

Acco[®] VAC-U-LIFT[®]

vacuum lifters
product series 3200

installation
operation
maintenance
and parts
manual

SERIAL NUMBER

PAD SEAL RING NUMBER

⚠ WARNING

This equipment should not be installed, operated or maintained by any person who has not read all the contents of these instructions. Failure to read and comply with the instructions or any one of the limitations noted herein can result in serious bodily injury or death, and/or property damage.

There are no other warranties which extend beyond the description on the Order Acknowledgment and as it may apply to the specifications provided in this publication. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED. Acco shall in no event be liable for any special, direct, indirect, incidental or consequential damages to anyone beyond the cost of replacement of the goods sold hereby.

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NOTICE

Manual 69903 covers information in reference to standard models of the VAC-U-LIFT® Series 3200 Vacuum Lifters. This manual includes instructions and parts information for a variety of vacuum lifters. Therefore, all instructions or parts information may not apply to any one type or size of specific vacuum lifter. Disregard those portions of the manual that do not apply. Manuals for special engineered vacuum lifters will contain additional pages in accordance with product specifications. When a VAC-U-LIFT® Series 3200 Vacuum Lifter is used with a VAC-U-LIFT® Series 1600 90°-Upender Attachment, refer also to Manual 70126, Installation, Operation, Maintenance, and Parts Manual for VAC-U-LIFT® 90°-Upender Attachment, Product Series 1600.

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NOTICE

TO ORDER PARTS: Provide part number, part description, quantity required, and Product Number or Serial Number of Vacuum Lifter.

IMPORTANT INFORMATION AND WARNINGS

CAUTION

These general instructions deal with the normal installation, operation, inspection, and maintenance situations encountered with the equipment described herein. The instructions should not be interpreted to anticipate every possible contingency or to anticipate the final lifting system, hoist, crane, or configuration that uses this equipment.

This manual includes instructions and parts information for a variety of vacuum lifters. Therefore, all instructions and parts information may not apply to any one type or size of vacuum lifter. Disregard those portions of the instructions that do not apply.

Record vacuum lifter serial number on the front cover of this manual for identification and future reference to avoid referring to the wrong manual for information or instructions on installation, operation, inspection, maintenance, or parts.

Use only VAC-U-LIFT® authorized replacement parts in the service and maintenance of this equipment.

WARNING

Equipment described herein is not designed for and should not be used for lifting, supporting, or transporting humans.

Equipment described herein should not be used in conjunction with other equipment unless necessary and/or required safety devices applicable to the lifting system, hoist, crane, or application are installed by the system designer, system manufacturer, crane manufacturer, installer, or user.

Modifications to upgrade, rerate, or otherwise alter this equipment shall be authorized only by the original equipment manufacturer or qualified professional engineer.

Equipment described herein may be used in the design and manufacture of cranes, monorail systems, or lifting systems. Additional equipment or devices may be required for the crane, monorail system, or lifting system to comply with applicable design and safety standards. The crane or system designer, crane or system manufacturer, or user is responsible to furnish these additional items for compliance. Refer to ASME B30.20, Safety Standard for Below-the-Hook Lifting Devices. If a hoist is used with this equipment, refer to ASME B30.16, Safety Standard for Overhead Hoists. If a crane is used with this equipment, refer to ASME B30.17, Safety Standard for Top-Running Single-Girder Cranes; ASME B30.2 Safety Standard for Top-Running Double-Girder Cranes; and ASME B30.11 Safety Standard for Underhung Cranes and Monorails.

Hoists, cranes, monorails, and lifting systems used to handle hot molten material may require additional equipment or devices. Refer to ANSI Z241.2, Safety Requirements for Melting and Pouring of Metals in the Metalcasting Industry.

Electrical equipment described herein is designed and built in compliance with Acco Chain & Lifting Products interpretation of ANSI/NFPA 70, National Electrical Code. The system designer, system manufacturer, crane designer, crane manufacturer, installer, or user is responsible to assure that the installation and associated wiring of these electrical components is in compliance with ANSI/NFPA 70, and all applicable Federal, State, and Local Codes.

Failure to read and comply with any one of the limitations noted herein can result in serious bodily injury or death, and/or property damage.

DANGER

HAZARDOUS VOLTAGES ARE PRESENT IN THE CONTROL BOX, OTHER ELECTRICAL COMPONENTS, AND CONNECTIONS BETWEEN THESE COMPONENTS.

Before performing ANY mechanical or electrical maintenance on the equipment, de-energize (disconnect) the main switch supplying power to the equipment; and lock and tag the main switch in the de-energized position. Refer to ANSI Z244.1, Personnel Protection - Lockout/Tagout of Energy Sources.

Only trained and competent personnel should inspect and repair this equipment.

IMPORTANT INFORMATION AND WARNINGS

NOTICE

It is the responsibility of the owner/user to install, inspect, test, maintain, and operate a vacuum lifter in accordance with ASME B30.20, Safety Standard for Below-the-Hook Lifting Devices, OSHA Regulations, and ANSI/NFPA 70, National Electrical Code. If the vacuum lifter is installed as part of a total lifting system, it is also the responsibility of the owner/user to comply with the applicable ASME B30 volume that addresses other types of equipment used in the system.

It is the responsibility of the owner/user to have all personnel that will install, inspect, test, maintain, and operate a vacuum lifter read the contents of this manual and applicable portions of ASME B30.20, Safety Standard for Below-the-Hook Lifting Devices, OSHA Regulations, and ANSI/NFPA 70, National Electrical Code. If the vacuum lifter is installed as part of a total lifting system, the applicable ASME B30 volume that addresses other types of equipment used in the system must also be read by all personnel.

Any ANSI Standards referenced in this manual may be obtained from the American National Standards Institute, 1430 Broadway, New York, New York 10018.

This manual contains information for safe operation of a vacuum lifter. Taking precedence over any specific rule, however, is the most important rule of all - "USE COMMON SENSE." Operation of a vacuum lifter involves more than operating the controls. The operator must consider and anticipate the motions and actions that will occur as a result of operating the controls.

If the vacuum lifter owner/user requires additional information, or if any information in the manual is not clear, contact Acco Chain & Lifting Products, York, Pennsylvania or the distributor of the vacuum lifter. Do not install, inspect, test, maintain, or operate this equipment unless this information is fully understood.

When contacting Acco Chain & Lifting Products or the distributor of the vacuum lifter, always make reference to the serial number of the equipment.

A regular schedule of inspection of the vacuum lifter in accordance with the requirements of ASME B30.20 should be established and records maintained.

⚠ WARNING

Before installing, removing, inspecting, or performing any maintenance on a vacuum lifter, hoist, crane, monorail, or lifting system; the main switch shall be de-energized. Lock and tag the main switch in the de-energized position in accordance with ANSI Z244.1. Follow other maintenance procedures outlined in this manual and applicable ASME B30 volumes.

Additional WARNINGS are listed in various portions of this manual. Personnel shall read and follow these WARNINGS. Failure to read and comply with these WARNINGS as well as other instructions or any limitations noted in this manual and applicable ASME B30 volumes could result in serious bodily injury or death, and/or property damage.

NOTICE

Manual 69903 covers information in reference to standard models of the VAC-U-LIFT® Series 3200 vacuum lifters. Manuals for special engineered vacuum lifters will contain additional pages in accordance with product specifications.

SERIES 3200 VACUUM LIFTER TYPES

VAC-U-LIFT® Series 3200 vacuum lifters are available in a variety of configurations. The basic components assembled into these various configurations include the VAC-U-LIFT® Series 3200 power pac, load beam, cross arms, and vacuum pads. Refer to Figure 1.

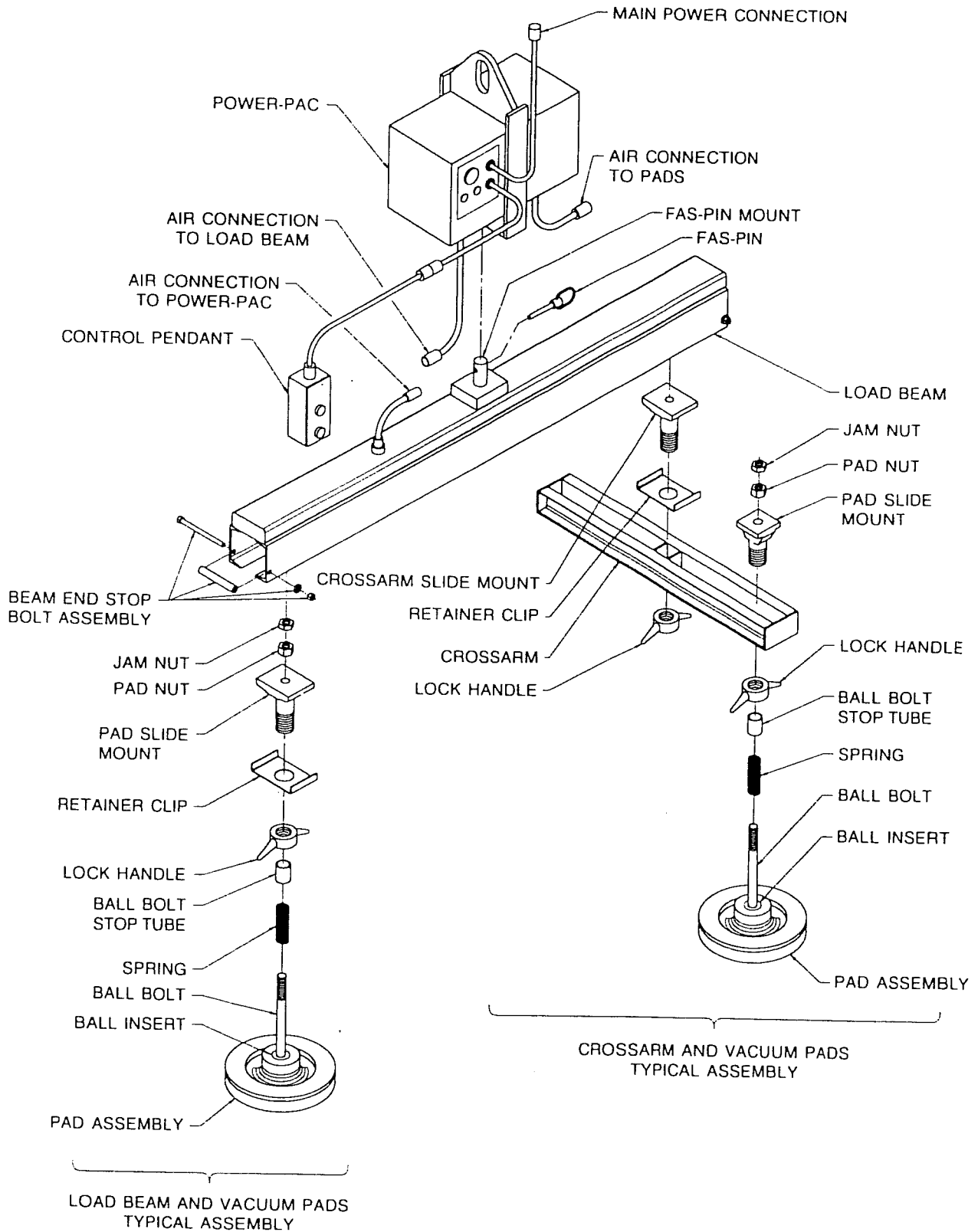


FIGURE 1

SERIES 3200 VACUUM LIFTER TYPES

VAC-U-LIFT® Series 3200 vacuum lifters have a maximum rated load capacity of 3200 pounds. When the VAC-U-LIFT® Series 3200 power pac is used with a 90° upender attachment, the maximum rated load capacity is 1600 pounds. Actual rated load capacity, and size limit of load to be handled, of any individual lifter is dependent on the number, size, and style of vacuum pads; size and length of load beam; and number, size, and length of cross arms. Refer to Figure 2. Detailed specifications can be obtained from catalog data or order specifications.

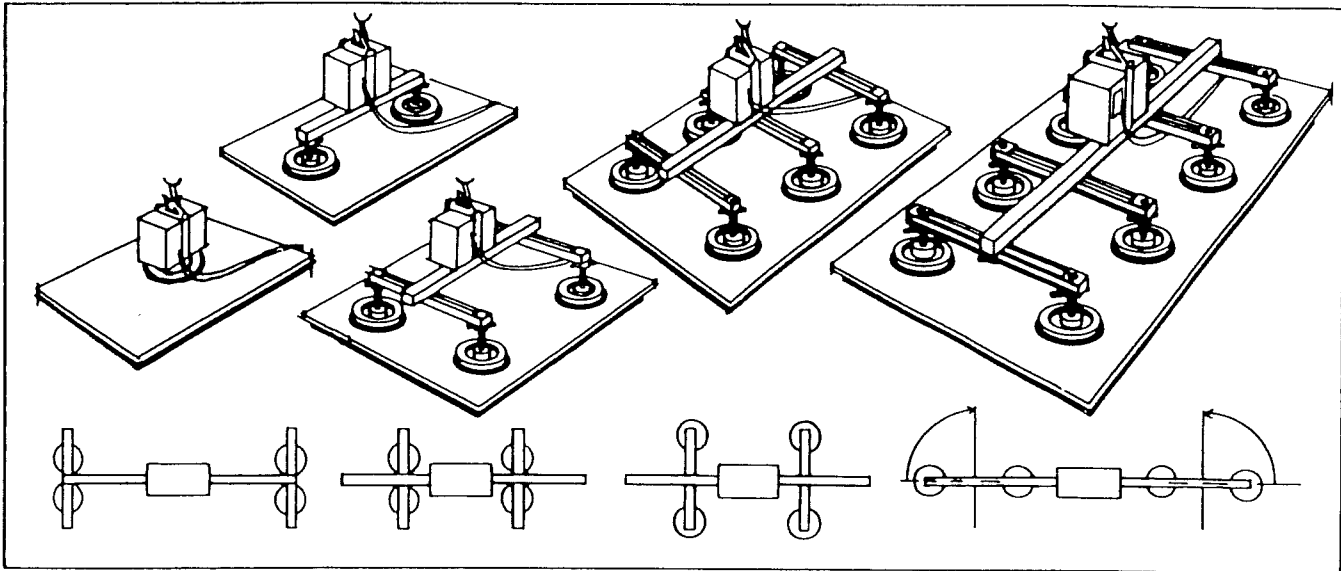


FIGURE 2

General descriptions of different VAC-U-LIFT® Series 3200 vacuum lifter components are presented below for information purposes, and to serve as a guide to aid in using the instructions and parts information outlined in this manual. If additional information is required, contact Acco Chain & Lifting Products or the distributor of the vacuum lifter.

VAC-U-LIFT® SERIES 3200S AND 3200U POWER PAC:

The VAC-U-LIFT® Series 3200S power pac is the standard model power pac for use in Series 3200 lifters with multiple pads where a vacuum reserve tank is available external to the power pac for positive holding of the load being lifted, in the event of power failure. The VAC-U-LIFT® series 3200U power pac is the standard model power pac for use in Series 1600 upenders with multiple pads where a vacuum reserve tank is available external to the power pac for positive holding of the load being lifted in the event of power failure. The Series 3200S and Series 3200U do not contain an internal vacuum reverse tank.

⚠ CAUTION

DO NOT USE THE SERIES 3200S POWER PAC WITH SINGLE-PAD LIFTERS UNLESS AN EXTERNAL VACUUM RESERVE TANK IS AVAILABLE. THE SERIES 3200U POWER PAC SHOULD BE USED WITH SINGLE-PAD LIFTERS.

The VAC-U-LIFT® Series 3200S or 3200U power pac is equipped with a 3 feet long pigtail power cord with a twist lock connector for 115 volt, single-phase, 60 hertz, AC power supply; two-button control pendant station with a 10 feet long control cord; 1/3 hp oil-less 4 cfm vacuum pump; dual purpose, visual indicator vacuum/pressure gauge; and red/green visual indicator lights.

While the standard catalog VAC-U-LIFT® Series 3200S or 3200U power pac is furnished for 115 volt, single-phase, 60 hertz, AC power supply; the unit can be furnished for other power supply voltages and phases in accordance with specification requirements using optional transformers to step the voltage down to 115 volt, single-phase.

SERIES 3200 VACUUM LIFTER TYPES

VAC-U-LIFT[®] SERIES 3200R POWER PAC:

The VAC-U-LIFT[®] Series 3200R power pac is identical to the Series 3200S power pac except that it contains an internal vacuum reserve tank for positive holding of the load being lifted in the event of power failure.

VAC-U-LIFT[®] SERIES 3200B POWER PAC:

The VAC-U-LIFT[®] Series 3200B power pac is a 12 volt DC battery-powered version of the Series 3200R. It has the same features as the Series 3200R except without external power supply requirements. The Series 3200B power pac will operate up to 16 hours under normal conditions without recharging, and contains a panel-mounted plug for a standard 12 volt DC charger. The unit is capable of being recharged in eight hours when using the recommended 70 amp battery. Battery is not included with the Series 3200B. Battery and charger are available as optional equipment. Acco part number for the battery charger is 22027. Acco part number for the battery is 28052.

VAC-U-LIFT[®] SERIES 3200 POWER PAC DIMENSIONS:

General dimensions of the Series 3200 power pac are shown in Figure 3. Headroom figure dimension (distance from top surface of hook opening in power pac bail to vacuum pad surface) will vary in accordance with pad configuration and pad type. Refer to order specifications for headroom dimension.

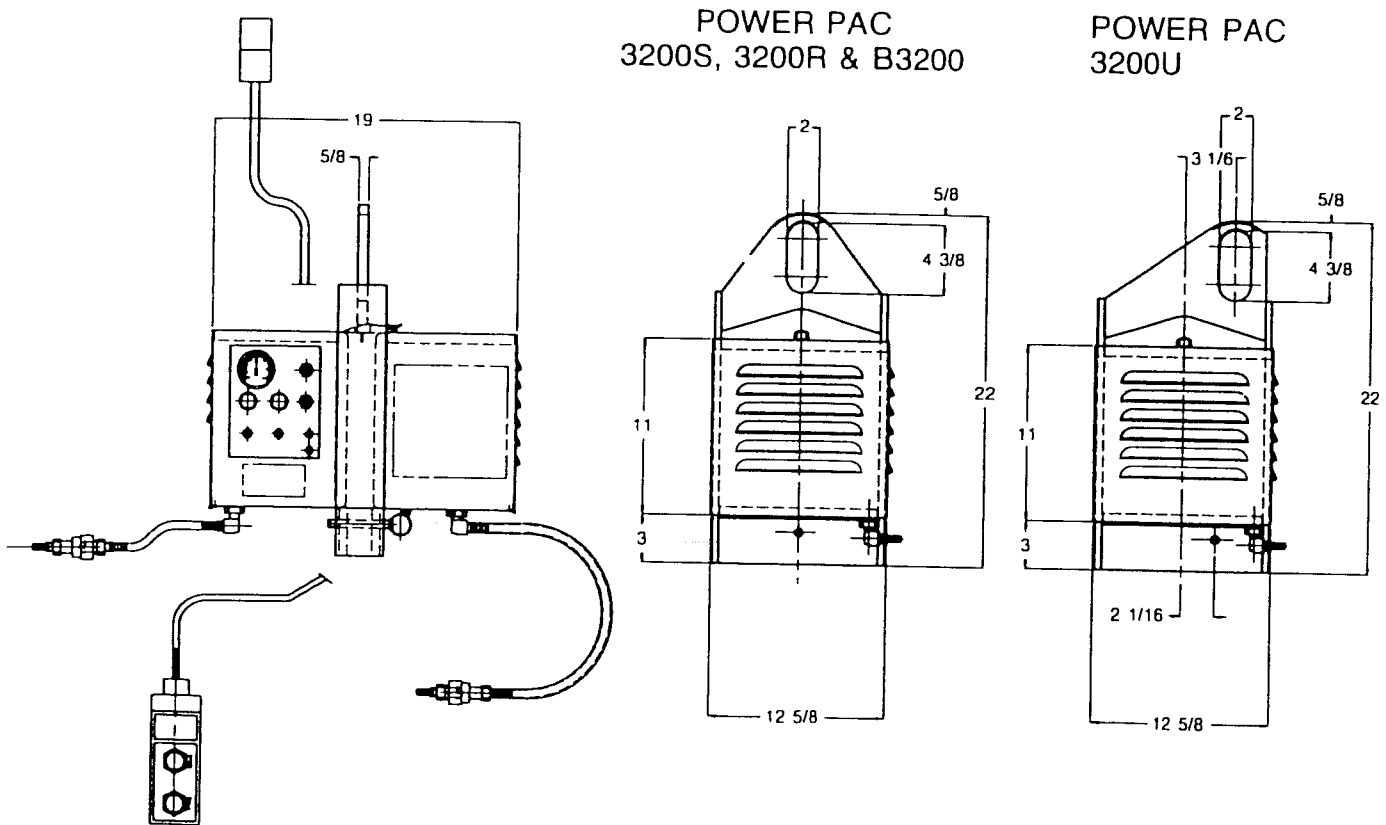


FIGURE 3

Dimensions of the opening in the bail for suspension of the power pac or lifter from a hoist or crane hook is shown in Figure 3. The bail of the power pac must be compatible with the size of the hoist or crane hook to be used; must be properly seated in the base, bowl, or saddle of the hoist or crane hook to be used; and must not prevent the hook latch from properly operating to bridge or close the hook throat opening. If the lifter does not properly seat in the base, bowl, or saddle of the hoist or crane hook to be used; do not use the lifter with this hoist or crane. Contact Acco Chain & Lifting Products or the distributor of the vacuum lifter.

