TRANS-VAC 300DH

OPERATING INSTRUCTION MANUAL

By

SLICKBAR

PRODUCTS CORPORATION

WARNING

When skimming petroleum products, flammable vapors may be present within the receiving tank, at the vacuum pump discharge, and inside all piping.

The unit must not be operated in the presence of flammable vapors, as uncontrolled engine over-speed can occur.

If a small vessel is being used to carry the TRANS-VAC 220D to a remote recovery site, the vessel's carrying capacity must be sufficient to accommodate the load. The unit's weight, the weight of liquid within the tank, the weight of any recovered liquid to be stored on board, the weight of hose and accessory equipment, and that of all operating personnel should be considered. The TRANS-VAC pumping unit weighs 2500 lbs. empty, (1134 Kg) and approximately 5000 lbs. (2268 Kg) when its tank is filled the power unit weighs 2500 lbs. (1134 Kg). The total weight could cause a marginally sized vessel to capsize.

INTRODUCTION

This manual is intended as a guide in using the **TRANS-VAC 300DH OIL SPILL RECOVERY UNIT.** It contains information concerning maintenance, operation, and trouble shooting for the various components of the **TRANS-VAC SYSTEM**. Most information concerning repair and maintenance of the various system components is discussed in the "Component Manufacturers' Manuals" which are included. Before attempting operation of this machine, it is important to be familiar with its mechanisms and uses.

PURPOSE

The purpose of the **TRANS-VAC** is to supply the pumping power required for recovering oil spills. The **TRANS-VAC** is also useful for tank and sump cleaning.

Drawings 12B5983, 12B5994, and 12B5995 respectively, should be referenced for piping and hydraulic schematics.

Basic components of the unit include a hydraulic power unit and a pumping unit with a positive displacement fluid pump, driven by a hydraulic motor, and a rotary lobe vacuum pump driven by a second hydraulic motor. Both take suction on floating skimming heads through floating hoses. Fluid, debris, and air are separated in a 300-gallon receiver tank. Large debris is screened out, and the liquid is transferred through a positive displacement pump, into a portable holding tank, or storage facilities (not supplied with **TRANS-VAC**) where water and oil are allowed to gravity separate.

Engine, pumps, tank, piping, and controls are mounted on two heavy duty, structural steel "oil field" style skids.

The suction and discharge rates are controlled by adjusting the hydraulic motor speeds powering the transfer and vacuum pumps, and by admitting air through the fresh air inlet into the vacuum pump.

In addition to manual controls, the unit is equipped with an automatic vacuum breaking at has been pre-set at approximately 15" Hg to begin to admit air into the vacuum tank.

ENGINE

The **TRANS-VAC** Power Unit is equipped with a John Deere, water-cooled, 4 cylinder, 4 cycle diesel engines. An "Operator's Manual" is included with these instructions.

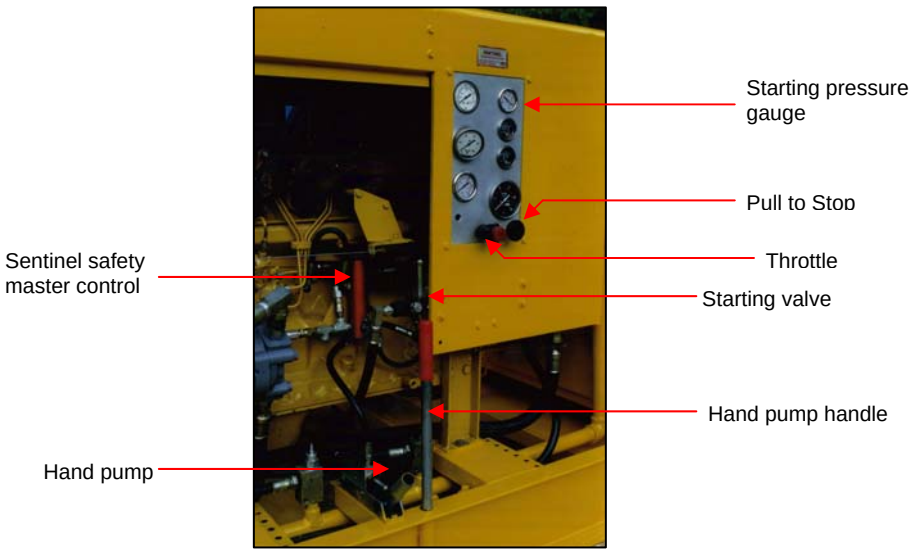
This engine is hydraulic start and has a safety shutdown for high temperature and low oil pressure. Before attempting to start the engine, the operator must be thoroughly familiar with the engine "Operator's Manual" included with these instructions. The power unit engine is equipped will a Sentinel diesel engine protection system that shuts down the engine if it has a loss of oil pressure, coolant overheats or loss of cooling water flow.

