Kinney

High Vacuum Pump
Setup, Operation & Maintenance

15 HP motor

~~Model~~ Size # 14-9-18

Serial # 14454

DIRECTIONS FOR SETTING UP AND OPERATING

Model # KD310

30 gal. oil

Mobil Vacuum pump oil

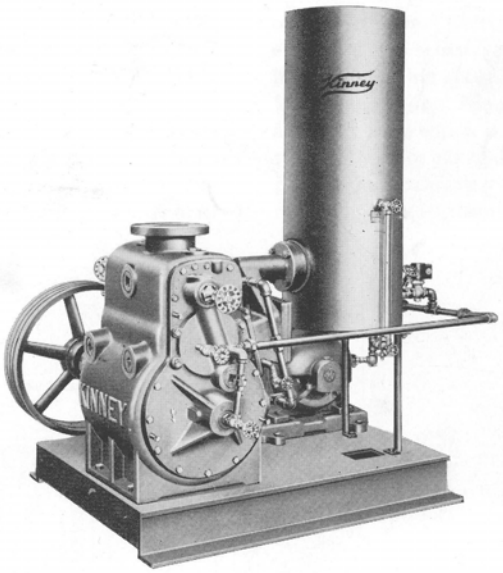
Chevron UCL pump oil

Kinney

HIGH VACUUM PUMPS

TYPE DVD

WITH REPAIR PARTS LIST



KINNEY MANUFACTURING DIVISION
THE NEW YORK AIR BRAKE COMPANY
BOSTON 30, MASSACHUSETTS

CHICAGO (La Grange) 17-19 LaGRANGE ROAD
CLEVELAND 15 2036 E. 22nd ST.
DETROIT 4 9190 ROSELAWN AVE.
HOUSTON 23 1682 INGEBORG ST.
LOS ANGELES 19 5058 VENICE BLVD.
NEW ORLEANS 13 1000 S. PETERS ST.
NEW YORK 6 90 WEST ST.
PHILADELPHIA 7 1638 PHILA. NAT'L BANK BLDG.
PITTSBURGH 3 BRADY & SIDNEY STS.
SAN FRANCISCO 11 360 JEFFERSON ST.
ST. LOUIS 8 4910 W. PINE BLVD.

DESCRIPTION OF OPERATING MECHANISM

Model DVD Single Stage Pumps

The main operating mechanism of the Kinney Mechanical, Oil Sealed Vacuum Pumps is similar, with certain modifications of detail, to the mechanism of the well known Kinney Rotating Plunger Liquid Pump. The simplicity of design and inherent high vacuum characteristic of these pumps have established an enviable record for dependability and low cost operation over a great many years in vacuum and liquid pump service, respectively.

This mechanism consists of three moving parts (1) the shaft with eccentric cams keyed on; (2) the rotating plungers with hollow arms cast integral which move freely in (3) the slide pins. There is one shaft with two sets of these parts operating in parallel in the duplex Model DVD pump, with cams set 180° apart.

The parts are accurately and carefully finished all over, and fit with minimum operating clearances in the pump cylinder and between the two heads. In the DVD pump, there is a center wall in the cylinder separating the chambers in which these parts operate. All parts are interchangeable and accessible without disturbing the pipe assembly. In the arm of the rotating plunger there are diagonal cored slots providing a passageway from the hollow portion of the slide into the cylinder, through which air is admitted.

INLET AND OUTLET VALVE DESIGN

Just before the plunger attains its highest position, these slots are completely closed mechanically by the slide pin, thus forming a positively operated inlet valve. As this device is not spring operated, no pressure difference is required to open this valve. Therefore, the pressure differential between system and pump is governed only by the "pumping speed" of the connecting pipe. This is an original Kinney design. There is also an outlet valve which is forced open by compression of the air or gas against atmospheric pressure plus slight spring pressure. For valve details refer to pages 10 through 13.

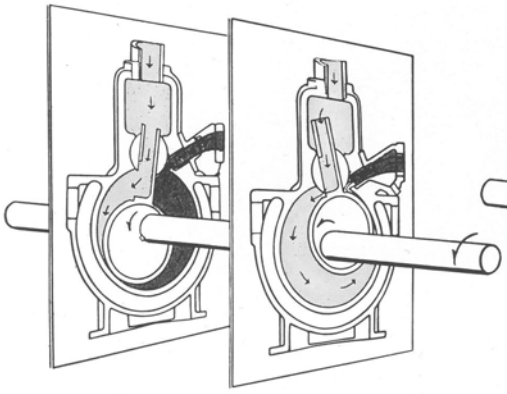


Fig. DVD 481 Single Stage Duplex Model DVD, with two plungers set 180° apart.

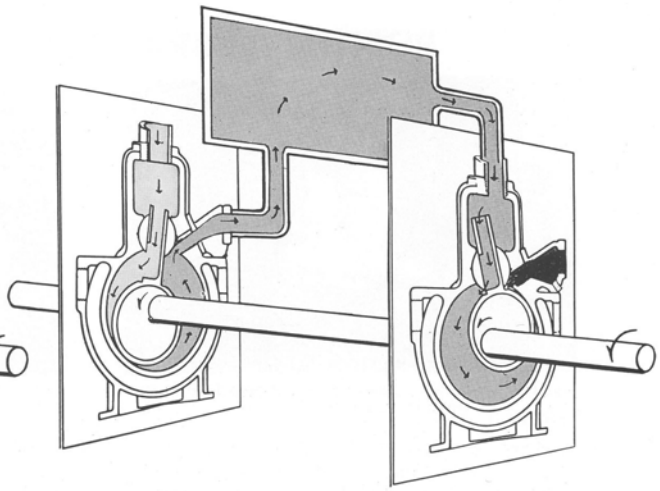


Fig. DVD 482 Compound Model CVD, with two plungers in series connected to oil chamber between stages.

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Description of Operating Mechanism (Cont'd)

MECHANISM OF EVACUATION

In order to produce and maintain high vacuum (low pressure) it is necessary to continuously exhaust air or gas from the space undergoing evacuation until the pressure in the system is reduced to the specified amount. The Kinney high vacuum pump accomplishes this by providing at each revolution additional space into which some of the gas molecules diffuse as a result of their natural motion. These molecules are thus trapped and expelled from the pump cylinder to the atmosphere by the motion of the rotating plunger.

HAND OPERATED UNLOADING VALVES

DVD 12814 and larger pumps are equipped with hand operated unloading valves in the heads as standard equipment. These valves may be opened for starting a cold pump or one which has accumulated an excess of sealing oil or condensate while shut down. These valves should be closed as soon as the motor gets up to speed.

OIL SEALING AND LUBRICATING SYSTEM

The oil separator tank is connected to the pump by suitable piping to provide both sealing and lubrication of the various working parts. In the main feed line a hand valve next to the tank is provided to shut off all flow of oil when the pump is stopped. A solenoid valve (next to this hand valve) for automatically stopping the oil flow can also be furnished at a small additional cost and is usually recommended. For instructions on the use and care of solenoid valves, see Page 7.

