

INTRODUCTION

This manual is intended for the guidance of the operator and furnishes necessary information for operation as well as installation and maintenance.

MWI uses several different manufacturers of diesel engines. Except for a difference in appearance, the operation is basically the same. Engine make, serial number and size are located on a plate attached to the block. When repairs or replacement parts are needed, always insist on a qualified mechanic familiar with the make and model installed on your MWI Hydraflo pump driver.

When your Hydraflo pump driver is supplied with an electric motor, operation of the Hydraflo pump and its hydraulic system will be basically the same. Ignore diesel engine instructions when using electric motor.

You will find after reading this manual that the number one enemy of the Hydraflo hydraulic system is contamination of hydraulic oil. Reminders are used throughout to make you aware of this.

Many years of trouble free service can be obtained from your Hydraflo pumping unit by following the simple operating and maintenance instructions included in this manual.

WARRANTY INFORMATION

MWI Corporation will be relieved of its warranty obligations under the following conditions:

1. When hydraulic oil of a type, weight and manufacture are different than recommended by MWI is used in the Hydraflo hydraulic system.
2. When physical damage is found to be the source of the problem.
3. When reasonable maintenance is not performed (filters).
4. When the high pressure relief valve or switch gauge setting has been improperly changed.
5. When wrong filter elements are used or when no filter element is used.
6. When failure shutdowns are bypassed, jumped or haywired.
7. When hose assemblies are disconnected, reconnected wrong, not fully tightened, contaminated or pinched.
8. When any mechanical linkages or moving parts are restricted, purposefully jammed, rigged, etc.
9. When abrasive material has been pumped.
10. When corrosive material has been pumped.
11. When excessive trash has been allowed to enter the pump bowl.

The **HYDRAFLO**® System

MWI APPROVED HYDRAULIC OIL

The following chart is a list of interchangeable oils used in the Hydraflo hydraulic system. Serious damage may result if other types of oils are used.

- NOTE:** 1) The viscosity of the oil selected must be S.A.E. 20W.
2) Type oil used is high pressure (anti-wear and anti-foam).

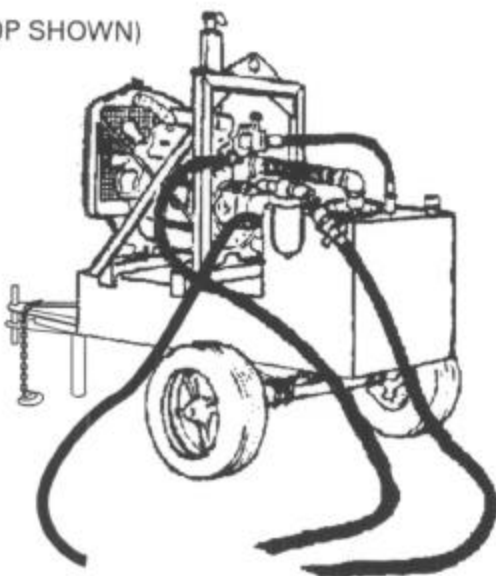
MANUFACTURER	TRADE DESIGNATION S.A.E. 20W
Amalie Refining Company Amoco Oil Company Ashland Oil Company Gulf Oil Company Standard Oil Company Mobile Oil Company Shell Oil Company Texaco, Inc.	#AMA-Oil 300 #Rykon Oil No.31 #Anti-Wear Oil No.30 #Gulf Harmony 54AW #Industron 53 #DTE 26 #Tellus 33 #Rando Oil HD 68
If none of the above oils are available, consult factory for list of oils that are available to you locally.	

The drawing below will identify the major components inside the Hydraflo® pump.



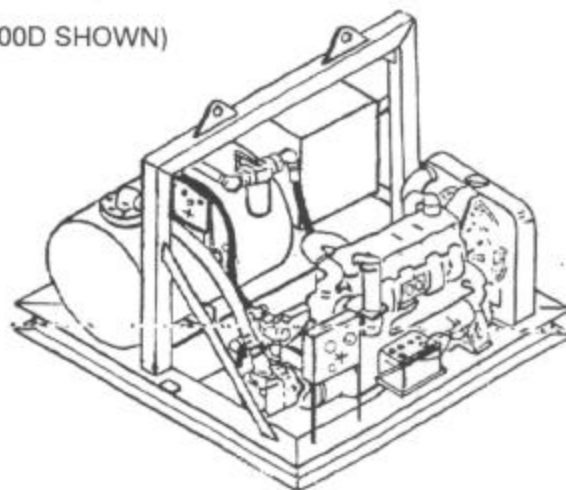
Standard portable Diesel
Hydraflo® Drive Unit with
built in fuel tank and
oil reservoir

(MODEL 1200P SHOWN)



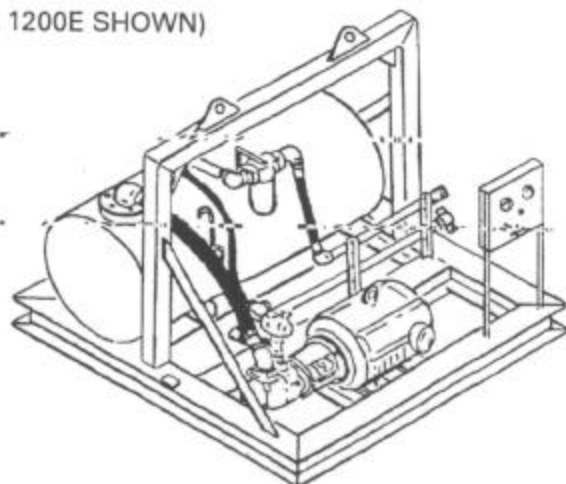
Standard skid mounted
Diesel Hydraflo® Drive
Unit with oil reservoir

(MODEL 1200D SHOWN)



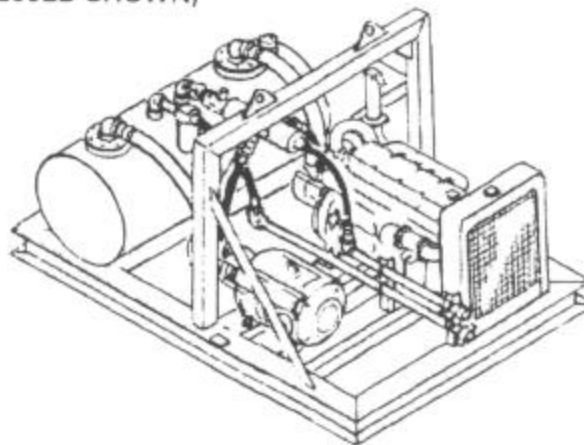
Standard skid mounted
Electric Hydraflo® Drive
Unit with built in oil
reservoir

(MODEL 1200E SHOWN)

