

MEDÆS Intermittent Duty Medical Vacuum System

OPERATION & MAINTENANCE MANUAL

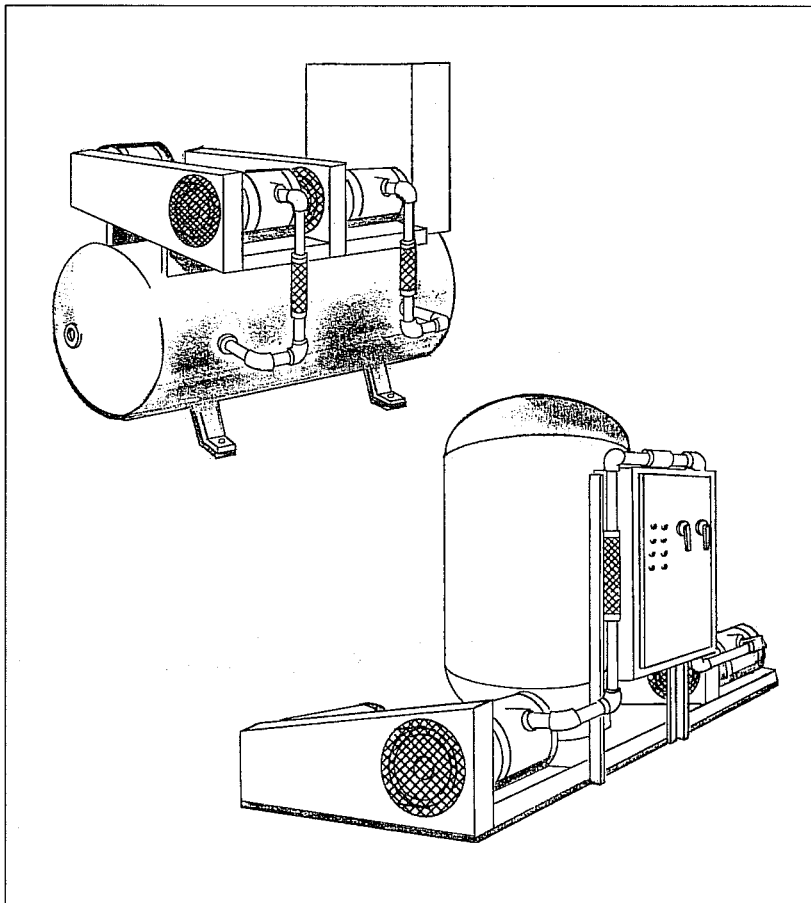


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USER RESPONSIBILITY

This Product will perform in conformity with the description thereof contained in this operating manual and accompanying labels and/or inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided.

This Product must be checked periodically. A defective Product should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, Hill-Rom MEDÆS recommends that a telephonic or written request for service advice be made to the Hill-Rom MEDÆS Service Center. Offices are listed on the back cover of this manual.

This Product or any of its parts should not be repaired other than in accordance with written instructions provided by Hill-Rom MEDÆS, or altered without the prior written approval of Hill-Rom MEDÆS' Service Department. The user of this Product shall have the sole responsibility for any malfunctions which result from improper use, faulty maintenance, improper repair, damage or alteration by anyone other than Hill-Rom MEDÆS.

PRECAUTIONS

Warnings

Have more than one person on hand during Pre-Startup and Startup procedures to ensure safety and to facilitate certain checks.

Electrical shock hazard. Ensure that ALL electrical power to the vacuum pump system is OFF, including the disconnect switches and H-O-A switches on the control panel.

Ensure that all loose articles, packing materials and tools are clear of the vacuum pump system.

Electrical shock hazard. Use extreme care during checkout procedures when units are energized.

Electrical shock hazard. Switch off all electrical power to the pump being removed when disconnecting wiring from the pump motor.

Close the isolation valve to the pump unit being removed to prevent possible injury from the system's vacuum when disconnecting the piping at the inlet port.

Support the pump unit when removing the anchoring bolts to prevent the motor from falling and causing personal injury or damage to the equipment.

Be careful in handling and discarding the material because there are nails and staples present which could cause personal injury.

Notify hospital personnel before shutting down the system to ensure patient safety.

Cautions

The engineer should size the exhaust line piping so that back pressure in the line does not exceed 1 psi (1.24 kPa).

Electrical service must be the same as called for on the control panel nameplate.

Vibration during shipment can loosen electrical terminals, mechanical connections and fuse inserts. Tighten as necessary.

Complete all PRE- startup checks before continuing with the actual start.

This startup procedure is for pump unit # 1 and should be duplicated for any additional pumps. Each pump is to be individually started, run and adjusted.

If the motor cannot be turned by hand, DO NOT ATTEMPT TO START THE PUMP. Contact Hill-Rom MEDÆS Service Department at 800-511-2333 for instructions.

Do not use solvents to flush out the pump. Solvents will damage the seals.

Notify appropriate hospital personnel if repairs will affect available hospital vacuum levels.

The unit should not be left in the HAND position for more than 10 minutes. The pump will get warm and may be hot to the touch.

1/INTRODUCTION

This manual contains operation and maintenance procedures to ensure proper and safe use of the Intermittent Duty Medical Vacuum System. The descriptions, stock numbers and procedures included in this manual provide information for normal operation, maintenance and service of this Product. The first half of this manual contains information directed at the normal operation and use of this equipment. The second half of the manual contains information directed specifically to qualified service personnel.

Read the entire manual before starting the Intermittent Duty Medical Vacuum System. Pay special attention to the warnings and cautions which appear throughout this manual and which are summarized in the "Precautions" section.

Read the "User Responsibility" statement. It lists what is required of the operator to maintain a safe and functional vacuum pump system. Read the warranty. It lists Hill-Rom MEDÆS responsibility in case of a functional defect.

