TECHNICAL MANUAL

OPERATOR, UNIT AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

FOR

HYDRAULIC MOTOR GENERATOR
AL35000H
(NSN 6115-01--304-0312)
(EIC: YX6)

STANLEY HYDRAULIC TOOLS
3810 S.E. Naef Road
Milwaukie, Oregon 97267-5698

This technical manual is an authentication of the manufacturers commercial literature and does not conform with the format and content requirements normally associated with the Army technical manuals. This technical manual does, however, contain all essential information required to operate and maintain the equipment.

HEADQUARTERS, DEPARTMENT OF THE ARMY
31 OCTOBER 1994

SAFETY WARNINGS

Tool operators and maintenance personnel must always comply with the safety precautions given in this manual and on the stickers and tags attached to the tool and hose.

These safety precautions are given for your safety. Review them carefully before operating the tool and before performing general maintenance or repairs.

Supervising personnel should develop additional precautions relating to the specific work area and local safety regulations.

GENERAL SAFETY PRECAUTIONS

The hydraulic motor generator will provide safe and dependable service if operated in accordance with the instructions given in this manual. Read and understand this manual and any stickers and tags attached to the hydraulic motor generator and hose before operation. Failure to do so could result in personal injury or equipment damage.

- Operator must start in a work area without bystanders. Keep bystanders clear of your work area. The operator must be familiar with the work area such as excessive slopes and dangerous terrain conditions.
- Establish a training program for all operators to ensure safe operation.
- Do not operate the hydraulic motor generator unless thoroughly trained or under the supervision of an instructor.
- Always wear safety equipment such as goggles, ear and head protection, and safety shoes at all times when operating the hydraulic motor generator.
- Never use tools near energized transmission lines. Know the location of buried or covered services before starting your work.
- Do not overreach. Maintain proper footing and balance at all times.
- Do not inspect or clean the hydraulic motor generator while the hydraulic power source is connected. Accidental engagement of the tool can cause serious injury.
- Always connect hoses to the hydraulic motor generator hose couplers before energizing the hydraulic power source. Be sure all hose connections are tight
- Do not operated the hydraulic motor generator at oil temperatures above 140°F/60°C. Operation at higher temperatures can cause higher than normal temperatures at the tool which can result in operator discomfort.
- Never transport or carry the hydraulic motor generator with the unit energized and connected to electrical loads.
- Do not operate a damaged, improperly adjusted, or incompletely assembled hydraulic motor generator.
- Observe local and national electrical codes for load wiring. To prevent electrical shock from faulty equipment, ground the hydraulic motor generator. If ground bonding is required, connect a length of heavy wire between the hydraulic motor generator ground terminal and the ground bond point.
- Exercise reasonable caution to prevent electrical shock; do not operate the hydraulic motor generator with wet hands.
- Do not operate the hydraulic motor generator in rain or snow. Do not let the hydraulic motor generator get thoroughly wet.

SAFETY WARNINGS CONTINUED

- Do not connect the hydraulic motor generator to a building circuit. This could cause damage to the hydraulic motor generator or to electrical equipment in the building.
- Do not start the hydraulic motor generator with electrical loads connected and in a power "ON" state.
- Ensure that the hydraulic motor generator is at operating speed/voltage before connecting an electrical load.
- Only use hydraulic hose labeled and certified as non-conductive when using hydraulic tools on or near electrical lines. Failure to do so may result in death or serious injury.
- Before using hose labeled and certified as non-conductive be sure the hose is maintained as nonconductive. The hose should be regularly tested for electric current leakage in accordance with your safety department instructions.
- A hydraulic leak or burst may cause oil injection into the body or cause other severe personal injury.
- Do not exceed specified flow and pressure for the hydraulic motor generator. Excess flow or pressure may cause a leak or burst.
- Do not exceed rated working pressure of hydraulic hose used with the hydraulic motor generator. Excess pressure may cause a leak or burst.
- Check the hydraulic motor generator hose couplers and connectors daily for leaks. Do not feel for leaks with your hands. Contact with a leak may result in severe personal injury.
- Do not lift or carry the hydraulic motor generator by the hoses. Do not abuse the hoses. Do not use kinked, torn or damaged hydraulic hose.
- Make sure hydraulic hoses are properly connected to the hydraulic motor generator before pressuring the hydraulic system. The system pressure hose must always be connected to the hydraulic motor generator "IN" port. The system return hose must always be connected to the hydraulic motor generator 'OUT" port. Reversing the connections may cause reverse tool operation which can result in severe personal injury.
- Do not connect open-center hydraulic tools to closed center hydraulic systems. This may result in loss of other hydraulic functions powered by the same system and/or may cause severe personal injury. The hydraulic motor generator is a open-center hydraulic tool.
- To avoid personal injury or equipment damage all tool repair maintenance and service must only be performed by authorized and properly trained personnel.

TECHNICAL MANUAL

NO. 9-6115-667-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 October 1994

TECHNICAL MANUAL

OPERATOR, UNIT AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR

HYDRAULIC MOTOR GENERATOR AL35000H (NSN 6115-01-304-0312)

REPORT ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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INTRODUCTION

DESCRIPTION AND FEATURES

The hydraulic motor generator is an electrical generator which produces 3000 watts power at a nominal 120 volts a.c. single phase at 60 Hertz frequency. The unit requires hydraulic power delivered at 7-9 gallons per minute (gpm) with pressure up to 2000 pounds per square inch (psi).

The hydraulic motor generator features one NEMA 120 volt duplex receptacle and one GFI (Ground Fault Interrupt) duplex receptacle. Each receptacle is protected by a circuit breaker. A third circuit breaker is provided as a main breaker.

CAPABILITIES

The motor generator is designed to provide power for lights, small power tools, and small appliances.

Normal Operating Data:

	No Load	**Full Load**
RPM	3660-3720	3480-3600
Hertz	61-62	58-60
At 120V Outlets	130-135	110-120

SPECIFICATIONS

Capacity	3500W 120, 60-Hz at 8 gpm/30 lpm Input
Outlets	125V/20A NEMA 120V/20A GFI Duplex
Pressure Range	1000-2000 psi70-140 bar
Flow Range	7-9 gpm/26-34 lpm
Optimum Flow	8 gpm/30 lpm
Porting	-10 SAE O-ring
Connect Size and Type	1/2 NPT Pipe Fitting
Hose Whips	-8 x 1/2 NPT x 18”
Weight (with couplers & hose whips)	66 lb/30 kg
Overall Length	17 inches/43.2 cm
Width (with handles)	10-1/2 inches/26.7 cm
Height (with handles)	12-1/2 inches/31.8 cm
Hyrevz™ Motor	24577

ENVIRONMENTAL CAUTION

The hydraulic motor generator's enclosure is designed to prevent water intrusion in the event the unit is exposed to rain water. However, because of air vents in the enclosure for. cooling, the unit is not water tight. A shock hazard exists if operated in rain or snow. DO NOT OPERATE THE HYDRAULIC MOTOR GENERATOR IN RAIN OR SNOW. READ THE SAFETY PRECAUTIONS ON THE FOLLOWING PAGES.

ITEMS FURNISHED

The hydraulic motor generator is furnished with short hose whips and hydraulic quick disconnect couplings installed. As furnished, the unit is ready to be connected to a hydraulic power source. There are no other parts, tools, or test equipment furnished with this unit

SPECIAL TOOLS AND TEST EQUIPMENT

No special tools are required for general maintenance or general disassembly or re-assembly. Typical electrical test equipment such as an Ohm Meter and Voltage Meter and typical hydraulic test equipment such as a flow and pressure tester may be required to perform specific diagnostic tests.