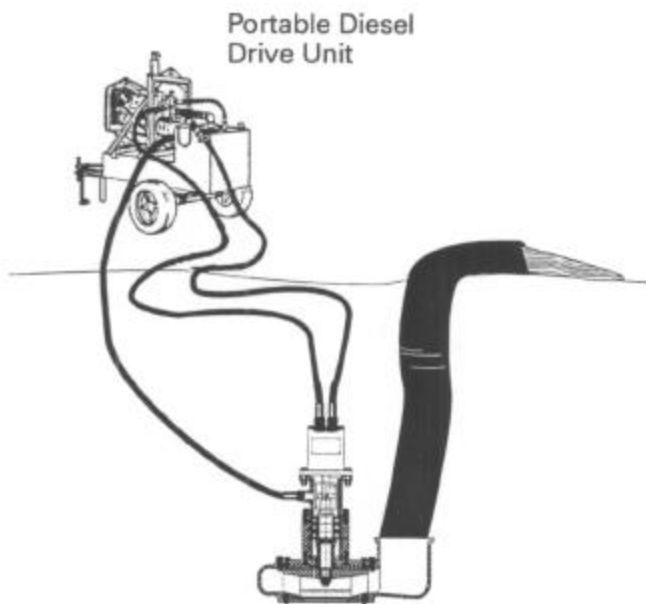


Skid mounted electric
with standby diesel
with oil reservoir

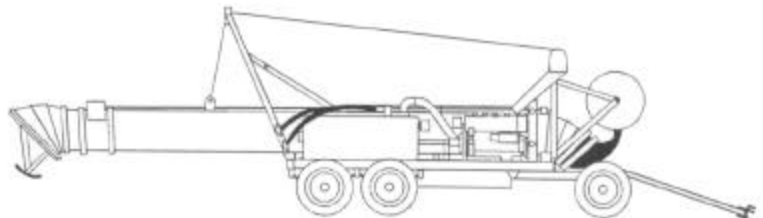
(MODEL 1200ED SHOWN)



The **HYDRAFLOW™** System



Mobile Hydraflo®
Complete pumping
station on wheels



NOTE: Drawings are representative of our product.

GENERAL

It is impossible, due to the versatility of the MWI Hydraflo pump, to cover all the different types of installations. Designs of sump and structural supports (if needed) and permanent pumping stations are most often shown in a shop drawing supplied by factory or your local dealer. The following paragraphs and illustrations will help you obtain a better installation.

RECEIVING AND HANDLING

Your new Hydraflo was designed and built tough, as with any new well-built equipment, proper care in transportation, unloading and storage until installation must be exercised.

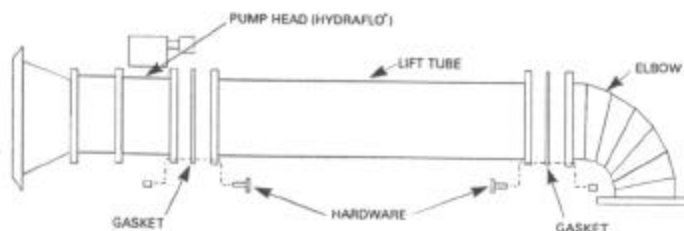
The lifting eyes on the equipment are there only for lifting--use them.

Make sure slings and other lifting cables do not get wrapped around any of the components of the Hydraflo.

Keep the drive unit in an upright position at all times and properly leveled.

PUMP INSTALLATION

Generally the pump is shipped without discharge pipe or hydraulic oil hose attached. This simple operation must be performed at installation.

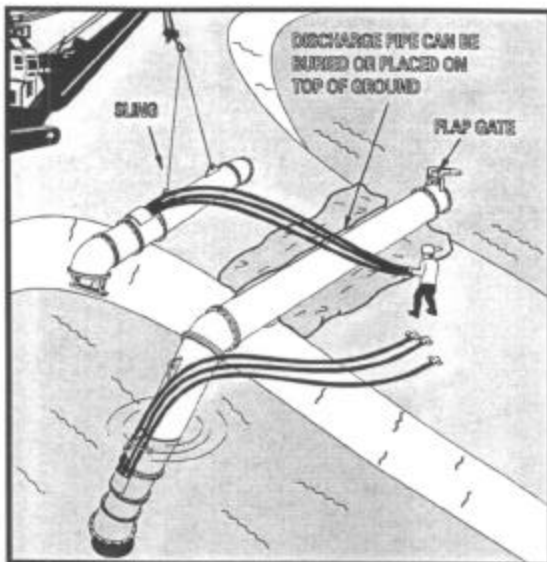
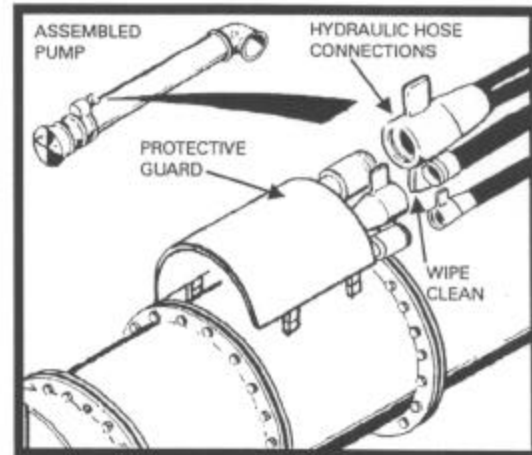


Attached lift tube discharge pipe and elbow to pump head with gaskets and hardware provided.

Wipe hose connections clean with lint free cloth before connecting.

Unroll hydraulic oil hoses and stretch out full length on ground. Connect high pressure hose (normally the second largest of the three hoses) to the matching fitting on the pump. On units with the same size hose, fittings are reversed or ends are color-coded for correct orientation. Tighten by hand until fittings seat. Sometimes additional force may be required to seat the connection. An adjustable wrench, applied to the ear of the fitting will give the additional force needed.

Follow the same procedure for connecting the larger return hose, and the smallest hose, the case drain.



LIFTING INTO SUMP

WARNING: DO NOT ATTEMPT TO LIFT PUMP BY HOSE

Inspect the inside of pump for any foreign material. With a suitable lifting device swing pump into sump, making sure no strain is put on hose. While holding in position connect the additional discharge pipe sections and supports if necessary.

In fixed pumping stations where support is provided per plans and specifications -- the same basic procedure outlined here is observed.

DRIVE UNIT INSTALLATION

Set drive unit as close as possible to the pump but far enough away from bank to avoid any cave-in. The area you select for the drive unit should be accessible to a fuel or service truck.

After drive unit has been properly leveled, connect the hydraulic oil hoses to the fittings on the unit in the same manner as discussed for pump installations.

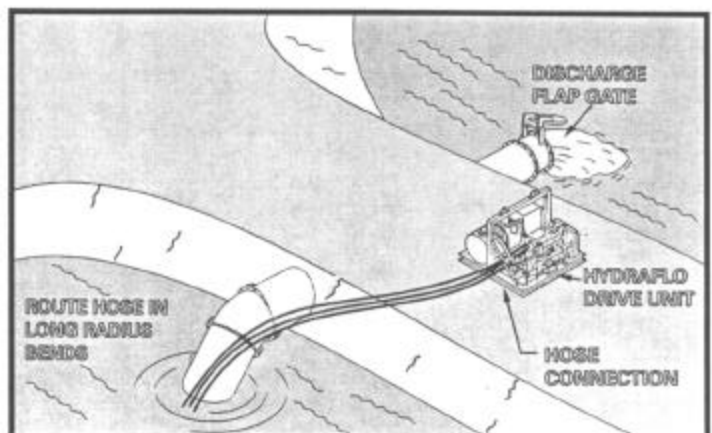
Electrically driven units should be connected by a qualified electrician observing all local codes, electric motor nameplate, wiring diagram, and connection of failure shutdown circuitry for the protection of hydraulic equipment.