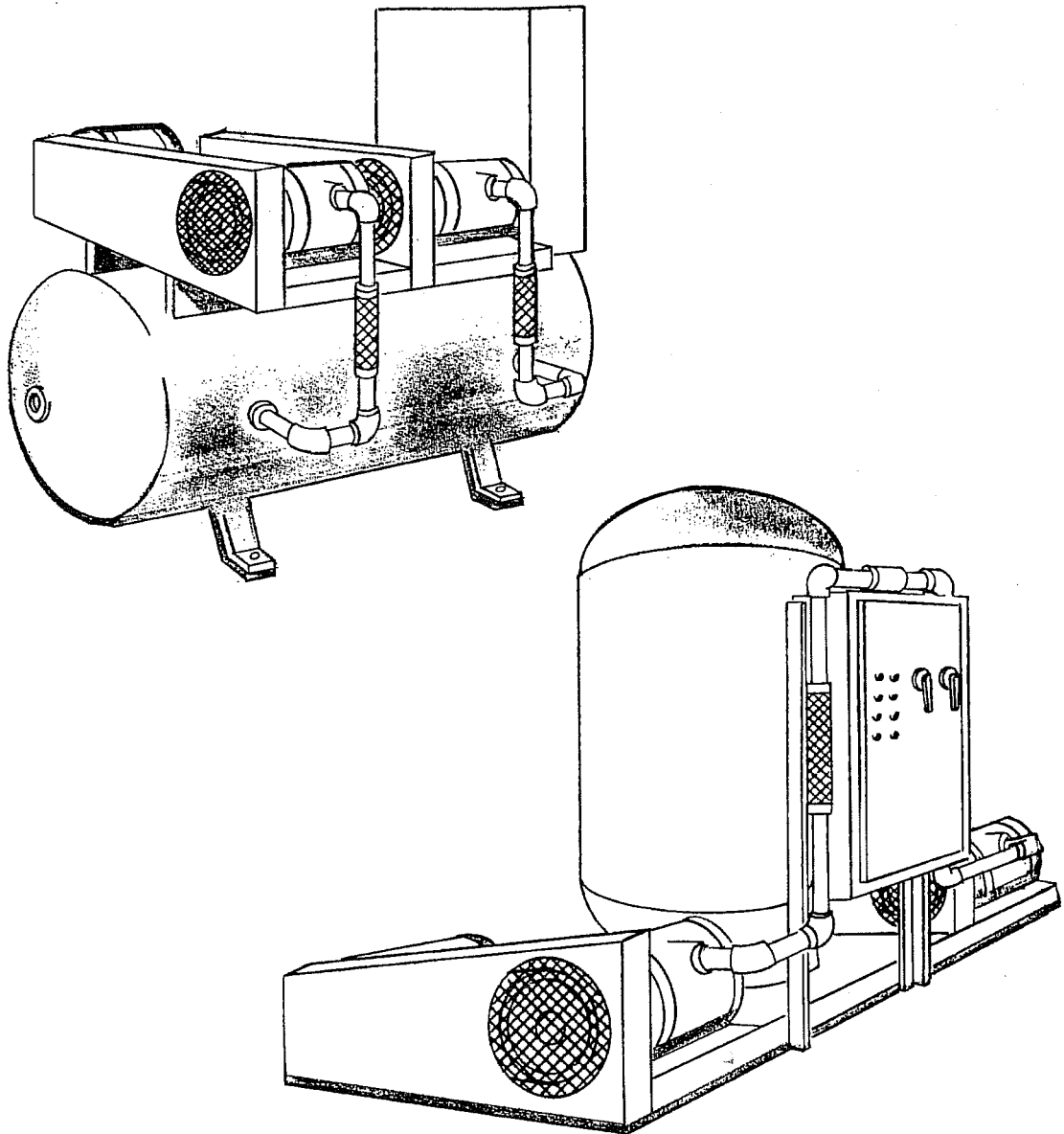


Figure 1
Base Mount and Tank Mount Duplex Systems

2/GENERAL INFORMATION

2.1 Description and Operation

The "Description and Operation" section of this manual contains a functional description of each component of the Intermittent Duty Medical Vacuum System and details how each component operates within the system. This section also includes typical electrical and piping schematics.

2.2 Configurations

Four configurations of pumps within the Medical Vacuum System are available: simplex (1 pump); duplex (2 pumps); triplex (3 pumps); and quad (4 pumps). Larger multiplexed systems are available. These systems may contain five or more pumps. The most common is the duplex configuration for which a detailed description follows. The procedures discussed in detail for the duplex system are to be used for the other systems. General descriptions of the simplex, triplex and quad are included also.

2.3 Duplex

(See Figures 1 and 2)

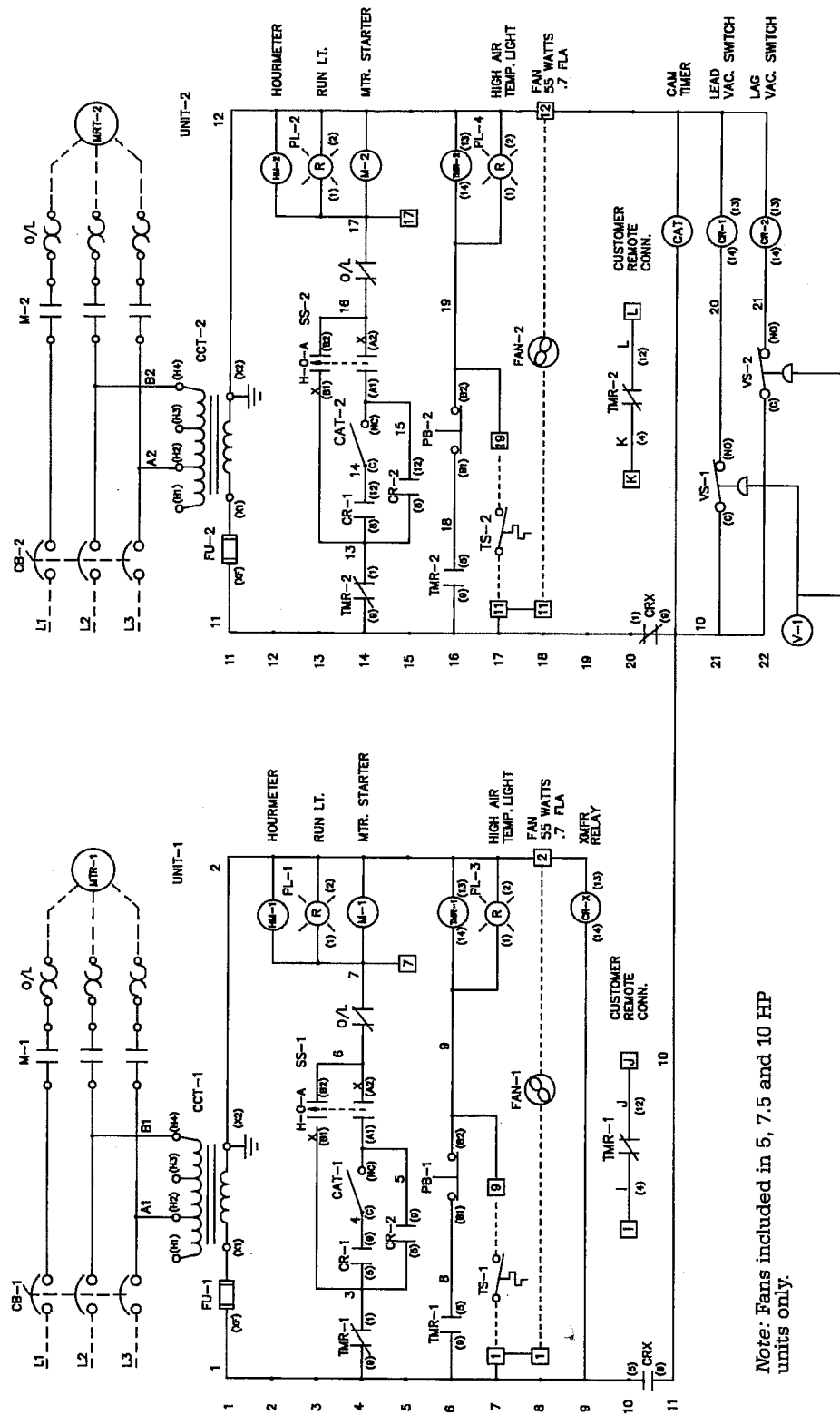
The duplex medical vacuum system is typically a completely packaged tank or base mounted assembly consisting of two rotary vane vacuum pumps, a vertical or horizontal vacuum receiver, a U.L. listed duplex electrical control system housed in a NEMA Type 12 control cabinet, and all the necessary interconnecting plumbing and wiring. Installation consists of setting the system in place, running the power source to the control panel, connecting the inlet flex piping to the receiver and connecting the exhaust flex piping to the vacuum pumps. A drip leg and drain valve off the exhaust line also are recommended.

The control system for a duplex configuration automatically alternates the lead position between the two pumps. A cycle timer with a preset cycle regulates the time interval between alternating cycles.

The control panel provides separate disconnect and control switches for each pump. During normal operation, both disconnect switches should be in the ON position, and both selector switches should be in the AUTO (automatic) position.

The AUTO selector switch position allows both pumps to run to meet vacuum requirements. Normally, only the lead pump runs. The lead unit will cycle on and off according to the vacuum level in the system. The lead unit's vacuum switch is set at 18 inches Hg to start operating and 22 inches Hg to stop. Should the lead pump be unable to maintain adequate vacuum, both the lead and lag pumps operate. Operation of the lag pump is determined by the setting of a vacuum switch, typically set to start the lag pump at 17 inches Hg and to stop it at 21 inches Hg.

2/GENERAL INFORMATION



Note: Fans included in 5, 7.5 and 10 HP units only.

Figure 2
System Schematic for Tank and
Base Mounted Duplex Systems

2/GENERAL INFORMATION

2.4 Simplex, Triplex and Quad

The simplex, triplex and quad configured Intermittent Duty Medical Vacuum systems are typically completely packaged assemblies. The simplex package consists of one pump, the triplex package consists of three pumps, and the quad package consists of four pumps. Each package also includes a vertical (or horizontal for a simplex) vacuum receiver, a U.L. listed electrical control system housed in a NEMA Type 12 control cabinet, and all the necessary interconnecting plumbing and wiring.