PACKAGING

The hydraulic motor generator will be packaged Level A/B in accordance with Army Master Data File (AMDF) Packaging. MIL-STD-2073-1 (DOD Materiel Procedures for Development and Application of Packaging Requirements) and MIL-STD-20732 (Packaging Requirement Codes) will be used when data is unavailable in AMDF Packaging. Depot repairables will be packaged Level A/A. Marking shall be in accordance with MIL-STD-129. Packaging is required when the item is returned to supply system.

ADMINISTRATIVE STORAGE

Placement of equipment in administrative storage should be for short periods of time when a Shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period appropriate maintenance records will be kept.

Before placing equipment in administrative storage, current maintenance services and equipment serviceable criteria (ESC) evaluations should be completed, shortcomings and deficiencies should be corrected, and all modification work orders (MWO's) should be applied.

Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers and other containers may be used.

WARRANTY

The hydraulic motor generator and its parts are warranted against defects in materials and workmanship for a period of 12 months from the date of purchase. Exceptions are cutting parts, steels, and other parts (such as impact mechanisms, regulators, and hoses), and parts subject to normal wear and tear (such as o-rings, saw blades, and other parts that become worn through normal use of the tool).

The Warranty Registration Card packed with the hydraulic motor generator must be filled out and returned to the manufacturer upon receipt of the tool.

The manufacturer reserves the right to replace or repair only those parts which under our examination prove to have been defective at the time of purchase.

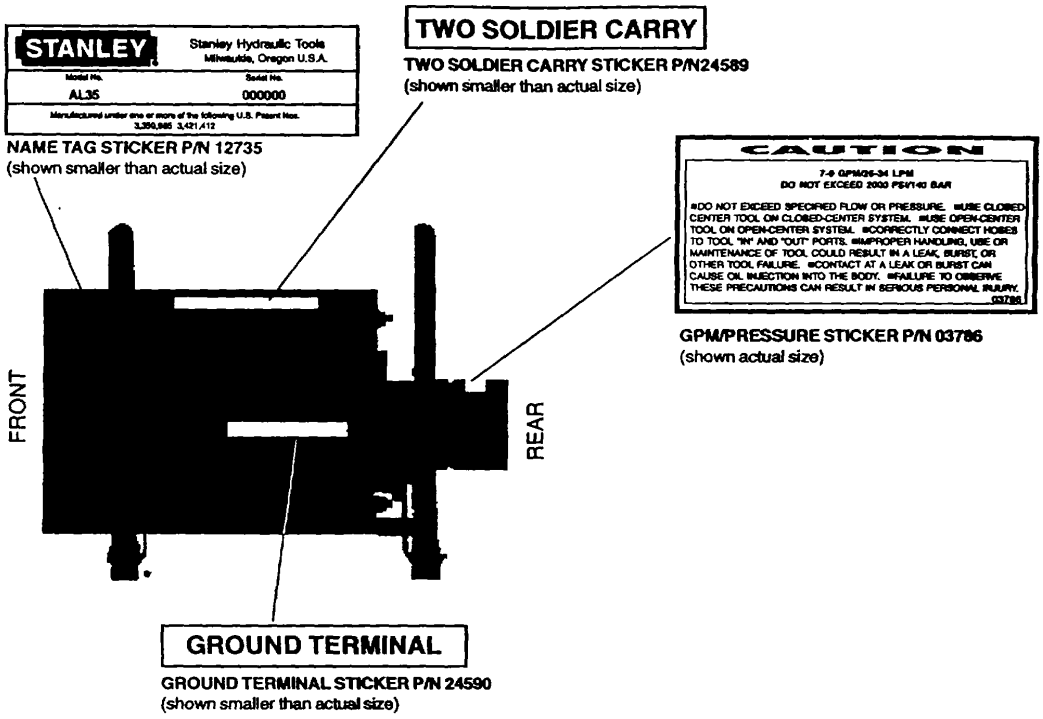
Shipping charges are prepaid by the customer unless otherwise authorized by the manufacturer.

The warranty is void if maximum flow and pressure ratings are exceeded.

Report all defects in material or workmanship to your supervisor who will take appropriate action.

Reporting Equipment Improvement Recommendations (EIRs). If your hydraulic motor generator needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MDO, 4300 Goodfellow Blvd., ST. Louis, MO 63120-1798. We'll send you a reply.

TOOL STICKERS AND TAGS



NAME TAG STICKER P/N 12735
(shown smaller than actual size)

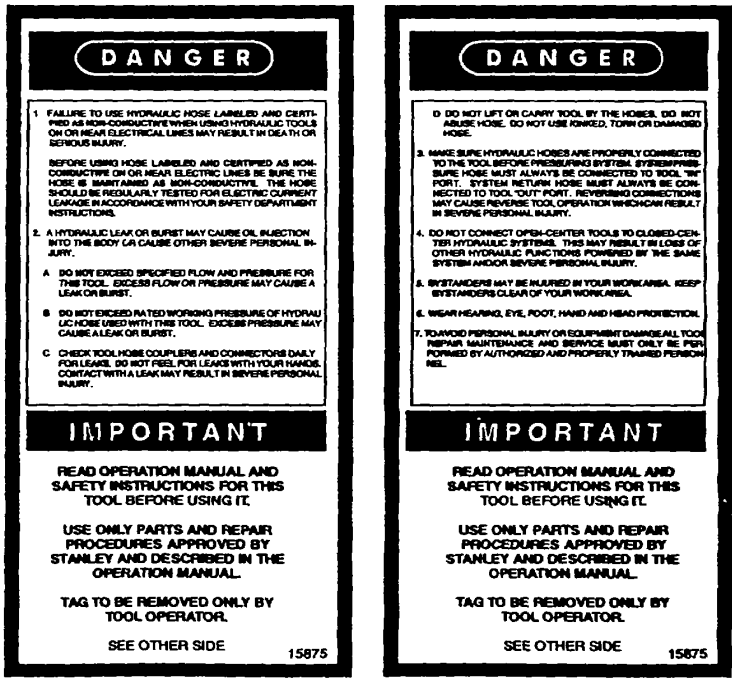
TWO SOLDIER CARRY STICKER P/N24589
(shown smaller than actual size)

GPM/PRESSURE STICKER P/N 03786
(shown actual size)

GROUND TERMINAL STICKER P/N 24590
(shown smaller than actual size)

The flow and pressure sticker above is attached to the hydraulic motor generator at the location shown. Never exceed the flow and pressure levels specified on this sticker. The information listed on the flow and pressure sticker must be legible at all times. Replace this sticker if it becomes worn or damaged. A re-placement is available in the parts list of this manual.

The safety tag (P/N 15875) at right is attached to the hydraulic motor generator when shipped from the factory. Read and understand the safety instructions listed on this tag. Keep it attached to the hydraulic motor generator.



SAFETY TAG P/N 15875 (shown smaller then actual size)

HYDRAULIC HOSE REQUIREMENTS

HOSE TYPES

Hydraulic hose types authorized for use with this unit are as follows:

(1) Certified non-conductive
(2) Wire-braided (conductive)

(3) Fabric-braided (not certified or labeled non-conductive)

Hose (1) listed above is the only hose authorized for use near electrical conductors.