CAUTION

Wipe hose connections with lint free cloth before connecting.

Route hoses on ground with long radius bends -- avoid short turns or kinks.

You have read through a typical installation. The pump station is now ready for use.



The **HYDRAFLO™** System

OPERATING INSTRUCTIONS

NOTE: If your drive unit is electric motor driven, skip to page 13.

THE DIESEL ENGINE

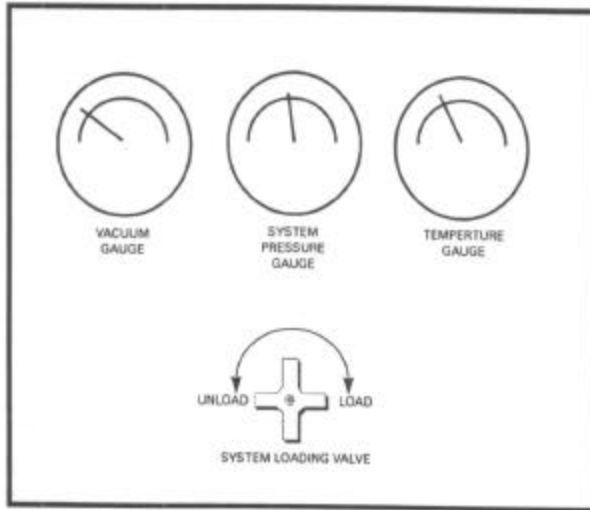
The following section covers those items which are of particular interest to the operator and does not necessarily cover such work as might be performed by the maintenance man. The scope of this section is to cover a typical diesel engine driven Hydraflo pump.

READ BEFORE STARTING ENGINE (See engine literature also)

Know how to stop the engine before attempting to start.

The following precautions, if followed, will help eliminate many operating difficulties and insure satisfactory service and engine life:

1. Do not start the engine until the lubricating oil, water and fuel supplies have been checked.
2. Never run the starting motor longer than 7 or 8 seconds without a rest period of at least one minute before allowing it to run again.
3. Remember: Dirt, grit, water, lint, or any foreign matter is detrimental, and it is your duty to see that they do not get into the engine. Keep all filters clean and serviced regularly.
4. Fuel oil -- keep it clean -- use only clean containers.
5. Designation and Type: Diesel fuels are marketed according to ASTM Designation D-975. MWI diesel engines use summer #2D, and winter #2D. The final maximum boiling point for summer fuel is 675°F and for winter fuel is 600°F
6. Lubricating oil -- keep it clean -- drain the crankcase often. Use the best brands obtainable.
7. VISCOSITY CHART
CC-CD recommended for all engines.
Adjust weight to suit temperature.
10°F to 30°F - 10W
30°F to 60°F - 20-20W
40°F and up - 30W
8. Oil level - maintain the level at the "Full" mark on the bayonet gauge; however, do not overfill. Never allow the engine to run without oil pressure showing on the gauge.
9. Do not put cold water in an overheated engine. A cracked cylinder head or block may result. Add water slowly to radiator with engine operating at a slow idle. Never operate with the water boiling. Use antifreeze/coolant solutions.
10. Never allow your batteries to run low or dry of water. In cold weather do not fill the batteries with water when shutting down, as this makes them more likely to freeze. Add water after starting the engine for day's run.
11. Do not attempt to make repairs or adjustments to the engine or fuel injection equipment; rather, take it to the nearest authorized service station.
12. Do not operate the fuel injection pump with any lines shut off or blocked. The high pressure will ruin the pump. Correct fuel nozzle pressure is essential to efficient operation.
13. Keep the fan belts properly tightened. Loose belts allow slippage and wear rapidly. Overtightening can damage water pump or alternator bearings.
14. Do not permit oil, water, or fuel leaks to go uncorrected.
15. Do not run engine out of fuel (see priming fuel system).



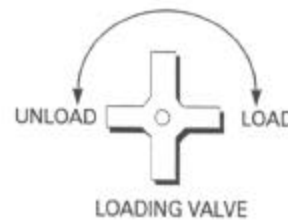
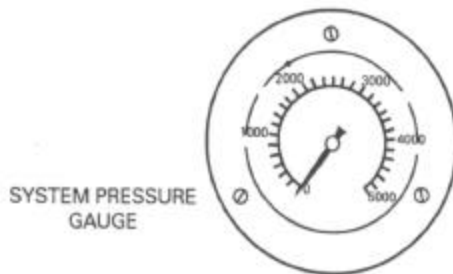
TYPICAL HYDRAFLO SYSTEM® CONTROL PANEL

1. Above devices are located near engine controls when prime mover is a diesel. Control voltage is either 24VDC or 12VDC.
2. Above devices are located in motor starter enclosure when prime mover is an electric motor and motor starter is supplied by MWI. Control voltage is normally 120VAC.

If motor starter is remote (or by others), devices and shut-down circuitry will be supplied in a small enclosure on the drive unit.

MANUALLY STARTING DIESEL HYDRAFLO® PUMPING SYSTEM

- (Step 1) Check the fuel supply in tank, lube oil in pan and cooling water level in the radiator of the engine.
- (Step 2) Be sure the stop control is not in the "shut-off" position (see stopping engine).
- (Step 3) Open loading valve -- counter clockwise -- one half turn -- valve located near system pressure gauge.



- (Step 4) Place the throttle at $\frac{1}{4}$ to $\frac{1}{2}$ position.
- (Step 5) "Push in" override push-button and "hold in" while starting engine. This function will bypass the engine oil pressure "low" safety shut down. On some models, this feature is automatic.
- (Step 6) Start the engine by operating the starter switch. (Some engines utilize a "push-button type" starter button.)

PUSH-BUTTON
(OIL PRESSURE
SAFETY SHUTDOWN
OVERRIDE)



STARTER
SWITCH
(KEY OR LEVER)



