMENTATION

Insert the appropriately sized cement restrictor into the humeral canal, approximately 1.5 cm below the distal tip of the RSP Humeral Stem implant. Brush, irrigate, and dry the humeral canal before bone cement is pressurized into the humeral canal. Mix the bone cement according to the manufacturer's instructions. Extrude the bone cement into the humeral canal by filling the humeral canal, distal to proximal, using a retrograde technique. This technique is critical to avoid embolization of the intramedullary humeral canal with debris such as air and bone marrow. Pressurize the bone cement using a pressurizing nozzle or a digit.

When the bone cement has reached a dough-like consistency, insert the assembled RSP Humeral Prosthesis into the humeral canal in the established 30 degrees of retroversion. Lightly tap the prosthesis into the humeral canal using the appropriate Humeral Socket Impactor (**FIGURE 47**).

Upon completion, remove the Humeral Socket Impactor and any remaining excess bone cement.

› Final Implantation

FIGURE 48

FIGURE 49

FIGURE 50

FIGURE 51

RSP® MONOBLOCK HUMERAL CEMENTATION

Insert the appropriately sized cement restrictor into the humeral canal, approximately 1.5 cm below the distal tip of the RSP® Monoblock Humeral Stem implant. Brush, irrigate, and dry the humeral canal before bone cement is pressurized into the humeral canal. Mix the bone cement according to the manufacturer's instructions. Extrude the bone cement into the humeral canal by filling the humeral canal, distal to proximal, using a retrograde technique. This technique is critical to avoid embolization of the intramedullary humeral canal with debris such as air and bone marrow. Pressurize the bone cement using a pressurizing nozzle or a digit.

When the bone cement has reached a dough-like consistency, insert the RSP Monoblock Stem – Socket Insert assembly into the humeral canal in the established 30 degrees of retroversion. Lightly tap the prosthesis into the humeral canal using the appropriate Humeral Socket Impactor (**FIGURE 47**).

Upon completion, remove the Humeral Socket Impactor and any remaining excess bone cement. In certain cases (such as a fracture case), it may be necessary to insert the Monoblock Stem implant directly into the patient's humerus prior to assembling the Socket Insert and 8mm Spacer (if required). In these cases, the Monoblock Inserter/Impactor should first be threaded into the socket portion of the Monoblock Humeral Stem implant (**FIGURE 48**).

A Retroversion Alignment Rod should then be threaded into the appropriate hole (according to the desired amount of retroversion) on the end of the Monoblock Inserter/Impactor handle. When the bone cement has reached a dough-like consistency, the assembled Retroversion Alignment Rod should be used to orient the Monoblock Humeral Stem into the humeral canal, and the Monoblock Inserter/Impactor should be gently tapped with a surgical mallet to seat the implant (**FIGURE 49**).

If the Monoblock Humeral Stem is cemented into the humeral canal prior to assembly of the Socket Insert implant, confirm the initial choice of humeral build-up by trialing the Socket Insert Trial and 8mm Spacer Trial (construct shown in **FIGURE 33**) with the implanted Monoblock Stem.

If the 8mm Spacer is determined to be needed, insert the Spacer implant into the socket of the Monoblock Humeral Stem implant, ensuring that that the alignment features are appropriately aligned with the mating pockets on the Monoblock socket shell (**FIGURE 50**). Insert and tighten the retaining screw using the 45 in-lb Torque Limiting Driver Handle and 5/16" Hex Socket Driver (assembled construct shown in **FIGURE 51**). Assemble the appropriately sized Socket Insert into the Monoblock Stem socket or the 8mm Spacer by gently impacting the Socket Insert with the appropriately sized Humeral Socket Impactor (**FIGURE 47**).

