



**DEKKER**  
**VACUUM TECHNOLOGIES, INC.**

Installation  
Operation  
and  
Maintenance  
Manual



**Oil-sealed  
liquid ring vacuum pump systems**

SERIAL NO.: \_\_\_\_\_

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## OIL-SEALED LIQUID RING VACUUM PUMP SYSTEMS TABLE OF CONTENTS

<b>INTRODUCTION</b>	<b>3</b>
Safety	3
<b>STORAGE</b>	<b>3</b>
<b>INSTALLATION</b>	<b>3</b>
Unpacking	3
Lifting	3
Location	3
Mounting	3
Ventilation	4
Electrical preparation	4
Vmax-VFD operational instructions	5
Vmax-VFD value chart	6
Pipe connections and sizing	7
Inlet piping	7
Discharge piping	7
Cooling water piping (water-cooled systems only)	7
<b>THEORY OF OPERATION</b>	<b>8</b>
<b>START-UP PROCEDURES</b>	<b>8</b>
<b>SHUT-DOWN PROCEDURES</b>	<b>10</b>
<b>SEQUENCE OF OPERATION</b>	<b>10</b>
<b>SYSTEM ALARM CONDITIONS</b>	<b>11</b>
<b>MAINTENANCE</b>	<b>11</b>
Bearing lubrication – Pump	11
Bearing lubrication – Motor (where required)	12
Inlet filter	13
Seal fluid	13
Devarnishing	13
Seal fluid strainer	13
Spin-on oil filter (if installed)	14
Separator element	14
Separator element oil return line	14
Mechanical shaft seals	14
<b>MAINTENANCE SCHEDULE</b>	<b>14</b>
<b>ELECTRICAL CONTROLS</b>	<b>15</b>
<b>ACCESSORIES AND PROTECTIVE DEVICES</b>	<b>16</b>
Accessories	16
Protective devices	19
<b>TROUBLE SHOOTING</b>	<b>20</b>
Trouble shooting guide	20
<b>CUSTOMER SERVICE AND INFORMATION</b>	<b>22</b>
Order information	22
<b>WARRANTY POLICY</b>	<b>23</b>

## **INTRODUCTION**

The **Vmax** oil-sealed liquid ring vacuum pump system have been designed to give you safe, reliable trouble-free service, provided some of the basic maintenance guidelines as set out in this manual are followed. Compared with other vacuum pump systems the **Vmax** oil-sealed liquid ring vacuum pump system offers the advantages of no metal-to-metal contact between the impeller and casing. Grease lubricated bearings are mounted external to the pumping chamber, isolated by mechanical shaft seals. This means that the pump requires no internal lubrication. However, a vacuum pump is a rotating piece of equipment and operators must exercise good judgment and follow proper safety procedures to avoid damage to the equipment or personal injury. Please review and follow all instructions in this manual before attempting to install, start or operate equipment.

### **Safety**

All products offered by DEKKER have been designed and manufactured for safe operation. However, the responsibility for safe operation rests with those who use and maintain these products. Your safety department should establish a safety program based on OSHA, federal, state and local codes. It is important that due consideration be given to hazards which arise from the presence of electrical power, hot liquids, toxic gases and rotating equipment. Proper installation and care of protective devices is essential to safe system operation. These safety procedures are to be used in conjunction with the instructions contained in this manual.

## **STORAGE**

Keep the system in a cool dry environment and close the seal fluid isolation valve. Plug all open ports to keep out dirt and foreign objects. Every 2 - 3 months rotate the impeller by rotating the shaft by hand.

## **INSTALLATION**

The design of the piping system, foundation layout and plant location are the responsibility of the purchaser. Dekker Vacuum Technologies, Inc. and its representatives may offer advice but cannot assume responsibility for operation and installation design.

Please consult an authorized dealer or a specialist skilled in the design of plant layout, system piping design and foundation design. The installer should carefully read this manual before installing the equipment. DEKKER or your local dealer can provide start up assistance in most instances at reasonable cost.

### **Unpacking**

**Upon receipt of pump or system, immediately inspect for signs of damage.** Carefully remove packing or crating from around pump or system. Be sure to keep equipment in upright position. DEKKER products ship F.O.B. factory, which means that any damage is the responsibility of the carrier and should be reported to them.

### **Lifting**

Lift the equipment carefully and with weight evenly distributed. DEKKER is not responsible for equipment that has been damaged through mishandling or dropping.

### **Location**

Install the unit in a well ventilated and dust free area. The pump or system should be a minimum distance of 3 feet from surrounding walls to allow for checking fluid level, temperatures, pressures and general servicing.

### **Mounting**

The pump or system must be installed on a level surface in a horizontal position. The foundation must be designed to support the total unit weight, without any settlement or crushing, be rigid and substantial enough to absorb any equipment vibration, maintain true alignment with any drive mechanism, and must permanently support the system baseplate at all points. The vacuum system must be leveled and secured with foundation bolts. Foundation bolts must be of adequate size to withstand the mechanical stresses exerted on it.

Systems larger than 40 HP should also be grouted into position. The foundation should be constructed to allow for  $\frac{3}{4}$  to 1- $\frac{1}{2}$  inch of grout. The baseplate is set on shims and the grout is poured between the foundation and the baseplate. To have the required body to support the baseplate, grout should be at least  $\frac{3}{4}$  inch thick.

The number and location of shims will be determined by the design of the baseplate. Firm support should be provided at points where weight will be concentrated at the anchor bolt locations. Use enough, and large enough shims to provide rigid support. Baseplates are usually designed with openings to allow pouring grout. When the baseplate has been shimmed and leveled and the anchor bolts have been snugly tightened, a dam is constructed around the foundation to contain the grout. The dam level should be at least  $\frac{1}{2}$  inch above the top surface of the shims. Grout should be poured inside and around the outside of the baseplate and leveled. Allow the grout to dry for a minimum of 48 hours before tightening the anchor bolts.

**Please note that the pump/motor coupling and V-belt units will need to be realigned prior to start-up, except with monoblock units.**

## Ventilation

Locate the vacuum system in an area with sufficient airflow and accessibility. To prevent excessive ambient temperature rise it is imperative to provide adequate ventilation. Cooling is an important aspect of reliable equipment operation and it is therefore important to install the unit in a reasonably cool area where the temperature does not exceed 110°F (43°C). For higher ambient temperatures contact the factory.

For water-cooled vacuum systems it is necessary to check cooling water supply. A proper, consistent water flow must be maintained for adequate cooling.

## Electrical Preparation

All system wiring is performed at the factory if a control panel is supplied. Check area classification to ensure all electrical enclosures comply to code. Required customer wiring is minimal, but should be done by a qualified electrician in compliance with OSHA, National Electric Code and any other applicable local electrical code concerning switches, fused disconnects, etc. DEKKER includes a wiring diagram in the control panel for use by the installer. DEKKER recommends that a main disconnect switch be fitted between the vacuum system and the incoming power.

**Wire Size Chart (AWG) by Vmax Horsepower  
Recommended Wire Size and Disconnect Size for Vmax Systems**

Vmax			Full Load Amperage at				Volt. Tol.	Copper AWG (kcmil)			Recommended Conduit Size in Inches			Recommended Disconnect (Amps)			Recommended Class J Fuse							
System Model No.	HP	Serv Fact	200V	230V	460V	200V		230V	460V	200V	230V	460V	200V	230V	460V	200V	230V	460V						
VMX0023MA1	1.5	1.15		4.0	2.0	±13%	14			1/2"				15	15		9	5						
VMX0023KA1	1.5	1.15		3.8	1.9	±10%							10			1/2"				25	15		17.5	8
VMX0036MA1	3	1		7.8	3.9	±13%													10			1/2"		
VMX0036KA1	3	1.15		7.2	3.6	±10%							10			1/2"								
VMX0063MA1	5	1.15		14.4	7.2	±13%	10			1/2"										60	35		40	20
VMX0063KA1	5	1.4	13.8	12.0	6.0	±10%							8			1/2"				60	60	35	40	35
VMX0083MA1	5	1.15		14.4	7.2	±13%	8			1/2"										60	35		45	25
VMX0083KA1	5	1.4	13.8	12.0	6.0	±10%							10			3/4"				70	60	35	50	45
VMX0103MA1	7.5	1		18.8	9.4	±13%	10			3/4"										100	100	60	80	70
VMX0103KA1	7.5	1.3	22.0	19.0	9.5	±10%							4			1"				125	110	60	100	90
VMX0153MA1	10	1		24.8	12.4	±13%	4			1"										150	150	70	125	110
VMX0153KA1	10	1.28	27.6	24.0	12.0	±10%							2			1-1/4"				200	200	100	200	175
VMX0203KA1	15	1.3	45.0	39.0	19.5	±10%	00			1-1/4"										250	225	150	250	200
VMX0303KA1	20	1.25	58.4	50.8	25.4	±10%							000			2"			1-1/4"				300	250
VMX0303KA1-20	20XP	1.15		50.8	25.4	±10%	000			2"												1-1/4"		
VMX0453KA1	25	1.3	74.6	62.0	31.0	±10%							250			0000			2-1/2"					
VMX0453KA1-20	25XP	1.15	83.0	72.2	36.1	±10%	400			350												0		
VMX0553KA1	40	1.3	114.0	99.0	49.5	±10%							4			1"								
VMX0553KA1-20	40XP	1.15	142.3	123.4	61.9	±10%	2			1-1/2"														
VMX0753KA1	50	1.28	142.3	123.8	61.9	±10%							2			1-1/2"								
VMX1003KA1	60	1.15	169.7	146.8	73.4	±10%	2			1-1/2"														
VMX1103KA1	75	1.15	200.0	174.0	87.0	±10%							2			1-1/2"								
VMX1203KA1	100	1.15	266.8	232.0	116.0	±10%	2			1-1/2"														

- NOTES: 1. Based on no more than three single insulated conductors rated 0-2000 volts.  
 2. Conduit sizes shown does include ground conductor if required (over 60 amperes).  
 3. Wire sizes are based on THHN 75 deg. C rated conductors.  
 4. Approved trade size conduit or metal tubing.  
 5. Motors with voltage tolerance of +/-13% have a voltage range of 200-260V, and 400-520V. Use the disconnect and fuse corresponding to the 230V or 460V range  
 6. Above information is general information. Please confirm actual motor full load amperage before proceeding.