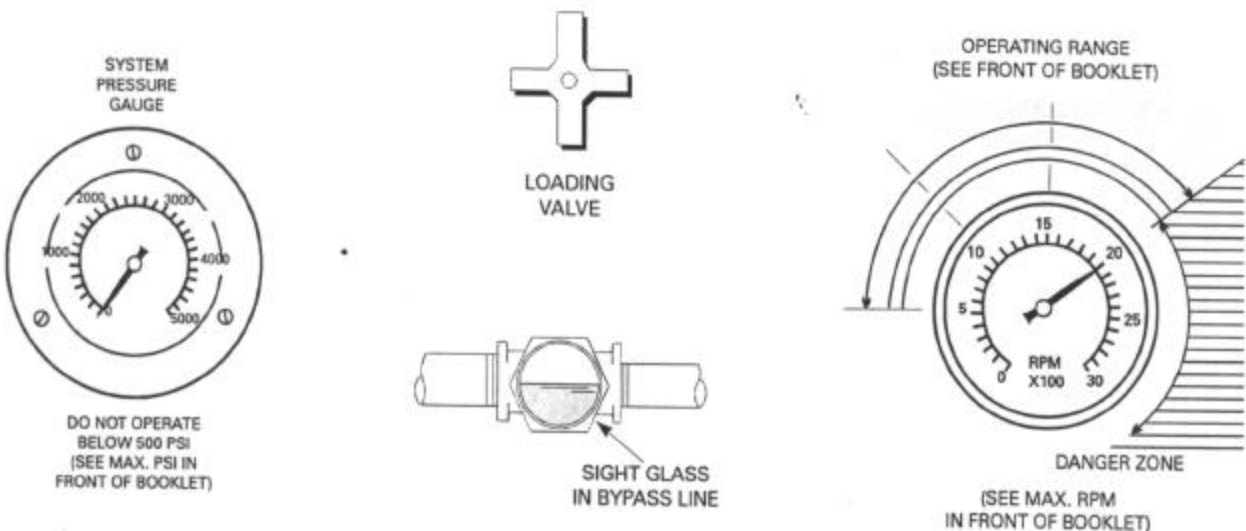
The HYDRAFLO™ System

NOTE: Save your batteries

One 12 or 24 volt battery will crank the engine against compression for five or six periods of 15 seconds each with a recuperation or rest of one minute between each period of cranking.

If a battery replacement is necessary, use one with a rating as high as the one furnished with new equipment.

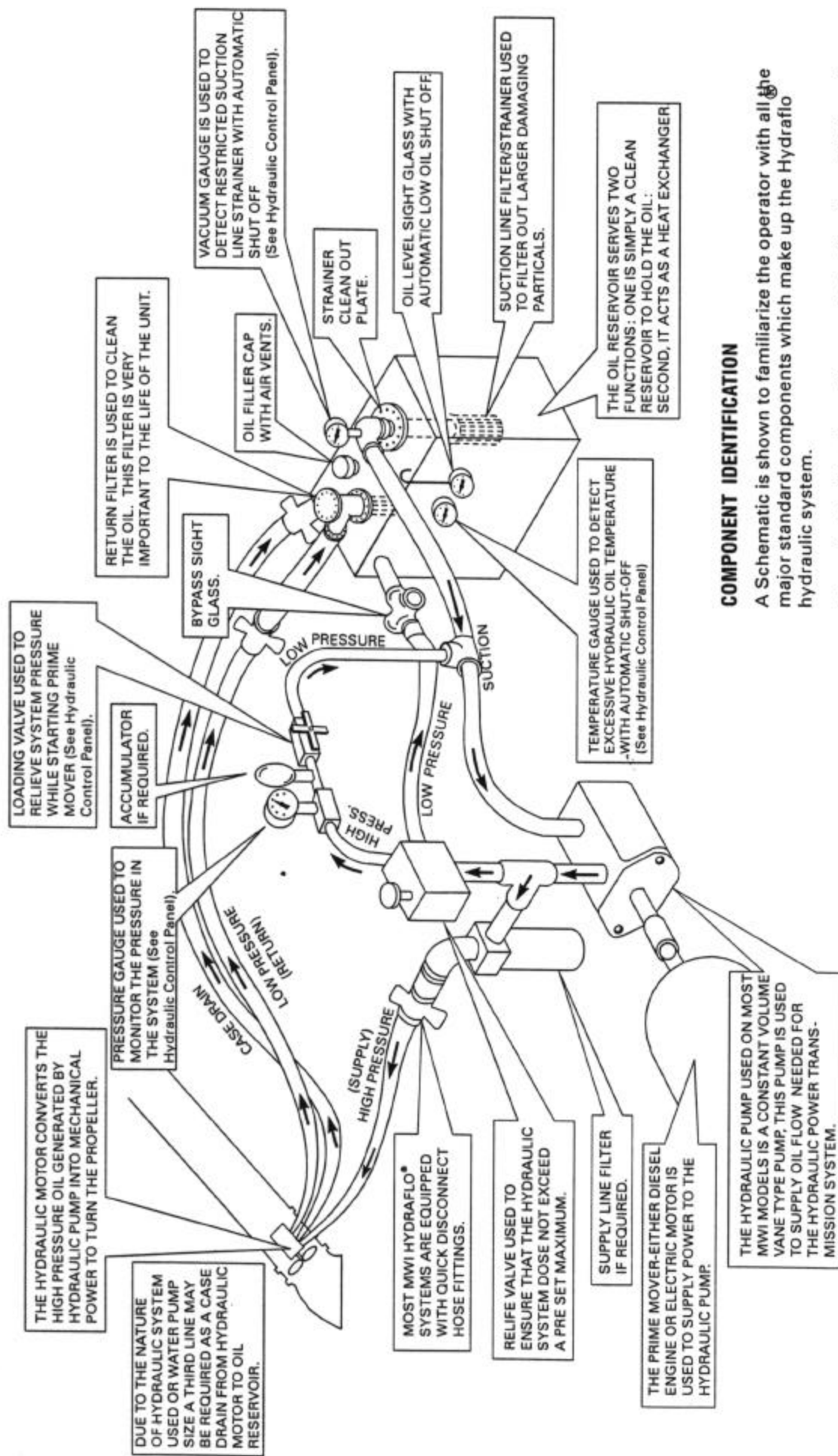
- (Step 7) After oil pressure rises (or engine starts), release override pushbutton.
- (Step 8) After engine starts, reduce the engine speed to a fast idle and observe engine oil pressure gauge. Oil pressure should read between 40 and 60 P.S.I. at full speed. As oil heats, pressure will reduce slightly.
- (Step 9) Allow the engine to run for several minutes at half speed before applying load.
- (Step 10) Increase engine speed to $\frac{3}{4}$ throttle.
- (Step 11) Slowly close loading valve to start pumping water (close snugly).
- (Step 12) Slowly increase engine speed to design speed (see front of booklet for RPM).



CAUTION

On new installations which are started for the first time, leave the loading valve cracked open for two minutes to allow oil lines to fill and to bleed air from the system.

- (Step 14) Observe system pressure. It should read close to P.S.I. listed in front of this booklet. (See trouble shooting chart if system pressure is above or below design).
- (Step 15) Practice this procedure a few times to acquaint yourself with the Hydraflo's operation. If you change operators, make sure the new operator reads this manual.



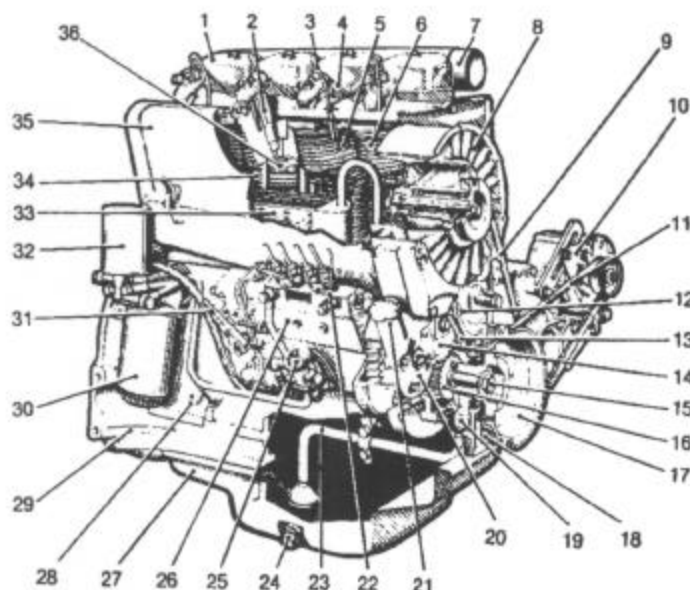
COMPONENT IDENTIFICATION

A Schematic is shown to familiarize the operator with all the major standard components which make up the Hydraflo hydraulic system.