STUFFING BOX SEAL

A branch line, without valve, leads to the stuffing box and insures a positive head of sealing oil in the lantern ring ahead of the packing, thereby preventing leakage of atmospheric air into the pump. Further description of the oiling system is given below.

OIL USED OVER AGAIN

The separator tank is of sufficient capacity to allow any condensed vapor to settle out. The oil is then used over again. The above process, continuous and automatic, provides ample lubrication and very effective sealing at all times, insuring maximum efficiency, reliability and long life.

GRADE OF OIL TO USE

If very low absolute pressures are required, as .05 millimeter and less, a suitable grade of dried out oil should be used, such as KINNEY REGULAR DRY VACUUM OIL. In any case, the oil used should not be heavy and should be free from gases or moisture; otherwise vapors will be pulled out of the oil and prevent production of high vacuums. For higher pressures, a good grade of turbine lubricating oil may be used, having a viscosity of about 300 Seconds Saybolt Universal at 100° F. Automotive engine oils are not recommended. Most of the petroleum producers have a line of highly refined oils for use in rotary high vacuum pumps. Oils having a low vapor pressure are desirable for this service.

POSITIVE LUBRICATION AND SEALING

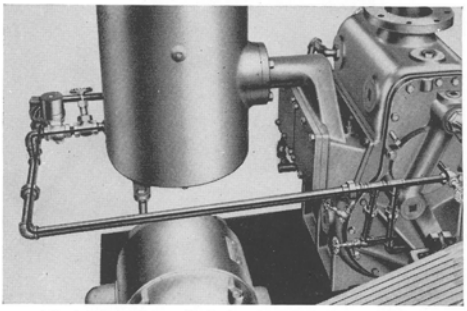

Fig. DVD 483 Lubricating Oil Seal Line to Open Head and Stuffing Box.

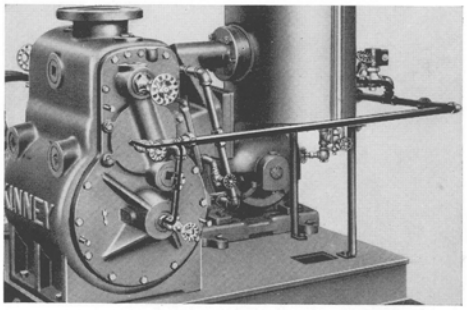

Fig. DVD 484 Lubricating Oil Seal Line to Closed Head.

A simple and very effective system of lubricating as well as sealing the working parts is provided for these pumps. A main feed line, with hand valve to shut off the oil flow when the pump is stopped, is fitted with branch piping connected to each pump head. Each of these branch lines is fitted with a needle valve to regulate the flow of the small amount of lubricating oil necessary. On the open head a branch line, without valve, leads to the stuffing box. The separator tank is located so that there is a static head of oil on the system at all times. In the case of the stuffing box, air leakage into the pump is prevented because it is always sealed with oil at a pressure above atmosphere. In the branch lines equipped with needle valves, the vacuum in the pump, plus the pressure due to the static head, assures a positive flow of oil under all conditions of operation.

HIGH VACUUM PUMPS • TYPE DVD

OPERATING CYCLE

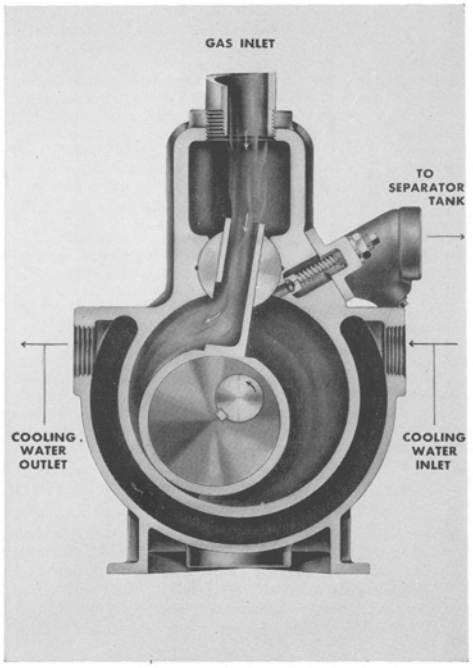

Fig. DVD 485 Rotating Plunger rapidly creates space for gas in pump chamber.

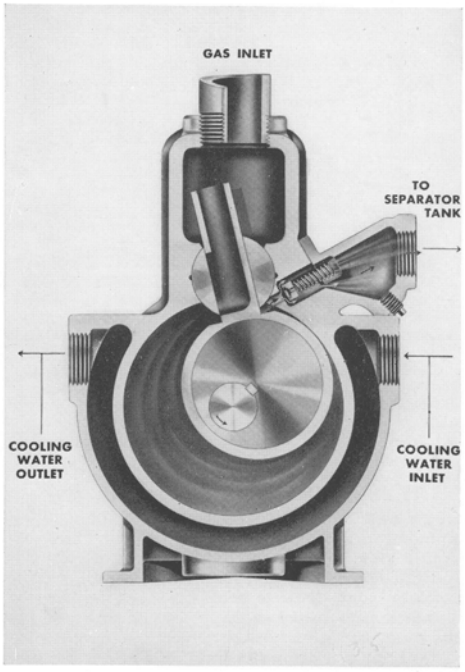

Fig. DVD 486 Rotating Plunger approaching end of discharge expels gas from chamber.

The operating cycle of the Kinney pump is shown by the cutaway views above. In Fig. DVD 485, the plunger moving in the direction of the arrow is rapidly creating space into which some of the gas is admitted through the inlet valve; at the same time, compression of gas previously trapped is taking place. In Fig. DVD 486, the plunger has almost reached its highest position, expelling all air or gas and surplus sealing oil through the outlet valve (feather type) and nozzle into the oil separator tank where the oil is retained and the air or gas is discharged to the atmosphere. With further movement of the plunger, the inlet valve is completely closed and the air or gas admitted to the full space created is trapped and then expelled in the manner previously described.

Throughout the operating cycle, the cylindrical part of the plunger is always tangent to the bore of the pump chamber. At the moving point of tangency, an effective oil seal is built up ahead of the plunger, which, in addition to the film of oil between the ends of the plunger and face of heads, as well as in the slide pin clearances, prevents leakage from the atmospheric to the vacuum side. Re-expansion is reduced to a minimum—a condition essential to low ultimate pressure and high pumping speed over the complete range of vacuum.

