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Revision 1

UNDERWATER SHIP HUSBANDRY MANUAL

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CHAPTER 10
DIVER TOOLS

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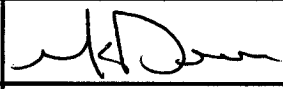
Acquisition	M. S. DEAN		NAVSEA	00C5	9/21/99
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FOREWORD

The purpose of this manual is to provide operation and maintenance instructions for Underwater Hydraulic Diver Tools. It applies to organizational level maintenance activities.

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CHAPTER 10
DIVER TOOLS
SAFETY SUMMARY

GENERAL SAFETY PRECAUTIONS. General safety precautions are outlined in Chapter 2, Section 6 of this publication. The operation of diver tools can be extremely hazardous. Hazards to operators may be encountered from moving parts and flying debris. The following additional safety precautions supplement the specific warnings provided in the Appendices for individual tools. These general precautions are related to the task of underwater hydraulic diver tools. They are precautions that shall be understood and applied before and during work using both underwater hydraulic powered diver tools. In addition, personnel shall be familiar with and observe safety precautions set forth in the following publications:

1. Navy Safety Precautions for Forces Afloat, OPNAV 5100 series
2. Naval Ships' Technical Manual (NSTM)
3. Technical/operating manuals for equipment
4. U.S. Navy Diving Manual, Volume I, NAVSEA 0994-LP-001-9010

Do Not Repair or Adjust Alone.

Do not repair or adjust energized equipment alone. The presence of a qualified individual capable of rendering aid is required. Always protect against electrical grounding hazards and make adjustments with one hand free and clear of equipment. Be aware that even after equipment has been deenergized, dangerous electrical hazards can exist due to capacitors retaining electrical charges. Circuits must be grounded and capacitors discharged.

Do Not Operate Diver Tools Alone.

Do not operate diver tools alone. Diver tools operate through the action of hydraulic fluid under pressure. Failure at any point in a pressurized hydraulic system presents a hazard in addition to those inherent in the operation of the tools themselves. The presence of a qualified individual capable of rendering aid is required.

Equipment in Motion.

Remain clear of equipment in motion. A safety watch will be posted if the equipment requires adjustment while in motion. The safety watch shall be in communication with divers and have immediate access to controls which are capable of stopping equipment. If at any time equipment or any tool appears to be out of control, stop the equipment immediately.

Exercise caution when moving equipment and tools between underwater work sites and the surface.

First Aid.

Attend to all injuries, however slight, by obtaining first aid or medical attention immediately.

Resuscitation.

Personnel shall be familiar with approved resuscitation methods. Begin resuscitation immediately if someone is injured and stops breathing. A delay could cost the victim's life. Resuscitation procedures shall be posted where electrical or other hazards exist.

Minimize Relative Motion.

Relative motion is the movement of two or more objects in relation to each other. This poses unique hazards to divers. A common example is a nest of ships swaying and bouncing against each other as a result of wind and wave motion. This motion would easily crush a diver caught between two of the ships. To reduce the hazards of relative motion and simplify the work, suspend any down lines or other rigging, work platforms, or repair habitats from fittings on the ship. Ensure that hydraulic hoses for diver tools are deployed in the safest and most efficient manner.

WARNINGS AND CAUTIONS.

Specific warnings and cautions related to diver tools usage are summarized below for emphasis and review.

WARNINGS

Always operate the saw with the bar tip guard installed to reduce the possibility of kickback and operator injury. The only task which requires removal of the guard is piercing a hole (e.g., through a wooden deck) to begin cutting.

Always wear eye protection when drying components with pressurized air.

Always wear eye protection when operating the chainsaw.

Always wear eye protection when operating the grinder.

Always wear eye protection when using diver operated pump and cutter on surface.

Always wear eye protection when using diver operated pump and the wire rope cutter on the surface.

Always wear eye protection when using diver operated pump or Jack Ram on the surface.

Always wear eye protection when using grinder topside.

Always wear eye protection when using grinder topside.

Avoid kinking of thermal plastic hose, never apply pressure through a kinked hose.

Avoid prolonged contact with skin or prolonged breathing of vapors. Use with adequate ventilation.

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

WARNINGS

Before attaching auger bits, ensure 1 1/2” square female to 5/8” quick change chuck adapter is secured by retainer pin and O-ring.

Brake fluid, cylinder oil, etc., will seriously damage this hydraulic cylinder. Use only Houghton 1192 hydraulic fluid.

Carry the saw with the bar pointing to the rear.

Center load on the cylinder plunger. Do not lift off-center loads. Off-center loads place considerable strain on cylinders and plungers and may be unstable.

Come-along wire rope, hooks, and safety catches must be inspected for damage prior to each use or operation and daily by a competent person.

Cylinder saddle or attachments must fully engage the load and not be partially engaged in any way.

Diver must wear 1/4-inch neoprene wet suit hood while operating chipping hammer underwater. The maximum operating time per diver is three hours and 40 minutes per each 24-hour period.

Do not allow fingers to come between the latch and drill steel when closing the latch.

Do not allow the loaded wire rope to rotate.

Do not charge the accumulator to more than 90 psi

Do not exceed the maximum recommended operating pressure or flow.

Do not lift pump by pulling on hydraulic hoses. Use a suitable line secured through the eye in the motor housing. Do not put hand near suction screen while pump is running.

Do not operate wrench with relief adjustment screw turned in more than one turn from bottom or less than three turns from top of its travel.

Do not puncture, incinerate, or store can above 120°F.

Do not use chains less than 5/8-inch in diameter. Use Spectrum 7 chain as specified. Other chain could break under the load.

Do not use grinding wheels without an internal reinforced fiber bond on the surface after use underwater. Water remaining in the wheel could cause that wheel to explode during surface operation.

Do not use the oiler underwater.

During the operation of this tool a wet suit must be worn.

Ensure hoses being set up are of the proper pressure rating. Never substitute a hose assembly rated for medium pressure application for a high-pressure application.

WARNINGS

Ensure hydraulic power to the grinder is secured before removing or attaching grinding wheels or brush attachments.

Ensure that hose connections are secure between pump and cylinder. Due to pressure in the accumulator, it may be necessary to use a pair of slip-joint pliers to connect the quick-disconnect couplings.

Exercise caution when cutting wire rope under tension to prevent personal injury.

Guard against chainsaw kickback to prevent serious injury to the operator or observers. To avoid kickback, keep the top side of the bar nose free from contact with other objects. Run at full power; do not run the chainsaw slowly at start or during cut. Never cut with a loose or dull chain.

High pressure hydraulic fluid is combustible. Avoid contact with ignition sources.

High-pressure fluid leaks can be extremely dangerous. Never operate a system with damaged or leaking components.

High-pressure leaks are extremely dangerous. Wear eye protection when working with high-pressure hoses. Use only high-pressure hoses rated for the working pressure of the tools to be used.

Hoses must be checked for damage before starting any operation.

HPU must be set to zero flow rate (gpm) before lowering tools to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

Hydraulic components utilized by the cutter have a maximum safe working pressure of 2,500 psi. Exceeding this pressure may cause damage to the hydraulic system and could be dangerous to the operator.

Inspect all components before use, do not use worn or damaged components.

Kinked wire rope will not operate in the come-along.

MIL-C-23411 and equivalent water-displacing oils are extremely flammable. Keep from open sparks, fires and open flames.

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

Never cut a cable that may be under tension without attaching a stopper to both sides of the intended cut. A taut cable whips when cut and may result in serious injury to the operator.

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

Never exceed 5,000 psi inlet pressure to Jack Rams when they are configured with accessories.

WARNINGS

Never exceed the 5-ton rated load capacity of the jack attachments.

Never exceed the 8-ton rated load capacity of the pull cylinder.

Never exceed the maximum recommended operating pressure (psi) or flow (gpm).

Never lift by or have hands near blades. Always tie safety tag lines to the pile to control its fall.

Never operate the grinder without its guard in place.

Never operate the saw with a loose chain.

Never operate wrench without securing relief screw jam nut.

Never pressurize a hose assembly unless quick-disconnect couplers are properly mated together.

Never pressurize hose assemblies or diver operated pump without hose end couplings properly connected between pump and tool being used. High pressures applied when couplings are improperly coupled could break hose connections and cause dangerous high-pressure leaks.

Never stand directly in front of the grinding wheel when it is first started or is operating.

Never stand under a load being lifted by the come-along.

Never stand under a load being lifted by the jack. Tool or hose failure could cause the load to drop and result in injury to personnel.

Never stand under a load being moved by the pull cylinder. Tool or hose failure could cause the load to drop.

Never use a grinding wheel rated at less than 6,000 rpm. Never exceed the maximum operation speed for the grinding wheel.

Never use a grinding wheel rated at less than 8,900 rpm. Never exceed the maximum operation speed for the grinding wheel.

Never use an unreinforced grinding wheel which has been dropped.

Never use dirty or unlubricated wire rope.

Never use grinding wheels which do not contain internal reinforcement and have been dropped.

Never-Seez or equivalent anti-seizing compound is combustible.

Never-Seez or equivalent contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting. Call a physician.

WARNINGS

Only 7/16-inch wire ropes (Part number C-12) may be used. Other wire ropes may deform under pressure of the jaws, or develop other defects causing malfunction of the machines. Personnel injury or death may result.

Operate the chainsaw with caution to avoid physical contact with the moving chain.

Operators must wear gloves when handling the wire rope to prevent injury to their hands.

Protect the wire rope from abrasion due to rubbing over sharp edges.

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

Secure the material being cut underwater. Pieces could float upward and strike the operator or become navigation hazards. While cutting, hold the saw firmly with both hands and thumb firmly locked around front handle. Do not relax grip. Keep left arm straight for best control.

See manufacturer's literature for grinding wheel or wire brush safety warnings.

Set up hoses to preclude vehicle traffic from driving over hose.

Special training in the use of the underwater hydraulic pile cutter is required from NAVCONSTRACEN Port Hueneme, California.

The constant lift buoy has a working depth of 120 fsw. Exposure of buoy to water pressure at depths beyond 120 feet may cause implosion.

The cutoff saw must only be operated underwater. Modifications made to the cutoff wheel guard make the tool unsafe for surface operation. Never operate the saw without the wheel guard in place. Failure to secure wheel attachments can cause personal injury.

The cylinder end cap could be under slight spring tension. Remove it carefully to avoid injury.

The grinder is a high-speed rotary motion tool. To prevent attachments from accidentally coming off during operation, ensure that the grinding wheel and jam nut are securely tightened with a wrench before use. Failure to lock the attachments with this jam nut or other prescribed method of securing attachments can lead to personal injury.

The HPU must be set to a zero flow rate (gpm) before lowering tool to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

The hydraulic power source should be off or set for zero flow while the blades are being changed. Inadvertent triggering of the saw could result in serious injury.

The maximum operating time per diver per 24 hour period is 2 hours 9 minutes with SCUBA headgear, and 2 hours 49 minutes with MK 12 headgear.

The tool must be operated by two divers.

WARNINGS

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

To avoid hose damage, do not place heavy objects on the hose or drive vehicles over the hose. Avoid sharp bends or kinks in the hose. Do not allow the hose to contact sharp edges, rough projections, or hot surfaces. Do not use hydraulic hose to carry a hydraulic component (i.e., pumps, cylinders and valves).

To avoid injury to the diver, open the hydraulic fluid recirculation valve to isolate the hydraulic fluid from the bandsaw while lowering the band-saw to the diver.

To prevent personnel and/or material damage, use caution when applying compressed air. Always wear eye protection. Oil may squirt out of the front cylinder port.

Use in well-ventilated area only.

Use independent wire rope center (IRWC) wire rope only. Standard cable can buckle under pressure, causing the tool to malfunction.

Use recommended accessories only. Use the grinder attachments only for their designated purpose.

Use recommended accessories only. Using grinding wheels with a diameter over 10-inches can produce excessive hydrodynamic drag on the wheel. Use the grinder attachments only for their designated purpose.

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure the work area is well ventilated and away from open flame or possible fire hazards.

Verify proper rotation of the chain on the surface before operating the saw.

Wear eye protection when using chipping hammer topside.

Wearing a wet suit hood is required.

When connecting or disconnecting hoses or fittings, system pressure (psi) must be at “0” psi. Ensure system pressure is at “0” psi.

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool’s operating system.

CAUTIONS

After the next step, the two hammers will be free to slide from hammer frame. Be careful not to drop hammers.

Always use sockets and accessories designed for impact type applications. Standard sockets or accessories shall not be used. They can crack, or fracture, during operation.

Apply clean grease or O-ring lubricant to all parts during reassembly.

Apply O-ring lubricant to all O-rings and areas over which O-rings must slide.

Avoid damaging the fasteners by excessive impacting. When operated at full power or for prolonged periods of impacting, the wrench can twist off the heads of bolts or strip the threads of even high-strength nuts and bolts. The IW12 impact wrench is capable of producing up to 1200 ft-lbs of torque.

Avoid damaging the fasteners by excessive impacting. When operated at full power or for prolonged periods of impacting, the wrench can twist off the heads of bolts or strip the threads of even high-strength nuts and bolts. The IW24 impact wrench is capable of producing up to 3500 ft-lbs of torque.

Be careful not to damage the oil tube bores in the motor and the valve handle.

Be careful not to drop valve body (23), oil tube (21), and piston (18) during their removal.

Be sure that the accumulator diaphragm is free of wrinkles and the seal bead is in its groove before completing assembly. An arbor press may be required to completely seat the assembly.

Because pull cylinder is stored with the plunger extended, plated surfaces must be protected against nicks and corrosion.

Before disassembling the tool, clean the exterior to prevent foreign matter from entering the tool interior.

Before disassembling the tool, clean the exterior to prevent foreign matter from entering the tool interior. Replace all seals exposed during disassembly. Note the orientation of the seals before removing them, to ensure proper installation. Before reassembly, clean all parts with a degreasing solvent. Apply clean grease to all parts during reassembly.

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139 grease or equivalent to all parts prior to or during reassembly.

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

Before reassembly, clean all parts with a degreasing solvent. Apply clean grease to all parts during reassembly.

CAUTIONS

Before using come-along, lubricate generously.

Care must be taken when removing bolt not to damage grease fitting at center of the bolt.

Care should be taken not to damage lips of wiper seals.

Care should be taken not to lubricate abrasive surface of drive wheel or saw blades as this will cause blade slippage.

Changing tools underwater is not recommended as seawater will enter hydraulic system during the change procedure.

Couplings must be clean before connecting hose to pump and to hydraulic tool.

Damage to the hydraulic system or drill can result from use with oil that is too viscous or thick.

Do not allow paint to enter inlet or outlet ports or bore of retaining nose assembly.

Do not apply excessive hydraulic pressure to jack when extended.

Do not apply heat to seals.

Do not attempt to cut hard nuts with the nut splitter cutterhead.

Do not attempt to cut wire which exceeds the cutter limitations.

Do not clamp flow sleeve assembly (19) too tightly in a vise.

Do not cross-thread ram plug.

Do not damage locating pin at control knob end of spool.

Do not damage O-ring during installation of motor assembly.

Do not damage piston seal when inserting piston assembly into cylinder bore.

DO NOT exceed the maximum flow or pressure.

Do not force parts together.

Do not lubricate the new handle grips. They will not be secure on the handle if any grease or oil is used.

Do not mix substitute hydraulic fluid with Houghton P.R. 1192.

Do not over tighten the pump release valve. Over tightening can destroy the Teflon valve seat, impairing pump operation.

Do not overfill mechanism or wrench will fail to operate.

CAUTIONS

Do not over-tighten the vice and distort the accumulator cylinder.

Do not place any lubricant in the tapped hole of the valve spool.

Do not place any lubrication in threaded hole.

Do not pry or in any way excessively force motor cap assembly off main housing. If necessary, loosen motor cap by tapping lightly with a non-metallic mallet.

DO NOT pry or in any way excessively force motor cap assembly off of main housing.

DO NOT pry or in any way excessively force the motor cap assembly off the main housing. If necessary, loosen motor cap by tapping lightly with a non-metallic mallet.

DO NOT pry or use excessive force when removing bearing carrier.

Do not put cylinder in a vise. This could cause distortion in cylinder bore.

Do not use a coarse grit or try to file or grind parts.

Do not use a hammer or powered arbor press.

Do not use cloth to dry the motor parts. Lint will damage the motor parts.

Do not use pliers to remove the oil tubes. The use of pliers may severely damage the oil tube seals.

Do not use Teflon tape.

Ensure Loctite does not contact outside of reversing spool.

Ensure Loctite does not contact outside of valve spool.

Ensure that all O-rings which were exposed during disassembly are replaced with new parts.

Ensure that the two small holes in the small diameter section of the manual oiler plug remain clean.

Ensure there is no lubricant on reversing spool threads.

Excessive feed force may cause the saw blade to stop. Do not twist the saw, since this may cause the blade to stall or break.

Exercise extreme care that all quick disconnect couplings are clean when couplings are mated.

Extend tool plunger before disconnecting any tool underwater. Extending plunger will fill inner cavities of tool with hydraulic fluid, reducing corrosion damage to interior surfaces of the tool.

Extended impacting (beyond 10 seconds duration) may result in excessive heat buildup in impact section of wrench seriously reducing life of the impact mechanism of the wrench.

CAUTIONS

Failure to install new seals in the correct orientation can result in system leakage.

Fill the bearing carrier (10, Figure R-2) with NOVATEX EP 1 Grease or equivalent before assembly of parts.

Fill the front hollow of the main housing with NOVATEX EP 1 Grease or equivalent before installing motor gears and motor cap.

Hydraulic cylinder stop ring (14, Figure D-4) threads are lightly staked during manufacturing to prevent turning during use. Prior to removing a stop ring, the staked area must be removed to prevent damaging other threads.

Hydraulic diver tool systems are designed for operation with petroleum-based hydraulic fluids. Use of non petroleum-base fluids can cause extensive system damage.

Hydraulic flow rates greater than 3 gpm produce excessive loads on the cylinder stops, causing fluid leakage and equipment damage.

Hydraulic fluid temperatures above 140º F significantly reduce hydraulic fluid life and increase the production rate of harmful precipitates. Fluid temperatures exceeding 150º F can damage equipment seals.

If chainsaw will remain in water after task has been completed, secure it away from any iron or steel to reduce the chance of corrosion damage.

If cutoff saw will remain in water after task has been completed, secure it away from any iron or steel to reduce the chance of corrosion damage.

If peanut grinder will remain in water after task has been completed, secure it away from any iron or steel to reduce the chance of corrosion damage.

If the front bearing retainer, rear bearing retainer or gear chamber has been replaced, the motor might require break-in.

Install new seals in direction noted during removal.

Install rod seals (31) with their lips facing the direction noted during removal.

Keep the cutter jaws at right angles to material being cut. Cutting diagonally can twist the cutter jaws out of line or chip the cutting edge. Do not twist or pry with the tool while cutting

Monitor hydraulic fluid for sea water contamination. Flush system and replace hydraulic fluid if the fluid is dirty, cloudy or discolored.

Monitor hydraulic fluid temperature to prevent system overheating. Hydraulic fluid temperature must never exceed 140º F when using Houghton P.R. 1192 fluid. Operating at temperatures in excess of 140º F will result in damage to the system. Recommended operating temperature range for the hydraulic diver tools is 80º F to 120º F.

CAUTIONS

Never allow direct strain to be taken on hydraulic hoses.

Never attempt to cut solid metal with wire rope cutter.

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

Never exceed the maximum flow (gpm) of a tool.

Never use the wire rope as a sling. Never pass it around any object for anchoring the load of the machine. this would bend and damage the wire rope and cause problems with the come-along.

Note orientation of seals before removing them.

Obtain Seal Kit (part number 03258). Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

Obtain Seal Kit (part number 16969). Replace all seals that are exposed during tool disassembly to guard against leaks. Note the orientation of seals before removal. Install new seals in the same position as the original seals.

Prior to any cutting operations, make sure control valve works freely by activating it several times.

Prolonged deadheading of cutter blades in closed position imposes a potentially damaging strain on cutter tool and blades.

Proper hydraulic fluid level should be maintained in the tool system at all times. Operating without sufficient fluid level will result in serious damage to pumps and motors.

Pulling directly on pile cutter while it is engaged in timber pile will result in damage to blades.

Remove any obstructions at the wire rope outlet. Wire rope must be able to travel freely or it will be forced back into the come-along.

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

Replace hydraulic filter elements in accordance with the HPUs scheduled maintenance program or as contamination occurs.

Take care to avoid wrinkling or damaging the kap seal.

The bar stock cutter cuts up to 1/2-inch diameter standard and steel cable, hard bolts, rods and bars. Never attempt to cut wire rope with the bar stock cutter.

CAUTIONS

The chain should cut with very little pressure applied to the handle. If the saw must be forced to cut or if the saw cuts crooked, stop immediately to avoid further damage to the chain and the bar.

The cylinder is nearly identical on each end and could be assembled with either end next to the yoke. The end of the cylinder without a spacer index should be assembled on the yoke. (See Figure E-3).

The graphite seal liner must not be forced, pried or pushed on directly because it can be easily damaged.

The Hydraulic Hammer Drill is not suitable for drilling steel or wood.

The majority of couplings used in hydraulic diver tool systems contain O-rings. These O-rings become extremely brittle when exposed to cold weather conditions. When connecting and disconnecting hydraulic lines, take care to avoid O-ring damage and subsequent leakage of hydraulic fluid from the system.

The moving cutter blade is designed with a 1/64-inch flat on its cutting edge. Do not sharpen to a knife edge.

The pile cutter is designed for cutting timber piles only. Any steel beams, chains, etc., which interfere with cutter will damage blades.

The pump reservoir and compensator bladder must be completely filled with hydraulic fluid.

The saw chain is design to cut wood only. Do not allow the chain to come in contact with dirt, sand, or other foreign material which would dull the cutters immediately.

The two hammers in hammer frame are identical. However, hammers must be positioned in frame in a certain relationship. Be sure to mark and note hammer relationship before removing them.

The valve sleeve remains in the main housing. It is not removable in the field. If the sleeve is damaged, return the main housing to a Stanley dealer.

There is only a small visual difference between the valve spools used for OC and CC grinders. DO NOT confuse them when reassembling the grinder. An OC spool has outer ring widths of less than 0.6 inches (14 mm) while CC spools have outer ring widths of over 1 inch.

To avoid damaging cylinder rod seals, never lift the come-along by the hydraulic cylinder.

To avoid U-cup packing damage, do not use excessive force when installing piston into cylinder.

Use a rag in the bottom of the flow sleeve removal tube to protect the flow sleeve when it drops out.

Use a rag in the bottom of the flow sleeve removal tube to protect the automatic valve body when it drops out.

CAUTIONS

Use a rag in the bottom of the removal tube to protect the automatic valve body when it drops out.

Viewing from the shaft end, the wheel must rotate counter-clockwise. If the wheel is rotating clockwise, stop the HPU and reverse the tool's whip hose connection.

Water/air flow must be continuous during drilling to avoid clogging of water/air passages and back flushing of waste products into the drill.

When installing control knob on reversing spool assembly, do not damage locating pin in valve sleeve.

When installing control knob on reversing valve, be careful not to damage locating pin in valve sleeve.

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

When operating two hydraulic power tools using the flow divider assembly, the combined flow requirements of the two tools combined should not exceed the maximum flow (gpm) capacity of the HPU. If combined flow requirements exceed capacity of HPU, anticipate diminished performance of one or both tools. Or with both tools on site, operate one tool at a time and adjust the flow meter as required for each tool.

When pulling assembled bearing carrier (10) away from main housing (24), the woodruff key on end of spindle shaft may damage O-ring and bushings in main housing. It will be necessary to remove motor cap to remove woodruff key first.

When returning the flow divider to an authorized DANFOSS repair facility, ensure to specify buna-N replacement seals.

Wide bevels of each hammer must face upper or lower web of hammer frame.

SECTION 1. INTRODUCTION

10.1 GENERAL INFORMATION.

Hydraulic diver tools perform the same basic functions as standard topside hydraulic tools: drilling, sawing, impacting, grinding, chipping, pumping, hoisting, shearing, etc,. Designed for use underwater, most diver tools can also be used for surface applications. Refer to appropriate Appendix for operating instructions prior to using the tool. This section introduces the power sources and presents a brief description of their operation. Diver tools enable divers to perform underwater tasks which would otherwise be impossible or extremely time-consuming and costly. Many Underwater Ship Husbandry (UWSH) operations which previously required dry-docking can be performed underwater with the support of hydraulic diver tools. Hydraulic diver tools are powered by NAVSEA approved hydraulic power units (HPUs), or by a diver operated pump. See Table 10-1 for HPUs.

Table 10-1. Hydraulic Power Units.

MODEL	NAME/TITLE	CAPACITY		DOCUMENT ID NO.
		GPM	PSI	
Model 2	Diesel Hydraulic Power Unit NAVSEA Model 2	0-15	0-2,000	S9233-A3-MMO-010
Model 4	Electro-Hydraulic Power Unit, NAVSEA Model 4	0-15	0-2000	SS500-AB-MM1-010
Model 6	Hydraulic Power Unit, Model 6	0-26	0-2500	S9597-AB-OMP-010
Model 9	Portable Hydraulic Power Unit, MARK 9 Mod 0	0-10	0-2000	SG700-D6-MMO-010

Diver tools in this manual are grouped according to their required power source (i.e., diver operated pump, or HPU). Tools grouped according to their power sources are not interchangeable. Each tool or system covered in this manual has its own Appendix (See Sections 10.1.1 and 10.1.2) providing a general description, function, structure, and available operational, maintenance, troubleshooting and reference information specific to that tool or system. An assortment of hoses and hose reels are used with the diver tools. These hoses and hose reel are covered in Appendix X.

10.1.1 Diver Operated Pump Powered Tools. Diver operated pump powered tools, are powered by a small volume of hydraulic fluid with pressures as high as 10,000 psi from a diver operated pump. Table 10-2 provides a quick reference to the diver operated pump, associated tools and hose assemblies appendixes.

Table 10-2. Diver Operated Pump Associated Appendixes.

APPENDIX	TITLE
A	Operation and Maintenance Procedures for the Diver Operated Pump
B	Operation and Maintenance Procedures for the Hydraulic Cutters
C	Operation and Maintenance Procedures for the Jack Ram
D	Operation and Maintenance Procedures for the Pull Cylinder
E	Operation and Maintenance Procedures for the Wire Rope Cutter
X	Operation and Maintenance Procedures for the Hose Assemblies and Hose Reels

10.1.2 Hydraulic Power Unit Operated Tools. A hydraulic flow divider permits the simultaneous operation of two tools using a single HPU. Table 10-3 provides a quick reference to the hydraulic flow divider assembly, HPU operated tools, and associated hose assemblies and reels appendixes.

Table 10-3. Hydraulic Power Unit Associated Appendixes.

APPENDIX	TITLE
F	Operation and Maintenance Procedures for the Hydraulic Flow Divider Assembly
G	Operation and Maintenance Procedures for the Chipping Hammer CH18
H	Operation and Maintenance Procedures for the Come-Along TU-28
I	Operation and Maintenance Procedures for the Cutoff Saw CO23
J	Operation and Maintenance Procedures for the Grinder GR24
K	Operation and Maintenance Procedures for the Grinder GR29
L	Operation and Maintenance Procedures for the Impact Wrench IW06
M	Operation and Maintenance Procedures for the Impact Wrench IW12
N	Operation and Maintenance Procedures for the Impact Wrench IW20
O	Operation and Maintenance Procedures for the Impact Wrench IW24
P	Operation and Maintenance Procedures for the Peanut Grinder HU6935
Q	Operation and Maintenance Procedures for the Chainsaw CS11
R	Operation and Maintenance Procedures for the Hydraulic Brush HB29
S	Operation and Maintenance Procedures for the Sump Pump with Jetting Nozzle SM22
T	Operation and Maintenance Procedures for the Bandsaw
U	Operation and Maintenance Procedures for the Hammer Drill
V	Operation and Maintenance Procedures for the Pile Cutter
W	Operation and Maintenance Procedures for the Sinker Drill
X	Operation and Maintenance Procedures for the Hose Assemblies and Hose Reel

SECTION 2. HYDRAULIC FLUID

10.2 GENERAL INFORMATION

The diver tool systems covered in this manual require an approved petroleum-based hydraulic fluid for their operation. The hydraulic fluid transmits power from the HPU pump of the system to the tools. Because hydraulic fluid cannot be compressed, very little energy is lost during power transfer.

10.2.1 HYDRAULIC FLUID. E.F. HOUGHTON P.R. 1192 petroleum-base hydraulic fluid is approved for use in NAVSEA hydraulic power units and diver tool systems. The viscosity, demulsibility, and performance characteristics of the Houghton P.R. 1192 hydraulic fluid are particularly well suited for operation with diver tools in a marine environment.

10.2.2 OPERATING GUIDELINES. The following guidelines should be observed when operating hydraulic diver tool systems.

WARNING

High pressure hydraulic fluid is combustible. Avoid contact with ignition sources.

WARNING

High-pressure fluid leaks can be extremely dangerous. Never operate a system with damaged or leaking components.

CAUTION

Hydraulic diver tool systems are designed for operation with petroleum-base hydraulic fluids. Use of non petroleum-base fluids can cause extensive system damage.

CAUTION

Do not mix substitute hydraulic fluid with Houghton P.R. 1192.

CAUTION

Proper hydraulic fluid level should be maintained in the tool system at all times. Operating without sufficient fluid level will result in serious damage to pumps and motors.

CAUTION

Monitor hydraulic fluid temperature to prevent system overheating. Hydraulic fluid temperature must never exceed 140º F when using Houghton P.R. 1192 fluid. Operating at temperatures in excess of 140º F will result in damage to the system. Recommended operating temperature range for the hydraulic diver tools is 80º F to 120º F.

CAUTION

Monitor hydraulic fluid for sea water contamination, flush system and replace hydraulic fluid if the fluid is dirty, cloudy or discolored.

CAUTION

Replace hydraulic filter elements in accordance with the HPUs scheduled maintenance program or as contamination occurs.

10.2.3 Hydraulic fluid should be clear (amber color). Cloudiness or discoloration indicates water contamination. Although the system can operate for a short period of time with mildly contaminated fluid, change fluid as soon as possible. Follow HPUs manual to flush a contaminated system.

10.2.4 Correct fluid viscosity is essential for proper system lubrication. The following paragraphs discuss ways of maintaining proper fluid viscosity in extreme ambient temperatures.

CAUTION

Hydraulic fluid temperatures above 140º F significantly reduce hydraulic fluid life and increase the production rate of harmful precipitates. Fluid temperatures exceeding 150º F can damage equipment seals.

10.2.4.1 HIGH TEMPERATURE OPERATION. To ensure efficient hydraulic tool system performance, maintain hydraulic fluid temperature 80º F to 120º F. Warm weather operations can lower fluid viscosity, impairing overall system efficiency through increased leakage, higher pressure loss, and increased wear on moving parts. Overheating problems can be controlled in most situations by placing any excess hydraulic hose in the water to effect heat exchange.

CAUTION

The majority of couplings used in hydraulic diver tool systems contain O-rings. These O-rings become extremely brittle when exposed to cold weather conditions. When connecting and disconnecting hydraulic lines, take care to avoid O-ring damage and subsequent leakage of hydraulic fluid from the system.

10.2.4.1 LOW TEMPERATURE OPERATION. As ambient temperature decreases, fluid becomes more resistant to flow. Cold weather or cold water operations increase fluid viscosity, possibly causing difficulty in startup and operation, increased pressure drop, excessive heat generation, sluggishness, lowered mechanical efficiency, and starvation at pump inlet (which leads to pump cavitation). When operating at temperatures within ten degrees of freezing, fluid viscosity can be decreased by heating the fluid. One or more of the following measures can be taken to heat the fluid.

a. Using procedures in a HPU manual, start the power unit with no tools connected. Set system maximum system relief pressure as recommended in the respective tool appendix. Observe temperature gauge until fluid temperature reaches desired level (at least 80º F).

b. Store hydraulic system in a warm place.

c. Operate tool with minimum amount of hydraulic hose in the water.

d. Insulate hydraulic reservoir.

e. Use dipstick-type heater in reservoir.

f. Install flexible electric heating panel on hydraulic reservoir.

APPENDIX A

OPERATION AND MAINTENANCE PROCEDURES FOR THE DIVER OPERATED PUMP

A-1 DESCRIPTION.

The diver operated pump (Figure A-1) is a self-contained, lightweight hydraulic unit which provides hydraulic energy to other diver tools. The diver operated pump operates above or below water, provided the system is completely full of hydraulic fluid. Because the pump is at an angle when operated on the surface, fluid settles away from the pump head and therefore the pump cannot operate on the surface with low fluid levels. Underwater, pressure compresses the bladder forcing hydraulic fluid into the pump head, permitting the diver operated pump to be used in any orientation.

A-1.2 The diver operated pump has a female half coupler for connection with a high-pressure hose which transfers pump hydraulic output to a diver operated tool. The pump is used with tools and hoses listed in Table A-1.

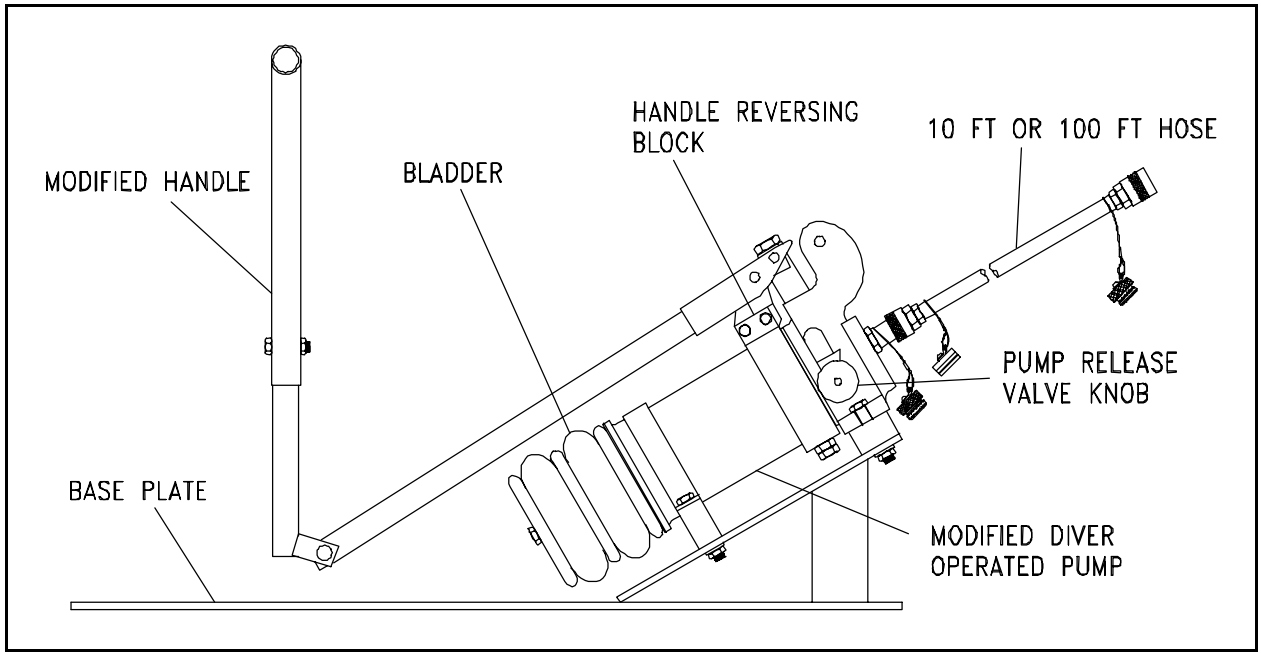


Figure A-1. Diver Operated Pump Setup.

Table A-1. Diver Operated Pump References.

DESCRIPTION	APPENDIX
Bar Stock Cutter/Nut Splitter	Appendix B
Jack Ram	Appendix C
Pull Cylinder	Appendix D
Wire Cutter	Appendix E
10 and 100 foot hose	Appendix X

A-2 REFERENCE.

NAVSEA Drawing 5366581.

A-2.1 Technical characteristics for the diver operated pump are provided in Table A-2.

Table A-2. Diver Operated Pump Technical Characteristics.

CHARACTERISTICS	REMARKS
Maximum operating pressure	10,000 psi
Bypass valve setting (first stage)	10,000 psi
Relief valve setting (second stage)	10,000 psi
Maximum safety valve setting	10,200 psi
Maximum operating depth	300 fsw

A-3 MODIFICATIONS.

NAVSEA modifications have adapted the Enerpac P-80 pump for use with U.S. Navy hydraulic diver tools. The piston-linkage assembly has been modified to produce pressure on the up-stroke of the handle rather than on the downstroke. The pump handle has been lengthened and a hinged joint was incorporated to enable a diver in heavy gear to operate the pump with less effort in a standing position. Approximately six inches have been removed from the aft end of the hydraulic reservoir. A flexible, pressure-compensating bladder has been installed adjacent to and common with the hydraulic fluid reservoir. This bladder reduces seawater intrusion and increases hydraulic reservoir volume.

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

CAUTION

The pump reservoir and compensator bladder must be completely filled with hydraulic fluid.

A-4 OPERATION.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

CAUTION

Couplings must be clean before connecting hose to pump and to hydraulic tool.

a. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

CAUTION

Do not over tighten the pump release valve. Over tightening can destroy the Teflon valve seat, impairing pump operation.

b. Turn pump release valve knob counterclockwise to open valve.

WARNING

High-pressure leaks are extremely dangerous. Wear eye protection when working with high-pressure hoses. Use only high-pressure hoses rated for the working pressure of the tools to be used.

WARNING

Hoses must be checked for damage before starting any operation.

WARNING

To avoid hose damage, do not place heavy objects on the hose or drive vehicles over the hose. Avoid sharp bends or kinks in the hose. Do not allow the hose to contact sharp edges, rough projections, or hot surfaces. Do not use hydraulic hose to carry a hydraulic component (i.e., pumps, cylinders and valves).

WARNING

Never pressurize hose assemblies or diver operated pump without hose end couplings properly connected between pump and tool being used. High pressures applied when couplings are improperly coupled could break hose connections and cause dangerous high-pressure leaks.

WARNING

When connecting or disconnecting hoses or fittings, system pressure (psi) must be at “0” psi. Ensure system pressure is at “0” psi.

NOTE

Use a 10-foot hose if both pump and tool will be operated underwater. Use a 100-foot hose when pump will be operated by a tender from the surface.

c. Attach proper hose to pump and tool couplings. Ensure that all connections are secure.

d. Remove any air from system. With pump higher than tool cylinder, advance and retract cylinder plunger several times.

NOTE

To remove air from the cylinder and hose after refilling the pump with hydraulic fluid, pump until the cylinder plunger is fully extended.

e. Invert cylinder (plunger end down) and open pump release valve. Any air in system will flow into pump reservoir.

f. Test operate system topside to ensure that pump and tool work properly.

NOTE

To extend cylinder plunger, turn pump release valve knob clockwise and close it finger tight. To retract cylinder plunger, turn release valve knob counterclockwise.

g. Retract cylinder plunger.

h. Adjust length of T-bar handle to suit operator.

i. Refer to Table A-1 for specific tool appendix to be used, observing all warnings and cautions.

A-5 CHANGING TOOLS UNDERWATER.

CAUTION

Changing tools underwater is not recommended as seawater will enter hydraulic system during the change procedure.

CAUTION

Extend tool plunger before disconnecting any tool underwater. Extending plunger will fill inner cavities of tool with hydraulic fluid, reducing corrosion damage to interior surfaces of the tool.

a. Extend tool plunger to fullest position.

b. Ease open pump release valve until tool plunger retracts approximately 1/8-inch; then close.

c. Disconnect tool. Open pump release valve. Attach a new tool to hose.

d. After each task which requires an underwater tool change, replace pump fluid as outlined in A-8, scheduled maintenance.

A-6 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for diver operated pump Maintenance Requirement Cards (MRCs).

A-7 TROUBLESHOOTING.

Refer to Table A-3 for the diver operated pump troubleshooting.

Table A-3. Diver Operated Pump Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Pump reciprocates, but tool is not completely actuated.	Release valve is not completely closed.	Close release valve firmly.
	Low reservoir fluid level.	Fill reservoir with hydraulic fluid.
	Leaks in hydraulic line.	Ensure that connections are secure. Check hose for cuts or ruptures. Repair or replace if damaged.
Pump reciprocates, but tool fails to operate.	Loose coupling.	Ensure connections are secure.

A-8 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to replacement of parts, and repair kit component replacement in the pump head. Figure A-2 and Figure A-3 illustrate the parts breakdown.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

A-8.1 Pump Head.

A-8.1.1 Disassemble.

a. Remove 10-foot or 100-foot hose at hose coupling, and remove pump (2, Figure A-2) from base plate (1).

b. Introduce air into the pump by removing plug (25) and drain hydraulic fluid.

c. Remove reservoir tube (11) and bladder (10) from pump head.

d. Remove pins (2, 3, Figure A-3) from beam (1).

e. Pull pump plunger (4) out along with wiper ring (5), backup ring (6), and packing O-ring (7). On P-80-1 pump, also remove packing nut (30), packings (31), spacer (32), pump

cups (33), and spreader (34).

f. Unscrew valve plug (14) and remove it along with gasket (9), spring (11), and balls (12, 13).

g. Unscrew valve plug (8) and remove it along with gasket (9), ball spacer (10), spring (11), and balls (12, 13).

h. Remove bypass valve (15) and gasket (9).

i. Remove safety valve (16) and gasket (9).

j. On pump models P-80-2 and P-80-3 only, remove relief valve (17) and gasket (18).

k. Remove oil strainer screen (19).

l. Remove release valve spindle (20), release valve packing nut (21), and release valve packing (22). On the P-80-3 model, also remove release valve ball (not shown).

m. Inspect and clean all parts, replacing damaged or worn parts as necessary. Replace O-rings and gaskets.

A-8.1.2 Reassemble.

a. To reassemble, place spreader (26, Figure A-3), pump cup (27), and spreader (28) on capscrew (25) and reinstall in pump head. Replace gasket (24) and install plug (23).

b. Replace release valve packing (22). On P-80-3 model, install release valve ball (not shown). Install release valve packing (22), release valve packing nut (21), and release valve spindle (20).

c. Install oil strainer screen (19).

d. On P-80-2 and P-80-3 models only, replace gasket (18) and install relief valve (17).

e. Replace gasket (9) on safety valve (16). Install safety valve (16).

f. Replace gasket (9) on bypass valve (15). Install bypass valve (15).

g. Insert ball (13) and ball (12) in opening of pump head (29) next to release valve. Insert spring (11) and ball spacer (10). Install valve plug (8) with gasket (9).

h. Insert ball (13) and ball (12) in opening of pump head (29) away from release valve. Insert spring (11). Install valve plug (14) with gasket (9).

i. Replace packing O-ring (7), backup ring (6), and wiper ring (5) and assemble on pump plunger (4). For P-80-1 pump, also assemble packing nut (30), packings (31), spacer (32), pump cups (33), and spreader (34) on pump plunger (4). Install plunger into opening in pump head (29).

j. Install reservoir tube (11, Figure A-2) and bladder (10) on pump head (2).

k. Connect female hose coupler to pump head (2).

l. Add hydraulic fluid to pump, and install plug (25).

m. Mount pump on base plate (1).

A-9 HOSES.

For complete details concerning hoses refer to Appendix X.

A-10 ILLUSTRATED PARTS BREAKDOWN.

a. Figure A-2 illustrates the NAVSEA pump components.

b. Figure A-3 illustrates the ENERPAC pump components.

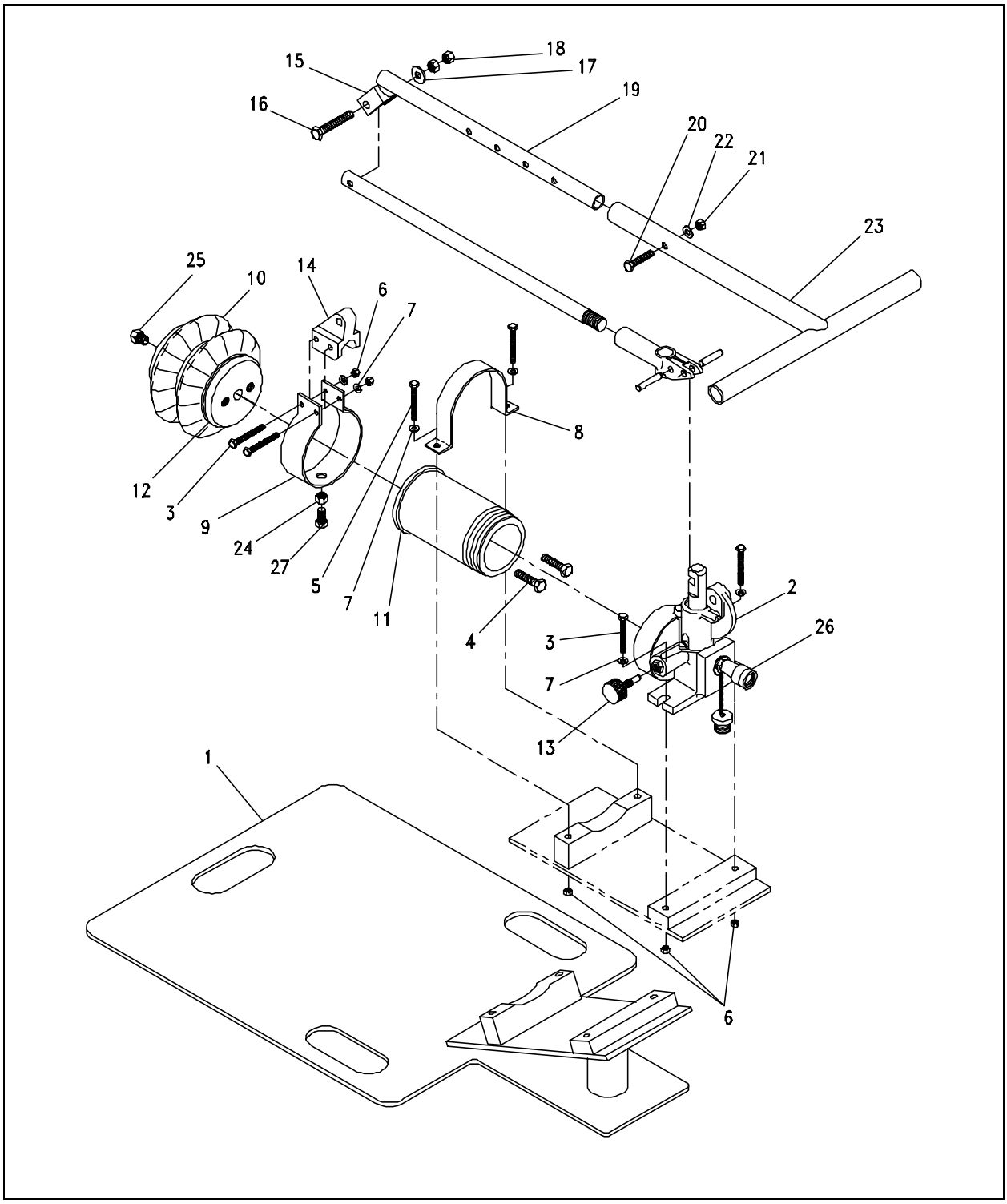


Figure A-2. Diver Operated Pump Assembly, NAVSEA Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Diver operated pump	1	5366581	53711
1	Base plate, 1/4 thk	1	5366581-1	53711
2	Hand pump hyd (see Figure A-3)	1	P-80	26952
3	Screw, hex hd 1/4-20UNC-21 x 2 1/4	4	MS35307-315	96906
4	Screw, hex hd 3/8-16UNC-2A x 1	2	MS35307-360	96906
5	Screw, hex hd 1/4-20UNC-21 x 2.5	2	MS35307-316	96906
6	Nut, hex 1/4-20UNC-2B	6	MS35649-2254	96906
7	Washer, flat 1/4 nom	6	MS15795-852	96906
8	Strap, clamp 1/8 flat	1	5366581-13	53711
9	Handle, reverse band	1	5366581-14	53711
10	Compensator, air stroke	1	25	22337
11	Plate, cylinder	1	5366581-17	53711
12	Gasket	1	5366581-17	53711
13	Release valve knob	1	5366581-18	53711
14	Handle reversing block	1	5366581-19	53711
15	Handle yoke	1	5366581-20	53711
16	Screw, hex hd 3/8-16UNC-2A x 2 1/2	1	MS35307-368	96906
17	Washer, flat 3/8 nom	1	MS15795-406	96906
18	Nut, hex stop 3/8-16UNC-2B	2	MS17830-6C	96906
19	Mod handle ext 13/16 round rod	1	5366581-24	53711
20	Screw, hex hd 5/16-18UNC-2A x 1 1/2	1	MS35307-338	96906
21	Nut, hex stop 5/16-18UNC-2B	1	MS35649-2314	96906
22	Washer, flat 5/16 nom	1	MS15795-812	96906
23	Handle, tel. 3/4 pipe sched 40	1	5366581-28	53711
24	Nut, hex 3/8-18UNC-2B	1	MS35649-2384	96906
25	NPT plug, 1/4-16 NPT	1	B-4-P	11649
26	Coupler, female, high flow	1	CH400	26952
27	Screw, hex hd 3/8-16UNC-2A x 5/8	1	MS35307-331	96906

Figure A-2. Diver Operated Pump Assembly, NAVSEA Components (Sheet 2).

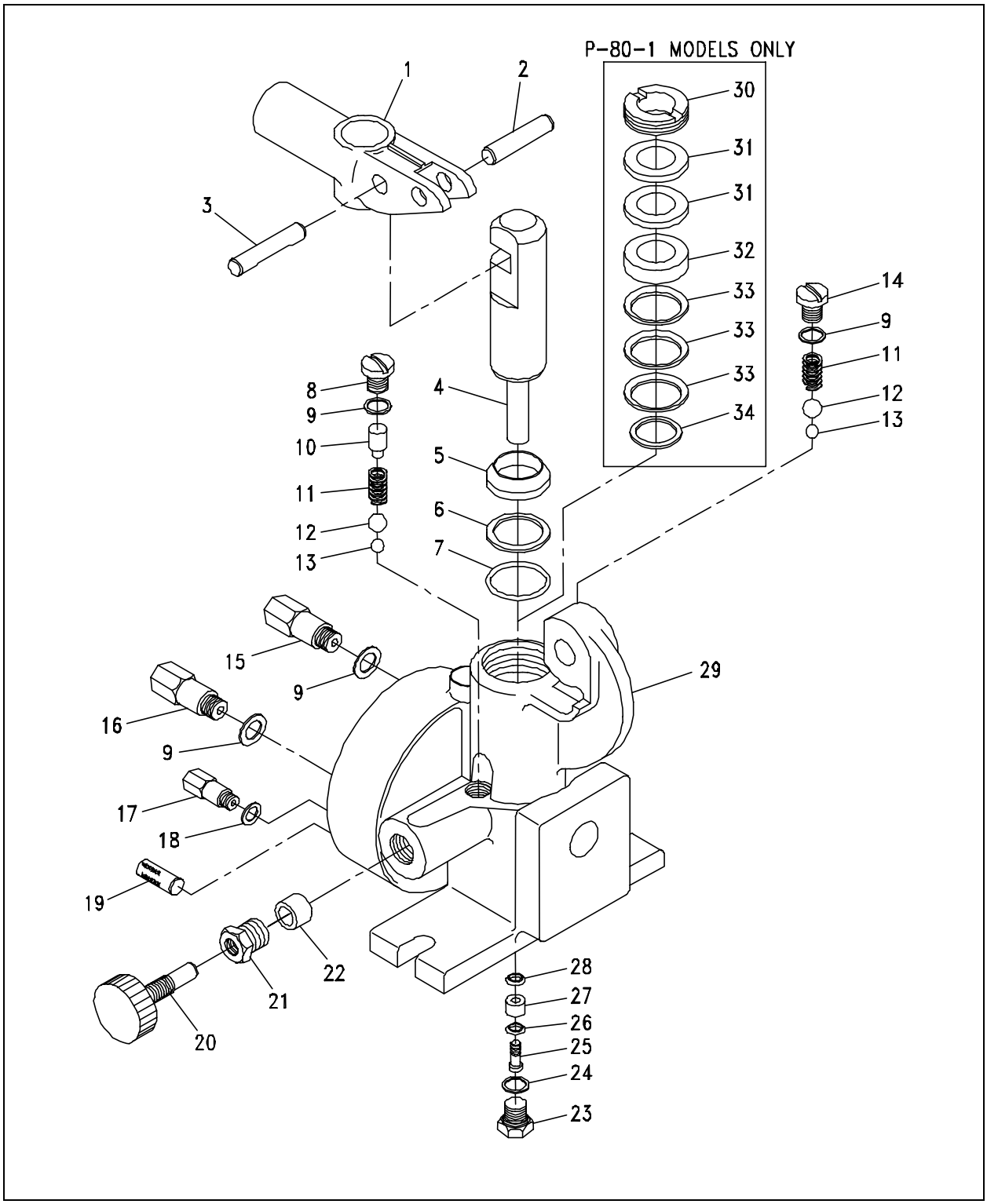


Figure A-3. Diver Operated Pump, Pump Assembly, ENERPAC Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Pump	1	P-80-1	26952
		1	P-80-2	26952
		1	P-80-3	26952
	Repair kit		P-80-K-1	26952
	For P-80-2	1	P-80-K-4	26952
1	Beam	1	B113.060-1	26952
2	Pin, beam	1	CB334.060	26952
3	Cross pin, plunger	1	P7557	26952
4	Plunger, pump	1		
	P-80-1		B246-051	26952
	P-80-2 and P-80-3		C910-051	26952
5	Ring, wiper	1	P80-K2/P80-K3	26952
6	Ring, backup	1	P80-K2/P80-K3	26952
7	O-ring, packing		P80-K1/P80-K2/P80-K3	26952
8	Plug, valve	1	S4-185	26952
9	Gasket	4	P80-K1/P80-K2/P80-K3	26952
10	Spacer, check ball	1	B248.186	26952
11	Spring	2	P80-K1/P80-K2/P80-K3	26952
12	Ball, 5/16	2	P80-K1/P80-K2/P80-K3	26952
13	Ball, 7/32	2	P80-K1/P80-K2/P80-K3	26952
14	Plug, valve	1	B349.185	26952
15	Valve, bypass			26952
	P-80-1	1	P181.190	26952
	P-80-2 and P-80-3	1	C960.900	26952
16	Valve, safety	1	P181.190	26952
17	Valve, relief			26952
	P-80-2 and P-80-3	1	C949-900	26952
18	Gasket	1	P80-K1/P80-K2/P80-K3	26952
19	Screen, oil strainer			26952
	P-80-1	1	E394-018	26952
	P-80-2 and P-80-3	1	P307-18	26952
20	Spindle, release valve	1	B109-900 (Note 1)	26952
21	Nut, release valve packing	1	MJ11-1	26952
22	Release valve packing	2	P80-K1/P80-K2/P80-K3	26952
23	Plug	1	247.185	26952
24	Gasket	1	P80-K1/P80-K2/P80-K3	26952
25	Capscrew	1	B257.128	26952
26	Spreader	1	F11-52	26952
27	Pump cup	1	P80-K1/P80-K2/P80-K3	26952
28	Spreader			26952
	P-80-1		B119.317	26952
	P-80-2 and P-80-3		F11-52	26952

Figure A-3. Diver Operated Pump, Pump Assembly, ENERPAC Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
29	Pump head			26952
	P-80-1		N/A	N/A
	P-80-2 and P-80-3	1	C948.005	26952
30	Packing nut			26952
	P-80-1	1	N/A	N/A
31	Packing			26952
	P-80-1	2	P80-K1	26952
32	Spacer			26952
	P-80-1	1	B255/004	26952
33	Pump cup			26952
	P-80-1	3	P80-K2/P80-K3	26952
34	Spreader			26952
	P-80-1	1	B253.016	26952
	P80-3	1	B1005-016	26952

Notes: 1. Included in pump repair kits P-80-K-1, P-80-K-2, and P-80-K-3.
2. Included in pump repair kits P-80-K-2 and P-80-K-3.
3. Included in pump repair kit P-80-K-1.

Figure A-3. Diver Operated Pump, Pump Assembly, ENERPAC Components (Sheet 3).

APPENDIX B

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC CUTTERS

B-1 DESCRIPTION.

Three components are associated with hydraulic cutters (Figure B-1): a hydraulic cylinder assembly; bar stock cutter (with swinging keeper); and a nut splitter cutterhead. They are supplied hydraulic power from the diver operated pump (Appendix A). The bar stock cutter and the nut splitter are interchangeable. Both cutterheads and cylinder assembly have a corrosion-resistant black oxide endurion finish. The bar stock cutter cuts up to 1/2 inch diameter standard and steel cable, hard bolts, rods, and bars. The keeper holds stranded cable, guy wire, and prestressed cable to prevent spreading and cable distortion during cutting operations. The nut splitter cuts soft nuts, up to 1-1/4 inches across the flats, without damaging bolt or threads. The nut splitter blades swivel 360 degrees.

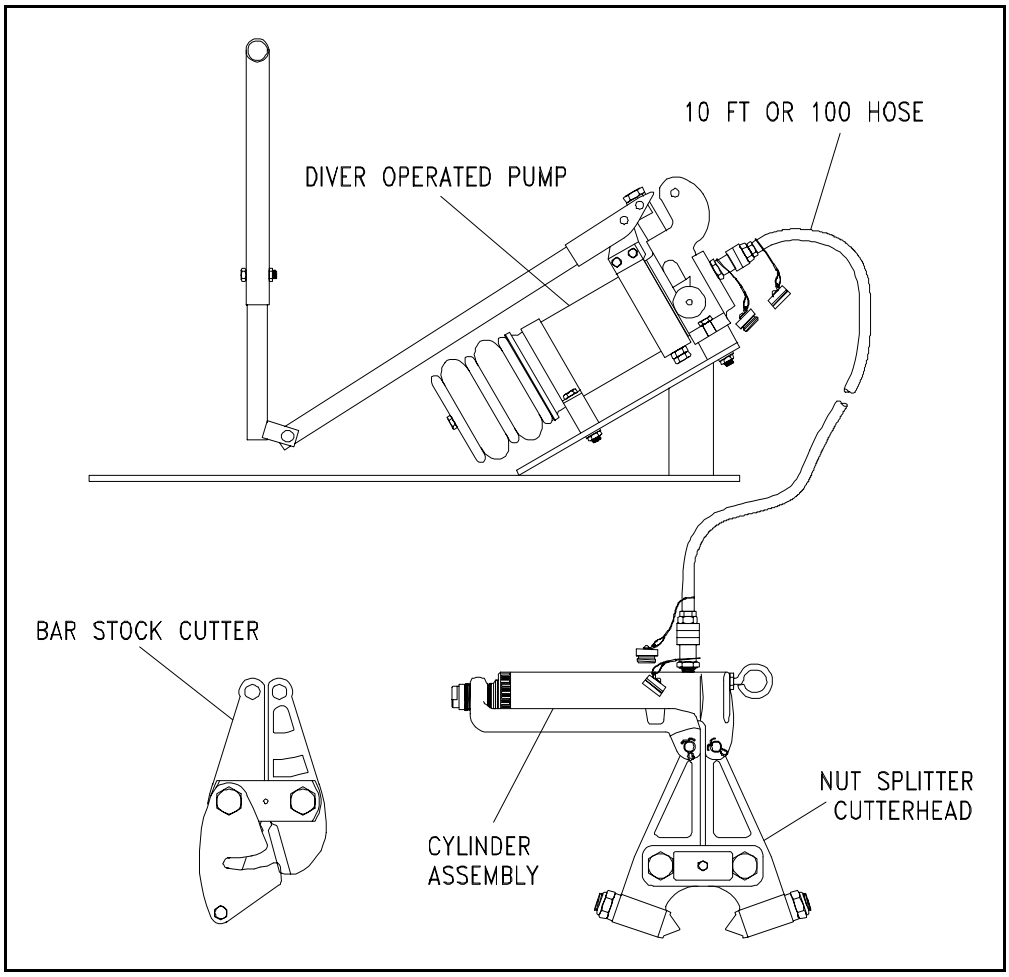


Figure B-1. Bar Stock Cutter, Nut Splitter Cutterhead and Hydraulic Cylinder, used on Diver Operated Pump.

B-1.1 Technical characteristics for the hydraulic cutters are provided in Table B-1.

Table B-1. Hydraulic Cutters Technical Characteristics.

CHARACTERISTIC	REMARKS
Maximum operating depth	300 fsw

B-2 PREOPERATIONAL SET-UP.

Before connecting tools to the diver operated pump, refer to Table B-2 for set-up requirements.

Table B-2. Set-up Requirements.

TOOL	ACTION	REFER TO:
Bar stock cutter	A spacer is required in the cylinder	Paragraph B-2.1, and Figure B-2.
Nut splitter	No spacer is used in the cylinder	Paragraph B-2.1, and Figure B-2.
Nut splitter on nut 7/8-inch or smaller	Place the spacer under the head of both cutting blades	Paragraph B-2.2, and Figure B-3.
Nut splitter on nut 7/8-inch or larger	Place the spacer under the blade nut	Paragraph B-2.2, and Figure B-3.

B-2.1 Cylinder Spacer And Cylinder Adjustment.

When the bar stock cutter is being used, a spacer is required inside the cylinder. Conversely, when the nut splitter is being used, the spacer is not used inside the cylinder. To verify the presence of a spacer or to install or remove a spacer, see Figure B-2, and use the following procedures:

a. Remove cutterhead (bar stock cutter or nut splitter cutterhead) from cylinder assembly.

b. Using an appropriate wrench, turn plug (1, Figure B-2) counterclockwise, to separate lifter (2) from cylinder (3).

c. Remove outer collar (4).

d. Verify, install or remove spacer (5).

e. Replace outer collar (4), ensuring wiper ring (6) is in place.

f. Replace lifter (2) on cylinder (3), turning the plug (1) clockwise.

g. Turn plug until there is a hairline separation between the lifter ear and the cylinder ear. Occasionally press inward with the heel of the hand on the piston, to bottom out the piston, and remove the trapped air from the cylinder.

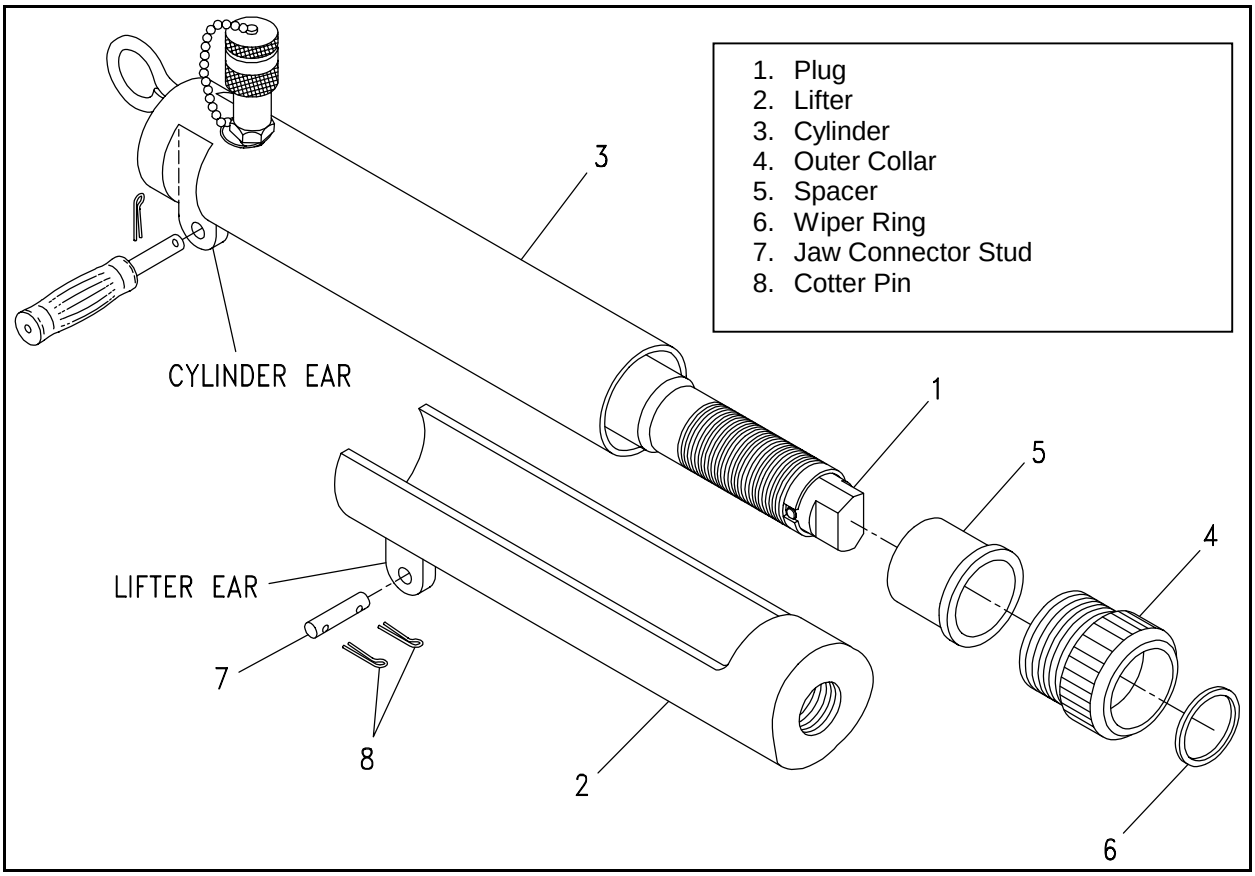


Figure B-2. Cylinder Spacer and Cylinder Adjustment.

B-2.2 Nut Splitter Spacer Placement (Figure B-3).

a. When splitting nuts that are greater than 7/8-inch, it is necessary to insert a blade spacer under each blade nut to keep the cutting action parallel.

b. When splitting nuts that are of 7/8-inch size or smaller, it is necessary to insert a blade spacer under the head of each cutting blade to keep the cutting action parallel.

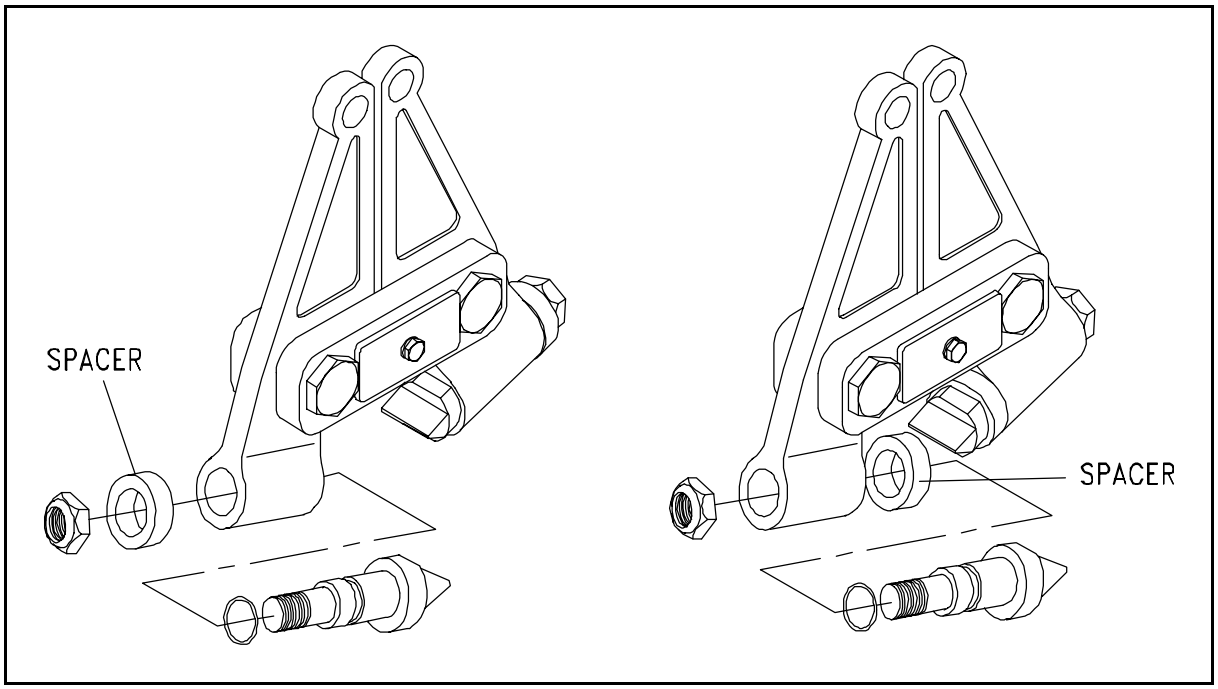


Figure B-3. Nut Splitter Spacer Placement.

B-2.3 Attaching Cutterhead To Cylinder Assembly.

The cutterhead jaw mounting holes align with the cylinder and lifter ears. A jaw connector stud (1, Figure B-4) and two cotter pins (2) mounted through the lifter ear and jaw mounting hole secure one side, while the handle bar (3) and cotter pin (4), inserted through the cylinder ears and the jaw mounting hole, secures the other.

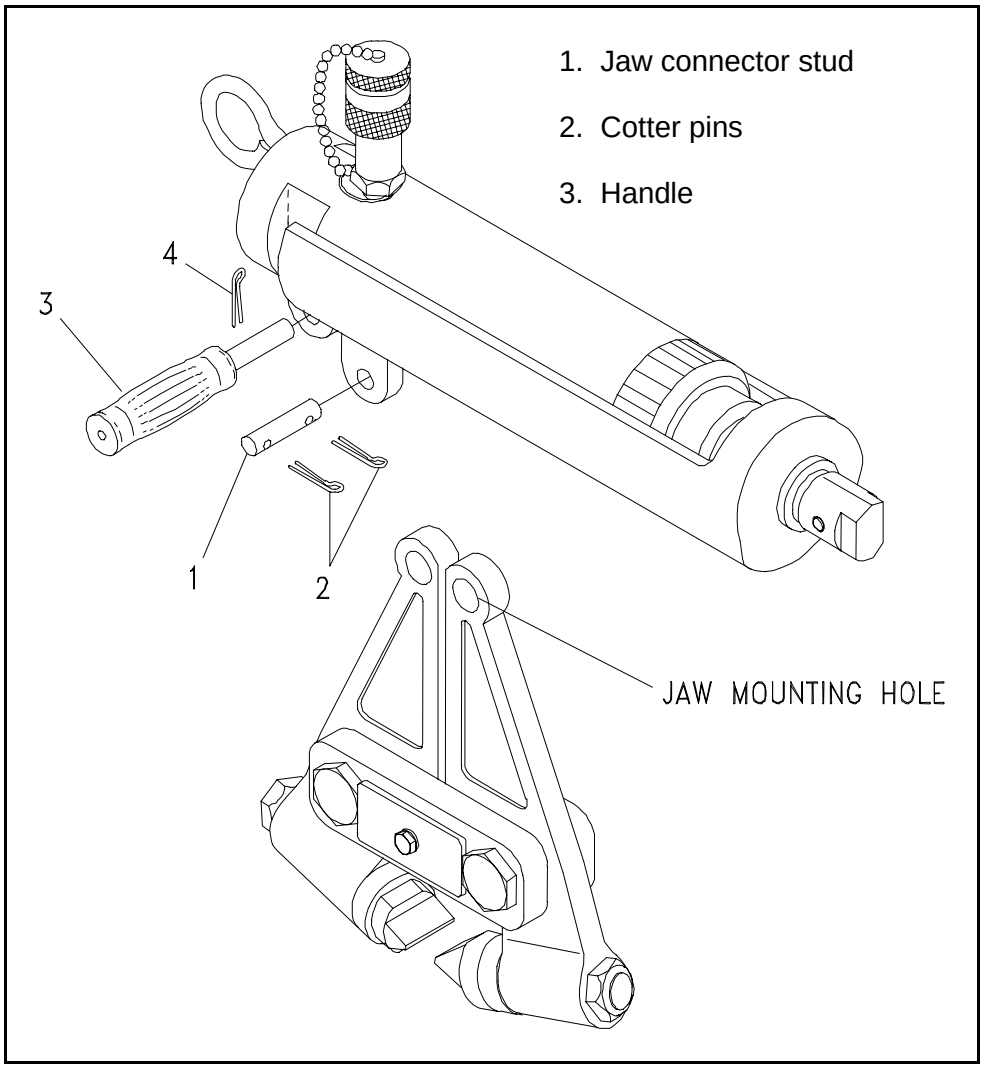


Figure B-4. Attaching Cutterhead to Cylinder Assembly.

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

B-3 OPERATION.

a. Follow the operating procedure for the diver operated pump.

b. Set up hydraulic cutter per Table B-2 for desired cutting operation.

c. Ensure air is bled from system (10.0 ft).

(1) Use short hose.

(2) Place pump higher than cylinder with pressure port up.

(3) Extend and retract cutter several times allowing spring tension to retract.

d. Check for leaks.

e. Check cutter blade by operating diver operated pump handle several times.

WARNING

Always wear eye protection when using diver operated pump and cutter on surface.

CAUTION

The bar stock cutter cuts up to 1/2-inch diameter standard and steel cable, hard bolts, rods and bars. Never attempt to cut wire rope with the bar stock cutter.

CAUTION

Do not attempt to cut hard nuts with the nut splitter cutterhead.

CAUTION

Keep the cutter jaws at right angles to piece being cut. Cutting diagonally can twist the cutter jaws out of line or chip the cutting edge. Do not twist or pry with the tool while cutting.

f. Place open cutter blades of bar stock cutter around bar to be cut or place open cutter blades of nut splitter across nut flats to be split.

g. Close diver operated pump release valve.

h. Operate diver operated pump handle until cut is complete.

i. Open release valve on diver operated pump to open cutter blades.

j. Make additional cuts or return to the surface, as the mission requires.

B-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for cutter Maintenance Requirement Cards (MRC).

B-5 TROUBLESHOOTING.

Refer to Table B-3 for the cutter troubleshooting.

Table B-3. Cutter Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Cutting blades do not open when diver operated pump, pump release valve knob is opened.	Weak or broken pull back spring. Over tightening of hardware securing cutter blades.	Replace pull back spring. Loosen hardware on cutterhead.
Oil leaks from cylinder.	Damaged O-ring.	Replace O-ring.
Cutting blades will not close.	Improper hydraulic system flow and pressure. Material is too hard.	Check hydraulic system for proper connection. Verify that the proper cutter is installed.

B-6 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to replacement of parts and repair kit component replacement in the hydraulic cylinder. Figures B-5, B-6, and B-7 illustrate the parts breakdown.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

B-6.1 Special Tools Required.

Table B-4 describes special tools required.

Table B-4. Special Tools Required.

PART NUMBER	DESCRIPTION
S-121	Spring Holder
S-123	Spring Puller

B-6.2 Hydraulic Cylinder.

B-6.2.1 Disassemble.

a. Remove cutterhead from hydraulic cylinder.
b. Clamp cylinder (5, Figure B-5) ear in a vise.
c. Remove hose coupler (21) from cylinder (5).
d. Unscrew lifter (19) from piston (14).
e. Drive out pin (17).
f. Grip ram plug (18) in a vise across its flats, with cylinder assembly in a horizontal position.
g. Turn cylinder (5) and attached piston (14) counterclockwise to unscrew ram plug (18).
h. When ram plug (18) reaches end of its threads, firmly grasp cylinder (5) with one hand.

While pulling cylinder outward to expose pull back spring (4), insert spring holder (Special Tool S-121) between coils, about six turns down from loop at end of spring.

i. Remove ram plug (18) and attached swivel spring pull back (16) from pull back spring (4) loop. Remove and discard O-ring (15) from ram plug.

j. Secure spring puller (Special Tool S-123) in a vise, and hook end of tool to loop of exposed pull back spring (4). Firmly pull cylinder (5), to extend pull back spring (4). Then remove spring holder (Special Tool S-121) from between coils of pull back spring (4). Remove spring hook from loop end of spring.

k. Insert a 12-inch screwdriver through center of pull back spring (4) and loosen and remove machine screw (6) securing spring to bottom of cylinder (5).

l. Remove pull back spring (4) and machine screw (6) from piston (14).

NOTE

Cutterhead cylinder blade spacer (3) is only required with bar stock cutterhead. It is not required with nut splitter cutterhead.

m. Loosen and remove outer collar (2) and attached wiper ring (1) from cylinder (5) by unscrewing it. Remove blade spacer (3), if installed, from cylinder.

n. Remove piston assembly (14) from cylinder (5).

o. Using retaining ring pliers, remove retaining ring (9) from piston (14).

p. Remove bronze collar (11) and U-cup packing (10) from piston (14). It is not necessary to remove stop collar (13) from piston.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

q. Clean all parts using MIL-C-81309.

B-6.2..2 Reassemble.

a. Install bronze collar (11, Figure B-5) and U-cup packing (10) on piston.

b. Using retaining ring pliers, install retaining ring (9) on piston (14). Ensure that retaining ring is completely seated in its groove.

WARNING

Brake fluid, cylinder oil, etc., will seriously damage this hydraulic cylinder. Use only Houghton 1192 hydraulic fluid.

c. Lubricate inside of cylinder (5), U-cup packing (10), and bronze collar (11) on piston (14) with Houghton 1192 hydraulic fluid.

CAUTION

To avoid U-cup packing damage, do not use excessive force when installing piston into cylinder.

d. Insert piston assembly piston (14) into cylinder (5) with a gentle downward push. Gently continue pushing piston until it is on bottom of cylinder.

e. Drop spring screw (6) through mounting hole in pull back spring (4). Install spring and screw into piston (14). Using a 12-inch screwdriver, screw machine screw into cylinder (5) to secure pull back spring. Tighten machine screw.

NOTE

Cutterhead cylinder blade spacer is only required with bar stock cutter. It is not used with nut splitter cutterhead.

f. Install blade spacer (3), if required, in cylinder (5).

g. Screw outer collar (2) with attached wiper ring (1) in cylinder (5) and tighten.

h. Replace O-ring (15) on ram plug (18) by sliding it over end with flats.

i. Using spring puller (Special Tool S-123), hook loop on pull back spring (4). Secure tool in a vise with its shank in a horizontal position.

j. Grasping cylinder (5) in one hand and holding spring holder (Special Tool S-121) in other, pull on cylinder to extend pull back spring (4). Insert spring holder (Special Tool S-121) between coils, about six turns down from loop at end of spring. Remove spring

puller (Special Tool S-123).

k. Hook swiveled spring pull back (16) attached to ram plug (18) on helical loop of spring pull back (4).

l. Grip flats of ram plug (18) in a vise while maintaining cylinder (5) in a horizontal position.

m. Pull on cylinder (5) to extend pull back spring (4). Remove spring holder (Special Tool S-121) from between coils of spring.

WARNING

Never-Seez anti-seizing compound is combustible.

WARNING

Avoid prolonged contact with skin or prolonged breathing of vapors. Use with adequate ventilation.

WARNING

Never-Seez contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting. Call a physician.

n. Add Never-Seez or its equivalent to threaded portion of ram plug (19).

CAUTION

Do not cross-thread ram plug.

o. With ram plug (18) still in vise, turn cylinder (5) and attached piston (14) clockwise to screw ram plug into piston. Be sure not to cross-thread ram plug. Turn cylinder until bottom of hole in ram plug aligns with bottom of notch in piston.

p. Drive pin (17) through hole in ram plug (18) until it is flush with threads on both sides of piston (14).

q. Clamp ear on cylinder (5) in a vise.

r. Screw lifter (19) on piston (14) until it bottoms out.

s. Align ear of lifter (19) with ear on cylinder (5).

t. Screw female coupler (21) in cylinder (5) port.

u. Add Houghton 1192 hydraulic fluid to cylinder (5) until it is full.

B-7 HOSES.

For complete details concerning hoses refer to Appendix X.

B-8 ILLUSTRATED PARTS BREAKDOWN.

The manufacturer is transitioning from one set of part numbers to another, thus the listing of two part numbers for an item number.

a. Figure B-5 illustrates the Hydraulic Cylinder components.

b. Figure B-6 illustrates the Bar Stock Cutter components.

c. Figure B-7 illustrates the Nut Splitter Cutterhead components.

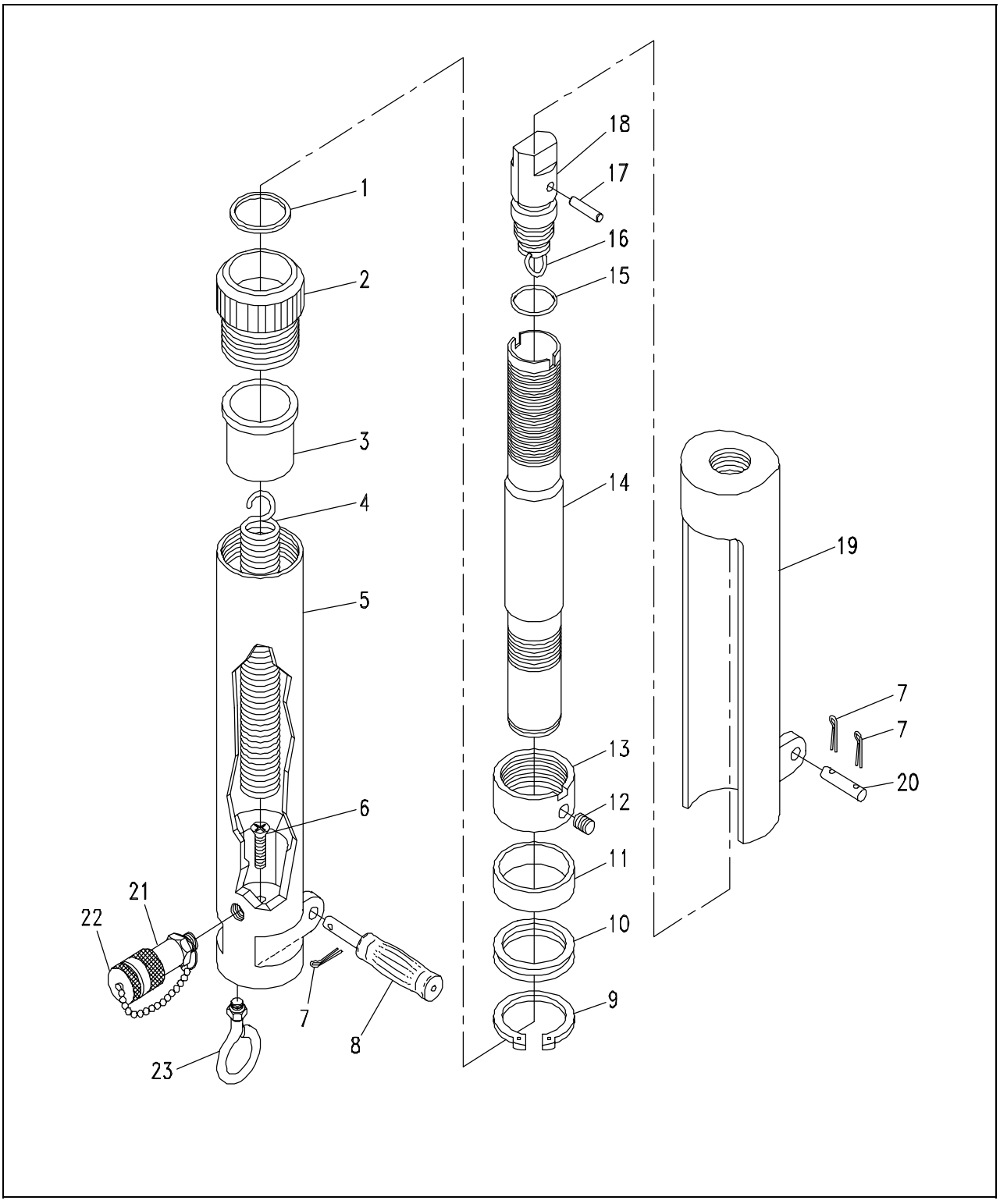
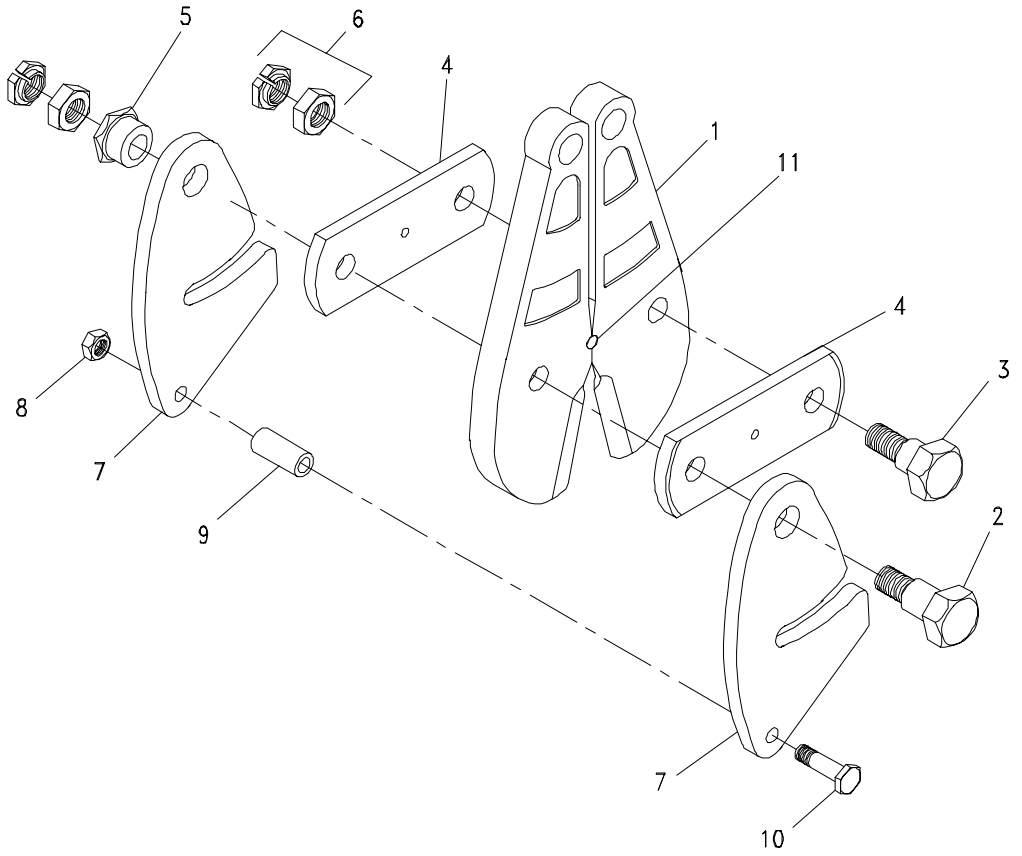


Figure B-5. Special Hydraulic Cylinder Assembly (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Special hydraulic cylinder assembly	1	45418N	96508
			1752	77428
1	Ring, wiper	1	330447	77428
2	Collar, outer	1	45458N	96508
			330439	77428
3	Spacer, blade	1	45468N	96508
			1784	77428
4	Spring, Helical pull back	1	45478N	96508
			209892	77428
5	Cylinder, 3/8 in pipe thread	1	45488	96508
			330469	77428
6	Screw, machine	1	45498N	0FUR2
			200429	77428
7	Pin, cotter	3	45588N	0FUR2
			1747	77428
8	Handle assembly	1	1768	77428
9	Ring, retaining	1	45568N	96508
			33044	77428
10	Packing, u-cup	1	330736	0FUR2
11	Collar, bronze	1	330738	0FUR2
12	Screw, set	1	45558N	96508
			213462	77428
13	Collar, stop	1	45548N	96508
			330437	0FUR2
14	Piston	1	45538N	96508
			330429	77428
15	O-ring	1	330452	0FUR2
16	Spring, swivel pull back	1	45518N	96508
			209884	0FUR2
17	Pin	1	45449N	96508
			330465	77428
18	Plug, ram	1	45508N	96508
			330451	0FUR2
19	Lifter	1	45528N	96508
			1719	77428
20	Stud, jaw connector	1	45578N	96508
			1735	77428
21	Coupler, female, high flow	1	CR400	26952
22	Dust cap	1	CD411	26952
23	Eye-bolt with nut	1	45428N	96508
			1725N	77428
	Grip, handle	1	BU0180	0FUR2
	Spring holder	AR	S-121	77428
	Spring puller	AR	S-123	77428
	REPAIR KIT (Contains Find Nos. 9, 10, and 15)	AR	R1790A	77428

Figure B-5. Special Hydraulic Cylinder Assembly (Sheet 2).

