

QED Environmental Systems

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QED EZ-Tray™ Air Stripper System Operations and Maintenance Manual

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***EZ-TRAY™ AIR STRIPPER
OPERATION AND MAINTENANCE MANUAL***

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Thank you for relying on QED Treatment Systems to handle your treatment needs. After reading your Operation and Maintenance Manual, if you have any questions regarding the startup or operation of your system, please contact the **QED Service and Repair Department at 1-800-624-2026.**

PLEASE NOTE!

Read your QED Operation and Maintenance Manual First!

The manual will assist you in the proper procedure for equipment hookups, installation, startup, maintenance, and troubleshooting.

It is Important That a Qualified, Licensed Electrician Perform All Electrical/Wiring Installation Work.

Please see Equipment Set-Up in the Operating Instructions section of this manual.

Follow the Manufacturers Instructions

All the mechanical equipment that was supplied with your air stripper system should include the respective manufacturer's instruction manual for each piece of equipment. The documentation will either be found with the actual piece of equipment (if shipped loose) or found within a QED Operation and Maintenance manual that includes all relevant manufacturers' instruction sheets.

Follow Safe Work Practices

Be sure to follow all associated safety practices.

BASIC SYSTEM DESCRIPTION

EZ-Tray™ systems are fabricated from rugged stainless steel, or treated carbon steel. Each system is pre-assembled and factory tested before shipment to your site. EZ-Tray™ low profile air strippers are built to meet site and project specifications, which can include a number of standard or optional pieces of equipment. Depending upon the specifics of your order, the equipment described in this manual may or may not be included with your system configuration. Please refer to your sales order for the equipment that should be included with your system. Equipment information will be found either within this O&M manual or in separate documentation provided in addition to this manual.

Air Pressure Gauge (Standard)

The standard pressure gauge reads the differential pressure between the sump pressure and atmospheric pressure, in inches of water column. The gauge is connected to the system via tubing that is attached to a pressure port on the air stripper sump. The air hose connected to the sump leads to the "high" pressure port on the gauge. The "low" pressure port is left open to the atmosphere.

Demister (Standard)

A demister pad is installed beneath the air discharge stack located on the top cover of the unit. The purpose of the demisting pad is to remove entrained water droplets that would have blown through the discharge stack. It is possible, though unlikely, that the demisting pad may become plugged or fouled. If this occurs the demisting pad is easily removed. Disconnect the vent line, take off the demister cap, and remove the demister. The demisting pad can be cleaned with a pressure washer or replaced with a new one.

Gaskets (Standard)

Three gaskets are used in the EZ-Tray™ air stripper units. One gasket is installed in the air discharge stack flange, one gasket is used to form an airtight seal between the front hatch and aeration trays, and a felt gasket is located on the underside of each aeration tray. Through the course of regular maintenance, these gaskets will eventually wear and will not seal effectively. When the gaskets are ripped, worn, or do not seal properly, these gaskets should be replaced. Contact QED for replacement gaskets and adhesive. Please contact QED prior to making any gasket repairs or adjustments.

Sight Tube (Standard)

The sight tube provides a means of easily viewing the water level in the sump tank.

Blower

The blowers on the EZ-Tray™ low profile air stripper units are typically cast aluminum type B spark resistant, direct drive @ 3450 rpm, with motor options of TEFC or EXP. Each blower is selected to meet the proper air flow requirements (cfm) at the anticipated working pressures (inches of water column) of each system.

It is critical that the blower damper be opened wide enough to provide the unit with the designated minimum flow. If the damper is opened too wide, however, high airflow can cause water entrainment, with water droplets caught up in the airstream and sent out of the air stripper discharge stack.

It is also critical that water does not enter the blower housing while the blower is in operation; this will damage your blower and void the warranty. The high water level alarm switch prevents this from happening. Make sure it is installed correctly. If not installed by QED, it is recommended that the blower piping be of an inverted-U design, capable of collecting water within the blower piping and minimizing the potential for blower flooding. Please refer to Figure 3 for a typical blower piping configuration.

If water does accumulate in the blower, it must be removed from the blower housing before continuing operation. A small drain hole may be drilled and plugged on the bottom side of the blower housing to provide a means of discharging any water that may accumulate. Remove the plug temporarily to drain any water. Else, take off the front panel of the fan housing and remove the water.

When starting the unit for the first time, *check that the blower wheel is rotating in the direction of the arrow on the blower housing.* If you hear the blower wheel rubbing or any odd sounds shut down the system immediately and call QED.

Damper

The standard QED blowers normally have a damper on the discharge side of the blower. The damper is used to make adjustments to the air flow rate (cubic feet per minute) of your system. The air flow rate is increased (higher cfm's) by opening the damper, and decreased by closing the damper.

Use the damper to adjust the sump pressure to its proper operating value. By adjusting the sump pressure, the proper operating airflow through the air stripper will be achieved. Follow the instructions given in the earlier "Air Pressure Gauge" section to obtain the correct sump operating pressure. Using an air flow meter and an air pressure gauge together is desirable for confirming airflow and sump pressure, especially when attempting to troubleshoot any problems encountered with the air stripper operation. It is also recommended that you keep a log book of pressure readings so you can determine when and the frequency of system fouling.

Air Blower Silencer

The air blower silencer reduces the dynamic noise level of the blower. The size of the silencer and the type of connection used to mount it is dictated by the size of the blower and the choice of options. If a silencer is purchased through QED, they are typically shipped loose, for customer installation. The silencer can be mounted either horizontally or vertically (through the use of an elbow) but should be properly supported to avoid over-stressing the blower housing. Silencers exposed to high wind velocities should also be properly secured.

Air Flow Meter

The air flow meter measures the amount of air flowing through the system. If it is a pitot tube-type, two air tubes lead from the air piping to a meter/gauge. To operate effectively, the pitot tube must be located a minimum required distance upstream and downstream from elbows, valves, etc. Refer to manufacturer's installation instructions for proper installation procedures.

The air flow meter typically gives readings in feet per minute, which is then multiplied by the cross sectional area, square feet, of the vent line to give cubic feet per minute (CFM). As stated in the damper section, the air flow meter is needed to make damper adjustments, especially after initial start-up.

Control Panel

The control panel serves two basic functions required for the safe operation of the system. The first is to provide the required electrical safety components for each motor (blowers and pumps) per NEC standards. These components consist of fuses, motor starters, and overload relays.

The second function is to provide the required process safety alarm components. The alarm circuit monitors the low air pressure switch and the high water level alarm switch. If either of these alarms occur then the alarm contacts will shut off the incoming water source (feed or well pumps) if the appropriate connections have been made. A qualified, licensed electrician should perform any and all electrical connections.

Control Panel Intrinsically Safe Components

EZ-Tray™ low profile air stripper systems that process potentially explosive concentrations of vapors require intrinsically safe (IS) signals to all electrical components housed in non-explosion proof enclosures. The IS signal does not have enough energy to ignite the concentration of any NEC classified explosive vapor. Typical components that need IS signals are the float switches and well probes. Determination of when IS signals are required is generally the responsibility of the groundwater remediation engineer who has placed the order for a system. A qualified, licensed electrician should perform any and all electrical connections.

Water Flow Indicators and Totalizers

The digital water flow indicator, typically installed in the incoming process water line or shipped loose, reads the rate of flow (GPM) and the totalized flow (gallons). The flow meters are selected to exceed the maximum flow of your system while providing a wide working range. The digital face plate is battery operated and intrinsically safe. The mechanical components of the meter is the turbine styled rotor which spins around a shaft that is axial to the flow of water.

The standard nutating disc meters have a totalizing function only. They operate upon the positive-displacement principle, where the flow of water through the meter moves a disc which in turn rotates a magnet. Every magnet rotation corresponds to a fixed volume of fluid which is then added to the summed total of flow.

Feed and Discharge Pumps

Any transfer pumps included in the air stripper order have been selected by our engineering staff to meet all known flow and pressure requirements. The standard pumps are typically stainless steel centrifugal-type with motor options of EXP or TEFC. The standard pumps are not self-priming; they must be primed before starting by filling either the discharge port or the priming port with clean water until the entire pump chamber is full. The pipe/hose leading into the pump should also be full of water, too. Install throttle valves on the discharge lines for adjusting water flowrate. The valve should be throttled back until the motor draws the nameplate current rating. Warning: If the pump is running wide open and it is not pumping against the required head, the pump will cavitate and adversely affect pump performance and pump life.

Centrifugal transfer pumps used by QED typically must be throttled back if they are not pumping against the required head. Before initial system startup, double check the pump rotation. A pump shaft rotating in the wrong direction could spin off the pump impeller and cause serious damage to the pump. Pumps operating in the wrong

rotation will show poor performance. Systems using pumps should have the flow rates tuned so that the discharge is keeping up with the feed pump.

High Water Level Alarm Switch

The high water level alarm switch is one of the two alarm interlocks that must be properly connected by a licensed electrician prior to the system's initial start-up. Please see the Special Cautions at the beginning of the Operating Instructions section for more information. The purpose of the high water level alarm switch is to prevent water from flooding the blower by shutting off the incoming contaminated water once it has reached a designated level. The high water level switch will send an alarm signal when it is approximately 3½ inches above the coupling its cord emerges from.

Line Sampling Ports

The line sampling ports provide a quick and easy means to take a water sample of both incoming contaminated water and outgoing clean water. The sampling ports are the ball valves located on both of the inlet and outlet piping. When starting the unit for the first time double check that the valves on the sample ports are closed.

When taking a water sample, open the valve and let the water flow for at least 1 minute prior to taking the sample. This purges the sample port of any stagnant water. When purging the sample port on the contaminated water line, make the contaminated water is collected in some sort of storage container and then properly dispose of the water after sampling.

Low Air Pressure Alarm Switch

The low air pressure alarm switch is one of the two alarm interlocks that must be properly connected by a licensed electrician prior to the system's initial start up. Please see the Special Cautions at the beginning of Operating Instructions section for more information. The low air pressure alarm switch monitors the blower for continuous water treatment.

Should the blower fail, the low air pressure switch should be wired to shut off all incoming water. It, like the air pressure gauge, is connected to the system via an air hose which is attached to a pressure port on the sump tank. The air hose is connected to the "high" pressure port on the switch. The "low" pressure port is open to the atmosphere. Periodically inspect and remove any water which may have accumulated in the tubing. The presence of water can affect proper switch operation.

Test the switch, at initial start up, by removing the air hose from the pressure port on the sump tank once the system is in full operation. This should set the system into an alarm condition and shut off the incoming contaminated water.

Main Disconnect Switch

The main disconnect switch removes power from the EZ-Tray™ low profile air stripper. A disconnect is required by the National Electric Code (NEC) and must be installed. Some control panels, not supplied by QED, contain an internal disconnect or circuit breaker to remove power. Disconnects supplied by QED are external to the control panel, providing flexibility in situations where a site already contains a disconnect for the air stripped system. A qualified, licensed electrician should perform any and all electrical connections.

Intermittent Operation

Some systems are ordered with the intermittent operation option. EZ-Tray™ low profile air stripper systems can be designed to run intermittently when continuous blower

operation is a concern. When the feed water is flowing into the system, the blower will be in operation and the outlet pump (if provided) will maintain proper sump tank levels. When the feed water is shut down, the blower will run for an additional period of time to treat the water that had previously entered the air stripper before shutting down. When the feed water is restored, the blower will start up to treat the new incoming water. The benefits of intermittent operation are lower operating costs, better control of noise, and longer motor life.

Water Temperature Gauge

The temperature gauges can be installed on both the inlet and outlet piping. The water temperature represents an important factor when estimating the system's performance since it directly effects removal efficiency. Temperature gauges provided by QED typically have read outs of 0-140 degrees F.

Water Pressure Gauge

Water pressure gauges can be installed on both the inlet and outlet water lines. The gauges can be used to determine the water pressures entering and exiting the system. Excessively high readings could signal that something in your system is plugged. Large fluctuations in the pressure readings could be a sign that the water flow rate is varying.

EQUIPMENT SET UP

Special Cautions!

Use a Licensed, Qualified Electrician for Any and All Electrical/Wiring Work, and Always Use Proper Work Safety Practices!

Follow All Applicable Codes

The plumbing and electrical installations must be performed by qualified personnel. All installations must be done in accordance with local, state and national codes.

Install Adequate Supports on Piping and Ductwork

The external process piping that will connect into and from the QED equipment should be properly supported to minimize stresses and vibration from non-QED equipment. The QED equipment is not designed to support the process water and air lines without proper structural support.

Do Not Run Free Product, Oil or Grease Through the Air Stripper

Free product will contaminate the unit by coating the sidewalls with a film of free-product. Air strippers are not designed to treat free product, oil, grease, or any other type of immiscible phase.

Equipment Setup Steps Depending upon how the system was ordered, some of the following instructions may not apply.

Setup Step 1. Secure/Mount the Equipment

For shipping purposes, the EZ-Tray™ unit may come either already skid-mounted or the equipment shipped loose. If shipped loose, locate the equipment as required and firmly secure to the floor, base, etc.

Setup Step 2. Install the Blower Piping

If the blower is not already pre-piped on a QED skid, install the blower piping to connect the blower outlet to the air inlet nozzle on the air stripper sump. Refer to Figure 3 for an example of a blower piping configuration.

Setup Step 3. Level the EZ-Tray™ Unit

Level the EZ-Tray™ unit. This is a critical step in the proper assembly of the equipment. The aeration trays must be as close to level as possible.

Setup Step 4. Install Discharge Piping, either gravity-discharge or pump-discharge.

Install the Gravity Discharge Pipe (For Gravity Discharge Units Only)

Refer to the outlet piping drawing in Figure 4 to assemble the piping kit and vacuum breaker. Customers providing their own gravity discharge piping must ensure that proper water sump levels are maintained during operation.

It is essential that the piping be mounted vertically and that it be properly supported. Install outlet piping from the pump's discharge port. Use proper pipe sealant, PVC cement, and proper plumbing techniques as necessary.

Caution: The vertical height of the piping should not be changed from that provided in the kit unless air stripper conditions have changed dramatically from the originally-specified flows. The piping kit includes flexible couplings to allow easy vertical height adjustment, should it be necessary.

Install the Pump Discharge Pipe (For Pump Discharge Units Only)

For a unit with a discharge pump that has not come mounted to a QED skid, install the water line from the air stripper sump to the pump inlet. If customer has purchased a QED pump kit, the components will be found in a separate box. Install outlet piping from the pump's discharge port. Use proper pipe sealant, PVC cement, and proper plumbing techniques as necessary.

Prime the pump. Allow the inlet line and pump chamber to fill completely.

Setup Step 5. Install the Sump Drain Valve and the Sight Tube (if not already installed at the factory)

Setup Step 6. Connect the Water Lines

Connect the process water lines to the inlet and discharge piping. **Firmly support the process water lines to prevent excessive stress on the piping. The piping is not designed to support the weight of the customer's process water lines.**

Use proper pipe sealant, PVC cement, and proper plumbing techniques as necessary.

Setup Step 7. Connect the Tubing Between Pressure Gauges, Pressure Switch(es), and Air Stripper Sump

Connect the air line tubing from the hose barb located on the top of the sight tube to the high pressure ports on both the air pressure gauge and the air pressure switch(es). Keep the low pressure ports open to the atmosphere (remove plugs or caps).

Setup Step 8. Install Air Discharge Stack

Install any necessary extension to the air stripper air discharge stack as necessary. **Caution: Any added extension should have an inner diameter at least as large as the air stripper stack.** Connect the stack extension to the exhaust stack using a flexible rubber coupling or other suitable means. Support the extension independently of the air stripper so that it can be easily disconnected if the demister element must be removed for maintenance purposes.

Setup Step 9. Wire the Electrical Components

Have a qualified, licensed electrician wire up the electrical components in compliance with local, state, and national codes.

IMPORTANT! Make sure the safety interlocks are connected properly! To avoid damage to the blower and flooding of the equipment with contaminated feed water, install the high water level and low air pressure interlock switches. If the water level in the sump tank rises beyond the maximum level water could

flood the blower. This will destroy the blower and void the warranty. The high water level interlock switch will shut off the feed water pump in an emergency situation. The low air pressure interlock switch will shut off the feed water pump in the event of a blower failure. This reduces the risk of having untreated water passing through the air stripper.

If QED is supplying the control panel, refer to the appropriate wiring diagrams.

Setup Step 10. Install Optional Items

Refer to manufacturers' installation instructions for all equipment and properly support all equipment in an appropriate manner. This also applies to the optional air stripper blower silencer which requires support to avoid overstressing the air stripper blower housing.

START UP

Please refer to Figures 1 and 2 at the end of this manual for a general drawing of an E-Z Tray air stripper and its aeration tray. Upon completion of the equipment set-up procedure (above), mechanical and electrical installation (including float switches, air pressure switches, etc.), proceed as follows:

Startup Step 1. Turn Off Electrical Components Using the Site's Appropriate "Lock-Out" Procedure. Close Drain and Sample Valves.

Check that all electrical components associated with the unit are turned off, and all drain and sample valves are closed.

Startup Step 2. IMPORTANT! Fill the Inlet Chambers with Clean Water.

Each downcomer (see Figures 1 and 2) must be sealed by having its end immersed in the seal pot water of the tray below it. Remove the air stripper front hatch and fill the seal pots to their proper levels (to the height of the weir). Failure to do so may create a situation where not enough back pressure is provided upon blower startup, causing the blower motor overload to trip.

Startup Step 3. IMPORTANT! Fill the Sump Tank with One Foot of Clean Water.

On initial start-up, the sump tank must be filled with clean water to a height of about one foot. The sump tank can be filled by taking off the front hatch and filling the sump directly or by disconnecting the water inlet piping and using a hose applied through the water inlet connection. The water level should be seen in the sight tube.

Startup Step 4. Power May Now Be Supplied to the System.

Startup Step 5. IMPORTANT! Check the Blower Rotation (IMPORTANT for proper air stripper operation)

Check the blower rotation by momentarily turning the Hand-Off-Auto (HOA) Switch to the "Hand" position ("bumping" the motor). Verify that the fan turns in the direction of the arrow on the blower casing. If rotation is incorrect 1) have a licensed electrician correct the wiring per manufacturer's instructions, and 2) check and correct the rotation of the other motor(s) in the system.

(This is a common oversight and very often is the reason for inadequate blower operation. If the blower is not providing the expected airflow or backpressure, please double-check this step).

Startup Step 6. Connect a Clean Water Line to the Air Stripper Inlet. Trial-run Air Stripper System Using Clean Feed Water at the Expected Flowrate.

Start the QED Air Stripper System by closing the Blower Damper and Placing the Appropriate HOA Switches in the "Auto" Position. Carefully open the damper to achieve the desired tray pressure or air flowrate at the anticipated water flowrate for the system.

Startup Step 7. Monitor the Trial Run and Adjust the System Accordingly.

The following items should be monitored as water builds up on each tray:

1. Proper sump pressure. This may require 15-30 minutes for the water to reach the proper depth on each tray. Once the blower has reached its operational speed and water flow is steady, the blower can be throttled to adjust airflow to optimal conditions. QED wet-tests every EZ-Tray unit for proper sump pressures at the customer's expected water flow rates for "clean tray" and "fouled tray" conditions. The wet-test values are normally printed on a label and affixed to the side of the air stripper. Adjustments should be made first by referring to these wet-test pressure values. If no values are given, refer to the table below. The values are estimates, and vary depending upon the influent water flowrates. The table assumes there is no additional pressure from equipment downstream of the air stack. If downstream equipment adds backpressure, these values may not be accurate.

<u># of Trays</u>	<u>Typical Sump Operating Pressures,</u> <u>(approximate*)</u>
1 tray system	4-6" wc
2 tray system	8-12" wc
3 tray system	12-18" wc
4 tray system	16-24" wc
etc.	etc.

IT IS RECOMMENDED THAT A BOOSTER BLOWER BE USED IF IT IS EXPECTED THAT THE COMBINED PRESSURE LOSS OF THE QED AIR STRIPPER AND ANY DOWNSTREAM EQUIPMENT EXCEEDS 40" WC.

Be careful when making damper adjustments—fouling of the system over time will affect the air flow rate. A "fouled" system will have lower air flow at the same sump pressure reading than a clean system. A severely fouled air stripper will not produce the minimum air flow the system requires for proper performance. The blower damper should therefore be adjusted to the proper sump pressure after the trays have been properly cleaned. Refer to the "Equipment Maintenance Instructions" for proper cleaning procedures.

2. Check for any leaks and correct.

Note: If the blower overload trips, the system will shut down. This overload may indicate that the damper needs to be partially closed. Reset the overload and try to start the system again.

Once Step 7 is successfully completed, turn HOA switches to "Off" and proceed to Step 8.

Startup Step 8. Replace the Clean Water Feed Line with the Contaminated Feed Line.

Install the inlet piping according to proper plumbing practices. Use proper pipe sealant and PVC cement where necessary.

Startup Step 9. Initiate Full Operation.

Switch all air stripper system HOA switches to "Auto".

PLEASE NOTE: The blower damper should now already be in its proper position to provide the desired airflow for the system's anticipated influent water flowrate; however, the airflow through the air stripper upon initiating "full operation" will be greater until water builds up on the trays. If this increased airflow is a concern, it is advised to close the damper slightly to throttle the airflow until the water has built up to its final height on each tray.

Startup Step 10. Inspect and Record Unit's Operation Data

Inspect the unit's operation at regular intervals and take pertinent instrument readings. Record readings and performance data in an operations log book.

Startup Step 11. Set the Throttle Valve on Discharge Pump

Units with a discharge pump are supplied with a throttle valve. The valve should be set so that the pump matches the influent flow rate without cavitation and draws no more than the rated full load amps stamped on the pump motor.

SYSTEM SHUT DOWN PROCEDURE

Shut Down Step 1. Shut Water Off

Shut off the water feed to the system.

Shut Down Step 2. Wait 5 Minutes Before Blower Shutoff

Wait 5 minutes to allow the water in the aeration trays to be completely treated, then shut off the blower.

Shut Down Step 3. Shut Power Off

Shut off power at the main disconnected switch if more than a temporary shut down is anticipated.