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INSTALLATION AND OPERATION

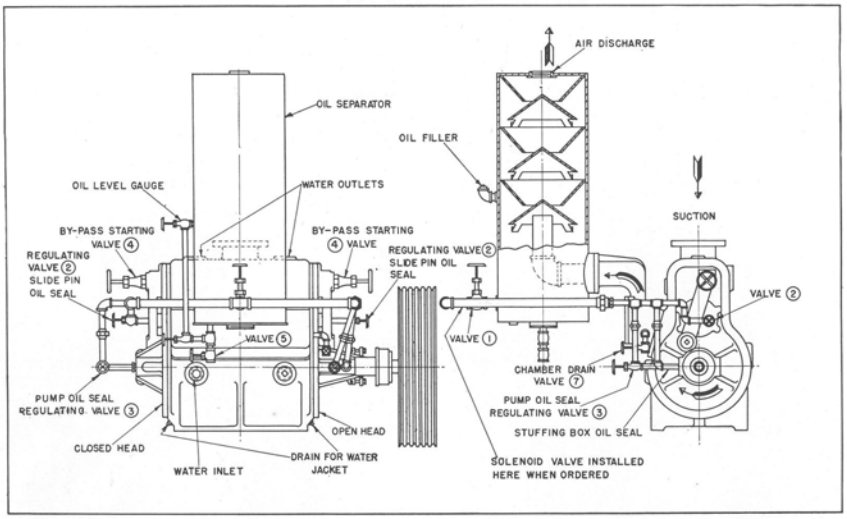

Fig. DVD 487 Diagram showing operating parts.

METHOD OF INSTALLATION

The pump should be mounted on a suitable rigid foundation and securely fastened down. The separator may be mounted adjacent to the pump as indicated in Fig. DVD 487 or, if desired, may be mounted some distance away, provided its elevation is sufficient to insure an ample flow of sealing oil to the pump.

DVD pumps are water-jacketed. The water outlet pipe should discharge into an open funnel in plain sight so that the operator can tell whether or not water is actually flowing through the jacket and can also make sure that flow and temperature are satisfactory. The water inlet is beneath the discharge nozzle of the pump. Only one inlet opening is generally piped up, the other being blanked off with a plug. Likewise only one water outlet at the top of the pump is used. For the water outlet, choose the one diagonally opposite the inlet to obtain cross flow through the jacket.

OPERATING INSTRUCTIONS

1. *Be sure that suction lines are absolutely free from all foreign matter and are perfectly tight.*
2. See that Hand Valve No. 1 in the oil seal pipe is closed.
3. Fill the oil separator to the level indicated by the gauge.
4. Be sure that the anti-friction bearing (V40—see Pages 10 and 12) on open head has been packed with grease.
5. Open Valves Nos. 2 and 3 from one to one and a half turns.
6. Open Starting Valves No. 4—furnished on larger sizes of Kinney Vacuum Pumps to permit the pump to be brought up to speed practically under no load conditions. (Valves Nos. 2 and 4 not furnished on DVD 8810.)
7. Turn on the power.
8. Be sure pump is rotating in the direction indicated by arrow on pump head. See Figs. DVD 485 and DVD 486.
9. Immediately open Hand Valve No. 1 wide—as this line supplies both sealing and lubricating oil to the pump. If oil seal line is equipped with a solenoid valve, it will open and close automatically. With solenoid valve, Hand Valve No. 1 may be left open during starting operation.
10. Open the water inlet valve until water flows out of outlet pipe in a small stream about the size of a pencil. This should be sufficient flow.
11. Close Starting Valves No. 4, if any, when pump is up to speed.

With the pump operating up to speed and after oil has had an opportunity to reach all parts, Valve No. 2 should be adjusted to about one-eighth turn open. No further adjustment of oil valves should be necessary unless operating conditions of the system change.

Solenoid valve may be furnished at extra cost to supplement Hand Valve No. 1 to automatically open and close oil seal line when power is turned on or shut off. The solenoid valve is electrically connected in parallel with motor starting switch.

TO STOP THE PUMP

1. Close Hand Valve No. 1 and allow pump to run about half a minute to free itself of oil. (It is NOT necessary to change Valves Nos. 2 and 3.) If solenoid equipped, it is not necessary to close Valve No. 1.
2. Close Valve in water inlet line.
3. Shut off the power.

Keep Valve No. 1 closed at all times when pump is shut down if oil seal line is not provided with solenoid valve. This prevents excess oil from being drawn into pump which would cause relatively hard starting.

The oil may be changed by drawing off through Valve No. 5 in the bottom of the oil separator tank.

HIGH VACUUM PUMPS • TYPE DVD

SOLENOID VALVES

GENERAL INSTRUCTIONS

1. All standard ASCO Solenoid Valves should be installed with solenoid (magnet) *vertical and on top.*

2. Valve bodies should be connected in the pipe line with the pressure drop across the valve in such a direction as to hold the valve disc or needle firmly on its seat when the solenoid is de-energized and the valve closed. (This applies to "normally-closed" valves in which the valve is closed when the solenoid is de-energized—the type supplied with DVD pumps.) The arrow on the valve body indicates the proper direction of pressure drop. If handling vacuums, the higher vacuum should be toward the point of the arrow or, in other words, at the downstream side.

3. Operating pressure must not exceed that specified on the nameplate. A valve rated at 15 psi will operate under a perfect vacuum or less.

4. Material handled by the valve should not be corrosive to or contaminated by the metal of which the valve body or trim is composed.

5. Pipe strain on valve bodies should be avoided by having the piping properly supported and aligned. *Note:* Sufficient support for the valve is usually afforded by pipe lines alone except in the case of valves with tubing connections.

6. Electrical connections must be made to line of proper voltage (and frequency, if AC) as specified on nameplate. Typical wiring connections for various methods of control are shown in Fig. DVD 488. Fig. 1 shows valve connected to line through a double pole control switch. For manual remote control, the switch may be an ordinary 5 amp. push button, tumbler, rotary, or similar switch. A single pole switch may be used but there is some chance of failure due to grounded wiring or control equipment.

Fig. 2 shows characteristic method of connecting Solenoid Valves to line through a Relay for 3-wire, momentary contact control by instruments having delicate contacts not suitable for handling the valve solenoid or its control circuits.

Figs. 3, 4, and 5 show very common methods of connecting Solenoid Valves. The valve is connected in such a manner that the valve opens when the motor is started, the case of normally-closed types—and vice versa for normally-open. When Multi-step Starter is used, full voltage must be applied to valve solenoid on all steps.

OVERHEATING OF COILS

Coils of ASCO Valves are designed to operate at about 50° C rise above normal room temperature. This is below the safe operating temperature of the type of windings used, but is too high to be borne by the bare hand. If coils emit a strong "hot" smell or smoke, they should be de-energized and the reason for overheating determined. Such overheating may be caused by abnormally high or low voltages if AC or over-voltage if DC. Failure of the solenoid plunger to rise when the coil of an AC valve is energized will cause overheating due to the high current which flows under this condition. Low voltage, sticking or jamming also cause overheating.

STICKING AND JAMMING

A periodic cleaning of any Solenoid Valve is desirable. Foreign matter will interfere with proper operation by causing leaks, sticking, or jamming.