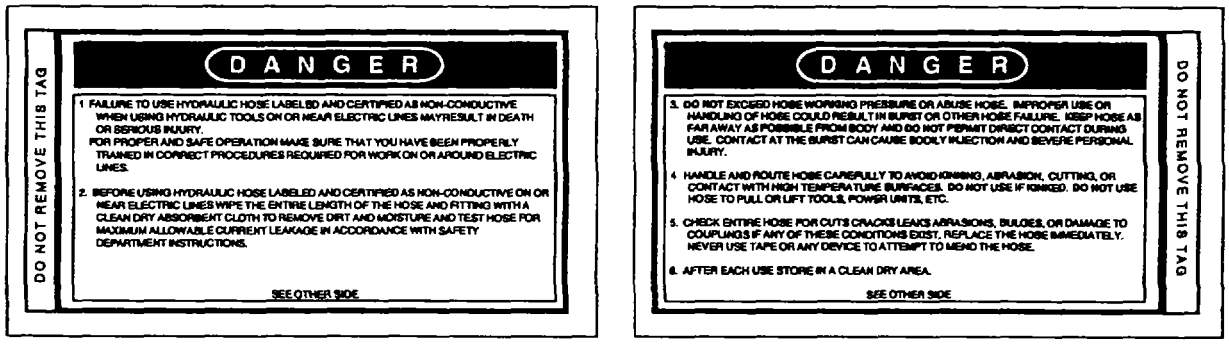
Hoses (2) and (3) listed above are **conductive** and **must never** be used near electrical conductors.

To help ensure your safety, the following DANGER tags are attached to all hose exceeding 6 feet in length purchased from Stanley Hydraulic Tools. DO NOT REMOVE THESE TAGS.

If the information on a tag is illegible because of wear or damage, replace the tag immediately. A new tag may be obtained at no charge from the manufacturer or any dealer.

(1) **CERTIFIED NON-CONDUCTIVE HOSE**

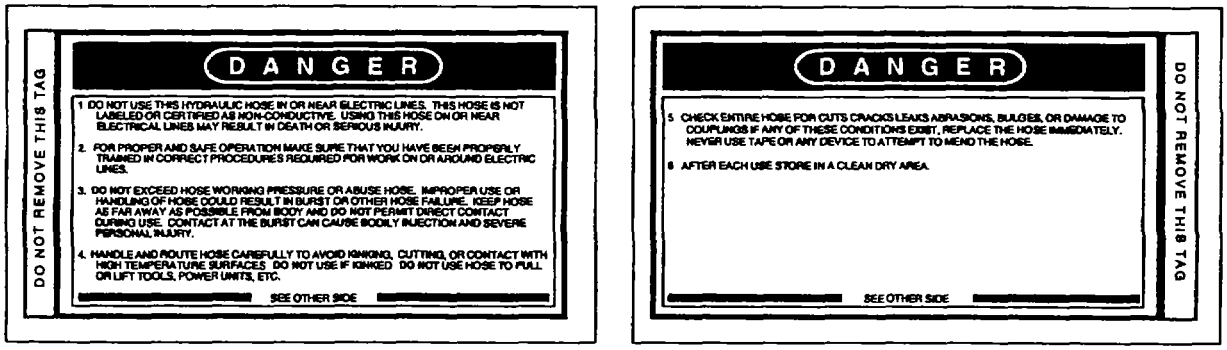
This tag is attached to all certified **non-conductive** hose.



SIDE 1 (shown smaller then actual size) SIDE 2

(2) **AND** (3) **WIRE-BRAIDED AND FABRIC-BRAIDED (NOT CERTIFIED OR LABELED NON-CONDUCTIVE) HOSE**

This tag is attached to all conductive hose.



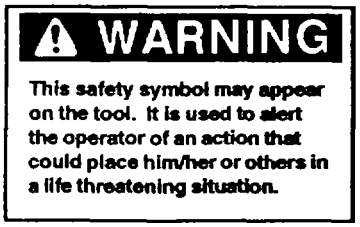
SIDE 1 (shown smaller then actual size) SIDE 2

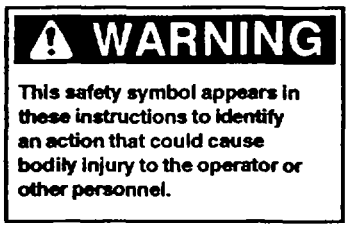
HOSE PRESSURE RATING

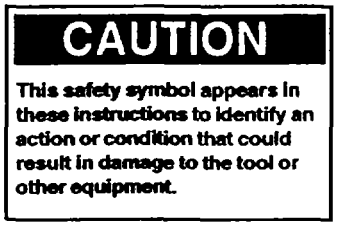
The rated working pressure of the hydraulic hose must be equal or higher than the relief valve setting on the hydraulic system used to power the hydraulic motor generator.

SAFETY SYMBOLS

Safety symbols are used to emphasize all operator, maintenance and repair actions which, if not strictly followed, could result in a life-threatening situation, bodily injury or damage to equipment.







Always read and observe safety symbols. They are included for your safety and for the protection of the tool.

OPERATION

CAUTION

In addition to the Safety Precautions on pages 1 thru 4 of this manual, observe the following for equipment protection and care.

• Always store an idle hydraulic motor generator in a clean dry space, safe from damage or pilferage.
• Do not exceed the rated electrical load limits or use the hydraulic motor generator for applications beyond its design capacity.
• Protect the hydraulic motor generator from extremely dusty or wet conditions.
• Always keep critical hydraulic motor generator markings, such as lables and warning stickers legible.
• Always replace hoses, couplings and other parts with replacement parts as identified in this manual's parts listing. Supply hoses must have a minimum working pressure rating of 2500 psi/175 bar.
• Permit only experienced personnel to perform hydraulic motor generator repairs.
• Be sure to wipe all couplers clean before connecting. Use only lint-free cloths.
• The hydraulic circuit control valve must be in the 'OFF" position when coupling or uncoupling the hydraulic motor generator. Failure to do so may result in damage to the quick couplers and cause overheating of the hydraulic system.
• The hydraulic motor generator should be up to operating speed before connecting and applying power to the electrical load.
• For continuous operation, do not exceed the rated output power of 3500W.
• Do not exceed the current rating specified for the electrical outlet in use.
• Check fastener tightness often and before each use daily.

HYDRAULIC SYSTEM REQUIREMENTS

• The hydraulic system should provide a flow of 79 gpm/26-34 lpm at an operating pressure of 10002000 psi/70-140 bar. Recommended relief valve setting is 2100 psi/145 bar.
• The system should have no more than 250 psi/ 17 bar backpressure measured at the tool end of the operating hoses. The system conditions for measurement are at maximum fluid viscosity of 400 ssu/82 centistokes (minimum operating temperatures).
• The hydraulic system should have enough heat rejection capacity to limit the maximum oil temperature to 140"F/60°C at the maximum expected ambient temperature. The recommended minimum cooling capacity is 5 hp/3.73 kW at a 400 F/ 220C difference between ambient temperature and oil temperature.
• The hydraulic system should have a minimum of 25 micron filtration. Recommend using filter elements sized for a flow of at least 30 gpm/114 lpm for cold temperature startup and maximum dirt holding capacity.
• The hydraulic fluid used should have a viscosity between 100 and 400 ssu/20 and 82 centistokes at the maximum and minimum expected operating temperatures. Petroleum base hydraulic fluids with antiwear properties and a viscosity index over 140 ssu/28 centistokes will meet the recommended requirements over a wide range of operating temperatures.
• The recommended hose size is .500 inch/12 mm I.D. up to 50 ft/15 m long and .625 inch/16 mm I.D.
minimum up to 100 ft/30 m long.

PREOPERATION PROCEDURES

PREPARATION FOR INITIAL USE

The unit as shipped has no special unpacking or assembly requirements prior to usage. Inspection of ventilation holes to assure they do not contain packing debris is all that is required. Otherwise, the unit may be connected to a hydraulic source upon receipt.

ELECTRICAL BONDING

If required, ground bond the electrical load and hydraulic motor generator at the ground lug mounted on the alternator frame, lower right (as viewed from the front SEE PAGE 3).