Caution:

If proper shut down procedures are not followed contaminated water will drain into the sump and contaminate the water that has collected in the sump. Allow the blower to run the additional 5 minutes after the feed water is shut off.

EQUIPMENT MAINTENANCE INSTRUCTIONS

This information describes how to clean the QED EZ-Tray™ Air Stripper unit. Please refer to the manufacturer's instructions for maintenance on the non-air stripper equipment.

Tray Fouling

With normal operation of the air stripper, the sump pressure will typically increase over time. This typically indicates that the air stripper trays are becoming fouled. If this occurs, shut down the system. Remove the door and visually inspect for signs of fouling and clean the air stripper as outlined in the "Maintenance" section of this manual. Occasionally inspect the pressure gauge tubing for water build up. Water trapped in the air tubing could produce an erroneous reading. A pinch clamp is provided on the tubing and should be closed when no one is at the site in order to prevent potential condensate accumulation. Condensation buildup will ruin the pressure gauge.

Dealing with High Mineral Concentrations

Minerals, dissolved in high concentrations, tend to precipitate out of groundwater during aeration processes. These minerals form insoluble deposits commonly referred to as "fouling". Deposits from iron-rich or mineral-rich feed water can be reduced by pre-treating it with sequestering agents or possibly other types of technologies. There are a number of sequestering suppliers that should be able to offer recommendations or suggestions. The recommended cleaning procedure is pressure washing. Follow the instructions detailed below.

Cleaning the Air Stripper

Recommended cleaning equipment:

Pressure Washer with Washer Wand

2 GPM minimum flow at 900 PSI maximum. Equipment rental companies can usually supply such a unit on a daily rental basis.

Clean Water Supply

Clean water supply with a capacity of at least 2 GPM at 20 PSI, connected to the pressure washer by means of an ordinary garden hose.

Cleaning the Unit. The QED air stripper is designed for easy cleaning. Trays can either be removed for cleaning or left in the unit and cleaned. Another option would be for the customer to purchase a spare set of trays which would allow maintenance personnel to replace the fouled trays with clean trays and reduce air stripper downtime and allow the maintenance personnel to clean the trays at a more convenient time.

Cleaning Step 1. Turn Off Equipment, Perform Electrical "Lockout" Procedure

Turn off the feed water supply and all associated electrical equipment.

Cleaning Step 2. Provide for Waste Disposal

Make provisions for disposing of the sludge and waste generated during cleaning.

Cleaning Step 3. Remove Front Cover(s). Either remove the trays from the air stripper unit or leave them in for cleaning.

Cleaning Step 4. Turn On Water and Pressure Washer

Turn on the water supply to the pressure washer. Then, turn on the pressure washer itself. Wear protective goggles while spraying.

Cleaning Step 5. Insert Wand into Air Stripper (This step is for cleaning trays while they remain in the air stripper unit. If trays have been removed for cleaning, skip step 5 and proceed to step 6.)

Insert the wand all the way into the door opening. Point the spray nozzle up towards the bottom of the lowest tray.

Cleaning Step 6. Clean Bottom Side of Tray

Holding the wand tightly, pull the trigger to start the pressurized water flow. Expect the wand to kick back as flow starts. Move the wand side to side at a rate of about 1" per second. Be sure to cover the entire tray bottom area. The tray holes must be cleaned of all deposits. Periodically stop the cleaning operation and inspect the cleaned area. The area is clean when there are no deposits around the aeration holes.

Cleaning Step 7. Clean Top Side of Tray

Move the wand to the top side of the tray. Continue spraying with the nozzle pointed down onto the top surface of the tray. Also clean the downcomer and sealpot areas. Remove all visible deposits from the tray baffles and the walls of the unit. Inspect the cleaned area for deposits.

Cleaning Step 8. Repeat for all Trays

Repeat the procedure for all trays, working up to the top-most tray.

Cleaning Step 9. Spray the Ceiling and Walls of the Air Stripper. If the air stripper is a mild-steel unit with coal tar epoxy coating, extra care must be taken not to remove the epoxy with the high pressure water. Cleaning the walls and ceiling are not necessarily required for proper air stripper operation.

Cleaning Step 10. Rinse

After the cleaning operation is finished, rinse the ceiling, trays, baffles, and walls with the pressure sprayer. Work down from the top down to the sump tank. Make sure the surfaces are clean and the holes are not blocked by loosened debris.

Cleaning Step 11. Check the Demister Pad and Replace as Necessary

Inspect the demister pad and clean as needed.

Use the pressure sprayer to remove debris, deposits and gummy residues sometimes found on the demister pad.

Demister pads that are excessively plugged should be replaced.

Cleaning Step 12. Inspect the Air Stripper

Visually inspect the air stripper box for the following:

1. Gasket integrity
2. a. If this is a mild steel unit, the internal and external epoxy-coatings must be inspected for exposed areas. Scratches, chips, burns, etc. will expose the mild steel to water, contaminants, and the elements, creating potential for corrosion. These exposed areas must be cleaned, dried, and re-epoxyed before commencing air stripper operation. Contact QED for touchup epoxy.
b. If this is a steel unit, inspect the air stripper for any damage and repair as necessary.
3. Aeration tray integrity. Inspect trays for structural damage, felt gasket integrity, and acceptable silicone sealant in the sealpot area. Check the downcomer of each tray for holes, rips, etc. Replace as necessary. Contact QED for replacement items.
4. Inspect the internal piping (typically PVC piping) and replace as necessary.

Cleaning Step 13. Follow Manufacturer's Instructions for Maintenance on Non-Air Stripper Equipment

TROUBLESHOOTING

Problem 1. Blower Won't Start or Run

No Power to Blower

Check that all switches are in "ON" or "AUTO" position.

Position main disconnect switch to "ON" position. Turn control switches to "ON" or "AUTO".

Blown Fuse

Check to see if fuses are okay. Check fuses in main disconnect switch and in control panel.

If blown, replace with fuse of same size and rating.

Overload Relay Trips

Locate reset button on blower overload relay.

Rush reset button in. Reasons for tripping: incorrect line voltage, motor wired incorrectly, inadequate ventilation, bearings are bad.

Tubing to Pressure Switch Plugged with Water or Debris

Remove tubing from pressure switch and blow into it towards tank.

Clean or replace tubing if plugged or kinked.

Blower Wheel Jammed Against Side of Housing

TURN OFF ALL power to the system. Try to spin wheel by hand. Wheel should rotate freely. Call QED.

Problem 2. Outlet Pump Won't Shut Off

Suction or Discharge Piping for Pump is Clogged

Check water flow from discharge pipe. Piping should be clean inside. Look for narrowing caused by scale or iron accumulation.

Remove piping, inspect and clean or replace as necessary.

Float Switch in Tank is Stuck in Down Position

Look into sump and check that all floats are floating on the water.

Clean all deposits from float. Replace float is necessary.

Normal Operation - Water Level in Sump is Okay

Pump will stop when water level reaches pre-determined height in tank.

Allow water level to decrease until pump turns off.

Let water level reach pre-determined lower level, which will cause outlet pump to turn off.

Problem 3. Outlet Pump Won't Start or Run

No Power to Pump

Check that all switches are in "ON" or "AUTO" position.

Position main disconnect switch to "ON" position. Turn control switches to "ON" or "AUTO".

Blown fuse

Check to see if fuses are okay. Check fuses in main disconnect switch and in control panel.

If blown, replace with fuse of same size and rating.

Overload Relay Trips

Locate reset button on pump overload relay.

Push reset button in. Reasons for tripping: incorrect line voltage, motor wires incorrectly, inadequate ventilation, bearings are bad.

Normal Operation - Water Level in Sump is Okay

Pump will start when water level reaches pre-determined height in tank.

Allow water level to increase until pump turns on. be sure pump switch is in "Auto" position.

Let water level reach pre-determined upper level, which will cause outlet pump to turn on.

Level Switch in Tank is Wired Incorrectly in Control Panel

Check wiring circuit against diagram. See that all connections are tight and no short circuits exist because of worn insulation, crossed wires, etc.

Rewire any incorrect circuits. Tighten connections, replace defective wires.

Impeller, Seal or Bearing Damaged

TURN OFF POWER. Try to turn impeller by hand.

If impeller won't turn, remove housing and locate source of binding.

Problem 4. Low Air Pressure in Stripper Tank

Blower Damper Closed

Visually check position of damper on inlet of blower.

Open damper to get proper reading on pressure gauge. Firmly tighten screws.

Motor Rotation Backwards

Watch rotation of blower wheel at slow speed.

Reconnect for proper rotation as per motor diagram.

Gravity Discharge Trap Installed Incorrectly

Tray should be positioned vertically.

Install discharge trap per outlet plumbing drawings provided in Figure 4.

Inlet Chamber (Sealpot) in each Tray is Not Full of Water

Slide tray aside and look at water level in chamber.

Remove front cover. Fill up inlet chambers with a hose. Or, follow inlet chambers fill up procedures above in Initial Start Up.

Front Cover not in Place

Front cover must be secured during operation.

Tubing to Pressure Gauge Plugged with Water or Debris

Remove tubing from pressure gauge and blow into it towards tank.

Clean or replace tubing if plugged or kinked.

Debris Blocking Blower Intake

Look at blower intake. Remove any accumulated debris.

Normal Operation for Automatic Unit

When inlet pump starts, blowers will start, air pressure will rise to operational level.

No action necessary.

Problem 5. High Pressure in Stripper

Air Exhaust Piping is Restricted

Check vent piping for obstructions. Check that vent pipe diameter does not decrease.

Vent piping diameter must be the same as the outlet vent diameter on the cover.

Air Holes in Bottom of Trays are Plugged

Remove inspection and cleanout caps and visually inspect holes.

For iron fouling, clean out unit with a 1000 PSI pressure washer. For scaling, scrape or bang scale from all surfaces, then use a pressure washer to open holes. Consider using sequestering agent or other technology to reduce scaling.

Demister Pad is Plugged

Inspect the bottom of the demister pad in the cover. Clean and/or replace as necessary.

Problem 6. Water Won't Flow into Unit

Inlet/Well Pump Functioning Properly

Allow water level to rise in well pump, which will turn on inlet pump to system.

No action necessary.

Tank Air Pressure is Low. System is in Alarm Condition

Read tank air pressure from pressure gauge. System should be in alarm condition if pressure is below about 2 inches w.c.

Check that blower is operating properly. Check that all rubber caps are in place on end of trays.

Inlet Piping is Plugged

Remove inlet piping and inspect for debris and buildup.

Clean or replace clogged parts.

Problem 7. Iron Fouling is a Problem

Iron Precipitates Out of Water When Treated with an Air Stripper Causing Iron Build Up in Unit

Remove the front door(s) and inspect inside of tray for buildup/fouling.

Clean out unit with 1000 PSI pressure washer on routine basis.

Pretreat incoming water using sequestering agents or other appropriate technology.

QED TREATMENT EQUIPMENT WARRANTY

QED Environmental Systems Inc. (QED) warrants to the original purchaser of its products that, subject to the limitations and conditions provided below, the products, materials and/or workmanship shall reasonably conform to descriptions of the products and shall be free of defects in materials and workmanship. Any failure of the products to conform to this warranty will be remedied by QED in the manner provided herein.

QED warrants the equipment components of its manufacture for a period of one (1) year from date of delivery. Our sole obligation during this warranty will be to repair or replace (at our option) the defective components. We are not responsible for consequential damages. Labor costs are not included.

Purchaser's exclusive remedy for breach of said warranty shall be as follows: if, and only if, QED is notified in writing within the applicable warranty period of the existence of any such defects in the said products, and QED upon examination of any such defects, shall find the same to be within the term of and covered by the warranty running from QED to Purchaser, QED will, at its option, as soon as reasonably possible, replace or repair any such product, without charge to Purchaser. If QED for any reason, cannot repair a product covered hereby within four (4) weeks after receipt of the original Purchaser's notification of a warranty claim, then QED's sole responsibility shall be, at its option, either to replace the defective product with a comparable new unit at no charge to the Purchaser, or to refund the full purchase price. In no event shall such allegedly defective products be returned to QED without its consent, and QED's obligations of repair, replacement or refund are conditioned upon the Purchaser's return of the defective product to QED.

IN NO EVENT SHALL QED ENVIRONMENTAL SYSTEMS INC. BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF SAID WARRANTY.

The foregoing warranty does not apply to major subassemblies and other equipment, accessories, and other parts manufactured by others, and such other parts, accessories, and equipment are subject only to the warranties supplied by their respective manufacturers. In the event of failure of any such product or accessory, QED will give assistance to Purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY (INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE), WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED HEREBY, and of any other obligations or liabilities on the part of QED, and QED neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with said products, materials and/or workmanship.

It is understood and agreed that QED shall in no event be liable for incidental or consequential damages resulting from its breach of any of the terms of this agreement, nor for special damages, nor for improper selection of any product described or referred to for a particular application.

This warranty will be void in the event of unauthorized disassembly of component assemblies. Defects in any equipment that result from abuse, operation in any manner outside the recommended procedures, use and applications other than for intended use, or exposure to chemical or physical environment beyond the designated limits of materials and construction will also void this warranty.

The equipment is warranted to perform as specified under the conditions specified here and within the air stripper model or QED will make the necessary changes at no cost to the owner. Some restrictions apply. Requirements for warranty consideration include, (but are not limited to):

1. Current operating conditions do not differ from the previously-modeled conditions.
2. The system should be cleaned regularly to maintain system performance.
3. The equipment is installed, operated and maintained according to QED's instruction or non-QED manufactured subassembly manufacturer's instructions.
4. Air stripper influent air is not "dirty" (does not contain VOC's, etc.).
5. No surfactants, oils, greases, or other immiscible phases are present in the water.
6. Each influent contaminant does not exceed 25% of its maximum solubility under modeled conditions.

QED shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the consent of QED. If any product covered hereby is actually defective within the terms of this warranty, Purchaser must contact QED for determination of warranty coverage. If the return of a component is determined to be necessary, QED will authorize the return of the component, at owner's expense. If the product proves not to be defective within the terms of this warranty, then all costs and expenses in connection with the processing of the Purchaser's claim and all costs for repair, parts and labor as authorized by owner hereunder shall be borne by the Purchaser.

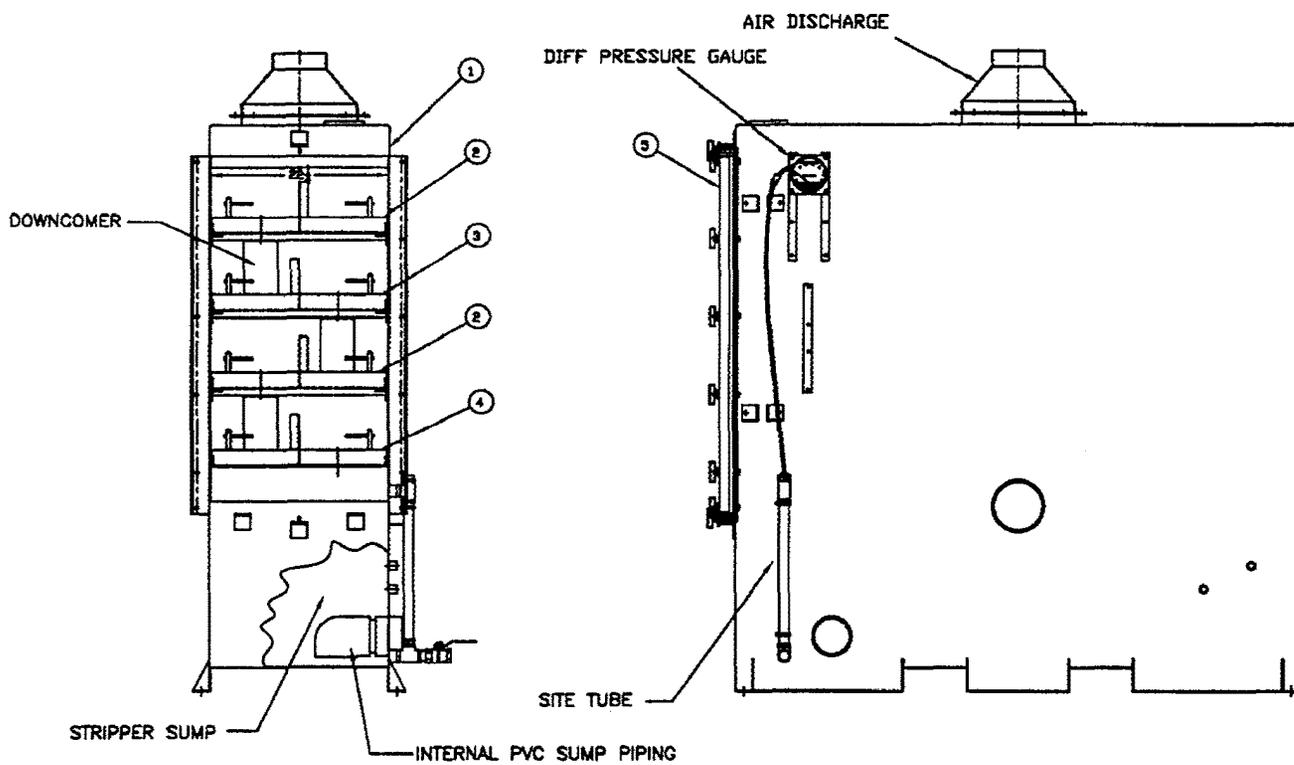
In the event of air stripper performance issues, QED may require customer to conduct a variety of troubleshooting steps. These include, but are not limited to, modifying operational parameters, cleaning air stripper system, modifying (temporarily or permanently) process piping, and obtaining reasonable and necessary influent/effluent samples. These steps are the responsibility of the customer and will be conducted by customer prior to consideration by QED for a site visit. These steps and the associated costs incurred are the responsibility of the customer, regardless of future action. Should customer request a site visit by QED or accept a site visit offer by a QED-trained technician, the visit and associated costs: a) will be the responsibility of the customer at \$500/day, plus travel, lodging, and meals, if the visit finds improper sampling, process piping installation, or equipment operation inconsistent with QED's Operation and Maintenance Manual; or b) will be the responsibility of QED if the visit finds QED responsible for the performance issue(s) raised.

The original Purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. You may secure performance of obligations hereunder by contacting the Customer Service Department of QED and:

1. Identify the product or system involved by job number or QED order number.
2. Specifying where, when, and from whom the product was purchased.
3. Describing the nature of the defect or malfunction covered by this warranty.
4. If applicable, send the malfunctioning component, *after receiving a Return Authorization Code (RAC) Number by the QED Service Department, to:*

QED Environmental Systems Inc.
6241 Jackson Road
Ann Arbor, MI 48103
Attn: R.A.C. No. (Return Authorization Code Number provided by QED Service Dept.)

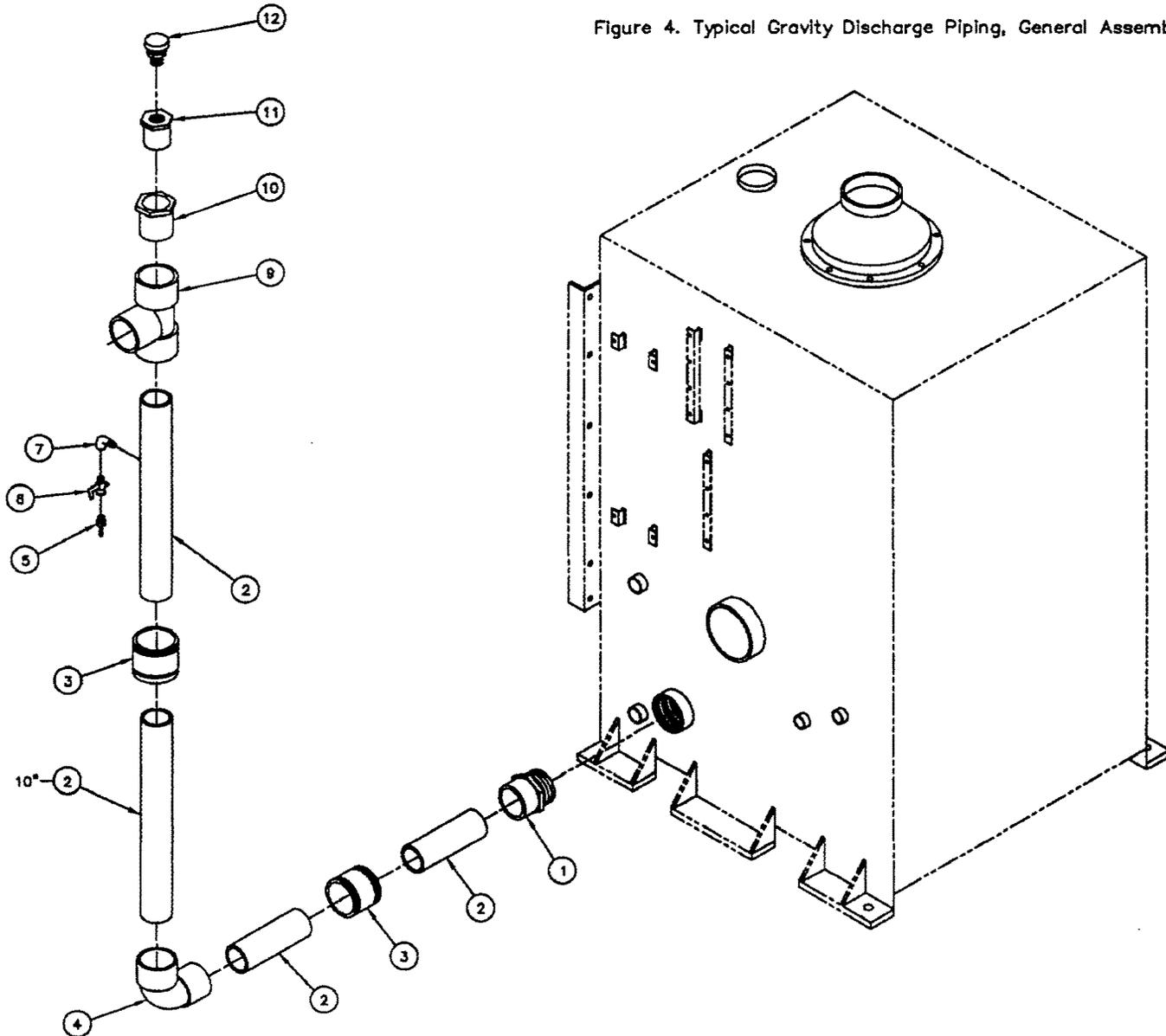
FIGURE 1. GENERAL DWG OF E-Z TRAY AIR STRIPPER



HATCH REMOVED

6	1	WELDMENT, DEMISTER	QED #807048
5	1	STANDARD HATCH	QED #807018
4	1	SIEVE TRAY ASSEMBLY, BOTTOM RH	QED #807082
3	1	SIEVE TRAY ASSEMBLY, INTERMEDIATE RH	QED #807058
2	2	SIEVE TRAY ASSEMBLY, INTERMEDIATE LH	QED #807058
1	1	BOX ASSEMBLY 12.4 R/L AIR STRIPPER	QED #807044
ITEM	QTY	DESCRIPTION	REMARKS
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS		DRAWN BY MEB	DATE 01/20/97
TOLERANCES 300+/- .01 FRACT +/- .1/34 300+/- .005 ANGLES +/- .1/2 OTHER TOLERANCES AS SPECIFIED		APPROVED BY DATE	Q.E.D. ENVIRONMENTAL SYSTEMS INC. 6155 JACKSON ROAD, ANN ARBOR, MI
		MPL APPROVAL	
		MATERIAL	TITLE EZ-TRAY AIR STRIPPER DWG
			DRAWING NUMBER eztdwg.dwg REV
NEXT ASSY	USED ON	FINISH	SCALE 1 of 1

Figure 4. Typical Gravity Discharge Piping, General Assembly



NOTE:

1. CENTER LINE OF WATER OUT (ITEM 1)
TO CENTER LINE OF DRAIN CONNECTOR
(ITEM 9) TO BE 27" - 6 TRAY
18" - 4 TRAY

(DIMENSIONS ARE APPROXIMATE—REQUIRES SOME ADJUSTMENT
AS NECESSARY BASED UPON SUMP PRESSURES AND WATER FLOWS.
ASSUMES STANDARD OPERATING CONDITIONS.)