WET COILS

Coils will fail if allowed to become wet. Standard ASCO Solenoids are designed for use in comparatively dry locations. Where valves are exposed to water or oil spray or very high humidity, weather-proof solenoids should be used. These are equipped with female connections for pipe threaded conduit, and solenoid housing is gasketed.

LEAKING

Needle point disc and seats may be reground with very fine grinding compound if scored, without removing the valve body from the pipe line. When renewable seats are used, new needle points should be installed whenever seats are replaced.

Renewable flat discs (Jenkins Type) of leather, composition, or metal should be replaced before they become unduly worn as continued leakage will destroy the valve seat. New discs should be installed when renewable seats are replaced.

NOISE

A slight magnetic hum like that in a small transformer is always present in an AC Solenoid Valve. A rattling noise when valve is energized is usually caused by foreign material collected around the core preventing proper seating of the plunger. To correct, remove solenoid and clean the inside of the tube and core. If rattling noise is present and valve fails to open, the difficulty is probably due to low voltage, attempting to operate the valve at pressure higher than its nameplate rating, or jamming due to foreign matter.

COIL REPLACEMENT

ASCO Valve solenoid coils can be replaced without removing the valve from the pipe line. In removing the original coil, note position of each washer and replace in proper order to insure that the coil will be held firmly in place to prevent chafing of insulation or broken leads.

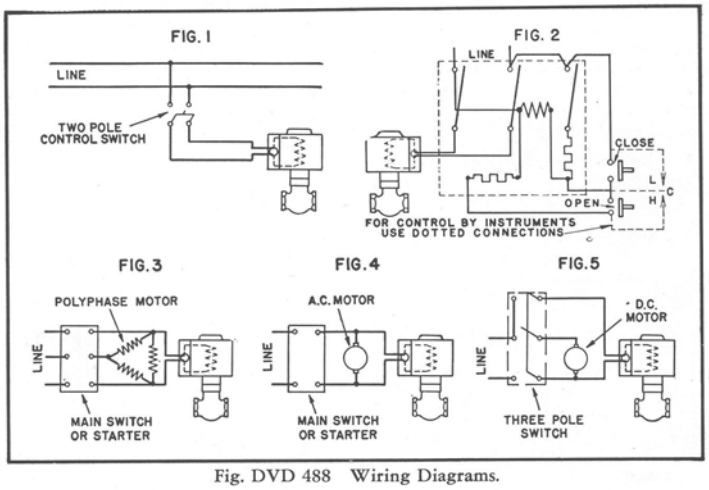

Fig. DVD 488 Wiring Diagrams.

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OIL SEPARATORS Plain and Heated

PLAIN

The Kinney Standard Separator Tank is carefully designed to separate the oil and water from the exhaust gases of the pump discharge and is equipped with a gauge glass to insure maintaining seal oil at proper level. The inlet to the oil line is located several inches above the bottom of the separator to allow water and foreign matter to settle out. This keeps seal oil in good condition and allows any waste accumulation to be drawn off by a valve.

HEATED

For vacuum distillation and similar services where considerable condensate is present, a special heated Kinney Separator (Fig. DVD 489) is available. This separator consists of a tank with upper and lower chambers. The upper, or heating chamber, into which the pump discharges, contains baffles over the entering pipe from the pump and a flat steam coil in a pan or, in some units, a large steam bulb. The separator may be furnished with an electrical heating element and thermostatic control (Fig. DVD 4810) to maintain proper flashing temperature. The lower, or cooling chamber, contains a large cooling coil.

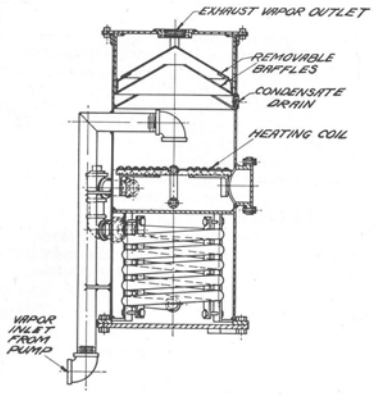

Fig. DVD 489 Oil Separator, steam heated.

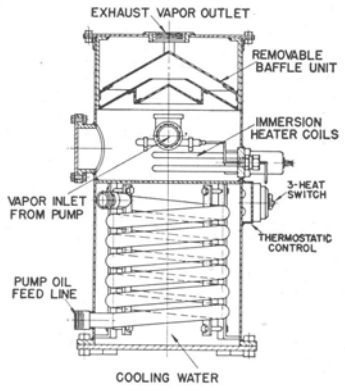

Fig. DVD 4810 Oil Separator, electrically heated.

In operation, oil discharged from the pump into the upper chamber falls on the heating coil where water is flashed off. All oil collected in the upper chamber then flows through the by-pass from the upper chamber into the cooling coil immersed in water where it is brought to proper temperature before returning to the pump.

Vapor flashed off by the heating unit rises and condenses on baffles or collector rings and is caught and automatically drained off instead of dropping back into the oil being processed. By flashing off condensable vapors, this system preserves the sealing oil and eliminates frequent changing of oil due to contamination. The oil is purified without being churned full of entrained air. This is important since entrained air would be re-expanded when taken back into the pump and would greatly reduce the pump's effective capacity.

DRAINING

Any moisture in the system being evacuated will be drawn over into the pump and condensed and will collect as water in the oil separator. This water should be periodically drawn off by the drain cock provided for this purpose.

Where this moisture comes over in sufficient amount to require frequent drainage this might be taken care of automatically by connecting a tube to the drain cock and carrying it vertically outside the tank to a point slightly below the normal oil level, thence to the sewer. When this arrangement is used (Fig. DVD 4811) it is well to carry about an inch of water in the bottom of the separator at all times; then, as the level of oil and water is raised by additional moisture from the pump, the water in the bottom will be gradually forced up through the tube and overflow to the sewer and will be replaced by the gradual settling out of the water that comes from the pump. A vent should be made in the top of the leak-off pipe to prevent siphoning. A valve, installed in this line as shown, is kept closed while starting the pump.

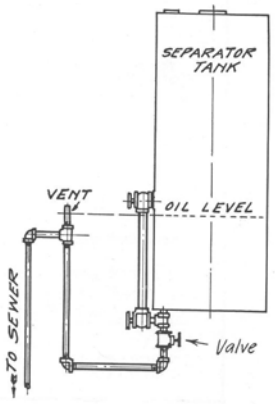

Fig. DVD 4811 Piping connection for automatic drainage of moisture from separator.

HIGH VACUUM PUMPS · TYPE DVD

LOCATING TROUBLES

If the system is not operating perfectly, a few simple checks should be made to determine the source of trouble before dismantling the equipment. Probably the most common pump troubles will be due to leaks in pump or system and contamination of the sealing oil.

VACUUM PIPING

To maintain efficient and satisfactory operation of the unit as a whole, all joints and connections should be inspected periodically for leaks and where suspected, the area should be given a liberal coat of General Electric Red Glyptol No. 1201, shellac, or similar material. Should any pipe connections be found which have been loosened due to vibration or other causes, they should be tightened before applying the Glyptol.

