

Comprehensive Total Shoulder System
Featuring Comprehensive Access Glenoid Instrumentation

Surgical Technique



BIOMET

One Surgeon. One Patient.

Over 1 million times per year, Biomet helps one surgeon provide personalized care to one patient.

The science and art of medical care is to provide the right solution for each individual patient. This requires clinical mastery, a human connection between the surgeon and the patient, and the right tools for each situation.

At Biomet, we strive to view our work through the eyes of one surgeon and one patient. We treat every solution we provide as if it's meant for a family member.

Our approach to innovation creates real solutions that assist each surgeon in the delivery of durable personalized care to each patient, whether that solution requires a minimally invasive surgical technique, advanced biomaterials or a patient-matched implant.

When one surgeon connects with one patient to provide personalized care, the promise of medicine is fulfilled.

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This brochure is presented to demonstrate the Comprehensive Access Glenoid Instrumentation surgical technique utilized by John Sperling, M.D.; Professor Simon Frostick; Jason Hurst, M.D.; Thomas Throckmorton, M.D.

This brochure is presented to demonstrate the Comprehensive Total Shoulder System surgical technique utilized by John Sperling, M.D.; David Dines, M.D.; Russell Warren, M.D.; Edward Craig, M.D.; Donald Lee, M.D.; and Timothy Codd, M.D. Biomet, as a manufacturer of this device, does not practice medicine and does not recommend this device or technique. Each surgeon is responsible for determining the appropriate device and technique to utilize on each individual patient.

INDICATIONS

1. Non-inflammatory degenerative joint disease including osteoarthritis and avascular necrosis.
2. Rheumatoid arthritis.
3. Revision where other devices or treatments have failed.
4. Correction of functional deformity.
5. Fractures of the proximal humerus, where other methods of treatment are deemed inadequate.
6. Difficult clinical management problems, including cuff arthropathy, where other methods of treatment may not be suitable or may be inadequate.

Humeral components with a MacroBond surface coating are indicated for either cemented or uncemented press-fit applications.

Humeral/glenoid components with a porous coated surface coating are indicated for either cemented or uncemented biological fixation applications. (Metal backed glenoid components offer optional screw fixation).

Glenoid components with Hydroxyapatite (HA) coating applied over the porous coating are indicated only for uncemented biological fixation applications. (Metal backed glenoid components offer optional screw fixation).

Humeral components with a non-coated (Interlok) surface are indicated for cemented application only.

Polyethylene glenoid components not attached to a metal back are indicated for cemented application only.

The Comprehensive Modular Hybrid Glenoid is intended to be implanted with bone cement. The optional porous titanium peg may be inserted **with-out** bone cement. The optional polyethylene peg should be inserted **with** bone cement.

The Comprehensive Humeral Positioning Sleeves are for cemented use only and are intended for use with the Comprehensive Fracture Stem.

The Comprehensive Shoulder Stems (Fracture, Primary and Revision) are intended for use with the Bio-Modular Humeral Heads and glenoid components and Versa-Dial Humeral Heads.

The Versa-Dial Humeral Head Prosthesis is intended for use only with the Comprehensive Shoulder Stems (Fracture, Primary and Revision), the Bio-Modular Shoulder Stems and the glenoid components of the Bio-Modular Shoulder System.

In addition to those specified above, the Proximal Shoulder Replacement prostheses are indicated for use in oncology applications, complex humeral fractures and revisions.

The Titanium Versa-Dial Humeral Head Prosthesis are indicated for patients with suspected cobalt alloy sensitivity. The wear properties of Titanium and Titanium alloys are inferior to that of cobalt alloy. A Titanium humeral head is not recommended for patients who lack suspected material sensitivity to cobalt alloy.*

*The Titanium Versa-Dial Humeral Head Prosthesis is not for sale in Canada

Comprehensive Total Shoulder System

Patient Positioning and Incision



Figure 1



Figure 2

Surgical Position

The arm and shoulder are prepped and draped free (Figure 1). Utilize a modified beach chair position.

Surgical Incision

Utilize an extended deltopectoral anterior incision with an optional biceps tenodesis beginning immediately above the coracoid process and extending distally and laterally, following the deltopectoral groove along the anterior border of the deltoid (Figure 2). Laterally retract the deltoid muscle, avoiding release of the deltoid from the clavicle. The deltoid may be partially released from its distal insertion by subperiosteal dissection. Make a partial relaxing incision through the proximal coracoid tendon and medially retract the conjoined tendon.

Comprehensive Total Shoulder System

Patient Positioning and Incision

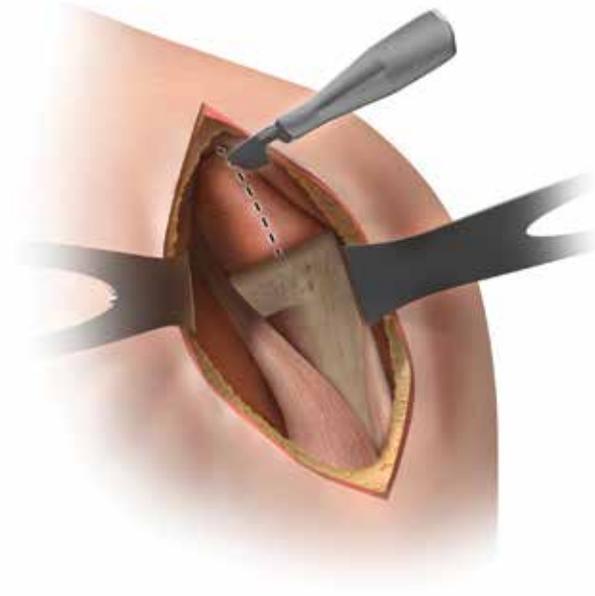


Figure 3

Identify anterior structures and externally rotate the humerus. Make a longitudinal incision through the tendinous portion of the subscapularis muscle and capsule, just medial to the lesser tuberosity (Figure 3). In cases of severe contracture, subscapularis lengthening may be required.

Tag the subscapularis tendon with non-absorbent sutures. Externally rotate and extend the humerus to expose the humeral head, while protecting the axillary nerve.

Note: A lesser tuberosity osteotomy may also be performed in order to release the subscapularis.

Standard, Mini, and Micro Stem Technique

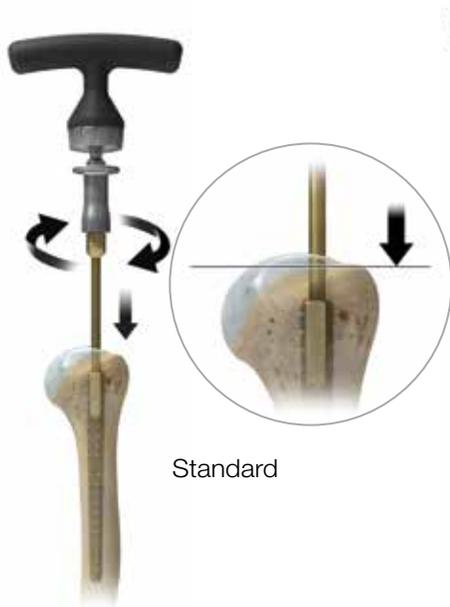


Figure 4

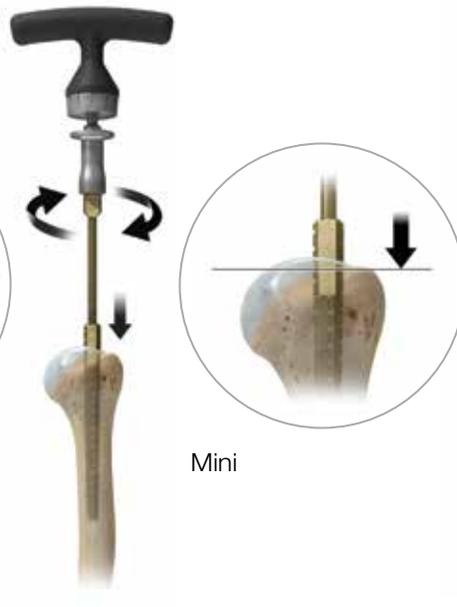


Figure 5

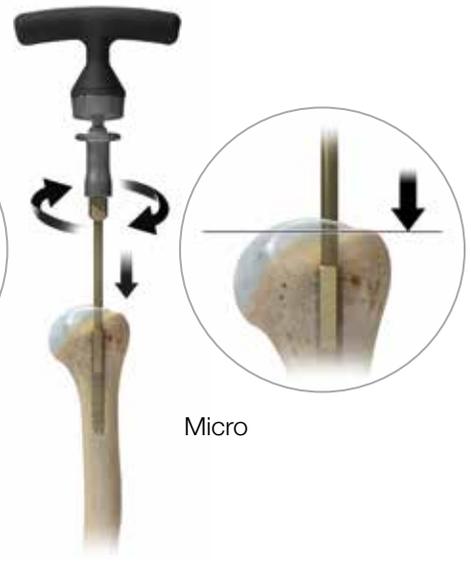


Figure 6

Humeral Preparation

Using the 4, 5 or 6 mm starter reamer and ratcheting T-handle, bore a pilot hole through the humeral head along the axis of the humeral shaft, just lateral to the head's articular surface and just medial to the rotator cuff attachment. Insert the humeral reamer to the depths described below for the chosen stem. Continue reaming in 1 mm increments until cortical contact is achieved. Note the reamer size for future reference.