SERIES 3200 VACUUM LIFTER TYPES

⚠ WARNING

DO NOT USE A VACUUM LIFTER IF THE LIFTER IS NOT PROPERLY SEATED IN THE BASE, BOWL, OR SADDLE OF THE HOIST OR CRANE HOOK TO BE USED.

LOAD BEAM:

Standard load beams are welded construction using steel tubing and standard structural steel channels, and are provided with fas-pin connection to the power pac. The steel tubing portion of the load beam serves as a vacuum reserve tank. Cross arms or vacuum pads can be adjusted along the load beam length to match load size requirements. Standard load beam lengths are 4 feet, 6 feet, 8 feet, and 10 feet. Longer load beam lengths can be furnished in accordance with specification requirements.

CROSS ARMS:

Cross arms are welded construction using standard structural formed steel and are fixed in a perpendicular position to the load beam. Rotating cross arms are available as an option that can be turned and locked in position on the load beam for reduced load size width. Vacuum pads can be adjusted along the cross arm length to match load size requirements. Standard cross arm lengths are 3 feet, 4 feet, 5 feet, and 6 feet.

VACUUM PADS:

Standard vacuum pads are ball-bolt mounted, spring loaded, and adjustable along either the load beam or cross arms. Neoprene seal rings are standard. Silicone seal rings are available when specified for operating surface temperatures of 200°F to 500°F. Other seal materials are available for special applications in accordance with specification requirements. Seal rings are supplied with a standard lip unless long lip or sponge is specified.

Pad configuration and location is determined by the Acco engineers at the time of purchase in accordance with specification requirements. When more than one pad is used, they are attached by means of a load beam or a load beam and cross arms.

In multiple-pad configurations, vacuum lines connect all pads to the power pac unit. Hand-operated shut-off valves are standard when the application requires certain pads to be disconnected from the vacuum circuit.

OPTIONAL ACCESSORIES:

Numerous standard optional accessories are available, when requested or specified, for VAC-U-LIFT® Series 3200 vacuum lifters. These optional accessories include the following:

- Transformer for AC voltages other than 115 (3200S, 3200R and 3200U only).
- Longer control pendant station cord lengths.
- Multiple-button control pendant station for controlling the vacuum lifter and hoist or hoist and crane.
- Coil cord kits to supply power from hoist or hoist and crane to hook complete with twist-lock connections to 3200S, 3200R, or 3200U unit.
- Hose assemblies for using single-or multiple-pads with remote power unit.
- Hand-operated shut-off valves to allow certain pads to be disconnected from the vacuum circuit.
- Guide handle bar for positioning lifter.
- Auxiliary red/green visual indicator lights.
- Low vacuum warning device.
- Load beam support leg for storing lifter that keeps lifter from being supported on the vacuum pads.
- Special length load beam or cross arms.
- Rotating cross arms.
- Vacuum pad seal ring material.
- 90° upender attachment.
- Upender guide handle bar.
- Water trap.
- Internal reserve tank for 3200S and 3200U.

In addition to the standard optional accessories available for VAC-U-LIFT® Series 3200 vacuum lifters; Acco designs and manufactures engineered vacuum lifters in accordance with application and specification requirements. Manuals for special engineered vacuum lifters will contain additional pages in accordance with product specifications.

EQUIPMENT/OPERATING PRINCIPLES

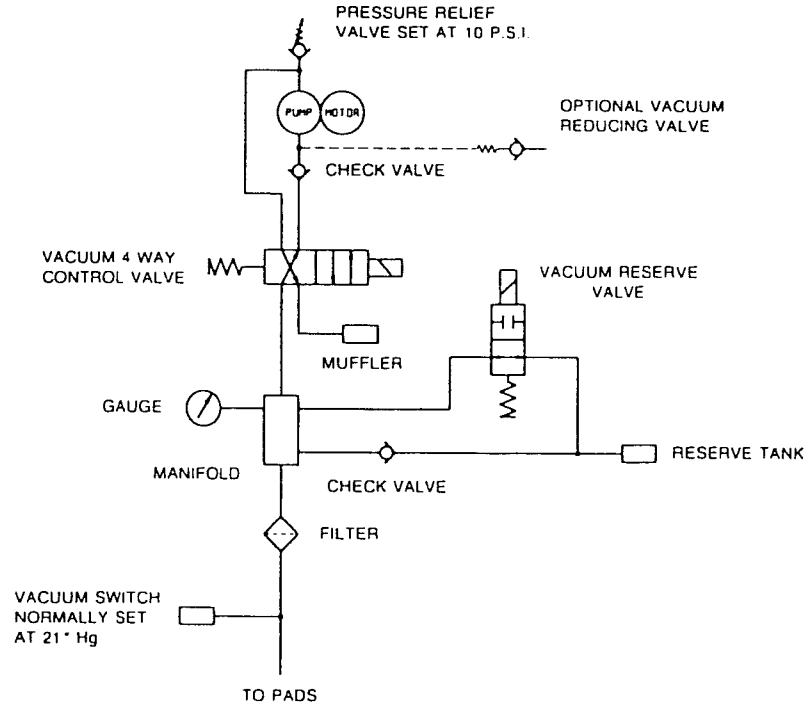


FIGURE 4

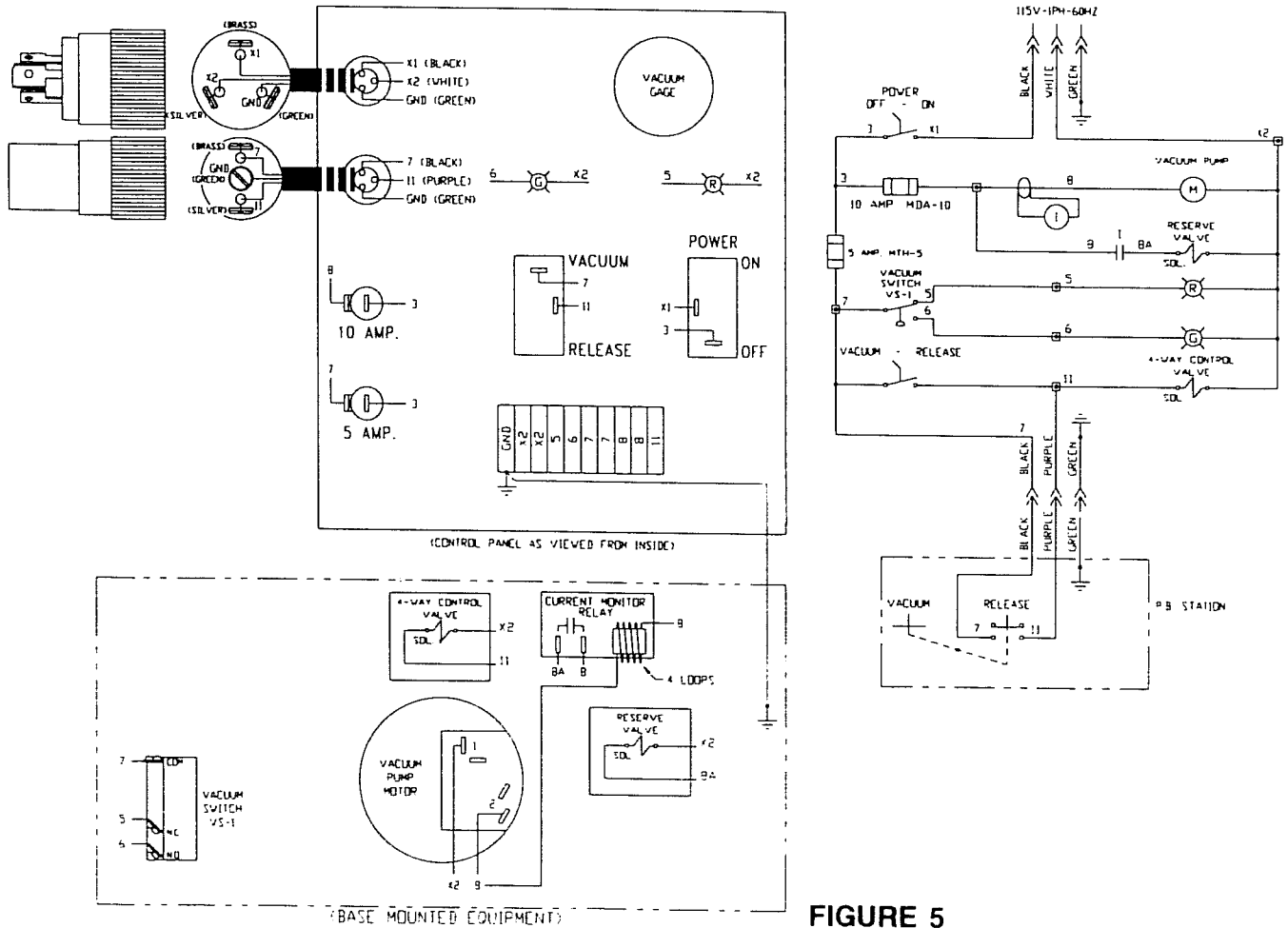


FIGURE 5

EQUIPMENT/OPERATING PRINCIPLES

Vacuum lifting is accomplished by setting a vacuum pad or pads on the surface of the material or load to be lifted and handled. Air is then withdrawn from the area between the pad and the surface of the load. The pressure differential between atmospheric pressure outside the pad and the partial vacuum created inside the area covered by the pad binds both pad and load together. Pad capacity is directly proportional to the square inch area covered by the pad and the pressure differential created.

There are three important factors that govern successful vacuum attachment.

- **Effective seal.**
- **Load distribution.**
- **Weight-to-area ratio.**

Effective Seal: The vacuum pad seal ring will not seal well if; the material of the load is too porous; the surface of the load is uneven or pebbly causing leakage; the surface temperature of the load is too high for the seal ring material causing melting and damage to the seal ring; or the lip of the seal ring is worn or damaged causing leakage.

Load Distribution: Thin, flexible material having excessive deflection by its own weight may peel away from the pad. An improved balanced lift can be achieved by the use of a load bar and cross arms. Standard vacuum pads are ball-bolt mounted to the load beam or cross arm allowing the pad to tilt a maximum of 7½° in any direction from horizontal. This produces a gimbal effect that reduces bending stresses in the pad attachment.

Weight-to-Area Ratio: The surface of the material to be handled must be large enough for a pad or pads to attach that have sufficient pad lifting capacity for the weight of the load to be handled.

The VAC-U-LIFT® Series 3200 vacuum lifter is attached to the surface of the load to be lifted by creating a partial vacuum over the area covered by the pads. The system used to create and control the vacuum in Series 3200S, 3200R, and 3200U is shown in Figure 4. The system used to create and control the vacuum in Series 3200B is shown in Figure 6. The electrical control circuit for the Series 3200S, 3200R, and 3200U is shown in Figure 5. The electrical control circuit for the Series 3200B is shown in Figure 7.

OPERATING PRINCIPLES - SERIES 3200S, 3200R, AND 3200U:

Refer to Figures 4 and 5.

When the "ON/OFF" switch on the power pac control panel is in the "ON" position, and the "VACUUM/RELEASE" switch on the power pac control panel is in the "VACUUM" position, and the "VACUUM" button on the control pendant station is depressed; the four-way control solenoid valve is de-energized allowing the vacuum pump to evacuate air from the pads through the filter, the control valve, and the check valve. The pump vents the air to the atmosphere through the control valve and the muffler. The check valve prevents air from re-entering the pads should the vacuum pump stop.

At the same time that air is evacuated from the pads, air is also drawn from the vacuum reserve tank through a second check valve. The vacuum reserve solenoid valve is held in the closed position as long as electrical power is supplied to the unit. If the power is interrupted, the solenoid is de-energized, connecting the reserve tank directly to the pad vacuum lines. The vacuum in the pads is maintained for a period of several minutes. If power is not restored, this allows the load to be lowered and released from the pads before the vacuum is lost and the load is released and falls from the pads.

CAUTION

THE SERIES 3200S AND 3200U DO NOT CONTAIN AN INTERNAL RESERVE TANK. THEREFORE, AN EXTERNAL RESERVE TANK IS REQUIRED WITHIN THE VACUUM SYSTEM. ON MULTIPLE-PAD LIFTERS, THE LOAD BEAM NORMALLY IS DESIGNED TO ACT AS A RESERVE TANK.

THE SERIES 3200R DOES CONTAIN AN INTERNAL RESERVE TANK.

DO NOT USE THE SERIES 3200S OR 3200U POWER PAC WITH SINGLE-PAD LIFTERS UNLESS AN EXTERNAL VACUUM RESERVE TANK IS AVAILABLE. THE SERIES 3200R POWER PAC SHOULD BE USED WITH SINGLE-PAD LIFTERS.

To release the vacuum pads from the load after it has been handled, positioned, and landed; the "RELEASE" button on the control pendant station is depressed. This will energize the vacuum control solenoid valve that connects the pad vacuum line to the exhaust side of the vacuum pump and the muffler to the intake (vacuum) side of the pump. This process forces air to the vacuum pads, releasing the vacuum and allowing removal of the pads from the load.

EQUIPMENT/OPERATING PRINCIPLES

Because the check valve in the reserve tank line prevents air from flowing into the vacuum reserve tank during the release process, it is not necessary to re-evacuate the reserve tank each time a load is to be lifted. This minimizes the attach time to lift additional loads.

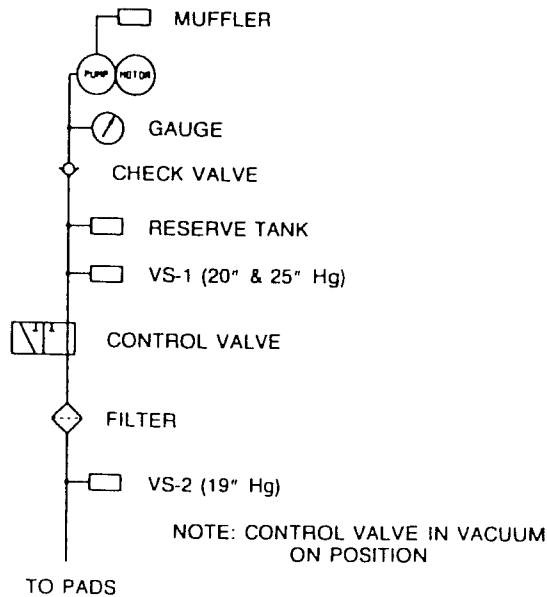


FIGURE 6

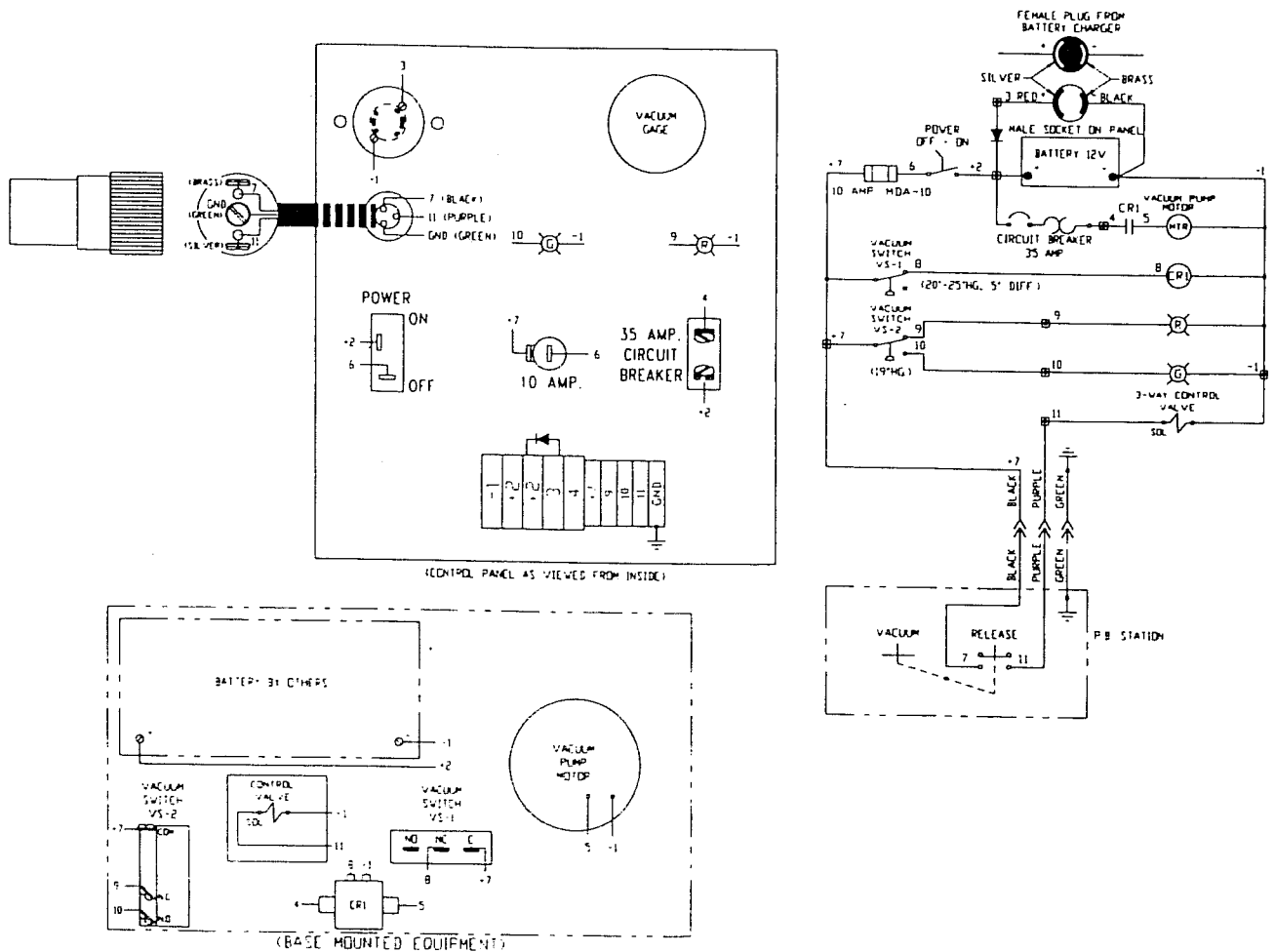


FIGURE 7

EQUIPMENT/OPERATING PRINCIPLES

OPERATING PRINCIPLES - SERIES 3200B:

Refer to Figures 6 and 7.

Before turning the power pac on after an idle period, the pendant control "RELEASE" button should be depressed first prior to putting the "ON/OFF" switch in the "ON" position. When the "ON/OFF" switch on the power pac control panel is put in the "ON" position, the vacuum pump will run until 25" Hg of vacuum is reached in the vacuum reserve tank.

When the "ON/OFF" switch on the power pac control panel is in the "ON" position, and the "VACUUM" button on the control pendant station is depressed; the control valve opens, allowing the vacuum pump to evacuate air from the pads through the filter and check valve. The pump vents the air to the atmosphere through the muffler. The check valve prevents air from re-entering the pads should the vacuum pump stop.

At the same time that air is evacuated from the pads, air is also drawn from the vacuum reserve tank. If the power is interrupted, control valve will stay in the open position, connecting the reserve tank directly to the pad vacuum lines. The vacuum in the pads is maintained for a period of several minutes. If power is not restored, this allows the load to be lowered and released from the pads before the vacuum is lost and the load is released and falls from the pads.

To release the vacuum pads from the load after it has been handled, positioned, and landed; the "RELEASE" button on the control pendant station is depressed. This will close the control valve; opening the vacuum pads to atmospheric pressure.

Because the control valve in the closed position prevents air from flowing into the vacuum reserve tank during the release process, it is not necessary to re-evacuate the reserve tank each time a load is to be lifted. This minimizes the attach time to lift additional loads.

The "ON/OFF" switch on the power pac control panel should be placed in the "OFF" position when the power pac is not being used.

VACUUM SYSTEM - SERIES 3200S, 3200R, AND 3200U:

Vacuum Pump: The vacuum pump is a rotary-vane, oil-less pump designed for continuous duty under full vacuum in ambient temperatures of 32 °F to 100 °F. For operation in other ambient temperatures, contact Acco Chain & Lifting Products.

NOTICE

DO NOT LUBRICATE THE PUMP.

Routine maintenance and cleaning of the filter and muffler, as well as periodic flushing of the pump chamber will prolong vane life. Refer to the MAINTENANCE AND REPAIR section of this manual.

Four-way Control Valve: The vacuum to the pads is controlled by a four-way solenoid valve. The valve is in the "VACUUM" position when the solenoid is de-energized. The valve is energized by the "RELEASE" button on the control pendant station. This will force exhaust air of the vacuum pump into the line to the pads and supply air pressure required for a quick release.

Pressure Relief Valve: This valve is located on the exhaust side of the vacuum pump between the pump and the four-way control valve. Its purpose is to prevent pressure build-up at the pump. This condition could occur during the "RELEASE" cycle if all of the pad valves are closed or if the filter or vacuum line is clogged. This valve will release at a pressure greater than 10 psi.

Check Valve: Two check valves are used in the vacuum system. One is located between the vacuum pump intake port and the four-way control valve. It is installed to permit air to be pumped from the vacuum line system, but to prevent air from entering the system when the vacuum pump is not operating. One is located between the vacuum reserve tank and the vacuum system in such a manner the air can be evacuated from the reserve tank during the "VACUUM" cycle; but cannot re-enter the reserve tank when the vacuum lines are pressurized during the "RELEASE" cycle. The reserve tank, therefore, does not have to be completely evacuated each time a load is lifted, reducing the length of time required to attach the pad or pads to the load.