After the electrical wiring connections are completed, check the incoming voltage to make sure that the incoming voltage is the same as the vacuum system voltage. Line voltage should be within the voltage tolerance as specified on the motor. Check the system for proper motor rotation. The direction of rotation is always clockwise when looking at the shaft of the pump and is marked by an arrow on the motor or pump housing. Jog the motor by pressing the START button, and then the STOP button. If the rotation is incorrect switch any two of the three main power leads on the contactor inside the control panel. Failure to do so could result in serious equipment damage.

**WARNING: Install, ground, and maintain equipment in accordance with the National Electrical Code and all applicable federal, state and local codes.**

**WARNING: For NFPA 99 hospital and generator applications: please shut down the vacuum pumps prior to generator testing. The rapid stop and restart may cause damage to the pump and/or motor.**

## Vmax-VFD Operational Instructions

Some systems are equipped with a Variable Frequency Drive (VFD) with an Operator Interface Module (OIM) remote keypad.

**Following are brief general instructions and charts. Please refer to Vmax-VFD system-specific operation instructions included with each Vmax-VFD system.**

On systems with a VFD, remember to open the seal fluid valve located under the separator tank before startup. Upon power up of the system, the VFD will go thru an initial self-check, and the remote OIM will display the main menu.

There are two custom windows that will display on the OIM (Operator Interface Module) screen by pressing the ESC/PROG button on the keypad. The first screen shows three items, the first item is total run hours that the motor has run, second is Torr set point (vacuum level set point) and finally Torr feed back (vacuum level pump is at) (Torr (mmHg) = 760 – (“HgV x 25.4). When you press F3 again, the second screen shows HP (horse power), AMPS, and Hz (Hertz). Pressing F3 again will bring you back to the first display screen.

The High Temperature light will be on. You must push the Alarm Condition Reset button before you can place the system in the required mode of operation.

In Manual Mode, the system will run at a constant RPM. In Auto Mode, the system will monitor a set point that the operator sets. The vacuum set point for the system is achieved by using the Operator Interface Module (OIM) on the front door of the control panel (some models may have the OIM inside the front door of the panel). Using the up and down arrows on the keypad, a window will pop up displaying the (% OIM Ref). By pressing the up or down arrow key, the % value will increase or decrease to the required percentage of the transducer output signal (preset to 26.33% = 22” HgV).

The VFD chart on the next page gives you the % VFD value that is associated with the transducer voltage which then correlates to a vacuum level. The VFD will maintain the vacuum level at the set point by increasing or decreasing the RPM of the motor. To verify whether the VFD is in Auto or Manual mode, look in the upper right-hand corner of the screen. If it is in Manual mode it will display Man, and if it is in Auto mode it will display Auto. To change the desired mode, press the F1 button in the main menu screen.

All system wiring is performed at the factory. Check area classification to ensure all electrical enclosures comply to code. Required customer wiring is minimal, but should be done by a qualified electrician in compliance with OSHA, National Electric Code and any other applicable local electrical code concerning switches, fused disconnects, etc. DEKKER includes a wiring diagram in the control panel for use by the installer. DEKKER recommends that a main disconnect switch be fitted between the vacuum system and the incoming power.

**Wire Size Chart (AWG) by Vmax-VFD Horsepower  
Recommended Wire Size and Disconnect Size for Vmax-VFD Systems**

Vmax-VFD			Full Load Amperage at		Volt. Tol.	Copper AWG (kcmil)		Recommended Conduit Size in Inches		Recommended Disconnect (Amps)		Recommended Class J Fuse (Amps)	
System Model No.	HP	Serv. Fact.	230V	460V		230V	460V	230V	460V	230V	460V	230V	460V
VMX-VFD0063KA1	5	1.0	12.0	6.0	±10%	12	16	1/2"		20	15	15	10
VMX-VFD0083KA1	5	1.0	12.0	6.0	±10%	12	16			20	15	15	10
VMX-VFD0103KA1	7.5	1.0	19.0	9.5	±10%	10	14			30	20	25	15
VMX-VFD0153KA1	10	1.0	24.0	12.0	±10%	10	12			35	25	30	20
VMX-VFD0203KA1	15	1.0	39.0	19.5	±10%	8	10	3/4"		60	30	50	25
VMX-VFD0303KA1	20	1.0	50.8	25.4	±10%	6	10	1"		60	35	60	30
VMX-VFD0453KA1	25	1.0	62.0	31.0	±10%	4	8			80	40	70	35
VMX-VFD0553KA1	40	1.0	99.0	49.5	±10%	1	6			125	70	125	60
VMX-VFD0753KA1	50	1.0	123.0	61.9	±10%	1/0	4	1-1/4"	1"	150	80	150	70
VMX-VFD1003KA1	60	1.0	146.8	73.4	±10%	2/0	4	2"			200	100	175
VMX-VFD1103KA1	75	1.0	174.0	87.0	±10%	3/0	2			1-1/4"	200	100	200
VMX-VFD1203KA1	100	1.0	232.0	116.0	±10%	250	1	2-1/2"		250	150	250	125

- NOTES: 1. Based on no more than three single insulated conductors rated 0-2000 volts.  
 2. Conduit sizes shown does include ground conductor if required (over 60 amperes).  
 3. Wire sizes are based on THHN 75 deg. C rated conductors.  
 4. Approved trade size conduit or metal tubing.  
 5. Use the disconnect and fuse corresponding to the 230V or 460V range  
 6. Above information is general information. Please confirm actual motor full load amperage before proceeding.

## VFD value , transducer voltage and vacuum level chart

VFD Value %	Transd. Voltage	Vac.lvl. Torr	Vac.lvl. "HgV		VFD Value %	Transd. Voltage	Vac.lvl. Torr	Vac.lvl. "HgV
10.00	1.00	0.00	29.92		56.00	5.60	349.60	16.16
11.00	1.10	7.60	29.62		57.00	5.70	357.20	15.86
12.00	1.20	15.20	29.32		58.00	5.80	364.80	15.56
13.00	1.30	22.80	29.02		59.00	5.90	372.40	15.26
14.00	1.40	30.40	28.72		60.00	6.00	380.00	14.96
15.00	1.50	38.00	28.42		61.00	6.10	387.60	14.66
16.00	1.60	45.60	28.12		62.00	6.20	395.20	14.36
17.00	1.70	53.20	27.83		63.00	6.30	402.80	14.06
18.00	1.80	60.80	27.53		64.00	6.40	410.40	13.76
19.00	1.90	68.40	27.23		65.00	6.50	418.00	13.46
20.00	2.00	76.00	26.93		66.00	6.60	425.60	13.16
21.00	2.10	83.60	26.63		67.00	6.70	433.20	12.87
22.00	2.20	91.20	26.33		68.00	6.80	440.80	12.57
23.00	2.30	98.80	26.03		69.00	6.90	448.40	12.27
24.00	2.40	106.40	25.73		70.00	7.00	456.00	11.97
25.00	2.50	114.00	25.43		71.00	7.10	463.60	11.67
26.00	2.60	121.60	25.13		72.00	7.20	471.20	11.37
27.00	2.70	129.20	24.83		73.00	7.30	478.80	11.07
28.00	2.80	136.80	24.53		74.00	7.40	486.40	10.77
29.00	2.90	144.40	24.24		75.00	7.50	494.00	10.47
30.00	3.00	152.00	23.94		76.00	7.60	501.60	10.17
31.00	3.10	159.60	23.64		77.00	7.70	509.20	9.87
32.00	3.20	167.20	23.34		78.00	7.80	516.80	9.57
33.00	3.30	174.80	23.04		79.00	7.90	524.40	9.28
34.00	3.40	182.40	22.74		80.00	8.00	532.00	8.98
35.00	3.50	190.00	22.44		81.00	8.10	539.60	8.68
36.00	3.60	197.60	22.14		82.00	8.20	547.20	8.38
37.00	3.70	205.20	21.84		83.00	8.30	554.80	8.08
38.00	3.80	212.80	21.54		84.00	8.40	562.40	7.78
39.00	3.90	220.40	21.24		85.00	8.50	570.00	7.48
40.00	4.00	228.00	20.94		86.00	8.60	577.60	7.18
41.00	4.10	235.60	20.64		87.00	8.70	585.20	6.88
42.00	4.20	243.20	20.35		88.00	8.80	592.80	6.58
43.00	4.30	250.80	20.05		89.00	8.90	600.40	6.28
44.00	4.40	258.40	19.75		90.00	9.00	608.00	5.98
45.00	4.50	266.00	19.45		91.00	9.10	615.60	5.68
46.00	4.60	273.60	19.15		92.00	9.20	623.20	5.39
47.00	4.70	281.20	18.85		93.00	9.30	630.80	5.09
48.00	4.80	288.80	18.55		94.00	9.40	638.40	4.79
49.00	4.90	296.40	18.25		95.00	9.50	646.00	4.49
50.00	5.00	304.00	17.95		96.00	9.60	653.60	4.19
51.00	5.10	311.60	17.65		97.00	9.70	661.20	3.89
52.00	5.20	319.20	17.35		98.00	9.80	668.80	3.59
53.00	5.30	326.80	17.05		99.00	9.90	676.40	3.29
54.00	5.40	334.40	16.76		100.00	10.00	684.00	2.99
55.00	5.50	342.00	16.46					