In making up pipe connections, the use of flanged connections with neoprene rubber or other suitable gasket is recommended in preference to conventional pipe unions. This latter type of connection requires exceptional care to make sufficiently tight for suction lines on high vacuum systems. In making up threaded joints, the members should be screwed together about 2 turns; the exposed thread then heavily coated with Glyptol or shellac, and the joint finally screwed together tightly. It is desirable to let the Glyptol dry for a few hours before evacuation to prevent sucking in.

BLANKOFF VALVE

When installing the system, it is highly desirable to provide a vacuum valve between the system and the pumping unit.

This permits checking the system and pump independently in the process of locating leaks or other faults.

Gauges used in testing equipment are of two general types: (1) total pressure reading type such as Pirani or Thermo-couple and (2) partial pressure type such as the McLeod Gauge. This latter type will indicate the mechanical condition of the rotary pump. The Pirani or Thermo-couple is preferable for checking the entire system as the trouble may be due to water or other vapors. Water vapor is a condensable type of gas whose exact pressure the McLeod Gauge fails to record.

Except on the 8810, the DVD pumps have a pipe connection on the throat under the suction flange which may be used for the vacuum gauge. The 8810 pump has a suitable connection on the head. A connection should also be provided on the system side of the valve in suction line. By attaching a pipe nipple at these points, the vacuum gauge or gauges may be attached by a short piece of rubber tubing. By means of special clamps, the gauges may be cut off from the pump or system merely by compressing the rubber tube with the clamp.

By closing the valve in the suction line after the system has been pumped down, any leaks that are present will be indicated by a rapid rise in pressure. The leakage indicated by this pressure rise on the system side may be measured by the formula

$$Q = \frac{Pl - Po}{T} \times C$$

where Po (mm Hg) = Attainable pressure with valve open
Pl (mm Hg) = Pressure after the valve has been closed for a measured interval
T (minutes) = Measured time interval for pressure rise Po to Pl
C (Cubic Ft.) = Volume of system
Q (C.F.M. @ 1 mm Hg = Rate of leakage into the system = 760 × rate at atmospheric pressure.

If the system is reasonably tight, readings can then be observed on the pump side of the valve. If the total pressure is in the range of 50 to 100 microns on Pirani gauge, the trouble may be due to a vaporous oil condition, possibly water in the oil. If water, this may be observed by a definite separation in bottom of the gauge glass. If this condition exists, the pump should be shut down and the oil drained.

Open the pump suction to the atmosphere. This may be done by removing the vacuum gauge from its connection on the pump. Start the pump and run for about a minute in order to clear itself of all contaminated oil. Close the oil drain valve and reconnect the gauge. Refill the separator with fresh oil until the oil is level about 1″ from the top of the glass. Start the pump, making sure that it is blanked off to atmosphere. Sometimes the desired results are obtained with one change of oil, but it may be necessary to repeat the process to fully clear the pump of contaminants.

If changing of oil fails to correct the trouble, the exhaust valves should be inspected. The oil should be drained from the nozzle chamber by opening the Drain Valve No. 7 (Fig. DVD 487) or, in the 8810, by removing pipe plug from bottom of nozzle. On 12 x 8 and larger, the nozzle covers V47 (Fig. DVD 4816) may be removed, permitting of examination or removal of valves. In the poppet valve type Model DVD 8 x 8, the valve can be reached by removing valve cover V70 (Fig. DVD 4813).

DVD 8 x 8 is also manufactured with feather type exhaust valves (Fig. DVD 4812). With this construction, the separator tank can be removed by breaking the union in the oil seal piping and also the union at bottom of separator. The nozzle screws can now be removed and the nozzle lifted off, care being taken not to break the nozzle gasket. Carefully remove the valve assembly (springs, spring covers, valve blocks and feather valves) checking the location of each. The feather valve should show well defined circular marks corresponding to the exhaust ports in the pump housing. If the markings are not absolutely uniform, a leak is indicated and the valve should be replaced. If the valve is marred in any other way, it should also be replaced.

The valve assembly should then be reassembled exactly as it was, the nozzle put back and the separator tank reconnected.

Inspect the oil lines and stuffing boxes of the needle valves for leaks. Solenoid valve should also be checked (see instructions Page 7).

If the oil separator tank is cool and the pump excessively warm, it is an indication that proper oil circulation is not being obtained. By occasionally opening the needle valves fully, the piping and valves of the oil seal lines can be kept clean for proper circulation.

OVERHAULING THE PUMP

In dismantling the pump, stop the pump in accordance with instructions on Page 6 and drain the oil from the nozzle through Valve No. 7. The tank, nozzle and valves can now be removed. Probably the simplest method to remove the poppet valve would be by use of an improvised puller after removing cotter pin, unscrewing valve guard, lifting out the spring and valve disc. Sketch of puller will be furnished if requested. Remove the working parts, observing the assembly of these parts and being sure of their location, so that when reassembled they will be put back in their original position.

To reassemble the pump, clean all parts thoroughly and put back in accordance with the original assembly. As shown in Fig. DVD 4814, the ends of the slide pins, Part No. 7 of DVD 8810, are of unequal thicknesses. The thin ends must go toward the cylinder centerwall—otherwise the head cannot be made up tight to the cylinder. Be sure to coat all bearing surfaces with clean turbine or pump seal oil so that these surfaces will be lubricated when starting pump. Use shellac on the heads to make tight joint between faces of cylinder and heads. *Never use gaskets.*

(Continued on next page.)

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Locating Troubles (Cont'd)

When starting pump after an overhaul, Valves 1, 2 and 3 (Fig. DVD 487) should be wide open until pump has been thoroughly lubricated. The needle valves in the sealing line should then be adjusted to give the best results for the particular operating conditions under which the pump will operate.

GENERAL

Both the poppet valve and feather valve have a distinct noise when operating at a high vacuum. If large quantities of gasses are passing through the pump, the valves will be quieter.