12	1	BREAKER, VACUUM RELIEF 1/2"	
11	1	BUSHING, SPI X THD PVC SCH 80	
10	1	BUSHING, REDUCER SPI. X SOC.	
9	1	TEE, SOCKET PVC SCH 80	
8			
7	1	ELBOW, STREET 1/8" FPT BRASS	
6	1	COCK, SHUTOFF 1/8" MPT X 1/8" FPT BRASS	
5	1	BARB, 1/8" MPT X 3/16" BARB	
4	1	ELBOW, 90 DEGREE PVC SCH 80 SOCKET	
3	2	FERNCO, FLEXIBLE PVC	
2		TD PIPE, PVC SCH 80	
1	1	ADAPTER, PVC SCH 80	
ITEM	QTY	DESCRIPTION	PART #
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE FLANGES REMOVE ALL BURRS		DESIGNED BY DATE MEB 10/29/99	 ENVIRONMENTAL SYSTEMS INC. 8155 JACKSON ROAD, ANN ARBOR, MI.
TOLERANCES UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES AND INCLUDE FLANGES REMOVE ALL BURRS		CHECKED BY DATE	
TELEPHONED APPROVED BY DATE JOH/-BY FRACT +/-1/64 JOH/-BY ANGLES +/-1/16 OTHER TOLERANCES AS SPECIFIED		APPROVED BY DATE	TITLE GRAVITY DRAIN ASSEMBLY/BOM/KIT
EZ-TRAY (24.X)		MATERIAL	DRAWING NUMBER eztravd1s REV
NEXT ASBY	USED ON	PRINT	SCALE N.T.S. SHEET 1 OF 1

nybThe
**New York Blower
Company®**7660 QUINCY STREET--WILLOWBROOK, ILLINOIS 60527-5530
TEL: [630]794-5700 • FAX: [630]794-5776 • WEB: <http://www.nyb.com> • E-MAIL: nyb@nyb.comINSTALLATION,
MAINTENANCE,
OPERATING
INSTRUCTIONS**IM-140****PRESSURE BLOWERS
TYPE HP PRESSURE BLOWERS****SOUND**

Some fans can generate sound that could be hazardous to exposed personnel. It is the responsibility of the system designer and user to determine sound levels of the system, the degree of personnel exposure, and to comply with applicable safety requirements to protect personnel from excessive noise. Consult **nyb** for fan sound power level ratings.

AIR PRESSURE AND SUCTION

In addition to the normal dangers of rotating machinery, fans present another hazard from the suction created at the fan inlet. This suction can draw materials into the fan where they become high velocity projectiles at the outlet. It can also be extremely dangerous to persons in close proximity to the inlet, as the forces involved can overcome the strength of most individuals. Inlets and outlets that are not ducted should be screened to prevent entry and discharge of solid objects.

! WARNING

THIS FAN HAS MOVING PARTS THAT CAN CAUSE SERIOUS BODILY INJURY. BEFORE OPERATING OR STARTING MAINTENANCE READ THE INSTALLATION AND MAINTENANCE INSTRUCTIONS AND THE AMCA SAFETY PRACTICES MANUAL PROVIDED WITH THIS FAN.

DURING OPERATION

1. KEEP BODY, HANDS, AND FOREIGN OBJECTS AWAY FROM THE INLET, THE OUTLET, AND THE OTHER MOVING PARTS OF THE FAN SUCH AS SHAFTS, BELTS, AND PULLEYS.
2. DO NOT OPERATE AT EXCESSIVE SPEEDS OR TEMPERATURES.

BEFORE STARTING MAINTENANCE WORK:

LOCK POWER SUPPLY IN OFF POSITION AND IMMOBILIZE FAN WHEEL.

98-0250

A WORD ABOUT SAFETY

The above **WARNING** decal appears on all **nyb** fans. Air moving equipment involves electrical wiring, moving parts, sound, and air velocity or pressure which can create safety hazards if the equipment is not properly installed, operated and maintained. To minimize this danger, follow these instructions as well as the additional instructions and warnings on the equipment itself.

All installers, operators and maintenance personnel should study AMCA Publication 410, "Recommended Safety Practices for Air Moving Devices", which is included as part of every shipment. Additional copies can be obtained by writing to New York Blower Company, 7660 Quincy St., Willowbrook, IL 60527.

ELECTRICAL DISCONNECTS

Every motor driven fan should have an independent disconnect switch to isolate the unit from the electrical supply. It should be near the fan and must be capable of being locked by maintenance personnel while servicing the unit, in accordance with OSHA procedures.

MOVING PARTS

All moving parts must have guards to protect personnel. Safety requirements vary, so the number and type of guards needed to meet company, local and OSHA standards must be determined and specified by the user. Never start a fan without having all safety guards installed. Check regularly for damaged or missing guards and do not operate any fan with guards removed. Fans can also become dangerous because of potential "wind-milling", even though all electrical power is disconnected. Always block the rotating assembly before working on any moving parts.

! DANGER

DO NOT OPEN UNTIL THE POWER SUPPLY HAS BEEN LOCKED OFF AND THE SHAFT HAS STOPPED ROTATING. FAILURE TO DO THIS CAN RESULT IN SERIOUS BODILY INJURY.

98-0249

ACCESS DOORS

The above **DANGER** decal is placed on all **nyb** cleanout doors. These doors, as well as access doors to the duct system, should never be opened while the fan is in operation. Serious injury could result from the effects of air pressure or suction.

Bolted doors must have the door nuts or fasteners securely tightened to prevent accidental or unauthorized opening.

RECEIVING AND INSPECTION

The fan and accessories should be inspected on receipt for any shipping damage. Turn the wheel by hand to see that it rotates freely and does not bind. If dampers or shutters are provided, check these accessories for free operation of all moving parts.

F.O.B. factory shipping terms require that the receiver be responsible for inspecting the equipment upon arrival. Note damage or shortages on the Bill of Lading and file any claims for damage or loss in transit. **nyb** will assist the customer as much as possible; however, claims must be originated at the point of delivery.

HANDLING AND STORAGE

Fans should be lifted by the base, mounting supports, or lifting eyes only. Never lift a fan by the wheel, shaft, motor, motor bracket, housing inlet, outlet, or any fan part not designed for lifting. A spreader should always be used to avoid damage.

On a direct drive Arrangement 8 fan, lifting holes are provided in the motor base to assist in handling the fan assembly. These lifting holes should be used in conjunction with the lifting eyes when lifting and positioning the fan onto its foundation. A heavy round steel bar or appropriate fixture can be passed through the lifting holes to simplify attachment of the lifting device. Be sure to follow all local safety codes when moving heavy equipment.

Whenever possible, fans and accessories should be stored in a clean, dry location to prevent rust and corrosion of steel components. If outdoor storage is necessary, protection should be provided. Cover the inlet and outlet to prevent the accumulation of dirt and moisture in the housing. Cover motors with waterproof material. Refer to the bearing section for further storage instructions.

Check shutters for free operation and lubricate moving parts prior to storage. Inspect the stored unit periodically. **Rotate the wheel by hand every two weeks to redistribute grease on internal bearing parts.**

FAN INSTALLATION

nyb wheels are dynamically balanced when fabricated. Complete assembled fans are test run at operating speeds to check the entire assembly for conformance to **nyb** vibration limits. Nevertheless, all units must be adequately supported for smooth operation. **Ductwork or stacks should be independently supported as excess weight may distort the fan housing and cause contact between moving parts.** Where vibration isolators are used, consult the **nyb** certified drawing for proper location and adjustment.

Slab-Mounted Units

A correctly designed and level concrete foundation provides the best means of installing floor-mounted fans. The mass of the base must maintain the fan/driver alignment, absorb normal vibration, and resist lateral loads. The overall dimensions of the concrete base should extend at least six inches beyond the base of the fan. The weight of the slab should be two to three times the weight of the rotating assembly, including the motor. The foundation requires firmly anchored fasteners such as the anchor bolts shown in Figure 1.

Move the fan to the mounting location and lower it over the anchor bolts, leveling the fan with shims around the bolts. Fasten the fan securely. When grout is used, shim the fan at least 3/4-inch from the concrete base. (See Figure 1.) When isolation is used, check the **nyb** certified drawing for installation instructions.

Elevated Units

When an elevated or suspended structural steel platform is used, it must have sufficient bracing to support the unit load and prevent side sway. The platform should be of welded construction to maintain permanent alignment of all members.

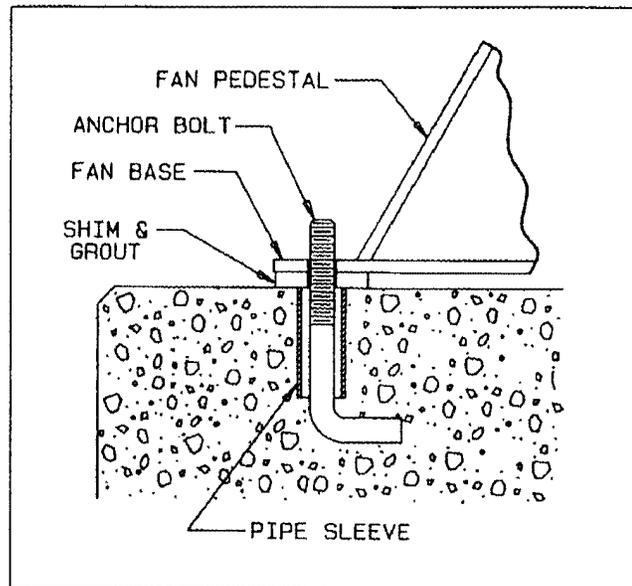


Figure 1

V-BELT DRIVE

Installation

1. Remove all foreign material from the fan and motor shafts. Coat shafts with machine oil for easier mounting. Mount the belt guard backplate at this time if partial installation is required prior to sheave mounting.
2. Mount sheaves on shafts after checking sheave bores and bushings for nicks or burrs. Avoid using force. If resistance is encountered, lightly polish the shaft with emery cloth until the sheave slides on freely. Tighten tapered bushing bolts sequentially so that equal torque is applied to each.
3. Adjust the motor on its base to a position closest to the fan shaft. Install belts by working each one over the sheave grooves until all are in position. Never pry the belts into place. On **nyb** packaged fans, sufficient motor adjustment is provided for easy installation of the proper size belts.
4. Adjust sheaves and the motor shaft angle so that the sheave faces are in the same plane. Check this by placing a straightedge across the face of the sheaves. Any gap between the edge and sheave faces indicates misalignment. Important: This method is only valid when the width of the surface between the belt edge and the sheave face is the same for both sheaves. When they are not equal, or when using adjustable-pitch sheaves, adjust so that all belts have approximately equal tension. Both shafts should be at the right angles to the center belt.

Belt Tensioning

1. Check belt tension with a tensioning gage and adjust using the motor slide base. Excess tension shortens bearing life while insufficient tension shortens belt life, can reduce fan performance and may cause vibration. The lowest allowable tension is that which prevents slippage under full load. Belts may slip during start-up, but slipping should stop as soon as the fan reaches full speed. For more precise tensioning methods, consult the drive manufacturer's literature.
2. Recheck setscrews, rotate the drive by hand and check for rubbing, then complete the installation of the belt guard.

- Belts tend to stretch somewhat after installation. Recheck tension after several days of operation. Check sheave alignment as well as setscrew and/or bushing bolt tightness.

COUPLING

Coupling alignment should be checked after installation and prior to start up. Alignment is set at the factory, but shipping, handling, and installation can cause misalignment. Also check for proper coupling lubrication. For details on lubrication and for alignment tolerances on the particular coupling supplied, see the manufacturer's installation and maintenance supplement in the shipping envelope.

Installation

Most **nyb** fans are shipped with the coupling installed. In cases where the drive is assembled after shipping, install the coupling as follows:

- Remove all foreign material from fan and motor shafts and coat with machine oil for easy mounting of coupling halves.
- Mount the coupling halves on each shaft, setting the gap between the faces specified by the manufacturer. Avoid using force. If mounting difficulty is encountered, lightly polish the shaft with emery cloth until the halves slide on freely.

Alignment

- Align the coupling to within the manufacturer's limits for parallel and angular misalignment (see Figure 2). A dial indicator or laser can also be used for alignment where greater precision is desired. Adjustments should be made by moving the motor to change shaft angle, and by the use of foot shims to change motor shaft height. Do not move the fan shaft or bearing.
- When correctly aligned, install the flexible element and tighten all fasteners in the coupling and motor base. Lubricate the coupling if necessary.
- Recheck alignment and gap after a short period of operation, and recheck the tightness of all fasteners in the coupling assembly.

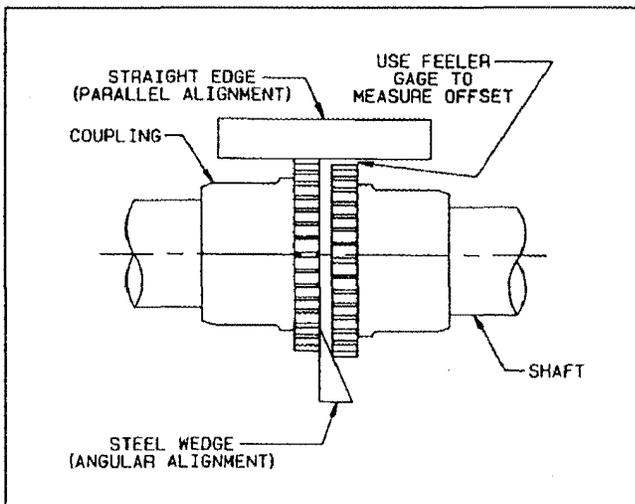


Figure 2

START-UP

Safe operation and maintenance includes the selection and use of appropriate safety accessories for the specific installation. This is the responsibility of the system designer and requires consideration of equipment location and accessibility as well as adjacent components. All safety accessories must be installed properly prior to start-up.

Safe operating speed is a function of system temperature and wheel design. Do not under any circumstances exceed the maximum safe fan speed published in the **nyb** engineering supplement, which is available from your **nyb** field sales representative.

! CAUTION

BEFORE INITIAL OPERATION:

- TIGHTEN ALL SET SCREWS IN FAN WHEEL.
- TIGHTEN ALL SET SCREWS IN BEARINGS.
- REPEAT AFTER 8 HOURS OF OPERATION.
- REPEAT AGAIN AFTER TWO WEEKS OPERATION.

98-0271

Procedure

- If the drive components are not supplied by **nyb**, verify with the manufacturer that the starting torque is adequate for the speed and inertia of the fan.
- Inspect the installation prior to starting the fan. Check for any loose items or debris that could be drawn into the fan or dislodged by the fan discharge. Check the interior of the fan as well. Turn the wheel by hand to check for binding.
- Check drive installation and belt tension.
- Check the tightness of all setscrews, nuts and bolts. When furnished, tighten hub setscrews with the wheel oriented so that the setscrew is positioned underneath the shaft.
- Install all remaining safety devices and guards. Verify that the supply voltage is correct and wire the motor. "Bump" the starter to check for proper wheel rotation.
- Use extreme caution when testing the fan with ducting disconnected. Apply power and check for unusual sounds or excessive vibration. If either exists, see the section on Common Fan Problems. To avoid motor overload, do not run the fan for more than a few seconds if ductwork is not fully installed. On larger fans, normal operating speed may not be obtained without motor overload unless ductwork is attached. Check for correct fan speed and complete installation. Ductwork and guards must be fully installed for safety.
- Setscrews should be rechecked after a few minutes, eight hours and two weeks of operation (see Tables 1 & 2 for correct tightening torques).

NOTE: Shut the fan down immediately if there is any sudden increase in fan vibration.

Table 1 - WHEEL SETSCREW TORQUES

Setscrew Size Diameter (in.)	Carbon Steel Setscrew Torque*	
	lb.-in.	lb.-ft.
1/2	600	50
5/8	--	97
3/4	--	168

* Stainless Steel setscrews are not hardened and should not be tightened to more than 1/2 the values shown.

Table 2 - BEARING SETSCREW TORQUE, lb.-in.

Setscrew Diameter	Manufacturer				
	Link-Belt	Sealmaster	SKF	McGill	Dodge
1/4	90	65	50	85	--
5/16	185	125	165	165	160

Note: Split pillow block bearings are fixed to the shaft with tapered sleeves and generally do not have setscrews.

FAN MAINTENANCE

nyb fans are manufactured to high standards with quality materials and components. Proper maintenance will ensure a long and trouble-free service life.

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

The key to good fan maintenance is regular and systematic inspection of all fan parts. Inspection frequency is determined by the severity of the application and local conditions. Strict adherence to an inspection schedule is essential.

Regular fan maintenance should include the following:

1. Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures. Check also for the build-up of material which can cause unbalance resulting in vibration, bearing wear and serious safety hazards. Clean or replace the wheel as required.
2. Check the V-belt drive for proper alignment and tension (see section on V-belt drives). If belts are worn, replace them as a set, matched to within manufacturer's tolerances. Lubricate the coupling of direct-drive units and check for alignment (see section on couplings).
3. Lubricate the bearings, but do not over lubricate (see the bearing section for detailed specifications).
4. Ceramic-felt shaft seals require no maintenance, although worn seals should be replaced. When lip-type shaft seals are provided, lubricate them with "NEVER-SEEZ" or other anti-seize compound.
5. During any routine maintenance, all setscrews and bolts should be checked for tightness. See the table for correct torques.
6. When installing a new wheel, the proper wheel-to-inlet clearance must be maintained (see Figure 3).

WHEEL BALANCE

Airstreams containing particulate or chemicals can cause abrasion or corrosion of the fan parts. This wear is often uneven and can lead to significant wheel unbalance over time. When such wear is discovered, a decision must be made as to whether to rebalance or replace the wheel.

The soundness of all parts should be determined if the original thickness of components is reduced. Be sure there is no hidden structural damage. The airstream components should also be cleaned to remove any build-up of foreign material. Specialized equipment can be used to rebalance a cleaned wheel that is considered structurally sound.

Balance weights should be rigidly attached at a point that will not interfere with the housing nor disrupt airflow. Remember that centrifugal forces can be extremely high at the outer radius of a fan wheel. Welding is the preferred method of balance weight attachment. Be sure to ground the welder directly to the fan wheel. Otherwise, the welding current could pass through the fan bearings and damage them.

WHEEL-INLET CLEARANCE

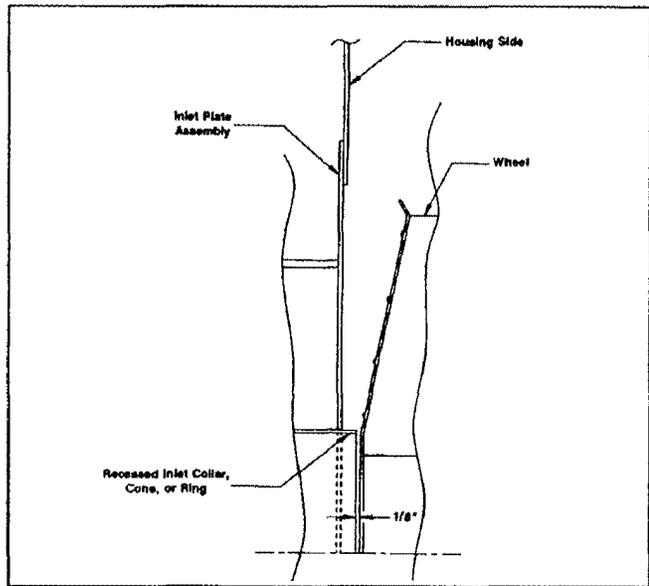


Figure 3

BEARINGS

Storage

Any stored bearing can be damaged by condensation caused by temperature variations. Therefore, nyb fan bearings are filled with grease at the factory to exclude air and moisture. Such protection is adequate for shipment and subsequent immediate installation.

For long term or outdoor storage, mounted bearings should be regreased and wrapped with plastic for protection. **Rotate the fan wheel by hand at least every two weeks to redistribute grease on internal bearing parts.** Each month the bearings should be purged with new grease to remove condensation, since even a filled bearing can accumulate moisture. Use caution when purging, as excessive pressure can damage the seals. Rotate the shaft while slowly adding grease.