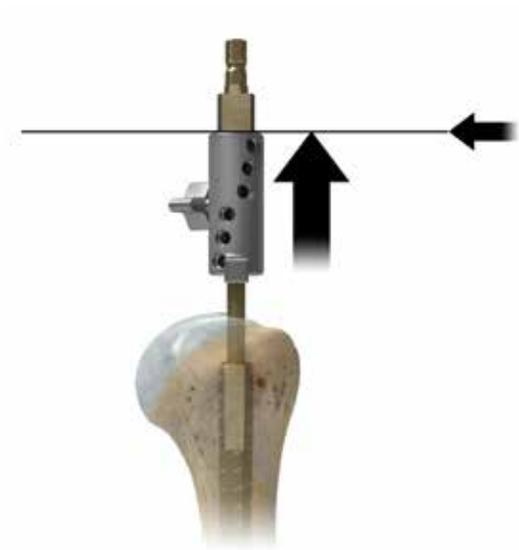
Standard Stem – Using the standard length reamers, insert each reamer until the engraved line just above the cutting teeth is even with the greater tuberosity (Figure 4).

Mini Stem – Using the standard length reamers, insert each reamer until the large hashmark between the 3 and 4 on the reamer is even with the greater tuberosity (Figure 5).

Micro Stem – Using the Micro length reamers, insert each reamer until the engraved line just above the cutting teeth is even with the greater tuberosity (Figure 6).

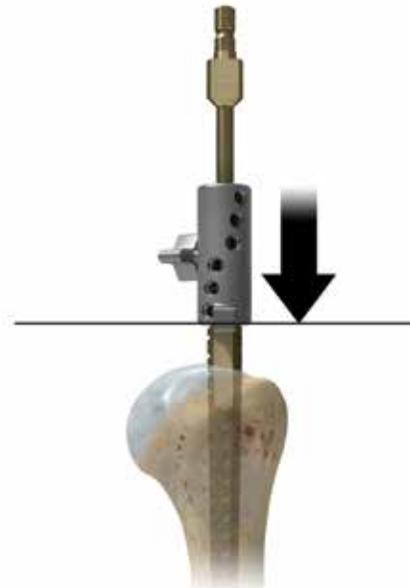
Comprehensive Total Shoulder System

Standard, Mini, and Micro Stem Technique



Standard/Micro

Figure 7



Mini

Figure 8

Intramedullary Resection Guide

Place the resection guide boom onto the reamer shaft to the below described locations depending on stem selection.

Note: The position of the resection guide boom on the reamer shaft, along with the calibrated reaming depth and stem choice, are directly related to the proper resection height. However, the final resection height should be based off the location of the rotator cuff insertion (approximately 1 mm above the insertion). An ideal humeral resection is slightly above the rotator cuff insertion. This allows for greater glenoid exposure and easier conversion to a subsequent reverse shoulder arthroplasty should that be indicated.

Standard Stem – Place the resection guide boom on the reamer shaft and slide it up until it rests against the top of the reamer, just below the sizing engraving (Figure 7).

Mini Stem – Place the resection guide boom on the reamer shaft and slide it down until it rests against the base surface of the reamer, just above the cutting teeth (Figure 8).

Micro Stem – Place the resection guide boom on the reamer shaft and slide it up until it rests against the top of the reamer, just below the sizing engraving (Figure 7)

Note: The resection guide boom is NOT engraved with Micro.

Standard, Mini, and Micro Stem Technique



Standard/Micro

Figure 9



Mini

Figure 10

Place the IM resection guide block onto the arm of the boom in the proper orientation. For example, “right” should be visible for a right shoulder.

Standard and Micro Technique (Figure 9). Mini Technique (Figure 10).

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Standard, Mini, and Micro Stem Technique

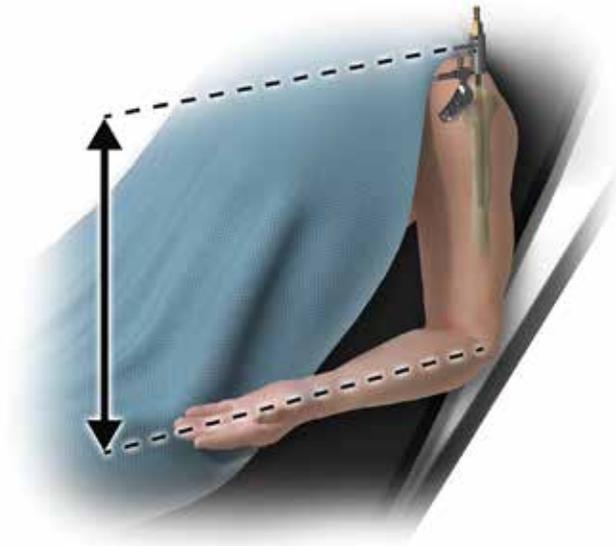


Figure 11

Screw the version rod into the appropriate version hole, and align the rod with the forearm flexed at 90 degrees (Figure 11).

Note: The thumb screw on the resection boom is not captured. Care should be taken when adjusting/tightening

Standard, Mini, and Micro Stem Technique



Standard/Micro

Figure 12



Mini

Figure 13

Set the correct version using the amount of external rotation of the forearm, slide the resection guide against the humerus and finger tighten the thumb screw.

Note: The thumb screw on the resection boom is not captured. Care should be taken when adjusting/tightening.

Place two threaded Steinman pins through converging angled holes in the resection guide block and into the bone to secure the block to the bone. Standard and Micro Technique (Figure 12). Mini Technique (Figure 13).

Comprehensive Total Shoulder System

Standard, Mini, and Micro Stem Technique



Standard/Micro

Figure 14



Mini

Figure 15

Completely loosen the thumb screw on the resection guide block and reamer shaft. Rotate the resection guide boom until the arm clears the resection block.

Standard and Micro Technique (Figure 14). Mini Technique (Figure 15). Remove the reamer and guide boom.

Standard, Mini, and Micro Stem Technique



Figure 16



Figure 17



Figure 18

Prior to making the humeral resection, the planned resection should be confirmed with the angel wing/tissue probe. Place a saw blade through the cutting slot in the guide. The saw blade should be moving when it comes in contact with the bone (Figure 16). Resect the humeral head. Remove the Steinmann pins and the cut block.

Humeral Broaching

Select a broach that is at least 2 to 3 mm smaller than the last reamer used and attach it to the broach handle.

Standard and Mini Stem – Use Mini length broaches (Figure 17).

Micro Stem – Use Micro length broaches (Figure 18).

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Standard, Mini, and Micro Stem Technique



Figure 19

Insert the version rod into the same position used during resection. Flex the forearm to 90 degrees, and externally rotate the arm to be parallel with the version control rod indicating the chosen amount of retroversion. Sequentially broach in 1 mm increments until the broach size is equal to the size of the humeral reamer. For example, if the etching on the last reamer used indicated 10 mm, broach up to 10 mm (Figure 19).

Tip: Advance each broach into the humerus in several successive motions, tapping it up as well as down between advancements. The broach is fully seated when the collar on the broach handle rests on the resected surface of the humerus. Remove the broach handle, leaving the last broach in place to be used as a trial.

Caution: If the broach feels too tight and will not seat, finish broaching with next smaller size.

Note: The porous coating on the humeral stem is 0.75 mm thick on all sides (1.5 mm circumferentially), which will cause the final implant to fit tighter than the broach.



Figure 20

Calcar Planer

Use the calcar planer to refine the resected surface. Attach the planer blade that most closely matches the diameter of the resected surface to the barrel of the calcar planer. Insert the planer plunger into the female taper of the broach. Begin rotation of the calcar planer before contacting the resected surface. Apply slight pressure and plane the resected surface (Figure 20).

Note: The calcar planer should not be used in conjunction with the definitive implant. This could potentially damage the reverse Morse taper.

Standard, Mini, and Micro Stem Technique

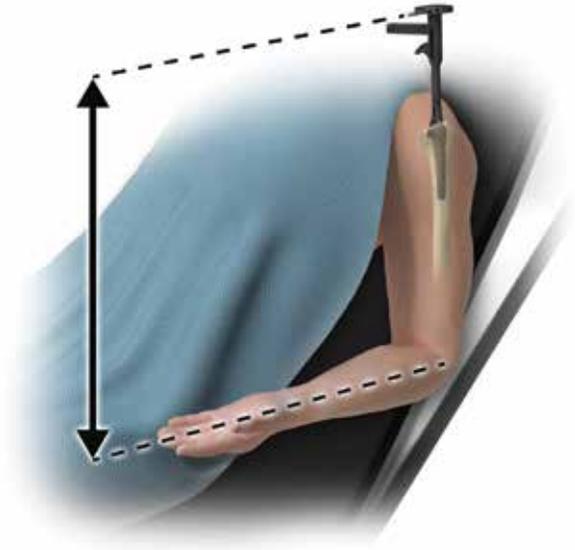


Figure 21



Figure 22

Humeral Stem Insertion – Press-fit Technique

Attach the broach handle to the broach/trial, and remove it from the humeral canal. Select a humeral stem which matches the final broach/trial used. Assemble the humeral stem onto the humeral stem inserter. Place the version control rod into the appropriate version hole and align it with the forearm flexed at 90 degrees (Figure 21).

Insert the stem into the humeral canal (Figure 22) impacting if necessary.

Comprehensive Total Shoulder System

Standard, Mini, and Micro Stem Technique

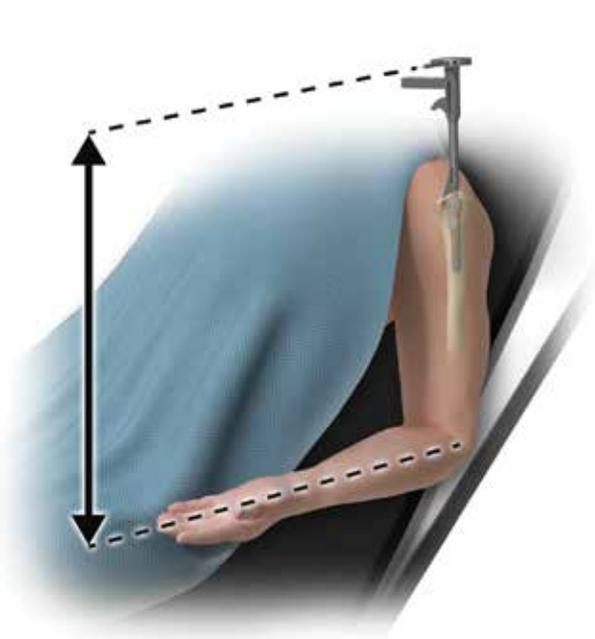


Figure 23



Figure 24

Humeral Stem Insertion – Cemented Technique

Attach the broach handle to the broach/trial, and remove it from the humeral canal. Select a humeral stem 2 mm smaller than the final broach/trial used. Assemble the humeral stem onto the humeral stem inserter. Use a pulse lavage/suction unit to thoroughly clean the humeral canal. Dry the canal with absorbent gauze and inject doughy cement in a retrograde manner, completely filling the humeral canal. Place the version control rod into the appropriate version hole and align it with the forearm flexed at 90 degrees (Figure 23).