Filter and Muffler: A filter is located in the vacuum line between the pads and the four-way control valve to prevent dirt and foreign matter from entering the vacuum pump and valves. The muffler reduces the noise of the vacuum pump exhaust during the "VACUUM" cycle; and filters the air entering the pump during the "RELEASE" cycle.

The filter and muffler must be maintained in a clean condition for maximum vacuum system efficiency and prolonged vacuum pump life. Refer to the MAINTENANCE AND REPAIR section of this manual.

EQUIPMENT/OPERATING PRINCIPLES

Three-way, Hand-operated, Shut-off Valves: Hand-operated valves, located on or near each vacuum pad, are provided to shut off certain pads from the vacuum circuit. Normally, the valve is a three-way type to allow the pad to be connected to either the vacuum system or an open port. This feature provides an escape for the slight vacuum formed in the pad when it is lowered onto the material and prevents the unused pad or pads from sticking to the load during the release cycle.

Vacuum Reserve Valve: A solenoid-actuated, two-way valve parallels the check valve located between the vacuum reserve tank and the vacuum system. When energized, the valve is held in the closed position. The solenoid is connected directly to the vacuum pump power line. If electrical power to the vacuum pump is de-energized, the valve will open, connection the vacuum reserve tank to the pad vacuum circuit.

Toggle Switches: Two toggle-type switches are mounted on the power pac control panel. One is an "ON/OFF" switch that turns the power pac unit on and off. The second switch is a "VACUUM/RELEASE" switch that controls the operation of the four-way control solenoid valve to turn the vacuum circuit on and off. It is wired in parallel with the "VACUUM/RELEASE" buttons in the control pendant station. The control panel switch should be left in the "ON" position as it will override the switch in the control pendant station when in the "OFF" position. It is provided for use during maintenance when the control pendant station is disconnected.

Fuses: Two fuses are located in the electrical circuit. Both are accessible when the power pac cover is opened. Fuse no. 1 is rated at 5 amps and protects the control circuit. Fuse no. 2 is a 10 amp dual-element, slow-blow type that protects the vacuum pump motor. Power for the vacuum reserve tank is also connected through fuse no. 2; and if this fuse opens, the vacuum reserve valve will open, connecting the vacuum reserve tank to the pad vacuum circuit.

Vacuum Gauge, Indicator Lights, and Vacuum Switch: A vacuum gauge and a pair of indicator lights are mounted on the power pac control panel to indicate vacuum level. The vacuum gauge serves as a diagnostic device during testing and maintenance of the unit, and provides a means of checking vacuum level during a power failure.

The red and green visual indicator lights mounted on the power pac control panel are actuated by a vacuum switch connected to the vacuum line. When the vacuum level reaches 21" Hg, the vacuum switch de-energizes the red light and energizes the green light to indicate that sufficient vacuum has developed for lifting purposes. Optional, auxiliary red/green visual indicator lights are available for remote mounting, and will operate in the same manner as the indicator lights mounted on the power pac control panel.

The vacuum switch, shown in Figure 8, may be adjusted, if necessary, to switch the lights at the correct vacuum level. Adjustment is made by turning the nut indicated in Figure 8.

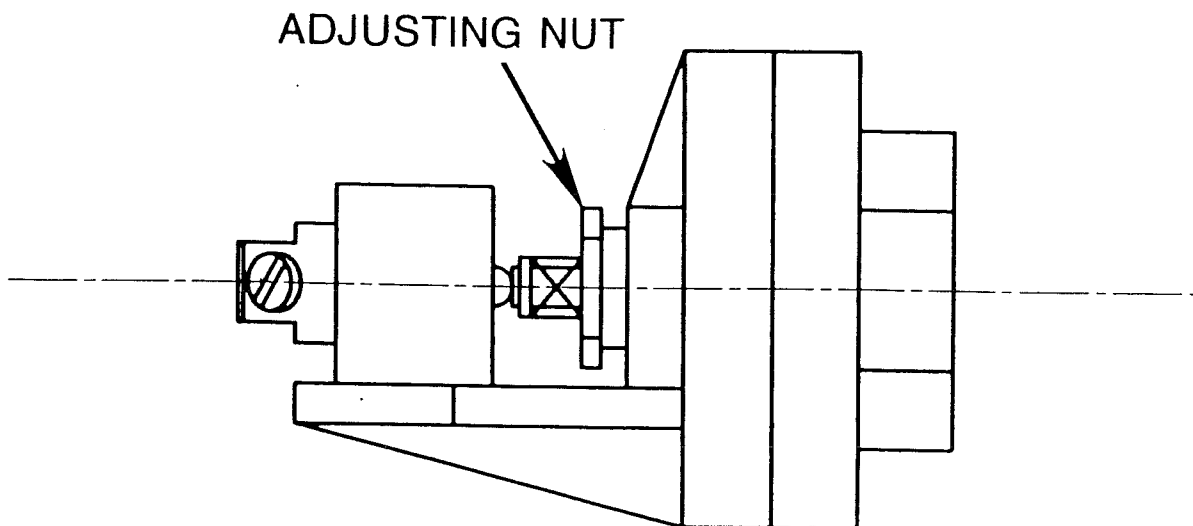


FIGURE 8

EQUIPMENT/OPERATING PRINCIPLES

⚠ CAUTION

PRIOR TO ADJUSTING THE VACUUM SWITCH, REMOVE THE VACUUM FILTER ELEMENT. A PARTIALLY PLUGGED FILTER WILL CAUSE THE GAUGE TO INDICATE A HIGHER VACUUM LEVEL THAN THAT AT THE VACUUM SWITCH. IF THE VACUUM SWITCH IS ADJUSTED UNDER THIS CONDITION, THE SWITCH WILL TRIP AT A LEVEL THAT IS NOT OF SUFFICIENT CAPACITY TO LIFT A LOAD.

VACUUM SYSTEM - SERIES 3200B:

Vacuum Pump: The vacuum pump is a rotary-vane, oil-less pump designed for continuous duty under full vacuum in ambient temperatures of 32 °F to 100 °F. For operation in other ambient temperatures, contact Acco Chain & Lifting Products.

NOTICE

DO NOT LUBRICATE THE PUMP.

Routine maintenance and cleaning of the filter and muffler, as well as periodic flushing of the pump chamber will prolong vane life. Refer to the MAINTENANCE AND REPAIR section of this manual.

Check Valve: The check valve used in the Series 3200B will permit air to be pumped from the vacuum line system, but will prevent air from entering the system when the vacuum pump is not running.

Vacuum Reserve Tank: A vacuum reserve tank is provided. If the power is interrupted, the reserve tank will provide a source of vacuum directly to the pad vacuum lines. The vacuum in the pads is maintained for a period of several minutes. If power is not restored, this allows the load to be lowered and released from the pads before the vacuum is lost and the load is released and falls from the pads. The reserve tank is evacuated to full vacuum each time a load is lifted.

Three-Way Control Valve: The vacuum to the pad(s) is controlled by a three-way solenoid valve. The valve is in the "VACUUM" position when the solenoid is de-energized. In the "VACUUM" position, the valve allows vacuum from the pump and vacuum reserve tank to enter the vacuum pad(s). The valve is energized by the "RELEASE" button on the control pendant station. In the "RELEASE" position, the valve is open to the atmosphere and vacuum is retained in the vacuum reserve tank.

Vacuum Gauge: A vacuum gauge is mounted on the power pac control panel to indicate vacuum level in the system in inches of mercury. The primary function of the vacuum gauge is to set the vacuum switches and check the condition of the filter.

Filter: A filter is located in the vacuum line between the pads and the control valve to prevent dirt and foreign matter from entering the vacuum pump and control valve.

The filter must be maintained in a clean condition for maximum vacuum system efficiency and prolonged vacuum pump life. Refer to the MAINTENANCE AND REPAIR section of this manual.

Muffler: A muffler is located on the exhaust side of the vacuum pump. The muffler reduces the noise of the vacuum pump exhaust.

The muffler must be maintained in a clean condition for maximum vacuum system efficiency and prolonged vacuum pump life. Refer to the MAINTENANCE AND REPAIR section of this manual.

Three-way, Hand-operated, Shut-off Valves: Hand-operated valves, located on or near each vacuum pad are provided, when specified, to shut off certain pads from the vacuum circuit. Normally, the valve is a three-way type to allow the pad to be connected to either the vacuum system or an open port. This feature provides an escape for the slight vacuum formed in the pad when it is lowered onto the material and prevents the unused pad or pads from sticking to the load during the release cycle.

Toggle Switch: The "ON/OFF" toggle-type switch mounted on the power pac control panel turns the power pac unit on and off.

Power Contactor: A power contactor CR-1 is located inside the power pac. It is used to start and stop the vacuum pump motor. The coil of CR-1 is energized and the contacts close when vacuum switch VS-1 senses less than 20" Hg of vacuum and the "ON/OFF" switch is in the "ON" position.

EQUIPMENT/OPERATING PRINCIPLES

Fuse and Circuit Breaker: A fuse and circuit breaker are located in the electrical circuit. Both are accessible when the power pac cover is opened. The fuse is rated at 10 amps and protects the control circuit. The 35 amp thermal circuit breaker protects the vacuum pump motor. The circuit breaker button may be pulled out to stop the pump motor, if necessary.

Vacuum Gauge, Indicator Lights, and Vacuum Switches: A vacuum gauge and a pair of indicator lights are mounted on the power pac control panel to indicate vacuum level. The vacuum gauge serves as a diagnostic device during testing and maintenance of the unit, and provides a means of checking vacuum level during a power failure.

The red and green visual indicator lights mounted on the power pac control panel are actuated by a vacuum switch VS-2 connected to the vacuum line. When the vacuum level reaches 19" Hg, vacuum switch VS-2 de-energizes the red light and energizes the green light to indicate that sufficient vacuum has developed for lifting purposes.

The motor and pump will continue to operate until vacuum reaches 25" Hg, when VS-1 will de-energize CR-1 and stop the pump motor. If vacuum drops to 20" Hg, VS-1 will energize CR-1 and will restart the pump motor. The motor will continue to operate until vacuum reaches 25" Hg.

The vacuum switches, shown in Figures 8 and 9, may be adjusted, if necessary, to switch the lights at the correct vacuum level. Adjustment is made by turning the nut indicated in Figures 8 and 9.

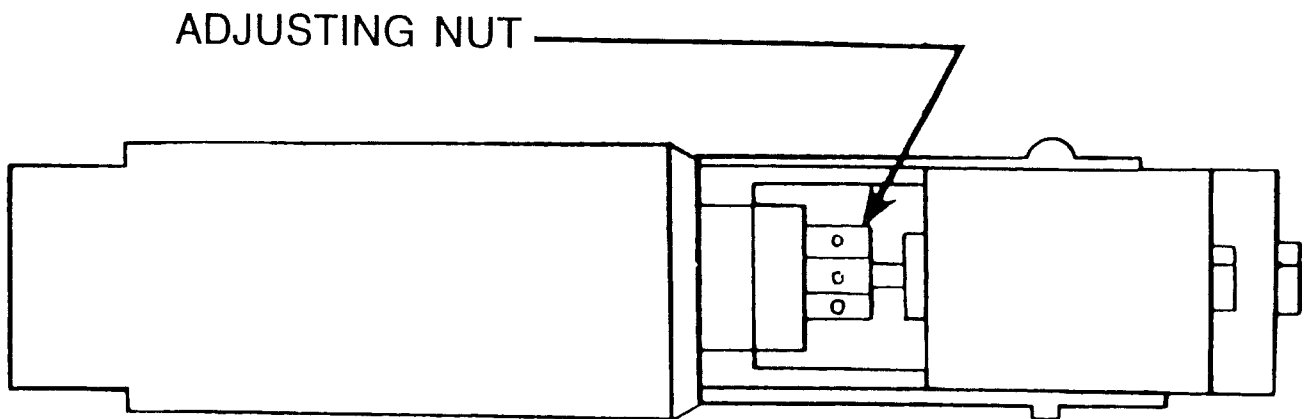


FIGURE 9

⚠ CAUTION

PRIOR TO ADJUSTING THE VACUUM SWITCH, REMOVE THE VACUUM FILTER ELEMENT. A PARTIALLY PLUGGED FILTER WILL CAUSE THE GAUGE TO INDICATE A HIGHER VACUUM LEVEL THAN THAT AT THE VACUUM SWITCH. IF THE VACUUM SWITCH IS ADJUSTED UNDER THIS CONDITION, THE SWITCH WILL TRIP AT A LEVEL THAT IS NOT OF SUFFICIENT CAPACITY TO LIFT A LOAD.

BATTERY CHARGER SPECIFICATIONS - SERIES 3200B:

Battery charger to be 12 volts with a charging rate of 6 amperes. Battery charger should be of the automatic type which adjusts charging rate to battery conditions automatically; delivering full amp output to a low battery, decreasing rate as battery approaches full charge, and provides a trickle charge as required to maintain full charge. Battery charger should compensate automatically for temperature and AC voltage variations, and adjust automatically so it can be left connected for an extended period without damaging charger or battery. For information on charging the battery, refer to the BATTERY RECHARGE section of this manual.

⚠ CAUTION

REFER TO AND READ ALL INSTRUCTIONS AND WARNINGS FURNISHED WITH THE BATTERY CHARGER.

INSTALLATION

PRIOR TO INSTALLING VACUUM LIFTER:

1. Read and observe the instructions and warnings contained in this manual. Read and observe any instructions and warning tags attached to the lifter.
2. Check for any damage to the lifter during shipment. If any damage has occurred, place a claim with the carrier. DO NOT install or use a damaged lifter.

NOTICE

DO NOT STORE THE VAC-U-LIFT® VACUUM LIFTER BY ALLOWING IT TO REST ON THE VACUUM PAD SEALS AS THIS COULD DAMAGE AND SHORTEN THE LIFE OF THE VACUUM PAD SEAL RINGS. STORE THE VACUUM LIFTER BY SUPPORTING THE LOAD BEAM OR LIFTING YOKE SO THAT VACUUM PADS ARE FREELY SUSPENDED.

3. Check that the crane, hoist, monorail, or other supporting structure where the lifter will be installed has a load rating capable to handle loads equal to the sum of the rated load capacity of the lifter and the weight of the lifter.
4. If lifter is to be installed on an existing crane or hoist, the crane or hoist should be run to a location where it will cause the least interference with other cranes or hoists and operations in the area; and all controllers placed in the off position.
5. Warning signs and barriers shall be utilized on the floor beneath the crane, hoist, or area where the lifter will be installed.

⚠ DANGER

6. The main switch (disconnect) supplying power to the crane, hoist, monorail, or other piece of equipment where the lifter is to be installed, shall be de-energized. Lock and tag the main switch in the de-energized position in accordance with ANSI Z244.1.
7. If the lifter is to be installed on an existing crane, and the crane runway remains energized because of other cranes operating on the same runway; stops or a signal person(s), located full-time at a visual vantage point for observing the approach of an active crane(s), shall be provided to prohibit contact by the active crane(s) with the idle crane.
8. If personnel will be required to work on the runway during installation, a guard or barrier shall be installed between adjacent runways for the length of the established work area to prevent contact between persons performing installation and a crane on the adjacent runway.
9. If personnel are required to work at elevations in excess of 6 feet above floor or ground level, a fall prevention policy and procedure shall be developed, documented, and implemented prior to installation being started.
10. Check power supply that will be furnished to the lifter. It must be the same as shown on the lifter serial plate. While the standard catalog VAC-U-LIFT® Series 3200S, 3200R, and 3200U power pac is furnished for 115 volt, single-phase, 60 hertz, AC power supply; the unit can be furnished for other power supply voltages and phases in accordance with specification requirements. If the power supply that will be furnished to the lifter is not the same as shown on the lifter serial plate; DO NOT INSTALL. Contact Acco Chain & Lifting Products or the distributor of the lifter.
11. Conductors supplying power to the lifter and associated equipment must be sized to maintain the operating voltage at the lifter at plus or minus 10% of the nominal operating voltage at all times.
12. Conductors supplying power to the lifter and associated equipment must be protected against short circuit and overcurrent conditions in compliance with ANSI/NFPA 70, National Electrical Code. These requirements are listed in Article 610 and are the responsibility of the owner/user. It is also the responsibility of the owner/user to insure that all protective devices and associated wiring comply with applicable Federal, State, and Local Codes.

⚠ CAUTION

IF THE VACUUM LIFTER WAS PURCHASED WITHOUT A PENDANT CONTROL BECAUSE A PENDANT CONTROL WILL BE FURNISHED BY OTHERS: ONLY MAINTAINED CONTROL BUTTONS SHOULD BE USED; AND ONLY A RECESSED OR GUARDED "RELEASE" BUTTON SHOULD BE USED TO PREVENT INADVERTENT RELEASE OF THE VACUUM SYSTEM.

INSTALLATION

INSTALLING VACUUM LIFTER:

1. Every VAC-U-LIFT® vacuum lifter is fully assembled at the factory prior to shipment. Some lifters are disassembled to facilitate shipment, but the original assembly assures that all parts fit and that the lifter is complete. If assembly is required, refer to Figure 10 and assemble the lifter as follows:

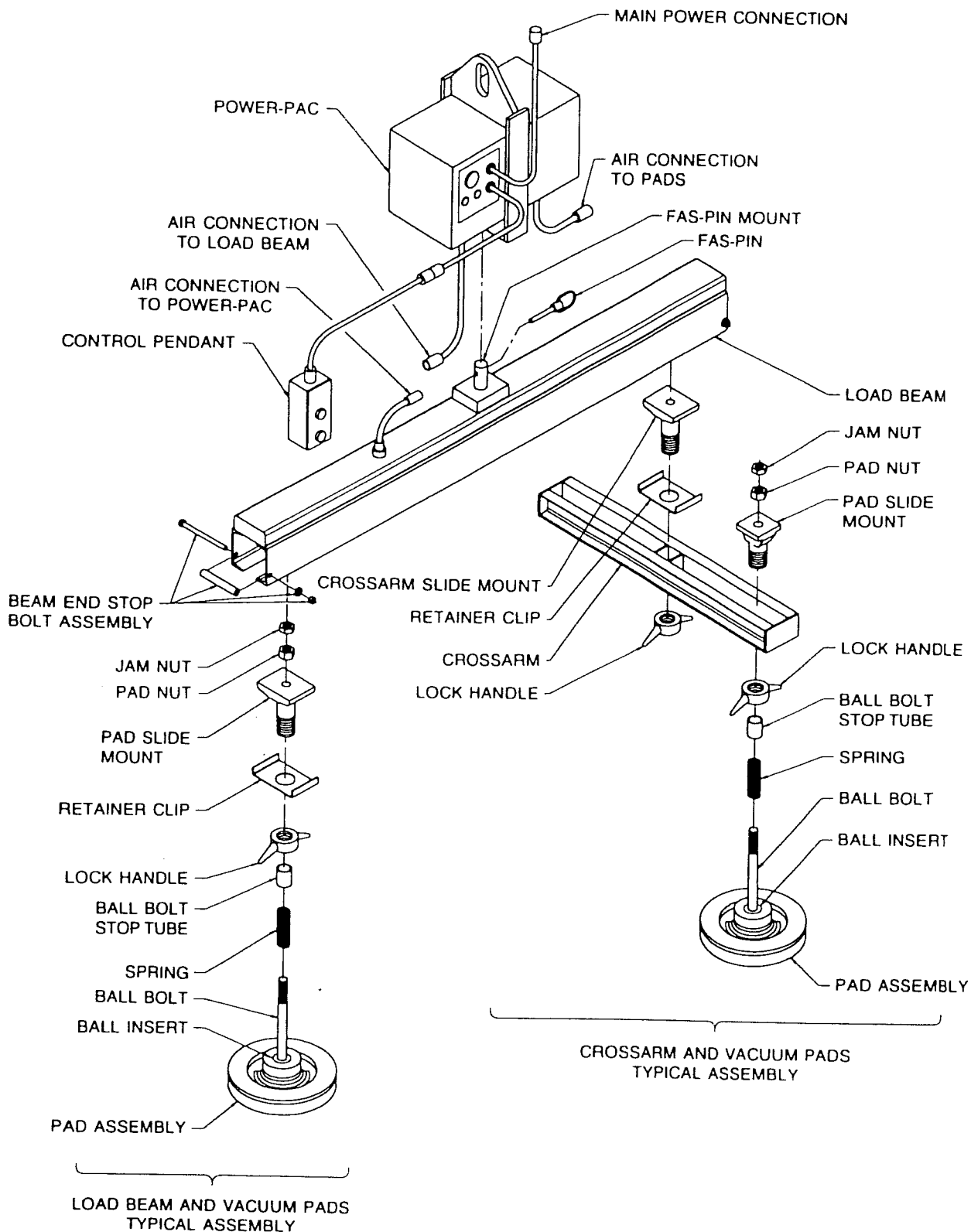


FIGURE 10

INSTALLATION

If cross arms are included in the lifter configuration:

- a. Attach the load beam to the power pac by means of the fas-pin.
- b. Remove the beam end stop bolt assembly from one end of the load beam.
- c. Slide cross arm slide mounts onto the load beam. Replace the beam end stop bolt removed in step b.
- d. Assemble retainer clips and cross arms to the cross arm slide mounts and fasten into place with the lock handles.
- e. Insert pad slide mounts into openings in cross arms and fasten into place with the lock handles.
- f. Insert vacuum pad unit through pad slide mount and fasten into place with pad nut and jam nut.