TRANSVAC 300 DH POWER PACK STARTING PROCEDURE

Check fuel, oil, and cooling levels—top off as required. This unit is supplied with two sets of hydraulic hoses. The short set is used in trailer applications. An extension set is provided for remote locations. It is recommended that hydraulic hoses be connected to vacuum unit prior to starting. Once the power unit is running, system pressure is created making hydraulic hose connecting nearly impossible.

The hydraulic starting system consists of a hand pump, engine driven pump, accumulator, hydraulic starter, and a starting valve. In order to start the engine; approximately 2500 lbs. of starting pressure is required. Assuming that there is no starting pressure, the hand pump is located on the power pack frame on the control side. Remove the handle from its holder and insert into socket on hand pump. Make sure starting valve is closed (handle vertical), the override lever on the sentinel safety master control is in the start position (lever down turned counter clockwise) and the engine pull to stop knob is pushed in. Start pumping. The first one or two pumps will bring starting pressure to about 1000 lbs. After that, it is slow going requiring about 10 to15 minutes of pumping.

NOTE: The hand pump draws oil from the reservoir and pumps it to the accumulator. Once 2500 lbs. starting pressure is achieved, open throttle part way, open starting valve to crank engine. When engine catches, immediately close starting valve. If engine does not start, hand-pumping procedures must be followed again. When engine starts, the engine driven pump will recharge the starting system. After warming up the engine for several minutes set the throttle of the power unit to run at 2400 RPM.



VACUUM PUMP

The **TRANS-VAC** is equipped with an M-D Pneumatics, Inc., standard duty, 3-lobe rotary, positive displacement vacuum pump, Model 4012-46, rated for 520 CFM at 3600 RPM.

Under most circumstances, normal operating temperature and pressure will not be exceeded by the vacuum pump. Insufficient air flow will cause high temperature in the vacuum pump. Fresh air valve #1 should be opened to reduce the load and allow air to cool the vacuum pump. This condition usually indicates a plugged skimmer head, hose or internal air piping.

A dial thermometer is installed in the discharge air pipe to allow the operator to visually monitor the discharge air temperature. "Maintenance and Repair Instructions" for the vacuum pump are included with this manual.

DISCHARGE PUMP

The **TRANS-VAC** is equipped with a Bowie 400 series rotary gear positive displacement discharge pump rated at 300 gpm at 500 RPM. A pressure relief valve, set to open at 75 psig, is installed in the event that excessive discharge pressure is encountered during operation. A pressure gauge is connected to the discharge piping.

After running the **TRANS-VAC,** the drain plug on the pump's end plate should be removed, and the pump run slowly to clear as much fluid as possible from the pump cavity. Replace the drain plug in the pump and close the main drain and again run the unit slowly while a mixture of kerosene or diesel oil and motor oil are injected into the pump through the receiver tank by opening the access hatch. A 50% mixture of permanent anti-freeze (ethylene glycol) can be used in place of the hydrocarbon mixture. This should displace any remaining water and coat the pump's interior, providing corrosion protection. The "Maintenance and Repair Instructions" for the discharge pump are included with this manual.

FUEL SYSTEM

The power unit is equipped with a 60-gallon diesel fuel tank. Clean fuel must be used. The fuel strainer on the engine should be cleaned periodically. Filter elements should be changed every 500 hours of operation. Refer to Engine Operating and Maintenance instructions.