CHECK HYDRAULIC POWER SOURCE

1. Using a calibrated flowmeter and pressure gauge, check that the hydraulic power source develops a flow of 7-9 gpm/26-34 lpm at 10002000 psi/70-140 bar.
2. Make certain the hydraulic power source is equipped with a relief valve set to open at 2100 psi/145 bar maximum.

CONNECT HOSES

1. Wipe all hose couplers with a clean lint-free cloth before making connections.
2. Connect the hoses from the hydraulic power source to the hose couplers on the hydraulic motor generator. It is a good practice to connect the return hose first and disconnect it last to minimize or avoid trapped pressure within the hydraulic motor on the hydraulic motor generator.
3. Observe flow indicators stamped on hose couplers to be sure that oil will flow in the proper direction. The female coupler is the inlet coupler.

Note: The pressure increase in uncoupled hoses left in the sun may result in making them difficult to connect. When possible, connect the free ends of operating hoses together.

OPERATING PROCEDURES

1. Observe all safety precautions.

CAUTION

Do not connect or otherwise apply power to an electrical load until the hydraulic motor generator has come up to speed.

2. Move the hydraulic circuit control on the Pioneer Tool Outfit (PTO) to the 'ON' position. As the hydraulic motor generator comes up to speed, a maximum electrical load of 3500W, single-phase 60-Hz alternating current, at 120-volts becomes available.
3. Connect the electrical loads.

CAUTION

***Do not exceed the hydraulic* motor generator's rated 3500W capacity.**

Note: Output voltage is proportional to the RPM of the hydraulic motor.

COLD WEATHER OPERATION

1. Before using the hydraulic motor generator in cold weather, preheat the hydraulic oil at low engine speed. When using the normally recommended oils, oil should be at or above 50F/1 0°C (400 ssu/82 centistokes) before use.

CAUTION

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

SERVICE INSTRUCTIONS

Note: For orientation of piece parts in the following procedures, refer to the parts location diagram contained in the PARTS LIST section of this manual.

RECEPTACLE PANEL REMOVAL AND REPLACEMENT

REMOVAL

1. Clean the exterior of the hydraulic motor generator and place on a clean work surface.
2. Remove the four 5/16-24 x 1/2 inch/1.27 cm long machine screws (21, figure 2) securing the receptacle panel assembly (2) to the receptacle box (5).
3. Locate the wire harness connected between the stator (13) and the receptacle panel (2). In this wire harness are a green, white, and black wire.
Tag and disconnect each of these from the receptacles (19 & 20) on the receptacle panel (2).
4. The receptacle panel assembly (2) can now be laid aside or its components individually inspected and serviced as required.

REPLACEMENT

1. Connect the green, white, and black wires in the wire harness to the appropriate terminals. Refer to the wiring diagram for the correct connections.
2. Install the receptacle panel (2) onto the receptacle box (5) and secure with four 5/16-24 x 1/2 inch long phillips head machine screws (21).

CAUTION

Any excess pressure can fracture the molded bearing support on the rotor. Damage to the molded support causes replacement of the complete rotor assembly.

ROTOR REMOVAL AND REPLACEMENT

REMOVAL

1. Remove nuts (10), washers (9), and feet (35) which secure the frame weldment (36) to the hydraulic motor generator. Remove the hydraulic motor generator from the frame weldment (36).
2. Perform steps 1 through 4 of the RECEPTACLE PANEL REMOVAL procedure.
3. Locate the capacitor (18) in the receptacle box (5), tag and disconnect the two red wires connected to it.
4. Remove the four 1/4-20 x 91/2 inchl32 cm long stator bolts (4) securing the stator (13) between the receptacle box (5) and the outboard bearing bracket assembly (7) and the inboard engine end adapter (26). Set the receptacle box (5) aside.

CAUTION

Any excess pressure can fracture the molded bearing support on the rotor. Damage to the molded support causes replacement of the complete rotor assembly.

5. Using a soft-faced mallet, carefully and lightly tap around the outboard bearing bracket assembly (7) from the inboard side until it is free of the stator (13).
6. Lift the stator (13) free of the inboard engine end adapter (26) and lay it aside.
7. Remove the rotor assembly (24) from the Hyrevz motor (31) drive shaft by loosening the rotor attaching capscrew (22) using a typical thinwall 1/2-inch end wrench until the "C" washer (23) drops out. Lift the rotor assembly (24) up and away from the inboard engine end adapter (26). It may be necessary to loosen the capscrew (22) against the rotor assembly to force the rotor assembly off the Hyrevz motor drive shaft.

REPLACEMENT

Note: Be sure all machined surfaces are clean, free of burrs and damage.

1. Turn the capscrew (22) about halfway into the Hyrevz motor (31) drive shaft; then slip the rotor assembly (24) onto the Hyrevz motor drive shaft.

2. Install the "C" washer (23) onto the capscrew (22) between the bolt head and the hydraulic motor drive shaft. Tighten the capscrew with a thinwall 1/ 2-inch end wrench.

3. Position the stator (13) so that stickers (11 & 12) are positioned as shown on page 3 of this manual. Slip the stator (13) over the rotor assembly (24) and onto the inboard motor end adapter (26) pilot. Seat into place by lightly tapping with a soft-faced mallet.

4. The webs of the outboard bearing bracket assembly (7) resemble the letter 'Y". Position the outboard bearing bracket assembly (7) so the vertical portion of the 'Y' is at the bottom of the bracket.

5. Align the outboard bearing bracket assembly (7) stub shaft with the rotor assembly (24) bearing inner race bore and the bearing bracket pilot with the stator (13).

CAUTION

Any pressure or tapping on the bearing bracket assembly, other than in the center, can fracture the molded bearing support on the rotor. Damage to the molded support causes complete replacement of the rotor assembly.

6. Carefully and lightly tap on the outboard bearing bracket assembly (7), center only, until the bracket seats on the stator (13).

7. Secure the stator between the outboard bearing bracket assembly (7) and receptacle box (5) and the inboard engine end adapter (26) using the four 1/4-20 x 9-1/2 inch/32 cm long stator bolts (4) and nuts (29).

Note: The stator bolt holes must line up on both surfaces.

8. Perform steps 1 and 2 of the RECEPTACLE PANEL REPLACEMENT procedure to complete the reassembly.

HYREVZ™ MOTOR REMOVAL, DISASSEMBLY, INSPECTION, CLEANING,

Obtain Seal Kit, part number 07388, to replace all seals exposed during disassembly. Note orientation of seals before removing them. Install new seals in the same way.

REMOVAL

1. Perform steps 1 through 7 of the ROTOR REMOVAL procedures and lay the removed assemblies aside.

2. Remove the four 3/8-16 x 2 inch/51 mm long capscrews (25) securing the inboard engine end adapter (26) to the motor adapter plate (30).

3. Lift the Hyrevz motor (31) and attached motor adapter plate (30) up and away from the inboard engine end adapter (26).

4. Place the Hyrevz motor (31) in a vise (with soft jaws or V-blocks) with the motor adapter (30) up.

5. Remove the two 5/16-18 x 3/4 inch/19 mm long capscrews (28) securing the motor adapter plate (30) to the Hyrevz motor (31).

DISASSEMBLY

1. Place the Hyrevz motor (31) in the vise so the soft jaws or V-blocks are around the bearing housing (9) end with the drive shaft down.

2. Remove the eight 1/4-20 x 2-1/4 inch/57 mm long capscrews (5, figure 3) securing the gear housing assembly (1) and bearing housing (9).

3. Using a flat-blade screwdriver or similar tool, gently pry the gear housing assembly (1) away from the bearing housing (9). Lift the gear housing assembly (1) straight up.

