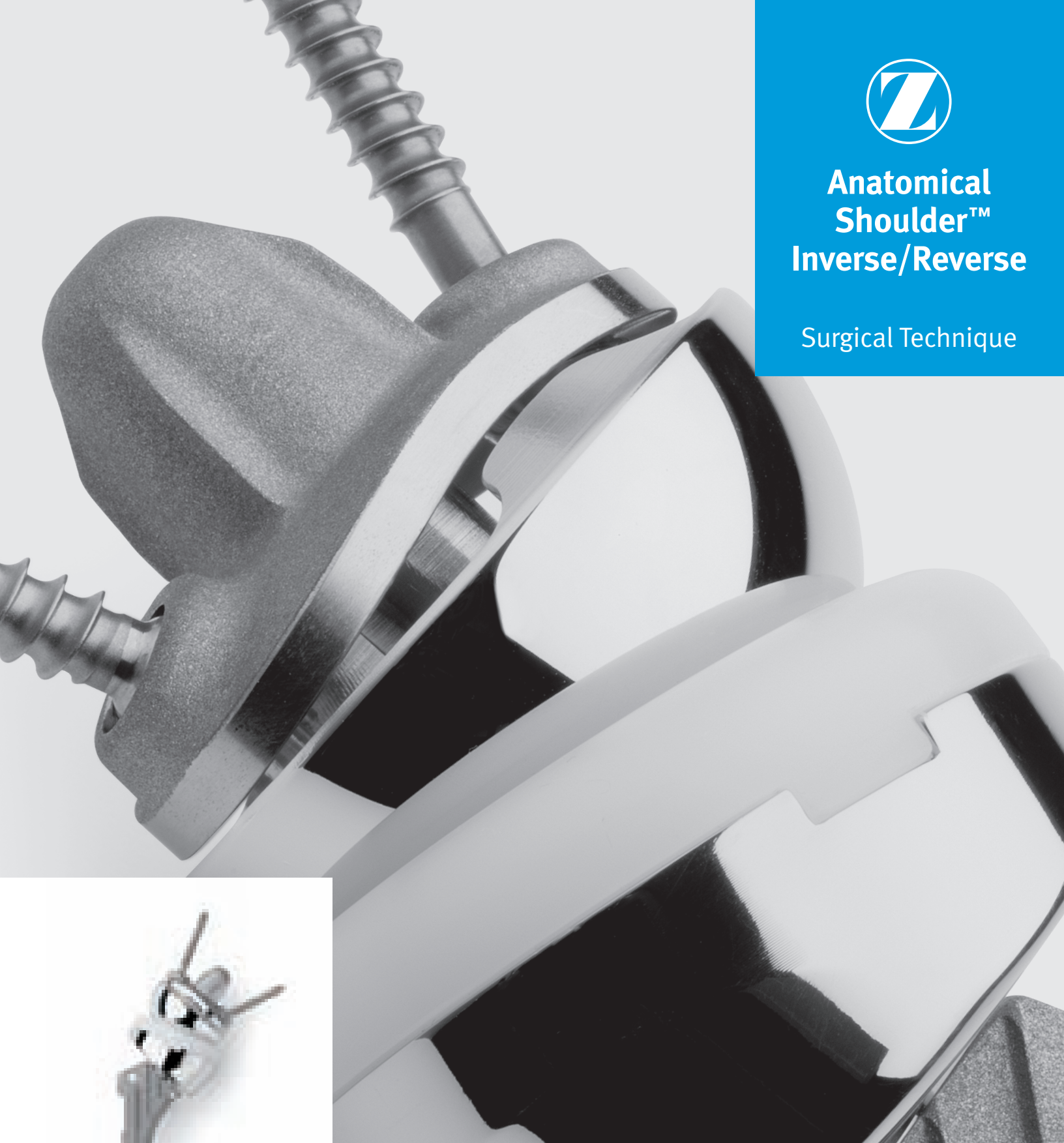




Anatomical Shoulder™ Inverse/Reverse

Surgical Technique



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Anatomical Shoulder Inverse/Reverse Surgical Technique

Table of Contents

Preoperative Planning	5
Preoperative Planning – Humerus	5
Preoperative Planning – Glenoid	5
Template Options	5
Instruments for an Inverse/Reverse Surgery	5
Surgical Technique	6
Patient Positioning and Surgical Approach	6
Humeral Head Resection	7
Preparation of the Proximal Humerus	7
Retrotorsion (i.e. Retroversion) Adjustment Technique	8
Humeral Protection	9
Glenoid Preparation and Implantation	10
Anatomical Shoulder Glenoid Adapter Revision	10
Positioning and Screw Fixation of the Glenoid Base Plate	12
Trial Reduction	13
Glenosphere Placement	13
Humeral Placement	14
Implantation of the Prosthesis into the Humeral Shaft	14
Reduction and Closure	15
Postoperative Treatment	15
From Anatomical to Inverse/Reverse	16
Removal of the Anatomical Head	16
Revision	18
Humeral Side	18
Glenoid Side	19
Preparation and Description of Assembly of the Instruments	20
Assembly Block for Humeral Stem	20
Assembly and Disassembly Impactor	21
Charging the Impactor	21
Review of the Instrument Trays	22
Appendix A	25

Preoperative Planning

Three radiographic images of the shoulder joint are required for planning the operation:

1. Full size true anterior-posterior view with neutral rotation (0°), centered on the articular cavity
2. Axial view
3. CT scan for planning glenoid insertion

Preoperative Planning – Humerus

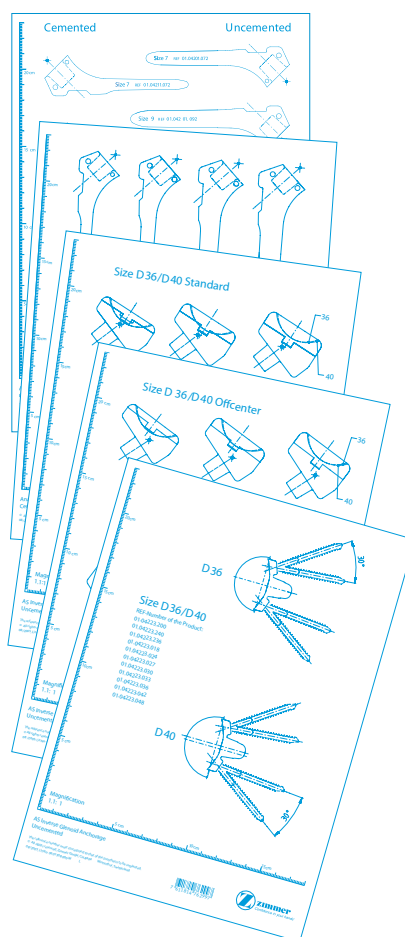
An initial assessment is made of the bone in the superior and inferior aspects of the glenoid, using radiographic and CT imaging in order to determine the suitability of the patient's available bone stock for implant insertion.

Preoperative planning is also carried out, using AP and lateral shoulder radiographs of known magnification, and the available templates to confirm the size and alignment of the implant.

Preoperative Planning – Glenoid

Most indications for inverse/reverse (i.e. reverse shoulder) arthroplasty do not require correction of the version of the glenoid. Nevertheless the glenoid should be evaluated on CT scans. Preoperative CT investigation is recommended whenever a total shoulder prosthesis is used. If there is a severe defect in the posterior glenoid, this must be corrected either by corrective reaming or by bone reconstruction (using the resected head).

See also Preoperative Planning *Anatomical Shoulder* System Surgical Technique Lit.No. 06.006.070.12.



Template Options

- *Anatomical Shoulder* Humeral Stem, Cemented/ Uncemented (Press-Fit) Lit.No. 06.01313.000
- *Anatomical Shoulder* Humeral Stem Revision, Cemented Lit.No. 06.00641.000
- *Anatomical Shoulder* Inverse/Reverse Humeral Cup Standard Lit.No. 06.01310.000
- *Anatomical Shoulder* Inverse/Reverse Humeral Cup Off-Center Lit.No. 06.01309.000
- *Anatomical Shoulder* Inverse/Reverse Glenoid Lit.No. 06.01308.000

Instruments for an Inverse/Reverse Surgery

The preparation and implantation of the *Anatomical Shoulder* Inverse/Reverse System (ANSH800) should be carried out in a standardized manner. The special set of instruments has been logically developed.

Next to the *Anatomical Shoulder* Inverse/Reverse Instrument tray, further instruments are needed:

- *Anatomical Shoulder* Instruments Standard Tray I (ANSH500)
- *Anatomical Shoulder* Instrument Standard Tray II (ANSH600)
- *Anatomical Shoulder* Glenoid Tray (ANSH0100)

For revision surgery, the following instrumentation is also needed:

- *Anatomical Shoulder* Revision Tray (ANSH700)

Surgical Technique

Patient Positioning and Surgical Approach

The patient should be placed in a beach chair position on the edge of the operating table (Fig. 1).

The arm must be freely movable, and it must be able to extend fully. An armrest is optional.

The *Anatomical Shoulder Inverse/Reverse System* may be implanted using either a superior-lateral or delto-pectoral approach.

Superior-lateral or delto-pectoral approach depends mainly on surgeon preference and clinical parameters.

Revision surgery for instance usually dictates a delto-pectoral approach as it allows a longer humeral incision when faced with difficult removal of the humeral stem.



Fig. 1

Superior-Lateral Approach

The incision is made from the anterior-lateral acromial border downward approximately 4cm.

Following subcutaneous dissection, the anterior and middle deltoid muscle bundles are separated opposite the lateral margin of the acromion, using blunt dissection. Care should be taken to avoid any damage to the axillary nerve, which is located approximately 4cm distal to the acromion.