If vacuum pads are mounted directly to the load beam:

- a. Attach the load beam to the power pac by means of the fas-pin.
- b. Remove the beam end stop bolt assembly from one end of the load beam.
- c. Assemble retainer clips to the pad slide mounts and fasten into place with the lock handles.
- d. Insert vacuum pad unit through pad slide mount and fasten into place with pad nut and jam nut.
- e. Slide pad slide mounts onto the load beam and fasten into place with the lock handles. Replace the beam end stop bolt removed in step b.
2. Attach the lifter to the hook of the hoist or crane to be used with the lifter. Dimensions of the opening in the bail for suspension of the power pac or lifter from a hoist or crane hook is shown in Figure 3. The bail of the power pac must be compatible with the size of the hoist or crane hook to be used; must be properly seated in the base, bowl, or saddle of the hoist or crane hook to be used; and must not prevent the hook latch from properly operating to bridge or close the hook throat opening. If the lifter does not properly seat in the base, bowl, or saddle of the hoist or crane hook to be used; do not use the lifter with this hoist or crane. Contact Acco Chain & Lifting Products or the distributor of the vacuum lifter.

WARNING

DO NOT USE A VACUUM LIFTER IF THE LIFTER IS NOT PROPERLY SEATED IN THE BASE, BOWL, OR SADDLE OF THE HOIST OR CRANE HOOK TO BE USED.

3. Lifter and hoist or crane load block must hang straight and directly under the hoist drum. Hoist wire rope must be free of kinks or twists or any other damage that has distorted the rope structure.
4. If length of pendant control cable is too long, it may be shortened only under the following conditions:
 - a. Only a qualified electrician should perform this work.
 - b. If lifter is connected to the main power supply, de-energize, lock, and tag the main switch (disconnect) in accordance with step 6 of "prior to installing vacuum lifter" instructions.
 - c. Shorten cable at the lifter end. DO NOT disturb connections inside the pendant station.
 - d. Check that all wires shortened are reconnected the same as originally connected. Refer to electrical wiring diagram located inside control enclosure.
5. If length of pendant control cable is too short, it must be replaced. Never lengthen pendant control cable by splicing two cable lengths together. Replace cable only under the following conditions:
 - a. Only a qualified electrician should perform this work.
 - b. If lifter is connected to the main power supply, de-energize, lock, and tag the main switch (disconnect) in accordance with step 6 of "prior to installing vacuum lifter" instructions.
 - c. Remove pendant control cable. Install new pendant control cable and make connections inside the power pac and pendant station.
 - d. Check that all wires are connected the same as originally connected. Refer to electrical wiring diagram located inside control enclosure.

INSTALLATION

CONNECTING POWER SUPPLY TO VACUUM LIFTER:

For 3200S, 3200R, and 3200U:



1. DISCONNECT POWER AND LOCKOUT DISCONNECTING MEANS BEFORE CONNECTING POWER SUPPLY TO LIFTER.
2. Only a qualified electrician should connect the power supply to the lifter.
3. Check power supply that will be furnished to the lifter. It must be the same as shown on the lifter serial number plate. If the power supply that will be connected to the lifter is not the same as shown on the lifter serial number plate, DO NOT connect power supply to lifter. Contact Acco Chain & Lifting Products or the distributor of the lifter.
4. Make all electrical connections in accordance with wiring diagram located inside control enclosure.

For 3200B:

1. Install a 12-volt battery in the power pac unit. Battery should be a marine type, spill-proof battery with safety-vent caps and with brass wingnut terminals of 70 ampere, 20 hour rate. Example: Marine Battery Type 24. Connect black wire to the negative terminal of the battery, and the red wire to the positive terminal of the battery.
2. Activate the battery in accordance to the battery manufacturer's instructions.
3. A receptacle for a battery charger is located on the control panel. An electrical plug, for the charger furnished by the owner/user, is included with the power pac unit. Connect the black wire (negative) to the silver contact, and the red wire (positive) to the brass contact. Battery charger leads must be fitted with this plug or with a 2-wire female connector body to match the receptacle on the front of the control panel.

NOTICE

IF DURING INITIAL AND DAILY START-UP, THE VAC-U-LIFT® IS EXPOSED TO EXTREME COLD, ALLOW IT TO RETURN TO ROOM TEMPERATURE BEFORE ATTEMPTING TO START IT. BATTERY EFFICIENCY DROPS AS THE TEMPERATURE DROPS. BATTERY EFFICIENCY IS 100% AT 80° F. AT 32° F, EFFICIENCY DROPS TO 60%, AND AT 0° F, EFFICIENCY DROPS TO 40%. THIS WILL AFFECT THE NUMBER OF STARTS THAT CAN BE MADE.

BEFORE OPERATING VACUUM LIFTER:

1. Before energizing the power supply, and inspecting and testing the lifter prior to initial operational use, check that all electrical connections are in accordance with the wiring diagram located inside control enclosure.
2. ASME B30.20 requires that all new, altered, or modified lifters be inspected by a designated person prior to initial use to verify that the equipment and installation comply with applicable provisions of the standard. Such an inspection should be performed at this time, using ASME B30.20 as the basis for inspection procedures.
3. Energize the power supply to the hoist.
4. Operate the hoist or crane without a load on the lifter to check that the lifter properly seats in the base, bowl, or saddle of the hoist or crane hook; and that the hook latch properly operates to bridge or close the hook throat opening. If the lifter does not properly seat in the base, bowl, or saddle of the hoist or crane hook, or the lifter prevents the hook latch from bridging or closing the hook throat opening; do not use the lifter with this hoist or crane. Contact Acco Chain & Lifting Products or the distributor of the vacuum lifter.
5. Operate the hoist without a load on the lifter through the entire lifting range to check that limit switches function properly and that lifter does not strike or interfere with any part of the hoist or crane, or any other items or pieces of equipment located in the operating area. If any interference occurs or the lifter strikes any part of the hoist or crane, the limit switches must be adjusted. Refer to the manual furnished with the hoist or crane for instructions on limit switch adjustment.

INSTALLATION

WARNING

NEVER OPERATE A LIFTER ON A HOIST OR CRANE WITHOUT THE PROTECTION OF PROPERLY FUNCTIONING LIMIT SWITCHES.

6. Lifter is now ready to be load tested.

VACUUM LIFTER LOAD TEST:

1. Complete lifters are operational tested by Acco in accordance with ASME B30.20.
2. Complete lifters must be load tested in accordance with ASME B30.20. Therefore, it is the responsibility of the owner/user to load test the lifter or final lifting system in accordance with ASME B30.20. Refer to the TEST section of this manual.
3. Complete lifters must be proof load tested in accordance with the TEST section of this manual. Therefore, it is the responsibility of the owner/user to proof load test the lifter or final lifting system in accordance with the TEST section of this manual. Refer to the TEST section of this manual.
4. All personnel that will operate the lifter shall read the OPERATION section of this manual, the WARNINGS contained in this manual, and instruction and WARNING labels on the lifter before operating the lifter or lifting system.

OPERATION

Operation of a vacuum lifting device usually includes the operation of a crane and/or an overhead hoist. Information in this section addresses the vacuum lifting device. Some information is furnished that addresses the crane and/or hoist; however, the operation section of the manuals furnished with the crane and/or hoist must be reviewed for specific operation procedures that apply to the crane and/or hoist.

Operation of an overhead hoist, crane, and vacuum lifting device involves more than activating the buttons or levers of the hoist and crane control devices, or the control devices of the vacuum lifter. It is emphasized in the ASME B30 Standards that the use of overhead hoists and cranes are subject to certain hazards that cannot be met by mechanical means, but only by the exercise of intelligence, care, common sense, and experience in anticipating the motions that will occur as a result of activating the hoist or crane controls. Certain precautions are necessary before moving the load and this includes the proper rigging of loads to the hoist hook.

⚠ WARNING

CRANE, HOIST, AND VACUUM LIFTING DEVICE OPERATORS SHALL BE REQUIRED TO READ THE OPERATION SECTION OF THIS MANUAL, THE WARNINGS CONTAINED IN THIS MANUAL, THE INSTRUCTION AND WARNING LABELS ON THE VACUUM LIFTER, THE OPERATION SECTION AND WARNINGS CONTAINED IN THE MANUAL FURNISHED WITH THE CRANE, INSTRUCTION AND WARNING LABELS ON THE CRANE, THE OPERATION SECTION AND WARNINGS CONTAINED IN THE MANUAL FURNISHED WITH THE HOIST, INSTRUCTION AND WARNING LABELS ON THE HOIST, AND THE OPERATION SECTIONS OF ASME B30.2, ASME B30.11 OR ASME B30.17, AS APPLICABLE; ASME B30.16; AND ASME B30.20; AND TO BE FAMILIAR WITH THE CRANE, HOIST, AND VACUUM LIFTER; AND CRANE, HOIST, AND VACUUM LIFTER CONTROLS BEFORE BEING AUTHORIZED TO OPERATE THE CRANE, HOIST, AND VACUUM LIFTER OR LIFTING SYSTEM.

CRANE, HOIST, AND VACUUM LIFTING DEVICE OPERATORS SHOULD BE TRAINED IN PROPER RIGGING PROCEDURES TO BE FOLLOWED IN THE ATTACHMENT OF LOADS TO THE HOIST HOOK.

CRANE, HOIST, AND VACUUM LIFTING DEVICE OPERATORS SHOULD BE TRAINED TO BE AWARE OF POTENTIAL MALFUNCTIONS OF THE EQUIPMENT THAT REQUIRE ADJUSTMENT OR REPAIR, AND TO BE INSTRUCTED TO STOP OPERATION IF SUCH MALFUNCTIONS OCCUR, AND TO IMMEDIATELY ADVISE THEIR SUPERVISOR SO CORRECTIVE ACTION CAN BE TAKEN.

CRANE, HOIST, AND VACUUM LIFTING DEVICE OPERATORS SHOULD HAVE NORMAL DEPTH PERCEPTION, FIELD OF VISION, REACTION TIME, MANUAL DEXTERITY, AND COORDINATION.

CRANE, HOIST, AND VACUUM LIFTING DEVICE OPERATORS SHOULD NOT BE SUBJECT TO SEIZURES, LOSS OF PHYSICAL CONTROL, PHYSICAL DEFECTS, OR EMOTIONAL INSTABILITY THAT COULD RESULT IN ACTIONS OF THE OPERATOR BEING A HAZARD TO THE OPERATOR OR OTHERS.

CRANE, HOIST, AND VACUUM LIFTING DEVICE OPERATORS SHOULD NOT OPERATE A CRANE, HOIST, VACUUM LIFTING DEVICE, OR LIFTING SYSTEM WHEN UNDER THE INFLUENCE OF ALCOHOL, DRUGS, OR MEDICATION.

CRANES, OVERHEAD HOISTS, AND VACUUM LIFTING DEVICES ARE INTENDED ONLY FOR VERTICAL LIFTING SERVICE OF FREELY SUSPENDED UNGUIDED LOADS. DO NOT USE VACUUM LIFTING DEVICE, CRANE OR HOIST FOR LOADS THAT ARE NOT LIFTED VERTICALLY, LOADS THAT ARE NOT FREELY SUSPENDED, OR LOADS THAT ARE GUIDED. IF SUCH CONDITIONS EXIST, CONTACT ACCO CHAIN & LIFTING PRODUCTS.

OPERATING INSTRUCTIONS - VACUUM LIFTING DEVICE:

1. Position the vacuum pads over the load so that the pads will support the load evenly. Lower the vacuum lifter onto the material to be lifted.
2. On multiple-pad lifting devices, each pad is equipped with a hand-operated shut-off valve. BE CERTAIN to open the valves on the pads required to lift the load.
3. Put the "ON/OFF" switch on the power pac control panel in the "ON" position, and "VACUUM/RELEASE" switch on the power pac control panel in the "VACUUM" position.

OPERATION

4. Depress the "VACUUM" button on the control pendant station. The motor and pump will start running and the red indicator light will come on. The vacuum gauge on the control panel will indicate the system vacuum level in inches of mercury (Hg). The gauge reading will begin to rise.

FOR 3200S, 3200R, AND 3200U:

At 21" Hg, the red indicator light will go out and the green indicator light will come on. When the green light comes on, the load may be lifted and moved. The motor and pump will continue to run and the vacuum gauge will continue to rise until it reaches 25" Hg or more.

FOR 3200B:

At 19" Hg, the red indicator light will go out and the green indicator light will come on. When the green light comes on, the load may be lifted and moved. The motor and pump will continue to run and the vacuum gauge will continue to rise until it reaches 25" Hg.

At 25" Hg, the motor and pump will stop running. The motor and pump will not start running again until the vacuum has dropped to 20" Hg. The green light will stay on.

⚠ CAUTION

DO NOT ATTEMPT TO LIFT THE LOAD IF THE GREEN LAMP DOES NOT COME ON EVEN IF THE VACUUM GAUGE INDICATES THAT AN ADEQUATE VACUUM LEVEL HAS BEEN REACHED. THE LIGHTS ARE A MORE RELIABLE INDICATION OF SUFFICIENT VACUUM THAN THE GAUGE.

5. When the load has been moved and lowered to its new position, press the "RELEASE" button on the control pendant station. The vacuum will be released and the red indicator light will come on. This indicates the vacuum lifting device is ready to be raised and repositioned for the next lift.
6. The "ON/OFF" switch on the power pac control panel should be left in the "ON" position until the end of the shift or until use of the vacuum lifting device is completed. At the end of the shift or when use of the vacuum lifting device is completed, the "ON/OFF" switch on the power pac control panel should be placed in the "OFF" position.
7. On 3200B units, the battery should be recharged as required or at the end of each shift. Refer to BATTERY RECHARGE section of this manual.
8. Conduct a PROOF LOAD TEST daily. Refer to the TEST section of this manual.

⚠ CAUTION

A PROOF LOAD TEST MUST BE CONDUCTED DAILY TO VERIFY THAT THE VAC-U-LIFT® UNIT IS OPERATING PROPERLY. IN EFFECT, THE TEST SIMULATES AN EQUIPMENT FAILURE, EITHER ELECTRICAL OR MECHANICAL, SO THAT PERFORMANCE OF THE VACUUM SYSTEM CAN BE CHECKED.

BEFORE EACH SHIFT OR BEFORE THE FIRST TIME THE HOIST, CRANE, OR VACUUM LIFTING DEVICE IS TO BE USED EACH SHIFT:

THE OPERATOR:

- SHALL visually inspect wire rope for broken wires, broken strands, kinks, and any type of deformation or damage of the rope structure.
- SHALL visually inspect hooks for nicks, gouges, deformation of the throat opening, wear on saddle or load bearing point, and twisting.

OPERATION

- SHALL visually inspect hook latches for proper operation or damage that does not allow proper operation.
- SHALL replace warning label or labels if missing or illegible.
- SHALL report any damage or malfunctions to the supervisor.
- SHALL NOT operate vacuum lifter, crane, or hoist if any damage or malfunctions exist.
- SHALL NOT operate vacuum lifter, crane, or hoist if it is tagged with an out-of-order sign.
- SHALL conduct a PROOF LOAD TEST of the vacuum lifting device.

BEFORE OPERATING THE HOIST, CRANE, OR VACUUM LIFTING DEVICE, AND APPLYING THE LOAD:

THE OPERATOR:

- SHALL be familiar with all operating controls of the vacuum lifting device, crane, and/or hoist.
- SHALL be familiar with the OPERATION Section of this manual, the WARNINGS contained in this manual, instructions and WARNING labels on the vacuum lifting device, crane and/or hoist or lifting system, the OPERATION section of the manual furnished with the crane and/or hoist, and the OPERATION Sections of ASME B30.2, ASME B30.11 or ASME B30.17, as applicable; ASME B30.16; and ASME B30.20.
- SHALL be instructed in the operation or operations to be performed.
- SHALL NOT operate vacuum lifting device, crane, or hoist if any damage or malfunctions exist; and SHALL report any damage or malfunctions to the supervisor.
- SHALL NOT operate vacuum lifting device, crane, or hoist if it is tagged with an out-of-order sign.
- SHALL center vacuum lifting device, crane and/or hoist over load.
- SHALL NOT use the hoist wire rope as a sling to wrap around the load.
- SHALL attach the load to the hoist hook by means of the vacuum lifting device.
- SHALL only lift loads by the vacuum lifting device that do not exceed the rated load capacity of the vacuum lifting device.
- SHALL only attach loads to the hoist hook that do not exceed the rated load capacity of the crane, hoist, or lifting system.
- SHALL verify that the size of the attachment of the vacuum lifting device is compatible with the size of the hoist hook.
- SHALL verify that the attachment part of the vacuum lifting device is properly seated in the base, bowl, or saddle of the hoist hook.
- SHALL verify that the hook latch operates properly and that the hook latch properly bridges and closes the hook throat opening.
- SHALL verify that the latch of the hoist hook will not support any part of the vacuum lifting device or load.
- SHALL verify that the load or any part of the load will not be applied to and/or not supported by the tip or point of the hook.
- SHALL verify that load will be properly balanced when it is lifted.
- SHALL verify that side loads will not be applied to the crane, and/or hoist when the load is lifted.
- SHALL verify that hoist wire rope is not kinked or twisted, and that wire rope parts are not twisted about each other.
- SHALL verify that hoist wire rope is properly seated in the drum grooves and sheaves.
- SHALL verify position of the vacuum pads over the load so that the pads will support the load evenly.
- SHALL verify that the temperature of the load does not exceed the allowable limits of the vacuum lifter.

OPERATION

- SHALL verify that the surface of the load subject to vacuum pad contact is clean and free of loose particles.
- SHALL verify that the vacuum level indicator has reached the required level before lifting the load.
- SHALL notify personnel in the area that a load will be lifted and verify that all personnel are clear of the load.
- SHALL verify that when the load is lifted, it will clear all material, machinery, or other obstructions in the area.
- SHALL perform an every lift inspection as outlined in ASME B30.20 and the INSPECTION section of this manual.

WHILE OPERATING THE HOIST, CRANE, OR VACUUM LIFTING DEVICE, AND MOVING THE LOAD:

THE OPERATOR:

⚠ WARNING

IN CASE OF POWER FAILURE, ANY LOAD SHOULD BE LOWERED AND RELEASED FROM THE PADS. IF THE LOAD CANNOT BE LOWERED BECAUSE OF A TOTAL POWER FAILURE OF THE ENTIRE LIFTING SYSTEM, OTHER SUPPORTING MEANS SHOULD BE PLACED UNDER THE LOAD TO PREVENT IT FROM FALLING FROM THE PADS WHEN THE VACUUM RESERVE IS DEPLETED. WHEN POWER IS RESTORED, LOWER THE LOAD BY MEANS OF THE HOIST OR CRANE AFTER RESTARTING POWER PAC.

- SHALL NOT engage in any activity that will divert the attention of the operator.
- SHALL NOT lift, lower, or transport a load with the vacuum lifting device, crane, and/or hoist until the operator and all other personnel are clear of the load and the path of the load.
- SHALL verify that the load, vacuum lifting device, crane, and/or hoist will clear all obstacles before moving or rotating the load.
- SHALL avoid moving loads over personnel.
- SHALL NOT lift, lower, or transport personnel by means of the vacuum lifting device, crane, hoist, trolley, hoist hook, or load.
- SHALL slowly inch the hoist hook into engagement with the vacuum lifting device attachment to eliminate wire rope slack and reduce impact loading of the crane or hoist.
- SHALL avoid unnecessary inching and quick reversals of direction.
- SHALL only lift the load a few inches to verify that the load is properly balanced before continuing with the lift.
- SHALL only lift the load a few inches to verify that the hoist braking system is functioning properly before continuing with the lift.
- SHALL only traverse the load a few inches to verify that the crane or trolley braking system is functioning properly before continuing with travel.
- SHALL avoid swinging of the vacuum lifting device, load, or hoist hook when the crane and/or hoist is traveling.
- SHALL avoid sharp contact between trolleys or between trolleys and stops.
- SHALL avoid sharp contact between cranes or between cranes and stops.
- SHALL NOT use hoist limit switches or devices as a normal means of stopping the hoist.
- SHALL NOT lower the load beyond the point where less than two wraps of wire rope remain at each anchorage on the drum, unless a lower limit device is provided, in which case no less than one wrap of wire rope shall remain at each anchorage on the drum.

PARKING THE LOAD:

THE OPERATOR:

- SHALL NOT lower a load with the hoist until the operator and all other personnel are clear of the load and the path of the load.
- SHALL verify that the load will clear all obstacles before lowering the load.

OPERATION

- SHALL block loads before landing if slings or other lifting devices must be removed from under the landed load.
- SHALL exercise care when removing a sling from under a landed and blocked load.
- SHALL NOT leave a suspended load unattended unless specific precautions to prevent the load from inadvertent lowering have been instituted and are in place.
- SHALL position the hoist load block and hook above head level for storage when the hoist is not in use.

GENERAL:

THE OPERATOR:

- SHALL know hand signals used for hoist and crane operations if a signal-person is used in the operation, and accept signals of only persons authorized to give hand signals EXCEPT to obey a stop signal regardless who gives it.
- SHALL NOT adjust or repair a vacuum lifting device, crane, or hoist unless qualified and authorized to perform maintenance.
- SHALL NOT use a hoist load limiting device as a means to measure the load.