Do Not tilt the housing or pry on the flat surface inside of the surrounding groove. For prying, only use the groove provided at the split between the parts to prevent scratches on the inner mating' surfaces.

4. Remove the idler gear (7), drive gear (8), needle roller key (12), and the idler shaft (6).

5. Remove the large o-ring (4) while being careful not to damage the o-ring groove or surrounding surface.

6. Remove the bearing housing (9) from the vise. While protecting the mating surface from damage, remove the retaining ring (10) from around the bearing. Hold the bearing housing and tap lightly on the small diameter end of the drive shaft (11) to remove it and the bearing (13) from the front of the bearing housing.

CAUTION

Do not remove the ball bearing from the drive shaft unless it requires replacement. Damage can occur during its removal.

7. To remove the bearing (13) from the drive shaft (11), remove the retaining ring (14) on the drive shaft next to the bearing. Press on the gear end of the drive shaft while supporting the outer race of the bearing. Discard the old bearing.

8. Remove the retaining ring (15) at the bottom of the bearing bore to service the seal gland (16), o-ring (17) and quad ring (18). Remove the seal gland (16) using typical o-ring service tools to pry it out of its bore. Take care to avoid damaging the seal surfaces. Note seal orientation. Remove the o-ring (17) from the outside of the seal gland. Remove the quad ring (18) from the inside of the seal gland.

9. If the bushings (3) are to be replaced, remove the four bushings (3) from the bearing housing (9) and gear housing assembly (1) using a typical bushing removal tool with a 7/16 inch collet.

INSPECTION AND CLEANING

Inspect and clean all parts as follows:

Cleaning

WARNING

Use clean solvent in well ventilated areas. Avoid prolonged inhalation of vapors and prolonged or repeated contact with skin. Keep away from heat or open flame.

Clean all parts with a degreasing solvent. Blow dry with compressed air and wipe clean. Use only lintfree cloths.

Gear Housing Assembly (1, figure 3)

The chamber bores and bottoms around the shaft bushings (3) should be polished and not rough or grooved. If the bushing bores are yellow-bronze, replace them and investigate the cause of wear.
The flat surfaces at each end of the gear housing assembly (1) should be flat and free of nicks or burrs that could cause misalignment or leaks.

Bushings (3, figure 3)

The inside of the bushings should be gray with some bronze showing through. If significant yellow-bronze shows, replace the bushings.
Inspect drive shaft (11) for corresponding wear and replace as required.

Gears (7 & 8, figure 3)

The drive gear (8) and idler gear (7) should have straight tips without nicks; square tooth ends and a smooth even polish on the teeth and end faces. Check for cracks between the drive gear keyway and gear tooth root. Replace the gear if cracks are present.

Bearing Housing (9, figure 3)

The surface near the gears should show two interconnecting polished circles without a step.
The bottom of the o-ring groove should be smooth as should the rest of the flat surface.
The bore for the drive shaft seal (inside of the seal gland [16]) should be smooth or oil leakage may occur. The bore in which the seal gland fits should also be smooth.
Shake the bearing housing and a rattle should be

heard. The bearing housing contains two seal check balls which are retained by hex socket type plugs. The hex socket plugs can be viewed from the outside of the bearing housing (9). The check balls and hex socket plugs are not field serviceable items and therefore, are not shown in figure 3. The purpose of the seal balls is to prevent oil pressure from damaging the drive shaft seals in the event hydraulic system supply and return hoses are connected incorrectly (see CONNECT HOSES on page 7 of this manual). If the balls do not rattle, this may mean they are jammed because of fluid contaminants. Replace the bearing housing (9).

Drive Shaft (11, figure 3) and Idler Shaft (6, figure 3)

Shaft diameters at bearing and seal locations must be smooth. Grooves, roughness or a reduced diameter indicate fluid contamination or damaged bushings. Grit particles may have been imbedded in the bushings grinding into the hardened shaft. If abnormal shaft wear as above occurs (more than normal polishing), replace both the shaft and associated bushings.
Also check the hydraulic system for excess contamination in the fluid and for filter condition.
Operating conditions may require changing from a 25-micron filter to an oversized 10-micron filter.

RE-ASSEMBLY

• Be sure to replace all exposed seals with new parts.
• Apply clean grease or o-ring lubricant to all parts during reassembly.

1. Carefully install the quad ring (18) into the groove on the inside of the seal gland (16). Carefully install the o-ring (17) onto the smaller outside diameter of the seal gland (16) and install the seal gland into the bore of the bearing housing (9). Replace the retaining ring (15).

2. To replace the bearing (13) on the drive shaft (11), support the bearing inner race and press the drive shaft through the bearing inner race. Install the retaining ring (14) next to the bearing on the shaft.

3. Install the bushings (3) into the housings using a typical bearing pusher. Make sure the bushing is flush with the surface of the bearing housing. A protruding bushing will bind the gears.

4. Place the bearing housing (9) on a smooth clean arbor press surface (protected from damage) TM96115-667-13&P with the large bearing bore facing up. Position the piece so a clearance hole exists for the insertion of the drive shaft (11).

5. Apply grease to the drive shaft (11) and keyway; then insert it through the seal gland (16). Using a bearing pusher, or a sleeve/socket with a diameter of the bearing, press the bearing and drive shaft assembly into place. Press only on the outer race. Install the bearing retaining ring (10).

6. Install the needle roller (12) in the keyway of the drive shaft. Use grease to keep the needle roller in place. Slide the drive gear (8) over the needle roller and drive shaft. Install the idler shaft (6) and idler gear (7).

7. Apply grease to the face seal o-ring groove; then install the o-ring (4).

8. Note the screw hole pattern on the bearing housing (9) and the gear housing assembly (1). They will only assemble one way. With all parts aligned, carefully slide the gear housing assembly over the gears until it contacts the bearing housing.

CAUTION

Do not force parts together.

9. Turn the drive shaft (11) manually to check for free rotation. Install the eight 1/4-20 x 2-1/4 inch/ 57 mm long capscrews (5) and tighten to 100-120 in-lbs torque. Recheck rotation.

10. Connect the Hyrevz motor to a hydraulic power source and check for smooth running.
Note: Make sure the hydraulic power source is running at the lowest gpm/lpm rate it can while still producing full pressure.

⚠ WARNING

During this break-in procedure, maintain grip on wrench while hydraulic power is applied to motor. Loosing grip may result in injury.

11. Hyrevz motors will sometimes be tight and require “break-in”. Accomplish this by turning the

drive shaft with a wrench while applying hydraulic pressure. Turn the shaft both with and against the hydraulic pressure until the Hyrevz motor starts and runs freely.

REPLACEMENT

1. Place the Hyrevz motor (31, figure 2) in a softjawed vise. Install the Hyrevz motor on the motor adapter plate (30) using the two 5/16-18 x 3/4 inch/i 19 mm long capscrews (28).
2. Secure the motor adapter plate (30) to the inboard engine end adapter (26) using the four 3/816 x 2 inch/51 mm long capscrews (25), 3. Perform steps 1 through 8 of the ROTOR REPLACEMENT procedure to complete the reassembly.

PREVENTATIVE MAINTENANCE SCHEDULE

DIRTY, MOIST, OR SALT MOISTURE ENVIRONMENTS EVERY 90 DAYS

If the unit is operated or stored in a dirty, moist, or salt moisture environment the electrical contacts, rotor, and stator should be inspected and cleaned every 90 days or as deemed necessary.

CLEAN AND DRY ENVIRONMENTS EVERY 12 MONTHS

If the unit is operated or stored in a clean and dry environment the electrical contacts, rotor, and stator should be inspected and cleaned every 12 months or as deemed necessary.

No other preventative maintenance is required.