TRANS-VAC OPERATION

The **TRANS-VAC** should be placed where it is to be used, and not moved during operation. It should be positioned above the high tide or water level on solid ground, or left on its trailer or truck bed with wheels chocked. The unit should be upwind from the oil spill that is to be recovered and remote from any flammable vapors evaporating from the spill **(see warnings, Page 1)**.

Proper skimmer head selection is necessary. Under most circumstances, when more than 1 inch of oil is present on at least 12 inches of water a **High Capacity Skimming Head** is best. For less than 1 inch of oil and when debris is present, a **Rigid Manta Ray Head** is best because it is easily cleaned. However, the **High Capacity Skimming Head's Weir** can also be adjusted to efficiently skim thin slicks. A **Flexible Manta Ray** is best when waves are present because of its ability to conform to the surface. The Manta Ray Skimmers can be used in shallow water (less than 3 inches). The skimmer heads are connected to the suction hose (4 inches for High Capacity and 3 inches for Manta Rays), and the suction hose is connected to the **TRANS-VAC** at the inlet port.

To allow the 3 inch head to float at the proper attitude for the most efficient recovery, the skimmer head and at least two, 10 foot lengths (or one, 25 foot length) of suction hose with floats should be floating in the water. The suction head should be placed in the water at a position downwind from the oil slick's perimeter, or at the apex of deflection booms. This allows the wind or current to push the oil towards the skimmer heads, and improves the ratio of oil to water recovered.

To place the skimming head(s) into a boomed area **never** place the hoses directly on the boom's flotation.,

The discharge pump cap must be removed, and the discharge hose tightly connected to the coupling (cam handles against the hose). If the washer is not in place, the coupling will leak. Ideally, the discharge hoses are run to a barge inlet, fabric storage container, or tank truck inlet connection, and tightly joined. Under some circumstances, the discharge hose's end can be dropped into a tank truck hatch or placed in a temporary storage tank. If this is done, the hose must be securely tied to the tank to prevent the thrust generated from the discharge pump from pushing the hose out of the tank.

ASSEMBLING THE SKIMMING HEADS

A. The Manta Ray - Flexible and Rigid Heads

Flexible and Rigid Mantas arrive from the factory fully assembled. All Rigid Manta cover wing nuts should be checked for tightness prior to placing in the water. For the sake of uniformity of production, all suction hoses are furnished with hose floats symmetrically placed. However, when placed in operation, it is best if one extra hose float is placed at each skimming head. One float should be removed from the length placed next to the **TRANS-VAC** receiver tank and re-assembled next to the float located nearest the female fitting at the skimming head.

B. High Capacity Skimming Head

1. Floats and head should be removed from the boxes.

2. The head should be placed on its back with the front raised about 1 ft.

3. The float struts should be inserted in the slots provided on the bottom of the head. The tab on the side of the head should be in the hole on the strut.

4. The pin attached to the strut should be inserted through the hole in the tab to secure the floats to the head.

5. The head should be placed in the water with the adjustment rods pointed upward.

ADJUSTING THE SKIMMING DEPTH

Before making the depth adjustment on any of the skimming heads, the air must be evacuated from the system. The pump should be started and pumping allowed to continue until liquid passes from the discharge hose. The system must remain filled with liquid or the adjustment will be faulty. Skimming head adjustment should be made to match oil slick thickness. It must be remembered that as oil is recovered, the conditions will change. For maximum efficiency, the skimming heads should be adjusted as follows:

A. Flexible or Rigid Manta Ray Skimming Heads

The Manta skimming head must lie flat on the water surface. The following adjustments should be made while not pumping so that the fluid surface is at the top of the slots, just under the top cover (figure 1). Hose floats may be adjusted (see arrows) to maintain proper front-to-back skimming level. Twist of the skimmer head can be removed by loosening and re-tightening hose couplings.

The lower fluid level (Figure 2) illustrates the skimmer's operating level. This change in fluid level is caused by the entrance of air into the skimming head along with the oil causing the head and hose to rise.