When the subacromial bursa is visible, gentle longitudinal traction in line with the limb will allow a retractor to be placed in the subacromial space.

The humeral head is dislocated by placing the arm in retroversion and internally rotating it. To optimize the exposure, the anterior border and the rest of the superior cuff can be resected.

Delto-Pectoral Approach

Make a skin incision in a straight line starting from the lateral edge of the coracoid as far as the insertion of the deltoid muscle. Seek the cephalic vein between the deltoid muscle and the pectoralis major muscle. Make the approach medial to the vein, to open the delto-pectoral groove.

The coracoid process is identified. The clavi-pectoral fascia is incised at the external border of the coraco-brachialis. The axillary nerve is then identified before identification of the subscapularis.

With adequate releases, the humeral head is dislocated into the delto-pectoral interval by abduction of the arm and progressive external rotation and extension.

Humeral Head Resection

The humeral head should be resected exactly at the level of the anatomical neck.

In the superior and anterior superior aspects, the anatomical neck corresponds to the insertions of the tendons of the cuff (supraspinatus and uppermost section of the subscapularis). In the inferior aspect, there is a smooth transition between the cartilage of the head and the cortical bone of the humerus.

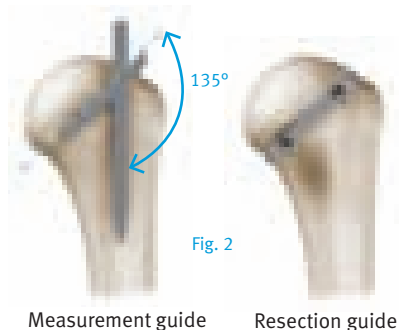
In the posterior aspect, in the region of the infraspinatus and teres minor, is the sulcus, which is a groove of 6 to 8mm in length, without cartilage or attached tendons.

The resection must start exactly on the cartilage. Do not resect the cartilage-free area.



The humeral head is now resected exactly at the height of the anatomical neck with the aid of an oscillating saw, i.e. in the cartilage-covered section of the head.

The resection is in the caudal direction. Measurement and/or resection guides can be used for orientation or assistance (Fig. 2). In this case the inclination is 135 degrees.

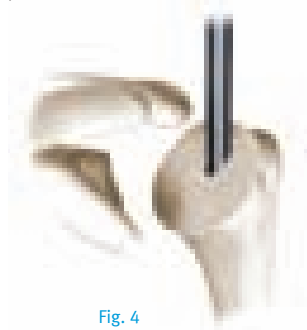


After the osteotomy of the humeral head, the point of insertion of the reamer can be marked with a 3mm awl under the highest point of the resection, directly medial to the bicipital tendon (Fig. 3).

For this purpose, the arm is externally rotated and extended, and the elbow is rested on the body.

Preparation of the Proximal Humerus

After the point of insertion has been determined, the medullary cavity is opened, starting with a size 7 reamer (Fig. 4).



The medullary cavity is gradually widened, using reamers of increasing sizes as required – sizes 9, 10.5, 12 and 14.

Note: The depth of penetration is defined by the uppermost tooth. Care should be taken to ensure that the uppermost tooth of the reamers is fully inserted into the medullary cavity. If a revision stem is used, the reamer should be inserted all the way down to the black etch line.

After opening the medullary canal, the proximal section of the humerus is prepared with the aid of modular rasps, starting with rasp size 7 (Fig. 5).

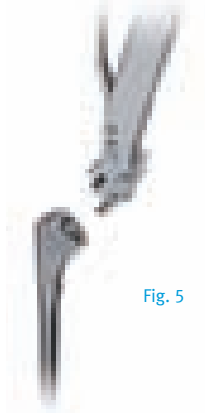


Fig. 5

The fin is directed towards a point approximately 9mm behind the sulcus. The proximal section of the humerus is then prepared stepwise with rasps of size 9, 10.5, 12 and 14, up to the size of the previously used reamer (Fig. 6).

Note: The cemented stem is available in sizes 7, 9, 12 and 14. The uncemented (press-fit) stem is available in sizes 7, 9, 12, 10.5, 12 and 14.

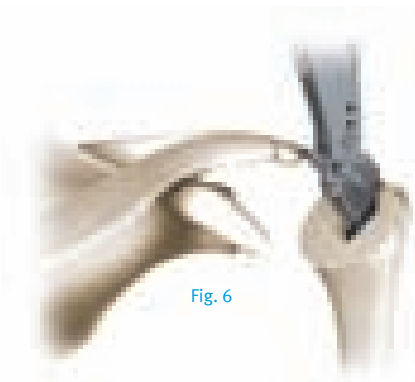


Fig. 6



Fig. 7

Retrotorsion (i.e. Retroversion) Adjustment Technique

Insert the Alignment Rod into the appropriate retroversion hole on the Rasp Handle. Use the right or left hole for the corresponding shoulder side and the preferred hole for orientation to the forearm or to the condyles (Fig. 7). Continue rasping with the elbow bent at 90° parallel to the axis of the epicondyle of the distal humerus. This sets the retroversion at 18°.



Fig. 8

Optional

Optional

In order to perform a superior-lateral approach, the Straight Rasp Handle can be used (Fig. 8).

Care should be taken to ensure that the rasps are fully inserted into the humerus, i.e. until the movable cross-pin is visible on top and contacts both anterior and posterior metaphyseal surfaces (Fig. 9).

Note: If full insertion of the rasp to this extent is not successful, the uncemented (press-fit) stem of this size may not be used.

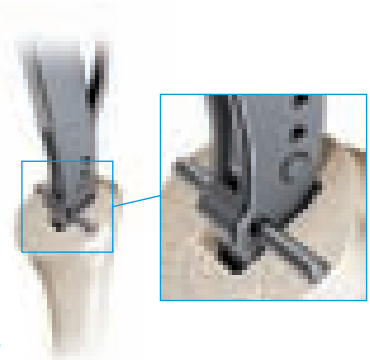


Fig. 9

The Rasp Handle is now removed and the modular rasp left in the humerus. The rasp is now seated 5mm below the resection line (Fig. 10).

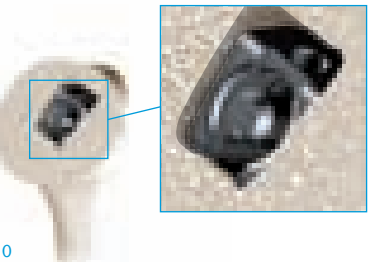


Fig. 10

The rasped lateral fin is now visible posterior to the bicipital tendon.

Cement mantle:

The average thickness of the cement mantle is 1mm.

Press-fit:

The average press-fit is 0.55mm. The distal fins generate the major part of the press-fit.

Optional

Additional fixation of the modular rasp in the humerus can be performed by inserting a Rasp Fixation Screw into the modular rasp (Fig. 11) (this is recommended for poor bone quality). This ensures that the rasp will not subside when the humeral head is impacted onto it.



Fig. 11

Now mount the Humeral Inverse Milling Cutter together with the Cannulated Handle and start reaming the resected humeral surface up to the pin in the rasp (Fig. 12).

Note: The Cannulated Handle is located in the *Anatomical Shoulder* Glenoid Tray.

Note: Care should be taken to ensure that reaming is continued as far as possible up to the pin in the rasp.

To generate an even humeral resection area, use the oscillating saw for resection of the nonreamed humeral surface area.



Fig. 12

Humeral Protection

The plane of the humeral resection can be protected with a disk-shaped protector (Fig. 13).

Disks of three different diameters (40, 44 and 48mm) are available. The pins of the lower side of the disks are inserted at the level of the incision.



Fig. 13

Glenoid Preparation and Implantation

To expose the glenoid, perform a capsulotomy and resect the remaining glenoid labrum. Position a retractor at the inferior border of the glenoid, seated on the scapular pillar for the superior-lateral approach or at the posterior part of the glenoid during the delto-pectoral approach. Use additional retractors positioned anterior and posterior to the glenoid. Any peripheral osteophytes should be removed to restore the natural anatomic shape of the glenoid.

Identify the optimal position for the Glenoid Adapter. Three different Glenoid Adapters are available, Small, Medium, and Large. Use the size of the Glenoid Adapter that best covers the glenoid surface (Fig. 14).

Note: Fig. 14a illustrates an incorrect size Glenoid Adapter used. The Glenoid Adapter chosen here is too large and overhangs the glenoid surface in all directions.

Now use the appropriate Glenoid Adapter to cover the glenoid surface and press the hook of the instrument against the inferior border of the glenoid and vertical to the ground (Fig. 14). Introduce the 3mm Kirschner Wire into the chosen Glenoid Adapter (Small, Medium, or Large) (Fig. 14b). The laser marking on the Kirschner Wire (a) must disappear slightly into the eyelet of the Glenoid Adapter Positioning Guide.

Remove the Glenoid Adapter over the Kirschner Wire. The Kirschner Wire is now perpendicular to the required alignment of the articulating surface, which was determined preoperatively.



Fig. 14 (correct size)



Fig. 14a (incorrect size)

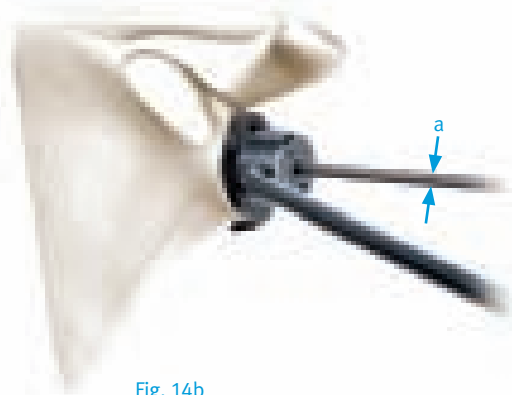


Fig. 14b

Anatomical Shoulder Glenoid Adapter Revision

The Glenoid Adapter Revision (Fig. 15) might be helpful in cases where the surgeon is not completely satisfied with the Kirschner Wire position, after using the Glenoid Adapter Small, Medium or Large. In such cases, while leaving the initial Kirschner Wire in place, insert a new Kirschner Wire into another hole in order to correct the initial Kirschner Wire placement.