## Pipe Connections and Sizing

Before installation, remove all protective inserts on the pump suction and discharge. Piping connected to the system must be installed without imposing any strain on the system components. Improperly installed piping can result in misalignment, general operating problems and pump failure. Use flexible connectors where necessary. Piping must be cleaned of debris before installation.

## Inlet Piping

**Note: Install a temporary screen at the pump inlet flange at first start-up to protect the unit against carry over of pipe debris and welding slag. The screen must be removed after the initial run in period.**

Inlet piping should be at least the size of the pump inlet. Install the system as close as possible to the process to minimize losses due to the length of the suction line. If the system has to be installed further away from the process, be sure that the inlet piping is oversized accordingly to minimize the overall line pressure drop. For more information consult your dealer or call the factory.

Pump systems operating in parallel on a common manifold must each have a manual or automatic shut-off valve and a suitable check valve installed in the suction line close to the pump suction flange. This allows each individual system to be isolated when it is not in operation. The line size of the manifold should be a minimum equal to the sum of the individual system pipe areas.

**Vmax** systems are supplied with an inlet check valve as standard. This valve provides a minimum of resistance close to the pump suction flange to prevent back flow of process gas and seal fluid when the pump is stopped.

If the inlet gas pumped contains dust or foreign particles, a suitable 10 micron (or finer) inlet filter should be installed at the inlet port

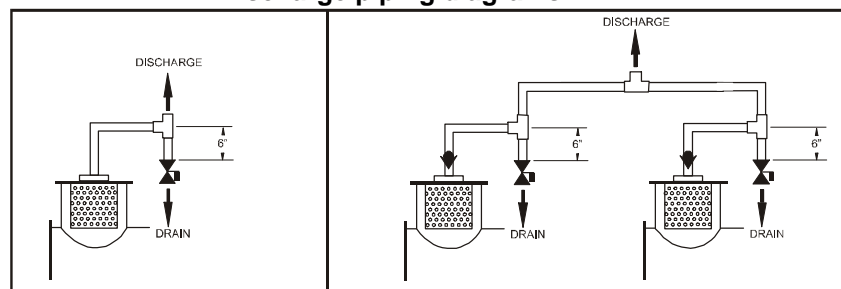
If the possibility exists that the pump inlet can become closed during operation it will be essential to install some type of vacuum relief valve (anti-cavitation valve) so that air can enter the pump inlet. **Never run a pump with a closed suction, which causes cavitation and will damage the pump.**

## Discharge Piping

Discharge piping should be at least the size of the separator discharge. Do not discharge the exhaust gases from the pump system into the area where the system is installed. Vapors pulled over from the process could be hazardous. Install an exhaust line of at least the same diameter as the discharge connection on top of the separator reservoir leading outside. Install a dripleg with tee on the discharge line to prevent condensables from draining back into the separator reservoir. See the "Discharge piping diagram" on the next page.

For pump systems operating in parallel on a common discharge, we recommend the installation of a suitable check valve close to the separator discharge flange of each unit. When discharging more than one pump in a common discharge line and/or over a long distance, oversize pipe accordingly.

Discharge piping diagrams



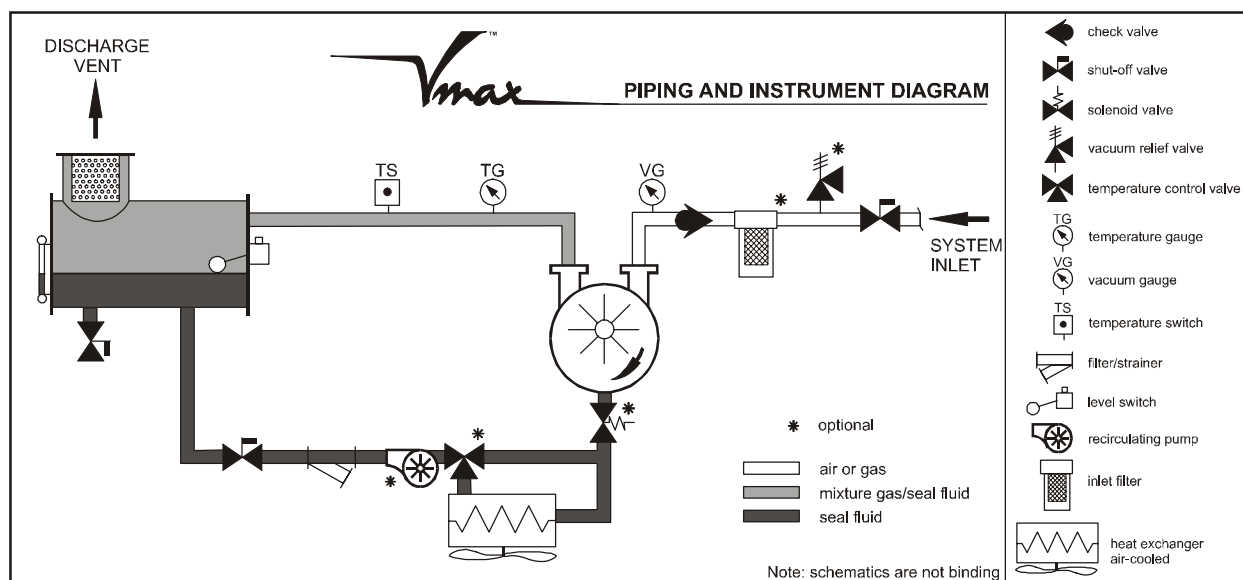
## Cooling water piping (water cooled systems only)

Water-cooled systems require an adequate supply of cooling water at a maximum of 85°F and a minimum supply pressure of 20 psig. If the cooling water temperature is higher or available pressure lower, consult your dealer or call the factory.

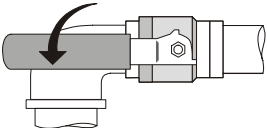
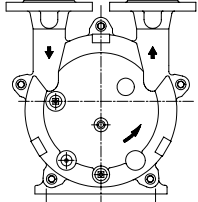
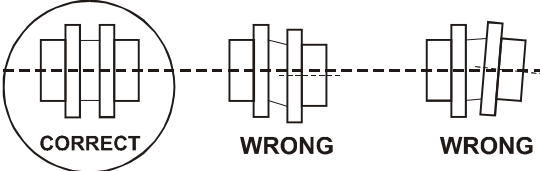
The cooling water outlet connection of the heat exchanger may be fitted with an optional automatic temperature control valve, which regulates the cooling water flow rate depending on pump operating temperature. The valve is preset at the factory. To raise the system operating temperature, turn the valve-adjusting screw counter-clockwise. To lower operating temperature, turn clockwise. Normal system operating temperature is between 140° - 185° F. The valve will only open when the system operating temperature is reached.

## THEORY OF OPERATION

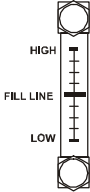
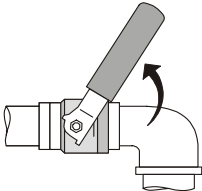
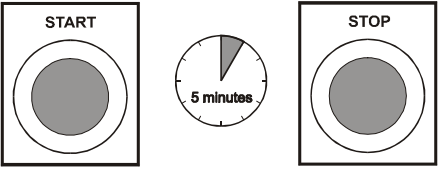
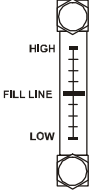
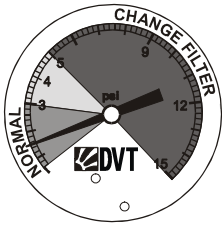
The DEKKER **Vmax** oil-sealed liquid ring vacuum pump system includes our high efficiency liquid ring vacuum pump. The liquid ring vacuum pump is known for its simplicity in design and low maintenance requirements, due to the absence of wearing parts such as pistons, sliding vanes and internal bearings. The impeller assembly is the only moving part, which rotates freely in the casing without metal-to-metal contact. This means that no internal lubrication is required. The function of the sealing liquid is to create a liquid piston action *used to produce vacuum* and to remove the heat of compression. The seal fluid in the system circulates in a closed loop passing through an air- or water-cooled heat exchanger that removes the heat of compression. The discharge separator/reservoir holds the seal fluid and incorporates the DEKKER patented high-efficiency separator arrangement to separate the seal fluid from the air or gases discharged by the pump. See "Piping and Instrument Diagram" of the **Vmax** oil-sealed liquid ring vacuum pump system below.