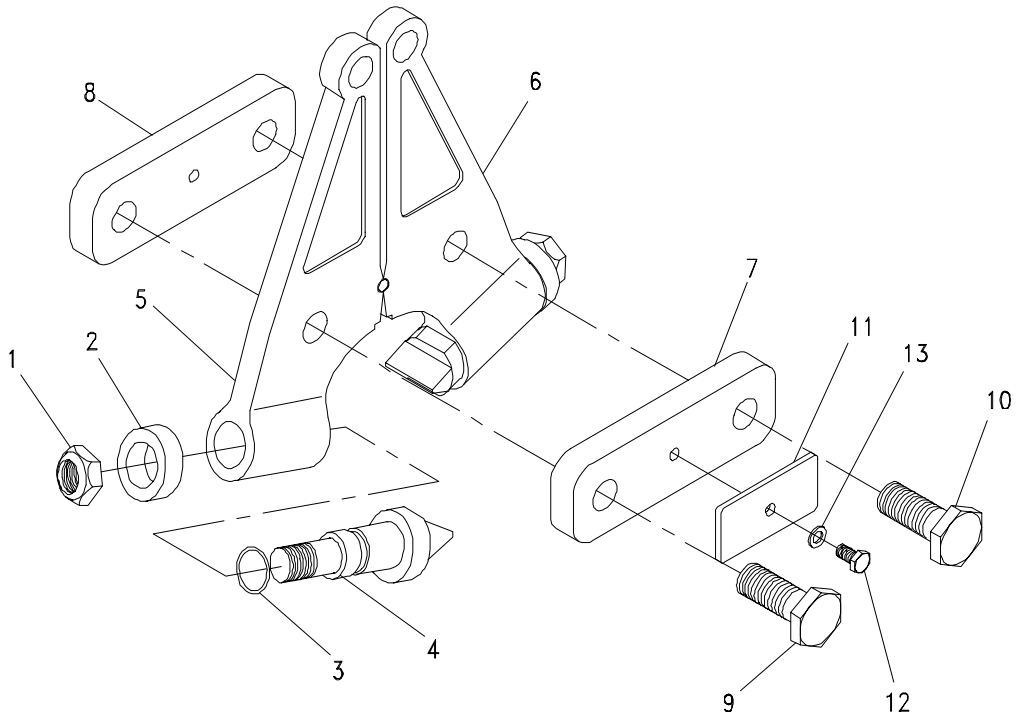


ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Bar stock cutter NAVSEA Dwg 5366579 Cutterhead, hard metal	1	45178N 0513MCK	96508 77428
1	Jaw	2	45198N 0510C	96508 77428
2	Bolt, strap	1	45228N 535MCK	96508 77428
3	Bolt, keeper	1	45238N 536MCK	96508 77428
4	Strap	2	45218N 0520	96508 77428
5	Spacer, jaw bolt	1	45188N 341MCK	96508 77428
6	Locknut	2	45248N 5666B	96508 77428
7	Keeper	2	45268N 544MCK	96508 77428

Figure B-6. Bar Stock Cutter (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
8	Nut, spacer bolt	1	45258N 963C	96508 77428
9	Spacer, bushing	1	45278N 561MCK	96508 77428
10	Bolt, shoulder	1	45288N 7127DA	96508 77428
11	Center pin	1	45208N 0514	96508 77428

Figure B-6. Bar Stock Cutter (Sheet 2).



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Nut splitter cutterhead NAVSEA dwg 5366579	1	44474N 1713PQ	96508 77428
1	Blade nut	2	1766PQ	96508
2	Spacer, blade	2	45298N	77428
3	Packing, preformed	2	SM0078	0FUR2
4	Blade insert	2	45328N 1722PO	96508 77428

Figure B-7. Nut Splitter Cutterhead (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
5	Jaw, left	1	45308N 1710PO	96508 77428
6	Jaw, right	1	45318N 1711PO	96508 77428
7	Strap, top	1	45338N 1720PO	96508 77428
8	Strap, bottom	1	45348N 1721PO	96508 77428
9	Bolt, left thread	1	45368N 1736PO	96508 77428
10	Bolt, right thread	1	45358N 1735PO	96508 77428
11	Lockplate	1	45388N 1756PO	96508 77428
12	Screw	1	45398N 1757PO	97508 77428
13	Washer	1	45378N	77428

Figure B-7. Nut Splitter Cutterhead (Sheet 2).

APPENDIX C

OPERATION AND MAINTENANCE PROCEDURES FOR THE JACK RAM

C-1 DESCRIPTION.

The jack rams have either a 6 1/8-inch or 10 1/2-inch stroke (Figure C-1). When operated with a diver operated pump (Appendix A), jacks should be limited to 80% of the rated load capacity.

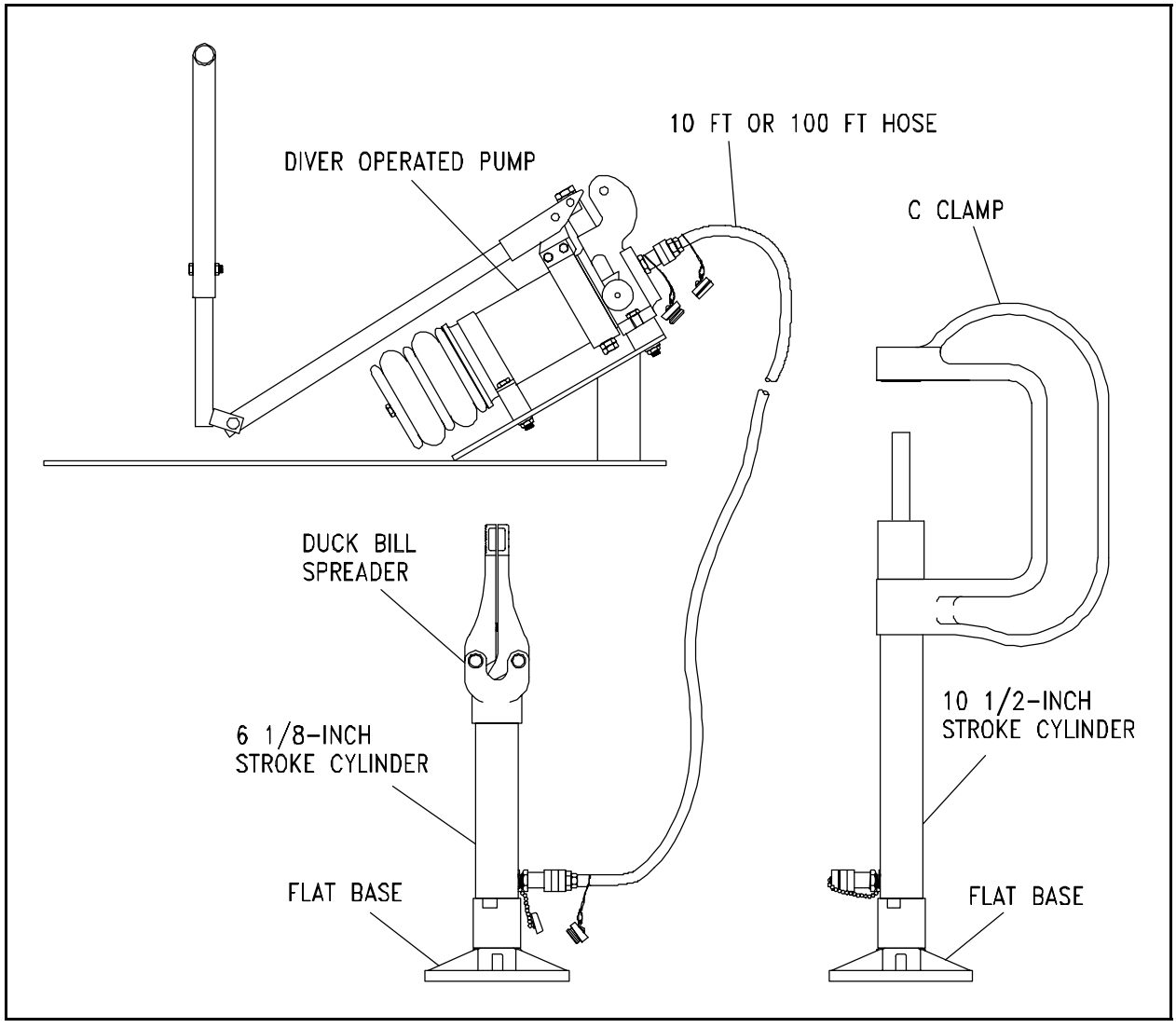


Figure C-1. Jack Ram and Accessories Setup.

C-2 REFERENCE.

NAVSEA Drawing 53665573.

C-2.1 Technical characteristics for the RC-106 and RC-1010 Jack Rams are provided in Table C-1.

Table C-1. Jack Ram Technical Characteristics.

CHARACTERISTIC	RC-106	RC-1010
Weight	9.8 lbs	14.0 lbs
Stroke	6 1/8 inches	10 1/2 inches
Load Capacity (Maximum)	10 tons	
Operating Pressure	10,000 psi	
Maximum Operating Depth	300 fsw	
Cylinder Effective Area	2.23 inches	
Collapsed Height	9 3/4 inches	13 3/4 inches

C-3 OPERATION.

WARNING

Positive voice communications shall be established between the diver and topside before operating any tool underwater.

WARNING

Never exceed the 5-ton rated load capacity of the jack attachments.

WARNING

Never exceed 5,000 psi inlet pressure to Jack Rams when they are configured with accessories.

WARNING

Center load on the cylinder plunger. Do not lift off-center loads. Off-center loads place considerable strain on cylinders and plungers and may be unstable.

WARNING

Cylinder saddle or attachments must fully engage the load and not be partially engaged in any way.

WARNING

Never exceed the maximum recommended operating pressure or flow.

WARNING

Never stand under a load being lifted by the jack. Tool or hose failure could cause the load to drop and result in injury to personnel.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

a. Follow operating procedures to prepare diver operated pump, Appendix A, but consider:

   (1) Jack ram assemblies alone operate at 80% of rated capacity.

   (2) Jack ram with accessories operate at 50% of rated capacity.

   (3) “Toe” style accessories reduce to 25% of rated capacity.

b. To return jack ram to service after storage with its protective sleeve in place, close diver operated pump release valve, actuate diver operated pump to extend cylinder plunger, unscrew attachment on end of jack and remove protective PVC sleeve.

c. Ensure air is bled from system.

   (1) Use short hose (10.0 ft).

   (2) Place pump higher than cylinder with pressure port up.

(3) Extend and retract jack ram several times allowing spring tension to retract.

d. Operate using the following steps:

WARNING

Always wear eye protection when using diver operated pump or Jack Ram on the surface.

WARNING

Never pressurize a hose assembly unless quick-disconnect couplers are properly mated together.

(1) Close diver operated pump release valve.

(2) Operate diver operated pump handle as required to extend the jack plunger.

(3) Open diver operated pump release valve to retract the plunger. If necessary, push down on the jack plunger to aid full retraction.

CAUTION

Do not apply excessive hydraulic pressure to jack when extended.

e. The jack plunger is protected by a 3-inch schedule 40 PVC protective sleeve (Figure C-2). The sleeve is 6 or 10 inches long according to the length of the plunger used.

(1) Close diver operated pump release valve.

(2) Operate diver operated pump handle as required to extend the jack plunger.

(3) Unscrew attachment on end of jack plunger.

(4) Coat surface of plunger with light coating of lubricant.

(5) Place PVC sleeve over plunger.

(6) Reinstall attachment on plunger.

(7) Open diver operated pump release valve to retract plunger.

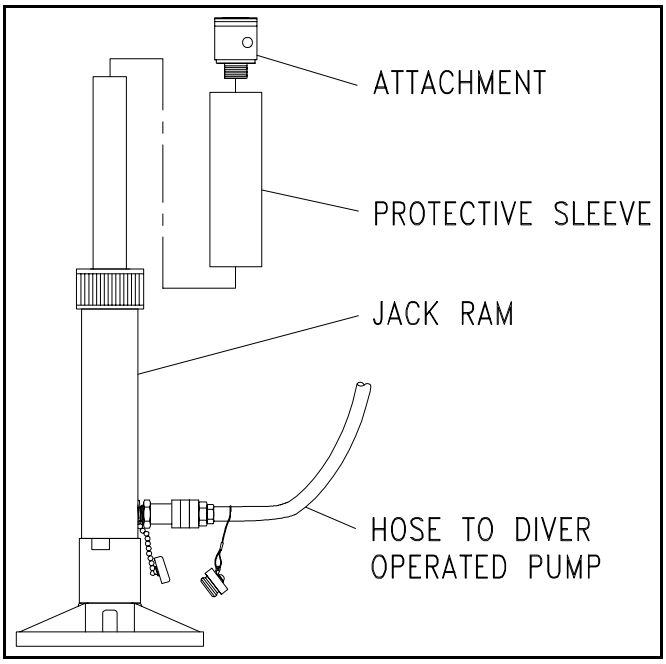


Figure C-2. Jack Ram and Protective Sleeve

C-4 ACCESSORIES.

Accessories for Jack Rams are described in Table C-2.

Table C-2. Jack Ram Accessories.

DESCRIPTION	PART NUMBER
C-clamp	A-210
Pin Pusher	A-183
Duck bill spreader	A-92
90º V-base	A-15
Flat Base	A-14
Rubber flexhead	A-128
Serrated saddle	A-18
Extensions	MZ-1002, 1003, 1004

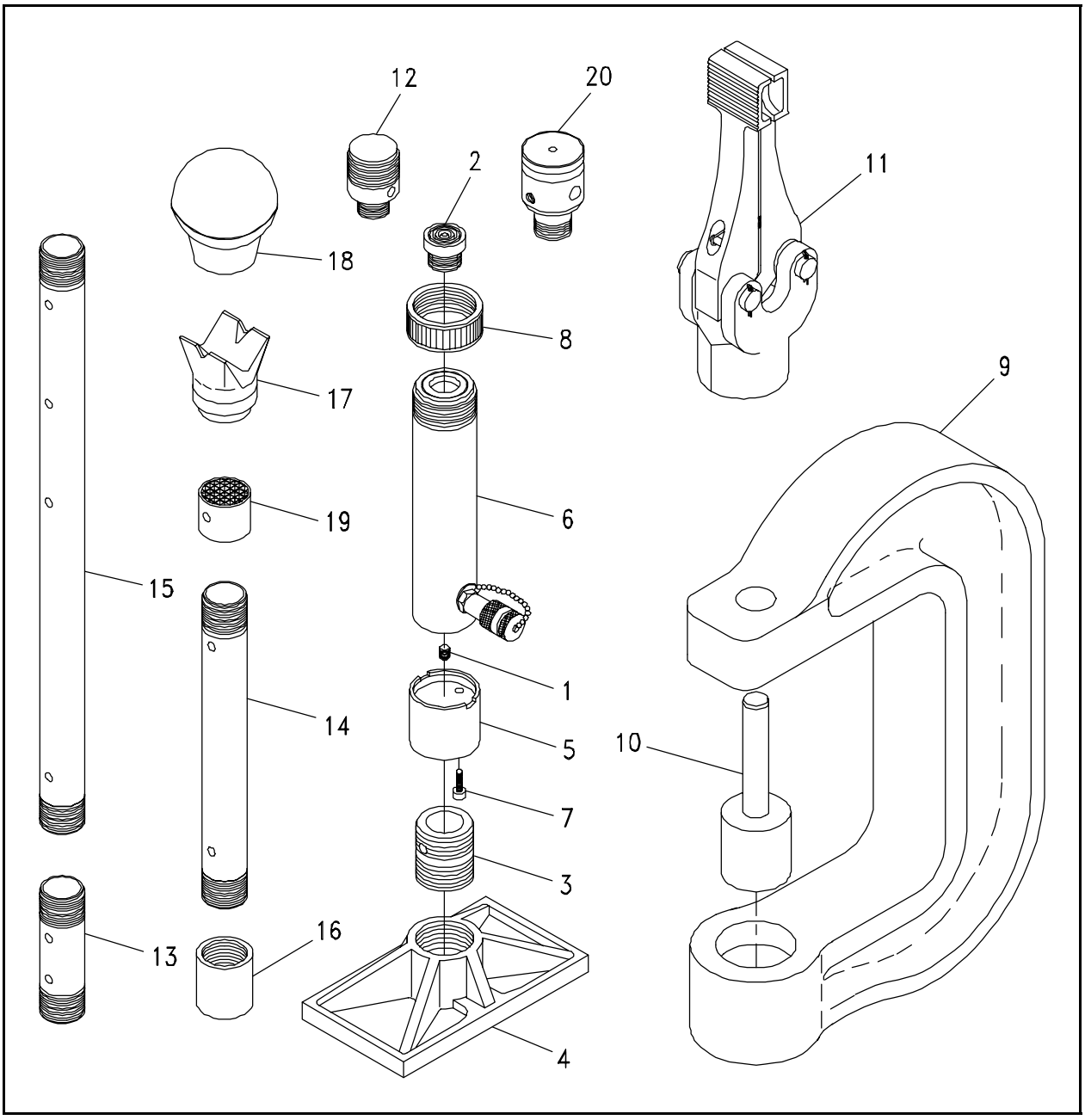
WARNING

Inspect all components before use. Do not use worn or damaged components.

NOTE

Typical accessory operating configurations are illustrated in Figure C-3.

Each jack ram cylinder is equipped with two plugs (1, Figure C-3), which are installed flush with the cylinder base to protect cylinder mounting holes, and a saddle (2). Remove plugs (1) and saddle (2) before making following attachments.



1. Plug
2. Saddle
3. Threaded Connector
4. Flat Base
5. Female Adapter
6. Cylinder
7. Cap screw
8. Thread Protector
9. C-Clamp
10. Pusher Pin
11. Duckbill Spreader
12. Male Adapter
13. Extension Tube (5”)
14. Extension Tube (10”)
15. Extension Tube (18”)
16. Female Coupling
17. V-Base
18. Rubber Flexhead
19. Serrated Saddle
20. Plain Saddle

Figure C-3. Attaching Accessories.

C-4.1 C-Clamp and Pusher Pin Attachment.

a. Thread wide end of threaded connector (3, Figure C-3) into flat base (4).

b. Secure female adapter (5) to cylinder (6) base with two cap screws (7).

c. Screw adapter (5) onto other end of threaded connector (3).

d. Thread large end of male adapter (12) into pusher pin (10) and thread entire assembly into top of cylinder (6). Remove protective sleeve (8) and thread C-Clamp (9) onto cylinder (6).

C-4.2 Duckbill Spreader Attachment.

a. Thread wide end of threaded connector (3, Figure C-3) into flat base (4).

b. Secure female adapter (5) to bottom of cylinder (6) with two cap screws (7).

c. Screw adapter (5) onto other end of threaded connector (3).

d. Thread large end of male adapter (12) into base of duckbill spreader (11) and thread entire assembly into top of cylinder (6).

C-4.3 V-Base, Flexhead, and Serrated Saddle Attachment.

a. Thread wide end of threaded connector (3, Figure C-3) into flat base (4).

b. Secure female adapter (5) to bottom of cylinder (6) with two cap screws (7).

c. Screw adapter (5) onto other end of threaded connector (3).

d. Install male adapter (12) in top end of cylinder.

e. If extension tube(s) (13, 14, or 15) must be used, attach a threaded female coupling (16) onto male adapter (12).

f. Thread one of tubes provided into other end of coupling (16).

g. Connect two or more extension tubes with a threaded female coupling (16).

h. Screw 90º V-base (17), rubber flexhead (18), or serrated saddle (19) onto free end of extension tube.

C-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for Jack Ram Maintenance Requirement Cards (MRCs).

C-6 TROUBLESHOOTING.

Refer to Table C-3 for Jack Ram troubleshooting.

C-7 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to replacement of parts. Figure C-4 illustrates parts breakdown for the rams.

C-8 HOSES.

For complete details concerning hoses refer to Appendix X.

Table C-3. Jack Ram Troubleshooting Guide

Trouble	Possible Cause	Remedy
Plunger does not advance.*	Pump release valve open. Low or no fluid in pump. Air in hydraulic system. Loose coupling. Blocked hydraulic hose. Pump not operating.	Close valve. Fill pump fluid reservoir. Remove air from system. See Appendix A. Ensure quick-connect couplings are secure. Clear hose. See pump operating procedures in Appendix A.
Plunger advances part way.*	Low pump fluid level. Plunger binding.	Fill pump fluid reservoir. Replace jack ram.
Plunger advances in spurts.*	Air in system. Plunger binding.	Remove air from system. See Appendix A. Replace jack ram.
Plunger advances slower than normal.*	Leaking or loose quick-connect couplings. Restriction in hose or fitting. Pump malfunction.	Check and tighten quick-connect couplings. Clear hose, quick-connect coupling, and fitting. See Appendix A, troubleshooting guide.
Plunger advances, but does not hold pressure.*	Leaking cylinder seals. Leaking connection. Pump malfunction.	Replace seals. Tighten quick-connect couplings. See Appendix A, troubleshooting guide.
Plunger does not retract or retracts slower than normal.	Pump release valve closed. Loose quick-connect couplings. Blocked hydraulic hose. Broken retraction spring. Overfilled pump fluid reservoir. Internal cylinder damage.	Open valve. Check and tighten quick-connect couplings. Clear hose. Replace spring. Drain necessary amount of fluid from reservoir. Disassemble, inspect; repair or replace.
Plunger does not fully retract.	Weak retraction spring. Overfilled pump fluid. Partially blocked hose. Internal cylinder damage.	Replace spring. Drain necessary amount of fluid from reservoir. Clear hose. Disassemble, inspect; repair or replace.
Cylinder fluid leak.	Worn or damaged seals. Loose quick-connect couplings.	Replace seals. Tighten quick-connect couplings.

***** For topside operations, pump assembly is required to be oriented to allow oils to flow into pump head during operation.

C-9 ILLUSTRATED PARTS BREAKDOWN.

a. Figure C-4 illustrates the parts breakdown for the Jack Ram.

b. Figure C-5 illustrates the accessories.

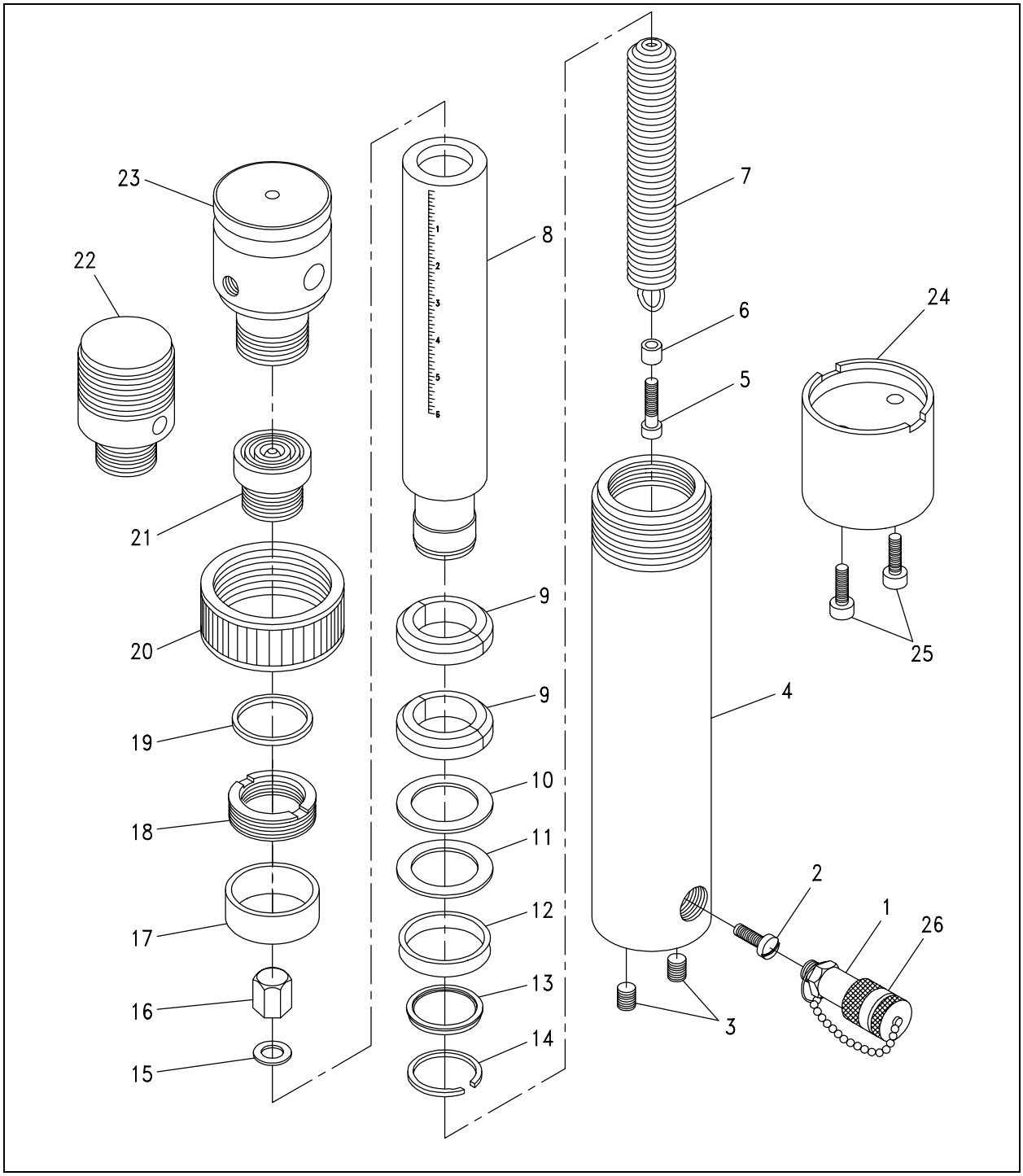
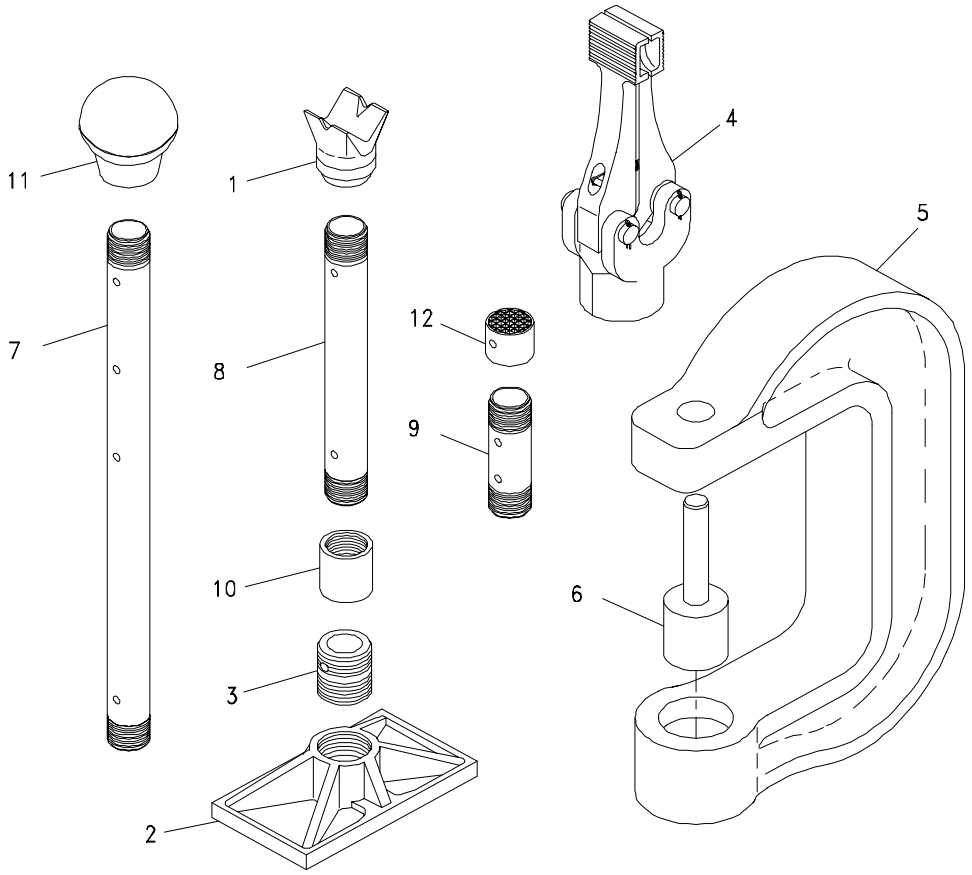


Figure C-4. Jack Ram Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Jack ram (6 1/2-inch stroke)	1	RC-106	26952
	Jack ram (10-inch stroke)	1	RC-1010	26952
1	Half coupler, female	1	CR400	26952
2	Screw	1	G836.028	26952
3	Plug	2	G655.028	26952
4	Cylinder RC-106 (6 1/2-inch) RC-1010 (10-inch)	1	 G837.005 G829.005	 26952
5	Screw	1	F958.028	26952
6	Bushing	1	F948.209	26952
7	Spring RC-106 RC-1010	1	 F937.110 F938.110	 26952 26952
8	Plunger RC-106 RC-1010	1	 G838.040 G830.040	 26952 26952
9	Bearing, rod	2	G382.107	26952
10	Washer	1	See note	26952
11	Washer, backup RC-106 only	1	See note	26952
12	U-cup	1	See note	26952
13	Washer (RC-106 only)	1	F942.108	26952
14	Ring, retaining	1	N/A	26952
15	Gasket	1	G834.167	26952
16	Cap nut	1	G833.055	26952
17	Bearing	1	G831.446	26952
18	Ring, bearing stop	1	G385.004	26952
19	Ring, wiper	1	See note	26952
20	Thread protector	1	R28.271	26952
21	Saddle	1	L602.900	26952
22	Adapter, male, 1-1/4 NPT	1	A-13	26952
23	Plain saddle	1	A-12	26952
24	Adapter, female, 1-1/4 NPT	1	A-21	26952
25	Cap Screw, socket head	2	G824.028	26952
26	Cap, dust	1	CD410	26952
	Cylinder repair kit (Contains Find Nos. 10, 11, 12, 14, and 19)	AR	RC-102K	26952

NOTE: Included in cylinder repair kit RC-102K.

Figure C-4. Jack Ram Components (Sheet 2).



Item	Description	Qty	Part Number	CAGE
1	V-base (90-degree)	1	A-15	26952
2	Flat base	1	A-14	26952
3	Threaded connector	1	A-10	26952
4	Duckbill spreader	1	A-92	26952
5	C-clamp	1	A-210	26952
6	Pusher pin	1	A-183	26952
7	Extension tube (18” length)	1	MZ-1004	26952
8	Extension tube (10” length)	1	MZ-1003	26952
9	Extension tube (5” length)	1	MZ-1002	26952
10	Coupling	1	A-19	26952
11	Rubber flexhead	1	A-128	26952
12	Serrated saddle	1	A-18	26952

Figure C-5. Jack Ram Accessories

APPENDIX D

OPERATION AND MAINTENANCE PROCEDURES FOR THE PULL CYLINDER ASSEMBLY

D-1 DESCRIPTION.

The pull cylinder assembly, Figure D-1, uses a modified ENERPAC Model RD-1610 double-acting hydraulic cylinder connected to a Greer accumulator. The accumulator automatically extends the cylinder rod after each retracting stroke of the rod. Compressed gas inside the accumulator extends the rod when the diver operated pump release valve is opened. The pull cylinder can move a load approximately 6-inches for each cylinder stroke. The pull cylinder is supplied hydraulic power from the diver operated pump (Figure D-1). Repetitive pulling action is accomplished by moving the clevis grab hook up the 8-foot length of chain after each cylinder retraction. The accumulator has a charging adapter to charge the accumulator with nitrogen. Other components included in a pull cylinder assembly are: two connecting blocks (1/2-inch steel plate with high-strength steel bolts); four clevis grab hooks; a clevis sling hook; and 5/8-inch Spectrum 7 chains (two 8-foot lengths and one 6-foot length).

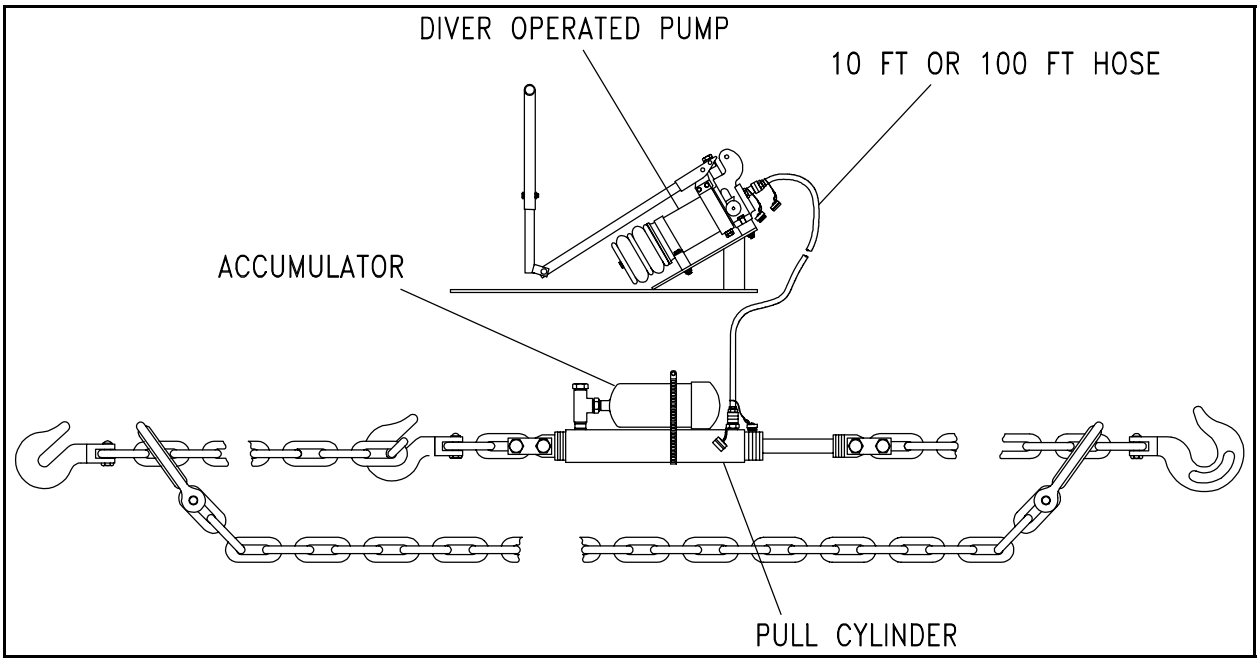


Figure D-1. Pull Cylinder Setup

D-2 REFERENCE.

NAVSEA Drawing 5366575.

D-2.1 Technical characteristics for the pull cylinder assembly are provided in Table D-1.

Table D-1. Pull Cylinder Assembly Technical Characteristics.

CHARACTERISTICS	REMARKS
Maximum operating pressure	10,000 psi
Stroke	10 inches
Pulling capacity	8 tons
Maximum operating depth	250 fsw

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Wear eye protection when using the diver operated pump topside. High-pressure fluid leaks are hazardous to personnel.

WARNING

Do not exceed the maximum recommended operating pressure or flow.

WARNING

Never exceed the 8-ton rated load capacity of the pull cylinder.

WARNING

Never stand under a load being moved by the pull cylinder. Tool or hose failure could cause the load to drop.

WARNING

Ensure that hose connections are secure between pump and cylinder. Due to pressure in the accumulator, it may be necessary to use a pair of slip-joint pliers to connect the quick-disconnect couplings.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

D-3 OPERATION.

a. Follow the operating procedure for the diver operated pump.

(1) Bleed air from system.

(a) Use short hose.

(b) Place pump higher than cylinder with pressure port up.

(c) Place cylinder with pressure port up.

(d) Extend and retract pull cylinder several times.

(2) Check for leaks.

WARNING

Do not use chains less than 5/8-inch in diameter. Use Spectrum 7 chain as specified. Other chain could break under the load.

b. Attach blocks, hooks, and chains to the pull cylinder as illustrated in Figure D-1. Pull all slack from chain before connecting chain to the cylinder. Otherwise, most of the cylinder stroke will be used to tighten chain instead of pulling the load.

c. Close pump release valve. Operate pump handle to retract cylinder plunger.

d. Open pump release valve. Relocate rigging as job requires.

D-3.1 Accumulator Recharging.

Set up charging apparatus as shown in Figure D-2.

a. Position the pull cylinder at a 45° angle with plunger down and the tee up.

b. Remove the 3/8” NPT pipe plug.

c. With the plunger fully extended, fill the pull cylinder and accumulator through the tee

with Houghton PR 1192 hydraulic fluid.

NOTE

It is important that there is no air in the pull cylinder.

CAUTION

Do not use Teflon tape.

a. Reinstall 3/8” NPT pipe plug.
b. Remove female half coupler from pull cylinder.
c. Remove Schrader valve dust cap.
d. Attach the charging and gauging system to the charging valve on accumulator.

WARNING

Do not charge the accumulator to more than 90 psi.

a. Charge accumulator to 70-90 psi with dry nitrogen.
b. Secure and remove the charging and gauging system from the charging valve.
c. Reinstall Schrader valve dust cap.
d. Place the pull cylinder in the horizontal position with inlet ports up.
e. Fill the pull cylinder through female half coupler hole with Houghton PR 1192 Hydraulic fluid.
f. Reinstall female half coupler. Use thread sealing compound on threads.
g. Connect diver operated pump with hose to the pull cylinder.
h. Vent system per paragraph D-3a(1).
i. Test operate pull cylinder by retracting cylinder plunger and then opening the release valve of the diver operated pump. The plunger should extend when valve is opened.
j. Replace female-male dust cap.

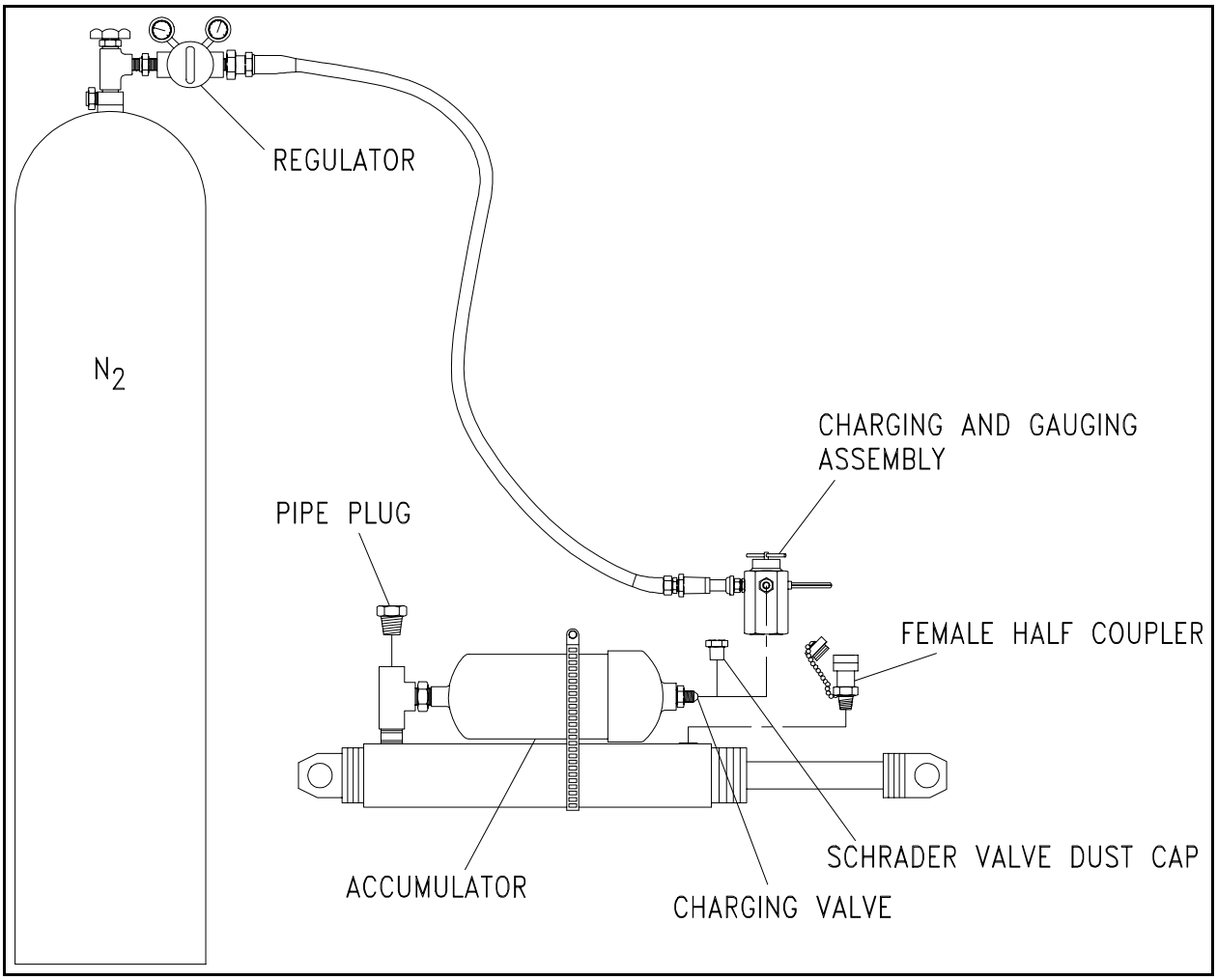


Figure D-2. Accumulator with Charging and Gauging Assembly.

D-4 SCHEDULED MAINTENANCE.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

a. After each use, rinse pull cylinder and accessories with fresh water, wipe clean, and spray with MIL-C-81309 or equivalent. Inspect for damage, and repair or replace any damaged parts.

CAUTION

Because pull cylinder is stored with the plunger extended, plated surfaces must be protected against nicks and corrosion.

b. Before storage, extend plunger and coat it with MIL-L-24139A or equivalent.

c. Place a dust cap on cylinder coupling.

D-5 TROUBLESHOOTING.

Refer to Table D-2 for pull cylinder assembly troubleshooting.

Table D-2. Pull Cylinder Troubleshooting Guide.

Trouble	Possible Cause	Remedy
Plunger does not advance.	Pump release valve open. No fluid in pump. Air in lines. Loose quick-disconnect coupling. Blocked hydraulic line. Pump not operating. Compressed gas leaking from accumulator.	Close valve. Fill pump reservoir. Bleed lines. Check and tighten. Remove obstruction. See Diver Operated Pump Appendix A Isolate leak. Recharge accumulator.
Plunger advances part way.	Low pump fluid level. Plunger binding.	Fill pump reservoir. Charge accumulator.
Plunger advances in spurts.	Air in hydraulic system. Plunger binding.	Bleed system. Charge accumulator.
Plunger advances slower than normal.	Loose or leaking quick-disconnect coupling. Restricted hydraulic line or fitting. Pump malfunction.	Ensure quick-disconnect couplings are secure. Clear lines and fittings. See Diver Operated Pump Appendix A.
Plunger advances, but does not hold pressure.	Cylinder seals leaking. Leaking quick-disconnect coupling. Pump malfunction.	Replace seals. Tighten quick-disconnect couplings. See Diver Operated Pump Appendix A.
Cylinder leaks fluid.	Worn or damaged seals. Loose quick-disconnect coupling. Pump malfunction.	Replace seals. Tighten quick-disconnect couplings. See Diver Operated Pump Appendix A.
Plunger does not retract or retracts slower than normal.	Pump release valve closed. Loose quick-disconnect coupling. Blocked hydraulic line. Internal cylinder damage.	Open valve. Tighten quick-disconnect couplings. Clear line. Disassemble, inspect; repair or replace damaged parts.
Plunger does not fully retract.	Partially blocked line. Internal cylinder damage.	Clear line. Disassemble, inspect; repair or replace damaged parts.

D-6 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to removing and replacing accumulator, replacing or repairing the cylinder. Figures D-3 and D-4 illustrate the parts breakdown.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

D-6.1 Accumulator.

D-6.1.1 Replace.

a. Depress valve stem core of Schrader valve located in end of accumulator to bleed off compressed gas.

b. Unscrew accumulator from tee.

c. Replace accumulator and recharge per paragraph D-3.1.

D-6.2 Cylinder.

If the cylinder malfunctions and is not an RD-1610, remove and discard. Replace with RD-1610.

D-6.2.1 Repair.

a. If cylinder is an RD-2620, remove accumulator (9), tee (7), and female coupler half (11) (Figure D-3) per paragraph D-6.1.1.

b. Remove lockscrew (1, Figure D-4).

CAUTION

Hydraulic cylinder stop ring (14, Figure D-4) threads are lightly staked during manufacturing to prevent turning during use. Prior to removing a stop ring, the staked area must be removed to prevent damaging other threads.

a. Drill out entire deformed material until good threads are visible on all sides and bottom of staked area (usually 1 or 2 threads).

b. Remove internal parts and using repair kit replace backup washer (3), O-ring (4), U-cup (6), piston (7), O-ring (9), U-cup (12) and wiper ring (15).

c. Torque setscrew (8) to 7 to 20 in-lbs.

d. Torque piston (7) and plunger (13) to 55-65 ft-lbs and secure with Loctite #222.

e. Replace lockscrew (1).

f. After assembly and testing, restake stop ring threads on new location on cylinder.

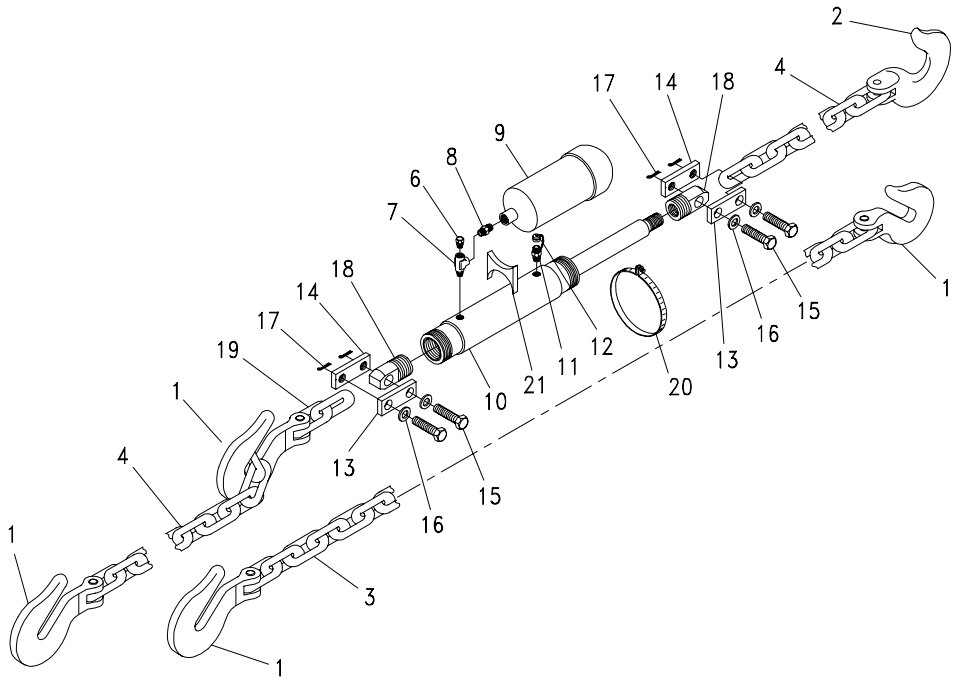
D-7 HOSES.

For complete details concerning hoses refer to Appendix X of this document.

D-8 ILLUSTRATED PARTS BREAKDOWN.

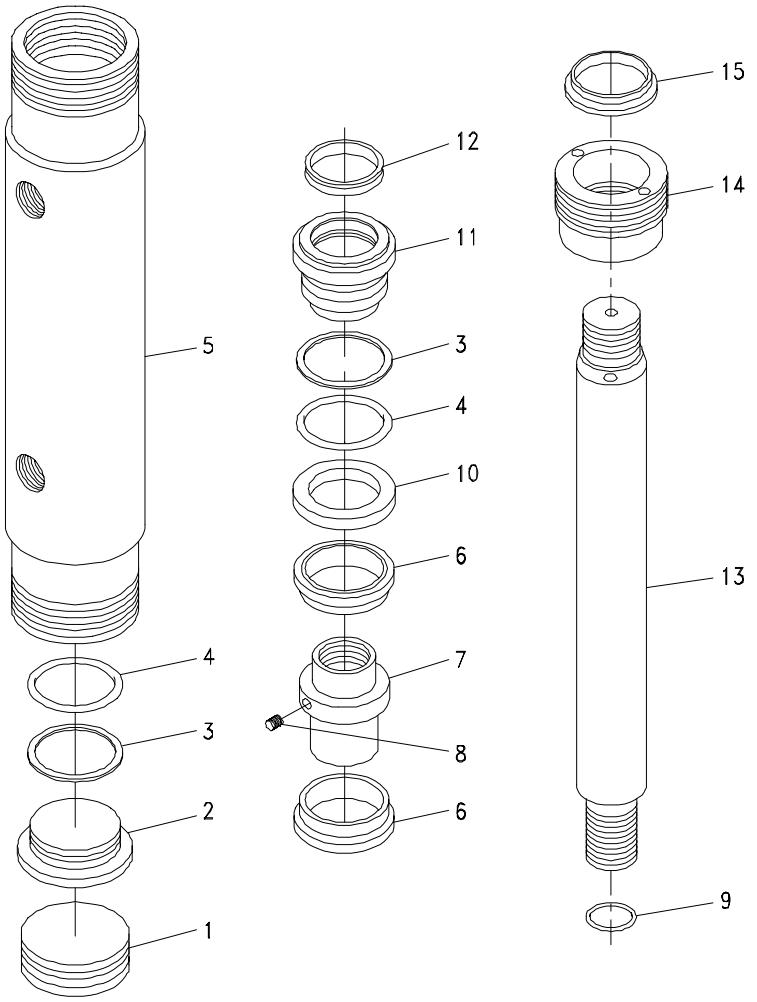
a. Figure D-3 illustrates the parts breakdown for the NAVSEA Pull Cylinder Assembly.

b. Figure D-4 illustrates the ENERPAC Cylinder.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Pull Cylinder	1	5366575	53711
1	Hook, Clevis grab, 5/8 chain size	4	A-330	75535
2	Hook, Clevis sling, 5/8 chain size	1	A-339	75535
3	Chain, Spectrum 7, 5/8 X 6 foot	1		75535
4	Chain, Spectrum 7, 5/8 X 8 foot	2		75535
5	Nipple	1	2084-6S-2	16717
6	Plug, pipe 3/8 NPT	1	2082-6	16717
7	Pipe tee	1	2090-6-6S	16716
8	Adapter pipe	1	00936	50252
9	Accumulator 1/2 NPT ported	1	80012	26337
10	Cylinder Pull 8 ton 10 1/4 stroke	1	RD-1610	26952
11	Half coupler, female	1	CR400	26952
12	Cap, Dust female-male	1	CD-4	26952
13	Plate	2	5366575-13	53711
14	Plate, threaded	2	5366575-14	53711
15	Bolt 3/4-10UNC-2A X 2.75	4	5366575-15	53711
16	Washer	4	5366575-16	53711
17	Pin, Cotter 7/64 IOC	4		
18	Mounting clevis pin	2		
19	Chain, Spectrum 7, 5/8 2 links	1		75535
20	Hose clamp, 6” dia, 9/16 wide. SS, Worm Geared	1	5417K37	39428
21	Saddle	1	5366575-23	53711

Figure D-3. Pull Cylinder Components.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Cylinder		RD-1610	26952
1	Lock screw	1	F312.048	26952
2	Cap	1	CJ280.570	26952
3	Backup washer	2	B1224.565	26952
4	O-ring	2	B1224.903	26952
5	Base	1	L218.030	26952
6	U-cup	2	CF297.041	26952
7	Piston	1	CW188.107	26952
8	Set screw	1	CF623.028	26952
9	O-ring	1	B1212.903	26952
10	Bearing	1	CL768.107	26952
11	Internal stop ring	1	CJ281.044	26952

Figure D-4. Cylinder Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
12	U-cup	1	CH869.041	26952
13	Plunger	1	CL794.040	26952
14	External stop ring	1	L233.044	26952
15	Wiper ring	1	CF664.044	26952
	Repair kit (contains find nos. 3, 4, 6, 7, 9, 12, and 15)	AR	RD1610K2	26952

Figure D-4. Cylinder Components (Sheet 2).

APPENDIX E

OPERATION AND MAINTENANCE PROCEDURES FOR THE WIRE ROPE CUTTER

E-1 DESCRIPTION.

The wire rope cutter (Figure E-1) is a Cooper Tools Model 36262N hand-held wire rope cutter. The cutter makes cuts at any point along a hard wire (including stainless steel) rope up to 1-1/4 inches thick, 1-inch diameter common guy strand cable, and 3/4-inch diameter extra-high-strength guy strand cable. The wire rope cutter has a corrosion-resistant black oxide endurion finish. It is used with the diver operated pump (Appendix A).

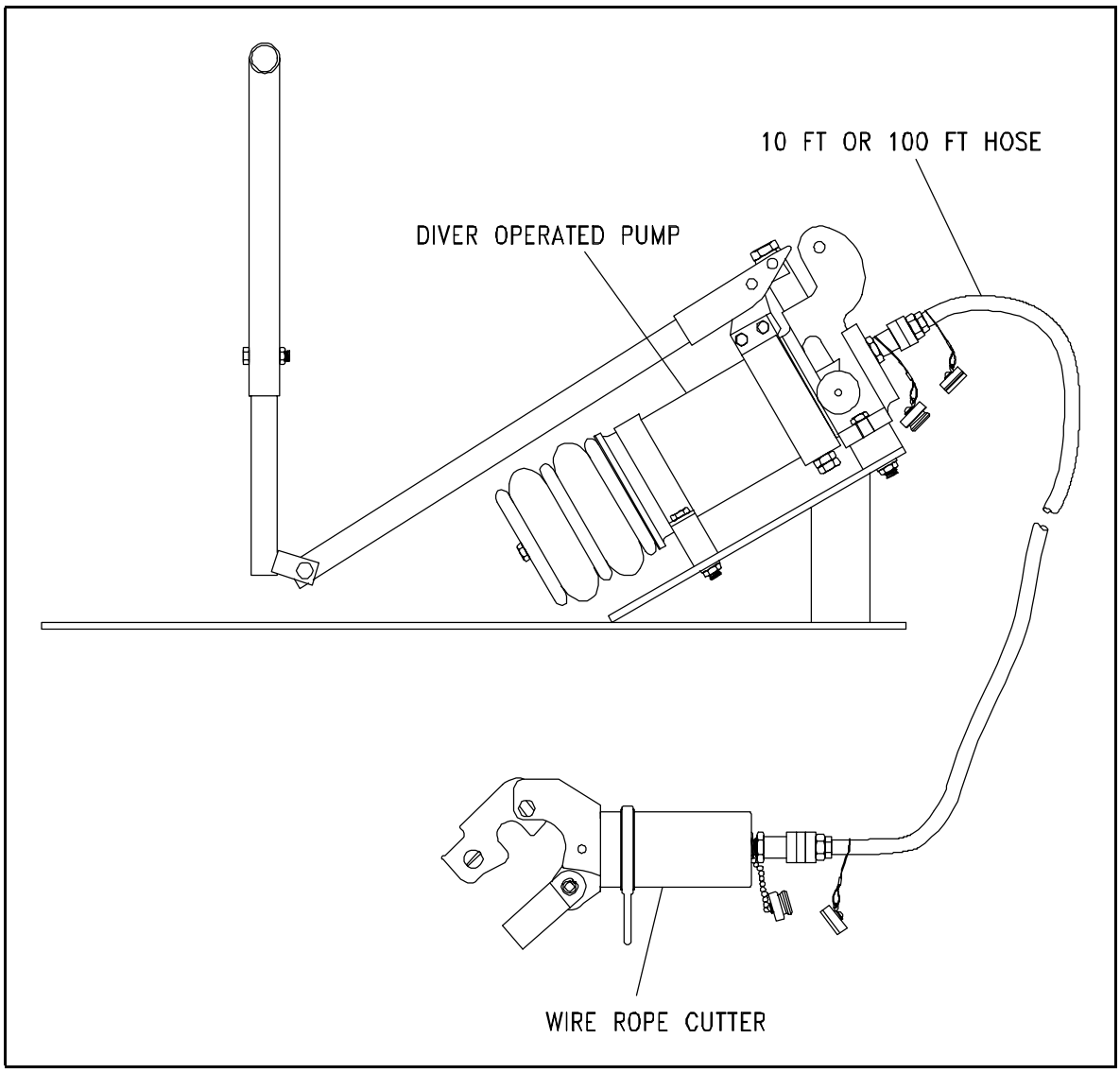


Figure E-1. Wire Rope Cutter Setup.

E-2 REFERENCE.

NAVSEA Drawing 5366567.

E-2.1 Technical characteristics for the wire rope cutter are provided in Table E-1.

Table E-1. Wire Rope Cutters Technical Characteristics

CHARACTERISTIC	REMARKS
Maximum operating depth	300 fsw

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

E-3 OPERATION.

a. Follow operating procedures for the diver operated pump.

b. Ensure air is bled from system.

(1) Use short hose (10.0 ft).

(2) Place pump higher than cylinder with pressure port up.

(3) Open and close cutter blade several times allowing spring tension to retract.

c. Operate diver operated pump handle to extend the moving cutter blade.

d. Open diver operated pump release valve to retract moving cutter blade.

WARNING

Always wear eye protection when using diver operated pump and the wire rope cutter on the surface.

WARNING

Exercise caution when cutting wire rope under tension to prevent personal injury.

CAUTION

Do not attempt to cut wire which exceeds the cutter limitations.

CAUTION

Never attempt to cut solid metal with wire rope cutter.

CAUTION

Keep the cutter jaws at right angles to material being cut. Cutting diagonally can twist the cutter jaws out of line or chip the cutting edge. Do not twist or pry with the tool while cutting.

e. Place cutterhead fixed blades around the wire to be cut and secure with the clevis.

f. Close diver operated pump release valve.

g. Operate diver operated pump handle until cut is complete.

h. Open diver operated pump release valve. The moving cutter blade will retract.

i. Make additional cuts or return to the surface, as mission requires.

E-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for wire rope cutter Maintenance Requirement Cards (MRC).

E-5 TROUBLESHOOTING.

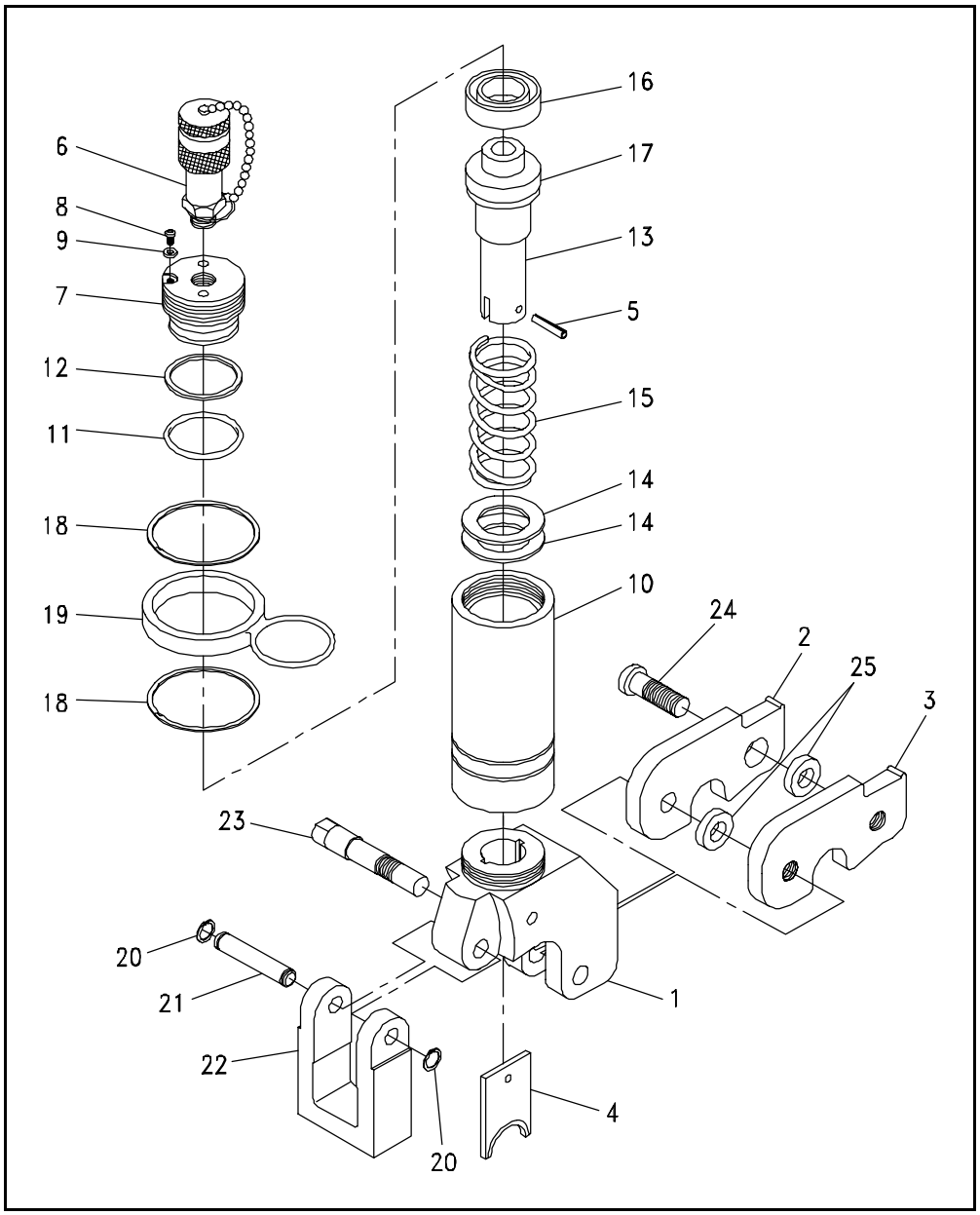
Refer to Table E-2 for wire rope cutter troubleshooting.

Table E-2. Wire Rope Cutter Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Fluid leakage at moving blade.	Piston seal failure.	Replace piston seal.
Fluid leakage at threads of cylinder end cap.	Loose cylinder end cap. Cylinder end cap seal failure.	Tighten. Replace seal.
Moving cutter blade does not retract after cut.	Wire fragments between sliding blade and faces of fixed blade. Compression spring in cylinder not strong enough to return cutter piston.	Remove wire with pliers or screwdriver. Replace compression spring in piston assembly.
Moving cutter does not move forward when diver operated pump is actuated.	Loose quick-disconnect couplings. No pressure from diver operated pump.	Ensure quick-disconnect couplings are securely fastened. See diver operated pump operating procedures Appendix A.

E-6 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to replacement of moving cutter blade and disassembly/reasssembly of cutter for replacement of internal components.



1	Yoke	10.	Cylinder	18.	Suspension Retaining Rings
2.	Fixed Blade, Right	11.	Seal		
3.	Fixed Blade, Left	12.	Backup Washer	19.	Suspension Ring
4.	Moving Cutter Blade	13.	Piston	20.	Retaining Rings
5.	Moving Blade Pin	14.	Washers	21.	Grooved Pin
6.	Female Coupler	15.	Spring	22.	Clevis
7.	Cylinder End Cap	16.	Seal	23.	Pivot Pin
8.	Guard Screw	17.	Wear Sleeve	24.	Clamping Screw
9.	Spacer			25.	Spacers

Figure E-2. Wire Rope Cutter Maintenance.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

E-6.1 Moving Cutter Blade.

E-6.1.1 Remove.

CAUTION

The moving cutter blade is designed with a 1/64-inch flat on its cutting edge. Do not sharpen to a knife edge.

a. Clamp cutterhead in a vise by large part of yoke (1, Figure E-2).

b. Connect cutter to diver operated pump with an appropriate diver operated pump hose.

c. With fixed blades (2, 3) open, and diver operated pump release valve closed, actuate diver operated pump to extend the moving cutter blade (4) until moving blade pin (5) is aligned with the holes in side of yoke (1).

d. Remove moving blade pin (5) through holes in yoke (1). Remove moving cutter blade (4).

E-6.1.2 Replace.

WARNING

Never-Seez or equivalent anti-seizing compound is combustible.

WARNING

Avoid prolonged contact with skin or prolonged breathing of vapors. Use with adequate ventilation.

WARNING

Never-Seez or equivalent contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting. Call a physician.

a. Insert a new moving cutter blade (4). Coat moving blade pin (5) with Never-Seez and reinstall.

b. Actuate cutter several times to check moving cutter blade alignment.

c. Open diver operated pump release valve to retract piston.

d. Disconnect diver operated pump hose.

E-6.2 Cutter.

E-6.2.1 Disassemble.

a. Remove moving cutter blade (4, Figure E-2) per paragraph E-6.1.1.

b. Remove female coupler (6) from cylinder end cap (7) and allow fluid to drain from cylinder.

c. Using a 5/32-inch Allen wrench, remove end cap guard screw (8) and spacer (9) from cylinder end cap (7).

d. Place two close-fitting steel dowel pins (approximately 3/8-inch diameter) in holes provided in cylinder end cap. (See Figure E-3).

WARNING

The cylinder end cap could be under slight spring tension. Remove it carefully to avoid injury.

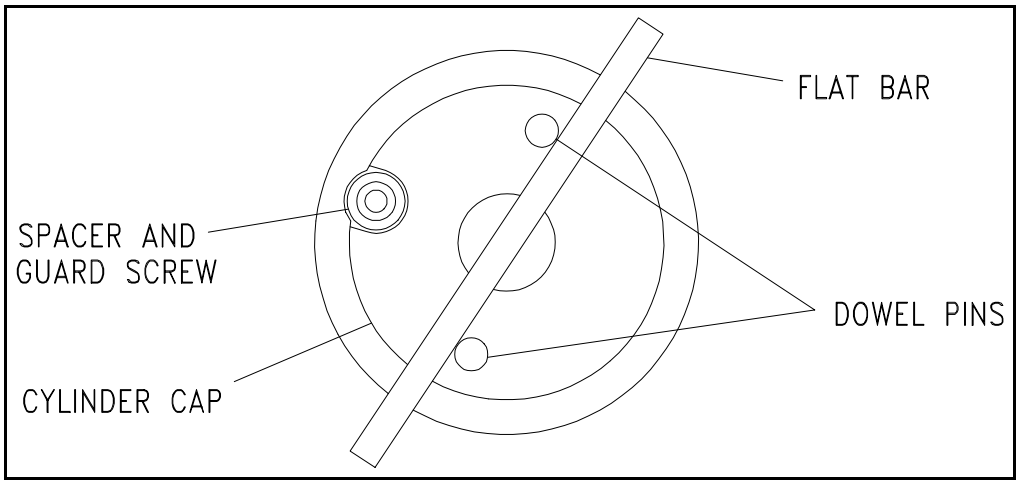


Figure E-3. Cylinder End Cap.

e. Using a flat bar between dowel pins, turn flat bar counterclockwise and remove cylinder end cap from cylinder.

f. Remove cylinder cap seal (11, Figure E-2) and Teflon backup washer (12) from cylinder end cap (7).

NOTE

Do not remove the piston wear sleeve from the piston.

g. Push piston (13), piston spring washers (14), compression spring (15), piston seal (16), and attached piston wear sleeve (17) out of cylinder (10) from front.

h. Using retaining ring pliers, remove two suspension retaining rings (18) and suspension ring (19) from cylinder (10).

CAUTION

Do not put cylinder in a vise. This could cause distortion in cylinder bore.

i. Using a strap or chain wrench, remove cylinder (10) from yoke (1) by turning cylinder counterclockwise.

j. Using retaining ring pliers, remove two retaining rings (20) from grooved pin (21). Remove grooved pin (21) from clevis (22) and separate from yoke (1).

k. Remove pivot pin (23) out of yoke (1).

l. Remove assembled fixed blades (2, 3) from yoke (1). Unscrew fixed blade clamping screw (24) to separate two fixed blades. Remove two fixed blade spacers (25) from between fixed blades.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep away from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

m. Clean all parts using MIL-C-81309.

NOTE

The piston is equipped with a wear sleeve which is shrunk onto the steel piston. If it is necessary to replace the sleeve, return the piston to the manufacturer for repair.

n. Inspect all parts for damage or excessive wear. Replace any damaged or excessively worn parts.

E-6.2.2 Reassemble.

CAUTION

Do not damage piston seal when inserting piston assembly into cylinder bore.

a. Clamp the cutterhead in a vise horizontally by the large part of the yoke (1, Figure E-2).

CAUTION

The cylinder is nearly identical on each end and could be assembled with either end next to the yoke. The end of the cylinder without a spacer index should be assembled on the yoke. (See Figure E-3).

b. Coat threads of yoke (1) and interior of cylinder (10) bore with a light coat of Never-Seez or equivalent.

c. Using a strap or a chain wrench, reinstall cylinder (10) with yoke marking on the yoke (1) by turning it clockwise.

d. Assemble two fixed blades (2, 3) with the two fixed blade spacers (25) between them and secure them with the fixed blade clamping screw (24).

e. Insert assembled fixed blades (2, 3) into yoke (1) and secure with pivot pin (23).

f. Attach clevis (22) to yoke (1) with grooved pin (21) and two retaining rings (20).

g. Add Never-Seez or equivalent to compression spring (15) and surrounding cavity until thoroughly coated.

h. Insert the two piston spring washers (14), the compression spring (15) and the piston assembly (13, 17) in the cylinder (10) bore.

i. Install piston seal (16), Teflon backup washer (12), and cylinder cap seal (7) in the cylinder (10) behind the piston (13).

j. Coat threads of cylinder end cap (7) with Never-Seez or equivalent.

k. Ensure Teflon backup washer (12) and cylinder cap seal (11) are in place.

l. Thread cylinder end cap (1, Figure E-3) into cylinder (14).

m. Insert two close fitting steel dowel pins (approximately 3/8-inch diameter) in holes provided in cylinder end cap. Place a flat bar between dowel pins. Turn flat bar clockwise to tighten cylinder end cap.

n. Align spacer index in cylinder end cap (7, Figure E-2) with cylinder (10) housing grooves.

o. Install spacer (9) and guard screw (8) in cylinder (10).

p. Using a 5/32-inch Allen wrench, secure spacer (9) with guard screw (8). Tighten screw.

q. Install suspension ring (19) on outside of cylinder (10) and secure with two suspension retaining rings (20).

r. Install moving cutter blade (4) in yoke (1) and secure with moving blade pin (5).

s. Add Houghton PR 1192 hydraulic fluid through female coupler port until cutter is full.

t. Coat threads of female coupler (6) with Never-Seez or equivalent and install coupler into cylinder end cap (7).

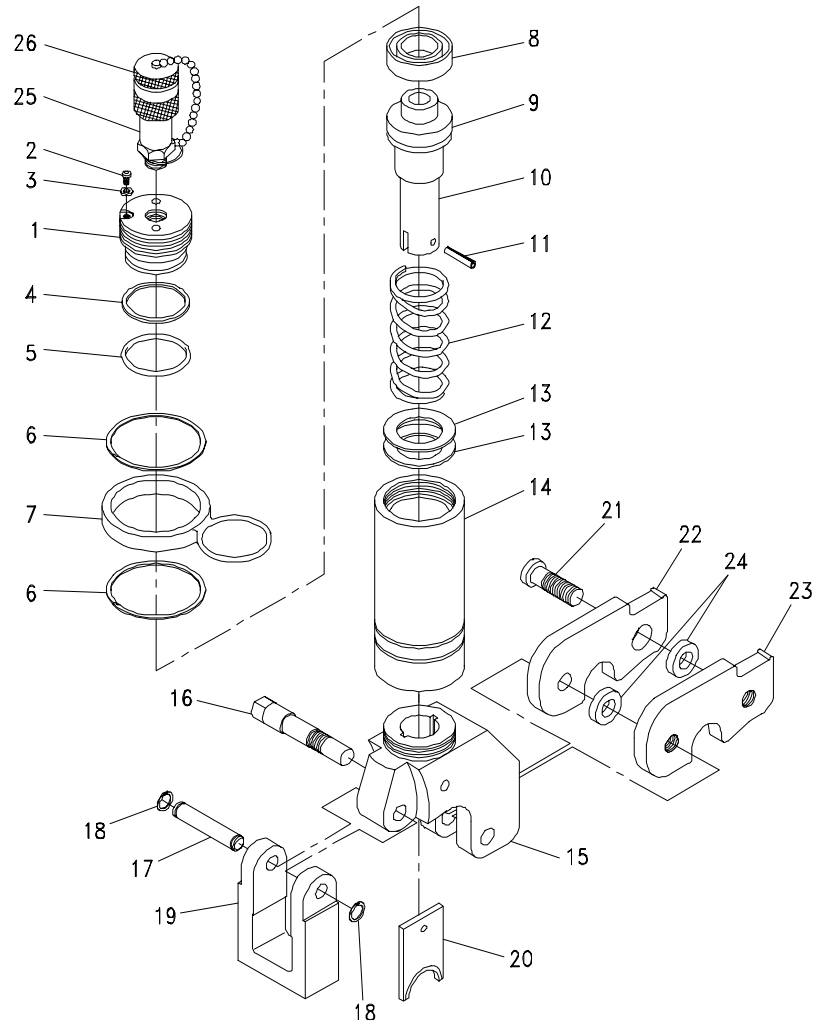
u. Actuate cutter several times to test its performance.

E-7 HOSES.

For complete details concerning hoses refer to Appendix X of this document.

E-8 ILLUSTRATED PARTS BREAKDOWN.

Figure E-4 illustrates the Wire Rope Cutter.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Cutter, wire rope	1	36262N	96508
1	Cap, cylinder end	1	13304N	96508
2	Screw, guard	1	42258N	96508
3	Spacer	1	1584N	96508
4	Washer, Teflon backup	1	22838	96508
5	Seal, cylinder cap	1	13278	96508
6	Ring, suspension retaining	2	14998N	96508

Figure E-4. Wire Rope Cutter (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
7	Ring, suspension	1	13254N	96508
8	Seal, piston	1	3846	96508
9	Sleeve, piston wear	1	13338	96508
10	Piston	1	29184N	96508
11	Pin, moving blade	1	29208N	96508
12	Spring, compression	1	29198N	96508
13	Washer, piston spring	2	33718N	96508
14	Cylinder	1	28634N	96508
15	Yoke	1	34164N	96508
16	Pin, pivot	1	28628N	96508
17	Pin, grooved	1	29168N	96508
18	Ring, retaining	2	19178N	96508
19	Clevis	1	29098N	96508
20	Blade, moving cutter	1	34138N	96508
21	Screw, fixed blade clamping	1	29158N	96508
22	Blade, right fixed	1	34158N	96508
23	Blade, left fixed	1	34148N	96508
24	Spacer, fixed blade	2	29088N	96508
25	Coupler, female half	1	CR400	26952
26	Cap, dust	1	CD411	26952

Figure E-4. Wire Rope Cutter (Sheet 2).

APPENDIX F

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC FLOW DIVIDER ASSEMBLY

F-1 DESCRIPTION.

The NAVSEA hydraulic flow divider assembly is used to divide the output flow of hydraulic fluid from a Hydraulic Power Unit (HPU) to operate two hydraulic power tools at the same time. The hydraulic flow divider assembly consists of an adjustable flow divider (DANFOSS Model 2V21-L8-6-6-40S), flow meter (Hedland Model 701-015), return and supply hose quick-connect couplings, and 4-foot return and supply hose assemblies. The flow divider is mounted in a tubular frame. Figure F-1 illustrates a typical flow divider setup, including a flow divider assembly, two hydraulic hose reels, two hydraulic power tools, and a diesel Hydraulic Power Unit Model 2.

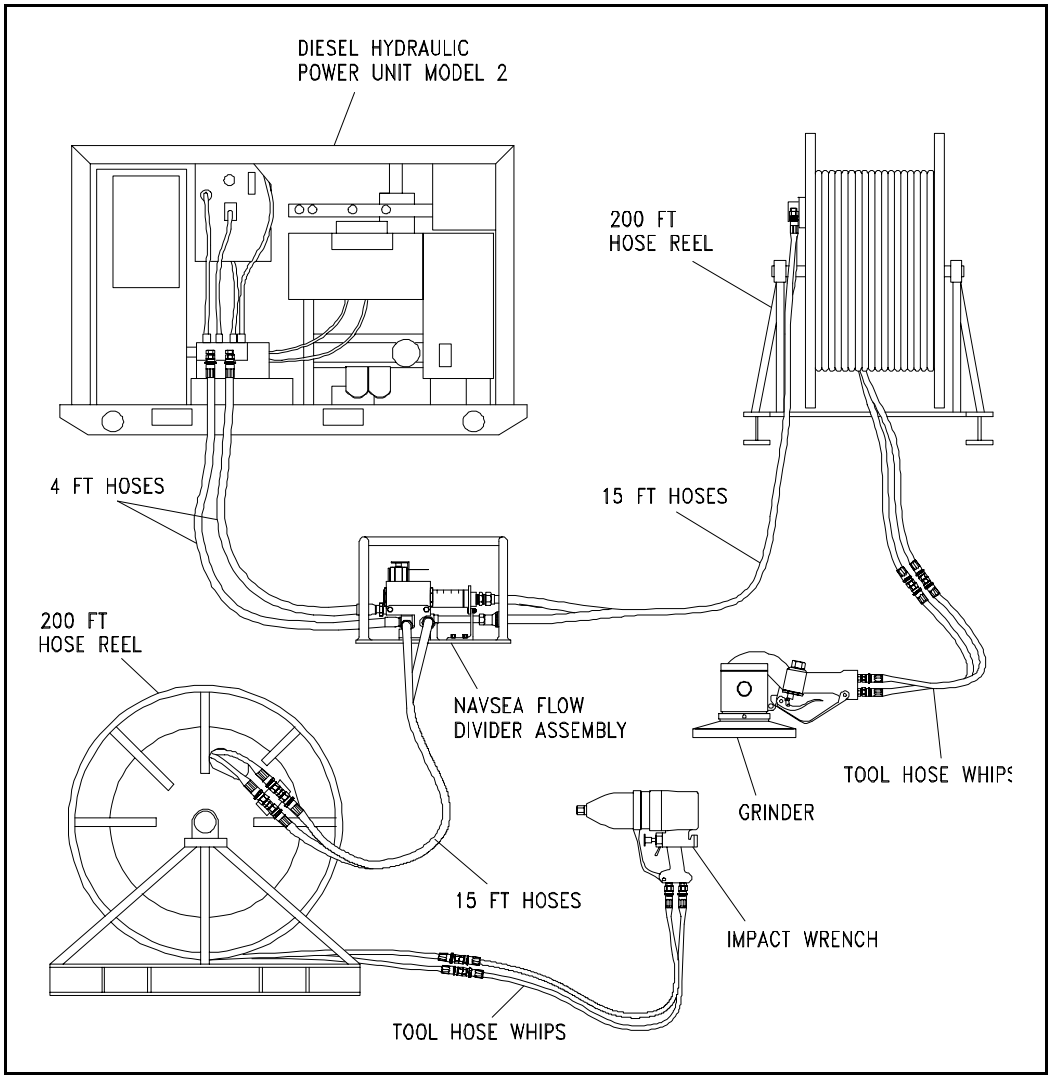


Figure F-1. Hydraulic Flow Divider Assembly Setup.

F-2 REFERENCE.

NAVSEA Drawing 5366571.

F-2.1 Technical Characteristics for the NAVSEA flow divider assembly are provided in Table F-1.

Table F-1. NAVSEA Flow Divider Technical Characteristics.

CHARACTERISTICS	REMARKS
Rated flow	1 to 40 gpm inlet
Maximum rated pressure	3,000 psi
Ratio of flow division %	Adjustable from 90:10 through 10:90

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

CAUTION

Never exceed the maximum flow (gpm) of a tool.

CAUTION

When operating two hydraulic power tools using the flow divider assembly, the combined flow requirements of the two tools combined should not exceed the maximum flow (gpm) capacity of the HPU. If combined flow requirements exceed capacity of HPU, anticipate diminished performance of one or both tools. Or with both tools on site, operate one tool at a time and adjust the flow meter as required for each tool.

F-3 OPERATION.

a. Verify that selected tools can operate safely within the pressure (psi) and flow (gpm) capacity of the HPU.

b. Position flow divider and other components in close proximity to each other, relative to length of interconnecting hoses. See Figure F-1.

c. Remove sufficient amount of hose from both hose reels to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting does not exceed the maximum operating pressure (psi) of the lowest rated operating pressure of the tools being used. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and flow divider assembly.

h. Connect return and supply hoses between flow divider assembly and hose reels.

i. Connect two tools to hose reels.

j. Monitor the flow meter located at HPU control panel and set HPU flow (gpm) to the maximum added flow of both tools.

k. Adjust flow divider hand lever until flow meter on flow divider assembly indicates desired flow rate to the tool coupled to the flow meter circuit.

l. Test actuate tools in accordance with applicable tool procedure.

WARNING

HPU must be set to zero flow rate (gpm) before lowering tools to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

m. Set HPU flow (gpm) to zero before lowering tools to diver(s).

n. Operate tools in accordance with the applicable tool procedures.

F-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for approved NAVSEA flow divider assembly Maintenance Requirement Cards (MRC).

F-5 TROUBLESHOOTING.

Refer to Table F-2 for hydraulic flow divider assembly troubleshooting.

Table F-2. Hydraulic Flow Divider Assembly Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
One or both tools fail to actuate.	Improperly mated quick disconnect couplings. Hose rupture. Tool malfunction.	See troubleshooting guide in applicable tool section.
Tool speed(s) too fast or too slow.	Incorrect flow divider setting. Sum of operating flows exceeds maximum power unit output.	Check operating flow rate. Adjust setting. See paragraph F-3.
One or both tools actuate, but fail to develop power.	Relief valve setting is below recommended maximum. One tool is not receiving recommended flow. Tools are not receiving recommended flow.	Check and adjust the power unit relief valve setting. Check the flow divider setting; adjust hand lever. Check HPU output flow and adjust.

F-6 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to flow meter and flow divider removal and replacement.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

F-6.1 Flow Meter.

F-6.1.1 Remove.

a. Remove reducer nipple (10, Figure F-2) from flow meter (9).

b. Remove screws (18), washers (24), and nuts (20) that secure piping bracket (7).

c. Remove flow meter (9) from elbow (7).

F-6.1.2 Replace.

a. Using thread sealant (MIL-C-24716 or equivalent), install reducer nipple (10, Figure F-2) into flow meter (9).

b. Place piping bracket (26) on flow meter (9).

c. Using thread sealant (MIL-C-24716), install flow meter (9) on elbow (7).

d. Secure piping bracket (26) using screws (18), washers (24), and nuts (20).

F-6.2 Flow Divider Assembly.

F-6.2.1 Remove.

a. Remove flow meter per paragraph F-6.1.1.

b. Remove elbow (7, Figure F-2).

c. Remove screws (17) and washers (22,23) that secure flow divider (1) to frame.

d. Remove hose (2) and remove reducer bushing (6).

e. Remove male quick-disconnect (4) and elbow (15).

f. Remove screws (27) that secure operating instructions plate and remove plate (16).

g. After removing flow divider unit (1) from assembly, plug or cap all exposed fitting ends and ports of flow divider to prevent hydraulic fluid contamination.

CAUTION

When returning the flow divider to an authorized DANFOSS repair facility, ensure to specify buna-N replacement seals.

h. Package flow divider unit in accordance with local procedures, and contact the nearest authorized DANFOSS repair facility.

F-6.2.2 Replace.

a. Install operating instructions plate (16, Figure F-2) and secure with screws (27).

b. Using thread sealant (MIL-C-24716), install elbow (15) and male quick-disconnect (4) on flow divider (1).

c. Using thread sealant (MIL-C-24716), install reducer bushing (6) into flow divider (1). Install hose (2) into reducer bushing (6).

d. Using screws (17) and washers (22,23), secure flow divider (1) to frame.

e. Using thread sealant (MIL-C-24716), install elbow (7) on flow divider.

f. Install flow meter per paragraph F-6.1.2.

F-6.3 Frame Weldment.

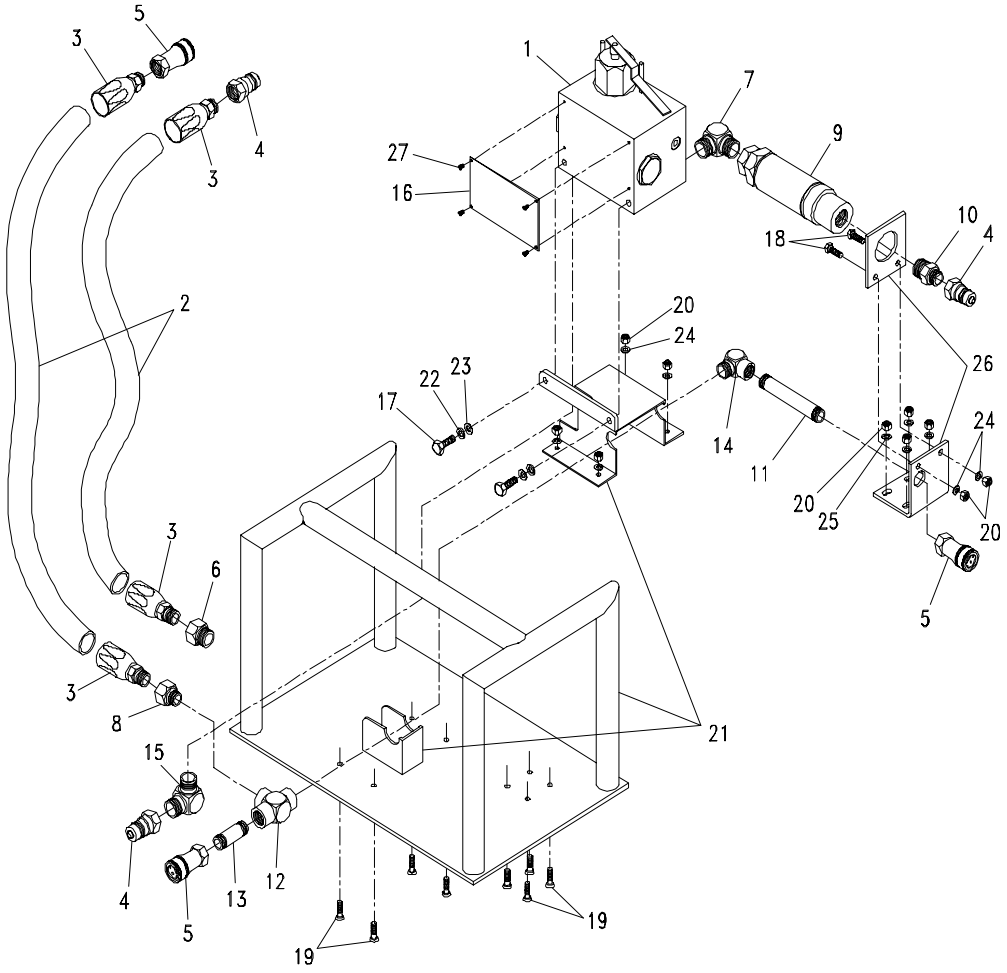
The frame weldment consists of welded plates and tubing. There are no repairable parts. If structural repairs are required, refer to Drawing 5366571.