2.5 Inlet Connection Vacuum Receiver

Piping from the hospital's vacuum system is connected to the inlet connection of the vacuum receiver.

2.6 Vacuum Receiver

(See Figure 3)

The vacuum receiver is a hollow, cylindrical casing constructed in accordance with American Society of Mechanical Engineers (ASME) standards. The vacuum receiver maintains the system's vacuum capability induced by the unit's vacuum pumps. System vacuum level must be reduced to atmosphere before condensate can drain from the manual tank drain.

Vacuum level is sensed and indicated by a vacuum gauge and switch located on the control panel and connected to the vacuum receiver by vacuum tubing. The vacuum switch controls the operation of the lead and lag pumps. The lead and lag pumps are activated when the level reaches the preset settings of its vacuum switch.

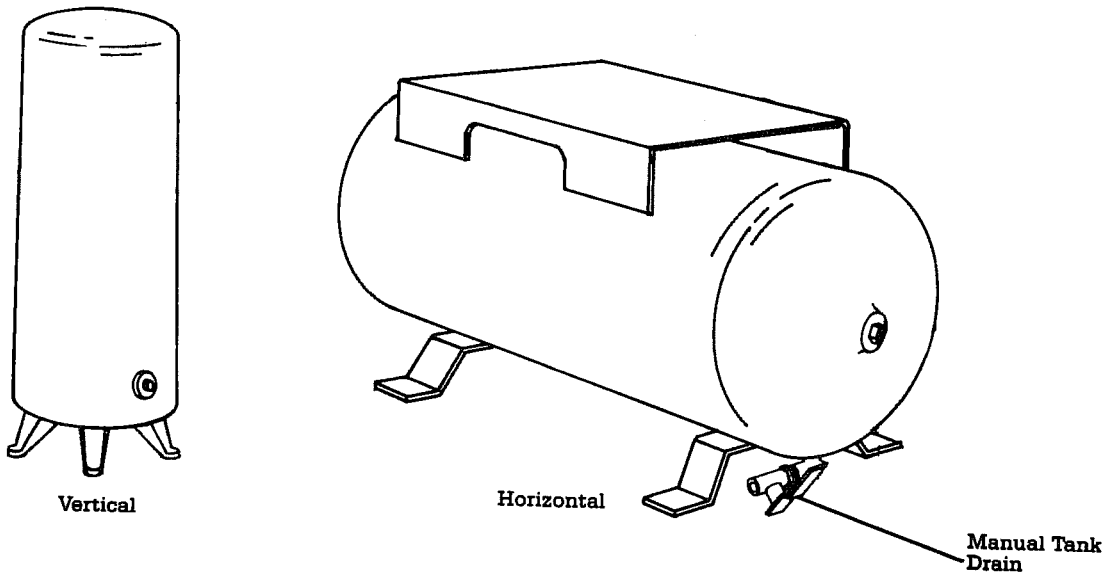


Figure 3
Vacuum Receiver

2/GENERAL INFORMATION

2.7 Isolation Valve

The isolation valve is a butterfly valve located in the line between the pump and the vacuum receiver. Closing the isolation valve to a pump unit that is being removed closes the system to atmospheric air. This allows one pump to be serviced while another pump maintains system operation.

2.8 Intermittent Duty Rotary Vane Vacuum Pump Unit

(See Figure 4)

The pump unit is a rotary vane, oil-sealed, air-cooled unit with one shaft seal. The 1 through 10 horsepower models are belt-driven.

The vacuum pump induces a vacuum in the vacuum receiver. The multi-pump configurations are a lead/lag system where the lead and lag pumps operate on demand when activated by the vacuum switch.

The vacuum pump is composed of a cast-iron round cylinder that contains a rotor set in the cylinder off center. For the rotor, four slots have been machined so that vanes can be inserted. As the rotor spins, the vanes are forced to the outside wall of the cylinder casting, creating four compartments.

Oil is induced to the pump by vacuum. Because the rotor is mounted off-center in the cylinder, the size of the compartments change as the rotor rotates, changing the pressure of the air trapped in each compartment.

The air in the compartment is forced out through the exhaust port. Air enters the compartment when it reaches the inlet port. Air movement is created, causing the evacuation of air from the hospital system.

2.9 Exhaust Discharge Piping

Discharge piping and sizing from other sources than Hill-Rom MEDÆS should be attached to the oil separator on each pump's discharge. The piping should have an inside diameter at least as large as the exhaust port.

When more than one pump is connected to an exhaust line, the cross sectional area of that line should equal at least the sum of the cross sectional areas of the exhaust ports for a short exhaust line. For longer exhaust line runs, the size of the piping must be calculated by an engineer to compensate for the impact that joints and elbows in the line have on air flow. This sizing is necessary to avoid creating back pressure in the line.

CAUTION: The engineer should size the exhaust line piping so that back pressure in the line does not exceed 1 psi.

The exhaust is piped to the drip leg to prevent condensation from draining into the pump.

A union should be installed in each exhaust line to aid in servicing the pump. An isolation valve may also be installed for each exhaust line and kept open.

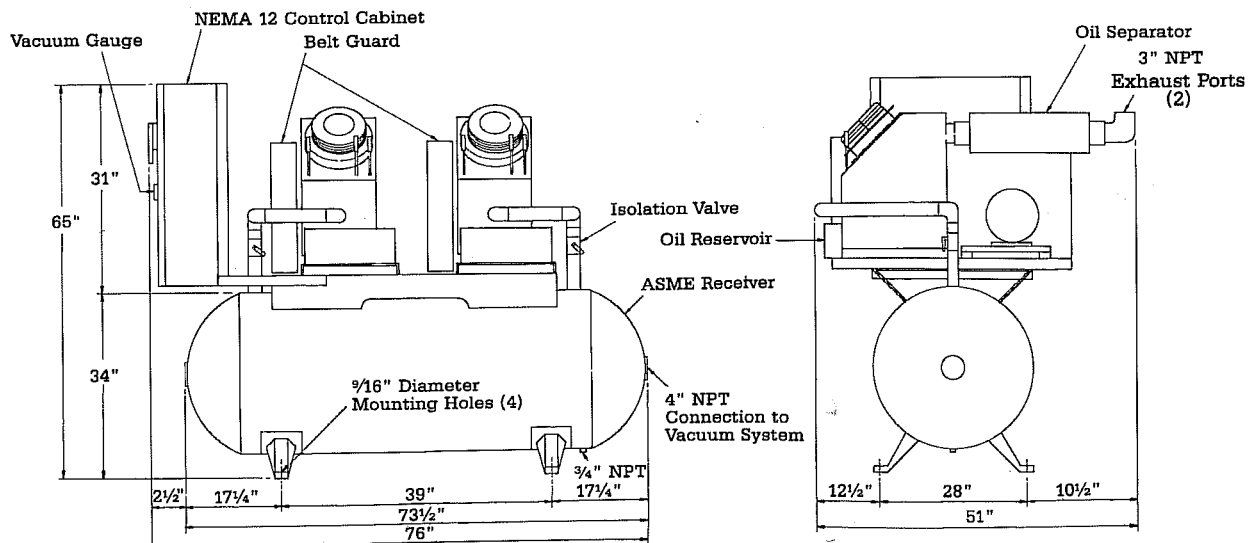


Figure 4
Rotary Vane Vacuum Pump (Typical of 7.5 Horsepower Unit.)

2/GENERAL INFORMATION

2.10 Control Panel

(See Figure 5)

The vacuum system control panel has a running light, an elapsed time meter (hour meter), a Thermal Mal function Protection Device (TMPD), and a Hand-Off Auto (H-O-A) switch for each vacuum pump. The hour meter displays the cumulative total operating hours for each pump. This information can be used for scheduling maintenance. Each pump has separate magnetic starters with 3 phase overload protection. The main power source for energizing the control panel comes from the facility's main panel and must include a circuit breaker enabling a complete shut-down of the vacuum pump system.