GENERAL DO'S AND DO NOT'S:

- DO establish a regular inspection schedule and maintain a record of all inspections performed with special attention directed to wire ropes, hooks, and brakes.
- DO remove the vacuum lifting device, crane and/or hoist from service to perform necessary maintenance and repair.
- DO follow recommended maintenance procedures for taking a vacuum lifting device, crane, or hoist out of service to inspect and perform maintenance and repair.
- DO use the original vacuum lifting device, crane, and hoist manufacturer's recommended parts when repairing a vacuum lifting device, crane, or hoist and replacing worn or damaged parts.
- DO NOT allow unqualified or unauthorized personnel to operate, inspect, maintain, or repair a vacuum lifting device, crane, or hoist.
- DO NOT operate a crane and/or hoist that is damaged or has any actual or suspected mechanical or electrical malfunction.
- DO NOT attempt to lengthen wire rope or repair damaged wire rope.
- DO NOT use the wire rope, any part of the monorail, vacuum lifter, crane, hoist, or the load block and hook as a ground for welding.
- DO NOT allow a welding electrode to be touched to the wire rope.
- DO NOT remove or obscure any warnings or warning labels on the vacuum lifting device, crane, hoist, or lifting system.
- DO NOT store the VAC-U-LIFT® vacuum lifter by allowing it to rest on the vacuum pad seals as this could damage and shorten the life of the vacuum pad seal rings.
- DO store the vacuum lifter by supporting the load beam or lifting yoke so that vacuum pads are freely suspended.
- DO NOT walk under a suspended load.
- DO NOT perform ANY work on a suspended load that requires a worker to be positioned under the suspended load.

WARNING

DO NOT WALK UNDER A SUSPENDED LOAD.

DO NOT PERFORM ANY WORK ON A SUSPENDED LOAD THAT REQUIRES A WORKER TO BE POSITIONED UNDER THE SUSPENDED LOAD.

IF IT IS ESSENTIAL THAT A WORKER BE POSITIONED UNDER A SUSPENDED LOAD TO PERFORM WORK ON THE SUSPENDED LOAD; SUCH WORK SHALL NOT BE STARTED OR PERFORMED UNTIL OTHER AUXILIARY SUPPORTING MEANS ARE PLACED UNDER THE SUSPENDED LOAD. FAILURE TO USE OTHER AUXILIARY SUPPORTING MEANS COULD RESULT IN SERIOUS BODILY INJURY OR DEATH, AND/OR PROPERTY DAMAGE.

MAINTENANCE AND INSPECTION PROCEDURES

Vacuum lifting devices shall be maintained, inspected, and tested in accordance with the MAINTENANCE AND REPAIR, INSPECTION, and TEST sections of this manual and in accordance with the intervals and requirements of ASME B30.20. Hoists shall be maintained, inspected, and tested in accordance with the manual furnished by the hoist manufacturer and in accordance with the intervals and requirements of ASME B30.16. Underhung cranes shall be maintained, inspected, and tested in accordance with the manual furnished by the crane manufacturer and in accordance with the intervals and requirements of ASME B30.11. Top-running single-girder cranes shall be maintained, inspected, and tested in accordance with the manual furnished by the crane manufacturer and in accordance with the intervals and requirements of ASME B30.17. Top-running double-girder cranes shall be maintained, inspected, and tested in accordance with the manual furnished by the crane manufacturer and in accordance with the intervals and requirements of ASME B30.2. Monorails shall be maintained, inspected, and tested in accordance with the manual furnished by the monorail manufacturer and in accordance with the intervals and requirements of ASME B30.11.

Before maintenance or inspections are performed on a vacuum lifting device, hoist, trolley, crane, crane runway, monorail, or monorail support, or crane runway or monorail conductors, the following precautions shall be taken as applicable.

1. The vacuum lifting device, hoist, trolley, or crane to be inspected, tested, or repaired shall be run to a location where it will cause the least interference with other hoists, cranes, and operations in the area.
2. If a load is attached to the vacuum lifting device, crane or hoist, it shall be landed.
3. All controllers shall be placed in the off position.
4. If a trolley hoist is installed on the crane or monorail, the trolley shall be blocked to prevent trolley movement.
5. The crane shall be blocked to prevent crane movement.

DANGER

6. HAZARDOUS VOLTAGES ARE PRESENT IN THE CONTROL BOX, OTHER ELECTRICAL COMPONENTS, AND CONNECTIONS BETWEEN THESE COMPONENTS.

The main switch (disconnect) of the monorail, hoist, crane, or lifting system shall be de-energized. Lock and tag the main switch in the de-energized position in accordance with ANSI Z244.1.

7. Warning signs and barriers shall be utilized on the floor beneath the vacuum lifting device, monorail, hoist, crane, or lifting system where overhead maintenance, repair, or inspection work creates a hazardous area on the floor beneath the monorail, hoist, crane, or lifting system.
8. If the monorail or crane runway remains energized because other cranes or hoists on the same monorail or runway are in operation, rail stops or a signal person(s), located full-time at a visual vantage point for observing the approach of an active hoist(s) or crane(s), shall be provided to prohibit contact by the active hoist(s) or crane(s) with the idle hoist or crane; with persons performing maintenance, repair, or inspection; and with equipment used in performing the maintenance, repair, or inspection.
9. A guard or barrier shall be installed between adjacent runways for the length of the established work area to prevent contact between persons performing maintenance, repair, or inspection and a crane on the adjacent runway.
10. Safe access to the vacuum lifting device, monorail, hoist, crane, or lifting system, such as scaffolding, work platforms, etc., shall be provided for personnel that will perform maintenance, repair, or inspection. If personnel are required to work at elevations in excess of 6 feet above floor or ground level, a fall prevention policy and procedure shall be developed, documented, and implemented by the owner/user.
11. After maintenance, repair, or inspection work is completed, and before the vacuum lifting device, monorail, hoist, crane, or lifting system is returned to normal operation:
 - a. Any guards on the vacuum lifting device, monorail, hoist, crane, or lifting system that were removed to perform maintenance, repair, or inspection work shall be reinstalled.
 - b. Any safety devices on the vacuum lifting device, monorail, hoist, crane, or lifting system that were deactivated to perform maintenance, repair, or inspection work shall be reactivated.

MAINTENANCE AND INSPECTION PROCEDURES

- c. Any parts that were replaced and other loose material shall be removed.
 - d. All equipment used in the maintenance, repair, or inspection work shall be removed.
12. Warning signs, barriers, and guards shall be removed only by authorized personnel.
 13. Lock and tag on the main switch (disconnect) of the vacuum lifting device, monorail, hoist, crane, or lifting system shall be removed only by the person that locked and tagged the main switch originally, or an authorized person.
 14. If the extent of the maintenance or repair work requires any testing as outlined in the TEST section of this manual; the manual furnished by the hoist manufacturer; the manual furnished by the crane manufacturer; or as required by, as applicable, the provisions of ASME B30.2, ASME B30.11, ASME B30.16, ASME B30.17, or ASME B30.20; such tests shall be conducted before the vacuum lifting device, monorail, hoist, crane, or lifting system is returned to normal operation.

INSPECTION

Inspection procedure for vacuum lifting devices in regular service is divided into three general classifications as outlined in ASME B30.20. These three general classifications are based upon the intervals at which inspections should be performed. The intervals are dependent upon the nature of the critical components of the vacuum lifting device, and the degree of their exposure to wear and deterioration. The degree of their exposure is dependent upon vacuum lifting device activity, severity of vacuum lifting device service, and the environment of vacuum lifting device location. These three general classifications of vacuum lifting device inspection are designated as *every lift*, *frequent*, and *periodic*. In addition, daily inspections and a Proof Load Test are required to be performed by the operator at the start of each shift, or at the time the vacuum lifting device is first used during each shift. Refer to the TEST section of this manual for instructions on performing the Proof Load Test.

EVERY LIFT INSPECTION: Items to be inspected by the operator before and/or during every lift, with records not required, include the following:

1. Surface of the load to be lifted for dirt and debris. Clean as required.
2. Seal of vacuum pads for dirt and debris. Clean as required.
3. Seal of vacuum pads for damage. Replace pads having damaged seal rings.
4. Condition and proper operation of controls. Discontinue use if controls do not function properly.
5. Condition and operation of indicators, meters, and pumps where applicable. Discontinue use if indicators and meters do not function properly or if motors and pumps make unusual sounds.

FREQUENT INSPECTION: Frequent inspections are visual inspections and examinations by the operator or other designated personnel with records not required. Nominal inspection intervals are as follows:

Normal service - monthly

Heavy service - weekly to monthly

Severe service - daily to weekly

Special or infrequent service - as recommended by a qualified person before and after each occurrence

PERIODIC INSPECTION: Periodic inspections are visual and audio inspections and examinations, with the vacuum lifting device in place, by designated personnel making records of external conditions to provide the basis for a continuing evaluation of the vacuum lifting device and components. If the external inspection indicates the need, some disassembly may be required to make a more detailed inspection and examination. Nominal inspection intervals are as follows:

Normal service - annually

Heavy service - semiannually

Severe service - quarterly

Special or infrequent service - as recommended by a qualified person before the first occurrence and as directed by the qualified person for any subsequent occurrences

WARNING

THE INSPECTION INTERVALS LISTED ABOVE ARE NOMINAL RECOMMENDATIONS FOR REFERENCE PURPOSES ONLY. THEY ARE BASED ON SINGLE SHIFT OPERATION UNDER NORMAL OPERATING CONDITIONS AND NORMAL ENVIRONMENTAL CONDITIONS. ACTUAL OPERATING AND ENVIRONMENTAL CONDITIONS SHOULD BE REVIEWED BY A QUALIFIED PERSON AND INSPECTION INTERVALS ESTABLISHED ON THE RECOMMENDATIONS OF THE QUALIFIED PERSON.

Definitions of service from ASME B30.20 are as follows:

Normal service involves operation of the vacuum lifting device with randomly distributed loads within the rated load limit, or uniform loads less than 65% of rated load.

Heavy service involves operation of the vacuum lifting device within the rated load limit that exceeds normal service. **Severe service** involves operation of the vacuum lifting device in normal service or heavy service with abnormal operating conditions.

A vacuum lifting device that is not in regular service, that has been idle for a period of one month or more, but less than one year, should be inspected in accordance with the requirements for frequent inspection before being placed into service.

INSPECTION

A vacuum lifting device that is not in regular service, that has been idle for a period of one month or more, but less than one year, should be inspected in accordance with the requirements for frequent inspection before being placed into service.

A vacuum lifting device that is not in regular service, that has been idle for a period of one year or more, should be inspected in accordance with the requirements for periodic inspection before being placed into service.

Required daily inspection items to be performed by the operator at the start of each shift, or at the time the vacuum lifting device is first used during each shift are shown in Table 1.

**TABLE 1
DAILY INSPECTIONS BY THE OPERATOR**

INSPECTION ITEM	DESCRIPTION OF INSPECTION CHECK POINTS
Tagged Equipment	Check that vacuum lifting device, hoist, or crane is not tagged with an out-of-order sign.
Control Devices	Check that all motions agree with control device markings.
Brakes	Check that all motions do not have excessive drift.
Oil Leakage	Check for any sign of oil leakage on the equipment and on the floor area beneath the equipment.
Unusual Sounds	Check for any unusual sounds from the equipment and equipment mechanism while operating the equipment.
Warning Label	Check that warning label or labels are not missing and that they are legible.
PROOF LOAD TEST	Conduct PROOF LOAD TEST as outlined in the TEST section of this manual.
Vacuum Pad Seals	Check seal rings for dirt, debris, and damage.

NOTICE

IF VACUUM LIFTING DEVICE IS USED WITH A CRANE, REFER TO THE MANUAL FURNISHED WITH THE CRANE AND APPLICABLE ASME B30 STANDARD TO DETERMINE THE DAILY INSPECTION ITEMS THAT MUST BE PERFORMED BY THE OPERATOR.

IF VACUUM LIFTING DEVICE IS USED WITH A HOIST, REFER TO THE MANUAL FURNISHED WITH THE HOIST AND ASME B30.16 TO DETERMINE THE DAILY INSPECTION ITEMS THAT MUST BE PERFORMED BY THE OPERATOR.

⚠ WARNING

IF ANY DAMAGE OR MALFUNCTIONS ARE NOTED BY THE DAILY INSPECTION ITEMS OF TABLE 1, THE OPERATOR SHALL NOT OPERATE THE VACUUM LIFTING DEVICE, AND SHALL IMMEDIATELY ADVISE THE SUPERVISOR SO CORRECTIVE ACTION CAN BE TAKEN. IF THE VACUUM LIFTING DEVICE IS TAGGED WITH AN OUT-OF-ORDER SIGN, THE OPERATOR SHALL NOT OPERATE THE VACUUM LIFTING DEVICE.

VACUUM LIFTING DEVICE OPERATORS SHOULD BE TRAINED TO BE AWARE OF MALFUNCTIONS OF THE EQUIPMENT DURING OPERATION, AND TO IMMEDIATELY STOP OPERATION IF SUCH MALFUNCTIONS OCCUR, AND TO IMMEDIATELY ADVISE THE SUPERVISOR SO CORRECTIVE ACTION CAN BE TAKEN.

INSPECTION

Recommended items to be checked for deficiencies or damage during *frequent* and *periodic* inspections are shown in Table 2. Detailed inspection procedures for some items will be found in specific sections of this manual. These inspections may be performed with the vacuum lifting device in its normal location and do not require that the vacuum lifting device be disassembled. Covers and other items normally supplied to allow inspection of components should be opened or removed for these inspections. Any deficiencies or damage such as those listed in Table 2 shall be examined by a designated person to determine whether they constitute a hazard, or whether any disassembly is necessary for a more detailed examination. The vacuum lifting device operator should make observations during regular operation for any deficiencies or damage that might appear between inspections.

**TABLE 2
FREQUENT AND PERIODIC INSPECTIONS**

INSPECTION ITEM	FREQUENCY		DEFICIENCIES OR DAMAGE TO LOOK FOR
	FREQUENT	PERIODIC	
All functional operating mechanisms	•	•	Maladjustment that interferes with operating mechanisms proper operation and unusual sounds
Control devices	•	•	Improper operation
WARNING label(s)	•	•	Missing or illegible
Control device markings	•	•	Missing or illegible
Load carrying portions	•	•	Deformation, cracks, corrosion, or excessive wear
Vacuum pump	•	•	Noise or insufficient output
Vacuum seal rings	•	•	Cuts, tears, excessive wear, and presence of foreign particles
Vacuum lines and connections	•	•	Leakage, cuts, kinks, and collapsed areas of hoses
Vacuum reservoir	•	•	Leaks and visual damage
Vacuum system	•	•	Check all components and devices by performing a Proof Load Test as outlined in the TEST section of this manual
Fastening devices bolts, nuts, pins, etc.)		•	Not properly secured (tightened), damaged or missing parts
Supporting structure		•	Deformation, cracks, corrosion, or excessive wear
Electrical apparatus		•	Pitting, deterioration, wear
Contactors		•	Pitting, deterioration, wear, and improper operation
Wiring and fittings		•	Loose connections, abraded, cut, or nicked insulation

NOTICE

IF VACUUM LIFTING DEVICE IS USED WITH A CRANE, REFER TO THE MANUAL FURNISHED WITH THE CRANE AND APPLICABLE ASME B30 STANDARD TO DETERMINE THE FREQUENT AND PERIODIC INSPECTION ITEMS THAT MUST BE PERFORMED.

IF VACUUM LIFTING DEVICE IS USED WITH A HOIST, REFER TO THE MANUAL FURNISHED WITH THE HOIST AND ASME B30.16 TO DETERMINE THE FREQUENT AND PERIODIC INSPECTION ITEMS THAT MUST BE PERFORMED.

INSPECTION

⚠ WARNING

IF ANY DAMAGE OR MALFUNCTIONS ARE NOTED BY THE FREQUENT OR PERIODIC INSPECTION ITEMS OF TABLE 2, THE VACUUM LIFTING DEVICE SHALL BE TAGGED WITH AN OUT-OF-ORDER SIGN AND SHALL NOT BE RETURNED TO REGULAR OPERATION UNTIL MAINTENANCE AND REPAIR OF THE DAMAGE OR DEFICIENCIES FOUND DURING THE INSPECTION HAVE BEEN CORRECTED.

Records of the condition of critical components observed during frequent and periodic inspections should be established. This record should also record replacement, maintenance, and repair information. Use of this recorded information will allow a preventative maintenance program to be established for replacement of wearing components on a regular basis, thereby eliminating or reducing unscheduled downtime situations.

If maintenance, adjustment, replacement of parts, or repair of the vacuum lifting device is required because of any damage or malfunctions noted during the frequent or periodic inspections, refer to the MAINTENANCE AND REPAIR section of this manual and other sections of this manual for specific instructions or parts identification. Before performing any maintenance on the vacuum lifting device, refer to the MAINTENANCE AND INSPECTION PROCEDURES section of this manual. After performing maintenance, adjustment, or replacement of parts or components, refer to the TEST section of this manual.

TEST

After installation, it is the responsibility of the owner/user to test the vacuum lifting device in accordance with ASME B30.20. If the vacuum lifting device is used with a crane, it is the responsibility of the owner/user to test the crane in accordance with the applicable ASME B30 standard, and instructions in the manual furnished with the crane. If the vacuum lifting device is used with a hoist, it is the responsibility of the owner/user to test the hoist in accordance with ASME B30.16, and instructions in the manual furnished with the hoist.

In addition to the tests outlined in ASME B30.20, a PROOF LOAD TEST must be conducted daily to verify that the VAC-U-LIFT® unit is operating properly. In effect, the test simulates an equipment failure, either electrical or mechanical, so that performance of the vacuum system can be checked. Instructions for conducting the PROOF LOAD TEST are outlined later in this section.

Testing of vacuum lifting devices after original installation as outlined in ASME B30.20 is required when the vacuum lifting device has been altered, reinstalled, modified, or repaired; has been idle for a period of 12 months or longer; or in accordance with specific testing requirements established by the owner/user. General testing requirements are outlined in ASME B30.20 and should be followed. ASME B30.20 lists two types of tests as follows:

1. Operational test
2. Load Test

NOTICE

IF VACUUM LIFTING DEVICE IS USED WITH A CRANE, REFER TO THE MANUAL FURNISHED WITH THE CRANE AND APPLICABLE ASME B30 STANDARD TO DETERMINE TEST REQUIREMENTS FOR THE CRANE.

IF VACUUM LIFTING DEVICE IS USED WITH A HOIST, REFER TO THE MANUAL FURNISHED WITH THE HOIST AND ASME B30.16 TO DETERMINE TEST REQUIREMENTS FOR THE HOIST.

OPERATIONAL TEST:

All new, altered, reinstalled, modified, or repaired vacuum lifting devices, or vacuum lifting devices that have not been used within the preceding 12 months, **SHALL** be tested by the owner/user before being placed in operational service.

Operational test steps are as follows:

1. Seals and connections shall be tested for leaks by attaching a nonporous clean surface to the vacuum pad or pads and then stopping the vacuum source. Vacuum level shall not decrease by more than 1" Hg in two minutes.
2. All indicator lights, gauges, vacuum level indicators, and other warning devices shall be checked during this test.

NOTICE

A PROOF LOAD TEST AS OUTLINED LATER IN THIS SECTION CAN BE PERFORMED IN LIEU OF THE ABOVE OPERATIONAL TEST.

LOAD TEST:

All new, altered, reinstalled, modified, or repaired vacuum lifting devices **SHALL** be load tested by the owner/user before being placed in operational service.

The load test shall be conducted under the direction of a designated person and a record of the test should be made. The test load applied to the vacuum lifting device shall be not less than 100% of the rated load capacity of the vacuum lifting device, or greater than 125% of the rated load capacity of the vacuum lifting device.

TEST

Load test steps are as follows:

1. Attach vacuum pads to the test load.
2. Lift the test load a minimum distance to assure that the test load is supported by the vacuum lifting device.
3. Hold test load suspended for 2 minutes.
4. Lower and release the test load.
5. Visually inspect the vacuum lifting device.

Upon completion of the operational and load tests, the crane is ready to be released for operating purposes.

PROOF LOAD TEST:

⚠ CAUTION

A PROOF LOAD TEST MUST BE CONDUCTED DAILY TO VERIFY THAT THE VAC-U-LIFT® UNIT IS OPERATING PROPERLY. IN EFFECT, THE TEST SIMULATES AN EQUIPMENT FAILURE, EITHER ELECTRICAL OR MECHANICAL, SO THAT PERFORMANCE OF THE VACUUM SYSTEM CAN BE CHECKED.

Conduct the PROOF LOAD TEST as follows:

1. Position the vacuum pads over a sheet on non-porous material such steel or aluminum. On multiple-pad units, adjust the crossarms and vacuum pads to evenly distribute weight of the load on each pad.
2. On multiple-pad lifting devices, each pad is equipped with a hand-operated shut-off valve. BE CERTAIN to open the valves on all pads and BE CERTAIN that all pads will support the load. Lower the vacuum lifting device onto the test load.
3. **FOR 3200S, 3200R, AND 3200U:**
Put the "ON/OFF" switch on the power pac control panel in the "ON" position, and "VACUUM/RELEASE" switch on the power pac control panel in the "VACUUM" position.
FOR 3200B:
Put the "ON/OFF" switch on the power pac control panel in the "ON" position.
4. Depress the "VACUUM" button on the control pendant station. The motor and pump will start running and the red indicator light will come on.
5. **FOR 3200S, 3200R, AND 3200U:**
At 21" Hg, the red indicator light will go out and the green indicator light will come on. When the green light comes on, the load may be lifted. The motor and pump will continue to run and the vacuum gauge will continue to rise until it reaches 25" Hg or more. Note the reading of the vacuum gauge. It should stabilize at 25" Hg or more.
FOR 3200B:
At 19" Hg, the red indicator light will go out and the green indicator light will come on. When the green light comes on, the load may be lifted. The motor and pump will continue to run and the vacuum gauge will continue to rise until it reaches 25" Hg. At 25" Hg, the motor and pump will stop running.
6. Lift the vacuum lifting device and test load so that the test load is between 1 and 2 inches above its rest position.
7. Simulate a power failure by putting the "ON/OFF" switch on the power pac control panel in the "OFF" position. Observe the reading of the vacuum gauge. If the reading drops more than 1" Hg in 2 minutes or less, the vacuum system has a leak. Lower test load immediately. Refer to the TROUBLE SHOOTING section of this manual for guidance in locating leaks.