Introduce the implant into the humeral canal (Figure 24), keeping the alignment rod in line with the forearm, until the desired position is attained. Remove excess cement.

Versa-Dial Head Technique

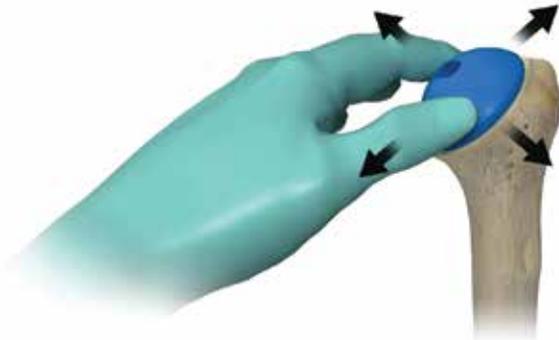


Figure 25



Figure 26

Head Selection

Using the resected humeral head for comparison, select an appropriately sized head trial and assemble to a standard trial taper adaptor. Determine the amount of desired offset by maximizing the coverage of the Versa-Dial provisional over the resected surface of the humerus (Figure 25). After maximum coverage of the resected surface is achieved, tighten the taper adaptor trial in the head trial with a hex driver (Figure 26). Reduce the joint and perform a trial range of motion.

Note: The head trial will still rotate within the broach. The screw only locks in the desired amount of offset. It also may be advisable to mark the humerus with the offset direction in order to accurately replicate the exact position when it comes to implanting the definitive humeral head.

Head Offset

Remove the Versa-Dial trial assembly from the humeral stem. Determine the amount of offset needed by referencing the indications on the underside of the trial head and trial adaptor (Figure 26 inset), keeping in mind that the offset chosen may be between letters.

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Versa-Dial Head Technique



Figure 27



Figure 28

Head Assembly

Place the Versa-Dial head into the impactor tray. Ensuring the components are clean and dry, insert the Versa-Dial taper adaptor into the head (Figure 27). Rotate the taper adaptor until the trial offset is replicated. For example, if trialing indicated halfway between the B and C hashmarks, the implant taper adaptor is aligned so its hashmark is halfway between the B and C on the head.

Engage the Morse taper with two firm strikes, using the taper impactor tool and mallet (Figure 28). The taper/head assembly is now securely fastened.

Versa-Dial Head Technique



Figure 29

Head Insertion

Clean and dry the reverse Morse taper with the taper swabs packaged with the stem. Gently place the Versa-Dial head onto the stem and rotate to achieve maximum coverage of the resected surface (Figure 29). This coverage should replicate the offset direction that was used while performing the trial reduction.

Impact the head onto the stem to complete humeral head implantation by using at least two blows with an appropriately sized surgical mallet and the head impactor tool.

Comprehensive Total Shoulder System

Access Cannulated Glenoid Technique

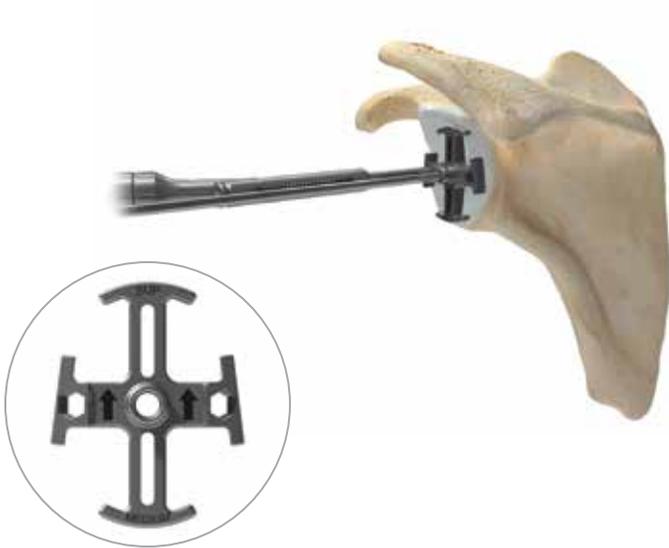


Figure 30



Figure 31

Sizer Pin Guides

Based on the operative shoulder, attach the quick-connect guide handle to the appropriate Sizer Pin Guide (Figure 30). Place the sizer in the middle of the glenoid in the correct orientation. Slots in the guide are provided for visualization if the glenoid has been sectioned into quadrants by using a bovie.

Insert the 3.2 mm threaded Steinman pin through the sizer and carefully drill under power until the Steinman pin has engaged the medial cortex of the glenoid vault. Once the Steinman pin is securely placed, back the guide out over the pin and remove from the joint.

Glenoid Vault Pin Guide

As an alternative method of placing the initial Steinman pin, the Glenoid Vault Pin Guide can be used to place the guide pin by referencing the junction of the anterior glenoid neck and the scapular body.

Attach the quick-connect guide handle to the Glenoid Vault Pin Guide. Prior to inserting into the joint, be sure that the screw is locked into place to prevent the guide hinge from moving. Insert the Glenoid Vault Pin Guide into the joint and proceed to slide the tip of the guide down the anterior wall of the glenoid until it reaches the lateral aspect of the subscapularis fossa. A finger can be used to assess the correct placement of the guide along the scapular body. Once desired placement is found, identify the pin hole that best locates the center of the glenoid and insert the 3.2 mm Glenoid Vault Pin Guide (Figure 31).

Note: This guide will help control version, however, careful attention should be made to the inclination of the pin. Each hole in the guide will direct the Steinman pin towards the tip of the guide.

Access Cannulated Glenoid Technique



Figure 32

Proceed carefully under power until the medial cortex is engaged with the threaded tip of the Steinman pin. Remove the drill from the pin, leaving the pin in place. Release the pin guide by unthreading the thumb screw and back the guide out over the pin and remove from the joint. The glenoid sizer can then be placed over the pin to determine appropriate glenoid size.

Note: The Versa-Dial screw driver can be used to unthread the thumb screw if needed.

Glenoid Reaming/Central Post Preparation

Choose the appropriate size Glenoid Face Reamer based off of the previous glenoid sizer. Assemble the chosen Glenoid Face Reamer with the modular handle. Insert the reamer into the joint over the pin. The glenoid should be reamed to the proper version and inclination as determined by the preoperative plan and intraoperative observation (Figure 32).

Caution: As with any reaming, it is important to start the reamer rotating prior to coming into contact with bone. This will ensure that the reamer is rotating freely and clear of any soft tissues or other instruments that may be an obstruction.

Caution: Over-reaming can decrease the surface area of the glenoid and the depth of the glenoid vault which can lead to insufficient seating or subsidence of the implant.

Comprehensive Total Shoulder System

Access Cannulated Glenoid Technique



Figure 33

Once the desired amount of reaming is completed, the 2-in-1 Central Post Cutter will be used to prepare for the central boss and Regenerex Central Post geometry. Insert the 2-in-1 central post cutter into the joint over the guide pin and proceed to ream until the stop is engaged against the newly reamed surface of the glenoid face (Figure 33).

Caution: As with any reaming, it is important that the central post cutter is rotating prior to coming into contact with bone to avoid any undesirable outcomes.

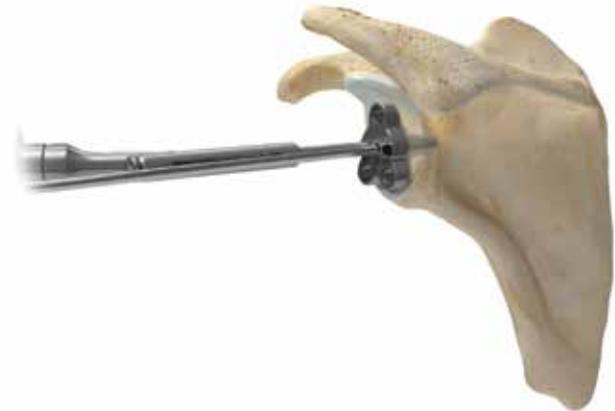


Figure 34

Peripheral Peg Preparation

Select the appropriate size Cannulated Peripheral Peg Drill Guide and attach a quick-connect guide handle. Insert the guide over the Steinman Pin and into the joint until it is fully seated against the face of the glenoid (Figure 34).

Access Cannulated Glenoid Technique



Figure 35

Insert a quick-release drill into the quick-release driver. Drill the superior hole until the stop is engaged. Remove the driver from the joint while leaving the drill bit in place to function as an anti-rotation peg. The drill bit is connected to the driver with a magnetic connection. Once drilled, the bone will provide enough friction to retain the drill bit as an anti-rotation peg.

Note: Be sure that the drill driver has stopped rotating prior to disconnecting from the drill bit/anti-rotation peg.

Insert a second quick-release drill bit into the driver and drill the anterior-inferior hole. Remove the driver from the joint while leaving the drill bit in place to function as a second anti-rotation peg. Using a third drill bit, drill the remaining posterior-inferior hole (Figure 35).

Remove the guide and alignment pins/drill bits from the joint by backing the guide and drill bits out over the Steinman pin. Remove the Steinman pin from within the joint by using the drill on reverse.

Note: The standard peripheral peg drill and anti-rotation pegs can be used in place of the quick-connect drill bits if needed.

