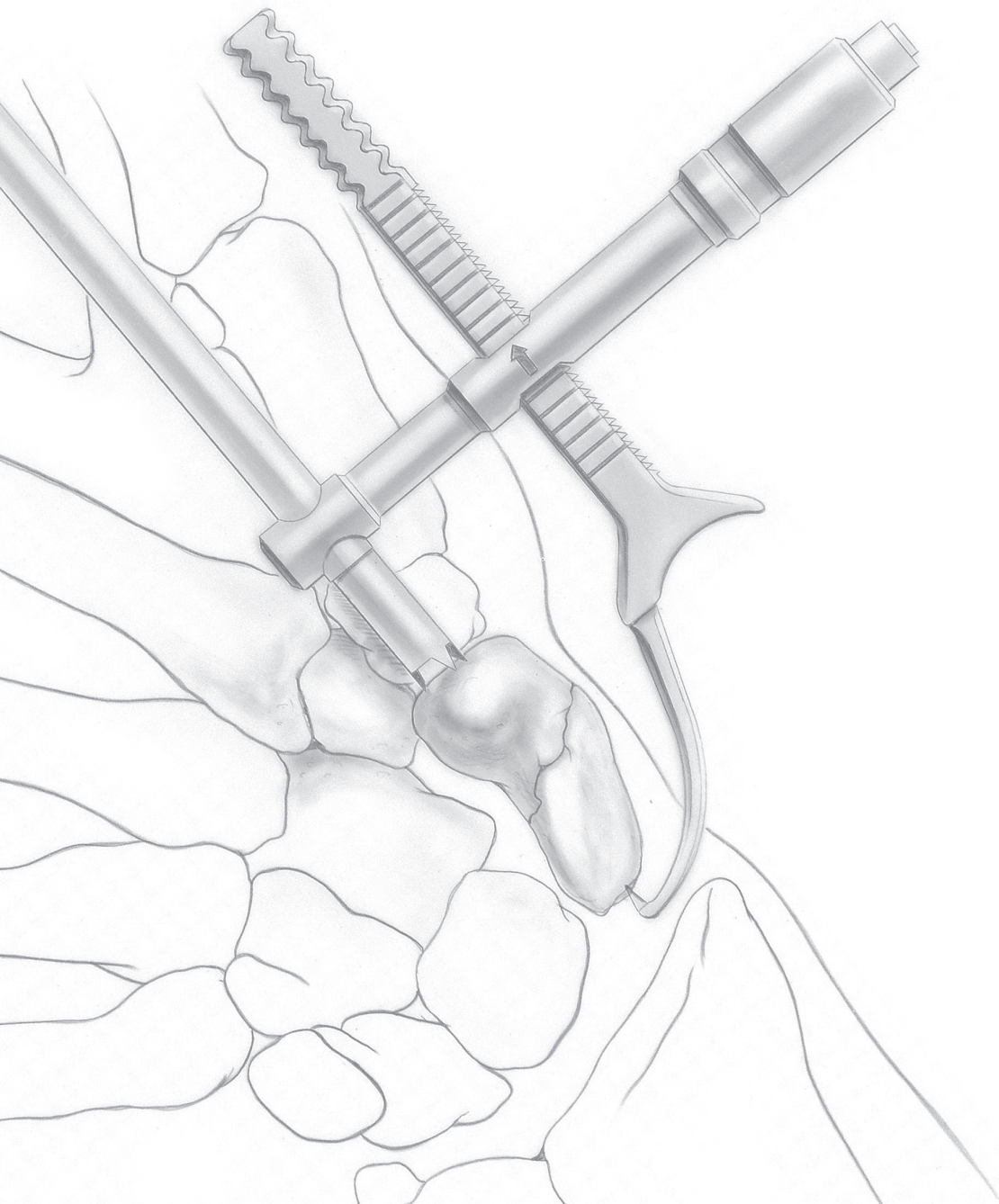




Zimmer® Herbert/Whipple® Bone Screw System

Screw Installation
Surgical Technique



zimmer
Personal Fit. Renewed Life.®

INDICATIONS FOR USE

The *Herbert/Whipple*® Bone Screw System (3.0mm diameter, cannulated) are indicated for the fixation of fractures and non-unions of small bones and small bone arthrodeses, including, but not limited to, scaphoid fractures; intra-articular fractures of the tarsals, metatarsals, carpals and metacarpals; bunionectomies and osteotomies; arthrodeses of small joints (e.g. phalanges); fractures of the patella, ulna and radial styloid.

CALIBRATION CHECK

The calibration of the Alignment Guide (Fig. 1) should be checked periodically as it is possible for the blade to become distorted with rough usage.