If symptoms of poor performance develop, the following chart can be used as a guide to correct the problem.

When diagnosing faults in operation of the hydraulic motor generator, always check that the hydraulic power source is supplying the correct hydraulic flow and pressure to the alternator as listed in the table. Use a flowmeter known to be accurate. Check the flow with the hydraulic oil temperature at least 80°F/270C.

PROBLEM	CAUSE	REMEDY
Hydraulic motor generator does not run.	Hydraulic power source not functioning.	Check power source for proper flow and pressure (7-9 gpm/26-34 Ipm, 1000-2000 psi70-140 bar.)
	Couplers or hoses blocked.	Locate and remove restriction.
	Hyrevz motor failure.	Inspect and repair.
	Hydraulic lines not connected.	Connect lines.
No electrical output.	Open circuit breaker.	Reset circuit breaker.
	Faulty receptacle.	Replace receptacle.
	Loose or broken wires.	Locate and repair.
	Loss of residual magnetism.	Flash the Field. 1. Stop the generator. 2. Remove the receptacle panel (2, figure 2). 3. Using a 12 volt automotive battery, touch the positive lead to the end of the diode set with the white or silver band located on the rotor assembly. At the same time touch the negative lead to the opposite end of the diode set. Hold the leads across the diode set for 2-4 seconds. NOTE: Do not reverse the polarity of the leads. This may cause damage to the diodes or the rotor or both. 3. Replace the receptacle panel and start the generator.
	Short circuit in rotor field or rotor diodes.	Return the unit to Authorized Service Dealer.
	Shorted AC or exciter stator windings.	Check with ohmmeter. Continuity should exist from black to white wires and also from red to red wires. No continuity should exist from either black or whitewire to red wire or from any wire to ground. If a short circuit is detected, replace the stator.

PROBLEM	CAUSE	REMEDY
Low output.	Hyrevz motor speed too slow.	Check power unit for proper flow (7-9 gprn26-34 Ipm).
	Unbalanced or excessive load.	Balance load between circuits. Load should not exceed rated capacity.
	High backpressure.	Check hydraulic system for excessive backpressure (over 250 psi/l7 bar).
	Couplers or hoses blocked.	Locate and remove restriction.
	Oil too hot (above 150°F/660C) or too cold (below 50°F/100C).	Check hydraulic power source for proper oil temperature. Bypass cooler to warm oil or provide cooler to maintain proper temperature.
	Relief valve set too low.	Adjust relief valve to 2100-2250 psi/145-155 bar.
	Hyrevz motor worn.	Inspect and repair or replace.
Output too high.	Hyrevz motor overspeeding.	Check power unit for proper flow (7-9 gpm/26-34 Ipm).
Hydraulic Motor Generator overheats.	Overloaded.	Reduce electrical load. Load should not exceed rated capacity.
	Air intake plugged or covered.	Clean air intake.
	Windings covered with dirt.	Clean windings.

