Westinghouse

Rotary Oil-Sealed Vacuum Pump

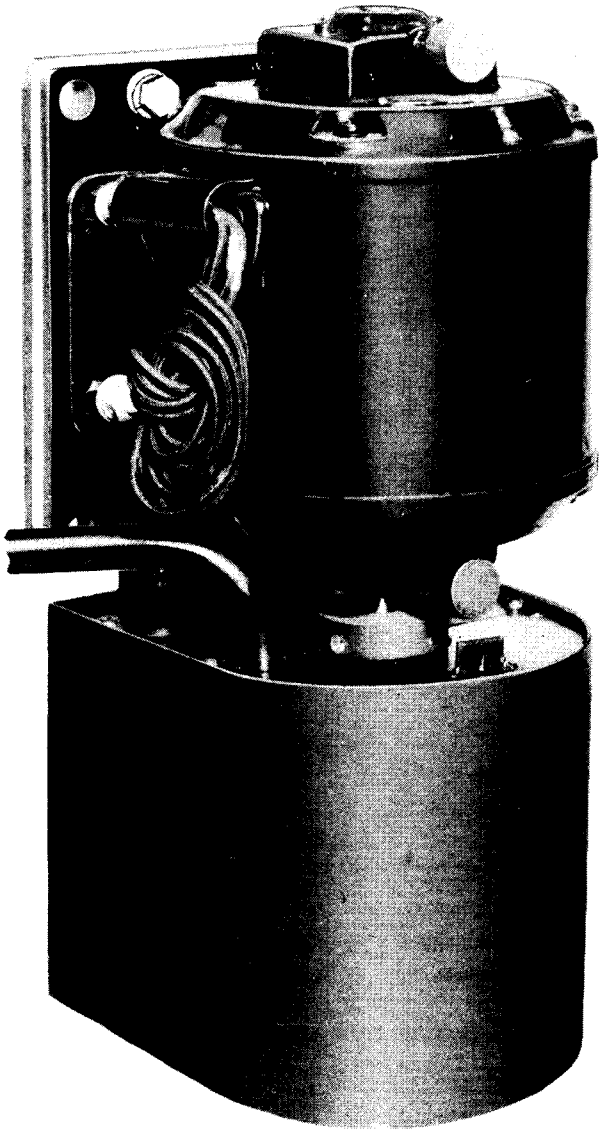

FIG. 1 – ROTARY OIL-SEALED VACUUM PUMP – VERTICAL MOUNTING

APPLICATION

The rotary oil-sealed vacuum pump is designed especially to be used as a backing pump for a mercury vapor diffusion pump, but may be used in any application where pressures of the order of 1 millimeter are desired. Although usually applied for intermittent operation, it is designed for continuous operation.

PRINCIPLE OF OPERATION

A cross section of the pump is shown in Figure 2. The rotor is eccentric to the frame so that there is a crescent-shaped chamber for entrapping gas between the frame and rotor. Two blades sliding in slots in the rotor are held in contact with the frame wall by centrifugal force. The action of the rotating blades draws the air through the intake port and forces it out the discharge port. The gas tightness of the working parts is obtained by accurately finished surfaces sealed with a film of oil. The oil also provides lubrication for the moving parts.

CONSTRUCTION

Figure 1 is a photo of the pump and driving motor with the vertical mounting. Figure 2 shows a cross section and top view of the pump. Figure 3 is a sketch of the general assembly of the pump, coupling and driving motor.

End Shields and Frame

The end shields consist of two accurately ground nickel steel castings as shown in Figure 2. An aluminum foil gasket of ".002 is inserted between the end shield and the frame to give the proper clearance between the rotor and the end shield. A special pivot stud pin is used to permit the rotor to be adjusted with respect to the frame. The frame consists of an accurately ground nickel steel casting.

Packing Gland and Bearings

The pump is equipped with self-aligning ball-bearings and the rotor shaft is also supported by a ball-bearing. The pressure applied to the supporting bearing can be adjusted by turning the bearing bolt on the bottom end shield. The rotor shaft is sealed with a graphitized fibre gland to prevent entrance of excess oil.

Intake Connection

This consists of a piece of copper tubing sealed into the pump frame with Kerotest fittings. When these fittings are tightened together they form a vacuum tight joint. A small opening, ".013, in the intake of the pump and below the oil level is provided to allow the proper amount of oil from the reservoir to enter the pump for lubrication and sealing purposes.

Discharge Valve

This is a ball type check valve. The insert in a machined steel bar is designed to allow the ball the proper travel for most efficient operation of the pump. A small hole is provided in the discharge pipe, below the oil level, to allow sufficient oil to be maintained in the valve assembly for proper seating of the ball.

Oil Reservoir

The oil reservoir is shown in Figure 3. A special vacuum oil is used which is free from moisture and retains its viscosity at low and high temperatures. The oil supplied with the pump is Westinghouse M. No. 2726.