Comprehensive Total Shoulder System

Access Cannulated Glenoid Technique

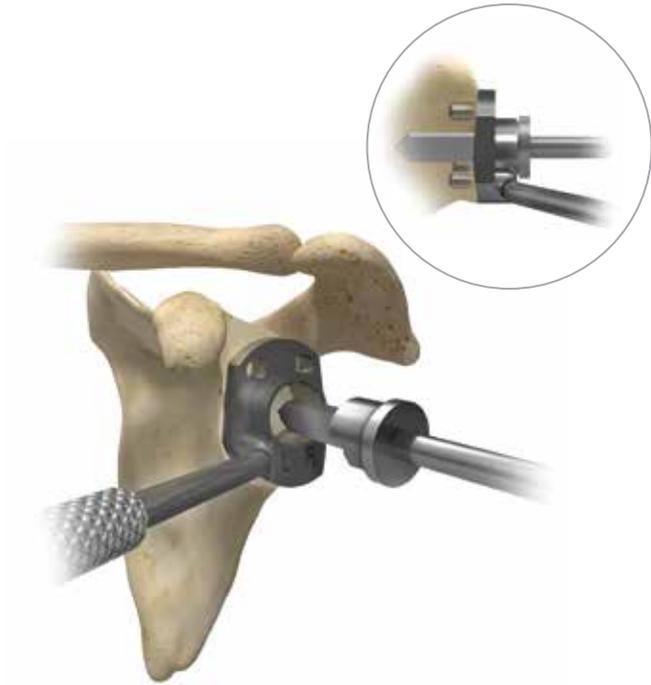


Figure 36

Optional Poly Post Preparation

If a polyethylene central post is preferred, select the correct size central post cutter guide and insert into the three prepared peripheral holes. Once the guide is fully seated against the face of the glenoid, insert the Poly Post Cutter through the guide and continue to ream until the reamer is fully seated within the guide (Figure 36). Remove the Poly Post Cutter and guide.

Note: This step removes additional bone beyond what was previously prepared for the Regenerex Central Post.

Proceed to page 27 for Trial Reduction, Glenoid Insertion and cementing technique

Non-cannulated Glenoid Technique

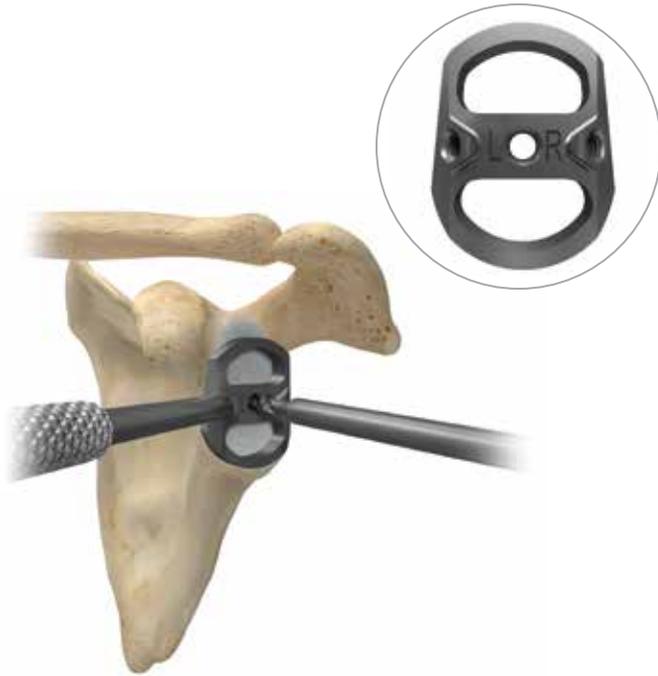


Figure 37

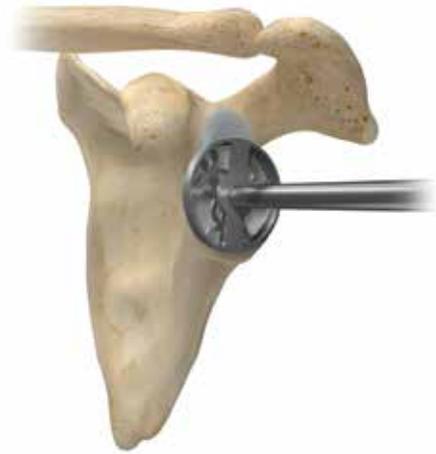


Figure 38

Sizing and Reaming

Based on the operative shoulder, attach the threaded guide handle to the appropriate anatomic glenoid sizer. Place the sizer in the center of the glenoid with the wide side inferior and firmly seated against the face of the glenoid to give the appropriate position for the centering hole to be drilled.

Drill the hole for the centering peg until the stop is engaged (Figure 37). For both the central pilot hole and subsequent peripheral holes, angled drill bits and instruments are available for tighter/challenging exposure.

Attach the appropriate size glenoid reamer to the desired/ chosen reamer shaft. Position the reamer's center peg in the center hole on the glenoid. Ream the face of the glenoid until concentric reshaping is achieved (Figure 38). When finished, the glenoid face should be congruent with the medial side of the glenoid trial and implant. In cases of excessive glenoid wear, ream eccentrically to neutralize the glenoid and prevent instability.

Caution: As with any reaming, it is important that the reamer is rotating prior to coming into contact with bone to avoid any undesirable outcomes.

Comprehensive Total Shoulder System

Non-cannulated Glenoid Technique



Figure 39

Peripheral Peg Drilling

Choose the appropriate anatomic drill guide and attach to the threaded guide handle. Place the centering peg in the center hole drilled in the prior step. Ensure the pegged glenoid drill guide is firmly seated on the face of the glenoid. Drill the superior hole until the stop is engaged (Figure 39).

Use the alignment pin forceps to place an alignment pin through the guide and into the superior hole. Move to the anterior-inferior hole and drill until the stop is engaged. Place an additional alignment pin in this hole following drilling with two anti-rotation pegs in place, the peripheral drill guide will not rotate and the posterior-inferior hole can be drilled. Move to the posterior-inferior hole and drill until the stop is engaged, thereby creating the three peripheral peg holes.

Non-cannulated Glenoid Technique

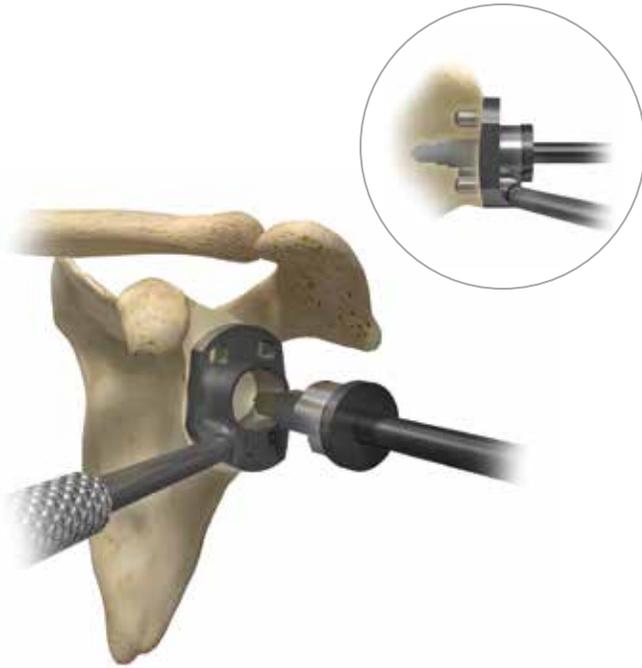


Figure 40



Figure 41

Regenerex Porous Titanium or Polyethylene Central Peg

Regardless of whether a central peg will be utilized, attach the threaded handle to the center peg drill guide. Firmly seat the alignment pegs on the medial side of the boss cutting guide in the outer peg holes just created. Use the boss cutter and drill until the stop is engaged (Figure 40).

Using the threaded handle attached to the center peg drill guide, place the guide on the face of the glenoid. Firmly seat the drill guide with the three pegs inserted into the outer holes. Based on the chosen central peg, use the appropriate post cutter (Figure 42–Regenerex post cutter shown). Drill until the stop is engaged (Figure 40 inset).

Trial Reduction

Seat the appropriate size glenoid trial firmly on the face of the glenoid (Figure 41). Ensure the trial is congruent with the reamed surface.

Reassemble the humeral head trial on the humeral broach/trial and evaluate range of motion. Make any necessary adjustments to the humeral head height and diameter to properly tension the joint.

Comprehensive Total Shoulder System

Non-cannulated Glenoid Technique

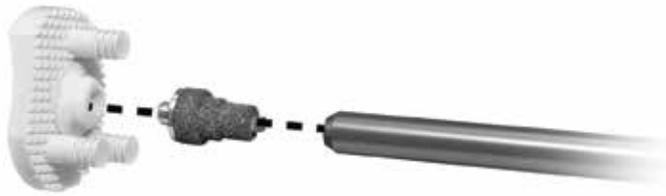


Figure 42

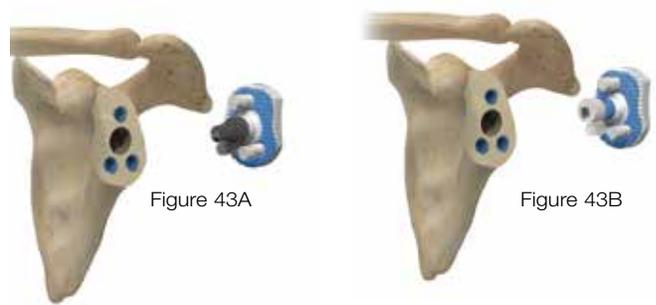


Figure 43A

Figure 43B



Figure 44

Glenoid Fixation

Remove the glenoid trial. Using a high-speed irrigation lavage system, cleanse the prepared surface. If used, thread the appropriate central peg into the modular hybrid glenoid with the central post driver (Figure 42). Digitally pressurize Colbalt bone cement into the three peripheral holes.