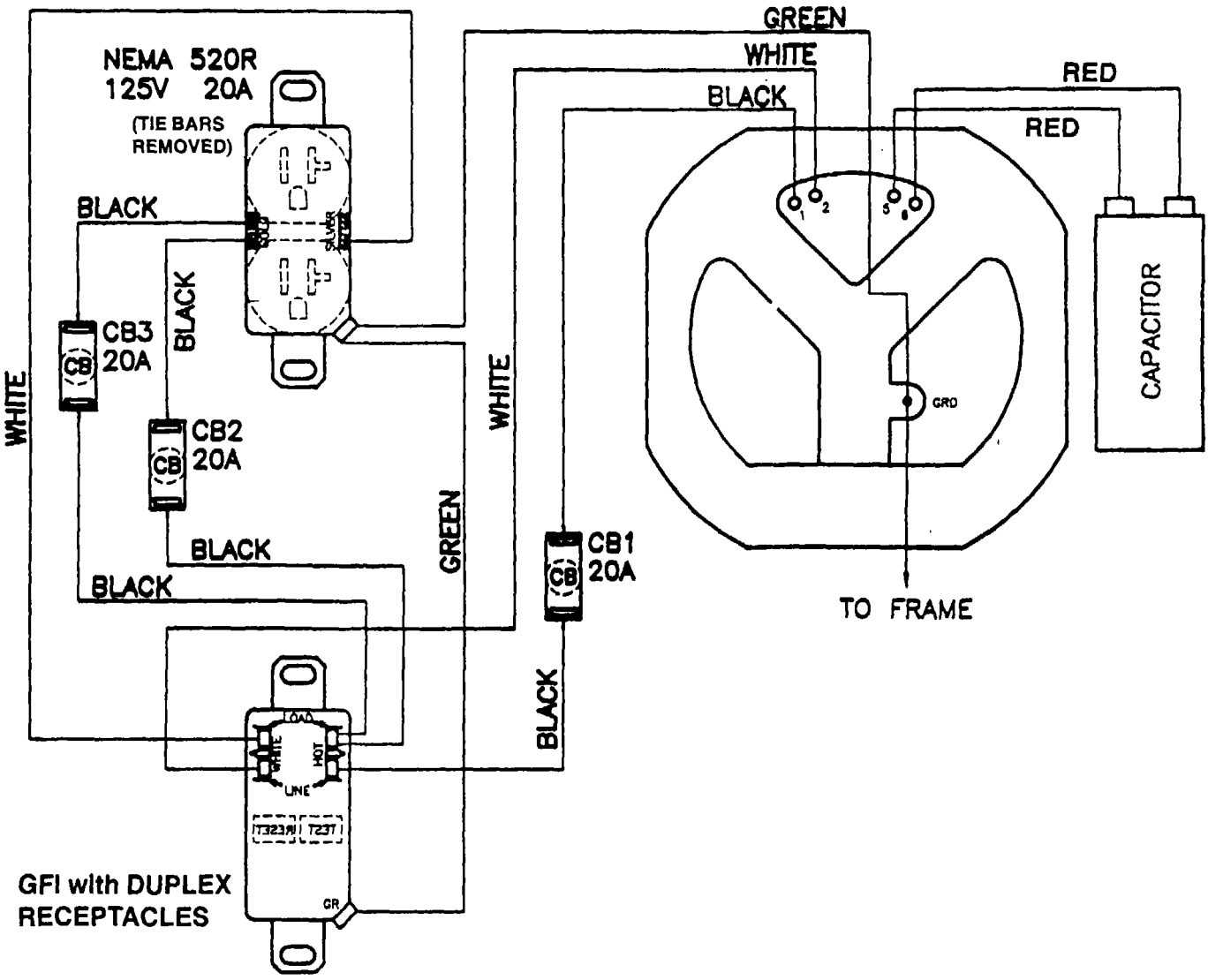


FIGURE 1. Wiring Diagram

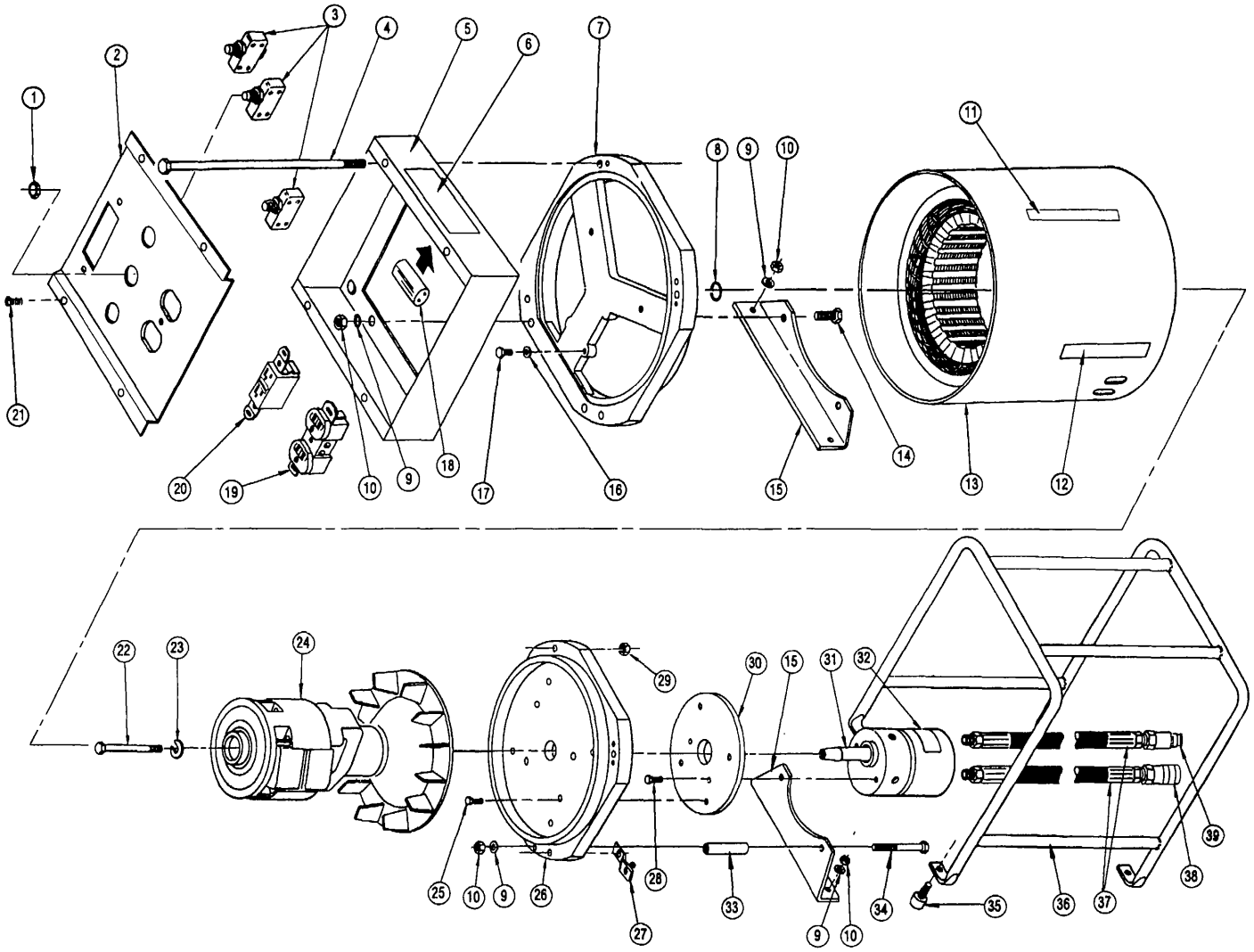


FIGURE 2. Hydraulic Motor Generator Assembly

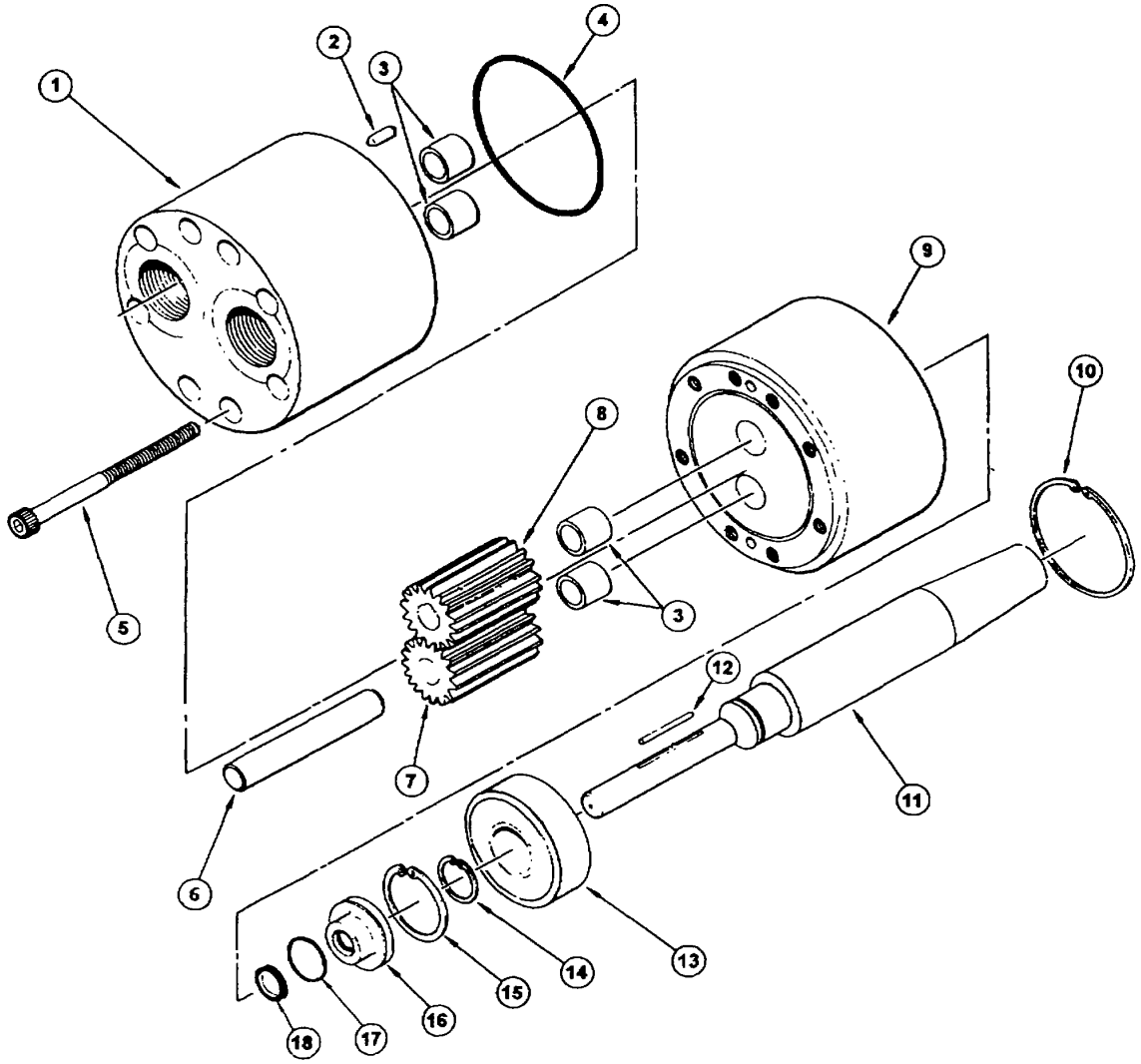
ALTERNATOR PARTS LIST

Item No.	Part No.	Qty	Description
1	-	1	Part of item 3
2	26605	1	Receptacle Panel
3	26613	3	Circuit Breaker - 20A
4	26608	4	Stator Bolt 1/4-20x 9-1/2
5	26604	1	Receptacle Box
6	12735	6	Name Tag
7	26607	1	Outboard Bearing Bracket Assy
8	00171	1	O-Ring
9	02634	8	Washer 5/16
10	00429	8	Hex Nut 516-18
11	24589	2	Striker-Two Soldier Carry
12	245890	1	Sticker - Ground Terminal
13	26600	1	Stator
14	21315	2	Capscrew Y5/16-18 x 1-1/4 Hex Head
15	12628	2	Mounting Bracket
16	01324	1	Lockwasher
17	COM*	1	Capscrew, 1/4-20 x 3/8
18	26612	1	Capacitor
19	26609	1	Receptacle 20A NEMA
20	26611	1	Receptacle GR 20A
21	COM*	4	Phillips Head Machine Screw, 5/16-24 x 12
22	12690	1	Capscrew
23	12691	1	C" Washer
24	26601	1	Rotor Assy
25	04723	4	Capscrew 3/816 x Hex Socket Head
26	26606	1	Adapter, Inboard Engine End
27	12694	1	Ground Lug
28	02688	2	Capscrew Y5/16-18 x 3/14 Hex Socket Head
29	20051	4	Nut, 1/4-20
30	24215	1	Motor Adapter Plate
31	24577	1	Hyrez Motor
32	03786	1	Sticker-GPM
33	24612	2	Spacer
34	370512	2	Capscrew Y16-18 x 3-1/2 Hex Head
35	05351	4	Foot
36	13427	1	Frame Weldment
37	06830	2	Hose Assy -8 x 1/2NPT (O conductive) see page 4 of this manual
38	03975	1	Coupler Body 3/8 x 1/2 NPT
39	03976	1	Coupler Nose 3/8 x 1/2 NPT
15875	1		Safety Tag (not illustrated - see stickers & Tags, page 3 of this manual)

COM* Commercial Parts available through local sources
** See illustration of tag on page 3

SEAL KIT DATA

Part No	Qty.	Description
Seal Kit Part No. 07388		
00669	1	Quad Ring
00171	2	O-ring
00178	1	O-ring
07387	1	Service Instructions



Item No.	Part No.	Qty	Description
1	07386	1	Gear Housing Assy (Consists of items 1. 2, 3)
2	00713	2	Dowel Pin
3	06316	4	Bushing
4	00178	1	O-Ring)
5	00120	8	Capscrew, 14-20 x2-1/4HSH
6	06854	1	Idler Shaft
7	06855	1	Idler Gear
8	06853	1	Drive Gear
9	21432	1	Bearing Housing (Consists of items 3, 9)

Item No.	Part No.	Qty.	Description
10	00166	1	Retaining Ring
11	24216	1	Drive Shaft
12	06881	1	Needle Roller
13	00148	1	Bearing
14	00708	1	Retaining Ring
15	00170	1	Retaining Ring
16	19884	1	Seal Gland
17	00171	1	O-Ring O
18	00669	1	Quad Ring E

FIGURE 3. Hydraulic Motor Assembly

Appendix A. MAINTENANCE ALLOCATION CHART (MAC)

Section I. INTRODUCTION

A-1. THE ARMY MAINTENANCE SYSTEM MAC.

a. This introduction (section I) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b. The Maintenance Allocation Chart (MAC) in section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be constant with the capacities and capabilities of the designated maintenance levels, which are shown in the MAC in column (4) as:

Unit - includes two subcolumns, C (operator/crew) and O (unit) maintenance.
Direct Support - includes an F subcolumn.
General Support - includes an H subcolumn.
Depot - includes an D subcolumn.

c. Section III lists the tools and test equipment (both special tools and common tools sets) required for each maintenance function as referenced from section II.

d. Section IV contains supplemental inspections and explanatory notes for a particular maintenance function.

A-2. MAINTENANCE FUNCTIONS. MAINTENANCE FUNCTIONS WILL BE LIMITED TO AND DEFINED AS FOLLOWS:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (i.e., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to dean (includes decontamination, when required), to preserve, to paint or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3rd position code of the SMR code.

i. Repair. The application of maintenance services[1] including fault location troubleshooting[2], removal/installation, and disassembly/assembly[3] procedures, and maintenance actions[4] to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul in normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those service/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment and components.

A-3. EXPLANATION OF COLUMNS IN THE MAC. SECTION II.

a. Column 1 - Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2 - Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3 - Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2. (For detailed explanation of these functions, see paragraph A-2.)

---

[1]Service - Inspect, test, service, adjust, aline, calibrate, and/or replace