Assemble the Guide and insert the Drill or Tap through the barrel. Apply tension to the blade as shown. Check to be sure that the blade tip is centered on the tip of the Drill or Tap within a 1mm diameter range. When the blade is assembled to the barrel body, the distance between the tips of the barrel and blade should measure 2mm longer than the screw length read on the calibrated blade.

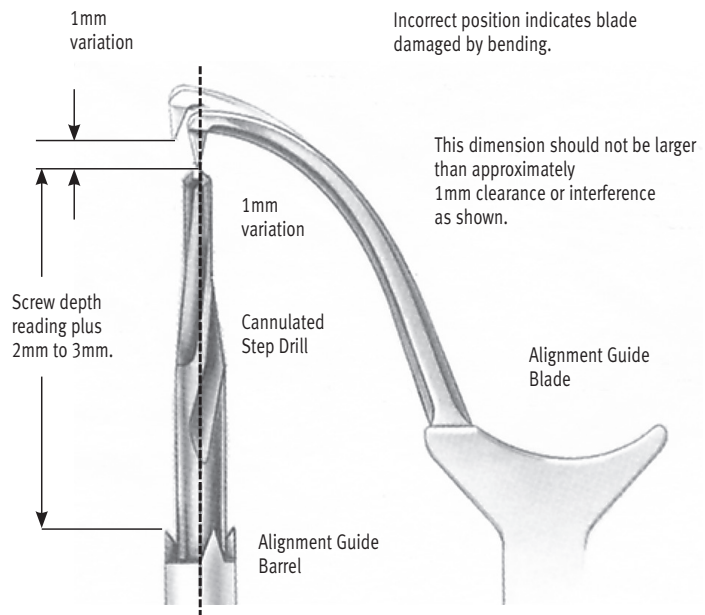


Fig. 1 – Calibration Check

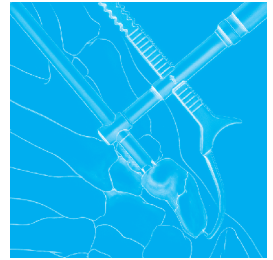
SCREW INSTALLATION

(Scaphoid Fracture Example)

Step 1—Alignment Guide Application

Set the screw depth on the Alignment Guide at approximately 30mm. Distract the wrist by pulling on the index and long fingers. Use a curved mosquito, or other clamp to develop the 1-2 portal from the inside out, adjacent to the extensor carpi radialis longus tendon. The 1-2 portal is located between the first and second extensor compartments in the dorsal aspect of the snuff box. Introduce the blade of the Alignment Guide through this portal. Advance the blade in an ulnar direction to the level of the scapholunate ligament with the hook facing “volarward”. Then sweep the hook dorsally and seat it into the articular surface of the proximal pole of the scaphoid. Optimal placement is essential to avoid the Guide Wire or screw penetrating either the volar or ulnar concave surfaces of the scaphoid. To insert the Guide Wire more centrally in the cancellous bone, the target hook of the Alignment Guide should engage the proximal pole adjacent to the widest part of the lunate facet, 1mm to 2mm radial to the scapholunate ligament.

This position requires a familiarity with the three-dimensional shape of the scaphoid and may not be as far dorsal as expected (Fig. 2). When the hook is engaged, hold it in position with traction on the handle of the Alignment Guide.