F-7 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

F-8 ILLUSTRATED PARTS BREAKDOWN.

Figure F-2 illustrates the parts breakdown for the Hydraulic Flow Divider Assembly.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Hydraulic flow divider assembly	1	5366571	53711
1	Divider, hydraulic	1	2V21-L8-6-6-40S	96259
2	Hose, hydraulic 4 ft	2	2781-12	16717
3	Fitting, hose	4	4722-12-12S	16717
4	Qdisc, male	3	5602-12-10S	16717
5	Qdisc, female	3	5601-12-10S	16717
6	Bushing, reducer	1	2081-16-12S	16717
7	Elbow, 90º	1	2085-12-12S	16717
8	Reducer	1	2040-8-12S	16717
9	Flow meter, hydraulic	1	701-015	2R256

Figure F-2. Hydraulic Flow Divider Assembly Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
10	Nipple, reducer	1	2083-12-8S	16717
11	Nipple, pipe, sch 80 (1/2-14 NPT x 6.0 L)	1		
12	Tee, pipe (1/2-14 NPT)	1	2090-8-8S	16717
13	Nipple, pipe (1/2 npt x 2.5 L)	1	2084-8S2 1/2	16717
14	Elbow, 90º	1	2089-8-8S	16717
15	Elbow, 90º	1	2085-12-8S	16717
16	Plate, operating instr, 1/16 thk	1	5366571-15	53711
17	Screw, hex head 1/4-20UNC x 3/4 L	2	MS35307-308	96906
18	Screw, hex head 3/8-16UNC x 1.00 L	2	MS35307-306	96906
19	Screw, 82º csk flh, 1/4-20UNC x 1.00 L	8	MS51959-83	96906
20	Nut, stop, 1/4-20UNC	10	MS17830-4C	96906
21	Frame weldment	1	5366571-20 5366571-21 5366571-24	53711 53711 53711
22	Washer, flat, plain, 3/8 nom	2	MS15795-814	96906
23	Washer, lock, 3/8 nom	2	MS35338-141	96906
24	Washer, flat, large area, 1/4 nom	6	MS15795-853	96906
25	Washer, flat, plain, 1/4 nom	4	MS15795-852	96906
26	Piping bracket	1	5366571-27	53711
27	Screw, pan hd, no. 2-56UNC x .19 L	4		96906

Figure F-2. Hydraulic Flow Divider Assembly Components (Sheet 2).

APPENDIX G

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC CHIPPING HAMMER

G-1 DESCRIPTION.

The approved hydraulic chipping hammer is a modified version of the Stanley model CH18311 hydraulic chipping hammer. It is a reciprocating tool designed for chipping concrete. Figure G-1 illustrates a typical setup for a chipping hammer using a single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0.

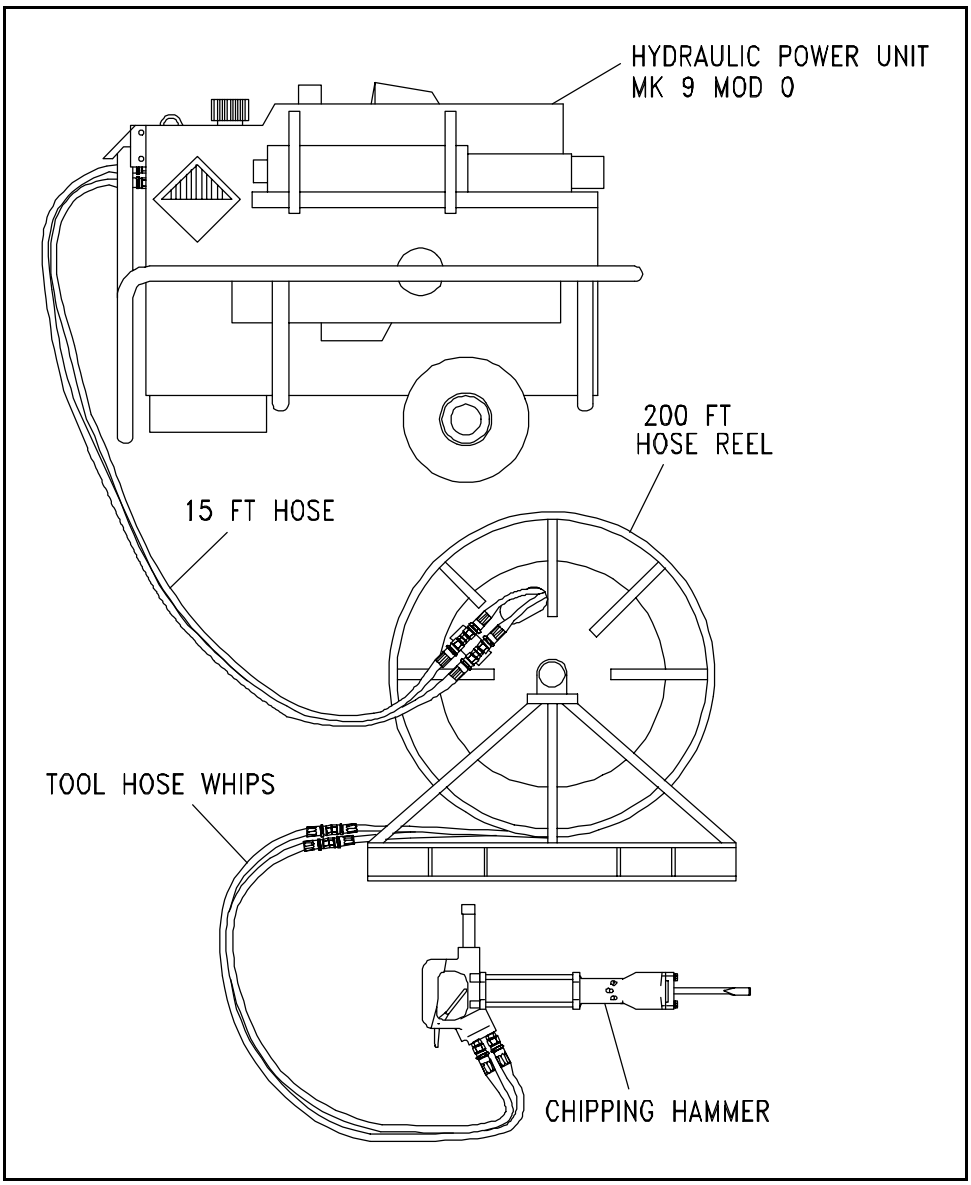


Figure G-1. Hydraulic Chipping Hammer Setup.

G-2 REFERENCE.

NAVSEA Drawing 5366577.

G-2.1 Technical characteristics for the hydraulic chipping hammer are provided in Table G-1.

Table G-1. Hydraulic Chipping Hammer Technical Characteristics

CHARACTERISTICS	REMARKS
System type	Open-center
Capacity	2.5-inch shank x 0.580-inch hex, round collar steel bits and chisels
Weight	24 lbs in air
Length	20 inches
Width	3 inches
Pressure range	1500 to 2000 psi
Flow range	7 to 9 gpm
Optimum flow	8 gpm
Blows per minute	2000
Maximum operating depth	300 fsw
Porting	-6 SAE O-ring

G-3 MODIFICATION.

The chipping hammer includes an optimal diver-assist handle available from Stanley. The hammer has a D-handle with heat-insulated hand grips to protect operator from heat buildup.

WARNING

Positive voice communications shall be established between the diver and topside before operating any tool underwater.

WARNING

Wear eye protection when using chipping hammer topside.

WARNING

Diver must wear 1/4-inch neoprene wet suit hood while operating chipping hammer underwater. The maximum operating time per diver is three hours and 40 minutes per each 24-hour period.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

G-4 OPERATION.

a. Verify that chipping hammer can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet pressure is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect chipping hammer hose whips to hose reel.

i. Select chisel from Table G-2 for task, and attach chisel to tool.

j. Set HPU flow rate not to exceed 2 gpm.

k. Test actuate chipping hammer.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering chipping hammer to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

l. Set HPU flow (gpm) to zero prior to lowering chipping hammer to diver.

m. Lower tool to diver.

G-4.1 Attachments.

Attachments for the chipping hammer are described in Table G-2.

Table G-2. Chipping Hammer Chisels.

CHISEL	PART NUMBER	CAGE
Flat Chisel	77511	16745
Round Nose Chisel	7743	16745
Wide Chisel	77462	16745

G-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for chipping hammer Maintenance Requirement Cards (MRC).

G-6 TROUBLESHOOTING.

Refer to Table G-3 for the chipping hammer troubleshooting.

Table G-3. Chipping Hammer Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Failure to operate.	Loose connections. Break in hose between power unit and tool. On-off valve spool stuck closed.	Check and reconnect. Inspect hose for rupture; repair or replace. Check and repair.
Reduced volume due to leakage.	Seals improperly installed. Wrong seals installed.	Check orientation of seals and repair. Replace with underwater seals.

G-7 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to replacement of parts and repair kits. Figure G-3 illustrates the parts breakdown.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

G-7.1 Disassemble.

CAUTION

Note orientation of seals before removing them.

CAUTION

Install new seals in direction noted during removal.

a. Remove optional handle tube (4, Figure G-3) if installed, from handle body assembly (3).

b. Clamp bolt flange of retaining nose assembly (30) in vise, with retaining nose assembly in horizontal position.

c. Remove four bolt assemblies (5) securing retaining nose assembly (30) to handle body assembly (3).

d. Pull on handle body assembly (3) while driving it out of flow sleeve assembly (19) with soft-faced mallet. Remove pin (22) from flow sleeve assembly.

CAUTION

Be careful not to drop valve body (23), oil tube (21), and piston (18) during their removal.

NOTE

Hold tool by retaining nose assembly (30) until piston (18) has been removed.

e. Place 1/2-inch rod through retaining cap (26) end of retaining nose assembly (30). Using hammer, drive valve gland (8) with its attached O-ring (9), reversing spool (6), valve body (23) with attached O-rings (7), oil tube (21), and piston (18) with attached O-ring (20) out of flow sleeve assembly (19).

CAUTION

Do not clamp flow sleeve assembly (19) too tightly in a vise.

f. Clamp flow sleeve assembly (19) in vise. Do not overtighten. Then drive retaining nose assembly (30) out of flow sleeve assembly with soft-faced mallet. Hammer against bolt flange of retaining nose assembly while pulling retaining nose assembly from flow sleeve assembly.

g. Remove O-ring (10), backup ring (11), and two rod seals (31), making note of their direction, from bolt flange end of retaining nose assembly (30).

NOTE

Depending on age of chipping hammer used, there may be either a slide retainer (27) or a wire retainer (not illustrated). Accomplish applicable disassembly and reassembly steps as required.

NOTE

Springs (29) and steel balls (28) will push slide retainer (27) and retaining cap (26) away from retaining nose assembly (30) as cap screws (24) are loosened. Springs will be unloaded before cap screws are fully out of their threads.

h. Slowly loosen and remove two cap screws (24) and lockwashers (25) securing retaining cap (26) to retaining nose assembly (30).

i. Separate slide retainer (27) and retaining cap (26) from retaining nose assembly (30), being careful not to drop steel balls (28) and springs (29).

NOTE

A wire retainer (not illustrated) is only present on very old models, and is not illustrated.

j. Drive unswaged end of wire retainer (not illustrated) out of hole in retaining nose assembly (30).

k. Rotate swaged end of wire retainer (not illustrated) 90° off end of retaining nose assembly (30).

l. Remove wire retainer (not illustrated) from retaining nose assembly (30).

m. Drive out dowel pin (2) securing trigger (1) to handle body assembly (3).

n. Remove trigger (1) from handle body assembly (3).

o. Remove spool screw (17), O-ring (16), and spring (15) from trigger (1) end of on-off valve spool (14).

p. At bolt flange end of handle body assembly (3), remove external retaining ring (12) from on-off valve spool (14).

q. Pull on-off valve spool (14) out of its bore in handle body assembly (3).

r. Remove two O-rings (13) from inside on-off valve spool (14) bore of handle body assembly (3).

s. Remove backup ring (11) and O-ring (10) from bolt flange end of handle body assembly (3).

G-7.2 Reassemble.

WARNING

MIL-C-81309 is extremely flammable. Keep away from open sparks, fires, and flames. Use in well-ventilated areas only.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well-ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

CAUTION

Ensure that all O-rings which were exposed during disassembly are replaced with new parts.

CAUTION

Apply O-ring lubricant to all O-rings and areas over which O-rings must slide.

CAUTION

Install rod seals (31) with their lips facing the direction noted during removal.

a. Clean all parts with MIL-C-81309. Blow dry the parts with compressed air and wipe them clean with lint-free cloths.

b. Inspect all parts for excessive wear or damage. Replace all worn or damaged parts as required.

NOTE

Install rod seals (31) in bolt flange end of retaining nose assembly (30) in direction noted during their removal.

c. Install two rod seals (31, Figure G-3), backup ring (11), and new O-ring (10) in bolt flange end of retaining nose assembly (30).

d. Using soft-faced mallet, install flow sleeve assembly (19) on bolt flange end of retaining nose assembly (30).

e. Place piston (18) with new O-ring (20) into flow sleeve assembly (19). Then push oil tube (21) into counterbore in end of flow sleeve assembly (19).

f. Reassemble valve body (23), reversing spool (6), two new O-rings (7), valve gland (8), and new O-ring (9). Check for free reversing spool movement.

g. Install backup ring (11) and new O-ring (10) in face of bolt flange of handle body assembly (3).

h. Using pin (22) in flow sleeve assembly (19) for alignment, push assembled valve body (23) into flow sleeve assembly. Continue pressing on assembled valve body until it is seated in flow sleeve assembly.

i. Carefully push handle body assembly (3) onto bolt flange end of retaining nose assembly (30) and into flow sleeve assembly (19), making certain that pin (22) enters alignment hole in handle body assembly.

j. Install four bolt assemblies (5) through handle body assembly (3) and screw them into bolt flange of retaining nose assembly. Torque four bolts to 20 foot-pounds in increments of 5 foot-pounds, using sequence shown in Figure G-2.

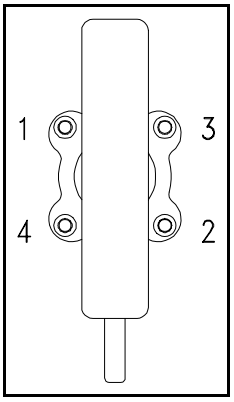


Figure G-2. Bolt Torquing Sequence.

NOTE

Depending on age of chipping hammer used, there may be either a slide retainer (27) or a wire retainer (not illustrated). Accomplish applicable disassembly and reassembly steps as required.

k. Place retaining nose assembly (30) bolt flange in a vise with retaining cap (26) facing

upward.

l. Install two springs (29) in spring holes in retaining nose assembly (30).

m. Place a steel ball (28) on end of each spring (29). Position ball-and-spring detent impressions of retainer (27) on steel balls.

n. Place retaining cap (26) on retainer (27) while holding retainer in position, and secure with two cap screws (24) and lockwashers (25). Use a threadlocking adhesive such as Loctite #242 on the cap screw threads. Torque cap screws to 25-30 foot pounds.

NOTE

A wire retainer (not illustrated) is only present on very old models.

o. To reassemble, install wire retainer in side of retaining nose assembly which has retainer holes closest together.

p. Rotate wire retainer 90° to assembled position. Insert swaged end of wire retainer (not illustrated) into oblong hole in retaining nose assembly.

q. Rotate wire retainer to assembled position and force free end into second hole in retaining nose assembly. Push wire retainer into place.

r. Install two new O-rings (13) in on-off valve spool (14).

s. Lubricate on-off valve spool (14). Then, to guard against cutting O-rings, carefully push valve spool through on-off valve spool bore and O-rings (13) in handle body assembly (3) with a twisting motion.

t. At bolt flange end of handle body assembly (3), install external retaining ring (12) in its groove on the on-off valve spool (14).

u. Install spool screw (17), O-ring (16), and spring (15) on trigger (1) end of the on-off valve spool (8).

v. Position trigger (1) in place on handle body assembly (3). Drive dowel pin (2) through trigger until it is slightly below the handle surface on both sides of handle body assembly. Stake aluminum handle material around dowel pin to retain it.

CAUTION

Do not allow paint to enter inlet or outlet ports or bore of retaining nose assembly.

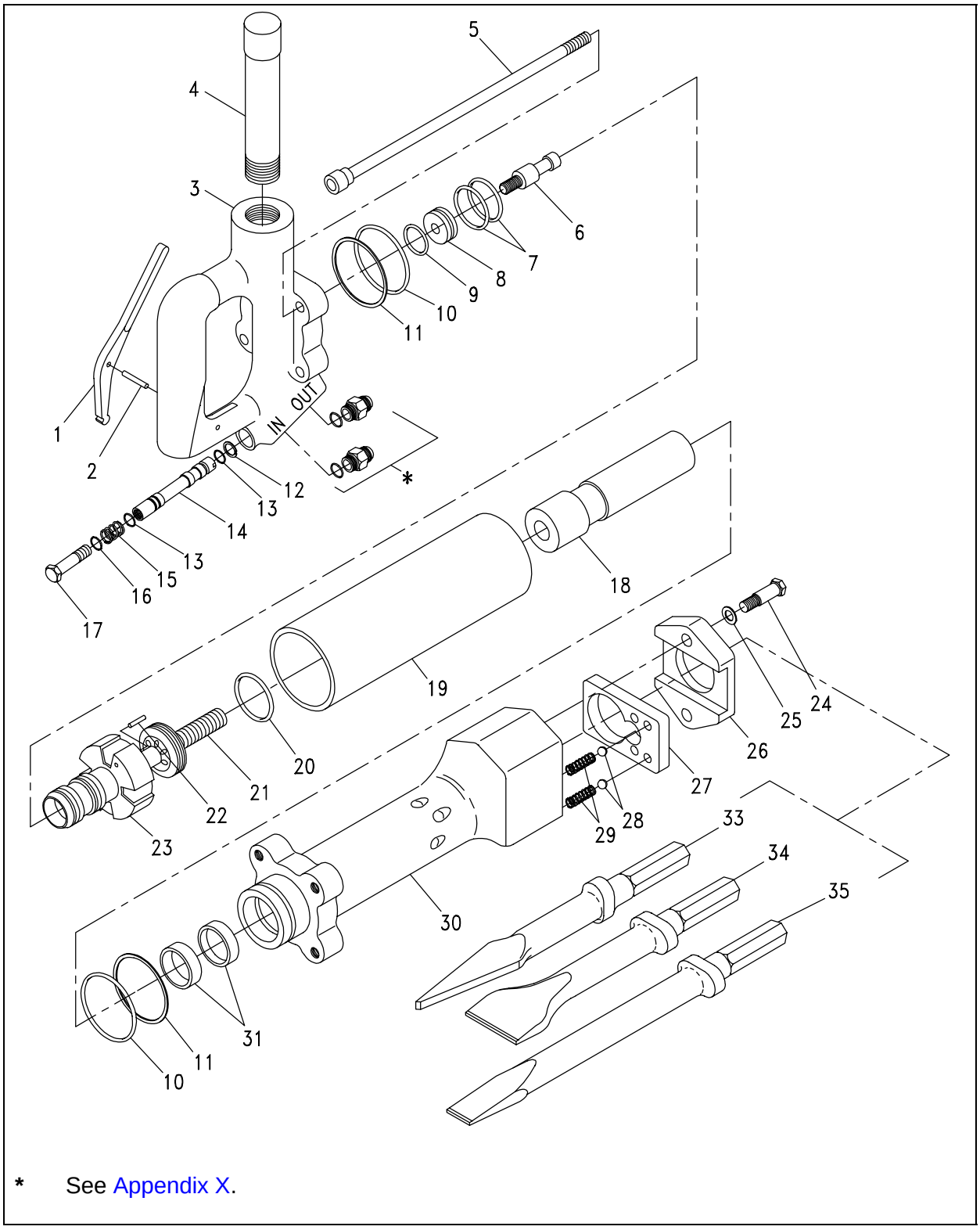
w. If repainting the tool, mask off exposed end of on-off valve spool (14) and its spring (15).

G-8 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reel refer to Appendix X.

G-9 ILLUSTRATED PARTS BREAKDOWN.

Figure G-3 illustrates the parts breakdown for the chipping hammer.



* See Appendix X.

Figure G-3. Chipping Hammer Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Chipping Hammer	1	CH18311	54252
1	Trigger	1	02853	54252
2	Pin, dowel, 3/16 x 1-1/2	1	02898	54252
3	Handle body assembly	1	02890	54252
4	Tube, handle (optional)	1	02864	54252
5	Bolt assembly	4	02848	54252
6	Spool, reversing	1	02880	54252
7	O-ring	2	00211	54252
8	Gland, valve	1	03254	54252
9	O-ring	1	01772	54252
10	O-ring	2	02177	54252
11	Ring, backup	2	02865	54252
12	Ring, ext retaining	1	00752	54252
13	O-ring	2	03252	54252
14	Spool, on-off valve, o.c.	1	02881	54252
15	Spring	1	02846	54252
16	O-ring	1	02901	54252
17	Screw, spool	1	02959	54252
18	Piston	1	03959	54252
19	Flow sleeve assembly	1	02869	54252
20	O-ring	1	01259	54252
21	Tube, oil	1	03958	54252
22	Pin	1	02843	54252
23	Body, valve	1	03253	54252
24	Cap screw	2	02665	54252
25	Lockwasher	2	03031	54252
26	Cap, retaining	1	04010	54252
27	Retainer, slide	1	04012	54252
28	Ball, steel	2	02436	54252
29	Spring	2	03190	54252
30	Retaining nose assembly	1	04014	54252
31	Seal, rod	2	02302	54252
32	Not used			
33	Flat chisel	1	77511	16745
34	Round nose chisel	1	7743	16745
35	Wide chisel	1	77462	16745
	Repair kit (includes items 5, 8, 12, 22)	AR	03844	54252
	Seal kit (includes 7, 9, 10, 11, 13, 16, 20)	AR	03843	54252

Figure G-3. Chipping Hammer Components (Sheet 2).

APPENDIX H

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC COME-ALONG

H-1 DESCRIPTION.

The hydraulic come-along is a modified version of the Griphoist TU-28H-SS-2 come-along (Figure H-1). It is designed to assist in pulling and lifting heavy objects. The lever-operated wire rope hoist permits short-stroke operation for tensioning and relaxing the wire rope. The wire rope is pulled through the come-along in a straight line. A releasable ratchet controls the opening and closing action of the two jaws. The jaws alternately grip the wire rope to pull it while lifting or hold it while lowering. The grip jaws are locked by the wire rope pull.

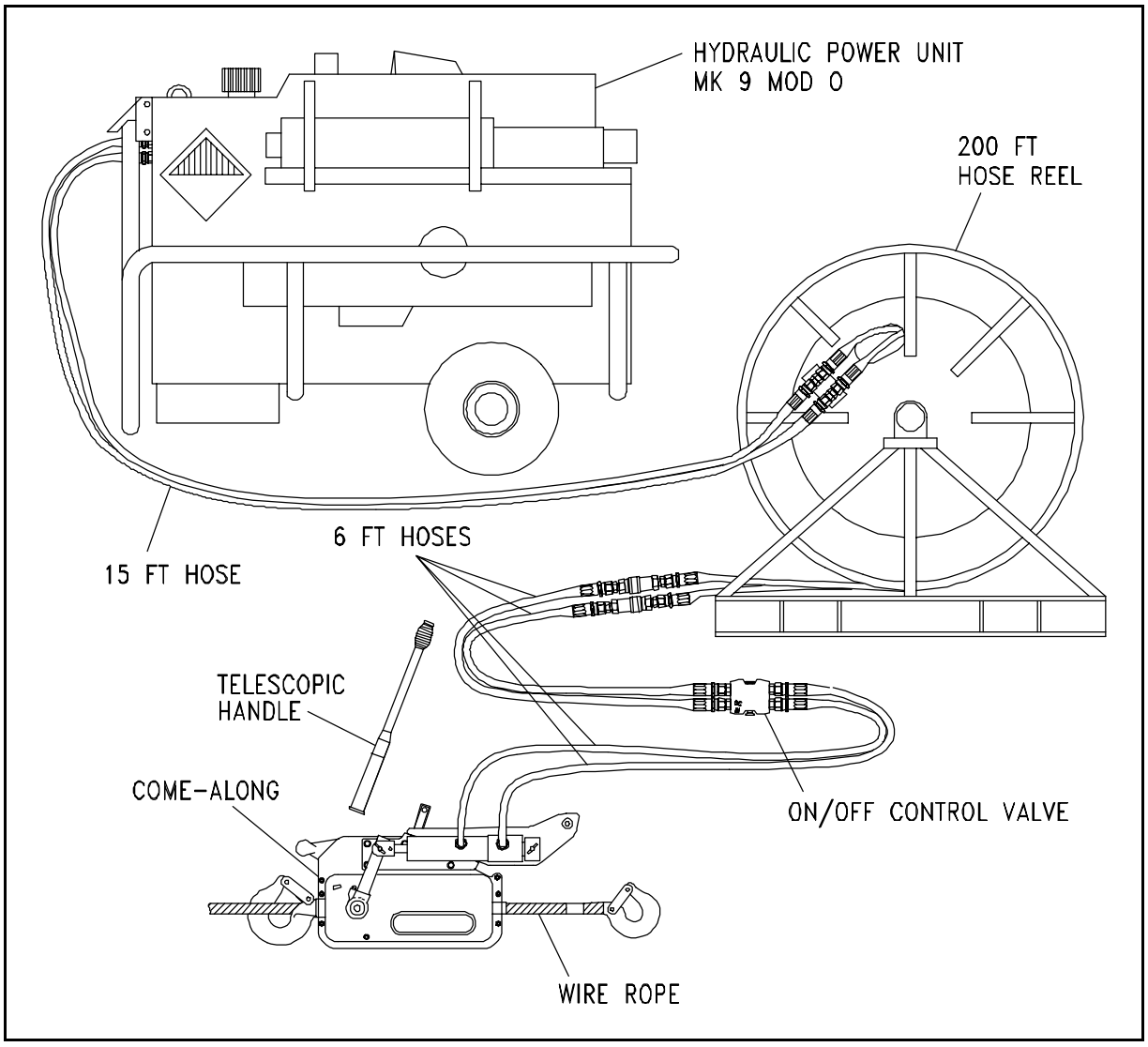


Figure H-1. Hydraulic Come-Along Setup.

The heavier the load, the stronger the grip. The tool has a telescopic handle for manual operation. The hydraulic come-along can be used underwater or on the surface at its 2-ton capacity. Using the come-along with a block and tackle, its pull capacity can be increased up to four times. Overload protection is provided by three shear pins, which key the power stroke lever to the crankshaft. Depending on working conditions, shear pins will shear at overloads of 50 to 100 percent. Although sheared pins prevent further lifting or pulling, reverse action is still possible to lower or release the load. The wire rope is fitted with a standard latching eyehook at one end and a welded point at the other. A lightweight metal cable reel facilitates relocating and storing the tool. Figure H-1 illustrates a typical setup for a hydraulic come-along, using a 200-foot hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0.

H-2 REFERENCE.

NAVSEA Drawing 5366561.

H-2.1 Technical characteristics for the NAVSEA Come-Along are provided in Table H-1.

Table H-1. Come-Along Technical Characteristics.

CHARACTERISTICS	REMARKS
Capacity to hoist materials	4000 lbs
Dimensions	26 X 13 X 5.75 inches
Weight Come-along unit Telescoping operating handle Standard 60-foot wire rope on reel Total weight of standard equipment	 41 lbs 5 lbs 25.5 lbs 72 lbs
Flow Rates Minimum Recommended Maximum	 1 gpm 2 gpm 3 gpm
Operating pressure Minimum Maximum	 300 psi 1500 psi
Maximum operating pressure and relief valve setting	1500 psi
Porting	1/4 inch BSPP
Wire rope	7/16 inch diameter x 60 feet long 4 x 26 EIP IWRC galvanized

H-3 MODIFICATIONS.

NAVSEA installed a double-acting hydraulic cylinder on the come-along to allow its operation by hydraulic power. Power is transferred to the hydraulic cylinder through a twin hose whip which connects to a hose reel umbilical. The diver operates a push-pull valve in the whip hose assemblies to actuate ("ON" on - "OFF" off) the come-along. In the hydraulic power mode, the cylinder moves the power stroke lever back and forth, pulling the cable. A shuttling valve in the cylinder automatically reciprocates when hydraulic power is applied. The cylinder can be moved to different positions to activate the cable payout lever.

WARNING

Positive voice communications shall be established between the diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

H-4 OPERATION.

H-4.1 Manual Operation. To operate the come-along manually, remove the hydraulic cylinder and operate the power stroke lever with the telescopic handle. Install wire rope according to the following procedures and Figure H-2.

CAUTION

Before using come-along, lubricate generously.

a. Lubricate the come-along generously by pouring StaLube inside the machine through its opening (lever opening and oil hole). There is no risk of over lubricating.

b. Place reversing lever (1, Figure H-2) in vertical position.

c. Push in clutch lock pusher (2). While releasing the clutch lock pusher (2), raise rope release lever (3) until it locks in position.

WARNING

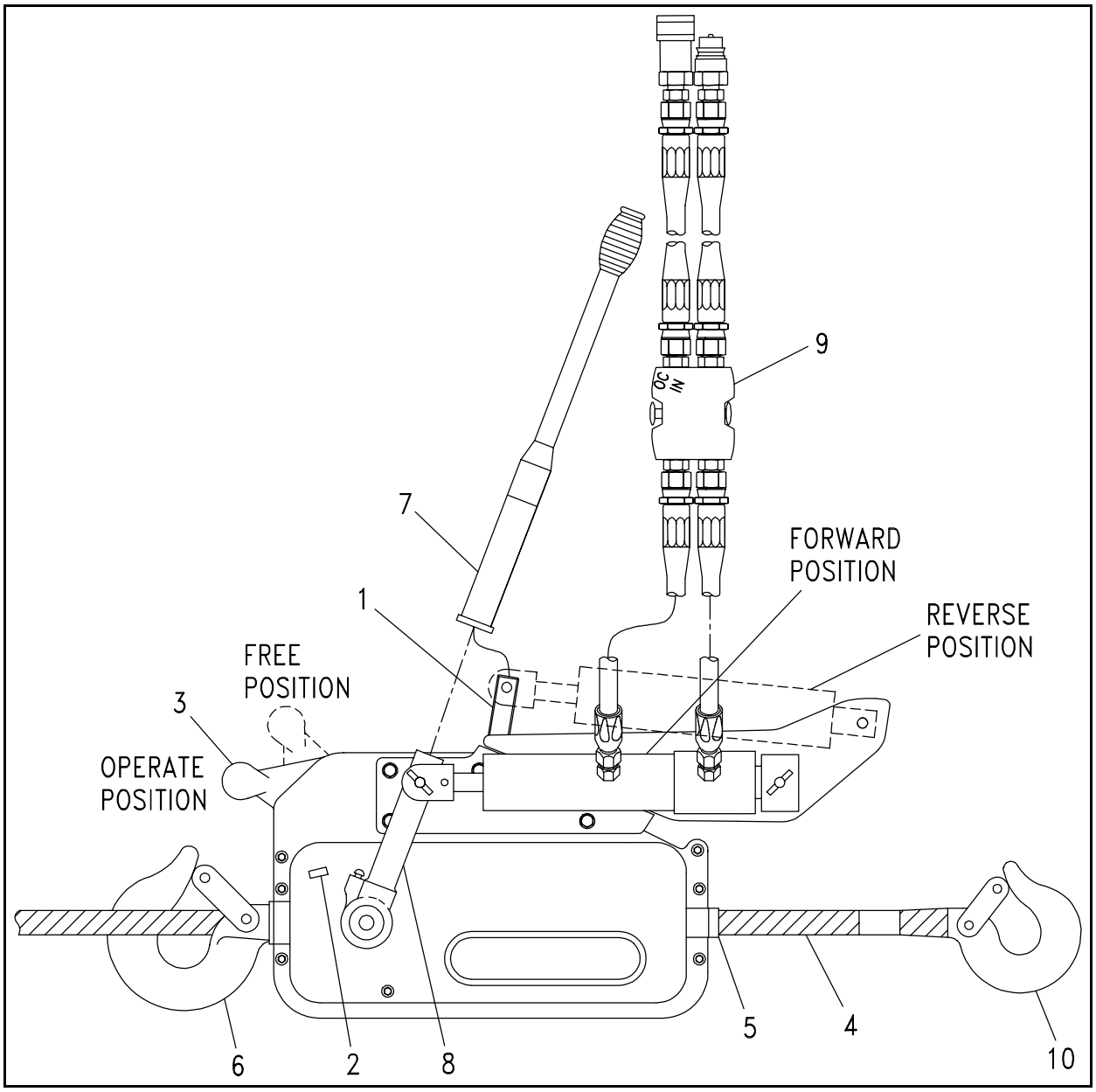
Come-along wire rope, hooks, and safety catches must be inspected for damage prior to each use or operation and daily by a competent person.

WARNING

Only 7/16-inch wire ropes (Part number C-12) may be used. Other wire ropes may deform under pressure of the jaws, or develop other defects causing malfunction of the machines. Personnel injury or death may result.

CAUTION

Never use the wire rope as a sling. Never pass it around any object for anchoring the load of the machine. This would bend and damage the wire rope and cause problems with the come-along.



1. Reversing Lever
2. Clutch Lock Pusher
3. Rope Release Lever
4. Wire Rope
5. Wire Rope Entry
6. Anchoring Hook w/Safety Catch
7. Telescopic Handle
8. Power Stroke Lever
9. ON/OFF Control Valve
10 Wire Rope Hook

Figure H-2. Hydraulic Come-Along.

d. Insert wire rope (4) at wire rope entry (5) and push until it comes out of the anchor hook (6).

WARNING

Operators must wear gloves when handling the wire rope to prevent injury to their hands.

e. Pull slack wire rope (4) through the come-along by hand, until it becomes nearly tight on the load.

f. Secure the anchoring hook (6) and the wire rope hook (10). Check that hook latches are closed.

g. To close jaws on wire rope (4), pull release lever (1) up slightly and clutch lock pusher (2). Allow the rope release lever (3) to slowly return to initial position. Release clutch lock pusher (2).

h. Place the telescopic handle (7) on power stroke lever (8) to lift or pull, or on reversing lever (1) to lower or slacken the wire rope. Twist the handle to ensure that it is in the locked position.

i. To remove the wire rope (4) from the come-along, slacken the wire rope by operating the reversing lever (1) before operating the rope release lever (3) and clutch lock pusher (2) as in steps b and c above.

j. Pull wire rope (4) manually from wire rope entry (5).

H-4.2 Hydraulic Operation. To operate the come-along with a NAVSEA Power Unit, install wire rope per paragraph H-4.1.

WARNING

Never stand under a load being lifted by the come-along.

WARNING

Do not allow the loaded wire rope to rotate.

WARNING

Protect the wire rope from abrasion due to rubbing over sharp edges.

WARNING

Kinked wire rope will not operate in the come-along.

WARNING

Use independent wire rope center (IRWC) wire rope only. Standard cable can buckle under pressure, causing the tool to malfunction.

WARNING

Never use dirty or unlubricated wire rope.

WARNING

Wear eye protection when using the come-along on the surface.

CAUTION

To avoid damaging cylinder rod seals, never lift the come-along by the hydraulic cylinder.

CAUTION

Remove any obstructions at the wire rope outlet. Wire rope must be able to travel freely or it will be forced back into the come-along.

CAUTION

Hydraulic flow rates greater than 3 gpm produce excessive loads on the cylinder stops, causing fluid leakage and equipment damage.

a. Verify that hydraulic cylinder can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

NOTE

Ensure open-center (OC-IN) end of ON-OFF control valve (9) is upstream from tool as shown in Figure H-2.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect hydraulic cylinder hose whips to hose reel.

i. Put the hydraulic cylinder in the power stroke position.

j. Set HPU flow rate not to exceed 3 gpm.

k. Shift the rope release lever to the operate position.

l. Use the ON-OFF control valve to regulate the pulling action of the wire rope.

m. Test actuate come-along.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering come-along to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

n. Set HPU flow (gpm) to zero prior to lowering come-along to diver.

o. Lower come-along to diver.

p. To slack the wire rope, use one of the following methods:

1. When no load is on the wire rope, put the rope release lever (3) in the free position and manually pull the wire rope through the come-along.

2. Disconnect the hydraulic cylinder from the power stroke lever (2). Put the telescopic operating handle on reversing lever (1) and operate the handle.

3. Put the hydraulic cylinder in reverse position (Figure H-2). Operate the ON-OFF control valve to slacken the wire rope (4).

H-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for approved NAVSEA come-along Maintenance Requirement Cards (MRC).

H-6 TROUBLESHOOTING.

Refer to Table H-2 for the approved NAVSEA Come-Along troubleshooting.

Table H-2. Come-Along Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Wire rope jams.	Dirt in the mechanism. Use of kinked or damaged cable. Broken or kinked rope.	Wash and lubricate. Use only independent wire rope core wire rope. Check and replace as required.
As the forward lever is moved forward and backward, the machine moves up and down by about one inch.	A lack of lubricant.	Pour StaLube inside the casing.
Power stroke lever works, but wire rope does not move.	Shear pins in power stroke lever sheared.	Replace shear pins.

H-7 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to replacement of shear pins.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

H-7.1 Shearpin Replacement.

a. Stop or lower load; leave come-along under light tension to facilitate operation.

b. Remove bolt (1, Figure H-3), and shearpin retaining washer (2) from crankshaft.

c. Use gear puller to remove power stroke lever (3) from crankshaft. If no gear puller is available, work telescopic operating handle (4) back and forth to pull off power stroke lever (3).

d. Remove broken shearpins (5); clear off burr produced by shearing.

e. Grease end of crankshaft. Replace power stroke lever on crankshaft. Drive new shearpins in smoothly with hammer, taking care not to damage crankshaft.

f. Replace washer (2) and bolt (1).

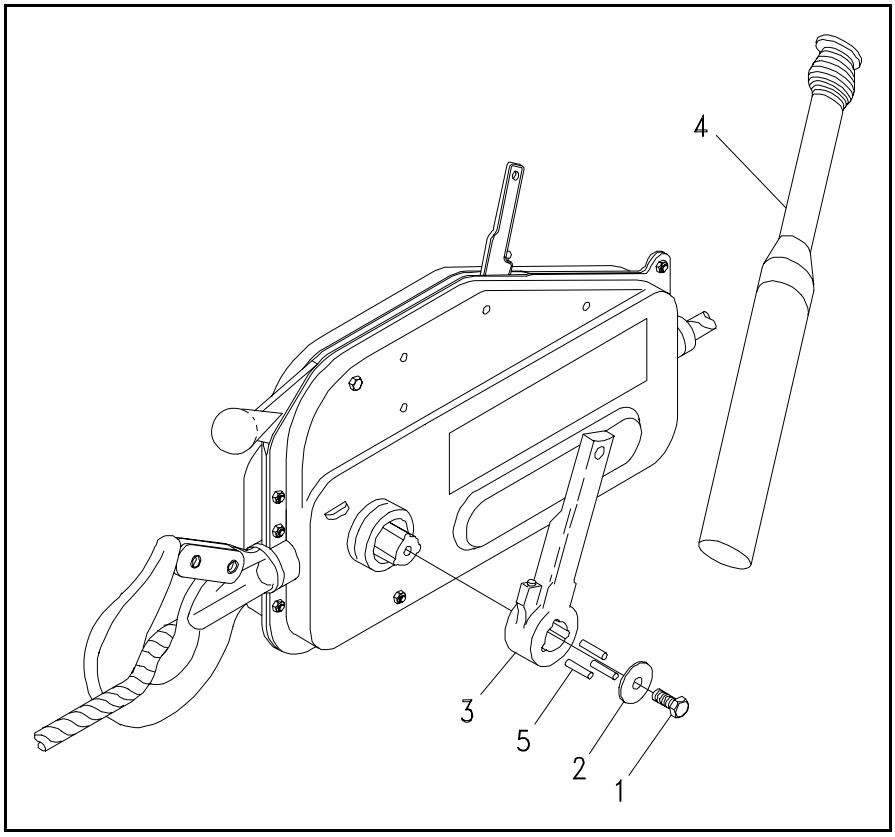


Figure H-3. Shear Pin Replacement.

H-8 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

H-9 ILLUSTRATED PARTS BREAKDOWN.

Figure H-4 illustrates the parts breakdown for the come-along.

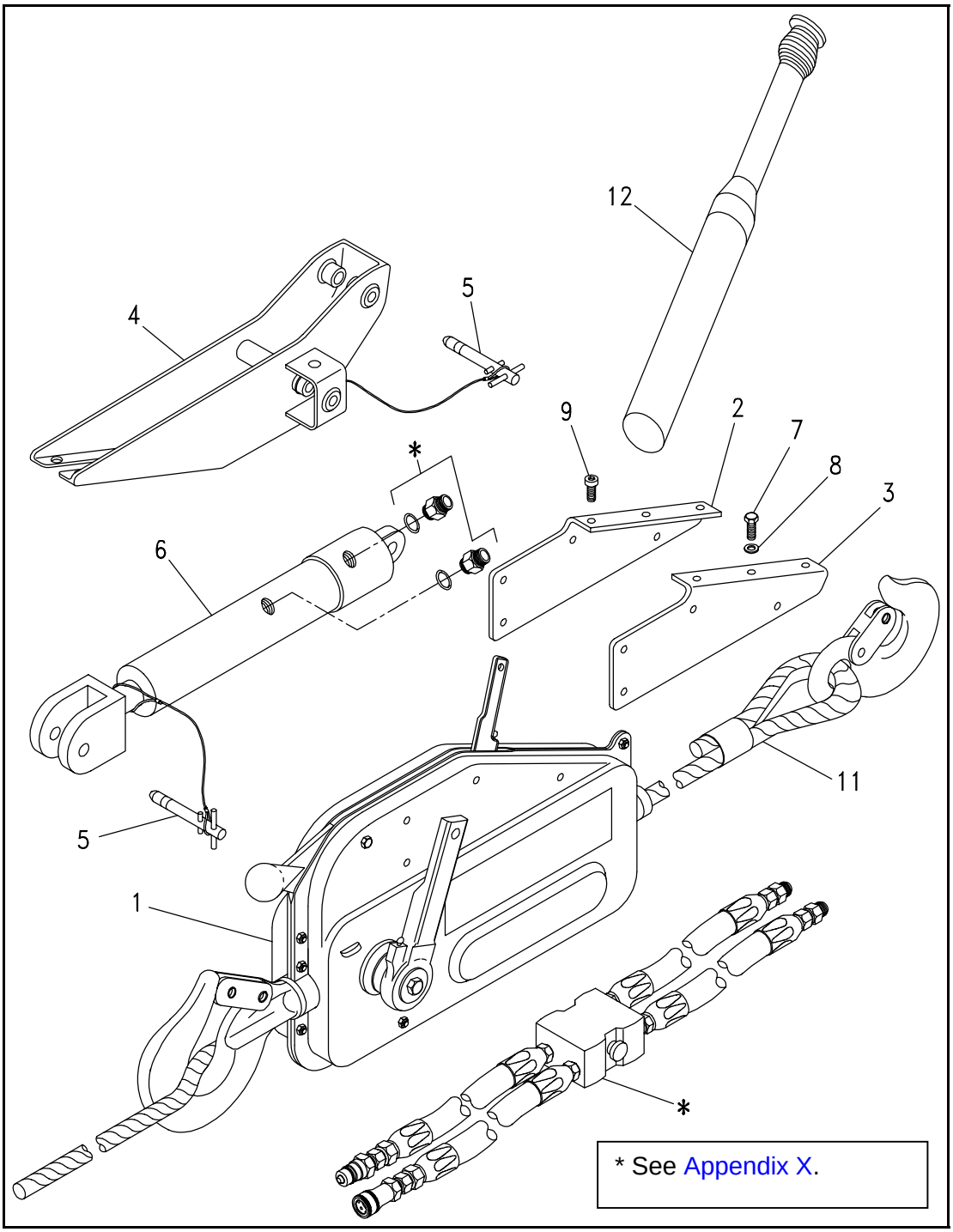


Figure H-4. Hydraulic Come-Along Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
1	Hydraulic Come-Along (Griphoist) with Hydraulic brackets and cylinder	1	TU-28H-SS-2	12708
2	Casing bracket, right hand	1	0161910	12708
3	Casing bracket, left hand	1	0161909	12708
4	Ram fixing bracket	1	0163902	12708
5	Ram anchor pin	1	0163903	12708
6	Hydraulic Ram, VA 2	1	3351990	12708
7	Bolt	12	431059SS	12708
8	Washer	12	433306SS	12708
9	Socket Head Screw	2	MS24671-29	96906
10	Not Used			
11	Wire rope, 7/16 dia, 18,000 lb breaking load	1	C-12	12708
12	Telescopic handle	1	28998	12708

Figure H-4. Hydraulic Come-Along Components (Sheet 2).

APPENDIX I

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC CUTOFF SAW

I-1 DESCRIPTION.

The Hydraulic Cutoff Saw is a modified version of the Stanley Underwater Hydraulic Cutoff Saw, C023. Figure I-1 illustrates a setup for a cutoff saw using a single hydraulic hose reel and a diesel hydraulic power unit (HPU) MK 9 Mod 0. For maximum performance of the cutoff saw, employ with NAVSEA Model 2 or Model 4 HPU.

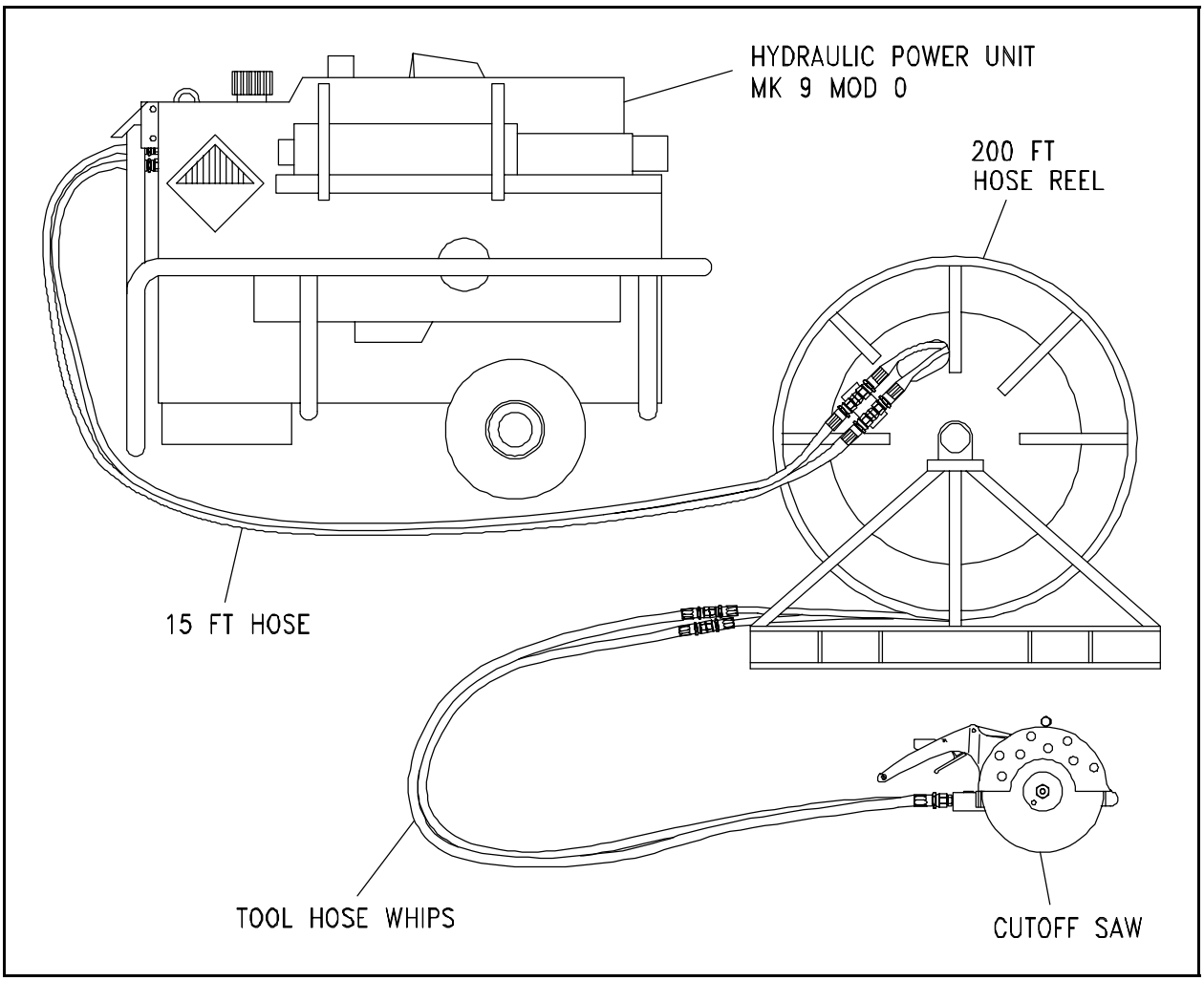


Figure I-1. Hydraulic Cutoff Saw Setup.

I-2 REFERENCE.

NAVSEA Drawing 5366569.

I-2.1 Technical characteristics for the NAVSEA Cutoff Saw are provided in Table I-1.

Table I-1. Cutoff Saw Technical Characteristics.

CHARACTERISTICS	REMARKS
System type	Open-center
Weight	23 lbs
Flow Rates Minimum Recommended Maximum	 10 gpm 15 gpm 15 gpm
Recommended operating pressure	1500-2000 psi
Recommended relief valve setting	2000 psi
Maximum back pressure	250 psi
Maximum operating speed	5000 rpm
Porting	-8 SAE O-ring

I-3 MODIFICATIONS.

On early models of the cutoff saw, modifications were made to improve its underwater handling. Newer Stanley tools function without modifications.

a. Eight 3/4-inch diameter holes were drilled in the grinding wheel guard assembly to reduce the flow of seawater against the grinding wheel guard during cutting operations.

b. A V-notch was made in the right front corner of the sole plate assembly to provide a cutting alignment guide.

An 8-inch long assist handle attachment was designed for use by left-handed divers.

I-4 OPERATION.

WARNING

The cutoff saw must only be operated underwater. Modifications made to the cutoff wheel guard make the tool unsafe for surface operation. Never operate the saw without the wheel guard in place. Failure to secure wheel attachments can cause personal injury.

WARNING

Positive voice communications shall be established between the diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

a. Verify that cutoff saw can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

Connect cutoff saw whips to hose reel.

i. Select proper wheel for task in accordance with Table I-2.

j. Check wheel condition prior to installation for the following:

(1) Before installing abrasive wheels, “sound” wheel for possible damage by hanging wheel vertically by arbor hole and rapping lightly with a screwdriver handle or similar instrument. Thin, organic bond wheels will produce a low drumming tone if it is physically sound. If wheel produces a “dead” or “flat” sound, it may be cracked.

(2) Check to ensure surfaces of wheel that come in contact with blotters and flanges are free of dirt and other foreign particles.

(3) Check to ensure that the cutoff wheel fits freely on drive flange and remains free under all cutting conditions.

(4) Check to ensure diamond wheel segments are intact.

(5) Inspect drive flange and outer flange prior to installation. Check for burrs. Check that bearing surfaces are flat and run true when mounted on drive shaft.

(6) Inspect drive shaft threads.

k. Install selected wheel.

l. Perform operational checkout of cutoff saw as follows:

(1) Check that trigger operates smoothly and is free to travel between the “ON” and “OFF” positions.

(2) Check that trigger is set to disengage cutoff saw when released.

(3) Check that safety catch on handle assembly is operating properly. It should prevent engagement of trigger unless catch is fully pressed down into handle slot.

(4) Check that handle bar is securely fastened to motor housing and handle bar strut. Remove any oil from handle bar.

(5) Inspect wheel guard for cracks and other structural damage.

(6) Rotate guard to ensure that it moves freely on wheel-arbor centerline.

(7) Check locking mechanism to ensure it operates properly to hold guard in a set position.

(8) Adjust sole plate assembly for proper depth of cut.

m. Set HPU flow at 15 gpm.

n. Test actuate cutoff saw.

CAUTION

Viewing from the shaft end, the wheel must rotate counter-clockwise. If the wheel is rotating clockwise, stop the HPU and reverse the tool's whip hose connection.

o. Verify proper wheel rotation as shown in Figure I-2.

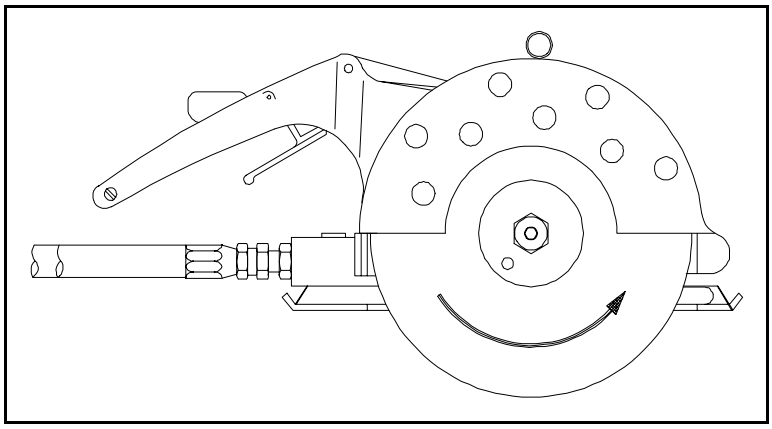


Figure I-2. Blade Rotation.

WARNING

The HPU must be set to a zero flow rate (gpm) before lowering tool to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

p. Set HPU flow (gpm) to zero prior to lowering tool to diver.

CAUTION

If cutoff saw will remain in water after task has been completed, secure it away from any iron or steel to reduce the chance of corrosion damage.

q. Lower tool to diver.

I-5 ATTACHMENTS.

Attachments for the GR24 are described in Table I-2.

Table I-2. Cutoff Saw Attachments.

DESCRIPTION	PART NUMBER	CAGE
10-inch diamond wheel for masonry, 1-inch arbor	03694	16745
10-inch abrasive wheel for metal, 1-inch arbor, fast cutting	04116	16745
10-inch abrasive wheel for metal, 1-inch arbor, long wearing	04117	16745

I-6 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for approved NAVSEA cutoff saw Maintenance Requirement Cards (MRC).

I-7 TROUBLESHOOTING.

Refer to Table I-3 for the approved NAVSEA cutoff saw troubleshooting.

Table I-3. Cutoff Saw Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Tool does not run.	Power not functioning. Coupler or hoses blocked. Mechanical failure.	Check HPU for proper flow and pressure (15 gpm at 2000 psi). Remove obstruction. Disassemble tool and inspect for damage.
Tool runs backwards.	Pressure and return reversed.	Correct hose connection or flow direction.
Oil leakage between motor housing and on-off block or motor.	Oil tube o-ring failure. Motor face seal failure.	Replace as required. Replace as required.
On-off trigger is hard to press.	Back pressure too high. Pressure and return reversed.	Should not exceed 250 psi at 15 gpm measured at the end of the tool operating hoses. Correct for proper flow direction.
Saw cuts too slow.	Insufficient oil flow or low relief valve setting. Wrong wheel for material being cut.	Adjust oil flow to proper gpm. For optimum performance, adjust relief valve to 2200 psi. Use correct wheel.
Saw gets hot.	Hot oil or excessive oil flow.	Check power unit for adequate cooling; should maintain fluid at or below 140° F. Power unit may be producing more flow than the saw will accept under the existing cutting conditions. Reduce flow until saw performance starts top drop off.

I-8 TOOLS REQUIRED.

Table I-4 contains a list of the tools required to maintain the Cutoff Saw.

Table I-4. Tools Required.

TOOLS	PART NO.
Bearing Installation Tool	05044
Bearing Puller Kit	05064

I-9 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to removing and replacing on-off valve, safety catch and motor.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

I-9.1 ON-OFF VALVE.

I-9.1.1 Remove.

a. Using a 1/4-inch diameter punch, drive trigger pivot roll pin (10, Figure I-3) from the valve handle assembly.

b. Remove trigger (11) and trigger spacer (22) from valve handle (15).

c. Remove pipe plug (28) and on-off valve cap (9) with attached O-rings (6,7) from the top of the valve handle (15).

d. Remove port plug (20), O-ring (20a) and spring (23) from the bottom of valve handle (15).

e. Remove valve spool (8) from inside valve handle (15).

I-9.1.2 Replace.

a. Push on-off valve cap (9) and O-rings (6,7) onto valve spool (8) and thread the cap into on-off valve port in the top of the valve handle (15).

b. Install spring (23) into on-off valve block port at bottom of valve handle (15).

c. Install port plug (20) and O-ring (20a) into on-off valve block port at bottom of valve handle (15).

d. Align trigger (1) and trigger spacer (22) in the valve handle (15) with 1/4-inch punch. Secure with roll pin (10).

e. Install pipe plug (28).

I-9.2 Safety Catch.

I-9.2.1 Remove.

a. Using a 3/16-inch diameter punch, drive safety catch pivot roll pin (12) from valve handle (15).

b. Remove torsion spring (13) and safety catch (14) from valve handle (15).

c. Remove fillister head machine screw (16) from end of valve handle (15).

I-9.2.2 Replace.

a. Place torsion spring (13) on boss of safety catch with tab on top facing the back of safety catch.

b. Slide safety catch (14) and torsion spring (13) into position in valve handle (15). Align mounting holes with a 3/16-inch diameter punch.

c. Drive roll pin (12) through valve handle (15), torsion spring (13) and safety catch (14).

d. Push down on torsion spring (13) until it snaps into place under safety catch (14).

I-9.3 Motor.

I-9.3.1 Remove.

a. Remove knob (32) and washer (31) from stud (30), securing sole plate assembly (19) to grinding wheel guard assembly (29).

b. Remove sole plate (19) from grinding wheel guard (29). The stud (30) should remain attached to grinding wheel guard.

c. Remove cap screw (2) securing handle bar (1) to angle strut assembly (5). Remove cap screws (2) securing handle bar to motor housing (25). Remove handle bar and neoprene washer (4) from saw. Remove three handle bar retainers (3), one from top and two from bottom, inside handle bar (1).

d. Remove cap screw (2) securing handle strut assembly (5) to grinding wheel guard (29). Remove handle strut (5) from between motor housing (25) and grinding wheel guard (29).

e. Remove arbor hex nut (33), outer flange (34), drive flange (36) with attached spiral pin (35), and woodruff key (47) from motor shaft (48).

f. Remove three cap screws (2) securing grinding wheel guard assembly (29) to motor housing (25).

g. Remove grinding wheel guard assembly (29) from motor housing (25).

h. Push seal race (37), O-ring (18), seal carrier (38), with attached O-rings (40), seal (39), and seal carrier washer (41) with attached O-ring (40) out of grinding wheel guard (29) from grinding wheel side.

i. Remove four cap screws (51) securing motor housing cap (50) to motor housing (25).

j. Pull motor housing cap (50) off of motor housing (25) and remove motor housing cap O-ring (49).

k. Remove motor shaft (48), retaining ring (44), support washer (43), and bearing (42) from grinding wheel side of motor housing (25) bearing bore.

l. To remove bearing (42) if required, from motor shaft (48), support bearing by its outer race in an arbor press; push motor shaft out from its threaded end. Discard bearing if removed. Remove support washer (43) and retaining ring (44) from motor shaft.

m. Remove spacer washer (45) and shaft seal (46) from grinding wheel side of motor housing (25) bore.

n. Remove drive gear (53), and idler gear (54) from motor housing cap (50) and motor housing (25).

o. Using Puller kit 05064, remove four bearings (52), from motor housing cap (50) and motor housing (25).

p. Separate motor housing (25) from valve handle (15) by removing four cap screws (2).

q. Remove two oil tubes (21) with attached O-rings (24) from either the motor housing (25) or valve handle (15) as applicable.

r. Clean and inspect motor parts.

s. Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lint-free cloths.

t. The inside of the bushings should be gray in color. If a significant amount of yellow bronze is evident, bushing replacement is required. Inspect shafts for corresponding wear and replace as required.

u. The gear chamber bores and end faces around the bores should be polished, not rough or grooved. The flat surfaces around the chamber and bolt holes should be flat and free of nicks and burrs that could cause misalignment or leaks.

v. The idler gear should have flat, straight tips without nicks. It should have a smooth even polish on the teeth and end faces. Discard the gear if cracks are present.

w. The gear running surfaces should show two interconnecting polished circles without a step or roughness.

x. dler shaft diameter at the associated bushings must be smooth. Grooves, roughness, or a reduced diameter indicates fluid contamination and damaged bushings. If abnormally worn (in excess of normal polishing), both shafts and associated bushings must be replaced. The hydraulic system should be thoroughly flushed and the filter replaced before further operation of the hydraulic system.

I-9.3.3 Replace.

a. With split lines facing each other, use Installation Tool 05044 to push bearings (52) in place with an arbor press in the motor housing cap (50) and the motor housing (25).

b. Install a new motor shaft seal (46) in motor housing (25) bearing bore with its lips facing the motor housing cap (50).

c. Place spacer washer (45) in motor housing (25) bearing bore with its counterbore facing outward.

d. Install retaining ring (44), support washer (43), and bearing (42) if removed on the motor shaft (48) from shaft's threaded end.

e. Using MIL-G-24139A, grease motor shaft (48) and inside diameter of installed motor shaft seal (46) and carefully push the assembly motor shaft through the motor shaft seal into the motor housing.

f. Push bearing (42) on inner race into motor housing (25) bearing bore with an arbor press.

g. With lips facing bottom of gland, place motor shaft seal (39) in seal gland of seal carrier (38).

h. Install a new O-ring (40) on outside diameter of seal carrier (38).

i. Push the assembled seal carrier (38) with O-ring (40), followed by the seal carrier washer (41), O-ring (18), into counterbore of grinding wheel guard (29) from grinding wheel side.

j. Supporting motor housing (25) with motor shaft (48) in a vertical position, fill motor shaft bearing (42) with clean hydraulic fluid.

k. Slide assembled grinding wheel guard (20) over motor shaft (48) and bearing (42). Secure guard with three cap screws (2). Torque to 11 foot-pounds.

l. With chambered end first, slide seal race (37) on motor shaft (48).

m. Install woodruff key (47), drive flange (36) with attached spiral pin (35), outer flange (34), and arbor hex nut (33) on motor shaft (48).

n. Install idler gear (54) and drive gear (53) in motor housing cap (50).

o. Using MIL-G-24139A, grease O-ring (49) and install in motor housing cap (50).

p. Slide motor housing cap (50) over motor gears (53, 54) and align it with dowel pins (17).

q. Secure motor housing cap (50) to motor housing (25 with four cap screws (51). Tighten in even increments (in a cross pattern) to 25 foot-pounds.

r. Insert two oil tubes (21) with attached O-rings (24) in motor housing (25) ports.

s. Secure valve handle (15) to motor housing (25) with four cap screws (2). torque to 11 foot-pounds.

t. Install handle strut assembly (5) between grinding wheel guard (29) and motor housing (25). Secure with cap screws (2).

u. Install handle bar retainer (3) in top of handle bar (1). Install two handle bar retainers in bottom of handle bar. Install assembled handle bar on handle strut (5) and on motor housing (25) with neoprene washer (4) between handle bar and handle strut.

v. Align handle bar (1), handle bar retainers (3) and motor housing (25) mounting holes.

Secure with three cap screws (2), one on top two on bottom.

w. Install sole plate assembly (19) over stud (30) on grinding wheel guard assembly (29). Secure with washer (31) and knob (32).

I-10 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

I-11 ILLUSTRATED PARTS BREAKDOWN.

Figure I-3 illustrates the parts breakdown for the Cutoff Saw.

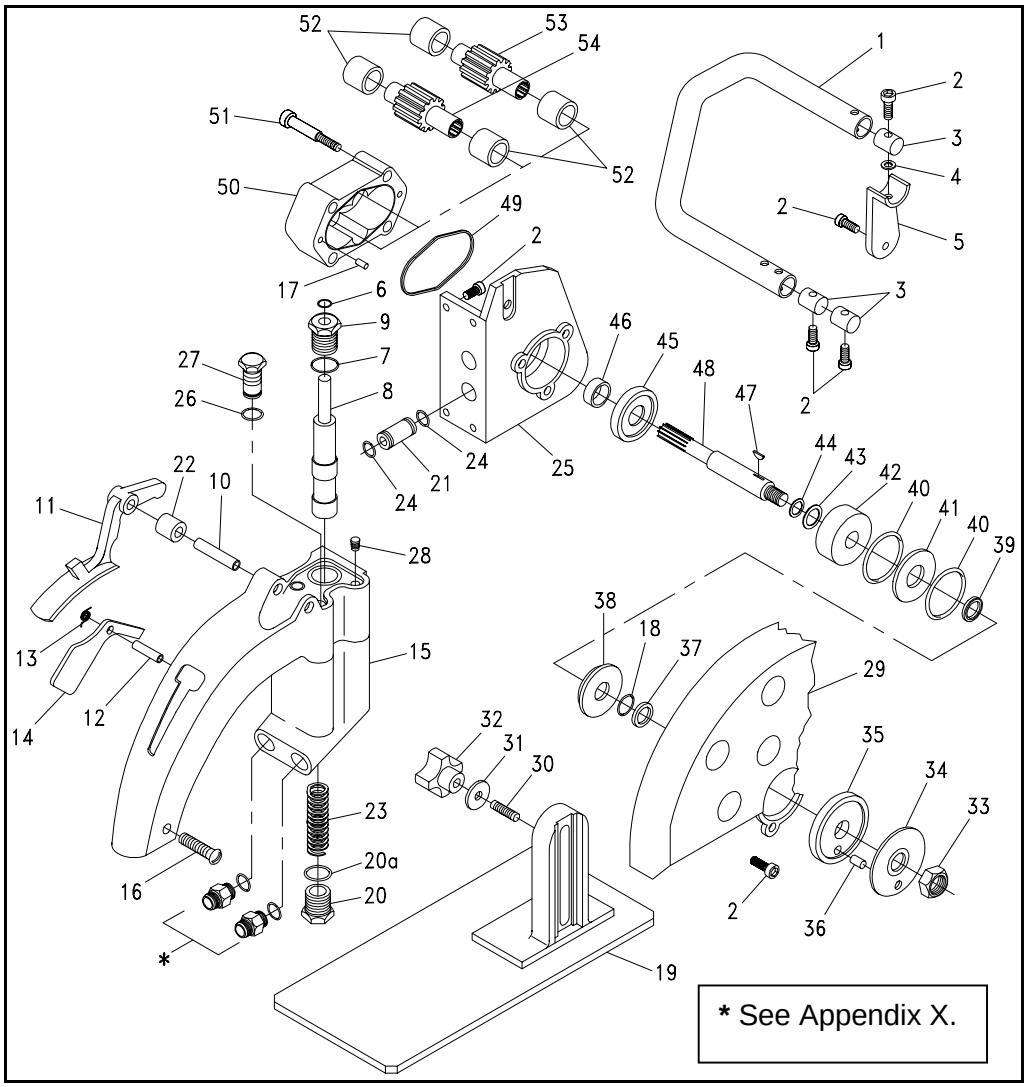


Figure I-3. Cutoff Saw Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Cutoff saw	1	CO23	54252
1	Handle bar	1	02654	54252
2	Cap screw, 5/16-18 x 3/4	11	02764	54252
3	Handle bar retainer	3	02649	54252
4	Neoprene washer	3	02643	54252
5	Handle strut assembly	1	02650	54252
6	O-ring	1	00717	54252
7	O-ring	1	01604	54252
8	Valve spool, o.c., counterclockwise	1	02926	54252
9	On-off valve cap	1	02931	54252
10	Pin, roll	1	03008	54252
11	Trigger	1	02941	54252
12	Pin, roll	1	03009	54252
13	Torsion spring	1	02915	54252
14	Safety catch	1	02943	54252
15	Valve handle assembly	1	02945	54252
16	Screw, fillister head machine	1	00165	54252
17	Pin, roll, safety catch pivot	2	00713	54252
18	O-ring	1	01211	54252
19	Sole plate assembly	1	03806	54252
20	Port plug, hex (includes 20a)	1	03010	54252
20a	O-ring	1	01605	54252
21	Tube, oil	2	00174	54252
22	Spacer, trigger	1	02920	54252
23	Spring	1	02916	54252
24	O-ring	4	00175	54252
25	Housing, motor	1	03814	54252
26	O-ring	1	01362	54252
27	Plug, oiler	1	02917	54252
28	Plug, pipe	1	00955	54252
29	Grinding wheel guard assembly	1	03804	54252
30	Stud	1	03821	54252
31	Washer	1	03827	54252
32	Knob	1	03819	
33	Nut, arbor hex	1	01714	54252
34	Flange, outer	1	03802	54252
35	Pin. spiral	1	03969	54252
36	Flange, drive	1	03803	54252
37	Race, seal	1	03810	
38	Carrier, seal	1	03811	54252
39	Seal, motor shaft	1	03823	54252
40	O-ring	2	01262	54252
41	Washer, seal carrier	1	03822	54252
42	Bearing, motor shaft	1	03109	54252
43	Washer, support	1	03825	54252
44	Ring, retaining	1	00708	54252
45	Washer, spacer	1	03812	54252

Figure I-3. Cutoff Saw Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
46	Seal, motor shaft	1	03824	54252
47	Key, woodruff	1	00600	54252
48	Shaft, motor	1	03813	54252
49	O-ring, housing cap	1	00253	54252
50	Cap, motor housing	1	03816	54252
51	Cap screw	4	01217	54252
52	Bearing	4	03826	54252
53	Gear, drive	1	03818	54252
54	Gear, Idler	1	04033	54252
	Seal kit (Includes items 6, 7, 18, 24, 26, 39, 40, 46, and 49)	AR	04120	54252

Figure I-3. Cutoff Saw Components (Sheet 3).

APPENDIX J

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC UNDERWATER STANLEY GR24 GRINDER

NOTE

The Stanley GR24 underwater hydraulic grinder is no longer in production. The information in this appendix is presented as an aid in the operation and maintenance of units already in the fleet. The Stanley GR 29 underwater hydraulic grinder is the recommended replacement. Refer to Appendix K.

J-1 DESCRIPTION.

The underwater grinder is a modified hydraulic tool which can operate as a standard grinder or an abrasive cut-off saw. The abrasive saw configuration should be used only when the hydraulic cutoff saw (Model CO23/Appendix I) is unavailable. The grinder operates at 5,800 rpms. Figure J-1 illustrates a typical setup for a grinder, using a single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0.

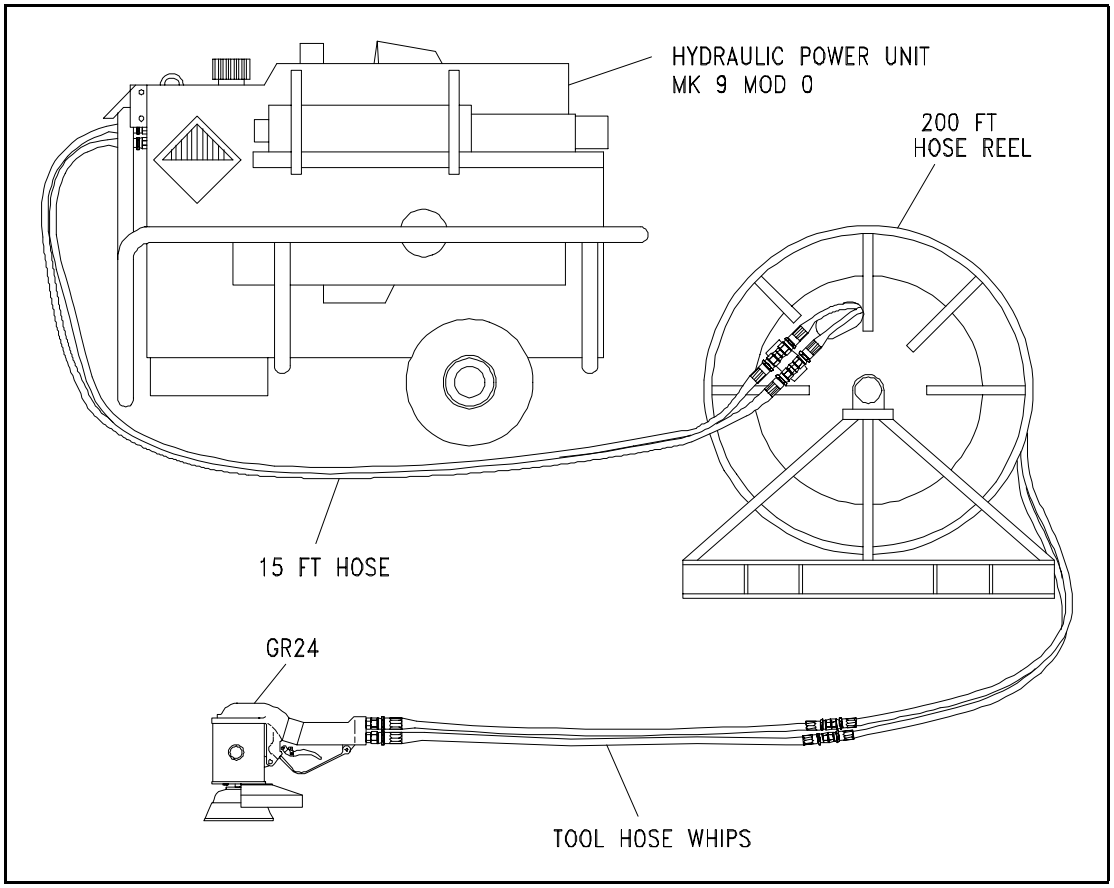


Figure J-1. Hydraulic Underwater Stanley GR24 Grinder Setup.

J-2 REFERENCE.

NAVSEA Drawing 5366565.

J-2.1 Technical characteristics for the Stanley GR24 are provided in Table J-1.

Table J-1. Grinder Technical Characteristics.

CHARACTERISTICS	REMARKS
System type	Open center
Dimensions	14 inches by 9 inches
Weight	11 lbs
Flow Rates: Minimum Recommended Maximum	 7 gpm 9 gpm 9 gpm
Maximum speed (rpm)	5800 rpm
Recommended operating pressure	1,000 to 2,000 psi
Recommended relief valve setting	2000 psi
Maximum operating depth	300 fsw

WARNING

Positive voice communications shall be established between the diver and topside before operating any tool underwater.

WARNING

Always wear eye protection when using grinder topside.

WARNING

Never operate the grinder without its guard in place.

WARNING

Diver must wear 1/4-inch neoprene wet suit hood while operating grinder under water. The maximum operating time per diver is 3 hours and 40 minutes per each 24 hour period.

WARNING

The grinder is a high-speed rotary motion tool. To prevent attachments from accidentally coming off during operation, ensure that the grinding wheel and jam nut are securely tightened with a wrench before use. Failure to lock the attachments with this jam nut or other prescribed method of securing attachments can lead to personal injury.

WARNING

Use recommended accessories only. Using grinding wheels with a diameter over 10-inches can produce excessive hydrodynamic drag on the wheel. Use the grinder attachments only for their designated purpose.

WARNING

Never use an unreinforced grinding wheel which has been dropped.

WARNING

Do not use grinding wheels without an internal reinforced fiber bond on the surface after use underwater. Water remaining in the wheel could cause that wheel to explode during surface operation.

WARNING

Ensure hydraulic power to the grinder is secured before removing or attaching grinding wheels or brush attachments.

WARNING

See manufacturer's literature for grinding wheel or wire brush safety warnings.

WARNING

Never use a grinding wheel rated at less than 6,000 rpm. Never exceed the maximum operation speed for the grinding wheel.

WARNING

Never exceed the maximum recommended operating pressure or flow.

WARNING

Never stand directly in front of the grinding wheel when it is first started or is operating.

WARNING

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

WARNING

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

J-3 OPERATION.

a. Verify that hydraulic grinder can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect grinder hose whips to hose wheel.

i. Select proper attachment from Table J-2 and attach to grinder.

j. Set HPU flow rate not to exceed 2 gpm.

k. Test actuate grinder as follows.

(1) Check that the trigger operates smoothly and is free to travel between the ON and OFF positions.

(2) Check that the trigger is set to disengage the grinder when released.

(3) Check that the cross handle is securely screwed into the handle bracket. Remove any oil from the handle.

(4) Inspect the wheel guard for cracks and other structural damage. If necessary,

adjust the position of the wheel guard by loosening the two cap screws on the guard clamp. Make sure the cap screws are tightened securely after adjustment.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering tool to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

l. Set HPU flow (gpm) to zero prior to lowering grinder to diver.

m. Lower grinder to diver.

J-4 ATTACHMENTS.

Attachments for the GR24 are described in Table J-2. Tool accessories include grinding wheels for metal and masonry, cup brushes and an abrasive cut-off wheel for metal masonry. The cup type grinding wheels recommended for underwater applications have a coarser grit and looser bond than do standard surface grinding wheels.

Table J-2. GR24 Grinder Attachments.

DESCRIPTION	PART NUMBER	CAGE
Cup Brush - Note: Attach with cap screw MS35308-312 and washer MS15795-810	4209-S-30-TY	45092
Wire Cup Brush - Note: Attach with cap screw MS35308-308 and washer MS15795-810	20137	83217
Grinding Wheel (6-inch) - Note: Attach with cap screw MS35308-308 and washer MS15795-810	Type 11 - A-16-9-B03-T	00773
Grinding Wheel – Note: Attach with cap screw MS35308-308 and washer MS15795-810	Type 27 - A-24-GP	00773
Grinding wheel for metal, 9 inch diameter x 5/8 inch -11 THD Arbor	02587	54252
Grinding wheel for masonry, 9 inch diameter x 5/8 inch -11 THD Arbor	02588	54252
Wire brush, 6 inch diameter	02816	54252
Grinding wheel, 7 inch diameter x 5/8 inch -11 THD Arbor	03691	54252
Depressed Center wheel adapter	05194	54252
Adapter Plate (For brushes and disc holders)	28098	54252
Brush (9-inch diameter 46 grit silicon carbide imbedded in nylon bristle)	18726	54252
Brush (9-inch steel flat wire bristles)	18728	54252
Disc (9-inch 3M #3 density)	18730	54252
Disc (7.5-inch 3M #3 density)	18731	54252
Disc (9-inch 3M #5 density)	18732	54252
Disc (7.5-inch 3M #5 density)	18733	54252
Disc Holder (Required for 3M 9-inch dia Disc)	18734	54252
Disc Holder (Required for 3M 7.5-inch dia Disc)	18735	54252

J-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for Stanley GR24 grinder Maintenance Requirement Cards (MRCs).

J-6 TROUBLESHOOTING.

Refer to Table J-3 for the approved Stanley GR24 grinder troubleshooting.

Table J-3. Grinder Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Tool doesn't run.	Power unit not functioning. Coupler or hoses blocked. Mechanical failure.	Check power unit for output of 9 gpm at 2000 psi. Remove obstruction. Disassemble tool and inspect for damage.
Tool runs backwards.	Pressure and return hoses reversed.	Correct for proper flow direction. Wheel should always rotate counterclockwise when viewed from shaft end.
Grinding wheel comes to abrupt stop after release of trigger.	Mechanical failure.	Disassemble tool and inspect for damage.

J-7 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to removing and replacing the trigger and valve and the motor.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Obtain Seal Kit (part number 03258). Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

J-7.1 Trigger And Valve.

J-7.1.1 Remove.

a. Remove trigger guard screw (11, Figure J-2) and trigger guard (14).

b. Remove stop screw (49) and washer (47) from the end of on-off valve.

c. Remove trigger link (9), trigger (12), trigger hinge (13) and trigger hinge pin (10) from handle. Drive trigger hinge pin (10) out of trigger hinge (13).

d. Remove seal cap assembly (45), spring cap (48); remove and discard two O-rings (50).

e. Remove spring (51).

f. Push valve spool (46) out.

J-7.1.2 Replace.

a. Install new O-ring (50, Figure J-2), and thread seal cap assembly (45) into trigger side of handle finger tight.

b. Assemble trigger (12) to trigger hinge (13) with trigger hinge pin (10).

c. Thread trigger assembly into handle (7).

NOTE

When inserting valve through O-ring of end caps, DO NOT FORCE. A slight push combined with rotary motion will allow easy insertion without damaging O-rings.

d. Insert valve (46) and spring (51) through back of handle. Install new O-ring (50) and thread spring cap (48) finger tight.

e. Install trigger link (9) connecting trigger to valve spool.

f. Thread stop screw (49) and washer (47) into end of valve spool and tighten securely.

g. Check to make sure valve spool moves freely and tighten end caps (45, 48); recheck.

h. Install trigger guard (14) and screw (11).

J-7.2 Motor.

J-7.2.1 Remove.

a Remove attachment (i.e., grinding wheel, wire brush).

b. Remove guard by removing three hex cap-screws (17) and washers (16).

c. Remove two flat head housing-to-motor assembly screws (4) from shaft end of motor housing.

d. Remove six hex socket cap screws (3) securing motor housing (1) to handle (7).

e. Separate the motor from the handle. (At this point, the oil tubes are holding the two parts together).

f. Insert a hooked instrument through the oil tubes (5) and pull out. Take care to avoid damaging oil tube bores in motor and handle.

g. Remove oil tube O-rings (6).

J-7.2..2 Replace.

Replace oil tube O-rings (6).

b. Install oil tubes (5) in rear of motor.

c. Push the motor assembly with oil tubes into handle (7) (motor shaft offset to the left, facing the shaft with the handle down.

d. Place motor housing (1) over motor assembly and install two flat head screws (4) securing the motor assemby to motor housing (1).

e. Replace six socket head cap screws (3) through back of handle (7) into motor housing.

f. Attach guard with three hex head cap screws (17) and lock washers (16).

J-8 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

J-9 ILLUSTRATED PARTS BREAKDOWN.

Figure J-2 illustrates the parts breakdown for the hydraulic underwater grinder.

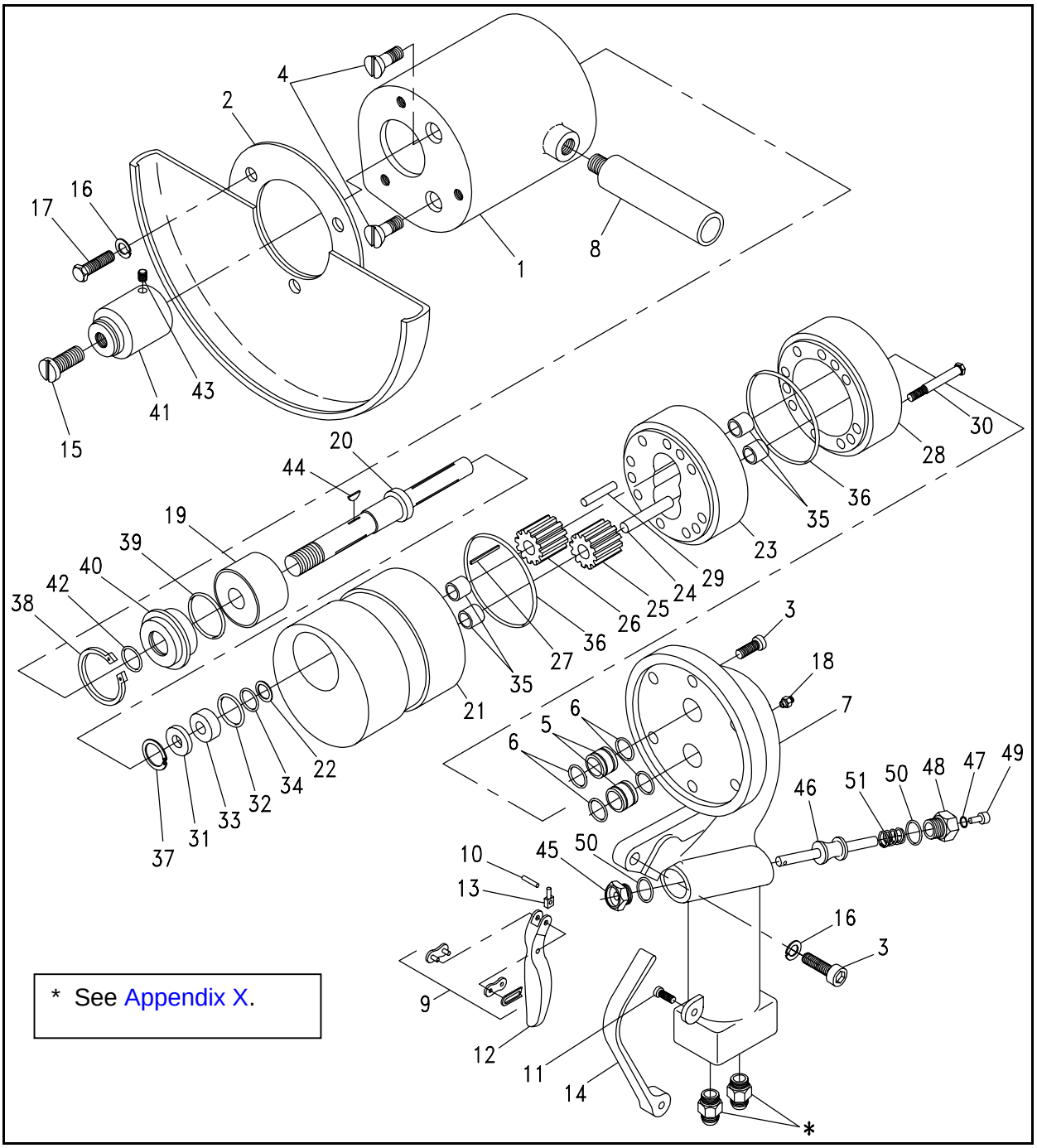


Figure J-2. Hydraulic Grinder GR24 (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Grinder, Underwater, GR24	1	GR24301	54252
1	Housing, Motor	1	00594	54252
2	Guard,. Grinding Wheel	1	06127	54252
3	Screw, Socket Head, Cap	7	00596	54252
4	Screw, Housing To Motor	2	00597	54252
5	Oil Tube	2	00174	54252
6	O-Ring	4	00175	54252
7	Handle, Including Valve Sleeve	1	01977	54252
8	Handle, Cross	1	00234	54252
9	Link, Trigger	1	00615	54252
10	Hinge, Trigger	1	00616	54252
11	Screw, Trigger Guard	1	00050	54252
12	Trigger	1	00898	54252
13	Pin, Trigger Hinge	1	00128	54252
14	Guard, Trigger	1	00159	54252
15	Screw, Safety	1	00883	54252
16	Lock washer	4	00093	54252
17	Screw	3	01213	54252
18	Grease Fitting	1	00767	54252
19	Bearing, Outer Motor	1	03109	54252
20	Shaft, Motor	1	03106	54252
21	Retainer, Front Bearing	1	00603	54252
22	Quad ring washer	1	01203	54252
23	Gear housing	1	00605	54252
24	Idler shaft	1	00606	54252
25	Gear. Idler	1	00607	54252
26	Gear With Keyway	1	00608	54252
27	Key	1	00609	54252
28	Retainer, Rear Bearing	1	00610	54252
29	Pin, Dowel	2	00611	54252
30	Bolt, Motor Assembly	8	00612	54252
31	Washer, Seal Liner	1	00169	54252
32	O-Ring, Seal Liner	1	00171	54252
33	Seal Liner	1	00172	54252
34	Ring, Seal Liner Quad	1	00173	54252
35	Bearing, Needle	4	00177	54252
36	O-Ring, Motor Seal	2	00178	54252
37	Ring, Seal Liner Retaining	1	00405	54252
38	Ring, Retaining	1	00633	54252
39	O-Ring	1	02905	54252
40	Keeper	1	03104	54252
41	Collar, Thrust	1	03108	54252
42	Seal	1	03110	54252
43	Screw, Set	1	00580	54252

Figure J-2. Hydraulic Grinder GR24 (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
44	Key	1	00600	54252
45	Seal Cap Assembly	1	00130	54252
46	Spool, Valve	1	00131	54252
47	Washer, Stop	1	01176	54252
48	Cap, Spring	1	00132	54252
49	Screw, Stop	1	00134	54252
50	O-Ring	2	00074	54252
51	Spring, Valve	1	00006	54252
-	SEAL KIT, Underwater Model (Includes Find Nos. 6, 22, 32, 33, 34,, 36, 39, 42, and 50)	AR	03258	54252
-	REPAIR KIT, Underwater Model (Includes Find Nos. 9, 10, 13, 19, 27, 31, 37, 38, 51, and SEAL KIT 03258)	AR	03113	54252

Figure J-2. Hydraulic Grinder GR24 (Sheet 3).