Operation

Check the setscrew torque before start-up (see table for correct values). Since bearings are completely filled with grease at the factory, they may run at an elevated temperature during initial operation. Surface temperatures may reach 180°F. and grease may bleed from the bearing seals. This is normal and no attempt should be made to replace lost grease. Bearing surface temperatures will decrease when the internal grease quantity reaches a normal operating level. Relubrication should follow the recommended schedule.

Lubrication

Use the table for relubrication scheduling according to operating speed and shaft diameter. Bearings should be lubricated with a premium quality lithium-based grease conforming to NLGI Grade 2. Examples are:

Mobil - Mobilith AW2 Chevron - Amolith #2
 Texaco - Premium RB Shell - Alvania #2

These greases are for bearing surface temperatures of 40°F. to 180°F. For surface temperatures of 181°F. to 230°F. use Mobilith SHC220.

Do not use "high temperature" greases, as many are not formulated to be compatible with fan bearings.

Add grease to the bearing while running the fan or rotating the shaft by hand. Be sure all guards are in place if lubrication is performed while the fan is operating. Add just enough grease to cause a slight purging at the seals. Except on split pillowblocks. Completely filled bearings will run hotter until a sufficient amount of grease is purged out of the seals.

Split pillowblock bearings (Link-Belt P-LB6800 & P-LB6900, SKF SAF 22500, Dodge SAF-XT) should be cleaned and repacked at approximately every eighth lubrication interval. This requires removal of the bearing cap. Clean out old grease and repack the bearing with fresh grease. Pack the bearing fully and fill the housing reservoir to the bottom of the shaft on both sides of the bearing. Replace the bearing cap, being careful not to mix caps as they are not interchangeable from one bearing to another. **Do not over lubricate.**

BEARING LUBRICATION INTERVAL [months]

RPM Shaft	1 - 500	501- 1000	1001- 1500	1501- 2000	2001- 2500	2501- 3000	3001- 3500	3501- 4000
1 7/16	6	6	5-6	4-6	4-6	3-5	2-4	2-4
1 11/16	6	6	4-6	4-6	2-4	2-4	2	1-2
2 3/16			6	4-6	4	2-4	2	--
2 7/16			6	4-6	4	2-4	2	--
2 15/16			4-6	4-6	2-4	2	1-2	--

Ball Bearings & Split Pillowblock →  ← Non-Split Pillowblock Spherical Roller Bearings

NOTE:

- These are general recommendations only; specific manufacturer's recommendations may vary slightly.
- Assumes clean environment, -20°F. to 120°F.
 - Consult The New York Blower Company for operation below -20°F. ambient.
 - Ambient temperatures greater than 120°F. will shorten bearing life.
 - Under extremely dirty conditions, lubricate more frequently.
- Assumes horizontal mounting configuration. For vertically mounted applications, lubricate twice as frequently.

COMMON FAN PROBLEMS

Excessive Vibration

A common complaint regarding industrial fans is "excessive vibration". **nyb** is careful to ensure that each unit is precisely balanced prior to shipment; however, there are many other causes of vibration including:

- Loose mounting bolts, setscrews, bearings or couplings.
- Misalignment or excessive wear of couplings or bearings.
- Misaligned or unbalanced motor.
- Bent shaft due to mishandling or material impact.
- Accumulation of foreign material on the wheel.
- Excessive wear or erosion of the wheel.
- Excessive system pressure or restriction of airflow due to closed dampers.
- Inadequate structural support, mounting procedures or materials.
- Externally transmitted vibration.

Inadequate Performance

- Incorrect testing procedures or calculations.
- Fan running too slowly.
- Fan wheel rotating in wrong direction or installed backwards on shaft.
- Wheel not properly centered relative to inlet cone.
- Damaged or incorrectly installed cut off sheet or diverter.
- Poor system design, closed dampers, air leaks, clogged filters, or coils.
- Obstructions or sharp elbows near inlets.
- Sharp deflection of airstream at fan outlet.

Excessive Noise

- Fan operating near "stall" due to incorrect system design or installation.
- Vibration originating elsewhere in the system.
- System resonance or pulsation.
- Improper location or orientation of fan intake and discharge.
- Inadequate or faulty design of supporting structures.
- Nearby sound reflecting surfaces.
- Loose accessories or components.
- Loose drive belts.
- Worn bearings.

Premature Component Failure

- Prolonged or major vibration.
- Inadequate or improper maintenance.
- Abrasive or corrosive elements in the airstream or surrounding environment.
- Misalignment or physical damage to rotating components or bearings.
- Bearing failure from incorrect or contaminated lubricant or grounding through the bearings while arc welding.
- Excessive fan speed.
- Extreme ambient or airstream temperatures.
- Improper belt tension.
- Improper tightening of wheel setscrews.

REPLACEMENT PARTS

It is recommended that only factory-supplied replacement parts be used. **nyb** fan parts are built to be fully compatible with the original fan, using specific alloys and tolerances. These parts carry a standard **nyb** warranty.

When ordering replacement parts, specify the part name, **nyb** shop and control number, fan size, type, rotation (viewed from drive end), arrangement and bearing size or bore. Most of this information is on the metal nameplate attached to the fan base.

For assistance in selecting replacement parts, contact your local **nyb** representative or visit: <http://www.nyb.com>.

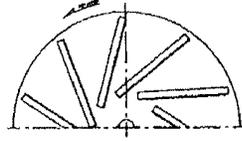
Example: Part required: Wheel/shaft assembly
 Shop/control number: B-10106-100
 Fan description: Size 2206A10 Pressure Blower
 Rotation: Clockwise
 Arrangement: 4

Suggested replacement parts include:

Wheel	Component parts: Damper
Shaft •	Motor
Bearings*	Coupling*
Shaft Seal*	Sheaves*
	V-Belts*

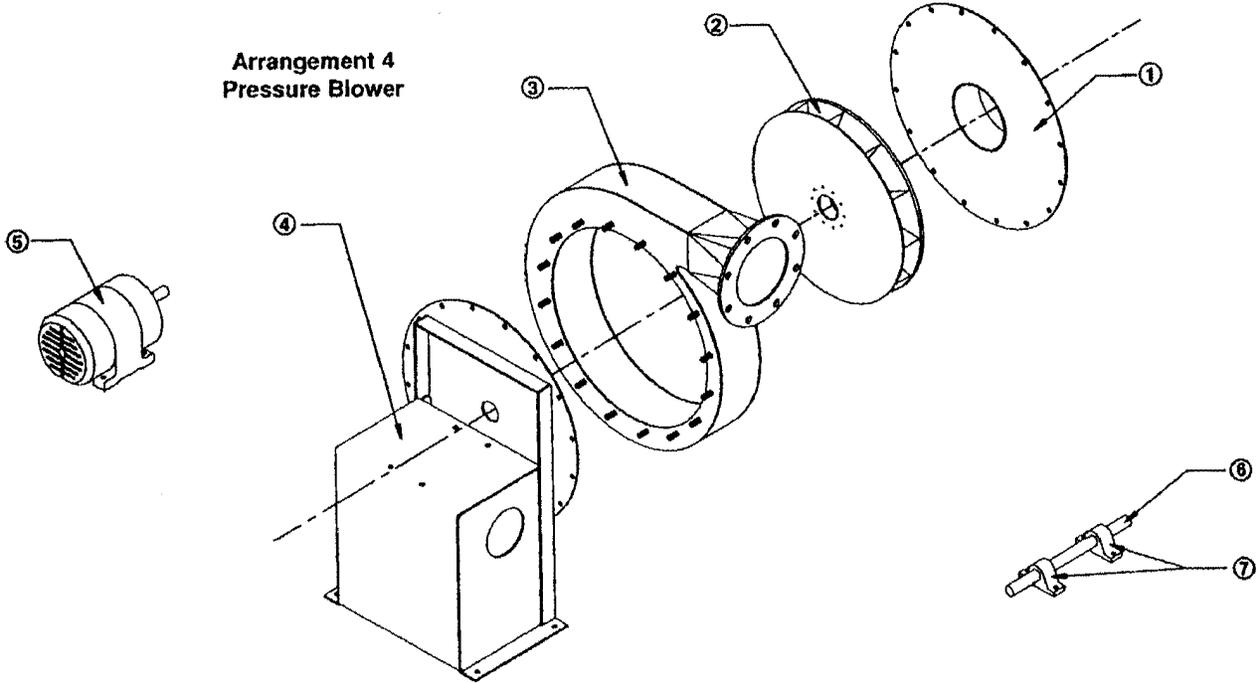
• For Arrangement 1/8 fan only.

SPECIFY ROTATION AS VIEWED FROM DRIVE SIDE

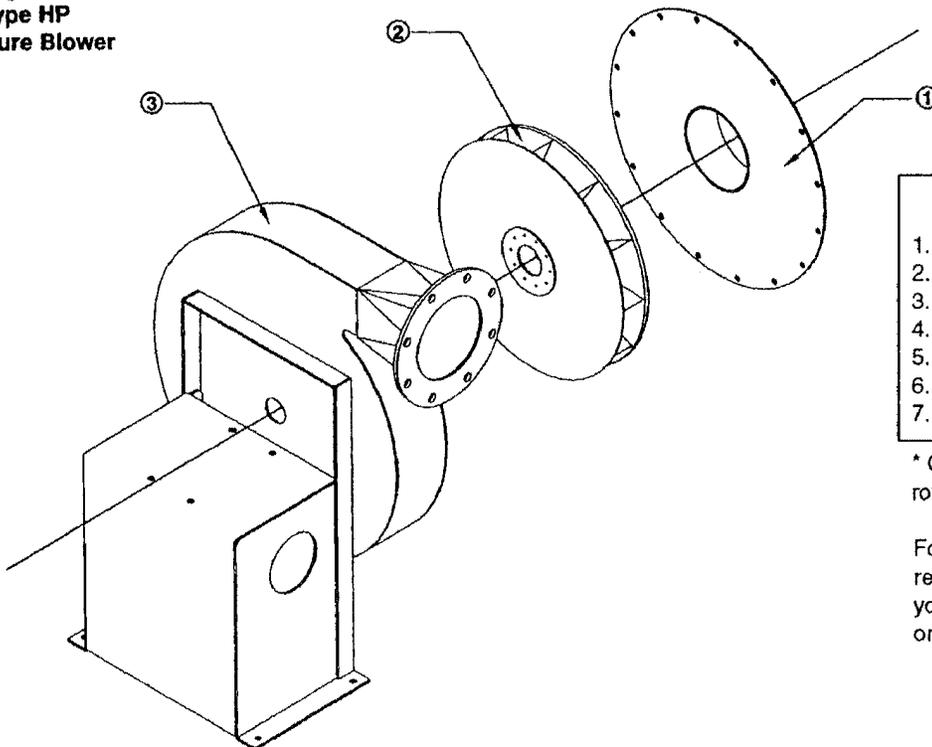


ARROW INDICATES COUNTER CLOCKWISE ROTATION

Arrangement 4
Pressure Blower



Arrangement 4
Type HP
Pressure Blower



Parts List

1. Inlet Plate Assembly
2. Wheel*
3. Housing*
4. Pedestal Assembly
5. Motor
6. Shaft
7. Bearings

* Order for parts must specify rotation.

For assistance in selecting replacement parts, contact your local **nyb** representative or visit: <http://www.nyb.com>.

USING PERFORMANCE CURVES

Performance is shown according to outlet sizes for quick reference to duct diameter and velocity. Brake horsepower increments are identified on each curve. Recommended standard blower size and motor combinations are based on the most efficient area of operation and are indicated by the arrows. Nonstandard combinations are generally available, but are usually less efficient than the standard combinations.

SIZING NOMENCLATURE

7-digit model number designates the wheel diameter, outlet size, wheel type, and nominal motor horsepower.

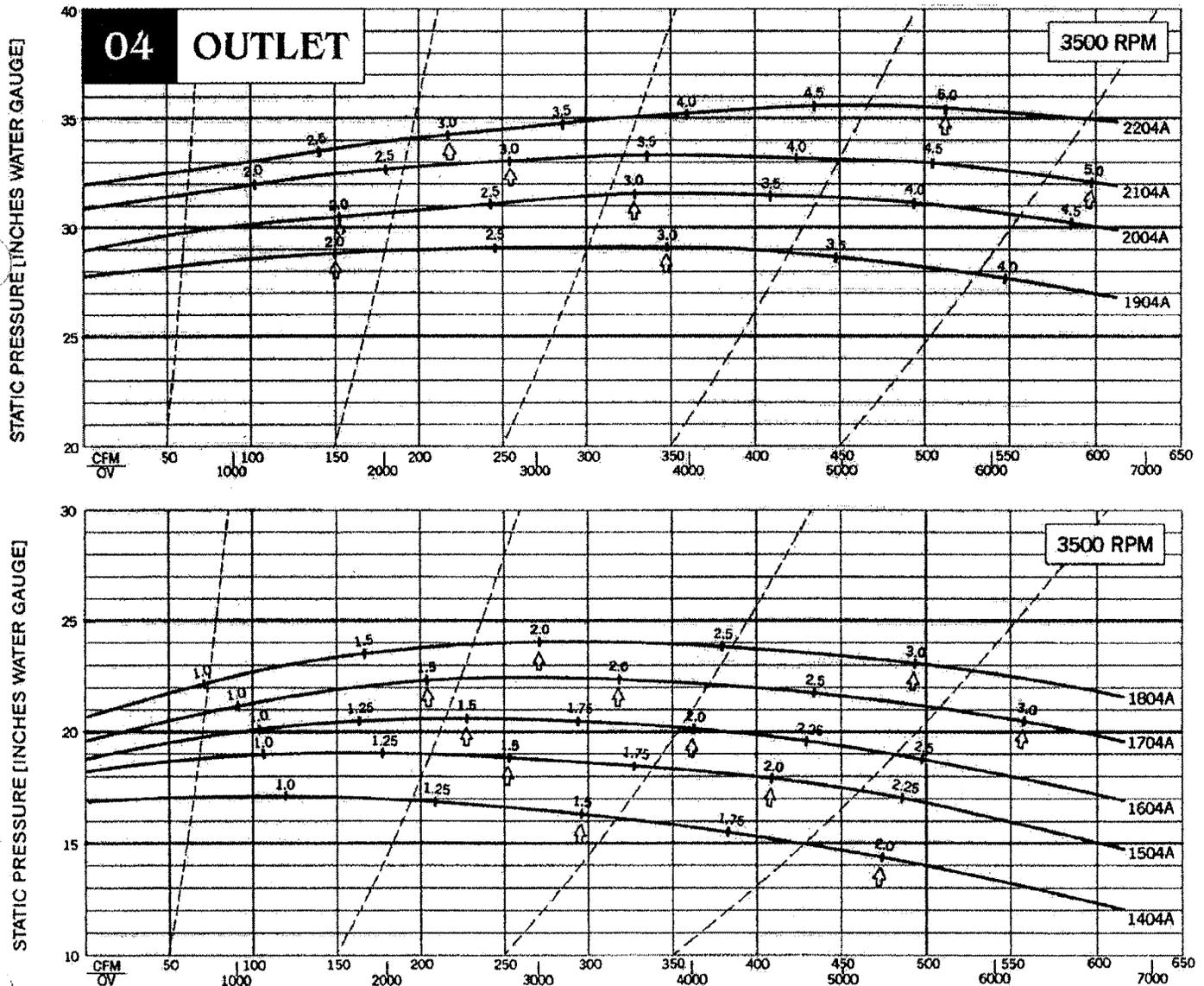
EXAMPLE

21	06	A	7½
Wheel diameter	Outlet size [inches]	Wheel type	Nominal horsepower
		A = aluminum	
		S = steel/ stainless steel	

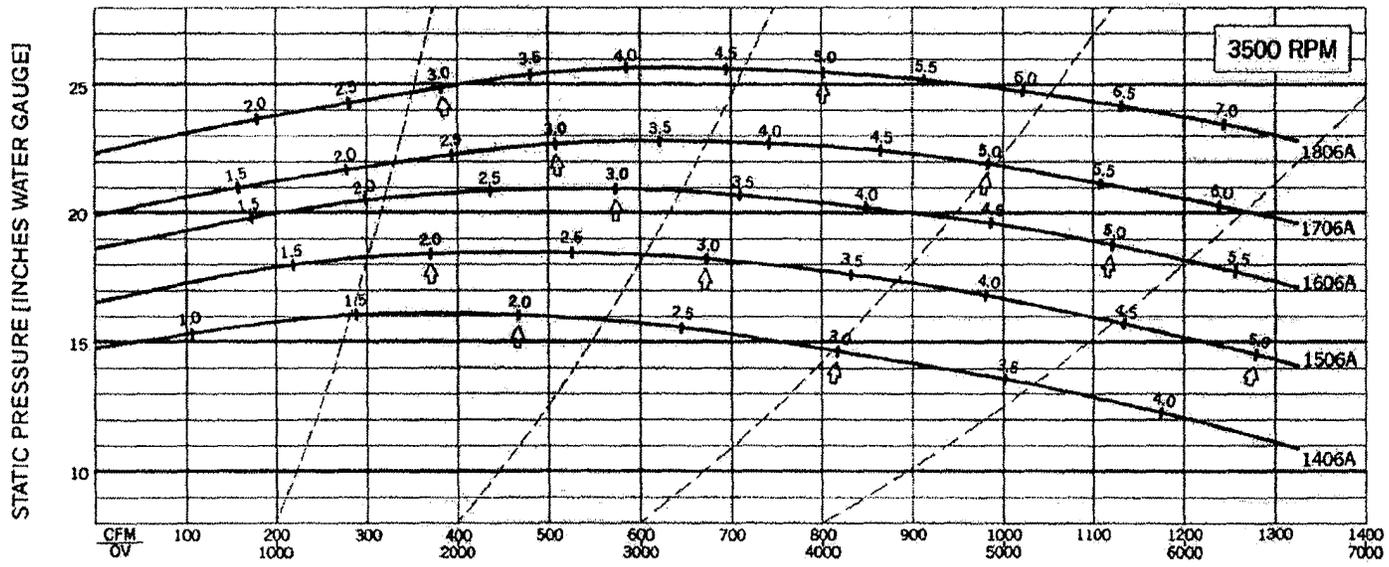
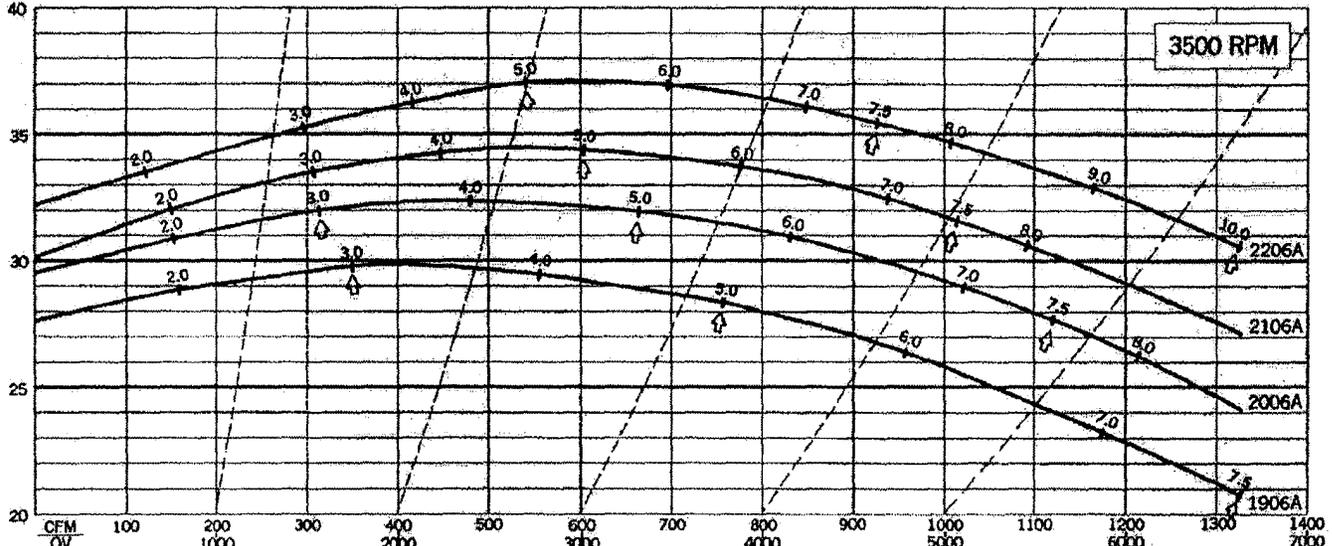
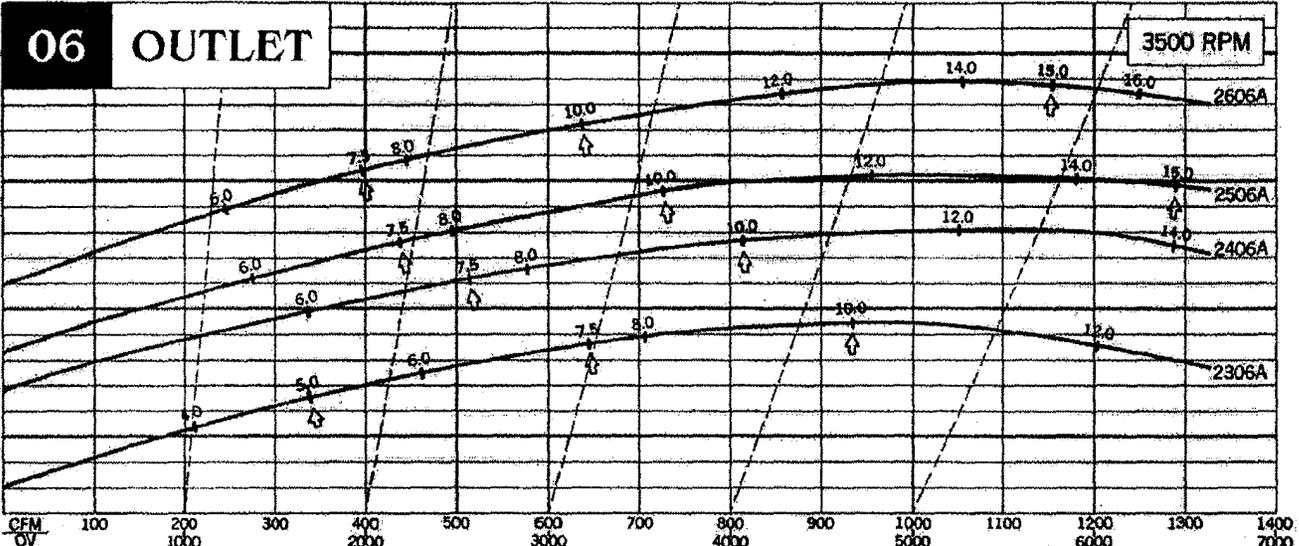
Note: the last two digits showing motor horsepower are not required for Arrangement 1 Pressure Blowers.