Preoperative A/P—Acute compressed fracture of the volar cortex

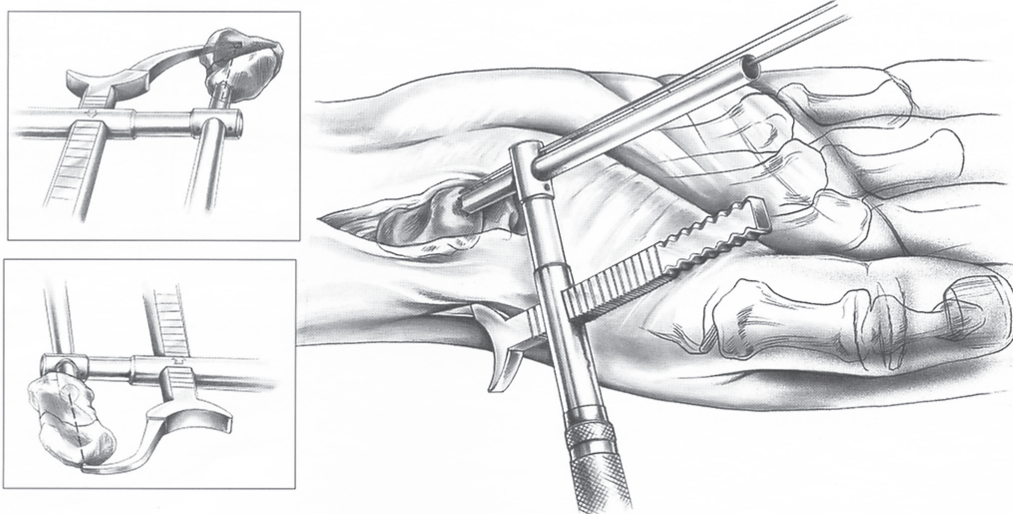


Fig. 2 – Showing correct alignment of Alignment Guide perpendicular to fracture



Hyperextend the thumb to move the trapezium dorsally. Maintaining traction on the Alignment Guide, compress the barrel portion of the Alignment Guide against the distal pole of the scaphoid just above the volar scaphoid tubercle. The most dorsal tooth of the guide barrel must engage articular cartilage, ideally about mid-width on the distal pole. Try to be as perpendicular to the fracture as possible. When the line appears to be correct, squeeze the blade toward the barrel to push the teeth of the barrel onto the bone.

Check the reduction of the fracture and make any necessary adjustments (Fig. 3). When bone grafting, be sure that the graft remains in position while the Alignment Guide is compressed as tightly as possible.

Step 2—Determine Screw Length

Read the screw length from the calibrations on the Alignment Guide (Fig. 3 Inset). Be sure that the screw depth is read from the correct portion of the Alignment Guide as illustrated.

Step 3—Insert Wires

NOTE: It is imperative that only the Guide Wires included with the set are used to perform this procedure. These wires are sized precisely for the depth gauges and cannulated instruments. Guide Wires should be inserted at high RPMs, but with minimal axial pressure. Excessive pressure to speed the insertion compromises the cutting capability of the Guide Wire point. This leads to bending in cortical bone.

Insert the Free-Hand Guide Insert Sleeve (Guide Sleeve) into the barrel of the Alignment Guide. Wire penetration can be controlled using the Depth Gauge to insert the primary Guide Wire into a wire driver at the correct depth (Fig. 4). Drive the wire into the bone through the Guide Sleeve until the wire driver bottoms out on the Guide Sleeve (Fig. 5). Remove the wire driver and Guide Sleeve.

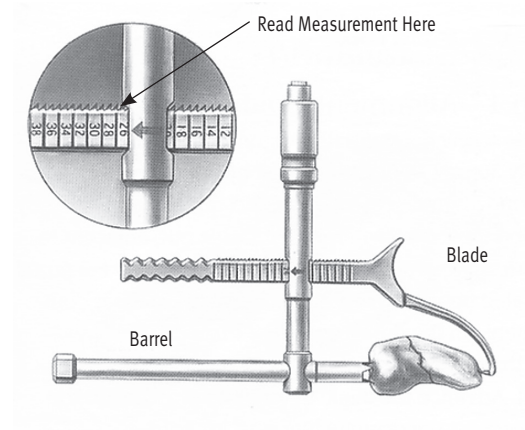


Fig. 3— Positioning of Alignment Guide

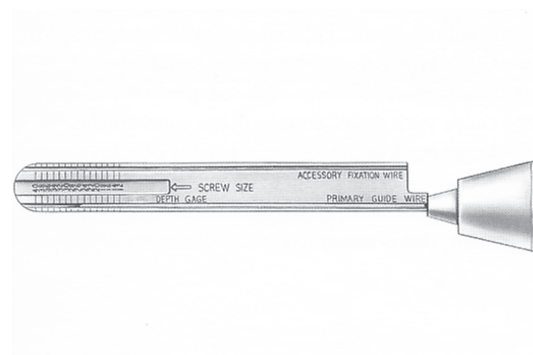


Fig. 4 – Depth Gauge showing primary Guide Wire measurement

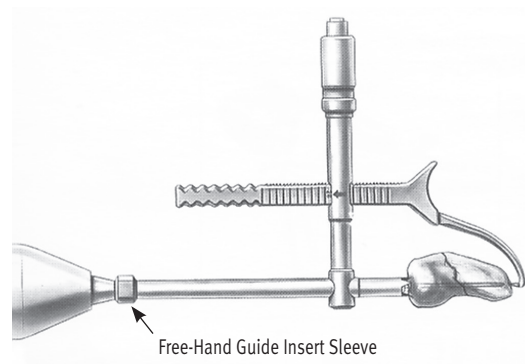


Fig. 5 – Primary Guide Wire Placement

Use an x-ray or image intensifier to verify the positions of both the Alignment Guide and the primary Guide Wire. There should be at least 2mm of bone on each side of the wire in every projection. If necessary, withdraw the wire, reposition the Alignment Guide, and reinsert the Guide Sleeve and the wire.