Based on the chosen central peg, use cement as follows: if using the polyethylene central peg, place a small amount of bone cement between the fins and the base of the central peg; if using the Regenerex Porous Titanium central peg, bone cement should not be used on the central post.

Place a thin layer of cement on the medial side of the glenoid component (Figure 43A–Regenerex Porous Titanium central peg; Figure 43B–polyethylene central peg). Insert the glenoid and carefully remove any excess cement (Figure 44).

Keeled Glenoid Technique

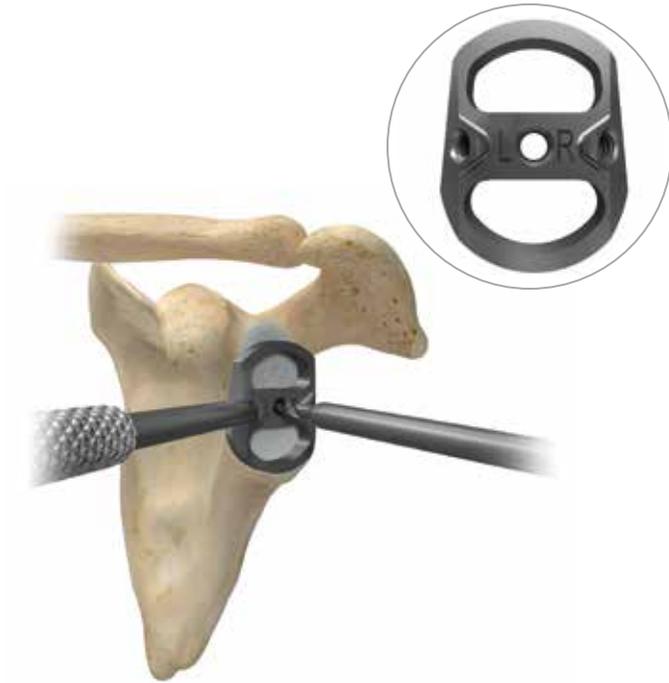


Figure 45

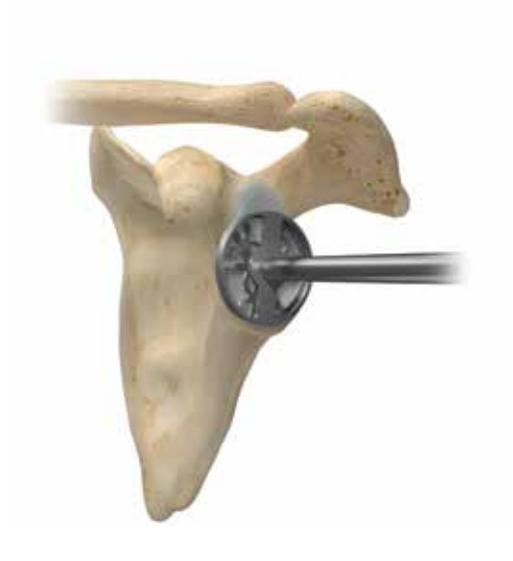


Figure 46

Sizing and Reaming

Based on the operative shoulder, attach the threaded guide handle to the appropriate anatomic glenoid sizer. Place the sizer in the center of the glenoid with the wide side inferior and firmly seated against the face of the glenoid to give the appropriate position for the centering hole to be drilled. Drill the hole for the centering peg until the stop is engaged (Figure 45).

Attach the appropriate size glenoid reamer to the angled or straight reamer shaft. Position the reamer's center peg in the center hole on the glenoid. Ream the face of the glenoid until concentric reshaping is achieved (Figure 46). When finished, the glenoid face should be congruent with the medial side of the glenoid trial and implant. In cases of excessive glenoid wear, ream eccentrically to neutralize the glenoid and prevent instability.

Comprehensive Total Shoulder System

Keeled Glenoid Technique

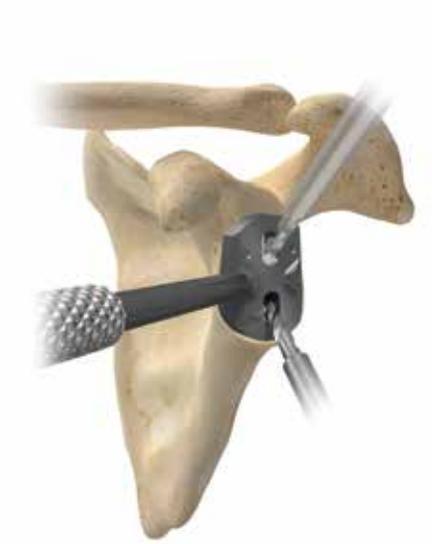


Figure 47



Figure 48

Drilling

Attach the threaded guide handle to the keeled glenoid drill guide. Ensuring that the center peg is in the 4 mm center hole and the wide side is inferior, place the drill guide firmly against the glenoid.

Using the 4 mm drill bit, drill holes angling toward the center of the guide in each of the two slots (Figure 47).

Remove the guide and connect the angled holes with a high speed burr. Use the glenoid broach to complete the keel slot (Figure 48). Insert the appropriate size keeled glenoid trial. Reassemble the humeral head trial on the humeral broach/trial and evaluate range of motion. Make any necessary adjustments to the humeral head height or glenoid thickness to properly tension the joint.

Keeled Glenoid Technique



Figure 49

Glenoid Fixation

Remove the glenoid trial. Using a high-speed irrigation lavage system, cleanse the prepared surface. Introduce the appropriately sized component into bone cement with digital pressure to ensure proper component fixation. The glenoid impactor should be used to seat the component (Figure 49). Carefully remove any excess cement, particularly posterior to the component where visualization may be impaired.

Postoperative Care

Evaluate the limits of external rotation at the time of the subscapularis tendon repair to determine the maximum amount of external rotation during the rehabilitation period. Immobilize the patient in a sling and swathe for 24 hours; use the sling intermittently for up to three weeks to protect the subscapularis repair. Encourage early active motion of the hand and elbow. Begin gentle passive range of motion two days postoperatively. Initiate active assisted elevation three to four days after surgery, based on surgeon preference. Begin strengthening exercises two to three months postoperatively. Continue therapy for many months; patients may show improvement in range of motion and function for up to one year.

Comprehensive Total Shoulder System

Hybrid Glenoid Removal



Figure 50

Figure 51

Figure 52

Polyethylene Preparation

After gaining access to the implanted glenoid, section off the three peripheral pegs by making three cuts in a triangular fashion around the central peg using an oscillating saw (Figure 50, 51, and 52).

This will allow the removal of the outer portion of the polyethylene glenoid independently from the central portion.

Hybrid Glenoid Removal



Figure 53



Figure 54



Figure 55

Polyethylene Removal

Using a thin osteotome or rongeur, remove the outer portion of the polyethylene glenoid, including the cemented peripheral pegs (Figure 53)

The central portion of the polyethylene can then be unthreaded from the well-fixed polyethylene or Regenerex central post (Figure 54 and 55).

Comprehensive Total Shoulder System

Hybrid Glenoid Removal



Figure 56

Figure 57

Figure 58

Central Post Removal

Thread the guide rod onto the central post (Figure 56). Using the guide rod as a cannula, proceed to cut down over the central post using the trephine (Figure 57).

Once the trephine has bottomed out on the central post, remove the trephine from the joint. The guide rod can now be used to remove the central post (Figure 58).

Hybrid Glenoid Removal

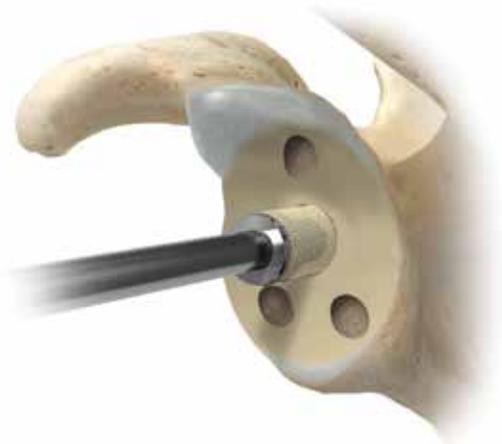


Figure 59



Figure 60

Central Post Removal

Note: This technique and instrumentation can be used with either previously implanted Polyethylene or Regenerex central post (Figure 59).

Note: The outside diameter of the trephine is smaller than the outside diameter of the Comprehensive Reverse Baseplate central boss. This will leave enough glenoid bone for the Comprehensive Reverse Baseplate Reamer to achieve cancellous reaming (Figure 60).

Note: When considering which reverse baseplate to use on a revision, consider that there will be more interference fit on the standard baseplate as compared to the mini baseplate. This is due to the dimension of the boss being larger on the standard baseplate.

Comprehensive Total Shoulder System

Appendix–Humeral Stem Sizing

MINI STEM		
Last Reamer Used	Broach To Size	Implant Size
20 STD / 19 MI*	20 mm	20 mm
20 STD / 19 MI	19 mm	19 mm
19 STD / 18 MI	18 mm	18 mm
18 STD / 17 MI	17 mm	17 mm
17 STD / 16 MI	16 mm	16 mm
16 STD / 15 MI	15 mm	15 mm
15 STD / 14 MI	14 mm	14 mm
14 STD / 13 MI	13 mm	13 mm
13 STD / 12 MI	12 mm	12 mm
12 STD / 11 MI	11 mm	11 mm
11 STD / 10 MI	10 mm	10 mm
10 STD / 9 MI	9 mm	9 mm
9 STD / 8 MI	8 mm	8 mm
8 STD / 7 MI	7 mm	7 mm
7 STD / 6 MI	6 mm	6 mm
6 STD / 5 MI	5 mm	5 mm
5 STD / 4 MI**	5 mm	5 mm
4 STD**	4 mm	4 mm

STANDARD STEM		
Last Reamer Used	Broach To Size	Implant Size
20 STD / 19 MI	20 mm	20 mm
19 STD / 18 MI	19 mm	19 mm
18 STD / 17 MI	18 mm	18 mm
17 STD / 16 MI	17 mm	17 mm
16 STD / 15 MI	16 mm	16 mm
15 STD / 14 MI	15 mm	15 mm
14 STD / 13 MI	14 mm	14 mm
13 STD / 12 MI	13 mm	13 mm
12 STD / 11 MI	12 mm	12 mm
11 STD / 10 MI	11 mm	11 mm
10 STD / 9 MI	10 mm	10 mm
9 STD / 8 MI	9 mm	9 mm
8 STD / 7 MI	8 mm	8 mm
7 STD / 6 MI	7 mm	7 mm
6 STD / 5 MI	6 mm	6 mm
5 STD / 4 MI**	5 mm	5 mm
4 STD**	4 mm	4 mm

*Ream to horizontal hashmark in order to implant the 20 mm mini stem, as there is not a larger reamer to facilitate reaming to a point between the 3 and 4 hashmark.