The Driving Motor

The rotary vacuum pump is directly coupled to the driving motor. Satisfactory operation will result at speeds from 800 to 1800 rpm. The vertical mounting arrangement eliminates the need of an oil tight stuffing box where

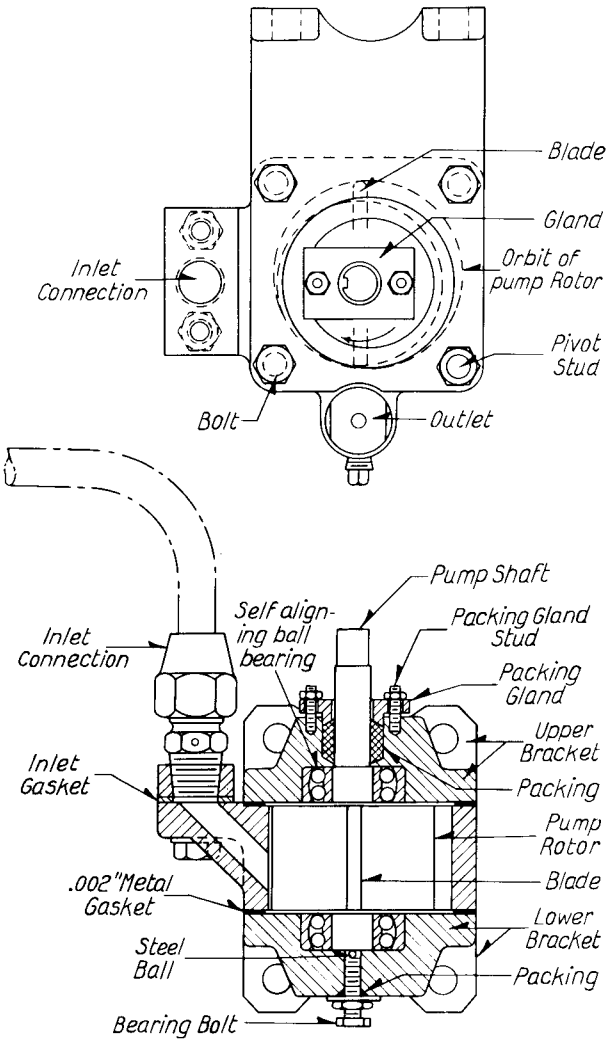

FIG. 2 – TOP AND CROSS SECTION VIEW OF ROTARY OIL-SEALED VACUUM PUMP ONLY

the rotor shaft enters the oil reservoir. This motor is rated at 1/4 H.P. and its voltage and frequency depend on the system supply. The motor is mounted on an insulated bedplate and is coupled to the pump with an insulated coupling, thereby providing insulation between the auxiliary power circuit and the mounting. This insulation is desirable where the pump bedplate is mounted on equipment that has high potentials above ground.

PUMP CHARACTERISTICS

The average rate of evacuation is approximately .7 to .8 liter per second, or it will evacuate a 55-liter tank from atmospheric pressure to 1 millimeter of mercury pressure in approximately 7.5 minutes.

ADJUSTMENTS

To produce vacuum the direction of rotation of the pump must be as indicated by the arrow.

The pump is properly adjusted and tested in the factory and should require very little adjustment in service. The proper adjustment for the pump has been determined by extensive tests and most of these settings have been made fixed. Provisions are made to prevent wear from changing these settings.

The packing gland around the rotor shaft must be kept tightened so that it fits snugly. The oil in the reservoir should be kept at the oil level mark, or approximately 1/8 inch below the coupling.

MAINTENANCE

If this pump is applied on either intermittent or continuous operation, no major maintenance or repair should be required for a period of years. Inspection periods vary with individual users and it is possible to allow some flexibility in inspecting the pump. The following inspections are suggested:

The level of the oil in the reservoir should be checked every six weeks.

The oil should be checked every three months to determine if it contains any dirt or grit. In case the oil is dirty, it should be replaced with clean vacuum pump oil. This will require from 3-1/4 to 3-1/2 quarts of oil.

A check should be made every six months on the time required to evacuate the tank to which connected. In case the time has greatly increased, it may be necessary to adjust the rotor contact to the frame or it may mean that the packing gland is allowing oil to leak into the pump. The pump can be rotated by hand with the discharge port temporarily closed. If the gland is leaking, oil and air will bubble out around the shaft. If it is necessary, the bolts on the gland may be tightened until a snug fit around rotor shaft is secured. If the packing is worn it should be replaced with new graphitized fibre packing.

Another check on the speed of pumping should be made. If there still is no improvement in the time of evacuation, the rotor should be adjusted to make better contact with the frame surface. To do this, remove the oil reservoir and then remove the pump from the bedplate. Place the end shield feet on a level surface and slightly loosen the four bolts that hold the top end shield to the frame. Tap the frame until the rotor's contact with the frame makes the rotor rather stiff to turn by hand. Then tighten bolts on end shield and replace the pump on bedplate. Care should be taken to see that the pump shaft is properly aligned with the motor shaft, and that no strain is placed on the pump body in bolting to the bedplate as a slight distortion will cause binding and faulty operation of the pump.