PROCEDURE	STEPS	EXAMPLE
Determine the appropriate outlet size.	1	The 06 outlet is selected for 800 CFM at 32"SP.
Plot the CFM and SP [standard] and follow a projected system line up to the pressure curve that meets or slightly exceeds the required performance.	2	A Size 2106A will provide 820 CFM at 33.6"SP.
Determine the BHP required for the point of operation . . . see page 4 for steel or stainless-steel wheel factors.	3	2106A requires 6.3 BHP. 2106S requires 7.2 BHP [6.3 x 1.15].
Read to the right to select motor horsepower.	4	A 7½ HP motor will cover both wheel types.

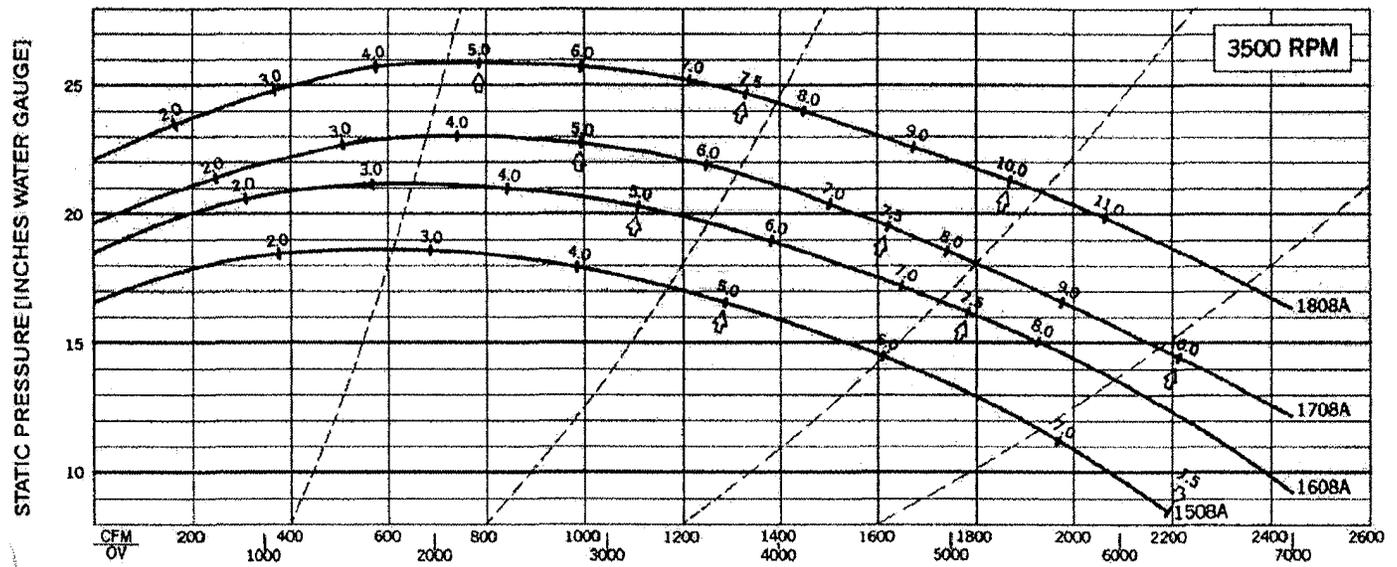
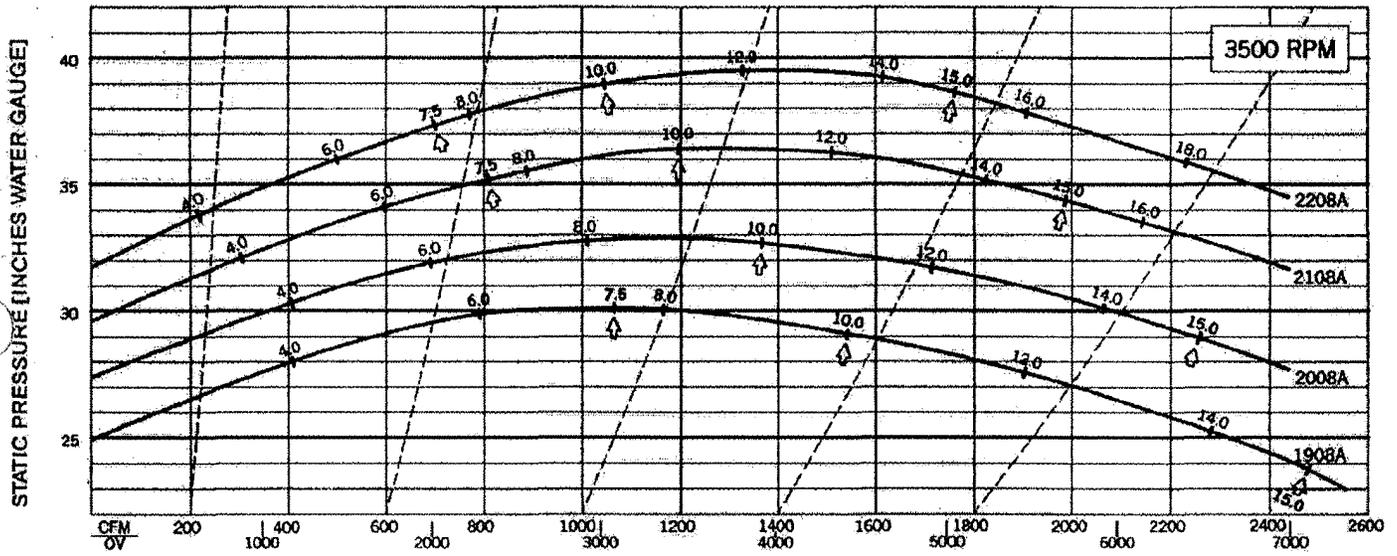
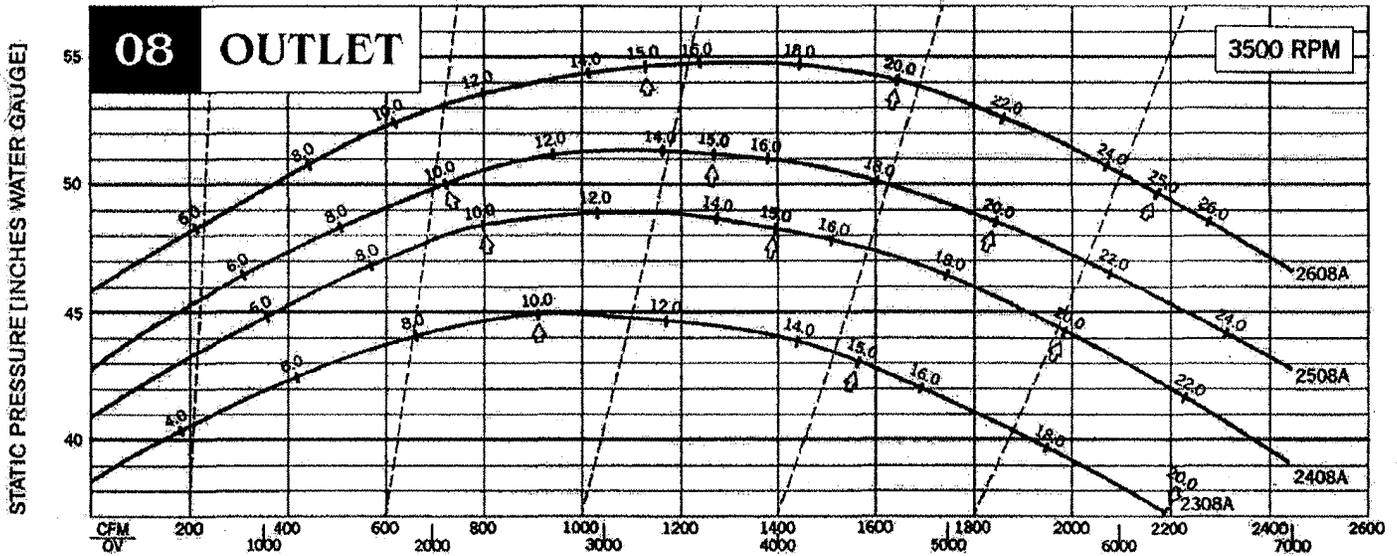
Note: The horsepower coverage of a given motor will increase 15% when a 1.15 service factor motor is utilized.



Performance shown is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include drive losses. Performance ratings do not include the effects of appurtenances in airstream.



Performance shown is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include drive losses. Performance ratings do not include the effects of appurtenances in airstream.



Performance shown is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include drive losses.
Performance ratings do not include the effects of appurtenances in airstream.

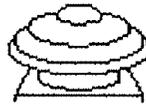


Recommended SAFETY PRACTICES

for Users and Installers
of Industrial and Commercial Fans
AMCA Publication 410-96

FOREWORD

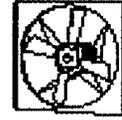
- i. This publication has been prepared by the Air Movement Division of the Air Movement and Control Association International, Inc. (AMCA International). The information contained in this publication has been derived from many sources. The suggestions made necessarily should be general in their meaning and cannot be applied literally to all specific situations or conditions.
- ii. *The safe installation and operation of fans is the responsibility of the system designer, installer, maintainer, and user.* From the initial system design through the life of the equipment, safety should be a foremost consideration. Some areas which require some special attention include system design, layout and construction, fan performance specification, foundation and installation details, storage procedures, start-up and commissioning procedures, operation, maintenance, and repair. Specific safety requirements are mandated by federal, state, and local codes. *Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans* is published by AMCA International for assistance. System designers, installers, maintainers, and users should consult and properly comply with all applicable codes and guidelines.
- iii. The safety recommendations contained herein are intended to assist designers, installers, maintainers, or other users of air moving devices in the safe operation and use of the devices mentioned. These recommendations do not represent the only methods, procedures, or devices appropriate for the situations discussed. Caution should be used at all times when working in or around moving parts.
- iv. AMCA International disclaims any and all warranties, expressed or implied, regarding the products sold by the manufacturer with which this booklet has been provided. Further, AMCA International recommends that competent personnel be consulted in deciding what is the preferred or recommended safety procedure in a particular instance where the guidelines contained in this booklet are unclear or in any way incomplete.
- v. AMCA International has offered the information within this booklet to assist in the safe operation, maintenance, and use of the products sold by members of AMCA International. In so doing, AMCA International does not assume any legal duties of the designer or manufacturer to instruct or warn about their product. AMCA International expressly disclaims liability for any injury or damage arising out of the operation or use of the product or the guidelines contained herein.
- vi. These recommended safety practices were adopted by the AMCA International membership on April 28, 1996.



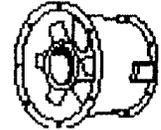
Power Roof Ventilator



Wall Exhauster



Propeller Fan



Axial Fan

1. INTRODUCTION

1.1 Fans and other air moving devices are made in a wide variety of types, sizes, and arrangements. This publication addresses the proper use and installation of industrial and commercial fans. It is not intended to address residential and consumer fans.



Centrifugal Fan



Upblast Roof Exhauster

1.2 Various "size" factors are important when assessing potential for injury; some factors are: diameter of impeller (wheel, rotor, propeller), rotational inertia, voltage, and current.

1.3 This guide is intended to assist in the safe installation of air moving equipment and to warn operating and maintenance personnel of the commonly recognized hazards associated with this equipment.

1.4 *Handling and installation should always be performed only by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury.* In addition to following the manufacturer's installation instructions, care should be taken to ensure compliance with specific safety requirements mandated by federal, state, and local codes. Industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be consulted and followed where applicable.

2. PERSONNEL SAFETY ACCESSORIES

2.1 GENERAL

2.1.1 Protective devices are incorporated as standard construction on some types of fans but on many fans, these devices are offered as optional accessories. This is done because the need for the devices and the design required will frequently depend upon the type of system, fan location, and operating procedures being employed. Proper protective safety devices; company safety standards; specific safety requirements mandated by federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be determined by the user, who should specify and obtain the appropriate devices from the fan manufacturer or others, and should not allow operation of the equipment without them. Examples of available devices include the following:

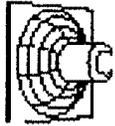
2.2 FAN GUARDS

2.2.1 All fans have moving parts which require guarding in the same way as other moving machinery. Fans located less than seven (7) feet above the floor require special consideration. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be followed.

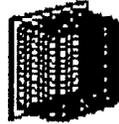
2.2.2 Roof-mounted fans and other fans which are not generally accessible may not require safety guards which might otherwise be appropriate. Where accessibility to these fans is occasional or infrequent, the expense of permanent guarding may be reduced through the use of lockout switches and suitable warnings. In such cases, maintenance personnel



should engage the lockout switch before undertaking any maintenance or repairs. As is the case with other machinery involving moving parts, common sense and caution will preserve personal safety.



Industrial Type Guard
For Propeller Fan



Maximum Safety
Guard for Propeller Fan



Screen on Roof
Ventilator

2.3 INLET AND OUTLET GUARDS

2.3.1 Axial and centrifugal fans are often connected directly to ductwork which will prevent contact with the internal moving parts; when an exposed inlet or outlet represents a hazard, a suitable guard should be installed.



Centrifugal Fan
Protected by Ductwork



Inlet or Outlet Guard
on Centrifugal Fan



Guard for Axial Fan With
Non-Ducted Inlet or Outlet

2.4 DRIVE GUARDS

2.4.1 Fans may be driven directly from the motor shaft or through a belt drive. Where the bearing assembly, rotating shaft, sheaves, or belts are exposed, a suitable guard may need to be provided. Some example guards are shown below.



Drive Coupling
Guard



Heat Slinger Guard
(Shaft and bearing
guard omitted for clarity)



Shaft and Bearing
Guard

2.4.2 Drive guards may be required for tubular centrifugal or axial fans to cover the exposed drive sheave and belts outside the fan housing.



Drive Guard - Axial Fan

2.4.3 A typical centrifugal fan drive guard may vary with the arrangement. Safety guards should be used when drive systems are accessible to personnel. In restricted areas, omission of the back cover may be acceptable.



Drive Guard -
Centrifugal Fan

2.4.4 Dampers and their linkage may operate suddenly without warning at high speeds. Dampers and their linkage contain pinch points which should be identified and guarded.

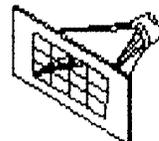
3. HIDDEN DANGERS

3.1 GENERAL

3.1.1 In addition to the obvious hazards associated with the moving parts of rotating machinery, fans present additional potential hazards that are not so obvious and should be considered by the system designer and user for safe operation.

3.2 SUCTION AND AIR PRESSURE

3.2.1 Fans operate by creating suction and air pressure which can be hazardous. Solid objects can be drawn into a fan's inlet and then become dangerous projectiles when they are exhausted through the fan's outlet. **Solid objects can also**



Special Purpose
Intake Screen

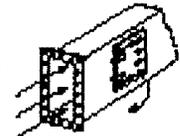
cause fan failure or impeller failure due to imbalance or damage to the impeller blades. Personnel in close proximity to a fan inlet can be overcome by the suction, and drawn into the fan.

3.2.2 Whenever there is a possibility that solid objects can be drawn into a remote intake, the intake should be guarded at all times. Before a guard is removed, the fan should be disconnected and the power supply locked out.

3.2.3 Where fans are installed over an occupied area, safety guards should be provided to prevent dropped objects from entering this area during installation and maintenance.

3.2.4 Access doors to a fan or duct system should never be opened while the fan is operating or coasting to a stop. On the downstream (or pressure) side of the system, releasing the door with the system in operation may result in an explosive opening. On the upstream (or suction) side, the inflow may be sufficient to draw in tools, clothing, and other materials. The power supply should always be locked out prior to accessing a fan or ductwork.

3.2.5 Fan design sometimes requires access doors to be supplied with internal components such as a plug to fill a hole in the fan casing. These doors can often be heavy and difficult to handle. Care should be exercised when opening, removing, and installing these components.



Bolted Access Door in
Duct

3.3 WINDMILLING

3.3.1 Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.

3.4 TEMPERATURE

3.4.1 Many fans, fan motors, and fan components run at temperatures that could burn someone who comes in contact with the hot areas, including discharged or leaking gases. If this potential hazard is present, steps should be taken so that personnel working near the fan are aware of the danger and can exercise caution.

3.5 FAN NOISE AND ENVIRONMENT

3.5.1 Some fans can generate sound that could be hazardous to exposed personnel. Sound pressure can be measured in the field, but obtaining accurate data is difficult. The environment in which the fan operates can impact the ability to obtain accurate fan sound readings. Consult the manufacturer for fan sound data. It is the responsibility of the system designer, installer, user, and maintainer to comply with specific safety requirements mandated by federal, state, and local codes; and to follow industry safety standards and practices published by AMCA International and by other recognized agencies and associations, regarding personnel safety from exposure to fan noise associated with use and exposure to equipment.



Hearing Protection

3.6 STROBOSCOPIC EFFECT

3.6.1 The stroboscopic effect of certain lights in combination with certain fan speeds may cause a rotating assembly to appear stopped. In these cases, irregular markings can be placed on the moving parts to prevent this type of effect. Personnel should be warned that the fan may be in motion even if it appears not to be.

3.7 SPECIAL PURPOSE FANS AND SYSTEMS

3.7.1 The hidden dangers associated with Special Purpose Fans used in special systems are covered in Section 6.

4. POWER ISOLATION

4.1 Every fan should be installed with a suitable device allowing it to be completely disconnected or isolated from the power supply.

4.2 Many fans are started by remote switches or push-buttons, by interlocks with other equipment, or by automatic controls. Before performing any maintenance, inspection, or other activity which will require removal of guards, ductwork, access doors, etc., or exposure of moving parts, the fan power supply should be locked out and the fan tagged out of service.



4.3 In some installations other equipment, such as gas burners, may be interlocked with the fan so that disconnecting the fan will automatically shut off the burner or other device. Maintenance on systems of this type should be performed only under the supervision of competent engineering personnel and in accordance with applicable codes and standards.



Remote Switch



Disconnect Switch



Lock Carried by
Maintenance Personnel

4.4 In cases where the fan is power driven by a source other than an electric motor, appropriate provisions should be made for the isolation or disengagement of the power supply.

5. START-UP CHECK LIST

5.1 GENERAL

5.1.1 Before putting any fan into initial operation, the manufacturer's instructions should be followed. Transportation, handling, and installation can cause fasteners to loosen, and cause misalignment of fan components. Carefully follow this check list when commissioning equipment.

5.1.2 Lock out the primary and all secondary power sources.

5.1.3 A complete inspection should be made of all of the ductwork and the interior of the fan. Make certain there is no foreign material which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures might include the use of goggles, respirators, or other personal protective devices.

5.1.4 Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices and with the fan manufacturer's recommendations.

5.1.5 Check and tighten all bolts, fasteners, and set screws as necessary.

5.1.6 Check the fan assembly and bearings for proper grounding to prevent static electricity discharge.

5.1.7 Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.

5.1.8 Check bearings for recommended lubricant and lubrication amount.

5.1.9 Spin the rotating assembly to determine whether it rotates freely, without hitting anything, and is not grossly out of balance.

5.1.10 Inspect impeller for proper rotation for the fan design.

5.1.11 Check alignment of drives and all other components.

5.1.12 Check the belt drive for proper sheave selection and installation and make sure the sheaves are not reversed (excessive speeds could develop).

5.1.13 Check for recommended belt tension.

5.1.14 Properly secure all safety guards.

5.1.15 Assume that all appropriate warnings have been put in place.

5.1.16 Secure all access doors to the fan and ductwork.

5.1.17 Momentarily energize the fan to check the direction of rotation. Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

5.1.18 Switch on the electrical supply and allow the fan to reach full speed. Check carefully for:

- (1) Excessive vibration
- (2) Unusual noise
- (3) Proper belt alignment
- (4) Proper lubrication
- (5) Proper amperage, voltage, or power values.
- (6) If any problem is indicated, **SWITCH OFF IMMEDIATELY.**
- (7) Lock out the power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for the cause of the trouble, correct as necessary, and repeat check list procedure.

5.2 Even if the fan appears to be operating satisfactorily, shut down after a brief period, lock out the power supply, and recheck items 5.1.5 through

5.1.17 as the initial start-up may have loosened the bolts, fasteners, and set screws.

5.3 The fan may now be put into operation, but during the first eight hours of running, it should be closely observed and checked for excessive vibration and noise. At this time checks should also be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacturer's recommendations.

5.4 After eight hours of operation, the fan should be shut down and the power locked out. Check list items 5.1.5 through 5.1.17 should be inspected and adjusted, if necessary.

5.5 After twenty-four (24) hours of satisfactory operation, the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension.

5.6 After commissioning and start-up, the fan should be operated and maintained in accordance with the manufacturer's and component manufacturer's recommendations. Some basic guidelines for **WARNING SIGNS** and **ROUTINE MAINTENANCE** are included in Sections 7 and 8 of this publication. These sections are meant as a supplement to other publications and are not intended to replace the manufacturer's instructions.

6. SPECIAL PURPOSE FANS

6.1 Most fans are designed to handle clean air at standard temperatures between 32 F and 120 F. These fans should not be placed in systems or used for other than their design intended use. *Special Purpose Fans* are designed for use in systems that may include extreme temperatures, explosive, toxic, or special gases, material handling, corrosive environments, or other special hazards which should be carefully considered. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be followed.