Remove the old Kirschner Wire and continue the glenoid preparation as the Glenoid Adapter Revision will prevent the new wire from skiving off into the initial hole.



Fig. 15

Note: The Zimmer® Trabecular Metal™ Reverse Shoulder System glenoid component assembly (i.e. base plate and glenosphere) is compatible with the PE-inlay, humeral cup, and humeral stem of the Anatomical Shoulder Inverse/Reverse System. Please refer to Appendix A at the end of this document for this alternate glenoid preparation and implant fixation.

If the complete surgical technique is desired, please refer to the following document and/or website.

Paper Copy: Zimmer Trabecular Metal Reverse Shoulder System Surgical Technique (item number: 97-4309-103-00)

Online Copy: www.zimmer.com
Please select Medical Professional and then select surgical techniques.

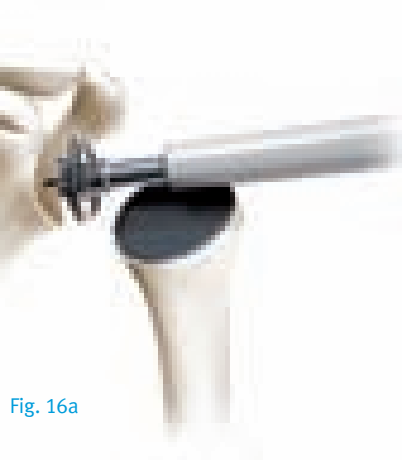


Fig. 16a

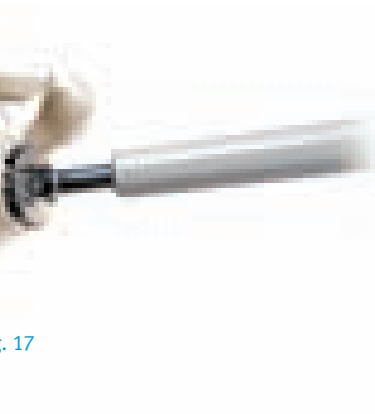
Fig. 16b
Sclerotic Reamer

Fig. 17

The glenoid reamer size S (small) and the Cannulated Handle are mounted on the Kirschner Wire (Fig. 16a). For a sclerotic glenoid the separate Sclerotic Reamer (Fig. 16b) may be used to start the reaming process. Now ream the glenoid in the new alignment of the articulating surface (Fig. 16a/17).

Now use the reamer size L (large).

Note: The reamer size S (small) corresponds to the back surface of the *Anatomical Shoulder Inverse Glenoid Base Plate*. The reamer size L (large) is needed to generate enough clearance for the backside of the *Anatomical Shoulder Inverse/Reverse Glenosphere*.

Now mount the Glenoid Inverse Drill Guide with the central hole on the 3mm Kirschner Wire, and place it on the surface of the glenoid (Fig. 18). Ensure that the Drill Guide is seated flush onto the glenoid face.

Use the Glenoid Inverse Drill (Fig. 18) to prepare the inferior and the superior Base Plate holes. The Drill can be used with either the Flexible or the Rigid Shaft. These shafts have an A.O. coupling but can also be used with a chuck. After drilling the inferior hole, place the Peg inside the hole to set as an anti-rotation pin. Now drill the superior hole. Remove the Drill Guide and the Peg.

Mount the Glenoid Inverse Milling Cutter together with the Cannulated Handle and ream over the Kirschner Wire to create the central hole until the collar is flush with the glenoid surface (Fig. 19).

Stop reaming until the full diameter of the reamer marks the glenoid surface (Fig. 19a). Remove the Kirschner Wire.

The *Anatomical Shoulder Inverse Glenoid Base Plate* is available in one size for both 36mm and 40mm glenospheres and is implanted without cement.

Note: The Kirschner Wire, Reamers, Cannulated Handle, Flexible Shaft, and Rigid Shaft are located in the *Anatomical Shoulder Glenoid Tray*.



Fig. 18



Fig. 19



Fig. 19a

Positioning and Screw Fixation of the Glenoid Base Plate

The *Anatomical Shoulder* Inverse Glenoid Base Plate is attached to the Holding Forceps. Align the glenoid Base Plate with the central peg into the previously drilled center hole.

Start the impacting with the Base Plate Impactor, using controlled force. Once impacted, the glenoid Base Plate should seat fully on the glenoid. If not, impact until fully seated (Fig. 20).

The Impactor is removed, and the Drill Guide for screws is located in the inferior glenoid Base Plate hole. Both inferior and superior screw positions allow angulation of 30°. The Drill Guide is used to set the most appropriate angle to ensure that each screw is located in reliable bone stock (Fig. 21). Preferential position is usually determined by palpating the inferior and superior aspects of the scapula as well as examining the x-rays and CT scans. The inferior hole is drilled with the 3.3mm drill. The screw lengths are laser marked on the Drill, for use with the Drill Guide. Remove the Drill Guide.

The 4.5mm screw (available in lengths 18–48mm in 6mm incremental steps) is introduced into the inferior hole and fully tightened with the Hexagonal Screw Driver.

Now secure the inferior screw position by using the Locking Screw Cap. The Locking Screw Cap is then fastened with the Torque Wrench, until the Torque Wrench slips or audibly clicks (Fig. 22).

Next, prepare the superior hole in the same manner as the inferior hole.



Fig. 20

Note: Care should be taken to correctly orient the superior/inferior position of the glenoid Base Plate before impacting it.



Fig. 21



Fig. 22

Trial Reduction

The appropriate Trial Glenosphere 36 (green) or 40 (yellow) is attached to the glenoid Base Plate. The Trial Humeral Cup is inserted into the rasp located in the humerus and a corresponding Trial Humeral PE Inlay 36 (green) or 40 (yellow) is then inserted into the Trial Humeral Cup.

Three thicknesses of the Humeral PE Inlays are available: standard 0, +3mm and +6mm. In case of severe bone defects or inadequate deltoid tension, a +9mm humeral cup component can be used (possible humerus heights: standard 0, +3mm, +6mm, +9mm, +12mm and +15mm).

The shoulder is then reduced and assessed for a full range of movement.

If soft tissue tension is correct, the glenoid bearing will not impinge on the inferior rim of the resected humeral head.

The shoulder joint remains stable when the arm is adducted, with no indication of subluxation (Fig. 23). To change the trial humeral PE Inlays, a Lexer Chisel may be used to disconnect the Inlays from the Humeral Cups.



Fig. 23

Glenosphere Placement

The Glenosphere is typically inserted prior to the humeral component to maximize exposure of the glenoid and ease of insertion. Ensure all osteophytes and soft tissue are removed around the Glenoid Base Plate to allow the Glenosphere to completely seat.

The definitive *Anatomical Shoulder* Inverse/Reverse Glenosphere is now unpacked. The size of the Glenosphere has been defined by the previously used Trial Glenosphere 36mm or 40mm.

Note: The *Anatomical Shoulder* Inverse/Reverse Glenosphere has a laser mark for correct connection. This laser mark must face the acromion.

The Glenosphere is now fitted onto the oval taper of the glenoid Base Plate by hand while ensuring that the laser mark is facing the acromion. Use three consecutive mallet strikes on the Impactor to seat the Glenosphere (Fig. 24a). The Glenosphere is now prepared.



Fig. 24a

Glenosphere Placement: Using the Optional Suction Cup Inserter

Press the suction cup onto the appropriate diameter Glenosphere so that the Glenosphere is held in place by the body of the suction cup (Fig. 24b). Now, place the Glenosphere onto the Glenoid Base Plate with the help of the Suction Cup Inserter. When approaching the Glenoid Base Plate, a finger can be placed on top of the Glenosphere to help guide and feel the Glenosphere slide over the oval taper into position. Once the Glenosphere is seated evenly and circumferentially, remove the suction cup from the Glenosphere by pulling up on the clear tab. Using the Glenosphere Impactor, use three consecutive mallet strikes on the Impactor to seat the Glenosphere to the Base Plate.



Fig. 24b

Note: The Suction Cup Inserter must be disassembled for cleaning and sterilization.

Humeral Placement

Remove, if used, the optional Rasp Fixation Screw from the rasp located in the humerus. Remove the rasp with the modular Rasp Handle. Unpack the definitive *Anatomical Shoulder* humeral stem (size determined by the size of the last modular rasp used) cemented or uncemented (press-fit). Unpack the inverse humeral cup and the inverse humeral PE inlay. The size and retroversion have been defined by the previously used trials.

The humeral implant stem (cemented or uncemented) is now placed into the stem holder of the assembled mounting block. The inverse humeral cup is now placed on the humeral implant stem, after appropriate rotation (Fig. 25).

The inverse humeral cup is now impacted onto the humeral implant stem with the aid of the Impactor (Fig. 25).



Fig. 25

Implantation of the Prosthesis into the Humeral Shaft

With the cemented prosthesis, a cement restrictor can be inserted into the humerus, followed by the cement, in a relatively fluid consistency. The implant is now inserted into the humerus, by applying controlled force with the thumb on the humeral cup.

Note: If it is not possible to seat the implant with the thumb until you reach a maximum of 1cm distance between the proximal humerus resection line and the bottom of the humeral cup, extract the implant and re-ream with the last rasp used.

