TECHNICAL MANUAL
PLM-TM-85-002

OPERATION AND MAINTENANCE INSTRUCTIONS WITH ILLUSTRATED PARTS LIST PORTABLE FLUID PURIFIER

MODEL NO.:	PE-00440-1H
SERIAL NO.:	A110
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PALL LAND AND MARINE CORP.

A SUBSIDIARY OF PALL CORPORATION

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ATTACHMENTS:

1. Assembly Drawing: P/N PE-00440-1 G

1.0 WARNINGS AND CAUTIONS

The following warnings and cautions are stated here for emphasis purposes and will be referenced in their appropriate locations within this manual.

1.1

WARNING: If there is any possibility that the oil being purified is contaminated with a solvent or fluid the vapors of which could be hazardous (toxicant, irritants, etc.). The purifier should not be used unless adequate precautions are taken to capture and vent away vapors in a safe manner according to local codes and appropriate safety standards. Connect a suitable outlet line (3/4" I.D. minimum) to the coalescing filter outlet. Use the hole in the side of the frame cover for this purpose. If the vapor is particularly hazardous, it may be necessary to disconnect the drain tube from the coalescer to the bumper/sump assembly and exhaust the coalescer liquid in a safe manner also. This warning is necessary in order to prevent the possibility of toxic injury damage, or discomfort to persons and/or property.

1.2 CAUTION: The process fluid must be compatible with the Buna-N chamber o-rings, mechanical seal, sealing washers and float valve seals. Buna-N is suitable for service with most petroleum (mineral) oils. It is also suitable for service with some silicone fluids. If in doubt, contact the factory. Buna-N is not suitable for service with any phosphate ester fluid such as Skydrol 500, Fyrquel A60, Aerosafe 2300, Hyjet, or Fyrquel EHC. Buna-N is also not suitable for service with di-ester based lubricants, silicate ester based lubricants, non-petroleum brake fluids, pyridine oil or low molecular weight esters. Should there be any question or doubt as to the safety or feasibility of processing a particular fluid, contact the factory.

1.3

CAUTION: Do not use the purifier on any fluid which may be contaminated with a solvent or fluid which is explosive and/or flammable. Do not use on any fluid having a flash point below 150°F. This caution is necessary to prevent the possibility of fire explosion, and injury or damage to persons and/or property.

1.4 CAUTION: Before connecting this unit to the electrical supply, check that the receptacle conforms to NEMA 5-15R. Also check that the receptacle is wired and fused for the correct voltage, phase, frequency, and amperage (power requirements are: 115 VAC, 60 Hz, 15 AMP, single phase).

1.5 **CAUTION:** During purifier start up, it is important that the "START" button (located on the side of the electrical enclosure, with a black or gray boot) not be held depressed longer than three minutes after the purifier is running successfully. The "START" button must be released in order to activate the low level shutdown switch and the coalescer pressure switch which protect the entire unit from improper operating conditions. Under no circumstances may the purifier be operated for an extended period of time with the "START" button depressed. If the unit will not operate successfully after a reasonable period of time (3 to 5 minutes), refer to trouble shooting, Section 8.0, in this manual.

2.0 GENERAL INFORMATION, INTRODUCTION, AND SPECIFICATIONS

2.1 GENERAL

This manual provides all necessary installation, operation, maintenance, trouble shooting, illustrated parts lists, and repair procedures applicable to the portable fluid purifier. All correspondence concerning the portable fluid purifier, whether it be ordering of spare parts or technical information, should include the systems part number and serial number as shown on the identification plate attached to the unit.

2.2 INTRODUCTION

2.2.0 The portable fluid purifier (herein after called the purifier) is designed to remove water, air, chlorinated solvents, and solid contaminants from lubricating, hydraulic, and heat transfer fluids. The purifier itself is a portable system requiring only an open space close to the contaminated fluid reservoir and ready access to the required electrical power (refer to Section 2.3).

2.2.1 **CAUTION:** The process fluid must be compatible with the purifier seals. Refer to the CAUTION note in paragraph 1.2.

2.3 SPECIFICATIONS

The following table lists the specifications applicable to the purifier.

TABEL 2.3: PORTABLE FLUID PURIFIER SPECIFICATIONS

FLUID TYPE	INLET FLUID TEMP. (MAX)	FLUID CIRCULATION RATE (MAX)	OPERATING VISCOSITY (MAX)	DISCHARGE PRESSURE (MAX)	VACUUM CHAMBER OPERATING VAC	INLET Y-STRAINER FILTRATION
Hydraulic, lubricating & heat transfer oils compatible with Buna-N having a flash point of 200°F per ASTMD92 or below 180°F per ASTMD93.	+145°F (62°C)	5 GPM	1300 SSU	70 PSIG	24" Hg ± 2" Hg	100 Mesh

DISCHARGE FILTER ELEM. RATING	INLET PRESSURE (MAX)	INLET PRESSURE (MIN)	POWER REQ'MTS	HOSE CONNECTION REQ'MTS.	ELEC. POWER CONNECTION REQ'MTS.	OVERALL DIMENSIONS
3 micron abs. with a gravimetric efficiency of 99.9% min., when tested per MIL-F-8.36.	+20 psig	-10" Hg	120 Volts, 15 Amps, 60 Hz, 1 Phase, 20 KW max. connected load.	Inlet-1" I.D. min. Inlet hose should be rated for suction & return line svc. per SAE 100R4; Outlet - 3/4" I.D. min. NOTE: Connecting hoses to be furnished by customer	The elec. receptacle must conform to NEMA 5-15R. Recommended line fuse or circuit breaker size is 15 Amps.	Height (max) -34" Width (max) -27½" Length (max) -34"

3.0 NORMAL OPERATING PROCEDURES - GENERAL INFORMATION

3.0.1 Prior to hooking up the purifier to a contaminated reservoir, refer to the WARNINGS and CAUTIONS in Section 1.

3.0.2 If the purifier is to process a fluid different from the fluid previously used, the unit must undergo the special flushing procedure in Section 7.0. If the purifier is to be used for the first time, check the top of the functional test procedure PLMS-PT-0001 (enclosed as Attachment II at the end of this manual) to determine the fluid used during factory testing. If the factory test fluid is not compatible with the fluid to be processed, flush the unit per the instructions in Section 7.0.

3.1 SET-UP PROCEDURES

3.1.0 Connect one inch I.D. (-16) hose to inlet of the purifier and fluid reservoir. The inlet hose should be rated for suction and return line service per SAE 100R4. In same manner connect 3/4 inch I.D. (-12) hose to the outlet of the purifier and the fluid reservoir. NOTE: All connections should be equal to or greater than the minimum line sizes stated above. Any reduction may result in operating difficulties and possible malfunction.

3.1.1 Remove cap from the vacuum pump oil reservoir and fill to the stem only with a high detergent automotive engine oil, (SAE 10 wt.) API service rating SB, SC, SE, CB, CD, or a combination of these ratings or Gast Manufacturing Corporation [illegible] Do not use a multigrade such as 10W40 oil.

[illegible] minutes before replacing cap or an air lock may develop in the [illegible].

3.1.2 CAUTION: Before energizing this unit, check that the power supply wiring and over current protection are adequate for 120 VAC, 15 Amp service. Refer to the CAUTION note in para. 1.4.

3.1.3 Connect electrical plug to a 120 Volt, 60 Hz, single phase, 15 Amp power receptacle conforming to NEMA 5-15R. Check the purifier "POWER ON" light. It should be energized. If it does not energize, refer to Section 8.0 (TROUBLE SHOOTING).

3.2 START UP PROCEDURES

A. Open the inlet, outlet, and all other applicable valves.

B. Recheck hose connections between the purifier and the contaminated reservoir for tightness.

C. Depress the "START" button and hold (1 to 3 minutes) and check the following indicators:

CAUTION: During purifier start up it is important that the "START" button (black or gray boot) not be held depressed longer than three minutes after the unit is running successfully. The button should be released in order to activate the chamber low level and coalescer pressure switches which protect the entire unit from improper operating conditions.

Operational Checkout

1. Discharge pressure gauge should not exceed +70 psig.

2. Inlet pressure gauge should read between - 10" Hg vacuum and +20 psig.

3. Inlet oil temperature gauge should not exceed +145 degrees F.

4. Check discharge filter replacement light. If lit, release "START" button. If unit continues to run, depress "STOP" button.

5. After one to three minutes of successful operation, check the chamber vacuum gage. It should read between 22" and 26" Hg vacuum.

D. Release "START" button if all readings are correct.

E. If any problems are encountered with unit operation, refer to Section 8.0 (TROUBLE SHOOTING).

3.3 RUN

The amount of time which the purifier requires to service a fluid system is dependent on contaminant levels, fluid volume, temperature, and type. As a general guideline, the purifier should be operated approximately 10 minutes per gallon of system fluid.

3.4 STOP

A. To stop the purifier, depress the red "STOP" button.

B. Close the purifier inlet and outlet valves.

4.0 ROUTINE MAINTENANCE

4.0.0 The following items will require periodic attention to maintain the purifier at its full operating efficiency.

EVERY 24 OPERATING HOURS:

4.1.0 **Coalescer Bumper/Sump Assembly**: Drain and discard fluid from coalescer bumper/sump assembly every 24 operating hours.

4.2.0 **Vacuum Pump Oiler**: The vacuum pump oiler should be checked for oil level every 24 operating hours. Never allow the oiler to run dry. When adding oil, fill to the stem only with SAE 10 wt. oil (see paragraph 3.1.1). Replace cap snugly. Operating the unit while filling the reservoir will speed and ease the filling process, as will the use of a flexible spout, pump type oiler.

WHEN INDICATED BY OPERATING PANEL:

4.3.0 **Discharge Filter Assembly**. The discharge filter must be replaced when the red indicating light energizes (for fluids with viscosity at operating temperature of less than 1300 SSU). To replace the spin on filter element, refer to Figure 9.2-A and proceed as follows:

4.3.1 Remove spin on filter element by turning counter-clockwise. Remove and discard old spin on element gasket.

4.3.2 Lubricate new spin on gasket and element threads with clean process fluid.

4.3.3 Replace with new spin on filter element P/N GC-00273F-168H. Tighten by hand approximately 3/4 of a turn after contact.

4.4.0 **Coalescing Filter Element**. The coalescing filter element must be replaced when the red light indicating the need to drain or replace the coalescer continues to come on when the "START" button is released, after the drain sump has been emptied. To replace the filter cartridge, refer to Figure 9.4-A and proceed as follows:

4.4.1 Drain bumper/sump assembly.

4.4.2 Loosen and remove clamp which joins the filter head to the filter bowl.

4.4.3 Remove filter bowl, and slide the filter element off of the filter housing. Install new filter element P/N AA-4463F-1 by reversing the above two steps. Be sure to lubricate element o-ring with clean process fluid before installing. Replace tube which connects to coalescer bumper/sump assembly.

4.5.0 Inlet Y-Strainer. The strainer element should be checked whenever the inlet oil pressure begins to drop, particularly if it drops below 10" Hg vacuum. To clean the inlet y-strainer, proceed as follows:

4.5.1 Close the inlet valve and operate the unit until it shuts off on low level.

4.5.2 Remove the plug from the strainer body and drain.

4.5.3 Remove the hex cap and withdraw the strainer element.

4.5.4 Clean element in a non-flammable solvent, blow off.

4.5.5 Reinstall by reversing steps 4.5.2 and 4.5.3. To prevent galling and leaks, it is recommended that a pipe sealant compound such as Loctite Pipe Sealant with Teflon (PST) No. 592 be used sparingly on the male threads of both the hex cap and the pipe plug.

4.6.0 Inlet Air Breather Element: The inlet air breather element should be replaced before it begins to restrict airflow through the vacuum chamber. If the chamber vacuum gauge reads 26" Hg or above, change the breather element. The suggested service interval is weekly (every 40 operating hours) if the machine is operated in a dirty, dusty, or otherwise heavily contaminated environment. The service interval may be extenced to monthly (every 200-250 operating hours) if the operating environment is exceptionally clean. Actual service intervals will be dictated by the customer's particular application.

4.6.1 Replace the breather element by first thoroughly cleaning the element threads and connection. This is to prevent contaminant from entering the elbow. Unscrew the old element and discard. Replace with the new element P/N 9A-00440F-1A (hand tighten only). Take particular care not to allow contaminant to enter the connection. This could obstruct the inlet air orifice, possibly causing excessive chamber vacuum, discharge pump cavitation, low flowrate, and greatly reduced efficiency. Reassemble the new filter dry. Do not use any pipe tape or pipe compound on the element threads as these may also clog the air inlet orifice.

SECTION 5

SPARE PARTS LIST

5.1 Table 5-1 lists those spare parts that should be stocked to support the basic purifier maintenance requirements.

TABLE 5-1 SPARE PARTS LIST

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	QTY.
9.1-67	PA-00440-D2154	V-Belt, Link Type	1
N/A	PA-00440-T1	Link Belt Tool	1
9.4-3	AA-4463F-1	Coalescing Filter Element	3
9.2-2	GC-00273F-168H	Discharge Filter Element	6
N/A	*PA-00440-EASPRK1T	Electrical Spare Parts Kit	1
9.1-4	PA-00440F-1A	Inlet Air Breather Filter	4

*See Section 9.3 for the contents of the electrical spare parts kit.

SECTION 6

LONG TERM SCHEDULED MAINTENANCE

6.0.0 The following items should be checked at regular intervals to insure long life and dependable, trouble-free operation.

6.1.0 Drive Belt. The segmented link type V-belt should be checked at 3 month intervals for wear, oil stains, and tension. Worn or oil stained belts should be replaced. Tension should be adjusted as needed. Loosen the discharge pump and adjust tension as required. The use of link belt tool part no. PA-00440-T1 will ease installation of new belts. Refer to para. 10.7.4.0 through 10.7.4.2 for V-belt replacement and tensioning procedure.

6.2.0 Power Cable. The power cable and plug should be checked at 6 month intervals for damage. Check the cable for cuts, abrasion, kinking, and condition of cover. Check plug and cord grip where cable enters electrical box. Replace parts as required. Refer to Section 9.1 and Figure 9.1-A for replacement parts.

6.3.0 Indicating Lights. The three indicating lights labelled "POWER ON", "CHANGE DISCHARGE FILTER", and "CHANGE OR DRAIN COALESCER" should all be checked at 12 month intervals.

WARNING: To avoid danger of electrical shock, disconnect the unit from its power supply when making all connections to test indicating lights. The following checks should only be performed by a properly trained, experienced, and competent electrician.

6.3.1 To check all three lights, first plug the unit in. The yellow "POWER ON" light should energize. If it does not, verify that the unit is receiving power by connecting a voltmeter across terminal numbers 1 and 5. If unit is receiving power and yellow light will not energize, replace it. If unit is not receiving power, check that all three unit circuit breakers are closed. If breakers are closed and unit does not receive power, check supply wiring.

6.3.2 To check the red "CHANGE DISCHARGE FILTER" light, connect a jumper wire across terminal numbers 2 and 5. If the light will not energize, replace it.

6.3.3 To check the red "CHANGE OR DRAIN COALESCER" light, connect a jumper wire across terminal numbers 3 and 5. If the light will not energize, replace it. Depress the red "STOP" button to reset the coalescer switch latching relay 4CR.

6.4.0 Hoses. Check all oil and air hoses at 24 month intervals for wear, kinking, abrasion, condition of inner tube (liner), and general damage. Replace as required.

SECTION 7

FLUSHING PROCEDURE

7.1 The following flushing procedures should be performed on the fluid purifier whenever an oil different from previously processed oil is to undergo purification.

A. If connected, disconnect inlet hose (supplied by customer) from the unit and drain.

B. Operate the fluid purifier until all retained oil is exhausted through the discnarge hose.

C. Disconnect discharge hose (supplied by customer) from the unit and drain.

D. *Remove spin on discharge filter element, drain, and reassemble.

E. Reinstall inlet and discharge hoses.

F. Flush unit for 15 minutes using approximately 20 gallons of new oil.

G. Drain flushing oil from the unit by repeating steps A through D and discard the new oil.

H. Install new discharge filter element. Refer to Sect. 4.3.0.

I. Unit is now ready for new fluid operation.

*If the fluids are highly incompatible, replace spin-on filter element with free flow flushing dummy element PLM part number PA-00440-T10 for sequences D through G inclusive.