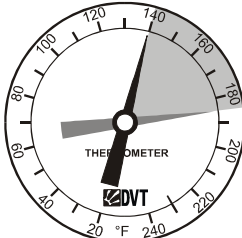


## START UP PROCEDURES

1	Ensure seal fluid isolation valve is open. This valve is located below the separator and/or before the strainer.	
2	Jog the motor briefly and check direction of rotation. The correct direction of rotation is marked by an arrow on the motor or pump housing. If direction is incorrect switch any two of the three leads at the power connection. The correct direction of rotation is clockwise facing the pump from the drive end and counter-clockwise if viewed from the non-drive end.	
3A	Check drive coupling alignment. Angular alignment should be within .035" - .175". Parallel alignment should be within .010" - .025". Consult the factory for specific system size alignment. Mono-block units do not require any field adjustment (motors are C-face mounted).	



<p><b>3B</b></p>	<p>For units utilizing V-belt drives, make sure the sheaves are properly installed and aligned before attempting to tension the drive. The V-belts should be placed over the sheaves and in the grooves without forcing them over the sides of the grooves. The tensioning steps 1, 2, 3 and 4 can be used for all types of V-belts, all cross sections and number of belts and all types of construction.</p> <p><b>Avoid excessive heat</b> (140°F and higher); belt life will be shortened. <b>Never switch</b> or mix <b>belts</b> from one groove to another on the sheaves. <b>Do not use belt dressing.</b> Sheaves should remain free of oil and grease. <b>When replacing belts install an identical set.</b> For more specific V-belt tensioning guidelines consult factory.</p>	<ol style="list-style-type: none"> <li>1. With all belts in their grooves, adjust centers to take up the slack until they are fairly taut. Use standard V-belt tensioning guidelines.</li> <li>2. Start the drive and continue to adjust until the belts have only a slight bow on the slack side while operating <b>with load conditions.</b></li> <li>3. After several days of operation, the belts will seat themselves in the sheave grooves. Further tensioning may be necessary to the point that the drive shows a slight bow in the slack side. Insufficient tension is often evidenced by slipping (squealing) at start-up.</li> <li>4. If the unit is idle for an extended period of time, the tension on the belts should be removed.</li> </ol>
<p><b>4</b></p>	<p>Check fluid level in separator reservoir. The fluid level should be at the FILL LINE on the sight gauge. Add oil if necessary.</p>	
<p><b>5</b></p>	<p>If your system contains an inlet valve, set it to approximately 3/4 closed, and start pump. If valve is not supplied, one should be installed.</p>	
<p><b>6</b></p>	<p>Run the pump for a few minutes, then turn it off.</p>	
<p><b>7</b></p>	<p>With the pump shut off, check fluid level again. The fluid level should be at the FILL LINE on the sight gauge. Add fluid if necessary.</p> <p><b>Warning: never remove the oil fill plug while the pump is running.</b></p>	
<p><b>8</b></p>	<p>Start pump again and check that discharge pressure on the separator pressure gauge does not exceed 2 psig when operating under vacuum conditions. A pressure higher than 2 psig is a sign of high back-pressure in the discharge pipe system. Pressure gauge might show a higher pressure at start-up at low vacuum (0-10" Hg).</p>	

<p><b>9</b></p>	<p>Check the voltage and motor current, they should be within the specifications for the motor. Standard motors have a 1.15 S.F. (Service Factor).</p> <p><b>Note:</b> This test should also be performed under normal system operating conditions.</p>	 <p><b>DANGER: HIGH VOLTAGE!</b>  <b>Lethal shock hazard present.</b>  <b>USE EXTREME CAUTION!</b></p>
<p><b>10</b></p>	<p>After 15-30 minutes of operation, check pump operating temperature, which should be in the 140° to 185° F range. Some smaller units may run cooler.</p>	

## SHUT DOWN PROCEDURE

To stop the pump system follow the procedure as lined out below.

Push the STOP button, or turn switch to the OFF position. The inlet check valve will prevent fluid from the system being sucked back into the inlet manifold.

**Note: If inlet piping could be under vacuum for an extended period of time without the pump running, inlet piping should be vented to atmosphere.**

**Note: Close the seal fluid isolation valve and the pump inlet isolation valve during extended periods of storage or when transporting. Open valves before starting system.**

## SEQUENCE OF OPERATION

The following sequence of operation is a description of how the **Vmax** oil-sealed vacuum pump system should operate. The description is general to cover simplex to multiplex (more than one pump) systems. It is assumed that all start-up procedures have been followed. Ensure that pump reservoirs are filled with oil (See "Start-up Procedures", page 5). Make sure that the seal fluid isolation valve is in the open position. If unsure about the function of one of the electrical controls mentioned below, see the "Electrical Controls" section (page 10) for a description of the component. If any of the below do not occur, see the "Trouble-shooting" section (page 12).

Once the power connection to the system has been made, the following should occur:

- ◆ If disconnects or circuit breakers are installed on the control panel, and are turned to the ON position, the system will be energized. If POWER ON indicating lights are installed on the panel, the lights will be illuminated.
- ◆ If any other lights are illuminated, see the "Trouble-shooting" section (page 12).
- ◆ If HAND-OFF-AUTO selector switches are installed and are turned to the HAND mode, the pump(s) will immediately start. If PUMP ON light(s) are installed on the panel, they should light up to indicate pump operation. We suggest that each pump be tested ("bump started") in the HAND mode initially to check rotation of the pump. When facing the drive end of the pump, the correct rotation is clockwise. When in HAND mode, the pumps will run continuously unless an alarm condition is triggered. If such a condition occurs, see the "Trouble-shooting" section.
- ◆ When the HAND-OFF-AUTO selector switch is placed in the AUTO mode, the pumps will operate from vacuum switches (if installed). In multiplex pump systems, each vacuum switch is set with a differential as well as an offset relative to the next switch. The switches should not be set identically. The differential is usually between 3 to 6" Hg. For details on setting the vacuum switches, see the "Accessories and Protective Devices" section on page 11. Below is an example for a duplex system. The differential for each switch is 4"Hg, the offset between the two switches is 2"Hg.

PUMP	PUMP ON	PUMP OFF
Pump 1 (lead pump)	@ 21"Hg	@ 25"Hg
Pump 2 (lag pump)	@ 19"Hg	@ 23"Hg

- ◆ The switches are set in this manner so that if pump 1 (lead pump) cannot satisfy demand and the vacuum level drops below 21"Hg, the lag pump (2) will start-up when the vacuum level reaches 19"Hg and stops at 23" Hg.
- ◆ All multiplex systems are supplied with "Automatic alternation" and "Frequent stop/start protection" unless otherwise specified.
- ◆ "**Automatic alternation**" allows the pumps to operate equally (even run time) by alternating each pump whenever the pump(s) shut down. When alternation occurs, the "lead" pump becomes the "lag" pump and the "lag" pump becomes the "lead" pump.
- ◆ "**Frequent stop/start protection**" is used to allow the pump(s) to operate a minimum amount of time. The time period is factory-set at 10 minutes. This allows the pump(s) to warm up and eliminate frequent starting of the pump(s) which can cause premature coupling failure and breakdown of electrical components. The pump(s) will continue to operate after the vacuum level has been satisfied. If the possibility exists that the pump could work with a closed suction, a relief valve must be installed to prevent cavitation.
- ◆ If the pump(s) are not alternating and/or are frequent starting, one of the electrical components may be defective. Contact the factory for more information.

## **SYSTEM ALARM CONDITIONS**

The following is a description of how alarm conditions will affect the operation of the system.

- ◆ If a "**Lag pump in operation**" alarm is installed in the panel, observe the following. Such an alarm is usually only supplied with medical packages. The alarm consists of a warning light and an audible alarm. The alarm will trigger when the "lag" pump starts up. The alarm will not affect the operation of the system. The light will illuminate and the alarm will sound. The audible alarm can only be silenced by physically (or remotely) pushing the ALARM SILENCE button. This will not stop the LAG PUMP ON light from illuminating. The light can be reset by physically (or remotely) pressing the ALARM RESET button.

Note: If the lag pump is still operating when the ALARM SILENCE or ALARM RESET buttons are pressed, the alarm will continue to sound. The alarm will only reset if the lag pump is not running.

- ◆ "**Transformer failure**" light (optional). Only installed if more than one control voltage transformer is supplied. If the TRANSFORMER FAILURE light is illuminated, one of the transformers has malfunctioned and the second one has picked up. As long as a back-up transformer is available, the above alarm will not affect the operation of the system. If both transformers fail, the system will shut down.
- ◆ "**High temperature**" light. If the HIGH TEMPERATURE light illuminates, the affected pump will shut down unless otherwise specified at time of purchase of the equipment. The back-up pump(s) will continue to operate unless a high temperature (or other) alarm occurs in those pump(s).
- ◆ "**Low level**" light (optional). If the LOW OIL LEVEL light is illuminated, the affected pump will shut down. The back-up pump(s) will continue to operate unless a similar condition occurs in those pump(s).

