VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS

The Vmax is a direct-drive, gravity-fed, self-contained, oil-sealed, air- or water-cooled, vacuum system utilizing a liquid ring vacuum pump. A Vmax system can incorporate either a single-stage or a two- stage vacuum pump.

The separator tank holds the seal fluid and incorporates the DEKKER Vacuum Technologies' patented high-efficiency separator arrangement to separate the seal fluid from the air or gases discharged from the pump.

Start the system via the DEKKER Controller, manual motor starter or other customer-supplied means. This will supply power to the motor and to the seal fluid solenoid valve.

Supplying power to the seal-fluid solenoid opens the valve and allows the seal fluid to flow from the separator tank, past the oil-isolation value and Y-strainer to the heat exchanger.

On air cooled Vmax systems, the seal fluid travels through the heat exchanger and is cooled by a motor-mounted fan. Standard air flow up to late 2001 was outside in (pull fan). Standard air flow after late 2001 is inside out (push fan).

VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 1)*

On water-cooled Vmax systems, the seal fluid travels through the heat exchanger which is usually a shell and tube or plate and frame style that utilizes chilled water to cool the seal fluid. Exceptions are Vmax systems larger than 40 HP which will be covered later.

From the heat exchanger, the seal fluid flows through the lower seal-fluid line to the solenoid valve then to the vacuum pump. The static head from the overhead-mounted reservoir, together with the vacuum in the pump, pulls the seal fluid through the heat exchanger.

The seal fluid enters the liquid ring pump and circulates as described in Principles of Operation — Single Stage Liquid Ring Vacuum Pump.

Discharged seal fluid, together with process gas, exits the discharge manifold, past the temperature switch and temperature gauge, back into the separator tank.

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Vacuum is created and drawn in through the optional inlet filter, past the optional vacuum relief valve and inlet check valve, through the pump, then discharged along with the seal fluid/process gas mixture into the separator tank. Discharged air and seal fluid enter the inner shell of the separator tank, beginning the separation process.

The outer shell acts as a condenser, as the surrounding ambient air is cooler than the discharge stream, allowing a condensing effect of the seal fluid from the air stream.

A series of baffle plates introduces a misdirection of flows, enhancing the condensing effect.

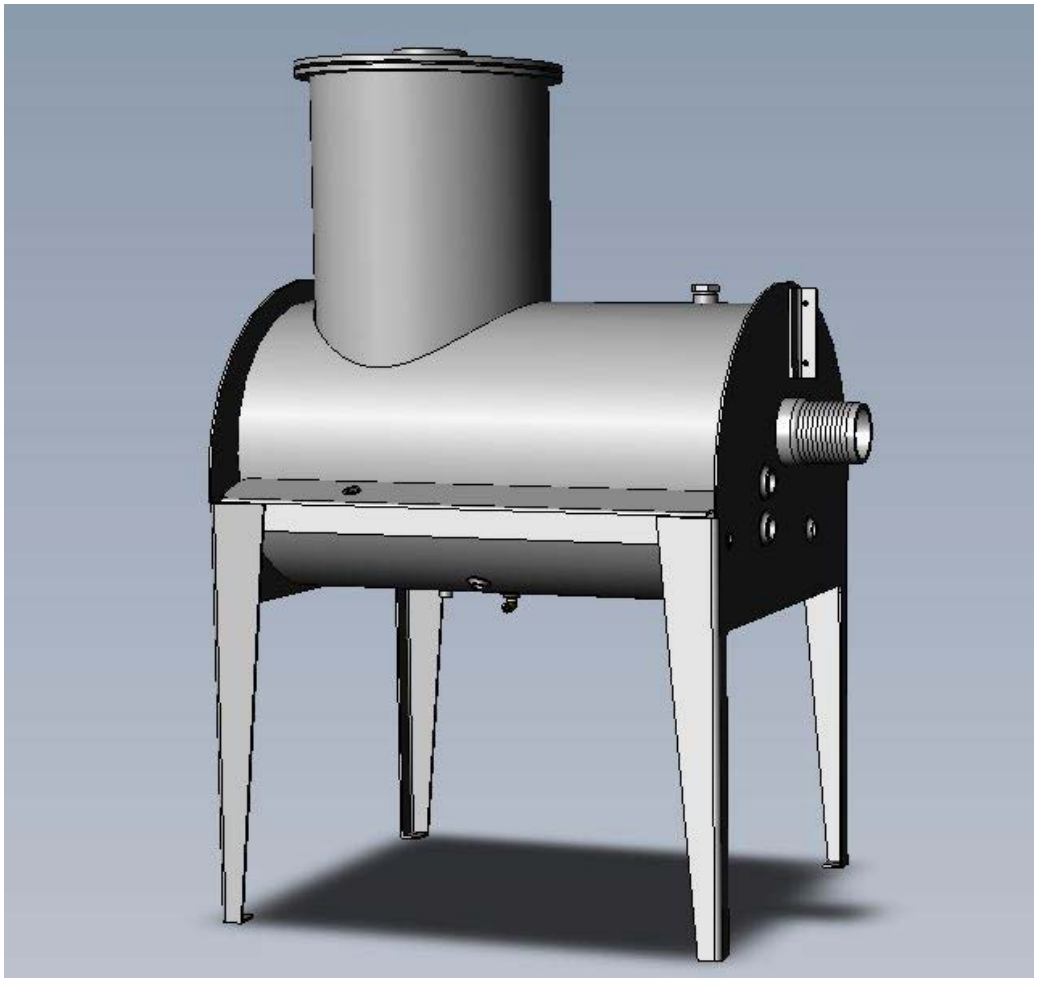
The seal fluid drops out of the air stream to the bottom of the tank and scavenged back to the inlet of the pump.