The lateral stem fin is used as orientation. This is done until the lower side of the humeral cup is resting on the humerus. The implant is brought into the final position with careful blows from the Humeral Cup Impactor (Fig. 26).



Fig. 26

If the cement prosthesis is being used, excess cement is then carefully removed.

If desired, the deltoid tension can be checked again, with the Trial Humeral PE Inlays on the humeral cup implant. Now insert the Inverse Humeral PE Inlay (with the snap in locking mechanism) with the help of the PE Inlay Impactor (Fig. 27).

Cement mantle:

The average thickness of the cement mantle is 1mm.

Press-fit:

The average press-fit is 0.55mm. The distal fins generate the major part of the press-fit.

Reduction and Closure

The prosthesis is then reduced and stability is checked (Fig. 28). Once the joint space is irrigated and cleared of debris, a drain is left in place. Layered closure of the soft tissue normally leads to an adequate range of motion, without instability.

Postoperative Treatment

It is the responsibility of the doctor to decide which postoperative treatment is appropriate depending on each patient's health condition.

The following outlines recommendations which are generally made by doctors.

The arm is put into a sling, but passive and active elevation to the front is not recommended. Weight lifting and active elevation with the extended elbow are not recommended for the first six weeks after the operation.



Fig. 27

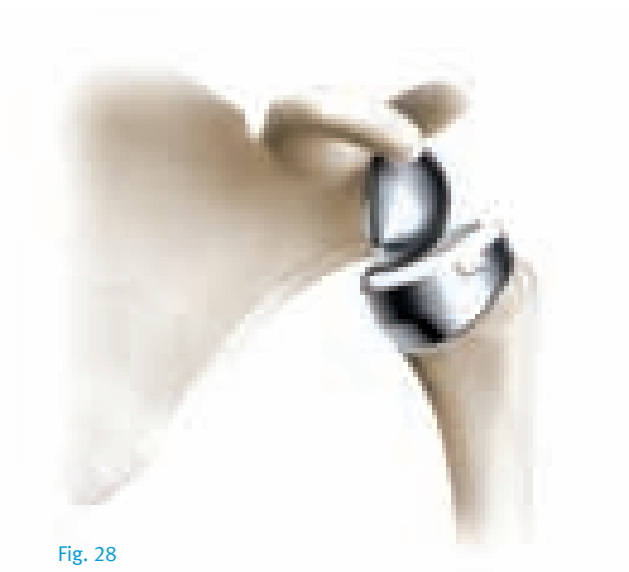


Fig. 28

From Anatomical to Inverse/Reverse

Removal of the Anatomical Head

With a cemented humeral stem, remove cement from the lower side of the humeral head with a Lexer Chisel, so that the extraction instrument can be applied (Fig. 29).

The Humeral Head Extractor is now applied to the humeral head and fixed with a two-edged screw (Fig. 30).

With the aid of the Extractor instrument and the Slide Hammer Weight, the humeral head is separated from the humeral stem parallel to the lower side of the humeral head (Fig. 30).

To remove the cement from the thread, if the humeral stem is cemented, a Drill Guide is first inserted into the oval cone of the humeral stem and then used to guide the Drill (Fig. 31).

Note: Care should be taken to ensure that drilling is continued as far as possible.

Note: Instruments are from Revision Tray.

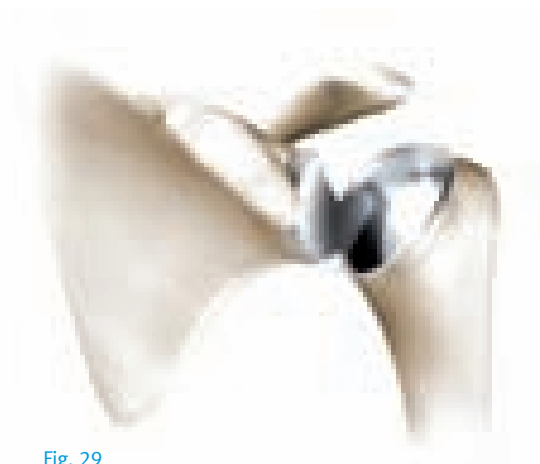


Fig. 29

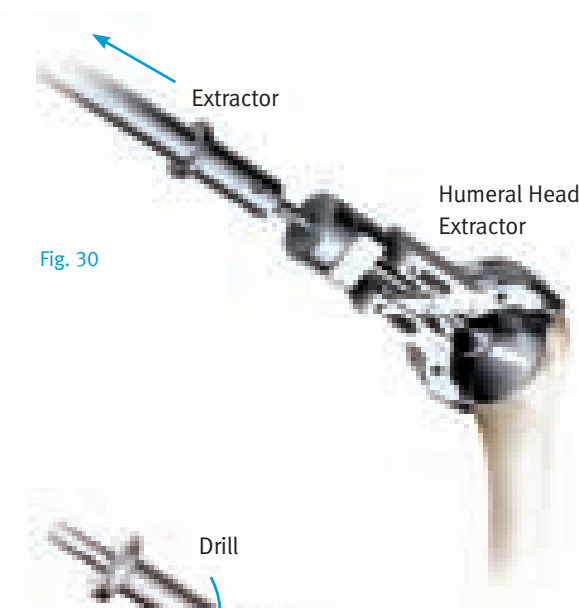


Fig. 30

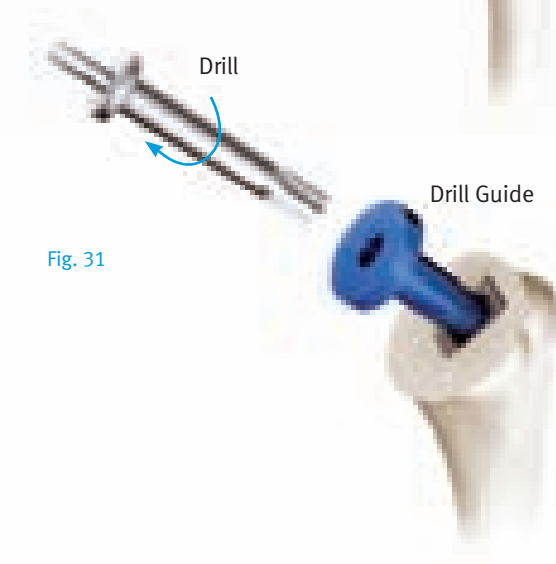


Fig. 31

Any remaining cement is now removed from the thread of the stem with the Thread Cutting Head (Fig. 32).

The X-pin is now screwed into the humeral stem (Fig. 33a). The X-pin guides the reamer and is essential for directing and fixing the inverse humeral cup.

Note: Care should be taken to ensure that the X-pin is fully screwed in and that the oval internal cone is not damaged when this happens.

To remove the cement above the oval cone, use the RH Reamer (Fig. 33b). Reaming is performed with the Cannulated Handle from the glenoid tray.

To prepare the humeral surface for the inverse humeral cup, place a Milling Cutter Bushing onto the humeral stem. The Milling Cutter Bushing is secured in the humeral stem with the Milling Cutter Bushing Screw, using the Hexagonal Screw Driver. If the Milling Cutter Bushing cannot be placed onto the humeral stem, remove bone or cement with a Lexer Chisel. Now attach the Revision Humeral Inverse Milling Cutter together with the Cannulated Handle and start reaming the inverse/reverse humeral surface up to the Milling Cutter Bushing in the humeral stem (Fig. 34a).

Note: Care should be taken to ensure that reaming is continued as far as possible up to the Bushing in the humeral stem.

If necessary for a well prepared humeral resection area, use the oscillating saw for resection of the nonreamed humeral surface area.



Fig. 32

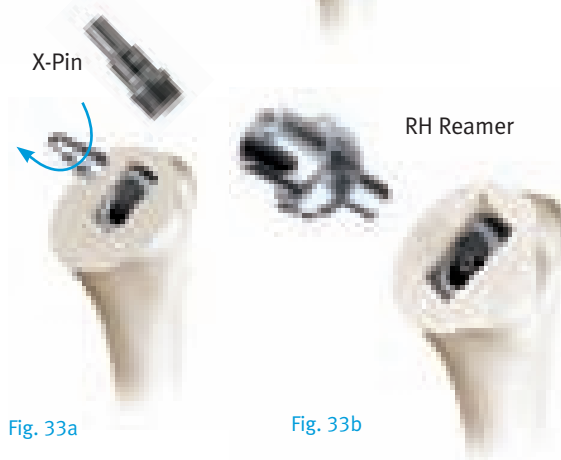


Fig. 33a

Fig. 33b



Fig. 34a



Fig. 34b

Note: The Milling Cutter Bushing comes in five different types (straight, $\pm 10^\circ$ retro and $\pm 20^\circ$ retro version). To set the Milling Cutter Bushing correct onto the humeral stem, all bushings have a marking line. This line always needs to face the lateral hole of the stem (Fig. 34b).

The plane of the humeral resection can be protected with a disk-shaped protector (Fig. 35). Disks of three different diameters (40, 44 and 48mm) are available. The pins of the lower side of the disks are inserted at the level of the incision.



Fig. 35

Glenoid Preparation and Implantation

Please see pages 10–13.

Humeral Placement/Reduction and Closure/Postoperative Treatment

Please see pages 14–15.

Revision

Humeral Side

Should a Humeral PE Inlay ever have to be removed from the Humeral Cup, slide a Lexer Chisel underneath the PE Inlay and pry the PE Inlay off (Fig. 36a).

Note: The Humeral PE Inlay can not be reused after removal.