Shown is the direction of flow and identification of high and low pressure piping.

Also see general control panel illustration.

The HYDRAFLO™ System



1. Rocker chamber cover
2. Injector
3. Injection line to No 3 Cylinder
4. Backleakage line
5. Cylinder head anti-fatigue bolt (4 bolts securing each cylinder head with cylinder to crankcase)
6. Cylinder head
7. Air intake manifold
8. Cooling blower (V-belt-driven)
9. Cooling blower V-belt
10. Generator (or alternator)
11. Generator V-belt
12. Camshaft gear
13. Oil gallery
14. Idler gear (driving injection pump and camshaft)
15. Anti-fatigue bolt (securing V-belt pulley too crankshaft)
16. Crankshaft gear
17. Vibration dampener
18. Oil pump
19. Injection pump drive gear with advance/retard unit
20. Oil filler neck
21. Overflow line
22. Oil suction pipe
23. Oil drain plug
24. Fuel feed pump
25. In-line injection pump with mech. centrifugal governor
26. Oil sump
27. Oil dipstick
28. Crankcase
29. Oil filter
30. Speed control lever
31. Fuel filter
32. Integral oil cooler
33. Finned cylinder
34. Removable air cowl
35. Piston
36. Piston
37. Piston
38. Piston

1. Rocker chamber cover
2. Injector
3. Injection line to No 3 Cylinder
4. Backleakage line
5. Cylinder head anti-fatigue bolt (4 bolts securing each cylinder head with cylinder to crankcase)
6. Cylinder head
7. Air intake manifold
8. Cooling blower (V-belt-driven)
9. Cooling blower V-belt
10. Generator (or alternator)
11. Generator V-belt
12. Camshaft gear
13. Oil gallery
14. Idler gear (driving injection pump and camshaft)
15. Anti-fatigue bolt (securing V-belt pulley too crankshaft)
16. Crankshaft gear
17. Vibration dampener
18. Oil pump
19. Injection pump drive gear with advance/retard unit
20. Oil filler neck
21. Overflow line
22. Oil suction pipe
23. Oil drain plug
24. Fuel feed pump
25. In-line injection pump with mech. centrifugal governor
26. Oil sump
27. Oil dipstick
28. Crankcase
29. Oil filter
30. Speed control lever
31. Fuel filter
32. Integral oil cooler
33. Finned cylinder
34. Removable air cowl
35. Piston
36. Piston
37. Piston
38. Piston

AIR COOLED DIESEL ENGINE
TYPICAL VIEW / COMPONENT IDENTIFICATION

STOPPING THE DIESEL ENGINE HYDRAFLO® SYSTEM

After engine has been running with load applied, the proper stopping procedure is as follows:

1. Slow engine to half-speed.
2. Slowly open loading valve one half turn on hydraulic system. This will reduce the pumping load.
3. Slow engine to idle speed and let run for a few minutes to cool before stopping.

TYPICAL STOPPING DEVICES

White Engines -- Turn off starter switch.
Perkins Engines -- Turn off fuel at injector pump.
Caterpillar Engines -- Turn off fuel with throttle.
Other -- See manual for your engine.

AUTOMATICALLY STARTING DIESEL HYDRAFLO® PUMPING SYSTEM

Depending on the specific application, the customer may require that the pump start and stop automatically, utilizing a float switch(s) arrangement. This system can be controlled by many different types of float devices. Basically, it requires an auto-starting device at the engine and added features in the Hydraflo control circuitry. A manual loading valve is still supplied with this system for alternative manual operation.

ELECTRIC MOTOR

Read before starting electric system.

1. Always have qualified electrician connect electrical feeders.
2. Observe electric motor nameplate, wiring diagram, and operating voltage.
3. Observe correct rotation of electric motor. Facing shaft end, the motor should turn counterclockwise.
4. Make sure that the hydraulic failure circuitry is interlocked in the motor starter coil circuit. This must be connected for the protection of hydraulic components.

**MANUALLY STARTING ELECTRIC HYDRAFLO®
PUMPING SYSTEM**

- (Step 1) Open loading valve -- counter-clockwise, one half turn -- valve located below the system pressure gauge.
- (Step 2) Start electric motor.
- (Step 3) Slowly close loading valve to start water pump to pumping (close snugly)
- (Step 4) Observe system pressure. It should read close to P.S.I. listed in front of this booklet when pumping a full head of water. (See troubleshooting chart if system pressure is above or below design.)

STOPPING ELECTRIC HYDRAFLO® SYSTEM

- (Step 1) Open loading valve one-half turn.
- (Step 2) Turn off electric motor at starter (or disconnect switch).

**AUTOMATICALLY STARTING ELECTRIC HYDRAFLO®
PUMPING SYSTEM**

Depending on the specific application, the customer may require that the pump start and stop automatically, utilizing a float switch(s) arrangement. This system can be controlled by many different types of float devices.

Basically, it requires an auto mode of operation at the motor starter and added features in the Hydraflo control circuitry.

A manual loading valve is still supplied with this system for alternative manual mode operation. After initial set up it is not necessary to operate the loading valve for starting and stopping. This makes the electric Hydraflo ideal for automatic controls.

MWI HYDRAFLO® PUMP TWO WAY OPERATION

In some cases the customer may require that the pump be able to pump in both directions. This is accomplished by special hydraulic plumbing and valving so that the inlet and outlet at the hydraulic motor (at water pump) can be reversed (allows the propeller to be turned in both directions).

This system is similar in operation to the procedure for manual starting diesel and electric.

Because the hydraulic hoses can be easily crossed when connecting relative to pump intake and discharge, etc., the position of the directional valve is determined only after the following steps are taken.

1. Position directional valve in or out and note.
2. Station a person at water pump to manually open flap valve (gates). Open both.

The **HYDRAFLO™** System

3. Slowly close loading valve at drive unit. Person at water pump should immediately note direction of water flow and release discharge end flap valve.
4. Note direction of flow as to position of directional valve.
5. Open loading valve and release flap valve at intake end. (Stop pumping.)
6. Now to check reverse pumping direction, place directional valve in opposite position from step 1.
7. Open flap valve at water pump on intake end of pump. (This should be flap valve released in step 3.) Close loading valve.
8. Discharge end flap valve should now open automatically.
9. Direction of water flow and position of directional valve should now be recorded.

After flow directions are established, simply follow steps below:

1. Set directional valve in position which will pump water in desired direction.
2. Start prime mover.
3. Open intake end flap valve manually.
4. Close loading valve.
5. Monitor system as outlined in standard operation details.
6. Never change position of directional valve while system is loaded (pressurized).

SCHEDULE YOUR MAINTENANCE

SYSTEM CONTAMINATION

Contamination accounts for the largest portion of our repair cost and down time.

The oil in the hydraulic system is its life line. It must be kept clean.