APPENDIX K

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC UNDERWATER STANLEY GR29 GRINDER

K-1 DESCRIPTION.

The NAVSEA Hydraulic Underwater Grinder is a Stanley underwater hydraulic grinder GR29. The Stanley GR29 is right angle and the recommended replacement for the Stanley GR 24 underwater hydraulic grinder (Appendix J). Figure K-1 illustrates a typical setup for a hydraulic underwater Stanley GR29 grinder, using a single hydraulic hose reel and a hydraulic power unit (HPU) Mk 9 Mod 0.

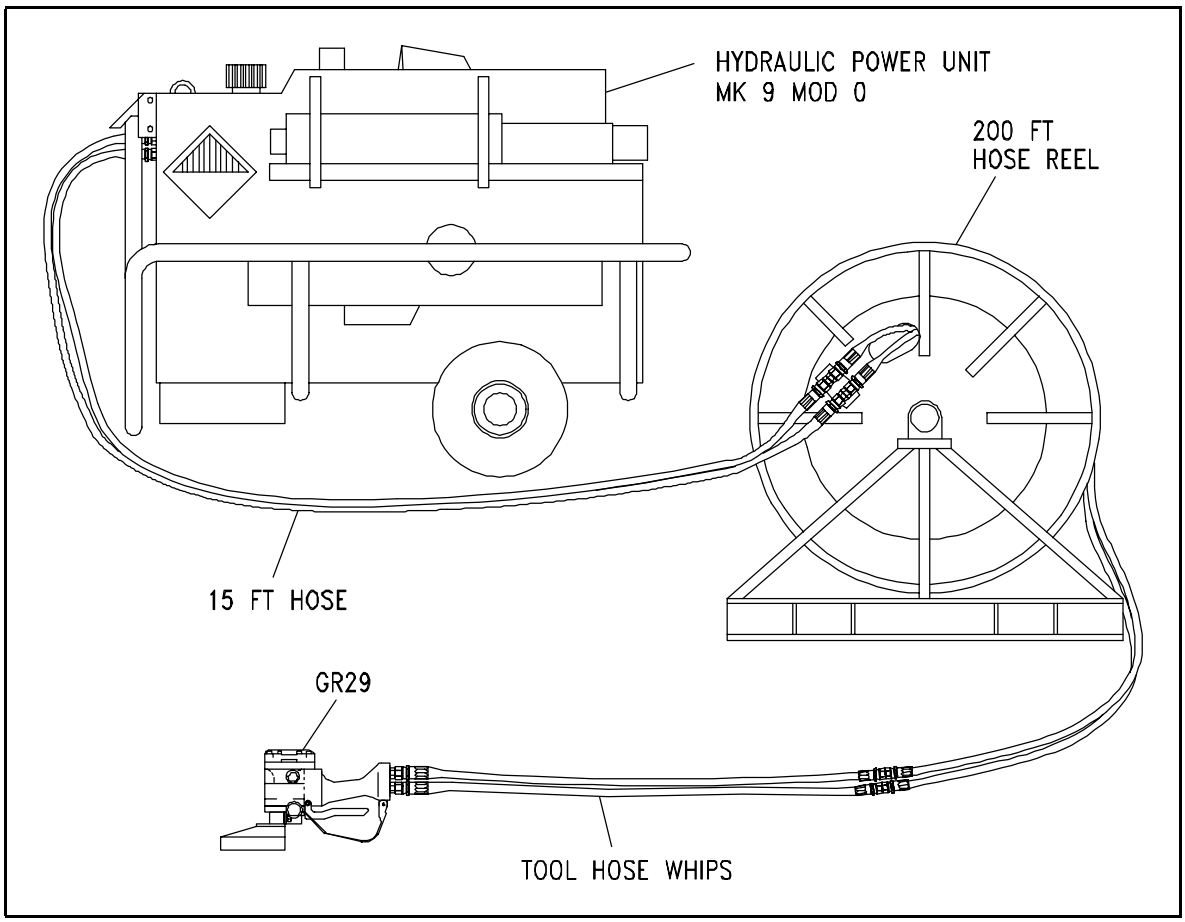


Figure K-1. Hydraulic Underwater Stanley GR29 Grinder Setup

K-1.1 Technical characteristics for the Stanley GR29 are provided in Table K-1.

Table K-1. Grinder Technical Characteristics

CHARACTERISTICS	REMARKS
System type	Open-circuit
Length	9 inches
Width w/o guard	4.5 inches
Dimensions	19.5 inches x 11 inches
Weight (dry)	15 lbs
Flow Rates: Minimum Recommended Maximum	 4 gpm 10 gpm 12 gpm
Recommended operating pressure	750-2000 psi
Recommended relief valve setting	2000 psi
Maximum back pressure	250 psi
Porting	-8 SAE O-ring
Maximum operating depth	300 fsw

WARNING

Positive voice communications shall be established between the diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

WARNING

Always wear eye protection when operating the grinder.

WARNING

Never operate the grinder without its guard in place.

WARNING

The grinder is a high-speed rotary motion tool. To prevent attachments from accidentally coming off during operation, ensure that the grinding wheel and jam nut are securely tightened with a wrench before use. Failure to lock the attachments with this jam nut or other prescribed method of secured attachments can lead to personal injury.

WARNING

Use recommended accessories only. Using grinding wheels with a diameter over 10-inches can produce excessive hydrodynamic drag on the wheel. Use the grinder attachments only for their designated purpose.

WARNING

Never use grinding wheels which do not contain internal reinforcement and have been dropped.

WARNING

Do not use grinding wheels without an internal reinforced fiber bond on the surface after use underwater. Water remaining in the wheel could cause that wheel to explode during surface operation.

WARNING

Never use a grinding wheel rated at less than 6,000 rpm. Never exceed the maximum operation speed for the grinding wheel.

WARNING

Never exceed the maximum recommended operating pressure (psi) or flow (gpm).

WARNING

Never stand directly in front of the grinding wheel when it is first started or is operating.

WARNING

Ensure hydraulic power to the grinder is secured before removing or attaching grinding wheels or brush attachments.

K-2 OPERATIONS.

a. Verify that hydraulic grinder can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect grinder hose whips to hose reel.

i. Perform operational check of grinder as follows:

(1) Check that the trigger operates smoothly and is free to travel between the ON and OFF positions.

(2) Check that the trigger is set to disengage the grinder when released.

(3) Check that the cross handle is securely screwed into the handle bracket. Remove any oil from the handle.

(4) Inspect the wheel guard for cracks and other structural damage. If necessary, adjust the position of the wheel guard by loosening the two cap screws on the guard clamp. Make sure the cap screws are tightened securely after adjustment.

j. Select proper grinder attachment from Table K-2 and attach to grinder as follows:

(1) Remove and set aside the jam nut from the output shaft.

(2) Position the grinding wheel over the shaft.

NOTE

Never over-tighten the grinding wheel jam nut by impacting either wrench with a mallet or hammer. Sufficient torque is attained by hand-tightening the nut with two open-end wrenches.

(3) Screw the jam nut down onto the spindle shaft. Tighten the nut securely by using two open-end wrenches; one wrench on the flats of the spindle shaft, the other wrench on the jam nut.

k. Set HPU flow rate not to exceed 2 gpm.

l. Test actuate grinder.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering grinder to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

m. Set HPU flow (gpm) to zero prior to lowering grinder to diver.

n. Lower grinder to diver.

K-3 ATTACHMENTS.

Attachments for the GR29 are described in Table K-2.

Table K-2. GR29 Grinder Attachments.

DESCRIPTION	PART NUMBER	CAGE
Cup Brush - Note: Attach with cap screw MS35308-312 and washer MS15795-810	4209-S-30-TY	45092
Wire Cup Brush - Note: Attach with cap screw MS35308-308 and washer MS15795-810	20137	83217
Grinding Wheel (6-inch) - Note: Attach with cap screw MS35308-308 and washer MS15795-810	Type 11 - A-16-9-B03-T	00773
Grinding Wheel – Note: Attach with cap screw MS35308-308 and washer MS15795-810	Type 27 - A-24-GP	00773
Grinding wheel for metal, 9 inch diameter x 5/8 inch -11 THD Arbor	02587	54252
Grinding wheel for masonry, 9 inch diameter x 5/8 inch -11 THD Arbor	02588	54252
Wire brush, 6 inch diameter	02816	54252
Grinding wheel, 7 inch diameter x 5/8 inch -11 THD Arbor	03691	54252
Depressed Center wheel adapter	05194	54252
Adapter Plate (For brushes and disc holders)	28098	54252
Brush (9-inch diameter 46 grit silicon carbide imbedded in nylon bristle)	18726	54252
Brush (9-inch steel flat wire bristles)	18728	54252
Disc (9-inch 3M #3 density)	18730	54252
Disc (7.5-inch 3M #3 density)	18731	54252
Disc (9-inch 3M #5 density)	18732	54252
Disc (7.5-inch 3M #5 density)	18733	54252
Disc Holder (Required for 3M 9-inch dia Disc)	18734	54252
Disc Holder (Required for 3M 7.5-inch dia Disc)	18735	54252

K-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for Stanley GR29 grinder Maintenance Requirement Cards (MRC).

K-5 TROUBLESHOOTING.

Refer to Table K-3 for the approved Stanley GR29 grinder troubleshooting.

Table K-3. Grinder Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Low performance.	Incorrect hydraulic flow. Defective quick disconnects.	Check that power source is producing 4-12 gpm at 1000-2000 psi. Check each quick disconnect.
Oil leak at motor cap face.	Fasteners loose. Face O-ring worn or missing. Motor cap/main housing damaged.	Tighten to recommended torque. Replace as required. Replace as required.
Oil leaks at reversing spool.	Damaged O-rings.	Replace as required.
Oil leaks at reversing spool. (cont)	Wrong hydraulic fluid. Circuit too hot.	See Hydraulic System Requirements for fluid and circuit specifications.
Oil gets hot, power unit working hard.	Open-center tool on a closed center circuit and vice versa. Too much oil going through tool. Circuit is generating high heat with flow controls, relief, etc. Circuit has contaminants that have caused wear and high heat generation.	Use tools to match circuit. Adjust flow for 12 gpm. Use pump size and rpm for producing needed flow only. Eliminate circuit heating cause. Replace worn pump and valves; install a large clean filter and keep circuit fluid clean.
Tool doesn't run.	Power unit not functioning. Coupler or hoses blocked. Mechanical failure.	Check power unit for output of 4-12 gpm at 1000-2000 psi. Remove obstruction. Disassemble tool and inspect for damage.
Tool runs backwards.	Pressure and return hoses reversed.	Correct for proper flow direction. Grinding wheel should always rotate counterclockwise when viewed from shaft end.
Grinding wheel comes to abrupt stop after release of trigger.	Reversing spool incorrectly assembled. Mechanical failure. Check valve in trigger spool not functioning correctly.	Refer to reassembly of main housing. Disassemble tool and inspect for damage. Replace trigger spool assembly. Check valve not serviceable.

K-6 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to disassembly and reassembly for piece part replacement.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

Obtain Seal Kit (part number 16969). Replace all seals that are exposed during tool disassembly to guard against leaks. Note the orientation of seals before removal. Install new seals in the same position as the original seals.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

K-6.1 Disassemble.

a. Remove wheel guard (1, Figure K-2) by loosening two bolts on wheel guard clamp.

b. Remove trigger guard (8) by removing nut (9) and cap screw (10) along with two cap screws (6) and two lock washers (23) from lower section of bearing carrier.

c. Remove the remaining two cap screws (6) and two lock washers (23) securing bearing carrier (13) to main housing (24). Remove dead handle bracket weldment (7) along with handle (5).

CAUTION

When pulling assembled bearing carrier away from main housing, the woodruff key on end of spindle shaft might damage O-ring and bushing in the main housing. It might be necessary to remove motor cap to remove woodruff key first.

CAUTION

DO NOT pry or use excessive force when removing bearing carrier.

d. Carefully separate bearing carrier (13) from main housing (24). The spindle shaft (19), seal (12), O-ring (18), bearing (16) and two retainer wings (15, 17) remain with carrier.

e. To remove spindle shaft (19) and bearing (16) from bearing carrier (13), remove jam nut (11) and large internal retaining ring (17). Remove the bearing (16) from spindle shaft (19) by removing small external retaining ring (15).

f. Remove O-ring (18), then press seal (12) out of bearing carrier (13).

CAUTION

Do not pry or in any way excessively force motor cap assembly off main housing. If necessary, loosen motor cap by tapping lightly with a non-metallic mallet.

g. Remove eight socket head cap screws (30) and lock washers (29) securing motor cap assembly (28) to main housing (24). Carefully remove motor cap.

h. Remove large O-ring (34) from motor cap assembly (28). Discard O-ring.

i. Remove idler gear (36) and idler shaft (37). Slide drive gear (26) off spindle shaft (19). Be careful not to lose woodruff key (20).

j. Remove set screw (41) securing valve keeper (42) to reversing spool (40). Remove keeper.

k. Remove retaining ring (15) at opposite end of spool.

l. Push on retaining ring end of reversing spool (40) and slide spool out of housing. Remove two backup rings (38) and O-rings (39) from spool.

m. Remove trigger (44) by removing cap screw (43) and nut (9).

n. Unscrew and remove spool cap (33). Remove two O-rings (48, 49), rod wiper (50) and push pin (32) from cap.

o. Remove valve spool assembly (47) and spring (46).

CAUTION

The valve sleeve remains in the main housing. It is not removable in the field. If the sleeve is damaged, return the main housing to a Stanley dealer.

CAUTION

There is only a small visual difference between the valve spools used for OC and CC grinders. DO NOT confuse them when re-assembling the grinder. An OC spool has outer ring widths of less than 0.6 inches (14 mm) while CC spools have outer ring widths of over 1 inch.

p. Remove retaining ring (17) at bearing carrier end of main housing (24). Remove back-up washer (21) and O-ring (22). The O-ring is subject to severe service and should be replaced whenever main shaft is serviced.

q. Clean and inspect motor parts.

(1) Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lint-free cloths.

(2) The inside of the bushings should be gray in color. If a significant amount of yellow bronze is evident, bushing replacement is required. Inspect shafts for corresponding wear and replace as required.

(3) The gear chamber bores and end faces around the bores should be polished, not rough or grooved. The flat surfaces around the chamber and bolt holes should be flat and free of nicks and burrs that could cause misalignment or leaks.

(4) The idler gear should have flat, straight tips without nicks. It should have a smooth even polish on the teeth and end faces. Discard the gear if cracks are present.

(5) The gear running surfaces should show two interconnecting polished circles without a step or roughness.

(6) Idler shaft diameter at the associated bushings must be smooth. Grooves, roughness, or a reduced diameter indicates fluid contamination and damaged bushings. If abnormally worn (in excess of normal polishing), both shafts and associated bushings must be replaced. The hydraulic system should be thoroughly flushed and the filter replaced before further operation of the hydraulic system.

K-6.2 Reassemble.

NOTE

Before reassembly, clean all parts with a degreasing solvent. Apply clean grease or O-ring lubricant to all parts during assembly. Obtain seal kit (part number 16969) so all seals exposed during disassembly can be replaced during reassembly.

NOTE

For orientation of parts identified in the following procedures, see the parts location diagram Figure K-2.

a. Lubricate and install spring (46, Figure K-2) and spool assembly (52) in main housing. There is a hex plug in one end of spool to retain steel check ball and strut. This end of spool must be installed first.

b. Lubricate and install two O-rings (48,49) in spool cap (33), then screw cap into main housing (24). Tighten securely.

c. Lubricate and install push pin (32) and rod wiper (50).

d. Install trigger (44) using cap screw (43) and nut (9).

e. Grease one reversing spool O-ring (39) and position it onto small diameter end of reversing spool (40). Position back-up ring (38) toward end.

f. Insert end of reversing spool without O-ring and back-up ring into reversing spool bore in main housing. From left side, looking from behind tool, push spool just far enough through bore to expose empty O-ring groove. Be sure orientation of small diameter end of reversing spool matches that illustrated in parts location diagram, Figure K-2.

g. Grease second reversing spool O-ring (39) and position it in exposed O-ring groove in reversing spool. Position back-up ring (38). Push spool back to neutral position.

h. Install retaining ring (15) on large diameter end of reversing spool. Rotate spool so small hole in its small diameter end faces rear of tool.

i. Position valve keeper (42) on opposite end of reversing spool and secure it with set screw (41) into spool hole.

j. Lubricate and install spindle shaft O-ring (22) in main housing. Install back-up washer (21) and secure in place using internal retaining ring (17).

k. Reposition main housing in vise with bearing carrier (13) end facing up. Assemble and install bearing carrier as specified in following instructions.

l. Lubricate and install O-ring (18) in bearing carrier (13).

m. Install ball bearing (16) on spindle shaft (19) and secure in place using small external retaining ring (15).

n. Lubricate and install shaft seal (12) in bearing carrier. Make sure seal lip faces out.

o. Position bearing carrier on shaft far enough to install internal retaining ring (17).

p. Ensure spindle shaft is well lubricated and woodruff key (20) is removed. Carefully position assembled bearing carrier against main housing. Ensure that shaft does not damage the O-ring seal in main housing. Install jam nut (11) on spindle shaft (19).

q. Secure bearing carrier in place using four cap screws (6) and lock washers (23). Be sure to install the deadhandle bracket weldment (7) and cross handle (5) on the lower, right hand cap screw (6). The trigger guard (8) is fastened by two lower cap screws.

r. Connect lower section of trigger guard to main housing using nut (9) and cap screw (10).

s. Grip grinder main housing in a vise with handle (5) in vertical position.

t. Inspect motor cap gear chamber, gears and bushings as specified in this section.

u. Lubricate and install drive gear (26) and idler gear (36) in motor cap (28). Install idler shaft (37) in idler gear.

v. Lubricate and install new O-ring (34) in motor cap (28).

w. The spindle shaft (19) remains with bearing carrier (13) during disassembly. If carrier has been removed, it must be assembled and installed on main housing before motor cap can be installed.

x. With bearing carrier installed on main housing, install woodruff key (20) on spindle shaft. Align keyway in drive gear (26) with woodruff key, then position assembled motor cap against main housing. Make sure that drive gear slides on spindle shaft so that woodruff key enters keyway in the drive gear.

y. Lubricate and install eight socket head cap screws (30) and washers (29). Tighten to a torque of 22-25 ft-lbs .

z. Install wheel guard (1). Tighten two bolts on the wheel guard clamp securely.

K-7 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

K-8 ILLUSTRATED PARTS BREAKDOWN.

Figure K-2 illustrates the parts breakdown for the Grinder.

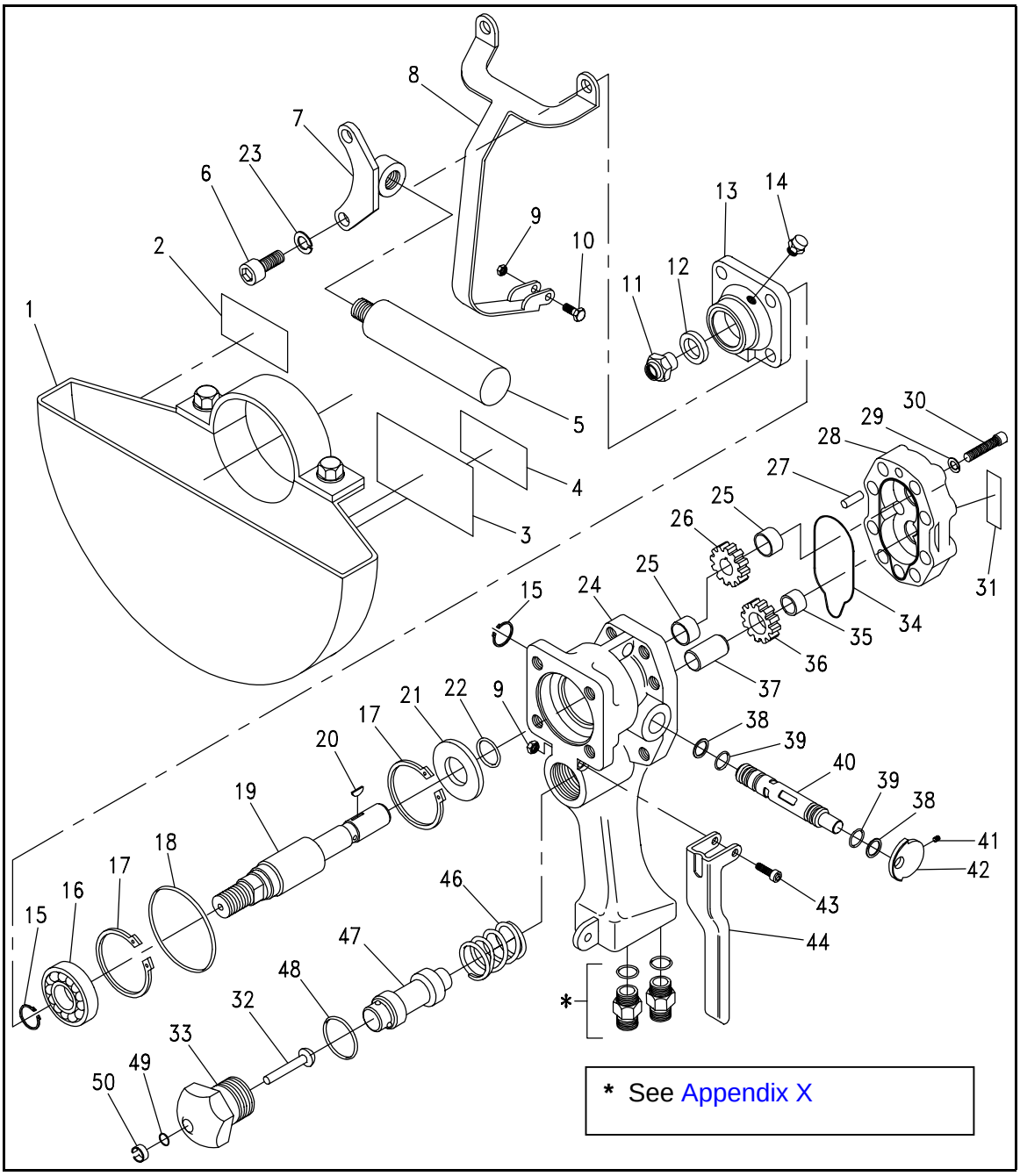


Figure K-2. GR29 Grinder Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Grinder, Underwater	1	GR29	54252
1	Guard, wheel	1	08322	54252
2	Sticker, warning	1	10396	54252
3	Sticker, safety	1	08688	54252
4	Sticker, GPM	1	03788	54252
5	Cross handle	1	00234	54252
6	Cap screw	4	13815	54252
7	Bracket weldment, dead handle	2	13796	54252
8	Guard, trigger	1	12285	54252
9	Nut, ESNA #10	2	07724	54252
10	Cap screw	1	12470	54252
11	Jam nut	1	13779	54252
12	Seal, shaft	1	13812	54252
13	Bearing carrier	1	13790	54252
14	Grease fitting w/cap	1	01220	54252
15	Retaining Ring .750 external	2	09275	54252
16	Ball bearing	1	13813	54252
17	Retaining ring 1.85 internal	2	00166	54252
18	O-ring	1	00149	54252
19	Shaft, spindle	1	13791	54252
20	Key, woodruff #404	1	13828	54252
21	Washer, backup	1	07987	54252
22	O-ring	1	08017	54252
23	Lock washer	2	00231	54252
24	Main housing assembly (includes item 25)	1	12286	54252
25	Bushing	2	08014	54252
26	Gear, drive	1	13783	54252
27	Dowel pin	1	08013	54252
28	Motor cap assembly (includes items 25, 27, 28, 32, & 33)	1	08006	54252
29	Lock washer	8	00812	54252
30	Cap screw	8	01870	54252
31	Name Tag, GR29 U/W	1	13778	54252
32	Headed push pin	1	23678	54252
33	Spool cap	1	22063	54252
34	O-ring	1	08023	54252
35	Bushing, idler gear	1	07978	54252
36	Idler gear	1	07983	54252
37	Idler shaft	1	07991	54252
38	Ring, backup	2	08015	54252
39	O-ring	2	01211	54252
40	Reversing spool	1	08002	54252
41	Set screw	1	00580	54252
42	Valve keeper	1	17061	54252
43	Cap screw	1	00786	54252

Figure K-2. GR29 Grinder Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
44	Trigger	1	12283	54252
45	Not used			
46	Spring	1	07988	54252
47	Spool assembly	1	13781	54252
48	O-ring	1	06533	54252
49	O-ring	1	00026	54252
50	Rod wiper	1	22064	54252
	Seal Kit (includes items 12, 18, 22, 34, 38, 39, 48, 49, & 50)	AR	16969	54252

Figure K-2. GR29 Grinder Components (Sheet 3).

APPENDIX L

OPERATION AND MAINTENANCE PROCEDURES FOR THE IMPACT WRENCH MODELS IW06

NOTE

The Stanley IW06330 (5/8-inch quick change) and IW06340 (3/4-inch square) impact wrenches were deleted from the manufacturer's product line in 1993. In this appendix, operation and maintenance information for these wrenches is provided for those tools remaining in the fleet. The Stanley IW12340 is the recommended replacement.

L-1 DESCRIPTION.

The Stanley IW06 is an open-centered hydraulic impact wrench with ball and cam style impact mechanism that greatly reduces or eliminates the torque transmission back to the diver during underwater operations. The impact wrench is also equipped with a gear-type motor that provides a high power-to-weight ratio and with an integral reversing valve that permits instant reversal when needed. Figure L-1 illustrates a typical setup for an IW06 impact wrench using a single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0.

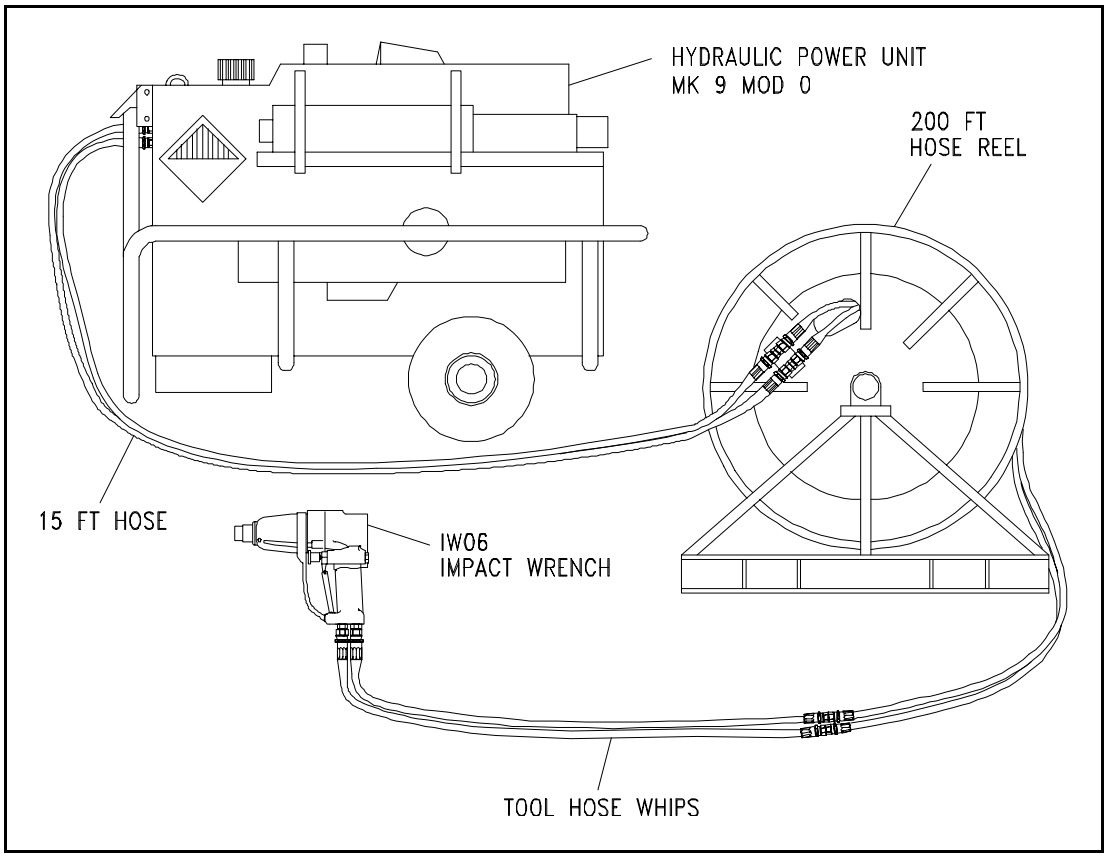


Figure L-1. IW06 Impact Wrench Setup.

L-2 REFERENCE.

NAVSEA Drawing 5366563.

L-2.1 Technical characteristics for the IW06 impact wrench are provided in Table L-1.

Table L-1. Impact Wrench IW06 Technical Characteristics.

CHARACTERISTIC	REMARKS
System type	Open-centered
Weight (Air)	10 lbs
Flow Rates: Minimum Recommended Maximum	 3 gpm 5 gpm 5 gpm
Recommended operating pressure	1000-2000 psi
Recommended relief valve setting	2000 psi
Maximum back pressure	250 psi
Porting	3/8-inch pipe
Drive type IW0633 W06340	 5/8-inch square 3/4-inch square
Maximum operating depth	300 fsw

The impact wrench is a rotary hammer tool which impacts the head of a bolt or nut. Since it does not apply slow, steady torque as does the standard torque wrench, the following factors can affect torque when using the impact wrench:

a. Long bolts that have high-friction threads with lubrication under bolt heads of their associated nuts may twist when impacted, then untwist before the next impact.

b. Heavy, loose, or multiple adapters between impact wrench and driven socket can dissipate intensity of impact on bolt head or nut.

c. The hydraulic flow rate (gpm) to tool must be within required range. If flow rate is too low, the wrench's impact speed will be reduced.

L-3 OPERATION.

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

a. Verify that impact wrench can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect impact wrench hose whips to hose reel.

CAUTION

Always use sockets and accessories designed for impact type applications. Standard sockets or accessories shall not be used. They can crack, or fracture, during operation.

i. Select accessories from Table L-2, and attach to impact wrench.

j. Set HPU flow rate not to exceed 2 gpm.

k. Test actuate impact wrench.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering impact wrench to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

l. Set HPU flow (gpm) to zero prior to lowering tool to diver.

m. Lower tool to diver.

CAUTION

Avoid damaging the fasteners by excessive impacting. When operated at full power or for prolonged periods of impacting, the wrench can twist off the heads of bolts or strip the threads of even high-strength nuts and bolts. The IW06 impact wrench is capable of producing up to 1200 ft-lbs of torque.

CAUTION

Extended impacting (beyond 10 seconds duration) may result in excessive heat buildup in impact section of wrench seriously reducing life of the impact mechanism of the wrench.

NOTE

In order to tighten bolts more accurately, lubricate the bolt threads. Then check bolt with a torque wrench and duplicate time of impacting for other bolts of same thread size, length, and lubrication conditions.

n. If hydraulic impact wrench is used during cold weather, preheat hydraulic oil following procedures reflected in respective HPU's O&M manual employed. Normally recommended oils should be at or above 50 degrees F before wrench is used.

L-4 ATTACHMENTS AND ACCESSORIES.

Attachments and accessories for the IW06330 are described in Table L-2. Attachments for the IW06340 are described in Table L-3. The hydraulic impact wrenches are configured with either 3/4-inch square drive or a 5/8-inch hex chuck. The quick-change 5/8-inch chuck with and without an adapter allows this.

CAUTION

Always use sockets and accessories designed for impact applications. Standard sockets or accessories shall not be used. They can crack, or fracture, during operation.

Table L-2. IW06330 Impact Wrench Attachments.

DESCRIPTION	PART NUMBER	CAGE
Socket set, impact 1/2 inch square drive - 3/8 inch through 1 inch	311IMY	55719
Adapter, 5/8 inch hex to 1/2 inch square	A-3021A	55719
Adapter, 5/8 inch hex to 3/4 inch square with pin	EX-621-3	
Screwdriver, Phillips, No. 3	SP32A	55719
Screwdriver Phillips, No. 4	SP42A	55719
Screwdriver, standard tip 7/16 x 0.050	SW28A	55719
Screwdriver, standard tip 1/2 x 0.075	SW32A	55719
Shell, impact	5366562-4	53711
Arbor, impact	5366562-2	53711
Chuck, Jacob's	N/A	55719

Table L-3. IW06340 Impact Wrench Attachments.

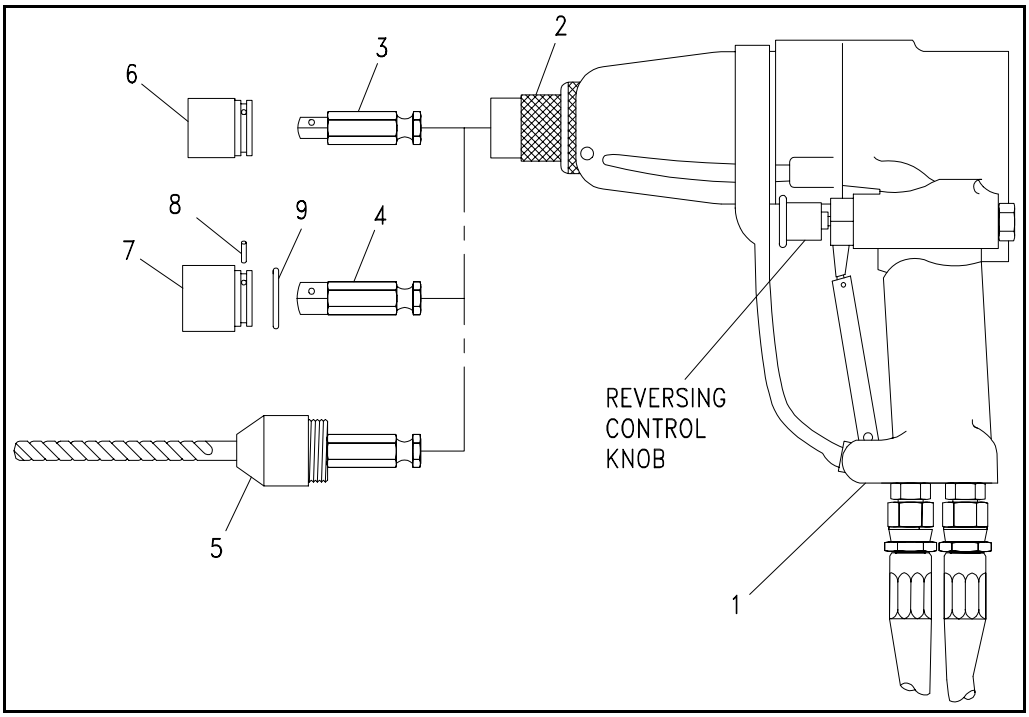
DESCRIPTION	PART NUMBER	CAGE
3/4 inch - 3/4 inch square drive socket	IM-242	55719
13/16 inch - 3/4 inch square drive socket	IM-262	55719
7/8 inch - 3/4 inch square drive socket	IM-282	55719
15/16 inch - 3/4 inch square drive socket	IM-302	55719
1 inch - 3/4 inch square drive socket	IM-322	55719
1 1/16 inch - 3/4 inch square drive socket	IM-342	55719
1 1/8 inch - 3/4 inch square drive socket	IM-362	55719
1 3/16 inch - 3/4 inch square drive socket	IM-382	55719
1 1/4 inch - 3/4 inch square drive socket	IM-402	55719
1 5/16 inch - 3/4 inch square drive socket	IM-422	55719
1 3/8 inch - 3/4 inch square drive socket	IM-442	55719
1 7/16 inch - 3/4 inch square drive socket	IM-462	55719
1 1/2 inch - 3/4 inch square drive socket	IM-482	55719
Locking ring	IM-182R	55719
Locking pin	IM-182P	55719

a. To attach an accessory (Table L-2) to the IW06330 (1, Figure L-2) hydraulic impact wrench fitted with 5/8-inch quick change chuck adapter, slide the outer portion of the quick-change chuck (2) forward and drop the accessory into the chuck mechanism. The spring-loaded chuck will return to its closed position automatically when released.

b. Use a 5/8-inch hex drive to 1/2-inch square adapter (3) or 5/8-inch hex drive to 3/4-inch square drive adapter (4) to attach impact sockets.

c. To use screwdriver bits, attach a Jacob's keyless chuck with a 1/2-inch square drive (5) to a 5/8-inch hex to a 1/2-inch square adapter (3). Install screwdriver bit in the Jacob's chuck.

d. To secure ½-inch impact sockets (6), align the ball on the 5/8-inch hex drive to ½-inch square drive with the hole in the socket (6).



1. IW06330 Impact Wrench 2. 5/8-inch hex quick change chuck	3. 5/8-inch hex drive to ½-inch square drive 4. 5/8-inch hex drive to ¾-inch square drive 5. Keyless chuck	6. ½-inch drive socket 7. ¾-inch drive socket 8. Locking pin 9. O-ring

Figure L-2. Sockets and Accessories.

e. To secure 3/4-inch impact sockets (7), insert locking pin (8). Place a rubber locking O-ring (9) over the socket and into the ring groove.

L-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for approved NAVSEA impact wrench Maintenance Requirement Cards (MRC).

L-6 TROUBLESHOOTING.

Refer to Table L-4 for impact wrench troubleshooting.

Table L-4. Impact Wrench Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Low performance or impact.	Incorrect hydraulic flow.	Check that power source is producing 5 gpm at 1000-2000 psi.
	Defective quick disconnect couplings.	Check each quick-disconnect coupling.
	Worn impact mechanism.	Repair or replace impact mechanism. See Impact Mechanism Removal, Cleaning and Installation procedure to extend mechanism life.
	Hammer pins broken.	Replace hammer pins.
	Incorrect grease or periodic maintenance of the impact mechanism is not being performed.	See paragraph L-7.
	Spools incorrectly installed.	Valve(s) incorrectly reassembled. See paragraph L-8-3 and L-8-4.
	Sockets or adapters too heavy or loose.	Use the correct impact type sockets or adapters.
	Long bolt with lubricated head.	Lubricate threads only.
	Spool sleeve out of alignment.	Check sleeve alignment by removing spool valve. Align properly.
	Impact mechanism sluggish from improper lubrication.	Check lubrication; add or remove grease as required.
	Motor worn or loose.	Inspect motor. Repair or secure to housing.
Wrench runs too fast.	Incorrect hydraulic flow (too high).	Check that HPU is producing recommended flow for tool operated.
Wrench produces excessive torque.	Faulty relief valve setting in HPU.	Adjust or repair as required.
Wrench operates in reverse.	Supply and return hose reversed.	Install hoses correctly. 10-foot whip hose fitted with female coupling on wrench “IN” port.
Grease leaks at anvil bushing, wrench warm.	Hard duty cycle and heat forces grease out.	Normal, unless greasing instructions in paragraph L-7 are not being followed.

Table L-4. Impact Wrench Troubleshooting Guide (Cont.)

TROUBLE	POSSIBLE CAUSE	REMEDY
Grease leaks at anvil bushing, wrench cold.	Main shaft O-ring leaking.	Replace.
Oil leaks at motor cap.	Fasteners loose or damaged.	Tighten to recommended torque.
	Face O-ring worn, missing, or damaged.	Replace.
	Motor cap/main housing damaged.	Replace.
Oil leaks at reversing spool.	Damaged O-rings. Wrong hydraulic fluid.	Replace. Use only PR 1192.
Oil drip from tip of hammer case.	Too much grease in hammer case compartment.	Disassemble hammer case and remove excess grease.
	Oil separating from grease due to high temperature.	Change grease.
	Lack of proper lubrication.	Add grease.
	Front seal of motor leaking hydraulic fluid.	Replace seal.
Wrench fails to operate; power unit relief valve actuates.	Improperly mated quick-disconnect coupling.	Ensure all quick-disconnect coupling connections are securely mated.
	Break in hose between power unit and tool.	Inspect hose for cuts or rupture; repair.
Previous remedial action fails.	Malfunction in motor or hammer assembly.	Remove hammer case and hammer assembly; depress trigger to operate motor without hammer. If motor shaft rotates, malfunction is probably in hammer assembly. If motor shaft does not rotate with trigger, alternate shaft rotation with reversing valve.
Remedial action above identifies hammer assembly malfunction.	Improper assembly.	Disassemble hammer case assembly. Inspect planetary gear. If gear is satisfactory, install hammer assembly in hammer case and test wrench.
	Failure of speed reduction gears.	If gear teeth are stripped or broken, replace gears.

L-7 SPECIAL LUBRICATION REQUIREMENTS.

L-7.1 Hammer Assembly Lubrication.

a. Before operating a new tool and after each 20 hours of operation, grease the impact unit. Do not fill the impact mechanism more than 10 percent full of grease. Overfilling results in immediate operating failure. Upon completion of every diving operation, hammer case should be removed and impact mechanism inspected for proper lubrication.

b. Remove impact mechanism per paragraph L-8.1.1.

c. Remove all grease. Clean hammer assembly in solvent. Dry with low pressure air.

d. Liberally apply MIL-G-24139A grease or equivalent to hammer assembly, lubricating jaws, cam balls, and bearing surfaces.

e. Reinstall impact mechanism per paragraph L-8.1.4.

Test actuate tool.

NOTE

Following step applies only if tool is to be used topside.

L-7.2 Anvil Shank Lubrication. Oil the tool before topside operation and every three hours of topside operation using the following procedures:

a. Hold wrench upward.

b. Place several drops of machine oil around shank of anvil where it emerges from hammer case bushing.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

L-7.3 5/8-inch Hex Quick Change Chuck Lubrication. After each use underwater and before storage, wash IW06330 quick-change chuck with fresh water and, while sliding locking sleeve forward, thoroughly lubricate with MIL-G-24139A. Spray interior and exterior with MIL-C-81309 or equivalent.

L-8 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to removing and replacing impact mechanism, motor, on-off valve, and reversing valve.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

L-8.1 Impact Mechanism.

L-8.1.1 Remove.

a. Remove machine screw (25, Figure L-3) and trigger guard (21).

b. Remove three cap screws (26) and lock washers (27) around hammer case (51 or 60).

c. Slide hammer case assembly off impact mechanism.

d. Remove O-ring (24) from motor housing (1).

e. Remove hammer assembly (39) as a unit.

L-8.1.2 Disassemble.

a. Remove the quick-change 5/8-inch anvil assembly (53, Figure L-3).

1. Place hammer case (51) and anvil assembly over a bar or block for support on inside end of anvil (54).

2. Push down on thrust ring (58) inside retaining sleeve (56) and remove lock ring (59).

3. Remove thrust ring (58), retaining sleeve (56), spring (57), and retainer balls (55), then remove rear lock ring (59).

NOTE

The anvil will drop free from the hammer case assembly.

b. The anvil (62) of the 3/4-inch square drive unit will drop free from hammer case assembly (60).

c. Remove packing nut (34) and O-ring (35). Be sure to retain two nylon locks (38) for reassembly.

d. Pull thrust bearing (46) from end of planet gear frame (45).

e. With small diameter of planet gear frame (45) down, place hammer assembly (39) over 1/4-inch or larger diameter hole.

f. Using an arbor press, press down on hollow end of planet gear frame until bearing race (42) is just below holes in side of hammer (40).

g. Insert pins in holes to hold bearing race (42) down and release the arbor press.

Remove 20 bearing balls (43).

i. Place remaining assembly in press as before.

j. Press down until pins can be removed; press further until two cam balls (50) drop free.

k. Release the arbor press and remove bearing race (42), hammer spring (41), and hammer (40) from planet gear assembly.

l. Turn planet gear frame (45) hollow end down and tap two planet gear shafts (49) out of planet gear frame (45).

m. Remove two planet gears (47) and bushings (48).

L-8.1.3 Reassemble.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure the work area is well ventilated and away from open flame or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

a. Before reassembly, clean all parts with degreasing solvent.

CAUTION

Do not overfill mechanism or wrench will fail to operate.

NOTE

Apply clean MIL-G-24139A grease or equivalent to all parts during reassembly.

b. Lubricate all hammer assembly parts (41 through 50, Figure L-3), with MIL-G-24139A grease or equivalent.

c. Place two planet gears (47) with bushings (48) in slots in planet gear frame (45). Align centers with holes, and install two planet gear shafts (49).

d. Turn assembly over, drop bearing race (42) on the planet gear frame (45), hollow end down.

e. Add spring (41) and hammer (40), end bars up.

f. Using an arbor press, press down on hammer and drop two greased cam balls (50) into grooves between hammer and planet gear assembly.

g. With small diameter of the planet gear frame (45) down, position over the 1 1/4-inch hole in press.

h. Press down just enough to install pins in hammer side (50) holes to hold bearing race (42) below holes.

i. Install 20 bearing balls (43).

j. Press to relieve and remove pins.

k. Remove from press.

l. Install thrust bearing (46) on end of planet gear frame (45).

m. Place two O-rings (35 and 36) on packing nut (34) and assemble to hammer case (51, 60).

n. Replace quad ring (37) on hammer case bushing (52) or anvil (64).

o. Assemble 5/8-inch quick-change anvil assembly (53):

1. Lubricate anvil (54) and install in hammer case assembly (51).

2. Place hammer case assembly (51) with anvil (53) over a bar so anvil supports parts from inside hammer case (51).

3. Install lock ring (59) in groove below hole in anvil (53).

4. Grease retainer balls (55) and place in holes in anvil (53).

5. With open end of sleeve and hollow end of thrust ring (58) up, place retaining sleeve (56), spring (57), and thrust ring (58) with hollow end up on anvil.

6. Press down on thrust ring (58) and install lock ring (59).

L-8.1.4 Replace.

a. Place lubricated hammer assembly (39, Figure L-3) on end of motor shaft. Install a new O-ring (29) on motor housing assembly (1).

b. Install greased anvil (54) onto end of planet gear frame (45) and between tabs on hammer (40).

c. Install O-ring (24) on hammer case assembly (51 or 60).

d. Position hammer case assembly (51 or 60) over hammer assembly. Secure to motor housing assembly with three cap screws (26) and lock washers (27).

e. Install trigger guard (21); secure with machine screw (25).

L-8.2 Motor Assembly.

L-8.2.1 Remove.

NOTE

The impact mechanism must be removed before the motor assembly can be removed.

a. Remove two cap screws (22, Figure L-3) and lock washers (23) from inside front motor housing (1).

b. Gently, but firmly, push motor assembly (33) through back of motor housing assembly (1).

c. Remove two oil tubes (30) and four O-rings (31) from front bearing retainer if they remained with motor assembly.

L-8.2.2 Replace.

a. Install a new O-ring (29, Figure L-3) in motor housing assembly (1).

b. Install oil tubes (30) with O-rings (31) in front bearing retainer.

c. Lubricate outside of motor assembly (33) and opening in motor housing (1) at O-ring (29).

CAUTION

Do not damage O-ring during installation of motor assembly.

d. With motor shaft through bearing (15), and oil tubes aligned with ports in motor housing assembly (1), carefully insert motor assembly (33) in motor housing assembly (1).

e. Secure motor assembly (33) with two cap screws (22) and lock washers (23).

f. Connect housing assembly (1) to hydraulic power unit and check motor for smooth operation.

CAUTION

If the front bearing retainer, rear bearing retainer or gear chamber has been replaced, the motor might require break-in.

g. Turn motor shaft with and against hydraulic pressure until motor starts and runs freely.

L-8.3 On-Off Valve

L-8.3.1 Disassemble.

a. Remove fillister head screw (6, Figure L-3) and washer (5).

b. Tap out three roll pins (19 and 20) to remove upper trigger (17) and lower trigger (18).

c. Remove front seal cap (12) and spring cap (4), being careful not to lose O-rings (7).

d. Remove valve spool (2) and spring (3) from on-off valve bore of motor housing assembly (1).

L-8.3.2 Reassemble.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure work area is well ventilated and away from open flame or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

a. Clean all parts with degreasing solvent.

NOTE

Apply clean grease to all parts during reassembly.

b. Replace quad rings (14, Figure L-3) in seal cap (12) and spring cap (4).

c. Position O-ring (7) around seal cap (12).

d. Install seal cap (12) in on-off valve bore.

e. Lubricate trigger end of valve spool (2); install in valve bore.

f. Connect upper trigger (17) to lower trigger (18) with a roll pin (19).

g. Place end of upper trigger (17) over trigger hinge (16) and connect to valve spool (2) with a roll pin (19).

h. Align slot in end of lower trigger between holes in tabs of housing assembly (1); install a roll pin (20) through tabs and lower trigger.

i. Install a spring (3) on valve spool.

CAUTION

Do not place any lubricant in the tapped hole of the valve spool.

j. Lubricate valve spool (2) around tapped hole end.

k. Position O-ring (7) around spring cap (4).

l. Install spring cap (4) in motor housing (1).

CAUTION

Ensure Loctite does not contact the outside of the valve spool.

m. While depressing lower trigger (18), place a small drop of Loctite 242 in tapped hole in valve spool (2).

n. Install fillister head screw (6) and washer (5).

o. Ensure that valve spool moves freely when trigger is depressed and released.

L-8.4 Reversing Valve.

L-8.4.1 Disassemble.

a. Remove seal cap assembly (13, Figure L-3).

b. With control knob up, place end of reversing spool (11) in a vise with soft jaws.

c. Unscrew control knob (10).

d. Remove detent unit (9), detent cap (8) and quad ring (14).

e. Remove reversing spool (11) from rear of valve bore.

L-8.4.2 Reassemble.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure work area is well ventilated and away from open flame or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

a. Before reassembly, clean all parts with degreasing solvent.

NOTE

Apply clean grease to all parts (except reversing spool threads) during reassembly.

b. Install a new quad ring (14, Figure L-3) in detent cap (8) and seal cap (13).

c. Install reversing spool (11) in valve bore, aligning locating pin with slot in valve sleeve.

d. Position O-ring (7) around seal cap (13).

e. Install seal cap (13) in valve bore.

f. Position O-ring (7) around detent cap (8).

g Install detent cap (8) in valve bore.

CAUTION

Ensure there is no lubricant on reversing spool threads.

CAUTION

When installing control knob on reversing spool assembly, do not damage locating pin in valve sleeve.

h. Place a small drop of Loctite 242 in tapped hole of control knob (10); screw onto reversing spool assembly (11).

i. Install detent unit (9) and adjust as necessary.

L-9 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

L-10 ILLUSTRATED PARTS BREAKDOWN.

a. Figure L-3 illustrates the IW06 Impact Wrench components.

b. Figure L-4 illustrates motor 02967 components.

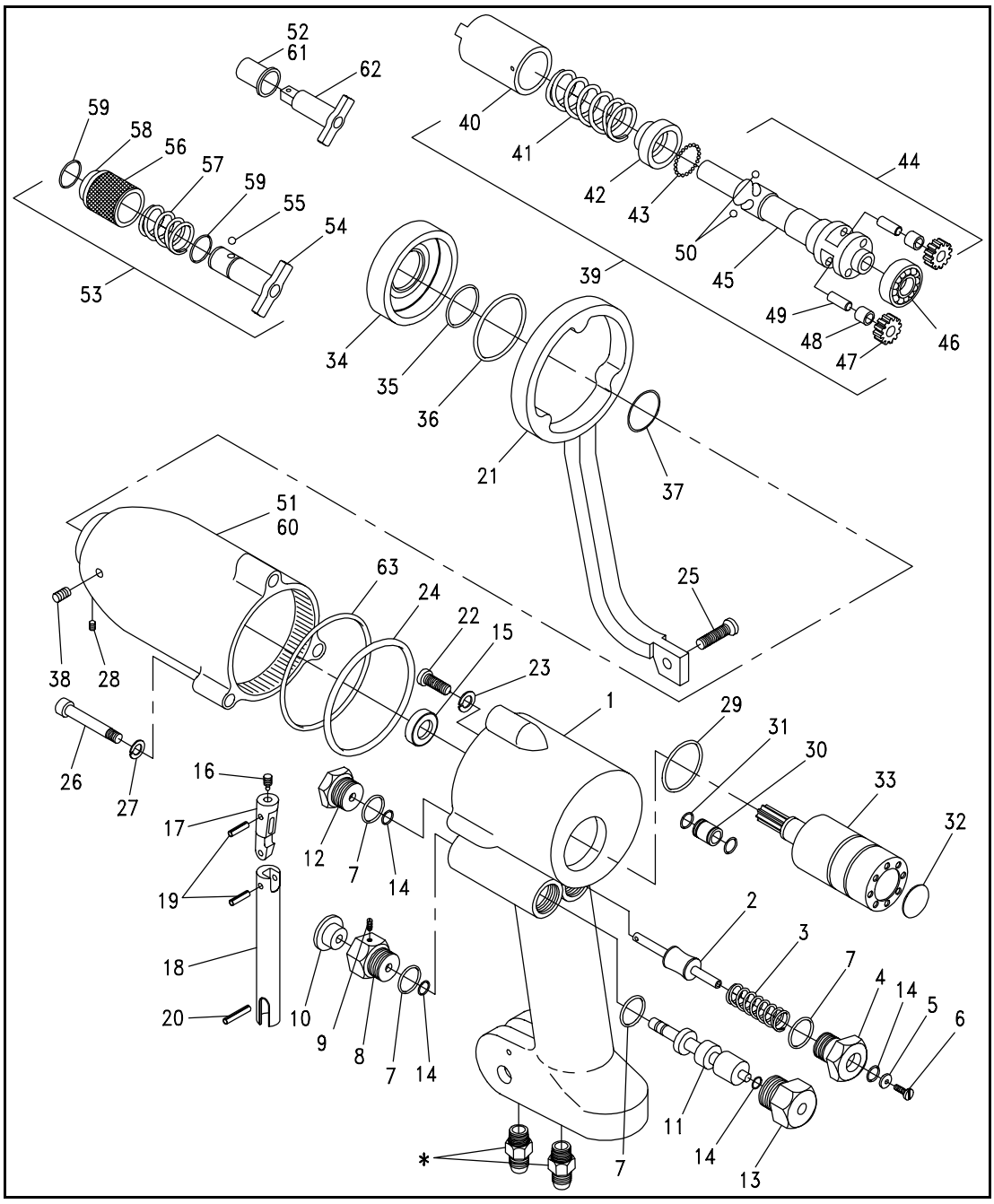


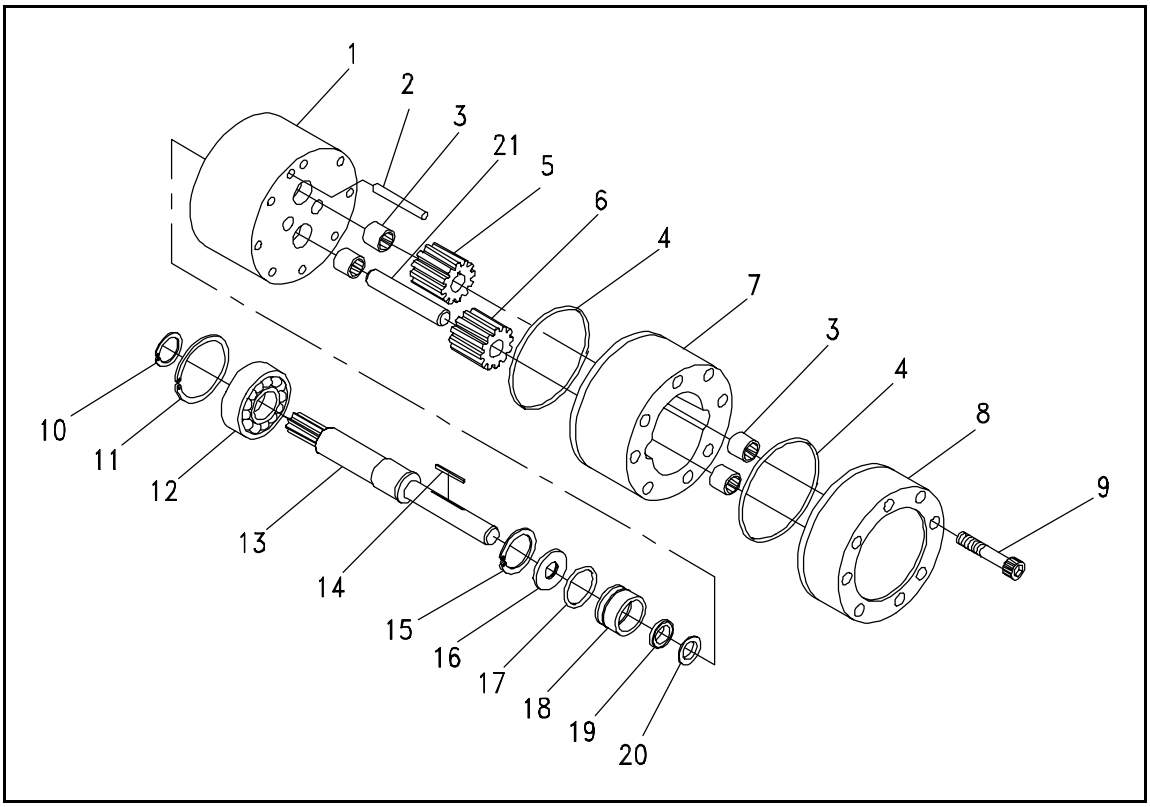
Figure L-3. IW06 Impact Wrench Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Impact Wrench, Stanley Model IW06		IW06	54252
1	Motor housing assembly	1	01958	54252
2	Valve spool	1	00131	54252
3	Spring	1	00006	54252
4	Spring cap assembly	1	00132	54252
5	Washer	1	01176	54252
6	Machine screw 10-24 1/4 fillister head	1	00134	54252
7	O-ring, 15/16 x 1 1/6 x 1/16	4	00074	54252
8	Detent cap assembly	1	00096	54252
9	Detent unit	1	00097	54252
10	Control knob	1	00100	54252
11	Reversing spool assembly	1	00098	54252
12	Seal cap assembly	1	00130	54252
13	Seal cap assembly	1	00099	54252
14	Quad ring, 3/8 x 1/2 x 1/16	4	00173	54252
15	Bearing	1	00048	54252
16	Trigger hinge	1	00911	54252
17	Upper trigger	1	00913	54252
18	Lower trigger	1	02393	54252
19	Roll pin, 1/8 x 1/2	2	00128	54252
20	Roll pin, 5/32 x 1	1	00129	54252
21	Trigger guard	1	00304	54252
22	Cap screw, 1/4-20 x 7/8 socket head	2	00047	54252
23	Lock washer	2	00046	54252
24	O-ring, 2 7/8 x 3 x 1/16	1	00141	54252
25	Machine screw, 1/4-20 x 1	1	00094	54252
26	Cap screw, 1/4-20 x 1 1/4 hex socket head	3	00092	54252
27	Lock washer	3	00093	54252
28	Pipe plug, 1/8 NPT	1	00961	54252
29	O-ring, 2 x 2 1/8 x 1/16	1	00049	54252
30	Oil tube	2	00057	54252
31	O-ring, 3/8 x 1/2 x 1/16	4	00106	54252
32	Nametag	1	02738	54252
33	Motor assembly	1	02967	54252
34	Packing nut	1	00137	54252
35	O-ring, 1 1/8 x 1 1/4 x 1/	1	00138	54252
36	O-ring, 1 7/16 x 1 9/16 x 1/16	1	00139	54252

Figure L-3. IW06 Impact Wrench Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
37	Quad ring, 1 1/8 x 1 3/8 x 1/8	1	00140	54252
38	Nylon lock	2	00634	54252
39	Hammer assembly	1	06038	54252
40	Hammer	1	06037	54252
41	Spring	1	06113	54252
42	Bearing race	1	06035	54252
43	Bearing ball	20	06002	54252
44	Planet gear assembly	1	06030	54252
45	Planet gear frame	1	06029	54252
46	Thrust bearing	1	06046	54252
47	Planet gear	2	06031	54252
48	Bearing race	2	06034	54252
49	Planet gear shaft	2	06032	54252
50	Ball	2	06036	54252
51	Hammer case assembly 5/8 quick-change	1	01390	54252
52	Hammer case bushing	1	00136	54252
53	Anvil assembly 5/8 quick-change	1	06041	54252
54	Anvil	1	06040	54252
55	Ball	2	06036	54252
56	Retaining sleeve	1	06116	54252
57	Spring	1	06117	54252
58	Thrust ring	1	06118	54252
59	Lock ring	2	06119	54252
60	Hammer case assembly ¾ square	1	01390	54252
61	Hammer case bushing	1	00136	54252
62	Anvil, 3/4 square	1	06039	54252
63	Backup ring	1	06886	54252
	Repair Kit includes items Figures L-3: 3, 7, 9, 15, 16, 19, 20, 24, 28, 31, 35, 36, 37, and 38; and Figures L-4: 4, 10, 11, 14, 15, 16, 18, 19, and 20	1	01158	54252
	Seal Kit includes items Figures L-3: 7, 14, 24, 29, 31, 35, 36, 37, 38; and Figures L-4: 4, 16, 18, 19, 20	1	01157	54252

Figure L-3. IW06 Impact Wrench Components (Sheet 3).



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Motor Assembly	REF	02967	54252
1	Front bearing retainer assembly including needle bearings	1	03400	54252
2	Dowel pin, 3/16 x 1 1/4	2	00061	54252
3	Bushing/Bearing	4	05238	54252
4	O-ring, 1 1/4 x 1 3/8 x 1/16	2	00621	54252
5	Drive gear	1	00065	54252
6	Idle gear	1	00064	54252
7	Gear chamber	1	00062	54252
8	Rear bearing retainer	1	03401	54252
9	Cap screw, 8-32 x 1 1/4	8	00095	54252
10	Retaining ring	1	00051	54252
11	Retaining ring	1	00011	54252
12	Bearing	1	00048	54252
13	Motor shaft	1	00052	54252
14	Key	1	01083	54252
15	Retaining ring	1	00054	54252

Figure L-4. Motor 02967 Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
16	Washer	1	00053	54252
17	O-ring, 3/8 x 1/2 x 1/16	1	00106	54252
18	Seal liner	1	00056	54252
19	Quad ring, 1/4 x 3/8 x 1/16	1	00112	54252
20	Washer, seal liner	1	00179	54252
21	Idler shaft	1	00063	54252

Figure L-4. Motor 02967 Components (Sheet 2).

APPENDIX M

OPERATION AND MAINTENANCE PROCEDURES FOR THE IMPACT WRENCH MODEL IW12

NOTE

The Stanley IW12340C (IW12) is the recommended replacement for the obsolete IW06330, IW06340, and IW13340 impact wrenches.

M-1 DESCRIPTION.

The IW12 is a 3/4-inch square drive, open-centered hydraulic impact wrench with a sling hammer style impact mechanism that greatly reduces or eliminates the torque transmission back to the diver during underwater operations. This impact wrench is also equipped with a gear-type motor that provides a high power-to-weight ratio and with an integral reversing valve that permits instant reversal when needed. Figure M-1 illustrates a typical setup for an IW12 impact wrench using a single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0.

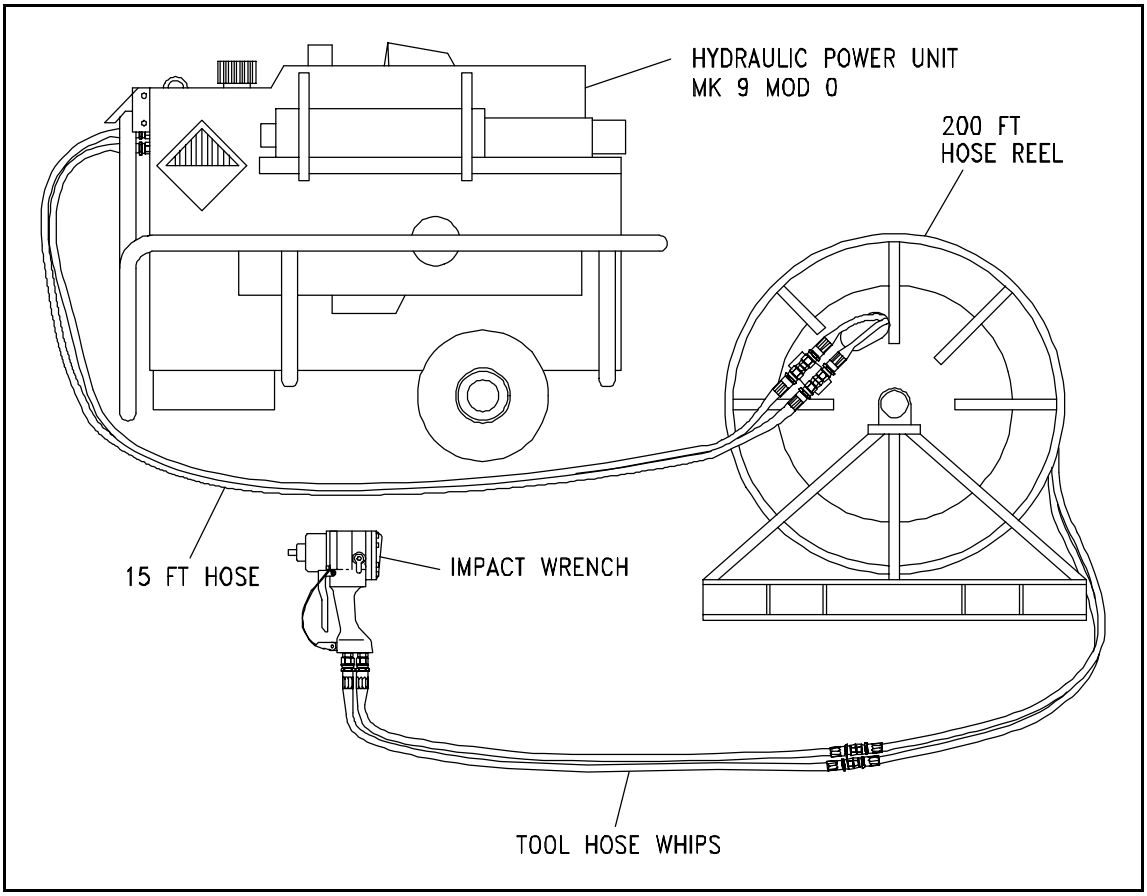


Figure M-1. IW12 Impact Wrench Setup.

M-2 REFERENCE.

NAVSEA Drawing 5366562.

M-2.1 Technical characteristics for the IW12 impact wrench are provided in Table M-1.

Table M-1. Impact Wrench IW12 Technical Characteristics.

CHARACTERISTIC	REMARKS
System type	Open-center
Torque	250-1200 ft-lbs.
Weight	14 lbs
Length	9.5 in.
Width	4 in.
Flow Rates: Minimum Recommended Maximum	 4 gpm 10 gpm 12 gpm
Recommended operating pressure	1000-2000 psi
Recommended relief valve setting	2000 psi
Maximum back pressure	250 psi
Input speed	1200 impacts per minute
Porting	-8 SAE O-ring
Drive type	¾" square
Maximum operating depth	300 fsw

The impact wrench is a rotary hammer which impacts the head of a bolt or nut. Since it does not apply slow, steady torque as does the standard torque wrench, the following factors can affect torque when using the impact wrench:

a. Long bolts that have high-friction threads with lubrication under bolt heads or their associated nuts may twist when impacted, then untwist before the next impact.

b. Heavy, loose, or multiple adapters between wrench and socket can dissipate intensity of impact on bolt head or nut.

c. The hydraulic flow rate (gpm) to tool must be within required range. If flow rate is too low, the wrench's impact speed will be reduced.

M-3 OPERATION.

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

a. Verify that impact wrench can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect impact wrench hose whips to hose reel.

CAUTION

Always use sockets and accessories designed for impact type applications. Standard sockets or accessories shall not be used. They can crack, or fracture, during operation.

i. Select accessories from Table M-2, and attach to impact wrench.

j. Set HPU flow rate not to exceed 2 gpm.

k. Test actuate impact wrench.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering impact wrench to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

l. Set HPU flow (gpm) to zero prior to lowering tool to diver.

m. Lower tool to diver.

CAUTION

Avoid damaging the fasteners by excessive impacting. When operated at full power or for prolonged periods of impacting, the wrench can twist off the heads of bolts or strip the threads of even high-strength nuts and bolts. The IW12 impact wrench is capable of producing up to 1200 ft-lbs of torque.

CAUTION

Extended impacting (beyond 10 seconds duration) may result in excessive heat buildup in impact section of wrench seriously reducing life of the impact mechanism of the wrench.

NOTE

In order to tighten bolts more accurately, lubricate the bolt threads. Then check bolt with a torque wrench and duplicate time of impacting for other bolts of same thread size, length, and lubrication conditions.

n. If hydraulic impact wrench is used during cold weather, preheat hydraulic oil following procedures reflected in respective HPU's O&M manual employed. Normally recommended oils should be at or above 50 degrees F before wrench is used.

M-4 ATTACHMENTS AND ACCESSORIES.

Attachments and accessories for the IW12 are described in Table M-2. The hydraulic impact wrenches are configured for 3/4-inch square drive impact sockets and accessories. Use of an adapter (Table M-2) permits the use of wrenches with 5/8-inch hex quick-change drive adapters to be adapted to 3/4-inch square drive accessories.

Table M-2. IW12 Impact Wrench Accessories.

DESCRIPTION	PART NUMBER	CAGE
Adapter, 5/8” hex to 1/2-inch square drive	A3021A	55719
Adapter, 5/8” hex to 3/4-inch square drive	NPN	55719
Anvil, 3/4 inch square to 3/4 inch Jacob’s Chuck	01857	54252
Male adapter, square 5/8 hex drive x 1/2	05080	54252
Male adapter, square 5/8 hex drive x 1/2	05082	54252
Anvil, 3/4 inch square to 5/8 inch hex quick change adapter	06790	54252
Auger 9/16 in x 12 in hex drive	05020	54252
Auger 9/16 in x 18 in hex drive	05021	54252
Auger 9/16 in x 24 in hex drive	05022	54252
Auger 11/16 in x 12 in hex drive	05023	54252
Auger 11/16 in x 18 in hex drive	05024	54252
Auger 11/16 in x 24 in hex drive	05025	54252
Auger 13/16 in x 12 in hex drive	05026	54252
Auger 13/16 in x 18 in hex drive	05027	54252
Auger 13/16 in x 24 in hex drive	05028	54252
Auger 15/16 in x 18 in hex drive	05029	54252
Auger 15/16 in x 24 in hex drive	05030	54252
Auger 17/16 in x 18 in hex drive	05031	54252
Auger 17/16 in x 24 in hex drive	05032	54252
Screwdriver bits	SP32A, SP42A, SW28A, SW32A	55719
3/4 inch - 3/4 inch square drive socket	IM-242	55719
13/16 inch - 3/4 inch square drive socket	IM-262	55719
7/8 inch - 3/4 inch square drive socket	IM-282	55719
15/16 inch - 3/4 inch square drive socket	IM-302	55719
1 inch - 3/4 inch square drive socket	IM-322	55719
1 1/16 inch - 3/4 inch square drive socket	IM-342	55719
1 1/8 inch - 3/4 inch square drive socket	IM-362	55719
1 3/16 inch - 3/4 inch square drive socket	IM-382	55719
1 1/4 inch - 3/4 inch square drive socket	IM-402	55719
1 5/16 inch - 3/4 inch square drive socket	IM-422	55719
1 3/8 inch - 3/4 inch square drive socket	IM-442	55719
1 7/16 inch - 3/4 inch square drive socket	IM-462	55719
1 1/2 inch - 3/4 inch square drive socket	IM-482	55719
Socket set, impact, 1/2-inch square drive – 3/8-inch through 1-inch	311MY	55719

CAUTION

Always use sockets and accessories designed for impact type applications. Standard sockets or accessories shall not be used. They can crack, or fracture, during operation.

a. To attach an accessory (Table M-2) to the IW12 hydraulic impact wrench (1, Figure M-2) fitted with 5/8-inch quick change chuck adapter, slide the outer portion of the quick-change chuck (2) forward and drop the accessory into the accessory shaft. The spring-loaded chuck will return to its closed position automatically when it is released.

b. Use a 5/8-inch hex drive to 1/2-inch square adapter (5) to attach impact sockets.

c. To use screwdriver bits, attach a Jacob's chuck with a 1/2-inch square drive to a 5/8-inch hex to a 1/2-inch square adapter. Insert the bit in the Jacob's chuck.

d. To secure 1/2-inch impact sockets (6), align the ball on the 5/8-inch hex drive to 1/2-inch square drive with the hole in the socket (6).

e. To secure 3/4-inch impact sockets (7), insert locking pin (8). Place a rubber locking O-ring (9) over the socket and into the ring groove.

M-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for the applicable Maintenance Requirement Cards (MRC).

M-6 TROUBLESHOOTING.

Refer to Table M-3 for impact wrench troubleshooting.

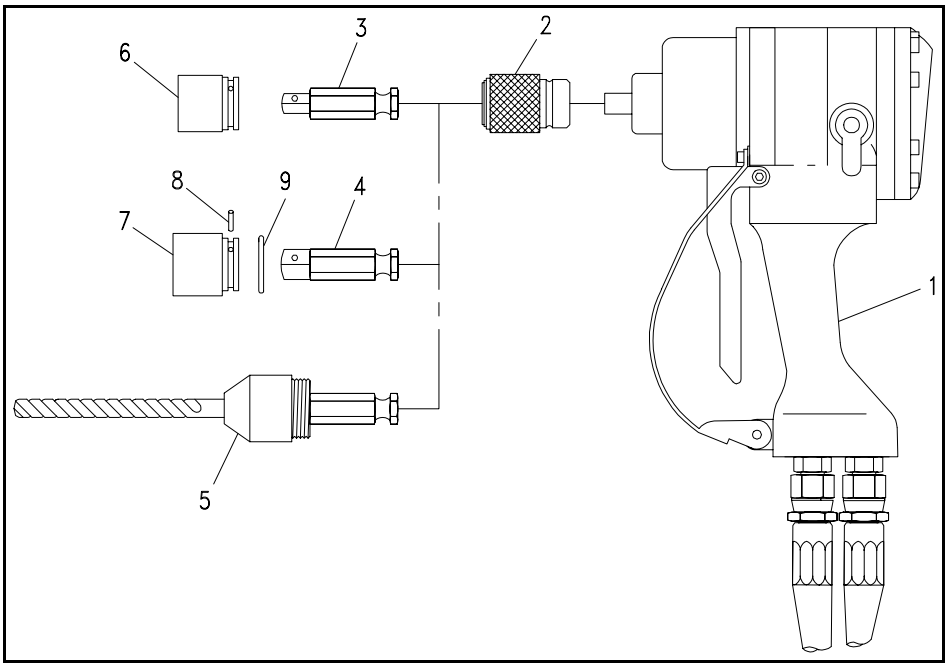


Figure M-2. Sockets and Accessories.

1. IW12 Impact Wrench 2. Adapter, quick change 3. 5/8-inch hex drive to ½-inch square drive	4. 5/8-inch hex drive to ¾-inch square drive 5. Keyless chuck 6. ½-inch drive socket	7. 3.4-inch drive socket 8. Locking pin 9. Rubber locking O-ring

Table M-3. Impact Wrench Troubleshooting Guide.

Trouble	Possible Cause	Remedy
Low performance or impact.	Incorrect hydraulic flow.	For IW12 recommended flow rate is from 5 to 10 GPM.
	Defective quick-disconnect coupling.	Replace.
	Worn impact mechanism.	Repair or replace impact mechanism. See paragraph M-8.1.
	Hammer pins broken.	Replace hammer pins. Check relief adjustment screw setting.
	Incorrect grease or periodic maintenance of the impact mechanism is not being performed.	See paragraph M-7.1.
	Spools incorrectly installed in On/Off Trigger and Forward/ Reversing Valve.	Valve(s) incorrectly reassembled. See paragraph M-8.3 and M-8.4.
	Sockets or adapters too heavy or loose.	Use the correct impact type sockets or adapters.
	Long bolt with lubricated head.	Lubricate threads only.
	Spool sleeve out of alignment.	Check sleeve alignment by removing spool valve. Align properly.
	Impact mechanism sluggish from improper lubrication.	Check lubrication; add or remove grease as required.
	Motor worn or loose.	Inspect motor. Repair or secure to housing.
Wrench runs too fast.	Incorrect hydraulic flow (too high).	Check that HPU is producing recommended flow (gpm) for tool operated.
Wrench produces excessive torque.	Faulty relief valve setting in HPU.	Adjust or repair as required.
Wrench operates in reverse.	Supply and return hose reversed.	Install hoses correctly. Whip hose fitted with female disconnect installs in wrench “IN” port.
Grease leaks at anvil bushing, wrench warm.	Hard duty cycle and heat forces grease out.	Normal, unless greasing instructions in paragraph M-7.1 are not being followed.
Grease leaks at anvil bushing, wrench cold.	Main shaft O-ring leaking.	Replace.

Table M-3. Impact Wrench Troubleshooting Guide (Continued).

Trouble	Possible Cause	Remedy
Oil leaks at motor cap.	Fasteners loose.	Tighten to recommended torque.
	Face O-ring worn or missing.	Replace as required.
	Motor cap/main housing damaged.	Replace as required.
Oil leaks at reversing spool.	Damaged O-rings.	Replace.
	Wrong hydraulic fluid.	Use Houghton P.R. 1192.
	Circuit too hot.	Place additional hydraulic hose in the water.
Oil drip from tip of hammer case.	Too much grease in hammer case compartment.	Disassemble hammer case and remove excess grease.
	Oil separating from grease due to high temperature.	Change grease.
	Lack of proper lubrication.	Add grease.
	Front seal of motor leaking hydraulic fluid.	Replace seal.
Wrench rotates, but does not impact.	Impact mechanism jammed.	Disassemble and inspect planetary gear. Remove any foreign matter jammed in gears.
Wrench fails to operate; power unit relief valve actuates.	Improperly mated quick-disconnect coupling.	Ensure all quick-disconnect couplings are securely mated.
Wrench fails to operate.	Break in hose between power unit and tool.	Inspect hose for cuts or rupture; repair.
Previous remedial action fails.	Malfunction in motor or hammer assembly.	Remove hammer case and hammer assembly; depress trigger to operate motor without hammer. If motor shaft rotates, malfunction is probably in hammer assembly. If motor shaft does not rotate with trigger, alternate shaft rotation with reversing valve.
Remedial action above identifies hammer assembly malfunction.	Improper assembly.	Disassemble hammer case assembly. Inspect planetary gear. If gear is satisfactory, install hammer assembly in hammer case and test wrench.
	Failure of speed reduction gears.	If gear teeth are stripped or broken, replace gears.

M-7 SPECIAL LUBRICATION REQUIREMENTS.

M-7.1 Hammer Assembly Lubrication.

a. Before operating a new tool and after each 20 hours of operation, grease the impact unit. Do not fill the impact mechanism more than 10 percent full of grease. Overfilling results in immediate operating failure. Upon completion of every diving operation, hammer case should be removed and impact mechanism inspected for proper lubrication.

b. Remove impact mechanism per paragraph M-8.1.1.

WARNING

Always wear eye protection when drying components with pressurized air.

c. Remove all grease. Clean hammer assembly in solvent. Dry with low-pressure air.

d. Liberally apply MIL-G-24139A grease or equivalent to hammer assembly, lubricating jaws, cam balls, and bearing surfaces.

e. Reinstall impact mechanism per paragraph M-8.1.4.

f. Test actuate tool.

M-8 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to removing and replacing impact mechanism, motor, on-off valve, and reversing valve.

CAUTION

Before disassembling tool, clean exterior to prevent foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

M-8.1 Impact Mechanism.

M-8.1.1 Remove.

a. Remove the four cap screws (42, Figure M-3) and lock washers (10) securing the hammer case (48) to the main housing assembly (1).

NOTE

Some wrenches use four 5/16-18 x 3/4 inch long socket head cap screws without lock washers. Replace these cap screws with 5/16-18 x 7/8 inch long socket head cap screws and lock washers.

b. Loosen and remove the 10-24 x 1 3/4 inch long hex socket head cap screw (43) and locknut (52) (or Spiral pin) securing lower end of trigger guard (53) to main housing assembly (1) and swing trigger guard (53) away.

c. Hold wrench with impact mechanism pointing down and depress trigger (15) while pulling hammer case (48), gasket (50), and impact mechanism away from main housing assembly (1).

d. Remove thrust bearing (40) and two thrust races (39), if they were not removed with impact mechanism.

M-8.1.2 Disassemble.

a. Turn hammer case assembly (48) up and let mechanism fall out in your hand.

b. Remove hammer pins (46) from hammer frame (45) and separate hammer (44), hammer frame (45), anvil (47) and bushing (49).

M-8.1.3 Reassemble.

a. Using MIL-G-24139A, grease inside of hammer frame assembly (45).

b. Assemble frame (45), hammer (44), anvil (47), and hammer case bushing (49) and install pins (46).

M-8.1.4 Replace.

a. Place lubricated impact mechanism on end of main shaft (27). Install a new O-ring (50) on motor housing assembly (1).

b. Secure to motor housing assembly and upper trigger guard (53) with cap screws (42) and lock washers (10). Torque 13-15 ft-lbs.

c. Secure lower trigger guard (53) to main housing (1) with cap screw (43) and lock nut (52).

M-8.2 Motor.

M-8.2.1 Remove.

a. Remove impact mechanism as described starting at paragraph M-8.1.1.

b. Remove eight 3/8-16 x 1 3/4 inch long socket head cap screws (31, Figure M-3) and lock washers (32) securing motor cap assembly (23) to main housing (1).

CAUTION

DO NOT pry or in any way excessively force motor cap assembly off of main housing.

c. With wrench handle gripped in a vise, press on splined end of main shaft (27) with one hand and support motor cap assembly (23) with other. Press motor cap assembly (23), gear (24), main shaft (27), and O-ring (33) out of main housing (1).

d. Remove large O-ring (33) from motor cap assembly (23).

e. Remove idler gear (24), idler shaft (26), and main shaft (27).

f. If relief adjustment screw O-ring (28) requires replacement, loosen jam nut (29) and remove relief adjustment screw (30), being sure to count number of turns required to remove it so it can be replaced in same position.

g. Remove retaining ring (35), backup washer (37), backup ring (36), and O-ring (35). The O-ring is subject to severe service and should be replaced whenever the main shaft (27) is serviced.

M-8.2.2 Replace.

a. Install new O-ring (28), relief adjustment screw (30) and nut (29) into motor cap assembly (23).

b. Install main shaft (27), idler shaft (26), and idler gear assembly (24) into motor cap assembly.

c. Install new O-ring (33) on motor cap assembly.

d. Slide main housing assembly (1) on to main shaft until housing and cap come together.

e. Install cap screws (31) and lock washers (32). Torque to 22-25 foot pounds.

f. Install new O-ring (35), back-up ring (36), back-up washer (37), and retaining ring (38).

g. Using MIL-G-24139A, grease thrust bearing (40) and install with thrust races (39).

h. Install impact mechanism per paragraph M-8.1.4.

M-8.3 On-Off Valve.

M-8.3.1 Remove.

a. Unscrew spool cap (12, Figure M-3) and remove needle roller (14), O-ring (13), O-ring (11), valve spool (9), relief seat (8), relief poppet (7), springs (6 and 4), and spring rest (5).

b. Remove valve sleeve (2).

M-8.3.2 Replace.

a. Install valve sleeve (2) into main housing assembly (1).

b. Install return spring (4) into valve sleeve.

c. Fit spring rest (5), relief spring (6), and relief poppet (7) together and slide into valve spool.

d. Turn unit trigger side up, then install relief seat (8).

e. Install valve spool (9).

f. Install rod wiper (41), needle roller (14) and new O-ring (13) in spool cap (12).

g. Install new O-ring (11) on spool cap (12).

h. Install spool cap (12).

M-8.4 Reversing Valve.

M-8.4.1 Remove.

a. Remove set screw (22, Figure M-3) and lever (21).

b. Remove retaining ring (20).

c. Push reversing spool (17) in at retaining ring end to expose back-up washer (19) and O-ring (18) at lever end.

d. Remove backup washer (19) and O-ring (18).

e. Push reversing spool towards retaining ring end and remove back-up washer (19) O-ring (18) and reversing spool (17).

M-8.4.2 Replace.

a. Install new O-ring (18) and back-up ring (19) on retaining ring end of reversing spool (17).

b. From retaining ring side of housing assembly, slide reversing spool (17) lever end first, into bore far enough to install new O-ring (18) and back-up ring (19) on lever end of spool (17).

c. Center spool and install retaining ring (20).

d. Install lever (21) with set screw (22), being sure it engages hole in lever and is tight.

M-9 IMPACT INTENSITY ADJUSTMENT.

NOTE

When it is shipped from Stanley, the IW12 impact wrench has been set to produce approximately 800-1000 ft-lbs torque using 8 gpm input flow.

WARNING

Do not operate wrench with relief adjustment screw turned in more than one turn from bottom or less than three turns from top of its travel.

WARNING

Never operate wrench without securing relief screw jam nut.

a. The hydraulic circuit and wrench should be at operating temperature.

CAUTION

DO NOT exceed the maximum flow or pressure.

b. Attach a flow and pressure tester to pressure port of impact wrench. Connect hoses normally and activate hydraulic power supply.

c. If power source is of unknown output, it is good practice to turn relief adjustment screw counterclockwise (no more than three turns from top of its travel) to ensure that operating pressure remains below 1500 psi. Tighten jam nut securely before operating wrench.

d. Install appropriate sockets or adapters to impact wrench and tighten bolt or fastener for which you wish to set wrench. Watch flow and pressure tester to be certain that maximum flow and pressure are not being exceeded.

e. Check fastener with a torque wrench to determine actual torque being delivered by impact wrench.

f. To increase torque, turn relief adjustment screw clockwise (no more than one turn from bottom). To reduce torque, turn relief adjustment screw counterclockwise (no more than three turns from top of its travel). Check torque with a torque wrench.

g. When adjustment is complete, securely tighten jam nut.

M-10 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

M-11 ILLUSTRATED PARTS BREAKDOWN.

Figure M-3 illustrates the IW12 Impact Wrench Components.