Remove the Guide Sleeve. Use the Depth Gauge to measure the accessory Guide Wire in a wire driver for the same depth as the primary Guide Wire (Fig. 6). Place this wire parallel to the primary wire through one of the two holes adjacent to the barrel of the Alignment Guide (Fig. 7). This will help prevent fragment rotation during screw insertion. Drive the wire until the wire driver bottoms out on the end of the Alignment Guide barrel. Then bend the accessory wire away from the Alignment Guide barrel slightly to move it from the path of the instruments.

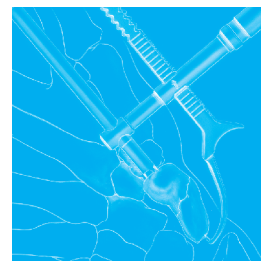


Fig. 6 – Depth Gauge showing accessory Guide Wire measurement

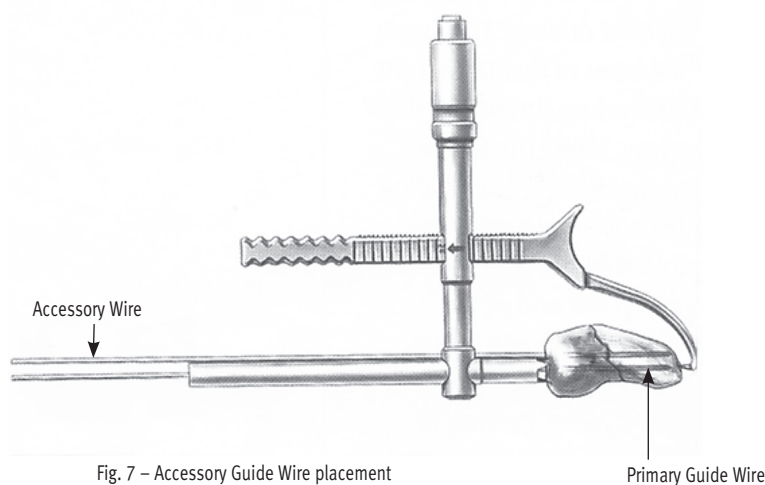


Fig. 7 – Accessory Guide Wire placement

Primary Guide Wire



Step 4—Broach the Cortex

For most scaphoid bones, this step is not necessary. For extremely hard bone, attach the Cannulated Cortical Broach to the Modular Handle and slide it over the primary Guide Wire (Fig. 8). Turn the handle clockwise and advance the broach until it bottoms out on the end of the Alignment Guide barrel. This will remove a small amount of bone from the cortical surface and facilitate the use of additional instrumentation. Alternatively, power instruments may be used to drive this broach.

NOTE: Use the Cortical Broach prior to drilling with the Step Drill when any hard cortical bone is encountered.

NOTE: Many scaphoid non-unions develop sclerotic bone at the pseudarthrosis. In such a case, the optional Gliding Hole Drill should be used in place of the Cortical Broach.

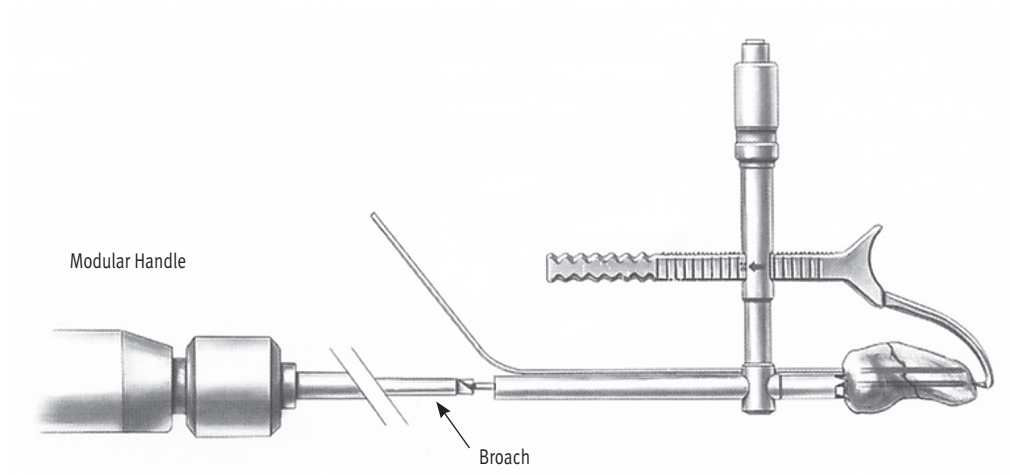


Fig. 8 – Broach

Step 5—Drill

Use the Cannulated Step Drill over the primary Guide Wire to drill the pilot hole (See Table 1 for drill options). Slide the adjustable stop Sleeve onto the Drill and set it for the appropriate screw length (Fig. 9 Inset). The hole should be drilled using a cannulated Jacob's Chuck and power drill. Alternatively, for soft bone, the Step Drill can be attached to the Modular Handle for manual drilling. The small diameter of this Drill is for the leading threads of the screw, while the larger diameter is for the trailing threads and shank. Drill until the Sleeve bottoms out on the end of the Alignment Guide barrel.