Pipe sizes should be maintained as short and as large in diameter as practicable. In general, the length and diameter of the pipe between the system and the pump should be such that the pressure drop along this connecting pipe does not exceed 20% of the desired operating pressure. The following formula provides a means of approximating this pressure drop:

$$\text{Pressure drop (mm Hg)} = \frac{1.9 \times S \times L}{1000 \times D^4}$$

where

S = "Pumping speed" in CFM of the DVD pump for the expected operating pressure, P, mm Hg (Obtain "pumping speed" from curve in Fig. V4524 of Bulletin V45)

L = Length of connecting pipe in feet

D = Inside diameter of connecting pipe in inches

ASSEMBLY DVD 8810

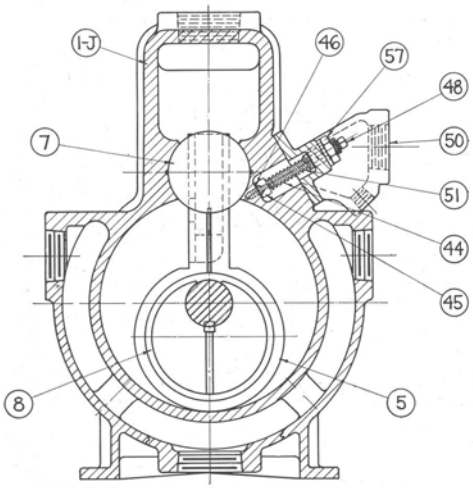

Fig. DVD 4812 Feather Valve Construction

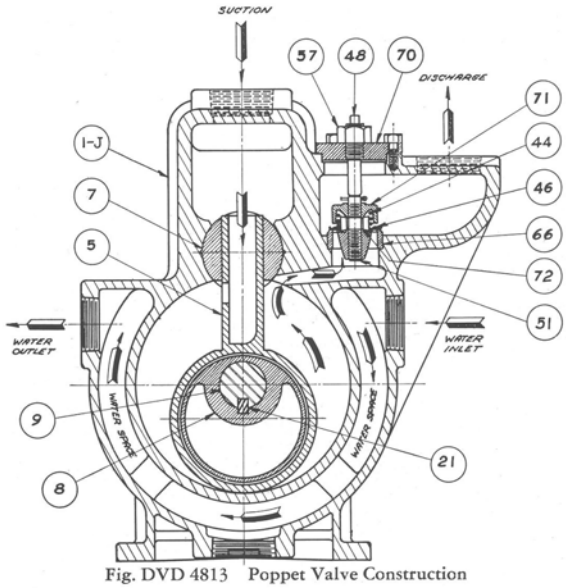

Fig. DVD 4813 Poppet Valve Construction

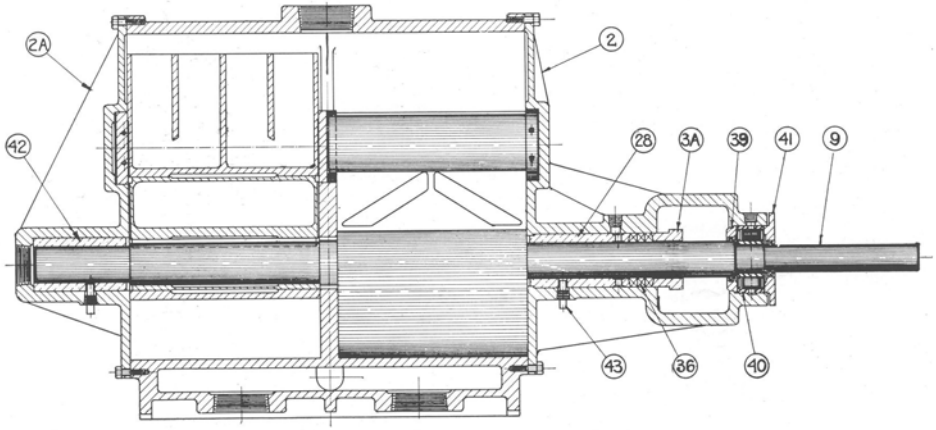

Fig. DVD 4814 Longitudinal Cross-Section.

HIGH VACUUM PUMPS • TYPE DVD

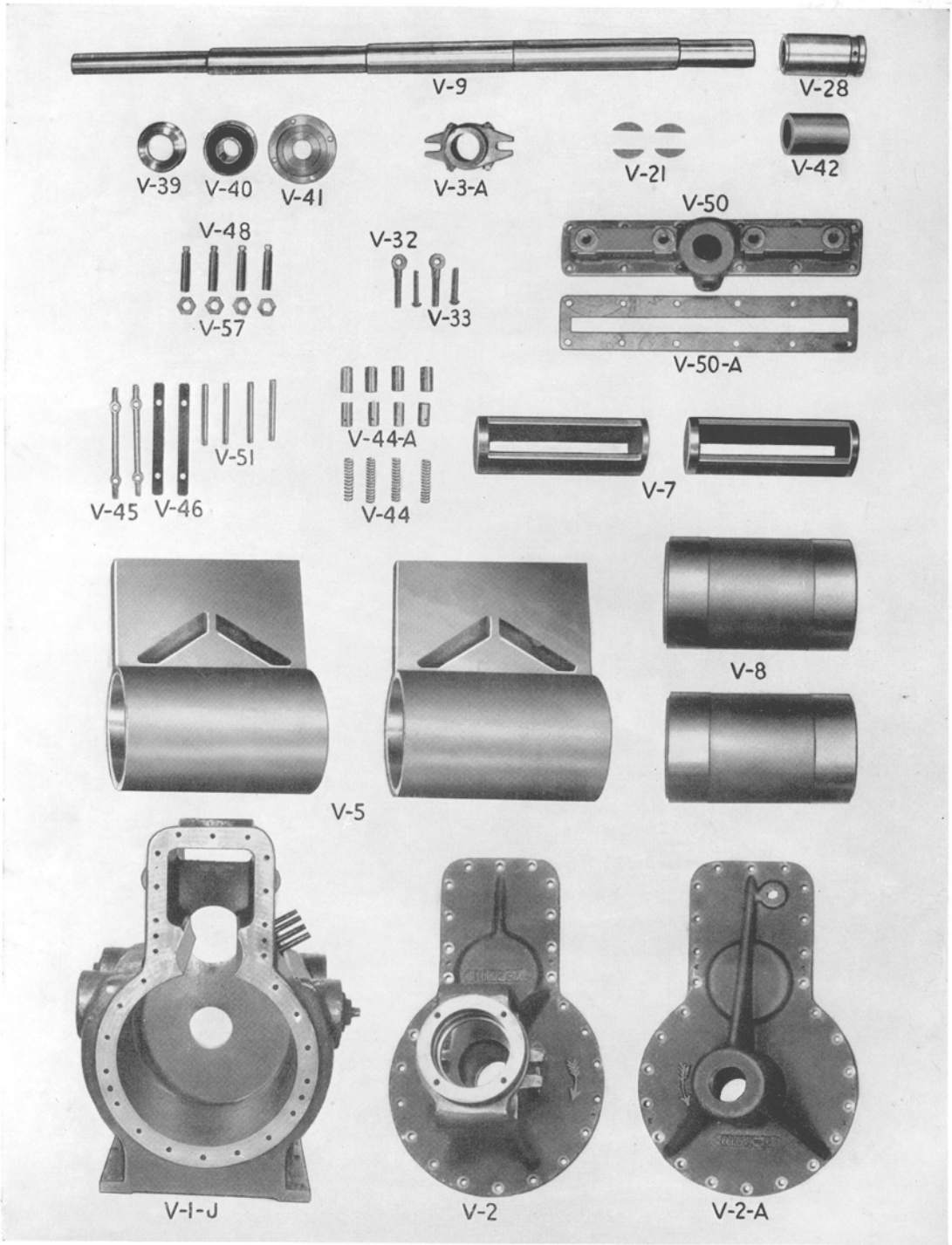

Fig. DVD 4815 Repair Parts for Model DVD 8810 (Feather Valve parts shown . . . for Poppet and Feather Valve Parts see parts list Page 14)