B. High capacity Skimming Heads

For correct operation, the High Capacity Head must be adjusted for both cut and depth. To adjust, the following procedures should be followed:

1. Cut: The throat gate can be moved up or down to adjust the cut before launching the skimmer. To change the setting, the wing nuts securing the throat gate to the front edge of the head should be loosened. If the oil is less than 1" thick, the throat gate should be set in the up position, providing a 1/2" opening into the head. If the oil is greater than 1" thick, the throat gate should be in a lower position. The gate opening can be adjusted between 1/4" and 2". Ideally, the opening should be about half the thickness of the oil layer.

2. Depth: The depth setting must be done when the skimmer is afloat in the water and oil. The wing nut located on each float top must be adjusted in an upward or downward position while the skimming system is operating so as to position the skimmer's top cover just at or above the fluid surface.

PRE-STARTING CHECKLIST

Prior to operating the **TRANS-VAC's** engine and pumps, the following functions should be performed:

A. Engine must be filled to the proper oil level. (The "Operator's Manual" should be referenced to determine proper oil for prevailing conditions.)

B. Vacuum pump must be filled with oil. (The “Operator’s Manual” should be referenced to determine proper oil for prevailing conditions.)

C. Fuel tank should be full. The engine "Operator's Manual" should be checked for proper diesel fuel grade.

D. Receiver tank end door must be closed and dogged.

E. All suction hoses and skimming heads must be cleared of debris. To prevent leakage, the rubber gaskets within all hose and piping quick connect fittings must

be in place prior to use. Skimming head(s) must be free floating in the water (oil), and hoses connected to receiver tank inlet fittings! Caps must be placed the unused inlet.