**Since there are no numeric hashmarks on the teeth of these reamers, ream to the horizontal hashmark.

Comprehensive Total Shoulder System

Ordering Information — Implants and Trials

Product	Part Number	Broach/Trial Part Number	Size	Description
	113644	407304	4 mm	Comprehensive Humeral Stem—Standard 122 mm
	113645	407305	5 mm	
	113646	407306	6 mm	
	113647	407307	7 mm	
	113648	407308	8 mm	
	113649	407309	9 mm	
	113650	407310	10 mm	
	113651	407311	11 mm	
	113652	407312	12 mm	
	113653	407313	13 mm	
	113654	407314	14 mm	
	113655	407315	15 mm	
	113656	407316	16 mm	
	113657	407317	17 mm	
	113658	407318	18 mm	
	113659	407319	19 mm	
113660	407320	20 mm		
	113624	407304	4 mm	Comprehensive Humeral Stem—Mini 83 mm
	113625	407305	5 mm	
	113626	407306	6 mm	
	113627	407307	7 mm	
	113628	407308	8 mm	
	113629	407309	9 mm	
	113630	407310	10 mm	
	113631	407311	11 mm	
	113632	407312	12 mm	
	113633	407313	13 mm	
	113634	407314	14 mm	
	113635	407315	15 mm	
	113636	407316	16 mm	
	113637	407317	17 mm	
	113638	407318	18 mm	
	113639	407319	19 mm	
113640	407320	20 mm		

Ordering Information—Implants and Trials

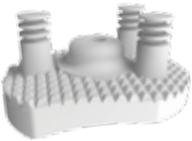
Product	Part Number	Broach/Trial Part Number	Size	Description
	113604	405304	4 mm	Comprehensive Humeral Stem—Micro 55 mm
	113605	405305	5 mm	
	113606	405306	6 mm	
	113607	405307	7 mm	
	113608	405308	8 mm	
	113609	405309	9 mm	
	113610	405310	10 mm	
	113611	405311	11 mm	
	113612	405312	12 mm	
	113613	405313	13 mm	
	113614	405314	14 mm	
	113615	405315	15 mm	
	113616	405316	16 mm	
	113617	405317	17 mm	
113618	405318	18 mm		
113619	405319	19 mm		
113620	405320	20 mm		
	113664	407344	4 mm	Comprehensive Humeral Stem—Revision 194 mm
	113666	407346	6 mm	
	113668	407348	8 mm	
	113670	407350	10 mm	
	113672	407352	12 mm	
	113674	407354	14 mm	

Comprehensive Total Shoulder System

Ordering Information—Implants and Trials

Product	Implant Part Number	Trial Part Number	Size	Description
	113022	407222	38 x 19 x 39 mm	Versa-Dial Humeral Head
	113024	407224	38 x 21 x 38 mm	
	113032	407232	42 x 18 x 46 mm	
	113034	407234	42 x 21 x 43 mm	
	113036	407236	42 x 24 x 42 mm	
	113042	407242	46 x 18 x 53 mm	
	113044	407244	46 x 21 x 50 mm	
	113046	407246	46 x 24 x 47 mm	
	113048	407248	46 x 27 x 46 mm	
	113053	407254	50 x 21 x 57 mm	
	113055	407256	50 x 24 x 52 mm	
	113057	407258	50 x 27 x 50 mm	
	113063	407264	54 x 21 x 64 mm	
	113065	407266	54 x 24 x 58 mm	
	113067	407268	54 x 27 x 55 mm	
	113075	407276	58 x 24 x 64 mm	
	113077	407278	58 x 27 x 61 mm	
	TI-113022	407222	38 x 19 x 39 mm	Versa-Dial Titanium Humeral Head
	TI-113024	407224	38 x 21 x 38 mm	
	TI-113032	407232	42 x 18 x 46 mm	
	TI-113034	407234	42 x 21 x 43 mm	
	TI-113036	407236	42 x 24 x 42 mm	
	TI-113042	407242	46 x 18 x 53 mm	
	TI-113044	407244	46 x 21 x 50 mm	
	TI-113046	407246	46 x 24 x 47 mm	
	TI-113048	407248	46 x 27 x 46 mm	
	TI-113053	407254	50 x 21 x 57 mm	
	TI-113055	407256	50 x 24 x 52 mm	
	TI-113057	407258	50 x 27 x 50 mm	
	TI-113063*	407264	54 x 21 x 64 mm	
	TI-113065	407266	54 x 24 x 58 mm	
	TI-113067	407268	54 x 27 x 55 mm	
	TI-113075*	407276	58 x 24 x 64 mm	
	TI-113077*	407278	58 x 27 x 61 mm	
	118001	407201	—	Comprehensive Standard Taper Adaptor

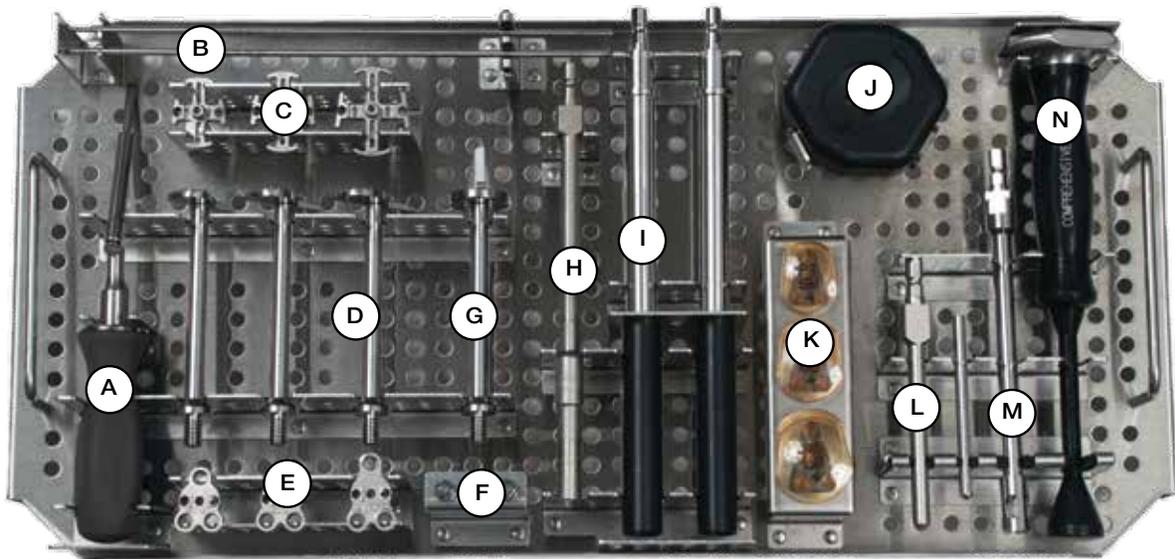
Ordering Information—Implants and Trials

Product	Implant Part Number	Trial Part Number	Size	Description
	113952 113954 113956	—	SM MD LG	Modular Hybrid Glenoid Base
	PT-113950	—	—	Modular Hybrid Glenoid Post—Regenerex
	113951	—	—	Modular Hybrid Glenoid Post—Polyethylene
	113849 113851 113853	406574 406575 406576	SM MD LG	Keeled Glenoid 4 mm
	113850 113852 113854	406577 406578 406579	SM MD LG	Keeled Glenoid 7 mm

Product	Part Number	Description
—	TMP407394	Comprehensive Humeral Primary Stem X-ray Template
—	TMP407294	Versa-Dial Humeral Head X-ray Template
—	TMP406199	Comprehensive Hybrid Glenoid X-ray Template

Comprehensive Total Shoulder System

Comprehensive Access Instrumentation, Top Tray

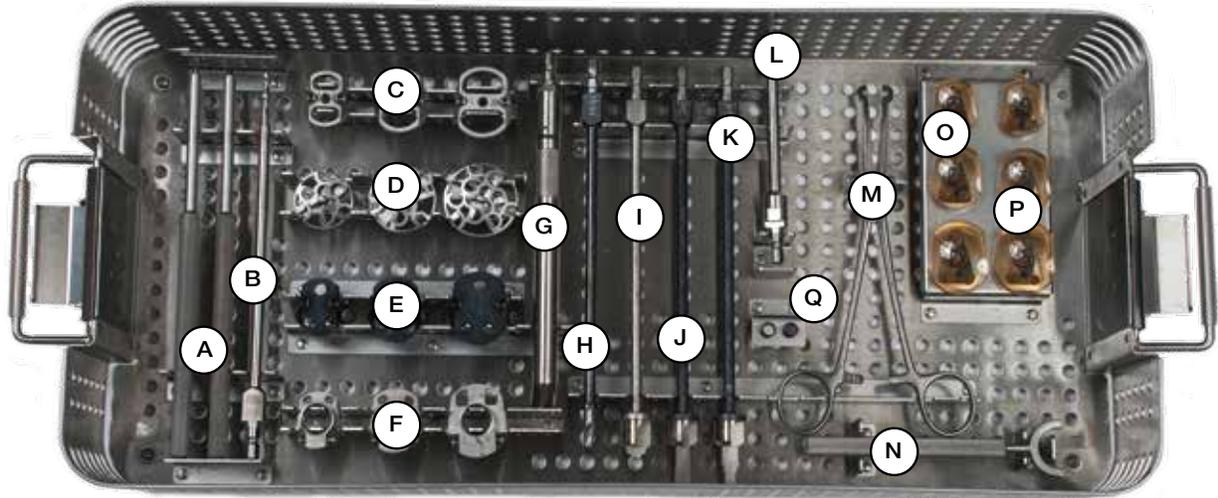


Product	Label	Part Number	Size	Description
—	—	110003488	—	Comprehensive Access Glenoid Instrument Case Only
—	—	110003489	—	Comprehensive Access Glenoid Instrument Case Kitted
	A	110004319	—	Access Quick-connect Guide Handle
	B	110003484	3.2 mm	Access Threaded Steinmann Pin (2)
	C	010001790 010001791 010001792	SM MD LG	Access Cannulated Glenoid Sizer
	D	110003472 110003474 110003476	SM MD LG	Access Cannulated Glenoid Reamer
	E	010001799 010001800 010001801	SM MD LG	Access Peripheral Drill Guide