8.0 TROUBLE SHOOTING

8.1 INTRODUCTION

Tables 8-1, 8-2, and 8-3 list the possible troubles which may occur during the operation of the purifier, their probable causes, and indicated remedies when the unit is operated in accordance with the instructions on the electrical box and in this manual.

Table 8-1 describes problems in which the unit operates automatically (with "START" button released), but where the gages and/or indicating lights show an abnormal operating condition.

Table 8-2 describes problems where the unit will operate only when the "START" button is depressed.

Table 8-3 describes problems where the unit will not operate at all, even when the "START" button is depressed.

The troubles, causes, and remedies are listed in the order of most likely to least likely to occur. Refer to flow schematic Figure 8.0-B (pg. 12B), electrical schematic, Figure 8.0-A (pg. 12A) and assembly drawing PE-00440-1 [G] as required.

WARNING: To avoid the danger of electrical shock, do not attempt any inspection or repairs to any electrical component of this machine without first disconnecting the machine from its power supply.

TABLE 8-1: Unit will run automatically (with "START" button released) but gage readings and/or indicating lights show an abnormal operating condition.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
High vacuum indicated on inlet pressure gage (greater than 10" Hg).	A. Dirty inlet strainer.	A. Remove, clean and reassemble. (See sect. 4.5.0.)
	B. Inlet line from reservoir too small or otherwise restricted.	B. Use 1" ID (SAE100R4) lines (min.) or clear obstructed lines. Open all valves. Refer to para. 3.1.0.
	C. Excessively high oil viscosity (greater than 1300 SSU).	C. Reduce oil viscosity by heating (145 degrees F maximum).
	D. Reservoir too far below purifier, or inlet line too long.	D. Lower purifier or use boost pump (PLM P/N SD-00440-BSTPMPH) to raise purifier inlet pressure.
	E. Excessively high chamber vacuum (greater than 26" Hg).	E. Replace breather element and check for obstruction in air inlet orifice. Refer to Sect. 4.6.0.
	F. Defective inlet gage.	F. Replace.

TABLE 8-1: Unit will run automatically (with "START" button released) but gage readings and/or indicating lights show an abnormal operating condition.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Excessive discharge pump pressure (>+70 psig), Read this pressure off the outlet pressure gage.	A. Clogged discharge filter element. Suspect this if red light is lit.	A. Replace. Refer to sect. 4.3.0.
	B. Closed outlet valve.	B. Open valve.
	C. Undersize or otherwise restricted outlet line.	C. Increase line size (refer to para. 3.1.0) or clear line.
	D. Defective outlet pressure gage.	D. Replace.
	E. Clogged discharge filter element and burnt out indicating lamp 2LT or defective differential pressure switch 1DPS not showing high differential high differential pressure across discharge filter element.	E. Check discharge filter indicating light (2LT) per para's. 6.3.0 & 6.3.2. If light is defective, replace it. Check differential pressure across filter by connecting delta P gage as follows: Remove oiler & gage cover. Disconnect line to outlet pressure gage and reconnect this line to the high pressure port on the delta P gage. Place a 3/4" tee immediately downstream of the purifier outlet ball valve. Connect the low pressure port of the delta P gage to this tee. Operate the machine. If the delta P gage shows a differential pressure of more than 58 PSID, the indicating light checked out OK from the previous instructions, but the indicating light still won't energize, the differential pressure switch is defective. Replace it. Refer to Section 9.2, Fig. 9.2-9, and Section 10.8.

TABLE 8-1: Unit will run automatically (with "START" button released) but gage readings and/or indicating lights show an abnormal operating condition.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Change discharge filter red light is lit (2LT).	Clogged element.	Replace. Refer to Sect. 4.3.0. Note, if the filter cannot be removed by hand, punch a hole thru both sides of canister with a large punch or screwdriver & use it to remove the canister.
	Excessively high viscosity.	Reduce oil viscosity by heating. (NOTE: Max. purifier operating temp. is +145 degrees F.)
	Defective differential pressure switch 1DPS.	Replace. Refer to sect. 10.8. Note that customer must replace and install the two external seals on replacement differential pressure switches.

TABLE 8-1: Unit will run automatically (with "START" button released) but gage readings and/or indicating lights show an abnormal operating condition.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
High vacuum indicated on chamber vacuum gage ()26" Hg).	A. Clogged inlet air breather element.	A. Replace. Refer to Sect. 4.6.0.
	B. Obstruction in air inlet orifice.	B. Remove air breather element (see Sect. 4.6.0). Remove the 3/4" street elbow from the upper vacuum chamber and clear the orifice. Reassemble street elbow and breather filter dry. Do not use any pipe tape or compound as these may clog the air inlet orifice. Refer to para. 4.6.1.
	C. Defective vacuum gage.	C. Replace.
High pressure indicated on inlet pressure gage ()+20 psig).	A. Purifier being used on a reservoir or fluid line whose pressure exceeds +20 psig.	A. & B. Install a pressure regulator (PLM P/N AA-9500-D1818) just before the inlet valve to reduce the inlet pressure. Recommend setting regulator between 0 and +10 psig.
	B. Reservoir too high above purifier ()45 feet).	
	C. Defective inlet press. gage.	C. Replace.
High oil temperature indicated on temp. gage ()+145 degrees fahrenheit).	Oil supply is too hot.	1. Lower oil supply connection in reservoir. 2. Use purifier when system is cooler (i.e. when system is shut-down). 3. Use a heat exchanger to reduce oil inlet temperature.
	Defective temp. gage.	Replace.
	Purifier is recirculating a very small quantity of oil.	Increase volume of fluid being purified.

TABLE 8-1: Unit will run automatically (with "START" button released) but gage readings and/or indicating lights show an abnormal operating condition.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Unit operates properly but "POWER ON" light is not lit (1LT).	Burnt out lamp or loose connection. Refer to para's. 6.3.0 & 6.3.1.	Replace or repair.
Low vacuum indicated on chamber vacuum gage ((22" Hg).	A. Leak in inlet or gage line plumbing.	A. Find and repair leak.
	B. Defective vacuum gage.	B. Replace.
	C. Vacuum pump problems.	C. See next item "Low vacuum pump output and/or excessive noise".
	D. Plugged coalescing element and defective coalescer pressure switch.	D. Check coalescer pressure switch by plugging coalescer exhaust port completely. If unit does not shut down within 30 sec., the coalescer pressure switch is defective. Replace it. Refer to Sect. 10.7.3. Replace coalescing filter element. Refer to Sect. 4.4.0. After replacing switch and element, restart the unit. Check to determine if the vacuum comes up to the specified level (24" Hg ± 2" Hg). If the vacuum still won't rise to at least 22" Hg, the vacuum pump has been damaged by overheating. Replace the vacuum pump. Refer to Sect. 10.7.0.

TABLE 8-1: Unit will run automatically (with "START" button released) but gage readings and/or indicating lights show an abnormal operating condition.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Low vacuum pump output and/or excessive noise.	Insufficient oil in oiler.	Fill oiler per para. 3.1.1.
	Broken pump vane.*	Replace pump. See section 10.7.*
	Loose or defective drive coupling.	Tighten or replace.
	Vane(s) sticky and hung up.	Disassemble line from top of chamber to vacuum pump. Spray several shots of non-flammable solvent (recommend freon TF) into pump inlet while pump is running. Follow by several shots of WD-40. If problem persists, replace pump.*
	Vacuum pump worn out.*	Replace.*

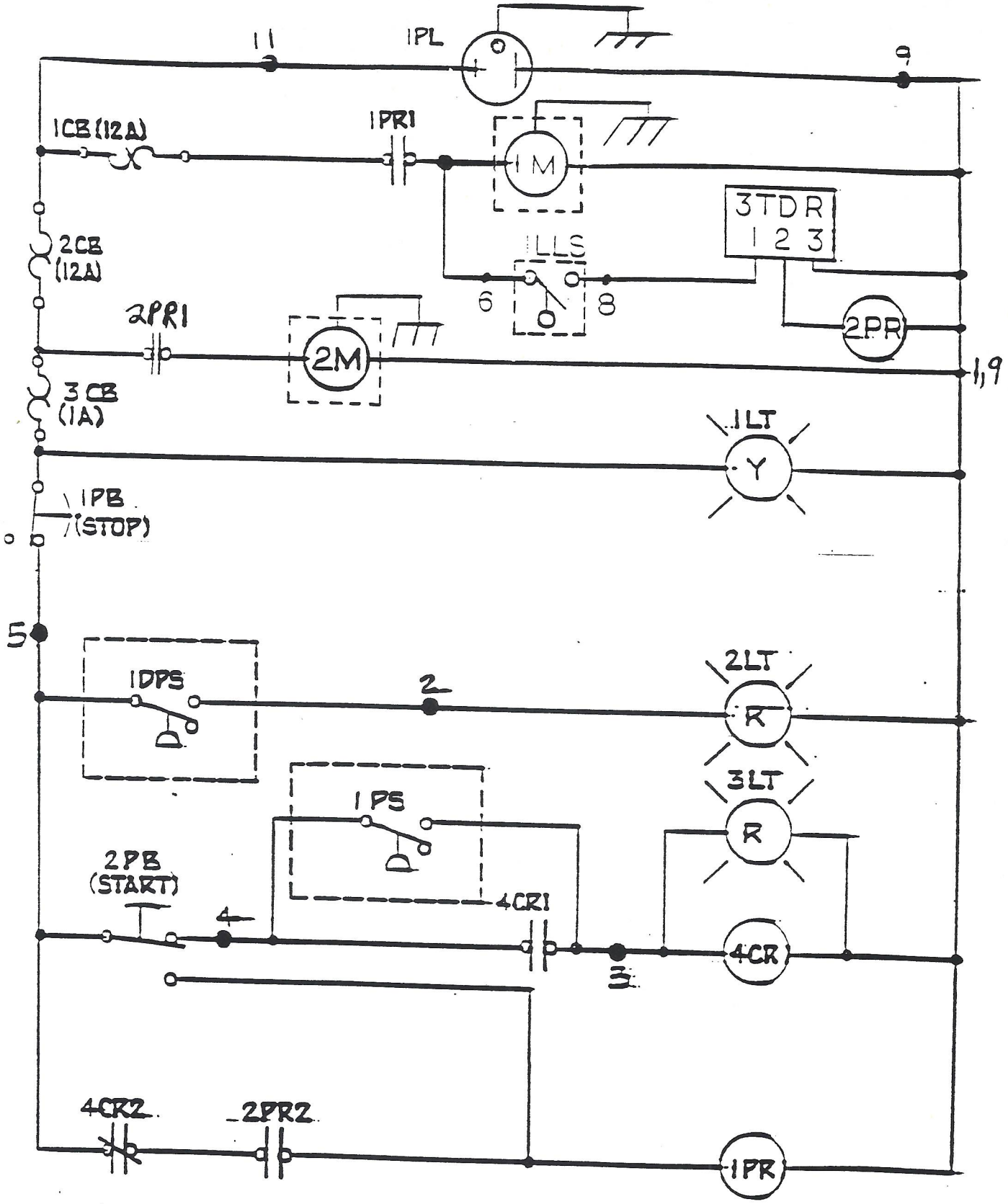
*IMPORTANT NOTE: PALL LAND AND MARINE CORPORATION DOES NOT RECOMMEND REBUILDING THE VACUUM PUMP.

TABLE 8-2: Unit runs only when "START" is held in. Unit will not operate after the "START" button has been released.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Unit stops. The main drive motor (1M) will restart & run only when "START" button is held down. The disc motor (2M) will not start even after the "START" button has been depressed for 5 minutes (continuous). The red light indicating the need to change or drain the coalescer (3LT) does not come on as soon as "START" button is released.	Chamber oil level is too low and does not correct itself after holding "START" button depressed for 5 minutes (see below and also see pg. 15).	Hold "START" button depressed for 5 min. If both motors (main, 1M, & disc, 2M) still won't run with "START" button released. See below:
	A. Partially or fully closed inlet valve.	A. Open valve to get inlet pressure between -10" Hg & +20 psig while unit is running.
	B. Dirty inlet strainer.	B. Shut unit down, disassemble, clean & reassemble. Refer to Sect. 4.5.0.
	C. Blocked or restricted inlet line.	C. Check inlet line between purifier & reservoir. Clear any obstruction.
	D. Vacuum leak in inlet line; or inlet line not submerged in reservoir, or inlet line plugged or stuck on bottom of reservoir.	D. Check all lines & connections between reservoir & purifier. Tighten or repair, as required.
	E. Defective control relay 3CR.	E. Check connections. Rewire or replace.
	F. Defective power relay 2PR.	F. Check connections. Rewire or replace.
	G. Defective low level switch (1LLS).	G. Replace. Refer to para's. 10.4.2.1 & 10.4.3.2.
	H. Power relay contact 1PR2 is bad.	H. Check connections. Rewire or replace relay as required.
	I. Control relay contact 3CR1 is bad.	I. Check connections. Rewire or replace relay as required.
	J. Power relay contacts 1PR2, 2PR1, or 2PR2 are bad.	J. Check connections. Rewire or replace relay as required.

TABLE 8-2: Unit runs only when "START" is held in. Unit will not operate after the "START" button has been released.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Low chamber oil level & system keeps shutting down (chamber won't fill). NOTE: Low chamber level can be detected by connecting a voltmeter, or a test light between terminal 8 in the electrical box and the machine frame (ground). Low level is indicated by the absence of voltage between these 2 points while the "START" button is depressed and the machine is operating. An alternate method is to connect an ohmmeter between terminals 6 & 8 on the electrical box terminal strip. The "START" button need not be depressed and the machine need not operate or be connected to its power supply when using an ohmmeter as described above. Low level is indicated by an infinite resistance between terminals 6 and 8.	A. Partially or fully closed inlet valve. Check inlet pressure gage. Suspect this if gage indicates high vacuum ()10" Hg).	A. Open valve to get inlet pressure between -10" Hg and +20 psig while unit is running.
	B. Dirty inlet strainer. Suspect this if inlet pressure gage indicates high vacuum ()10" Hg).	B. Disassemble, clean & reassemble. (See Sect. 4.5.0).
	C. "START" button is being released too soon. Chamber is not getting enough time to fill. Suspect this if inlet pressure gage readings are within specified limits.	C. Hold "START" button depressed for 3-5 minutes.
	D. Undersize or otherwise restricted inlet line. Check inlet pressure gage. Suspect this if gage indicates high vacuum ()10" Hg).	D. Use correct size line. Refer to specificati table, hose connection reqmts. in Sect. 2.3. Also refer to para. 3.1.0. Clear inlet line.