## **MAINTENANCE**

As you proceed in reading this section, it will become clear that the "Maintenance Schedule" for DVT **Vmax** oil-sealed liquid ring vacuum pump systems is quite minimal. The use of the service gauges will alert you when service is required.

**WARNING: Before attempting any maintenance such as changing the fluid, disconnect all power from the system by switching off the main breaker or disconnect switch. This will prevent the system from automatically starting from a vacuum switch.**

### **Bearing Lubrication - Pump**

The .25 – 20 HP Titan-series single-stage liquid ring vacuum pumps are installed with sealed bearings that require no field lubrication.

The 25 – 40 HP Titan-series single-stage liquid ring vacuum pumps which are belt-driven, the 50 – 100 HP Titan-series single-stage pumps and the 2 – 60 HP two-stage Titan-series pumps require lubricating every 3000 hours. Extreme operating conditions may require more frequent lubricating. Grease fittings are located on the top of each bearing housing.

For Titan-series two-stage pumps 100 HP and up, please consult Factory.

The Maxima-K series of large capacity single-stage liquid ring vacuum pumps require lubricating every 1500 hours of operation. Grease fittings are located on the top of each bearing housing.

Use a good quality high temperature lithium based grease of #2 consistency. Typical products are Texaco Premium RB and Chevron SR1 #2.

### Pump bearing lubricating schedule

Pump type	Pump HP	Greasing schedule
Titan-series single-stage	.25 - 20	none required
Titan-series single-stage	25 – 100	every 3000 hours
Titan-series two-stage	2 – 60	every 3000 hours
Titan-series two-stage	100 - up	consult factory
Maxima-K-series large capacity	50 - up	every 1500 hours

### Bearing Lubrication – Motor (where required)

The motors are shipped from the factory with the bearings properly packed with grease. During extended storage of 6 months or greater, the ball-bearings should be re-lubricated prior to starting with a good quality high temperature lithium based grease of #2 consistency. Typical products are Texaco Premium RB and Chevron SR1 #2. Roller-bearings (V-belt drive systems) use the Texaco Premium RB or Chevron Black Pearl EP #2.

The bearings may be lubricated with the motor running or stationary. Stationary with the motor warm is preferred. Locate the grease inlets – there is one on each end of the motor.

**Note: This is generally the case with domestic motors. European motors use sealed bearings and do not require lubrication. Consult Factory with any questions.**

Clean the area and replace the pipe plug with a grease fitting as generally they are not equipped with a grease fitting. Remove the grease drain plug, located at the lower portion of each motor face (typically a plastic plug), and loosen any hardened grease that may block the drain. Add the recommended volume of the previously described grease using a hand operated grease gun. Run the motor for two hours. Replace the pipe plug in grease drain.

Mixing of lubricants is not recommended due to possible incompatibility. Signs of incompatibility are extreme soupiness from the grease relief drain or from the shaft opening. If changing a lubricant, grease and then re-grease after 100 hours of service.

Frequency/volume of greasing is based on service conditions, speed and frame size. See table below.

**Standard conditions:** 8 hour day operation, normal or light loading, clean environment at a 100 °F maximum ambient temperature.

**Severe conditions:** 24 hour operation or shock loading, vibration, dirty or dusty environment, running at a 100 °F to 120 °F ambient temperature.

**Extreme conditions:** heavy shock, vibration, or dust.

See table below for lubricating details.

### Motor bearing lubricating schedule

Lubrication Frequency – Ball Bearings					Lubrication Volume	
Roller bearings – divide time by 2					Volume	
Speed (RPM)	NEMA Frame	Standard Conditions	Severe Conditions	Extreme Conditions	NEMA Frame	Volume (Cubic inches)
1800	182-215	3 years	1 year	6 months	182-215	0.5
1800	254-365	2 years	6-12 months	3 months	254-286	1.0
1800	404-449	1 year	6 months	1-3 months	324-365	1.5
3600	ALL	6 months	3 months	1 month	404-449	2.5

## Inlet Filter (if installed)

Check after first 8 hours of operation. Clean or replace inlet filter element every 1000 to 3000 hours depending on application or if excessive pressure drop is noticed. In some applications it may be necessary to clean inlet filter more often.

**CAUTION: Be careful not to allow accumulated foreign material to fall in the pump suction opening when removing the filter cartridge. Horizontal filter installation is recommended to prevent this. Filters must be disposed of properly as they might contain toxic substances carried over from the process.**

## Seal Fluid

The system(s) are shipped with our especially formulated **Vmaxol** seal fluid. These fluids are specifically designed for use in our **Vmax** systems, providing low viscosity, excellent water separating qualities, anti-foaming and low oxidation. We recommend that our **Vmaxol** sealing fluids be used for obtaining ultimate performance from your **Vmax** vacuum pump system and to guarantee the extended 3-year warranty period.

Container Size	Standard <b>Vmaxol</b> (10,000 hours of operation)	Synthetic/Food grade Long-life <b>Vmaxol</b> (15,000 hours of operation)
5 Gallon Container	5220-0050-000	5220-0050-001
55 Gallon Drum	5220-0550-000	5220-0550-001

### Material Safety Data Sheets available upon request

When using **Standard Vmaxol** it is recommended that the seal fluid be changed every 10,000 hours of operation or once a year, whichever comes first. When using **Synthetic/Food grade Long-life Vmaxol**, seal fluid may be changed every 15,000 hours of operation or once a year, whichever comes first. Extreme operating conditions may require more frequent changes.

To change the fluid, first make sure there is no power to the system and the pump is off. Drain the fluid reservoir, vacuum pump and heat exchanger using the drain valves. We recommend that the fluid be changed when the system is at operating temperature.

When charging the system with new fluid, make sure that the pump is filled with oil to the shaft centerline level. **Do not fill the pump above the shaft centerline.** Starting the pump with oil level above the shaft centerline may result in shaft or impeller damage or failure. You can add oil by removing the suction or discharge flange and pouring oil through pump suction or discharge port.

Fill the reservoir to the FILL LINE on the sight gauge. Open the air bleed valve on the heat exchanger to remove all air from the system. Run the pump for a few minutes, stop and check fluid level again. If required, add additional fluid to the reservoir. **Be sure not to overfill.**

Check seal fluid level in the reservoir. A high fluid level could mean a build-up of water in the reservoir, which should be drained. Check every 500 hours.

## Devarnishing

The operating life of the unit is greatly enhanced based on the quality of the seal fluid. Oxidized or darkened seal fluid is a sign of trouble. Plugged filters reduce performance and may damage pump. Periodic maintenance will offer the best protection for your equipment.

DEKKER offers a specially formulated devarnishing compound **Proclean 39V** for oil-sealed liquidring pumps and systems. Procedure for using Proclean 39V and MSDS sheet are included with the product. The compound is available in the following quantities:

**Proclean 39V (part no.: 5230-0010-000) – 1 gallon**

**Proclean 39V (part no.: 5230-0050-000) – 5 gallon**

**Proclean 39V (part no.: 5230-0055-000) – 55 gallon**

**NOTE: Varnished pumps are not covered under warranty.**

## Seal Fluid Strainer

After the first 50 hours of operation, clean the strainer in the seal fluid line. This is done to remove any debris carried over into the system from the process. Clean and inspect the strainer every 1000-3000 hours depending on application or if excessive oil discharge temperature (above 185°F) is indicated. An increase in pump discharge oil temperature is an indication of low oil flow and normally is an indication of

strainer blockage. If cleaning of strainer does not decrease temperature check the seal fluid line for blockage.

### **Spin-on Oil Filter (if installed)**

If you notice that the operating temperature of your system steadily increases, change the spin-on filter.

### **Separator Element**

The separator elements are located in the separator reservoir. Its purpose is to remove the oil from the discharge air. Replace the element every 10,000 hours or once a year. Earlier replacement may be necessary when the back-pressure is higher than 4 psig. High back-pressure is a result of dirt build-up on the separator element due to oil varnish, or contaminated inlet gas stream. Replacement may vary depending on application.

**NOTE: Thread-in style filters are installed hand-tight as an oil filter. Do not over-tighten with a wrench.**

### **Separator Element Oil Return Line**

The separator element oil return lines are 1/4" to 3/8" transparent tubing. The purpose of these lines is to remove excessive oil build-up from inside the separator and separator element. If excessive smoking or oil mist is present, check the oil return lines for blockage and replace if necessary. Also check that the steel section of oil return line located on top of the separator reservoir is cut at a 45° angle and is touching the bottom of the separator element.

### **Mechanical Shaft Seals**

All DEKKER oil-sealed liquid ring vacuum pumps are fitted with mechanical shaft seals. Mechanical seals do not require maintenance unless there is more than a small amount of leakage. To define this we differentiate between the following:

**Weepage:** Mechanical seals work by having two flat surfaces pushed together by axial force from the closing mechanism and by product pressure in the seal chamber. When the seal is in operation, the seal fluid lubricates the two faces. This thin film of lubrication protects the faces of the seal from heat and excessive wear, but it can also allow for a small amount of leakage across the seal face. This small leakage is called a "weep". While a weep has rather arbitrary limits, it is commonly considered to be a leakage rate of less than one drop of liquid every minute. Seal weeps are not covered under warranty.