Instrumentation

Humeral Socket Impactor [804-02-002, 804-02-036_037]	RSP Impactor Handle [800-01-018]	45 in-lb Torque Limiting Driver Handle [801-01-662]	5/16" Hex Socket Driver [804-02-075]	RSP Monoblock Inserter/Impactor [804-02-070]

› RSP® Hemi-Adaptors

FIGURE 52

FIGURE 53

FIGURE 54

MODULAR RSP® HEMI-ADAPTORS

Modular RSP® Hemi-Adaptors are designed to convert the modular RSP Humeral Stem from a reverse shoulder prosthesis to a hemiarthroplasty prosthesis. Modular RSP Hemi-Adaptor Implants and Trials are available in 6mm and 12mm head/neck heights. When trialing with Foundation® Head Trials, Humeral Stem Adaptor Trials should be used. Lightly impact the RSP Humeral Stem Adaptor Trial into the RSP Humeral Stem using three to four firm taps (assembled components shown in **FIGURE 52**). When trialing for/with Turon® Head Trials, the RSP to Turon Conversion Module Trials should be used (**FIGURE 53**) and are impacted in a similar manner.

NOTE: *Although Foundation and Turon head trials require different adaptor trials, both sets of head implants assemble to the same Modular RSP Hemi-Adaptor implants (**FIGURE 54**). The Humeral Stem Adaptor Trials and Modular RSP to Conversion Module Trials are located in the RSP and Turon instrument sets, respectively.*

Humeral head trials from the Foundation Shoulder System are available in five neutral and offset head diameters (38mm, 42mm, 46mm, 50mm, 54mm) in three neutral head heights (17mm, 22mm and 27mm) and two offset head heights (22mm and 27mm). Humeral head trials from the Turon Modular Shoulder System are available in five neutral and offset head diameters (38 mm, 42 mm, 46 mm, 50 mm and 54 mm) and various head thicknesses ranging from 14 mm to 26 mm depending on diameter. Select the appropriate Foundation Shoulder or Turon Humeral Head Trial with the correct diameter and height and position it onto the appropriate RSP Humeral Stem Adaptor. Perform trial reduction. The height of the humeral prosthesis above the greater tuberosity and degree of retroversion of the head are examined before reduction.

The appropriateness of the chosen humeral head thickness and modular RSP Hemi-Adaptor height is assessed by evaluating the tension present in the rotator cuff and deltoid muscles. Select the appropriately sized modular RSP Hemi-Adaptor Implant and position it into the taper of the RSP Humeral Stem. Lightly impact the modular RSP Hemi-Adaptor into the RSP Humeral Stem using three to four firm taps (assembled components shown in **FIGURE 54**).

Select the appropriate Foundation Shoulder or Turon Head Implant. Position the humeral head onto a clean, dry Morse taper of the modular RSP Hemi-Adaptor using a light rotational movement until firmly seated. Assemble the Impactor Handle to the Humeral Head Impactor. Lightly impact the humeral head implant onto the humeral stem implant using three to four firm taps. Pull on the implanted humeral head to confirm that it is locked on to the humeral stem. If it is not seated properly, soft tissue impingement may be present. Perform final trial reduction and inspection of the joint to ensure that no residual material or osteophytes are present. Final closure should be performed at this time.

Instrumentation

Humeral Stem Adaptor Trial [804-02-024_025]	Modular RSP to Turon Conversion Module Trial [804-02-076_077]

› RSP® Monoblock Hemi-Adaptors

FIGURE 55

FIGURE 56

FIGURE 57

FIGURE 58

RSP® MONOBLOCK HEMI-ADAPTORS

The RSP® Monoblock Hemi-Adaptors are designed to convert the newly cemented (primary case) or well-fixed (revision case) RSP Monoblock Humeral Stem from a reverse shoulder prosthesis to a hemiarthroplasty prosthesis. The Hemi-Adaptor is available in a single size.

Insert the RSP Monoblock Hemi-Adaptor Trial into the socket of the RSP Monoblock Humeral Stem by aligning the tabs on the trial with the mating pockets on the stem socket (**FIGURE 55**). Rotate the trial clockwise until it locks firmly into place (**FIGURE 56**).