Keeping the oil clean does not require much effort on the part of the operator or the maintenance personnel.

GENERAL STEPS YOU CAN TAKE TO INSURE A CLEAN HYDRAULIC SYSTEM:

1. Make personnel in charge of your new Hydraflo pump aware of the importance of a clean hydraulic system.
2. Use oil recommended by factory and purchased from a reputable dealer. (See page 2.)

CAUTION

Never substitute an oil which has not been approved by factory.

3. Check filters regularly and replace when needed. Keep a record.
4. Use clean lint free cloths to wipe away dirt.
5. Any equipment used to make the transfer of oil from a barrel to the reservoir, such as transfer pumps, fill cans, funnels, etc., should be scrupulously cleaned.
6. A 10 micron filter should be used when adding oil to reservoir.

I. HYDRAULIC SYSTEM MAINTENANCE (& FAILURE PROTECTION SYSTEM)

Very little maintenance is required of the hydraulic system. With proper care, years of trouble-free use will result. No lubrication is required on the system including the Hydraflo water pump. All lubrication is done by the hydraulic oil in the system.

A. HYDRAULIC OIL

1. Use MWI approved hydraulic oil. Must be Texaco Rando HD 68 (or equivalent) high pressure hydraulic oil (anti-wear and anti-foam).
2. To add hydraulic oil to system simply remove fill cap at top of hydraulic oil reservoir and fill tank to within 6 inches of top. (Always remember to transfer oil with clean containers, etc. Dirt, water and all other liquids should be considered contaminants to the hydraulic system.)
3. To protect the hydraulic system, a float switch has been provided in the hydraulic reservoir to shut down the prime mover when the oil level drops below a pre-determined level in the tank. The operator can visibly check the float switch to see if there is sufficient oil in the reservoir. After a failure has occurred causing the shut-down of the prime mover due to low level, the operator must; repair the fault that caused the low oil level, fill the reservoir and then reset the system at the panel before restarting the prime mover.

WARNING: DO NOT OVERRIDE OR RIG THIS SHUT DOWN FUNCTION - the hydraulic oil serves as a coolant as well as a lubricant to the hydraulic system and severe damage can result.

4. AFTER 2000 HOURS OF OPERATION:

Take a sample of oil from the hydraulic oil reservoir and compare it with a sample of new recommended oil. If the oil appears dirty or thick, have it professionally tested if required, flush the system and fill the reservoir with clean oil before restarting.

NOTE: As a customer service MWI will, at cost plus handling charges, send a sample of your oil to a lab to determine the exact condition.

INSTRUCTIONS: Draw a 5 ounce sample from the reservoir immediately after system has been shut down. Use very clean containers to insure an accurate test.

SENT TO: MWI Corporation
201 North Federal Highway
Deerfield Beach, Florida 33441-3624
ATTN: Oil Analysis

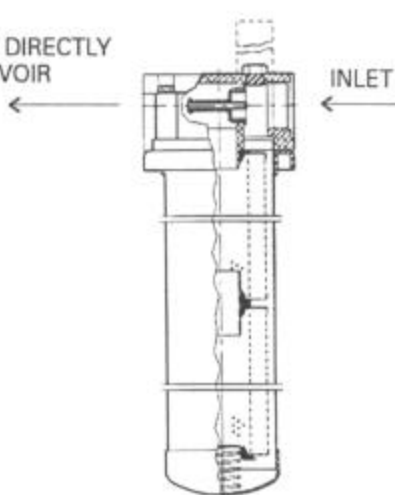
B. RETURN LINE FILTER (See illustration on page 16.)

1. Must be changed periodically.
Change element after first 50 hours of operation per indicator.
2. More frequent changes may be required due to adverse conditions at pump station.
3. To change filter - simply loosen bolt at base of unit or bolts at flange (depending on which type you have) with box end wrench and remove element housing. Inspect housing before replacing old element and 'O' ring with replacement set. Position housing back into place and tighten bolt(s).
4. **WARNING: DO NOT RUN SYSTEM WITHOUT ELEMENT**
The filter protects the hydraulic system from normal wear contaminants created within the system.
5. This filter element is not re-usable.

The HYDRAFLO™ System



OUTLET
CONNECT DIRECTLY
TO RESERVOIR



RETURN LINE FILTER

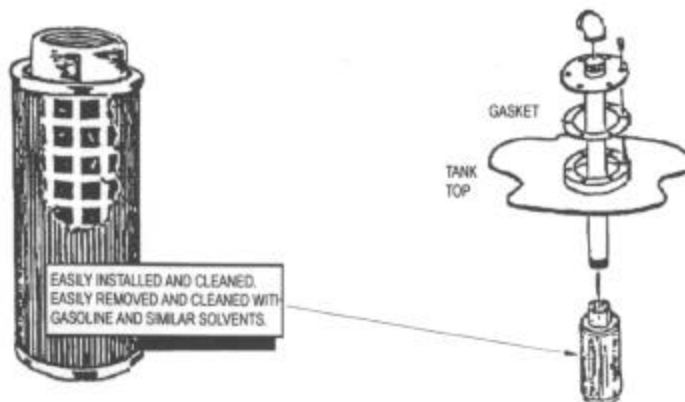
C. SUCTION LINE STRAINER(S)

(See Illustration below)

1. Remove and clean strainers if vacuum gauge reads high. Use clean fuel oil as cleaning solvent. When removing and replacing, be careful not to damage gasket. Re-tighten bolts securely with box end wrench.
2. To protect the hydraulic system, a vacuum switch has been provided in the hydraulic oil suction line to detect restricted suction to the hydraulic pump. This switch will shut down the prime mover when indicating an excess of 5 inches of Mercury (HG) at the gauge on panel. After a failure has occurred causing the shut-down of the prime mover due to a restricted suction line, the operator must first clean the strainer and then reset the system at the annunciator panel before restarting the prime mover.

WARNING: DO NOT OVERRIDE OR RE-ADJUST THIS SHUT DOWN FUNCTION

The hydraulic pump must have a sufficient supply of hydraulic oil or severe damage will occur to the pump.



SUMP STRAINER

D. HYDRAULIC OIL TEMPERATURE

1. To protect the hydraulic system from excessive oil temperature, a temperature switch has been provided at the hydraulic oil reservoir. This switch will shut down the prime mover when indicating an excess of 150° Fahrenheit at the gauge on the annunciator panel. After a failure has occurred causing the shut-down of the prime mover due to a high hydraulic oil temperature, the operator must first locate the heat source and then reset the system at the panel before restarting the prime mover.

WARNING: DO NOT OVERRIDE OR RE-ADJUST THIS SHUT-DOWN FUNCTION

Hydraulic oil tends to break down at excessive temperatures and will therefore lose its lubricating properties, thus subjecting all hydraulic components to damage.

2. Excessive hydraulic oil temperature could be created by the following:
 - Unit bypassing under load
 - Partially opened loading valve when system has operated for more than 15 minutes
 - Pinched or dented hydraulic line
 - Deteriorated components.

E. SUPPLY LINE FILTER

(See illustration on page 18.)

(Due to the nature of the hydraulic system used or size this item may be required.)