2.11 Disconnect Switch

(See Figure 5)

The vacuum system control panel includes one or two electrical disconnect switches, depending on the configuration (one disconnect switch for Simplex, Triplex and Quad; two for Duplex). Moving a disconnect switch to the ON position energizes the control panel and starts the cycle timer that controls alternating the pump units between lead and lag operational modes.

2.12 H-O-A Switch

(Hand/Manual-Off-Auto)

(See Figure 5)

The H-O-A switch for each pump unit is located on the upper lefthand side of the front of the control panel and has the following three positions:

HAND (manual) position—The pump runs continuously regardless of the vacuum level.

OFF position—The pump is turned OFF.

AUTO position—During normal operation, set the H-O-A switch to the AUTO position. In this mode, the lead pump operates using the two vacuum switches. The lag pump operates only if the lead pump cannot handle the demand.

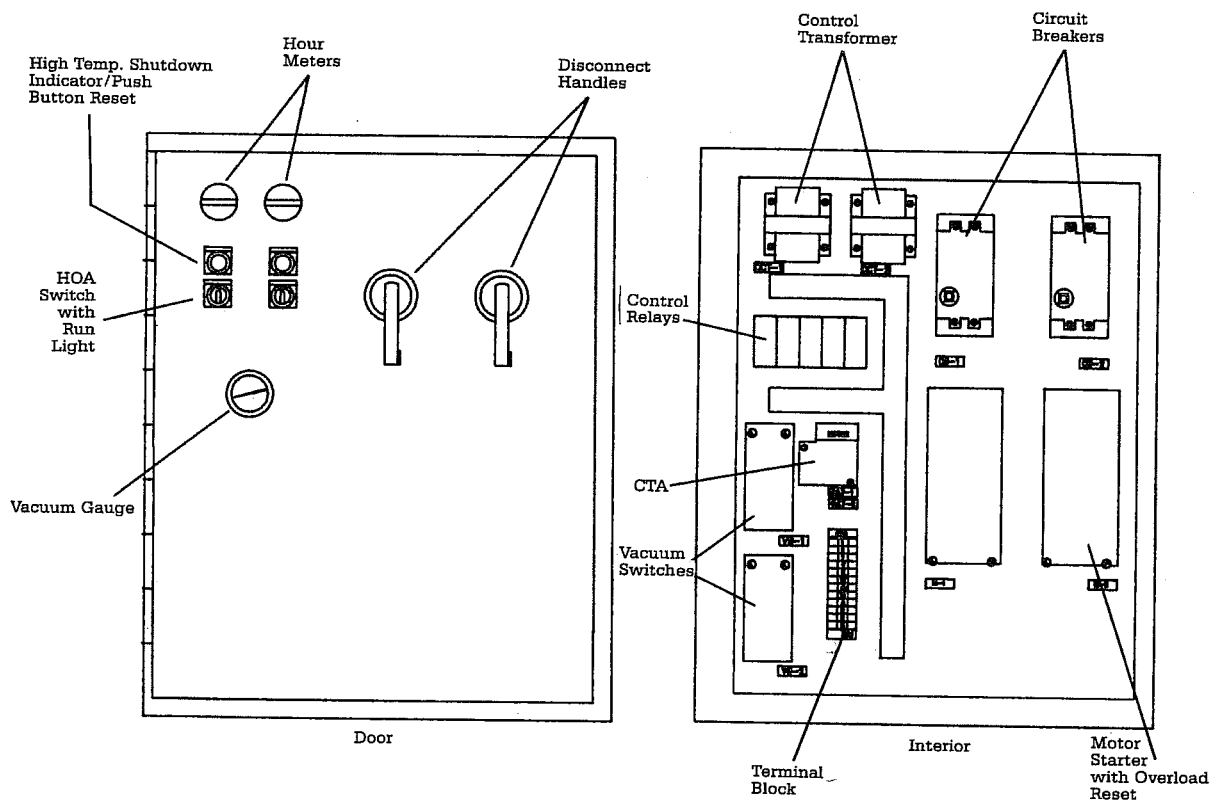


Figure 5
Control Panel

3/ACCESSORIES

Optional accessories are available to meet architectural and engineering requirements.

3.1 Elasto-Rib Vibration Damper

Elasto-Rib Vibration Damper have a core of high grade cork plate, permanently bonded between two layers of waffle-threaded, oil-resistant synthetic rubber.

Vibration dampeners are used as vibration isolators and are a resilient support for the vacuum pump module. They reduce vibration transmitted to the building structure.

3.2 Flexible Hose Connector

Flexible hose connectors reduce the amount of vibration transmitted to any piping associated with the overall hospital vacuum system, including the exhaust discharge piping.

Note: Flexible hose connectors are provided at the inlet connection of the pump. It is recommended that

they be installed elsewhere in the system in accordance with NFPA 99.

3.3 Absorption Silencers (Threaded or Flanged)

The absorption silencer is a muffler having a perforated air passage tube entirely enclosed by sound absorption material. It silences high-velocity air flow to and from the atmosphere. It may be used as a part of the exhaust discharge piping.

3.4 Vacuum Gauge

(0 inches - 30 inches Hg; 0 kPa 102 kPa)

The vacuum gauge measures vacuum in inches of Hg and kiloPascal. This gauge allows visual reference to the vacuum being maintained and can be installed at various points in the system.

4/INSTALLATION

The steps for installing the medical vacuum system are:

1. Inspect the system upon arrival.
2. Unpack the system.
3. Locate the system.
4. Make the electrical connections.
5. Make the mechanical connections.
6. Make a final inspection of the system.

4.1 Inspecting the System Upon Arrival

The medical vacuum system should be inspected thoroughly upon arrival using the following procedures.

1. Inspect the outside of the shipping container for any damage.

Note: If there is damage to the container, careful inspection of the system is mandated to make certain the medical vacuum system has not been damaged also.

2. Check the shipping information to verify the proper unit has been shipped. Items to verify include:
 - a. Stock number
 - b. Horsepower of each motor
 - c. Voltage
 - d. Electrical phase
3. Measure the dimensions of the unit to identify any problems associated with installation.

4.2 Unpacking the System

1. Remove the crating material around the medical vacuum system.

WARNING: Be careful in handling and discarding the material because there are nails and staples present which could cause personal injury.

2. Locate the small box that contains any accessory items ordered. Generally, the following accessories will be included for a duplex system:
 - a. Vibration dampeners (minimum of 4)
 - b. Flexible connectors (3)
 - c. Mufflers (2)
 - d. Isolation valve (1)
3. The shipping base should not be removed until the vacuum pump is moved to the installation location. The shipping base will prevent the vacuum pump from twisting or flexing when it is moved to the installation location.

Note: In some cases, the shipping base may have to be removed in order to reduce the dimensions for purposes of moving the unit through a small opening or low ceiling.

4. Check key information of the components, to include the following, and make certain that the unit matches the hospital requirements:
 - a. Motor horsepower
 - b. Motor voltage
 - c. Motor phase
 - d. Control cabinet voltage
 - e. Control cabinet phase
 - f. Component dimensions

4/INSTALLATION

5. Carefully inspect the unit for any signs of damage. If there are signs of damage:
 - a. Notify the shipping company.
 - b. Notify Hill-Rom MEDÆS Medical Engineering Customer Service at 800-556-5596.
6. Do not remove any of the protective covers from the inlet and exhaust ports until the system is ready for connection to the medical vacuum system.
7. Walk the route the unit must travel and note key dimensions. Match this information with the system dimensions. If there is a problem, contact the Hill-Rom MEDÆS Service Department at 800-511-2333.
8. The frame should not overhang the concrete base on which it rests.
9. Check to ensure the control cabinet door has adequate room to open before bolting the unit to the pad.