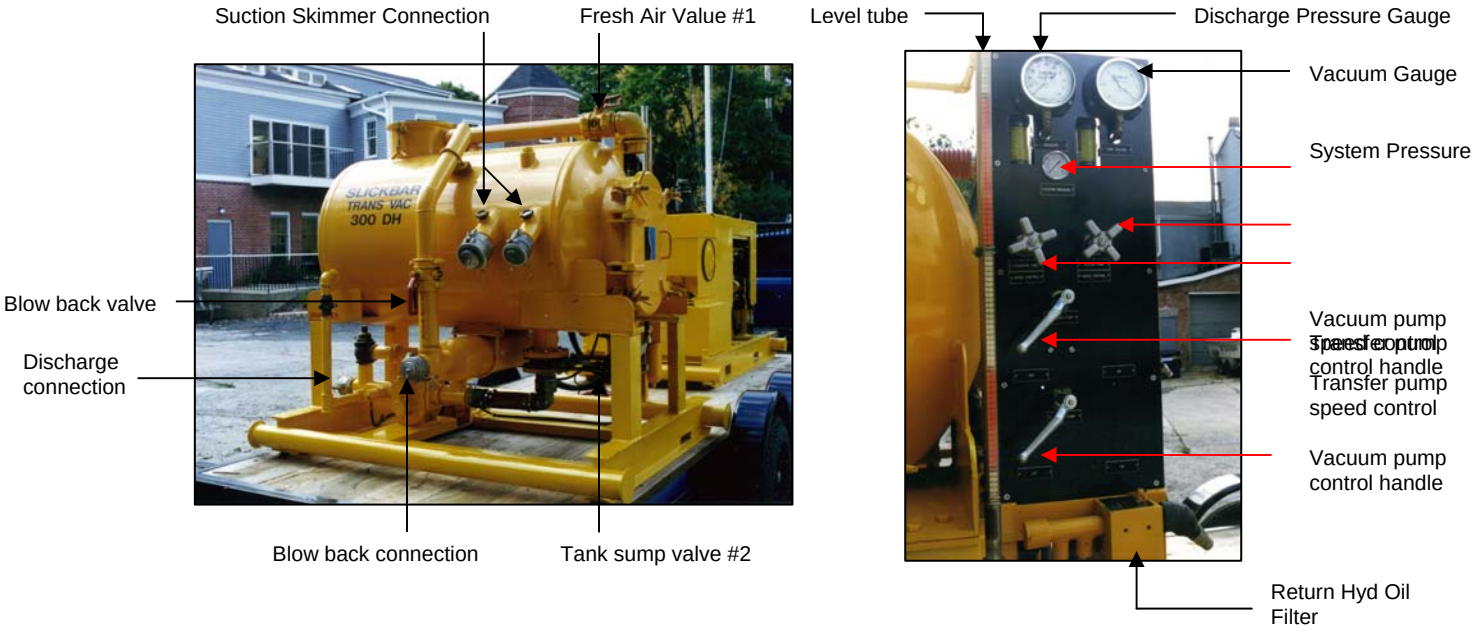
STARTING THE TRANS-VAC UNIT

A. The control valves for the vacuum and transfer pump should be in the off position and the fresh air inlet valve #1 to the vacuum pump must be opened, the under tank fluid transfer valve #2 should be closed. Connect the hydraulic hose (4) between the power unit and the pumping unit. The engine for the hydraulic power can now be started. See (The "TRANSVAC 300 DH POWER PACK STARTING PROCEDURE" above should be referenced for starting and running instructions.) While the power unit engine is warming up, connect the skimmer heads and suction hose to the tank inlet connection, and connect the discharge hose to the discharge connection.

B. To create vacuum in the tank move both the handle for the vacuum pump and the handle for the transfer pump to the on position and adjust the hydraulic flow the vacuum pump with the speed control to get 10 gpm. **Air inlet valve #1 is then closed momentarily** to start suction to the tank. Keep a careful eye on the **outlet temperature of the vacuum pump do not overheat the pump**. Once vacuum has been raised in the tank Open the fresh air inlet valve slightly while watching the vacuum gauge and the temperature gauge. Under normal operating conditions, tank vacuum will remain between 10 and 12 inches of mercury and the temperature should not exceed 160 degrees Fahrenheit

C. After the receiver tank has started to fill with liquid; the level indicating tube next to the access door will show the level within the tank. When the level reaches 10", open the tank sump valve #2 and start the transfer pump (turn the speed control to start the pump turning) and again check the air inlet valve #1. The vacuum pump speed can be adjusted to maintain the tank vacuum between 10" and 12" of mercury. Air flow is required through the vacuum pump for cooling. If the air flow is too low, the discharge air temperature from the vacuum pump will cause the vacuum pump to overheat. There is an air discharge thermometer which will allow the operator to visually check the air flow temperature. Air flow temperatures typically are 120^{o}F -160^{o}F under normal skimming conditions.

D. The pumping rate must be adjusted to maintain a constant level within the receiver tank. This can be accomplished by changing the pump speed with the speed control on the panel. The level within the tank will be indicated by the level tube next to the receiver tank door. It is desirable to keep a level of about 12 " inside the tank, as shown in the level gauge. It is not good practice to run the tank empty as this will cause excessive wear on the transfer pump. Conversely if the level gets too high, the float in the top of the tank will close off the air to the vacuum pump. At that time the vacuum breaker valve will open. It will be necessary to shut down the system, release the vacuum from the tank and pump out the tank before restarting the system. At this time, transfer pump should be run at full speed to lower the fluid level within the tank as quickly as possible.



SKIMMING PROCEDURE

All hose connections must be checked for tightness before skimming can begin. With the aid of an attached rope, the skimming head should be directed to the area of greatest oil accumulation. As skimming proceeds, the oil layer thickness will decrease. Adjustment should be made to maintain the optimum oil/water ratio by slowing the pumping rate, if using Manta skimming heads, or by reducing the throat opening of the High Capacity skimming head until an opening of approximately 1/4" remains (1/8" below water). When the skimming operation has been completed, a sorbent material may be used to remove any remaining sheen that the skimmer was unable to recover.

CLOGGED SKIMMING HEADS

If any skimming head or suction hose becomes clogged with debris or other foreign matter, the normal pulsing that occurs in the suction hose line will discontinue. An increase in vacuum and rise in air temperature on the vacuum pump discharge may also be noted.

To clear the blockage of the skimming heads, it will be necessary to dismantle them. In most circumstances, clogs or "birds' nests" occur at the skimmer heads to suction line connections or at the suction inlet port. To clear the skimmer or hose you may connect it to the Blow Back fitting run the vacuum pump at full speed and close the blow back valve #3. To avoid future contamination, debris removed from the system should not be

returned to the water. After the suction line has been cleared, it should be re-connected to the inlet port. Skimming may now resume.