6.2 Where the system will handle explosive or flammable material (i.e., dust, fumes, vapors or gases), fans of spark-resistant construction should be used.

6.3 Fans connected by ductwork or other piping may contain gases other than air which are hazardous. In these cases, procedures should be established to prevent exposure of personnel working on or near the fan, and by maintenance personnel who may need to enter the fan. Appropriate personal protective equipment as determined by the material safety data sheet, and system operators should be utilized. Appropriate environmental protective measures should also be taken.

6.4 Fan inlet boxes, housings, ductwork, and other system components which are large enough to permit entry should be considered confined spaces. System areas may also serve as low points where heavy gases, liquids, or other substances may accumulate and present explosive, fire, health, or suffocation hazards. Appropriate protective measures and safety practices should be observed when entering or working within these areas.

6.5 Material-handling fans are specially designed to allow the fan to handle a specific type of material without excessive accumulation of material on the fan impeller. Fans handling corrosive gases or erosive material should be checked periodically. If loss of material is evident, the fan should be shut down, power supply locked out, and tagged out of service. The manufacturer or other qualified personnel should be consulted to determine if the fan is within safety limits for operation. To ensure satisfactory operation it is essential to observe the manufacturer's limitations concerning the type of material to be handled by the fan.

6.6 Fan ratings and maximum speed limits are typically based on the use of air at 70 F. At temperatures above the normal range (specified by the manufacturer), a reduction should be made in the maximum speed limit. Information on this reduction and on other precautions to be taken for high temperature applications should be obtained from the fan manufacturer. Personnel working near high temperature fans should be aware that coming in contact with the fan's housing, ductwork, or handled gases could result in serious burns. Where the danger of burns is not apparent, appropriate warnings should be posted. Appropriate protective apparel should be worn whenever working in close contact with heated housings or ductwork.

6.7 Corrosive contaminants can be formed when moisture combines with an active airborne chemical. Fans subjected to corrosive contaminants will corrode; however, suitable protective coatings or material, if used in



the fan construction, can delay corrosion. Protected fans should be regularly inspected to ensure that the protection remains effective. Personnel working in environments with airborne chemicals may require personal protective apparel equipment.

6.8 Where liquid can accumulate within the fan, provide for the installation of adequately sized drains.

6.9 In those applications where there is a potential for chemical build-up (such as grease, creosote, etc.), periodic cleaning and proper drainage are necessary to avoid a fire hazard.

7. WARNING SIGNS

7.1 GENERAL

7.1.1 A change in the operating characteristics of a fan may indicate the need for maintenance. Sudden changes may indicate severe problems or dangerous conditions developing. Investigate any changes in the operational characteristics or unusual symptoms of the fan. Refer to AMCA Publication 202, *Troubleshooting*, for a more detailed explanation of investigating procedures. Consult your manufacturer or other qualified consultant with questions concerning changes observed.

7.2 EXCESSIVE VIBRATION

7.2.1 Operational vibration levels are one of the best indicators of the condition of the blower. Careful observation and monitoring of vibration levels can detect a minor problem in the early stages of development when correction is less costly and easier. Recommended maximum vibration levels should be obtained from the equipment manufacturer.

7.2.2 If excessive vibration is observed, stop the fan and lock it out until the cause is corrected. Check for material build-up on the impeller. Generally this will show up as material flaking off the fan impeller and causing an imbalance which may lead to catastrophic failure of the fan or its components. Excessive vibration can also be caused by looseness in the drive train, loose fasteners, misalignment or impeller damage. Contact the fan manufacturer or other qualified consultant to determine the maximum vibration level if it is not included in maintenance instructions.

7.3 NOISE

7.3.1 Changes to the sound level may indicate maintenance is needed. Some unusual noises often heard include: bearing noise indicating the bearings need lubricant or replacement; scraping or ticking noise indicating the rotating parts are hitting the stationary parts; squealing indicating the belt drive needs tensioning; repeated changing pitch of the blower indicating operation of the blower at too low a flow. If any of these noises or any other unusual noises are detected, their cause should be determined and corrective action taken as necessary.

7.4 HIGH MOTOR TEMPERATURES

7.4.1 Check that cooling air to the motor has not been diverted or blocked by dirty guards or similar obstacles. Check the input amperage. An increase in amperage may indicate that some major change has occurred in the system.

7.5 HIGH BEARING TEMPERATURES

7.5.1 This condition is usually caused by improper lubrication; this can be either "over," "under," or "unsuitable" lubrication. In every case, if the cause of the trouble is not easily seen, experienced personnel should examine the equipment before it is put back in operation.

7.6 POOR PERFORMANCE

7.6.1 Too much flow or pressure or too little flow or pressure is often a symptom of a change in the operating system. A fan will typically operate at the same performance in a static system some typical causes include: operating of the fan backwards after maintenance procedures; filters dirty or not in place; change or blockage in the ductwork; change in speed of the fan (switching the sheaves); loss or failure of the impeller. All of these causes and many others will affect the flow and pressure produced by the fan.

8. ROUTINE MAINTENANCE

8.1 A preventive maintenance program is an important aspect of an effective safety program. Consult your manufacturer or other qualified consultant with questions concerning changes observed during periodic inspections and routine maintenance.

8.2 The fan manufacturer's operating and maintenance recommendations, as well as the components manufacturer's instructions (such as motor, bearing, drives, etc.) should be strictly followed.

8.3 *Maintenance should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment.* Do not attempt any maintenance on a fan unless the fan power supply has been locked out and tagged out and the impeller has been secured.

8.4 When performing maintenance functions which include disassembly of the fan, careful consideration should be given to the size, weight, center of gravity, and lifting means of the fan components. It should also be noted that the outboard bearing on some fans such as arrangements 1, 8, 9, and 10 is often cap-loaded. Removal of the securing means may result in a sudden change in impeller position.

8.5 Historical data is often the best indicator for determining the operational condition of the fan. Maintenance logs which include relubrication, vibration levels, temperature levels, power requirements, inspection, and other pertinent records should be maintained and consulted as necessary when assessing the condition of the fan.

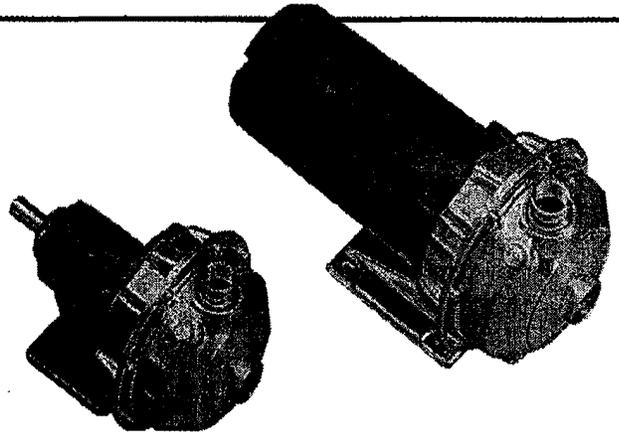
8.6 Under normal circumstances, handling clean air, the system should require cleaning only once a year. However, the fan and system should be checked at regular intervals to detect any unusual accumulation.

8.7 The fan impeller should be specially checked for build-up of material or dirt which may cause an imbalance with resulting undue wear on bearings and belt drives. A regular maintenance program should be established as needed to prevent material build-up.

8.8 Periodic inspection of the rotating assembly should be made to detect any indication of weakening of the rotor because of corrosion, erosion, or metal fatigue. Where signs of deterioration are found, lock out and tag out the impeller until the unit has been inspected and approved by a qualified consultant.

Installation, Operation and Maintenance Instructions

Model NPE/ NPE-F



DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. Important:

1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.

1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.

CAUTION

Always disconnect electrical power when handling pump or controls.

1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature: 212° F (100° C) with standard seal.
250° F (120° C) with optional high temp seal.

Pressure: 75 PSI.
Starts Per Hour: 20, evenly distributed.

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

2. Installation:

2.1. General

2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).

2.1.2. Protect from freezing or flooding.

2.1.3. Allow adequate space for servicing and ventilation.

2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

CAUTION

Never draw piping into place by forcing the pump suction and discharge connections.

2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units:

2.2.1. Units may be installed horizontally, inclined or vertically.

CAUTION

Do not install with motor below pump. Any leakage or condensation will affect the motor.

2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units:

2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Fig 1.

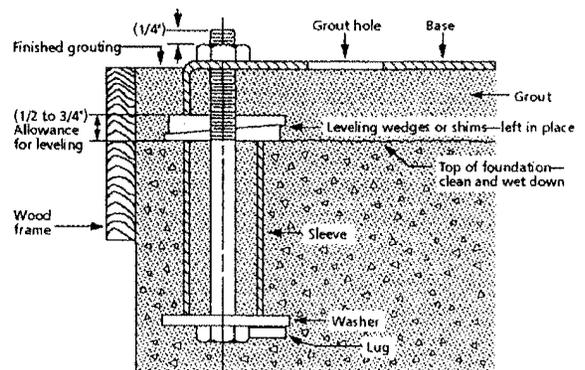


Figure 1

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. Suction Piping:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply:

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

CAUTION

Do not use suction isolation valve to throttle pump.

3.5. Installation with pump above source of supply:

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figs. 2-5

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

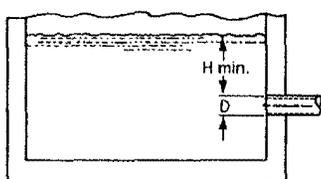


Figure 2

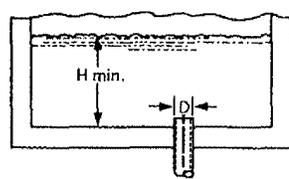


Figure 3

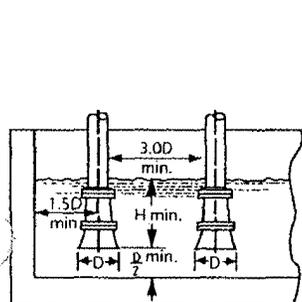


Figure 4

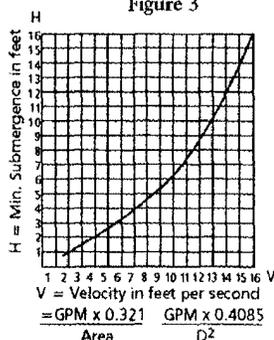


Figure 5

4. Discharge Piping:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. Motor-To-Pump Shaft Alignment:

5.1. Close-Coupled Units:

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units:

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Fig. 6.

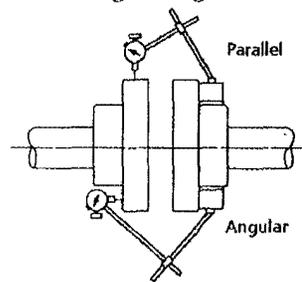


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

CAUTION

Always recheck both alignments after making any adjustment.

6. Rotation:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. Operation:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

CAUTION

Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. Maintenance:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units:

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. Disassembly:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End:

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

CAUTION

Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

CAUTION

Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame:

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 & 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 & 168).

10. Reassembly:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame:

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end:

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

CAUTION

Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. Trouble Shooting Chart:

MOTOR NOT RUNNING

(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:

(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:

(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:

(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

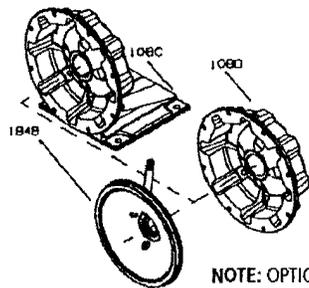
PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged.
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
Suction lift too high or suction losses excessive.
Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

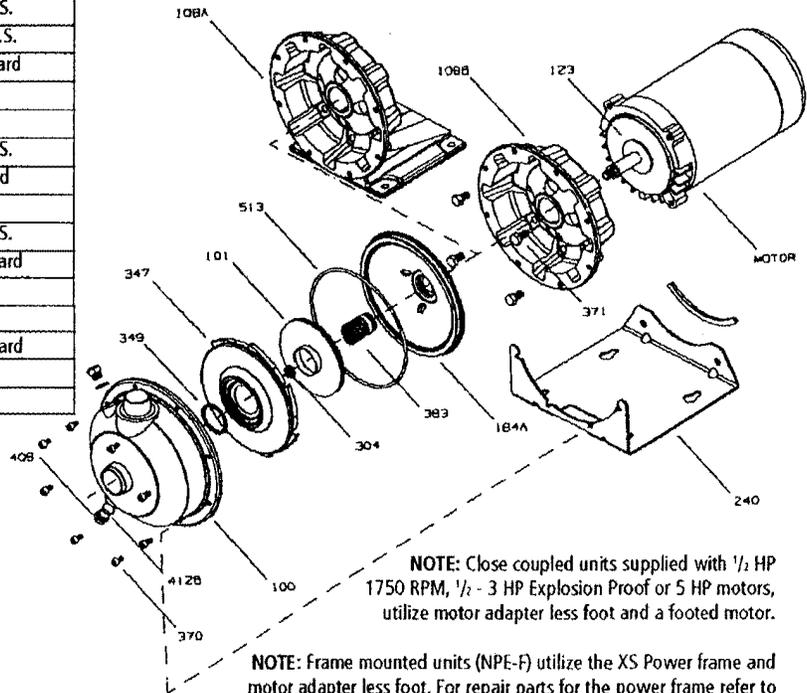
NPE Standard Repair Parts List

Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and Flush	
108D	Motor adapter less foot with Flush	BUNA-N
123	Deflector	AISI 316L S.S.
184A	Seal housing std.	300 S.S.
184B	Seal housing with seal flush	
240	Motor support	Rubber
304	Rubber channel	AISI 316 S.S.
347	Impeller locknut	AISI 316L S.S.
349	Guidevane	Viton Standard
370	Seal-Ring, guidevane	EPR
371	Socket head screw, casing	BUNA
383	Bolts, motor	AISI 410 S.S.
408	Mechanical seal	Steel/plated
412B	Drain and vent plug, casing	AISI 316 S.S.
513	O-Ring, drain plugs	Viton, standard
		EPR
		BUNA
513	O-Ring, casing	Viton, standard
		EPR
		BUNA

Item 383 Mechanical Seal (1/4" seal)				
Rotary	Stationary	Elastomers	Metal Parts	Part No.
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



NOTE: Close coupled units supplied with 1/2 HP 1750 RPM, 1/2 - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

- (a) Labor, transportation and related costs incurred by the dealer;
- (b) Reinstallation costs of repaired equipment;
- (c) Reinstallation costs of replacement equipment;
- (d) Consequential damages of any kind; and,
- (e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

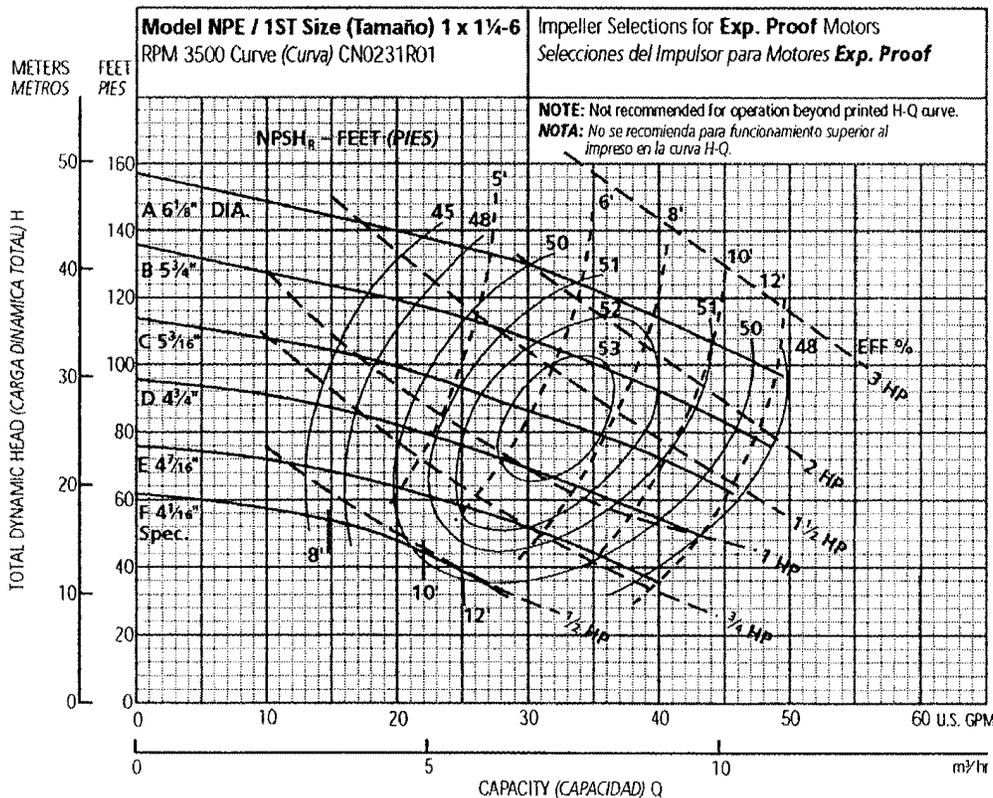
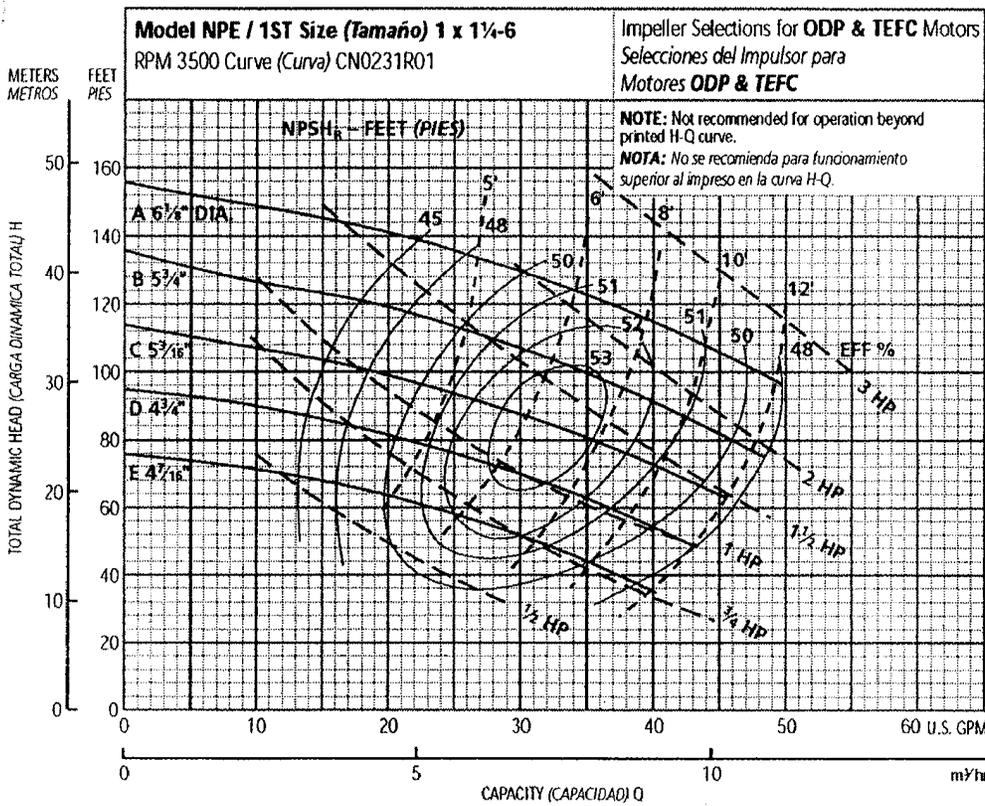
- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- (3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