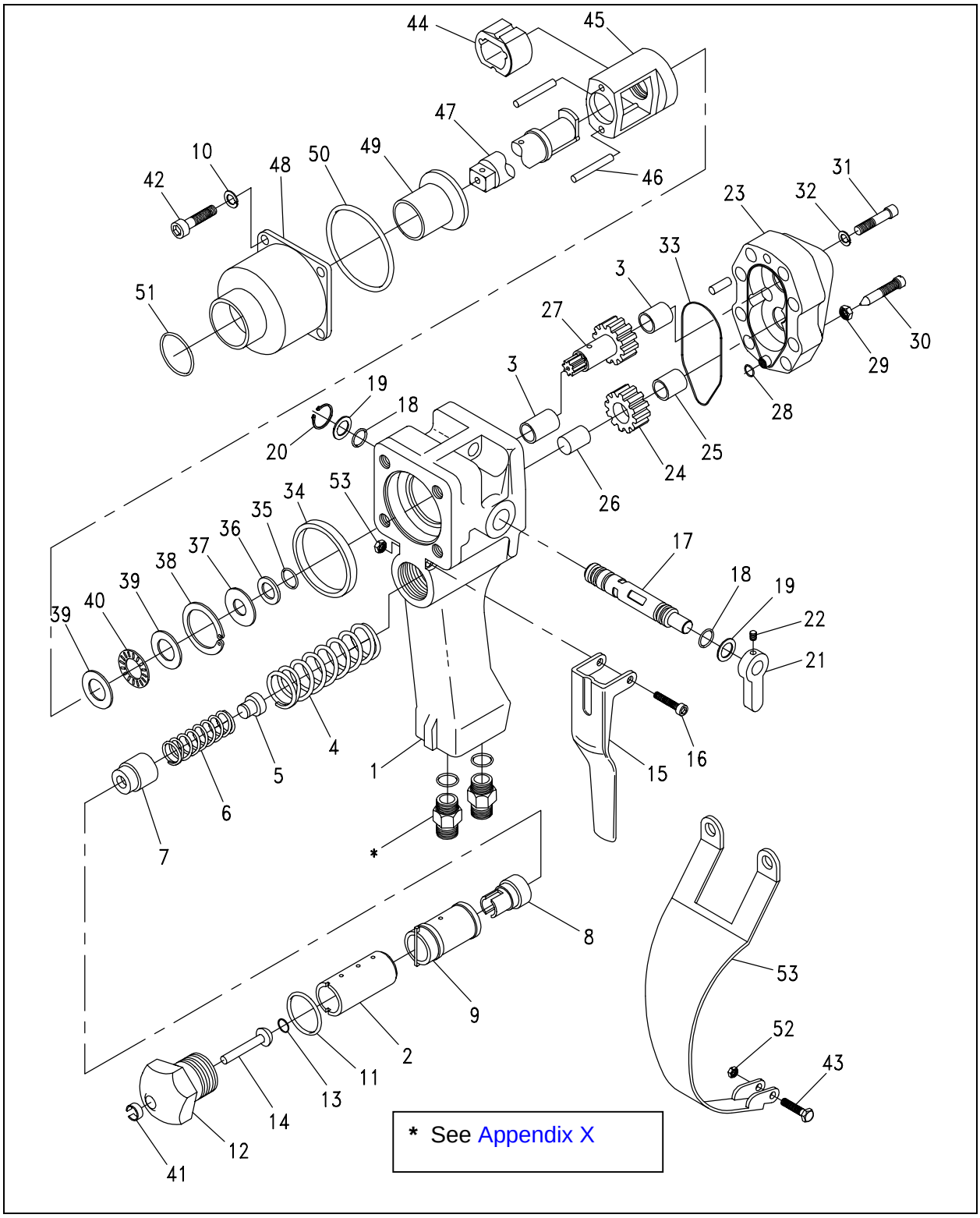


Figure M-3. Impact Wrench IW12 Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Impact Wrench, IW12	1	IW12	54252
1	Main housing assembly	1	12778	54252
2	Valve sleeve	1	07994	54252
3	Du bushing, Garlock 14Du12	2	08014	54252
4	Spring	1	07988	54252
5	Spring rest	1	07982	54252
6	Spring	1	07985	54252
7	Relief poppet	1	07993	54252
8	Relief seat	1	07986	54252
9	Valve spool open center	1	07998	54252
10	Lock washer	4	00231	54252
11	O-ring	1	06533	54252
12	Spool cap	1	22063	54252
13	O-ring	1	00026	54252
14	Headed push pin	1	23678	54252
15	Trigger	1	12283	54252
16	Cap screw, S.S.	1	00786	54252
17	Reversing Spool	1	08002	54252
18	O-ring	2	01211	54252
19	Backup ring	2	08015	54252
20	Retaining ring,	1	09725	54252
21	Lever	1	04939	54252
22	Set screw	1	00580	54252
23	Motor cap assembly (including item 3)	1	07997	54252
24	Idler gear assembly (including item 25)	1	07989	54252
25	Idler gear bushing	1	07978	54252
26	Idler shaft	1	07991	54252
27	Main shaft	1	08001	54252
28	O-ring	1	00717	54252
29	Nut	1	09277	54252
30	Relief adjustment screw	1	19453	54252
31	Cap screw, S.S.	8	01870	54252
32	Lock washer, 3/8 S.S.	8	00812	54252
33	O-ring	1	08023	54252
34	Pilot ring	1	07980	54252
35	O-ring	1	08017	54252
36	Backup ring	1	09396	54252
37	Backup washer	1	07987	54252
38	Retaining ring	1	00166	54252
39	Thrust race	2	08019	54252
40	Thrust bearing	1	08020	54252
41	Rod wiper	1	22064	54252
42	Cap screw, S.S.	4	10566	54252

Figure M-3. Impact Wrench IW12 Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
43	Cap screw, (includes item 52)	1	12287	54252
44	Hammer	1	08067	54252
45	Hammer frame assembly	1	19456	54252
46	Hammer pin	2	08069	54252
47	Anvil	1	12784	54252
48	Hammer case assembly	1	12785	54252
49	Hammer case bushing	1	13694	54252
50	O-ring	1	00149	54252
51	O-ring	1	00621	54252
52	Locknut	2	06971	54252
53	Trigger guard	1	12285	54252
	Seal Kit (Includes Find nos. 11, 13, 18, 19, 28, 33, 35, 36, 41, 50, and 51)		13695	54252
	Impact mechanism, underwater ¾-inch square drive (complete)	1	12783	54252

Figure M-3. Impact Wrench IW12 Components (Sheet 3).

APPENDIX N

OPERATION AND MAINTENANCE PROCEDURES FOR THE IMPACT WRENCH MODEL IW20

N-1 DESCRIPTION.

The Stanley IW20360 (IW20) is a 1-1/2-inch square drive, open-centered hydraulic impact wrench with a sling hammer style impact mechanism that greatly reduces or eliminates the torque transmission back to the diver during underwater operations. The impact wrench has been discontinued by the manufacturer. The IW24 (Appendix O) is its replacement. A gear-type motor provides high power-to-weight ratio. An integral reversing valve allows instant reverse. With drill attachments, the impact wrench can drill through wood up to 30 inches thick. Figure N-1 illustrates a typical setup for a IW20 impact wrench using a single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0. For maximum performance of the impact wrench, employ with NAVSEA Model 2 or Model 4 HPU.

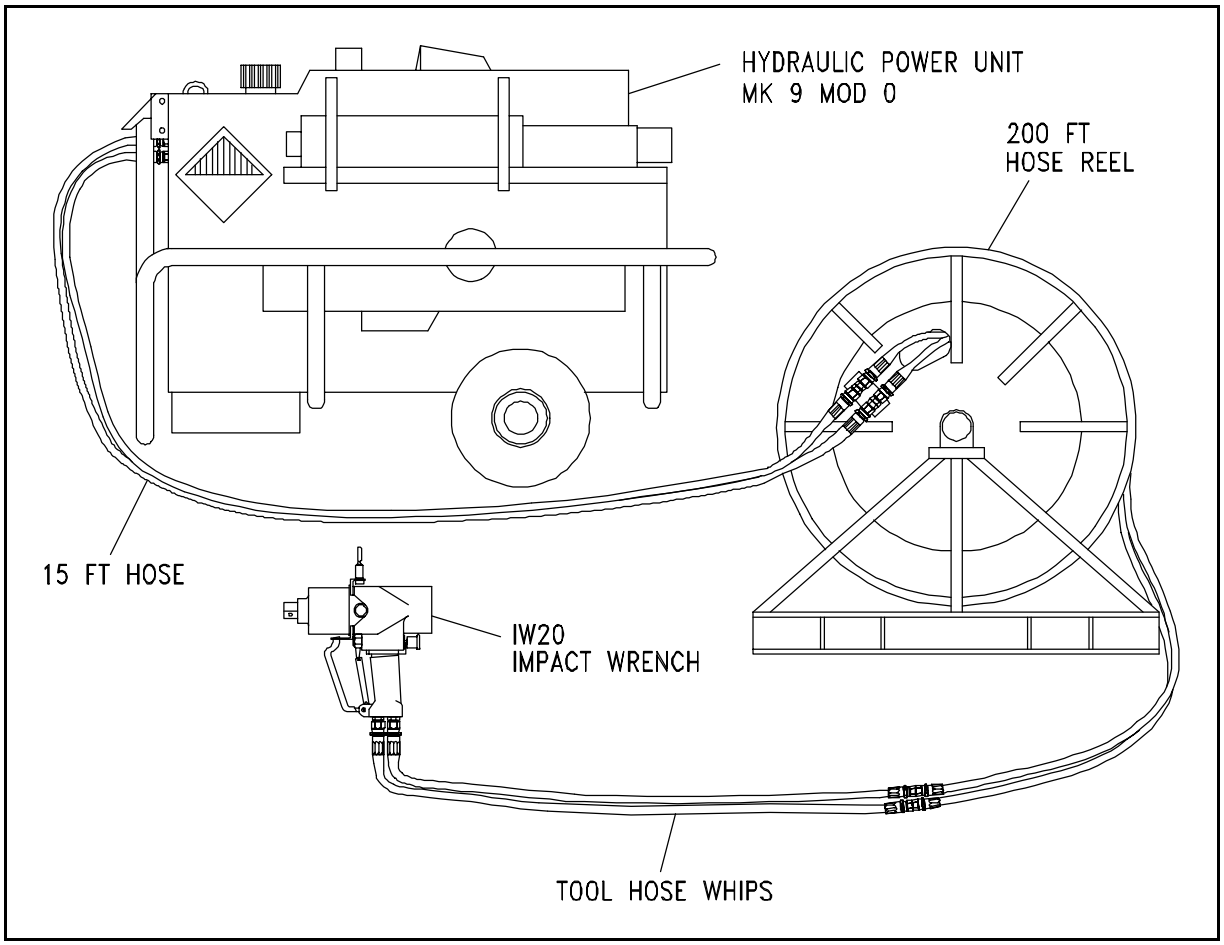


Figure N-1. IW20 Impact Wrench Setup.

N-2 REFERENCE.

NAVSEA Drawing 5367230.

N-2.1 Technical characteristics for the IW20 impact wrench are provided in Table N-1.

Table N-1. Impact Wrench IW20 Technical Characteristics.

CHARACTERISTIC	REMARKS
System type	Open-centered
Torque	Up to 2400 ft-lbs
Weight	34 lbs
Flow Rates: Minimum Recommended Maximum	 5 gpm 6 gpm 6 gpm
Recommended operating pressure	1000-2000 psi
Recommended relief valve setting	2000 psi
Maximum back pressure	250 psi
Porting	3/8” NPT pipe
Maximum operating depth	300 fsw
Drive type	1 ½-inch square

N-3 IMPACT WRENCH.

The impact wrench is a rotary hammer tool which impacts the head of a bolt or nut. Since it does not apply slow, steady torque as does the standard torque wrench, the following factors can affect torque when using the impact wrench:

a. Long bolts that have high-friction threads with lubrication under bolt heads of their associated nuts may twist when impacted, then untwist before the next impact.

b. Heavy, loose, or multiple adapters between impact wrench and driven socket can dissipate intensity of impact on bolt head or nut.

c. The hydraulic flow rate (gpm) to tool must be within required range. If flow rate is too low, the wrench’s impact speed will be reduced.

N-4 OPERATION.

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Diving Equipment Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

a. Verify that impact wrench can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet pressure is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect impact wrench hose whips to hose reel.

i. Select accessories from Table N-2, and attach to impact wrench.

j. Set HPU flow rate not to exceed 5 gpm.

CAUTION

Avoid damaging the fasteners by excessive impacting. When operated at full power or for prolonged periods of impacting, the wrench can twist off the heads of bolts or strip the threads of even high-strength nuts and bolts.

NOTE

In order to tighten bolts more accurately, lubricate the bolt threads. Then check bolt with a torque wrench and duplicate time of impacting for other bolts of same thread size, length, and lubrication conditions.

k. Test actuate tool on surface.

l. Attach impact socket or auger bit, as required for the task. See Table N-2.

m. Secure the socket with the locking pin and ring.

WARNING

Before attaching auger bits, ensure 1 1/2” square female to 5/8” quick change chuck adapter is secured by retainer pin and O-ring.

n. Slip outer portion of the quick change chuck forward; drop in auger shaft. The spring-loaded chuck will return to its closed position automatically upon release.

WARNING

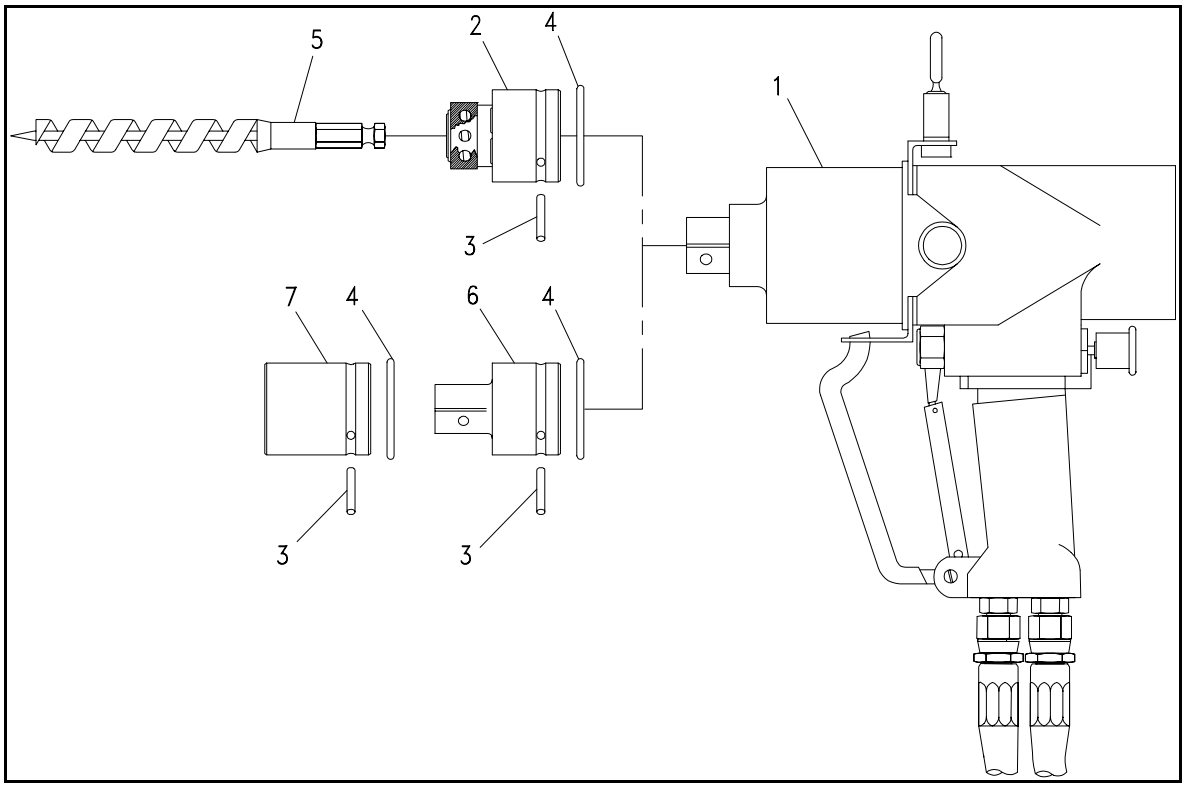
The HPU must be set to zero flow rate (gpm) before lowering impact wrench to diver. HPU zero flow is verified when pressure reading is indicated as zero (psi).

o. Set HPU flow (gpm) to zero prior to lowering tool to diver.

p. Lower tool to diver.

N-5 ATTACHMENTS AND ACCESSORIES.

Attachments and accessories for the IW20 are shown in Figure N-2 and described in Table N-2. The IW20 impact wrench is designed for 1-1/2-inch square drive sockets and accessories.



1. IW20 Impact Wrench 2. Chuck adapter, 1 ½" square drive to 5/8" hex drive	3. Locking ring 4. O-ring 5. Auger bit	6. Adapter 7. Impact socket

Figure N-2. Accessories.

Table N-2. IW20 Impact Wrench Accessories.

DESCRIPTION	PART NUMBER	CAGE
Chuck Adapter, 1 1/2” square female to 5/8” quick change	5367230-30	53711
Retainer Pin, 1/4” dia X 2 7/8” Long	8-2E	65014
O-Ring, 2 7/8” dia	8-1C	65014
Auger Bit, 1 1/16” dia X 24 L	1 1/16 41H24 with 5/8” hex	75055
Auger Bit, 15/16” dia X 24 L	15/16 41H24 with 5/8” hex	75055
Auger Bit, 13/16” dia X 24 L	13/16 41H24 with 5/8” hex	75055
Auger Bit, 11/16” dia X 24 L	11/16 41H24 with 5/8” hex	75055
Adapter, 1 1/2” sq fem to 1” male w/pin hole	IM-53	99397
Pin, locking	IM-445P	99397
Ring, locking	IM-445R	99397
Socket, Impact, 7/8”	IM-283	99397
Socket, Impact, 15/16”	IM-303	99397
Socket, Impact, 1”	IM-323	99397
Socket, Impact, 1 1/16”	IM-343	99397
Socket, Impact, 1 1/8”	IM-363	99397
Socket, Impact, 1 3/16”	IM-383	99397
Socket, Impact, 1 1/4”	IM-403	99397
Socket, Impact, 1 5/16”	IM-423	99397
Socket, Impact, 1 3/8”	IM-443	99397
Socket, Impact, 1 7/16”	IM-463	99397
Socket, Impact, 1 1/2”	IM-483B	99397
Pin, Locking, 7/8”-1 7/16” Sockets	IM-243P	99397
O-Ring, 7/8”-1 7/16” Sockets	IM-243R	99397
Pin, Locking, 1 1/2” Socket	IM-483P	99397
O-Ring, 1 1/2” Socket	IM-483R	99397

N-6 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for the applicable Maintenance Requirement Cards (MRC).

N-7 TROUBLESHOOTING.

Refer to Table N-3 for impact wrench troubleshooting.

Table N-3. Impact Wrench Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Oil dripping from tip of hammer case.	Too much grease in hammer case compartment.	Disassemble hammer case and remove excess grease.
	Oil separating from grease due to high temperature.	Change grease.
	Lack of proper lubrication.	Add grease.
	Front seal of motor leaking hydraulic fluid.	Replace seal .
Wrench does not function effectively.	Impact lugs or anvil worn excessively.	Visually check for wear. Repair or replace as necessary.
	Spool sleeve out of alignment.	Check sleeve alignment by removing spool valve. Align properly.
	Motor worn or loose.	Inspect motor. Repair or secure to housing.
Wrench rotates, but does not impact	Impact mechanism jammed.	Remove and inspect impact mechanism. Ensure that hammers are installed correctly. Remove any foreign matter.
Wrench fails to operate; power unit relief valve actuates	Loose or improperly mated connections.	Ensure connections are secure.
Wrench fails to operate; relief valve will not actuate	Break in hose between power unit and tool.	Inspect hose for cuts or rupture; repair.

Table N-3. Impact Wrench Troubleshooting Guide (Cont.).

TROUBLE	POSSIBLE CAUSE	REMEDY
Previous remedial action fails.	Malfunction in motor or hammer assembly.	Remove hammer case and hammer assembly; depress trigger to operate motor without hammer. If motor shaft rotates, malfunction is probably in hammer assembly. If motor shaft does not rotate with trigger, alternate shaft rotation with reversing valve. Proceed to next possible cause.
Remedial action above identifies hammer assembly malfunction	Improper assembly.	Disassemble hammer case assembly. Ensure that hammers are installed correctly. Install hammer assembly in hammer case and test wrench.

N-8 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to removing and replacing impact mechanism, motor, on-off valve, and reversing valve.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

N-8.1 Impact Mechanism.

N-8.1.1 Remove.

a. Remove the machine screw and trigger guard.

b. Remove the three 1 1/4 inch cap screws (53, Figure N-3), one 1 3/4 inch cap screw (54) and lock washers (52) around the hammer case (62).

c. Remove the three handle brackets (2) with the lifting eye and handle (1) attachments

d. Remove the trigger guard bracket (not shown).

e. Lift off the hammer case assembly (62).

f. Remove the impact mechanism (57).

g. Place the impact mechanism (57) with drive anvil (61) up, on work bench.

CAUTION

The two hammers in hammer frame are identical. However, hammers must be positioned in frame in a certain relationship. Be sure to mark and note hammer relationship before removing them.

h. Mark both hammers (60) on same end with a felt-tipped pen. Mark top hammer "T" and bottom hammer "B" with the arrows pointing upward.

N-8.1.2 Disassemble.

NOTE

Do not rotate the drive anvil past this point or it will cam the two hammers out of engagement.

a. Slowly rotate the drive anvil (61, Figure N-3) clockwise until it comes up solid.

NOTE

When the drive anvil is first lifted, it will raise about 3/16 inch and seem to stick. Maintain steady but gentle lifting pressure while rotating counter-clockwise. Drive anvil should not have to be rotated more than 1/4 inch before it can be lifted out.

b. Holding the hammer frame (58) firmly, and without disturbing hammers (60), gently lift the drive anvil (61) and rotate counter clockwise about 1/4 inch until it can be lifted out.

CAUTION

After the next step, the two hammers will be free to slide from hammer frame. Be careful not to drop hammers.

c. With the drive anvil (61) removed, tip the hammer frame assembly (58), so the two hammer pins (59) will fall out.

N-8.1.3 Reassemble.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure the work area is well ventilated and away from open flame or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

a. Before reassembly, clean all parts with degreasing solvent.

NOTE

Apply clean MIL-G-24139A grease or equivalent to all parts during reassembly.

b. Using MIL-G-24139A, coat the two hammers (60, Figure N-3) with a light film.

CAUTION

Wide bevels of each hammer must face upper or lower web of hammer frame.

c. Replace the hammers (60) in the hammer frame (58) in their exact positions prior to disassembly.

NOTE

When installing new hammers or relocating hammers to use both impact surfaces, slide hammers into hammer frame so half-round notch on one hammer is located on one side of hammer frame and half round notch on second hammer is on other side of hammer frame.

d. Replace the hammer pins (50).

e. Look at the contour of the drive anvil (61) base. While looking down through the hammer frame (58), swing the top hammer (60) to its full extreme either way until the contour of drive anvil is matched.

f. Place the drive anvil (61) in the hammer frame (58) through the first hammer (60).

g. Swing the bottom hammer (60) in opposite direction from the top hammer (60), so that the drive anvil (61) can be dropped into the bottom hammer (60).

N-8.1.4 Replace.

a. With motor shaft (8, Figure N-3) pointing upward, set impact mechanism (57) on motor shaft and align spines.

b. Using MIL-G-24139A, lubricate drive anvil (61), except square portion, with light film.

c. Install new O-ring (44) in hammer case (62) nose.

d. Install new O-ring (43) around hammer case pilot diameter on motor housing.

e. Slide hammer case assembly (62) over impact mechanism (57).

f. Place one dead handle bracket (2) at top of motor housing (4) (facing hammer case) and trigger guard bracket (not shown) at bottom.

g. Place a dead handle bracket (2) on each side. Align mounting screws.

NOTE

Be sure to install 1 3/4 inch cap screw (54) in mounting hole closest to detent cap (47).

h. Secure hammer case (62) to motor housing (4) with three 1 1/4 inch cap screws (53), one 1 3/4 inch cap screw (54) and lock washers (52).

i. Install trigger guard; secure with machine screws (not shown).

j. Attach handle (1) to one or both brackets at side of housing.

k. Attach lifting eye to bracket at top of housing.

N-8.2 Motor Assembly.

N-8.2.1 Remove.

NOTE

The impact mechanism must be removed before the motor assembly can be removed.

a. Remove impact mechanism per paragraph N-8.1.1.

b. Gently, but firmly, push motor assembly (6, Figure N-3) through back of motor housing assembly (4).

c. Remove two oil tubes (29) and four O-rings (3) from front bearing retainer (19) if they remained with motor assembly.

N-8.2.2 Replace.

a. Install a new O-ring (5, Figure N-3) in motor housing assembly (4).

b. Install oil tubes (29) with O-rings (3) in front bearing retainer (19).

c. Using MIL-G-24139A, lubricate outside of motor assembly (6) and opening in motor housing at O-ring (5).

CAUTION

Do not damage O-ring during installation of motor assembly.

d. With motor shaft (8) through bearing (7), and oil tubes aligned with ports in housing assembly (4), carefully insert motor assembly (6) in motor housing assembly (4).

e. Connect housing assembly (4) to hydraulic power unit and check motor for smooth operation.

CAUTION

If the front bearing retainer, rear bearing retainer or gear chamber has been replaced, the motor might require break-in.

g. Turn motor shaft with and against hydraulic pressure until motor starts and runs freely.

N-8.3 On-Off Valve.

N-8.3.1 Disassemble.

a. Remove machine screw (32, Figure N-3) and washer (31).

b. Tap out roll pins (37 and 40) to remove upper trigger (41) and lower trigger (38).

c. Remove seal cap (39) and spring cap (35), being careful not to lose quad ring (33) and O-rings (36).

d. Remove valve spool (30) and spring (34) from on-off valve bore of motor housing assembly (4).

N-8.3.2 Reassemble.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure work area is well ventilated and away from open flame or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

a. Clean all parts with degreasing solvent.

NOTE

Apply clean grease to all parts during reassembly.

b. Replace quad rings (33, Figure N-3) In seal cap (39) and spring cap (35).

c. Position new O-ring (36) around seal cap (39).

d. Install seal cap (39) in on-off valve bore.

e. Lubricate trigger end of valve spool (30); install in valve bore.

f. Install spring (34) on valve spool (30).

CAUTION

Do not place any lubrication in threaded hole.

g. Lubricate valve spool around threaded end without placing any lubrication in threaded hole.

h. Connect upper trigger (41) to lower trigger (38) with roll pin (40).

i. Place end of upper trigger (41) over trigger hinge (42) and to valve spool (30) with roll pin (40).

j. Place end of lower trigger (38) between tab s on end of housing assembly (4).

k. Align slot in end of lower trigger (38) with holes in tabs; install roll pin (37) through tabs and lower trigger (38).

l. Install spring cap (35) with O-ring (36) in motor housing assembly (4).

CAUTION

Ensure Loctite does not contact outside of valve spool.

n. While depressing trigger assembly, place a small drop of Loctite 242 in threaded hole in valve spool (30).

o. Install machine screw (32) and washer (31).

p. Ensure valve spool (30) moves freely when trigger assembly is depressed and released.

N-8.4 Reversing Valve.

N-8.4.1 Disassemble.

a. Remove detent unit (50, Figure N-3) and detent cap (47). Ensure O-ring (36) is removed with cap.

b. Unscrew seal cap (39). Ensure O-ring (36) is removed with seal cap (39).

c. Pull reversing valve spool assembly (48) from valve bore.

CAUTION

Do not damage locating pin at control knob end of spool.

d. With control knob (49) up, place reversing valve spool (48) in vise with soft jaws.

e. Unscrew control knob (49).

f. Remove seal cap (39).

g. Remove O-ring (36) and quad ring (33) from seal cap (39).

N-8.4.2 Reassemble.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure work area is well ventilated and away from open flame or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

a. Before reassembly, clean all parts with degreasing solvent.

NOTE

Apply clean grease to all parts (except reversing spool threads) during reassembly.

b. Install a new quad ring (33, Figure N-3) in detent cap (47) and seal cap (39).

c. Install new O-ring (36) in seal cap (39).

d. Lubricate non-threaded portion of reversing spool (48).

NOTE

Ensure there is no lubricant on threads of reversing spool.

e. Install seal cap (39) on reversing spool (48).

CAUTION

Ensure Loctite does not contact outside of reversing spool.

CAUTION

When installing control knob on reversing valve, be careful not to damage locating pin in valve sleeve.

f. Place small drop of Loctite 242 in threaded hole of control knob (40); screw onto reversing spool.

g. Position O-ring (36) around detent cap (47).

h. Install detent cap (47) in valve bore.

i. Lubricate detent end of reversing spool (48).

j. Install reversing valve spool (48) in valve bore, aligning locating pin with slot in valve sleeve and tighten seal cap (39).

k. Install detent unit (50) in detent cap (47); adjust as necessary.

N-9 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

N-10 ILLUSTRATED PARTS BREAKDOWN.

Figure N-3 illustrates the IW20 Impact Wrench Components.

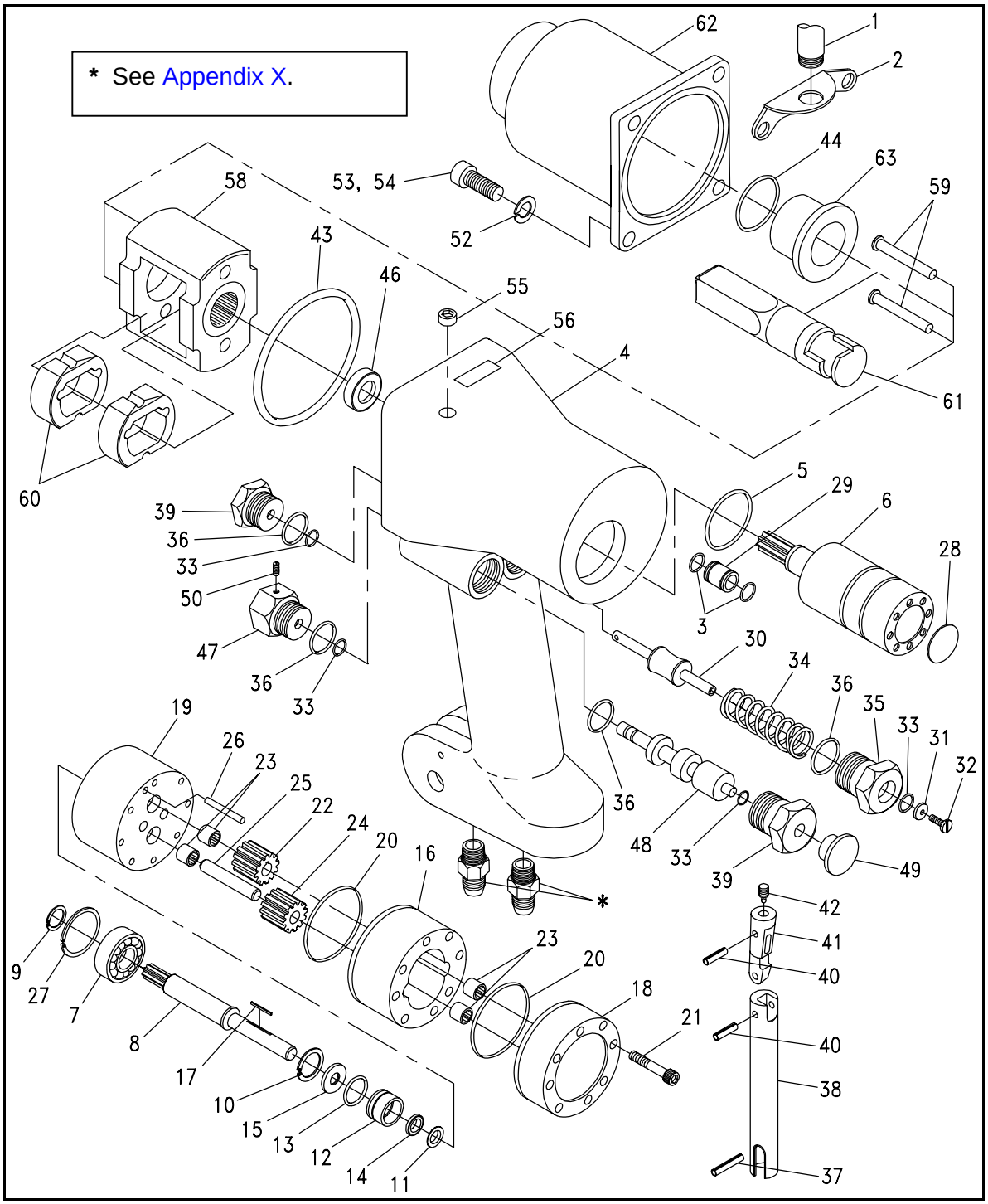


Figure N-3. IW20 Impact Wrench Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Impact Wrench, IW20	1	IW20	54252
1	Dead handle	1	00234	54252
2	Dead handle bracket	1	03592	54252
3	O-ring	4	00175	54252
4	Motor housing assembly	1	03593	54252
5	O-ring	1	00149	54252
6	Motor assembly	1	03594	54252
7	Bearing	1	00148	54252
8	Motor shaft	1	01720	54252
9	Retaining ring	1	00708	54252
10	Retaining ring	1	00170	54252
11	Washer	1	01203	54252
12	Seal liner	1	00172	54252
13	O-ring	1	00171	54252
14	Quad ring	1	00173	54252
15	Seal washer	1	00169	54252
16	Gear housing	1	00605	54252
17	Key	1	00609	54252
18	Rear bearing retainer (Including no 23)	1	03405	54252
19	Front bearing retainer (Including no 23)	1	03402	54252
20	O-ring	2	00178	54252
21	Cap screw	8	03274	54252
22	Drive gear	1	00608	54252
23	Needle bearing	4	00177	54252
24	Idler gear	1	00607	54252
25	Idler shaft	1	00606	54252
26	Dowel pin	2	00611	54252
27	Retaining ring	1	00633	54252
28	Name tag	1	03595	54252
29	Oil tube	2	00174	54252
30	Valve spool	1	00244	54252
31	Washer	1	01176	54252
32	Machine screw	1	00134	54252
33	Quad ring	4	00214	54252
34	Spring	1	00209	54252
35	Spring cap	1	00221	54252
36	O-ring	4	00211	54252
37	Roll pin	1	00129	54252
38	Lower trigger	1	00912	54252
39	Seal cap	2	00215	54252
40	Roll pin	2	00128	54252
41	Upper trigger	1	00913	54252
42	Trigger hinge	1	00911	54252
43	O-ring	1	01873	54252

Figure N-3. IW20 Impact Wrench Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
44	O-ring	1	01872	54252
45	Wear Spacer (not shown)	1	03598	54252
46	Bearing	1	01457	54252
47	Detent cap	1	00210	54252
48	Reversing spool Assembly	1	00238	54252
49	Control knob	1	00100	54252
50	Detent unit	1	00097	54252
51	Cap Screw (not shown)	2	01524	54252
52	Lock washer	4	01214	54252
53	Cap screw	3	00794	54252
54	Cap screw	1	03600	54252
55	Pipe plug	1	00961	54252
56	GPM sticker	1	03785	54252
57	Impact mechanism (includes 58, 59, 60, 61, 62, & 63)	1	03597	54252
58	Hammer frame assembly	1	03606	54252
59	Hammer pin	2	03610	54252
60	Hammer	2	03607	54252
61	Drive anvil	1	03608	54252
62	Hammer case assembly	1	04516	54252
63	Hammer case bushing	1	03978	54252
	Seal kit (Includes nos 3, 5, 11, 12, 13, 14, 20, 33, 36, 43, and 44)	AR	03602	54252
	Repair Kit (Includes seal kit 03602 and nos 9, 10, 17, 27, 34, 37, 40, 42, and 50)	AR	03601	54252

Figure N-3. IW20 Impact Wrench Components (Sheet 3).

APPENDIX O

OPERATION AND MAINTENANCE PROCEDURES FOR THE IMPACT WRENCH MODEL IW24

NOTE

The Stanley IW24360 (IW24) is the recommended replacement for the obsolete IW20360 impact wrench.

O-1 DESCRIPTION.

The Stanley IW24 is a 1-1/2-inch square drive, open-centered wrench with a sling hammer style impact mechanism that greatly reduces or eliminates the torque transmission to the diver during underwater operations. Figure O-1 illustrates a typical setup for an IW24 impact wrench using a single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0. For maximum performance of the impact wrench, employ with NAVSEA Model 2 or Model 4 HPU.

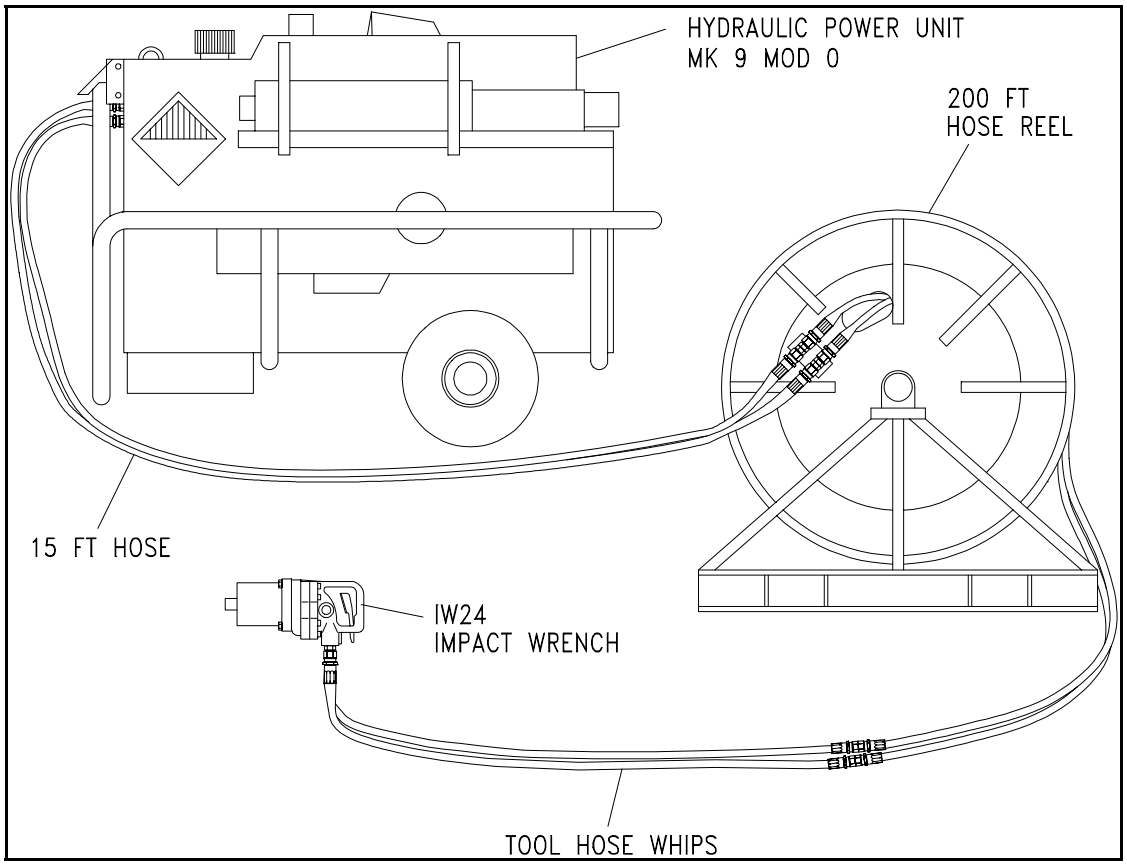


Figure O-1. IW24 Impact Wrench Setup.

O-1.1 Technical characteristics for the IW24 impact wrench are provided in Table O-1.

Table O-1. Impact Wrench IW24 Technical Characteristics.

CHARACTERISTIC	REMARKS
System type	Open-center
Torque	800-3500 ft-lbs
Weight	43 lbs
Length Width Height	16.5 inches 5.1 inches 7.5 inches
Flow Rates: Minimum Recommended Maximum	 7 gpm 13 gpm 13 gpm
Recommended operating pressure	1200-2000 psi
Recommended relief valve setting	2000 psi
Maximum back pressure	250 psi
Porting	8 SAE
Drive type	1-1/2-inch square
Maximum operating depth	300 fsw

The impact wrench is a rotary hammer which impacts the head of a bolt or nut. Since it does not apply slow, steady torque as does the standard torque wrench, the following factors can affect torque when using the impact wrench:

a. Long bolts that have high-friction threads with lubrication under bolt heads or their associated nuts may twist when impacted, then untwist before the next impact.

b. Heavy, loose, or multiple adapters between wrench and socket can dissipate intensity of impact on bolt head or nut.

c. The hydraulic flow rate (gpm) to tool must be within required range. If flow rate is too low, the wrench's impact speed will be reduced.

O-2 OPERATION.

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

a. Verify that impact wrench can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all interconnecting couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect impact wrench hose whips to hose reel.

CAUTION

Always use sockets and accessories designed for impact type applications. Standard sockets or accessories shall not be used. They can crack, or fracture, during operation.

i. Select accessories from Table O-2, and attach to impact wrench.

j. Set HPU flow rate not to exceed 2 gpm.

k. Test actuate impact wrench.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering impact wrench to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

l. Set HPU flow (gpm) to zero prior to lowering tool to diver.

m. Lower tool to diver.

CAUTION

Avoid damaging the fasteners by excessive impacting. When operated at full power or for prolonged periods of impacting, the wrench can twist off the heads of bolts or strip the threads of even high-strength nuts and bolts. The IW24 impact wrench is capable of producing up to 3500 ft-lbs of torque.

CAUTION

Extended impacting (beyond 10 seconds duration) may result in excessive heat buildup in impact section of wrench seriously reducing life of the impact mechanism of the wrench.

NOTE

In order to tighten bolts more accurately, lubricate the bolt threads. Then check bolt with a torque wrench and duplicate time of impacting for other bolts of same thread size, length, and lubrication conditions.

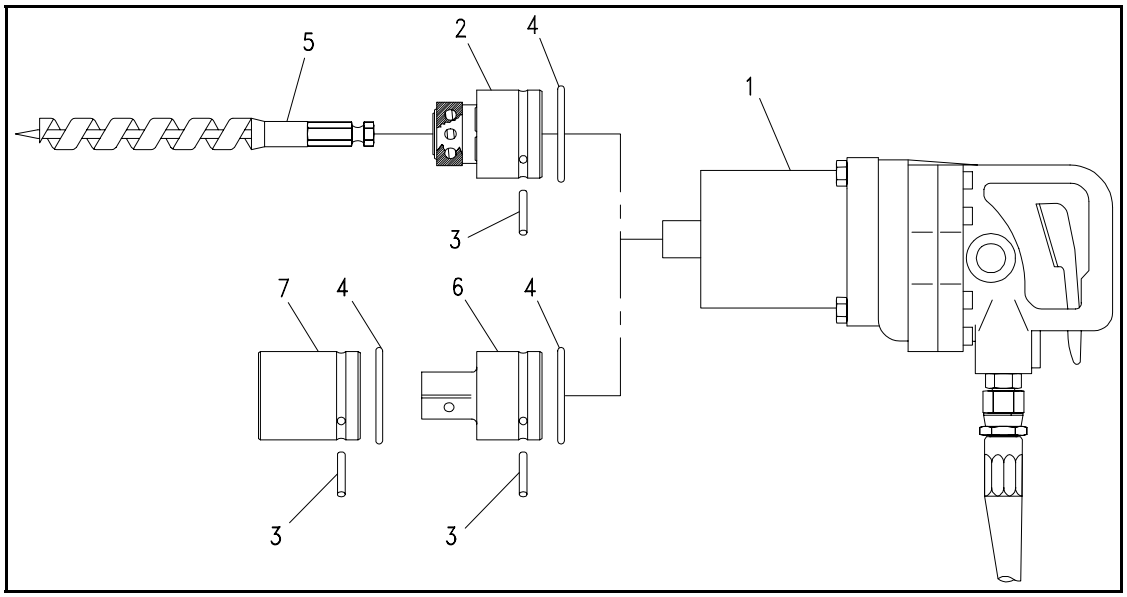
n. If hydraulic impact wrench is used during cold weather, preheat hydraulic oil following procedures reflected in respective HPU's O&M manual employed. Normally recommended oils should be at or above 50 degrees F before wrench is used.

O-3 ATTACHMENTS AND ACCESSORIES.

Attachments and accessories for the IW24 impact wrench are described in Table O-2 and shown in Figure O-2. The IW24 impact wrench is designed for 1-1/2-inch square drive sockets and accessories.

Table O-2. IW24 Impact Wrench Accessories.

DESCRIPTION	PART NUMBER	CAGE
Chuck adapter, 1 1/2" square female to 5/8"	5367230-30	53711
Retainer Pin, 1/4" dia X 2 7/8" Long	8-2E	65014
O-ring, 2 7/8" dia	8-1C	65014
Auger Bit, 1 1/16" dia X 24 L	1 1/16 41H24 with 5/8" hex	75055
Auger Bit, 15/16" dia X 24 L	15/16 41H24 with 5/8" hex	75055
Auger Bit, 13/16" dia X 24 L	13/16 41H24 with 5/8" hex	75055
Auger Bit, 11/16" dia X 24 L	11/16 41H24 with 5/8" hex	75055
Adapter, 1 1/2" sq fem to 1" male w/pin hole	IM-53	99397
Pin, locking	IM-445P	99397
Ring, locking	IM-445R	99397
Socket, Impact, 7/8"	IM-283	99397
Socket, Impact, 15/16"	IM-303	99397
Socket, Impact, 1"	IM-323	99397
Socket, Impact, 1 1/16"	IM-343	99397
Socket, Impact, 1 1/8"	IM-363	99397
Socket, Impact, 1 3/16"	IM-383	99397
Socket, Impact, 1 1/4"	IM-403	99397
Socket, Impact, 1 5/16"	IM-423	99397
Socket, Impact, 1 3/8"	IM-443	99397
Socket, Impact, 1 7/16"	IM-463	99397
Socket, Impact, 1 1/2"	IM-483B	99397
Pin, Locking, 7/8"-1 7/16" Sockets	IM-243P	99397
O-ring, 7/8"-1 7/16" Sockets	IM-243R	99397
Pin, Locking, 1 1/2" Socket	IM-483P	99397
O-ring, 1 1/2" Socket	IM-483R	99397



1. IW24 Impact Wrench 2. Chuck adapter, 1 ½" square drive to 5/8" hex drive	3. Locking pin 4. O-ring 5. Auger bit	6. Adapter 7. Impact socket

Figure O-2. IW24 Impact Wrench Sockets and Accessories.

O-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for the applicable Maintenance Requirement Cards (MRC).

O-5 TROUBLESHOOTING.

Refer to Table O-3 for impact wrench troubleshooting.

Table O-3. Impact Wrench Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Low performance or impact.	Incorrect hydraulic flow.	Check that power source is producing 7-13 gpm at 1200-2000 psi.
	Defective quick-disconnect couplings.	Check each quick-disconnect.
	Worn impact mechanism.	Repair or replace impact mechanism. See paragraph O-6.1.
	Hammer pins broken.	Replace hammer pins.
	Incorrect grease or periodic maintenance of the impact mechanism is not being performed.	See paragraph O-8.
	Spools incorrectly installed.	Valve(s) incorrectly reassembled. See paragraphs O-6.2.2 and O-6.3.2.
	Sockets or adapters too heavy or loose.	Use the correct impact type sockets or adapters.
	Long bolt with lubricated head.	Lubricate threads only.
	Spool sleeve out of alignment.	Check sleeve alignment by removing spool valve. Align properly.
	Impact mechanism sluggish from improper lubrication.	Check lubrication; add or remove grease as required.
	Motor worn or loose.	Inspect motor. Repair or secure to housing.
Wrench runs too fast.	Incorrect hydraulic flow (too high).	Check that HPU is producing recommended flow for tool.
Wrench produces excessive torque.	Faulty relief valve setting in HPU.	Adjust or repair as required.
Wrench operates in reverse.	Supply and return hose reversed.	Install hoses correctly. Install 10-foot whip hose fitted with female coupling into wrench “IN” port.
Grease leaks at anvil bushing, wrench warm.	Hard duty cycle and heat forces grease out.	Normal, unless greasing instructions in paragraph O-6.1.2 are not being followed.
Grease leaks at anvil bushing, wrench cold.	Main shaft O-ring leaking.	Replaced as required.
Oil leaks at motor cap.	Fasteners loose or damaged.	Tighten to recommended torque.
	Face O-ring worn, missing, or damaged.	Replace.
	Motor cap/main housing damaged.	Replace.
Oil leaks at reversing spool.	Damaged O-rings.	Replace.
	Wrong hydraulic fluid.	Use only PR 1192.

O-6 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to removing and replacing impact mechanism, motor, on-off valve, and reversing valve.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

O-6.1 Impact Mechanism.

O-6.1.1 Remove.

a. Remove the four socket head cap screws (17, Figure O-3) and lock washers (18) securing the hammer case assembly (15) to the motor housing (1).

b. With the wrench and impact mechanism pointing down, pull the hammer case (53) and impact mechanism (15) away from the motor housing assembly (1). Remove O-ring (6).

c. Remove the hammer frame (51) and hammer pins (14).

d. Remove inertia insert (13), thrust race (12), and needle bearings (11).

e. Turn the hammer case (53) until the impact mechanism components drop out (anvil up). Remove bushing (56) and O-ring (57).

f. Remove two hammer pins (14) from the hammer frame (51). The hammers (52) and anvil (50) can be removed at this time.

O-6.1.2 Replace.

a. Using MIL-G-24139A, grease the inside of the hammer frame and install the hammers (52, Figure O-3), anvil (50), and two hammer pins (14). The inside of the hammer should be free of grease to avoid over-lubrication.

b. Using MIL-G-24139A, grease the thrust bearing (11) and thrust races (12). Install thrust race (12), thrust bearing (11), and remaining thrust race (12) on the main shaft in that order.

c. Install the inertia insert (13) on impact mechanism (15).

d. Install bushing (56) and O-ring (57) in hammer case assembly (53).

e. Install a new hammer case O-ring (6) on motor housing assembly (1). Using MIL-G-24139A, lubricate and install the O-ring (7) in the hammer case bushing bore. Slide the hammer frame (51) assembly onto the anvil and secure with four socket cap screws (17) and lock washers (18). Torque 13-15 foot-lb.

O-6.2 Motor.

O-6.2.1 Remove.

a. Remove impact mechanism per paragraph O-6.1.1.

b. Remove the eight socket head cap screws (22, Figure O-3) and lock washers (21) securing the motor housing assembly (1) to the valve housing assembly (25).

c. With the motor housing (1) in a vise and the handle of the valve housing (25) facing up, lift the valve handle away from the motor housing (1).

d. Remove the large O-ring (49) from the motor housing assembly (1).

e. Remove the idler gear (24) , idler shaft (4) and main shaft (23).

f. If the relief adjustment screw O-ring (27) requires replacement, loosen the jam nut (20) and remove the relief adjustment screw (19). Be sure to count the number of turns required to remove it so it can be replaced in the same position.

g. Remove retaining ring (10), back-up washer (9), back-up ring (8), and O-ring (7).

O-6.2.2 Replace.

a. If adjustment screw (19, Figure O-3) was removed, use MIL-G-24139A to lubricate O-ring (27). Install O-ring (27) in the relief adjustment screw bore (19) in the motor housing (1). Install the relief adjustment screw (19) with jam nut (20) positioned near the screw head. Install with the same number of turns counted when disassembled to maintain the correct impact force. Tighten jam nut (20).

b. Install the main shaft (23), idler shaft (4) and idler assembly (24).

c. Using MIL-G-24139A, lubricate and install large O-ring (49) in groove of the motor housing (1) and O-ring (2) around the end of the insert (3).

d. Carefully position the valve housing assembly (25) and align the dowel pin.

e. Using MIL-G-24139A, lubricate and install eight socket head cap screws (22) and wash-

ers (21). Torque 22-25 foot-lb.

f. Using MIL-G-24139A, lubricate and install the O-ring (7) on the main shaft (23). Install the back-up ring (8), back-up washer (9) and retaining ring (10).

g. Using MIL-G-234139A, Lubricate the thrust bearing (11) between the thrust washers (12) and install the main shaft. Install the hammer case O-ring (6) and replace the mechanism. (See Figure O-3 for thrust bearing part sequence).

h. Install four socket head cap screws (17) and lock washers (18). Torque 13-15 foot-lb.

O-6.3 Valve Housing.

O-6.3.1 Remove.

a. Remove the internal hex set screw (33, Figure O-3) securing the reversing spool lever (32) and remove the lever (32) from the reversing spool.

b. Remove the retaining ring (31) at the opposite end of the reversing spool.

c. Pressing on the retaining ring end of the reversing spool (28), carefully slide the reversing spool "IN" just far enough to gain access to the back-up ring (30) and O-ring (29) on the "LEVER" side. Remove the back-up ring (30) and O-ring (29) with the appropriate O-ring tool.

d. Pressing on the lever end of the reversing spool (28), carefully slide the reversing spool (28) out of the valve housing (25). Remove the back-up ring (30) and O-ring (29) with the appropriate O-ring tool.

e. Remove the trigger (34) by tapping the roll pin (35) out of the valve housing.

f. Unscrew the spool cap (44), pull the needle roller (46) from the spool cap (44) and then remove the O-rings (43 & 45).

g. Slide the valve spool (42), relief seat (41), relief poppet (40), spring rest (37), and two springs (38 & 39) out of the main housing. If the valve sleeve (not shown) requires replacement, replace the valve housing (25). The valve sleeve remains in the valve housing (25); it is not removable.

h. Remove the retaining ring (10) at the impact mechanism end of the motor housing (1). Remove the seal back-up washer (9), back-up ring (8), and O-ring (7).

O-6.3.2 Replace.

a. Using MIL-G-24139A, lubricate and install the relief seat (41, Figure O-3) in the valve spool (42) (notched end aligned with strut), followed buy the relief poppet (40), small spring (39) and spring rest (37).

b. Set the large spring (38) on the open end of the valve spool (42).

c. Hold the valve housing (25) so the motor side faces up then place the stacked parts inside the valve cavity. Turn the valve housing so the motor faces down.

d. Using MIL-G-24139A, lubricate and install the two O-rings (43 & 45) on the spool cap. Install the needle roller (46), and screw the spool cap (44) into the valve housing (25). Tighten securely.

e. Install the trigger (34) on the valve housing (25) using the roll pin (35).

O-7 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

O-8 ILLUSTRATED PARTS BREAKDOWN.

Figure O-3 illustrates the IW24 Impact Wrench components.

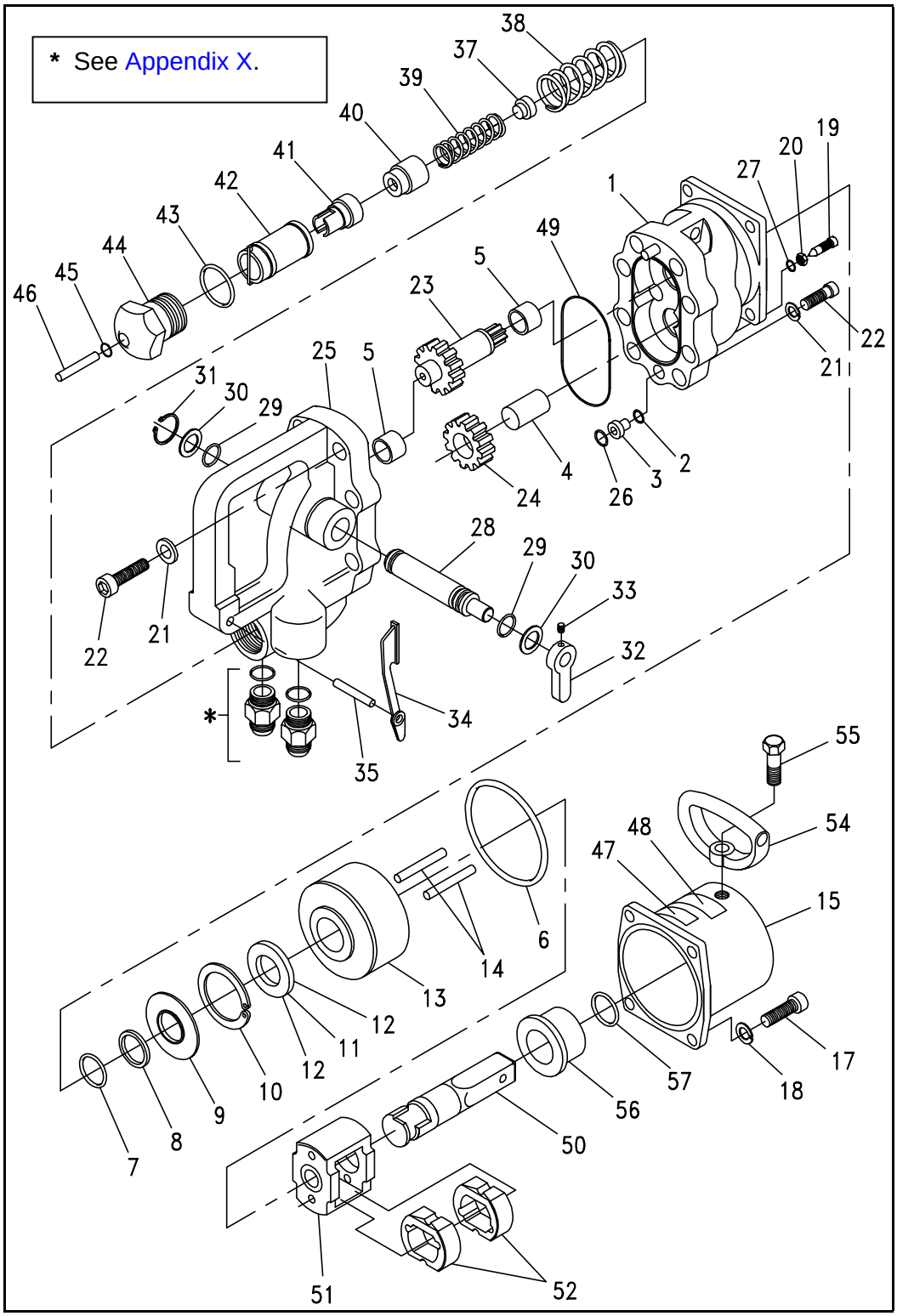


Figure O-3. IW24 Impact Wrench Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Impact Wrench, IW24	1	IW24	54252
1	Motor Housing assembly	1	09698	54252
2	O-ring	1	03252	54252
3	Insert	1	07995	54252
4	Idler Shaft	1	08123	54252
5	Bushing-Garlock 20DU12	2	08146	54252
6	O-ring	1	01873	54252
7	O-ring	1	04888	54252
8	Backup ring	1	08180	54252
9	Seal backup washer	1	08125	54252
10	Retaining ring	1	00663	54252
11	Needle bearing	1	08148	54252
12	Thrust race	2	08147	54252
13	Inertia Insert	1	09701	54252
14	Hammer pin	2	09695	54252
15	Impact mechanism (Includes nos 50-55)	1	10149	54252
16	Handle (not shown)	1	09706	54252
17	Cap screw	4	10793	54252
18	Lock washer	4	01214	54252
19	Relief adjustment screw	1	07984	54252
20	Nut	1	09277	54252
21	Lock washer	8	00697	54252
22	Cap screw	8	09234	54252
23	Main shaft	1	09702	54252
24	Idler gear assembly	1	09693	54252
25	Valve housing assembly (Includes no 5)	1	08138	54252
26	O-ring	1	00016	54252
27	O-ring	1	00717	54252
28	Reversing spool	1	08139	54252
29	O-ring	2	01211	54252
30	Backup ring	2	08015	54252
31	Retaining ring	1	09275	54252
32	Lever	1	04939	54252
33	Set screw	1	00580	54252
34	Trigger	1	08133	54252
35	Roll pin	1	09283	54252
36	Not used			
37	Spring rest	1	07982	54252
38	Spring	1	08131	54252
39	Spring	1	08122	54252
40	Relief Poppet	1	08135	54252
41	Relief seat	1	07986	54252
42	Valve spool - Open Center	1	07998	54252
43	O-ring	1	06533	54252

Figure O-3. IW24 Impact Wrench Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
44	Spool cap	1	08000	54252
45	O-ring	1	00026	54252
46	Needle roller	1	06634	54252
47	GPM sticker	1	03788	54252
48	Name Tag IW-24	1	09707	54252
49	O-ring	1	00255	54252
50	Anvil	1	03608	54252
51	Hammer frame	1	10194	54252
52	Hammer	2	03607	
53	Hammer case assembly (Includes no. 56) (not shown)	1	10193	54252
54	D-handle	1	10150	54252
55	Cap screw	1	10792	54252
56	Bushing	1	10563	54252
57	O-ring	1	01872	54252
	Seal Kit (includes 6, 7, 8, 26, 29, 30, 43, 45, & 49)	1	10567	54252
	Repair Kit (includes 11, 12, 14, 19, 20, 32, 33, 34, 44, 46, & 10567)	1	10798	54252

Figure O-3. IW24 Impact Wrench Components (Sheet 3).

APPENDIX P

OPERATION AND MAINTENANCE PROCEDURES FOR THE PEANUT GRINDER

P-1 DESCRIPTION.

The NAVSEA approved hydraulic Peanut Grinder, Fairmont Model HU6935, is designed for grinding in hard to get at places. Figure P-1 illustrates a typical setup for a peanut grinder using a 200-foot hydraulic hose reel and a MK-9 Mod 0 hydraulic power unit (HPU).

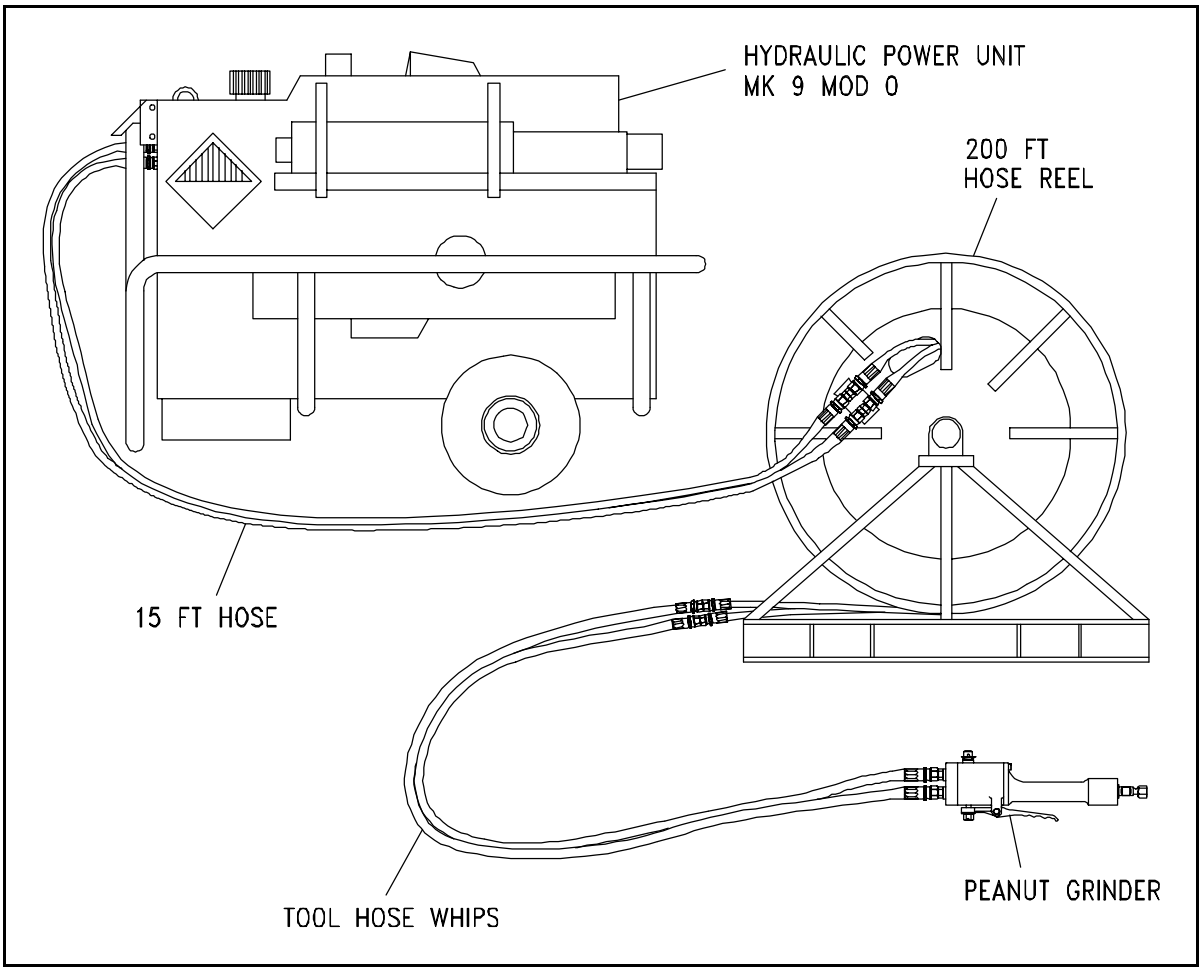


Figure P-1. Peanut Grinder Setup.

P-2 REFERENCE.

NAVSEA Drawing 6263821.

P-2.1 Technical characteristics for the Peanut Grinder are provided in Table P-1.

Table P-1. Peanut Grinder Technical Characteristics.

CHARACTERISTICS	REMARKS
Dimensions	13-7/16 inches (L) X 3-1/8 inches (W) X 2-1/8 inches (H)
Weight	5-1/2 lbs
Drive type	1/4 inch
Flow Rates Minimum Recommended Maximum	 9 gpm 10 gpm 11 gpm
Maximum operating back pressure	500 psi
Maximum operating pressure and relief valve setting	2000 psi
Grinder speed (rpm) @ 10 gpm	8900 rpm

WARNING

Positive voice communications shall be established between the diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

WARNING

Always wear eye protection when using grinder topside.

WARNING

The grinder is a high-speed rotary motion tool. To prevent attachments from accidentally coming off during operation, ensure that the grinding wheel and nut are securely tightened with a wrench before use. Failure to lock the attachments with this nut or other prescribed method of securing attachments can lead to personal injury.

WARNING

Use recommended accessories only. Use the grinder attachments only for their designated purpose.

WARNING

Never use grinding wheels which do not contain internal reinforcement and have been dropped.

WARNING

Do not use grinding wheels without an internal reinforced fiber bond on the surface after use underwater. Water remaining in the wheel could cause that wheel to explode during surface operation.

WARNING

Ensure hydraulic power to the grinder is secured before removing or attaching grinding wheels or brush attachments.

WARNING

Never use a grinding wheel rated at less than 8,900 rpm. Never exceed the maximum operation speed for the grinding wheel.

WARNING

Never exceed the maximum recommended operating pressure (psi) or flow (gpm).

WARNING

Never stand directly in front of the grinding wheel when it is first started or is operating.

P-3 OPERATION.

a. Verify that peanut grinder can operate safely within the pressure (psi) and flow (gpm) capacity of the HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses as shown in Figure P-1.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

WARNING

Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect peanut grinder hose whips to hose reel.

i. Set HPU flow at 10 gpm.

j. Test actuate peanut grinder.

WARNING

The HPU must be set to a zero flow rate before lowering tools to avoid injury to the diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

k. Set HPU flow (gpm) to zero prior to lowering tool to diver.

CAUTION

If peanut grinder will remain in water after task has been completed, secure it away from any iron or steel to reduce the chance of corrosion damage.

l. Lower tool to diver.

P-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for approved NAVSEA peanut grinder Maintenance Requirement Cards (MRC).

P-5 TROUBLESHOOTING.

Refer to Table P-2 for troubleshooting the peanut grinder (Fairmont Model HU6935).

Table P-2. Peanut Grinder Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Oil leaks from trigger spool valve.	Damaged O-rings.	Replace O-rings.
Trigger lever will not return after being released.	Broken spring Contamination. Excessive back pressure. Trigger lever binding.	Replace spring. Clean spool. Relieve condition. Check for restrictions in return line. Check to be sure lever is not binding; correct if required.
Drive shaft will not turn.	Improper hydraulic system flow and pressure. Failed woodruff key. Failed shaft or coupling. Damaged bearing.	Check hydraulic system for recommended flow and pressure. Replace key. Replace shaft or coupling as desired. Replace bearing.
Tool runs slow.	Improper hydraulic system flow and pressure. Center plate is excessively worn. Excessive back pressure.	Check hydraulic system for recommended flow and pressure. Replace center plate. Relieve condition. Check for restrictions in return line.
Tool runs fast.	Improper hydraulic system flow and pressure.	Check hydraulic system for recommended flow and pressure.
Oil leaks from tool body.	Damaged gaskets.	Replace gaskets.

P-6 CORRECTIVE MAINTENANCE.

Corrective maintenance is limited to disassembly and reassembly for part replacement.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

P-6.1 Motor.

P-6.1.1 Disassemble.

a. Remove plug (26, Figure P-2) and drain hydraulic fluid.

b. Remove screw (41), and washer (40).

c. Remove setscrew (46).

d. Remove cap screw (44) and elastic stop nut (45). Lever (43) can be removed.

e. Remove four cap screws (7) from cap (6). Cap can now be removed from body exposing O-rings (5).

f. Remove roll pin (39) and washer (36) from spool (37). Remove spring (34), sleeve (35), washer (33), and wiper ring (4). Slide spool (37) out of top of body (1). Remove O-rings (38) from spool (37). Remove O-ring (42) from screw (41). Wiper ring (4) and O-ring (3) can be removed from inside of bottom of body (1).

g. Remove cap screws (24) and housing (8) from shaft housing (19). Separate housing (8) from body (1). Discard gasket (10).

h. Remove retaining ring (16) from drive shaft (14). Remove dowel pins (9) only if required. Idler shaft (12), pin (13), drive shaft (14), key (15), and gears (11) should come out easily. Bearing (20) remains in housing (19). O-ring (18) can be removed from housing (19). Bearings (2) remain in body (1). Bearings (17) remain in housing (8).

i. Remove nut (32) from shaft (22). Remove set screw (31), collar (30), snap ring (29 spacer (28), and rotary seal components (27). Slide shaft (22) out of housing (19). Remove coupling (21) from end of shaft (22). Remove retaining ring (23) and bearing (25).

J. Clean and inspect motor parts.

(1) Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lint-free cloths.

(2) The inside of the bushings should be gray in color. If a significant amount of yellow bronze is evident, bushing replacement is required. Inspect shafts for corresponding wear and replace as required.

(3) The gear chamber bores and end faces around the bores should be polished, not rough or grooved. The flat surfaces around the chamber and bolt holes should be flat and free of nicks and burrs that could cause misalignment or leaks.

(4) The idler gear should have flat, straight tips without nicks. It should have a smooth even polish on the teeth and end faces. Discard the gear if cracks are present.

(5) The gear running surfaces shall show two interconnecting polished circles without a step or roughness.

(6) Idler shaft diameter at the associated bushings must be smooth. Grooves, roughness, or a reduced diameter indicates fluid contamination and damaged bushings. If abnormally worn (in excess of normal polishing), both shafts and associated bushings must be replaced. The hydraulic system should be thoroughly flushed and the filter replaced before further operation of the hydraulic system.

P-6.1.2 Reassemble.

NOTE

Apply MIL-G-24139A multipurpose, water resistant grease to all O-rings and to those areas over which the O-rings must slide.

a. Install ceramic seal with O-rings (part of (27)) polished side out and bearing (25) on shaft (22). Secure with retaining ring (23). Slide shaft into housing (19). Install spacer (28) and snap ring (29). Apply O-ring lubricant to ID of rotary seal and spring (part of (27)) ensuring the rotary seal contacts the ceramic seal. Install collar (30) and secure with set screw (31). Install nut (32).

b. Install O-ring (18), and place coupling (21) on end of shaft (22). Using lubricant, grease surfaces, and mate shaft housing (19), and housing (8). Insert two cap screws (24) to maintain alignment.

c. Assemble dowel pins (9), gears (11), idler shaft (12) with drive pin (13), drive shaft (14) with key (15) in body (1). Using lubricant, grease surfaces, and mate assembled body (1), gasket (10), and housing (8). Rotate nut (32) slightly to align slot in drive shaft (14) with coupling (21). Secure with all eight cap screws (24) and torque each to 80-inch pounds.

d. Install O-rings (5) and using lubricant, grease surfaces, and mate cap (6) with body (1). Secure with cap screws (7) and torque each to 80 inch-pounds.

e. Place O-ring (3) and wiper ring (4) on bottom side of body.

f. Attach lever (43) using cap screw (44) and nut (45). Install set screw (46).

g. Place O-ring (38) on spool (37), and insert roll pin (39). Place washer (36), spring (34), wiper ring (4), washer (33), and sleeve (35) on spool, and slide spool down through body (1). Place O-ring (42) and washer (40) on screw (41). Insert screw (41) and se-

cure spool (37).

h. Fill with hydraulic fluid and install plug (26).

P-7 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

P-8 ILLUSTRATED PARTS BREAKDOWN.

Figure P-2 illustrates the parts breakdown of the Peanut Grinder.

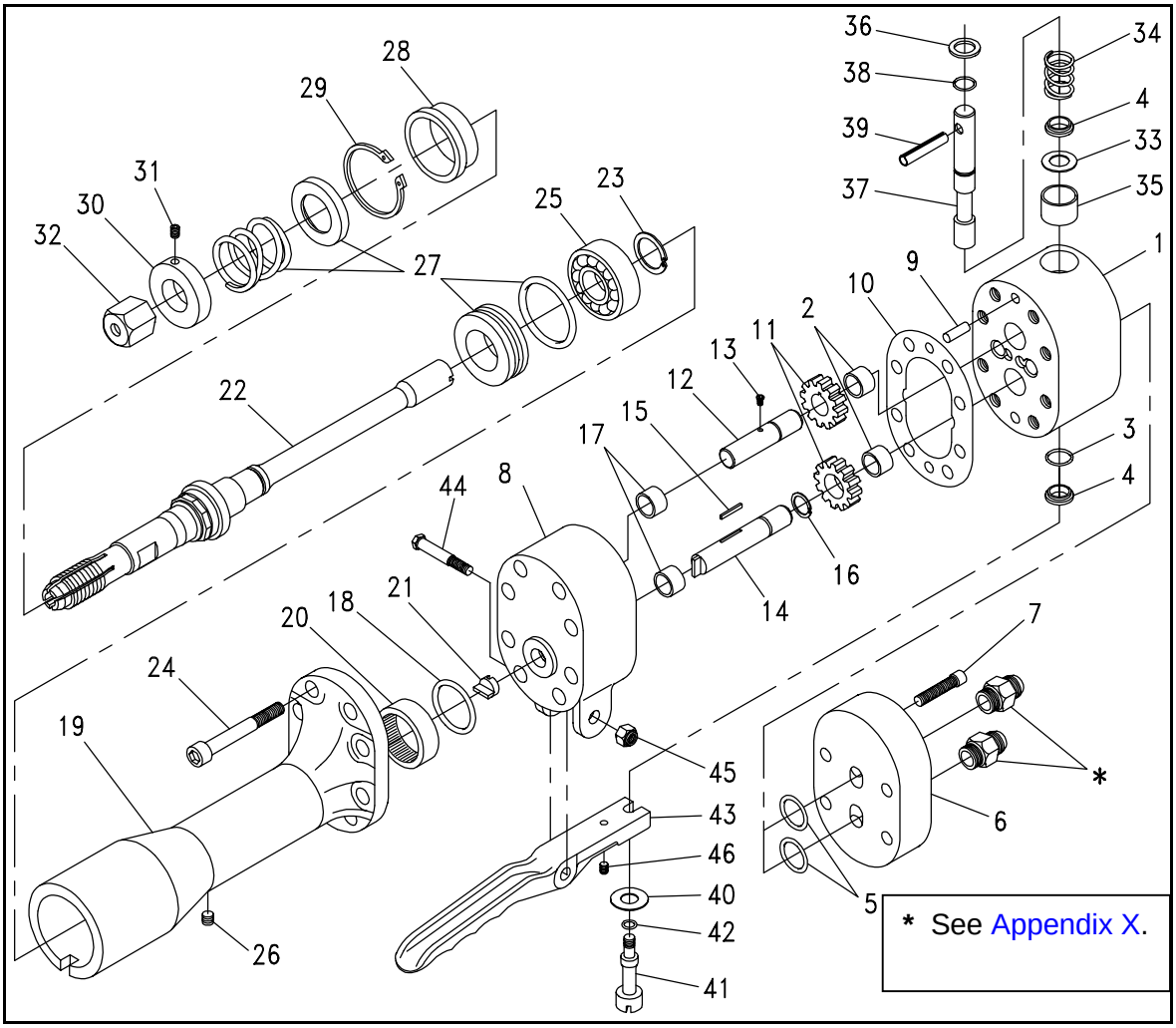


Figure P-2. Peanut Grinder Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Peanut Grinder	1	HU6935	26289
1	Body (includes item 2)	1	123807	26289
2	Bearing	2	F16727	26289
3	O-ring, 9/16 x 3/4 x 3/32-68	1	F15255	26289
4	Ring, wiper	2	F19816	26289
5	O-ring, 1/2 x 11/16 x 3/32-70	2	F10778	26289
6	Cap	1	123808	26289
7	Cap screw, socket head, 1/4-20 x 1	4	F16807	26289
8	Housing (includes bearing 17)	1	133419	26289
9	Pin, dowel, 1/4 dia x 1	2	F14146	26289
10	Gasket	1	F16732	26289
11	Gear	2	F17105	26289
12	Shaft, idler	1	104110	26289
13	Pin, drive	1	F16730	26289
14	Shaft, drive	1	125410	26289
15	Key, woodruff, 1/8 x 3/8	1	F16729	26289
16	Ring, retaining	1	F17010	26289
17	Bearing	2	F16729	26289
18	O-ring, 1/2 x 11/16 x 3/32-80	1	F17879	26289
19	Housing, shaft (includes item 21)	1	133872	26289
20	Bearing	1	F16375	26289
21	Coupling	1	F14845	26289
22	Shaft	1	133799	26289
23	Ring, retaining	1	F9288K	26289
24	Cap screw, 1/4-20 x 2-1/4	8	F21814	26289
25	Bearing	1	F20397	26289
26	Plug, pipe, 1/16 NPT	2	F21673	26289
27	Seal, rotary	1	F19951	26289
28	Spacer	1	125412	26289
29	Ring, snap	1	F20394	26289
30	Collar	1	123814	26289
31	Set screw, cup point, socket head 1/4-20 x 3/8	1	F22574	26289
32	Nut	1	123815	26289
33	Washer	1	122753	26289
34	Spring	1	F19817	26289
35	Sleeve	1	122754	26289
36	Washer	1	122755	26289
37	Spool	1	123817	26289
38	O-ring, 7/16 X 9/16 X 1/16-68	1	F15257	26289
39	Pin, roll, 1/4 dia x 1	1	F22572	26289
40	Washer	1	125414	26289
41	Screw, 5/8 dia x 1-5/8	1	125413	26289
42	O-ring, 1/4 x 3/8 x 1/16	1	F11060	26289
43	Lever	1	123818	26289
44	Cap screw, hex head, 1/4-20 x 2	1	F9659	26289

Figure P-2. Peanut Grinder Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
45	Nut, elastic stop, 1/4-20	1	F13588	26289
46	Set Screw, oval point socket head, 1/4-20 x ½	1	F 19345	26289
	Packing Kit (includes items 3, 4, 5, 18, 27, 38, 42)	1	15511	26289

Figure P-2. Peanut Grinder Components (Sheet 3).

APPENDIX Q

OPERATION AND MAINTENANCE PROCEDURES FOR THE CHAINSAW

Q-1 DESCRIPTION.

The underwater chainsaw is a modified Stanley CS 11 hydraulic chainsaw. The heavy-duty chainsaw is designed to cut wood such as railroad ties, construction timber, and pilings. The chainsaw has a bucking spur, safety trigger, and special bar tip guard. NAVSEA has incorporated a bypass valve in the hydraulic line and added a bar tip guard to prevent saw kickback. The chain saw is equipped with a 24-inch saw bar and chain. The saw is adaptable for use with 16-inch and 20-inch bars and chains. A manual oiler augments oil supply from a standard automatic oiler during sustained heavy cutting operations on the surface. Figure Q-1 illustrates a typical setup for a chainsaw using a single hydraulic hose reel and a MK 9 Mod 0 hydraulic power unit. For maximum performance of the chainsaw employ with NAVSEA Model 2 or Model 4 HPU.

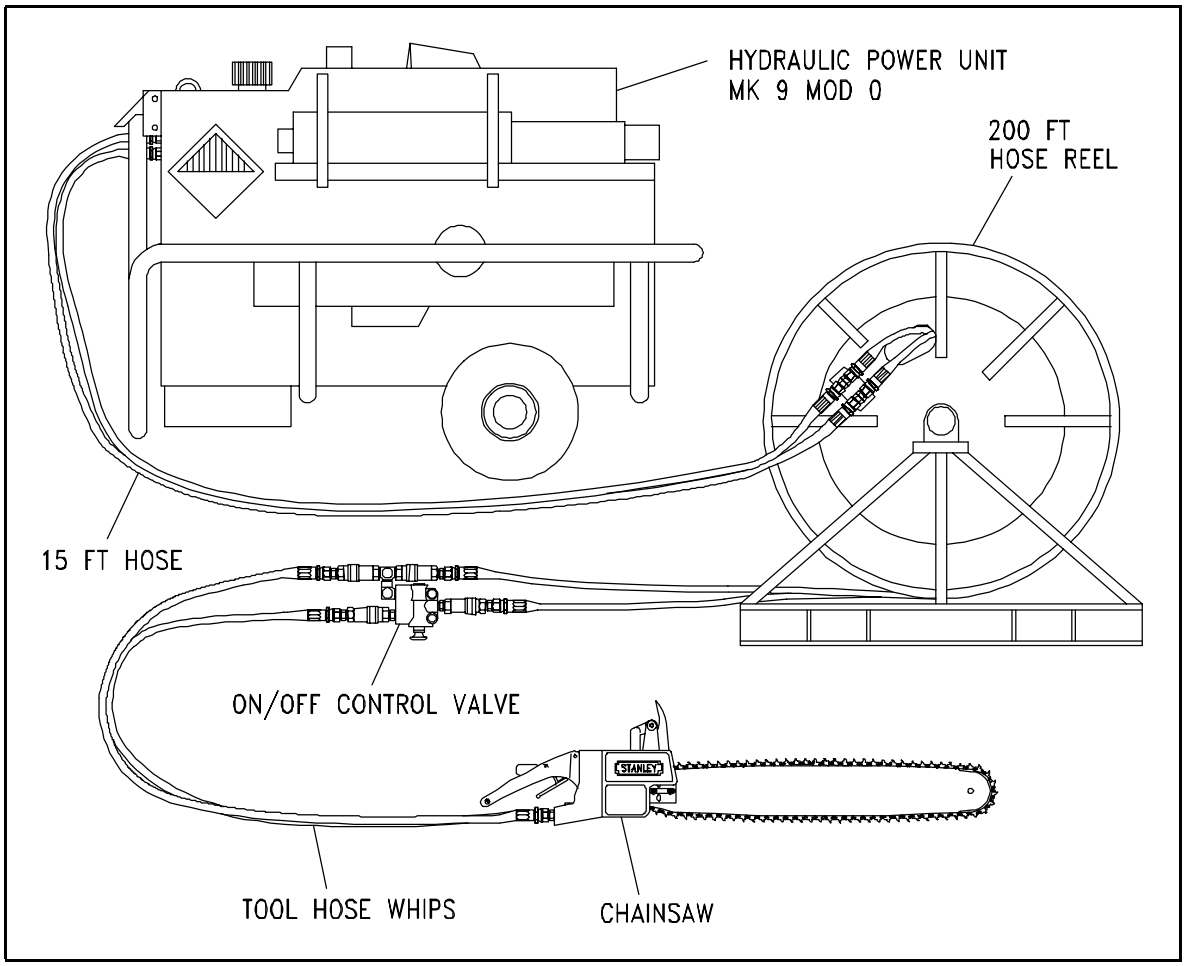


Figure Q-1. Underwater Chainsaw Setup.

Q-2 REFERENCE.

NAVSEA Drawing 5366975.

Q-2.1 Technical characteristics for the Stanley CS11340 chainsaw are provided in Table Q-1.

Table Q-1. Chainsaw Technical Characteristics.

CHARACTERISTICS	REMARKS
System type	Open-circuit
Weight	14 lbs
Flow Rates Minimum Recommended Maximum	 10 gpm 14 gpm 14 gpm
Recommended operating pressure	1500-2000 psi
Recommended relief valve setting	2000 psi
Maximum backpressure	250 psi
Porting	-8 SAE O-ring

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Always wear eye protection when operating the chainsaw.

WARNING

Operate the chainsaw with caution to avoid physical contact with the moving chain.

WARNING

Secure the material being cut underwater. Pieces could float upward and strike the operator or become navigation hazards. While cutting, hold the saw firmly with both hands and thumb firmly locked around front handle. Do not relax grip. Keep left arm straight for best control.

WARNING

Carry the saw with the bar pointing to the rear.

WARNING

Always operate the saw with the bar tip guard installed to reduce the possibility of kickback and operator injury. The only task which requires removal of the guard is piercing a hole (e.g., through a wooden deck) to begin cutting.

WARNING

Guard against chainsaw kickback to prevent serious injury to the operator or observers. To avoid kickback, keep the top side of the bar nose free from contact with other objects. Run at full power; do not run the chainsaw slowly at start or during cut. Never cut with a loose or dull chain.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

Q-3 OPERATION.

a. Verify that chainsaw can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet pressure is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect chainsaw hose whips to reel.

i. Select a bar of minimum length required for a specific task from Table Q-2, and attach to chainsaw.

j. Adjust the chain tension in accordance with Maintenance Requirement Card (MRC).

k. For underwater use, turn off automatic oiler by turning the adjustment screw fully clockwise.

WARNING

Do not exceed the maximum recommended operating pressure or flow.

WARNING

Do not use the oiler underwater.

WARNING

Never operate the saw with a loose chain.

WARNING

Verify proper rotation of the chain on the surface before operating the saw.

CAUTION

The saw chain is design to cut wood only. Do not allow the chain to come in contact with dirt, sand, or other foreign material which would dull the cutters immediately.

CAUTION

The chain should cut with very little pressure applied to the handle. If the saw must be forced to cut or if the saw cuts crooked, stop immediately to avoid further damage to the chain and the bar.

l. Set HPU flow at 14 gpm.

m. Test actuate chainsaw.

WARNING

The HPU must be set to a zero flow rate (gpm) before lowering chainsaw to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

n. Set HPU flow (gpm) to zero prior to lowering tool to diver.

CAUTION

If chainsaw will remain in water after task has been completed, secure it away from any iron or steel to reduce the chance of corrosion damage.

o. Lower tool to diver and operate tool in accordance with the application procedures.

Q-4 ATTACHMENTS.

Attachments for the chainsaw are described in Table Q-2.

Table Q-2. Bar and Chain Attachments.

DESCRIPTION	PART NUMBER	CAGE
16-inch Bar	PT16381-G5	29201
20-inch Bar	PT20381-G5	29201
24-inch Bar	PT24381-G5	29201
16-inch Chain	D92428-A	29201
20-inch Chain	D92431-A	29201
24-inch Chain	D92432-A	29201

Q-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for Stanley CS11 Chainsaw Maintenance Requirement Cards (MRC).

Q-6 TROUBLESHOOTING.

Refer to Table Q-3 for the approved Stanley CS11 Chainsaw troubleshooting. Chains and bars are particularly susceptible to damage or accelerated wear in the underwater environment. Follow manufacturers recommendations regarding repair or replacement and ensure adequate spares are available.