**Leakage:** a leakage rate of more than one drop per minute is considered to be a "leak". Seal leakage is normally a result of a build-up of abrasive particles carried over in the pump suction. These particles cause excessive wear on the seal faces. Leakage caused by wear and tear is not covered under warranty.

Seal replacement is addressed in the assembly and disassembly instruction for the specific pump model used. Consult factory for assistance.

## **MAINTENANCE SCHEDULE**

To help ensure trouble free system operation, a basic maintenance schedule consisting of the following system checks is recommended.

### **First 8 hours operation**

Check oil level and inlet filter element if installed. Clean strainers and remove temporary inlet screen. Check for water in sight gauge and drain if necessary. Check piping for signs of oil leakage and tighten if necessary.

### **500 hours operation**

Under normal operating conditions repeat 8 hour check procedure as described above

### **1000 hours operation**

Check back-pressure on separator element; it should not exceed 4 psig. Change separator element if back-pressure exceeds 4 psig. Also check discharge pipe system for blockage.

Clean or replace inlet filter element every 1000 to 3000 hours depending on application or if excessive pressure drop is noticed.

Remove debris from pump housing, motor fan guard and heat exchanger.

### **1,000-3,000 hours of operation**

Applicable to pumps equipped with grease fittings located on each bearing housing. Grease bearings with a #2 quality lithium grease. Do not over-grease, 3 to 4 pumps with a grease gun is sufficient under normal conditions.

## 10,000 hours of operation

Or once per year, change seal fluid. Use DEKKER *Vmaxol* seal fluid. Life of **Standard Vmaxol** is **10,000** hours of operation. **Synthetic/Food grade Long-life Vmaxol** may be changed every **15,000** hours of operation or once a year, whichever comes first.

Change separator element if back- pressure exceeds 4 psig.

Check coupling element for wear. Replace if worn.

Clean strainer in seal fluid line.

## 30,000 hours of operation

Or every 5 years, it is recommended that you replace the vacuum pump's mechanical seals and bearings as preventative maintenance. This should be done by a DEKKER authorized distributor or properly trained service technician.

## ELECTRICAL CONTROLS (if included)

- ◆ **Disconnect Handles:** must be turned on to energize the system. The handles must be turned off to open control panel.
- ◆ **CAUTION: High voltage, main disconnect must be off when servicing panel.**
- ◆ **HOA (Hand-Off-Auto) Selector Switches:** are supplied only if vacuum switches are supplied. Pump units will start in HAND mode (unless units are in a shutdown alarm condition). The pumps will bypass vacuum switches. AUTO mode, allows units to start upon contact closure of the vacuum switch.
- ◆ **Stop/Start Push Buttons:** are included if HOA selector switch is not installed.
- ◆ **Reset Button:** is used to reset the starter overloads.
- ◆ **Power On Light:** indicates that power is on in panel.
- ◆ **Pump Running Light:** indicates a pump is operating.
- ◆ **High Temperature Overload Light:** indicates a pump has overheated and shuts the pump down. The ALARM RESET button needs to be pressed to reset the alarm condition. If high temperature condition has not been fixed, the alarm will not reset.
- ◆ **High Back-pressure Light:** indicates the exhaust filter element in the vacuum pump needs to be replaced. Alarm does not shut down the pump. Replace element as soon as possible.
- ◆ **Transformer Failure Light:** indicates transformer failure. If alternate transformers are included in the panel, the alternate transformer will pick up. The pump will shut down if only one transformer is present and fails.
  
- ◆ **Lag Pump In Operation Light:** When the light illuminates, the lag pump is in operation.
- ◆ **Audible Alarm:** signals that the lag pump is in operation. The alarm can be silenced by pressing the ALARM SILENCE button. The audible alarm may also be used to signal other alarm conditions, such as high temperature, low oil level or high back pressure.
- ◆ **Alarm Silence Button:** is used to silence the audible alarm, but the light will remain on unless alarm condition has been corrected.
- ◆ **Alarm Reset Button:** is used to reset an alarm condition when the condition has been rectified. The ALARM RESET button will stop the light and alarm if alarm condition has been corrected.
- ◆ **Hour Meter:** is a running clock that indicates how many hours each pump has been operating. It should be used to determine when the oil in the pump and the discharge filter element needs to be replaced. See Maintenance Schedule (page 9) for oil life.

## ACCESSORIES AND PROTECTIVE DEVICES (if included)

### Accessories

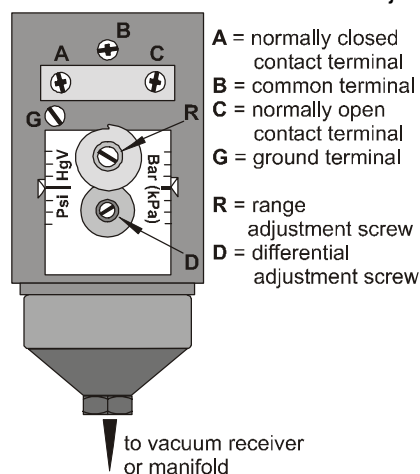
The following accessories are available for *Vmax* oil-sealed liquid ring vacuum pump systems.

- ◆ **Flexible Connectors (optional):** are used in piping systems to eliminate vibration transmission from machinery throughout the piping network. If ordered, DEKKER uses braided flexible connectors on the *Vmax* oil-sealed vacuum pump systems.

- ◆ **Vibration Isolators (optional):** are used to eliminate vibrations, noise and shock transmission from machinery to the floor. Floor-mount type vibration isolators are used for **Vmax** vacuum pump systems. The vibration isolators have a steel top plate, threaded insert and steel base, both totally imbedded in an oil-resistant neoprene. The isolators bolt onto a tank or base-frame with one bolt and have two mounting bolts to mount to the foundation or floor.
- ◆ **System Isolation Valve (optional):** may be installed on the vacuum receiver tank or vacuum pump manifold. Usually the valve is used to isolate the vacuum system from the piping network.
- ◆ **Inlet Filter (optional):** An inlet filter may be installed on the **Vmax** oil-sealed vacuum pump systems to prevent carry-over of particles into the pump.
- ◆ **Vacuum Relief Valve (optional):** This valve may be installed on the pump suction manifold or on the receiver. The vacuum relief valve is used to protect the vacuum pump from closed suction which can damage the pump.
- ◆ **Vacuum Switch (optional):** is used to automatically switch the vacuum pump ON and OFF, based on demand. This switch is standard on all multiplex systems.

**Switches are factory preset for your application and it is NOT RECOMMENDED to adjust the vacuum switch.** Each switch is labeled as LEAD or LAG and is marked with the corresponding PUMP ON and PUMP OFF points.

If the vacuum switch must be adjusted, please follow these instructions:



A = normally closed contact terminal  
 B = common terminal  
 C = normally open contact terminal  
 G = ground terminal  
 R = range adjustment screw  
 D = differential adjustment screw

1. To increase the point at which the vacuum pump turns ON, turn the RANGE ADJUSTMENT SCREW (R) counter-clockwise. See the range scale on switch for approximation. Use vacuum gauge to observe actual PUMP ON and PUMP OFF point.
2. To increase the differential, which is the difference between the PUMP ON and PUMP OFF point, turn the DIFFERENTIAL ADJUSTMENT SCREW (D) counter-clockwise. To obtain the correct PUMP OFF point observe the physical opening of the contact switch as compared to the vacuum gauge reading. The vacuum pump will not stop running, because all systems are equipped with "10 minute minimum run" timers.
3. Remember you will need to vary the vacuum level in the receiver or manifold to see a change in the vacuum level, and to adjust the switches.

- ◆ **Microprocessing Controller (optional):** system may be equipped with this very reliable and compact Controller module for controlling and monitoring basic machinery functions. The following instructions should help guide the end user to perform simple changes to the Controllers' pre-programmed settings. The specific preset areas that may be modified are outlined below.

Set the Internal Clock:

Upon powering the system control panel, the installation technician must ensure that the internal clock in the Controller has been set to the current military time setting. The Controller is equipped with an internal capacitor that will hold the time for approximately 80 hrs. If your system has not been installed within the allotted time frame, the alternation of the automatic mode will not occur and only one of the pumps will function until the time parameter has been updated. Refer to the following instructions for access to and changing of the parameters.

Sequence of Operation Automatic Mode:

The switch on the front of the system control panel must be placed in the automatic mode before the Controller program will initiate. Upon starting the system, all pumps should come on line and run for a minimum of 10 minutes each. As the demand for the vacuum pumps change, the individual units will turn off and on as required, each time running for a minimum of 10 minutes after initial start. If all the individual pumps are not placed in automatic mode simultaneously, there may be a pump that does not ramp up to speed with the lead pump. This does not mean that there is a problem with your vacuum system. The reason for this can be the switch settings for lead and lag pumps. When the system is started and individual units are placed in automatic mode at different times, the demand for lag pump may not be present due to the time lapse between placing the various pumps in automatic mode.