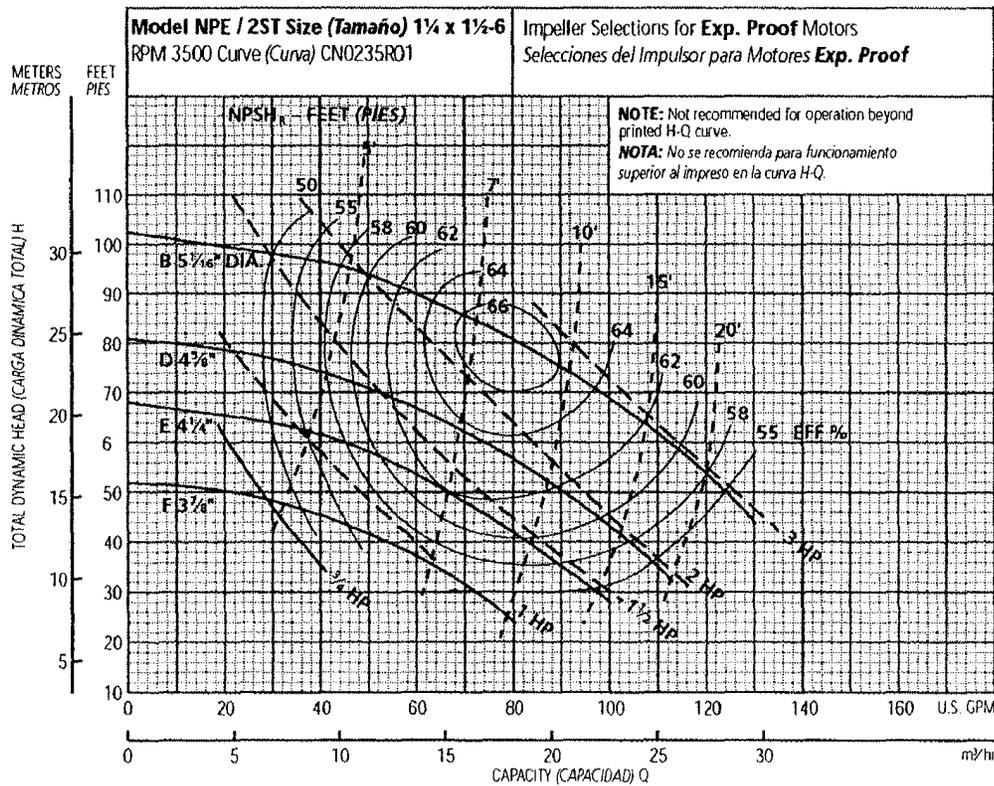
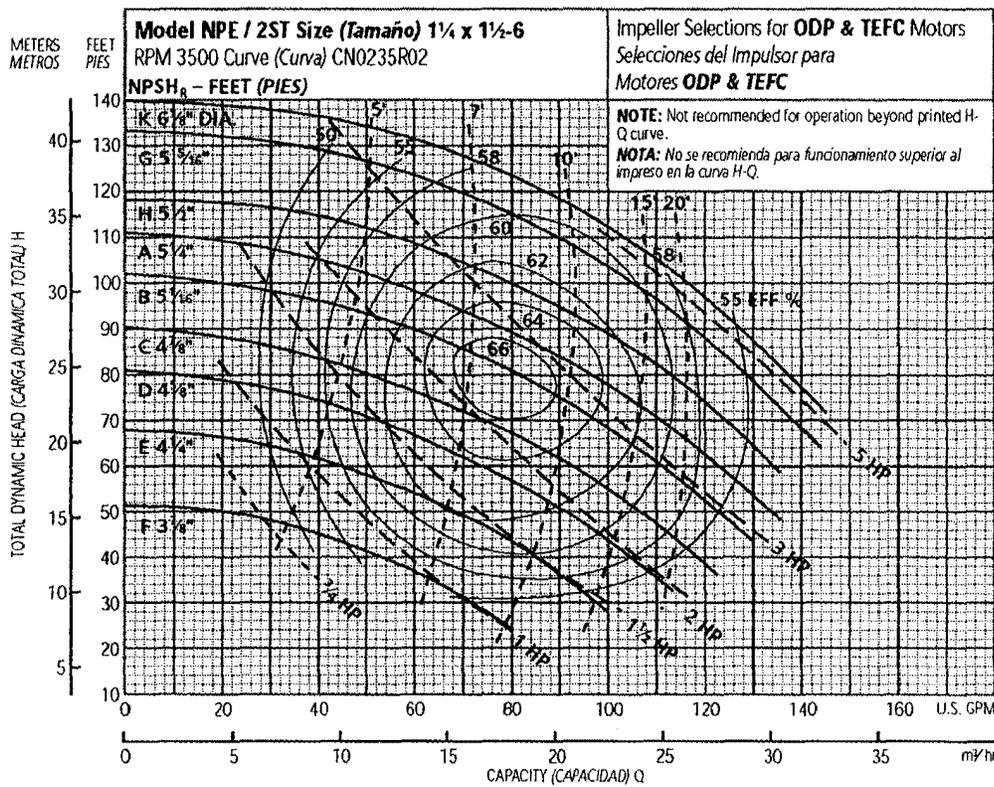
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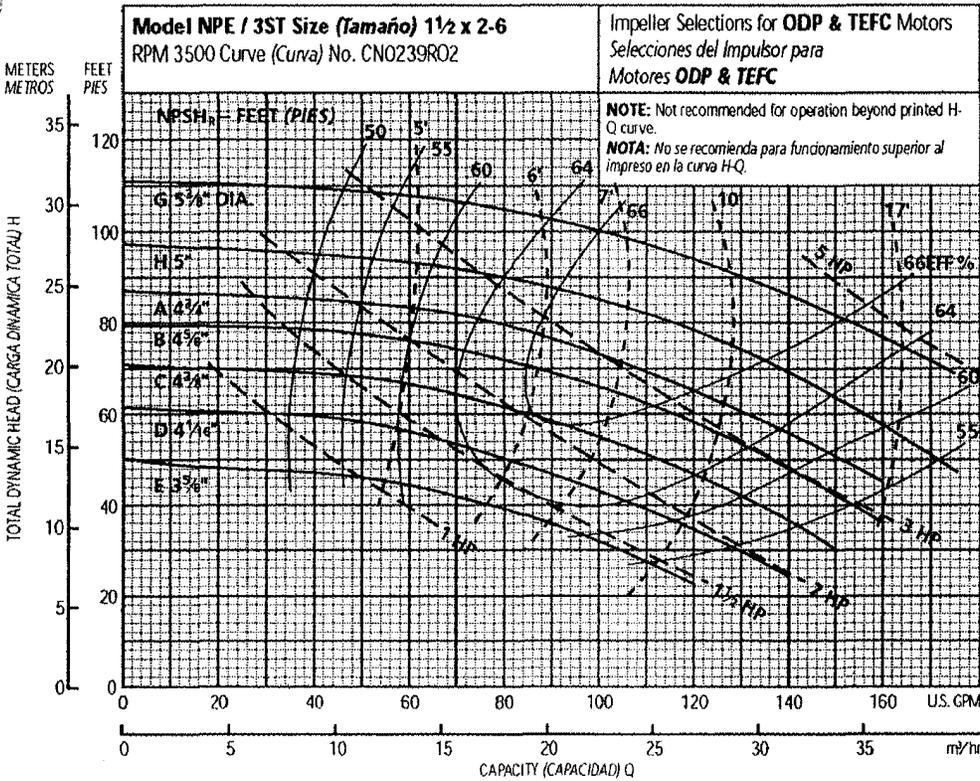
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Repair Parts

MODEL

NPE/NPE-F



TABLE OF CONTENTS

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Impeller Chart by Motor Size at 3500 RPM	4
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NOTE:

For units built before September, 1997
The following upgrades are interchangeable.

- (1) Item 349 Guidevane O-Ring was upgraded from O-Ring to Square Seal Ring.
- (2) Pump Components have been upgraded from 304 SS to 316L SS
- (3) Mechanical Seal upgrades as noted on page 1
- (4) Pump Mounting location for motor adapter with foot to pump support are interchangeable.

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F

SEAL VENT/FLUSH OPTION
MECHANICAL SEAL and O-RING
 4 = Pre-Engineered Standard

For Optional Mechanical Seal modify catalog order no. with Seal Code listed below.

21 Mechanical Seal (% seal)						
Seal Code	Rotary	Stationary	Elastomers	Metal Parts	Part No.	Casing O-Ring
2	Carbon	Sil-Carbide	EPR	316 SS	10K18*	EPR
4			Viton		10K55***	Viton
5	Sil-Carbide		EPR		10K81	EPR
6			Viton		10K62**	Viton

Note: *Replaces obsolete 10K56 **Replaces obsolete 10K29 ***Replaces obsolete 10K46 and 10K24

Impeller Option Code . . . No Adder Required

For Optional Impeller Diameters modify catalog order no. with Impeller code listed below.

Select Optional Impeller Diameter from Pump Performance Curve.

Impeller Code	Pump Size		
	1 x 1¼-6	1¼ x 1½-6	1½ x 2-6
	Diameter	Diameter	Diameter
K		6⅞	
G		5⅝	5⅞
H		5½	5
A	6⅞	5¼	4¾
B	5¾	5⅛	4⅝
C	5⅜	4⅞	4⅝
D	4¾	4⅝	4⅛
E	4⅞	4¼	3⅝
F	4⅛	3⅞	

Note: Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Note: Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

DRIVER

1 = 1PH, ODP 4 = 1 PH, TEFC 7 = 3 PH, XP
 2 = 3 PH, ODP 5 = 3 PH, TEFC 8 = 575 V, XP
 3 = 575 V, ODP 6 = 575 V, TEFC 0 = 1 PH, XP

HP RATING

C = ½ HP F = 1½ HP J = 5 HP
 D = ¾ HP G = 2 HP
 E = 1 HP H = 3 HP

DRIVER: HERTZ/POLE/RPM

1 = 60 HZ, 2 pole, 3500 RPM
 2 = 60 HZ, 4 pole, 1750 RPM
 3 = 60 HZ, 6 pole, 1150 RPM
 4 = 50 HZ, 2 pole, 2900 RPM
 5 = 50 HZ, 4 pole, 1450 RPM

MATERIAL

ST = Stainless Steel

PUMP SIZE

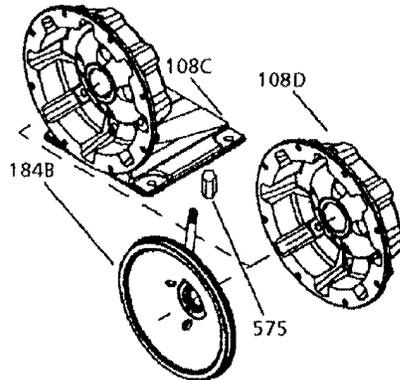
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

For Frame Mounted version, substitute the letters "FRM" in these positions.

NPE STANDARD REPAIR PARTS LIST

Item No.	Description	Materials of Construction	1ST 1 x 1¼	2ST 1¼ x 1½	3ST 1½ x 2	QTY.
100	Casing		1L81	1L82	1L83	1
101	Impeller		See Impeller chart on page 4			1
108A	Motor adapter with foot	AISI 316L SS				1
108B	Motor adapter less foot		1L80			
108C	Motor adapter with foot & flush		1L87			
108D	Motor adapter less foot with flush		1L334			
123	Deflector		BUNA-N	5K7		
184A	Seal housing standard	AISI 316L SS	1L79			1
184B	Seal housing with seal flush		1L333			
240	Motor support	300 SS	4L320			1
	Rubber channel	Rubber	9K188			1
304	Impeller locknut	AISI 316 SS	13K286			1
347	Guidevane	AISI 316L SS	3L23	3L24	3L25	1
349	Seal ring, guidevane	Viton standard	5K269	5K270		1
		EPR	5K273	5K274		
		BUNA	5K271	5K272		
370	Socket head screw, casing	AISI 410 SS	13L65			8
371	Bolts, motor	Steel/plated	13K252			4
383	Mechanical seal		See Mechanical Seal Chart on Page 1			1
408	Drain and vent plug, casing	AISI 316 SS	6L3			2
412B	O-ring, drain plugs	Viton, standard	5L99			2
		EPR	5L80			
		BUNA	5L62			
513	O-ring, casing	Viton standard	5K206			1
		EPR	5K193			
		BUNA	5K4			
575	Pipe Cap	304 SS	6K150			1

NOTE:
OPTIONAL SEAL FLUSH COMPONENTS

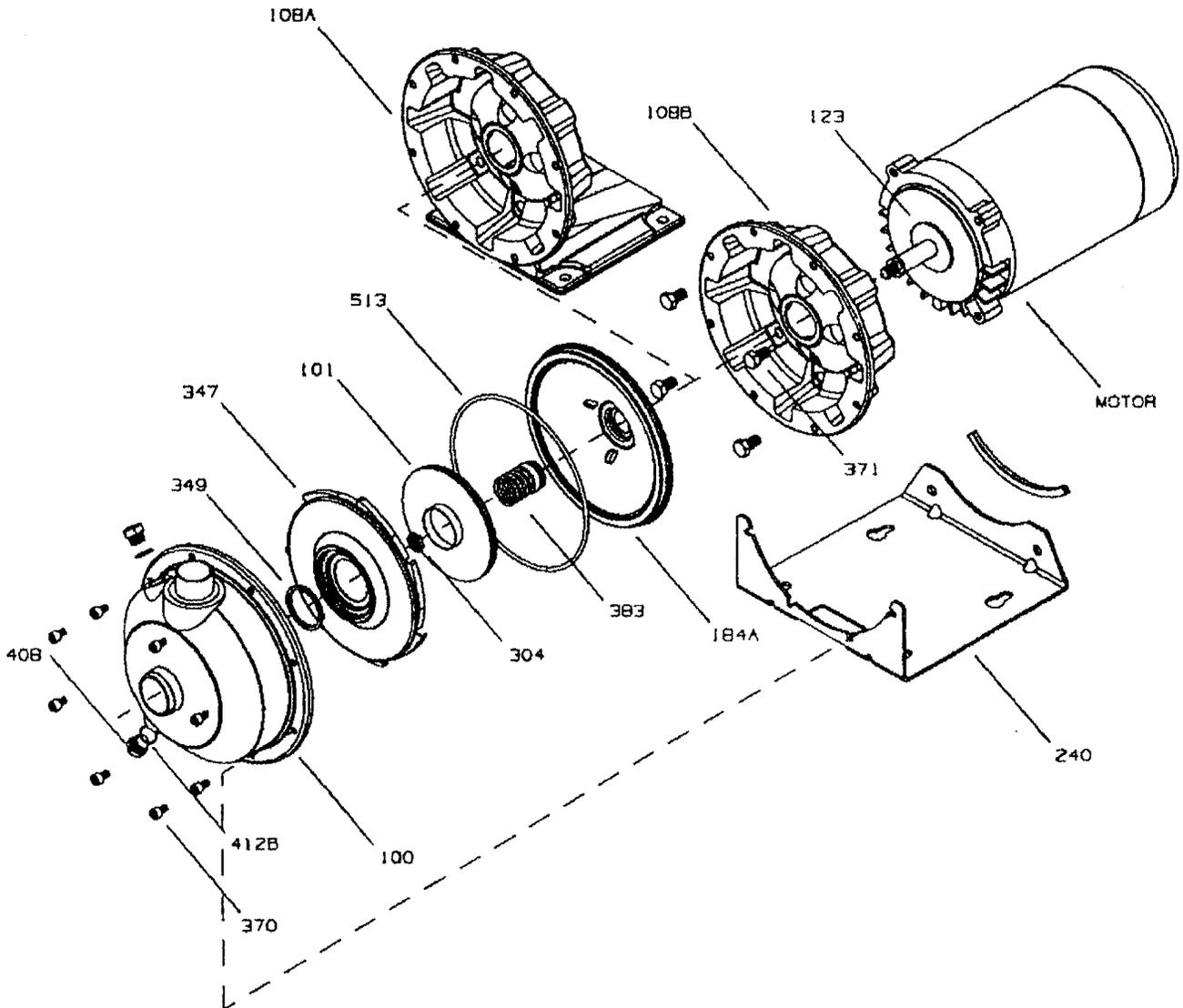


NOTE:

Close coupled units supplied with ½ HP 1750 RPM, ½ - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE:

Frame mounted units (NPE-F) utilize the XS Power Frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



NPE STANDARD IMPELLERS

Impeller Code	Pump Size					
	1 x 1½-6		1¼ x 1½-6		1½ x 2-6	
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.
K			6⅞	2L885		
G			5⅞	2L700	5⅞	2L702
H			5½	2L699	5	2L701
A	6⅞	2L47	5¼	2L48	4¾	2L49
B	5¾	2L44	5⅞	2L54	4⅞	2L58
C	5⅞	2L46	4⅞	2L53	4⅞	2L57
D	4¾	2L42	4⅞	2L52	4⅞	2L56
E	4⅞	2L45	4¼	2L51	3⅞	2L55
F	4⅞	2L59	3⅞	2L50		

NPE STANDARD IMPELLERS BY MOTOR SIZE AT 3500 RPM

For ODP/TEFC Units Built After September 1, 1997

HP	HP Code		1ST	2ST	3ST	
			ODP/TEFC	ODP/TEFC	ODP/TEFC	
½	C	Repair #	2L45			
		Dia.	4⅞			
		Imp. Code	E			
¾	D	Repair #	2L42	2L50		
		Dia.	4¾	3⅞		
		Imp. Code	D	F		
1	E	Repair #	2L46	2L51	2L55	
		Dia.	5⅞	4⅞	3⅞	
		Imp. Code	C	E	E	
1½	F	Repair #	2L44	2L52	2L56	
		Dia.	5¾	4⅞	4⅞	
		Imp. Code	B	D	D	
2	G	Repair #	2L47	2L53	2L57	
		Dia.	6⅞	4⅞	4⅞	
		Imp. Code	A	C	C	
3	H	Repair #	2L47	2L48	2L49	
		Dia.	6⅞	5¼	4¾	
		Imp. Code	A	A	A	
5	J	Repair #		2L700	2L885	2L702
		Dia.		5⅞	6⅞	5⅞
		Imp. Code		G	K	G

For Current Explosion Proof and All Units Built Before September 1, 1997

HP	HP Code		1ST		2ST		3ST	
			ODP	TEFC/EXP	ODP	TEFC/EXP	ODP	TEFC/EXP
½	C	Repair #	2L45	2L59				
		Dia.	4⅞	4⅞				
		Imp. Code	E	F				
¾	D	Repair #	2L42	2L45	2L50			
		Dia.	4¾	4⅞	3⅞			
		Imp. Code	D	E	F			
1	E	Repair #	2L46	2L42	2L51	2L50	2L55	
		Dia.	5⅞	4¾	4¼	3⅞	3⅞	
		Imp. Code	C	D	E	F	E	
1½	F	Repair #	2L44	2L46	2L52	2L51	2L56	2L55
		Dia.	5¾	5⅞	4⅞	4¼	4⅞	3⅞
		Imp. Code	B	C	D	E	D	E
2	G	Repair #	2L47	2L44	2L53	2L52	2L57	2L56
		Dia.	6⅞	5¾	4⅞	4⅞	4⅞	4⅞
		Imp. Code	A	B	C	D	C	D
3	H	Repair #	2L47	2L47	2L48	2L54	2L49	2L58
		Dia.	6⅞	6⅞	5¼	5⅞	4¾	4⅞
		Imp. Code	A	A	A	B	A	B
5	J	Repair #			2L700	2L885		2L702
		Dia.			5⅞	6⅞		5⅞
		Imp. Code			G	K		G

Note:** Max. Explosion Proof rating is 2 HP.

NPE CLOSE-COUPLED MOTORS

MODEL NPE 3500 RPM

HP	Single-Phase, 60 Hz, 115/230 V**, 56J Frame								
	Open, Drip-Proof ^⓪			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04853S	10.0/5.0	16	E04821	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854	26.8/13.4	36	E08821	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854	14.0	40	E09821	11.89	44			
5	E10754	14.4	55						

Note:** 3 and 5 HP Single-Phase motors are 230 V only.

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ^⓪			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04873	2.6/1.3	19	E04876	1.9/0.95	18	BBC04875	1.9/0.95	27
¾	E05873	3.4/1.7	19	E05876	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873	4.2/2.1	22	E06876	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878	5.8/2.9	25	E07876	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874	6.9/3.3	39	E08876	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874	7.2/3.6	31	E09876	7.6/3.8	37			
5	E10774	7.2/14.4	50	E10876	6.2/12.4	48			

⓪ For vertical mounting order motor canopy separately - 9K272 for ½, ¾ and 1 HP single phase or 9K273 for all other ODP motors.

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof ^⓪			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ^⓪			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/8	20	BBC04835	1.77/1.6/8	45

Note: Explosion Proof Motors are class 1 and 2, Group D

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS



SPECIFICATIONS

Dimensions: 4-3/4" dia. x 2-3/16" deep.

Weight: 1 lb. 2 oz.

Finished: Baked dark gray enamel.

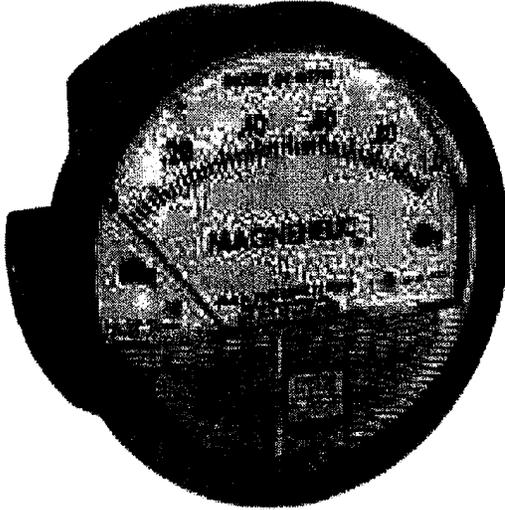
Connections: 1/8" NPT high and low pressure taps, duplicated, one pair side and one pair back.

Accuracy: Plus or minus 2% of full scale, at 70°F. (Model 2000-0, 3%; 2000-00, 4%).

Pressure Rating: 15 PSI (0,35 bar)

Ambient Temperature Range: 20° to 140°F (-7 to 60°C).

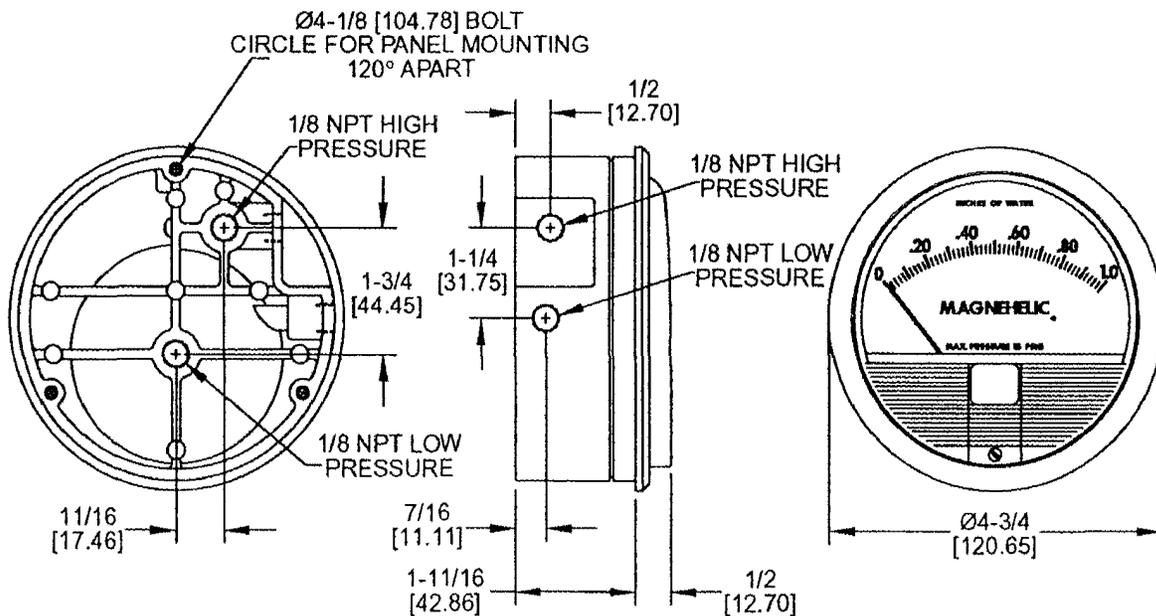
Standard gage accessories include two 1/8" NPT plugs for duplicate pressure taps, two 1/8" NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.