Humeral Head Trials from the Turon Total Shoulder System are available in five neutral and offset head diameters (38mm, 42mm, 46mm, 50mm, and 54mm) in various head heights. Select the appropriate Turon Humeral Head Trial, with the correct diameter and height, and position it onto the RSP Monoblock Hemi-Adaptor. Perform trial reduction. The height of humeral prosthesis above the greater tuberosity and degree of retroversion of the head are examined prior to reduction. The appropriateness of the chosen humeral head thickness is assessed by evaluating the tension present in the rotator cuff and deltoid muscles.

Select the RSP Monoblock Hemi-Adaptor implant and position it into the socket of Monoblock Humeral Stem by aligning the tabs on the adaptor with the mating pockets on the stem socket (**FIGURE 57**). Insert the retaining screw through the adaptor and tighten using the 45 in-lb Torque Limiting Driver Handle and 3.5mm Hex Driver (assembled construct shown in **FIGURE 58**).

Select the appropriate Turon Humeral Head implant. Position the humeral head onto a clean, dry Morse taper of the RSP Monoblock Hemi-Adaptor, and seat it firmly using a gentle rotational movement. Assemble the Impactor Handle to the Humeral Head Impactor. Lightly impact the humeral head implant onto the RSP Monoblock Hemi-Adaptor implant using three to four firm taps. Pull on the implanted humeral head to confirm that it is locked onto the RSP Monoblock Hemi-Adaptor. If it is not seated properly, soft tissue impingement may be present.

Instrumentation

RSP Monoblock Hemi-Adaptor Trial [804-02-072]	45 in-lb Torque Limiting Handle [801-01-662]	3.5 mm Hex Driver [803-05-167]

Shoulder Trial Reduction

FINAL REDUCTION AND CLOSURE

With the patient relaxed, reduce the humeral prosthesis onto the glenoid head prosthesis. If the prosthesis cannot be reduced, soft tissue impingement may be present.

Gently examine the shoulder while the bone cement is still curing to confirm the previously established motion and joint stability. Examine the axillary nerve again using the "tug" test.

Place the arm in about 30 degrees of abduction and slight external rotation.

Reattach any remaining subscapularis to the previously prepared sutures in the proximal humerus. Perform the final range of motion to ensure a safe range for postoperative therapy.

Final routine closure is performed in layers.

Place the arm in an immobilizer.

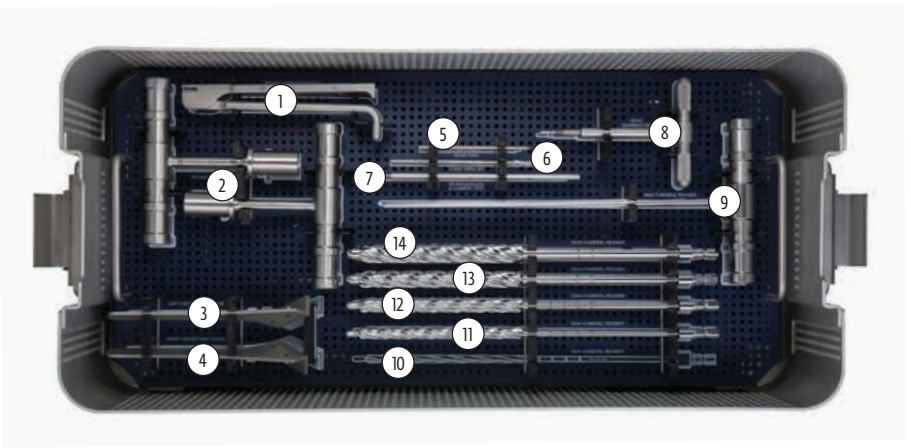
Reference Guide

INSTRUMENT GUIDE

RSP® Humeral Instrument Tray Guide - Top Tray

	Part No.	Description
1	800-01-339	Bone Pin Driver
2	804-03-051	Glenoid Head Inserter
3	804-03-038	Torque Limiting Driver
4	804-03-042	Glenoid Head Trial, 32 N
5	804-03-043	Glenoid Head Trial, 32 -4
6	804-03-044	Glenoid Head Trial, 36 N
7	804-03-045	Glenoid Head Trial, 36 -4
8	804-03-046	Glenoid Head Trial, 40 N
9	804-03-047	Glenoid Head Trial, 40 -4
10	804-02-468	Humeral Socket Insert Trial, 32 Standard