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ASSEMBLY DVD 12814 TO DVD 181420

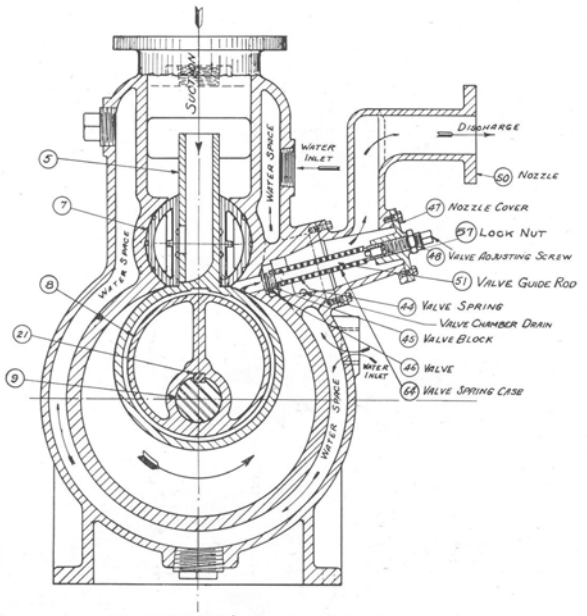

Fig. DVD 4816 Feather Valve Construction.

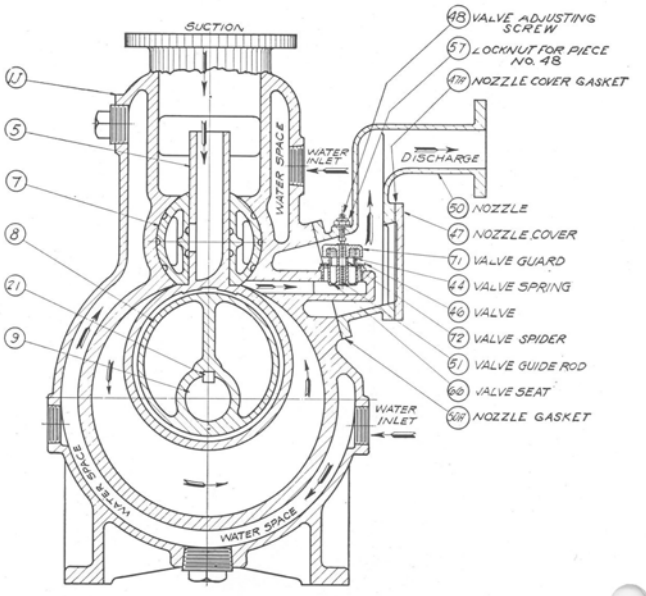

Fig. DVD 4817 Poppet Valve Construction.

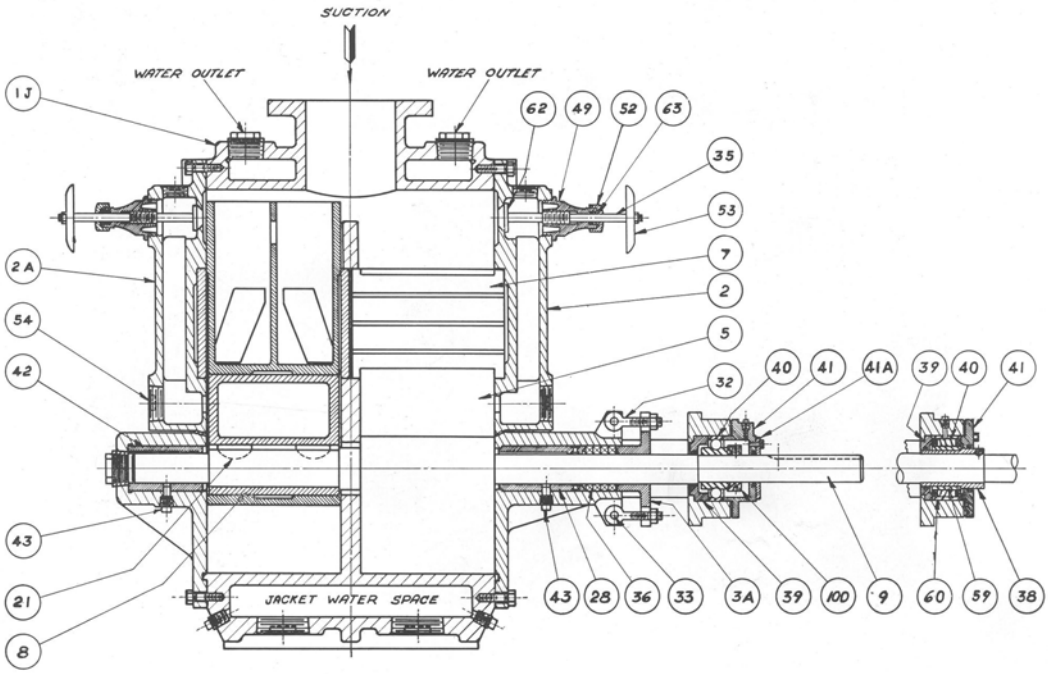

Fig. DVD 4818 Longitudinal Cross-Section.