In the final stage of the separation process, the air stream flows into the vertical tank section and through the separator element.

VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 3)*

The remaining seal fluid particles coalesced in the separator element accumulate in the bottom of the element is scavenged back to the pump inlet from the top scavenger line.

The final discharge flows out the discharge stack. The majority of seal fluid remains in the inner shell and is circulated back through the heat exchanger and to the vacuum pump.



Principles of Operation – Multiplex

Vmax is a self-contained, oil-sealed, air- or water-cooled vacuum system utilizing 2 or more liquid ring vacuum pump systems.

VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 4)*

The operation of the individual vacuum systems is identical to the simplex Vmax. The entire unit is controlled by the use of vacuum switches, PLC logic, or the DEKKER controller. The operation of the system can be varied through the use of the HOA (Hand / Off / Auto) switch on the control panel.

In the Hand mode, each pump can be individually started and operated. In this mode, the vacuum system runs constantly and is not controlled by the vacuum switches or PLC logic.

In the Auto mode, the pumps will be controlled by the vacuum switches, transducers tied to PLC logic, or by the DEKKER controller.

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VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 5)*

Typical operation would be to set the differential between vacuum cut in and vacuum cut out to 3" HgV and the offset between each vacuum system set to 1" HgV when using a vacuum transducer (2" HgV if using a vacuum switch).

For example:

Pump 1 set to vacuum cut in at 21" HgV and vacuum cut out at 24" HgV for a 3" HgV differential.
Pump 2 set to vacuum cut in at 20" HgV and vacuum cut out at 23" HgV for a 3" HgV differential and a 1" HgV offset to the values in pump 1.
These values are set in this manner so if pump 1 is unable to satisfy demand and the vacuum drops below 20" HgV the second pump will start.

The system includes automatic alternation to allow for even run time for each system. When using vacuum switches, alternation takes place whenever a pump shuts down due to vacuum switch settings. When using a PLC, alternation takes place at a predetermined time, such as every 24 hours. When using the DEKKER controller, alternation takes when the run hours on the Lead Pump have exceeded the run hours on the Lag pumps, and it reaches its cut-out point. The controller always keeps the pump with the lowest run hours as the lead pump.

The system also includes frequent-start/stop protection by incorporating a 10-minute minimum run timer to prevent premature coupling and electrical component failure. When in Auto mode, each time the pump starts due to vacuum demand, it will continue to operate for 10 minutes. At the end of the 10 minutes, if vacuum demand has been met the pumps will shut off. If vacuum demand has not been met, the pump will continue to run until vacuum demand has been met.

Note: The possibility exists that the pumps can work on closed suction; if so, a vacuum relief valve must be installed to prevent cavitations. All DEKKER medical multiplex vacuum systems comply with NFPA 99 standards.

Principles of Operation — Vmax^{LT}

The Vmax^{LT} is a direct-drive, suction and pressure feed, self-contained oil-sealed, air-cooled vacuum system utilizing a motor-mounted liquid ring vacuum pump.