INDICATES DEVICES WHICH ARE REMOTE FROM ELECTRICAL BOX

NOTE: TERMINALS 7 AND 10 NOT USED

FIG. 8.0-A ELECTRICAL SCHEMATIC

PORTABLE FLUID PURIFIER FLOW SCHEMATIC

FIG. 8.0-B

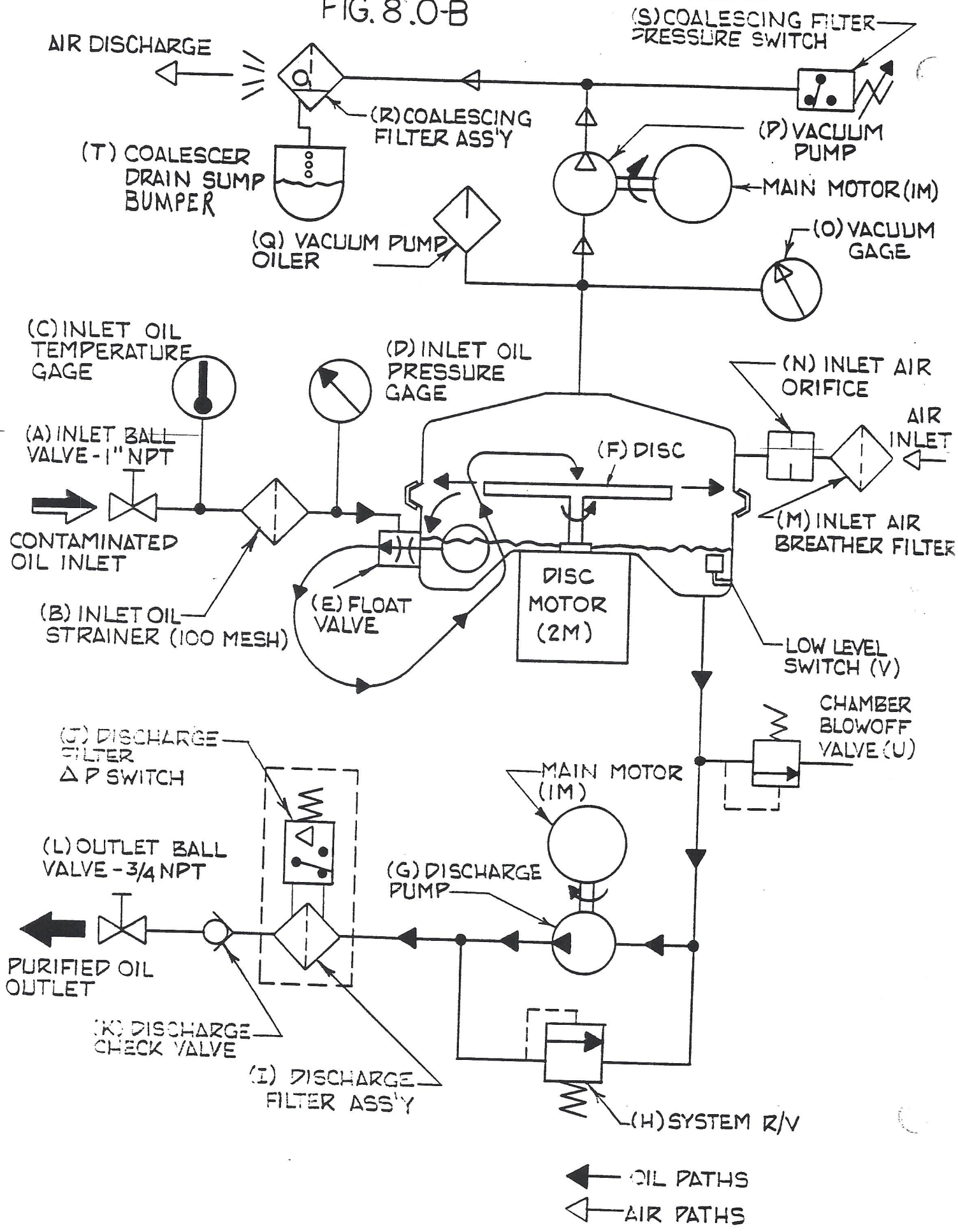


TABLE 8-2: Unit runs only when "START" is held in. Unit will not operate after the "START" button has been released.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
(CONTINUED)	E. Leak in suction plumbing between reservoir and oil inlet to purifier vacuum chamber. Suspect this if the inlet pressure gage reads within specified limits, the inlet valve is fully open, and the unit won't fill after holding "START" depressed for 5 minutes.	E. Find and repair as required. Suggest carefully applying positive oil pressure to reveal source of leak(s). WARNING: DO NOT APPLY POSITIVE AIR PRESSURE TO THE INLET OF THE PURIFIER AT ANY TIME IN ORDER TO AVOID THE DANGER OF EXPLOSION! IMPORTANT NOTE: The max. press. which may be applied to the inlet of the purifier is +20 psig. The customer is responsible for determining what the maximum pressure of the connected system is. Take care not to overpressurize the purifier or any connected component of the system.
	F. Inlet line not submerged below fluid level or inlet line stuck on bottom of reservoir.	F. Correct either condition.
	G. Excessively high viscosity. Check inlet pressure gage. Suspect this if gage indicates high vacuum and inlet valve is fully open.	G. Reduce oil viscosity by heating. NOTE: Max. purifier operating temp. is +145 degrees fahrenheit.

TABLE 8-2: Unit runs only when "START" is held in. Unit will not operate after the "START" button has been released.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
(CONTINUED)	H. Float valve stuck in closed position.	H. Open chamber V-band clamp. Remove upper chamber. Free float ball linkage. Determine & correct cause of binding. Refer to Sect. 10.1.1.0 for vacuum chamber disassembly/reassembly procedure. Replace float valve assy., if required. (See Sect. 10.3.)
	I. Defective low level switch (1LLS) or reverse polarity on low level switch. Suspect this if removal of upper chamber with machine shut down shows that level switch float is all the way up against its stop (fluid level is higher than switch) & ohmmeter still shows infinite resistance between terminals 6 and 8.	I. Reverse polarity of switch by removing its retaining clip, removing and inverting float. Replace retaining clip. If polarity is correct and switch still shows infinite resistance with the float all the way up, the switch must be replaced. Before reassembling unit, identify and correct cause of switch failure. It is not likely for the switch to have failed unless it was overloaded. Also check the float for buoyancy and free travel throughout its range.

TABLE 8-2: Unit runs only when "START" is held in. Unit will not operate after the "START" button has been released.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Change coalescer red light (3LT) is lit.	A. Operator releasing "START" button too soon.	A. Hold "START" button depressed until chamber reaches full vacuum (22-26" Hg; approx. 30-60 sec. after depressing "START".)
	B. Coalescer bumper/sump assembly.	B. Drain bumper/sump assy. Allow coalescer housing to drain any trapped liquid. Discard all fluid. Close drain valve. Restart unit. ~~Hold~~ "START" button for at least 60 sec. when re-starting to avoid coalescer pressure switch causing a nuisance trip-out and to allow excess oil to blow off coalescing element. If unit shuts down again and change coalescer light comes on, re-place coalescing element. Refer to Sect. 4.4.0.
	C. Plugged coalescer.	C. Drain bumper/sump assembly. Replace coalescer. Refer to Sect. 4.4.0 (drain coalescer housing). Reassemble & restart. Hold "START" button for at least 60 sec. when restarting to avoid coalescer pressure switch causing a nuisance tripout.
	D. Defective coalescer pressure switch 1PS.	D. Replace. Refer to Sect. 10.7.
	E. Defective control relay 4CR or contact 4CR1.	E. Rewire or replace.

TABLE 8-2: Unit runs only when "START" is held in. Unit will not operate after the "START" button has been released.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
One or both motors will operate only when "START" button is depressed. As soon as "START" button is released, the unit shuts down and the red light "3LT" (change or drain coalescer) stays on.	"START" button is being released by operator too soon.	Hold "START" button depressed for at least 30 sec. or until chamber vacuum reaches at least 22" Hg.
	Coalescer bumper sump assembly is full and/or coalescer filter element is clogged.	Open drain valve and drain sump. Discard fluid. Allow coalescer housing to drain completely. Close sump drain valve & restart. Hold "START" for at least 60 sec. If light comes on again as soon as "START" is released, replace coalescing filter element. Refer to section 4.4.0.
	Defective pressure switch 1PS.	Replace. Refer to section 10.7.
	Defective control relay 4CR or contact 4 CR1.	Rewire or replace.
	Obstruction, kink, or restriction in vacuum pump air exhaust line.	Clear line.
	Vacuum leak is allowing too high an airflow thru vacuum pump. (This will be indicated by a low chamber vacuum level while the unit is running.)	Find and repair leak.

TABLE 8-2: Unit runs only when "START" is held in. Unit will not operate after the "START" button has been released.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Low vacuum pump output and/or excessive noise.	Insufficient oil in oiler.	Fill oiler per para. 3.1.1.
	Broken pump vane.*	Replace pump. See section 10.7.*
	Loose or defective drive coupling.	Tighten or replace.
	Vane(s) sticky and hung up.	Disassemble line from top of chamber to vacuum pump. Spray several shots of non-flammable solvent (recommend freon TF) into pump inlet while pump is running. Follow by several shots of WD-40. If problem persists, replace pump.*
	Vacuum pump worn out.*	Replace.*

*IMPORTANT NOTE: PALL LAND AND MARINE CORPORATION DOES NOT RECOMMEND REBUILDING THE VACUUM PUMP.

TABLE 8-3: Unit will not operate at all, even when the "START" button is depressed.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Unit stops & does not restart when "START" button is depressed. (Both motors fail to start.)	Circuit breaker tripped (1CB, 2CB, or 3CB)	Find and correct cause of overload. Reset all tripped breakers.
	Unit is unplugged.	Plug in.
	Overcurrent protection in power receptacle or feeder lines have opened.	Reset/replace as req'd. Refer to para. 3.1.2 and 3.1.3.
	Defective "START" button (2PB) or "STOP" button (1PB).	Determine which button is defective & replace. Note that buttons must be wired correctly. Refer to electrical schematic. Reassemble with correct color boot ("START" is black or gray; "STOP" is red).
	Defective relay 1PR.	Rewire or replace.

TABLE 8-3: Unit will not operate at all, even when the "START" button is depressed.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
High chamber oil level & system keeps shutting down (chamber won't drain). NOTE: high chamber level is indicated by the disc motor (2M) circuit breaker (2CB) repeatedly tripping out shortly after depressing "START" button. (SEE NOTE ON THE FOLLOWING PAGE.)	A. Defective float valve assembly.	A. Replace. See sect. 10.3.
	B. Leaking poppet gasket.	B. Replace float valve assy. Refer to sect. 10.3.
	C. Float ball full of oil.	C. Replace ball. (See sect. 10.3.)
	D. Linkage binding open.	D. Open chamber V-band clamp. Remove upper chamber. Free linkage. Determine & correct cause of binding. Refer to para. 10.1.1.0 for vacuum chamber disassembly/ reassembly procedure. Replace float valve assembly if req'd. Refer to sect. 10.3.
	E. Inlet pressure greater than +20 psig.	E. Install a pressure regulator (PLM P/N AA-9500-D1818) at the inlet connection to reduce the inlet pressure. Recommend setting regulator between 0 and +10 psig.
	F. Float valve seat not bottomed in valve body.	F. Remove swivel fitting and plumbing from float valve inlet. Remove seat, clean seat & valve body. Pump out chamber if recd. Apply Loctite 242 or equiv. to seat threads. Reassemble and bottom seat. Re-assemble plumbing (use pipe sealant w/ teflon) and swivel hose fitting to valve.

NOTE: In order to drain fluid from a flooded vacuum chamber prior to repairing it or resuming normal operation, perform either one of the following steps (A or B).

A) Place a drain pan under the exhaust hose which runs from the chamber blowoff valve down thru the bottom of the frame. Lift the manual actuating lever of the chamber blowoff valve. Hold this lever until all fluid is drained from the vacuum chamber.

CAUTION: Do not perform step B if oil has vented from either the chamber blowoff valve or coalescing filter outlet.

WARNING: Never apply air pressure to the vacuum chamber! Failure to heed this warning could result in an EXPLOSION, causing possible property damage, injury, or death!

CAUTION: Never restart a unit which has vented oil from the chamber blowoff valve or the coalescing filter outlet before purging the vacuum pump and coalescer filter of all oil. If oil has vented from the blowoff valve and/or the coalescer, purge it as follows before restarting the machine.

1. Disconnect the hose which runs from the top of the vacuum chamber to the vacuum pump inlet, at the vacuum chamber.

2. Remove coalescing filter element, empty coalescer drain sump, and apply air pressure to the vacuum pump inlet. DO NOT APPLY AIR PRESSURE TO THE VACUUM CHAMBER. Refer to the previous WARNING. Blow out vacuum pump and lines with air pressure. Apply air to the free end of the hose which leads to the vacuum pump inlet.

WARNING: To avoid danger of electrical shock, disconnect the purifier from its power supply before performing Step B.

B) Disconnect the disc motor (2M) from its supply at either its circuit breaker (2CB), the bell box on the lower frame, power relay contact (2PR1), or at the disc motor itself. Close the inlet valve, open the outlet valve, and connect the purifier to its electrical power supply. Pump the fluid out of the vacuum chamber by depressing and holding the "START" button. Reconnect the disc motor to its power supply after fluid has been removed from the chamber.

TABLE 8-3: Unit will not operate at all, even when the "START" button is depressed.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Disc motor (2M) circuit breaker (2CB-12 Amp) keeps tripping out.	A. Chamber flooded with fluid.	A. See pg. 27.
	B. Circuit breaker 2CB is defective. Check disc motor current with Ampprobe.	B. Replace.
	C. Mechanical seal worn out.	C. Replace mechanical seal/plate assy., sealing washers, and mechanical seal o-ring. See sect. 10.1.
	D. Disc motor (2M) is worn out.	D. Replace motor, sealing washers, and mechanical seal o-ring. See sect. 10.1 for disassembly/reassembly procedure.
Main motor (1M) circuit breaker (1CB-12 Amp) keeps tripping out.	A. Circuit breaker 1CB is defective. Check main motor current with Ampprobe.	Replace.
	B. Main motor 1M is overloading due to vacuum pump, discharge pump or drive freeze-up.	Check entire drive for free movement. Replace components as required.
	C. Main motor 1M is worn out.	Replace.
	D. Circuit breaker 1CB is overheating due to frequent and repeated start-ups (jogging or plugging main motor).	Reset breaker. Allow to cool for 5 min. Restart. Do not jog or plug unit excessively.
	E. Relay coil 3CR is defective.	Replace relay 3CR.

TABLE 8-3: Unit will not operate at all, even when the "START" button is depressed.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Control circuit breaker 3CB keeps tripping out.	A. Fault in control circuit.	A. Find and correct fault. Refer to electrical schematic. Replace parts as required.
	B. Defective circuit breaker 3CB. Check control circuit current with Ampprobe.	B. Replace.

SECTION 9

ILLUSTRATED PARTS LIST

9.1 INTRODUCTION

This parts list describes and illustrates the maintenance parts applicable to the portable fluid purifier, Pall Land and Marine Corporation's part number PE-00440-1H.

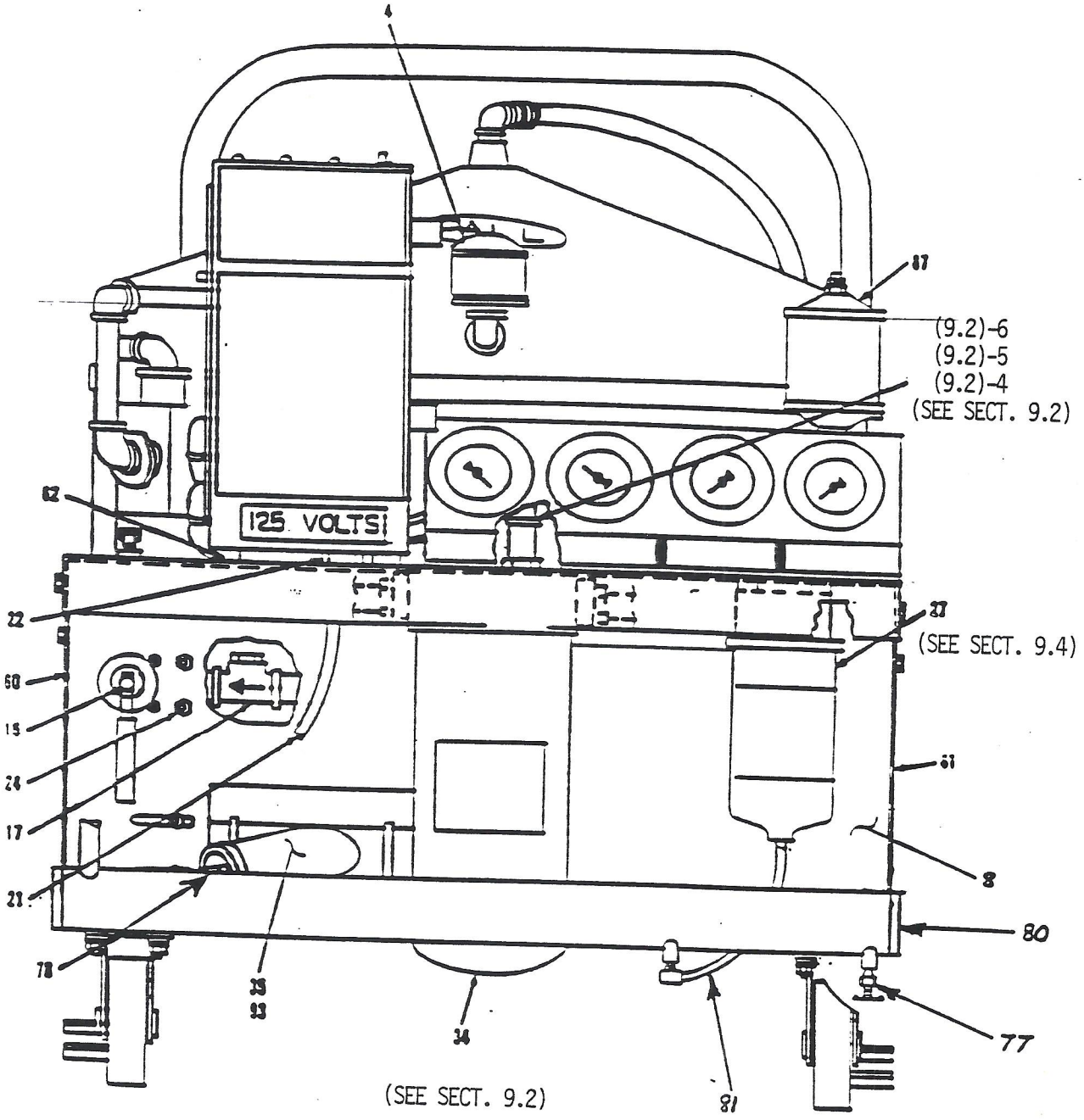
INDEX NO.	PART NUMBER	DESCRIPTION	QTY.
9.1-	PE-00440-1H	Portable Fluid Purification System	Ref.
-1	AA-9500-D1934	Motor	1
-2	PA-00440-D1935HA	Pump, Discharge	1
-3	PA-00440-D1936A	Pump, Vacuum	1
-4	PA-00440F-1A	Breather Filter	1
-5	PA-00440D-1937A	Motor, Disc	1
-6	AA-9500-D1939H	O-Ring, Buna N	1
-7	AA-9500-D1940	V-Band Clamp	1
-8	PA-00440-DFA1A	Frame Assembly	1
-9	PA-00440-DFA2A	Frame Cover Assembly	1
-10	AA-9500-D1944	Float Switch	1
-11	AA-9500-D725	Gauge Press 0-200 psig, 2 1/2" Dial, 1/4" CBM	1
-12	AA-9500-D726	Gauge Comp 30-0-30, 2 1/2" Dial, 1/4" CBM	1
-13	AA-9500-D1945	Gauge, Temperature 40-240 degrees F, 2 1/2" Dial	1
-14	AA-9500-D1387	Valve, Ball 1"	1
-15	AA-9500-D1952	Valve, Ball 3/4"	1
-16	PA-00440-D1787HA	Relief Valve, Preset	1
-17	AA-9500-D1837	Discharge Check Valve, 1/2" FPT	
-18	PA-00440-EAD3A	Electrical Assembly (see sect. 9.3 for breakdown)	1
-19	MS28775-327	O-Ring, Buna N	1
-20	AA-9500-D1965	Woodruff Key, #404	1
-21	AA-9500-D1966	Power Cord Set w/Plug	1
-22	AA-9500-D517	Cord Grip	1
-23	AB-A351-UBLT16	U-Bolt for 1" Pipe, 1/4-20 C'Stl	3