1. Change this filter element when red warning indicator is visible (located on port end of assembly).

2. TO REPLACE ELEMENT

- a. **TURN OFF AND DEPRESSURIZE SYSTEM.**
Open bleed plug at top of filter (or bottom at drain) one and one-half turns. Remove plug at bottom of filter and drain fluid into suitable container. Reinstall drain plug and tighten both plugs.

WARNING: FAILURE TO DEPRESSURIZE SYSTEM BEFORE PROCEEDING COULD RESULT IN EXPLOSIVE LOSS OF FLUID, DAMAGE OR PERSONAL INJURY.

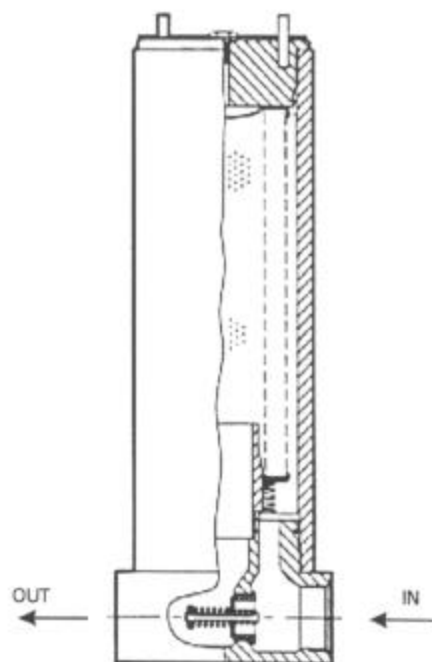
- b. Remove bowl - remove element. Discard both element and 'O' ring. Inspect bowl housing and its by-pass/reserve flow valve. **Do not attempt to clean or reuse element.**
- c. Wet threads and sealing surfaces on bowl and the 'O' ring in element with clean system fluid. Push open end of filter element straight onto nipple in head. Screw bowl to head until bottomed. ('O' ring sealing is not improved by overtightening. Do not exceed 15 ft. lbs. (20 N-M) torque.
- d. Bleed filter - open bleed plug at top of filter one and one-half turns. Jog system and fill filter until all air bleeds through plug, then tighten plug. Pressurize system fully and check for leaks.

3. **WARNING: DO NOT RUN SYSTEM WITHOUT ELEMENT**

The filter protects the hydraulic system from normal wear contaminants created within the system.

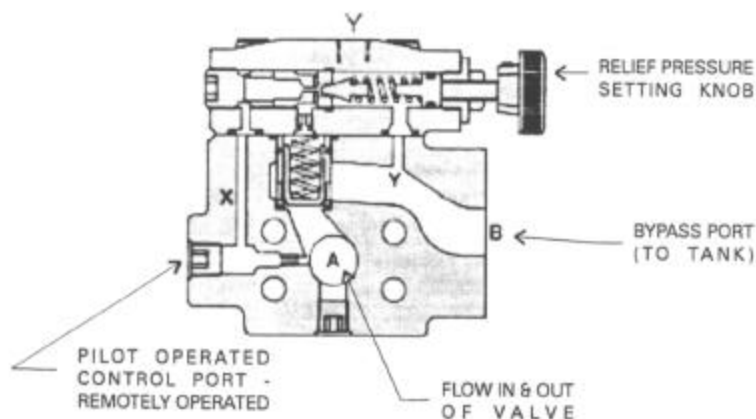
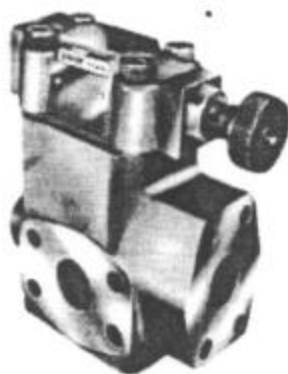
Do not ignore the red warning indicator!

The HYDRAFLO™ System



II. HYDRAULIC SYSTEM ADJUSTMENTS

- A. Relief valve, temperature switch, vacuum switch, and float switch are adjustable, however, these components are factory set at MWI and must not be reset or adjusted, etc..
- B. A high pressure (pilot operated) relief valve (as shown below) is provided in the hydraulic system to protect the system from excessive pressures. This device is factory set and must not be re-adjusted.



VALVE FUNCTION - MAXIMUM SYSTEM PRESSURE PROTECTION

- C. If the operator has any inquiries regarding devices listed above, please consult factory or representative.
- D. Because of normal prime mover vibrations transmitted to fittings utilized in the hydraulic system, periodic tightening of threaded joints, flanges, etc. may be required. All fittings utilized in the system are standard high and low pressure hydraulic fittings, requiring normal tools (pipe wrenches, crescent wrenches and allen wrenches).

DIESEL ENGINE SUGGESTED PREVENTATIVE MAINTENANCE SCHEDULE

This section covers brief instructions for engine service and maintenance requirements under normal operating conditions.

A. DAILY

1. Check air cleaner and all inlet connections. Clean or change filter as required.
2. Check crankcase oil level and oil condition.
3. Check coolant level and condition of the solution in radiator. Also keep the external parts of the radiator clean.
4. Check the fuel supply in the fuel tank. To avoid water condensation, fill the fuel tanks at the end of the day's run.
5. Drain water separator (if used in system). see drawing, page 20.
6. Check battery solution level. Never allow it to run low.
7. Check all gauges to be sure they are functioning properly.
8. Check general condition of unit. Tighten, repair, or replace parts.

B. 100 HOURS IN ADDITION TO "A" SERVICES

1. Change crankcase oil and filter element.
2. Clean crankcase breather system.
3. Tighten accessory drive belts to avoid slippage.
4. Check radiator air passages for air flow restriction, dirt, chaff, etc. Clean if dirty.
5. Replace primary and secondary fuel oil filters and reprime the fuel system. (For priming procedure see below.)

NOTE: If excessive water or materials are found, drain filters more often.

6. Lubricate accessory items as needed.

C 400 HOURS IN ADDITION TO "B" SERVICES

1. Major engine tune-up and inspection by authorized service center.
2. Lubricate accessory items as needed.
3. Replace fuel filters.

PRIMING AND STARTING PROCEDURE

In the event diesel engine is run completely out of fuel, air will be drawn into the fuel lines and engine will not start even after refueling.