	Part No.	Description
11	804-02-063	Humeral Socket Insert Trial, 32 Semi Constrained
12	804-02-469	Humeral Socket Insert Trial, 36 Standard
13	804-02-472	Humeral Socket Insert Trial, 36 Semi Constrained
14	804-02-470	Humeral Socket Insert Trial, 40 Standard
15	804-02-473	Humeral Socket Insert Trial, 40 Semi Constrained
16	804-02-025	Humeral Stem Adaptor Trial, 12mm
17	804-02-024	Humeral Stem Adaptor Trial, 6mm
18	804-02-057	Humeral Socket Shell Trial, Neutral
19	804-02-058	Humeral Socket Shell Trial, +4
20	804-02-059	Humeral Socket Shell Trial, +8



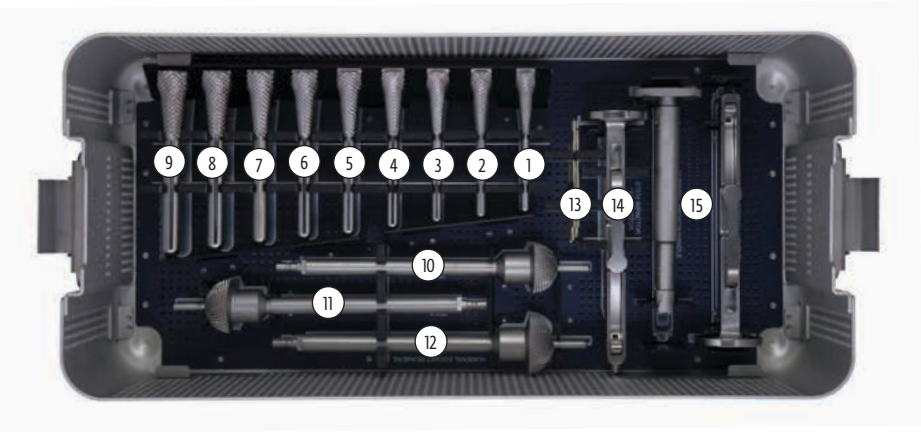
RSP® Humeral Instrument Tray Guide - Middle Tray

	Part No.	Description
1	800-01-035	Bone Pin Puller/Extractor
2	803-00-047	Detachable T-Handle (x2)
3	804-00-047	Osteotomy Guide, Left
4	804-00-046	Osteotomy Guide, Right
5	800-01-338	3" Quick Release Bone Pins (x2)
6	801-01-020	3.2mm Drill Bit (x2)
7	803-01-057	Retroversion Alignment Rod (x2)

	Part No.	Description
8	804-02-035	Head Distractor
9	804-00-002	T-Handle Starter Reamer
10	804-00-029	Humeral Reamer 6mm
11	804-00-031	Humeral Reamer 8mm
12	804-00-033	Humeral Reamer 10mm
13	804-00-035	Humeral Reamer 12mm
14	804-00-037	Humeral Reamer 14mm

Reference Guide

INSTRUMENT GUIDE



RSP® Humeral Instrument Tray Guide - Bottom Tray

	Part No.	Description
1	804-02-006	RSP Humeral Broach 6mm
2	804-02-007	RSP Humeral Broach 7mm
3	804-02-008	RSP Humeral Broach 8mm
4	804-02-009	RSP Humeral Broach 9mm
5	804-02-010	RSP Humeral Broach 10mm
6	804-02-016	RSP Humeral Broach 11mm
7	804-02-017	RSP Humeral Broach 12mm
8	804-02-018	RSP Humeral Broach 13mm

	Part No.	Description
9	804-02-019	RSP Humeral Broach 14mm
10	804-02-083	Humeral Socket Reamer Small
11	804-02-084	Humeral Socket Reamer Medium
12	804-02-085	Humeral Socket Reamer Large
13	804-02-089	Humeral Socket Reamer Guide Pin
14	804-02-011	Humeral Broach Handle
15	804-02-055	Quick Release Humeral Broach Handle (x2)