	F	110003481	—	Quick-Release Peripheral Drill/ Anti-rotation Peg
	G	110003478	—	Access 2-N-1 Regenerex Post/ Boss Cutter
	H	110003483	—	Access Quick-Release Peripheral Drill Shaft
	I	110004200	—	Cannulated Glenoid Reamer Shaft (2)
	J	110004265	—	Access Reamer Disassembly Puck
	K	406192 406193 406194	SM MD LG	Modular Hybrid Glenoid Base and Regenerex Glenoid Trial
	L	406183	—	Hybrid Glenoid Central Post Driver
	M	110003486	—	Hybrid Glenoid Removal Trepine and Rod
	N	406156	—	Hybrid Glenoid Impactor

Comprehensive Total Shoulder System

Comprehensive Access Instrumentation, Bottom Tray

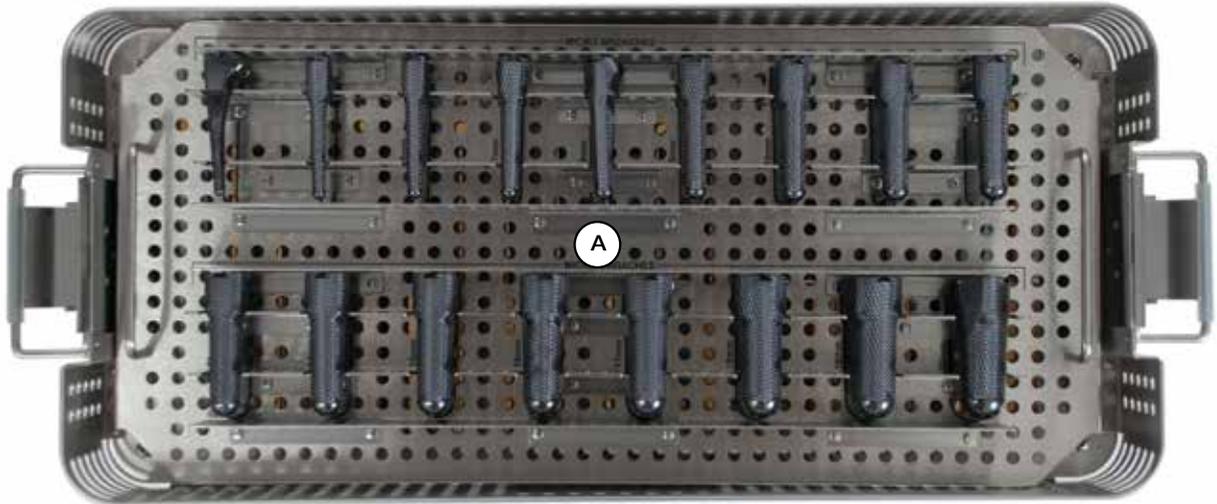


Product	Label	Part Number	Size	Description
—	—	110003488	—	Comprehensive Access Glenoid Instrument Case Only
—	—	110003489	—	Comprehensive Access Glenoid Instrument Case Kitted
	A	406849	—	Glenoid Guide Handle
	B	406181	4 mm	Hybrid Glenoid Straight Shank Drill
	C	406831 406832 406833	SM MD LG	Glenoid Sizer
	D	406632 406633 406634	SM MD LG	Glenoid Reamer
	E	406160 406162 406164	SM MD LG	Peripheral Drill Guide
	F	406161 406163 406165	SM MD LG	Hybrid Glenoid Central Peg Drill Guide

	G	RD481137	—	Reamer Shaft Angled
	H	406182	15/64 in	Hybrid Glenoid Straight Shank Peripheral Drill
	I	406150	—	Hybrid Glenoid Boss Cutter
	J	406152	—	Hybrid Glenoid Polyethylene Post Cutter (PC)
	K	406151	—	Hybrid Glenoid Regenerex Post Cutter (PT)
	L	402648	—	Straight Glenoid Reamer Shaft
	M	424417	—	Peripheral Peg Forceps
	N	406525	—	Glenoid Reamer Wrench
	O	406112 406113 406114	SM MD LG	Modular Hybrid Glenoid Base Trial
	P	406172 406173 406174	SM MD LG	Modular Hybrid Glenoid Base & Polyethylene Post Trial
	Q	406180	—	Hybrid Glenoid Drill Guide Alignment Pin

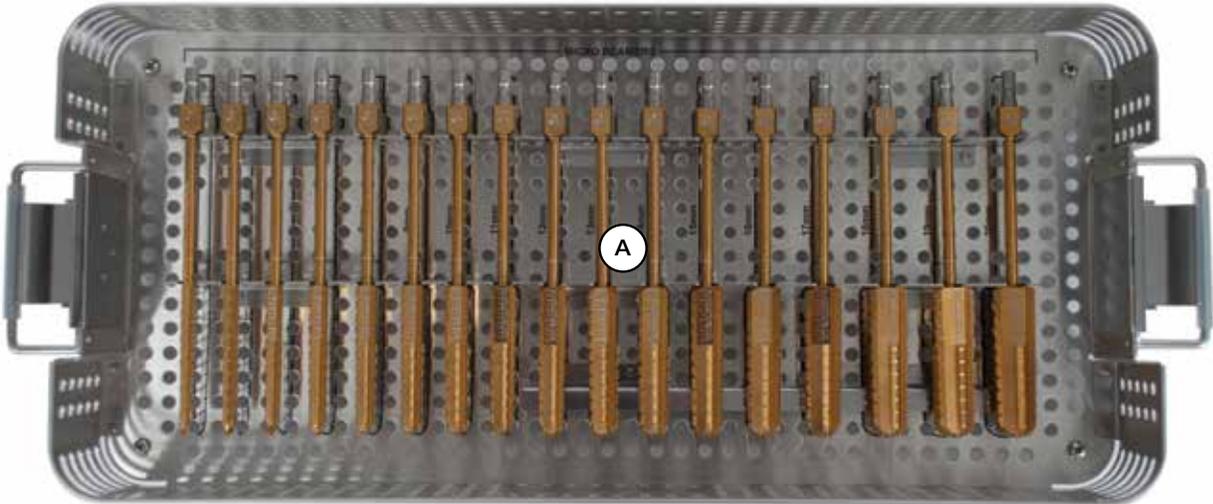
Comprehensive Total Shoulder System

Comprehensive Micro Instrumentation, Top Tray



Product	Label	Part Number	Size	Description
—	—	593693	—	Comprehensive Micro Stem Instrument Case Only
—	—	593694	—	Comprehensive Micro Stem Instrument Case Kitted
	A	405304 405305 405306 405307 405308 405309 405310 405311 405312 405313 405314 405315 405316 405317 405318 405319 405320	4 mm 5 mm 6 mm 7 mm 8 mm 9 mm 10 mm 11 mm 12 mm 13 mm 14 mm 15 mm 16 mm 17 mm 18 mm 19 mm 20 mm	Comprehensive Micro Broach/Trial

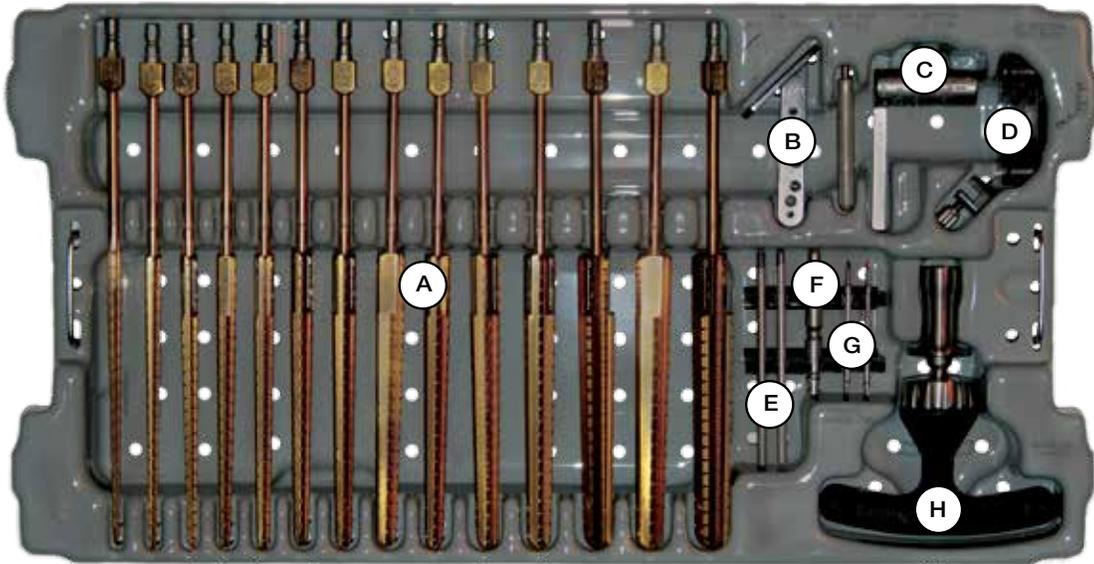
Comprehensive Micro Instrumentation, Bottom Tray