HIGH VACUUM PUMPS • TYPE DVD

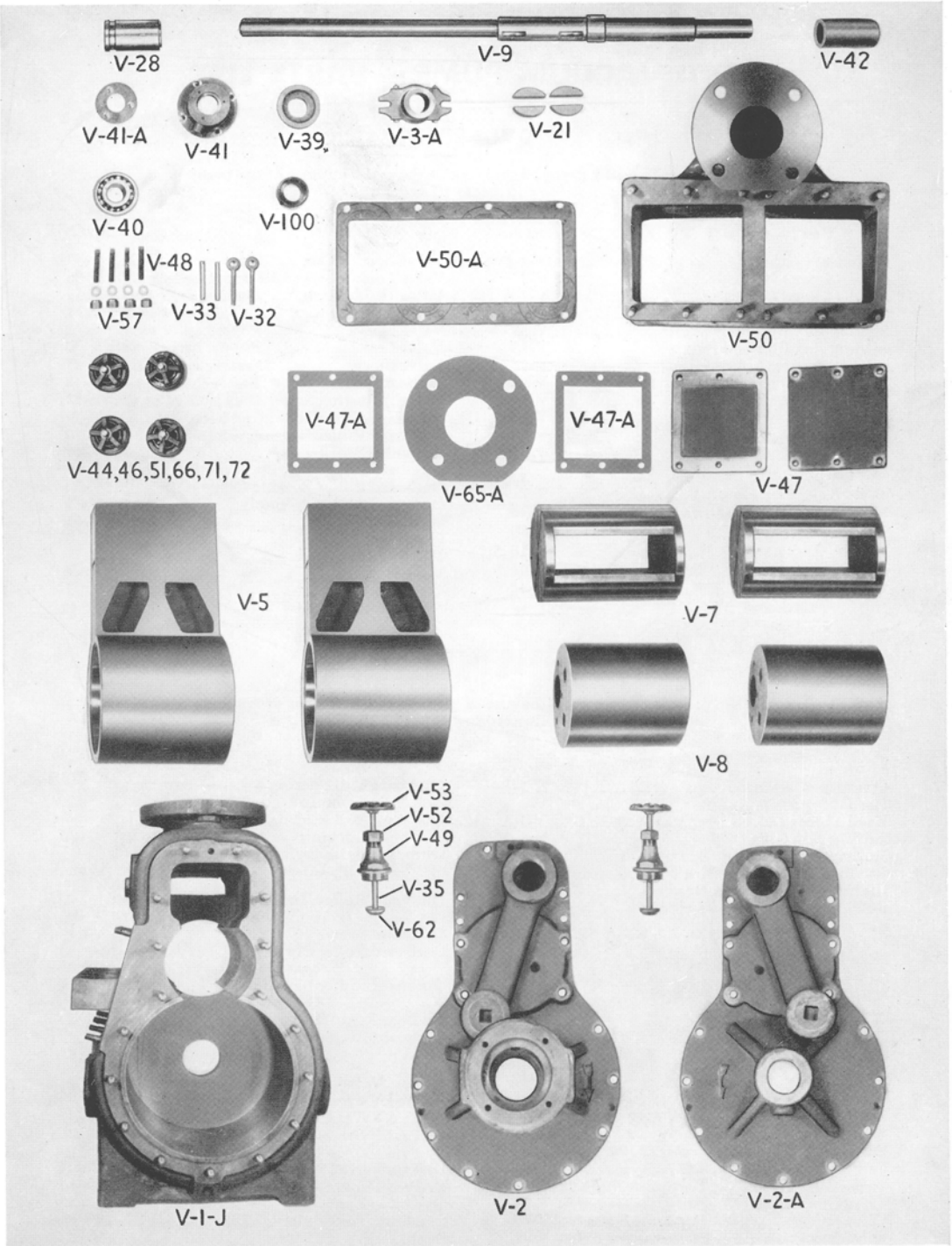

Fig. DVD 4819 Repair Parts for Models DVD 12814 to DVD 181420.
See Parts List, Page 14

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DVD VACUUM PUMP — PARTS LIST

DVD 8810

When ordering repair parts, be sure to give the serial number of the pump.
See cuts pages 10 and 11.

Part Name		Part No.
Cylinder (Jacketed)		V-1-J
Head (Open)		V-2
Head (Closed)		V-2-A
Stuffing Box Gland		V-3-A
Stuffing Box Rod Ends		V-32
Stuffing Box Rod End Pins		V-33
Bearing Lining (Open Head)		V-28
Bearing Lining (Closed Head)		V-42
Bearing Set Screw		V-43
Piston		V-5
Slide Pin		V-7
Cam		V-8
Shaft		V-9
Shaft Key		V-21
Shaft Packing (not shown)		V-36
Nozzle		V-50
Nozzle Gasket		V-50-A
Valve	*Feather or Poppet*	V-46
Valve Spring	*Feather or Poppet*	V-44
Valve Spring Case	*Feather valve only*	V-44-A
Valve Seat	*Poppet valve only*	V-66
Valve Guide Rod	*Feather or Poppet*	V-51
Valve Guard	*Poppet valve only*	V-71
Valve Spider	*Poppet valve only*	V-72
Valve Cover	*Poppet valve only*	V-70
Valve Block	*Feather valve only*	V-45
Valve Adjusting Screw	*Feather or Poppet*	V-48
Valve Adjusting Screw Lock Nut	*F. or P.*	V-57
Outboard Grease Retaining Ring		V-39
Outboard Roller Bearing Complete		V-40
Outboard Bearing Cap		V-41
Outboard Roller Bearing Inner Race		V-59
Outboard Roller Bearing Outer Race		V-60
Outboard Roller Assembly		V-61
Separator Tank		V-65
Pump Pulley		V-30
Motor Pulley		V-37
V-Belt		V-34
Taper Pins		V-92

DVD 12814 to DVD 181420

When ordering repair parts, be sure to give the serial number of the pump.
See also illustrations, pages 12 and 13.

Part Name		Part No.
Cylinder (Jacketed)		V-1-J
Head (Open)		V-2
Head (Closed)		V-2-A
Stuffing Box Gland		V-3-A
Stuffing Box Rod Ends		V-32
Stuffing Box Rod End Pins		V-33
Bearing Lining (Open Head)		V-28
Bearing Lining (Closed Head)		V-42
Bearing Set Screw		V-43
Piston		V-5
Slide Pin		V-7
Cam		V-8
Shaft		V-9
Shaft Key		V-21
Shaft Packing		V-36
Nozzle		V-50
Nozzle Gasket		V-50-A
Nozzle Cover		V-47
Nozzle Cover Gasket		V-47-A
Valve	*Feather or Poppet*	V-46
Valve Spring	*Feather or Poppet*	V-44
Valve Spring Case	*Feather valve only*	V-44-A
Valve Seat	*Poppet valve only*	V-66
Valve Guide Rod	*Feather or Poppet*	V-51
Valve Guard	*Poppet valve only*	V-71
Valve Spider	*Poppet valve only*	V-72
Valve Block	*Feather valve only*	V-45
Valve Adjusting Screw	*Feather or Poppet*	V-48
Valve Adjusting Screw Lock Nut	*F. or P.*	V-57
Outboard Grease Retaining Ring		V-39
Outboard Ball Bearing Complete	DVD 12814 and 14918	V-40
Outboard Ball Bearing Locking Collar	DVD 12814 and 14918	V-100
Outboard Ball Bearing Cap Cover	DVD 12814 and 14918	V-41-A
Outboard Roller Bearing Complete	DVD 141418 and 181420	V-40
Outboard Bearing Cap	DVD 141418 and 181420	V-41
Outboard Roller Bearing Inner Race	DVD 141418 and 181420	V-59
Outboard Roller Bearing Outer Race	DVD 141418 and 181420	V-60
Outboard Roller Assembly	DVD 141418 and 181420	V-61
Outboard Roller Bearing Sleeve	DVD 141418 and 181420	V-38
By-Pass Valve (Valve Disc)		V-62
By-Pass Valve Bonnet		V-49
By-Pass Valve Gland		V-63
By-Pass Valve Handwheel		V-53
By-Pass Valve Nut		V-52
By-Pass Valve Plug		V-54
By-Pass Valve Stem		V-35
Separator Tank		V-65
Separator Tank Inlet Gasket		V-65-A
Pump Pulley		V-30
Motor Pulley		V-37
V-Belt		V-34
Taper Pins		V-92

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