⚠ WARNING

DURING PROOF LOAD TEST, ALL PERSONNEL SHOULD BE ALERTED TO THE FACT THAT A FREE-FALL CONDITION OF THE TEST LOAD COULD BE EXPERIENCED. ALL PERSONNEL SHOULD BE POSITIONED AS FAR FROM THE PATH OF THE TEST LOAD AS POSSIBLE.

MAINTENANCE AND REPAIR

If maintenance, adjustment, replacement of parts, or repair of the vacuum lifting device is required because of any damage or malfunctions noted during the every lift, daily, frequent, or periodic inspections outlined in the INSPECTION section of this manual; because of conditions found during tests or a PROOF LOAD TEST as outlined in the TEST section of this manual; or based upon specific instructions outlined in other sections of this manual; the vacuum lifting device shall be taken out of service, and maintenance performed as required.

⚠ WARNING

BEFORE PERFORMING ANY MAINTENANCE OR ADJUSTMENTS ON THE VACUUM LIFTING DEVICE, REFER TO THE MAINTENANCE AND INSPECTION PROCEDURES SECTION OF THIS MANUAL.

⚠ DANGER

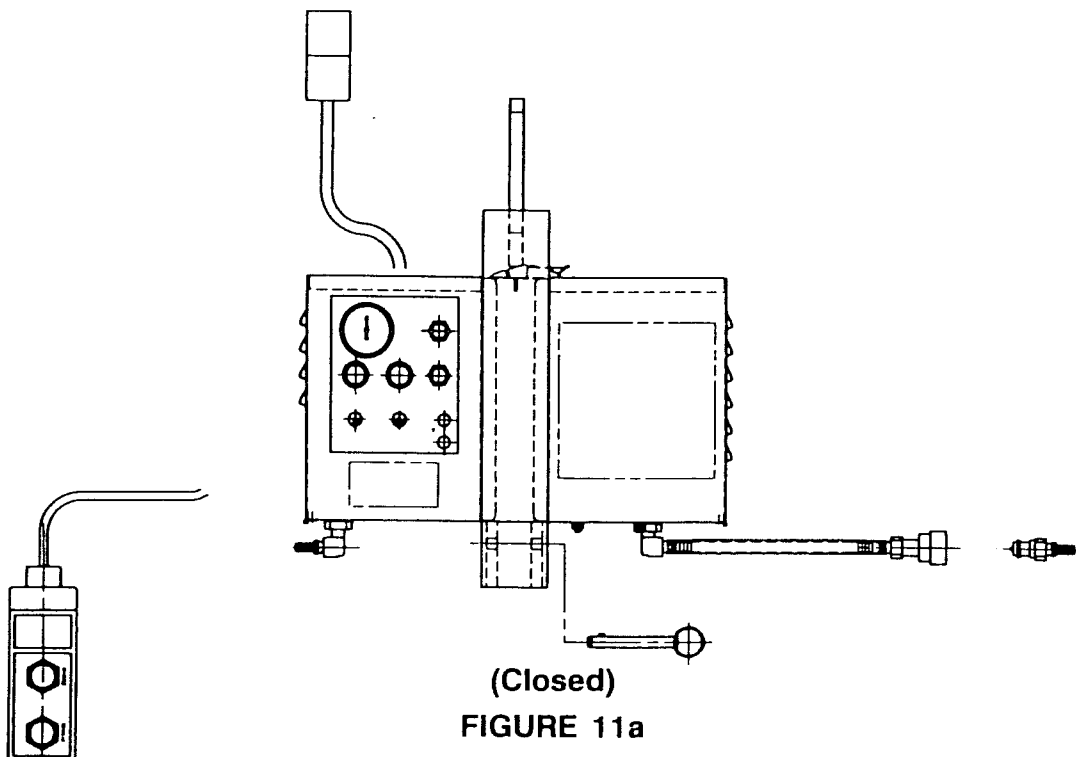
HAZARDOUS VOLTAGES ARE PRESENT IN THE CONTROL BOX, OTHER ELECTRICAL COMPONENTS, AND CONNECTIONS BETWEEN THESE COMPONENTS.

The main switch (disconnect) of the vacuum lifting device, hoist, crane, or lifting system shall be de-energized. Lock and tag the main switch in the de-energized position in accordance with ANSI Z244.1.

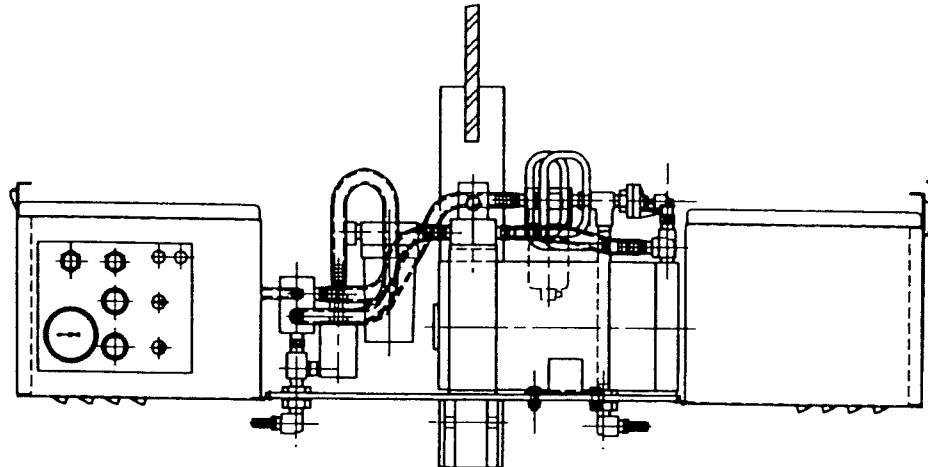
Follow the instructions outlined in this and other sections of this manual for specific components or portions of the vacuum lifting device where maintenance or adjustment is required. Refer to the parts identification pages for the specific portion of the vacuum lifting device where maintenance or adjustment is being performed and to identify any part numbers requiring replacement.

If any instructions are not clear; or if any additional information is required in reference to adjustment, maintenance, or identification of parts; contact Acco Chain & Lifting Products or the distributor of the vacuum lifting device.

Vacuum lifter components, vacuum system connections, and electrical wiring connections are all located inside a split control enclosure. The two parts of the split control enclosure are hinged and are retained together with a manually-operated latch. To open the control enclosure, manually open the latch and swing each half of the control enclosure out from the lifter bail as shown in Figure 11a and b.



MAINTENANCE AND REPAIR



(Opened)
FIGURE 11b

PERIODIC MAINTENANCE

Performing planned periodic maintenance procedures will help prolong the life of a vacuum lifter and maintain maximum operating efficiency. The schedule outlined below should be followed.

EVERY LIFT

- Perform every lift inspection as outlined in the INSPECTION section of this manual.

DAILY

- Perform PROOF LOAD TEST as outlined in the TEST section of this manual.

WEEKLY

- Clean vacuum filter and muffler. Check seal rings, hoses, and fittings. Check hoses for cuts and kinks; hoses should be firm; replace any hoses that are collapsed. Check for loose bolts, nuts, and other retaining devices. Tighten as required. Inspect and check for structural damage.

QUARTERLY

- Clean vacuum pump chamber by flushing.

FLUSHING VACUUM PUMP CHAMBER - 3200S, 3200R, AND 3200U

Flushing of the pump is accomplished by disconnecting the three hoses from the vacuum pump to the control valve. While the pump is running, add several teaspoonsful of Loctite Safety Solvent, Inhibisol Safety Solvent, Dow Chemical Chlorothane, or equivalent solvent at intake hose of pump. **DO NOT USE KEROSENE**. Repeat the flushing procedure again. After all solvent has passed through the pump, replace the three hoses to the vacuum pump.

⚠ CAUTION

FLUSH ONLY IN A WELL VENTILATED LOCATION AND AWAY FROM ANY OPEN FLAME.
DISPOSE OF USED SOLVENT IN ACCORDANCE WITH WASTE DISPOSAL REGULATIONS.

MAINTENANCE AND REPAIR

FLUSHING VACUUM PUMP CHAMBER - 3200B

Flushing of the pump is accomplished by removing the filter and muffler assemblies. While the pump is running, add several teaspoonsful of Loctite Safety Solvent, Inhibisol Safety Solvent, Dow Chemical Chlorothane, or equivalent solvent at intake of pump. **DO NOT USE KEROSENE.** Repeat the flushing procedure again. After all solvent has passed through the pump, replace the filter and muffler assemblies.

⚠ CAUTION

FLUSH ONLY IN A WELL VENTILATED LOCATION AND AWAY FROM ANY OPEN FLAME.
DISPOSE OF USED SOLVENT IN ACCORDANCE WITH WASTE DISPOSAL REGULATIONS.

CLEANING FILTER AND MUFFLER

It is important to keep both the filter and muffler clean and in good operating condition to prevent dirt, moisture, and oil vapor from entering the pump chamber. The filter should be cleaned weekly.

The condition of the filter can be checked by starting the vacuum pump and placing the vacuum control switches in the "VACUUM" position without material attached to the vacuum pads. The vacuum gauge should read less than 5" Hg. If the reading is higher, the filter element should be cleaned or replaced.

The elements in both the filter and muffler may be cleaned by washing them in methanol alcohol and blowing dry with compressed air. The filter and muffler bowls should be washed in mild soap and water.

VACUUM PUMP - 3200S, 3200R, AND 3200U

The vacuum pump vanes are made of hard fiber and are precision ground. Routine cleaning and checking of the filter and muffler, and periodic flushing of the pump chamber, will help prolong vane life.

The four vacuum pump vanes can be replaced by removing the end plate shroud and exchanging new vanes for worn or broken vanes. Use compressed air to clean out the pump chamber prior to inserting new vanes.

If a vane breaks, a piece of the vane may wedge between the top of the rotor and pump body causing the clearance between the rotor and body to be increased. The clearance between the rotor and body should be .004" and can be checked with a feeler gauge. The rotor should be turned while clearance is being checked. If clearance exceeds .004," reduce clearance by tapping very lightly on top of the body with a small soft hammer.

Never remove the rotor. Do not loosen the bolts on either the body or mounting brackets as this will alter the preset clearance between the rotor and these parts.

VACUUM PUMP - 3200B

The vacuum pump vanes are made of hard fiber and are precision ground. Routine cleaning and checking of the filter and muffler, and periodic flushing of the pump chamber, will help prolong vane life.

To replace the vanes or inspect the pump interior, remove only the dead end plate (opposite the drive shaft end).

⚠ CAUTION

THE RETAINER RING IS UNDER TENSION.

MAINTENANCE AND REPAIR

1. Remove the end plate bolts.
2. Use a standard gear puller to remove the dead end plate and bearing assembly. Refer to Figure 12.

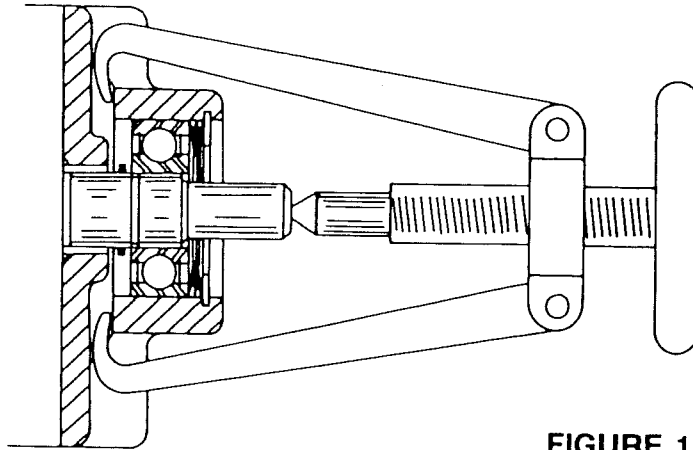


FIGURE 12

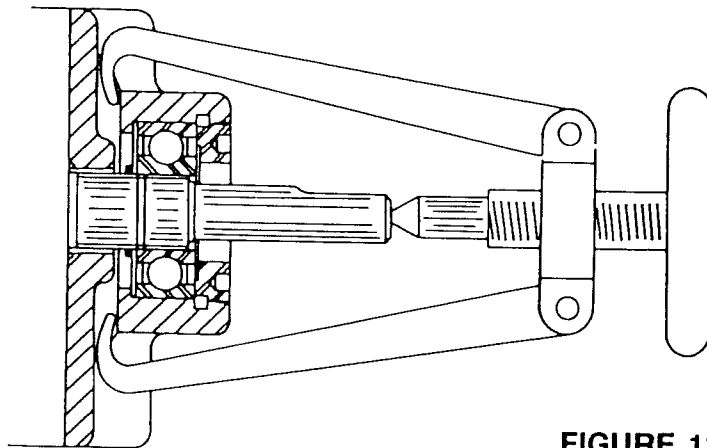


FIGURE 13

3. Do not disturb the drive end cap unless a new bearing is being installed. The drive end cap (threaded) may be removed by using a standard adjustable spanner wrench.

NOTICE

DO NOT LOOSEN OR REMOVE THE DRIVE END PLATE FROM THE BODY. USE THE GEAR PULLER OR AN ARBOR PRESS TO PRESS THE ROTOR OUT OF THE BEARING AND END PLATE. REFER TO FIGURE 13.

Reassembly if only the dead end plate was removed:

1. Insert the vanes with the beveled edge fitting the contour of the body bore.
2. Position the pump in a vertical position with the drive shaft down.
3. Replace the dead end plate and assemble end plate bolts finger tight. End plate should be free to move.
4. Insert the rubber deflector over the bearing shoulder on the shaft.

MAINTENANCE AND REPAIR

5. Keep the unit in a vertical position and support the end of the shaft.
6. Press the bearing, on the inner race only, until it bottoms on the shaft shoulder. An arbor press is recommended.
7. Replace dowel pins and tighten end plate bolts.
8. Install belleville springs, washer, and retainer ring as shown on parts identification pages of this manual.
9. Check for free rotor movement by turning it by hand. If interference is detected, the pump is not properly aligned. Disassemble and repeat the reassembly procedures.

Reassembly if new bearings were installed:

1. Install the rotor shaft through the drive end plate.
2. Insert the rubber deflector over the bearing shoulder on the shaft.
3. Position the unit in a vertical position and support the dead end shaft.
4. Press the bearing, on the inner race only, into its bore until it bottoms on the shaft shoulder.
5. Insert the vanes with the beveled edge fitting the contour of the body bore.
6. Position the pump in a vertical position with the drive shaft down.
7. Replace the dead end plate and assemble end plate bolts finger tight. End plate should be free to move.
8. Position the pump in a vertical position with the drive shaft down.
9. Replace the dead end plate and assemble end plate bolts finger tight. End plate should be free to move.
10. Insert the rubber deflector over the bearing shoulder on the shaft.
11. Keep the unit in a vertical position and support the end of the shaft.
12. Press the bearing, on the inner race only, until it bottoms on the shaft shoulder. An arbor press is recommended.
13. Replace dowel pins and tighten end plate bolts.
14. Install belleville springs, washer, and retainer ring as shown on parts identification pages of this manual.
15. Replace drive end cap. Turn in until shaft turns freely.
16. Check for free rotor movement by turning it by hand. If interference is detected, the pump is not properly aligned. Disassemble and repeat the reassembly procedures.

ELECTICAL COMPONENTS

⚠ DANGER

HAZARDOUS VOLTAGES PRESENT.
DISCONNECT POWER AND LOCKOUT DISCONNECTING MEANS BEFORE INSPECTING OR SERVICING.

Only qualified electricians should inspect, service, repair, or replace electrical components.

ELECTRICAL COMPONENTS INSPECTION:

Electrical components should be inspected every three months, and during scheduled frequent and periodic inspections, as follows:

1. Follow the procedures and instructions listed in the MAINTENANCE AND INSPECTION PROCEDURES section of this manual.
2. Components to examine:
 - a. Magnetic contactors. (3200B only)
 - b. Control devices.
 - c. Wiring and connections.
 - d. Vacuum indicator lights.
3. Damage to look for:
 - a. Pitting.
 - b. Corrosion.
 - c. Broken parts.
 - d. Damage and deterioration of any kind.
 - e. Damaged or frayed wire.
 - f. Loose terminal connections.
4. Corrective action required:
 - a. Tighten any loose connections.
 - b. Replace any damaged or frayed wires.
 - c. Replace any pitted, burned, or corroded contacts or the entire contactor. Replace contacts in sets only. NEVER attempt to smooth contacts by filing or other means.
 - d. Replace damaged components.
 - e. Lubricate controller parts only if recommended by the controller manufacturer.
 - f. Replace burned out lamps in indicator lights.

⚠ WARNING

WHENEVER ANY CHANGES HAVE BEEN MADE TO THE LIFTING SYSTEM, DO NOT OPERATE VACUUM LIFTING DEVICE, CRANE, OR HOIST UNTIL ALL SAFETY DEVICES HAVE BEEN RECHECKED IN THE SAME MANNER AS DURING ORIGINAL INSTALLATION. REFER TO INSTALLATION SECTION OF THIS MANUAL.

BATTERY RECHARGE

This section applies to Series 3200B vacuum lifters only. The battery should be recharged as required or at the end of each shift.

BATTERY CHARGER SPECIFICATIONS - SERIES 3200B:

Battery charger to be 12 volts with a charging rate of 6 amperes. Battery charger should be of the automatic type which adjusts charging rate to battery conditions automatically; delivering full amp output to a low battery, decreasing rate as battery approaches full charge, and provides a trickle charge as required to maintain full charge. Battery charger should compensate automatically for temperature and AC voltage variations, and adjust automatically so it can be left connected for an extended period without damaging charger or battery. Battery charger leads must be fitted with the plug furnished with the power pac unit or with a 2-wire female connector body to match the receptacle on the front of the control panel.

⚠ CAUTION

CHARGING CURRENT HIGHER THAN 6 AMPERES THROUGH THE CONTROL PANEL CONNECTOR WILL DAMAGE INTERNAL CIRCUIT COMPONENTS.

REFER TO AND READ ALL INSTRUCTIONS AND WARNINGS FURNISHED WITH THE BATTERY CHARGER.

⚠ DANGER

HAZARDOUS VOLTAGES PRESENT.

DISCONNECT POWER AND LOCKOUT DISCONNECTING MEANS BEFORE INSPECTING OR SERVICING.

Only qualified electricians should inspect, service, repair, or replace electrical components, and recharge batteries.

⚠ CAUTION

WORKING IN THE VICINITY OF LEAD-ACID BATTERIES IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION AND CHARGING.

To reduce the risk of battery explosion, follow these instructions, the instructions and warnings furnished by the battery manufacturer, the instructions and warnings furnished by the battery charger manufacturer, and the instructions and warnings furnished by the manufacturer of any equipment that will be located and used in the vicinity of the battery or battery charger.

1. Never work alone when working with or near a lead-acid battery.
2. Have plenty of fresh water and soap handy in case battery acid contacts skin, clothing, or eyes.
3. Install an emergency shower and an emergency eye wash station in the battery charger area.
4. Wear complete eye protection and clothing protection when working near a battery. Avoid touching eyes when working near a battery.
5. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 10 minutes and seek medical attention immediately.
6. NEVER smoke or allow a spark or flame in the vicinity of the battery or the battery charger area.
7. Remove personal items, such as rings, bracelets, necklaces, watches, etc., when working near a lead-acid battery or charging a battery. DO NOT hit the battery with metal tools or drop metal tools onto the battery.
8. NEVER charge a frozen battery.
9. NEVER connect battery positive and negative terminal posts or leads together.

BATTERY RECHARGE

CHARGING AND MAINTENANCE OF A LEAD-ACID BATTERY:

1. ALWAYS read, fully understand, and follow the instructions and warnings furnished by the battery manufacturer and battery charger manufacturer. Determine charge rates and exact charging procedures from these instructions.
2. Clean battery terminals. Be careful to keep corrosion from coming into contact with eyes.
3. Add distilled water in each cell, before charging, until battery acid reaches level specified by battery manufacturer. This will help purge excessive gas from the cells. DO NOT overfill. For a battery without cell caps, follow manufacturer's recharging instructions.
4. Read and understand all battery manufacturer's specific instructions, precautions, and warnings, such as removing or not removing cell caps while charging, and recommended rates of charge.
5. Check battery condition with a hydrometer or battery percent of charge tester. Correct all hydrometer readings for ambient temperature.
6. ALWAYS check polarity of battery posts before connecting battery charger or reconnecting to vacuum lifter circuit. Positive (POS, P, +) battery post normally has a larger diameter than the Negative (NEG, N, -) post.
7. NEVER reverse polarity of battery cables or battery charger cables.
8. NEVER touch battery charger cables together.
9. ALWAYS disconnect battery charger from AC power supply before connecting to battery terminals.