Fig. 36a

Should a Humeral Cup ever have to be removed from the *Anatomical Shoulder* Stem, slide the two components of the Extractor together, then slide the Humeral Cup Extractor between the humeral shaft and the undersurface of the Humeral Cup. Firmly tap the movable part of the instrument to loosen the Humeral Cup (Fig. 36b).



Fig. 36b

Glenoid Side

Should a Glenosphere ever have to be removed from the Glenoid Base Plate, slide the Glenosphere Extractor between the back surface of the Glenosphere and the front surface of the Glenoid Base Plate. Tap the end of the instrument to loosen the Glenosphere (Fig. 37a and 37b).



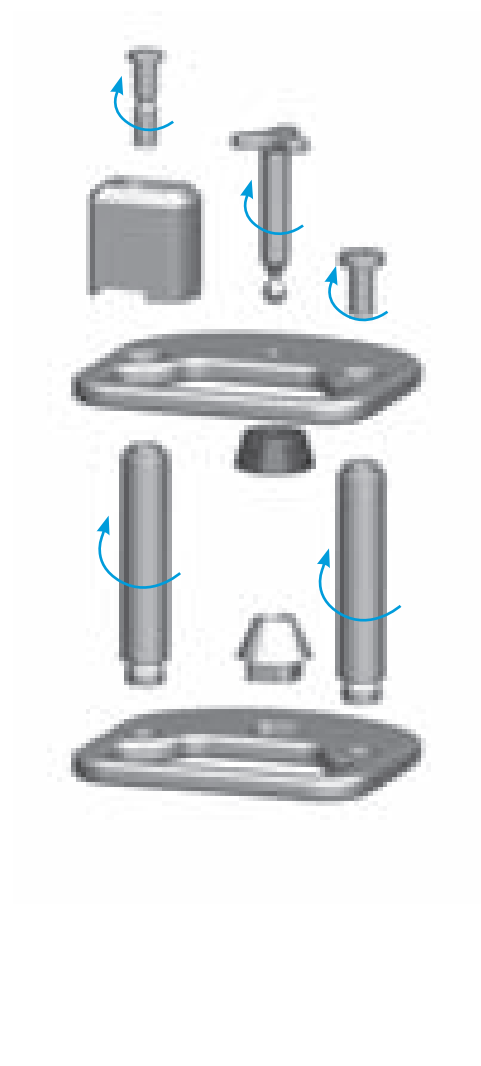
Fig. 37a



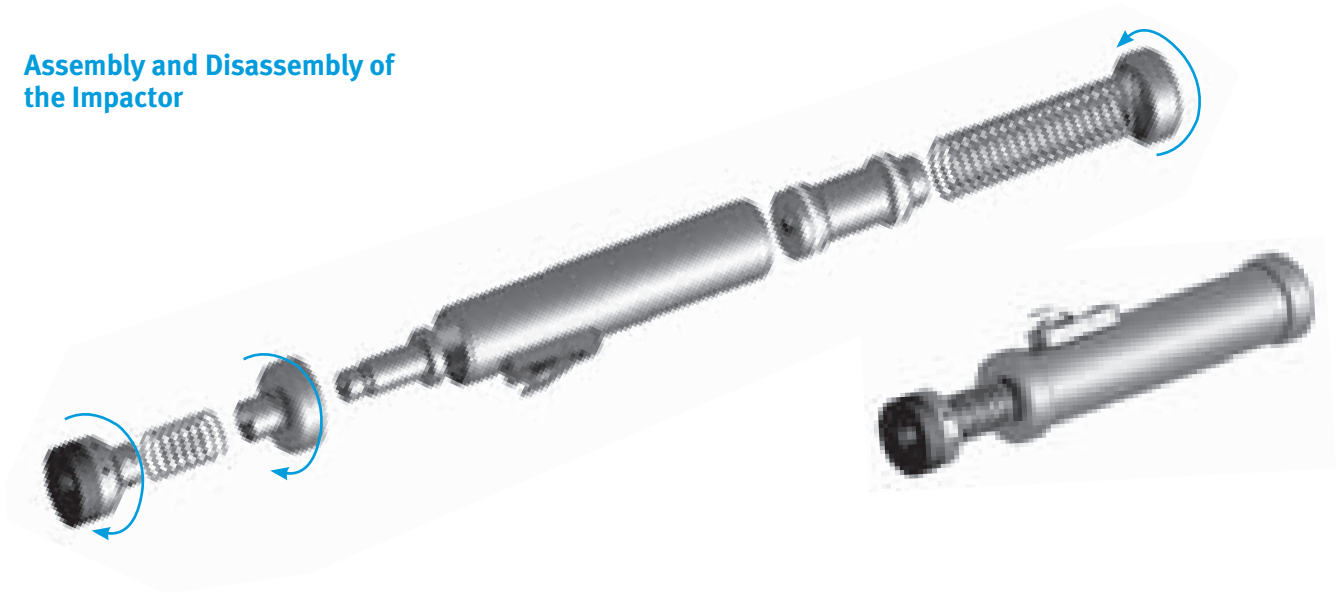
Fig. 37b

Preparation and Description of the Assembly of the Instruments

Assembly block for the Humeral Stem



Assembly and Disassembly of the Impactor



Charging the Impactor

Tense the Impactor with the help of the loading aid (Charger).

The Impactor is connected through the shaft of the Charger.

There are two possible procedures: Either the Charger is placed on the table (Fig. 38), or the Charger is held in one hand, the Impactor in the other (Fig. 39, 40), while the shaft of the Charger is inserted into the Impactor and tenses the Impactor.

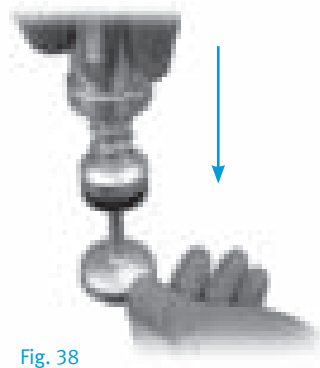


Fig. 38

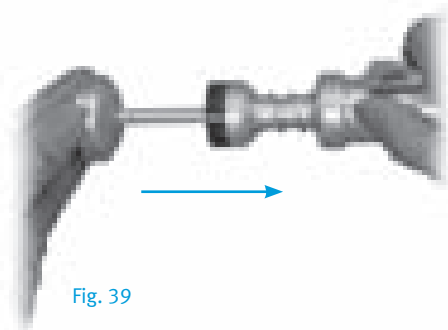


Fig. 39

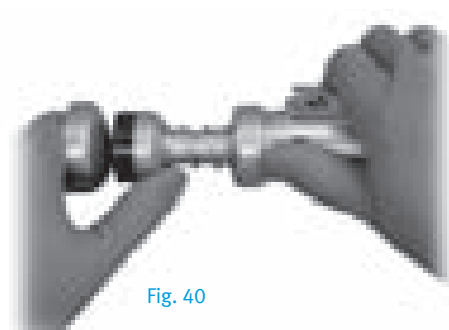
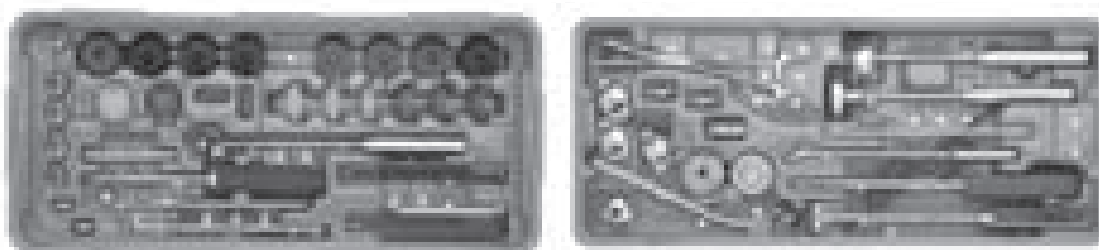


Fig. 40

Review of the Instrument Trays

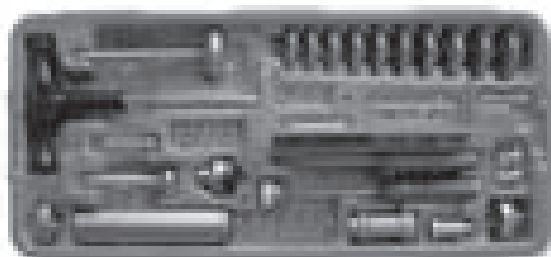
Inverse/Reverse Trays
ANSH800



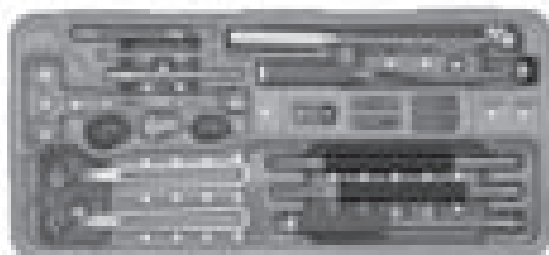
Instrument Tray I
ANSH500



Instrument Tray II
ANSH600



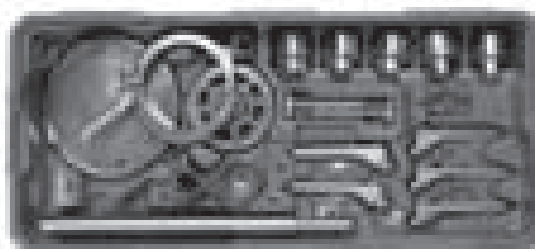
Glenoid Trays



Pegged
ANSH0100

Keeled
ANSH0101

Revision Tray
ANSH700



Instruments

Anatomical Shoulder Inverse/ Reverse Instrument Set

Contains the following:

Anatomical Shoulder Inverse/Reverse Lid

01.00029.031

Anatomical Shoulder Inverse/Reverse Base (empty)