NOTE: Never drill over a bent K-wire. Drilling of hard cortical bone should be done at high RPMs (700 to 1,500), but with minimal axial pressure and minimal bending force on the drill bit. Never force the drill bit

through the bone. Remove it periodically for cleaning and cooling if necessary. If the drill bit seems to stick, remove the bit and clean debris from the flutes with the brush provided. Rinse the bit and the bone with cool saline solution. Repeat as necessary.

Gliding Hole Drill (Optional)

In thick regions of hard bone, the Gliding Hole Drill should be used in place of the Cortical Broach. Over-drilling for the core diameter of the trailing threads facilitates burying the *Herbert/Whipple* Bone Screws in dense bone.

NOTE: The smaller-diameter Step Drill is appropriate for drilling cancellous bone. The Gliding Hole Drill should not be used in the cancellous bone.

NOTE: The Gliding Hole Drill requires use of AO Quick Connect.

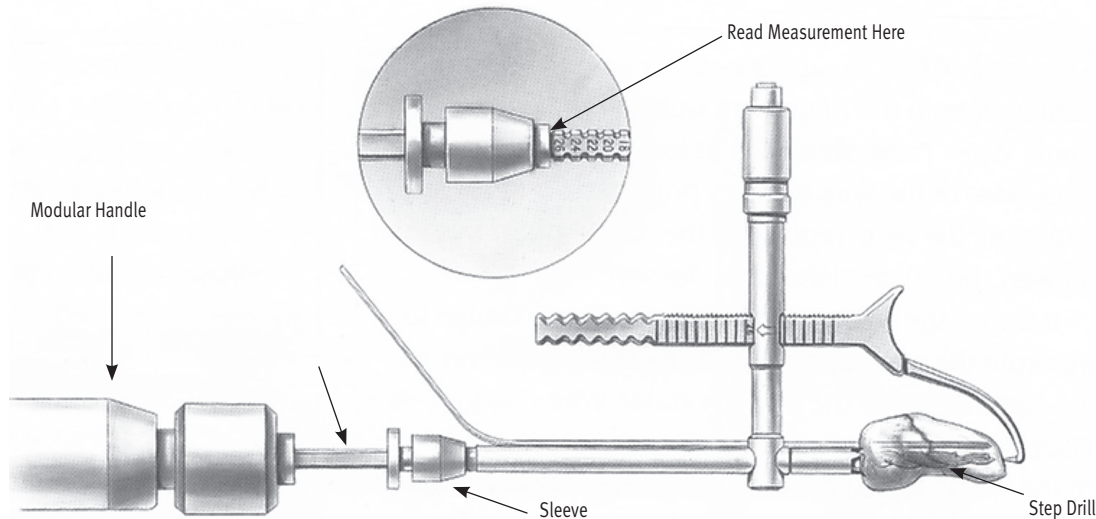


Fig. 9 – Drill pilot hole

Table 1: Cannulated Step Drills

Drill Shaft	Drill Tip	Connection Type
00-1152-013-00	00-1152-015-00	AO Quick Connect
00-1152-010-00	00-1152-015-00	Modular Handle
00-1152-003-00 (One Piece)		Modular Handle

Note: All step drills have the same drilling diameters.



Step 6—Tap (Recommended only for sclerotic bone)

Attach the Tap to the Modular Handle. Slide the adjustable stop Sleeve onto the Tap and set it for the appropriate screw length (Fig. 10 Inset). Tap the hole for the leading threads of the screw (Fig. 10). This is an optional step recommended only for sclerotic bone because the leading and trailing threads of the implant are self-tapping. Tap until the Sleeve bottoms out on the end of the Alignment Guide barrel. It is important that the Tap be inserted to the full drill depth selected to avoid losing the compressive action of the screw. The Tap must not be turned beyond the depth of the Sleeve or the bone threads will be stripped.