4.3 Locating the System

1. The location for the medical vacuum pump should meet the following requirements:
 - a. Minimum temperature of 40 degrees F.
 - b. Maximum temperature of 100 degrees F.
 - c. Adequate ventilation
 - d. 4 feet of clearance around the unit for easy maintenance and adequate ventilation.
2. Where possible, install the medical vacuum pump in the ground or lower level machinery spaces. If this unit is installed in the upper floors of a structure, an inertia base system is required to reduce noise and vibration transmission to the floors below. Consult an engineering firm in placing the unit in an upper floor of a facility and to size the inertia base system.
3. A 4 inch housekeeping pad is recommended for the support base of the unit.
4. The units may generate 85 dBA of noise. Though not excessive, the location of the unit should take this noise level into consideration.
5. The medical vacuum pump should be carefully removed from the base support crating so that the frame is not bent or twisted.
6. The unit should be firmly and securely bolted to the concrete housekeeping pad, to a solid, stable floor, or to the inertia pad. A vibration dampener should be located between the frame and the concrete at each mounting hole.

Note: Do not overtighten the bolts or make them too loose.

7. The frame should touch the concrete in all locations. If it doesn't, the frame should be shimmed at all locations that are not flush with the concrete. There should also be no bowing, bending, or twisting of the frame. Each point of the frame should be level to 1/16 inch.

4.4 Making the Electrical Connections

1. Locate the wiring diagram for the system and study it carefully.
2. Verify that the voltage, phase and frequency that will be supplied to the control cabinet are exactly as specified in the wiring diagram and are exactly what have been supplied.
3. Using a qualified electrician, provide power to the control cabinet. The wire size to the medical vacuum pump needs to be determined to ensure it is capable of handling the voltage and amps.
4. Check all electrical connections to ensure that they were not loosened during shipment.
5. Follow NEC and local procedures and recommendations throughout the connection process.

4.5 Making the Mechanical Connections

(See Figure 6)

Discharge Connection

1. A condensate trap and drip leg should be installed at each exhaust line.
2. Flexible connectors should be installed at each oil separator.
3. After each flexible connector, a muffler should be installed on the same line.
4. The discharge piping should be manifolded together, then continued outside the facility as a common line and turned down.
 - a. The back pressure in the exhaust line should not exceed 1 psi.
 - b. The engineer/consultant should size the exhaust line, properly accounting for bends, fittings and connections.
 - c. The pipe size at the oil separator should represent the size at the point. As the length of pipe run increases, the pipe diameter should increase to account for the length and back-pressure constraints.

Inlet Connection

An isolation valve and flexible connector should be installed on the line in front of the receiver.

4/INSTALLATION

4.6 Making a Final Inspection

1. All steps in the installation procedures should be reviewed.
2. Two weeks before startup, notify the Hill-Rom MEDÆS Service Center to arrange for a service representative to start up the system. Offices are listed on the back cover of this manual.

Note: Failure to have a Hill-Rom MEDÆS Service Representative present at startup will void the manufacturer's warranty.

Note: All accessories installed by others at site. All other units should follow this general (typical) installation.

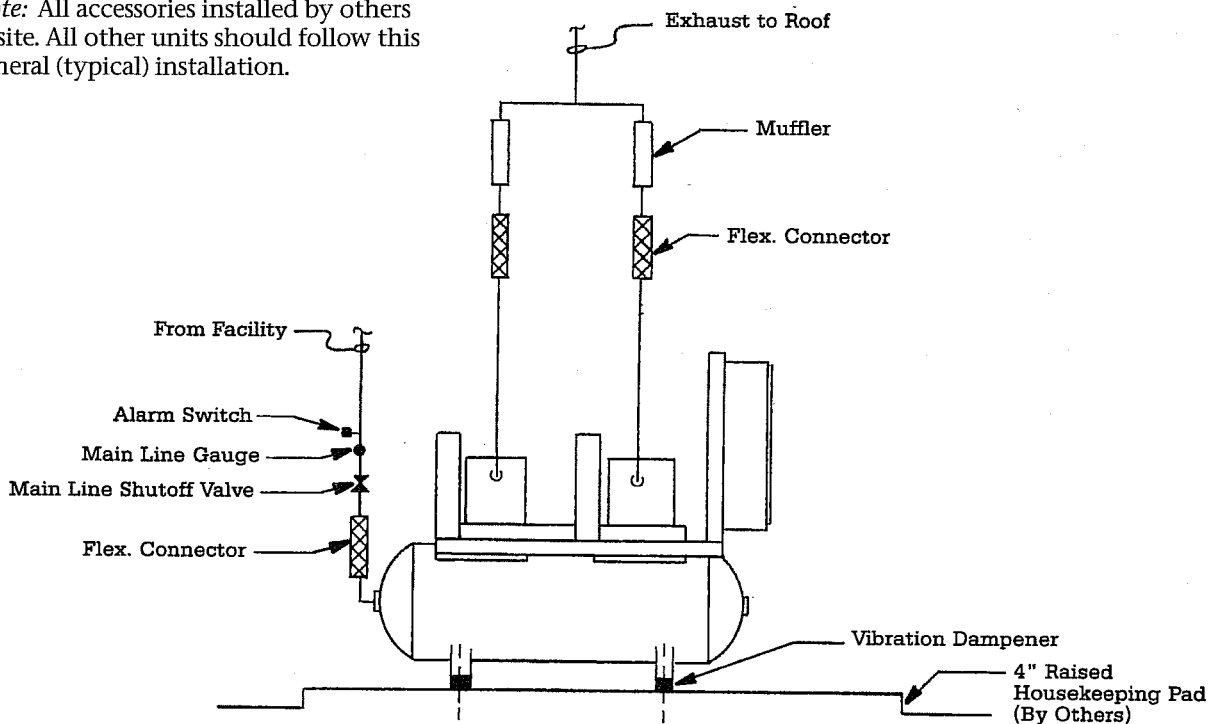


Figure 6
Making the Mechanical Connections

5/PRE-STARTUP, STARTUP AND SHUTDOWN PROCEDURES

5.1 Startup Service

Hill-Rom MEDÆS has included in the price of the Intermittent Duty Medical Vacuum System the presence of a factory trained service representative to review, per manufacturer's recommendations, the assembly prior to its initial startup and operation.

The contractor should notify Hill-Rom MEDÆS a minimum of two weeks before startup so this review can be scheduled.

Note: Failure to use this service will void the manufacturer's warranty.

5.2 Pre-Startup Procedure Initial Start

Pre-startup and startup procedures should be followed for a new installation or when major maintenance has been completed.

WARNING: Have more than one person on hand during pre-startup and startup procedures to ensure safety and to facilitate certain checks.

Prior to startup, complete the following inspection:

1. Ensure the main power source to the control panel is OFF. The power source should remain OFF for the duration of this visual inspection.
2. Ensure the equipment is installed level (within 1/16" or 1.59 mm), shimmed on all sides and bolted down securely. A minimum of 4 feet (1.2 m) is needed around all sides of the unit.
3. The temperature of the area should be approximately 70 degrees Fahrenheit (21.1 degrees Celsius) with a minimum of 40 degrees Fahrenheit (4.4 degrees Celsius) and a maximum ambient temperature of 100 degrees Fahrenheit (37.7 degrees Celsius).
4. Check the inlet piping for proper connection to the vacuum receiver. Check the exhaust discharge piping for proper connection to the pump unit. Check all the points where the piping may have come loose during shipment as this could lead to leaking.
5. Check the isolation valves for full open and close travel. Close each isolation valve.
6. Check each vacuum pump unit to ensure:
 - a. Pump unit is securely mounted.
 - b. Oil reservoir is full.
 - c. Belt tension is correct (see Figure 7).
7. Check the control panel.

WARNING: Electrical shock hazard. Ensure that ALL electrical power to the vacuum pump system is OFF, including the disconnect switches and H-O-A switches on the control panel.

CAUTION: Vibration during shipment can loosen electrical terminals, mechanical connections and fuse inserts. Tighten as necessary.