Table Q-3. Chainsaw Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Cuts slow.	Insufficient fluid flow or low relief valve setting. Chain dull. Backpressure too high.	Adjust fluid flow to proper gpm. For optimum performance adjust relief valve to 2250 psi. Sharpen per instructions or replace. Should not exceed 250 psi at 14 gpm measured at the end of the tool operating hoses.
Bar turns color. (Topside operation only.)	Insufficient oiler flow.	Use manual oiler during heavy cuts. Adjust oiler per service instructions.
Tool does not run.	Power unit not functioning. Coupler or hoses blocked. Mechanical failure.	Check power unit for proper flow and pressure. Remove obstruction. Disassemble tool and inspect for damage.
Tool runs backwards.	Pressure and return hoses reversed. Backpressure too high.	Correct for proper flow direction. Grinding wheel should always rotate counterclockwise when viewed from shaft end.
On-off trigger is hard to press.	Pressure and return reversed. Back pressure too high.	Correct for proper flow direction. Should not exceed 250 psi at 14 gpm measured at the end of the tool operating hoses.
Oil leakage around drive sprocket.	Motor shaft seal failure.	Replace as required.
Oil leakage between rear gear housing and valve handle assembly.	Motor face seal failure.	Replace as required.
Chain continues to move after valve is shut off.	Chain is too loose. Input flow too high.	Tighten chain. Decrease flow.

Q-7 CORRECTIVE MAINTENANCE.

Q-7.1 Chainsaw.

Q-7.1 Disassemble.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

CAUTION

Failure to install new seals in the correct orientation can result in system leakage.

a. To remove on-off valve, drive roll pin (16, Figure Q-2) from valve handle assembly (23) with a 1/4-inch diameter punch.

b. Depress the safety catch and remove triggers (15 and 19) through the bottom of valve handle.

c. Remove on-off valve cap (48) from top of valve handle assembly, and port plug (26) and

O-ring (26a) from bottom of valve handle assembly (23).

d. Withdraw valve spool (9) and coil spring (27).

e. Remove manual oiler plug (12) from valve handle assembly (23).

f. Disassemble manual oil plug (12) by removing retaining ring (13), washer (52) and spring (11). Push plunger (10) out.

g. Remove automatic oiler adjustment plug (6) from valve handle assembly (23).

h. To remove motor (30), loosen bar clamping nuts (49) and then bar adjustment machine screw (46).

i. Remove bar clamping hex nuts (49), washers (37), chain guard (45), saw bar (33), and chain (34).

j. Remove four 5/16-18 x 3/4-inch cap screws (2) (three cap screws not shown) holding chainsaw adapter assembly (31) to valve handle assembly (23).

CAUTION

Be careful not to damage the oil tube bores in the motor and the valve handle.

CAUTION

Do not use pliers to remove the oil tubes. The use of pliers may severely damage the oil tube seals.

k. Insert a hook-type tool through oil tubes (29) and pull out tubes.

l. Remove two 5/16-18 x 3/4-inch oval head machine screws (5) (one not shown).

Q-7.1.2 Reassemble.

NOTE

Apply clean grease or O-ring lubricant to all parts during reassembly.

a. Replace O-ring (8) on on-off valve cap bore.

b. Replace O-ring (7) on on-off valve cap (48).

c. Push valve cap (48) onto valve spool (9).

d. Thread valve cap (48) with valve spool (9) into top of valve handle assembly (23).

e. Install spring (27) through bottom of valve handle assembly (23).

f. Replace O-ring (7) in port plug (26).

g. Replace O-ring (26a) on port plug (26) and thread port plug (26) in place.

h. Depress the safety catch and slide the triggers (15 and 19) through the bottom of the handle assembly (23).

i. Align triggers (15 and 19) with valve handle assembly (23); drive roll pin (16) into valve

handle assembly (23).

j. Replace the O-rings (17 and 18).

CAUTION

Ensure that the two small holes in the small diameter section of the manual oiler plug remain clean.

k. Install O-rings (25) on plunger seat.

l. Push plunger (10) through manual oiler plug (12) from end opposite hex.

m. Replace O-ring (14) in manual oiler plug (12).

n. Install in sequence, spring (11), washer (52), and retaining ring (13) on that portion of plunger (10) protruding from hex end of manual oiler plug (12).

o. Install manual oiler plug (12) in valve handle assembly (23).

p. Replace O-ring (18) on automatic oiler adjustment plug (6) bore.

q. Install automatic oiler adjustment plug (6) into valve handle assembly (23).

r. Replace O-rings (28) on oil tubes (29).

s. Insert oil tubes (29) in valve handle assembly (23).

t. Push motor (30) into chainsaw adapter assembly (31), align motor mounting holes, and replace two 5/16-18 x 3/4-inch oval head machine screws (5). Torque screws to 15 foot-lbs.

u. Replace O-ring (41) in valve handle assembly (23).

v. Align oil tubes (29) and press the chainsaw adapter assembly (31) onto valve handle assembly (23).

w. Install four 5/16-18 x 3/4-inch cap screws (2). Torque screws to 15 foot-lbs.

x. Install saw chain (34) on saw bar (33) (note orientation of chain on bar).

y. Place saw bar (33) on mounting studs (36), aligning with bar adjustment nut (38).

z. Replace chain guard (45), washers (37), and clamping hex nuts (40).

aa. Follow chain tension adjustment procedure on Maintenance Requirement Card (MRC).

bb. Test actuate saw. Verify all components of chainsaw operate.

Q-7.2 Motor Repair.

Q-7.2.1 Disassemble.

NOTE

The chainsaw can have one of three motors. Identify the motor used on your saw. Disassemble motor in accordance with Figure Q-3 (Motor 03272), Q-4 (Motor 21444), or Q-5 (Motor 07362). General disassembly procedures for these three motors follow.

a. Place the motor in a vise (with soft jaws or V-block) around the bearing end; output end of motor shaft down.

b. On motor 03272, scribe assembly marks across the bearing retainers and the gear housing. Make sure that the marks will be visible during reassembly.

c. Remove the eight socket head cap screws securing the bearing retainers and the gear housing.

d. Pry the rear bearing retainer or gear housing away from the mating part. Be careful to lift the retainer or housing straight off. Use the inside groove provided at the split between parts to prevent scratches on the surfaces between the parts.

e. On motor 03272, pry the gear housing assembly away from the front bearing housing in the same manner as step d above.

f. Remove the two gears, motor shaft key (or roller) and idler shaft.

g. Remove the large face seal O-ring(s) being careful not to damage the O-ring grooves or surfaces.

h. To remove the motor shaft from the front bearing retainer or bearing housing, remove the large retaining ring securing the ball bearing(s). Place the retainer or housing on a flat surface with clearance for bearing removal. Push on the small end of the motor shaft until the shaft and bearing(s) slide free, being careful not to bend the motor shaft.

i. The ball bearing(s) should be removed from the motor shaft only if they must be replaced because damage can occur during removal. To remove the bearings from the motor shaft, press on the threaded end of the motor shaft while supporting the outer race of the bearing(s). Discard the bearings.

j. Remove the retaining ring at the bottom of the ball bearing bore to service the motor shaft seal(s).

k. To remove the seal liner and associated parts, insert the small end of the motor shaft through the seal liner. Place a rag across the gear face of the front bearing retainer and flow air through the small diameter motor shaft bearing. Use a shop air nozzle to force the seal liner onto the motor shaft for removal.

l. Clean and inspect motor parts.

(1) Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lint-free cloths.

(2) The inside of the bushings should be gray in color. If a significant amount of yellow bronze is evident, bushing replacement is required. Inspect shafts for corresponding wear and replace as required.

(3) The gear chamber bores and end faces around the bores should be polished, not rough or grooved. The flat surfaces around the chamber and bolt holes should be flat and free of nicks and burrs that could cause misalignment or leaks.

(a) The idler gear should have flat, straight tips without nicks. It should have a smooth even polish on the teeth and end faces. Discard the gear if cracks are present.

(b) The gear running surfaces should show two interconnecting polished circles without a step or roughness.

(c) Main and idler shaft diameter at the associated bushings must be smooth.

Grooves, roughness, or a reduced diameter indicates fluid contamination and damaged bushings. If abnormally worn (in excess of normal polishing), both shafts and associated bushings must be replaced. The hydraulic system should be thoroughly flushed and the filter replaced before further operation of the hydraulic system.

Q-7.2.2 Reassemble.

a. Assemble the seal liner assembly by installing the outside diameter O-ring, quad ring, and (seal liner washer) as shown in appropriate Figure. Place idler shaft through the seal liner; then loosely position the assembly in the seal bore of the front bearing retainer (quad ring side down). Place the seal liner washer over the shaft; then carefully push the seal liner into place. Install the retaining ring. Remove the idler shaft.

CAUTION

The graphite seal liner must not be forced, pried or pushed on directly because it can be easily damaged.

b. On motor 03272, carefully install the shaft seal with the lips facing the gear side. Replace the back-up washer and retaining ring.

c. To install the ball bearing(s) on the motor shaft; support the ball bearing inner race and press the motor shaft through the bearing inner race.

d. To install needle bearing in motor 03272, use Bearing Pusher (Part Number 11916). On motors 07362 and 21444, install bushings using Bearing Pusher (Part Number 11918).

e. Place the front bearing retainer/front bearing housing assembly on a smooth clean arbor press surface (protected from damage) with the large bearing bore facing up. Position the piece so that a clearance hole exists for the insertion of the motor shaft.

f. Apply grease to the motor shaft and keyway, then insert it through the shaft seal. Using Bearing Pusher (Part Number 00850), or a sleeve/socket with a diameter slightly smaller than the outside diameter of the ball bearing, press the bearing assembly into place. Press only on the outer race. Install the ball bearing retaining ring.

g. Install the key (or roller) in the keyway of the motor shaft. Use a small amount of grease to keep the key or roller in place. Slide the drive gear over the key and shaft. Install the idler shaft and gear.

h. Apply grease to the face seal O-ring groove(s) and then install O-rings.

i. On motor 03272, note the scribe marks made during disassembly; then align the scribe marks and carefully slide the gear chamber and rear bearing retainer into place, ensuring dowel pins and shafts are aligned during installation.

CAUTION

Do not force parts together.

j. On motor 07362 and 21444, note the screw hole pattern on both housings. they will only assemble one way. With all parts aligned, carefully slide the gear housing assembly over the gears until it contacts the front bearing assembly.

k. Turn the motor shaft manually to check for free rotation. Install the cap screws, then re-check rotation.

Q-8 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

Q-9 ILLUSTRATED PARTS BREAKDOWN.

a. Figure Q-2 illustrates the parts breakdown for the Chainsaw.

b. Figure Q-3 illustrates the parts breakdown for motor 03272.

c. Figure Q-4 illustrates the parts breakdown for motor 21444.

d. Figure Q-5 illustrates the parts breakdown for motor 07362.

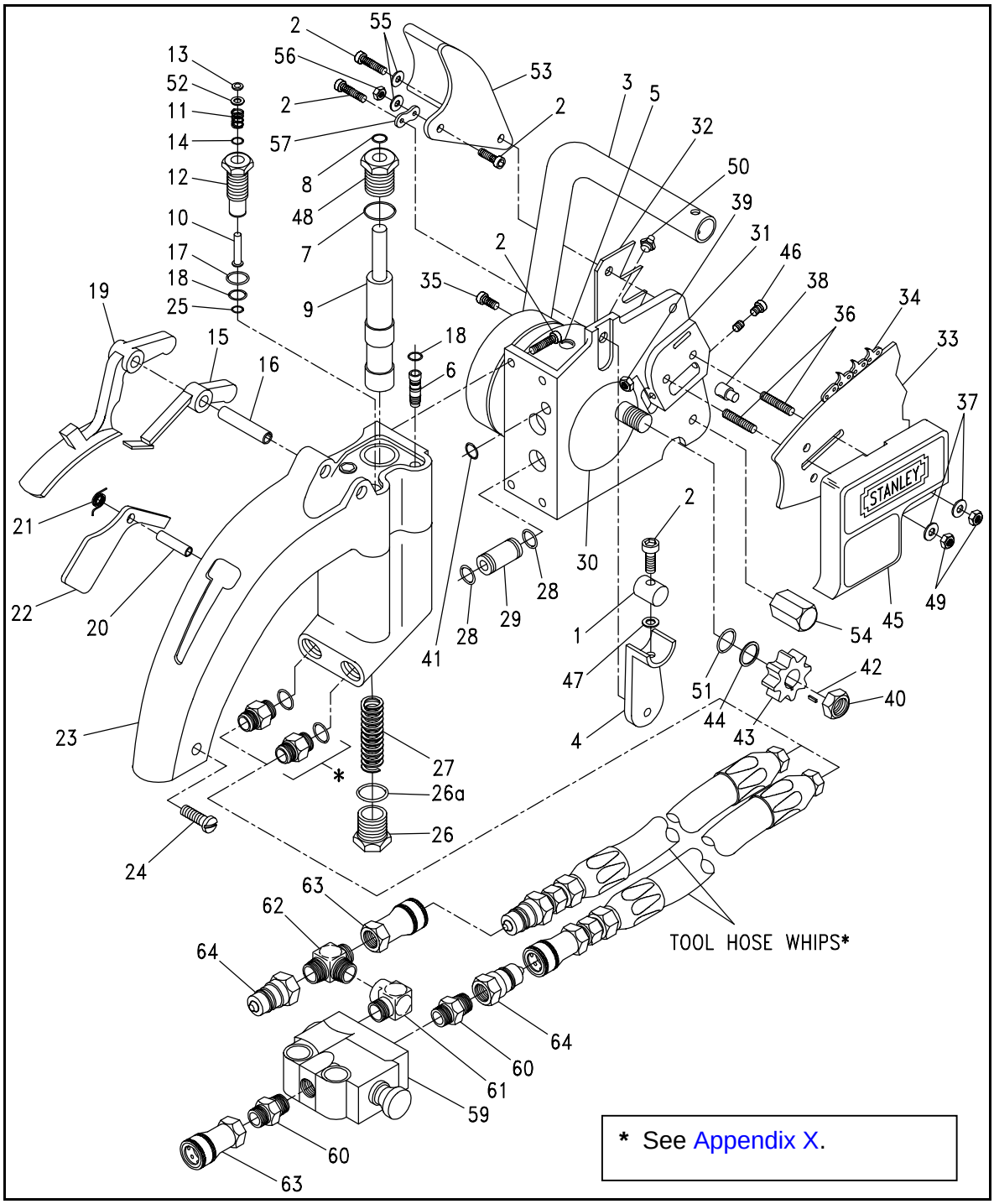


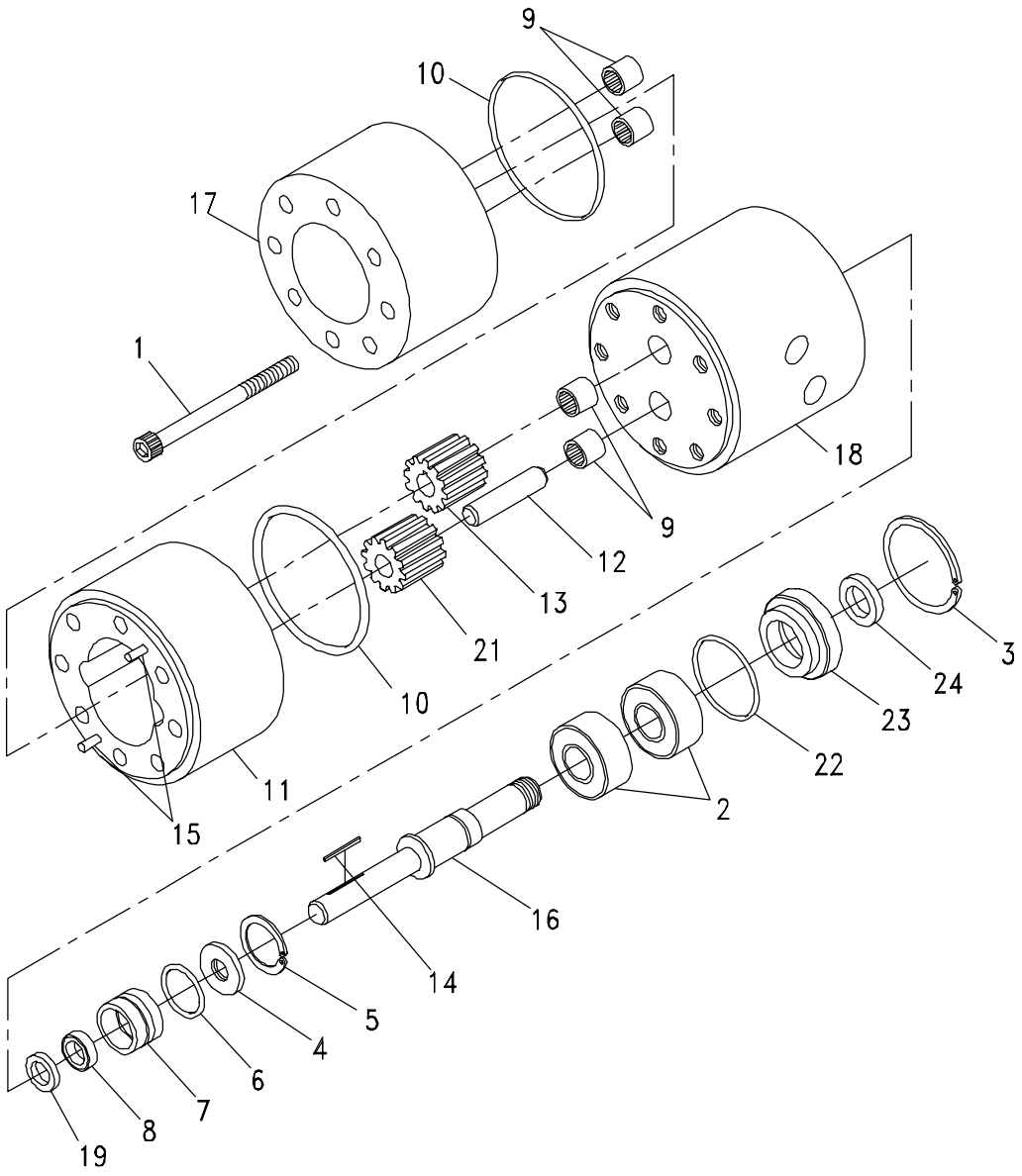
Figure Q-2. Chainsaw Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Chainsaw	1	CS11	54252
1	Handle bar retainer	3	02649	54252
2	Cap screw 5/16-18 x 3/4 soc head	10	02764	54252
3	Handle bar	1	02936	54252
4	Handle strut assembly	1	02650	54252
5	Machine screw 5/16-18 x 3/4	2	00597	54252
6	Automatic oiler adjustment plug	1	02921	54252
7	O-ring	2	01604	54252
8	O-ring	1	00717	54252
9	Valve spool, O.C.	1	02925	54252
10	Manual oiler plunger	1	02922	54252
11	Compression coil spring	1	02914	54252
12	Manual oiler plug	1	02932	54252
13	Retaining ring	1	03007	54252
14	O-ring	1	00026	54252
15	Manual oil trigger	1	02924	54252
16	Roll pin	1	03279	54252
17	O-ring	1	01411	54252
18	O-ring	2	01362	54252
19	Trigger	1	02941	54252
20	Roll pin	1	03278	54252
21	Torsion spring	1	02915	54252
22	Safety catch	1	02943	54252
23	Valve handle assembly	1	02945	54252
24	Machine screw	1	00094	54252
25	O-ring	1	05632	54252
26	Hex o-ring port plug 5/8 tube size (includes O-ring)	1	03010	54252
26a	O-ring	1	01605	54252
27	Compression coil spring	1	02916	54252
28	O-ring	4	00175	54252
29	Oil tube	2	02912	54252
30	Motor assembly	1	03272	54252
	Motor assembly	1	21444	54252
	Motor assembly	1	07362	54252
31	Chainsaw adapter assembly	1	02947	54252
32	Bucking cleat	1	02913	54252
33	Saw bar, 19-in sprocket nose	1	04642	54252
	Saw bar, 16-in	1	PT16381-G5	29201
	Saw bar, 20-in	1	PT20381-G5	29201
	Saw bar, 24-in	1	PT24381-G5	29201
34	Saw chain, 19-in	1	04643	54252
	Saw chain, 16-in	1	D92428-A	29201
	Saw chain, 20-in	1	D92431-A	29201
	Saw chain, 24-in	1	D92432-A	29201

Figure Q-2. Chainsaw Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
35	Cap screw 5/16-18 x 1 soc head	1	02449	54252
36	Stud 3/8-16 x 1-1/2	2	03277	54252
37	Flat washer	2	02766	54252
38	Bar adjustment nut	1	03275	54252
39	Nut 1/4-20 ESSNA	1	00719	54252
40	Heavy hex jam nut 5/8-11 LH thread	1	03273	54252
41	O-ring	1	00018	54252
42	Key	1	03023	54252
43	Sprocket	1	02938	54252
44	Sprocket spacer	1	03280	54252
45	Chain guard	1	02933	54252
46	Machine screw 1/4-20 x 2-1/2	1	02765	54252
47	Neoprene washer	3	02643	54252
48	On-off valve cap	2	02931	54252
49	Nut 3/8-16 hex	1	03276	54252
50	Grease fitting	1	00767	54252
51	O-ring	1	01211	54252
52	Washer	1	04139	54252
53	Hand guard	1	12171	54252
54	Chain stop	2	12174	54252
55	Washer	1	12175	54252
56	Nut	1	09277	54252
57	Link plate	1	12248	54252
58	Not Used			
59	Valve selector, two position	1	503-1	13829
60	Adapter, nipple, MPT/MPT	2	2083-8-8s	16717
61	Elbow, street, MPT/FPT	1	2089-3-10S	17818
62	Tee, MPT/MPT	1	2257-8-8S	16717
63	Qdisc, female half	2	5601-8-10S	16717
64	Qdisc, male half	2	5602-8-10S	16717
	Seal kit for 03272 motor	AR	03327	54252
	Seal kit for 07362 motor	AR	10569	54252
	Seal kit for 21444 motor	AR	10569	54252
	Repair kit for 03272 motor	AR	03328	54252
	Repair kit for 07362 motor	AR	10570	54252
	Repair kit for 21444 motor	AR	10570	54252
	Repair kit (includes items 38, 39, 42, 43, 46, 49, 50, seal kit 03327, and motor bearing 03109).	AR	03328	54252

Figure Q-2. Chainsaw Components (Sheet 3).

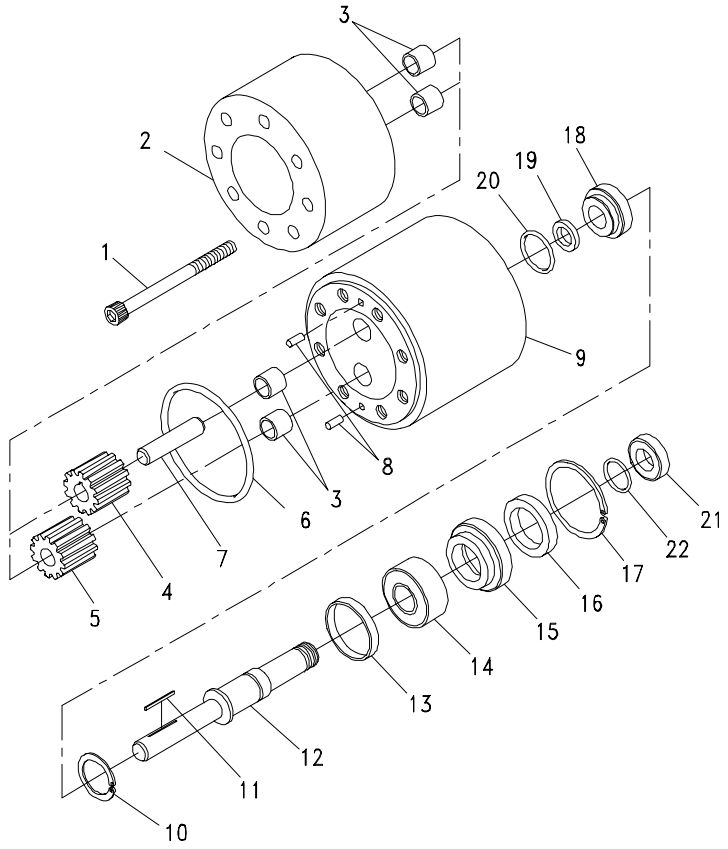


ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Motor	1	03272	54252
1	Cap screw	8	03274	54252
2	Bearing	2	03109	54252
3	Retaining ring	1	00633	54252
4	Washer, seal liner	1	00169	54252
5	Retaining ring	1	00170	54252
6	O-ring	1	00171	54252

Figure Q-3. Motor 03272 (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
7	Seal liner	1	00172	54252
8	Quad ring	1	00173	54252
9	Bearing	4	05459	54252
10	O-ring	2	00178	54252
11	Gear housing	1	00605	54252
12	Idler shaft	1	00606	54252
13	Gear w/keyway	1	00608	54252
14	Key	1	00609	54252
15	Dowel pin	2	00611	54252
16	Motor shaft	1	03268	54252
17	Rear bearing retainer assembly	1	03405	54252
18	Front bearing retainer assembly	1	03437	54252
19	Seal washer	1	01203	54252
20	Gpm sticker (not shown)	1	03790	54252
21	Gear	1	00607	54252
22	O-ring	1	02905	54252
23	Keeper, seal and bearing	1	03104	54252
24	Seal, teflon	1	03110	54252
	Seal kit (includes items 6, 7, 8, 10, 22, and 24)		03327	54252

Figure Q-3. Motor 03272 (Sheet 2).

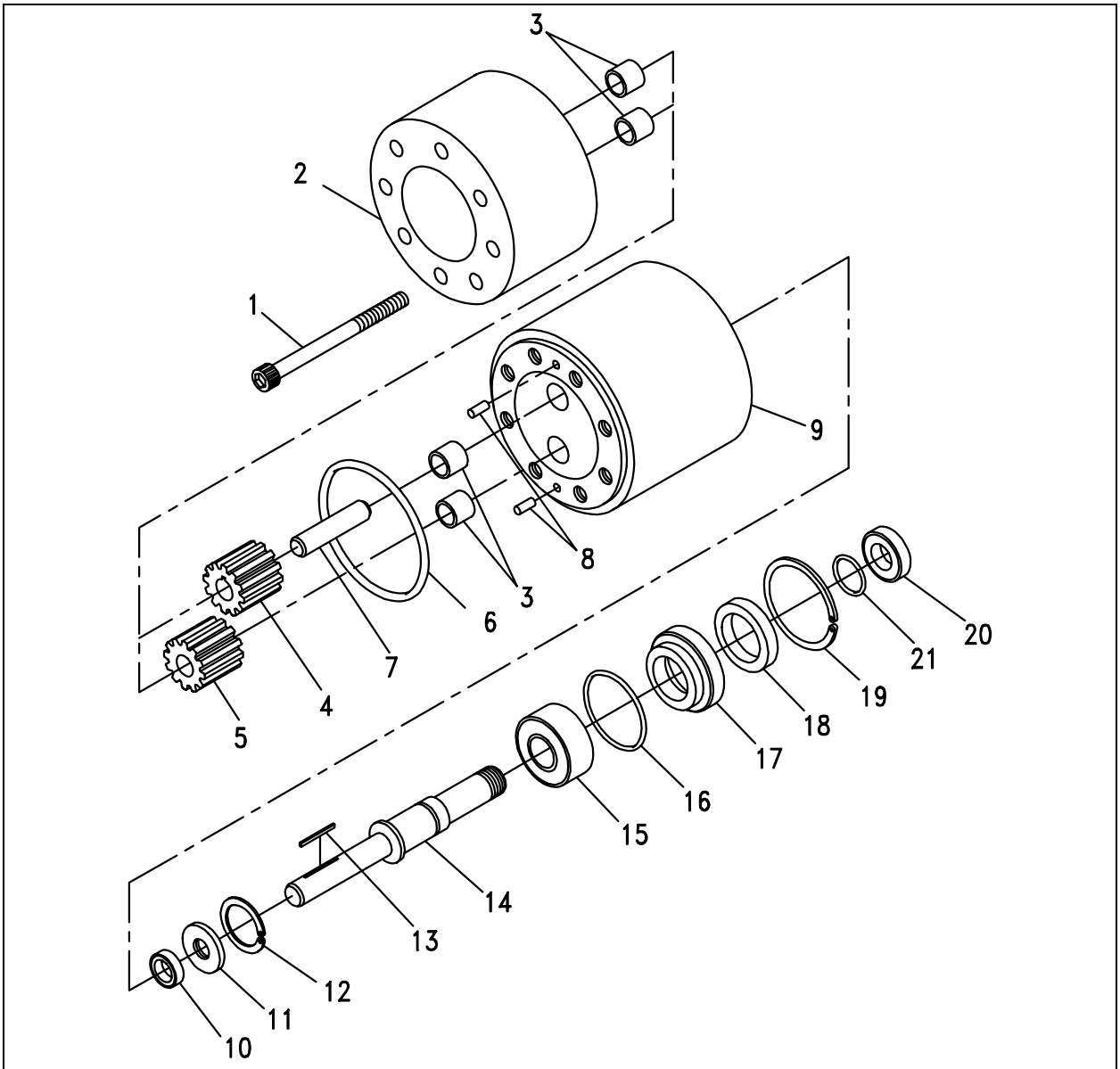


ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Motor		21444	54252
1	Cap screw, 1/4-20 x 2-1/4 hex soc head	8	00612	54252
2	Gear housing assembly	1	06866	54252
3	Bushing	4	06316	54252
4	Drive gear	1	06853	54252
5	Idler gear	1	06855	54252
6	O-ring	1	00178	54252
7	Idler shaft	2	06854	54252
8	Pin	1	00713	54252
9	Front bearing housing assembly	1	21436	54252
10	Retaining ring	1	00170	54252
11	Needle roller	1	06881	54252
12	Motor shaft	1	07359	54252
13	Spacer	1	03280	54252

Figure Q-4. Motor 21444 (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
14	Bearing	1	12119	54252
15	Keeper, seal bearing	1	03104	54252
16	Seal, teflon	1	03110	54252
17	Retaining ring	1	00633	54252
18	Seal gland	1	19884	54252
19	Quad ring	1	00669	54252
20	O-ring	1	00171	54252
21	Spacer seal ring	1	03280	54252
22	O-ring	1	01211	54252

Figure Q-4. Motor 21444 (Sheet 2).



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Motor		07362	54252
1	Cap screw, 1/4-20 x 2-1/4 hex soc head	8	00612	54252
2	Gear housing assembly	4	06866	54252
3	Bushing	1	06316	54252
4	Drive gear	1	06853	54252
5	Idler gear	1	06855	54252
6	O-ring	1	00178	54252
7	Idler shaft	2	06854	54252

Figure Q-5. Motor 07362 (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
8	Pin	1	00713	54252
9	Front bearing housing assembly	1	07357	54252
10	Seal	1	06315	54252
11	Seal washer	1	06304	54252
12	Retaining ring	1	00170	54252
13	Needle roller	1	06881	54252
14	Motor shaft	1	07359	54252
15	Bearing	1	12119	54252
16	O-ring	1	02905	54252
17	Keeper, seal bearing	1	03104	54252
18	Seal, teflon	1	03110	54252
19	Retaining ring	1	00633	54252
20	Spacer seal ring	1	03280	54252
21	O-ring	1	01211	54252
	Seal kit	1	10569	54252
	Repair kit	1	21444	54252

Figure Q-5. Motor 07362 (Sheet 2).

APPENDIX R

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC BRUSH

R-1 DESCRIPTION.

This single-brush tool has been designed for general waterborne hull cleaning, and to clean and polish ship propellers. It is a redesign of the Stanley model GR29 hydraulic underwater grinder (see Appendix K), and is designated the Stanley HB29301: Hydraulic Brush. An auxiliary or assist handle may be installed at 90 degrees, right or left, or at 180 degrees to the pistol-grip handle and tool trigger. For hull cleaning, the 9-inch L handle is recommended, at the 180 degree position. When cleaning and polishing propellers, the working diver may use a 6-inch L handle at the 90 degree position, especially for polishing in tight spots, such as blade root areas. A brush/disc adapter plate is provided which attaches to the 3/4-16 UNF thread tool spindle (output shaft). Figure R-1 illustrates a typical setup for a hydraulic brush using a single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0.

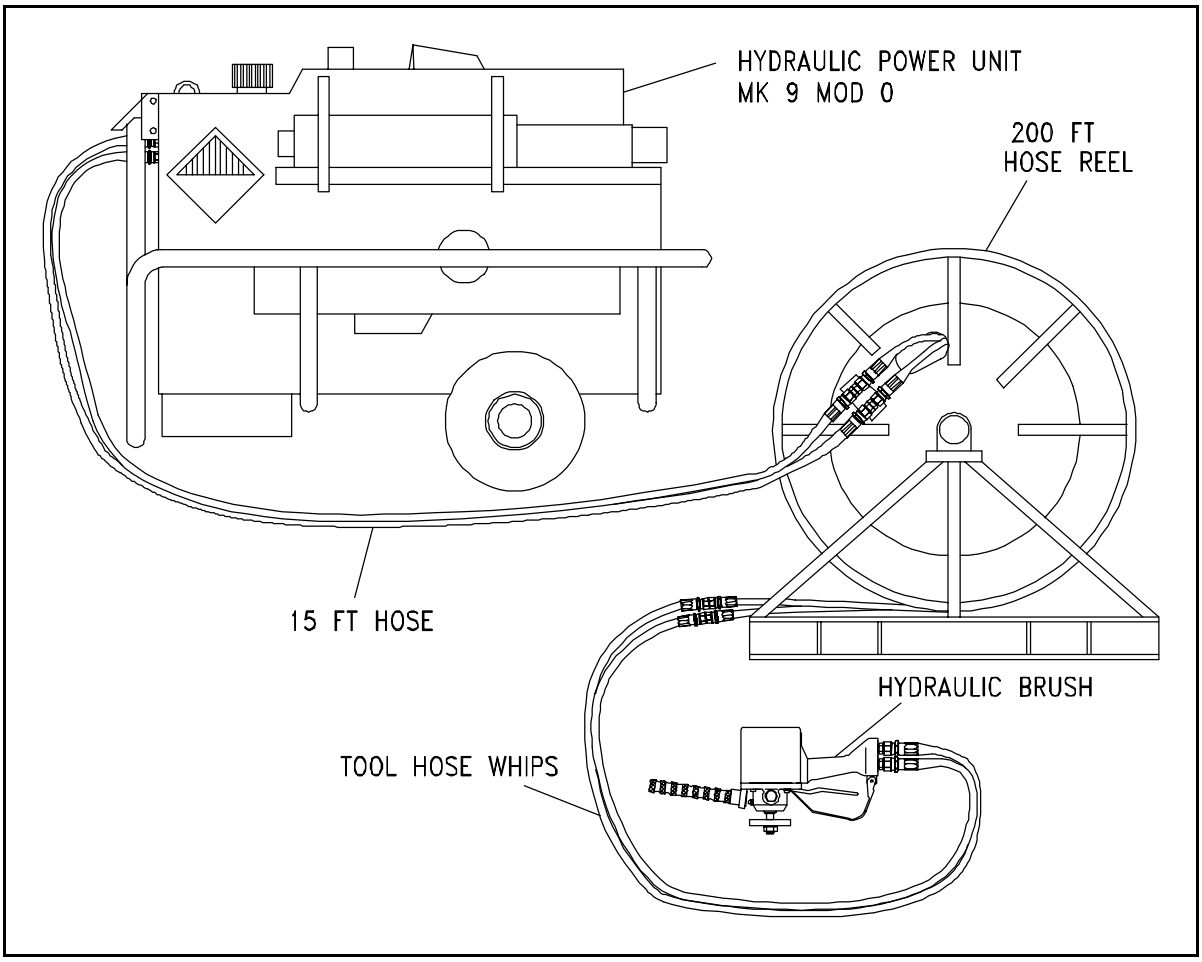


Figure R-1. Hydraulic Brush Setup.

R-1.1 Technical characteristics for the Hydraulic Brush are provided in Table R-1.

Table R-1. Hydraulic Brush Technical Characteristics.

CHARACTERISTICS	REMARKS
System type	Open-center
Weigh (dry)	15 lbs
Length (with flotation collar)	14-3/4 in.
Width (without handle)	8 in.
Flow range Recommended for cleaning/polishing	3-12 gpm 3-6.1 gpm
Operating pressure, maximum	2500 psi
Flow and RPM: Optimum Maximum	 10 gpm = 2200 rpm 12 gpm = 2640 rpm
Porting	-8 SAE O-ring
Maximum operating depth	300 fsw

WARNING

Positive voice communications shall be established between diver and topside before operating any tool underwater.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

R-2 OPERATION.

a. Verify that the hydraulic brush can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect hydraulic brush hose whips to hose reel.

i. Select attachment from Table R-2, and attach to hydraulic brush.

j. Set HPU flow rate not to exceed 3 gpm for hull cleaning, or 4.5 gpm for propeller cleaning/polishing.

k. Test actuate hydraulic brush.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering hydraulic brush to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

l. Set HPU flow (gpm) to zero prior to lowering tool to diver.

m. Lower tool to diver.

n. If ambient temperatures exceed about 80°F., immerse an additional portion of primary umbilical in seawater (e.g. tie-off hose at pier or seawall) to facilitate cooling of hydraulic fluid. When cleaning, hydraulic fluid temperature should not exceed 120°F.

o. The working diver will communicate with surface for adjustments in HPU hydraulic flow rate (gpm). Tool trigger should not be used to throttle flow, but as a “deadman switch” - either full on, or off. For good cleaning effectiveness, and to maintain brush or disc suction on work surfaces, the following flow rates are recommended:

   (1) HULL CLEANING, with Type C, D, or A Brush: 3.0 to 4.0 GPM (600 - 800 RPM)

   (2) PROPELLER CLEANING/POLISHING, Type D3 or D5 3M Disc: 4.5 to 6.1 GPM (890 - 1275 RPM)

p. For flow rates recommended, rotation of brush or disc will develop a suction effect at work surface. The cleaning action of brush/disc will feed itself into marine growth with little effort. It will take some period of time for a diver to become proficient with this single-brush tool, by learning to “ride the tool” during each cleaning pass. If the diver tends to fight the reaction torque of the tool, he will prematurely tire. With more experience, higher flow rates (thus higher brush/disc speed) may be used, which will improve cleaning production rate.

q. The 9-inch diameter Type C brush is recommended for cleaning ship running gear, struts, or in confined areas.

r. Replacing a brush or disc or changing out a tool should be done on surface and not under water.

R-3 ATTACHMENTS.

Attachments are described in Table R-2.

Table R-2. Hydraulic Brush Accessories.

ITEM	REMARKS
Brush, Hull Cleaning	NAVSEA Type C, in diameters of 9 to 13 inches
Brush, Cleaning	NAVSEA Type D, in diameters of 5, 7, 9, and 12 inches
Brush, Cleaning	NAVSEA Type A, 14 inch diameter
Disc, Propeller Cleaning and Polishing	9 inch diameter disc: #3 density, UPC No 04811-04481 #5 density, UPC No 7 1/2 inch diameter disc: #3 density, UPC No 04811-044171 #5 density, UPC No
Marine Disc Holder	9 inch diameter disc: #808, 3M UPC No 048011-04242 7 1/2 inch diameter disc: #807

R-3.1 Brush/Disc Attachment Plate.

a. Identify the spindle end nut (7, Figure R-2), and the brush/disc adapter plate (8).

WARNING

Never-Seez or equivalent anti-seizing compound is combustible.

WARNING

Avoid prolonged contact with skin or prolonged breathing of vapors. Use with adequate ventilation.

WARNING

Never-Seez or equivalent contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting. Call a physician.

b. Apply Never-Seez or equivalent to threads on the end of the spindle shaft (17), and thread items (8) and (7) onto the shaft as shown. Flats are provided on the Spindle Shaft for an open-end wrench, to facilitate assembly or disassembly.

c. Thoroughly tighten the adapter plate and nut.

R-3.2 Brush Attachment.

a. From Table R-2, note the listing of attachment hardware. For the NAVSEA Type C steel flat-wire hull cleaning brush, use four each 3/8-16 UNC x 1-inch hex head bolts, with flat washers and lock washers.

b. Apply Never-Seez or equivalent to the bolt threads; note that the 3.75 inch D counter-bore in the plywood brush backing plate fits the OD of the Brush/Disc Plate. When using Type A or Type D Brushes, the 3/8-16 UNC x 1-1/4 inch L bolts are required, since the brush block is 1 inch thick. Check the spindle end nut (7, Figure R-2) for tightness.

R-3.3 Disc Attachment.

a. To mount the 3M marine cleaning discs, refer to Table R-2. Select Marine Disc Holder for the size of disc to be used. The #808 Marine Disc Holder is for 9 inch D discs, and the #807 Holder is for 7-1/2 inch D discs. The 7-1/2 inch D disc will be best for smaller propellers, in order to clean and polish in root areas of the blades and other tight spots.

b. From the attachment hardware, use 4 each 3/8-16 UNC x 1-1/4 inch hex head bolts with lock washers; apply Never-Seez to the bolt threads and attach to the brush/disc adapter plate (8, Figure R-2). Insure that the spindle end nut (7) is tight. Select a Marine Cleaning Disc: #3 density (Type D3*) is for normal use, while the #5 density (Type D5*) disc is more dense/rigid and is used to remove calcareous marine growth from the Pacific Ocean and tropical waters. Review the 3M instructions supplied with the “Scotch-Brite” discs and holder. The discs have a light green fibrous backing surface which attaches to the velcro-type 3M Scotchmate mounting surface on the Marine disc Holder. Before mounting, visually center the disc around the self-centering ring of the holder. Press the disc firmly against the Scotchmate surface.

c. During operation, if vibrations occur, stop tool to check if the disc is improperly mounted, or mounted off-center.

* As described in NAVSHIPS Technical Manual S9086-CQ-STM-000, Chapter 081, Waterborne Underwater Hull Cleaning of Navy Ships.

d. Technique: clean the propeller blade, hub, etc. with the first pass; then on the second pass, polish the surfaces using a circular motion.

R-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for approved NAVSEA hydraulic brush Maintenance Requirement Cards (MRC).

R-5 TROUBLESHOOTING.

Refer to Table R-3 for single-brush tool troubleshooting.

Table R-3. Hydraulic Brush Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Low performance.	Incorrect hydraulic flow. Defective quick disconnects.	Check that power source is producing 4-12 gpm at 1000-2000 psi. Check each quick disconnect.
Oil leak at motor cap face.	Fasteners loose. Face O-ring worn or missing. Motor cap/main housing damaged.	Tighten to recommended torque (22-25 ft lbs). Replace as required. Replace as required.
Oil leaks at reversing spool.	Damaged O-rings. Wrong hydraulic fluid. Circuit too hot.	Replace as required. See Hydraulic System Requirements for fluid and circuit specifications. Cool oil.
Oil gets hot, power unit working hard.	Open-center tool on a closed center circuit and vice versa. Too much oil going through tool. Circuit contaminated.	Use open center circuit or use closed center spool. Adjust flow for 12 gpm maximum. Keep circuit fluid clean.
Tool doesn't run.	Power unit not functioning. Coupler or hoses blocked. Mechanical failure.	Check power unit for output of 4-12 gpm. Verify relief valve setting is 2000 psi. Remove obstruction. Disassemble tool and inspect for damage.
Tool runs backwards.	Pressure and return hoses reversed.	Correct for proper flow direction. Brush/disc should rotate counterclockwise when viewed from shaft end. Refer to service instructions.
Brush/disc stops abruptly after trigger release.	Mechanical failure. Check valve in trigger spool not functioning correctly. Reversing spool incorrectly assembled.	Disassemble tool and inspect for damage, and repair. Replace trigger spool assembly. Check valve not serviceable. Refer to reassembly of main housing.

R-6 CORRECTIVE MAINTENANCE.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

R-6.1 Remove Bearing Carrier and Spindle Shaft.

a. Remove flotation collar (28, Figure R-2) by removing four cap screws (2) that hold collar to flotation bracket (3).

b. Unfasten lower end of trigger guard (4) by removing nut (5) and cap screw (6).

CAUTION

When pulling assembled bearing carrier (10) away from main housing (24), the woodruff key on end of spindle shaft may damage O-ring and bushings in main housing. It will be necessary to remove motor cap to remove woodruff key first.

c. Remove motor cap (27), gears (30, 31) and woodruff key (18) from end of spindle shaft (17).

d. Remove four cap screws (2) that secure flotation bracket (3) and bearing carrier (10) to

main housing assembly (24).

e. Carefully separate bearing carrier (10) from main housing (24). The spindle shaft seal (9), O-ring (13), bearing (15) and two retainer rings (14, 16) will remain with carrier (10). DO NOT pry or in any way excessively force bearing carrier off of main housing.

f. To remove spindle shaft (17), and bearing (15) from bearing carrier (10), remove large internal retaining ring (16). Remove bearing from spindle shaft by removing small external retaining ring (14).

g. Remove O-ring (13), then press shaft seal (9) out of bearing carrier.

R-6.2 Disassemble Motor Section.

a. The motor section consists of drive gear (30, Figure R-2), idler gear assembly (31), idler shaft (32), motor cap assembly (27), O-ring (13) and spindle shaft (17).

b. Remove eight socket-head cap screws (25) and lock washers (26) securing motor cap assembly (27) to main housing. Carefully remove motor cap.

CAUTION

DO NOT pry or in any way excessively force the motor cap assembly off the main housing. If necessary, loosen motor cap by tapping lightly with a non-metallic mallet.

c. Remove large O-ring (27a) from motor cap. Discard O-ring. Use new O-ring provided in seal kit during assembly.

d. Remove idler gear (31) and idler shaft (32). Slide drive gear (30) off spindle shaft (17). Be careful not to lose woodruff key (18).

e. Clean and inspect motor parts.

(1) Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lint-free cloths.

(2) The inside of the bushings should be gray in color. If a significant amount of yellow bronze is evident, bushing replacement is required. Inspect shafts for corresponding wear and replace as required.

(3) The gear chamber bores and end faces around the bores should be polished, not rough or grooved. The flat surfaces around the chamber and bolt holes should be flat and free of nicks and burrs that could cause misalignment or leaks.

(4) The idler gear should have flat, straight tips without nicks. It should have a smooth even polish on the teeth and end faces. Discard the gear if cracks are present.

(5) The gear running surfaces shall show two interconnecting polished circles without a step or roughness.

(6) Idler shaft diameter at the associated bushings must be smooth. Grooves, roughness, or a reduced diameter indicates fluid contamination and damaged bushings. If abnormally worn (in excess of normal polishing), both shafts and associated bushings must be replaced. The hydraulic system should be thoroughly flushed and the filter replaced before further operation of the hydraulic system.

R-6.3 Disassemble Main Housing.

a. Remove set screw (41, Figure R-2) securing valve keeper (42) to reversing spool (43). Remove the keeper.

b. Remove retaining ring (23) at opposite end of spool.

c. Push on retaining ring end of reversing spool and slide spool out of housing. remove two backup rings (44) and O-rings (45) from spool.

d. Remove trigger (34) by removing cap screw (33) and nut (5).

e. Unscrew and remove spool cap (37). Remove two O-rings (36, 38) and needle roller (35) from cap.

f. Remove valve spool assembly (39) (with internal reverse check ball assembly).

NOTE

The valve sleeve will remain in the main housing. It is not removable in the field. If the sleeve is damaged, return the main housing to your Stanley dealer.

g. Remove retaining ring (19) at bearing carrier end of main housing. Remove back-up washer (20), back-up ring contour (21) and O-ring (22). The O-ring is subject to severe service and should be replaced whenever main shaft is serviced.

h. Clean and inspect main housing. Replace any parts found to be defective.

(1) Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lint-free cloths.

(2) The gear running surfaces should show two interconnecting polished circles without a step or roughness.

R-6.4 Assemble Main Housing.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

a. Lubricate and install spring and spool assembly (items 35 through 40, Figure R-2) in main housing. There is a hex plug in one end of spool (39) to retain steel check ball and strut. This end of the spool must be installed first.

b. Lubricate and install two O-rings (36, 38) in spool cap (37), then screw cap into main housing. Tighten securely.

c. Lubricate and install needle roller (35).

d. Install trigger (34) using cap screw (33) and nut (5).

e. Lubricate and install one O-ring (45) on small diameter end of reversing spool (43). Install one back-up ring (44) on same end.

f. Insert large diameter end of reversing spool (43) into left side of spool bore of main housing (24). Insert spool far enough to expose its second O-ring groove on far side of main housing.

g. Lubricate second O-ring (45) and install on exposed groove in large diameter end of reversing spool. Install second back-up ring (44) on same end.

h. Push reversing spool to original (neutral) position.

i. Install retaining ring (23) onto large diameter end of reversing spool. Turn spool so that hole on small end points toward motor cap end of tool.

j. Install valve keeper (42) onto small diameter end of reversing spool. Install set screw (41) and tighten securely.

k. Lubricate and install spindle shaft O-ring (22) in main housing. Install back-up ring contour (21) and backup washer (20) and secure in place using internal retaining ring (19).

R-6.5 Assemble and Install Bearing Carrier.

CAUTION

Fill the bearing carrier (10, Figure R-2) with NOVATEX EP 1 Grease or equivalent before assembly of parts.

a. Install ball bearing (15) on spindle shaft (17) and secure in place using small external retaining ring (14).

b. Lubricate and install shaft seal (9) in bearing carrier (10). Make sure new seal is installed in same direction as original seal.

c. Install O-ring (13) in bearing carrier.

d. Position bearing carrier onto shaft far enough to install internal retaining ring (19).

e. Make sure spindle shaft is well lubricated and that woodruff key (18) is removed. Carefully position assembled bearing carrier against main housing (24), making sure shaft (17) does not damage O-ring seal in main housing.

f. Install flotation bracket (3) against face of bearing carrier and secure bearing carrier in place using four cap screws (2). The trigger guard (4) is fastened by two cap screws as shown in Figure R-2.

g. Connect lower section of trigger guard to main housing using nut (5) and cap screw (6).

R-6.6 Assemble Motor Section.

a. Grip main housing (24, Figure R-2) in a vise with pistol-grip handle in vertical position.

b. Inspect motor cap gear chamber (27), gears (30, 31), and bushings as specified in this section.

CAUTION

Fill the front hollow of the main housing with NOVATEX EP 1 Grease or equivalent before installing motor gears and motor cap.

c. Lubricate and install drive gear (30) and idler gear (31) in motor cap (27).

d. Install idler shaft (32) in idler gear (31).

e. Lubricate and install large O-ring (27a) in motor cap.

f. The spindle shaft (17) remains with bearing carrier (10) during disassembly. If carrier has been removed, it must be assembled and installed on main housing before motor cap can be installed.

g. Install woodruff key (18) on spindle shaft. Align keyway in drive gear (3) with woodruff key, then position assembled motor cap against main housing. Make sure that drive gear slides on spindle shaft so that woodruff key enters keyway in drive gear.

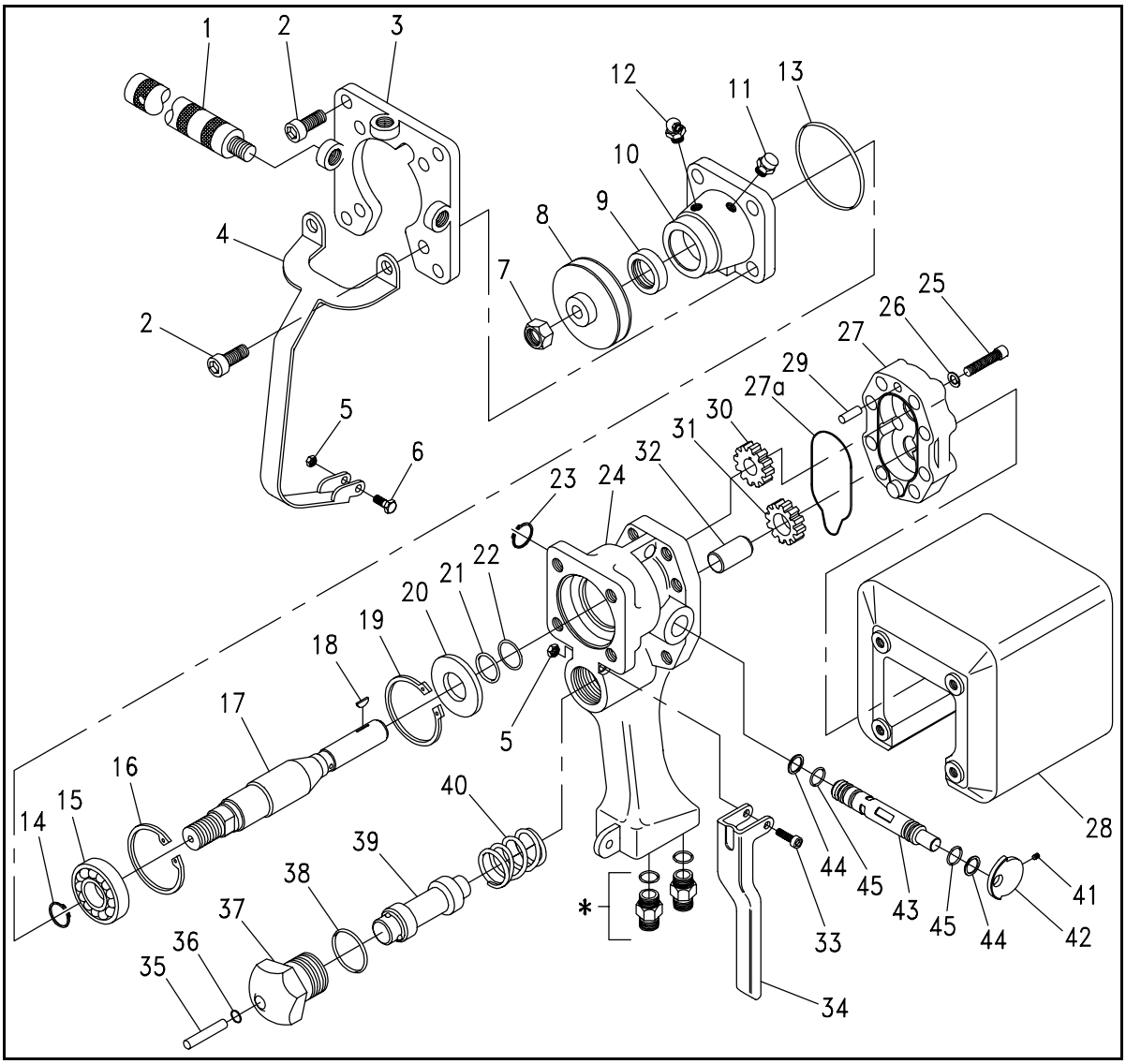
h. Lubricate and install eight socket head cap screws (25) and washers (26). Tighten to a torque of 22-25 lb. ft.

R-7 HOSES AND HOSE REELS.

For complete details concerning hoses and hose reels refer to Appendix X.

R-8 ILLUSTRATED PARTS LIST.

Figure R-2 illustrates the parts breakdown for the hydraulic brush.



* See Appendix X.

Figure R-2. Hydraulic Brush Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Hydraulic Brush	1	HB29301	54252
1	Handle, 9-in. Long	2	17699	54252
2	Cap screw	8	13815	54252
3	Flotation Bracket	1	17718	54252
4	Trigger Guard	1	12285	54252
5	Nut	2	07724	54252
6	Cap screw	1	12287	54252
7	Spindle End Nut	1	17690	54252
8	Brush/Disc Adapter Plate	1	17701	54252
9	Shaft Seal, J Crane “T”	1	17736	54252
10	Bearing Carrier	1	17705	54252
11	Pipe Plug	1	00961	54252
12	Grease Fitting	1	18088	54252
13	O-ring	1	00149	54252
14	Retaining Ring	1	17737	54252
15	Ball Bearing	1	17738	54252
16	Retaining Ring	1	17740	54252
17	Spindle Shaft	1	17769	54252
18	Woodruff Key	1	00772	54252
19	Retaining Ring	1	00166	54252
20	Backup Washer	1	07987	54252
21	Back-up Ring Contour	1	09396	54252
22	O-ring	1	17730	54252
23	Retaining Ring	1	09275	54252
24	Main Housing Assembly	1	12286	54252
25	Cap screw	8	01870	54252
26	Lock washer	8	00812	54252
27	Motor Cap Assembly (contains items 28 and 29)	1	17721	54252
27a	O-ring	1	08023	54252
28	Flotation Collar	1	17719	54252
29	Dowel Pin	1	08013	54252
30	Drive Gear	1	17700	54252
31	Idler Gear Assembly	1	17725	54252
32	Idler Shaft	1	07991	54252
33	Cap screw	1	00786	54252
34	Trigger	1	12283	54252
35	Needle Roller	1	06634	54252
36	O-ring	1	17733	54252
37	Spool Cap	1	08000	54252
38	O-ring	1	17732	54252
39	Spool Assembly. OC	1	13781	54252
40	Spring	1	08988	54252
41	Set Screw	1	00580	54252
42	Valve Keeper	1	17061	54252
43	Reversing Spool	1	08002	54252

Figure R-2. Hydraulic Brush Components (Sheet 2).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
44	Back-up ring	2	08015	54252
45	O-ring	2	17728	54252
-	Seal Kit (Includes Find Nos. 9, 13, 21, 36, 38, 44, and 45)	AR	17741	54252

Figure R-2. Hydraulic Brush Components (Sheet 3).

APPENDIX S

OPERATION AND MAINTENANCE PROCEDURES FOR THE SUMP PUMP WITH JETTING NOZZLE

S-1 DESCRIPTION.

The sump pump is a modified version of the Stanley model SM22 hydraulic sump pump. It is a hydraulic sump pump designed for high-volume operation, capable of up to 110-foot head, 500 gpm at 10-foot head, and can pass 3/8-inch solids. The jetting nozzle attachment adapts the pump for dredging operation capability. Figure S-1 illustrates a setup for a sump pump, using a hydraulic hose reel and a MK 9 Mod 0 hydraulic power unit (HPU). For maximum performance of pump, employ with NAVSEA Model 2 or Model 4 HPU.

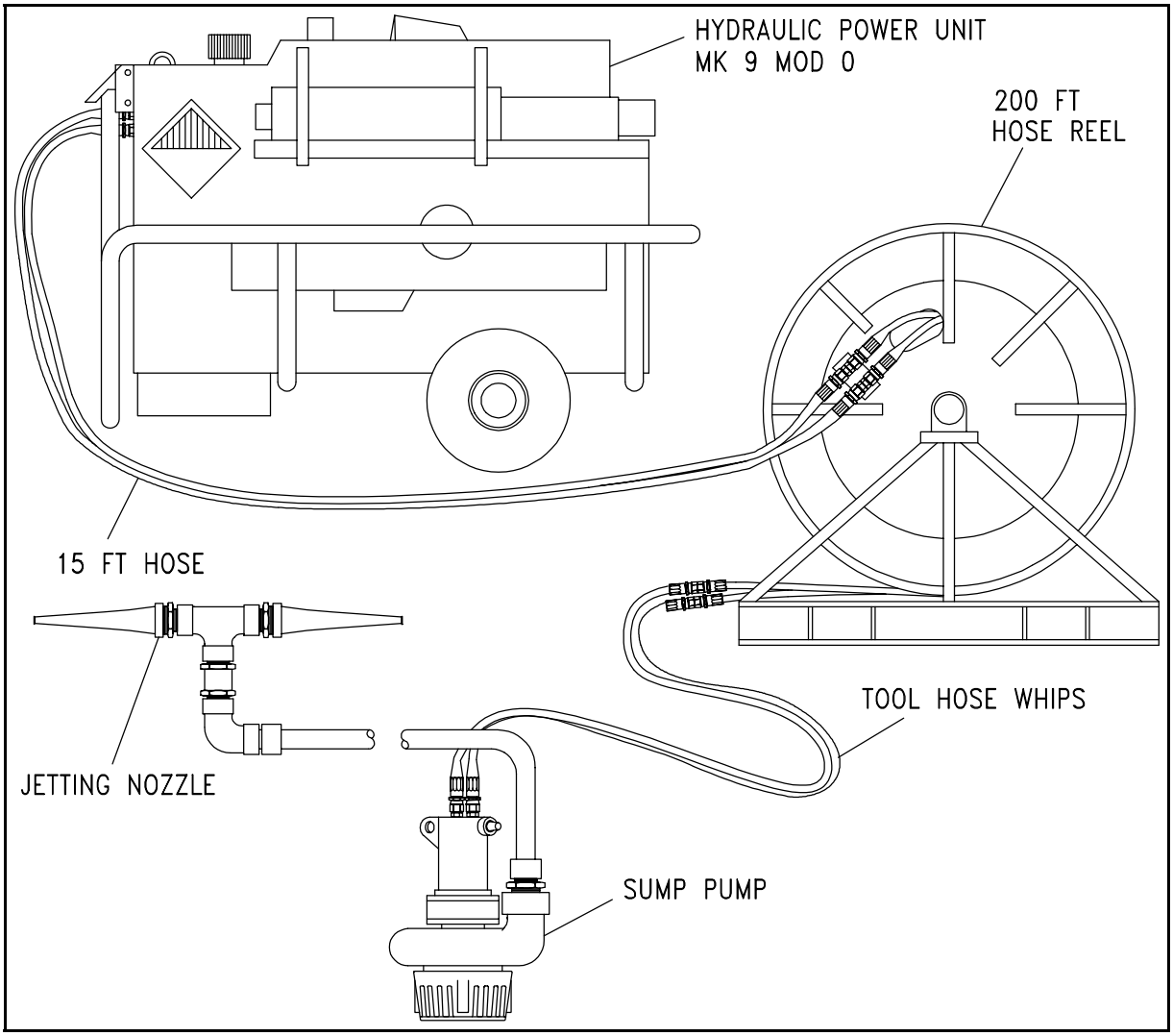


Figure S-1. Hydraulic Sump Pump Setup.

S-2 REFERENCE.

NAVSEA Drawing 5366572.

S-2.1 Technical characteristics for the sump pump are provided in Table S-1.

Table S-1. Sump Pump Technical Characteristics.

CHARACTERISTICS	REMARKS
System type	Open-center
Capacity	450 gpm
Weight	29 lbs in air
Length	13.5 inches
Width	11.75 inches
Pressure range	1000 to 2000 psi
Flow range	7 to 12 gpm
Optimum flow	11 gpm
Maximum operating depth	300 fsw
Porting	1/2 SAE pipe

S-3 MODIFICATION.

The sump pump includes an adaptation for connection to a firehose and jetting nozzle attachment.

WARNING

Positive communication shall be established between diver and topside before operating any tool underwater.

WARNING

Wear eye protection when using sump pump topside.

WARNING

Do not lift pump by pulling on hydraulic hoses. Use a suitable line secured through the eye in the motor housing. Do not put hand near suction screen while pump is running.

WARNING

Review current Authorized for Navy Use (ANU Publication) for any warnings, notes or comments associated with underwater tool and take appropriate measures. Failure to do so could cause injury or death to personnel.

S-4 OPERATION.

a. Verify that sump pump can operate safely within pressure (psi) and flow (gpm) capacity of HPU.

b. Position HPU and hose reel in close proximity to each other, relative to length of connecting hoses.

c. Remove sufficient amount of hose from hose reel to support planned task.

d. Start HPU. Refer to operating instructions for selected HPU to verify HPU pressure relief valve setting is 2000 psi. Adjust as required. Secure HPU flow.

NOTE

HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

e. Verify HPU outlet flow is zero.

WARNING

MIL-C-81309 water-displacing oils are extremely flammable. Keep from open sparks, fires, and flames. Use in a well-ventilated area.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

f. Ensure all quick-disconnect couplings are clean. If necessary, spray and clean all mateable surfaces with MIL-C-81309, wipe clean with a lint-free cloth, and respray.

g. Connect return and supply hoses between HPU and hose reel.

h. Connect sump pump hose whips to hose reel.

i. Set HPU flow rate not to exceed 9 gpm.

j. Test actuate sump pump.

WARNING

The HPU must be set to zero flow rate (gpm) before lowering sump pump to diver. HPU zero flow (gpm) is verified when pressure reading is indicated as zero (psi).

k. Set HPU flow (gpm) to zero prior to lowering tool to diver.

l. Connect discharge hose to pump outlet fitting.

m. Lower sump pump to diver.

n. Lower pump into liquid to be pumped. Locate outlet end of discharge hose to disperse liquid as required.

NOTE

Watch for solids in liquid being pumped. If solids are excessive, the discharge flow may decrease. If this happens, stop pump and check for cause of problem.

o. When pumping is completed, adjust HPU flow to zero. Remove pump from liquid.

S-5 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for sump pump Maintenance Requirement Cards (MRC).

S-6 TROUBLESHOOTING.

Refer to Table S-2 for sump pump troubleshooting.

Table S-2. Sump Pump Troubleshooting Guide.

TROUBLE	POSSIBLE CAUSE	REMEDY
Pump will not start.	No hydraulic flow or pressure. Defective quick-disconnect couplers. Impeller jammed with debris. Impeller rubbing against impeller cover. Defective hydraulic motor.	Turn on power unit and check that 7-12 gpm is available at the pump. Check each quick-disconnect coupling. Clean pumping chamber. Check and adjust the impeller clearance. Add cover shims as required. Repair or replace motor.
Pump plugs up with debris and shows rapid impeller wear.	Water velocity too slow to flush solids through the hose, therefore solids collect in hose and back up into volute portion of the pump.	Lift pump off silt bottom. Increase flow (gpm). Replace worn parts. Lower the elevation of hose discharge (discharge head).
Pump operates in reverse.	Hydraulic flow reversed.	Check that hoses are correctly connected to pump motor ports.
Poor pump performance.	Improper hydraulic oil flow. Pump inlet restricted. Pump settled to the bottom Discharge hose kinked or restricted. Water discharge hose too small. Water lift too high. Hydraulic flow not sufficient (11 gpm) to spin impeller fast enough. Impeller worn or damaged. Impeller cover worn or damaged. Hose used on suction side of pump.	Check that 7-12 gpm at 1000-2000 psi is available at pump. Hydraulic flow of 12 is required for maximum performance. Note: A 20 percent decrease in flow (below 11 gpm) can result in a 5- percent decrease in pump performance. Remove suction screen and clean thoroughly. Lift pump slightly off bottom. Straighten hose. Check for debris inside hose. Clean as required. Use 2-1/2 inch diameter fire hose. Lower outlet end of discharge hose. Verify hydraulic flow to pump is adequate. Check impeller for excessive wear. Replace impeller. Check impeller cover for damage or excessive wear. Replace. Do not use any plumbing on inlet to pump. Use pump with suction screen as designed.

S-7 CORRECTIVE MAINTENANCE.

Corrective maintenance includes: cleaning the pumping chamber, impeller and motor shaft seal functional check, impeller removal and replacement, volute removal and replacement, and motor removal, disassembly, reassembly, and replacement. Figures S-2, S-3, and S-4 illustrate the parts breakdown.

CAUTION

Before disassembling tool, clean exterior to aid in preventing foreign matter from entering tool interior.

CAUTION

Replace all seals exposed during disassembly. Note orientation of seals before removing them to ensure proper installation.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean MIL-G-24139A grease or equivalent to all parts prior to or during reassembly.

CAUTION

Never disassemble the tool unless proper troubleshooting procedures have isolated the problem to an internal part. Disassemble the tool only to the extent necessary to replace the defective part. Keep contaminants such as dirt and grit away from internal parts at all times.

CAUTION

When lubricating the tool, use clean lubricant and clean containers to prevent the entry of dirt into the tool's operating system.

S-7.1 Special Tools Required.

Table S-3 describes special tools required to perform corrective maintenance.

Table S-3. Special Tools Required.

TOOL	PART NUMBER
Stanley Bearing Puller	00933
Stanley Bearing Puller Kit	05064
Stanley Bearing Pusher	11916

S-7.2 CLEANING PUMPING CHAMBER.

NOTE

Debris such as weeds, sand and other solids may become trapped in pumping chamber. This can reduce pumping performance. It is important that pumping chamber be kept clean at all times.

a. Clean pump exterior.

b. Remove four hex head capscrews (27, Figure S-2) securing screen (26), impeller cover (25), and cover shims (24).

c. Remove all debris from screen (26), impeller cover (25), and pump volute (15). Do not remove impeller unless necessary for repair, replacement or to remove trapped debris.

d. Install cover shims (24) as required to obtain a 0.010-inch clearance between impeller (21) and impeller cover (25). Install screen (26). Using MIL-G-24139A, grease four 3/8-16 X 3-inch long hex head capscrews (27), and secure.

S-7.3 IMPELLER AND MOTOR SHAFT SEAL FUNCTIONAL CHECK.

a. Clean pumping chamber per paragraph S-7.2.

b. Secure pump so interior of pumping chamber is visible. Set up for operation per paragraph S-4.

c. Slowly turn “ON” the hydraulic power source and listen to pump operating in the air.

d. A “rough” sound accompanied with noticeable impeller shake and wobble normally signifies impeller shaft seal (17, Figure S-2) failure. Failure of this seal allows water to contaminate the hydraulic fluid and usually requires replacement of the bearing (14) and seal (17). If shaft (12) or seal sleeve (18) is worn at the bearing surfaces, it too must be replaced. After these repairs are completed, the hydraulic supply should be flushed out and filter replaced.

e. A smooth running pump showing excessive fluid loss from behind the impeller normally indicates either the automatic oiler is out of adjustment or the motor shaft seal has failed.

S-7.4 Impeller.

S-7.4.1 Remove.

a. Clean pumping chamber per paragraph S-7.2.

b. Secure impeller (21, Figure S-2) to prevent it from rotating. Remove arbor nut (23) (left-hand thread) and washer (22) holding impeller (21) to impeller shaft (12).

c. Remove impeller (21), hub bushing (20) (if installed), shims (24), closure seal (17), seal sleeve (18), and key (13) from impeller shaft (12). Take care not to lose key or shims.

S-7.4.2 Replace.

a. Using MIL-G-24139A, grease impeller shaft (12, Figure S-2) and install seal sleeve (18) and closure seal (17).

b. Place two impeller shims (24) (0.025 in thickness) against seal sleeve (18) on impeller shaft (12). Replace key (13), impeller (21), washer (22), and left-hand thread nut (23). Tighten while holding impeller (21). Do not force nut or impeller sideways while tightening.

c. Place four 0.010 cover shims (24) on cover (25) and then press them against volute face. Using a feeler gauge, check clearance between impeller (21) and impeller cover (25). Clearance should be between 0.005 and 0.020. Add or subtract shims as required to attain proper clearance.

d. Install inlet screen (26) and then secure with four 3/8-16 X 3 capscrews (27).

S-7.5 Volute.

S-7.5.1 Remove.

a. Remove impeller per paragraph S-7.4.1.

b. Remove two hydraulic adapters and O-rings shown in Figure S-2.

c. Remove three socket head capscrews (3, Figure S-2) securing motor housing (1) and adapter plate (9) to volute (15). Lift motor housing from adapter plate (9) and remove O-ring (4) from motor housing inlet/outlet.

d. Lift motor (6) and adapter plate assembly (9) from the volute (15). Take care not to lose key (7) at motor shaft end. Remove O-ring from adapter plate (volute side).

e. If bearing (14) and/or shaft (12) is to be replaced, remove as a subassembly by lightly tapping on small diameter end of shaft (12) while supporting volute (15). Use Bearing Puller (part number 00933) to remove bearing (14) from shaft (12).

f. Lubricate small diameter end of shaft (12). Support bearing (14) inner race and press shaft (12) through until bearing seats.

g. Lubricate volute (15) bearing bore and press bearing (14) and shaft (12) subassembly into bore using a sleeve with a diameter slightly smaller than the diameter of the bearing (14). Apply pressure only on bearing outer race.

S-7.5.2 Replace.

a. Using MIL-G-24139A, lubricate and install the O-ring (10, Figure S-2) on the volute (15) (in the groove around the lip). Grease motor shaft and install key (7) in shaft (12).

b. Align motor shaft (and key (7)) with impeller shaft (12) and place adapter plate (9) on volute (15).

c. Using MIL-G-24139A, lubricate and install O-ring (8) on lip (near inlet/outlet bore) of motor housing (1). Install motor housing (1) over motor (6) and align with adapter plate (9) and volute (15). Secure motor housing (1) and adapter plate (9) to volute (15) using three 3/8-16 X 2-1/4-inch long socket head capscrews (3).

d. Install two hydraulic adapters (5) to inlet and outlet ports of motor (6).

e. Replace impeller per paragraph S-7.4.2.

S-7.6 Motor

S-7.6.1 Remove.

a. Remove impeller and volute per paragraphs S-7.4.1 and S-7.5.1, respectively.

b. Remove two capscrews (11) from adapter plate (9) to free motor (6) and O-ring (8).

S-7.6.2 Replace.

a. Using MIL-G-24139A, lubricate and install O-ring on motor side of adapter plate (9). Using two 5/16-18 X 2-1/4-inch long socket head capscrews, secure adapter plate to motor assembly (6).

b. Replace volute and impeller per paragraphs S-7.5.2 and S-7.4.2, respectively.

S-7.6.3 Disassemble.

NOTE

The SM22 Sump Pump can have one of three motor assemblies: model 03001 (the original three piece motor assembly), model 06858 (a two piece motor assembly that replaced model 03001) and model 21451 (the current production two piece motor assembly). Motor assemblies 03001 and 06858 are no longer available as complete units; however, service parts are available. If a complete motor assembly is required, only the 21451 model can be ordered. Identify the motor used on your pump. Disassemble motor in accordance with Figure S-3 or S-4. General disassembly procedures for either motor follows:

a. Place motor assembly in a vise (with soft jaws) around front bearing housing/retainer. Make sure motor shaft is facing down.

b. On model 03001 motor assemblies only, scribe assembly marks across front and rear bearing retainers and gear housing. Make sure marks will be visible during assembly.

c. Remove eight socket head capscrews securing front bearing housing or front and rear bearing retainers to gear housing.

d. On model 03001 motor assemblies, gently pry rear bearing retainer and gear housing away from front bearing retainer. On model 06858 and 21452 motor assemblies, gently pry gear housing away from front bearing housing. Make sure you lift rear bearing retainer (model 03001) and/or gear housing straight off. Use inside groove provided at split between the parts to prevent scratches on the surface.

e. Remove two gears, motor shaft key (model 03001) or needle roller, and idler shaft.

f. Remove large face seal O-ring(s),being careful not to damage O-ring grooves or surrounding surfaces.

g. To remove motor shaft from front bearing retainer or front bearing housing, remove large retaining ring securing ball bearings. Place front bearing retainer or front bearing housing on a clean flat surface with clearance for bearing removal. Push on small end of motor shaft until shaft and bearings slide free. Be careful not to bend motor shaft.

h. The ball bearings should be removed only if they need replacing, since bearings are damaged during removal. To remove bearings from motor shaft, remove retaining ring and then press on threaded end of motor shaft while supporting outer race of bearings. Discard bearings.

i. Remove retaining ring securing shaft seal in ball bearing bore to service remaining parts.

j. To remove seal liner and associated parts on 03001 motor assemblies, insert small end of motor shaft through seal liner. Place a rag across gear face of front bearing retainer and blow air through small diameter motor shaft bearing using a shop air nozzle to force seal liner onto motor shaft for removal.

k. To remove seal from 06858 motor assemblies, use an appropriate O-ring service tool to pick it out of its bore. Make sure you do not damage seal surfaces. Also note the seal orientation.

l. On 21451 motor assemblies, after retaining ring is removed, gland, quad ring, and O-ring will drop out of front bearing housing.

m. To remove early needle bearings or bushing sleeves on 03001 motor assemblies, use collet (part number 05871) and actuator pin (part number 05872) along with slide hammer (part number 11931) These tools are available in bearing puller kit (part number 05064).

n. To remove larger bushings on 06858 and 21451 motor assemblies, use collet (part number 11930) and actuator pin (part number 05067) along with slide hammer (part number 11931)

S-7.6.4 Clean and Inspect Motor.

a. Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lint-free cloths.

b. The inside of the bushings should be gray in color. If a significant amount of yellow bronze is evident, bushing replacement is required. Inspect shafts for corresponding wear and replace as required.

c. The gear chamber bores and end faces around the bores should be polished, not rough or grooved. The flat surfaces around the chamber and bolt holes should be flat and free of nicks and burrs that could cause misalignment or leaks.

d. The idler gear should have flat, straight tips without nicks. It should have a smooth even polish on the teeth and end faces. Discard the gear if cracks are present.

e. The gear running surfaces should show two interconnecting polished circles without a step or roughness.

f. Main and idler shaft diameter at the associated bushings must be smooth. Grooves, roughness, or a reduced diameter indicates fluid contamination and damaged bushings. If abnormally worn (in excess of normal polishing), both shafts and associated bushings must be replaced. The hydraulic system should be thoroughly flushed and the filter replaced before further operation of the hydraulic system.

S-7.6.5 Reassemble.

a. All parts should be lubricated during assembly using MIL-G-24139A.

b. On 03001 motors, assemble seal liner assembly by installing outside diameter O-ring, quad ring and seal washer. Place idler shaft through seal liner; then loosely position the assembly in the seal bore of front bearing retainer (quad ring side down). Place seal liner washer over shaft; then carefully push seal liner into place. Install retaining ring. Remove idler shaft.

c. On model 06858 motors, carefully install shaft seal with lips facing gear side. Replace back-up washer and retaining ring.

d. The shaft and keyway must be deburred. The quad ring is larger than the shaft and gland. It must be heavily greased and compressed into the gland without twisting. Install greased O-ring on gland, then install gland into front housing.

e. To install ball bearings on motor shaft, support ball bearing inner race and press motor shaft through bearing inner race.

f. To install new DU bushing-sleeves on 03001 motor assemblies, use bearing pusher (part number 11916).

g. Place front bearing retainer/front bearing housing assembly on a smooth clean arbor press surface (protected from damage) with large bearing bore facing up. Position the piece so a clearance hole exists for the insertion of motor shaft.

h. Apply grease to motor shaft and keyway and then insert it through shaft seal. Using bearing pusher or a sleeve/socket with a diameter slightly smaller than the outside diameter of the ball bearing, press bearing assembly into place. Press only on outer race. Install ball bearing retaining ring.

i. Install motor shaft key (model 03001) or roller in keyway. Use a small amount of grease to keep motor shaft key or needle roller in place. Slide drive gear over key and shaft. Install idler shaft and gear.

j. Apply grease to face seal O-ring groove(s) and then install O-ring(s).

k. On 03001 motors, note the scribe marks made during disassembly; then carefully slide the gear chamber and rear bearing retainer into place.

NOTE

On 06858 and 21451 motors, note the screw hole pattern on both housings. They will only assemble one way.

l. Do not force parts together. With all parts aligned, carefully slide gear housing assembly over gears until it contacts front bearing housing assembly.

m. Turn motor shaft manually to check for free rotation. Install capscrews, then recheck rotation.

n. Install inlet and outlet fittings, connect to a hydraulic power source, and check for smooth running. When replacement of front bearing retainer, rear bearing retainer, or gear chamber has been made, motors will sometimes be tight and require “break-in”. This is accomplished by turning shaft while hydraulic pressure is applied, first at low pressure, then gradually raising pressure so as to burnish gear bore, both with and against the hydraulic pressure, until the motor starts and runs freely.

o. Adjust Automatic Oiler per paragraph S-7.7.

S-7.7 Automatic Oiler Adjustment

a. Remove impeller per paragraph S-7.4.1.

b. Remove three socket head capscrews securing motor housing and adapter plate to volute. Lift motor housing from adapter place and remove O-ring from motor housing inlet/outlet.

c. Lift motor and adapter plate assembly from volute. Take care not to lose key at motor shaft end. Remove O-ring from adapter plate (volute side).

d. Connect motor to a hydraulic power source. Stall motor by placing a wrench on motor shaft.

e. Oiler output is adjusted by turning lube screw with a hex wrench. Do not use a screwdriver. Turn clockwise to decrease or counter-clockwise to increase fluid flow until it is flowing at about one drop every two seconds.

f. Replace impeller per paragraph S-7.4.2.

S-8 HOSES AND HOSE REELS

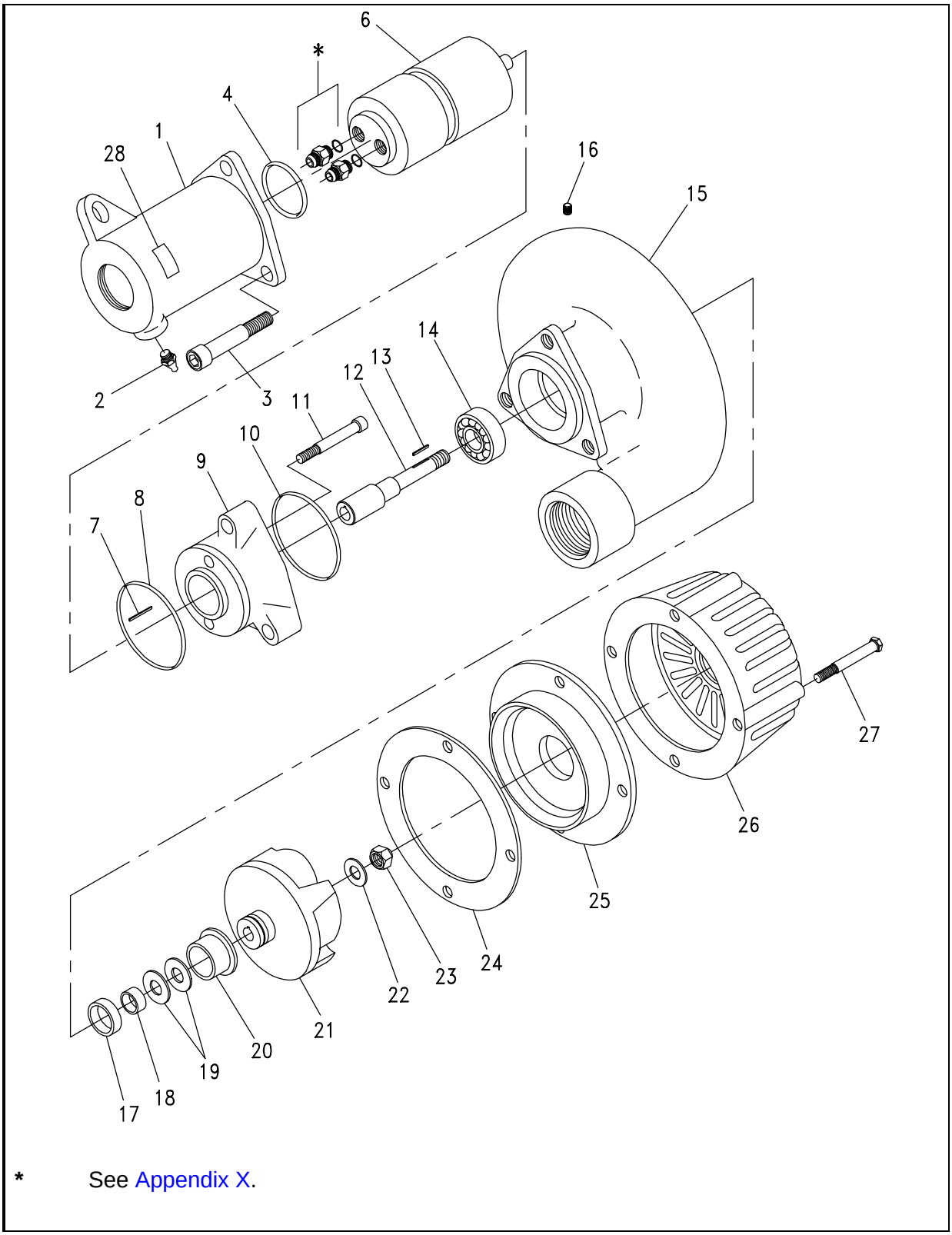
For complete details concerning hoses and hose reels refer to Appendix X.

S-9 ILLUSTRATED PARTS LIST

a. Figure S-2 illustrates parts breakdown for the sump pump.

b. Figure S-3 illustrates parts breakdown for motor 06858 and 21451.

c. Figure S-4 illustrates parts breakdown for motor 03001.



* See Appendix X.

Figure S-2. Sump Pump Components (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Hydraulic Sump Pump	1	SM22	54252
1	Motor Housing	1	01303	54252
2	Grease Fitting	1	01220	54252
3	Capscrew	3	01217	54252
4	O-ring	1	01205	54252
5	Not Used			
6	Motor Assembly	1	21451	54252
	Motor Assembly	1	06858	54252
	Motor Assembly	1	03001	54252
7	Key	1	01316	54252
8	O-ring	1	00466	54252
9	Adapter Plate	1	01302	54252
10	O-ring	1	01215	54252
11	Capscrew	2	00793	54252
12	Impeller Shaft	1	01321	54252
13	Impeller Key	1	01308	54252
14	Bearing	1	01218	54252
15	Volute	1	01301	54252
16	Pipe Plug	1	01219	54252
17	Closure Seal	1	01216	54252
18	Seal Sleeve	1	01309	54252
19	Impeller Shim	2	01320	54252
20	Hub Bushing	1	01307	54252
21	Impeller	1	01306	54252
22	Washer	1	01310	54252
23	Arbor Nut	1	01311	54252
24	Cover Shim	AR	01314	54252
25	Impeller cover	1	02815	54252
26	Screen	1	02784	54252
27	Capscrew	4	01208	54252
28	Sticker, GPM	1	09612	54252

Figure S-2. Sump Pump Components (Sheet 2).