9.1 (continued)

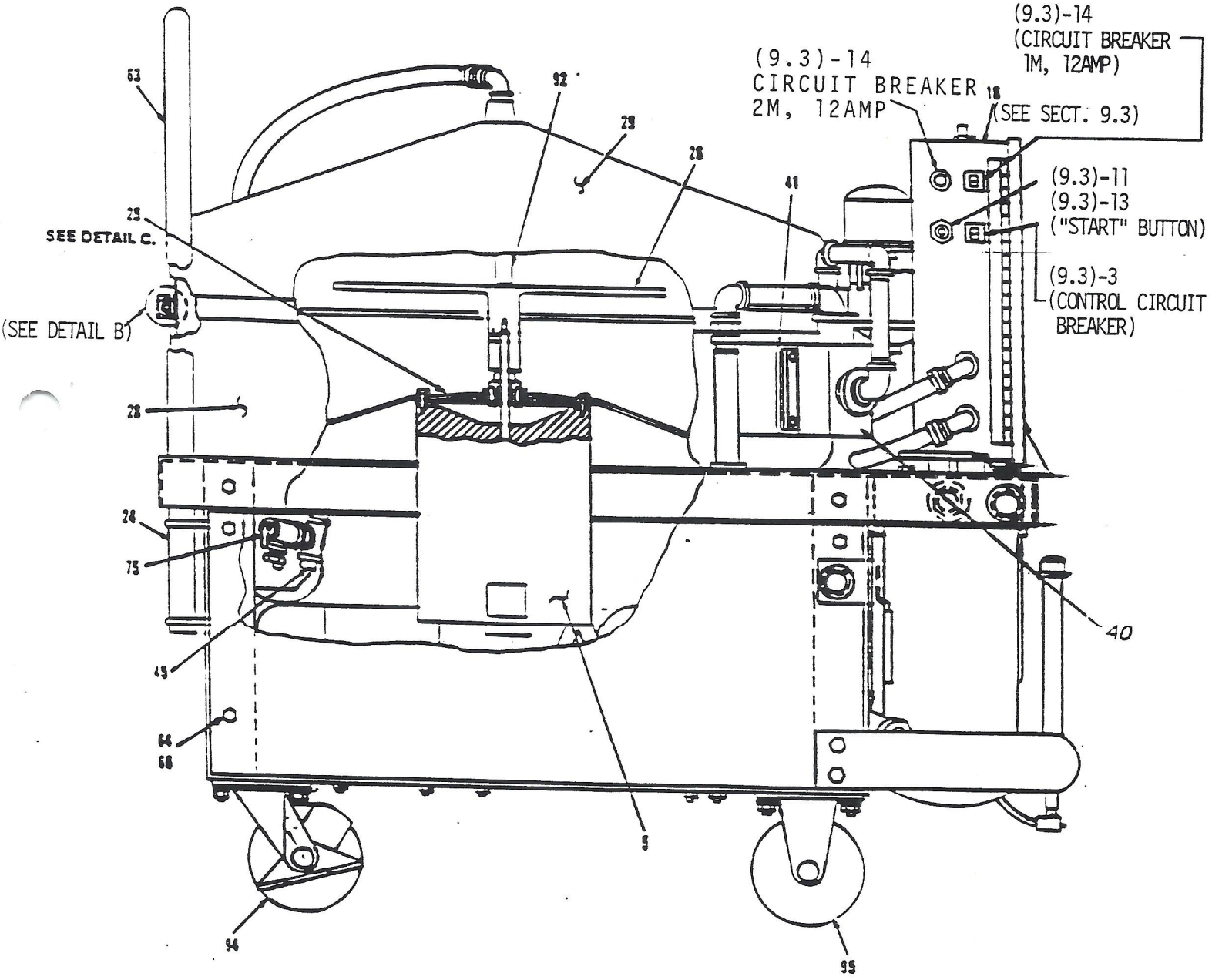
INDEX NO.	PART NUMBER	DESCRIPTION	QTY.
-24	AB-A351-UBLT12	U-Bolt for 3/4" Pipe, 1/4-20 C'Stl	5
-25	PA-00440-DVC5HA	Mech. Seal/Plate Assembly	1
-26	PA-00440-VCD4A	Disc	1
-27	PD-00440-SU80H	Coalescing Filter Assembly (see sect. 9.4 for breakdown)	1
-28	PA-00440-VCD1HA	Vac Chamber Assembly - Bottom	1
-29	PA-00440-VCD2HA	Vac Chamber Assembly - Top	1
-30	AB-A351-SHV25	Sheave, Motor - Browning P/N OK-25	1
-31	AC-A351-SCRH0906	Bolt Hex 1/4-20x3/4, C'Stl	8
-32	AC-A351-SCRH1306	Bolt Hex 3/8-16x3/4, C'Stl	7
-33	AB-A351-SHV26	Sheave, Discharge Pump - Browning P/N OK-40	1
-34	GD-00273-168H	Filter Assembly (see sect. 9.2 for breakdown)	1
-35	AA-9500-D1967	Y-Strainer	1
-36	AA-9500-D1985H	Sealing Washer, Buna-N	4
-37	PB-00440-D35	Valve Spacer Block	1
-38	MS35338-43	Lockwasher - #10	6
-39	AC-A351-SCRR0506	Bolt, Rd. Hd. 10-24x3/4, C'Stl	2
-40	AB-A352-8D999H	Float Valve Assembly	1
-41	AB-A351-12D92H	Valve Gasket	1
-42	AA-9500-D1968	Ball - 4" Spherical	1
-43	AA-9500-D399	Washer, Lock 1/4, C'Stl	28
-44	AA-9500-D210	Mach. Screw 1/4 20	4
-45	AA-9500-D1501	Hose 3/4" Parker Push-Lok (821-12)	8 Ft.
-46	AA-9500-D1757	Hose 1/2" Parker Push-Lok (821-8)	8 Ft.
-47	AA-9500-D684	Blt Hex 3/8-16x1 1/4 C'Stl	6
-48	AA-9500-D400	Washer, Lock 3/8, C'Stl	6
-49	AA-9500-D430	Washer, Flat 3/8, C'Stl	6
-50	AA-9500-D397	Nut, Hex 3/8-16, C'Stl	6
-51	AC-A351-SCRH1106	Bolt, Hex 5/16-18x3/4, C'Stl	4
-52	AB-A351-XNUT00	Nut, Hex 5/16 - 18, C'Stl	4
-53	AB-A351-LKWS01	Lockwasher 5/16, C'Stl	4
-54	MS25440-5	WSRF331C870088	4
-55	AA-9500-D1982	Hose - 3/8" Parker Push-Lok (821-6)	3 Ft.

ILLUSTRATED PARTS LIST (continued)

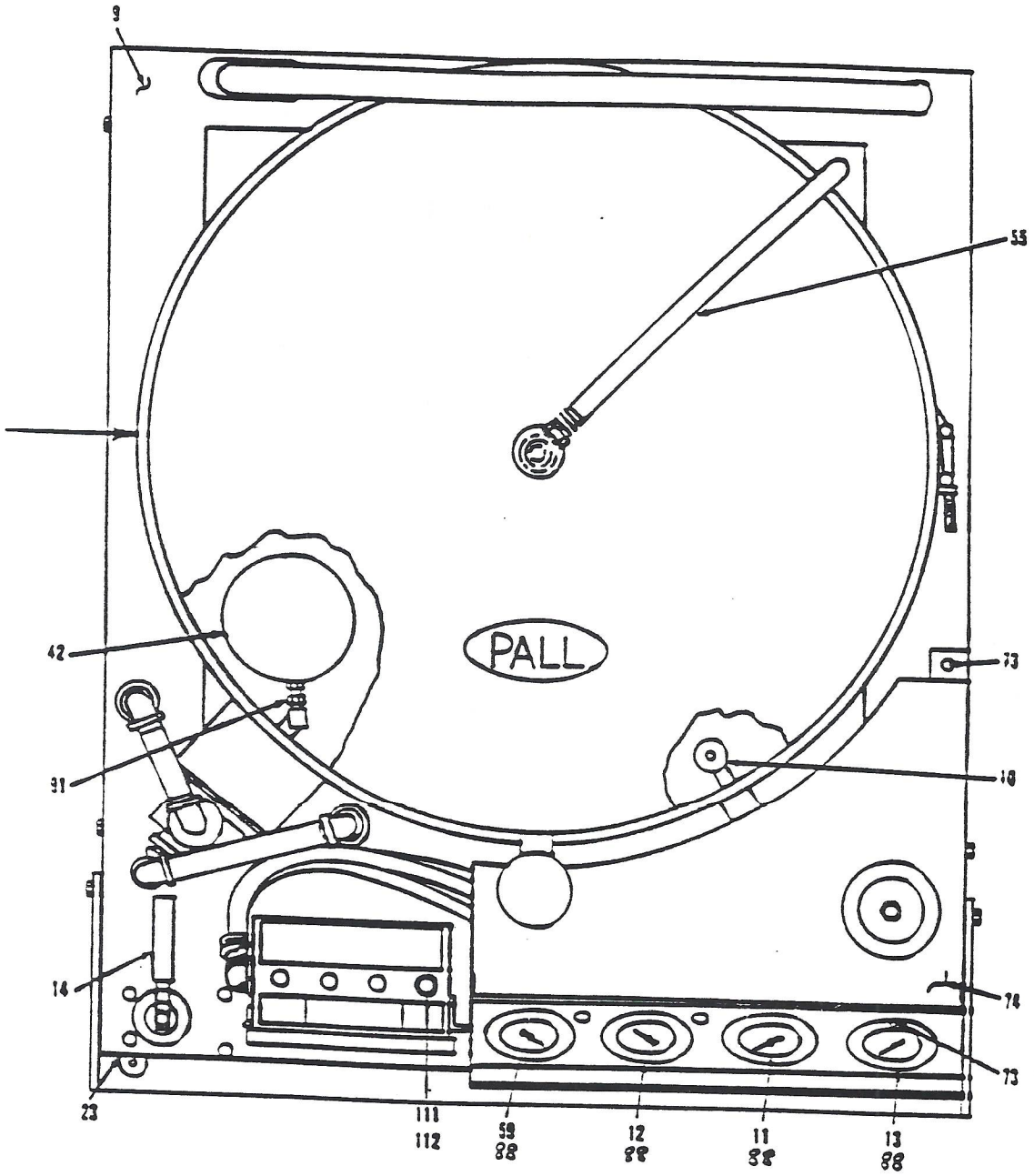
INDEX NO.	PART NUMBER	DESCRIPTION	QTY.
-56	AA-9500-D1555	Copper Tubing 3/16 OD x .030 Wall	AR
-57	AN960616	WSRF375C625063	12
-58	PA-00440-VCD3HA	Vac Seal Retainer	1
-59	AA-9500-D1978	Gage, Vacuum 0-30" Hg, 2 1/2" Dial, 1/4" CBM	1
-60	PD-00440-D12	Guard - Valve Side	1
-61	PD-00440-D14	Guard-Vac Pump Side	1
-62	PB-00440-D547	Elec. Box Spacer	4
-63	PC-00440-1D10	Handle	1
-64	AA-9500-D2132	Sheet Metal Screw #10 x 3/8, Type B, C'Stl	10
-65	PB-00440-D547B	Spacer, Vacuum Chamber	1
-66	AA-9500-D686	Washer, Flat #10, C'Stl	10
-67	PA-00440-D2154	Belt - V-Link	1
-68	PA-00440-D2182HA	Press. Switch, Coalescer - Preset	1
-69	AB-A351-GACNR01	Elbow, 1/8 Tube x 1/4 MPT	4
-70	AB-A351-GACNR02	Conn.-1/8 Tube x 1/4 FPT	3
-71	AB-A351-GACNR00	Tubing 1/8 OD Nylon	AR
-72	AB-A351-GACNR04	Elbow, 1/8 Tube x 1/8 MPT	1
-73	MS24629-23	BOLT138C32C06D07E	17
-74	PD-00440-1D25	Cover, Gages	1
-75	PA-00440-D2183HA	Valve, Chamber Blowoff	1
-76	AA-9500-D2188	Grommet, 1" Buna-N	2
-77	AC-A351-SCRF0604	Bolt, Flat Hd. 10-32x1/2, C'Stl	2
-78	AB-A351-PLG6D	Plug, Pipe 3/4 Brass	1
-79	AA-9500-D685	Nut, Hex, 10-32, C'Stl	5
-80	PD-00440-1D51	Bumper Coalescer Sump Assembly	1
-81	AA-9500-D2272	Tubing, Nylon 3/8 x .05 Wall	1
-82	AA-9500-D674	Grommet, 3/4	1
-83	PB-00440-D36	Valve Spacer Block	1
-84	AA-9500-D846	Bolt 3/8-16x1, C'Stl	4
-85	AB-A351-GACNR06	Tee, 1/8 Tube x 1/8 MPT	1
-86	AC-A351-SCRR0504	Bolt Rd. Hd., 10-24x1/2, C'Stl	2
-87	PA-00440-1D41A	Oiler Reserv./Diaphragm	1
-88	AB-A351-TYC01	Elbow, Hose Barb	1
-89	AA-9500-D1498	Box, Bell, 4 x 2 x 2 - 1/2	1
-90	PA-00440-1D40A	Coupling	1
-91	PB-00440-1D45	Offset Assy. - Float Ball	1
-92	PB-00440-1D23A	Feed Tube/Fitting Assy.	1
-93	PA-00440E-1967A	Element, Y-Strainer (Cleanable)	1
-94	AA-9500-D1942	Caster, Swivel	2
-95	AA-9500-D1943	Caster, Rigid	2
-96	AB-A351-SCRH0604	Bolt, Hex 10-32x1/2, C'Stl	3
-97	AA-9500-D398	Nut, Hex 1/4-20, C'Stl	16
-98	AA-9500-D490	Flatwasher, 1/4", C'Stl	16
-99	MS35489-42	Grommet	4
-100	MS27183-17	WSRF495CA28083	8



Portable Fluid Purifier (Front View)