[2]Fault location/troubleshooting - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

[3]Disassembly/assembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned as SMR code for the level of maintenance under consideration (i.e., identification as maintenance significant).

[4]Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

d. Column 4 - Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart The symbol designations for the various maintenance categories are as follows:

C Operator or Crew
O Unit Maintenance
F Direct Support Maintenance
H General Support Maintenance
D Depot Maintenance

e. Column 5 - Tools and Equipment Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6 - Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in section IV.

A-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS. SECTION III.

a. Column I - Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, section II, column 5.

b. Column 2 - Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3 - Nomenclature. Name or identification of the tool or test equipment.

d. Column 4 - National Stock Number. The National stock number of the tool or test equipment

e. Column 5 - Tool Number. The manufacturer's part number.

A-5. EXPLANATION OF COLUMNS IN REMARKS. SECTION IV.

a. Column 1 - Reference Code. The code recorded in column 6, section II.

b. Column 2 - Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	HYDRAULIC MOTOR GENERATOR	INSPECT	.5					1	
		REPAIR		2.0				1	
		SERVICE	.5					1	
01	GENERATOR	INSPECT	.5					1	
		REPAIR		1.0				1	
		REPLACE		1.0				1	
		TEST		.5				1	
		REBUILD		1.0				1	
02	HYDRAUUC MOTOR	INSPECT	.5					1	
		REPAIR		1.0				1	
		REPLACE		1.0				1	
		TEST		.5				1	
		REBUILD		1.0				1	
03	FRAME	INSPECT	.5					1	
		REPAIR		.5				1	
		REPLACE		.5				1	

Section III. TOOLS AND TEST EQUIPMENT REQUIREMENTS

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONALNATO STOCK NUMBER	TOOL NUMBER
1	0	TOOL KIT, GENERAL MECHANIC	5180-00-177-7033	

Section IV. REMARKS

REFERENCE CODE	REMARKS

APPENDIX B. COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS

Section I. INTRODUCTION

B-1. SCOPE.. This appendix lists components of the end item and basic issue items for the Hydraulic Motor Generator to help you inventory the items for safe and efficient operation of the equipment.

B-2. GENERAL. The Components of End Item and Basic Issue Items (Bll) Lists are divided into the following sections:

a. Section II, Components of End Item. This listing is for information purposes only, and is not authority to requisition replacements. These items are part of the Hydraulic Motor Generator but they are to be removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to help you find and identify the items.

b. Section III, Basic Issue Items. These essential items are required to place the Hydraulic Motor Generator in operation, operate it, and to do emergency repairs. Although shipped separately packaged, Bll must be with the Hydraulic Motor Generator during operation and when it is transferred between property accounts. Listing items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

B-3. EXPLANATION OF COLUMNS.

a. Column (1), Illustration Number, gives you the number of the item illustrated.

b. Column (2), National Stock Number, identifies the stock number of the item to be used for requisitioning purposes.

c. Column (3), Description and Useable On Code, identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the CAGEC (commercial and Government entity code) (in parenthesis) and the part number. If the item you need is not the same for different models of the equipment, a Usable On Code will appear on the right side of the description column on the same line as the part number. These codes are identified below as:

d. Column (4), UN (unit of issue), indicates how the item is issued for the National 'Stock Number shown on column two.

e. Column (5), Qty Rqd, indicates the quantity required.

Section II. COMPONENTS OF END ITEM LIST

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable On Code	(4) U/I	(5) Qty rqd

Section III. BASIC ISSUE ITEMS LIST

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number Usable On Code	(4) U/I	(5) Qty rqd
37, fig. 2		HOSE ASSY (54252) 06830	EA	2
38, fig. 2		COUPLER BODY (54252) 03975	EA	1
39, fig. 2		COUPLER NOSE (54252) 03976	EA	1

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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