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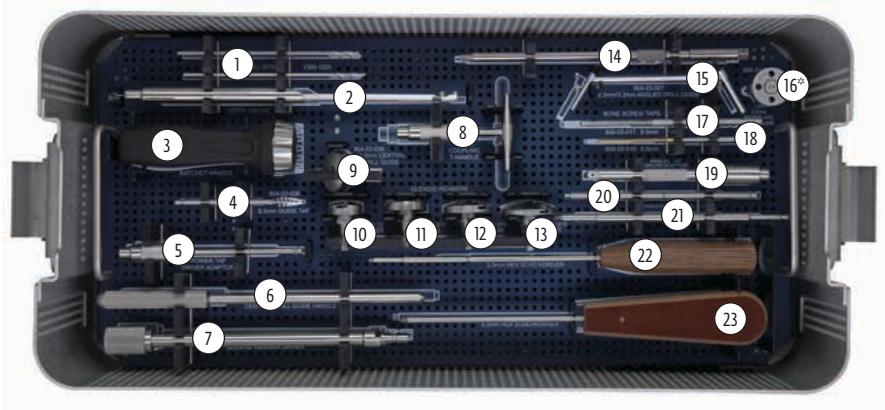
Reference Guide

INSTRUMENT GUIDE

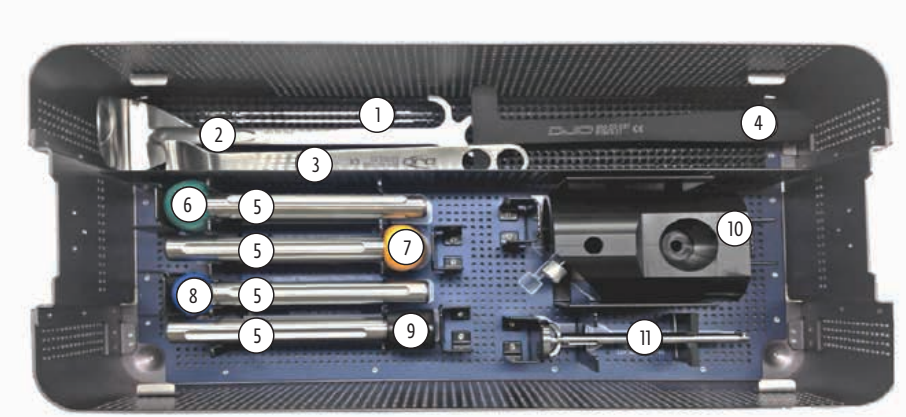


RSP® Glenoid Instrument Tray Guide - Top Tray

	Part No.	Description
1	1395-1025	2.5mm Drill Bit (x2)
2	804-03-003	Depth Gauge
3	803-05-163	Black Ratchet Handle
4	804-03-008	RSP 6.5mm Guide Tap
5	804-03-020	Power Driver Adaptor
6	804-03-037	Central Drill Guide Handle
7	804-03-011	Glenoid Reamer Driver
8	804-03-019	Quick-Coupling T-Handle
9	804-03-036	2.5mm Central Drill Guide
10	804-03-012	Glenoid Reamer, Starter
11	804-03-013	Glenoid Reamer, Small
12	804-03-014	Glenoid Reamer, Medium

	Part No.	Description
13	804-03-015	Glenoid Reamer, Large
14	803-05-167	3.5mm Hex Driver
15	804-03-007	2.5mm / 3.2mm Angled Drill Guide
16	804-03-048	Two Piece Drill Guide
17	804-03-017	5.0mm Bone Screw Tap
18	804-03-018	3.5mm Bone Screw Tap
19	804-03-016	Manual Tap Driver Adaptor
20	804-03-021	2.5mm Power Hex Driver
21	804-03-022	3.5mm Power Hex Driver
22	1395-1030	Small 2.5mm Hex Screwdriver
23	801-01-042	Large 3.5mm Hex Screwdriver