8. Before operating the system, complete the following checks:
 - a. Check the front of the control panel for any broken lights and loose parts or components.
 - b. Open the control panel door by unlocking the fasteners on the side of the panel.
 - c. Check that all electrical terminals inside the well fastened.
 - d. Check that all fuse inserts and relays are fully engaged.
 - e. Check that all motor starter connections are tight.
 - f. Close the panel door and lock the fasteners on the panel.

5.3 Startup Procedures (Initial Start)

WARNING: Electrical shock hazard. Ensure that ALL electrical power to the vacuum pump system is OFF, including the disconnect switches and H-O-A switches on the front panel.

CAUTION: Complete all PRE-startup checks before continuing with the actual start.

CAUTION: This startup procedure is for pump unit #1 and should be duplicated for any additional pumps. Each pump unit is to be individually started, run and adjusted.

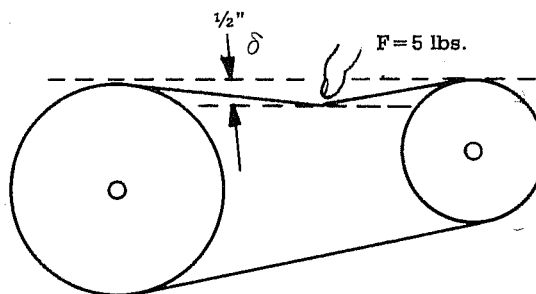


Figure 7
Checking the Belt Tension

5/PRE-STARTUP, STARTUP AND SHUTDOWN PROCEDURES

Note: All equipment has been tested by Hill-Rom MEDÆS to ensure proper operation.

1. Ensure the H-O-A selector switch to each pump is OFF.
2. Manually turn the pump shaft of each pump to ensure free rotation.

Note: Because the opening in the pump casing is small on some systems, it may be necessary to use a small rod to push gently in the direction of rotation in order to turn the pump shaft.

CAUTION: If the motor cannot be turned manually, **DO NOT ATTEMPT TO START THE PUMP.** Contact the Hill-Rom MEDÆS Service Center for Instructions at 800-511-2333.

3. Close the shutoff valve to the hospital vacuum system.
4. Open the isolation valve to each vacuum pump.
5. Turn ON electrical power to the control panel.
6. Turn the disconnect switches to ON.

WARNING: Ensure that all loose articles, packing materials and tools are clear of the vacuum pump system.

7. Check the oil level in the reservoir.
8. Check for correct rotation of each pump motor. Briefly switch the pump ON, check the direction of rotation, and immediately turn the pump OFF. Motors that rotate in the wrong direction must have their electrical connections rewired.

If the motor is rotating in the wrong direction, turn OFF all electrical power to the vacuum pump system. Have a competent electrician change the wiring to the affected motors by switching two of the three lead wires on the starter. Repeat steps 5 through 8 to recheck rotation.

WARNING: Electrical shock hazard. Ensure that incoming power to the pump is off before interchanging the input leads when connecting the direction of rotation.

9. Upon confirmation of correct motor rotation, continue with startup.
10. Turn the H-O-A switch to AUTO for starting each pump unit.

Note: The pump unit will start up, the run light will come on, and the pump should run relatively smoothly and quietly. If not, shut down the pump unit in ques-

tion by turning the H-O-A switch to the OFF position. Consult Table 1 in Section 6, "Troubleshooting."

11. The vacuum in the vacuum receiver should rise to approximately 22" Hg to 23" Hg (relative to sea level) and then stop.
12. Turn the H-O-A switch to HAND on the pump being checked. The pump unit should continue to run.

CAUTION: The unit should not be left in the HAND position for more than 15 minutes. The pump will get warm and may be hot to the touch. This heat may damage the unit.

13. Adjust the drip rate of oil while the unit is operating. Each of the three lines needs to be set when the pump is operating. By rotating the knob clockwise, the drip rate will be increased. By rotating the knob counterclockwise, the drip rate will be decreased. By viewing the drops through the sight gauge, the proper setting can be achieved. The drop rate should be set for two to three drops per minute (1, 2 and 3 horsepower units) or five to six drops per minute (5, 7.5 and 10 horsepower units).
14. The 5, 7.5 and 10 HP units have a fan mounted on each unit. The fan should operate when the disconnect is set in the ON position and should not stop. This constant operation is required to remove heat.
15. Turn the H-O-A switch to the OFF position. The pump being checked should be shut down.

Note: This concludes the initial startup procedure for vacuum pump #1. If this vacuum system is other than a simplex unit, each vacuum pump in the system will have to be checked separately. Shut down the pump unit and repeat steps 10 through 14 for each additional pump in the system.

Performing the Lead/Lag Check

1. Set the hospital valve to the CLOSED position.
2. Open the manual tank drain on the vacuum receiver until the vacuum gauge reads 0" Hg, then close the tank drain.
3. Check to ensure all isolation valves are set to OPEN.
4. Check to ensure that the main electrical power, the disconnect switches and the H-O-A switch are OFF.
5. Check to ensure the vacuum gauge is reading 0" Hg.

5/PRE-STARTUP, STARTUP AND SHUTDOWN PROCEDURES

WARNING: Electrical shock hazard. Exercise extreme care during checkout procedures when units are energized.

6. Turn the main electrical power ON.
7. Turn the disconnect switches ON.
8. Turn the H-O-A switches to AUTO.
9. Check to ensure that the lead pump and lag pumps are on and running.
10. Check to ensure the vacuum gauge and pump unit are indicating an increase in vacuum.
11. Check to ensure the vacuum receiver vacuum gauge is indicating an increase to 22" Hg or 23" Hg.
12. Check that each lag pump shuts down as the vacuum cutoff limit for each pump is reached. Limits are set by the vacuum switch located inside the control panel. The cutout setting should be 21" Hg.
13. Check to ensure the lead pump continues to run until cutout and that the vacuum level is reached at 22" Hg.
14. Shut down the vacuum pump system (see Section 5.5, "Shutdown Procedures").

Performing the Alternation Check

1. Set the hospital valve to the CLOSED position.
2. Open the manual tank drain on the vacuum receiver until the vacuum gauge reads 0" Hg, then close the tank drain.
3. Check to ensure all isolation valves are set to OPEN.
4. Check to ensure that the main electrical power, the disconnect switches and the H-O-A switch are OFF.
5. Check to ensure the vacuum gauge and the vacuum receiver are reading 0" Hg.

WARNING: Electrical shock hazard. Exercise extreme care during checkout procedures when units are energized.

6. Turn the main electrical power ON.
7. Turn the disconnect switches ON.
8. Turn the H-O-A switches to AUTO.
9. Check to ensure that the lead pump and lag pumps are on and running.
10. Check to ensure the vacuum gauge and pump units are indicating an increase in vacuum.
11. Check to ensure the vacuum receiver vacuum gauge is indicating an increase to 22" Hg to 23" Hg.
12. Check that each lag pump shuts down as the vacuum cutoff limit for each pump is reached. Limits are set by the vacuum switch located inside the control panel. The cutout setting should be 21" Hg. Mark this unit the lag unit.
13. Check to ensure the lead pump continues to run until cutout and the vacuum level is reached at 22" Hg.
14. Keep the system operating in the "AUTO" position.
15. The cam timer alternator will change the lead/lag of the units in the system. For a duplex system, the lead should change approximately every 15 minutes.

16. Watch the system for 15 minutes.
17. Open the valve in the tank slowly, causing the vacuum level to drop. Watch the gauge. At 18" Hg, the unit marked as "lag" in step 12 should operate first as it is now lead.
18. Repeat steps 14 through 17.
19. Shut down the vacuum pump system (see Section 5.5, "Shutdown Procedures").