TROUBLESHOOTING

Troubleshooting is always easier with a good understanding of how the equipment is intended to operate. A review of VAC-U-LIFT® operating principles can be found in the EQUIPMENT/OPERATING PRINCIPLES section of this manual. Piping and wiring diagrams are shown in Figures 4, 5, 6, and 7 in the EQUIPMENT/OPERATING PRINCIPLES section of this manual.

TESTING FOR LEAKS

A PROOF LOAD TEST is to be conducted daily. Refer to the TEST section of this manual for instructions on conducting a PROOF LOAD TEST. If the vacuum lifter fails the PROOF LOAD TEST, there is a leak somewhere in the vacuum system. The location of the leak can most readily be determined by a process of elimination. Check the power pac unit first. If it checks good, other sections or components of the vacuum system are connected, one at a time, until the leak is found.

Disconnect the vacuum hose that connects the power pac to the load beam, or the vacuum pad in a single-pad unit. Perform the power-off vacuum test in the same manner as outlined in the PROOF LOAD TEST. Put the "ON/OFF" switch on the power pac control panel in the "ON" position, and "VACUUM/RELEASE" switch on the power pac control panel in the "VACUUM" position. Allow the gauge reading to reach 25" Hg. Put the "ON/OFF" switch on the power pac control panel in the "OFF" position and observe the gauge. If the reading drops more than 1" Hg in two minutes, the leak is located in the power pac unit. If not, a leak is in the piping to the vacuum pads or the vacuum pads.

Reconnect the vacuum hose that connects the power pac to the load beam, or the vacuum pad in a single-pad unit. Disconnect the hose leading to one end of the assembly and plug the open end. Repeat the power-off vacuum test. If leakage is indicated, the leak is in the end of the load beam assembly tested. If not, a leak is in one of the pads or cross arms of the end that has been disconnected. Continue the process of elimination until the leak is determined.

The following components should be checked as possible sources of vacuum leaks:

- **Seal rings** - Check for cracks, cuts, or other damage.
- **Vacuum hoses** - Check for breaks, cuts, or pinch points.
- **Vacuum pads** - Check for cracks and loose bolts.

TRACING POWER PAC UNIT VACUUM LEAKS

If the tests have shown that leakage is occurring within the power pac unit, the process of elimination may be used to trace the problem to its source. As before, a power-off test is performed as each portion of the vacuum system is disconnected. Refer to the parts identification pages of this manual. The filter and check valve should be checked as possible sources of vacuum leaks. All threaded connections should be drawn up tight using pipe dope.

NOTICE

CARE SHOULD BE EXERCISED TO PREVENT PIPE DOPE AND OTHER FOREIGN MATERIALS FROM ENTERING THE VACUUM SYSTEM.

If vacuum lifter operates erratically, or not at all, the vacuum lifter should be taken out of service. Any problem should be diagnosed and corrected before the vacuum lifter is returned to regular service. Refer to Table 3 for some problem areas to consider and investigate.

DANGER

DISCONNECT POWER AND LOCKOUT DISCONNECTING MEANS BEFORE PERFORMING SERVICE TO ELECTRICAL PARTS OF THIS EQUIPMENT.

Only a qualified electrician should perform service to electrical parts of this equipment.

TROUBLESHOOTING

TABLE 3

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Motor will not run.	<p>Power failure in power lines.</p> <p>Low voltage or frequency.</p> <p>Blown fuse.</p> <p>Damaged "ON/OFF" switch.</p> <p>Improper, loose, or broken wire connections.</p> <p>Magnetic contactor not operating. (3200B)</p> <p>Motor damaged.</p> <p>Battery charge low. (3200B)</p>	<p>Check circuit breakers, switches, and connections in power lines.</p> <p>Check voltage and frequency, or power supply. They must agree with data on nameplate.</p> <p>Check and replace, if required.</p> <p>Check and replace, if required.</p> <p>Check connections and lead wires. Check connections in control devices.</p> <p>Check coil for open or short circuit. Check all connections in control circuit. Check for open contact. Replace as needed.</p> <p>Replace motor.</p> <p>Charge battery.</p>
Vacuum pump will not run.	<p>Damaged pump.</p> <p>Worn or damaged vanes.</p> <p>Bearing worn or frozen.</p> <p>Extreme low temperature.</p>	<p>Repair or replace.</p> <p>Replace vanes.</p> <p>Replace bearings.</p> <p>Bring unit to room temperature.</p>
Vacuum pump runs hot.	<p>Foreign material in pump.</p> <p>Worn vanes or vanes hanging up.</p> <p>Low voltage. (3200S, 3200R, and 3200U)</p>	<p>Flush pump assembly.</p> <p>Flush pump assembly. Check and replace vans as required.</p> <p>Check voltage and frequency, or power supply.</p>
No vacuum reading or low vacuum reading on vacuum gauge.	<p>Improper vacuum pad seal.</p> <p>Clogged filter or muffler.</p> <p>Damaged vacuum pad or seal rings.</p> <p>Damaged gauge.</p> <p>Loose or damaged hoses or fittings.</p> <p>Clogged vacuum lines. Clogged or damaged gauge line.</p> <p>Porous material being lifted.</p> <p>Damaged pump.</p>	<p>Inspect and replace pads as required. Check for leaks.</p> <p>Inspect, clean, or replace as required.</p> <p>Inspect and replace pads as required.</p> <p>Inspect and replace.</p> <p>Inspect, repair, or replace as required. Check for leaks.</p> <p>Inspect, clean, repair, or replace as required.</p> <p>Check unit using non-porous material.</p> <p>Repair or replace.</p>

TROUBLESHOOTING

TABLE 3 (CONTINUED)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Red lamp will not light.	Burned out bulb. Blown fuse. Loose, or broken wire connections. Damaged vacuum switch. Vacuum switch out of adjustment.	Check and replace, as required. Check and replace, as required. Check connections. Tighten or replace, as required. Check and replace, as required. Check and adjust, if required.
Green lamp will not light.	Burned out bulb. Blown fuse. Loose, or broken wire connections. Damaged vacuum switch. Vacuum switch out of adjustment. Unit remains in vacuum "RELEASE" cycle. No vacuum reading or low vacuum reading on vacuum gauge.	Check and replace, as required. Check and replace, as required. Check connections. Tighten or replace, as required. Check and replace, as required. Check and adjust, if required. Refer to problem item: Unit remains in vacuum "RELEASE" cycle. Refer to problem: No vacuum reading or low vacuum reading on vacuum gauge.
Unit remains in "VACUUM" cycle.	Blown fuse. Loose, or broken wire connections. Damaged 4-way control valve, or 4-way valve hanging up. (3200S, 3200R, and 3200U) Damaged control valve, or valve hanging up. (3200B) Damaged pendant control push buttons.	Check and replace, as required. Check connections. Tighten or replace, as required. Check, clean, or replace, as required. Check and replace, as required.
Unit remains in vacuum "RELEASE" cycle.	Blown fuse. Loose, or broken wire connections. Damaged 4-way control valve, or 4-way valve hanging up. (3200S, 3200R, and 3200U) Damaged control valve, or valve hanging up. (3200B) Damaged pendant control push buttons. VACUUM/RELEASE switch on control panel left in "RELEASE" position.	Check and replace, as required. Check connections. Tighten or replace, as required. Check, clean, or replace, as required. Check and replace, as required. Switch to "VACUUM" position.

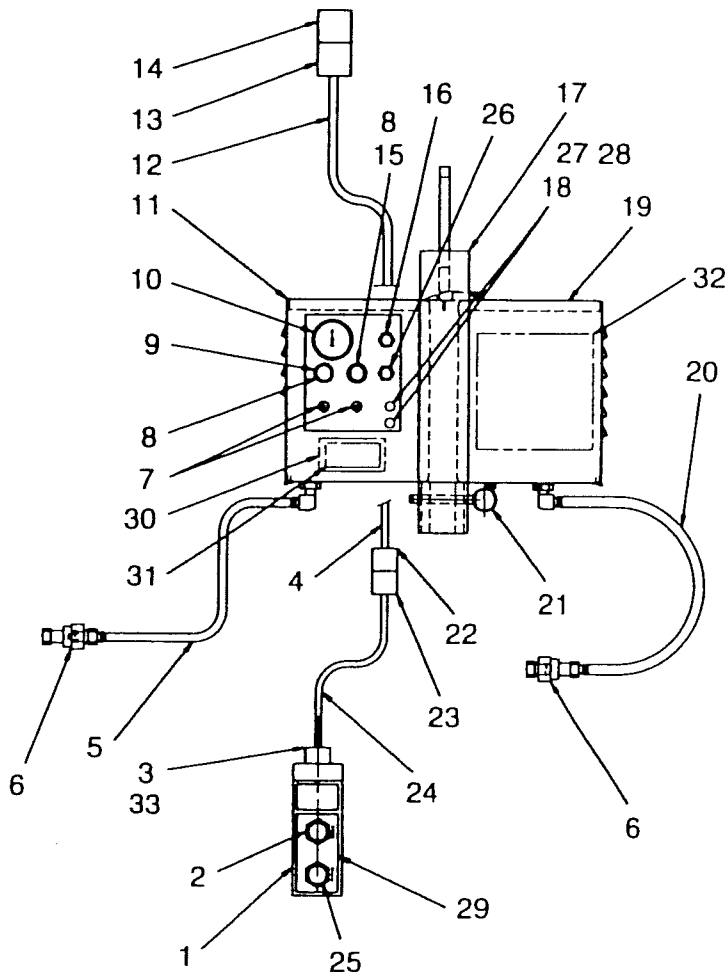
TROUBLESHOOTING

TABLE 3 (CONTINUED)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Excessive vacuum loss during PROOF LOAD TEST	Vacuum system leaks.	Refer to LOAD PROOF TEST in TEST section of this manual.
Noisy vacuum pump.	Pump is cold. Sticking vanes or broken vane.	Bring to room temperature. Flush pump. Replace vanes.
Unit blows fuses.	Low voltage or frequency. (3200S, 3200R, and 3200U) Short in electrical circuit. Vacuum pump freezing up. Clogged filter or muffler. Damaged relief valve.	Check voltage and frequency, or power supply. Check and repair, as required. Check for broken vanes or foreign material. Inspect, clean, or replace as required. Check and replace.
Excessive attach or release time.	Clogged filter or muffler. Clogged, loose, or damaged hoses or fittings. Loose or damaged hoses on vacuum reserve valve, or damaged vacuum reserve valve or check valve. Damaged 4-way valve. Pump vanes hanging up. Worn vacuum pump.	Check, clean, or replace, as required. Check and repair, as required. Check, clean, or replace, as required. Check, clean, or replace, as required. Flush pump assembly. Check and replace vanes, if required. Replace vanes or pump.
Excessive attach time.	Damaged vacuum pad or seal rings. Porous material being lifted.	Inspect and replace, as required. Check unit using non-porous material.
Excessive release time.	Damaged relief valve.	Check and replace.

PARTS LIST — POWER PAC EXTERNAL PARTS

POWER PAC EXTERNAL PARTS SERIES 3200S, 3200R, AND 3200U



POWER PAC ASSEMBLY EXTERNAL PARTS, SERIES 3200S, 3200R, AND 3200U

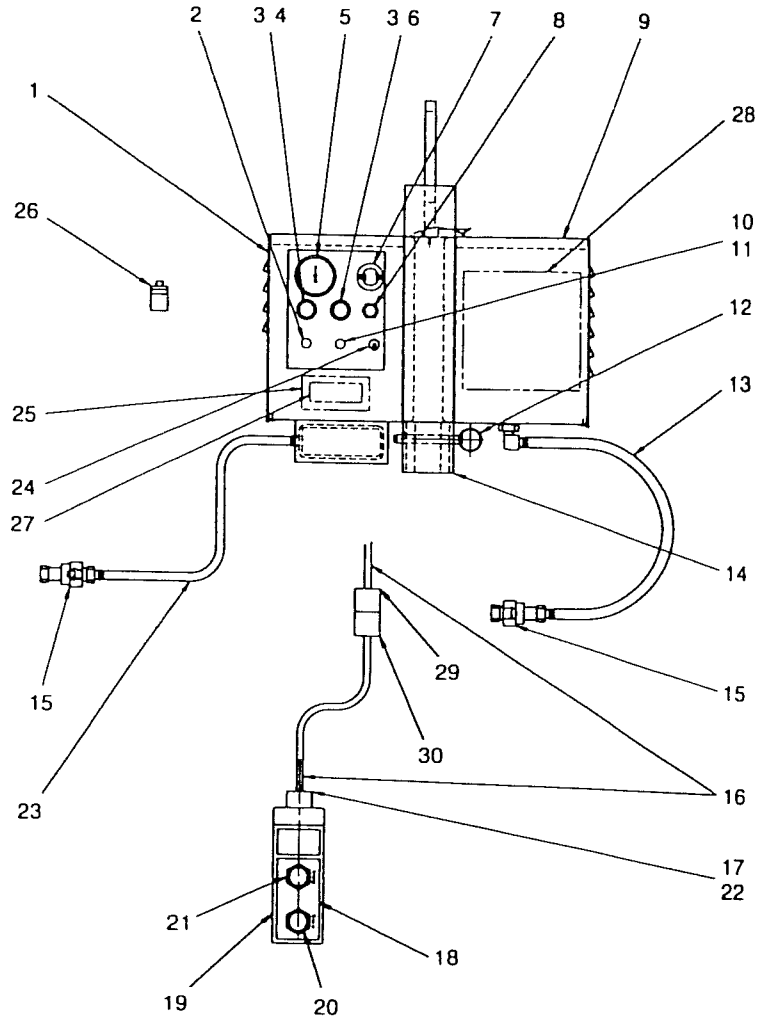
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	86716-01	Control Pendant Box	1
2	86716-22	Push Button Assembly	1
3	PA7454	Cord Grip	1
4	PA6258	Portable Cord 16-3	1
5	29198	Vacuum Hose 1/4" I.D.	1
6	28376	Quick Disconnect	2
7▲	22895	Toggle Switch	2
8▲	22192	Light Bulb	2
9▲	22592	Red Light Unit	1
10▲	29609	Vacuum Gauge	1
11	70073	Left Half Enclosure	1
12	90319	Portable Cord 14-3	1
13	23841	Male Disconnect	1
14	23842	Female Disconnect	1
15▲	22593	Green Light Unit	1
16	22367	Cord Grip	1
17	70109 70120	Base Weldment 3200S and 3200R 3200U	1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
18▲	22498	Fuse Mount	2
19	70074	Right Half Enclosure	1
20	29199	Vacuum Hose 3/8" I.D.	1
21	28484	Fas-Pin	1
22	23848	Female Disconnect	1
23	23847	Male Disconnect	1
24	62044	Pendant Cord 14-3	1
25	86716-23	Push Button Guard	1
26	22363	Cord Grip	1
27▲	22502	Fuse 10 Amp.	1
28▲	22490	Fuse 5 Amp.	1
29	86717-18	Pendant Control Plate "VAC/REL"	1
30	69505-01	Label, Danger Electrical	1
31	69505-02	Label, Danger Electrical	1
32	69700	Label, Warning	1
33	PA4333	Sealing Washer	1

▲ Recommended Spare Parts

PARTS LIST — POWER PAC EXTERNAL PARTS

POWER PAC EXTERNAL PARTS SERIES 3200B



POWER PAC ASSEMBLY EXTERNAL PARTS, SERIES 3200B

ITEM NO	PART NUMBER	DESCRIPTION	QTY
1	70073	Left Half Enclosure	1
2	61738	Circuit Breaker	1
3▲	PA7445	Light Bulb	2
4▲	22592	Red Light Unit	1
5▲	28609	Vacuum Gauge	1
6▲	22593	Green Light Unit	1
7	22744	Twistlock Terminal	1
8	22367	Cord Grip	1
9	70074	Right Half Enclosure	1
10▲	22498	Fuse Mount	1
11▲	22502	Fuse 10 Amp.	1
12	28484	Fas-Pin	1
13	29199	Vacuum Hose 3/8" I.D.	1
14	70134	Base Weldment	1
15	28376	Quick Disconnect	2

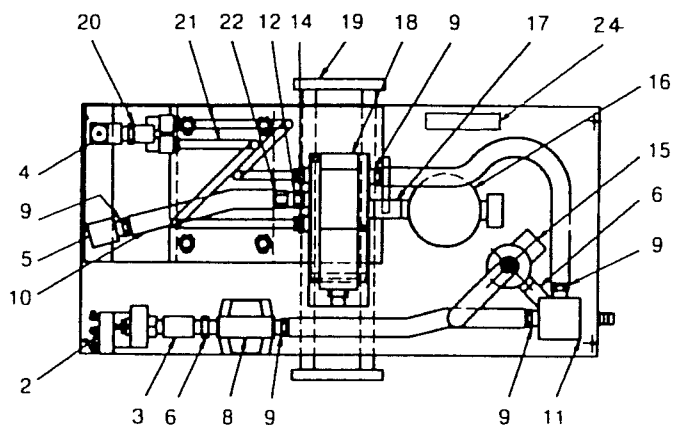
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
16	62044	Pendant Cord 14-3	1
17	PA7454	Cord Grip	1
18	86717-18	Pendant Control Plate "VAC/REL"	1
19	86716-01	Control Pendant Box	1
20	86716-23	Push Button Guard	1
21	86716-22	Push Button Assembly	1
22	PA4333	Sealing Washer	1
23	29198	Vacuum Hose 1/4" I.D.	1
24▲	22895	Toggle Switch	1
25	69505-01	Label, Danger Electrical	1
26	22739	Twistlock Connector	1
27	69505-02	Label, Danger Electrical	1
28	69700	Label, Warning	1
29	23848	Female Disconnect	1
30	23847	Male Disconnect	1

▲ Recommended Spare Parts

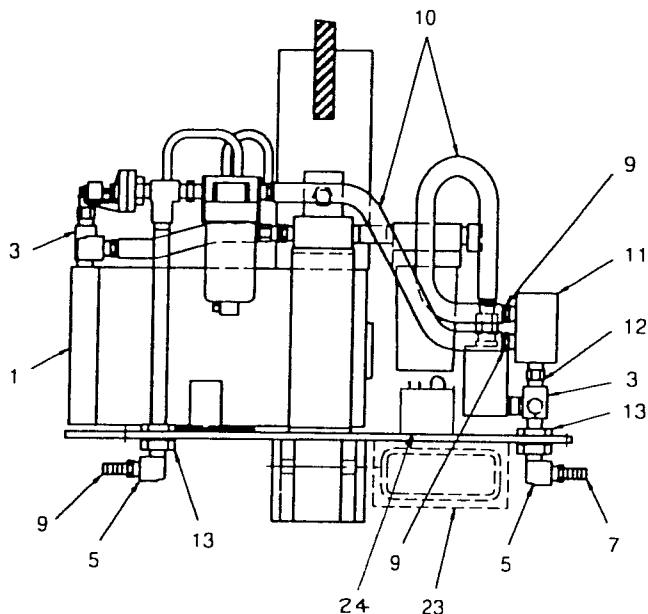
PARTS LIST — POWER PAC INTERNAL PARTS

POWER PAC INTERNAL PARTS SERIES 3200S, 3200R, AND 3200U

Power Pac Inside Top View



Power Pac Inside Rear View



POWER PAC ASSEMBLY INTERNAL PARTS, SERIES 3200S, 3200R, AND 3200U

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	70113	Vacuum Pump	1
2	22883	Vacuum Switch	1
3	29011	Street Tee	3
4	861790	Relief Valve	1
5	21135	Street Elbow	3
6	PA7420	Nipple	2
7	28908	Hose Stem	2
8	PA7419	Filter	1
9	28916	Hose Stem	6
10	29199	Vacuum Hose	1
11	28643	Manifold	1
12▲	PA7425	Check Valve	2

▲ Recommended Spare Parts

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
13	22461	Anchor Coupling	2
14	PA7423	Fitting	2
15	27863	Vacuum Reserve Valve	1
16	PA7421	Muffler	1
17	28652	Long Nipple	1
18	PA7422	Control Valve	1
19	70109 70120	Base Weldment 3200S and 3200R 3200U	1
20	PA7418	Branch Y	1
21	PA7417	Hose	2
22	PA7424	Hose Stem	1
23	70099	Tank Assembly (a)	1
24	PA7709	Current Monitor/Relay	1

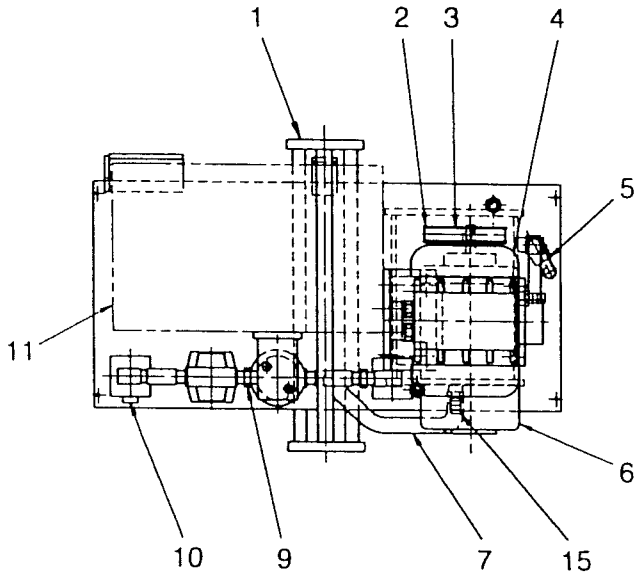
NOTE:

(a) Included with 3200R. Optional on 3200S and 3200U.