* Two Piece Drill Guide Photo



RSP® Glenoid Instrument Tray Guide - Bottom Tray

	Part No.	Description
1	804-03-049	4.0mm Drill Bit (x2)
2	804-00-098	Deltoid Retractor
3	804-00-099	Humeral Retractor
4	804-00-097	Glenoid Retractor
5	800-01-018	Impactor Handle
6	804-02-037	40mm Humeral Socket Impactor

	Part No.	Description
7	804-02-036	36mm Humeral Socket Impactor
8	804-02-002	32mm Humeral Socket Impactor
9	804-03-001	Glenoid Head Impactor
10	804-03-053	Humeral Stem / Socket Impaction Fixture
11	804-03-056	32mm Baseplate Rim Planer

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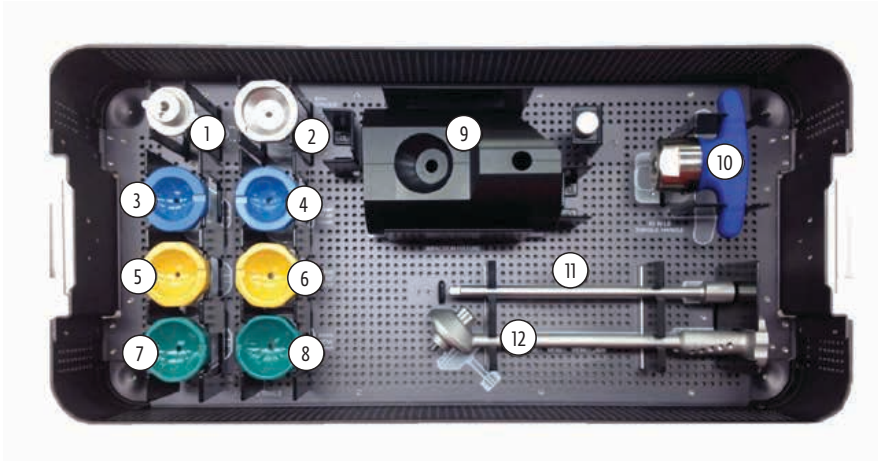
Reference Guide

INSTRUMENT GUIDE

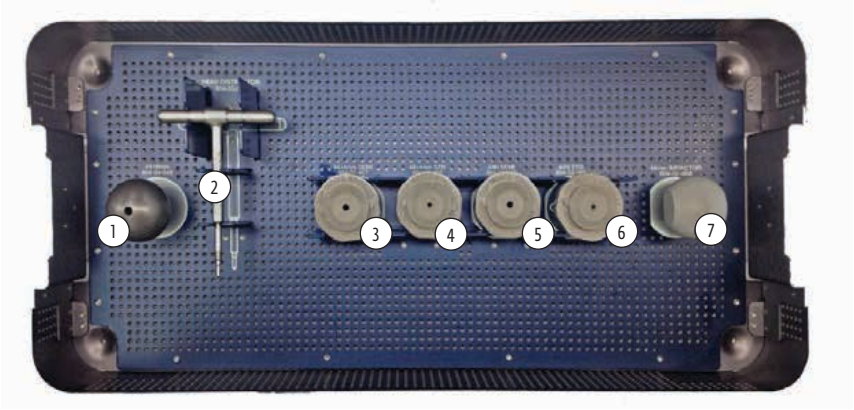


RSP® Monoblock Instrument Tray Guide

	Part No.	Description
1	804-02-072	RSP Monoblock Hemi Adapter Trial
2	804-02-071	RSP Monoblock 8mm Spacer Trial
3	804-02-460	Humeral Socket Liner Trial, 32 +4 Standard
4	804-02-461	Humeral Socket Liner Trial, 32 +4 Semi Constrained
5	804-02-462	Humeral Socket Liner Trial, 36 +4 Standard
6	804-02-463	Humeral Socket Liner Trial, 36 +4 Semi Constrained

	Part No.	Description
7	804-02-464	Humeral Socket Liner Trial, 40 +4 Standard
8	804-02-465	Humeral Socket Liner Trial, 40 +4 Semi Constrained
9	804-03-053	RSP Monoblock Impaction Fixture
10	801-01-662	Torque Limiting Driver Handle
11	804-02-075	5/16" Hex Driver
12	804-02-070	RSP Monoblock Inserter/Impactor