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VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 6)*

The seal-fluid oil is stored in the patented oil reservoir / separator tank. The vacuum system is started using a control panel, manual motor starter, DEKKER controller, or by other customer-supplied means. The vacuum created also acts to pull seal fluid to the pump. The discharge into the reservoir tanks creates positive pressure which also helps to push the seal fluid to the pump.

Starting the vacuum pump allows the seal fluid to flow from the separator tank, past the ball valve, the Y-strainer, and the check valve to the heat exchanger.

The seal fluid enters the heat exchanger through the lower seal-fluid line. Seal fluid exits the heat exchanger and feeds the pump. The seal fluid is pushed by tank pressure and pulled by a vacuum created by the pump.

VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 7)*

The seal fluid enters the liquid ring pump and circulates as described in the Principles of Operation – Liquid Ring Pumps. The discharged seal fluid exits the discharge manifold, past the temperature gauge and the optional temperature switch, then back into the reservoir tank.

The separation of seal fluid from the air stream follows the principles of the standard Vmax as described previously. Scavenger lines are located at the bottom of the outer shell and at the bottom of the separator element.

VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 8)*

Principles of Operation — Large-Capacity Vmax

The large capacity Vmax is a belt-driven, self-contained, oil-sealed air- or water-cooled vacuum system utilizing a liquid ring vacuum pump. Seal fluid is circulated by a circulation pump.

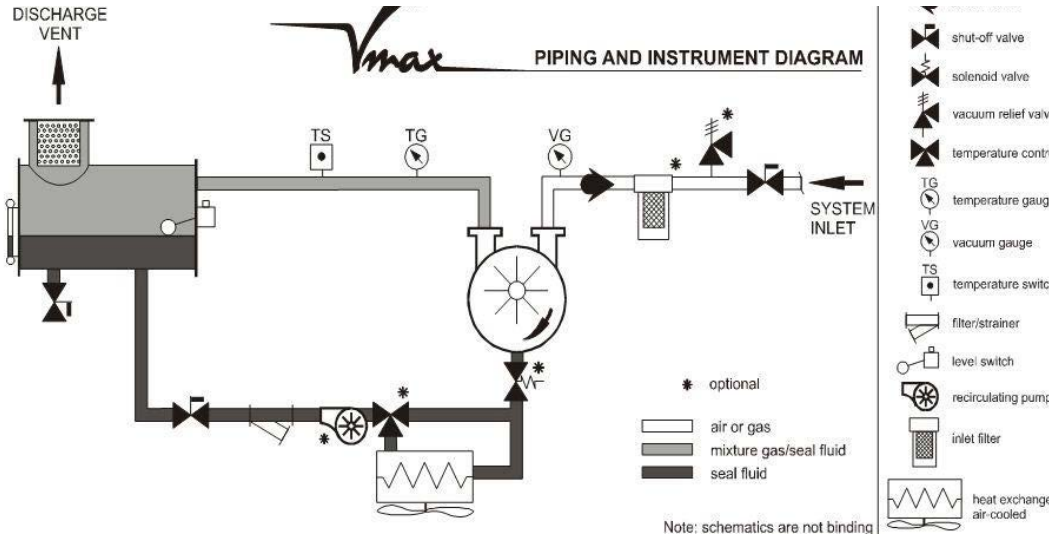
Operating principles are very similar to that of the standard Vmax systems. Seal fluid flows from the separator tank, through the heat exchanger to the vacuum pump. The large capacity vacuum pump produces vacuum as described in the Principles of Operation — Single Stage Liquid Ring Vacuum Pump. The seal-fluid separation process through the reservoir tank also remains similar to the standard Vmax systems.

Starting the vacuum system via the control panel, manual motor starter or DEKKER controller powers the seal-fluid circulation pump and energizes the vacuum pump motor. Seal fluid is pumped from the reservoir through the heat exchanger into the vacuum pump.

VMAX OIL-SEALED LIQUID RING VACUUM SYSTEMS *(continued from page 9)*

Seal-fluid flow is regulated by a globe valve and compound gauge located between the circulation pump and the vacuum pump. Compound gauge pressure is usually regulated to 0 psig. Excessive pressure indicates too much seal fluid to the vacuum pump. Excessive vacuum indicates too little seal fluid to the vacuum pump.

The pump operating temperature is controlled by the use of an adjustable temperature switch on the pump discharge which controls the heat exchanger fan. The switch is set to maintain a discharge temperature of 150°F to 180°F depending on the process application. The heat exchanger fan should be controlled using a 10-minute fixed timer to prevent excessive stop/starts.



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