ROUTINE MAINTENANCE

The pump should be overhauled and cleaned at least once every three years. To do this, first remove the oil reservoir and then the pump from the bedplate. Remove both end shields. Wash all parts in benzine. Blow out all ports and passages with compressed air or a bellows. Inspect surfaces of rotor, interior of frame, and inside of end shields for any excessive wear. In case any of the surfaces are badly scored from dirt or grit in the oil, a new part should be installed. However, the possibility of dirt causing trouble is rather remote as the reservoir cover is dust-proof. New packing should be installed in the gland around the rotor shaft. New aluminum foil gaskets should be used between the frame and end shield. Then assemble the pump and test for speed by checking speed of pumping.

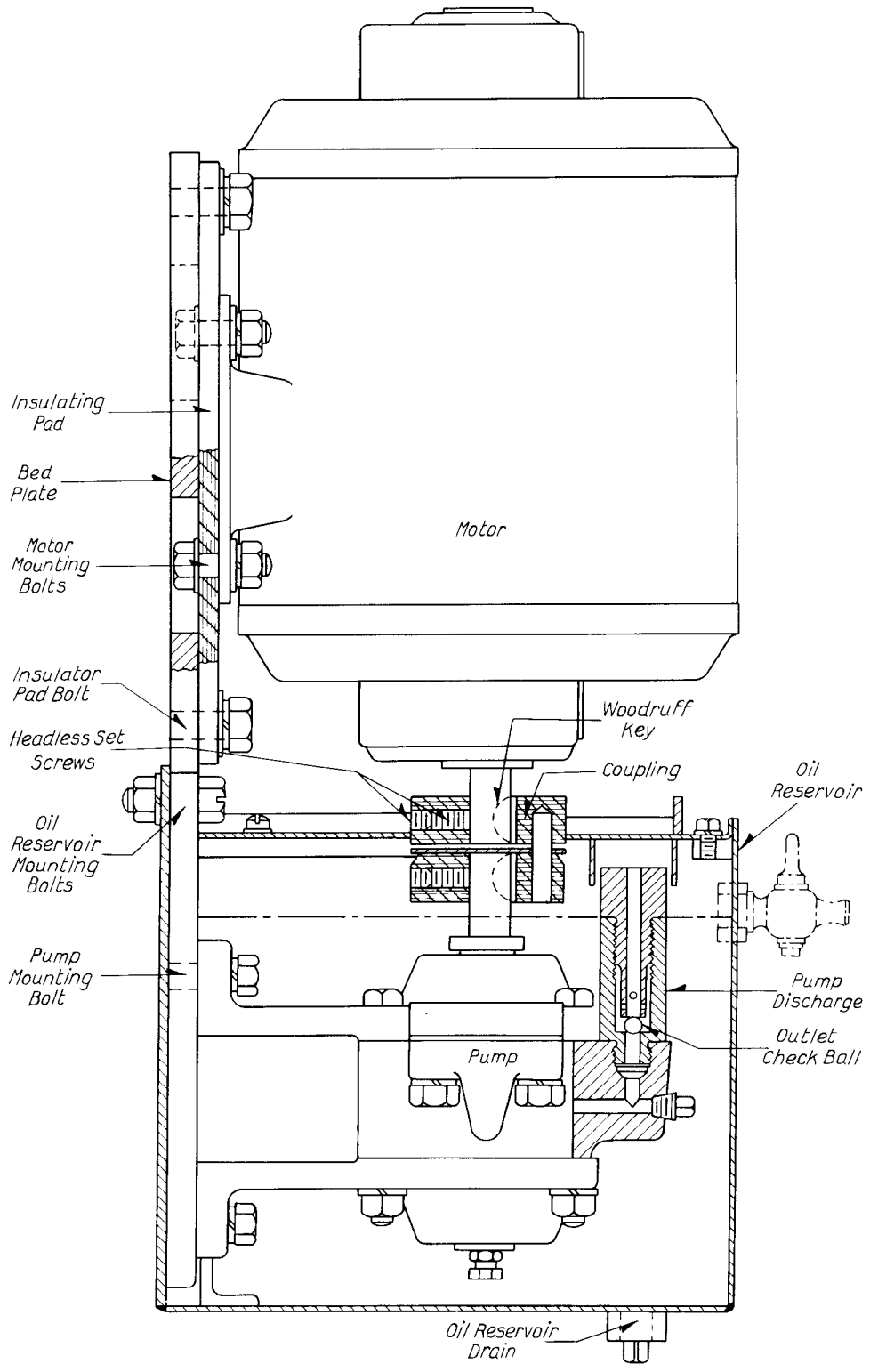

FIG 3 – SIDE VIEW OF ROTARY OIL-SEALED VACUUM PUMP SHOWING MOUNTING DETAILS AND COUPLING

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