Portable Fluid Purifier (Left View)



Portable Fluid Purifier (Top View)

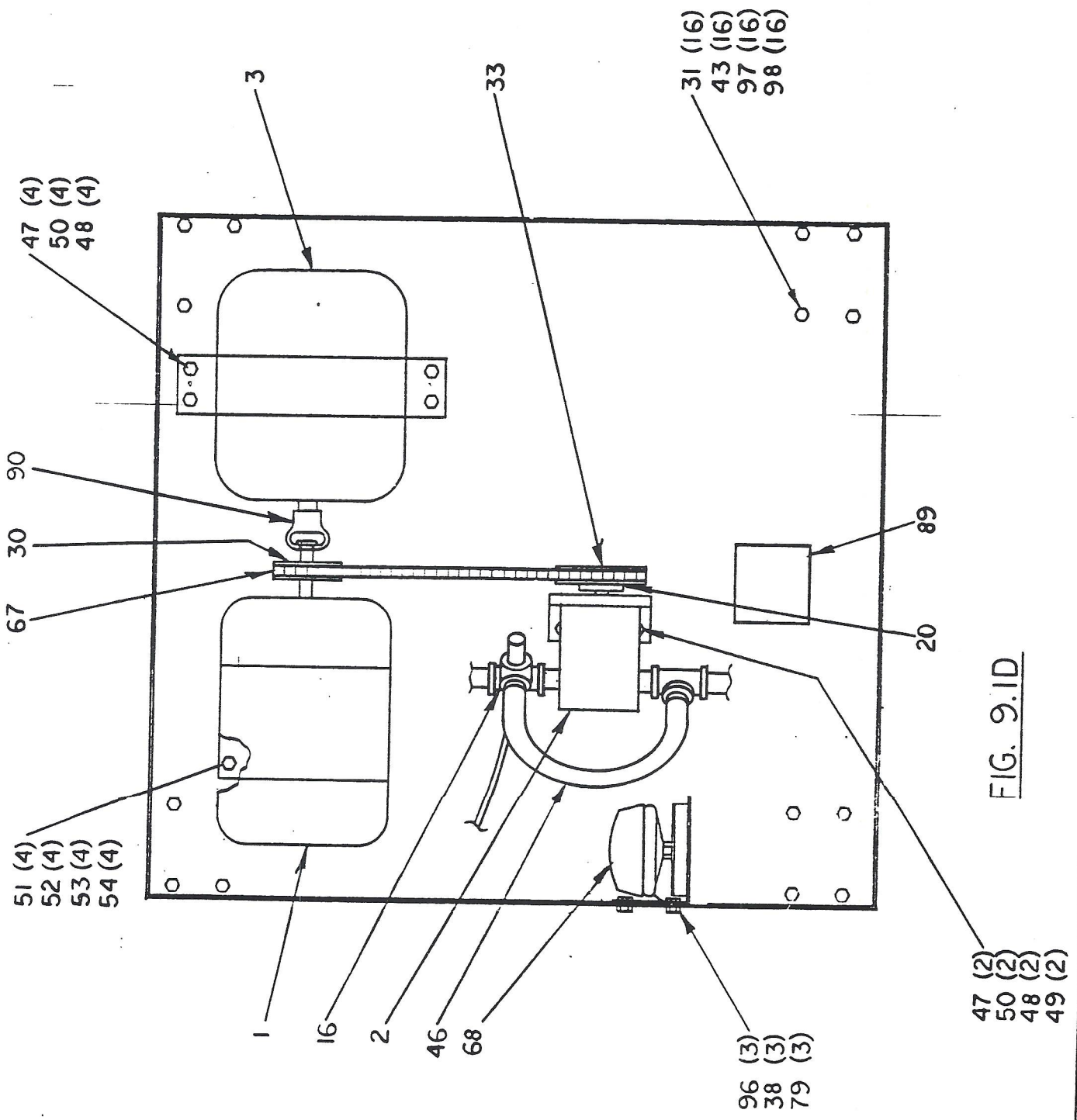
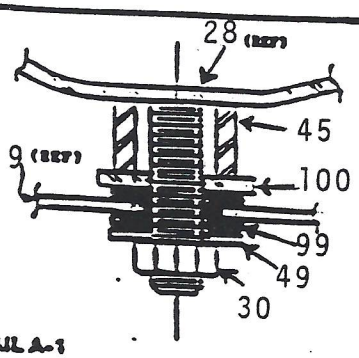


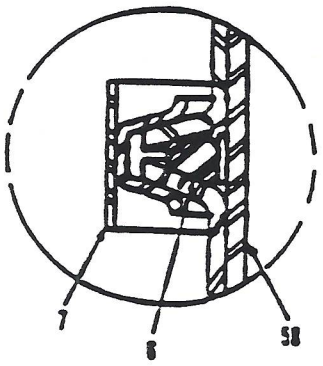
FIG. 9.1D

FED. MFG. CODE	Pall Land & Marine Corp.	PAGE 33D PORTABLE FLUID PURIFIER TOP WITH VACUUM CHAMBER A FRAME COVER
60047	PALL A SUBSIDIARY OF PALL CORPORATION	

LOWER CHAMBER TO FRAME COVER MOUNTING DETAIL (TYP. 4 PLACES).

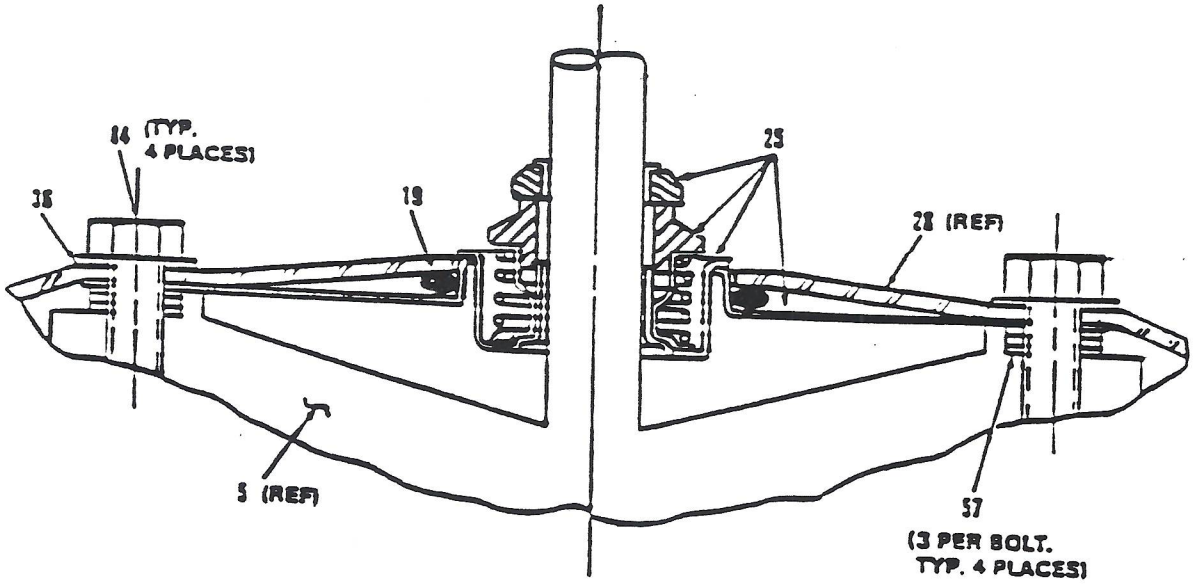


DETAIL A-1



VACUUM CHAMBER V-BAND CLAMP MOUNTING DETAIL

DETAIL B



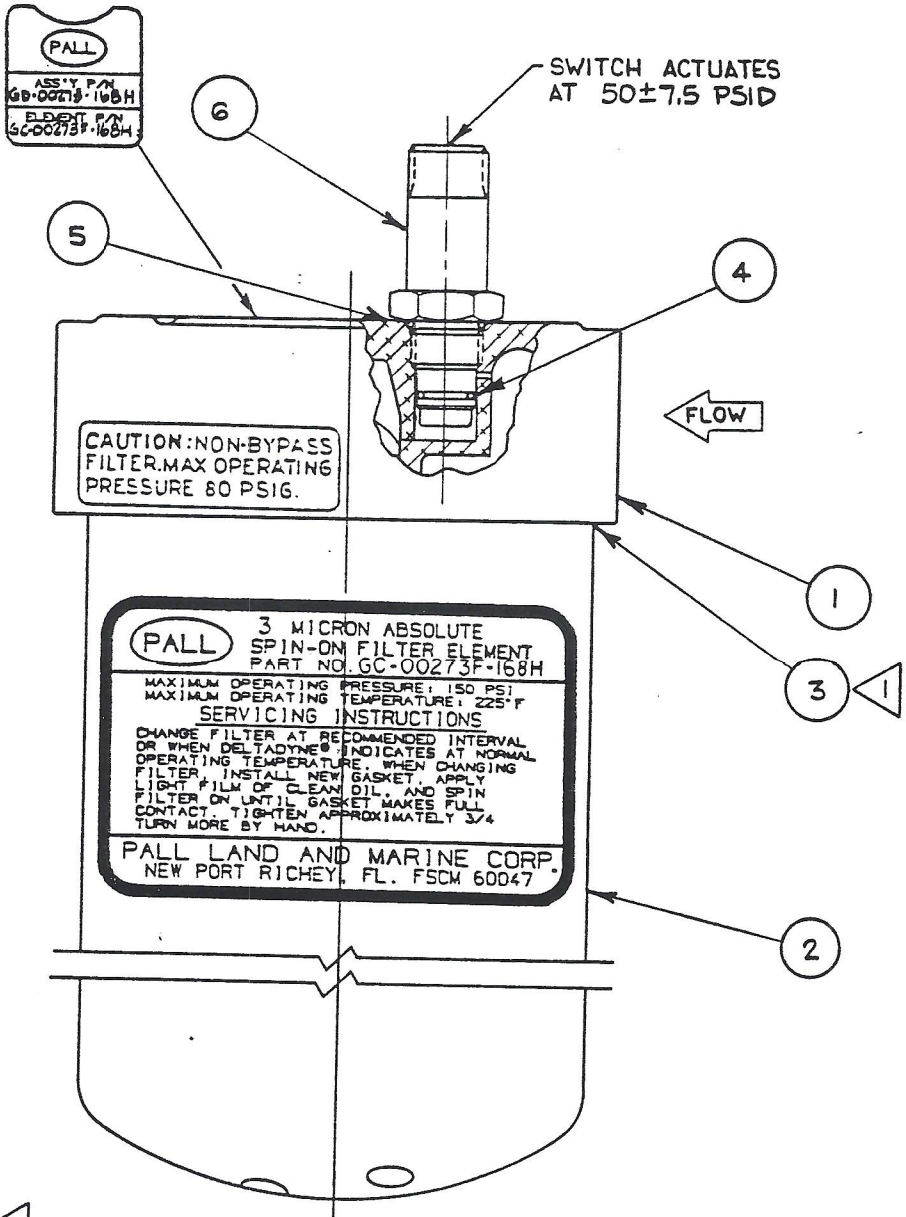
MECHANICAL SEAL/SEAL PLATE ASSEMBLY MOUNTING DETAIL

DETAIL C

Portable Fluid Purifier (Component Mounting Details)

9.2 DISCHARGE FILTER ASSEMBLY

INDEX NO.	PART NUMBER	DESCRIPTION	QTY.
9.2-	GD-00273-168H	Filter Assembly - Spin On	Ref.
-1	GA-00273-168D1HA	Head Assy., Non-Bypass	1
-2	GC-00273F-168H	Filter Element	1
-3	AA-9500-D1603	Gasket - Buna-N	1
-4	MS28775-014	O-Ring - Buna-N	1
-5	MS28778-8	Boss Seal - Buna-N	1
-6	RC991CZ091	Differential Pressure Switch	1



1: SPARE GASKET (1) PACKED WITH EACH SPARE SPIN ON ELEMENT.

DISCHARGE FILTER ASS'Y-SPIN ON
FIG. 9.2A

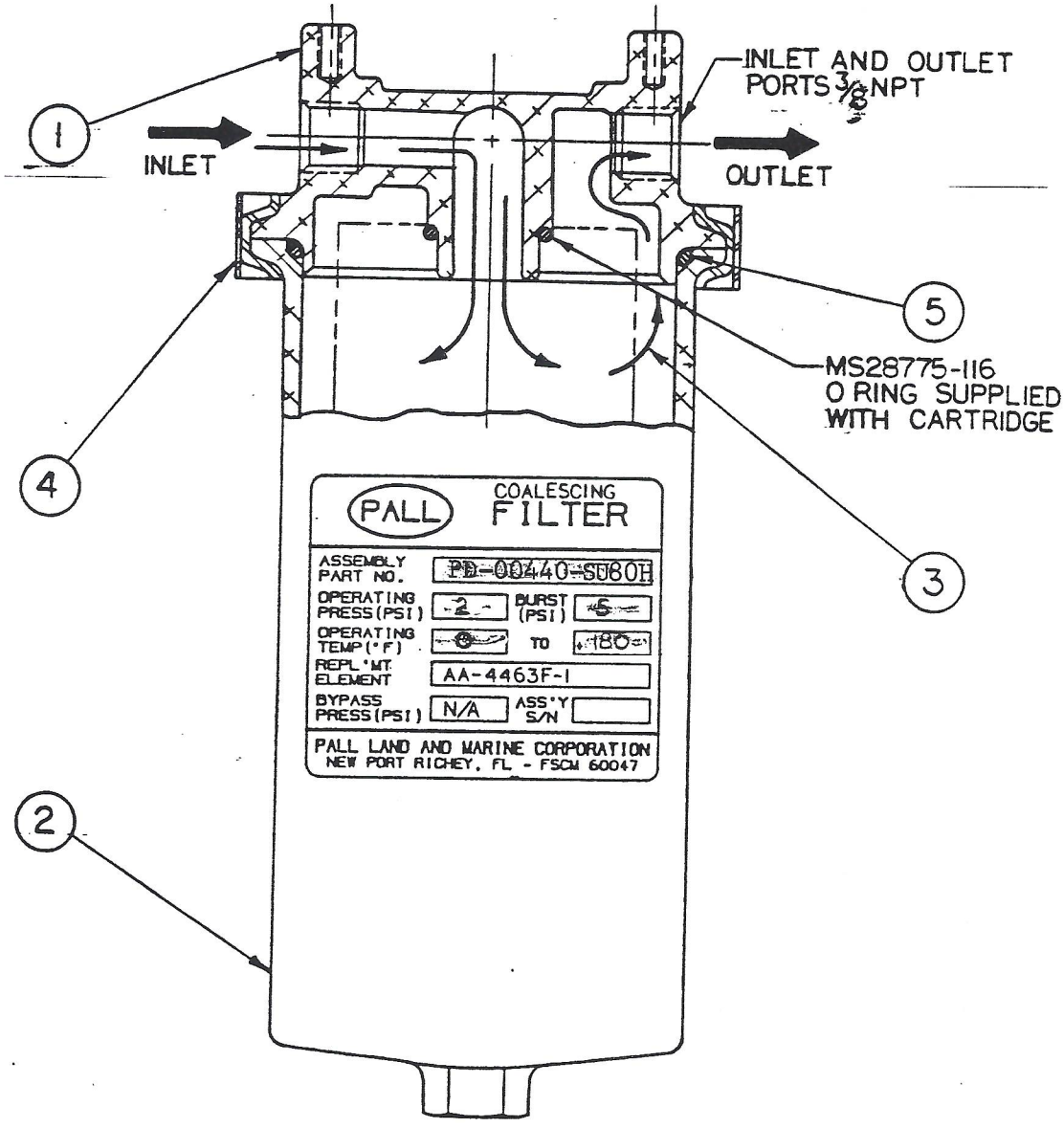
9.3 ELECTRICAL ASSEMBLY

INDEX NO.	PART NUMBER	DESCRIPTION	QTY.
9.3-	PA-00440-EAD3A	Electrical Assembly	Ref.
-1*(3)	AA-9500-D1505	Light, Red Indicator	2
-2*(2)	AA-9500-D1507	Light, Yellow Indic.	1
-3*(1)	AB-A351-CKTBKR01	Circuit Breaker, 1A	1
-4*(1)	PA-00440-EAD2454A	Time Delay Relay Ass'y	1
-5	AA-9500-D1994	Terminal Strip	1
-6	AA-9500-D210	Mach. Screw 1/4 - 20	1
-7	AA-9500-D466	Lug, Ground	1
-8*(5)	MS24629-23	BOLT138C32C06D07E	6
-9	PA-00440-EAD41A	Panel, Machined	1
-10	PA-00440-EAD4A	Elec. Box - Machined	1
-11*(2)	AA-9500-D2107	Switch, Momentary SPOT	2
-12*(1)	AA-9500-D2108RED	Rubber Boot, Red	1
-13*(1)	AA-9500-D2108BLK	Rubber Boot, Black	1
-14*(1)	AA-9500-D2153	Circuit Breaker, 12A	2
-15*(3)	AA-9500-D1992	Relay, DPDT	3
N/A*	PA-00440-EASPRK1T	Electrical Spare Parts Kit	Ref.