After 24 hours of operation (1 calendar day), the lead pump will become the lag pump and the remaining pumps will shift one spot forward, keeping the same on and off switch settings as before. The alternation of the vacuum pumps will allow equal usage of the equipment and will increase the life expectancy of the system. If the demand for the remaining pumps needs to change, you must enter the necessary value in the Controller for the level of vacuum you wish to maintain as a minimum/maximum for each on/off switch point. If there is not a demand for the lag pump(s) they will never run with the lead pump. Every day the lead pump will change.

When the lead pump cannot handle the demand of the system, the remaining pump(s) will turn on. For medical packages: when the last pump in the system is required to operate, the alarm condition will trigger the audio or visual signal that the lag pump is operating, and the system is near full capacity. The alarm reset button should be pressed and the light or audible sound will stop.

#### Manual Modes:

Any pump can be independently started manually by placing the system in manual mode. All high temperature and low/high level switches will still be monitoring the equipment, thus ensuring the safe operation of your Vacuum system. The Controller program will not initiate and the automatic alternation will not function. The cost of operating the system will be considerably higher than in automatic mode.

#### Switching to parameterization mode:

In order to change **any** of the preset values in the Controller, the initial procedure is the same:

1. Turn on power to the Controller.
2. Place pump(s) in manual (Hand) mode. This is done so vacuum will be maintained, otherwise when saving changes, the pump(s) will shut down.
3. Press **ESC**, then scroll down to "Set Param", then push **OK**.

The Controller switches to parameterization mode and displays the parameterization menu. The operator can now access the various menus by using the **up** or **down** arrows to toggle to desired menu.

#### Selecting a parameter:

The following can be parameters:

- The delay times of a time relay.
- The switching times of an alternation time switch.
- The threshold value of a counter.
- The monitoring time of an operating hours counter (internal clock).
- The switching thresholds of a vacuum switch.

To select a parameter, proceed as follows:

1. Select the "Set Param" option from the parameterization menu. (**UP** or **DOWN** arrows)
2. Once you have the cursor (>) on the desired parameter, press **OK**.

The Controller displays the first parameter. If parameters cannot be set or modified, you can use **ESC** to return to the parameterization menu. The **ESC** key can be used at any time to leave the parameterization mode and return to the running mode.

3. Select the desired parameter by using the **UP** or **DOWN** arrows to toggle through until the desired parameter is displayed in the window.
4. To change a parameter, you must select it and press **OK**.

#### Changing a parameter:

To change a parameter, you first must select it as shown above. Once you have selected the desired parameter, you can change the value by moving the cursor to the desired location with the < or > arrows. The actual value is changed by using the **UP** or **DOWN** arrow. The steps are as follows:

1. Move the cursor to the point at which you want to make the change. (< or > arrows)
2. Change the value. (**UP** or **DOWN** arrows)
3. Accept the value. (**OK**)

Once all parameters are modified, you'll need to exit the "Set Param" mode by following these steps:

1. Press **ESC** until you reach the screen that has **STOP**.
2. Arrow up to **STOP** and press **OK**.
3. When prompted **Stop Prg**, use arrow **UP** or **DOWN** to **Yes** and press **OK**.
4. Arrow down to **Start** and press **OK**. (This will save the changes)
5. Turn pump(s) to Automatic mode.

#### Vacuum pump ON/OFF settings for Microprocessing Controller (Vacuum in "Hg):

When setting the ON and OFF switch points in your Controller, use the following table for reference:

Inches of HgV	PLC Setting
29	234
28	488
27	742
26	996
25	1250
24	1504
23	1758
22	2012
21	2266
20	2520
19	2775
18	3028
17	3282
16	3536
15	3790
14	4044
13	4298
12	4552
11	4806
10	5060

This table will apply to all single and multiplex systems equipped with a Controller after 5/15/02 (all units supplied with a Controller prior to this date must contact the Service or Engineering department with serial number of supplied equipment for assistance). These values are entered directly into the Controller in the appropriate block number for lead and lag pumps. Refer to the specific instruction set provided with the IOM for block number identification.

- The correct value can also be determined by the following formula:

$$7600 - (\text{Inches of HgV} \times 254) = \text{Controller setting}$$

Example: SW $\uparrow$  = 3282 – switch pump on at 17”HgV ( $7600 - (17 \times 254) = 3282$ )

SW $\downarrow$  = 2520 – switch pump off at 20”HgV ( $7600 - (20 \times 254) = 2520$ )

- To determine the vacuum point displayed on the LED of the Controller unit use the following formula:

$$\text{“HgV} = 29.92 - (\text{Displayed Value}/254)$$

Please note that the values you are working with are Torr values multiplied by 10.

A perfect vacuum is approaching a setting of 0 and at atmospheric pressure at sea-level the setting is at 7600 (760 Torr x 10).

Settings for Simplex Systems:

- Unless otherwise noted, the standard switch points for a Simplex System will be set at:

Lead pump ON at 17”HgV – OFF at 20”HgV

- Specific block numbers for Simplex Controller Program:

Lead pump =B15

Setting for Duplex Systems:

- Unless otherwise noted, the standard switch points for a Duplex System will be set at:

Lead pump ON at 17”HgV – OFF at 20”HgV

Lag pump ON at 16”HgV – OFF at 19”HgV

- Specific block numbers for Duplex Controller Program:

Lead pump =B15

Lag pump =B16

Alarm visual/audible =B13 (Typically set to come on and off with lag pump settings)

Setting for Triplex Systems:

- Unless otherwise noted, the standard switch points for a Triplex System will be set at:

Lead pump ON at 17”HgV – OFF at 20”HgV

Mid pump ON at 16”HgV – OFF at 19”HgV

Lag pump ON at 15”HgV – OFF at 18”HgV

- Specific Block number for Triplex Controller Program:

Lead Pump =B15

Mid pump =B16

Lag pump =B23

Alarm visual/audible =B13 (Typically set to come on and off with lag pump settings)

## Protective Devices

The following protective devices are available to protect the unit from being damaged and to help with maintenance.

- ◆ **High Temperature Switch (standard except on Vmax<sup>LT</sup>):** will signal when the temperature of the oil is exceeding the shut-down level. The switch will shut the unit down. The unit will not restart until the alarm condition is acknowledged and is reset. The switch is a “snap disc” type of switch that is normally closed. When the temperature reaches the maximum setpoint, the switch will open. Once the switch has opened, there is a 10-20°F differential that the temperature will need to drop to, in order for the switch to close.
- ◆ **High Back-pressure Switch (optional):** is installed on the discharge of the separator. When the back-pressure reaches a pre-determined level (4 psi), the switch will signal the control panel. A high back-pressure light may be installed on the control panel, which, when illuminated, signals that the exhaust element in the vacuum pump needs to be replaced. Note that the high back-pressure switch will not shut the unit down, but the exhaust element must be replaced as soon as possible.
- ◆ **Lag Pump On Alarm (optional):** An NFPA 99 requirement on medical systems. This is an audio/visual alarm that signals lag pump operation. Once the alarm triggers, the alarm must be acknowledged and reset. The alarm will not reset if the lag pump is still in operation. This alarm indicates vacuum is greater than the supply of the lead pump only.
- ◆ **Transformer Failure Light (optional):** All standard medical NFPA 99 oil-sealed liquidring vacuum pump systems are supplied with two (2) control voltage transformers (one primary and one for backup). If indication is desired in the event that the primary transformer fails and the backup transformer picks up, a TRANSFORMER FAILURE light will be necessary. The defective transformer should be replaced as soon as possible. When the primary transformer fails, the operation of the system will not be interrupted. If the backup transformer also fails, the system will shut down.
- ◆ **Low Oil Level Switch (optional):** This switch is installed in the separator/reservoir of the liquidring vacuum pump. It is a float type of switch. If the level switch is triggered, the affected pump will shut down. The LOW OIL LEVEL light on the control panel will be illuminated. The low level switch will be wired into the main alarm of the panel. The alarm will have to be reset to restart the pump. **When filling the system with oil, make sure that the power to the pump is off because if the alarm reset button has been reset and the level switches contacts close while filling the pump, the pump will start-up automatically.**
- ◆ **Frequent Stop/Start Protection (standard on multiplex systems):** Allows each pump to run a minimum amount of time. Frequent stopping/starting can reduce coupling life and is also less efficient from a power consumption standpoint.
- ◆ **Automatic Alternation (standard on multiplex systems unless otherwise specified):** Allows the pumps to alternate. The primary feature of automatic alternation is to equalize the running time on all the pumps.

## **TROUBLE-SHOOTING**

Following is a basic trouble-shooting guide. We recommended that you consult your local dealer for service. Each **Vmax** system is tested and checked at the factory. Always indicate system model and serial number when calling.

**WARNING: Before attempting any repairs, disconnect all power from the system by switching off the main breaker or disconnect switch. This will prevent the system from automatically starting from a vacuum switch.**

### **TROUBLE SHOOTING FAQs (Frequently Asked Questions)**

#### **VMAX OIL-SEALED LIQUID RING VACUUM PUMP SYSTEMS**

##### **START-STOP PROBLEMS:**

***System will not start in HAND or AUTO position:*** (Vmax)

1. Check if the disconnect or circuit breaker is switched on.
2. Check the overload setting on the starter and fuses.
3. Check alarm reset, light should be off.
4. Ensure that the proper voltage is supplied and that the wire size is correct.
5. Check electrical control panel (if installed). Make sure that all wires are tight. Wires may vibrate loose during shipment or operation.
6. Check low oil level switch (if installed). Add oil to reservoir if needed.
7. Check if the pump has seized by rotating the coupling by hand (**disconnect power first**). If a rubbing noise or binding is observed, contact authorized dealer.
8. Check the high temperature switch, which should be set for 225°F.
9. Check if pump operates against high back-pressure (> 4 psig), if so replace oil separator element.
10. Check vacuum switch (if installed).