WARNING

When petroleum products are skimmed, flammable vapors may be present within the receiving tank, at the vacuum pump discharge, and inside all piping. Open lights, matches, and flames should never be allowed near this unit.

TANK CLEAN-OUT

The debris that accumulates on the screen inside the receiver tank must be periodically removed. The vacuum pump must be shut down and pumping continued until all liquid is discharged from the tank. The transfer pump should not run dry for more than a few seconds. The tank end door is now opened. A small hand rake is ideal for scraping the debris from within the tank. The debris should be stored in a basket or bag for proper disposal. After cleaning, a final check should be performed to ensure that there is no interference with the travel of the level indicator float at the rear tank head.

TRANS-VAC TROUBLE SHOOTING

A. When Engines Will Not Start

"Operator's Manual" should be read for complete engine trouble shooting details.

B. Most Common Causes of Engine's Failure to Start Are:

1. No fuel
2. Dead battery
3. Air bound fuel system

C. No Vacuum in Receiver Tank

1. The fresh air valve #1 is open and should be closed.
2. The clean-out door is leaking - The gasket seat should be cleaned and door closed "and dogged".
3. Suction ports open, but not connected to a skimmer hose--ports should be closed.

4. Valve on discharge manifold open.

D. Excessive Suction

Excessive vacuum, i.e., over 18 inch mercury, is generally the result of clogged suction lines or a suction lift that is too high. High suction will result in vacuum pump overheating and unnecessary wearing of the vacuum pump engine. The suction hoses/skimmer heads should be checked for clogging.

E. Vacuum Pump Overheating

If the vacuum pump overheats, the fresh air valve #1 must be opened to reduce the load and allow the air flow to cool it. This condition is usually an indication of insufficient air flow caused by a plugged skimmer head, hose, or internal air piping.

F. Discharge Pump

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If the tank is empty, it may be the result of a loss of suction, clogged suction lines, or improperly adjusted skimmer heads that are not taking in liquid. The clogged lines must be cleared and checked for suction leaks; and if necessary, the position or amount of "cut" of the skimmer heads readjusted.

G. Tank Overfilling

The tank will overfill as a result of the following:

1. The suction rate is set faster than the discharge rate. This problem is resolved by increasing the discharge pump speed, and admitting more air through the vacuum pump's fresh air inlet #1 and or reducing the vacuum pump speed.

2. If the pump becomes clogged, all liquid must be removed, even if it requires pumping at a reduced rate. The short length of hose from the tank sump valve to the pump must be opened. This will allow access to the hose and the inlet to the pump, which are common places of blockages. The foreign matter must be cleaned out.

   After the pump suction line is cleaned, the tank should be inspected and all debris removed. Care should be taken to be sure that the debris screen is in position and that it has no holes in. The purpose of the debris screen is to keep foreign material out of the transfer pump.

   When pumping is resumed the suction rate should be set not to exceed the discharge rate. This can be monitored through tank level indicator on the back of the tank.

SHUTDOWN PROCEDURES

A. The fresh air inlet valve, #1, should be completely opened to allow the incoming air to cool the vacuum pump. After 2 or 3 minutes move the vacuum pump control lever to the off position.

B. The transfer pump should be run until the discharge pressure falls to 0. At this time, there may be a change in the sound coming from the discharge pump. This indicates that the pump is running dry.

C. After the tank is empty, the transfer pump should be stopped by moving the control lever to the off position.

D. The diesel engine should be slowed to a fast idle of approximately 800 RPM for 3 to 5 minutes to allow the engine sufficient time to cool before shutting it off.

E. If the **TRANS-VAC** unit is shut down for an extended period, (over 12 hours) the receiver tank and transfer pump should be drained and flushed (Tank Clean-Out, Page 11, should be referenced).

F. A routine inspection of all fluid levels should be performed, and the tank diesel fuel and engine oil level in both engines checked and filled as necessary. The vacuum pump and gear box oil levels should be checked.

EQUIPMENT CLEANING PRIOR TO STORAGE

After use, it is essential that the equipment be thoroughly cleaned. There are several easy steps that should be followed to ensure equipment readiness for future use. The skimming system should be dismantled, and all equipment placed on an impervious surface with troughs for collection of contaminated water or oil from the **TRANS-VAC** Skimming Unit.