*Electrical spare parts kit contains all items marked with an asterisk, in the quantity next to the asterisk in parenthesis, plus (5) quick connect adaptors P/N AA-9500-D2212 and (1) float switch P/N AA-9500-D1944.

9.4 COALESCING FILTER ASSEMBLY

INDEX NO.	PART NUMBER	DESCRIPTION	QTY.
9.4-	PD-00440-SU80H	Coalescing Filter Assembly	Ref.
-1	AA-4463-6D1YA	Head	1
-2	AA-4463-8D2YA	Bowl	1
-3	AA-4463F-1	Filter Element	1
-4	AA-4463-6D3	V-Band Clamp	1
-5	MS28775-146	O-Ring	1



COALESCING FILTER ASS'Y
FIG 9.4-A

SECTION 10

REPAIR, REPLACEMENT, AND OVERHAUL PROCEDURES

10.0 GENERAL

This section details some of the more involved repair, replacement, and overhaul procedures for major components of the portable purifier. Any correspondence with either the factory or our local representative should include the system's complete part number and serial number as shown on the identification plate attached to the unit.

10.0.1 Introduction. This section is designed to assist an experienced mechanic or electrician, in the repair, replacement, and/or overhaul of the more difficult to service components of the portable fluid purification system.

When a problem with unit operation is encountered, refer to section 8 (TROUBLE SHOOTING). For assistance in diagnosing the cause of problems, refer to section 2.3 (SPECIFICATIONS), sections 3.1, 3.2.0, and 3.2.1 (SET-UP and START-UP PROCEDURES). All these should be reviewed and thoroughly understood in order to determine if the machine is being operated properly. Adherence to the ROUTINE AND LONG TERM MAINTENANCE GUIDE-LINES set forth in sections 4.0 and 6.0 will greatly reduce the likelihood and frequency of major problems which require extensive repairs.

10.0.2 How To Use This Section. In order to make the most efficient use of this section, it is first necessary to correctly diagnose the problem. Next, locate the closest description to the problem in the Section Contents (para. 10.0.3). Refer to the pages which most closely apply. Note the recommended parts to replace, any special tools, and the recommended repair procedures. Figures and/or schematics will be called out as required.

10.0.3 SECTION CONTENTS.

10.0.3 Section Contents (continued)

10.1 REPLACEMENT OF SPINNING DISC, MOTOR SEALING WASHERS, MECHANICAL SEAL/PLATE AND O-RING ASSEMBLY, AND DISC DRIVE MOTOR

10.1.0 Parts Required To Replace

A. DISC P/N PA-00440-VCD4A

B. SEALING WASHERS (Buna-N) P/N AA-9500-D1985H, qty. 4. Replacement of motor bolts is optional. P/N AA-9500-D846, quantity 4 (commercially available 3/8-16x1" long carbon steel bolt). Loctite 242 or equivalent for securing bolts to motor. Light, clean petroleum oil or clean process fluid for lubrication of seals before installation.

C. MECHANICAL SEAL/PLATE ASSEMBLY, P/N PA-00440-DVC5HA, qty. 1
MS28775-327 O-Ring, Buna-N, qty. 1
AA-9500-D1985H, Sealing Washers (Buna-N), qty. 4
Loctite 242 or equivalent
Light, clean process oil (for lubricating o-ring and sealing washers).

Optional Items:
Motor Mounting Bolts, P/N AA-9500-D846, qty. 4
(Commercial Grade, 3/8-16x1" long, Hex Head, Carbon Steel Bolt)
Permatex #2 Non-Hardening, Pliable Gasket Compound or equivalent

D. DISC DRIVE MOTOR
MS28775-327, O-Ring, (Buna-N), qty. 1
AA-9500-D1985H, Sealing Washers, Buna-N, qty. 4
PA-00440-D1937A, Motor, Disc Drive, qty. 1
Light, clean process oil (for lubricating o-ring and sealing washers).
Loctite 242 or equivalent

Optional Items:
AA-9500-D846, Commercial Grade Hex Head Bolt, 3/8-16x1" long carbon steel
Permatex #2 Non-Hardening Pliable Gasket Compound or equivalent

10.1.1 Removal and Replacement of Disc

10.1.1.0 Pump all oil out of unit by closing the inlet valve and holding the "START" button depressed for approximately 2 minutes after the low level switch shuts off the disc motor. Disconnect the unit from its electrical power supply. Disconnect the vacuum hose from the vacuum pump to the upper vacuum chamber, at the upper vacuum chamber. Remove oiler and gage cover. Remove V-band nut, V-band, upper chamber, and o-ring. Be sure to keep the o-ring clean. Do not dent the o-ring retainer, either chamber half, or the V-band. Inspect the o-ring, chambers, V-band and retainer for damage at this time. Replace if required.

NOTE: This paragraph will be referenced often in the remainder of this section. Before reassembling the upper vacuum chamber, be sure to fill the lower chamber with clean process oil to a height of approximately 2" below the sealing lip. This will prevent the discharge pump from damage due to dry startup. Adherence to this note will prolong pump life and reliability.

10.1.1.1 Remove the guard from the valve side of the machine. Using a screwdriver, remove the cap from the bottom of the disc drive motor. Remove the nylon tipped set screw from the hub of the disc. Remove the feed tube by referring to para. 10.2.1.0 except retain parts. Underneath the cap at the bottom of the disc motor is the motor shaft. This shaft is either slotted or has flats machined into it. Hold this shaft and unscrew the disc by turning it counter-clockwise.

10.1.1.2 Replace the disc by reversing step 10.1.1.1. Lubricate the rubber portion of the mechanical seal which grips the motor shaft and the mating face of the mechanical seal with clean process fluid. Do not use any grease. Turn the disc clockwise until it bottoms. Realign feed tube to disc per para. 10.2.1.4. Replace set screw, cap at bottom of motor, guard, and upper chamber by reversing para. 10.1.1.0. Refer to para. 10.1.2.1 for V-band reassembly procedure.

10.1.2 Removal and Replacement of Sealing Washers

IMPORTANT NOTE: The sealing washers should not be reused at any time. Whenever it is necessary to remove the sealing washers for any purpose, they should be replaced with new sealing washers. Sealing washers should always be lubricated (both sides) with clean process fluid before installing. The bolt and mating surface of the can should be clean and free from chips, loose paint, dirt, or other foreign matter which could gouge or disrupt the seal. Failure to follow these instructions could result in a serious leak. This would allow air into the chamber while the unit was operating (under vacuum). The leak would also allow fluid to drip out of the chamber while it was shutoff (zero vacuum). This fluid could then drip into the disc motor, or onto the lower frame. It could ruin the disc motor, main drive motor, or discharge pump drive belt. These could result in extensive repairs, expense, delay, and present a possible safety hazard in the event that the fluid were to result in the shorting out of a motor.

10.1.2.0 Remove upper vacuum chamber by referring to paragraph 10.1.1.0. It is not necessary to remove the disc or motor in order to replace the sealing washers. Replace the washers one at a time in an alternating pattern. Remove the 3/8-16x1" bolts which hold the motor and seal plate to the lower vacuum chamber. Note that these bolts are held in with Loctite 242 thread locker. It is optional to replace the bolts. If they are not replaced, the thread should be cleaned of cured Loctite with a wire brush. Be sure to lubricate both sides of the sealing washer with clean process fluid before reinstalling, and make sure that the bolt head and face of the lower vacuum chamber are clean. Refer to the previous paragraph (10.1.2). Apply Loctite 242 or equivalent to bolts before assembling.

IMPORTANT NOTE: Do not get any Loctite on the sealing washers. When assembling sealing washers to bolts, proceed as follows: Apply a small amount of clean oil to the ID of the sealing washer. Gently push the washer all the way onto the bolt, so that the washer is up against the hex head. Relubricate both sides of the sealing washers sparingly with clean oil. Wipe any oil off of the first 4 threads of the bolt. Apply Loctite 242 sparingly to the first 2 or 3 threads of the bolt. Install bolt. Careful adherence to this procedure will prevent the mixing of oil and Loctite.

10.1.2.1 Reinstall upper vacuum chamber and V-band by reversing the steps of paragraph 10.1.1.0. Be sure to lubricate large o-ring liberally. Lubricate both flange lips of upper and lower can with grease or vaseline. Lubricate inside of V-band in same manner. When drawing V-band tight, tap the outside circumference of the V-band lightly with a small soft-faced mallet while tightening V-band nut. Be sure to tap V-band all around its circumference while tightening. Tighten V-band slowly. Do not use an impact wrench, nut runner, screw gun, or other high-speed installation tool. Do not overtighten. The recommended installation tool is a 3/8" drive ratchet wrench and 7/16" deep well socket. Check and retighten the V-band nut if required after starting up the unit (chamber under vacuum). Applying vacuum to the chamber may be helpful in getting the V-band nut started.

10.1.3 Removal and Replacement of Mechanical Seal/Seal Plate Assembly

10.1.3.0 Remove V-band, upper vacuum chamber, and spinning disc. Refer to section 10.1.1.

IMPORTANT NOTE: Do not attempt to remove the stationary portion of the mechanical seal from the mechanical seal plate. These are pressed and sealed at the factory. Disasembly of the seal from the plate in order to replace the seal may result in a leak.

10.1.3.1 Remove (2) discharge pump bolts and slide discharge pump out from under the disc motor. This is done in order to provide sufficient clearance to remove the disc motor from the upper vacuum chamber. Remove the wire junction cover plate from the bottom of the motor. Disconnect the wires from the motor to the junction (bell) box. Disconnect and remove the liquid tight conduit from the motor.

10.1.3.2 Remove rotating portion of seal from motor shaft and discard. Loosen the four bolts which hold the mechanical seal plate assembly and the motor in an alternating pattern, approximately one turn at a time. This will avoid springing the lower vacuum chamber. Support the motor from the bottom and when all four bolts have been removed, withdraw the motor from the machine.

10.1.3.3 Remove the mechanical seal/seal plate assembly from the lower can. Take care to retain the twelve spacing washers (3 per bolt) part number AN960-616. Discard the mechanical seal/seal plate assembly and the seal o-ring part number MS28775-327.

10.1.3.4 Lubricate the new -327 o-ring with clean process fluid and stretch over hub of new seal plate. Lubricate face of mechanical seal with light oil or clean process fluid. Never use grease or heavy oil as an installation lubricant. Any heavy oil or grease on seal may cause faces of the seal to leak. Take care at all times not to nick or damage either mating surface of the mechanical seal. In order to ease installation of the spacing washers, it is recommended that they be bonded together in sets of three with a light film of a sealant such as Permatex #2 non-hardening gasket compound.

10.1.3.5 Reinstall the motor, seal plate, washers, and bolts by reversing the above steps. Be sure to install new sealing washers and to lubricate them with clean process fluid before installing. Tighten the bolts approximately one turn at a time in an alternating pattern, in order to avoid springing the lower vacuum chamber.

10.1.3.6 Lubricate the rubber shaft gripper of the rotating portion of the mechanical seal with clean process fluid, and install it on the motor shaft. The steel face is to be down, towards the phenolic face of the stationary portion of the seal. Apply light machine oil or clean process fluid to steel face of seal. Do not use WD-40 or silicone oils.

10.1.3.7 Reassemble disc, rewire motor, reassemble discharge pump, and reassemble remainder of machine by reversing the steps above.

10.1.4 Removal and Replacement of Disc Drive Motor

10.1.4.0 Remove V-band, upper vacuum chamber, disc, discharge pump, and motor by following steps 10.1.3.0 through 10.1.3.3, except do not discard mechanical seal and o-ring unless they are damaged.

10.1.4.1 Examine the mechanical seal (both faces) and mechanical seal o-ring for damage. Replace if required. Always replace the sealing washers.

WARNING: Inspect the replacement disc motor. There should be an adhesive-backed sticker on the outside of the motor body indicating that the motor is without thermal overload protection. It is essential that any motor which is used to drive the disc be without internal overload protection. The installation of a motor with thermal or other type of internal overload protection may result in an automatic restarting condition. This could cause a serious injury, for instance, in the event that the disc were to restart automatically while the upper vacuum chamber was removed, the power was connected, and an operator or mechanic had their hands inside the vacuum chamber. For replacement purposes, only use motors from which all internal overload protection has been removed or disconnected, and labelled as such.

10.1.4.1 (cont'd) Reinstall the motor by reversing the above steps. Be sure to install new sealing washers and to lubricate all seals correctly before installing.

10.2 FEED TUBE AND TUBE FITTING

10.2.0 It is unlikely that the feed tube will ever require complete replacement. In the event of severe jarring during shipment, handling, or rough usage, the centering of the tube to the disc or the gap between tube and disc may require adjustment. The specifications for tube position are:

Concentricity of tube OD to centerline of disc: .015" TIR
Vertical distance between tube and disc surface:
.250" ± .030"
Parallelism between tube end and disc surface: .030"

Of these three, concentricity has the greatest impact on machine performance.

If the feed tube becomes misaligned, it can usually be realigned in the machine by bending or tapping with a soft faced mallet. In some cases, removal of the tube from the machine will be required in order to use a vise or bender on the tubing.

In extreme cases such as kinking, collapsing, or splitting of the tubing, complete replacement is required. The spare feed tube and fitting assembly has the ferrule pre-set on the tube. The tube is pre-formed to be near the correct position. Final installation, inspecting, and positioning of the tube must be performed on the individual machine, by the customer. The required parts are:

PB-00440-1D23A	(1)	Spare Feed Tube and Fitting Assembly Pipe Sealant with Teflon (recommend Loctite PST #592 or equivalent).
PC-00440-T5	(2)	Feed Tube Centering Tool
PB-00440-T6	(1)	Gap Adjustment Spacer or a .210" Jo-Block
	(1)	Set of Flat Feeler Gages

10.2.1 Procedure for removing, replacing, and aligning feed tube. First remove upper vacuum chamber. Refer to procedures in para. 10.1.1.0. Refer to para. 10.1.2.1 for V-band installation procedure.

10.2.1.0 Loosen tube nut until it is completely disengaged. Remove tube, sleeve (locked to tube) and nut. Discard.

10.2.1.2 Remove tube fitting body and discard. Wipe inside of coupling clean.

10.2.1.3 Disassemble adaptor body from spare tube assembly by unscrewing tube nut. Fill the second and third pipe threads on the body 360 degrees around with pipe compound. Recommended sealant is Loctite PST #592 or equivalent. Install the adaptor body to the 3/4" weld coupling in the lower vacuum chamber. Wipe off any excess pipe compound. Assemble tube, sleeve, and nut. Apply light oil to adaptor body threads. Bottom tube in adaptor body. Wrench nut down easily until a sudden torque increase is felt. Tighten the nut an additional 1/6 turn (one wrench flat) from this point.

10.2.1.4 Set vertical gap and parallelism. Use gap adjustment tool or a .210 Jo-Block and feeler gage. Set concentricity using (2) feed tube centering tools. Place the two tools together so as to "collar" the feed tube. Slowly rotate the disc through one full revolution (360 degrees). Measure the gap between the two tools. This is the TIR of the tube OD with respect to the disc centerline. Adjust tube until vertical gap, parallelism, and concentricity are all within specified limits. Reassemble machine by reversing the procedures in para. 10.1.1.0. Refer to para. 10.1.2.1 for V-band installation procedure.

10.3 FLOAT VALVE ASSEMBLY, FLOAT BALL AND BALL OFFSET ASSEMBLY

10.3.0 The float valve, ball, and offset assembly regulate the inlet oil flowrate. When working properly, these three components maintain a steady chamber oil level between the low liquid level switch and the bottom of the spinning disc throughout the rated oil inlet pressure and viscosity ranges.