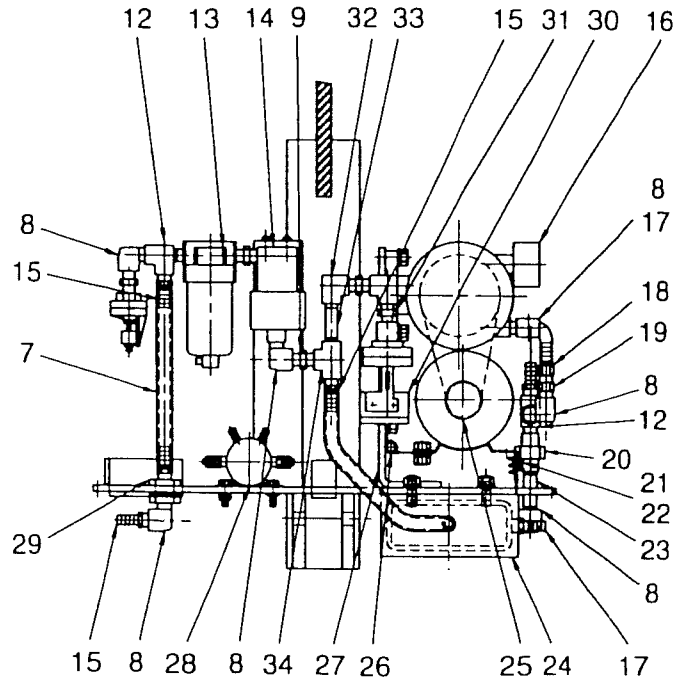
PARTS LIST — POWER PAC INTERNAL PARTS

POWER PAC INTERNAL PARTS SERIES 3200B

Power Pac Inside Top View



Power Pac Inside Rear View



POWER PAC ASSEMBLY INTERNAL PARTS, SERIES 3200B

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	70134	Base Weldment	1
2	61665	Sheave	1
3▲	61664	Belt	1
4	31101	Pump	1
5	29198	Vacuum Hose	1
6	31001	Motor	1
7	29199	Vacuum Hose	1
8	21135	Street Elbow	6
9	PA7420	Nipple	3
10	22883	Vacuum Switch	1
11	(a)	Battery	1
12	29011	Street Tee	1
13	PA7419	Filter	1
14▲	PA7453	Control Valve	1
15	28916	Hose Stem	3
16	26270	Muffler	1
17	28908	Hose Stem	2

ITEM NO	PART NUMBER	DESCRIPTION	QTY
18	28902	Hose Stem	1
19▲	PA7425	Check Valve	1
20	29079	Union	1
21	29606	Spring	2
22	PA1289	Cotter Pin	2
23	28652	Nipple	1
24	70133	Tank Assembly	1
25	61663	Sheave	1
26	28593	Hinge	1
27	28118	Mounting Bracket	1
28	861740	Relay	1
29	22461	Anchor Coupling	1
30	22878	Vacuum Switch	1
31	PA7444	Pipe Reducer	1
32	31128	90° Elbow	2
33	28652	Long Nipple	1
34	PA7452	Street Tee	1

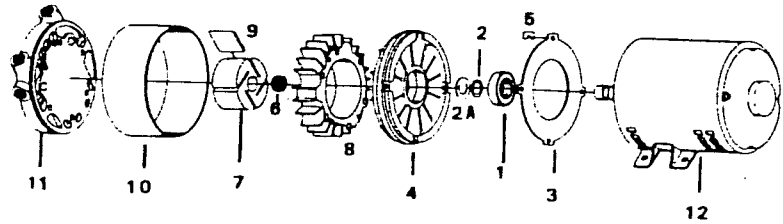
▲ Recommended Spare Parts

NOTE:

(a) Battery by others. Not included with 3200B. Battery is available from Acco as Acco part number 28052. A battery charger is also available from Acco as Acco part number 22027.

PARTS LIST — VACUUM PUMP

VACUUM PUMP SERIES 3200S, 3200R, AND 3200U



COMPLETE MOTOR AND PUMP ASSEMBLY
Part No. 71556

VACUUM PUMP PARTS, SERIES 3200S, 3200R, AND 3200U

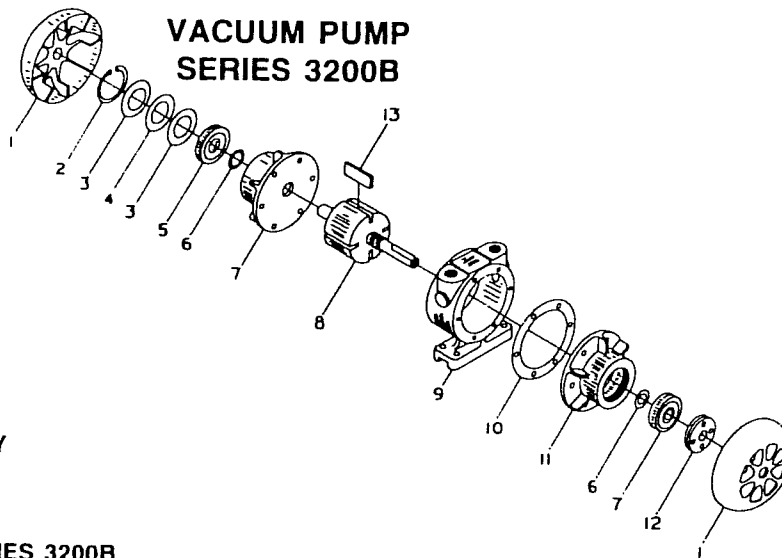
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	(a)	Bearing	1
2	(a)	Spacer	1
2A	(a)	Deflector	1
3	(a)	Inlet	1
4	(a)	Bracket	1
5	(a)	Shim	1

▲ Recommended Spare Parts

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
6	(a)	Tolerance Ring	1
7	(a)	Rotor	1
8	(a)	Body	1
9▲	G9135	Vane	4
10	(a)	Shroud	1
11	(a)	End Plate	1
12	71556	Complete Motor and Pump	1

NOTE:

(a) Not available as a spare part.



COMPLETE PUMP ASSEMBLY
Part No. 31101

VACUUM PUMP PARTS, SERIES 3200B

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	(a)	Fan	2
2	(a)	Retaining Ring	1
3	(a)	Belleville Spring	2
4	(a)	Washer	1
5	(a)	Bearing	2
6	(a)	Deflector	2
7	(a)	End Plate, Dead End	1

▲ Recommended Spare Parts

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
8	(a)	Rotor	1
9	(a)	Body	1
10	(a)	Gasket	1
11	(a)	End Plate, Drive End	1
12	(a)	End Cap	1
13	(a)	Vaness	4
(b) 14▲	26506	Repair Kit	(b)

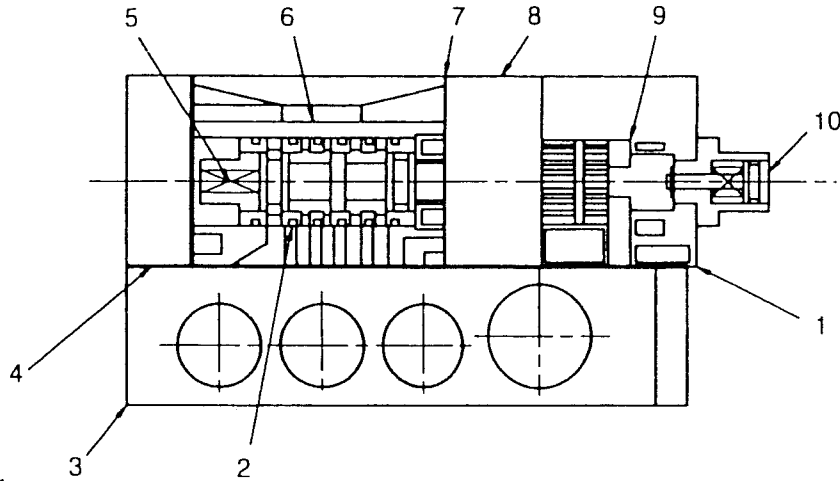
NOTE:

(a) Not available as a spare part.

(b) Not shown on drawing. Repair kit contains (2) bearings, item 5; (2) deflectors, item 6; (1) gasket, item 10; and (4) vanes, item 13.

PARTS LIST — 4-WAY CONTROL VALVE

4-WAY CONTROL VALVE SERIES 3200S, 3200R, AND 3200U



**COMPLETE
4-WAY CONTROL
VALVE ASSEMBLY**
Part No. PA7421

4-WAY CONTROL VALVE PARTS, SERIES 3200S, 3200R, AND 3200U

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	(a)	Valve Body	1
2	(a)	O-Ring	6
3	PA7429	Base Plate	1
4▲	PA7430	Gasket	1
5	(a)	Spring	1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
6▲	PA7431	Sleeve Assembly	1
7▲	PA7432	Gasket Set	1
8▲	PA7433	Solenoid Assembly	1
9	(a)	Bumper	1
10	(a)	Manual Operator	1

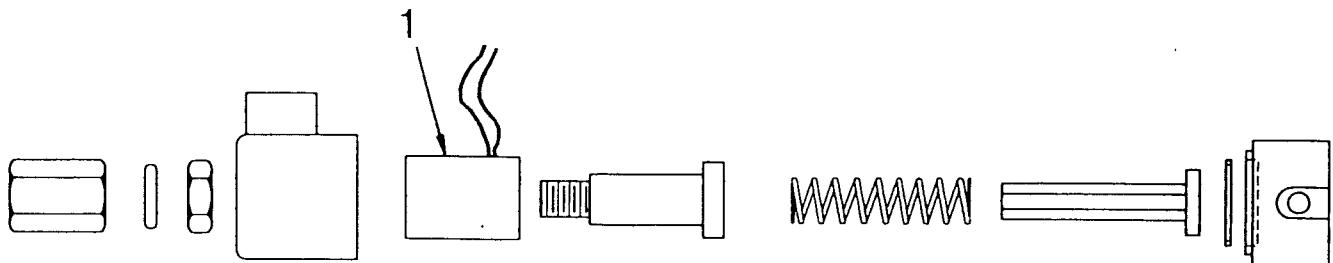
NOTE:

(a) Not available as a spare part.

▲ Recommended Spare Parts

PARTS LIST — VACUUM RESERVE VALVE

VACUUM RESERVE VALVE SERIES 3200S, 3200R, AND 3200U



COMPLETE VACUUM RESERVE VALVE ASSEMBLY
Part No. 27863

VACUUM RESERVE VALVE PARTS, SERIES 3200S, 3200R, AND 3200U

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1▲	27038	Coil	1

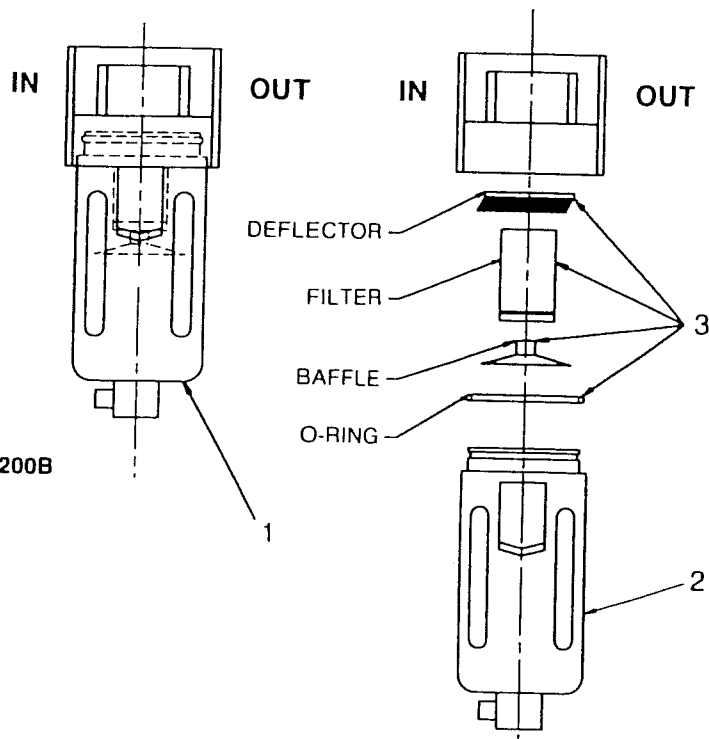
▲ Recommended Spare Parts

NOTE:

(a) Only coil is available as a spare part.

PARTS LIST — FILTER

FILTER SERIES 3200S, 3200R, 3200U, AND 3200B



COMPLETE FILTER ASSEMBLY

Part No. PA7419

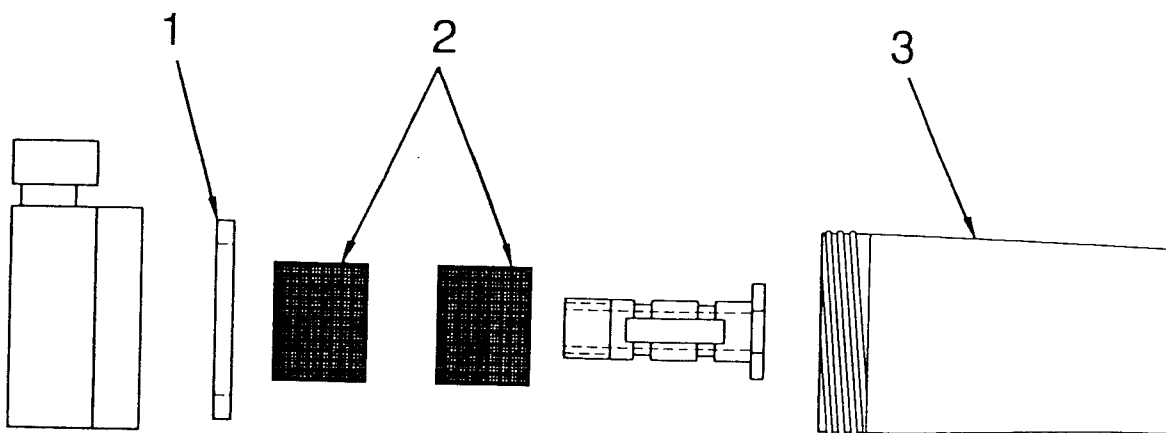
FILTER PARTS, SERIES 3200S, 3200R, 3200U, AND 3200B

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	PA7419	Complete Filter Assembly	1
2	PA7427	Bowl Assembly	1
3▲	PA7428	Repair Kit	1

▲ Recommended Spare Parts

PARTS LIST — MUFFLER

MUFFLER SERIES 3200S, 3200R, AND 3200U



COMPLETE MUFFLER ASSEMBLY

Part No. PA7421

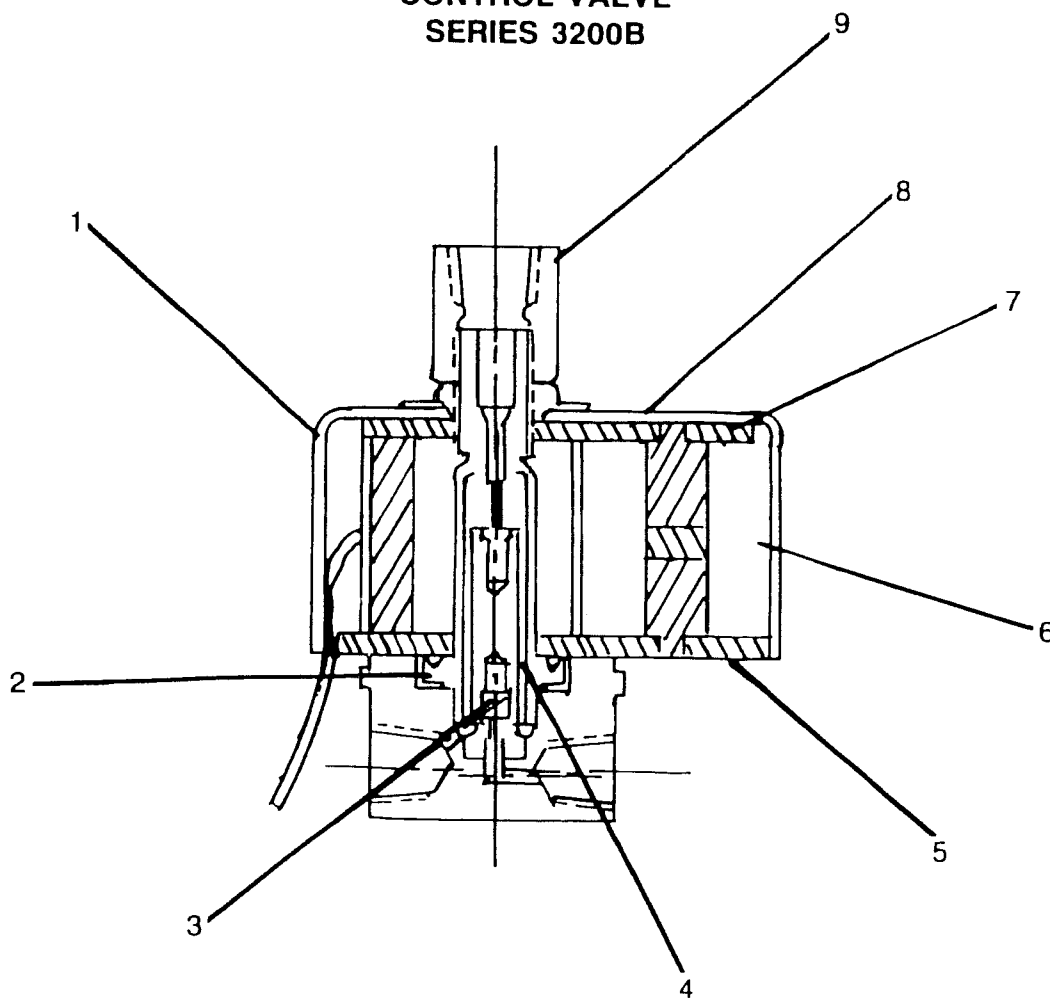
MUFFLER ASSEMBLY PARTS, SERIES 3200S, 3200R, and 3200U

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1▲	26201	Gasket	1
2▲	26168	Filter Element	2
3	26241	Jar	1

▲ Recommended Spare Parts

PARTS LIST — CONTROL VALVE

CONTROL VALVE SERIES 3200B



COMPLETE CONTROL VALVE ASSEMBLY

Part No. PA7453

CONTROL VALVE PARTS, SERIES 3200B

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1▲	PA7453	Complete Control Valve	1
2	(a)	Saddle Coupling	1
3	(a)	Plunger Spring	1
4	(a)	Plunger Insert	1
5	(a)	Plunger	1
6	(a)	Sole Plate	1
7	(a)	Coil Assembly	1
8	(a)	Saddle Plate	1
9	(a)	Cover	1

▲ Recommended Spare Parts

NOTE:

(a) Not available as a spare part.

GENERAL CONDITIONS OF WARRANTY

WARRANTIES: The Seller warrants to the original using Buyer thereof that the goods sold under this Agreement are free from defects in workmanship and materials for a period of one year from the date of shipment to the original using Buyer. No other express warranties are given and no affirmation of Seller or Seller's agents, by word or action, shall constitute a warranty. No warranty is made for components and accessories made by others when such items are warranted by their respective manufacturers.

Installation or operation of the equipment in any manner other than as recommended by Seller, shall void the warranty.

Any variations in details between the goods furnished herein and those covered in Buyer's specifications are due to standards of manufacture not to be construed as exceptions to the specifications.

DISCLAIMER OF IMPLIED WARRANTIES:

- (a) SELLER MAKES NO WARRANTY OF MERCHANTABILITY IN RESPECT TO THE GOODS SOLD UNDER THIS AGREEMENT.
- (b) This sale is made WITHOUT ANY WARRANTY BY SELLER THAT THE GOODS ARE SUITABLE FOR ANY PARTICULAR PURPOSE.
- (c) Buyer hereby waives all other warranties, guarantees, obligations, liabilities, rights, and remedies arising by law or otherwise including any obligation or liability of the Seller arising from tort, and Buyer shall indemnify Seller from any liability, loss, damage, or claim arising from Buyer's tortious use of the goods sold hereby.

REMEDIES:

- (a) Under no conditions shall any goods be returned to Seller without its prior written consent.
- (b) The Buyer's sole and exclusive remedy for breach of any warranty is limited to Seller furnishing, at its expense, duplicate or repaired parts F.O.B. Seller's plant with installation at Buyer's expense if discovery of a claimed defect occurs during the allowable warranty period, and if Seller's inspection determines a defect exists.
- (c) The quantity of material shown by invoice shall in all cases govern settlement for shortages, unless notice of shortage, appropriately documented, is given to the carrier and the Seller upon delivery by the Carrier.
- (d) Claims for errors, deficiencies or imperfections shall be deemed waived by the Buyer unless Seller is notified in writing of the basis of such claims within 10 days after discovery of claimed defect and such discovery occurs within the warranted period.
- (e) Neither Buyer nor User shall be entitled under this Agreement to recover from Seller any incidental or consequential damages of any nature including but not limited to the cost of any labor expended by others in connection with the goods sold hereby by reason of any alleged nonconformity or breach of warranty on the part of the Seller, nor costs of material or account thereof, nor any lost profits whether determinable or speculative.



Acco Chain & Lifting Products Division

76 Acco Drive, Box 792, York, PA 17405-0792
717-741-4863 800-967-7333 Fax 717-741-8572