PRIMING FUEL SYSTEM

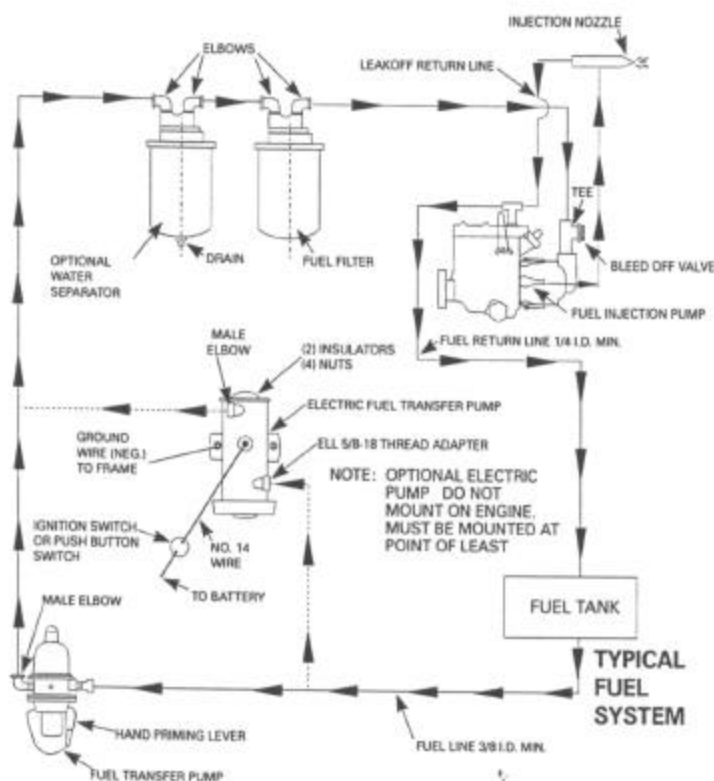
1. Open water separator drain sufficiently to eliminate water from the system.
2. On the engines equipped with spin-on-filters (single or dual) and one of the following priming pumps:
 - A. Electric fuel supply pump (optional)
 - B. Diaphragm type pump with hand priming lever.
 - C. Hand priming pump

The following procedure should be used:

Open bleed valve at fuel injection pump inlet. Using hand lever primer on supply pump, purge system of air. The fuel system is sufficiently purged when air-free fuel flows from bleed valve. (See illustration next page.)

The **HYDRAFLOW™** System

NOTE: Electric fuel supply pump (optional) -- energize Pump until air is purged from system.



OPERATOR TROUBLESHOOTING (MWI HYDRAFLOW® SYSTEM)

If you, the operator, are not thoroughly experienced in repair of hydraulic equipment, do not attempt repair beyond the scope of the items listed in the following charts.

WATER PUMP

TROUBLE	PROBABLE CAUSE	SOLUTION
NOISE FROM WATER PUMP	1. Check for trash in pump. 2. Intake bell restricted.	Clean Clean
PRESSURE TOO HIGH	1. Propeller jammed by debris. 2. Hose quick coupling not fully seated. 3. Hydraulic line pinched or kinked. 4. Excessive head or, lift beyond pump design.	Remove intake bell and carefully remove debris Check design
SUDDEN DECREASE IN PRESSURE	1. Loading valve not fully clockwise. 2. Engine RPM too low. 3. Relief valve bypassing.	Check sight glass for bypass examine valve

HYDRAULIC SYSTEM

TROUBLE	PROBABLE CAUSE	SOLUTION
NOISE FROM HYDRAULIC PUMP	1. Air in hydraulic system.	1. Check for cavitation
PRESSURE TOO HIGH	1. Relief valve not correctly set.	1. Dead head unit and correctly set max point
SUDDEN DECREASE IN PRESSURE	1. Hydraulic pump failure 2. Hose Blown	1. & 2. Check sight glass for bypass
SYSTEM PRESSURE TOO LOW	1. Improper relief valve setting. 2. Water head being pumped is lower than design (This is normal because it does not take as much power to pump water at lower heads.) 3. Water pump intake blocked off by debris (shutdown unit and clean).	1. Consult factory 2. If drive unit is equipped with diesel engine you can slow it. 3. Shut down unit and clean
SYSTEM SURGING	1. Pump in and out of water 2. Erratic engine performance	1. Check submergence 2. See engine troubleshooting
ENGINE SHUTS DOWN FOR NO APPARENT REASON	1. Engine oil pressure safety switch. 2. Engine oil pressure gauge. 3. Engine overheat safety switch. 4. Hydraulic oil level safety switch. 5. Hydraulic oil temperature switch. 6. Vacuum switch. 7. Out of fuel	1. Check engine oil level and fill if necessary. 2. If pressure does not rise, shut engine off and advise mechanic of problem 3. Let engine cool down before adding water. Check for leaks and repair if necessary. 4. Check for leaks, if none are apparent, refill reservoir with oil and restart system, checking for leaks under pressure. If leaks are detected, shut down unit and repair or tighten fittings. 5. Check for cause - partially opened loading valve, etc. 6. Check hydraulic strainer at suction line for restriction. 7. Refill
NONE OF THE ABOVE	If the problem cannot be solved on an operator level, call a qualified hydraulic mechanic.	

ENGINE TROUBLE SHOOTING

CAUSE	SYMPTOM										
	Engine will not start	Hard starting	Engine stops	Erratic engine performance	Black exhaust smoke	Blue exhaust smoke	White exhaust smoke	Low power	Engine over-heating	Engine over-cooling	Engine knocking
Air Cleaner Dirty		X		X	X			X			
Air Inlet Restricted	X	X		X	X	X		X			
Exhaust System Restricted			X	X	X			X	X		
Battery Weak or Discharged	X	X	X	X							
Battery Cables - Loose Connections	X	X	X	X							
Foreign Matter on Pistons				X							
Low Cylinder Compression	X	X		X		X		X		X	
Worn Pistons, Rings, etc.		X				X		X		X	
Scored Pistons				X		X		X	X	X	X
Valves Leaking		X		X	X			X			
Valves Sticking	X	X		X	X			X		X	
Valves Incorrectly Adjusted	X	X		X				X		X	
Luboil Level Too Low										X	X
Luboil Level Too High		X				X		X			X
Wrong Type of Luboil		X				X					X
Oil Pump Inlet Screen Plugged										X	X
Pressure Regulator Not Functioning										X	X
Luboil Contaminated										X	X
Rocker Arm Shaft Upside Down						X					X
Oil Header Plug Missing or Loose											X
Bearings Failed - Main, Rod, Cam				X		X		X		X	X
Excessive Angle Operations						X				X	X
Excessive Thrust Pressure On Shafts	X	X	X							X	X
Fuel Tank Empty *	X		X								
Fuel Tank Valve Closed	X		X								
Fuel Tank Vent Plugged			X	X							
Fuel Transfer Pump Worn	X	X		X				X			
Fuel Contamination	X	X		X		X		X		X	
Fuel Incorrect for Conditions	X	X	X	X	X	X		X			
Engine Too Cold to Ignite Fuel Properly	X	X		X			X	X			
Stop Control in Stop Position	X		X								
Electric Fuel Shutoff Not Functioning	X		X								
Throttle Linkage Adjustment Incorrect or Sticking				X				X			
Fuel Filters Dirty or Plugged	X	X	X	X				X			
Air Leaks in Fuel System	X	X	X	X				X			
Fuel Pump Incorrectly Timed	X	X		X	X		X	X		X	
Sticking or Fouled Nozzle		X	X	X	X			X		X	
Fuel Return Plugged or Restricted			X	X				X		X	
Incorrect Fuel Setting				X	X			X			
Nozzle Opening Pressure Incorrect				X	X			X		X	
Nozzle Incorrectly Torqued				X				X		X	
Fan Belt Loose or Slipping								X	X		
Radiator Fins or Tubes Dirty or Restricted								X	X		
Water System Piped Incorrectly								X	X		
Low Coolant Level								X	X		
Coolant in Cylinders	X	X		X				X	X	X	
Inoperative Thermostat					X			X	X		
Thermostat Missing					X			X	X		
Engine Overload					X			X	X	X	X
Engine Overspeed					X			X	X	X	X