10.3.1 Parts required to replace:

A) Float Ball - P/N AA-9500-D1968 (1)
B) Offset Assembly, Float Ball - P/N PB-00440-1D45 (1)
C) Float Valve Assembly - P/N AB-A352-8D999H (1)
Float Valve Gasket - P/N AB-A351-12D92H (1)
Light, clean process fluid for lubricating new float valve gasket.
Loctite PST #592 or equivalent should be used to seal all pipe threads.

10.3.2 Removal and replacement of:

A) Float Ball
B) Offset Assembly
C) Float Valve Assembly

10.3.2.0 Remove the upper vacuum chamber. Refer to para. 10.1.1.0. This applies to all three components (float ball, offset assembly and float valve assembly).

10.3.2.1 For Float Ball: Hold the top shoulder nipple of the offset assembly with a pair of locking pliers (vise grips). This is to avoid bending the float valve linkage and to avoid breaking the seals or misaligning the offset assembly. Unscrew and discard the ball. Check the offset assembly for presence of oil inside pipe or fittings. Replace offset assembly if oil is found. Replace ball.

10.3.2.2 For Offset Assembly: Remove float ball per preceding para. (10.3.2.1). Remove hose swivel fittings from inlet and outlet of float valve. Remove (4) 1/4-20 bolts which hold float valve to lower vacuum chamber. Tilt float valve, hold securely and remove defective offset assembly. Replace offset assembly and reassemble by reversing above steps. Be sure to retighten (4) float valve bolts evenly and in an alternating pattern to effect a good gasket seal. Be sure to replace chamber grounding wire on float valve bolt.

10.3.2.3 For Float Valve Assembly: Remove float ball and offset assembly by referring to paragraphs 10.3.2.1 and 10.3.2.2. Remove fittings from inlet and outlet of old float valve and replace on new float valve. Remove and discard both the old float valve and valve gasket. Lubricate both sides of new gasket with light, clean process fluid before installing. Also inspect both valve and face of mounting acaptor for burrs, nicks, scratches, contaminant, or damage which would cause the seal to leak. Reassemble by reversing the above steps.

10.3.3.0 To reassemble upper vacuum chamber, refer to paragraphs 10.1.1.0 and 10.1.2.1.

10.4 LOWER VACUUM CHAMBER

10.4.0 In the event that the lower vacuum chamber sustains serious damage, it will be necessary to replace it. This is a major repair, due to the large number of parts which must be removed, as well as the complexity involved.

10.4.1 Parts Required

PA-00440-VCD1HA	(1)	Lower Vacuum Chamber Assembly
MS28775-327	(1)	O-Ring, Buna-N
AA-9500-D1985H	(4)	Sealing Washer, Buna-N
AB-A351-12D92H	(1)	Float Valve Gasket - Buna-N

Light, clean process oil; gasket compound, Permatex #2 Non-hardening gasket compound or equivalent; Loctite PST #592 pipe compound or equivalent.

10.4.2 Removal and Replacement of Lower Vacuum Chamber

NOTE: Lubricate all seals with clean process fluid before installing. Apply pipe compound to all MPT joints before assembling.

10.4.2.0 Remove oiler and gage cover. Remove upper vacuum chamber by referring to para. 10.1.1.0. Remove -472 o-ring and o-ring retainer band. Refer to sect. 10.5. Remove float ball and float valve by referring to paragraphs 10.3.2.1 and 10.3.2.3. Remove feed tube and fitting assembly (paragraphs 10.2.1 through 10.2.1.2, except retain fitting body), and disc (para. 10.1.1.1).

10.4.2.1 Disconnect conduit and wiring to low level float switch. Remove low level float switch and elbow. Inspect for damage. Replace as required.

10.4.2.2 Note that all hoses which connect to the lower vacuum chamber have the swivel hose end at the vacuum chamber. Mark all hoses to facilitate reassembly and disconnect from vacuum chamber. Disconnect disc motor conduit and wiring. Remove (4) 3/8-16 nuts which hold chamber to frame cover. Lift lower chamber straight up. Retain spacing washers underneath chamber and inspect grommets for damage. Replace if required.

10.4.2.3 Support lower can on mounting surface (flat at bottom of can, where 4 weld studs are). Remove disc motor, mechanical seal, -327 o-ring, bolts, sealing washers, and spacing washers from can. Refer to para. 10.1.3.2 except do not discard the mechanical seal unless it is damaged.

10.4.2.4 Note orientation and location of all pipe and conduit fittings which connect to lower chamber. Remove all fittings from defective chamber and replace on new chamber.

NOTE: The two 3/4" close nipples which connect to the chamber oil inlet and outlet may be damaged during disassembly. If this occurs, replace them. Use a commercial grade, schedule 40, galvanized iron close pipe nipple. The chances of damaging the nipples during disassembly can be minimized by using a pipe nipple removing tool or a screw extractor ("E-Z Out") to disassemble the nipples from the weld couplings. Avoid using a pipe wrench to disassemble the nipples if it is necessary to reuse them.

10.4.3.0 Reinstall mechanical seal, new -327 o-ring, spacing washers, new sealing washers, bolts and motor. Be sure to position motor so that conduit connection is at the same location as at disassembly. Refer to sections 10.1.3 and 10.1.4.

10.4.3.1 Reassemble lower chamber to frame cover and reconnect all hoses. Rewire disc motor and reconnect sealtite conduit.

10.4.3.2 Replace low level float switch. Check polarity with an ohmmeter before rewiring. Low level switch is to be normally open. This is with the switch and can in their normal operating positions (right side up). Rewire and reconnect float switch conduit.

10.4.3.3 Replace float valve, new mounting gasket, float ball, feed tube, disc, and setscrew. Replace sheet metal cap on bottom end of motor. Replace retainer band and -472 o-ring. Be sure to reconnect chamber grounding wire to float valve.

10.4.3.4 Check alignment of tube to disc and align, if required. Refer to paragraphs 10.2.1.3 and 10.2.1.4.

10.4.3.5 Reinstall upper vacuum chamber and V-band clamp. Refer to paragraphs 10.1.1.0 and 10.1.2.1.

10.4.3.6 Note that the new lower vacuum chamber is shipped with a blank purifier identification nameplate attached. Using the nameplate on the old vacuum chamber as a reference, fill in the machine serial number with a vibrotool. It will also be useful, in the event that future service is required, to vibroetch: "REPLACED LOWER CAN" and the date of replacement on the nameplate.

10.4.3.7 Check all hose, pipe, tube, V-belt, coupling, and conduit lines for interference, leaks, kinking, or incorrect installation. Correct as required.

10.5 FRAME ASSEMBLY

Parts Required: Spare frame assembly P/N PA-00440-DFAH1A (1), gage line disconnecting tool P/N PA-00440-T13, plus any other damaged parts. Refer to illustrated parts breakdown (section 9) and assembly drawing PE-00440-1 G as required.

10.5.0 Remove (2) side guards, oiler, gauge cover, and coalescer bumper/sump assembly. Mark and disconnect all hoses to upper and lower vacuum chamber, at the vacuum chambers. Remove discharge filter element (not the head).

10.5.1 Mark and disconnect all wiring to motors and coalescer pressure switch. Note that the tube is connected to the high pressure port on the switch, and the low pressure port is vented to atmosphere. Mark and disconnect hose lines to discharge filter, coalescing filter, all gage lines and (3) lines to vacuum pump oiler (2 copper lines plus 1 nylon tube).

10.5.2 Remove handle. Remove (4) 3/8-16 bolts which secure frame cover assembly to frame. Lift frame cover off of frame and set aside. Be sure to support frame cover so that the entire weight is not supported by the motor. Do not support frame cover sideways, as this would cause the motor to be cantilevered outward. These cautions are necessary to avoid springing the lower vacuum chamber.

10.5.3 Remove vacuum pump, main drive motor, discharge pump, inlet Y-strainer manifold, outlet check valve manifold, coalescer pressure switch, and all 4 wheels. Replace all of these parts in their corresponding locations on the new frame. Refer to section 10.7 for specific component installation instructions.

10.5.4 Reassemble remainder of the machine by reversing steps 10.5.2, 10.5.1, and 10.5.0.

10.6 FRAME COVER ASSEMBLY

Parts Required: Spare frame cover assembly P/N PA-00440-DFAH2A (1), (1) gage line disconnecting tool P/N PA-00440-T13, plus any other damaged parts.

10.6.0 Remove (2) side guards, oiler, gauge cover, coalescer bumper/sump assembly, and discharge filter element. Note locations of and remove all gauges from the gage panel. Disconnect and remove oiler/diaphragm assembly.

10.6.1 Remove lower vacuum chamber, upper vacuum chamber, and disc motor as an assembly. Refer to sections 10.1 and 10.4.

10.6.2 Remove electrical assembly. Refer to section 10.10.

10.6.3 Disconnect conduit to differential pressure switch. Remove discharge filter head and disconnect its two hoses. Remove coalescing filter assembly. Refer to sections 10.8 and 10.9. Remove machine handle.

10.6.4 Remove the (4) 3/8-16 bolts which hold the damaged frame cover to the frame. Lift off and replace the frame cover. Remove the (4) mounting grommets from the damaged cover and replace them in the new cover.

10.6.5 Reassemble the machine by reversing the above steps. Note that the (4) bolts which secure the cover to the frame are held in place with Loctite 242 thread locker. Reapply Loctite. Do not over tighten bolts such that the cover or frame is visibly distorted.

10.7 VACUUM PUMP, DISCHARGE PUMP, MAIN DRIVE MOTOR, COALESCER PRESSURE SWITCH, V-BELT, SHEAVES, AND COUPLING

10.7.0.0 Vacuum Pump. To replace the vacuum pump, first disconnect both inlet and outlet lines, nylon tubing to coalescer pressure switch and oiler, and copper tubing to oiler, at the oiler.

10.7.0.1 Remove belt from motor sheave by either loosening discharge pump or working belt off of sheave. Loosen motor sheave and slide it towards the motor. Loosen both halves of coupling connecting vacuum pump to motor. Slide this coupling towards the motor. Remove the 4 bolts which hold the vacuum pump to the frame. Slide the coupling off of the vacuum pump and withdraw the pump from the machine.

10.7.0.2 Remove the fan covers from both ends of the old pump, and remove the copper oiler lines. Install these on the replacement pump after removing its fan covers. Replace the fan covers on the new pump. Remove all plumbing from the old pump, and replace it on the new pump. Be sure to maintain the same orientation of fittings.

10.7.0.3 Install the new vacuum pump by reversing the above steps. Realign belt and coupling drive.

10.7.1.0 Discharge Pump. Drain all oil from unit. Disconnect inlet and outlet hoses from the pump. Remove the (2) bolts which hold the pump to the frame. Remove the V-belt from the pump sheave. Withdraw the pump from the machine. Disconnect one end of the hose which runs from the system relief valve to the suction side of the pump.

10.7.1.1 Note the orientation of all pipe fittings on the old pump. Remove these, and reassemble them on the new pump. Remove the sheave and Woodruff key from the old pump and reassemble them on the new pump. Pour clean, new, process oil into the pump suction port and turn the shaft clockwise several times. This will insure that the pump gears are lubricated during the initial startup. For additional protection against dry startup, refer to the note in paragraph 10.1.1.0.

10.7.1.2 Replace pump in machine by reversing the above steps. It is desirable to remove the upper vacuum chamber and fill it with clean process fluid to insure that the new pump is well lubricated during startup (refer to para. 10.1.1.0).

10.7.2.0 Main Drive Motor. Remove belt from motor sheave by either loosening discharge pump or by working the belt off of one sheave. Remove (4) bolts holding motor to frame. Loosen setscrew on motor half of coupling and slide motor shaft off the coupling. Remove conduit and disconnect wiring to motor. Remove motor from frame. Remove sheave from old motor and reassemble it on the new motor.

10.7.2.1 Check the new motor to be sure it has no thermal or other type of internal overload protection. Pay particular attention to the following warning:

10.7.2.1 (cont'd) **WARNING:** Inspect the replacement motor carefully. There should be information on the nameplate indicating that the motor has no internal overload protection. It is essential that any motor used to drive the pumps be without internal overload protection. The installation of a motor with thermal or other type of internal overload protection may result in an automatic restarting condition. This could cause serious injury in the event that an operator or mechanic had their hands inside the machine and it were to restart automatically and without warning. For replacement purposes only use motors which do not contain any type of internal overload protection and which are labelled as such.

10.7.2.2 Check to be sure the motor is wired for 120 VAC (low voltage connections). Connect the motor to 120 VAC, 60 Hz, 15 Amp grounded power service and check for correct shaft rotation (clock-wise, facing shaft end of motor). If all these are in order, proceed. If not, rewire motor as required.

10.7.2.3 Install replacement motor by reversing the above steps.

10.7.3.0 Coalescer Pressure Switch. Disconnect the tube which runs to the vacuum pump outlet. Disconnect the conduit and wires. Note the terminals which the wires were connected to. Loosen the locknut which holds the switch to its mounting bracket, and withdraw it from the machine.

10.7.3.1 Inspect the replacement coalescer pressure switch. There should be a tag, packed with the switch, stating that it has been calibrated and tested, with the date of testing. Remove the conduit fitting and tube elbow from the old switch and replace on the new switch. Be sure that the tube elbow goes into the new switch's high pressure port. The low pressure port is to be left unobstructed and vented to atmosphere. Replace switch on mounting bracket. Note that switch diaphragm is to be mounted vertically with both ports (high and low pressure) facing downward. Rewire switch, replace conduit, secure locknut, be sure plastic cap is secured tightly over adjusting screw, cut 1/2" off of plastic tube to coalescer, and replace. The cut must be square with the tube centerline.

10.7.4.0 V-Belt. Remove V-belt from sheaves either by loosening tension at discharge pump or by working the belt off of one sheave while turning drive by hand.

10.7.4.1 Using V-belt tool P/N PA-00440-T1, disconnect and remove the old V-belt. Note the orientation of the V-belt links. The correct orientation of the belt is such that when turning the drive in the direction of rotation, the bottom tapered link enters the sheaves last. Measure out a sufficient length of new belting to allow for proper initial tension while still allowing enough discharge pump travel to compensate for approximately 10% stretch due to belt break in. Check sheaves for oil and damage. Clean off oil or replace sheaves if required.

10.7.4.2 Install new belt. Check for correct orientation. Use V-belt tool to join links. Align and tighten drive as follows: The initial belt tension should be 4.8 lbs., as measured with a belt tension gage at midspan, to produce a deflection of .16 in. Start up and check for looseness by closing discharge valve. There should be no slippage. Open discharge valve and allow unit to run for several hours. After several hours of operation, recheck tension and adjust as follows: The belt tension after break-in should be between 2.4 lbs. and 3.6 lbs., as measured with a belt tension gage at midspan, to produce a deflection of .16 in. Recheck belt tension frequently during the first 50 operating hours after installing a new belt.

10.7.5.0 Discharge Pump Sheave. Remove V-belt from sheaves. Refer to para. 10.7.4.0. Using a mirror, or by feeling with a finger, orient sheave so that keyway is pointing straight up. Insert a 5/32" long arm hex key (allen wrench) down through the groove milled in the pump mounting bracket and loosen the setscrew. Remove the sheave from the discharge pump shaft. Use a wheel or gear puller if required. Take care not to lose the Woodruff key. Replace the sheave by reversing the above step. Be sure to use Loctite 242 or equivalent on sheave setscrew.

10.7.5.1 Motor Sheave. Remove V-belt from sheaves. Refer to para. 10.7.4.0. Loosen setscrews on sheave and also on both halves of coupling. Remove the (4) bolts which hold the motor to the frame. Slide the motor all the way back until its rear hits the frame. Slide the coupling toward the vacuum pump until the coupling comes off of the motor shaft. Use a wheel or gear puller if required. Take care not to force the shaft key all the way back towards the motor. This would cause the key to ride up in the keyway and bind the sheave. Pull the shaft end of the motor at an angle towards the side opening, and slide the motor sheave off of the motor shaft. Replace by reversing the above step. Be sure to line up coupling and sheaves and to use Loctite 242 or equivalent on all setscrews.

10.7.5.2 Coupling. Remove the (4) bolts each which hold the motor and vacuum pump to the frame. Loosen the setscrews on both sides of the coupling. Move the motor back toward the frame as far as it will go. Slide the coupling towards the vacuum pump until it clears the motor shaft. Pivot the motor out of the way, and remove the coupling from the vacuum pump shaft. Replace by reversing above step. Be sure to align drive properly. Use Loctite 242 or equivalent on all setscrews. Note that the shaft ends of either the motor or the vacuum pump must not contact the center portion of the coupling.