01.04239.010

Milling Cutter Bushing Screws

01.04239.560

Inverse/Reverse Locking Screw Holder 3.5mm

02.00024.121

Inverse/Reverse Torque Wrench

02.00024.022

Centering Pegs for Glenoid Inverse

01.04239.135

Extractor Instruments for Glenosphere

01.04239.160

Extractor Instrument for Humeral Cup

01.04239.320

Trial Humeral PE Inlays

36-6 01.04239.720
36-3 01.04239.710
36-0 01.04239.700
40-6 01.04239.750
40-3 01.04239.740
40-0 01.04239.730

Milling Cutter Bushing

-20° retro 01.04239.550
+20° retro 01.04239.540
-10° retro 01.04239.530
+10° retro 01.04239.520
0° retro 01.04239.510

Trial Glenospheres

40 01.04239.810
36 01.04239.800

Trial Humeral Cups (Set 1)

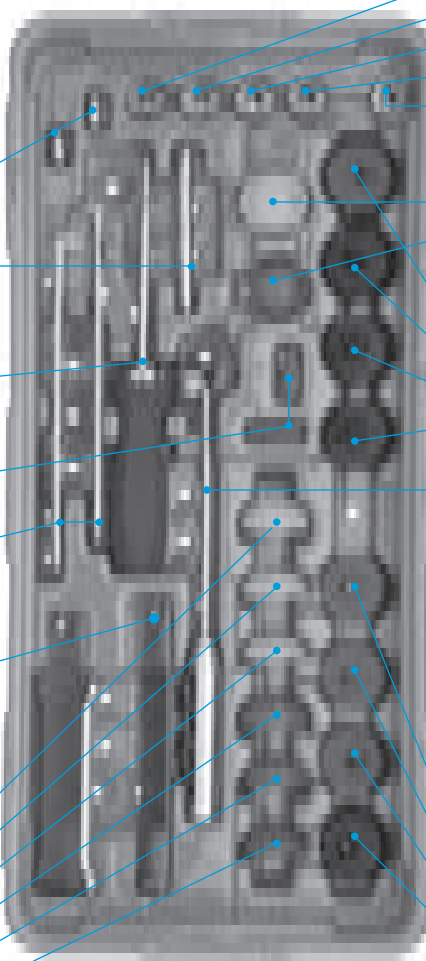
+9 0° retro +6mm 01.04239.670
+9 0° retro 01.04239.660
-20° retro 01.04239.650
+20° retro 01.04239.640

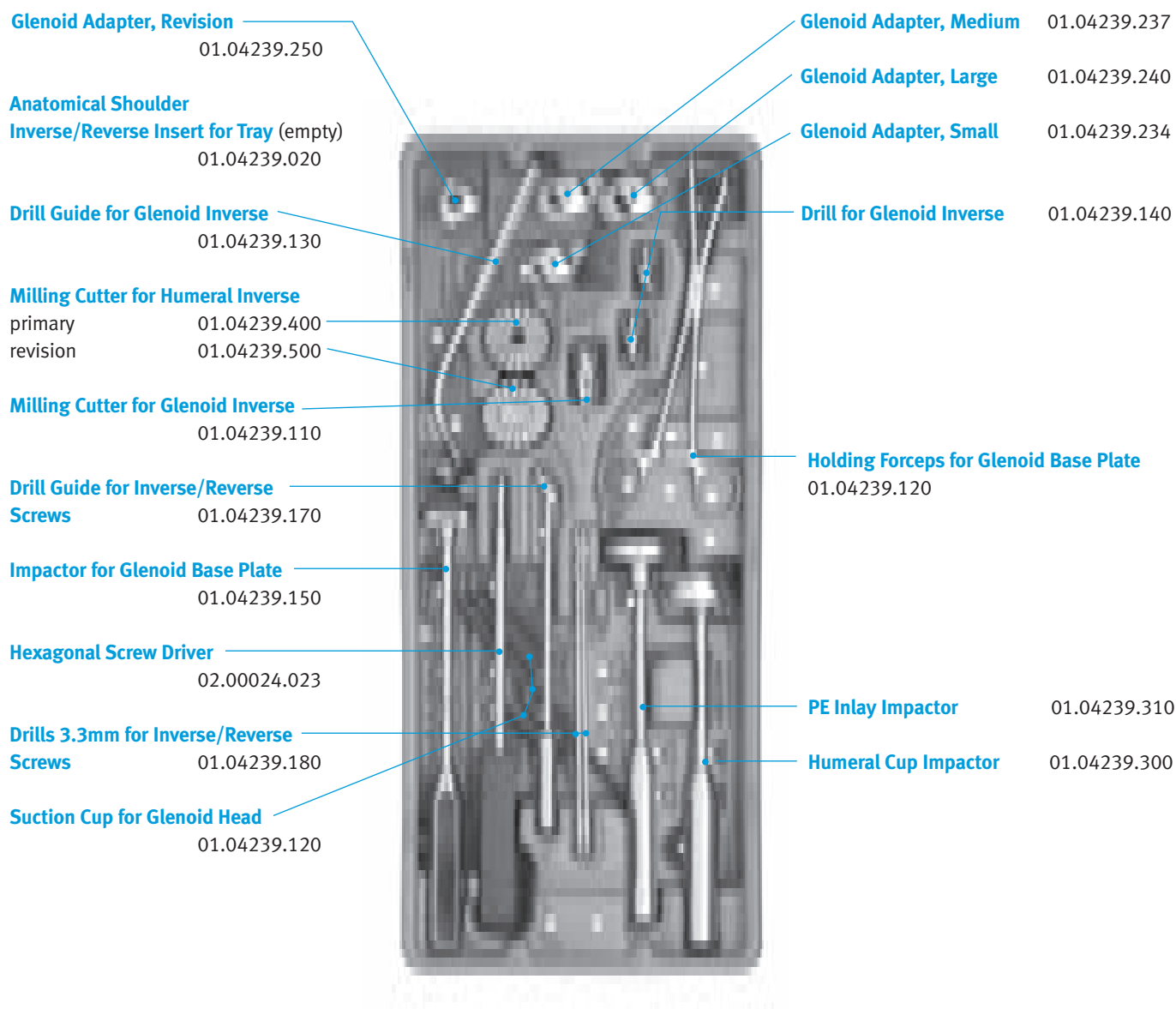
Guiding Instrument for Glenoid Inverse

01.04239.200

Trial Humeral Cups (Set 2)

-10° retro 01.04239.630
+10° retro 01.04239.620
0° retro +6mm 01.04239.610
0° retro 01.04239.600





Note: Standard *Anatomical Shoulder* Instruments are also required.

APPENDIX A:

Alternate Glenoid Preparation and Implant Fixation Using the Zimmer® Trabecular Metal™ Reverse Shoulder System

Straight-on exposure of the glenoid is necessary for proper reaming and component insertion. If the superior-lateral approach was utilized, a forked retractor or the *Zimmer* Shoulder Shoehorn Retractor (Fig. 41) can be placed inferiorly on the glenoid to retract the humeral head out of the way. If exposure is limited, re-evaluate the level of the humeral cut.

If the delto-pectoral approach was chosen, the proximal humerus is retracted posteriorly and inferiorly. Again if exposure is limited, re-check the humeral osteotomy level and ensure inferior capsular releases were thorough. Both approaches require circumferential exposure of the glenoid with labral excision. Inferiorly, the glenoid must be exposed to allow palpation of the inferior glenoid pillar and inferior positioning of the glenoid Base Plate.

Note: While preparing the glenoid, the placement of the proximal humerus and provisional along with retractors should be carefully considered. Their positions may allow for interference with Glenosphere seating. Exposure should allow for straight-on engagement of the Glenosphere on the Base Plate taper. Consider use of the *Zimmer* Shoulder Shoehorn Retractor as it has been designed to aid in retracting the humeral head and other soft tissue when placed on the posterior side of the glenoid (Fig. 42).



Fig. 41



Fig. 42

If desired, the Glenoid Scraper can be used to clean the glenoid face of any remaining articular cartilage or scar tissue. Assemble the Base Plate Drill Guide 1 by placing the face into the handle so that the two pieces mate and rotate into position (Fig. 43). Evaluate positioning of the Base Plate by placing the Base Plate Drill Guide 1 on the glenoid face. The outer rim of Drill Guide 1 is the same diameter as the Base Plate. The outer rim can be rotated relative to the handle to check coverage of the anterior, inferior and posterior edges of the glenoid. The Drill Guide should be placed so that the outer rim aligns with the inferior rim of the glenoid and is centered in the anterior/posterior direction (Fig. 44). This will place the Glenosphere at the edge of the inferior glenoid bone.



Fig. 44

Note: Inferior placement of the Glenosphere is critical and will help reduce the possibility of scapular impingement and notching.