NOTE: If at any time during the procedure, a Guide Wire is found to be bent, the wire must be removed and a new wire inserted. The 1mm Guide Wires are intended to be single-use items. Do not use Guide Wires that are bent,

cracked, or otherwise damaged. Check each Guide Wire prior to use to assure that it has not been damaged. Bent wires will cause the cannulated instruments to bind or break.

If the Guide Wire is removed with the Cannulated Drill, the wire can be reinserted by first inserting the Guide Sleeve into the barrel and then reinserting the wire, blunt end first. Tap the wire once or twice to anchor it in the bone.

The shafts and tips of the Drill bit and Tap should be evaluated periodically for straightness. A bent tip could lead to oversizing the hole or fracture of the tip. A bent shaft could cause impingement in the guide barrel and hinder the surgical procedure.

The Drill and Tap shafts should pass freely through the guide barrel. Carefully inspect these tools for bends, cracks, and dulling. Replace worn or damaged items.

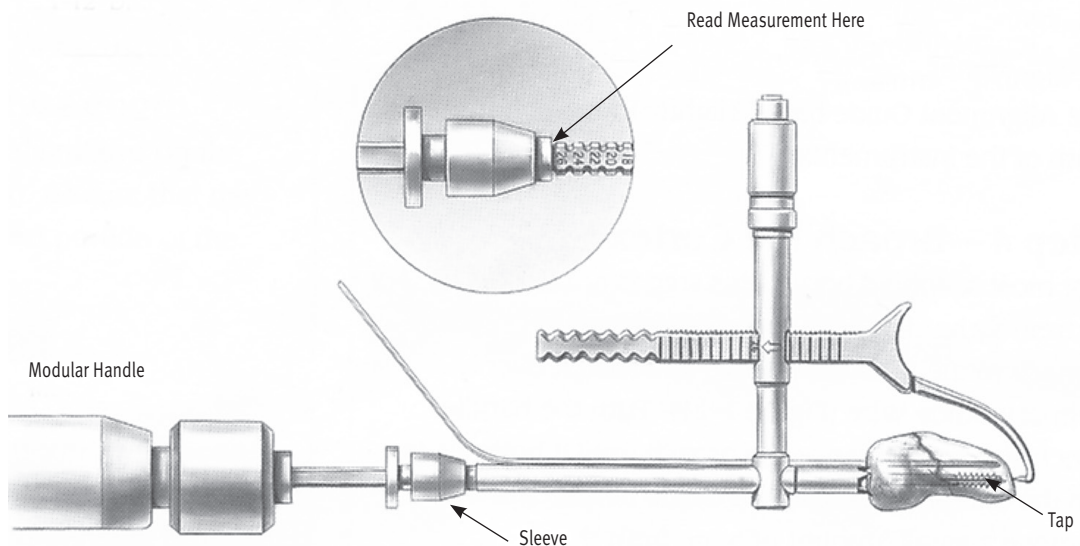


Fig. 10 – Tap

Step 7—Insert the Screw

Attach the Screwdriver to the Modular Handle. Insert the screw and Screwdriver over the Guide Wire and into the barrel of the Alignment Guide. Turn the Screwdriver until the stop bottoms out on the end of the guide barrel as shown (Fig. 11). The Screwdriver should be advanced a few more turns to further bury the screw head below the bone surface. The advancing screw will “walk” off the end of the Screwdriver as it is seated.

When the screw is fully seated, remove the Screwdriver, primary Guide Wire, and Alignment Guide. The accessory Guide Wire can be removed, or, if desired, it can be left in place for two weeks to help control rotation of the fragments during initial healing. If the accessory wire is bent, it must be cut before removing the Alignment Guide. To ensure that the screw head is completely buried, inspect the entry point on the distal pole of the scaphoid. If necessary, reapply the Screwdriver and rotate the screw one more revolution.

Put the wrist joint through a full range of movements to check the security of fixation and to ensure that the screw has not penetrated proximally. This can also be checked by feeling around the proximal pole of the screw with the curved blade of the Dissector or with a repeat x-ray image. Carefully trim off any protuberant bone graft.

SPECIAL NOTE: Although the Alignment Guide will normally ensure accurate positioning of the screw, intraoperative radiographs are suggested. It does take practice to become familiar with the application of the Alignment Guide and the use of an image intensifier may be helpful.

Familiarization with this procedure on cadaver wrists is strongly recommended. Intraoperative radiographs should also be made to confirm satisfactory reduction of the fracture and placement of the screw.

The most common error is to apply the barrel of the Alignment Guide either too volar so that the screw exits dorsally, or too medially so that the screw penetrates the scaphocapitate joint. This can be prevented by carefully checking the position of the Guide Wire before drilling and is an important failsafe of the *Herbert/Whipple* design.