10.8 DISCHARGE FILTER ASSEMBLY

10.8.0 Remove oiler and gage cover. Remove (3) screws each which hold the vacuum gage and the inlet oil pressure gage in the panel and pull both gages out of the panel. It is not necessary to disconnect the tubes to the gages, but do protect them from kinking, abrasion, or other damage. Remove spin on element and gasket from head. Remove conduit from differential pressure switch, disconnect wiring, and remove differential pressure switch and elbow. Remove (3) bolts which secure the filter head to the frame cover. Pull the filter head down and away from the cover and frame. Remove the two hose fittings which connect to the head. Remove the boss seal adaptor fittings from the old head and install on the new head. Lubricate bosseals before installing with clean process fluid. Check the orientation of the (2) 1/2" street elbows. They are to point straight back through the frame. Use Loctite pipe sealant with Teflon (PST) #592 or equivalent on all MPT joints. Reassemble by reversing above step.

10.9 COALESCING FILTER ASSEMBLY

10.9.1 Remove oiler and gage cover. Remove (3) screws each which hold the outlet oil pressure and inlet oil temperature gages in the panel. Pull the (2) gages out of the panel, but do not disconnect them. Protect tubing from damage. Remove coalescer drain sump and disconnect tube. Remove (2) bolts which hold coalescer head to frame cover. Pull assembly down and away from cover and frame. Disconnect line to coalescer inlet. Replace fitting on new assembly. Replace plastic tube elbow at bottom of bowl on new assembly. Reassemble by reversing above step.

10.10 ELECTRICAL CONTROL BOX ASSEMBLY

Remove conduit, fittings, and disconnect wiring to low level switch (1LLS), differential pressure switch (1DPS), 1/2" sealtite line connecting bottom of control box to bell (junction) box at bottom of frame, ground wire to float valve, and power supply cable. Remove (4) bolts and spacers which hold control box to frame cover and remove box. Replace by reversing above step.

PALL Land and Marine Corp.
A SUBSIDIARY OF PALL CORPORATION
7070 Moon Lake Road
New Port Richey, Florida 33553

WARRANTY

1. Seller warrants that it has good title to the products supplied and that they are free and clear from all liens and encumbrances. Seller warrants that all articles, materials, work and/or services furnished hereunder will be free from defects in material and workmanship, will conform to the Seller's applicable specification and drawings, and that Seller's design and/or specification will be free from design defects and suitable for the use intended and will function properly when installed in accordance with good commercial practice, and used within the limits of the specification and not subjected to abnormal use. These warranties, together with such service warranties as may be set forth in the specifications, if any, shall run to the Buyer and/or its customers. The responsibility of the Seller, except as hereinafter specifically agreed, is limited to repairing, replacing, modifying and/or overhauling* at its factory any part or parts which have been returned to the Seller and which have failed or are defective or do not conform to such specifications, drawings or other description, and are covered by these warranties; provided, however, that such part or parts are returned to the Seller within (60) days after such defect is discovered. The responsibility of the Seller under these warranties shall terminate in respect to design, materials and workmanship after (800) operating hours of the part or parts, or (12) months after delivery, whichever first occurs, or any longer period of service life or performance set forth in the Seller's specification in the manner and to the extent stated in such specification. In respect to design, a defect found in any part will be corrected in each similar part in which such defect exists, provided that any such part is still within the stipulated warranty period. The foregoing time limitations shall run from date the Buyer receives the part directly from the Seller. Seller will assume the responsibility for transportation charges to and from its factory on any defective part or parts shipped thereto for correction or replacement pursuant to these warranties.

2. In addition to the prompt repair, replacement or correction of any defects on defective equipment covered by the warranty provisions of this agreement, Seller shall promptly, on the order of the Buyer, perform such maintenance, service, repair, inspection or overhaul work on the equipment purchased hereunder and returned to its plant at the Buyer's expense as Buyer may reasonably require, at prices therefor which shall be reasonable. Repair cycle time shall not exceed (45) days on the average.

3. The aforesaid warranties and the obligations of Seller are in lieu of, and Buyer hereby waives, all other warranties and all other obligations. Said warranties may not be extended or altered except by an amendment agreed to by Buyer and Seller.

4. If in the opinion of Buyer a claim under this warranty arises, written notice of the nature of the claim and type and length of use should be forwarded to the Warranty Claims Department, Pall Land and Marine Corporation, 7070 Moon Lake Road, New Port Richey, Florida 33553.

UNIT SERIAL NO.: _____

EFFECTIVE DATE: _____

* At Its Expense

MOBIL

HMIS®

HEALTH 0
FLAMMABILITY 1
REACTIVITY 0
PERSONAL PROTECTION B

MOBIL OIL CORPORATION MATERIAL SAFETY DATA BULLETIN

REVISED: 12/15/89

********** I. PRODUCT IDENTIFICATION **********

MOBIL DTE 13M

SUPPLIER:
MOBIL OIL CORP.

CHEMICAL NAMES AND SYNONYMS:
PET. HYDROCARBONS AND ADDITIVES

USE OR DESCRIPTION:
HYDRAULIC OIL

HEALTH EMERGENCY TELEPHONE:
(609) 737-4411

TRANSPORT EMERGENCY TELEPHONE:
(800) 424-9300 (CHEMTREC)

PRODUCT TECHNICAL INFORMATION:
(800) 662-4525

********** II. TYPICAL CHEMICAL AND PHYSICAL PROPERTIES **********

APPEARANCE: AMBER LIQUID ODOR: MILD PH: NA
VISCOSITY AT 100 F, SUS: 170.0 AT 40 C, CS: 33.3
VISCOSITY AT 210 F, SUS: 47.8 AT 100 C, CS: 6.5
FLASH POINT F(C): > 330(166) (ASTM D-93)
MELTING POINT F(C): NA POUR POINT F(C): -40(-40)
BOILING POINT F(C): > 600(316)
RELATIVE DENSITY, 15/4 C: 0.884 SOLUBILITY IN WATER: NEGLIGIBLE
VAPOR PRESSURE-MM HG 20C: < .1

NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER INFORMATION, CONTACT YOUR LOCAL MARKETING OFFICE.

********** III. INGREDIENTS **********

	WT PCT (APPROX)	EXPOSURE LIMITS MG/M3	PPM	SOURCES (AND NOTES)
POTENTIALLY HAZARDOUS INGREDIENTS:				
NONE				
OTHER INGREDIENTS:				
REFINED MINERAL OILS	>90			
ADDITIVES AND/OR OTHER INGREDS.	<10			

SEE SECTION XII FOR COMPONENT REGULATORY INFORMATION.

SOURCES: A=ACGIH-TLV, A*=SUGGESTED-TLV, M=MOBIL, O=OSHA, S=SUPPLIER
NOTE: LIMITS SHOWN FOR GUIDANCE ONLY. FOLLOW APPLICABLE REGULATIONS.

********** IV. HEALTH HAZARD DATA **********

--- INCLUDES AGGRAVATED MEDICAL CONDITIONS, IF ESTABLISHED ---

EFFECTS OF OVEREXPOSURE: SLIGHT SKIN IRRITATION.

********** V. EMERGENCY AND FIRST AID PROCEDURES **********

--- FOR PRIMARY ROUTES OF ENTRY ---

EYE CONTACT: FLUSH WITH WATER.
SKIN CONTACT: WASH CONTACT AREAS WITH SOAP AND WATER.
INHALATION: NOT EXPECTED TO BE A PROBLEM.
INGESTION: NOT EXPECTED TO BE A PROBLEM. HOWEVER, IF GREATER THAN 1/2 LITER(PINT) INGESTED, IMMEDIATELY GIVE 1 TO 2 GLASSES OF WATER AND CALL A PHYSICIAN, HOSPITAL EMERGENCY ROOM OR POISON CONTROL CENTER FOR ASSISTANCE. DO NOT INDUCE VOMITING OR GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

********** VI. FIRE AND EXPLOSION HAZARD DATA **********

FLASH POINT F(C): > 330(166) (ASTM D-93)
FLAMMABLE LIMITS. LEL: .6 UEL: 7.0
EXTINGUISHING MEDIA: CARBON DIOXIDE, FOAM, DRY CHEMICAL AND WATER FOG.
SPECIAL FIRE FIGHTING PROCEDURES: WATER OR FOAM MAY CAUSE FROTHING. USE WATER TO KEEP FIRE EXPOSED CONTAINERS COOL. WATER SPRAY MAY BE USED TO FLUSH SPILLS AWAY FROM EXPOSURE. FOR FIRES IN ENCLOSED AREAS, FIREFIGHTERS MUST USE SELF-CONTAINED BREATHING APPARATUS. PREVENT RUNOFF FROM FIRE CONTROL OR DILUTION FROM ENTERING STREAMS OR DRINKING WATER SUPPLY.
UNUSUAL FIRE AND EXPLOSION HAZARDS: NONE
NFPA HAZARD ID: HEALTH: 0, FLAMMABILITY: 1, REACTIVITY: 0

********** VII. REACTIVITY DATA **********

STABILITY (THERMAL, LIGHT, ETC.): STABLE
CONDITIONS TO AVOID: EXTREME HEAT
INCOMPATIBILITY (MATERIALS TO AVOID): STRONG OXIDIZERS
HAZARDOUS DECOMPOSITION PRODUCTS: CARBON MONOXIDE.
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

********** VIII. SPILL OR LEAK PROCEDURE **********

ENVIRONMENTAL IMPACT: REPORT SPILLS AS REQUIRED TO APPROPRIATE AUTHORITIES. U. S. COAST GUARD REGULATIONS REQUIRE IMMEDIATE REPORTING OF SPILLS THAT COULD REACH ANY WATERWAY INCLUDING INTERMITTENT DRY CREEKS. REPORT SPILL TO COAST GUARD TOLL FREE NUMBER 800-424-8802.
PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: ADSORB ON FIRE RETARDANT TREATED SAWDUST, DIATOMACEOUS EARTH, ETC. SHOVEL UP AND DISPOSE OF AT AN APPROPRIATE WASTE DISPOSAL FACILITY IN ACCORDANCE WITH CURRENT APPLICABLE LAWS AND REGULATIONS, AND PRODUCT CHARACTERISTICS AT TIME OF DISPOSAL.
WASTE MANAGEMENT: PRODUCT IS SUITABLE FOR BURNING IN AN ENCLOSED, CONTROLLED BURNER FOR FUEL VALUE OR DISPOSAL BY SUPERVISED INCINERATION. SUCH BURNING MAY BE LIMITED PURSUANT TO THE RESOURCE CONSERVATION AND RECOVERY ACT. IN ADDITION, THE PRODUCT IS SUITABLE FOR PROCESSING BY AN APPROVED RECYCLING FACILITY OR CAN BE DISPOSED OF AT ANY GOVERNMENT APPROVED WASTE DISPOSAL FACILITY. USE OF THESE METHODS IS SUBJECT TO USER COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS AND CONSIDERATION OF PRODUCT CHARACTERISTICS AT TIME OF DISPOSAL.

********** IX. SPECIAL PROTECTION INFORMATION **********

EYE PROTECTION: NO SPECIAL EQUIPMENT REQUIRED.
SKIN PROTECTION: NO SPECIAL EQUIPMENT REQUIRED. HOWEVER, GOOD PERSONAL HYGIENE PRACTICES SHOULD ALWAYS BE FOLLOWED.
RESPIRATORY PROTECTION: NO SPECIAL REQUIREMENTS UNDER ORDINARY CONDITIONS OF USE AND WITH ADEQUATE VENTILATION.
VENTILATION: NO SPECIAL REQUIREMENTS UNDER ORDINARY CONDITIONS OF USE AND WITH ADEQUATE VENTILATION.

********** X. SPECIAL PRECAUTIONS **********

NO SPECIAL PRECAUTIONS REQUIRED.

********** XI. TOXICOLOGICAL DATA **********

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): LD50: > 5 G/KG SLIGHTLY TOXIC(ESTIMATED) --- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

DERMAL TOXICITY (RABBITS): LD50: > 2 G/KG SLIGHTLY TOXIC(ESTIMATED) --- BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

INHALATION TOXICITY (RATS): NOT APPLICABLE ---HARMFUL CONCENTRATIONS OF MISTS AND/OR VAPORS ARE UNLIKELY TO BE ENCOUNTERED THROUGH ANY CUSTOMARY OR REASONABLY FORESEEABLE HANDLING, USE, OR MISUSE OF THIS PRODUCT.

EYE IRRITATION (RABBITS): EXPECTED TO BE NON-IRRITATING. ---BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

SKIN IRRITATION (RABBITS): MAY CAUSE SLIGHT IRRITATION ON PROLONGED OR REPEATED CONTACT. ---BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

SEVERELY SOLVENT REFINED AND SEVERELY HYDROTREATED MINERAL BASE OILS HAVE BEEN TESTED AT MOBIL ENVIRONMENTAL AND HEALTH SCIENCES LABORATORY BY DERMAL APPLICATION TO RATS 5 DAYS/WEEK FOR 90 DAYS AT DOSES SIGNIFICANTLY HIGHER THAN THOSE EXPECTED DURING NORMAL INDUSTRIAL EXPOSURE. EXTENSIVE EVALUATIONS INCLUDING MICROSCOPIC EXAMINATION OF INTERNAL ORGANS AND CLINICAL CHEMISTRY OF BODY FLUIDS, SHOWED NO ADVERSE EFFECTS.

---CHRONIC TOXICOLOGY (SUMMARY)---

THE BASE OILS IN THIS PRODUCT ARE SEVERELY SOLVENT REFINED AND/OR SEVERELY HYDROTREATED. TWO YEAR MOUSE SKIN PAINTING STUDIES OF SIMILAR OILS SHOWED NO EVIDENCE OF CARCINOGENIC EFFECTS.

********** XII. REGULATORY INFORMATION **********

GOVERNMENTAL INVENTORY STATUS: ALL COMPONENTS REGISTERED IN ACCORDANCE WITH TSCA.

D.O.T. SHIPPING NAME: NOT APPLICABLE

D.O.T. HAZARD CLASS: NOT APPLICABLE

US OSHA HAZARD COMMUNICATION STANDARD: PRODUCT ASSESSED IN ACCORDANCE WITH OSHA 29 CFR 1910.1200 AND DETERMINED NOT TO BE HAZARDOUS.

RCRA INFORMATION: THE UNUSED PRODUCT, IN OUR OPINION, IS NOT SPECIFICALLY LISTED BY THE EPA AS A HAZARDOUS WASTE (40 CFR, PART 261D); DOES NOT EXHIBIT THE HAZARDOUS CHARACTERISTICS OF IGNITABILITY, CORROSIVITY, OR REACTIVITY, AND IS NOT FORMULATED WITH THE METALS CITED IN THE EP TOXICITY TEST. HOWEVER, USED PRODUCT MAY BE REGULATED.

U.S. SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) TITLE III:
THIS PRODUCT CONTAINS NO "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (302) REPORTABLE HAZARD CATEGORIES: NONE

THIS PRODUCT CONTAINS NO CHEMICALS REPORTABLE UNDER SARA (313) TOXIC RELEASE PROGRAM.

THE FOLLOWING PRODUCT INGREDIENTS ARE CITED ON THE LISTS BELOW:

CHEMICAL NAME		CAS NUMBER	LIST CITATIONS
ZINC (ELEMENTAL ANALYSIS)	(0.06%)	7440-66-6	15

--- KEY TO LIST CITATIONS ---

1 = OSHA Z, 2 = ACGIH, 3 = IARC, 4 = NTP, 5 = NCI,
6 = EPA CARC, 7 = NFPA 49, 8 = NFPA 325M, 9 = DOT HMT, 10 = CA RTK,
11 = IL RTK, 12 = MA RTK, 13 = MN RTK, 14 = NJ RTK, 15 = MI 293,
16 = FL RTK, 17 = PA RTK, 18 = CA P65.

--- NTP, IARC, AND OSHA INCLUDE CARCINOGENIC LISTINGS ---

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

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INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

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PREPARED BY: MOBIL OIL CORPORATION
ENVIRONMENTAL AFFAIRS AND TOXICOLOGY DEPARTMENT, PRINCETON, NJ
FOR FURTHER INFORMATION, CONTACT:
MOBIL OIL CORPORATION, PRODUCT FORMULATION AND QUALITY CONTROL
3225 GALLOWS ROAD, FAIRFAX, VA 22037 (703) 849-3265