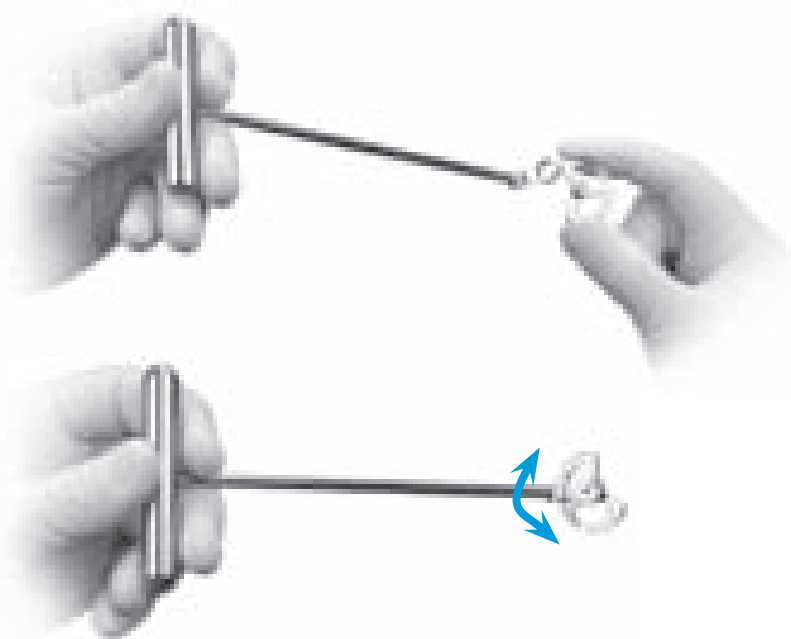


Fig. 43

Load the 2.5mm Pin into a K-wire driver or Jacobs chuck. The 2.5mm Pin is marked for the appropriate insertion depth (Fig. 45). Insert the 2.5mm Pin through Drill Guide 1 until the depth mark indicated on the pin meets the top of Drill Guide 1 (Fig. 46). Release the Pin from the K-wire driver or Jacobs chuck, and lift Drill Guide 1 from the glenoid leaving the 2.5mm Pin in place.

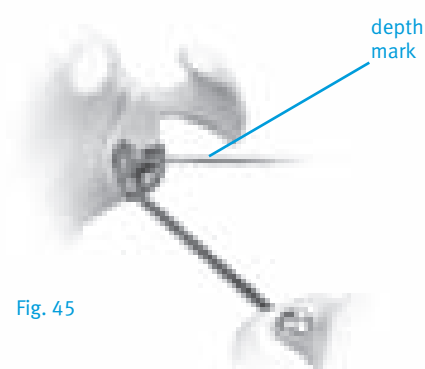


Fig. 45

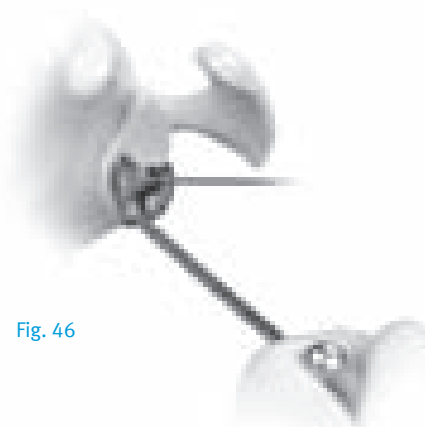


Fig. 46

The 6mm Cannulated Drill is now used to create a pilot hole for the glenoid reamers. It is attached to the Cannulated Straight Driver by sliding the Driver tabs into rounded slots of the 6mm Cannulated Drill. Turn the Cannulated Straight Driver to retain the 6mm Cannulated Drill. Place the Cannulated Drill assembly over the 2.5mm Pin and drill until the housing collar is flush to the glenoid face (Fig. 47). The 6mm Cannulated Drill and the 2.5mm Pin are now removed.

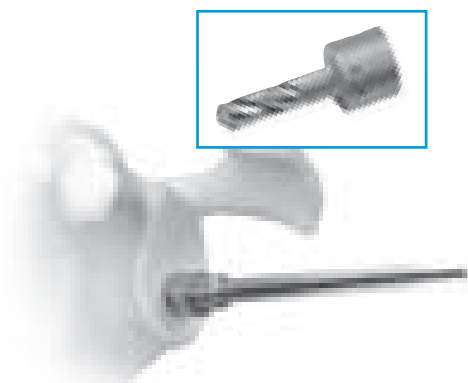


Fig. 47

Attach Base Plate Reamer 1 to the Cannulated Straight Driver assembly and hand ream to prepare the glenoid surface for the back of the base plate. This is a sharp reamer and power reaming may remove excessive bone. Ream until the reamer face is completely flush with the prepared surface and the subchondral bone is exposed inferiorly (Figs. 48 & 49).

Note: If necessary, remove any remaining prominent glenoid bone.



Fig. 48



Fig. 49

Attach either the 36mm or the 40mm Base Plate Reamer 2 to the Cannulated Straight Driver assembly (Fig. 50). Ream until the spokes are flush to the previously reamed face. The outer cutting teeth of Base Plate Reamer 2 will ream the surrounding bone to provide clearance for the Glenosphere. Once the Base Plate implant is in place, surface reaming is not possible.



Fig. 50

Note: This step is necessary to ensure the Glenosphere will lock on the Base Plate properly. All reasonable efforts should be made to use the appropriate Base Plate Reamer 2. The size of Base Plate Reamer corresponds to the Glenosphere to be used.

The Base Plate post hole must now be prepared. The system provides three tools, a 7.5mm Drill, a 7.5mm Cortex Drill and a 7.5mm Compression Plug, to aid in post hole preparation based on bone quality and surgeon preference (Fig. 51). All three are used through the Base Plate Drill Guide 2 which is placed in the cavity created by the last Base Plate Reamer used.

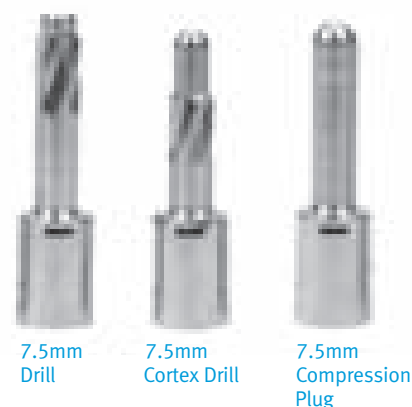


Fig. 51

Poor Bone Stock:

When poor bone stock exists, use the 7.5mm Cortex Drill (Fig. 52) to remove only the first 3 to 4mm of glenoid cortex. If a press fit of the distal end of the Glenosphere Base Plate post is desired, then the preparation is complete. If it is deemed appropriate to compress more bone, use the 7.5mm Compression Plug to compress the cancellous bone in the vault prior to implant insertion.

Note: The Compression Plug should not be used unless the 7.5mm Cortex Drill is first used. Otherwise there may be a risk of fracture.



Fig. 52

Good Bone Stock:

Only if there is good hard bone, use the 7.5mm Drill to ream bone for the full depth of the post of the Base Plate (Fig. 53).

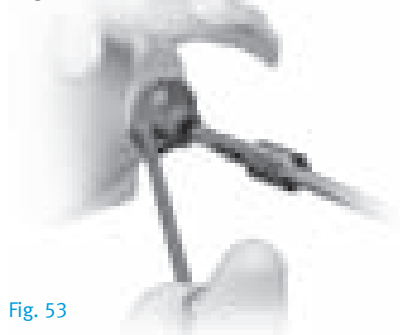


Fig. 53

Note: A small drill can be used to sound for confirming good bone quality. Drill Guide 2 has two reference marks to help aid in the superior/inferior placement of the Inverse/Reverse Screws. You may choose to make anatomical marks for the placement of the Inverse/Reverse Screws.

Base Plate Insertion

Before glenoid component insertion, carefully note and mark the inferior glenoid pillar. Place the Base Plate implant on the Base Plate Inserter and insert it into the preparation (Figs. 54 & 55). Achieve proper orientation by aligning the grooves on the Base Plate to the previously placed marks or anatomic reference points for placement of inferior and superior screws. The Base Plate is inserted by striking the Base Plate Inserter until the component is completely flush with the prepared surface (Fig. 56). Care should be taken to avoid tipping the Base Plate during insertion thus preventing circumferential contact.



Fig. 54



Fig. 55



Fig. 56

Screw Insertion

The 2.5mm Drill Guide is inserted into the screw holes and oriented to prepare for screw insertion (Fig. 57). The inferior screw should be oriented toward the inferior border of the scapula down the previously identified glenoid pillar. The superior screw should be oriented along the superior border of the scapula toward the coracoid.

Note: Do not aim the drill towards the central Trabecular Metal post.

Attach the 2.5mm Drill to power and drill the screw holes through the 2.5mm Drill Guide and Base Plate at the desired orientation (Fig. 58). The 2.5mm Drill has lines corresponding to the screw lengths available.



Fig. 57



Fig. 58

Remove the Drill and the Drill Guide.
Assemble the Depth Gauge and insert
into the screw holes to aid in selecting
the proper screw length (Figs. 59 & 60).

**Note: Screws are available in 18-48mm
lengths.**

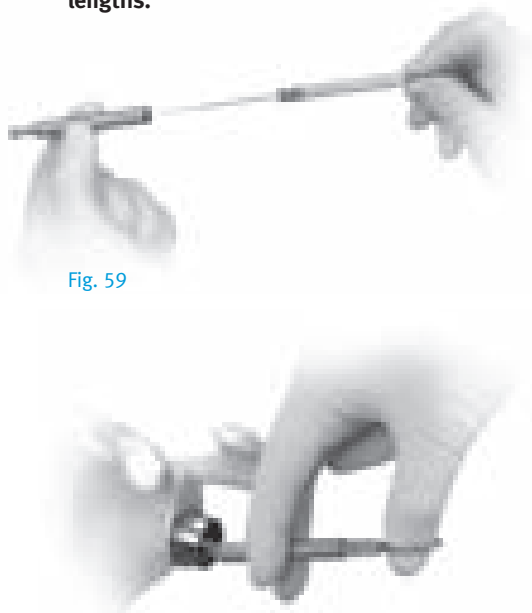


Fig. 59



Fig. 60

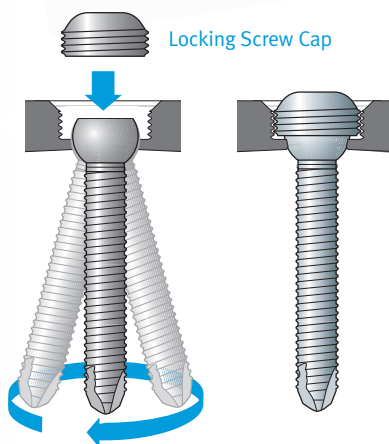


Fig. 61

Inverse/Reverse Screws are adjustable
within a possible 30° arc (Fig. 61) and
thus can readily be angled to achieve
good bone purchase. The screws
are inserted through the inferior and
superior screw holes with the
Hexagonal Screw Driver, making sure
good bone purchase is achieved
(Fig. 62). If good bone purchase is
not achieved, the screws should be
removed and prepared at a new angle.
The screws are then converted to a fixed
angle by placing the Locking Screw Caps
on the Inverse/Reverse screws using
the Inverse/Reverse Torque Wrench and
Locking Screw Holder.