Product	Label	Part Number	Size	Description
—	—	593693	—	Comprehensive Micro Stem Instrument Case Only
—	—	593694	—	Comprehensive Micro Stem Instrument Case Kitted
	A	41-405804 41-405805 41-405806 41-405807 41-405808 41-405809 41-405810 41-405811 41-405812 41-405813 41-405814 41-405815 41-405816 41-405817 41-405818 41-405819 41-405820	4 mm 5 mm 6 mm 7 mm 8 mm 9 mm 10 mm 11 mm 12 mm 13 mm 14 mm 15 mm 16 mm 17 mm 18 mm 19 mm 20 mm	Comprehensive Micro Humeral Reamer

Comprehensive Total Shoulder System

Comprehensive Humeral Reamer Instrumentation

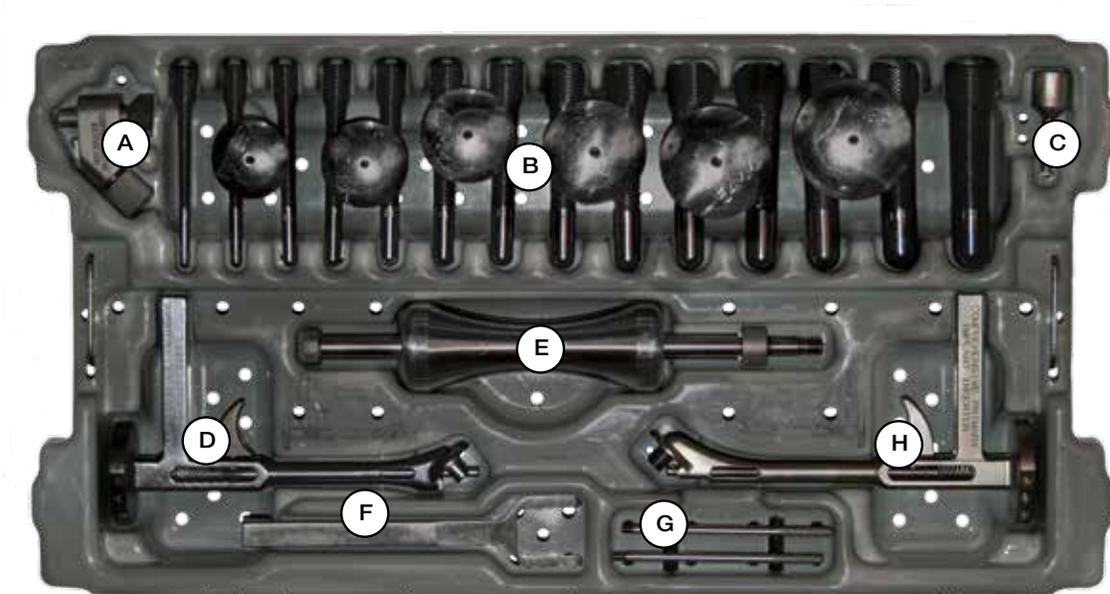


Product	Label	Part Number	Size	Description
—	—	595258	—	Comprehensive Primary Reamer Instrument Case
	A	41-406804 4 mm 41-406805 5 mm 41-406806 6 mm 41-406807 7 mm 41-406808 8 mm 41-406809 9 mm 41-406810 10 mm 41-406811 11 mm 41-406812 12 mm 41-406813 13 mm 41-406814 14 mm 41-406815 15 mm 41-406816 16 mm 41-406817 17 mm 41-406818 18 mm 41-406819 19 mm 41-406820 20 mm		Comprehensive Humeral Reamer
	B	407392	—	Comprehensive Extramedullary Resection Guide with Version Rod
	C	407397	—	Comprehensive Intramedullary Resection Guide Boom with Version Rod

	D	407396	—	Comprehensive Intramedullary Resection Guide Block
	E	407395	—	Comprehensive Screw-in Version Rod
	F	32-486259	—	Pin Driver
	G	406669	1/8 x 2.5 in	Threaded Steinmann Pins
	H	406801	—	Ratcheting T-handle

Comprehensive Total Shoulder System

Comprehensive Primary Broach Instrumentation



Product	Label	Part Number	Size	Description
—	—	595257	—	Comprehensive Primary Broach Instrument Case
	A	406997	—	Comprehensive Stem Extractor
	B	407304 407305 407306 407307 407308 407309 407310 407311 407312 407313 407314 407315 407316 407317	4 mm 5 mm 6 mm 7 mm 8 mm 9 mm 10 mm 11 mm 12 mm 13 mm 14 mm 15 mm 16 mm 17 mm	Comprehensive Mini Broach/Trial
	C	407393	—	Comprehensive Broach Extractor Tool
	D	407399	—	Comprehensive Broach Handle with Version Rod

	E	31-473621	—	Slide Hammer
	F	407389	—	Versa-Dial Head Removal Tool
	G	407395	—	Screw-in Version Rod
	H	407398	—	Comprehensive Stem Inserter with Version Rod

Comprehensive Total Shoulder System

Comprehensive Humeral Head Instrumentation

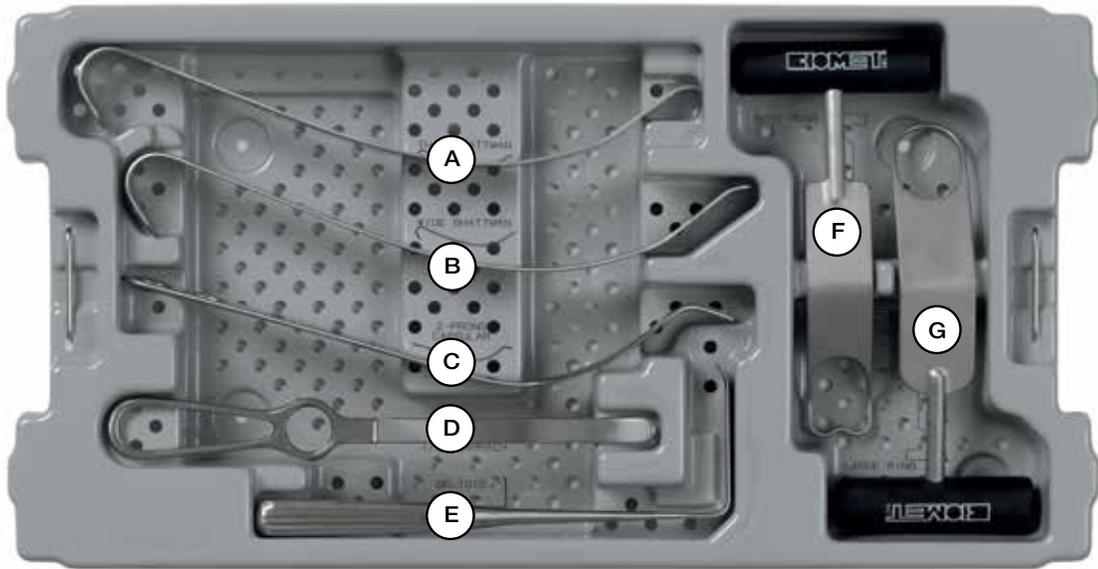


Product	Label	Part Number	Size	Description
—	—	595259	—	Comprehensive Primary Versa-Dial Humeral Head Instrument Case
	A	407298	—	Versa-Dial Taper Extractor
	B	407222 407224 407232 407234 407236 407242 407244 407256 407248 407254 407256 407258 407264 407266 407268 407276 407278	38 x 19 x 39 mm 38 x 21 x 38 mm 42 x 18 x 46 mm 42 x 21 x 43 mm 42 x 24 x 42 mm 46 x 18 x 53 mm 46 x 21 x 50 mm 46 x 24 x 47 mm 46 x 27 x 46 mm 50 x 21 x 57 mm 50 x 24 x 52 mm 50 x 27 x 50 mm 54 x 21 x 64 mm 54 x 24 x 58 mm 54 x 27 x 55 mm 58 x 24 x 64 mm 58 x 27 x 61 mm	Versa-Dial Humeral Head Trial

	C	406660	—	Calcar Planer with Six Blades
	D	407296	—	Versa-Dial Trial Head Screw Drive
	E	407297	—	Versa-Dial Head Impactor
	F	407201	—	Comprehensive Standard Trial Taper Adapters
	G	407281	—	Versa-Dial Taper Impactor Base
	H	407280	—	Versa-Dial Taper Impactor
—	I	407293	—	Versa-Dial Head Sizer Plate

Comprehensive Total Shoulder System

595505 Comprehensive Retractor Set Total Instrument Case



Product	Label	Part Number	Description
	A	405892	Thin Glenoid Retractor
	B	405893	Wide Glenoid Retractor
	C	402852	2-Prong Capsular Retractor
	D	405895	Modified Darrach Retractor
	E	405891	Golf Club Retractor
	F	994500850	Bent Ring Fukuda
	G	406699	Large Ring Fukuda

Comprehensive Keeled Instrumentation

Product	Part Number	Size	Description
	595265	—	Keeled Glenoid Instrument Case
	406837 406838 406839	SM MD LG	Keeled Glenoid Drill Guide
	406587	—	Keeled Broach

Instrumentation Not Included within Standard Set

Product	Part Number	Size	Description
	994500111	—	Angel Wing/Tissue Probe
	407391	—	Comprehensive Broach Protector Plate Set
	010001787 010001788 010001789	SM MD LG	Propeller Glenoid Reamer - Long Nipple
	406897 406898 406899	SM MD LG	Glenoid Reamer-Long Nipple
	406896	8 in	Straight Glenoid Reamer Shaft Long
	110004203	—	Glenoid Vault Pin Guide

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