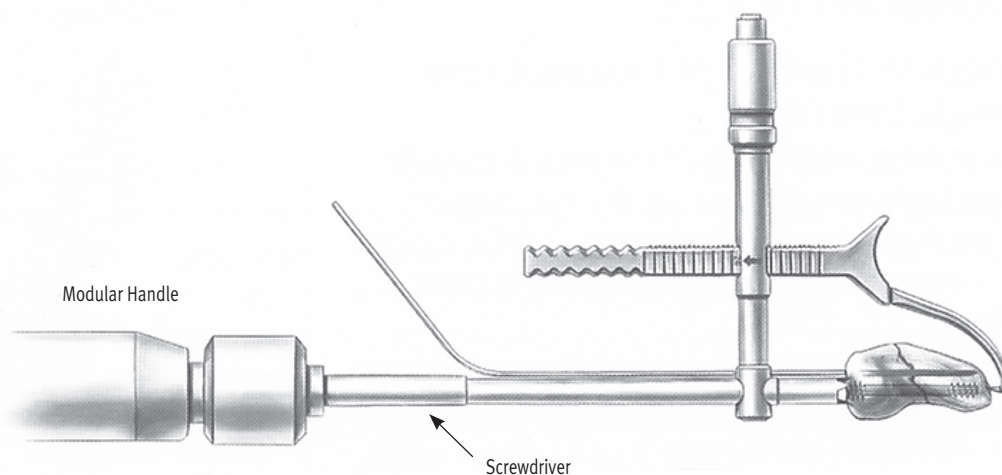
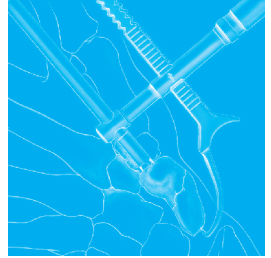


Fig. 11 – Insert Screw

Step 8—Screw Removal

Because the screw is completely buried within the bone, removal is not usually indicated. However, should removal become necessary, use the Trepine to cut the bone around the trailing thread of the screw (Fig. 11). Remember to remove all soft tissue from the sockets of the screw so the Screwdriver drive prongs can be fully engaged. Then insert a Guide Wire in the screw and place the Screwdriver over the Guide Wire to remove the screw.

Technique Variations

Hard Bone Fixation

The *Herbert/Whipple* Bone Screws were designed for use in both cancellous and cortical bone; however, alternate surgical steps are required to optimize use in hard bone (cortical bone, dense cortical/cancellous bone or sclerotic bone).

In small bones subject to high loads, e.g. metatarsals, it is best to capture cortical bone on both ends of the screw because cortical bone provides stronger fixation and the resistance to fracture gap motion will be greater. Situations include:

- Interphalangeal fusion of the digits
- Fixation of oblique metatarsal osteotomies
- Fixation of certain carpal or tarsal fractures

The Herbert/Whipple instrumentation has been calibrated to assure that the bone screw will be buried 1.6mm below the near cortex. If the bone screw is being inserted obliquely, a shorter length bone screw may be selected to allow further burying of the trailing threads.

These techniques may require selection of a bone screw which is 2mm to 6mm shorter than the number read on the instruments.

Conversely, when attempting to maximize cortical fixation on both ends of the *Herbert/Whipple* Bone Screw, a screw 2mm longer than indicated by the guide calibrations should be selected. Note that one end of the screw could protrude beyond the cortical surface by approximately 1mm.

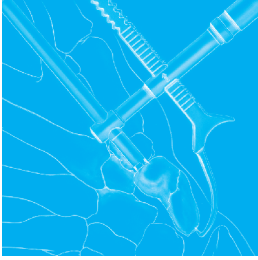


Fig. 11 – Use the Trepine to free the trailing threads from surrounding bony tissues prior to extraction.

Alternate steps:

- 1.If bone is too hard for the points of the drill guides to engage, gouge out a small hollow to assist in location of the guide.
- 2.Overdrill the trailing thread core diameter with the Gliding Hole Drill (00-1152-017-00). Then drill completely through any hard bone in the far fragment with the Step Drill. (See pg. 5, Table 1 for drill options).
- 3.Tap for the leading threads through all predrilled hard bone.

Drilling and tapping bicortically prevents the leading threads of the *Herbert/Whipple* Bone Screws from abutting against the inner cortical wall and accidentally stripping the cancellous thread purchase. Use of the Gliding Hole Drill completely through the near cortex and any sclerotic bone prevents the trailing thread from abutting against the near cortex.