*Please note that the RSP® Monoblock Instrument Tray needs to be used in conjunction with the RSP® Humeral and Glenoid Trays



RSP® 44mm Instrument Tray Guide

	Part No.	Description
1	804-04-048	Glenoid Head Trial, 44 +8
2	804-03-055	Glenoid Head Distractor
3	804-02-467	Humeral Socket Shell Insert Trial, 44 +4 Semi Constrained
4	804-02-466	Humeral Socket Shell Insert Trial, 44 +4 Standard

	Part No.	Description
5	804-02-067	Humeral Socket Shell Insert Trial, 44 N Semi Constrained
6	804-02-066	Humeral Socket Shell Insert Trial, 44 N Standard
7	804-02-068	44mm Humeral Socket Impactor

*Please note the 44mm Instrument Tray is a special order and needs to be used in conjunction with the RSP® Humeral and Glenoid Tray.

Reference Guide

IMPLANT PART NUMBERS

RSP® Primary Humeral Stems

Part No.	Description	Size
506-00-006	Primary Humeral Stem	6 x 101mm
506-00-007	Primary Humeral Stem	7 x 105mm
506-00-008	Primary Humeral Stem	8 x 109mm
506-00-010	Primary Humeral Stem	10 x 116mm
506-00-012	Primary Humeral Stem	12 x 124mm

RSP® Revision Humeral Stems

Part No.	Description	Size
507-06-175	Revision Humeral Stem	6 x 175mm
507-08-175	Revision Humeral Stem	8 x 175mm
507-10-175	Revision Humeral Stem	10 x 175mm
507-12-175	Revision Humeral Stem	12 x 175mm

RSP® Humeral Socket Shells

Part No.	Description
508-00-000	Humeral Socket Shell, Neutral
508-00-004	Humeral Socket Shell, +4mm Offset
508-00-008	Humeral Socket Shell, +8mm Offset

RSP® Monoblock Primary Humeral Stems

Part No.	Description	Size
510-00-006	Primary Humeral Stem	6 x 108mm
510-00-007	Primary Humeral Stem	7 x 108mm
510-00-008	Primary Humeral Stem	8 x 108mm
510-00-010	Primary Humeral Stem	10 x 108mm
510-00-012	Primary Humeral Stem	12 x 108mm

RSP® Monoblock Revision Humeral Stems, 175mm

Part No.	Description	Size
510-06-175	Revision Humeral Stem	6 x 175mm
510-08-175	Revision Humeral Stem	8 x 175mm
510-10-175	Revision Humeral Stem	10 x 175mm
510-12-175	Revision Humeral Stem	12 x 175mm

Reference Guide

IMPLANT PART NUMBERS

RSP® Monoblock +8mm Spacer

Part No.	Description
510-08-000	RSP Monoblock +8mm Spacer (Includes Retaining Screw)
510-08-001	Replacement Retaining Screw for RSP Monoblock +8mm Spacer

RSP® Standard Socket Inserts

Part No.	Description	Size
508-00-032	Standard Humeral Socket Insert	32mm
508-00-036	Standard Humeral Socket Insert	36mm
508-00-040	Standard Humeral Socket Insert	40mm

RSP® Semi Constrained Socket Inserts

Part No.	Description	Size
508-01-032	Semi Constrained Humeral Socket Insert	32mm
508-01-036	Semi Constrained Humeral Socket Insert	36mm
508-01-040	Semi Constrained Humeral Socket Insert	40mm

RSP® Standard Socket Inserts, +4mm

Part No.	Description	Size
508-00-432	Standard Humeral Socket Insert, +4mm	32mm
508-00-436	Standard Humeral Socket Insert, +4mm	36mm
508-00-440	Standard Humeral Socket Insert, +4mm	40mm

RSP® Semi Constrained Socket Inserts, +4mm

Part No.	Description	Size
508-01-432	Semi Constrained Humeral Socket Insert, +4mm	32mm
508-01-436	Semi Constrained Humeral Socket Insert, +4mm	36mm
508-01-440	Semi Constrained Humeral Socket Insert, +4mm	40mm