WARNING

Aromatic solvents, such as methyl ethyl ketone, ethers, or aldehydes, should never be used to clean the equipment. The result could be permanent damage or total destruction of the skimmer heads and hoses. Solvents also present serious explosion and/or fire hazards.

Diesel oil may be used to clean heavy oil from the equipment.

A. Skimming Heads

A tray large enough to hold the Flexible Manta Skimmer should be half filled with cold water and detergent or dispersant added. Both the interior and exterior of each skimming head must be cleaned. A long wire handled soft brush can be used for cleaning the interior. Care should be taken not to tear or gouge the Manta's interior rubber spacers. Detergent or dispersant should be completely rinsed with clean water, and the skimming heads allowed to thoroughly dry before storing.

Manta Ray Heads must be stored lying flat to remain in an operable condition. This storing method prevents distortion that could result in faulty performance. Flexible Manta Ray Skimmers should be stored upside down.

B. Hoses

The same procedure should be repeated. The hoses should then be thoroughly rinsed with fresh water, allowed to dry, and all metal parts coated with a lubricant before stowing. Female couplings should be inspected for missing gaskets, and gaskets replaced where necessary.

C. Trans-Vac 300DH

Upon completion of use, the **TRANS-VAC** should be thoroughly cleaned by removing oil from all exterior surfaces. All water and debris must be removed from inside the receiver tank and transfer pump to avoid corrosion, which could cause pump damage.

1. Plugs from both skimmer hose inlet fittings should be removed, liquid drained from the inlet pipes, and plugs replaced. This procedure must be done even when only one skimmer was used because liquid will splash into the unused pipe and remain there during the **TRANS-VAC's** storage if not drained.

2. The receiver tank should be opened and debris removed from the trash grate. After all trash has been physically removed, the interior of the tank should be hosed down with fresh water, the discharge pump engine started and run at idle, and all water and particulate matter discharged from the unit.

3. The drain located under the pump should be opened before the pump is stopped. A bucket should be placed beneath the drain to contain residual liquid coming from the pump. The pump should be stopped by turning off the engine, and the drain closed when liquid stops flowing.

4 After all liquid has been drained from the system (as in 1 through 4 above) approximately 5 gallons of light lubricating oil or permanent antifreeze (ethylene glycol) should be poured into the receiver tank (save a pint). The hatch should be closed and dogged. The pump engines should be run at slow speed for approximately 5 minutes to circulate the oil or antifreeze solution through the pump and adjacent piping, then shut off the engine. The oil or antifreeze will remain in the pump to minimize corrosion during storage. A tag should be placed on the pump engine control panel and hatch advising of oil/preservative within the unit.

6. With the vacuum pump engine running at slow and fresh air inlet valve #1 open, approximately one pint of light lubricating oil or permanent antifreeze fluid (ethylene glycol) should be sucked from a shallow container into the vacuum pump inlet. The fluid will coat the pump rotors

and interior of the piping and muffler to minimize corrosion. The power unit engine should then be shut off.

7. The diesel engine and vacuum pump lubricating oil levels should be checked, and refilled as required. The fuel system's filter should be drained and changed. The engine should be run for a few minutes at idle after changing the filter to ensure that the fuel system is not air bound.

8. All gaskets in quick connect couplings should be checked to ensure they are in place so that the system is ready for emergency operation.

TABLE OF CONTENTS

TRANS-VAC TROUBLE SHOOTING

COMPONENT MODEL & SERIAL NUMBERS

Transfer Pump	**BOWIE model # 3400 OB/SS/F** **SERIAL # 06205**
Transfer Pump Hydraulic Motor	**Char Lynn model #109110000** **SERIAL # 8779**
Vacuum Pump	**TUTHILL - M.D. PNEUMATICS # 4012-46 R3** **SERIAL # 6118A93**
Vacuum Pump Hydraulic Motor	**Volvo model # 3707314** **SERIAL # 1992440331**
Silencer	**Universal model # SD-3**
Main Hydraulic Pump	**SERIAL # 89-49-72250**
Power Unit Diesel Engine	**John Deere model # 4039DF001** **SERIAL # T04039D400023**