ORDER INFORMATION

Product No.	Description	Qty
00115209000	Herbert/Whipple Cannulated Screw Set	1
Instruments		
00-1152-001-00*	Herbert/Whipple Screwdriver	1
00-1152-002-00*	Herbert/Whipple Cort Broach	1
00-1152-003-00	Herbert/Whipple Bone Screw System Step Drill	1
00-1152-004-00*	Herbert/Whipple Flat Depth Gauge	1
00-1152-005-00*	Herbert/Whipple Cannulated Tap	1
00-1152-006-00*	Herbert/Whipple Alignment Guide	1
00-1152-008-00	Herbert/Whipple Bone Screw System Small-Cannula Cleaner	1
00-1152-009-00	Herbert/Whipple Bone Screw System Pencil-End Brush	1
00-1152-010-00	Herbert/Whipple Bone Screw System Cannulated Drill Shaft	1
00-1152-013-00*	Herbert/Whipple Cannulated Step Drill Shaft	1
00-1152-015-00*	Herbert/Whipple Cannulated Step Drill Tip	2
00-1152-017-00	Herbert/Whipple Bone Screw System Gliding Hole Drill	1
00-1152-050-00*	Herbert/Whipple Guide Wire, 1mm Dia X 15Cm	1
00-1152-052-00*	Herbert/Whipple Freehand Guide Insert Sleeve	1
00-1152-055-00*	Herbert/Whipple Freehand Depth Gauge	1
00-1152-060-00*	Herbert/Whipple Adjustable Stop Sleeve	2
00-1152-070-00*	Herbert/Whipple Cannula	1
00-1152-071-00*	Herbert/Whipple Obturator	1
00-1152-095-00*	Herbert/Whipple Screw/Instrument Case	1
00-1152-097-02	Herbert/Whipple Bone Screw System Cannulated Screw/Instrument Case	1
00-1154-008-00	Herbert Bone Screw, Dissector	1
00-1154-010-00*	Herbert/Whipple Trephine	1
00-1154-040-00	Herbert Bone Screw Double-Ended Retractor	2
00-1154-078-00	Herbert Small Retractor	1
00-1154-090-00*	Herbert/Whipple Modular Handle	1
00-1154-092-00	Herbert Bone Screw Freehand Guide**	1
00-1156-095-00	Herbert General Instrument Case	1
00-2910-002-00	Key Periosteal Elevator, 6.4mm Blade W	1
00-3027-000-00	Heiss Soft Tissue Retractor	1
00-3088-020-00	Hohmann Retractor, Small, 6mm	1
00-3088-021-00	Hohmann Retractor, Small, 8mm	1
00-4812-000-00*	Self-Holding Screw Forceps, Mini	1
00-4816-001-00	Reduction Forcep, Ratchet, Serr W/Pts, Nr, 133mm	1
00-4816-005-00	Reduction Forceps, Ratchet, W/Points, 130mm	1
00-4817-001-00	Sharp Hook	1
Implants		
00-1152-012-00*	Herbert/Whipple Cann Bone Screw 12mm	2
00-1152-014-00*	Herbert/Whipple Cann Bone Screw 14mm	2
00-1152-016-00*	Herbert/Whipple Cann Bone Screw 16mm	2
00-1152-018-00*	Herbert/Whipple Cann Bone Screw 18mm	2
00-1152-020-00*	Herbert/Whipple Cann Bone Screw 20mm	2
00-1152-022-00*	Herbert/Whipple Cann Bone Screw 22mm	2
00-1152-024-00*	Herbert/Whipple Cann Bone Screw 24mm	2
00-1152-026-00*	Herbert/Whipple Cann Bone Screw 26mm	2
00-1152-028-00*	Herbert/Whipple Cann Bone Screw 28mm	2
00-1152-030-00*	Herbert/Whipple Cann Bone Screw 30mm	2

*Note: This is a purchase only set - includes both implants and instruments

**Refer to the Zimmer Herbert Bone Screw and Zimmer Herbert Mini Bone Screw Surgical Technique (97-1150-002-00) for the Freehand Guide Technique.

WARNING: This device is not approved for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic or lumbar spine.

DISCLAIMER:

This documentation is intended exclusively for physicians and is not intended for laypersons. Information on the products and procedures contained in this document is of a general nature and does not represent and does not constitute medical advice or recommendations. Because this information does not purport to constitute any diagnostic or therapeutic statement with regard to any individual medical case, each patient must be examined and advised individually, and this document does not replace the need for such examination and/or advise in whole or in part.

Please refer to the package inserts for important product information, including, but not limited to, indications, contraindications, warnings, precautions, and adverse effects.

Contact your Zimmer representative or visit us at www.zimmer.com

The CE mark is valid only if it is also printed on the product label.