5.4 Normal Startup Procedures

To perform the normal startup procedures, complete the following steps:

1. Turn the hospital shutoff valve to the CLOSED (off) position.
2. Turn the isolation valves to the OPEN (on) position.
3. Check the oil level and condition through the sight gauge. Add oil if the level is below the sight gauge. If the oil looks contaminated with condensate, refer to Section 6, "Troubleshooting."
4. Turn the main electrical power ON.
5. Turn the disconnect switches ON.
6. Set the H-O-A switches to the AUTO position (starting all pump units).
7. Ensure that the vacuum gauges and pump units are increasing to 22" Hg.
8. Check to ensure each lag pump is shutting down as it reaches its vacuum limit cutoff.
9. The lead pump should operate to the cutout vacuum level (+/-) 22" Hg.
10. Slowly OPEN the hospital shutoff valve.

Note: Opening the hospital valve may cause a vacuum demand that brings the lag pumps back on line. This is a normal occurrence. The vacuum pump system is now on line and in the normal operating mode.

5.5 Shutdown Procedures

WARNING: Notify hospital personnel before shutting down the system to ensure patient safety.

To perform the shutdown procedure, complete the following steps:

1. Set the H-O-A switches to the OFF position.
2. Set the disconnect switches to the OFF position.
3. Turn the main power source OFF.
4. Set the hospital valve in the CLOSED position.
5. Set the vacuum receiver manual tank drain in the OPEN position.
6. Check to ensure the vacuum is dissipating to 0" Hg.
7. When the vacuum gauges read 0" Hg, set the vacuum receiver manual tank drain to the CLOSED position.

6/TROUBLESHOOTING

Clean oil is crucial to maintaining pump efficiency and ensuring long life of the pump. Contaminated oil resulting in poor lubrication causes most vacuum system problems. In most cases, changing the oil regularly will ensure trouble-free operation.

Table 1 contains the instructions for troubleshooting your pump if a malfunction occurs. To use the table, observe the symptom and then use the instructions in the "Solution" column to remedy the problem.

Refer to Section 8.1, "Repair Policy," before proceeding with system repairs.

Symptom	Probable Cause	Solution
High pitched pump noise and wrong direction of rotation.	Motor wired incorrectly.	Switch motor leads.
Motor will not start.	System equipped with optional low oil or high temp. shutdown.	Refill oil or allow unit to cool.
	Main disconnect off.	Turn main disconnect on.
	Unusually high or low voltage.	Electrical service must be the same as called for on the control panel nameplate.
	Power failure.	
	Heaters tripped.	Replace or reset heaters.
	Defective selector switch.	Replace selector switch.
	Defective vacuum switch.	Replace vacuum switch.
	System already at vacuum.	
	Vacuum system undersized.	
Frequent motor starts. (more than 6 starts per motor per hour.)	Plumbing restrictions.	
	Leaks in system.	Repair leaks.
	Defective vacuum switch.	Replace vacuum switch.
	Improper vacuum switch setting.	Reset vacuum switch.
	Vacuum switch differential set too close.	Reset vacuum switch.
Motor overheating.	Improper voltage.	Electrical service must be the same as called for on the control panel nameplate.
	Vacuum switch set too high.	Reset vacuum switch.
	Ambient temperature too high.	Reduce ambient temperature.
	Too many starts per hour.	
	Incorrect belt tension.	Readjust belt tension.
	Oil feed too slow.	
Pump overheating. (Note: Sliding vane vacuum pumps normally run quite hot, too hot to touch, when running continuously.)	Wrong oil.	Flush pump and change oil.
	Dirty oil.	Flush pump and change oil.
	No fan.	Install fan.
	Ambient temperature too hot.	Lower ambient temperature.
	Alternator failed.	Replace alternator.
	Vacuum switch set too high.	Adjust vacuum switch

Table 1
Troubleshooting Chart

6/TROUBLESHOOTING

Symptom	Probable Cause	Solution
Low vacuum level	Inadequate ventilation.	Open main shutoff valve.
	Belts too tight or out of alignment.	
	Main shutoff valve closed.	
	Restricted exhaust.	
	Blocked inlet.	
	Vacuum level too high.	Reset vacuum switch.
	RPM too high.	
	Pump running in the intermittent range longer than 15 minutes without an equal time off.	Remove restriction or repipe with larger pipe. Replace check valve.
	Inlet or outlet flow restriction.	
	Detective check valve on intake line of unit that is not running.	
No or low air flow	Pumps are undersized.	Replace vacuum gauge.
	Defective gauge - incorrect reading.	
	Defective check valve.	
	System leaks.	Replace check valve.
	Defective vacuum switch.	Locate and repair leaks.
	Broken, worn or sticking vanes.	Replace vacuum switch.
	Leaks in system.	Replace vanes.
	Damaged seals.	Locate and repair leaks.
	Moisture in oil.	Replace seals.
	Inlet restricted.	Change oil.
Excessive vibration or unusual noise.	Insufficient oil feed.	Reinstall check valve.
	Check valve installed wrong.	
	Incorrect belt tension.	
	Damaged bearings.	Adjust belt tension.
	Worn belt.	Replace bearings.
	Broken or sticking vanes.	Replace belt.
	Objects in pump.	Replace vanes.
	Inadequate lubrication.	Clear pump.
	Incorrect rotation.	Remove pipe plump on side of pump flange and pour a tablespoon of kerosene into the pump housing.
		Have a competent electrician rewire the motor by switching the leads.
High System Vacuum	Incorrect pump speed.	This is not unusual at higher vacuum levels.
	Out of balance.	
	Check valve chatter.	
	Improper mounting.	See Section 7.4.
	Faulty vacuum switch.	Replace vacuum switch.
	Vacuum switch set too high.	Reset vacuum switch.

Table 1 (continued)
Troubleshooting Chart

7/PREVENTIVE MAINTENANCE

Changing the oil regularly, in most cases, will ensure trouble-free operation. Contaminated oil resulting in poor lubrication causes most vacuum system problems.

7.1 Maintenance Schedule

Table 2 outlines the types and frequency of maintenance required to keep the vacuum pump operating efficiently. The steps for completing these procedures are detailed after the maintenance schedule.

Procedure	Frequency
Check oil level.	Daily
Check oil condition.	Daily
Check for oil leaks.	Weekly
Check belts for tension and wear.	Weekly
Change the oil.	Every 500 hrs or 3 months* or when oil becomes discolored.
Change fuses and lamps.	As required.
Check security of components.	Every six months.

*More frequent maintenance may be required depending on operating conditions. Change the oil more often if it darkens or appears milky.

Table 2
Maintenance Schedule

7.2 Checking the Pump Fluid Level

Under normal operating conditions, check the oil level once a day.

7.3 Changing the Oil

Changing the oil frequently helps ensure trouble-free operation and extends the life of your pump. Hill-Rom MEDÆS recommends using SAE30W nondetergent.

Under normal conditions, change the oil every 500 hours of operation or every three months. Operation with corrosive vapors or large amounts of dust or frequent cycling from atmospheric pressure to working pressure necessitate more frequent oil changes.

Always change the oil while the pump is warm from operation.

Change the oil as follows:

1. Shut OFF the pump that is to have an oil change. The other pump should remain operational.
2. Place a container under the oil plug to catch the used oil.
3. If the used oil is discolored, contains particulates, has a foul odor, or is very dirty, flush out the pump as follows:
 - a. Remove one of the oil-fill plugs from the oil casing.

CAUTION: Do not use solvents to flush out the pump because solvents will damage the seals.

CAUTION: Do not use oils with a detergent additive. Detergent additives clog the exhaust demister(s). Be sure to use the recommended oil in the pump.

- b. Pour the recommended oil or a flushing fluid into the oil-fill port in the reservoir.
 - c. Reinstall the oil-fill plug into the oil-fill port.
 - d. Turn the pump ON and allow it to run for 2 minutes.
4. Repeat steps 3a thru 3c to charge the pump with oil then reinstall the oil-fill plug.
 5. Turn the H-O-A switch to the HAND position and check the drip rate.
 6. Recheck the oil level while the pump is running.