Reference Guide

IMPLANT PART NUMBERS

RSP® Glenoid Heads with Retaining Screw

Part No.	Description	Size
508-32-101	Glenoid Head with Retaining Screw, Neutral	32mm
508-32-103	Glenoid Head with Retaining Screw, - 4mm Offset	32mm
508-36-101	Glenoid Head with Retaining Screw, Neutral	36mm
508-36-103	Glenoid Head withRetaining Screw, - 4mm Offset	36mm
508-40-101	Glenoid Head withRetaining Screw, Neutral	40mm
508-40-103	Glenoid Head withRetaining Screw, - 4mm Offset	40mm
508-00-101	Replacement Retaining Screw for Glenoid Head	

RSP® Hydroxyapatite-Coated Glenoid Baseplate

Part No.	Description	Size
508-32-104	Hydroxyapatite-Coated Glenoid Baseplate	6.5 x 30mm

RSP® Glenoid Baseplate Locking Bone Screws

Part No.	Description	Size
506-03-114	Glenoid Baseplate Locking Bone Screw	5 x 14mm
506-03-118	Glenoid Baseplate Locking Bone Screw	5 x 18mm
506-03-122	Glenoid Baseplate Locking Bone Screw	5 x 22mm
506-03-126	Glenoid Baseplate Locking Bone Screw	5 x 26mm
506-03-130	Glenoid Baseplate Locking Bone Screw	5 x 30mm
506-03-134	Glenoid Baseplate Locking Bone Screw	5 x 34mm
506-03-138	Glenoid Baseplate Locking Bone Screw	5 x 38mm

RSP® Glenoid Baseplate Non-locking Bone Screws

Part No.	Description	Size
506-02-114	Glenoid Baseplate Non-locking Bone Screw	3.5 x 14mm
506-02-116	Glenoid Baseplate Non-locking Bone Screw	3.5 x 16mm
506-02-118	Glenoid Baseplate Non-locking Bone Screw	3.5 x 18mm
506-02-120	Glenoid Baseplate Non-locking Bone Screw	3.5 x 20mm
506-02-122	Glenoid Baseplate Non-locking Bone Screw	3.5 x 22mm
506-02-124	Glenoid Baseplate Non-locking Bone Screw	3.5 x 24mm
506-02-126	Glenoid Baseplate Non-locking Bone Screw	3.5 x 26mm
506-02-128	Glenoid Baseplate Non-locking Bone Screw	3.5 x 28mm
506-02-130	Glenoid Baseplate Non-locking Bone Screw	3.5 x 30mm
506-02-132	Glenoid Baseplate Non-locking Bone Screw	3.5 x 32mm
506-02-134	Glenoid Baseplate Non-locking Bone Screw	3.5 x 34mm
506-02-136	Glenoid Baseplate Non-locking Bone Screw	3.5 x 36mm
506-02-138	Glenoid Baseplate Non-locking Bone Screw	3.5 x 38mm

Reference Guide

IMPLANT PART NUMBERS

RSP® Stem Adapters

Part No.	Description	Size
506-06-000	Humeral Stem Adapter	6mm
506-12-000	Humeral Stem Adapter	12mm

RSP® Monoblock Hemi-Adapters

Part No.	Description
510-99-000	RSP Monoblock Hemi-Adapter
510-99-001	Replacement Retaining Screw for RSP Monoblock Hemi-Adapter

RSP® 44mm Implants

Part No.	Description	Size
508-44-101	Glenoid Head with Retaining Screw, Neutral	44mm
508-00-044	Standard Humeral Socket Insert	44mm
508-01-044	Semi Constrained Humeral Socket Insert	44mm
508-00-444	Standard Humeral Socket Insert, +4mm	44mm
508-01-444	Semi Constrained Humeral Socket Insert, +4mm	44mm

Notes

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REVERSE® AND REVERSE® MONOBLOCK SHOULDER PROSTHESIS SURGICAL TECHNIQUE

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