***System shuts down while running:*** (Vmax)

1. Check oil temperature gauge for operating temperature.
2. Check the overload setting on the starter and fuses.
3. Ensure that the proper voltage is supplied and that the wire size is correct.
4. Check for loose electrical connections.
5. Check the vacuum switch setting (if installed).
6. Check low oil level switch (if installed), add oil to reservoir if needed.
7. Check if the pump has seized by rotating the coupling by hand (**disconnect power first**). If a rubbing noise or binding is observed, contact authorized dealer.
8. Check high temperature switch, which should be set for 225°F.
9. Clean oil strainer.
10. Check if pump operates against high back-pressure (> 4 psig), if so replace oil separator element.
11. Check the overload setting on the starter and fuses.

##### **VACUUM PROBLEMS:**

***System operates, but does not achieve desired vacuum level:*** (Vmax)

1. Stop system and disconnect power.
2. Check if the inlet valve is open and inlet filter is clean.
3. Ensure that no lines are open to the atmosphere, causing loss of vacuum.
4. Check for leaks in piping systems, using conventional leak detection methods.
5. Ensure that the oil level is correct and that the pump is primed and filled with oil to the shaft centerline only.
6. Check if the oil isolation valve is open.
7. Check if the oil solenoid valve (if installed) is working.
8. Check the vacuum switch setting (if installed).
9. Check setting of vacuum relief valve (if installed) and adjust as needed.
10. Check if the motor rotation is correct. Rotation should be clockwise (facing pump from motor side) and marked by an arrow on the motor or pump housing. If incorrect, switch any two of the three main power leads on the contactor inside the control panel.

## **OVERHEATING PROBLEMS:**

### ***System overheats or operates above 200°F: (Vmax)***

1. Stop system and disconnect power.
2. Check the oil cooler and fan. Clean cooler externally with compressed air. Ensure that 12" of space is available in front of the cooler and that the ambient temperature is below 110° F.
3. Check if the oil isolation valve is open.
4. Check if the oil solenoid valve (if installed) is working.
5. Ensure that the oil level is correct and that the pump is primed and filled with oil to the shaft centerline only.
6. Check if the temperature control valve (if installed) is working and that oil is flowing through the cooler. **Caution, hot oil!**
7. Clean oil strainer.
8. Check if oil cooler is blocked internally with solids passed through from the process, clean if necessary.

### ***Unit overheats on start-up in low ambient temperatures: (Vmax)***

1. Stop system and disconnect power
2. Oil tends to thicken in temperatures of 50°F and below. Place heat tape and insulation on the fluid seal line from the heat- exchanger to the pump inlet.
3. Also insulate the seal-fluid solenoid valve (if installed).

## **NOISE AND VIBRATION PROBLEMS:**

### ***The system is making an abnormal noise or sound: (Vmax)***

1. Stop system and disconnect power.
2. Check the coupling and/or element for proper alignment. If worn or damaged, replace.
3. Check if the bearings are greased. Rotate the coupling by hand, which should rotate freely. If a rubbing noise or binding is observed, contact authorized dealer.
4. Ensure that the oil level is correct and that the pump is primed and filled with oil to the shaft centerline only.
5. Check vacuum relief valve (if installed), check the setting and adjust as needed.
6. Check the inlet filter and clean if necessary. Pump will cavitate if filter is blocked.
7. Check if the inlet valve is closed. The pump will cavitate if inlet is closed.
8. Check vacuum level on vacuum gauge. Pump could cavitate as a result of a too high vacuum level.

### ***System is vibrating excessively: (Vmax)***

1. Stop system and disconnect power.
2. Check the coupling and/or element for proper alignment. If worn or damaged, replace.
3. Check if the bearings are greased. Rotate the coupling by hand, which should rotate freely. If a rubbing noise or binding is observed, contact authorized dealer.
4. Check if baseplate is properly supported. Uneven floor will distort baseplate, which could cause vibrating problems.
5. Check that the mounting bolts of pump, coupling, fan and cooler are not loose. Tighten as required.
6. Check belt alignment on belt drive systems.

## **OIL PROBLEMS:**

### ***System uses excessive oil or produces an oil-mist: (Vmax)***

1. Stop system and disconnect power.
2. Check the oil return line from the separator for blockage to ensure that oil flows from separator to vacuum pump.
3. Check if pump operates against high back-pressure (> 4 psig), if so replace oil separator element.
4. Vacuum level should be 15" Hg or higher. If not, consult authorized dealer.
5. Check for an excessive amount of water vapor carried over from the process.

## CUSTOMER SERVICE



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### **Order information**

When calling for service, parts or system information always have the pump or system model number and serial number(s) ready. Refer to the bill of lading or the gold-colored system information plate attached to the system.

Parts should be purchased from the nearest authorized DEKKER representative or from the vacuum pump system supplier. If for any reason parts cannot be obtained in this manner, contact the factory directly.

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June2006/ado/13

# WARRANTY POLICY

Warranty policy for DEKKER vacuum pumps and systems:

April 2006

DEKKER Vacuum Technologies, Inc. (hereafter referred to as the Company) warrants that the products hereunder shall be free of defects in material and workmanship and conform to the specifications given in connection with the sale of the product.

**Vmax systems: full 3-year warranty** from date of shipment, provided the system is operated exclusively with DEKKER **Vmaxol** sealing liquid and is operated during the full warranty period as per the instructions given in the Operation and Maintenance Manual. If purchaser elects not to use DEKKER seal-fluids, system warranty shall be 2 years if fluid is approved by DEKKER.

**Vmax<sup>MTH</sup> systems: 1-year warranty** from date of shipment, provided the system is operated exclusively with DEKKER **Vmaxol** sealing liquid and is operated during the full warranty period as per the instructions given in the Operation and Maintenance Manual. If purchaser elects not to use DEKKER seal-fluids, system warranty shall be 1 year if fluid is approved by DEKKER.

**DuraVane pumps, systems and compressors: 2-year warranty** from date of shipment, provided the pump(s) are operated during the full warranty period as per the instructions given in the Operation and Maintenance Manual, and where applicable are operated exclusively with DEKKER **Duratex** oil. If purchaser elects not to use DEKKER oil, pump and system warranty shall be 18 months if oil is approved by DEKKER.

**TiTan and Maxima-K liquid ring vacuum pumps and compressors and AquaSeal and ChemSeal systems: 2-year warranty** from date of shipment, provided the pump or system is operated during the full warranty period as per the instructions given in the Operation and Maintenance Manual.

**All other systems not specified above and all custom-engineered systems: 1-year warranty** from date of shipment, provided the pump or system is operated during the full warranty period as per the instructions given in the Operation and Maintenance Manual.

**Rebuilt pumps and systems: 6 months warranty** from date of shipment if operated as per the instructions given in the Operation and Maintenance Manual.

**All 3<sup>rd</sup> party components are subject to Manufacturers' warranty.**

**Mechanical shaft seals** are warranted for a period of **ninety (90) days** from date of shipment.

The replacement of **maintenance items** including, but not limited to oil, seals, bearings, filters, vanes in rotary vane pumps, etc., made in connection with normal maintenance service are **not covered** under this warranty.

No warranty shall apply to products that have been misused or neglected, which includes operation in excessive ambient temperatures, dirty environments or the pumping of corrosive, erosive or explosive liquids or gasses or for problems caused by a build-up of material on the internal parts of the product.

Under this warranty the purchaser is entitled to the repair or replacement (whichever DEKKER elects) of any part or parts of the product that do not conform to specifications. This warranty shall be void unless said nonconformance is discovered before the expiration of this warranty. For repairs, the Company has to be notified in writing, a return authorization has to be obtained and the nonconforming part or parts need to be returned to the Company, transport charges prepaid, within thirty (30) days of discovery. Repairs shall be made at the Company's facility without charge, except for return transport charges. Replacement parts provided under the terms of this warranty are warranted for the remainder of the warranty period applicable to the product in which they are installed, as if such parts were original components of that product.

No allowance will be granted for repairs or alterations made by the purchaser without the Company's written consent.

In lieu of the foregoing remedy, the company may (if the Company so elects), redesign and/or replace the product or refund the full purchase price thereof.

If purchaser disassembles the product for any reason without the written consent of the Company, this warranty shall be void.

**Limitation of liability for DEKKER vacuum pumps and systems:**

The Company's obligations are limited to repair, redesign, replacement or refund of the purchase price, at the Company's option. In no event shall the purchaser be entitled to recover incidental, special or consequential damages arising out of any defect, failure or malfunction of the product.

This warranty and the company's obligation there under is expressly in lieu of all other warranties, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. All warranties, which exceed the aforementioned obligations are hereby disclaimed by the company and excluded from this warranty. No other person is authorized to give any other warranty or to assume any other liability on the company's behalf without written authorization.