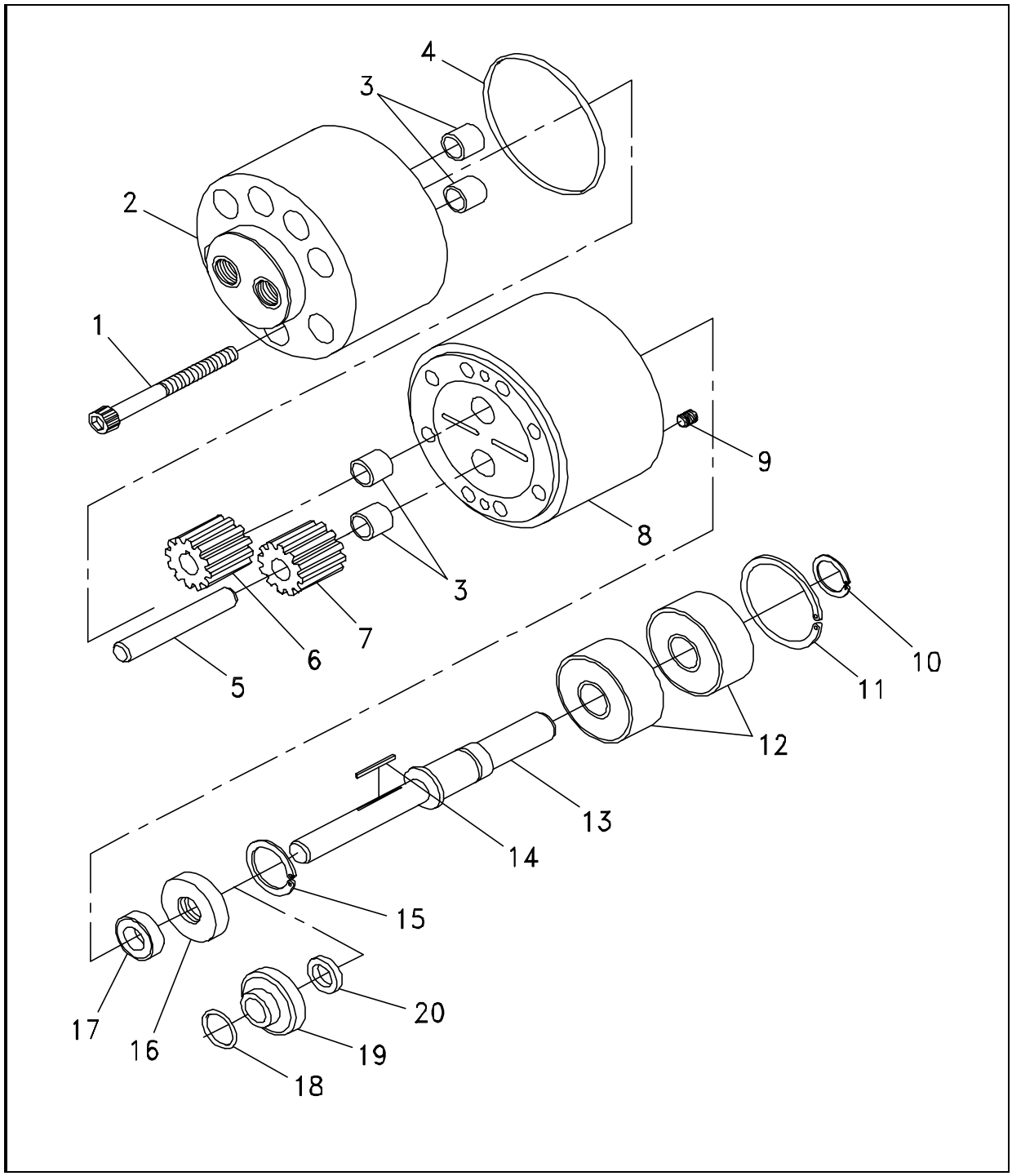


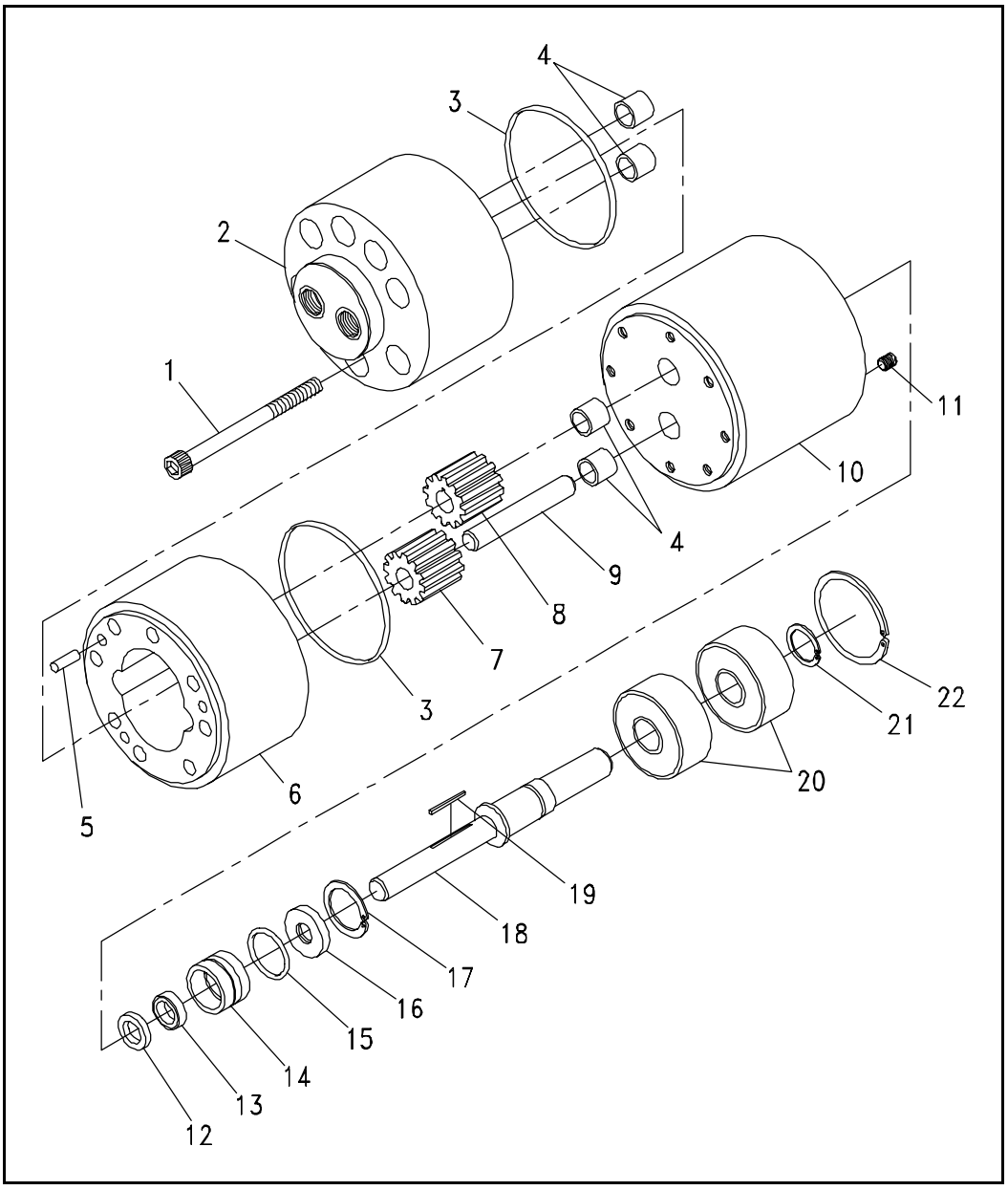
Figure S-3. Motor 06858 and 21451 (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Motor	1	06858	54252
	Motor	1	21451	54252
1	Capscrew	8	00612	54252
2	Gear Housing Assembly (includes item 3)	1	06857	54252
3	Bushing	4	06316	54252
4	O-ring	1	00178	54252
5	Idler Shaft	1	06854	54252
6	Drive Gear	1	06853	54252
7	Idler Gear	1	06855	54252
8	Front Bearing Housing Assembly (includes items 3 and 9)	1	21435	54252
9	Oiler Plug	1	06821	54252
10	Retaining Ring	1	00708	54252
11	Retaining Ring	1	00166	54252
12	Bearing	2	00148	54252
13	Motor Shaft	1	06859	54252
14	Needle Roller	1	06881	54252
15	Retaining Ring	1	00170	54252
16	Seal Washer (06858 only)	1	06304	54252
17	Seal (06858 only)	1	06315	54252
18	O-ring (21451 only)	1	00171	54252
19	Gland (21451 only)	1	19884	54252
20	Quad Ring (21451 only)	1	00669	54252

Repair kit (part number 07474) for motor 06858 or 21451 includes: 01218 - bearing, 01308 - key, 01309 - sleeve, 01316 - key, and 07475 - seal kit.

Seal kit (part number 07475) for motors 06858 or 21451 includes: 00178 - O-ring, 00466 - O-ring, 01205 - O-ring, 0-1215 - O-ring, 06315 - seal, 00669 - quad ring, 00171 - O-ring, 19884 - gland, 01216 – closure seal, and 07387 - service instructions.

Figure S-3. Motor 06858 and 21451 Components (Sheet 2).



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Motor	1	03001	54252
1	Capscrew 1/4 - 20 X 2-1/4 HSH stnls	8	00612	54252
2	Rear Bearing Retainer (includes item 10)	1	03426	54252
3	O-ring	2	00178	54252
4	DU Bushing and Sleeve	4	05459	54252
5	Dowel Pin	3	00611	54252

Figure S-4. Motor 03001 (Sheet 1).

ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
6	Gear Housing	1	00605	54252
7	Gear, Idler	1	00607	54252
8	Gear w/keyway, Drive	1	00608	54252
9	Idler Shaft	1	00606	54252
10	Front Bearing Retainer	1	03424	54252
11	Oiler Plug	1	00105	54252
12	Seal Washer	1	01203	54252
13	Quad Ring	1	00173	54252
14	Seal Liner	1	00172	54252
15	O-ring	1	00171	54252
16	Seal Liner Washer	1	00169	54252
17	Retaining Ring	1	00170	54252
18	Motor Shaft	1	00620	54252
19	Key	1	00609	54252
20	Bearing	2	00148	54252
21	Retaining Ring	1	00708	54252
22	Retaining Ring	1	00166	54252

Repair kit (part number 01150) for motor 03001 includes: 00148 - bearing, 00166 - retaining ring, 00169 - seal liner washer, 00170 - retaining ring, 00708 - retaining ring, 01316 - key, 01218 - bearing, 01308 - key, 01309 - sleeve, 00609 - key, and 01149 - seal kit.

Seal kit (part number 01149) for motor 03001 includes: 00172 - seal liner, 00173 - quad ring, 00178 - O-ring, 00466 - O-ring, 01203 - washer, 01205 - O-ring, 01215 – O-ring, and 01216 - closure seal.

Figure S-4. Motor 03001 Components (Sheet 2).

APPENDIX T

OPERATION AND MAINTENANCE PROCEDURES FOR THE BANDSAW

T-1 DESCRIPTION.

T-1.1 The portable hydraulic bandsaw is an oil driven hydraulic tool. The bandsaw can be used in the air or underwater to cut steel, aluminum, plastic, wood, rope, and cable. It is configured to cut up to 3-1/2 inches deep and 4-1/8 inches wide. Each bandsaw consists of a driven pulley section, a frame, a handle assembly, and a drive pulley section.

T-1.2 The driven pulley section contains a driven pulley and spindle; a blade guide with bearings; a mounting plate for a frame assembly; and a blade tensioning mechanism. The blade tensioning mechanism keeps proper tension on the saw blade so that it will not slip. The blade tensioning mechanism is also employed to release tension and move the pulley forward so the saw blade can be changed. The pulley housing is free floating between the mounting plate and the retainer plates. As the blade tensioning takeup handle is rotated, an eccentric on the takeup shaft moves the tension bar forward. The tension spring first moves the housing and driven pulley forward until they contact the blade, then the spring extends to properly tension the blade until the handle points forward. Detents in the pedestal keep the takeup handle from releasing tension on the blade.

T-1.3 The drive pulley section holds the drive pulley and spindle, the drive train, the rear blade guide, and the movable blade guard. It also supports the trigger and valve mechanism and serves as a motor mount.

T-1.4 The open-centered valve is directly attached to the hydraulic motor. The valve is controlled with a spring-loaded off trigger mechanism to prevent the saw from operating unless it is purposefully actuated by the diver-operator.

T-1.5 The hydraulic motor is a modified low speed, high torque motor and may be operated by a hydraulic power source capable of supplying a steady flow of at least 4 to 5 gpm at 1,000 psi. For general purpose use, the saw should be operated with a hydraulic fluid flow rate of 8 gpm with a fluid pressure of 300 to 800 psi, depending on the size and length of the supply hose. Maximum operating depth capability is 120 fsw.

T-2 MODIFICATIONS.

T-2.1 The Rockwell Model 9726 Porta Bandsaw has been modified with Civil Engineering Laboratory (CEL)-designed, corrosion resistant parts. Refer to CEL technical manual **Operation and Maintenance Instructions, Portable Hydraulic Bandsaw, Model 75-17-0178** for all operating and maintenance procedures.

T-2.2 The 3M Safety Walk has been applied to the drive pulley tire to develop adequate friction for driving the saw blade underwater.

T-2.3 The Char-Lynn motor output shaft has been modified to accommodate the chain driven system of the Porta Bandsaw.

T-3 OPERATION.

WARNING

Positive communication shall be established between the diver and the tender before operating the bandsaw.

WARNING

To avoid injury to the diver, open the hydraulic fluid recirculation valve to isolate the hydraulic fluid from the bandsaw while lowering the band-saw to the diver.

T-4 PRE-OPERATING PROCEDURE.

Set the hydraulic power to 8 gpm. Connect the hydraulic hose whips to the valve housing. As the hydraulic motor is fully reversible, no damage will result from reversing the hose whips. To ensure that the whips have been connected properly, turn the saw upside down and with the hoses connected to the hydraulic power supply, trigger the saw. The drive pulley should turn clockwise. If the drive pulley is rotating counterclockwise, reverse the hose whips.

T-4.1 Blade Selection. The saw blades supplied with the bandsaw have a blade selection guide printed on the package. Follow this guide for general cutting applications. If the saw blade is binding or catching, a finer tooth blade should be selected.

T-4.1.1 Disconnect the bandsaw from the hydraulic power unit.

WARNING

The hydraulic power source should be off or set for zero flow while the blades are being changed. Inadvertent triggering of the saw could result in serious injury.

T-4.2 Blade Installation. Install the blade either on the surface or underwater.

T-4.2.1 Rotate the blade tensioning handle until it points toward the frame assembly.

T-4.2.2 With the bandsaw upside down, rotate the safety shield clear and insert the saw blade into two blade guides.

T-4.2.3 Place the blade around the pulleys and into the rear blade guard.

T-4.2.4 Rotate the blade tensioning handle until it points forward, ensuring the handle engages with detents in the blade tension pedestal.

T-4.2.5 Reconnect the bandsaw to the hydraulic power unit.

T-4.2.6 With the hydraulic power unit set at a selected flow rate (normally 8 gpm), trigger the saw a few times to ensure that the blade is properly installed. For blade removal follow the blade installation procedure in reverse order.

T-5 OPERATING PROCEDURE.

WARNING

Never cut a cable that may be under tension without attaching a stopper to both sides of the intended cut. A taut cable whips when cut and may result in serious injury to the operator.

T-5.1 With hydraulic power unit set at the proper flow rate (normally 8 gpm), trigger the saw to ensure that it is operating.

T-5.2 Position the work stop against the work and push the saw forward until the blade contacts the work surface.

CAUTION

Excessive feed force may cause the saw blade to stop. Do not twist the saw, since this may cause the blade to stall or break.

NOTE

Pushing down on the saw is not necessary. The weight of the saw will feed the blade through the work.

T-5.3 Hold the saw vertically by the trigger and frame. Turn on the power to the saw.

T-5.4 Vertical and Overhead Cutting. Perform vertical and overhead cuts in the same manner except that the operator must provide the feed force when performing overhead cuts.

NOTE

The flush cutting attachments have been designed to cut reinforcing bars that are up to 1-1/8 inches in diameter and protrude from a flat surface.

T-5.5 Flush Cutting. If flush cutting is desired, follow the steps below.

T-5.5.1 Remove the retractable blade guard assembly from the rear housing. An access hole is provided in the movable part of the guard assembly so that the slide screws can be removed.

T-5.5.2 Remove the two blade guards, and replace them with PVC flush cutting guides.

T-5.5.3 Install the flush cut blade guide by bolting it to the front housing.

T-5.5.4 Note that the saw blade is not twisted anymore, resulting in limited depth of cut.

T-5.5.5 If the cut material is long enough to strike the rear blade, the cut will be angled.

T-5.5.6 If an angled cut is undesirable, another cut from the other side may be made to complete the flush cutting operation.

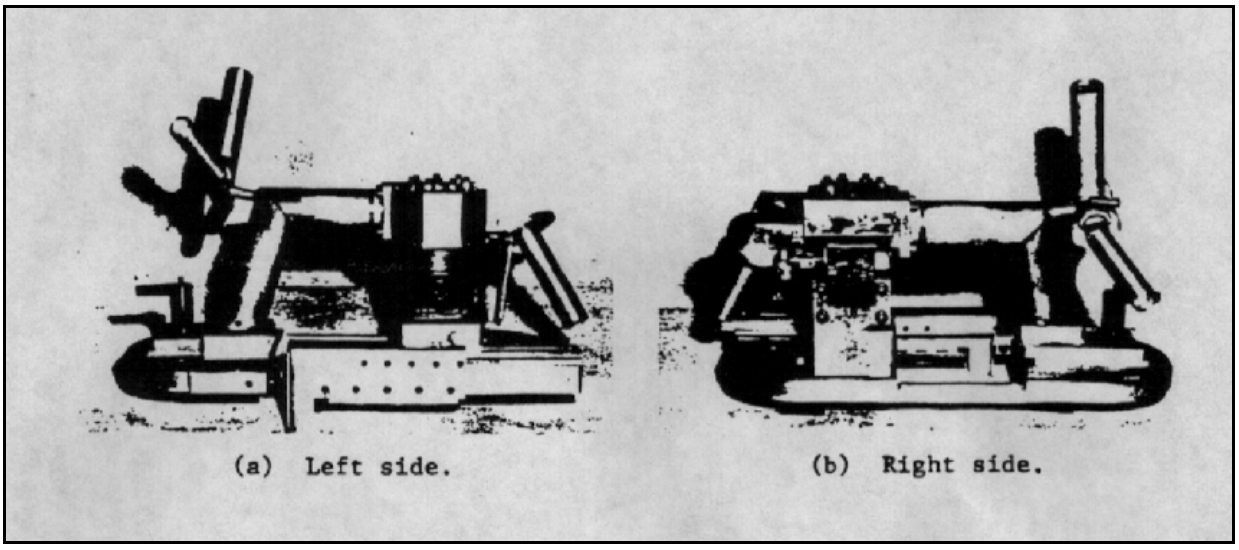


Figure T-1. Bandsaw.

T-6 SCHEDULED MAINTENANCE.

NOTE

The bandsaw does not have established Preventative Maintenance System (PMS) procedures.

T-6.1 After each underwater use the blade tensioning spring cavity should be greased until fresh grease comes out.

WARNING

MIL-C-23411 and equivalent water-displacing oils are extremely flammable. Keep from open sparks, fires and open flames.

WARNING

Do not puncture, incinerate, or store can above 120°F.

WARNING

Use in well-ventilated area only.

WARNING

MIL-C-23411 contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting, call a physician.

CAUTION

Care should be taken not to lubricate abrasive surface of drive wheel or saw blades as this will cause blade slippage.

T-6.2 After each underwater use, remove saw blade, wash saw with freshwater, and spray exposed metal parts with MIL-C-23411.

T-7 TROUBLESHOOTING.

T-7.1 Refer to Table T-1 for Portable Hydraulic Bandsaw Troubleshooting.

Table T-1. Portable Hydraulic Bandsaw Troubleshooting Guide.

Trouble	Possible Cause	Remedy
Slow sawing rate	Inadequate hydraulic flow rate. Blade not suitable for material being cut. Dull blade or broken saw teeth. Blade improperly installed. Improper rotation.	Check flow rate at power source. Check blade selection chart for proper pitch and blade hardness. Replace blade. Check running direction of blade teeth. Check hydraulic hookup; change motor rotation.
Saw running too slow for flow rate.	Spool valve not opening completely.	Check clearances at valve handle, fulcrum, and turnbuckle.
Blade slipping on drive pulley.	Blade tension not set correctly. Debris between 3M Safety Walk and blade. Safety Walk worn out.	Check tensioning device. Clean or replace Safety Walk. Replace Safety Walk.
Saw will not operate when valve handle is depressed	Safety Walk not installed. Blockage within hydraulic lines. Broken or slipped drive chain. Spool valve not opening. Valve blocked. Hydraulic motor failure.	Install Safety Walk. Check pressure at power source and if too high, look for restriction in hoses. Check chain through inspection hole in drive pulley housing. Check valve handle ports for damage and looseness. Disassemble valve. See Char-Lynn Manual.
Blade will not tighten on pulley.	Tension bar retaining ring slipped. Blade size incorrect.	Remove driven pulley and check retaining ring. Select proper blade (44-7.8 x 1/2 x 0.020 in blade).

T-8 CORRECTIVE MAINTENANCE.

CAUTION

Before disassembling the tool, clean the exterior to prevent foreign matter from entering the tool interior.

CAUTION

Replace all seals that were exposed during disassembly. Note the orientation of the seals before removing them, to ensure proper installation.

CAUTION

Before reassembly, clean all parts with degreasing solvent. Apply clean grease to all parts during reassembly.

T-8.1 Table T-2 is the Bandsaw parts list.

CAUTION

Do not use cloth to dry the motor parts. Lint will damage the motor parts.

T-8.2 Wash all motor parts in a clean solvent and dry them with compressed air.

T-8.3 During cleaning, inspect seal seats for scratches or other marks that might damage seal.

T-8.4 Cleaning

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes when in area using these chemicals. Ensure work area is well ventilated and away from flames or possible fire hazards.

WARNING

Avoid prolonged or repeated shin contact with cleaning solvents. Do not take these internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

T-8.4.1 All parts and fasteners, with the exception of the hydraulic motor, can be cleaned with most solvents.

T-8.4.2 If salt corrosion is noticed on the aluminum surfaces, remove the salt with fresh water and scrub the aluminum surfaces with a nonwire-bristled brush.

T-8.4.3 Solvents will dissolve the paint on the hydraulic motor, which is painted for corrosion protection. Therefore, the outside of the hydraulic motor should only be rinsed with fresh water, wiped clean, and dried.

T-8.4.4 If the solvent must be used to clean painted hydraulic motor parts, the solvent should be applied to those parts quickly by spraying and should be dried with compressed air. The solvent should not be allowed to remain on painted surfaces.

T-8.4.5 Cleanliness is important in the successful application of Loctite to the hydraulic motor.

T-8.5 Cleaning Procedure.

NOTE

Fully cured Loctite is resistant to most solvents, oil, gasoline, and kerosene; therefore, it is not affected by the cleaning operation.

T-8.5.1 Hydraulic Motor Maintenance.

Inspect all mating metal-to-metal surfaces (409, 418) for scratches or burrs that could cause leakage and replace all damaged parts.

CAUTION

Do not use a coarse grit or try to file or grind parts.

a. Ensure that all mating metal-to-metal surfaces are perfectly smooth as follows:

b. Ensure that the sharp edges have been removed from a piece of number 600 grit paper by rubbing it with a flat piece of scrap metal.

c. Place the grit paper on a smooth flat surface.

d. Place each surface on the grit paper and move it gently in a figure 8 motion several times.

e. Remove any burrs, nicks, or sharp edges around the shaft edges to prevent damage to the seal when reassembling.

f. Wash the motor housing with a nonpetroleum-base solvent to remove oil, grease, and debris. Petroleum-base solvents could leave a residue that would be detrimental to successful Loctiting. Pay particular attention to four tapped holes on the flange end of the motor housing.

NOTE

It is not necessary to remove cured Loctite that is securely bonded in the tapped holes; however, any loose particles of cured Loctite should be removed.

g. Blow dry the motor housing with compressed air. The tapped holes shall be clean and dry.

h. Wire brush the screw threads to remove any cured Loctite or other debris.

i. Wash the screw with nonpetroleum-base solvent. Blow dry with compressed air.

T-9 PARTS LIST.

Table T-2 is the parts list for the hydraulic bandsaw. Refer to the following for the complete hydraulic bandsaw assembly:

a. Figure T-2, Bandsaw Exploded View.

b. Figure T-3, Hydraulic Motor Exploded View.

c. Table T-2, Portable Hydraulic Bandsaw Parts List.

d. Table T-3, Char-Lynn Motor Technical Characteristics.

e. Table T-4, Char-Lynn Motor Parts List.

f. Table T-5, Portable Hydraulic Bandsaw Spare Parts List.

g. Figure T-4, NAVSEA dwg 5366568.

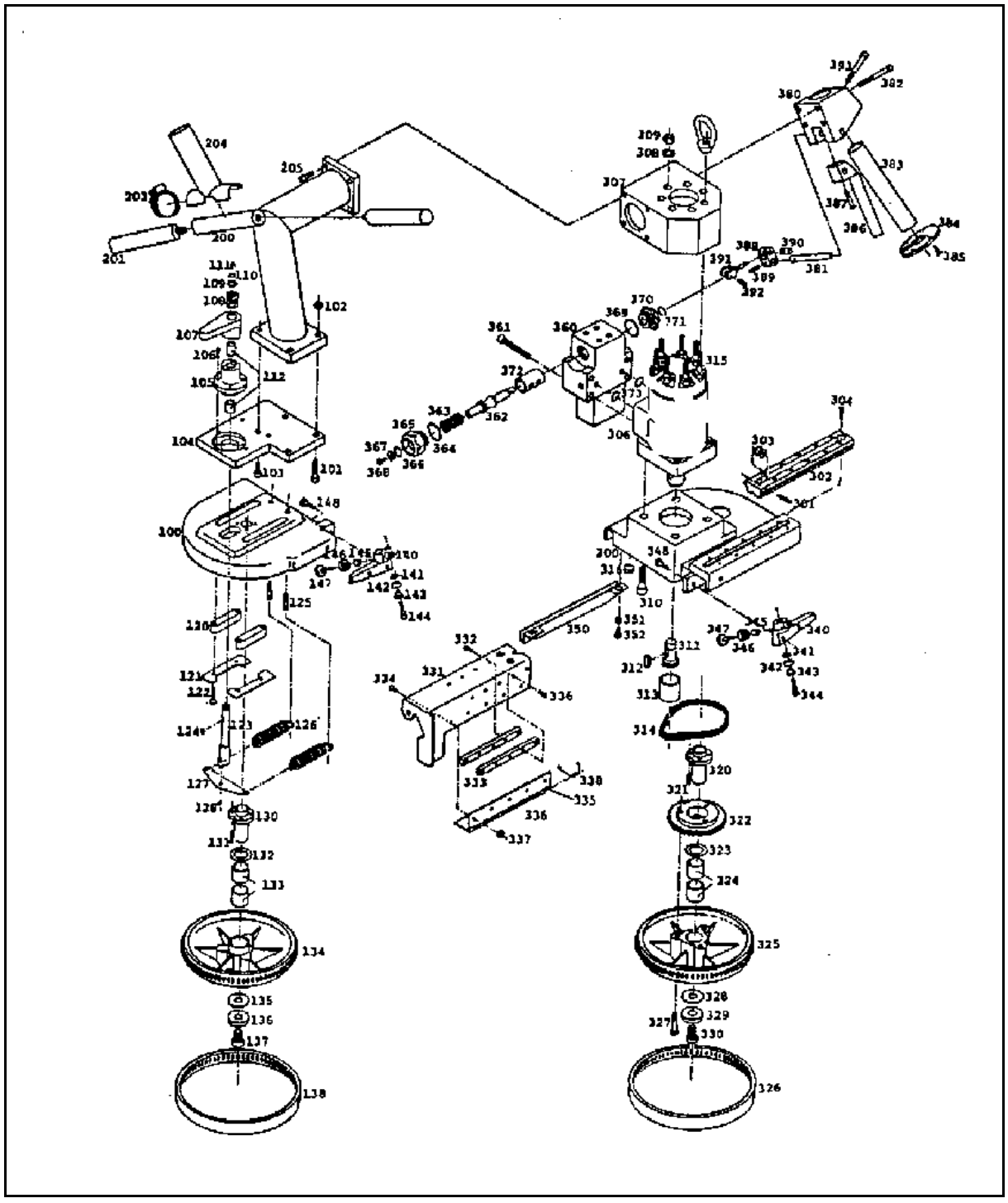


Figure T-2. Band Saw Exploded View.

Table T-2. Portable Hydraulic Bandsaw Parts List.

Item No.	Description	Qty	Manufacturer	Part No.
100	Housing, driven pulley	1	CEL	75-17-2F-1
101	Screw, 1/4-20 x 1-1/4 SOC HD	2		
102	Hex nut, 1/4-20	4		
103	Screw, 1/4-20 x 3/4, SOC HD	2		
104	Mounting plate	1	CEL	75-17-4F-15
105	Pedestal	1	CEL	75-17-4F-16
106	Screw, 10-24 x 1/2, RD HD	4		
107	Takeup handle	1	CEL	75-17-4F-6
108	Spring compression	1	Associated spring	c0600-049-0625
109	Springkeeper	1	CEL	75-17-4F-7
110	Snap ring, ext type (steel)	1	Truarc	5100-37H
111	Grease fitting	1	Alemite	1729
112	Bearing	2	Dixon Corp. CEL Mod	DRS-0609-4
120	Guide bar	2	CEL	75-17-4F-3
121	Retainer plate	2	CEL	75-17-4F-4
122	Screw, 8-32 x 3/8 FL HD	4		
123	Takeup shaft	1	CEL	75-17-4F--11
124	Woodruff key (steel)	1		No. 304
125	Spring anchor	2	CEL	75-17-4F-17
126	Extension spring	2	CEL	75-17-5F-4
127	Tension bar	1	CEL	75-17-4F-12
128	Snap ring, ext type (steel)	1	Truarc	5100-25-H
130	Spindle	1	CEL	75-17-4F-12
131	Screw, 8-32 x 3/8 FL HD	4		
132	Pulley shaft washer	1	Rockwell	803689
133	Bearing	2	Dixon Corp. CEL Mod	DRS 1014-6 75-17-4F-13
134	Driven pulley	1	Rockwell	44867
135	Pulley washer	1	Rockwell	803435
136	Pulley keeper	1	CEL	75-17-4F-9
137	Screw 5/16-18 x 1/2 SOC HD	1		
138	Pulley tire	1	Rockwell	44868
140	Front blade guide	1	Rockwell	863417
141	Spacer	1	CEL	75-17-5F-11
142	Roller	1	CEL	75-17-4F-22
143	Spacer	1	CEL	75-17-4F-24
144	Screw, 10-32 x 7/8 RD HD	1		
145	Bearing	1	CEL	75-17-4F-21
146	Roller	1	CEL	75-17-4F-18
147	Retaining Screw	1	CEL	75-17-4F-23
148	Screw, 1/4-20 x 3/4 HEX HD	1		
149	Screw, 1/4-20 x 1/2 HEX HD	1		
200	Frame assembly	1	CEL	75-17-4F-1
201	Extension handle	2	CEL	75-17-4F-2

Item No.	Description	Qty	Manufacturer	Part No.
202	Screw, 1/4-20 x 3/4 SOC HD	4		
203	Hose clamp	2		1-5/16 in
204	Auxiliary handle	1	CEL	75-17-5F-2
300	Drive pulley housing	1	CEL	75-17-2F-2
301	Rollpin (302 SS)	1	Atlantic	39-125-0875
302	Guard support	1	CEL	75-17-3F-7
303	Roller	1	CEL	75-17-3F-8
304	Screw, 6-32 x 7/8 FL HD	10	Bliss Co.	130-1/8 in
	Elastic cord (not shown)			
306	Hydraulic motor	1	Char-Lynn	101-1017-007
307	Motor fitting	1	CEL	75-17-4F-10
308	Washer, 5/16	6		
309	Hex nut, 5/16-18	12		
310	Screw, 3/8-16 x 7/8 SOC HD	4		
311	Jackshaft	1	Rockwell	802-265
			CEL Mod	75-17-3F
312	Key	1	CEL	75-17-3F-13
313	Key Retainer	1	CEL	75-17-3F-15
314	Chain	1	Rockwell	802524
315	Stud bolt	7	CEL	75-17-5F-6
316	Carbide disc	2	Newcomer	RNG42
320	Spindle	1	CEL	75-17-4F-12
321	Screw, 8-32 x 3/8 FL HD	4		
322	Driven sprocket	1	Rockwell	802375
323	Pulley shaft washer	1	Rockwell	803689
324	Bearing	2	Dixon Corp.	DRS 1014-6
			CEL Mod	75-17-4F-13
325	Drive pulley	1	Rockwell	44866
326	Pulley tire	1	Rockwell	44868
327	Screw 1/4-20 x 1-1/8 SOC HD	3		
328	Pulley washer	1	Rockwell	803435
329	Pulley keeper	1	CEL	75-17-4F-9
330	Screw, 4/16-18 x 1/2 SOC HD	1		
331	Safety guard	1	CEL	75-17-3F-4
332	Screw, 6-32 x 3/8 RD HD	5		
333	Guide	2	CEL	75-17-5F-9
334	Screw, 6-32 x 3/8 FL HD	5		
335	Hinge pin (include item 336)	1		
336	Shield	1	CEL Mod	MS20257-P5-600
				75-17-3f-6
337	Hex nut 6-32	5		
338	Spring	1	CEL	75-17-5F-10
340	Rear blade guide	1	Rockwell	863418
341	Spacer	1	CEL	75-17-5F-11
342	Roller	1	CEL	75-17-4F-22
343	Spacer	1	CEL	75-17-4F-24
344	Screw, 10-32 x 7/8 RD HD	1		
345	Bearing	1	CEL	75-17-4F-21
346	Roller	1	CEL	75-17-4F-18

Item No.	Description	Qty	Manufacturer	Part No.
347	Retaining Screw	1	CEL	75-17-4F-23
348	Screw, 1/4-20 x 1/2 HEX HD	1		
350	Rear Blade Guard	1	CEL	75-17-4F-19
351	Spacer	2	CEL	75-17-1F
352	Screw, 10-24 x 1/2 RD HD	2		
360	Valve housing	1	CEL	75-17-3F-5
361	Screw 5/16-18 x 1-7/8 SOC HD	2		
362	Spool	1	Stanley	131
363	Valve spring	1	Stanley	6
364	Spring cap O-ring	1	Stanley	74
365	Spring cap	1	Stanley	132
366	Spring cap quad ring	1	Stanley	173
367	Stop washer	1	Stanley	133
368	Stop washer screw	1	Stanley	134
369	Seal cap O-ring	1	Stanley	74
370	Seal cap	1	Stanley	130
371	Spool quad ring	1	Stanley	173
372	Valve sleeve	1	CEL	75-17-3F-2
373	O-ring	2	Parker	112
380	Rear handle fitting	1	CEL	75-17-3F-3
381	Valve shaft	1	CEL	75-17-3F-1
382	Screw, 1/4-20 x 2-1/8 SOC HD	2		
383	Rear handle	1	CEL	75-17-4F-20
384	Hand rest	1	CEL	75-17-5F
385	Screw, 1/4-20 x 1/2 FL HD	4		
386	Valve handle	1	CEL	75-17-4F-14
387	Screw, 6-32 x 7/8 RD HD	1		
388	Fulcrum	1	CEL	75-17-3F-10
389	Rollpin (302 SS)	1	Atlantic	39-125-0625
390	Anchor pin	1	CEL	75-17-3F-16
391	Tie rod	1	CEL	75-17-3F-9
392	Roll pin (302 SS)	1	Atlantic	39-125-0625
393	Screw, 10-24 x 1-5/8 SOC HD	2		

TABLE T-3. CHAR-LYNN MOTOR, MODEL 101-1017-007 TECHNICAL CHARACTERISTICS.

Gerotor	1/4 in
Displacement	3.0 (cu in/rev)
Speed	78 rpm per gal (theoretical) 885 rpm at max flow and continuous psi
Flow, maximum	12 gpm
Torque	47 in-lb per 100 (theoretical) 473 in-lb at continuous 15 gpm 735 in-lb at peak 15 gpm
Pressure Continuous Peak back pressure	 15.000 psi 2,250 psi 1,000 psi
Shaft load radial thrust	 1,000 lb

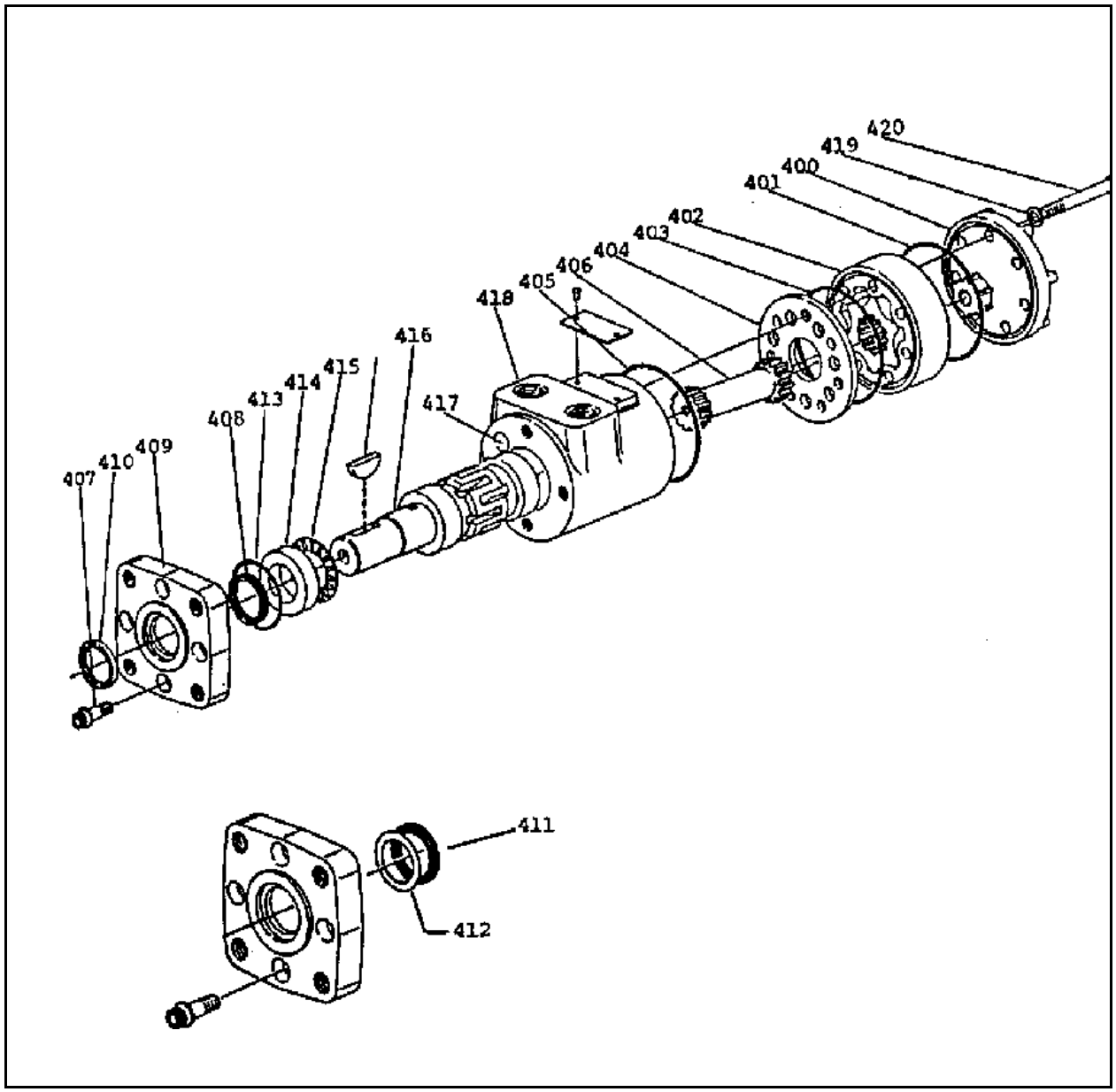


Figure T-3. Hydraulic Motor Exploded View.

TABLE T-4. CHAR-LYNN MOTOR, MODEL 101-1017-007, PARTS LIST.

Item No.		Description	Qty		Part No.
400		Cap, end	1		7461
401		Seal, O-ring (see note)	2		5776
402		Gerotor, set	1		7357-1
403		Seal, O-ring (see note)	1		5776
404		Plate, spacer	1		7358
405		Seal, O-ring (see note)	1		5776
406		Drive	1		602
407		Screw, cap 12 pt dr 5/16-12 NF x 7/8	4		5777
408		Seal, pressure	1		9057-1
409		Flange, mounting (4 bolt)	1		7464
410		Seal, dust (see note)	1		9055-1
411		Seal, quad ring (see note)	1		20599
412		Washer, back-up (see note)	1		5799
413		Seal, O-ring (see note)	1		15048
414		Race, bearing	1		7462
415		Bearing, thrust needle	1		7537
416		Shaft, output (keyed) CEL modified	1		7360-1
417		Plug, housing	1		20817
418		Housing	1		7359-3
419		Washer, seal (see note)	7		6049
420		Screw, cap 12 pt dr 5/16-12 NF x 1-1/2	7		5389-1
421		Seal, O-ring (see note)	1		15007
		Seal kit			60023

Note: Part contained in seal kit.

TABLE T-5. PORTABLE HYDRAULIC BANDSAW SPARE PARTS LIST.

Item No.	Description	Qty	Manufacturer	Part No.
126	Extension spring	2	CEL	75-17-54-4
108	Spring, compression	2	Associated Spring	75-17-1F-15
133/	Bearing	2	Dixon	1014-6
324			CEL Mod	75-17-4F-13
138/	Pulley tire	4	Rockwell	44868
326				
	Tire abrasive, strip	10	3M	
314	Chair	1	Rockwell	802524
366/	Quad ring, 3/8 x 1/2 x 1/16	8	Stanley	2-012
371				
364/	O-rings	8	Stanley	2-021
369				
	Seal Kit	2	Char-Lynn	60023
373	O-ring, 1/2 x 11/16 x 3/32	2	Parker	112
	Hose whips	2	Stanley	01652

APPENDIX U

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC HAMMER DRILL, HD 45

WARNING

The maximum operating time per diver per 24 hour period is 2 hours 9 minutes with SCUBA headgear, and 2 hours 49 minutes with MK 12 headgear.

U-1 DESCRIPTION.

U-1.1 The hydraulic hammer drill HD 45 is a heavy duty tool. This hydraulic hammer drill is commonly referred to as the rock drill. The hammer drill is used to drill test holes, set anchor bolts, and perform similar underwater functions. It drills 1/2-inch to 1 1/2-inch diameter holes, up to 30 inches deep, using standard carbide tipped fluted drills. The hammer drill has an adjustable (forward and reverse) bit rotation. This permits a choice of blows per minute or revolutions per minute ratios for easy starting of core drills and maximum penetration. The drill delivers 2,200 blows per minute. It will penetrate an average of 9 inches per minute using a 1/2-inch diameter bit in deep water. In shallow water, penetration will be slightly slower.

U-1.2 The hydraulic hammer drill gives the best penetration results when operated at 9 gpm with 54 pounds of additional weight.

U-1.3 The information presented in the following paragraphs is for the NAVSEA OOC supported Stanley Hydraulic Hammer Drill only. If the tool being used is not a Stanley Hydraulic Hammer Drill, follow the tool manufacturer's recommendations. Table U-1 provides technical characteristics.

U-2 OPERATION.

WARNING

Position communication shall be established between the diver and the tender before operating the hammer drill.

U-2.1 Preoperating Procedure.

U-2.1.1 Accumulator Checking. Check the accumulator for correct charge, using Stanley accumulator tester 02835 (see Figure U-1).

a. Holding the chuck end of the tester, turn the gauge counterclockwise until reaching the stop to ensure the valve is completely retracted.

TABLE U-1. HD 45 HYDRAULIC HAMMER DRILL TECHNICAL CHARACTERISTICS.

CHARACTERISTICS	REMARKS
System type	Open center (o.c.) or closed center (c.c.)
Weight	45 lbs (20.41 kg)
Length	22.5 in (57.15 cm)
Width	14 in (35.56 cm)
Pressure range	1,500-2,000 psi (105 -140 bar)
Flow range	7-9 gpm (26.50 - 34.07 lpm)
Optimum flow	8 gpm (30.28 lpm)
Porting	1/2 SAE

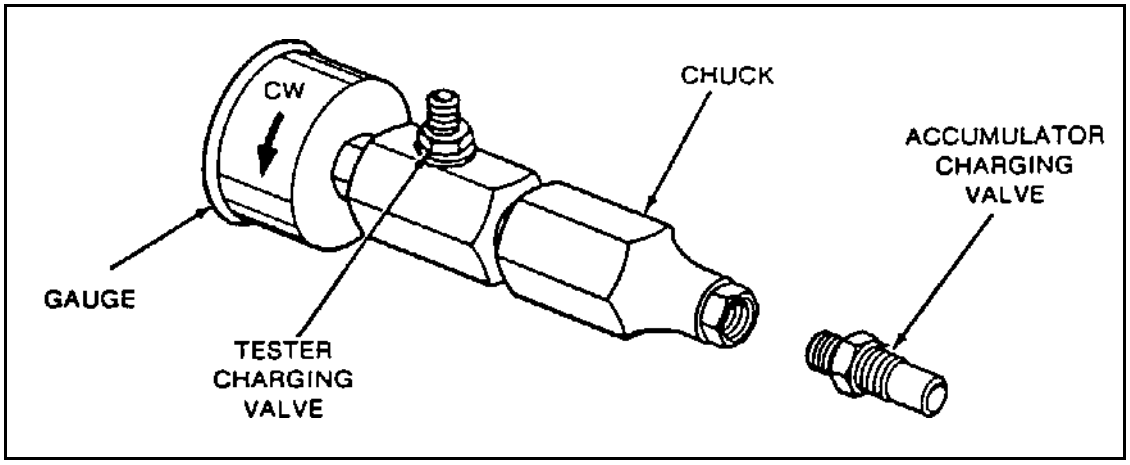


Figure U-1. Accumulator Tester.

b. Loosen the 5/8 hex charge valve nut 1-1/2 turns.

c. Thread the tester onto the charging valve of the accumulator. Do not advance the gauge end into the chuck end. Turn the tester as a unit.

d. Seat the chuck to the charging valve of the accumulator. Hand tighten only.

e. Advance the valve by turning the gauge end clockwise until a pressure is read on the gauge. The charge pressure should be 500-700 psi.

f. Reverse the above procedure to remove the accumulator tester.

U-2.2 Accumulator Charging. Charge the accumulator using the Stanley accumulator tester, Stanley charging assembly 06545, and a nitrogen bottle with 800 psi minimum charge as follows:

U-2.2.1 Follow the accumulator checking procedure in paragraphs U-2.1.1 through U-2.1.1.f.

NOTE

It may be necessary to adjust the regulator to 650-700 psi in order to overcome the pressure drop through the charging valve.

U-2.2.2 Attach the chuck from the nitrogen supply to the accumulator tester, or directly to the drill charge valve, and charge the accumulator to 600 psi.

U-2.2.3 Reverse the above procedure.

U-3 OPERATING PROCEDURE.

Observe all safety precautions.

WARNING

During the operation of this tool a wet suit must be worn.

WARNING

Do not allow fingers to come between the latch and drill steel when closing the latch.

U-3.1 The hammer drill is designed for use with 1-inch to 2-inch diameter bits. Select the appropriate drill bit for the job. To install the drill bit, pull the latch at the foot of the tool and insert the drill bit into the drive hex. Push the latch back into the latched position to lock the bit in place.

NOTE

The rotation of the drill bit is reversible. Drill bit speed can be varied by rotating the lever on the lower section of the tool. The tool is in neutral when the lever is in the vertical position. The lever can be rotated 90 degrees to the horizontal position in either direction and the distance that the lever is rotated determines the speed of the bit. The direction in which the lever is rotated determines the direction in which the bit will rotate. The horizontal position in either direction is the maximum speed setting.

U-3.2 Select the speed of the bit that is best suited for the material being drilled. Drilling is generally best accomplished with the lever halfway between its horizontal and vertical positions.

CAUTION

The Hydraulic Hammer Drill is not suitable for drilling steel or wood.

U-3.3 Squeeze the trigger to start the drill. Adequate down pressure is very important.

U-3.4 Start the drill bit into the work surface by partially depressing the trigger. The piston will cycle at a low rate and permit an easier starting operation.

U-3.5 Pull the drill out of the hole periodically while the bit is still rotating. This will clear the hole to permit more efficient penetration.

U-3.6 Reverse the direction of the bit rotation when the bit binds in the hole. Keep the drill bit centered in the hole.

CAUTION

Damage to the hydraulic system or drill can result from use with oil that is too viscous or thick.

U-4 SCHEDULED MAINTENANCE.

NOTE

If the hydraulic hammer drill is a tool supported by NAVSEA OOC, it already has an established Preventative Maintenance System (PMS). All other hydraulic hammer drills require that maintenance procedures be established in accordance with the **Ships' Maintenance and Material Management (30M) System Manual** guidelines, incorporating any manufacturer's maintenance specifications.

Refer to Maintenance Index Page (MIP) 5971 for applicable maintenance Requirement cards (MRC's).

U-5 TROUBLESHOOTING.

Refer to Table U-2 for hammer drill troubleshooting.

U-6 CORRECTIVE MAINTENANCE.

CAUTION

Before disassembling the tool, clean the exterior to prevent foreign matter from entering the tool interior.

CAUTION

Replace all seals exposed during disassembly. Note the orientation of the seals before removing them, to ensure proper reassembly.

CAUTION

Before reassembly, clean all parts with a degreasing solvent. Apply clean grease to all parts during reassembly.

Table U-3 lists the tools, parts, and materials required.

U-6.1 Hydraulic Hammer Drill Disassembly.

Refer to Figure U-2 for item number identification.

U-6.1.1 Secure the drill in a bench vise, with the **IN** and **OUT** ports belonging to the accumulator valve block assembly facing up. Clamp onto the flow sleeve tube (23) between the side rods (7).

TABLE U-2. HYDRAULIC HAMMER DRILL TROUBLESHOOTING GUIDE.

Trouble	Possible Cause	Remedy
Hammer drill does not run.	Power unit not functioning. Couplers or hoses blocked. Pressure and return line to hoses reversed at ports. Mechanical failure of piston or automatic valve.	Check power unit for proper flow and pressure, 7-9 gpm at 1,500-2,000 psi. Remove obstruction. Be sure hoses are connected to the proper ports. Disassemble drill and inspect damaged parts.
Hammer drill does not drill effectively.	Power unit not functioning. Couplers or hoses blocked. Accumulator charge-pressure hose pulses more than normal. Oil too hot or above 150°F.	Check power unit for proper flow and pressure, 7-9 gpm at 1,500-2,000 psi. Remove obstruction. Recharge accumulator. Replace diaphragm if charge loss continues. Provide cooler to maintain proper oil temperature, 100°F-130°F.
Hammer drill operates too slowly.	Low gpm supply from power unit. High back pressure. Couplers or hoses blocked. Orifice plug blocked. Oil too hot--above 150°F or too cold--below 60°F. Relief valve set too low.	Check power unit for proper flow, 7-9 gpm. Check hydraulic system for excessive back pressure, over 250 psi. Remove obstruction. Remove obstruction. Check power unit for proper oil temperature. Bypass cooler to warm oil up, or provide cooler to maintain proper temperature. Adjust relief valve to 2,100-2,250 psi.
Hammer drill gets hot.	Hot oil going through tool.	Check power unit. Be sure flow rate is not too high, causing part of oil to go through the relief valve. Provide cooler to maintain proper oil temperature of 100-130°F. Eliminate flow control devices. Check relief valve setting.
Oil leakage on gad.	Lower piston or drive hex seal failure.	Replace seals as needed.
Oil leakage around trigger.	Valve spool seal failure.	Replace seals as needed.
Low rotation torque.	Motor not completely broken in. Damage to motor clearances. Mechanical binding during drilling.	Continued operation or break-in with motor break-in block will correct. Repair as required. Take care to guide drill straight. Clear the hole frequently.

NOTE

The drill is full of oil, which will drip from the **IN** and **OUT** ports when the hoses are removed.

U-6.1.2 Remove the two hose assemblies (38) and its associated O-rings (A), orifice plug (31), three pipe plugs (47) and set screw (40).

U-6.1.3 Remove the charge valve cap (35) and its associated O-ring (B), trigger (2), and two spiral pins (5) which are connected to the top of the handle (1).

U-6.1.4 Discharge the accumulator valve block assembly (15) by removing the charging valve (4).

TABLE U-3. TOOLS, PARTS, AND MATERIALS REQUIRED.

Stanley seal replacement kit 05839.
Accumulator tester 02835.
Accumulator charge kit 06545.
Soft jaw vise.
Plastic or rubber hammer.
Stanley tamper sleeve tool 01120.
Stanley flow sleeve removal tool 04919.
Stanley flow sleeve removal tube 04910.
Arbor press.
Stanley accumulator cylinder puller 05640.
Stanley latch removal tool 05045.
Stanley bearing puller kit 05064.
Stanley bearing installation tool 05044.
Stanley bearing installation tool 05061.
Stanley latch installation tool 05879.
Stanley latch installation tool 05062.

U-6.1.5 Remove the cap screws (6), lock nuts (8) and side rods (7).

U-6.1.6 Remove the handle assembly (1) to expose the two valve spools (3) and the accumulator diaphragm (14).

U-6.2 Handle Grip Replacement.

U-6.2.1 Remove the handle grips (37) and clean the handle (1).

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure work area is well-ventilated and away from flames or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

U-6.2.2 Wash the new grips (37) with a solvent and follow with soap and water. Dry the handle grips thoroughly.

CAUTION

Do not lubricate the new handle grips. They will not be secure on the handle if any grease or oil is used.

U-6.2.3 With the grips (37) and handle (1) clean and dry, simply push the new grips onto the handle.

U-6.2.4 Remove the motor assembly by hitting the top of the flange with a plastic or rubber hammer.

U-6.2.5 Remove the accumulator valve block (15) by tapping on its underside with a plastic or rubber hammer. Tap on the alternate sides to ensure that the valve block comes off straight, without binding.

U-6.2.6 Remove the piston (26) from the flow sleeve (25) assembly.

U-6.2.7 Remove the accumulator diaphragm (14) and the charging valve (4) from the accumulator valve block (15), taking care not to damage the valve stem. The valve, bushing (12), and the associated rod wiper (9) and O-rings (10,11) will come out as an assembly. Turn the valve block upside down to remove the valve spring (13).

U-6.2.8 Clamp the accumulator valve block (15) in a bench vise with the **IN** and **OUT** ports up, being careful not to overtighten and distort the block.

U-6.2.9 Remove the porting block (16) with a Stanley tamper sleeve tool 01120. Remove and replace the O-ring (17) and backup ring (20).

U-6.3 Flow Sleeve Disassembly.

U-6.3.1 Remove the piston (26) if it was not previously removed.

U-6.3.2 Place the flow sleeve (25) assembly, automatic valve body (18) down, on the flow sleeve removal tool 04919. This, in turn, is placed on the flow sleeve removal tube 04910.

CAUTION

Use a rag in the bottom of the removal tube to protect the automatic valve body when it drops out.

U-6.3.3 Push on the flow sleeve (25) to remove the automatic valve body (18) and roll pin (19) with an arbor press using a Stanley accumulator cylinder puller 05640 to protect the flow sleeve.

U-6.3.4 Remove the automatic valve (22). This will cause the push pins (24) from the flow sleeve and push pins (21) from the automatic valve body (18) to come out.

U-6.3.5 Remove the automatic valve body (18), associated O-ring (17), and backup ring (20) from within the flow sleeve tube (23).

CAUTION

Use a rag in the bottom of the flow sleeve removal tube to protect the flow sleeve when it drops out.

U-6.3.6 Continue pushing on the flow sleeve (25) until it drops out.

U-6.3.7 Remove and replace the O-ring (27), cup seal (28), seal washer (29) and piston cup seal (30) in the motor control block (63). This, in turn, will allow the roll pin (69) to be removed.

U-6.4 Drive Motor Disassembly.

U-6.4.1 Place the motor on an aluminum plate in the arbor press, with the latch (64) end up.

U-6.4.2 Depress the spring backup (62) with the Stanley latch removal tool 05045.

U-6.4.3 Remove the wire retaining ring (67) and relax the wave springs (65). remove the latch (64), latch washers (66), 8 wave springs, and spring back-up (62).

U-6.4.4 Place the motor in a vise. do not overtighten.

U-6.4.5 Remove the cap screws (34, 39).

U-6.4.6 Remove the idler gear (49), drive gear (57), dowel pins (50), O-ring (52) and key (55).

U-6.4.7 Remove backup ring (36), quad ring (53), thrust backup washer (60) and thrust washer (59) from the drive (54).

U-6.4.8 Push the drive hex (54) through the drive motor control block (63) end of the drive motor chamber (56). Remove the roll pins (68) and O-ring from the motor chamber. Remove the gasket (61) from the drive motor control chamber.

U-6.4.9 Remove the bearings (48,58) as required using the Stanley bearing puller kit 05064. Remove the quad ring (53) and backup ring (36) from the groove in the motor plate (51).

U-6.4.10 Loosen the set screw (44) in the lever (45) and remove the lever.

U-6.4.11 Remove the retaining ring (46), washer (43), and O-ring (42).

U-6.4.12 Reattach the lever (45) and set screw (44).

U-6.4.13 Pull out the motor control valve (41) and the two roll pins (19) from the drive motor control block (63).

U-6.4.14 If the drill is repainted after servicing, do not allow paint to enter the **IN** and **OUT** ports or core of the motor assembly.

U-6.5 Hydraulic Hammer Drill Reassembly.

Refer to Figure U-2 item number identification.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure work area is well ventilated and away from flames or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

U-6.5.1 Clean all parts with a degreasing solvent.

CAUTION

Ensure that all seals that were exposed have been replaced with new parts.

CAUTION

Apply clean grease or O-ring lubricant to all parts during reassembly.

U-6.5.2 Motor Reassembly.

a. Support the four corners of the motor plate (51) and level the motor plate in an arbor press.

b. Press the two bearings (48, 58) in place on the motor plate (51) using Stanley bearing installation tools 05044 and 05061 with their split lines facing each other. Make sure that the bearings go in straight.

c. Place the motor plate (51) on an aluminum plate, with the latch (64) end up, in an arbor press.

d. Install the latch parts with Stanley latch installation tools 05879 and 05062, in the following order: Latch (64) in the open position, latch washer (66), four wave springs (65), second latch washer, four additional wave springs, spring backup (62), assembly guide, and wire retaining ring (67).

e. Place the bearing installation tool over the guide and press with an arbor press until the wire retaining ring (67) snaps into place.

f. Install the two remaining bearings (48, 58) into the motor chamber (56) in the same manner as they were installed in the motor plate (51). Separate support at the four corners is not necessary.

g. Slide the drive hex (54) through the motor chamber (56) from the motor control valve side (41).

h. Place the key (55) in the drive hex (54) and slide the drive gear (57) in place. Then slide the idler gear (49) in place.

i. Insert the O-ring (52) in the irregular groove of the motor chamber (56) and apply grease to retain the O-ring in place.

j. Place the quad ring (53) and back-up ring (36) through the bearing (58) and into the groove of the motor plate (51), with the lips of the quad ring facing the gear (57).

k. Slide the motor plate (51) over the drive hex (54) until it mates with the motor chamber (56). Then align the motor plate and motor chamber with the dowel pins (50) and idler gear (49).

l. Secure with cap screws (34). Torque to 25 foot-pounds.

m. Place the thrust washer (59), thrust back-up washer (60), quad ring (53), and back-up ring (36) over the exposed drive hex (54) on the motor control valve (41) side of the motor chamber (56), gray or brass side down. Then add the thrust backup washer (60), small diameter out.

n. Put the gasket (61) on the drive motor control block (56) adding a light coating of oil to retain it in place. Then align the gasket with the roll pin (68) and hole.

o. Install a new quad ring (53) into the counterbore of the motor control block (63), with the lips facing out. Install two new O-rings (70) into the counterbore of the motor chamber

(56).

p. Push the motor control block (63) over the drive hex (54), align it with the roll pins (68), and push it squarely with an arbor press until the block is mated with the motor chamber (56).

q. Install the cap screws (39). Torque to 60 foot-pounds. Place the roll pins (19) into the drive motor control block (63).

r. Install the motor control valve (41), followed by the O-ring (42), washer (43), large diameter of its taper facing up, and the retaining ring (46). Make sure the retaining ring is properly seated in its groove. Tapping on the ring with a small punch is sometimes required to seat the retaining ring.

s. Replace the lever (45), making sure the set screw (44) enters the hole in the valve (41) stem.

t. Align the roll pin (69) in the motor control block (63) with the corresponding hole in the flow sleeve (25). Place the piston cup seal (30) in the motor control block, lips facing down, followed by the seal washer (29) and cup seal (28), lips facing up. Install the O-ring (27) on the motor control block.

u. Place the Stanley flow sleeve removal tool 04919 on the base of the arbor press.

v. Lubricate the entire bore of the flow sleeve tube (23), and position it over the Stanley flow sleeve removal tool 04919 with the O-ring (17) and backup ring (20) groove up.

w. Press the flow sleeve (25) into the flow sleeve tube (23), using a Stanley accumulator cylinder puller 05640 to protect the flow sleeve, until it is flush with the flow sleeve tube. Do not seat the flow sleeve on the Stanley flow sleeve removal tool 04919.

x. Install the push pins (24) (three not shown), tapered end up, in the flow sleeve (25).

y. Install the push pins (21), (one not shown), tapered end up, in the automatic valve body (18).

z. Install the automatic valve (22), small diameter first, into the automatic valve body (18).

aa. Align the roll pins (19) and place the automatic valve body (18), with the side holes up, on top of the flow sleeve (25). Allow the automatic valve (22) to drop and pilot into the bore of the flow sleeve.

ab. Push the automatic valve body (18) into the flow sleeve tube (23) until the shoulder stops on top of flow sleeve tube. Use a Stanley accumulator cylinder puller, 05640, to protect the parts.

ac. Install the piston (26), small end first, into the flow sleeve (25) assembly from the automatic valve body end (18).

ad. Align the roll pin (19), and install the porting block (16), new O-ring (17), and new backup ring (20) into the flow sleeve (25) assembly.

ae. Place the accumulator valve block (15) in a bench vise. Do not overtighten and distort the block.

af. Install the spring (13) and the appropriate valve spool (3).

ag. Install the O-ring (11), bushing (12), O-ring (10), and the rod wiper (9) facing out. The bushing should project 0.200 inches.

WARNING

MIL-C-23411 and equivalent water-displacing oils are extremely flammable. Keep from open sparks, fires, and open flames.

WARNING

Do not puncture, incinerate, or store can above 120°F.

WARNING

Use in well-ventilated area only.

WARNING

MIL-C-23411 contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting. Call a physician.

ah. Apply a light coating of MIL-C-23411 to the accumulator diaphragm (14) and install it in the bore of the accumulator valve block assembly (15).

ai. Install the handle assembly (1) by inserting the cap screws (6) and locknuts to hold it in place. Do not tighten.

aj. Remove the handle assembly (1) from the vise and reclamp it on the flow sleeve tube (25) with the **IN** and **OUT** ports facing up.

ak. Rotate the flow sleeve (25) so that the motor roll pin (19) alignment holes will locate the motor control valve lever (45) under the handle on the valve lever side.

al. Push the handle/valve block assembly (1,15) onto the flow sleeve (23) assembly. Tap on the handle (1) with a rubber or plastic hammer, tapping on opposite sides to insure that the assembly goes on straight. Install the new handle grips (37) on the handle assembly.

Am. Install the motor assembly, using a plastic or rubber hammer.

an. Install the side rods (7).

ao. Torque the alternate side rods in 15 foot-pound increments to 100 foot-pounds.

ap. Torque the alternate cap screws (6) in 15 foot-pound increments to 75 foot-pounds.

aq. Install the charging valve (4) and backup ring (36) into the handle assembly (1).

ar. Charge the accumulator in accordance with paragraph U-2.1.1e this section.

as. Install the charge valve cap (35) and associated O-ring (B), trigger (2), and two spiral

pins (5).

at. Install the hose assemblies (38), and its associated O-rings (A), the orifice plug (31), the set screw (40), and the three pipe plugs (47).

U-7 PARTS LIST.

Table U-4 is the parts list for the Stanley HD 45 Hammer Drill. Refer to the following for the complete hydraulic hammer drill assembly:

a. Figure U-2, Hammer Drill Exploded View.

b. Table U-4, Hammer Drill Parts List and Accessories.

c. Table U-5, Hammer Drill Seal Kit Parts List.

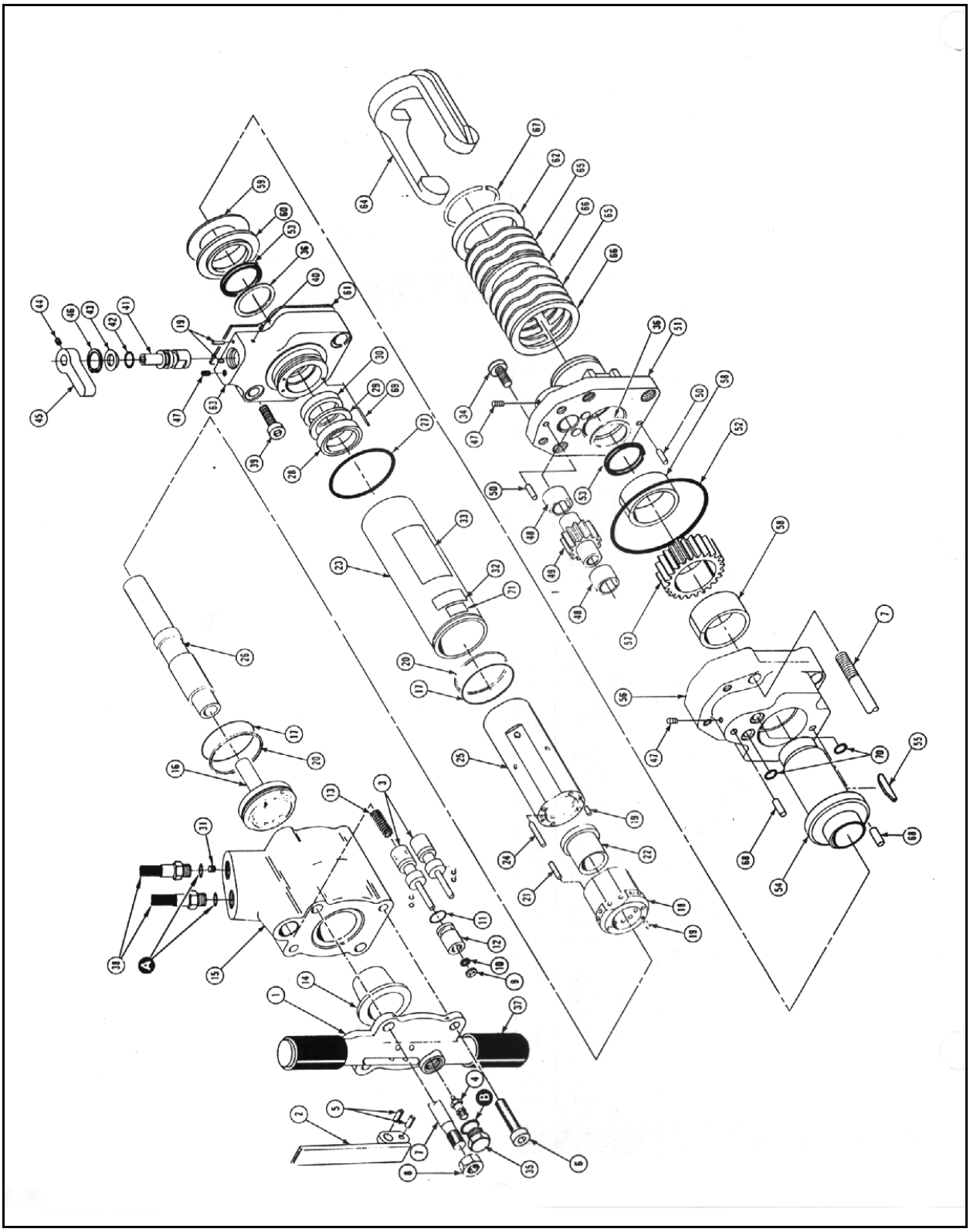


Figure U-2. HD45310 Stanley Hydraulic Drill Exploded View.

TABLE U-4. HYDRAULIC HAMMER DRILL PARTS LIST AND ACCESSORIES FIGURE U-2.

Item	Description	Qty	Part Number	CAGE
1	Handle	1	MFR-04369 NSN-5340-01-255-7441	54252
2	Trigger	1	MFR-04371 NSN-5130-01-278-2799	54252
3	Spool, valve o.c.	1	MFR-04077 NSN-4810-01-248-0162	54252
	Spool, valve c.c.	1	MFR-04593 NSN-N/A	54252
4	Valve, charging	1	MFR-01650 NSN-N/A	54252
5	Pin, spiral, 1/4 x 1/2	2	MFR-00844 NSN-5315-01-268-5455	54252
6	Cap screw, hex socket head, 1/2-13 x 5-1/2	2	MFR-04372 NSN-5304-01-247-9369	54252
7	Rod, side	2	MFR-04932 NSN-5306-01-249-3114	54252
8	Lock nut, 5/8-11	2	MFR-04374 NSN-N/A	54252
9	Wiper, rod (note 1)	1	MFR-04056 NSN-N/A	54252
10	O-ring, 5/16 x 7/16 (note 1)	1	MFR-01362 NSN-N/A	54252
11	O-ring, 11/16 x 7/8 x 3/32 (note 1)	1	MFR-00293 NSN-N/A	54252
12	Bushing	1	MFR-04057 NSN-N/A	54252
13	Spring	1	MFR-04058 NSN-5360-01-247-7944	54252
14	Diaphragm, accumulator	1	MFR-04375 NSN-3010-01-244-8464	54252
15	Accumulator - valve block assy.	1	MFR-05988 NSN-3040-01-248-0152	54252
16	Block, porting	1	MFR-04378 NSN-3820-01-247-7873	54252
17	O-ring, 2-9/16 x 2-3/4 x 3/32 (note 1)	2	MFR-04379 NSN-N/A	54252
18	Body, automatic valve	1	MFR-04380 NSN-4820-01-244-8476	54252
19	Pin, roll, 1/8 x 1/2	4	MFR-02900 NSN-N/A	54252
20	Ring, back-up, 2.581 x 2.753. 053 (note 1)	2	MFR-04381 NSN-N/A	54252
21	Pin, push, 3/16 x 1-1/4	2	MFR-04571 NSN-N/A	54252
22	Valve, automatic	1	MFR-04382 NSN-4810-01-248-3861	54252
23	Tube, flow sleeve	1	MFR-04383 NSN-3040-01-247-7016	54252

Item	Description	Qty	Part Number	CAGE
24	Pin, push, 1/4 x 1-1/2	4	MFR-04605 NSN-5315-01-249-8167	54252
25	Sleeve, flow	1	MFR-04384 NSN-3820-01-247-9504	54252
26	Piston	1	MFR-04954 NSN-2590-01-244-8481	54252
27	O-ring, 2-1/4 x 2-1/2 x 1/8 (note 1)	1	MFR-02022 NSN-N/A	54252
28	Seal, cup (note 1)	1	MFR-04386 NSN-N/A	54252
29	Washer	1	MFR-04780 NSN-5310-01-247-7498	54252
30	Seal, cup (note 1)	1	MFR-04934 NSN-N/A	54252
31	Plug, orifice	1	MFR-05243 NSN-5365-01-247-1074	54252
32	Sticker, GPM	1	MFR-03786 NSN-7690-01-243-6905	54252
33	Sticker, Stanley	1	MFR-05152 NSN-7690-01-248-9819	54252
34	Cap screw, hex socket head, 3/8-16 x 1-3/4	2	MFR-00682 NSN-5305-01-244-3986	54252
35	Cap, charge valve	1	MFR-07493 NSN-5365-01-249-4342	54252
36	Ring, backup, .755 x .949 x.097, 90 D (note 1)	1	MFR-11197 NSN-N/A	54252
37	Grip, handle	2	MFR-07424 NSN-N/A	54252
38	Hose assembly	2	MFR-01652 NSN-N/A	54252
39	Cap screw, hex socket head 1/2-13 x 4-1/2	2	MFR-04936 NSN-N/A	54252
40	Screw, set, 10-24 x 5/16	1	MFR-00842 NSN-N/A	54252
41	Valve, motor control	1	MFR-04937 NSN-4820-01-256-4881	54252
42	O-ring, 5/8 x 3/4 x 1/16 (note 1)	1	MFR-01211 NSN-N/A	54252
43	Washer	1	MFR-04938 NSN-5365-01-247-1151	54252
44	Screw, set, 1/4-20 x 1/4	1	MFR-01607 NSN-N/A	54252
45	Lever	1	MFR-04939 NSN-4910-01-244-3671	54252
46	Ring, retaining, 13/16 Int	1	MFR-04940 NSN-N/A	54252
47	Plug, pipe, 1/26-27 NPT	3	MFR-00783 NSN-4730-01-216-9355	54252
48	Bearing, 13 DU 12	2	MFR-03826 NSN-N/A	54252

Item	Description	Qty	Part Number	CAGE
49	Gear, idler	1	MFR-04033 NSN-3020-01-244-8495	54252
50	Pin, dowel, 1/4 x 1	2	MFR-00713 NSN-5315-01-249-3808	54252
51	Plate, motor	1	MFR-04942 NSN-4320-01-243-6390	54252
52	O-ring, 3-1/2 x 3-5/8 x 1/16 (note 1)	1	MFR-01257 NSN-N/A	54252
53	Ring, quad (note 1)	2	MFR-11196 NSN-N/A	54252
54	Hex, drive (note 2) Housing, Cylinder, PN) Hex, drive (note 3)	1	MFR-04944 NSN-3040-01-247-7015 MFR-06678 NSN-N/A	54252 54252
55	Key	1	MFR-04787 NSN-5315-01-247-1066	54252
56	Chamber, motor	1	MFR-05976 NSN-3040-01-248-0150	54252
57	Gear, drive	1	MFR-05975 NSN-3020-01-244-8496	54252
58	Bearing, 28DU 16	2	MFR-04947 NSN-N/A	54252
59	Washer, thrust	1	MFR-04948 NSN-3120-01-247-9094	54252
60	Washer, thrust backup	1	MFR-04949 NSN-3120-01-251-5052	54252
61	Gasket (note 1)	1	MFR-04950 NSN-N/A	54252
62	Backup, spring	1	MFR-04759 NSN-5330-01-251-1670	54252
63	Block, drive motor control (note 2) Block, drive motor control (note 3)	1 1	MFR-04951 NSN-3040-01-248-0151 MFR-06680 NSN-N/A	54252 54252
64	Latch	1	MFR-04952 NSN-5120-01-249-0371	54252
65	Spring, wave	8	MFR-07063 NSN-N/A	54252
66	Washer, latch	1	MFR-04756 NSN-5310-01-248-2680	54252
67	Ring, retaining	1	MFR-04761 NSN-5365-01-244-4864	54252
68	Pin, roll, 5/32 x 1/2	2	MFR-01749 NSN-N/A	54252
69	Pin, roll, 5/32 x 1	1	MFR-00114 NSN-N/A	54252
70	O-ring, 7/16 x 9/16 x 1/16 (note 1)	2	MFR-00018 NSN-N/A	54252

Item	Description	Qty	Part Number	CAGE
71	Sticker, closed-center	1	MFR-03693 NSN-N/A	54252

Notes: 1. Included in seal kit.

2. Land model only.

3. Water model only.

TABLE U-5. HD 45 HYDRAULIC HAMMER DRILL SEAL KIT PARTS LIST FIGURE U-2.

Item	Description	Qty	Part Number	CAGE
	Seal Kit		MFR-05839 NSN-4910-01-243-7723	54252
1	O-ring	1	MFR-01362 NSN-N/A	54252
2	O-ring	1	MFR-00293 NSN-N/A	54252
3	O-ring	2	MFR-04379 NSN-N/A	54252
4	Ring, backup	2	MFR-04381 NSN-N/A	54252
5	O-ring	1	MFR-02022 NSN-N/A	54252
6	Seal, cup	1	MFR-04386 NSN-N/A	54252
7	Wiper, rod	1	MFR-04056 NSN-N/A	54252
8	O-ring	2	MFR-01605 NSN-N/A	54252
9	O-ring	1	MFR-01604 NSN-N/A	54252
10	Seal, cup	1	MFR-04934 NSN-N/A	54252
11	Ring, quad	2	MFR-11196 NSN-N/A	54252
12	O-ring	2	MFR-00018 NSN-N/A	54252
13	O-ring	1	MFR-01257 NSN-N/A	54252
14	Gasket	1	MFR-04950 NSN-N/A	54252
15	O-ring	1	MFR-01211 NSN-N/A	54252
16	Ring, back-up	2	MFR-11197 NSN-N/A	54252

APPENDIX V

OPERATION AND MAINTENANCE PROCEDURES FOR THE PILE CUTTER

WARNING

Special training in the use of the underwater hydraulic pile cutter is required from NAVCONSTRACEN Port Hueneme, California.

V-1 DESCRIPTION.

V-1.1 The Underwater Hydraulic Pile Cutter Model 1351-0677 is a hydraulic oil powered linear shear cutter designed to cut wood timber piles no greater than 13 inches in diameter at mud line. The pile cutter consists of the beam frame assembly, hydraulic cylinders, cutting blades, and lift buoy.

V-1.2 The beam frame assembly includes the beam frame, the reaction guide, and the hydraulic control valve. The reaction guide is used to guide the pile cutter onto the pile, and provides a reaction force against the pile to prevent the pile cutter from rotating while retracting the blades. The hydraulic control valve is a three-position, four-way open centered spool valve.

V-1.3 The linear cutting force required to shear timber piles is provided by two 5-inch bore hydraulic cylinders. Each cylinder acts to close its cutter blade in a squeezing motion against the pile. The cutting blades have self gripping spikes which bite into the pile and prevent blade slippage.

V-1.4 The lift buoy compensates for the weight of the pile cutter in the water. When properly buoyed, the cutter should weigh 30 pounds. Power for operation is supplied by any hydraulic power source with the capability of supplying a flow rate of 15 gpm and a pressure up to 2,200 psi. Table V-1 provides pile cutter technical characteristics.

V-2 MODIFICATIONS.

V-2.1 The beam frame is a commercially available part modified by the Navy Civil Engineering Laboratory (NCEL) to include provisions for the lifting padeye and the diver positioning handles.

V-2.2 The commercial cutting blades have been modified by NCEL to incorporate self-gripping spikes.

V-3 TECHNICAL INFORMATION.

WARNING

The constant lift buoy has a working depth of 120 fsw. Exposure of buoy to water pressure at depths beyond 120 feet may cause implosion.

WARNING

Hydraulic components utilized by the cutter have a maximum safe working pressure of 2,500 psi. Exceeding this pressure may cause damage to the hydraulic system and could be dangerous to the operator.

TABLE V-1. HYDRAULIC PILE CUTTER TECHNICAL CHARACTERISTICS.

CHARACTERISTICS	REMARKS
System type	Open-center
Weight a. In air b. In seawater	 610 pounds 30 pounds with lift buoy
Width	64 inches
Length	38 inches
Height	15 inches
Pressure Range	2,200 psi
Flow range	15 gpm
Maximum cutting force	60,000 pounds
Maximum operating depth	120 fsw

WARNING

Never lift by or have hands near blades. Always tie safety tag lines to the pile to control its fall.

CAUTION

The pile cutter is designed for cutting timber piles only. Any steel beams, chains, etc., which interfere with cutter will damage blades.

V-3.1 Figure V-1 provides information regarding the cutting force required to shear piles under different conditions.

V-3.2 For unobstructed cutting, minimum clearance between piles is 17 inches (See Figure V-2).

V-3.3 The two hydraulic cylinders each have a stroke of 11 inches and a bore of 5 inches. At a maximum working pressure of 2,200 psi, they provide 43,000 pounds of force.

V-3.4 The moment arm acts to amplify the 43,000 pound force provided by the hydraulic cylinders to over 60,000 pounds at the blades.

V-3.5 The pile cutter is capable of use at 120 fsw.

V-4 PREOPERATING PROCEDURE.

V-4.1 Connect pressure hose to inlet port.

V-4.2 Connect tank return hose to outlet port.

V-4.3 Check to ensure proper initial hook-up.

V-4.4 Start power unit, setting flow at 15 gpm.

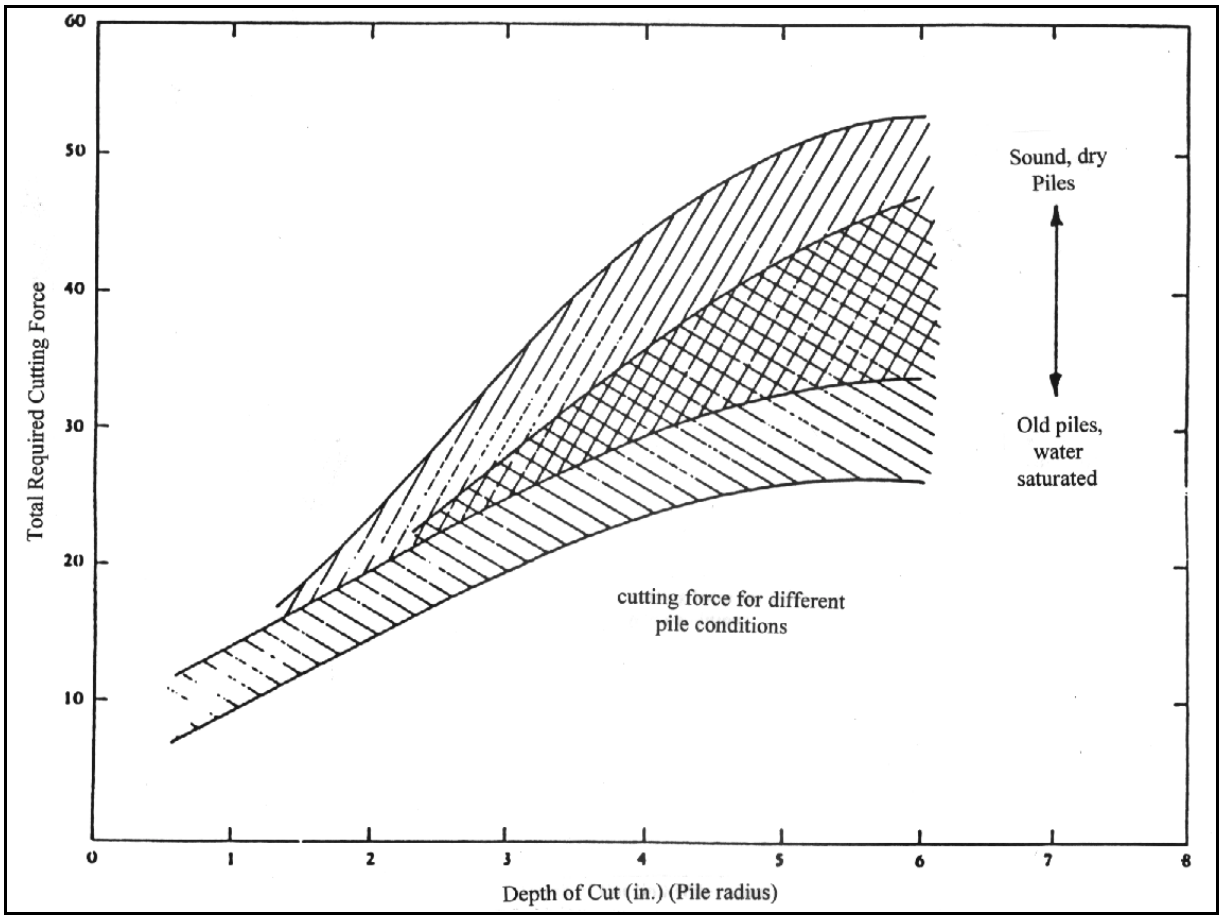


Figure V-1. Required Cutting force for Cutting Piles.

CAUTION

Prior to any cutting operations, make sure control valve works freely by activating it several times.

V-4.5 Push hydraulic control valve lever toward the blades. Blades should close.

V-4.6 Pull hydraulic control valve lever away from blades. Blades should slowly open.

V-4.7 Release hydraulic control valve lever. Blades should stop.

CAUTION

Prolonged deadheading of cutter blades in closed position imposes a potentially damaging strain on cutter tool and blades.

V-4.8 Check to ensure proper relief valve setting.

V-4.9 Push pile cutter control valve lever forward and allow blades to fully close; this will cause pressure to “deadhead”.

V-4.10 Hold control valve lever forward (blades fully closed) and check that relief pressure is set at 2,200 psi.

V-4.11 Release control valve lever immediately after relief valve check.

V-4.12 Open blades fully by pulling back on control valve lever and releasing.

V-5 OPERATING PROCEDURE.

V-5.1 If not already done, start power unit.

V-5.2 Set operating pressure at 2,200 psi.

V-5.3 Attach and shackle the lift buoy to the lift eye on the pile cutter.

CAUTION

Never allow direct strain to be taken on hydraulic hoses.

V-5.4 Attach deploying/retrieving line to lift eye shackle on the pile cutter.

V-5.5 Lower pile cutter and lift buoy to ocean bottom and release deployment line.

V-5.6 Tie safety tag lines to pile to control its fall or ascent.

V-5.7 Position pile cutter by lifting on handles.

V-5.8 Position pile cutter on sea floor with cutter blades located around pile.

V-5.9 Activate hydraulic control valve while pushing cutter into pile.

V-5.10 Ensure blade grippers are engaged, then activate control valve.

CAUTION

Prolonged deadheading of cutter blades in closed position imposes a potentially damaging strain on cutter tool and blades.

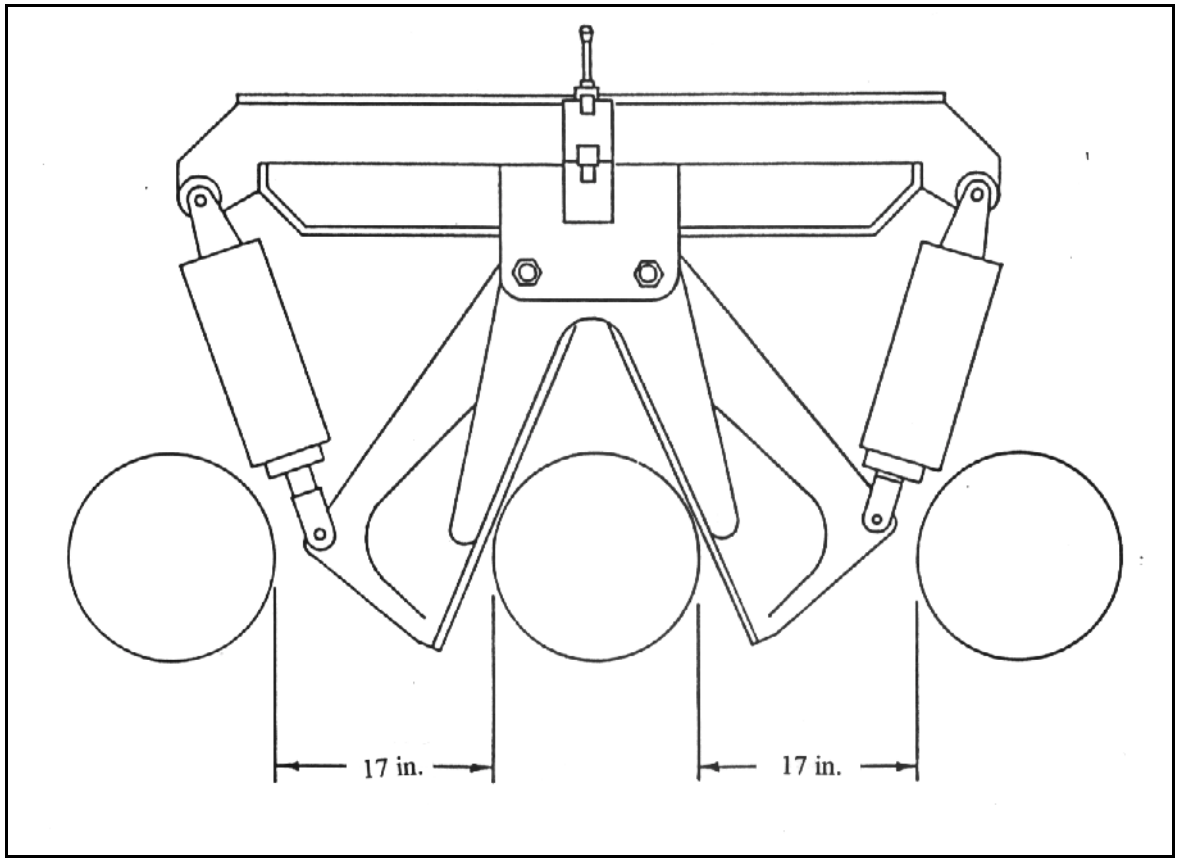


Figure V-2. Minimum Required Clearance Between Piles.

V-5.11 During cutting operation, pile will give off snapping sounds. This indicates that cutting is in progress. When snapping stops, cutter has completed cutting or has stalled.