7.4 Checking the Security of the Components

Vibration during the operation of a mechanical device may cause components to come loose. Schedule periodic checks to ensure that all attachment points remain tight and are secure. This check should include the following areas:

1. Base frame to floor bolting.
2. Condition of isolation dampeners (if used).
3. Bolting of pump units to base frames.
4. Security of piping and pipe connections.
5. Attachment of control panels to base frames.
6. Security of electrical wiring.
7. Security of electrical devices inside the control panel.
8. Security of electrical terminals inside the control panel and at the motor starters.

8/SERVICE

8.1 Repair Policy

A unit which is not functioning properly should not be used until all necessary repairs have been made and the unit has been tested to ascertain that it is functioning in accordance with the manufacturer's published specifications.

To ensure full reliability Hill-Rom MEDÆS recommends that all repairs be performed by an authorized Hill-Rom MEDÆS Service Representative. However if this cannot be done replacement of those parts designated in this manual may be undertaken by a competent individual having general experience in the repair of devices of this nature.

Refer to Figure 8 when performing the operations described in the next sections.

8.2 Removing the Vacuum Pump Unit

CAUTION: Notify appropriate hospital personnel if repair will affect available hospital vacuum levels.

WARNING: Electrical shock hazard. Switch OFF all electrical power to the pump that is to be removed when disconnecting wiring from the pump motor.

To remove the vacuum pump unit complete the following steps:

1. Turn the H-O-A switch OFF.
2. Disconnect the wiring at the junction box mounted on the pump motor.

WARNING: Close the isolation valve to the pump unit that is being removed to prevent possible injury from the system's vacuum when disconnecting the piping at the inlet port.

3. Close the isolation valve to the pump unit.

Note: Closing the isolation valve to the pump being removed allows the other pumps to continue operating without inducing atmospheric air into the system.

4. Disconnect the piping to the inlet port.
5. Disconnect the discharge piping to the exhaust port.

WARNING: Support the pump unit when removing the anchoring bolts to prevent the motor from falling and causing personal injury or damage to the equipment.

6. Remove the hex head screws and lockwashers securing the pump unit to the base frame.
7. Lift the pump unit from the support frame.

8.3 Disassembling the Pump

Complete the following steps to disassemble the pump.

1. Remove the four socket head screws (17) holding the seal housing (7) against the shaft-end cylinder head (2).
2. Remove the seal housing (7) by inserting a screw driver at the mating surfaces of the head and the cylinder and lightly tapping the screwdriver with a hammer.

CAUTION: Care should be taken not to damage the inner mating surfaces of the head and housing.

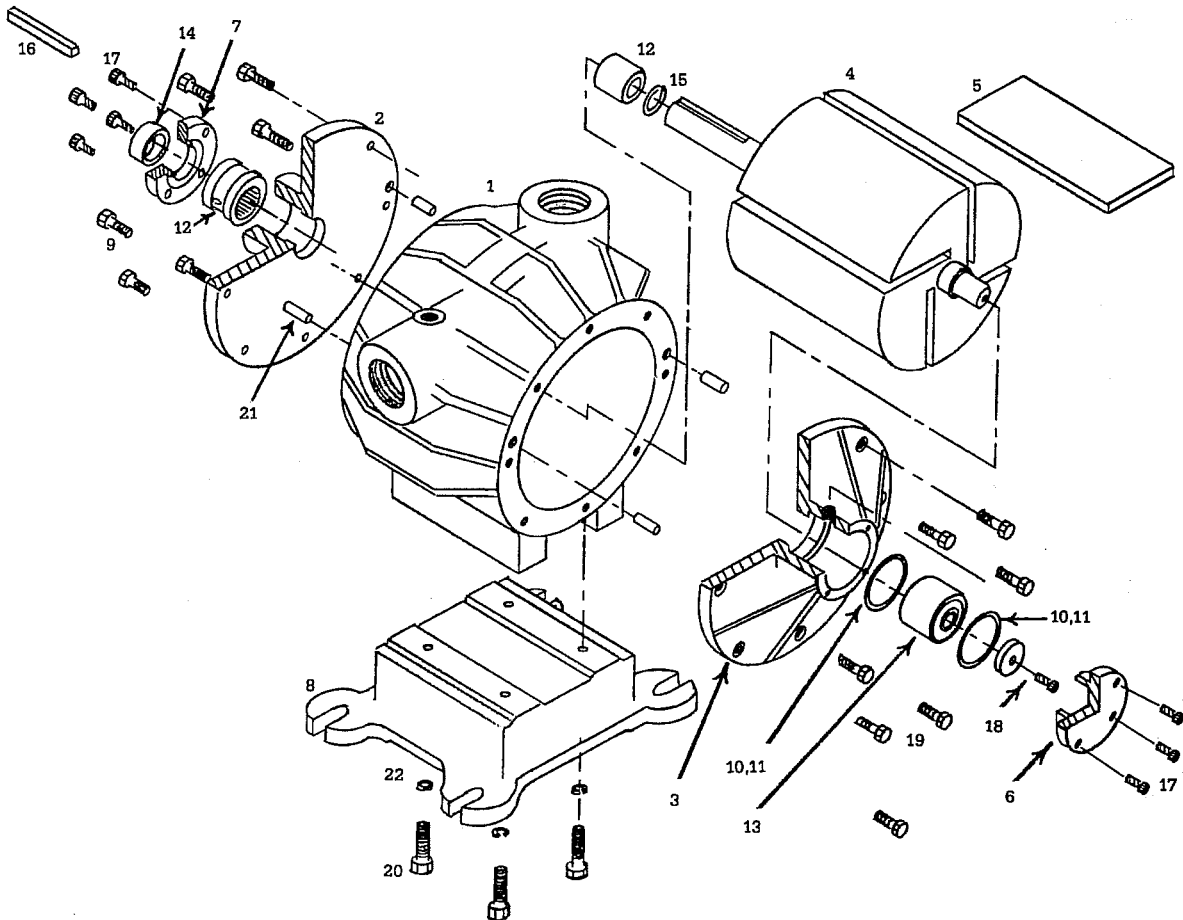
3. Remove the eight hex head screws (19) which secure the cylinder head (2) to the cylinder body (1).
4. Use head retaining screws in threaded holes to pull head from body.

Note: Two dowel pins (21) secure the head against the cylinder body to ensure original location of the head against the body. The head will have to be pried away from the body until these pins clear their holes.

CAUTION: Care should be taken not to scar or score the mating surfaces of the cylinder body and head.

5. After removing the cylinder head, visually inspect the following components:
 - a. interior surface of cylinder head
 - b. roller bearing assembly (12)
 - c. front section of rotor and shaft assembly (4)
 - d. vanes (5)
6. If replacement of vanes is the only repair to be made, this can be done at this point without any further disassembly.
7. Reassemble the pump by reversing these steps and reinstall into the system.

WARNING: Before operating the vacuum pump system again, complete all Pre-Startup and Startup procedures to ensure safe and proper operation.



Ref. No.	Description	Qty.
1	Cylinder, Pump Body	1
2	Cylinder Head, Shaft-end	1
3	Cylinder Head, Blind end	1
4	Rotor & Shaft & Assembly	1
5	Vanes, set of 4	1
6	End Cap	1
7	Seal Housing	1
8	Base Pump	1
9	Washer, Bearing	1
10	Shim, .002 in.	A/R
11	Shim, .005 in.	A/R
12	Bearing, Roller w/ Inner Race (30-6)	2
	Bearing, Roller w/ Inner Race (30-6DB)	1
13	Bearing, Ball Double, 30-6DB	1
14	Seal	1
15	Retaining Ring	1
16	Key, Square	1
17	Screw, 10-32 x 1/2, Soc. Hd. 8	1
18	Screw, 1/4-20 x 3/4, Hex Hd. Lock	
19	Screw, 1/4-20 x 3/4, Hex Hd.	16
20	Screw, 3/8-16 x 1, Hex Hd.	4
21	Dowel Pin	4
22	Lockwasher, 3/8 in. split ring	4

Figure 8
Exploded View of a Disassembled Pump (Typical)

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Intermittent Duty Medical Vacuum System/OM Rev. 12/98
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6810-0030-002