Fig. 62

To do this, the locking screws are
placed onto the tip of the Inverse/
Reverse Torque Wrench and the Locking
Screw Holder is gently slid over the
locking screws to secure them (Fig. 63).
The locking screws are placed over the
heads of the Inverse/Reverse Screws
and the Locking Screw Holder is slid
back (Fig. 64). Turn the locking screws
in place until the Torque Wrench slips or
an audible click is heard.

**Note: The locking screws only engage
in one orientation. The wider opening
(Fig. 65) must be pointing toward
the screw. Additionally, to avoid mis-
threading, the screwdriver shaft should
be perpendicular to the Base Plate
to properly screw down the locking
screw. Failure to slide back the Locking
Screw Holder can block locking screw
insertion.**



Fig. 63



Fig. 64



Fig. 65

Base Plate Removal

Should the Base Plate ever need to be removed, the Locking Screw Caps and Inverse/Reverse Screws are removed by utilizing the Hexagonal Screwdriver (Fig. 66). If removal is intraoperative, the Base Plate can be removed by levering with an osteotome. If removal is postoperative, standard osteotomes are first used to disassociate as much of the bone ingrowth area as possible from the implant. Each bolt of the Base Plate Remover is threaded into the Base Plate using the Hexagonal Screwdriver. This is done by moving the barrel over to one side, threading one bolt into a screw hole in the Base Plate, then moving the barrel to the other side and inserting the second bolt into the other screw hole (Fig. 67). Thread down the bolts until the instrument is securely attached.



Fig. 66



Fig. 67

A Standard Slaphammer, such as the VerSys® Slap Hammer (00-6551-006-00), should be screwed into the body of the Base Plate Remover (Fig. 68). Repeatedly impact until the Base Plate has been removed.



Fig. 68

If not placed previously, attach a Trial Glenosphere to the Base Plate by hand or with the Glenosphere Helmet (Fig. 69).



Fig. 69

Implant Insertion

Glenosphere Assembly

The Glenosphere is typically inserted prior to humeral component final seating to maximize exposure of the glenoid and ease of insertion. Ensure all soft tissue is removed around the Base Plate to allow the Glenosphere to completely seat.

Assemble the Glenosphere Helmet Inserter by threading the Dual Taper/Spacer Impactor into either the 36mm (green) or the 40mm (yellow) Glenosphere Helmet (Fig. 70). Insert the appropriate diameter Glenosphere into the helmet by sliding it into the helmet so that the Glenosphere is held in place by the body of the helmet and the tabs rest securely underneath the Glenosphere (Figs. 71 & 72). Wipe the Base Plate taper clean of all fluids. Place the *Zimmer* Shoulder Shoehorn Retractor on the posterior side of the glenoid to aid in retracting the humerus and other soft tissue (Fig. 73). When approaching the Base Plate, a finger can be placed on top of the Glenosphere to help guide and feel the Glenosphere slide over the taper into position. **Note: While engaging the Glenosphere, it is important to monitor the position of the proximal humerus and provisional along with retractors since they could interfere with Glenosphere placement.** Once the Glenosphere is seated evenly and circumferentially, use your free hand to press firmly on the Glenosphere to secure it to the Base Plate. Keeping a finger on the Glenosphere, remove the Glenosphere Helmet pulling the instrument away in the SAME DIRECTION used to insert the Glenosphere (i.e. If an anterior approach was used to insert the Glenosphere, remove the instrument by pulling it from the anterior direction). This will help minimize changes to the Glenosphere placement on the Base Plate and damage to the Glenosphere Helmet itself.

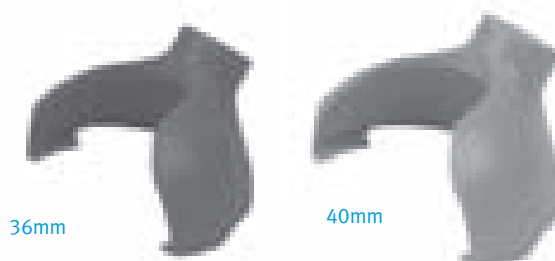


Fig. 70

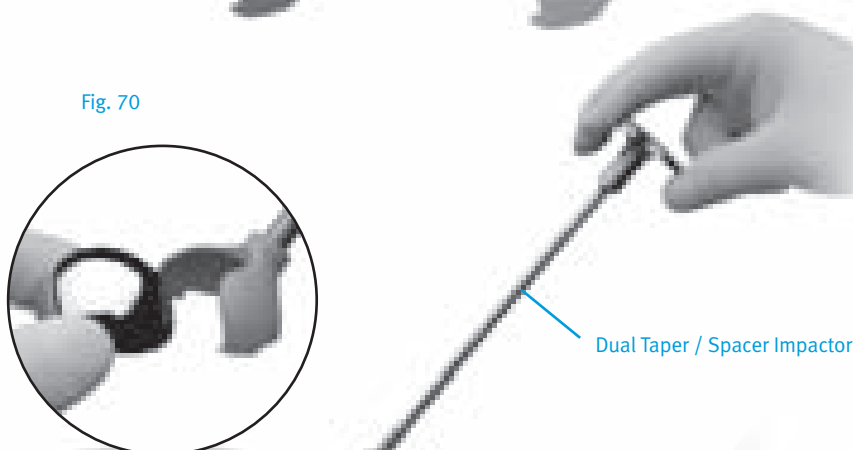


Fig. 71

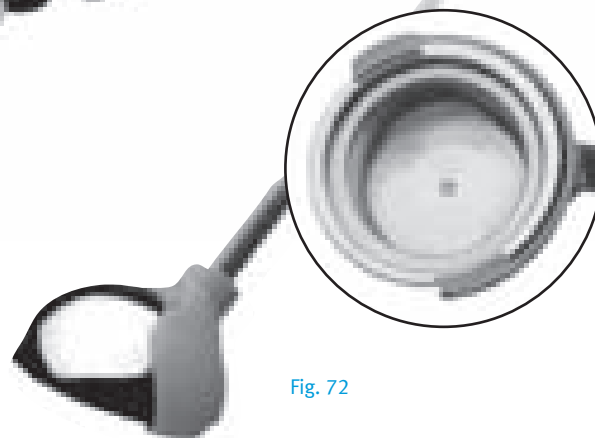


Fig. 72

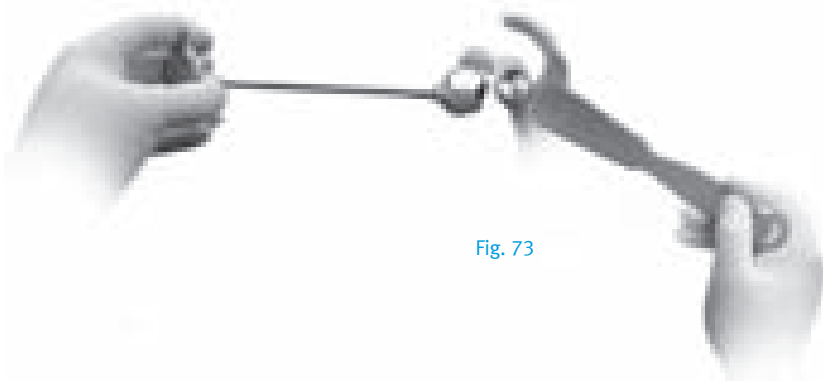


Fig. 73

Note: If unable to visually confirm an even, circumferential engagement of the Glenosphere to the Base Plate, consider the use of a fluoroscope to aid in the confirmation. Seating of the Glenosphere to the Base Plate can be examined in the axillary view or in a view parallel to glenoid version. The medial rim of the Glenosphere should be parallel to the face of the Base Plate (Fig. 74).

Assemble Glenosphere Impactor Head to the Impactor Handle and place the Glenosphere Impactor Head centrally on the Glenosphere. Strike the Glenosphere Impactor Head with 3 firm mallet strikes to engage the glenosphere on the base plate (Fig. 75). Pull on the Glenosphere to verify the taper is locked. Reconfirm the circumferential engagement with the Base Plate. Reduce the joint, and confirm range of motion.



Fig. 74

Glenosphere Removal

Should it become necessary to remove the Glenosphere, the Glenosphere Distractor can be used. Assemble the Glenosphere Distractor. Wedge the fin tip between the superior glenoid bone and the underside of the Glenosphere (Fig. 76). There must be good contact on these two surfaces for disengagement to occur. Pull the Glenosphere Distractor trigger until it fires. The Glenosphere head should be loose enough to gently remove by hand. If not, repeat the step making sure there is contact between the distractor tip, the glenoid bone surface and the Glenosphere. Trial if necessary and implant the final Glenosphere as described on pages 30-32. Reduce the joint and confirm range of motion.

Fig. 76



Please refer to page 14 for humeral placement.

Fig. 75





Anatomical Shoulder System Portfolio

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