V-5.12 If cut is complete, reverse control valve, open blades fully, and release control valve to "off" position.

V-5.13 If cutter blades stall, it means force required is greater than force available.

V-5.14 Open cutter blades, slide pile cutter closer to pile, and make second cut. Repeat around pile as necessary.

CAUTION

Pulling directly on pile cutter while it is engaged in timber pile will result in damage to blades.

NOTE

Avoid cutting into more than one pile at a time and do not attempt to cut piles greater than 13 inches in diameter.

V-5.15 If cutter jams, break off pile rather than pull on cutter.

V-5.16 Cap or bury exposed pile stubs to prevent further infestation from damaging marine borers.

V-6 SCHEDULED MAINTENANCE.

NOTE

It is essential that all Maintenance Requirement Cards (MRCs) and any technical documentation be acquired with the tool.

V-6.1 Scheduled Maintenance shall be performed in accordance with the Planned Maintenance System (PMS). Refer to Maintenance Index Page (MIP) 5971 for applicable Maintenance Requirement Cards (MRCs).

V-7 CORRECTIVE MAINTENANCE.

CAUTION

Replace all seals exposed during tool disassembly to guard against leaks.

CAUTION

When lubricating tool, use clean lubricant and clean containers to prevent entry of dirt into system.

V-7.1 Tools, Parts, and Materials Required.

Table V-2 lists tools, parts, and materials required to disassemble/reassemble pile cutter.

V-7.2 Removal/Installation of Blade. (See Figure V-3.)

V-7.2.1 Remove nut (101) from bolt (102) connecting blade (107) to hydraulic cylinder (200).

Install nut (T1) onto bolt.

CAUTION

Care must be taken when removing bolt not to damage grease fitting at center of the bolt.

V-7.2.2 Using heavy hammer, drive out bolt by hitting nut.

V-7.1.3 Use drive pin, if necessary, to pull bolt from cutter assembly.

V-7.1.4 Swing blade clear of hydraulic cylinder.

V-7.1.5 Remove hair clip pin (103) from lock pin (104).

V-7.1.6 Using drift pin, drive out lock pin (104).

V-7.1.7 Remove blade pin (104) by driving out from bottom of cutter assembly.

V-7.1.8 Remove blade.

V-7.1.9 Installation is reverse of removal.

V-7.1.10 When installing blades onto pile cutter, check that blade bushings (106 and 109) and bushing spacers (110) are properly installed.

V-7.1.11 Regrease bolts (103) and blade pins (105) through grease fittings (108).

V-7.2 Removal/Installation of Hydraulic Cylinder.

V-7.2.1 Disconnect hydraulic hoses at cylinders and cap open ports.

TABLE V-2. TOOLS, PARTS, AND MATERIALS REQUIRED.

Cylinder seal kit Metroplex H7020SK.
Special modified nut CEL T1.
Heavy hammer.
Drive pin.
Drift pin.
Strap wrench.
5/32 inch Allen wrench.
Vise.
Scribe.
Soft head mallet.
Anti-seize compound NEVER-SEEZ.
Marine grease Sta-Lube.

V-7.2.2 Remove nuts (101) and bolts (102) in accordance with paragraphs V-5.12 through V-5.15.

V-7.2.3 Installation is reverse of removal.

V-7.2.4 Regrease bolts through their grease fittings (108).

V-7.3 Cylinder Disassembly. (See Figure V-4).

NOTE

Oil may be reused if kept clean.

V-7.3.1 Drain hydraulic oil from each end of cylinder.

V-7.3.2 Clamp cylinder firmly in vise.

V-7.3.3 Ensure that front cylinder port is not capped and piston head collar (201) is firmly attached to cylinder.

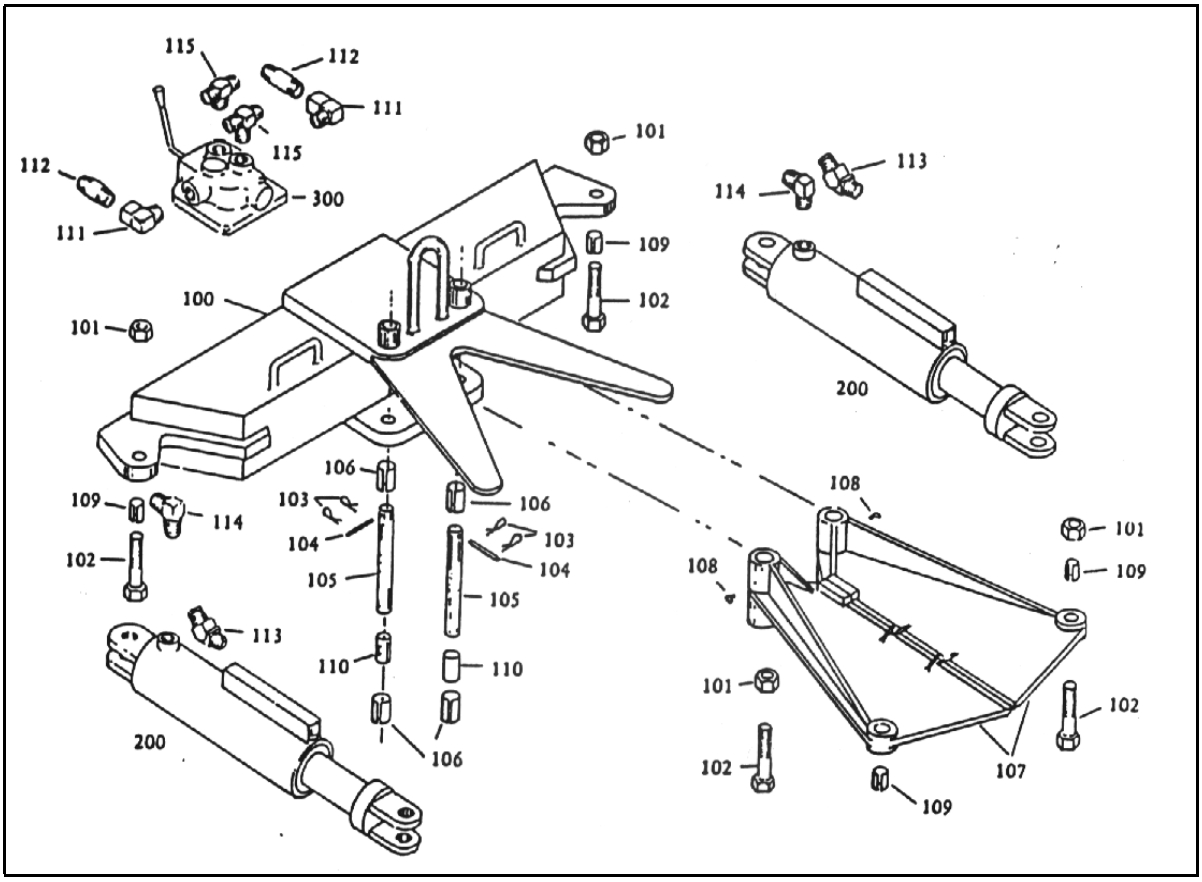


Figure V-3. Pile Cutter, Exploded View.

WARNING

To prevent personnel and/or material damage, use caution when applying compressed air. Always wear eye protection. Oil may squirt out of the front cylinder port.

V-7.3.4 Apply compressed air to rear cylinder port to extend rod and piston assembly (202).

V-7.3.5 Using strap wrench, unscrew piston head collar (201).

V-7.3.6 Remove piston rod and piston assembly from cylinder.

V-7.3.7 Using 5/32-inch Allen wrench, remove setscrew (206) from retaining nut (205).

V-7.3.8 Clamp retaining nut in vise and using socket wrench to turn piston rod, remove retaining nut.

V-7.3.9 Slide piston (204) and piston head (203) from piston rod.

NOTE

Note direction of lips on seals.

V-7.3.10 Remove seals using scribe, being careful not to scratch piston, piston head, or other metal surfaces.

V-7.4 Cylinder Assembly.

V-7.4.1 Clean cylinder bore and piston.

CAUTION

Care should be taken not to damage lips of wiper seals.

CAUTION

Do not apply heat to seals.

V-7.4.2 Install new seals by gently forcing them over piston and piston head (203) into grooves.

V-7.4.3 Carefully slide piston head onto piston rod (202).

V-7.4.4 Replace piston (204), retaining nut (205), and setscrew (206).

V-7.4.5 Carefully slide piston into cylinder bore (200) to ensure seals are not damaged.

V-7.4.6 Once piston has been inserted into bore far enough, slide piston head down piston rod into cylinder bore. Soft head mallet may be used to drive piston into bore.

WARNING

NEVER-SEEZ contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting. Call a physician.

V-7.4.7 Coat threads of cylinder lightly with anti-seize compound NEVER-SEEZ, to reduce corrosion.

V-7.4.8 Screw piston head retaining collar (201) on to cylinder.

V-7.5 Hydraulic Control Valve. For removal/installation refer to Figure V-5.

V-7.5.1 Disconnect hydraulic hoses at valve body (300) and cap open ports.

V-7.5.2 Remove mounting screws (309) from valve body and beam assembly, and remove valve.

V-7.6 Valve Seals Replacement. (See Figure V-5.)

NOTE

Valve seals may be replaced without removing valve from pile cutter.

V-7.6.1 Remove washer (302) and handle pin (301) connecting valve handle to spool, and swing handle away from spool.

V-7.6.2 Remove screws (305) holding valve spring cover (306) to valve body (300), and remove valve spring cover.

V-7.6.3 Remove O-ring (311) on valve spring cover and replace.

V-7.6.4 Gently pull spool (308) from the valve body.

V-7.6.5 Clean all parts and replace O-rings (310).

V-7.6.6 Assembly is reverse of disassembly.

V-8 PARTS LIST.

Table V-3 is the parts list for the Hydraulic Pile Cutter. Table V-4 lists Pile Cutter Spare Parts. Refer to the following for complete Pile Cutter Assembly:

a. Figure V-3, Pile Cutter Exploded View.
b. Table V-3, Hydraulic Pile cutter Parts List.
c. Figure V-4, Hydraulic Cylinder, Exploded View.
d. Table V-4, Hydraulic Pile Cutter spare Parts.
e. Figure V-5, Hydraulic Control Valve Exploded View.

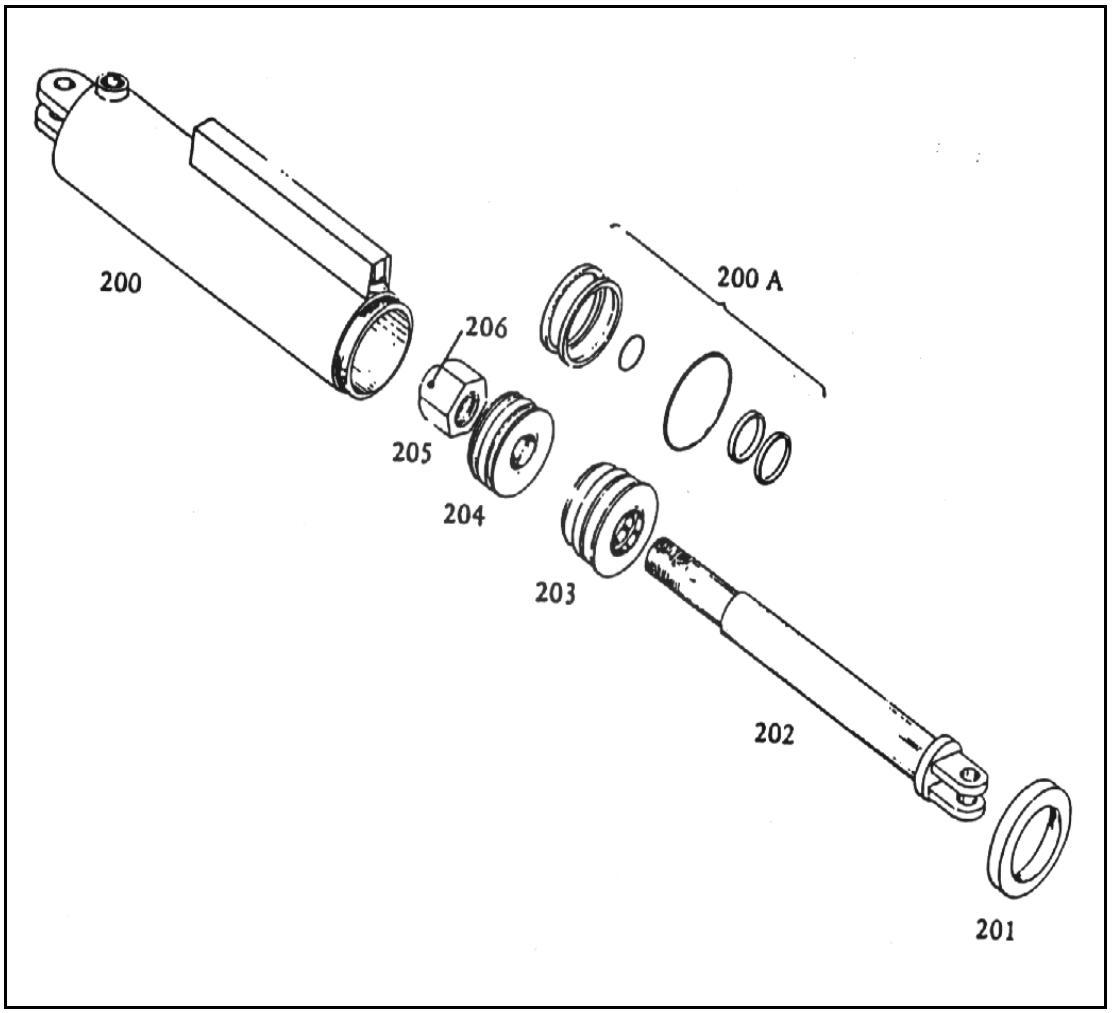


Figure V-4. Hydraulic Cylinder, Exploded View.

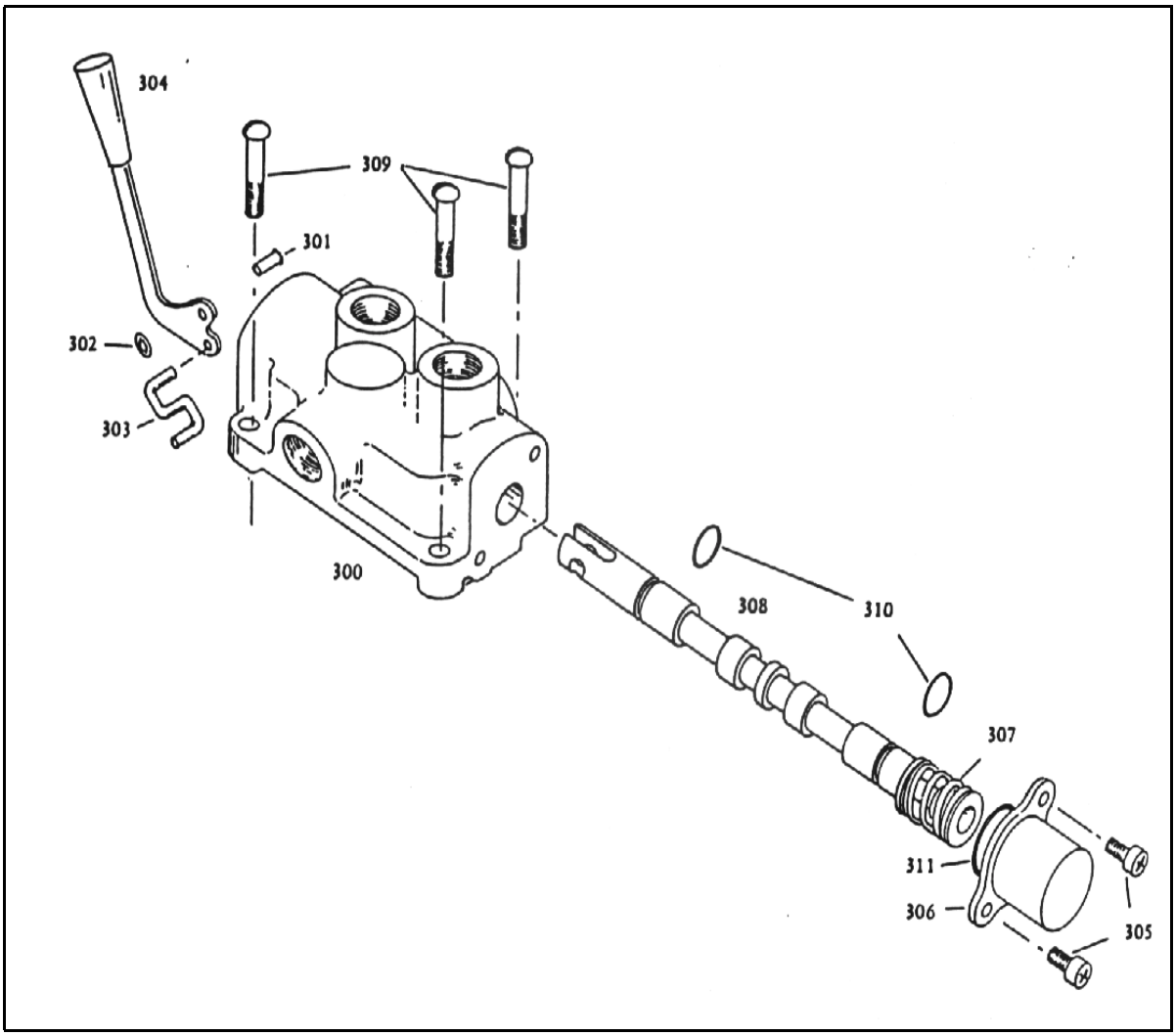


Figure V-5. Hydraulic Control Valve, Exploded View.

TABLE V-3. HYDRAULIC PILE CUTTER PARTS LIST.

Item No.	Description	Manufacturer	Part No.
100	Beam Frame assembly	CEL	SK 1352-0
101	Locknut, 1-1/4 in - 7	MPI	
102	Bolt, hex head 1-1/4 in - 7x5 in lg	MPI	
103	Hair pin clip, 1/8 in diam for 1/2 in pin		
104	Pin retainer, 1/2 in diam	CEL	SK 1351-2
105	Blade pin, 1-1/2 in diam x 10 ins lg	MPI	
106	Bushing	MPI	
107	Blade	CEL	SK 1352-10
108	Grease fitting	MPI	
109	Bushing	MPI	
110	Blade bushing spacer	MPI	
111	Pine elbow, 1/2 in male to female	Aeroquip	2089-8-8S
112	Pipe nipple, 1/2 in x 2 in lg, Sch 80		
113	45° elbow, 7/8-14 JIC 1/2 M. pipe	Aeroquip	2023-8-10S
114	Swivel joint	Imperial-Eastman	59WA-10X08X08
115	Tee, 7/8-14 JIC 3/8 in M. pipe	Aeroquip	2020-6-10S
T1	Special modified nut	CEL	T1
200	Cylinder assembly	MPI	
200-A	Seal kit for cylinder	MPI	H7020SK
300	Valve, 4-way open center	Victor (Dukes)	DV-10-T-S
306	Spring cover	CEL	SK 1351-7-A
310	O-ring	Parker	2-111
311	O-ring	Parker	2-022

TABLE V-4. HYDRAULIC PILE CUTTER SPARE PARTS.

Item No.	Description	Qty	Manufacturer	Part No.
107	Blade	2	CEL	SK 1352-10
200-A	Seal kit for cylinder	2	MPI	H7020SK
310	O-ring	4	Parker	2-111
311	O-ring	2	Parker	2-022
Not shown	Hose whips	2	CEL	

APPENDIX W

OPERATION AND MAINTENANCE PROCEDURES FOR THE HYDRAULIC SINKER DRILL

WARNING

The maximum operating time per diver per 24 hour period is 2 hours 9 minutes with SCUBA headgear, and 2 hours 49 minutes with MK 12 headgear.

W-1 DESCRIPTION.

W-1.1 The underwater sinker drill is designed for use in utility pole construction, blast hole drilling, gas line probing, and demolition work. It drills 1-inch to 3-inch diameter holes up to 20 feet deep in rock or concrete. the rotation rate is adjustable from 0 to 300 revolutions per minute. the drill has direct drive rotation and the rotation rate is independent of the impact rate or up to 2,500 blows per minute. The starting system incorporates a feathering valve for a fast startup. The hydraulic sinker drill will penetrate an average of 5-1/2 inches per minute using a 1-1/2-inch bit diameter.

W-2 MODIFICATIONS.

W-2.1 For a successful underwater operation of the hydraulic sinker drill, several modifications need to be made.

W-2.2 Replace the water tube (part number 04965) with the air tube (part number 04763).

W-2.3 Replace the water valve (part number 04768) with the air valve (part number 05202).

W-2.4 The two 3/16-inch diameter holes in the water drive motor control block (part number 06266) must be securely plugged, or the block can be replaced with the air drive motor control block (part number 04769) which does not have the two holes.

W-2.5 The seal retainer washer (part number 04750) must be added between the accumulator assembly and the automatic valve body in units made after serial 777.

W-2.6 If the drill is to be operated at depths greater than 300 feet, increase the accumulator charge by 40 psi per 100 feet of depth to offset the water pressure.

W-2.7 Table W-1 provides technical characteristics of the SK58 Sinker

W-3 TECHNICAL INFORMATION.

WARNING

Position communication shall be established between the diver and the tender before operating the sinker drill.

TABLE W-1. HYDRAULIC SINKER DRILL TECHNICAL CHARACTERISTICS.

CHARACTERISTICS	REMARKS
System type	Open center (o.c.) or closed center (c.c.)
Weight	65 lbs (29.48 kg)
Length	26 in (66.04 cm)
Width	18 in (45.72 cm)
Pressure range	1,500-2,000 psi (103.4 - 137.9 bars)
Flow range	7-9 gpm (26.5 - 34.1 lpm)
Optimum flow	9 gpm (34.1 lpm)
Porting	3/8 male pipe hose (air) 3/8 male pipe hose (hydraulic)

W-4 PREOPERATING PROCEDURES.

Before operating the sinker drill, it is necessary to check the accumulator.

W-4.1 Accumulator Checking. Check the accumulator for correct charge using the Stanley accumulator tester (part number 02835, Figure W-1).

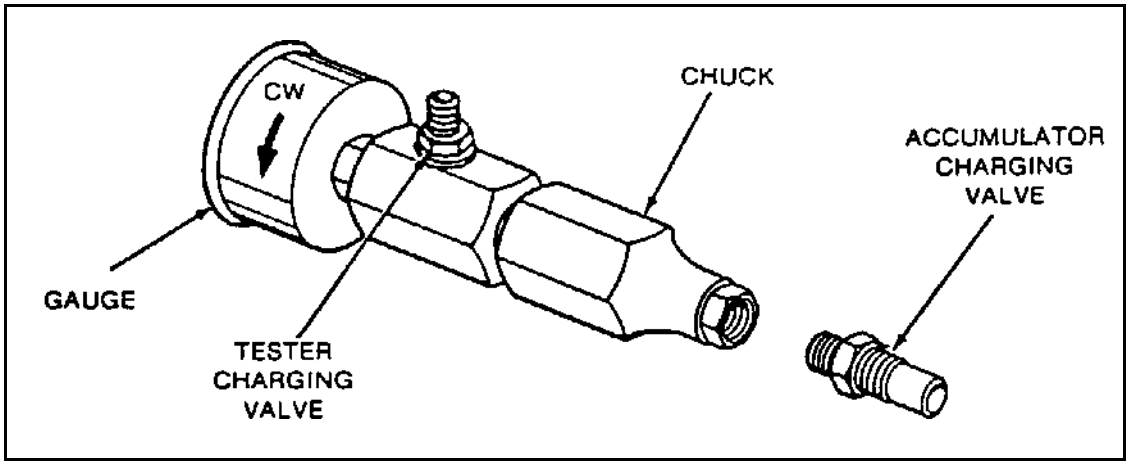


Figure W-1. Accumulator Tester.

W-4.1.1 Holding the chuck end of the tester, turn the gauge counterclockwise until reaching stop to ensure the valve is completely retracted.

W-4.1.2 Loosen the 5/8 hex charge valve nut 1-1/2 turns.

W-4.1.3 Thread the tester on to the charging valve of the accumulator (Do not advance the gauge end into the chuck end. turn as a unit).

W-4.1.4 Seat the chuck to the charging valve of the accumulator (hand tighten only).

W-4.1.5 Advance the valve by turning the gauge end clockwise until pressure is read on the gauge (charge pressure should be 500-700 psi).

W-4.1.6 Reverse the above procedure to remove the accumulator tester.

W-4.2 Accumulator Charging. Charge the accumulator using the Stanley accumulator tester, Stanley charging assembly 06929 or 06545, and a nitrogen bottle with 800 psi minimum charge as follows:

W-4.2.1 Follow the accumulator checking procedure in paragraphs W-4.1. Step W-4.1.5 is optional. If the accumulator tester is not used, see step W-4.1.2.

NOTE

It may be necessary to adjust the regulator to 650-700 psi in order to overcome the pressure drop through the charging valve.

W-4.2.2 Attach the chuck from the nitrogen supply to the accumulator tester, or directly to the drill charge valve, and charge the accumulator to 600 psi.

W-4.2.3 Reverse the above procedure to remove the charging assembly.

W-5 OPERATING CONDITIONS.

W-5.1 The greatest drill penetration rates will be achieved with a hydraulic fluid flow rate of 9 gpm.

W-5.2 **T**he drill rotational rate should be 100 rpm.

W-5.3 The bearing load should be 30 pounds in addition to the weight of the tool.

W-6 OPERATING PROCEDURES

WARNING

The tool must be operated by two divers.

WARNING

Wearing a wet suit hood is required.

CAUTION

Water/air flow must be continuous during drilling to avoid clogging of water/air passages and back flushing of waste products into the drill.

W-6.1 To start, hold the sinker drill on the desired location. Set the position valve lever midway between full on (90° rotation) and full off.

W-6.2 Throttle the drill at a slow cycle rate until the hole is started, then go to full power.

W-6.3 When drilling holes in excess of 10 feet deep with air, it is advantageous to stop drilling every 1-2 minutes, shutting off the air supply to charge the receiver and hoses, and then quickly open the air line to blow excess cuttings from the hole, before proceeding.

W-7 SCHEDULED MAINTENANCE.

a. After each use, rinse in fresh water.

WARNING

MIL-C-23411 and equivalent water-displacing oils are extremely flammable. Keep from open sparks, fires and open flames.

WARNING

Do not puncture, incinerate, or store can above 120°F.

WARNING

Use in well-ventilated area only.

WARNING

MIL-C-23411 contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting, call a physician.

b. Spray or flush exposed areas of on-off valve behind lever and motor control valve behind knob with MIL-C-23411.

c. Remove drill steel.

d. Turn tool upside down and spray MIL-C-23411 into drive hex and holes in side of motor control block to flush out water or debris.

e. Cycle tool hydraulically several times before storage.

W-8 TROUBLESHOOTING.

Refer to Table W-2 for sinker drill troubleshooting.

TABLE W-2. HYDRAULIC HAMMER DRILL TROUBLESHOOTING GUIDE.

Trouble	Possible Cause	Remedy
Sinker drill does not run.	Power unit not functioning. Couplers or hoses blocked. Pressure and return line to hoses reversed at ports. Mechanical failure of piston or automatic valve.	Check power unit for proper flow and pressure, 7-9 gpm at 1,500-2,000 psi. Remove obstruction. Be sure hoses are connected to the proper ports. Disassemble drill and inspect damaged parts.
Sinker drill does not drill effectively.	Power unit not functioning. Couplers or hoses blocked. Insufficient blowing air. Accumulator charge-pressure hose pulses more than normal. Oil too hot.	Check power unit for proper flow and pressure, 7-9 gpm at 1,500-2,000 psi. Remove obstruction. 15 cfm minimum. Recharge accumulator. Replace diaphragm if loss continues. Provide cooler to maintain proper oil temperature, 100°F-130°F.
Sinker drill operates slowly.	Low gpm supply from power unit. High back pressure. Couplers or hoses blocked. Orifice plug blocked. Oil too hot--above 150°F or too cold--below 60°F. Relief valve set too low.	Check power unit for proper flow, 7-9 gpm. Check hydraulic system for excessive back pressure, over 250 psi. Remove obstruction. Remove obstruction. Check power unit for proper oil temperature. Bypass cooler to warm oil up, or provide cooler to maintain proper temperature. Adjust relief valve to 2,100-2,250 psi.
Sinker drill gets hot.	Hot oil going through tool.	Check power unit. Be sure flow rate is not too high, causing part of oil to go through the relief valve. Provide cooler to maintain proper oil temperature of 100-130°F. Check flow control devices.
Oil leakage on gad.	Lower piston or drive hex seal failure.	Replace seals.
Oil leakage through charge valve cap.	Upper piston seal failure, accumulator O-ring failure, or accumulator charge loss or failure.	Replace seals, recharge ore replace accumulator diaphragm.
Oil leakage around trigger.	Valve spool seal failure.	Replace seals as needed.
Low rotation torque.	Motor not completely broken in. Excessive oil temperature causes operating pressure loss. Damage to motor clearances. Insufficient blowing air. Mechanical binding during drilling.	Continued operation or break-in with motor break-in block will correct. Provide cooler to maintain oil temperature (100-130°F) for short operating period. Repair as required. 15 cfm minimum. Take care to guide drill straight.

W-9 CORRECTIVE MAINTENANCE.

CAUTION

Before disassembling the tool, clean the exterior to prevent foreign matter from entering the tool interior. Replace all seals exposed during disassembly. Note the orientation of the seals before removing them, to ensure proper installation. Before reassembly, clean all parts with a degreasing solvent. Apply clean grease to all parts during reassembly.

NOTE

The drill is full of oil and will drip from ports when hoses are removed.

W-9.1 Tools and Parts Required. Table W-3 lists tools, parts, and materials required for sinker drill disassembly/reassembly.

TABLE W-3. TOOLS, PARTS, AND MATERIALS REQUIRED.

1/2-20 X 9” rod 05639.
Arbor press.
Degreasing solvent.
Grease or O-ring lubricant.
Plastic or rubber hammer.
Stanley aluminum disc 05640.
Stanley assembly tool 05048.
Stanley assembly tool 05062.
Stanley bearing installation tool 05044.
Stanley bearing installation tool 05061.
Stanley bearing puller kit 05064.
Stanley cylinder puller 05640.
Stanley flow sleeve installation spacer 04909.
Stanley flow sleeve removal tube 04910.
Stanley seal replacement kit 048056.
Stanley split ring 04908.
Stanley tool 05045.
Stanley tool 05073.
Vise.

W-9.2 Hydraulic Sinker Drill Disassembly.

Refer to Figure W-3 for item number identification.

W-9.2.1 Secure the drill in a bench vise, the on-off valve up, clamping on the flow sleeve tube (13) between the side rods (44). A vice with soft jaws is recommended.

W-9.2.2 Remove the pigtail hose assemblies (71,96).

W-9.2.3 Remove the charge valve cap assembly (55) from the top of the accumulator housing.

W-9.2.4 Loosen the charging valve lock nut 1-1/2 turns. Discharge the accumulator.

W-9.2.5 If the accumulator is to be removed, remove the blower tube nut (48).

W-9.2.6 Remove the side rod nuts (27).

W-9.2.7 Remove the drive motor assembly and set it aside.

NOTE

When moving the piston, the oil will come out of the ports and the flow sleeve.

W-9.2.8 Using a plastic or rubber hammer, tap the piston (15) toward the handle (3) until it stops.

W-9.2.9 Remove the accumulator housing (8) assembly from the flow sleeve (14) assembly by rapping ends of the side rods (44) with the plastic or rubber hammer while pulling on the handle (3).

W-9.3 Flow Sleeve Tube Assembly Removal.

W-9.3.1 If the automatic valve body (11) remains in the accumulator housing (8) assembly when the flow sleeve tub (13) assembly is removed, proceed with step W9.3.5. If it remains in the flow sleeve tube assembly it must be removed as follows:

W-9.3.2 Remove the piston (15) and washer (10).

W-9.3.3 Place split rings, 04980, between the automatic valve body (11) and the flow sleeve tube (13).

W-9.3.4 Place the flow sleeve (14) assembly with split rings in place on the flow sleeve removal tube, 04910, with the automatic valve body (11) down.

CAUTION

Use a rag in the bottom of the flow sleeve removal tube to protect the automatic valve body when it drops out.

W-9.3.5 With an arbor press, using an aluminum disc, 05640, to protect the flow sleeve (14),, push on the flow sleeve to remove the automatic valve body (11).

W-9.3.6 The automatic valve (12), push pins (45) from the flow sleeve (14) and two push pins (46) from the automatic valve body will come out.

W-9.3.7 Proceed with step W-52.

W-9.3.8 Remove the piston (15) and the automatic valve (14) from the handle (3) end of the flow sleeve (14).

W-9.3.9 Remove the push pins (45) by turning the flow sleeve (14) on end.

W-9.3.10 Remove the push pins (46) from the automatic valve body (11) by turning the handle (3) assembly on end.

W-9.4 Flow Sleeve Removal.

W-9.4.1 Place split ring 04908 on top of flow sleeve removal tube 04910.

W-9.4.2 Place the flow sleeve tube (13) assembly on top of the split rings.

CAUTION

Use a rag in the bottom of the removal tube to protect the flow sleeve when it drops out.

W-9.4.3 With an arbor press, using an aluminum disc, 05640, to protect the flow sleeve (14), push the flow sleeve out of the tube (15).

NOTE

Make sure the thin washer between the automatic valve body and the accumulator chamber is properly located in its counterbore before driving the automatic valve body and accumulator out of the accumulator housing.

W-9.4.4 Remove the accumulator cylinder (5) and the automatic valve body (11) from the accumulator housing (8) by threading a 1/2-20 X 9” rod, 05639, through the blower tube nut (48) hole and tapping the rod with a plastic or rubber hammer.

W-9.4.5 If the accumulator cylinder (5) remains in the handle, remove as follows:

W-9.4.6 Insert the cylinder puller, 05640, to seat on the inside, lower contour of the accumulator cylinder (5).

W-9.4.7 Insert the slide hammer through the 1/2-inch hole in the puller to remove the cylinder (5).

W-9.5 Accumulator Disassembly

W-9.5.1 Remove the washer (78) from the end of the automatic valve body (11) counterbore.

W-9.5.2 Remove the tube connector (50) from the accumulator chamber (7) or the bottom of the housing (8) bore.

CAUTION

Do not over-tighten the vice and distort the accumulator cylinder.

W-9.5.3 To remove the accumulator chamber (7) and diaphragm (6) from the accumulator cylinder (5), place the assembly in a vise.

W-9.5.4 Drive the chamber (7) and diaphragm (6) out by rapping or pushing with an arbor press on the charge valve (57) end while protecting the valve with a 3/4-inch deep socket.

W-9.5.5 Squeeze the accumulator diaphragm (6) and slide it off the charge valve end of the accumulator chamber (7).

W-9.5.6 Remove the cup seal (9) and seal retainer washer (10) from the accumulator chamber (7).

W-9.6 Throttle Valve Disassembly.

W-9.6.1 Remove the hex nut (66), valve lever (65) and key (74).

W-9.6.2 Remove the cap screws (60) and pull the inlet flange (59) out.

W-9.6.3 Push the throttle valve (67) out through the inlet flange (59) side.

W-9.6.4 Remove the washer (855), O-ring (89), and kap seal (61) from the inlet side.

W-9.6.5 Remove the 1-1/4-inch internal retaining ring (82) on the lever side and remove the washer (84), O-ring (88), and kap seal (64).

W-9.7 Drive Motor Disassembly

W-9.7.1 Place the motor on an aluminum plate in the arbor press, latch (32) end up, and depress the spring backup (30) with the Stanley tool 05045.

W-9.7.2 Remove the wire retaining ring (31) and the relax spring (29) allowing removal of the latch (32), latch washer (28), spring, and spring backup (30).

W-9.7.3 Place the motor in a vise (do not over-tighten) and remove the cap screws (54, 60).

W-9.7.4 Separate the motor housings and remove the idler gear (24), drive gear (37) and woodruff key (34), allowing the drive hex (38) to be pushed out through the drive motor control block (75) end of the drive motor chamber (25).

W-9.7.5 Remove the bearings (23, 35), as required, with the Stanley bearing puller kit 05064.

W-9.7.6 Remove the motor control valve assembly (16) by loosening the valve guide (17), then rotating the valve and guide together.

W-9.7.7 To disassemble the control valve (16) assembly, loosen the set screw (20) and push the control valve (16) stem through the knob (19).

W-9.8 Hydraulic Sinker Drill Assembly.

WARNING

Vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale fumes. When using these chemicals, ensure that the work area is well-ventilated and away from flames or possible fire hazards.

WARNING

Avoid prolonged or repeated skin contact. Do not take internally. If skin or eyes are accidentally contaminated with solvent, flush with water for 15 minutes.

W-9.8.1 Clean all parts with a degreasing solvent.

CAUTION

Ensure that all seals that were exposed have been replaced with new parts.

CAUTION

Apply clean grease or O-ring lubricant to all parts during reassembly.

W-9.9 Motor Assembly.

W-9.9.1 Support the four corners of the motor plate (26) and level them in the arbor press.

W-9.9.2 Press the bearings (23, 35) in place using Stanley bearing installation tools 05044 and 05061 with the split lines facing each other.

W-9.9.3 Place the motor plate (26) on an aluminum plate, latch (32) end up, in the arbor press.

W-9.9.4 Install the latch parts with the Stanley installation tools, 05048 and 05062, in the following order: latch (32) (in the open position); latch washer (28); spring (29); spring backup

(30) assembly guide; and wire retaining ring (31).

W-9.9.5 Place the bearing installation tool over the guide and press with the arbor press until the wire retaining ring (31) snaps in place.

W-9.9.6 Install the bearings (23, 35) in the motor chamber (25) in the same manner as for the motor plate (26) (separate support at four corners is not necessary) place on an aluminum plate to avoid damage to the machined face of the motor chamber.

W-9.9.7 Slide the hex drive (38) through the motor chamber from the control valve (16) side.

W-9.9.8 Place the woodruff key (34) in the hex drive (38) and slide the drive gear (37) in place followed by the idler gear (24).

W-9.9.9 Place the new O-ring in the irregular groove in the motor chamber *(25) with grease to retain.

W-9.9.10 Place a 1-5/8-inch bore cup seal (33) through the bearing (35) into the groove of the motor plate (26), lips facing the gears (24, 37).

W-9.9.11 Slide the motor plate (26) over the drive hex until mating with the motor chamber (25), then align with the dowel pins (72) and the idler gear (24).

W-9.9.12 Secure with the cap screws (54), and torque to 25 foot-pounds.

W-9.9.13 Place the thrust washer (39) over the exposed hex drive (38) on the control valve (16) side of the motor chamber (25), grey or brass side down, followed by the thrust backup washer (40), small diameter out.

W-9.9.14 Place the gasket (53) on the motor chamber (25) with a light film of oil to retain it, then align with the dowel pin (72) and hole.

W-9.9.15 Install the cup seal (41) in the counterbore of the motor control block (75), lips facing out.

W-9.9.16 Push the motor control block (75) over the hex drive (38) until mating with the motor chamber aligning it with the roll pin (51) and pushing squarely with an arbor press.

W-9.9.17 Secure with a cap screw (60). Torque to 15 foot-pounds.

W-9.9.18 Replace the control valve assembly (16).

W-9.9.19 Place the piston cup seal (41) in the control drive motor block (75), lips facing down, followed by a seal washer (86) and a cup seal (43), lips facing up.

W-9.10 Accumulator Assembly.

WARNING

MIL-C-23411 and equivalent water-displacing oils are extremely flammable. Keep from open sparks, fires, and open flames.

WARNING

Do not puncture, incinerate, or store can above 120°F.

WARNING

Use in well-ventilated area only.

WARNING

MIL-C-23411 contains petroleum distillates and is harmful or fatal if swallowed. If swallowed, do not induce vomiting. Call a physician.

W-9.10.1 Apply a light coating of MIL-C-23411 to the accumulator chamber (7) and slide the accumulator diaphragm (6) on from the charge valve end.

W-9.10.2 Use grease or rubber lubricant on the inside of the accumulator cylinder (5) and outside the diaphragm (6).

CAUTION

Be sure that the accumulator diaphragm is free of wrinkles and the seal bead is in its groove before completing assembly. An arbor press may be required to completely seat the assembly.

CAUTION

Do not use a hammer or powered arbor press.

W-9.10.3 Push the accumulator chamber (7) and the diaphragm (6), charge valve (57) end first, halfway into the accumulator cylinder.

W-9.10.4 The parts are assembled from the end of the cylinder (5)

W-9.10.5 Replace the backup washer (78), the cup seal (9), lips facing out, and the seal retainer washer (10) in the accumulator chamber (7) countebore.

W-9.11 Throttle Valve Assembly.

CAUTION

Take care to avoid wrinkling or damaging the kap seal.

W-9.11.1 Install the kap seal (64) on the O-ring (88) and slide the assembly into the counterbore of the accumulator housing (8), followed by a washer (84), and a retaining ring (82).

W-9.11.2 Install the O-ring (89) and kap seal (61) in the same manner and slide the throttle valve (67) into place.

W-9.11.3 Replace the woodruff key (74) and the valve lever (65) and secure with a locking jam hex nut (66).

W-9.11.4 Carefully install the O-ring (87) and the kap seal (62) on the inlet flange (59).

W-9.11.5 Push the inlet flange (59) in place and secure with cap screws (60). Torque to 15 foot-pounds

W-9.11.6 Install the tube connector (50) in the accumulator housing (8), small end first.

W-9.11.7 Align the accumulator with the Stanley tool 05073 and press into the accumulator housing (8) with an arbor press.

W-9.11.8 Place the flow sleeve installation spacer 04909 on the base of the arbor press.

W-9.11.9 Lubricate the entire bore of the flow sleeve tube (13) and position the tube over the spacer with the O-ring groove up.

NOTE

The flow sleeve has a wide groove around the outside of one end. Install this end first..

W-9.11.10 Press the flow sleeve (14) into the flow sleeve tube (13), using an aluminum disc 05640 until the sleeve is flush with the tube. Do not seat the flow sleeve on the installation spacer.

W-9.11.11 Install push pins (45), tapered end up, in the flow sleeve (14).

NOTE

The push pins must be installed such that the flat, ground faces bear on the flange of the automatic valve.

W-9.11.12 Install the push pins (46), tapered end up, in the automatic valve body (11).

W-9.11.13 Install the automatic valve (12), small diameter first, into the automatic valve body (11).

W-9.11.14 Align the push pins (45, 46) and place the automatic valve body (11), side holes up, on top of the flow sleeve (14).

W-9.11.15 Allow the automatic valve (12) to drop and pilot into the bore of the flow sleeve (14).

W-9.11.16 Use an aluminum disc, 05640, to protect the parts, and push the automatic valve body (11) into the flow sleeve tube (13) until the flow sleeve (14) stops on an installation spacer 04909. The bottom of the two side holes in the automatic valve body will be tangent to the top edge of the flow sleeve tube when properly seated.

W-9.11.17 Install the piston (15), large end first, into the flow sleeve assembly from the automatic valve body (11) end. (Replace the tube seal (99) in the piston of water models only).

W-9.11.18 Using a large amount of grease, install the washer (78) on the stem of the piston (15). Be sure the washer is against the automatic valve body (11).

W-9.11.19 Place the accumulator housing assembly, side rods (44) up, in the arbor press.

W-9.11.20 Holding the piston (15) by its lower end, place the flow sleeve (14) assembly in the accumulator housing (8) assembly.

W-9.11.21 Press on the flow sleeve tube (13) evenly around so that the tube assembly is straight when seated.

W-9.11.22 Place the accumulator housing (8) and the flow sleeve (14) assembly in the vise with the on-off valve (57) facing up, clamping on the flow sleeve tube (13) between the side rods (44).

W-9.11.23 Rotate the flow sleeve (14) in the accumulator housing (8) until the motor roll (52) pin alignment hole locates the motor control valve knob (19) under the handle (3) on the valve lever side.

W-9.11.24 Install the motor assembly using a plastic or rubber hammer.

W-9.11.25 Replace the side rod nuts (27). Torque in 20 foot-pound increments to 75 foot-pounds, in the patter shown in Figure W-2 with a 1-inch crowfoot wrench.

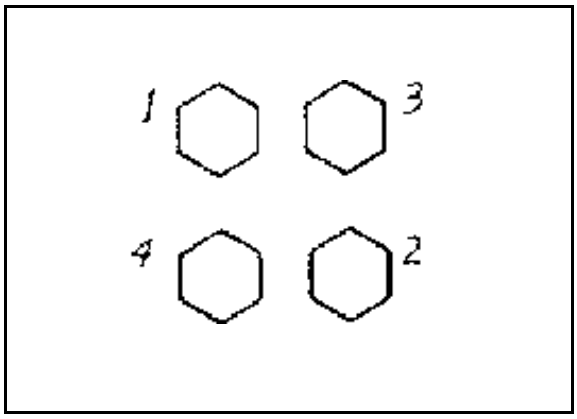


Figure W-2. Side Rod Nut Torquing Sequence

W-9.11.26 Charge the accumulator in accordance with Table W-1.

W-9.11.27 Bring the charge valve (57) locknut down snug. Do not over-tighten.

W-9.11.28 Install the valve cap assembly

W-9.11.29 Install the pigtail hose assemblies (71, 96)

W-9.11.30 Install the air or water tube (73) followed by the blower tube nut (48). torque to 15 foot-pounds.

W-10 PARTS LIST.

Table W-4 is the parts list for the Stanley SK58 Hydraulic Sinker Drill. Refer to the following for the complete hydraulic sinker drill assembly:

a. Figure W-3, Sinker Drill Exploded View.
b. Table W-4, Sinker Drill Parts List and Accessories.
c. Table W-5, Sinker Drill Seal Kit Parts List.
d. Table W-6, Sinker Drill Accessories.

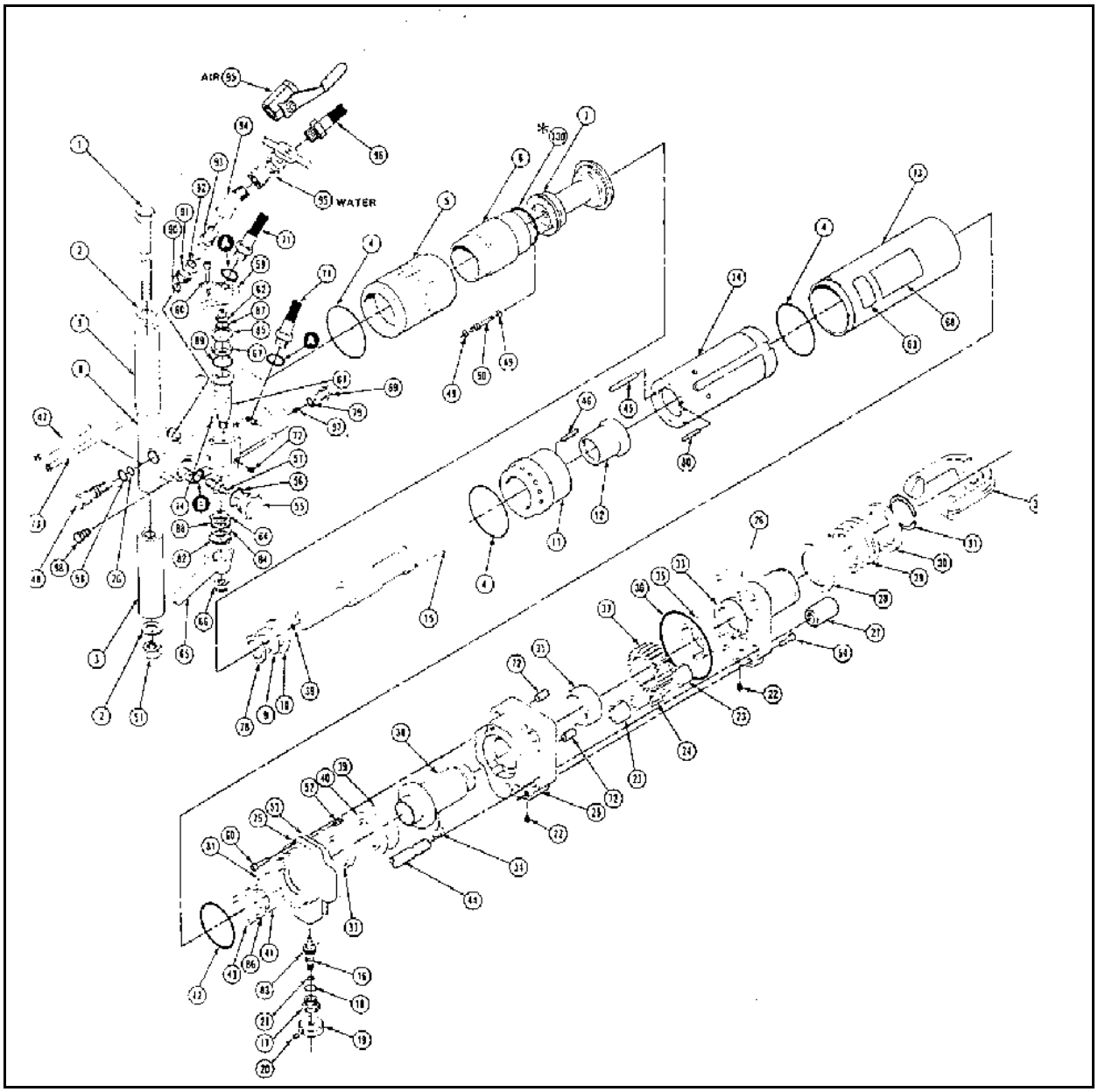


Figure W-3. Hydraulic Sinker Drill Exploded View.

TABLE W-4. HYDRAULIC HAMMER DRILL PARTS LIST AND ACCESSORIES FIGURE W-2.

Item	Description	Qty	Part Number	CAGE
1	Cap screw, hex head, 5/8-11 UNC X 18	1	MFR-07291 NSN-N/A	54252
2	Washer, flat, 5/8	2	MFR-04786 NSN-N/A	54252
3	Handle grip assembly	2	MFR-0496454252 NSN-N/A	54252
4	O-ring, 2-7/8 X 3-1/8 X 1/8	3	MFR-04054 NSN-N/A	54252
5	Cylinder, accumulator	1	MFR-04060 NSN-3820-01-244-4809	54252
6	Diaphragm, accumulator	1	MFR-04059 NSN-4810-	54252
7	Chamber, accumulator	1	MFR-04779 NSN-N/A	54252
8	Housing, accumulator	1	MFR-04660 NSN-N/A	54252
9	Seal, Cup 1-1/8 X 1-5/8 X 3/8	1	MFR-04386 NSN- N/A	54252
10	Washer, seal retainer	1	MFR-04750 NSN- N/A	54252
11	Body, automatic valve	1	MFR-04066 NSN-4810-01-244-4761	54252
12	Valve, automatic	1	MFR-04065 NSN-4810-01-248-1481	54252
13	Tube, flow sleeve	1	MFR-04068 NSN-4710-01-244-4482	54252
14	Sleeve,. Flow	1	MFR-07889 NSN- N/A	54252
15	Piston(air) Piston(water)	1	MFR-04734 NSN- N/A MFR-06265 NSN-N/A	54252
16	Valve, motor control	1	MFR-04783 NSN- N/A	54252
17	Guide, valve	1	MFR-04773 NSN- N/A	54252
18	O-ring .644 MFR- .818 MFR- .087	1	MFR-01605 NSN- N/A	54252
19	Knob, motor control valve	1	MFR-04753 NSN- N/A	54252
20	Screw, set	1	MFR-00842 NSN- N/A	54252
21	O-ring, 5/16 X 7/16 X 1/16	1	MFR-01362 NSN- N/A	54252
22	Plug, Pipe, 1/16-27 NPT	2	MFR-00783 NSN-4730-01-216-9355	54252
23	Bearing	2	MFR-03826	54252

Item	Description	Qty	Part Number	CAGE
			NSN- N/A	
24	Gear, idler	1	MFR-04033 NSN-3020-01-244-8495	54252
25	Chamber, drive motor	1	MFR-04744 NSN- N/A	54252
26	Plate, motor	1	MFR-04748 NSN- N/A	54252
27	Nut, side rod, 1-inch hex	4	MFR-04075 NSN-5310-01-247-7448	54252
28	Washer, latch	1	MFR-04756 NSN-5310-01-248-2680	54252
29	Spring. Relax	1	MFR-004758 NSN- N/A	54252
30	Back-up spring	1	MFR-04759 NSN-5330-01-251-1670	54252
31	Ring, wire retaining	1	MFR-04761 NSN-5365-01-244-4864	54252
32	Latch	1	MFR—04721 NSN- N/A	54252
33	Seal cup	2	MFR-04760 NSN- N/A	54252
34	Key woodruff	1	MFR-04787 NSN-5315-01-247-1066	54252
35	Bearing	2	MFR-04788 NSN- N/A01277	54252
36	O-ring 3-3/4 X 3-7/8 X 1/16	1	MFR-01277 NSN- N/A	54252
37	Gear, drive	1	MFR-04752 NSN- N/A	54252
38	Drive, hex 1 X 4-1/4 (air)	1	MFR-04784 NSN- N/A	54252
	Drive, hex 1 X 4-1/4 (water)	1	MFR-06276 NSN-N/A	
	Drive, hex 7/8 X 4-/14 (air)	1	MFR-05195 NSN-N/A	
39	Washer, thrust	1	MFR-04789 NSN- N/A	54252
40	Washer, thrust backup	1	MFR-04754 NSN- N/A	54252
41	Seal, piston cup	1	MFR-04090 NSN- N/A	54252
42	O-ring 2-5/8 X 2-7/8 X 1/8	1	MFR-04073 NSN- N/A	54252
43	Seal, cup	1	MFR-04072 NSN- N/A	54252
44	Rod, side	4	MFR-04373 NSN- N/A	54252
45	Pin, push 5/16 X 2	4	MFR-04067	54252

Item	Description	Qty	Part Number	CAGE
			NSN-5315-01-249-9711	
46	Pin, push 3/16 X 1-14	2	MFR-04571 NSN- N/A	54252
47	Tube, air	1	MFR-04763 NSN- N/A	54252
48	Nut, blower tube	1	MFR-04778 NSN- N/A	54252
49	O-ring 3/16 X 5/16 X 1/16	2	MFR-00026 NSN- N/A	54252
50	Connector, tube	1	MFR-04776 NSN- N/A	54252
51	Nut, hex 5/18-11 UNC	1	MFR- 01714 NSN- N/A	54252
52	Pin, roll, 3/16 X ¾	1	MFR- 03047 NSN- N/A	54252
53	Gasket	1	MFR- 04774 NSN- N/A	54252
54	Cap screw, hex socket head 3/8-16 X 2-1/4	2	MFR-01217 NSN- 5305-01-207-7439	54252
55	Cap, charge valve	1	MFR- 05775 NSN- N/A	54252
56	O-ring 1.048 X 1.280 X .116	1	MFR- 04052 NSN- N/A	54252
57	Valve, charge	1	MFR-04051 NSN- 4820-00-800-3572	54252
58	O-ring 9/16 X 11/16 X 1/16	1	MFR-00016 NSN- N/A	54252
59	Flange, inlet	1	MFR-04781 NSN- N/A	54252
60	Cap screw, hex socket head, 5/16-18 X 3/4	3	MFR-02688 NSN-5305-00-526-2347	54252
61	Seal, kap	1	MFR-04791 NSN- N/A	54252
62	Seal, kap	1	MFR-04792 NSN- N/A	54252
63	Sticker, Stanley	1	MFR-05152 NSN-7690-01-248-9819	54252
64	Seal, kap	1	MFR-044793 NSN- N/A	54252
65	Lever, valve	1	MFR-04718 NSN- N/A	54252
66	Nut, locking jam hex, 1/2-20 UNF	1	MFR-04147 NSN- N/A	54252
67	Valve, throttle	1	MFR-04777 NSN- N/A	54252
68	Sticker, GPM	1	MFR-03786 NSN-7690-01-243=6905	54252

Item	Description	Qty	Part Number	CAGE
69	Plug, orifice	1	MFR-04772 NSN- N/A	54252
70	Name tag (not illustrated)	1	MFR-04796 NSN- N/A	54252
71	Pigtail hose assembly	2	MFR-01642 NSN- N/A	54252
72	Pin, dowel, 1/4 X 1	2	MFR-00713 NSN-5315-01-243-3808	54252
73	Tube, air	1	MFR-04763 NSN- N/A	54252
74	Key, woodruff	1	MFR-00772 NSN- N/A	54252
75	Block, drive motor control (air)	1	MFR-04769 NSN- N/A	54252
	Block, drive motor control (water)	1	MFR-06266 NSN-N/A	
76	O-ring 1/2 X 5/8 X 1/16	1	MFR-00175 NSN- 5330-01-205-9797	54252
77	Plug, pipe 1/8-27 NPT	1	MFR-00955 NSN- N/A	54252
78	Washer, backup	1	MFR-04780 NSN-5310-01-247-7498	54252
79	O-ring, .468 X .624 X .078	1	MFR-01411 NSN- N/A	54252
80	Pin, roll 3/16 X 1-1/2	1	MFR-07890 NSN-N/A	54252
81	Pin, roll 3/16 X 1-3/8	1	MFR-03009 NSN- N/A	54252
82	Ring, retaining 1-1/4 int.	1	MFR-04902 NSN- N/A	54252
83	Lock, nylon cap	2	MFR-00634 NSN-5315-01-214-1885	54252
84	Washer	1	MFR-04751 NSN- N/A	54252
85	Washer	1	MFR-04755 NSN- N/A	54252
86	Washer, seal	1	MFR-04755 NSN- N/A	54252
87	O-ring 9/16 X 3/4 X 3/32	1	MFR-02003 NSN- N/A	54252
88	O-ring 1 X 1-1/4 X 1/8	1	MFR-04794 NSN- N/A	54252
89	O-ring 1-1/4 X 1-1/2 X 1/8	1	MFR-04795 NSN- N/A	54252
90	Ring, retaining 1/2	1	MFR-04512 NSN- N/A	54252
91	Fitting, swivel	1	MFR-04764 NSN- N/A	54252

Item	Description	Qty	Part Number	CAGE
92	O-ring, 3/8 X 1/2 X 1/16	1	MFR-00106 NSN-5330-01-213-9818	54252
93	Body, inlet swivel	1	MFR-04765 NSN- N/A	54252
94	Elbow, street, 45°, 3/8-18	1	MFR-04767 NSN- N/A	54252
95	Valve, air	1	MFR-05202 NSN- N/A	54252
96	Pigtail hose assembly	1	MFR-04801 NSN- N/A	54252
97	Plug, pipe (c.c. only)	1	MFR-00955 NSN- N/A	54252
98	Vent	1	MFR-07064 NSN- N/A	54252
99	Seal tube (water	1	MFR-06268 NSN- N/A	54252
100	O-ring, 2/38 X 2-1/2 X 1/16	1	MFR-05641 NSN- N/A	54252
	Seal Kit (Includes Find Nos. 4, 9, 18, 21, 33, 36, 41, 42, 43, 49, 53, 56, 58, 61, 62, 64, 76, 79, 87, 88, 89, 92, 99, and 100)	AR	MFR-04805 NSN-5330-01-266-2647	

TABLE W-5. HYDRAULIC SINKER DRILL ACCESSORIES.

Description	Qty	Part Number	CAGE
Bit, carbide, four point, 2-1/2 in. diameter	1	MFR-T34M07 NSN-3820-01-141-4123	06626
Bit, carbide, four point 2 in. diameter	1	MFR-T28M07 NSN-3820-00-239-7189	06626
Bit, carbide four point 1-3/4 in. diameter	1	MFR-T22M07 NSN-3820-00-239-7192	06626
Bit, carbide, four point 1-1/2 in. diameter	1	MFR-T16M07 NSN-3820-00-239-7193	06626
Drill shaft, extension	1	MFR-E00502 NSN-3820-00-282-4942	06626
Swivel, internal pipe	2	MFR-2045-6-6S NSN-4030-01-197-1484	50421
Tape, umbilical 3/4 in. wide, White	AR	MFR-827 NSN-4220-01-039-1876	80769
Spray, Teflon thd. sealant	AR	MFR-83276 NSN-8030-01-220-8414	91636
Hose, hydraulic 1/2 nom MP X 10.0 ± .1 ft L	2	MFR-2651-8 NSN-4720-00-967-8997	00624
Fitting, hose 1/2 MP to 3/8 NPT	2	MFR-4412-6-8S NSN-4730-00-551-2979	00624
Fitting, hose 1/2 MP to 1/2 NPT	2	MFR-4412-8-8S NSN-4730-00-879-5389	00624
Qdisc, male 1/2 NPT	1	MFR-5602-8-10S NSN-4730-00-449-5022	01276
Qdisc, female, 1/2 NPT	1	MFR-5601-8-10S NSN-4730-00-434-6321	01276

APPENDIX X

OPERATION AND MAINTENANCE PROCEDURES FOR HYDRAULIC HOSES AND HOSE REEL

X-1 DESCRIPTION.

The NAVSEA Hydraulic Hose Reel is a single compartment reel designed to handle 200 feet of 3/4-inch hydraulic hose. An array of hose combinations are available to set up an underwater task. Figure X-1 illustrates a typical hose setup (15 and 200 FT) for an underwater tool, using the single hydraulic hose reel and a hydraulic power unit (HPU) MK 9 Mod 0, and hose setup (10 or 100 FT) for a diver operated pump. The 6-foot low-pressure hose is not shown.

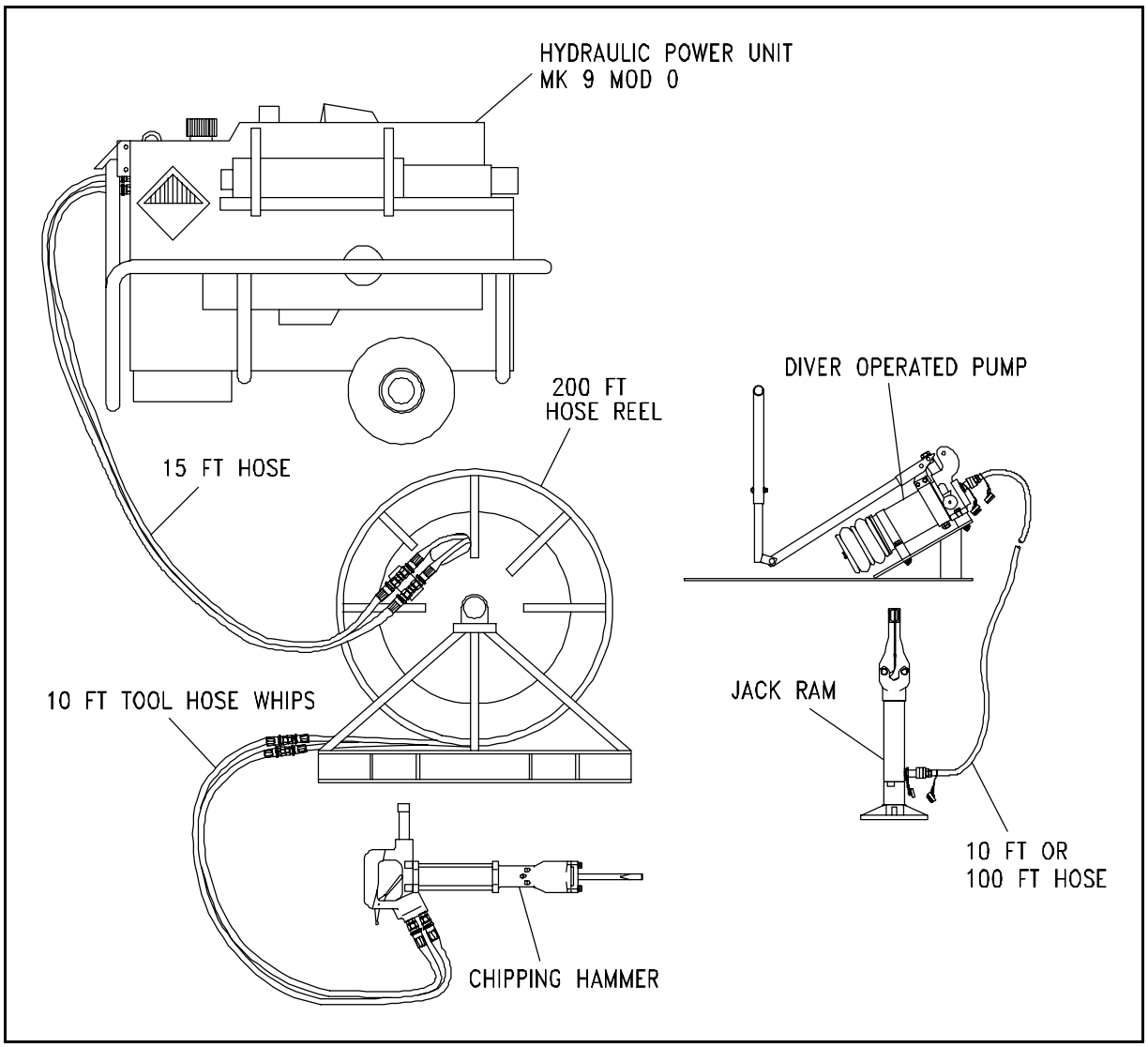


Figure X-1. Typical Setups.

X-2 REFERENCE.

NAVSEA Drawing 5366582.

X-3 OPERATIONS.

a. Select applicable hoses from Table X-1 for task.

Table X-1. Hoses.

HOSE	FROM/TO	REFER TO
6-Foot - 2,000 psi working pressure	Special hoses (hydraulic come-along)	Paragraph X-11
10-Foot - 2,000 psi working pressure	Hose Whip Tool/200-foot	Paragraph X-10
10-Foot - 10,000 psi working pressure	Diver operated pump/Tool	Paragraph X-7
15-Foot - 2,000 psi working pressure	HPU/200-Foot on Hose Reel	Paragraph X-8
100-Foot - 10,000 psi working pressure	Diver operated pump/Tool	Paragraph X-5.2
200-Foot - 2,000 psi working pressure	15-Foot/Tool Whips	Paragraph X-9

b. Inspect hoses for cuts, tears, or other damage.

c. Remove dust caps from couplings.

WARNING

MIL-C-81309 is extremely flammable. Keep away from open sparks, fires, and flames. Use in well-ventilated areas only.

WARNING

The vapors produced by many cleaning solvents are toxic and extremely flammable. Do not inhale the fumes. When using these cleaning solvents, ensure that the work area is well-ventilated and away from open flames or possible fire hazards.

WARNING

Avoid prolonged or repeated contact with skin. Do not take internally. If skin or eyes are accidentally contaminated with the solvent, flush with water for 15 minutes.

WARNING

Set up hoses to preclude vehicle traffic from driving over hose.

WARNING

Avoid kinking of thermal plastic hose. Never apply pressure through a kinked hose.

WARNING

Ensure hoses being set up are of the proper pressure rating. Never substitute a hose assembly rated for medium-pressure application for a high-pressure application.

CAUTION

Exercise extreme care that all quick-disconnect couplings are clean when couplings are mated.

d. Clean and spray all interfacing couplings with MIL-C-81309.

e. Connect hoses and ensure connections are secure.

f. Operate tool in accordance with applicable tool appendix.

g. After each use and before storage, wash hoses and couplings with fresh water.

h. Using MIL-C-81309, lubricate and place dust covers on couplings.

X-4 SCHEDULED MAINTENANCE.

Refer to Maintenance Index Page (MIP) 5971/005-25 for hose Maintenance Requirement Cards (MRC).

X-5 CORRECTIVE MAINTENANCE.

Repairs are limited to replacement of the pillow block on the hose reel and fittings, couplings, and dust caps on hose assemblies.

X-5.1 Hose Reel.

Corrective maintenance is limited to replacement of grease fittings and pillow block. Refer to Figure X-2.

X-5.2 10- and 100-Foot 10,000 psi Working Pressure Hoses. (Bar Stock Cutter, Nut Splitter, Jack Ram, Pull Cylinder, and Wire Cutter).

Corrective maintenance is limited to replacement of the quick disconnect couplings and dust caps. Refer to Figure X-3.

X-5.3 15-Foot 2,000 psi Working Pressure Hose. (Chipping Hammer, Come-Along, Cut-off Saw, Grinders, Impact Wrenches, Peanut Grinder, Chainsaw, Hydraulic Brush, and Sump Pump).

Corrective maintenance is limited to replacement of components in Figure X-4.

X-5.4 200-Foot 2,000 psi Working Pressure Hose. (Chipping Hammer, Come-Along, Cut-off Saw, Grinders, Impact Wrenches, Peanut Grinder, Chainsaw, Hydraulic Brush, and Sump Pump).

Corrective maintenance is limited to replacement of components in Figure X-5.

X-5.5 10-Foot 2,000 psi Working Pressure Whip Hose. (Chipping Hammer, Come-Along, Cutoff Saw, Grinders, Impact Wrenches, Peanut Grinder, Chainsaw, Hydraulic Brush, and Sump Pump).

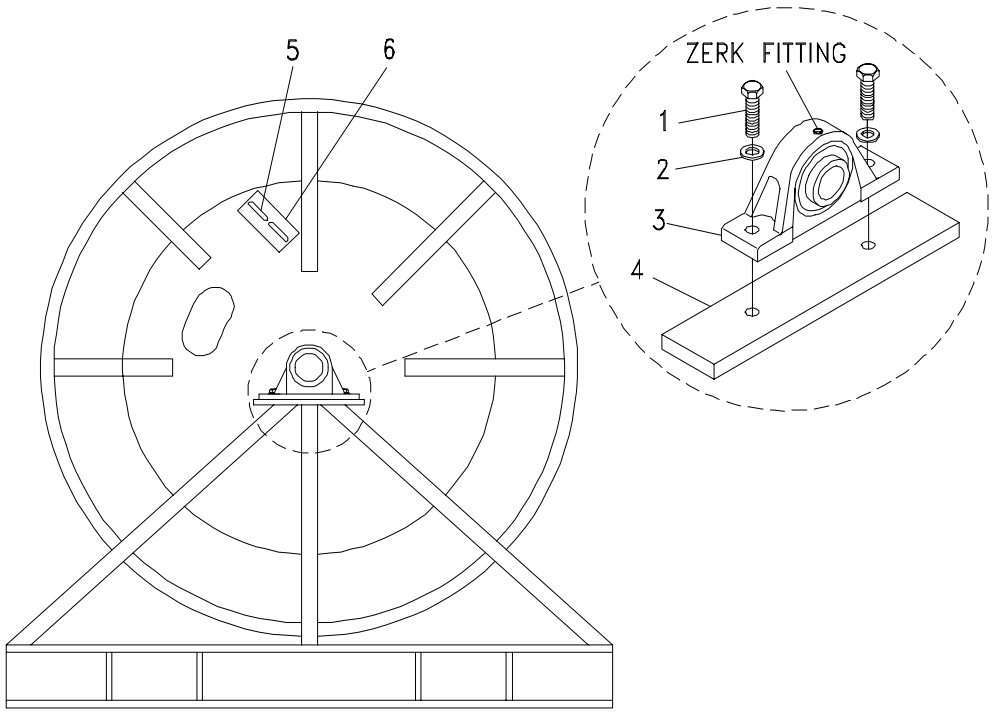
Corrective maintenance is limited to replacement of components in Figure X-6.

X-5.6 6-Foot 2,000 psi Working Pressure Special Hose. (Come-Along).

Corrective maintenance is limited to replacement of components in Figure X-7.

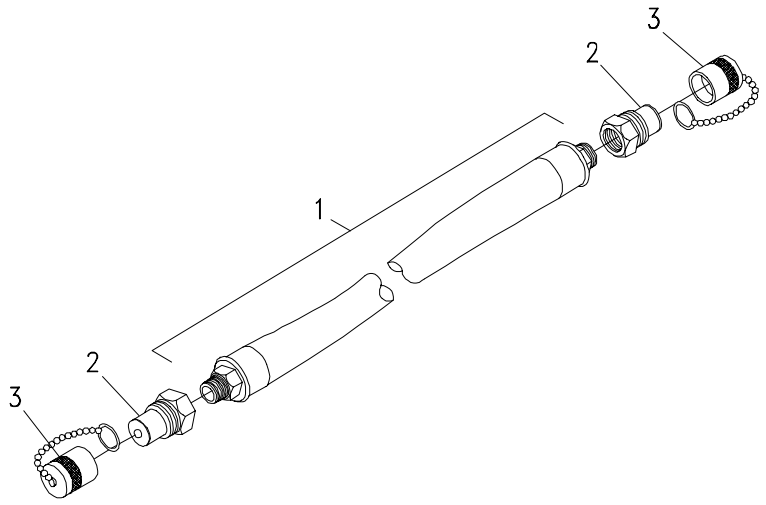
X-6 ILLUSTRATED PARTS BREAKDOWN.

See Figures X-2 through X-7 for Illustrated Parts Breakdown.



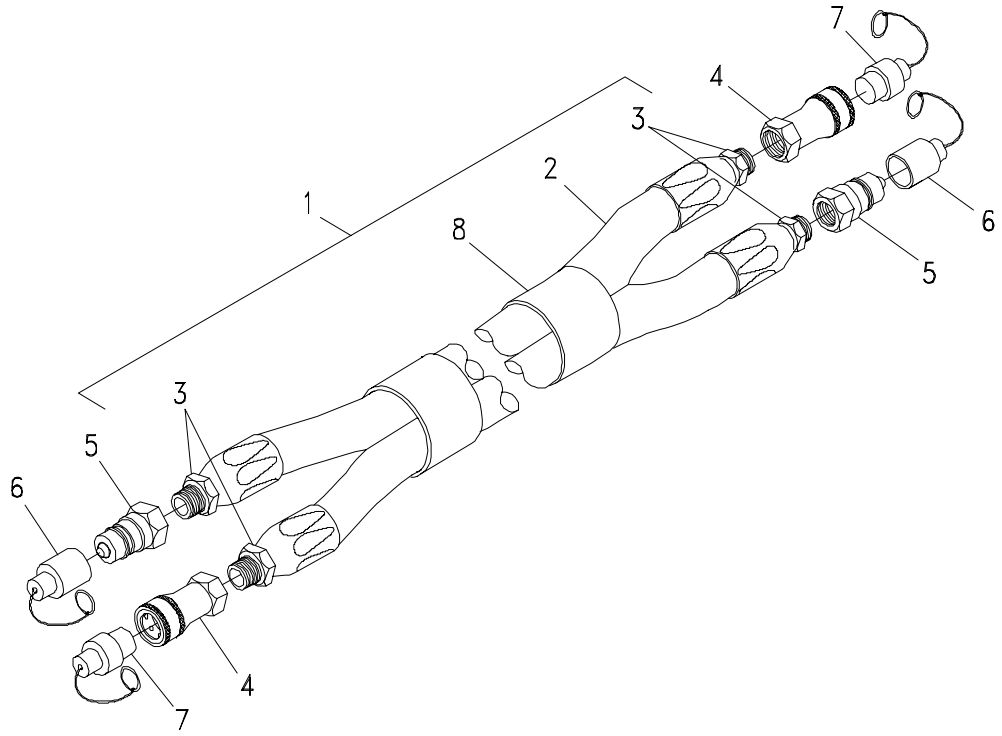
ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
	Reel, 3/4-inch Hose, Hydraulic		5366582	53711
1	Bolt, Hex Hd 3/8-16UNC-2A 1.0 L	4	5366582-14	53711
2	Washer, Lock, 3/8 Nom	4	5366582-15	53711
3	Pillow Block	2	VPLS-116	71176
4	Mounting Plate	2	5366582-10	53711
5	U-Bolt	2	5366582-8	53711
6	Nut, Stop, 1/4-20UNC-28	4	5366582-16	53711

Figure X-2. Hose Reel.



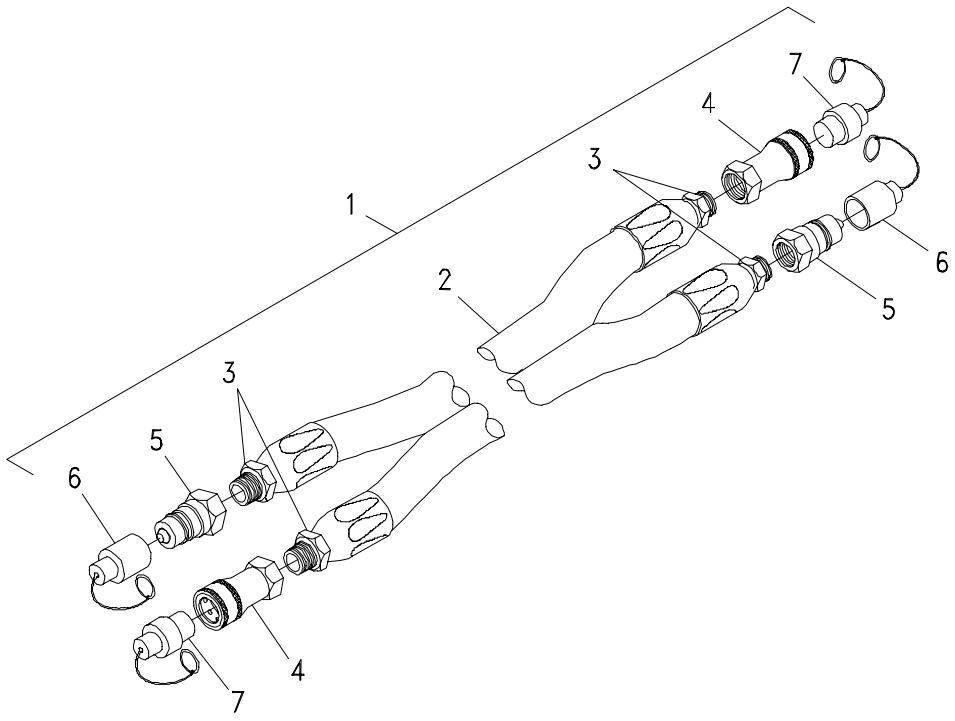
ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
1	10-foot Hose w/fittings 100-foot Hose w/fittings	1	3V10-04-106-106-120 3V10-04-106-106-1200	0ZEC5 0ZEC5
2	Quick disconnect coupling, male	2	CH604	K5017
3	Dust cap, male coupling	2	CD415	K5017

Figure X-3. 10-Foot and 100-Foot 10,000 psi Working Pressure Hose.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
1	Hose, Wire-Braid Hydraulic, 15-foot, with fittings	2	AQP FC195-12-4722-12-12-S	0ZEC5
2	Hose	2	FC195-180	16717
3	Reusable fitting	4	4722-12-12S	16717
4	Quick disconnect coupling, female	2	5601-12-10S	16717
5	Quick disconnect coupling, male	2	5602-12-10S	16717
6	Dust cap, male coupling	2	5659-10	16717
7	Dust cap, female coupling	2	5657-10	16717
8	Tape, diver's (2.0-inch wide)	AR	827	80769

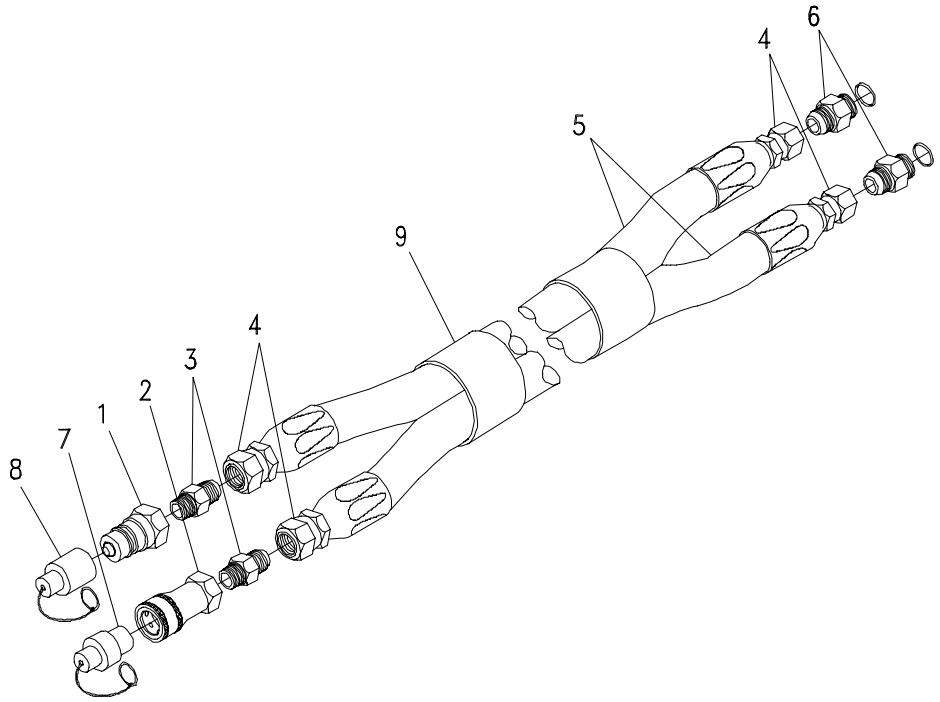
Figure X-4. 15-Foot 2,000 psi Working Pressure Hose.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
1	Hose Assembly, Hydraulic, 200-foot	1	3770-2R87-12-J-12112-7-12112-2400	0ZEC5
2	200-foot Hose	1	3770-2R87-12-2400	OZEC5
3	Reusable fitting	4	J-12112	16717
4	Quick disconnect coupling, female	2	5601-12-10S	16717
5	Quick disconnect coupling, male	2	5602-12-10S	16717
6	Dust cap, male coupling	2	5659-10	16717
7	Dust cap, female coupling	2	5657-10	16717

NOTE: If hose assembly is not twin lined, apply item 8 from Figure X-4 at 26.0 inch intervals as required.

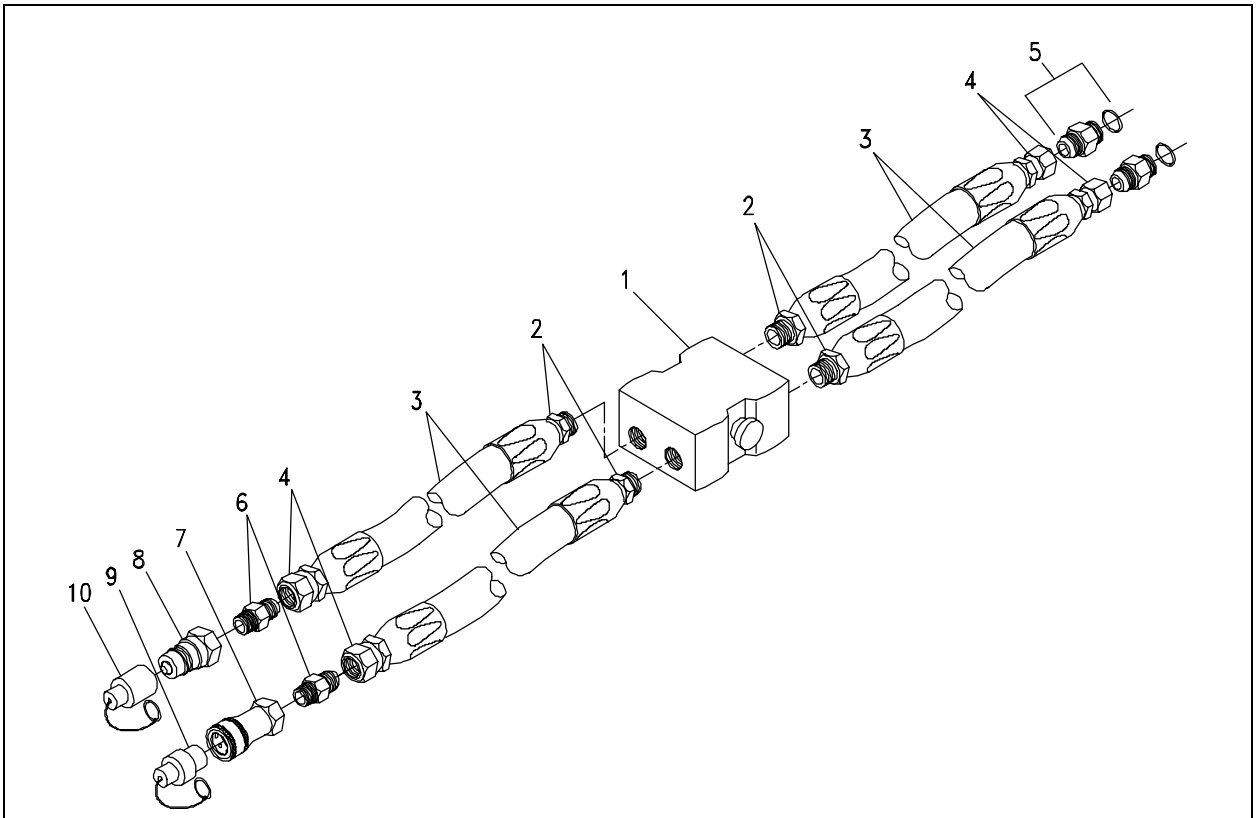
Figure X-5. 200-Foot 2,000 psi Working Pressure Hose Components.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
1	Quick disconnect, male	1	5602-8-10S	16717
2	Quick disconnect, female	1	5601-8-10S	16717
3	Adapter, 1/2 pipe to -8 SAE	2	2021-8-8S	16717
4	Hose fitting, -8 SAE flare swivel	2	4411-8S	16717
5	Hose, 10-foot, 1/2-inch	2	2651-8-120	16717
6	Adapter			
	CH18 Chipping Hammer	2	202702-6-8S [1]	16717
	CO23 Cutoff Saw	2	202702-8-8S [2]	16717
	CS11 Chainsaw	2	202702-8-8S [2]	16717
	GR24 Grinder	2	2021-6-8S (NPT)	16717
	GR29 Grinder	2	202702-8-8S [2]	16717
	HB29 Hydraulic Brush	2	202702-8-8S [2]	16717
	HU6935 Peanut Grinder	2	2021-6-8S (NPT)	16717
	IW06 Impact Wrench	2	2021-6-8S (NPT)	16717
	IW12 Impact Wrench	2	202702-8-8S [2]	16717
	IW20 Impact Wrench	2	2021-6-8S (NPT)	16717
	IW24 Impact Wrench	2	202702-8-8S [2]	16717
	SM22 Sump Pump	2	202702-8-8S [2]	16717
7	Dust cap, female coupling	1	5657-10	16717
8	Dust cap, male coupling	1	5659-10	16717
9	Tape, diver's (0.75 inch wide)	AR	827	80769

[1] Includes O-ring part number 22617-6
[2] Includes O-ring part number 22617-8

Figure X-6. 10-Foot 2,000 PSI Working Pressure Hoses.



ITEM	DESCRIPTION	QTY	PART NUMBER	CAGE
1	ON/OFF Control	1	1000	54252
2	Hose fitting, 3/8 Pipe	4	4412-6S	16717
3	Hose, 6-foot, 1/2-inch	4	2651-8-72	16717
4	Hose fitting, 37º SAE flare swivel	4	4411-8S	16717
5	Adapter, 1/4 BSPP to -8 37º SAE flare	2	GG106-NP-08-04*	16717
6	Adapter, 1/2 pipe to -8 37º SAE flare	2	2021-8-8S	16717
7	Quick disconnect, female	1	5601-8-10S	16717
8	Quick disconnect, male	1	5602-8-10S	16717
9	Dust cap, female coupling	1	5657-10	16717
10	Dust cap, male coupling	1	5659-10	16717

* Includes O-ring part number 22617-8

NOTE: Tape as required using item 9 from Figure X-6.

Figure X-7. 6-Foot 2,000 PSI Working Pressure Special Hose