Caution: For use with air or compatible gases only.

For repeated over-ranging or high cycle rates, contact factory.

Not for use with Hydrogen gas. Dangerous reactions will occur.

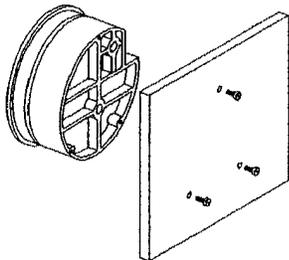


MAGNEHELIC® INSTALLATION

1. Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F. Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.

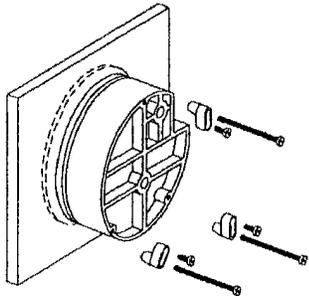
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range Model 2000-00 and metric equivalents must be used in the vertical position only.

3. Surface Mounting



Locate mounting holes, 120° apart on a 4-1/8" dia. circle. Use No. 6-32 machine screws of appropriate length.

4. Flush Mounting



Provide a 4-9/16" dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place. To mount gage on 1-1/4"-2" pipe, order optional A-610 pipe mounting kit.

5. To zero the gage after installation

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

Operation

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.

Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.

Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.

When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8" pipe thread to rubber tubing adapter and connect to source of pressure with rubber or Tygon tubing.

B. For permanent installation, 1/4" O.D., or larger, copper or aluminum tubing is recommended. See accessory bulletin S-101 for fittings.

Ordering Instructions:

When corresponding with the factory regarding Magnehelic® gage problems, be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service.

MAINTENANCE

Maintenance: No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves, (bulletin S-101), should be used in permanent installations.

Calibration Check: Select a second gage or manometer of known accuracy and in an appropriate range. Using short lengths of rubber or vinyl tubing, connect the high pressure side of the Magnehelic gage and the test gage to two legs of a tee. Very slowly apply pressure through the third leg. Allow a few seconds for pressure to equalize, fluid to drain, etc., and compare readings. If accuracy unacceptable, gage may be returned to factory for recalibration. To calibrate in the field, use the following procedure.

Calibration:

1. With gage case, held firmly, loosen bezel, by turning counterclockwise. To avoid damage, a canvas strap wrench or similar tool should be used.
2. Lift out plastic cover and "O" ring.
3. Remove scale screws and scale assembly. Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument. Make further adjustments as necessary.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulfide compound.

Warning: Attempted field repair may void your warranty. Recalibration or repair by the user is not recommended. For best results, return gage to the factory. Ship prepaid to:

Dwyer Instruments, Inc.
Attn: Repair Dept.
102 Indiana Highway 212
Michigan City, IN 46360

Trouble Shooting Tips:

**Gage won't indicate or is sluggish.*

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F, order gage with low temperature, (LT) option.

**Pointer stuck-gage can't be zeroed.*

1. Scale touching pointer.
2. Spring/magnet assembly shifted and touching helix.
3. **Metallic particles clinging to magnet and interfering with helix movement.**
4. Cover zero adjust shaft broken or not properly engaged in adjusting screw.

We generally recommend that gages needing repair be returned to the factory. Parts used in various sub-assemblies vary from one range of gage to another, and use of incorrect components may cause improper operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

Use with air or compatible gases only.

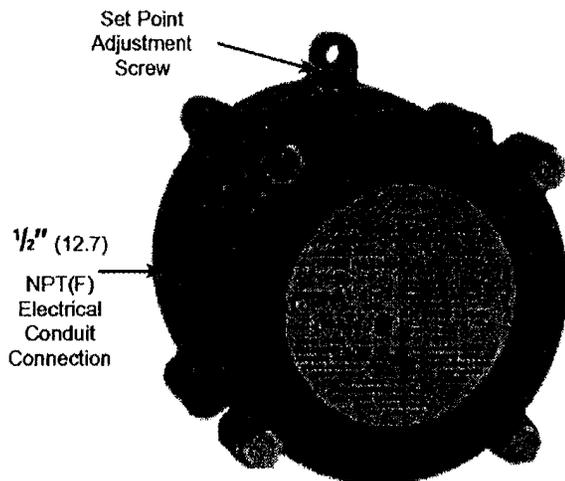
QED pln EZ-LOWP - Dwyer pln 1950-1

Kit Includes Pressure Switch, Fitting, Barb & Tubing



Series 1950 - Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions



UL and CSA Listed, FM Approved For

CL. I GR. C, D - CL. II GR. E, F, G - CL. III

Series 1950 Switches

Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.6

Model Number	Operating Range: PSI	Approximate Dead Band	
		Min. Set Point	Max. Set Point
1950P-2	0.5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Dwyer Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION

For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

NOTE: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; 1/8 H.P. 125 VAC; 1/4 H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton*.

PHYSICAL DATA

Temperature Limits: -40° to 140°F (-40° to 60°C); 1950P-8, -15, -25, -50: 0° to 140°F (-17.8° to 60°C); 1950-02: -30° to 130°F (-34.4° to 54.4°C).

Rated Pressure: 1950: 45 in. w.c. (0.1 bar); 1950P: 35 psi (2.4 bar); 1950P-50 only: 70 psi (4.8 bar).

Maximum Surge Pressure: 1950: 10 psi (0.7 bar); 1950P: 50 psi (3.4 bar); 1950P-50 only: 90 psi (6.2 bar).

Pressure Connections: 1/8" NPT(F).

Electrical Rating: 15A, 125, 250, 480 volts, 60 Hz. AC Resistive 1/8 H.P. @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. AC.

Wiring Connections: 3-screw type; common, normally open and normally closed.

Conduit Connections: 1/2" NPT(F).

Set point adjustment: Screw type on top of housing, field adjustable.

Housing: Anodized cast aluminum.

Diaphragm: Molded fluorosilicone rubber, 02 model: silicone on Nylon.

Calibration Spring: Stainless Steel

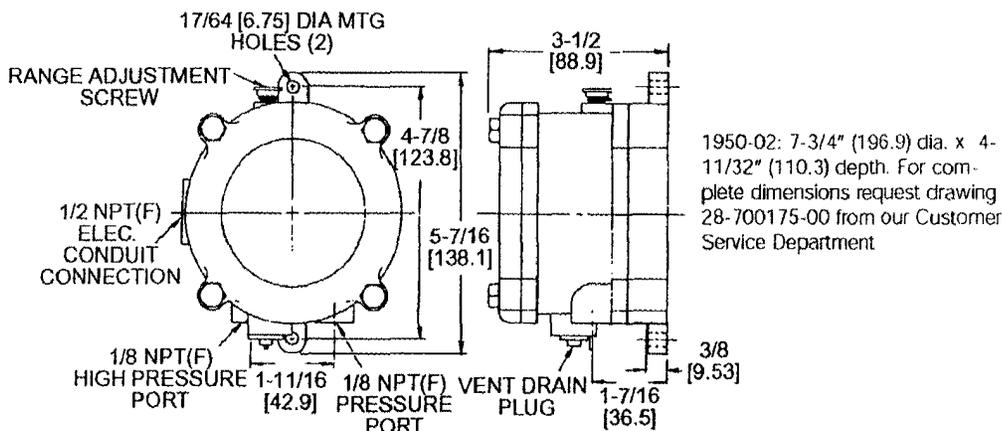
Installation: Mount with diaphragm in vertical position.

Weight: 3 1/4 lbs (1.5 kg), 02 model; 4 lbs, 7 oz. (2 kg).

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

Series 1950 – Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions



1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" NPT(F) pressure ports as noted below:

- A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.
- B. Pressure only (above atmospheric pressure) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.
- C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked "COM" (common), "NO" (norm open), "NC" (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point.

Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

1. Remove the plastic cap and turn the slotted Adjust-ment Screw at the top of the housing clockwise to raise the set point pressure and counter-clockwise to lower the set point. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.

Warrick®

Series M Mechanical Tilt Float Switch

Installation and Operation Bulletin

Specifications

Cord	16 gauge, 2 or 3 conductor SJOW, Oil Resistant CPE
Contact Rating	13 amp @ 120/240 VAC, 1/2hp
Contact Design	SPST, Normally Open or Normally Closed, Common with N.O. & N.C. (Form C)
Temperature Rating	32°F to 140°F (0°C to 60°C)
Overall Weight	1.0 lbs. (not including weight)
Tether Method	Tie-wrap nylon, weight: 2.5 lbs.
Approvals	U.L. Recognized, CSA Certified

Installation

Tether Tie-Wrap (Fig 1)

Attach cord, using a tie-wrap, to a stationary structure. This is known as the tether point, it will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

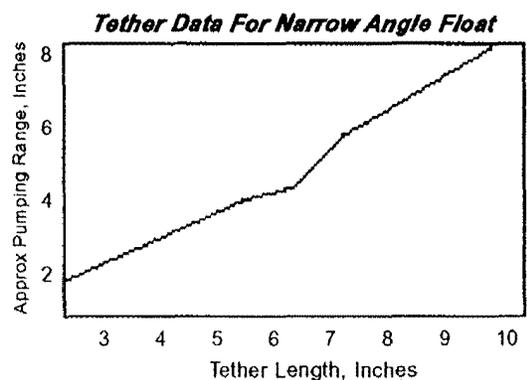
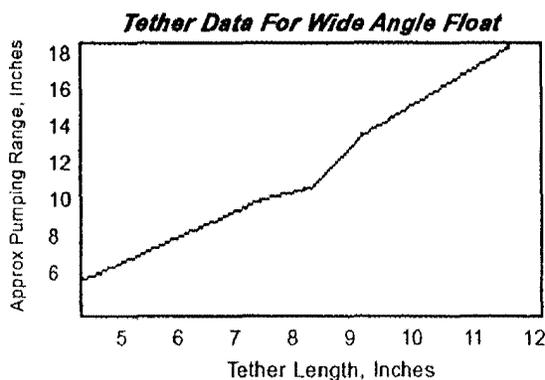
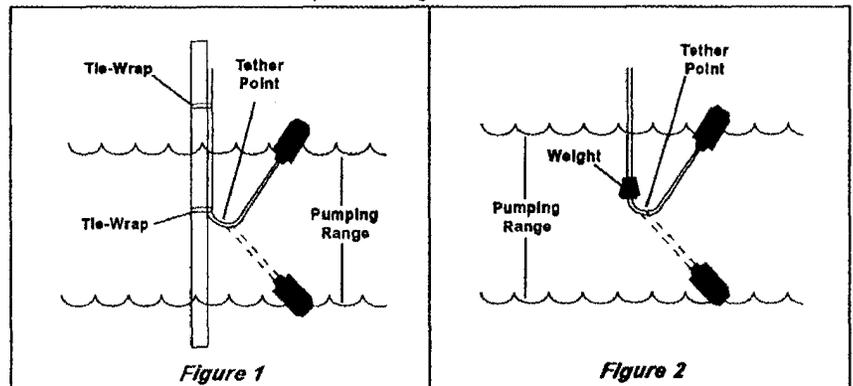
Tether-Weight (Fig 2)

Place tension-brand over the cord before installation. Place the weight at the desired position and secure with the tension-band. This position will determine the pumping range. The farther the float is placed from the tether point, the greater the pumping range. The minimum distance that the float should be placed from the tether point is 3 inches.

Notes:

1. To Prevent Motor Burnout - In a pumpdown application make sure the turn-off level is at least 2 inches above the intake of the submersible pump.
2. Securing Tether Points - Make sure levels are correct and that floats are free from any obstructions before securing tether points.
3. When using Tether Weight - Place the tension-band over the cord prior to installation.

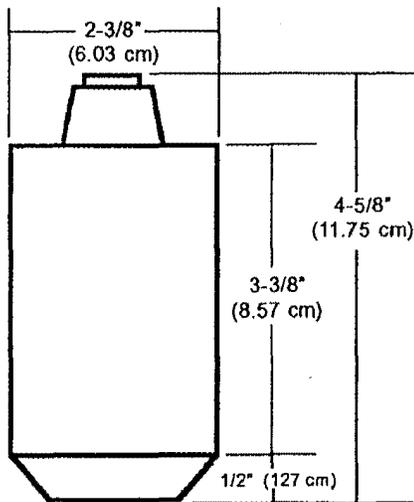
Determine tether point using charts below as a reference



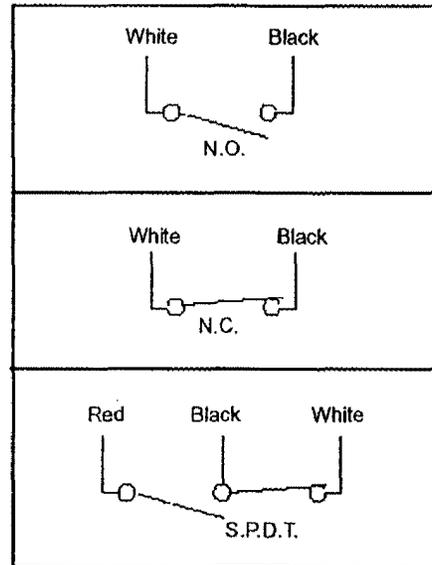
Notes:

1. Narrow angle pumping range is approximately 2 Ft. to 8 Ft.
2. Wide angle pumping range is approximately 5 Ft. to 18 Ft.

Dimensions



Contact Configurations



Important Points:

- Gems products must be maintained and installed in strict accordance with the National Electrical Code and the applicable Gems Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- For hazardous area applications involving such things as, but not limited to, ignitable mixtures, combustible dust and flammable materials, use an appropriate explosionproof enclosure or intrinsically safe interface device.
- Please adhere to the pressure and temperature limitations shown throughout this catalog for our level and flow sensors. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of Gems products. Take care in the proper selection of materials of construction, testing is required.
- NSF-approved sensors are made of materials approved for potable water applications according to Standard 61.
- Stainless steel is generally regarded as safe by NSF and FDA.
- Life expectancy of switch contacts varies with application. Contact Gems if life cycle testing is required.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

Return Policy

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Authorization (RA) number. Return the goods - freight prepaid - in the original container and include original packing slip. C. O. D. returns are not accepted. Gems reserves the right to apply restocking charges.

Tel: 860-793-4357
Fax: 860-793-4563



Gems Sensors Inc.
One Cowles Road
Plainville, CT 06062-1198
Tel: 860-793-4579
Fax: 860-793-4580



**Parts Order
UNC Waste site**

August 2006

***OPERATION AND MAINTENANCE
MANUALS***

Manual# WO-001315

Prepared for:
ARCADIS – RALEIGH
801 Corporate Center Dr
Suite 300
Raleigh, North Carolina

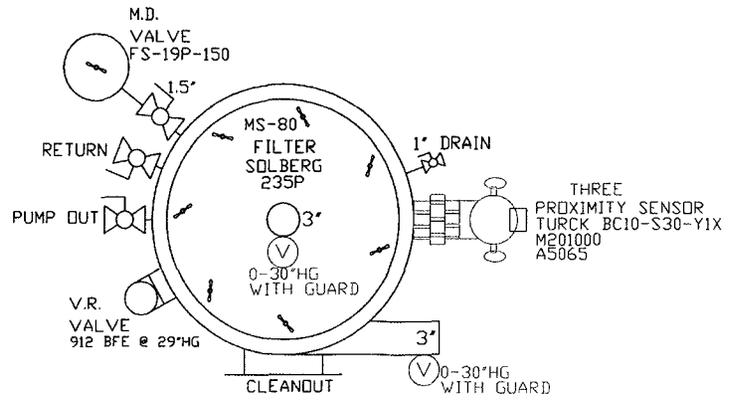
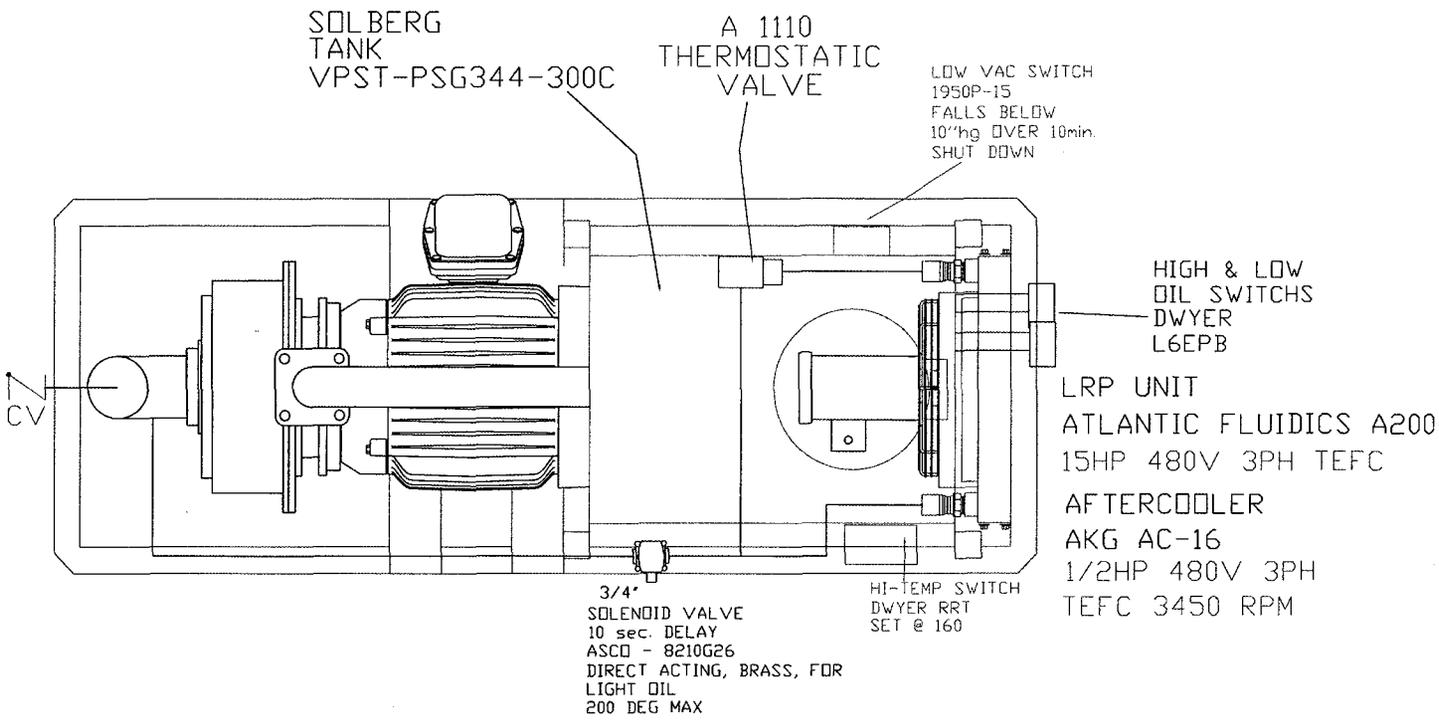
Prepared by:
Product Recovery Management
1705 New Raleigh Road
Durham, North Carolina 27703
(919) 957-8890

Model Numbers, Serial Numbers, Replacement Part Numbers:

COMPONENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	REPLACEMENT ELEMENT P/N	
Dual Phase Pump	Atlantic Fluidics	A 200	012748	PSG34412	
15Hp LRP Motor	Baldor	10N24W413G1	C0604260217		
Separator Unit	Solberg	VPSTPSG34412300C	N/A		
Low oil switch	Dwyer	L6EPB			
Aftercooler	AKG	AC 16-3-R			
Aftercooler motor	Lesson	N71T34FZ3A			
Temp Valve	Fluid Power Ener	A1110	071705		
Temp Switch	Dwyer	RRT	N/A		
Solenoid Valve	ASCO	8210 G95			
Moisture Separator	PRM	MS-80			
In-tank filter	Solberg	235P			235P
Auto vac relief valve	Kunkle	912BFE			
Low vac switch	Dwyer	1950-15-2F	N/A		
Dilution air filter	Solberg	FS-19P-150		19P	

All replacement parts and materials are available from Product Recovery Management as well as the manufacturer or manufacturers' representative.

Figures



ARCADIS - RALEIGH AIRPORT RD. UNC WASTE SITE PARTS ORDER	
PRM PRODUCT RECOVERY MANAGEMENT <small>a division of Philips Electric Company of Durham, Inc.</small> <small>This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM.</small>	
FIGURE	1
DRAWN	WO-001315
CHECKED	6/06
G.A.C.	N/A
REV #	1

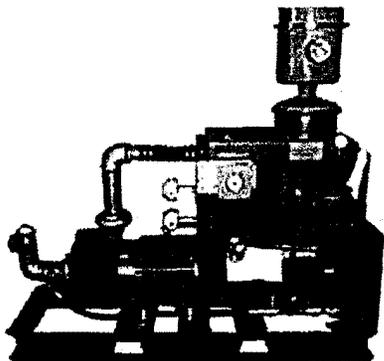
APPENDIX A

LRP Unit and MS tank

Dual Phase Extraction (DPE)

Dual Phase Extraction

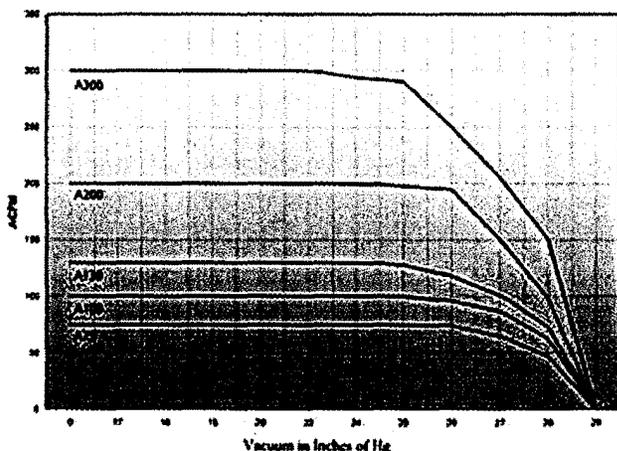
PRM manufactures complete dual phase extraction remediation equipment specifically designed for extraction of contaminated air and groundwater from the subsurface. These units are designed to operate from 8-28" Hg vacuum. PRM uses the Tuthill Atlantic Fluidics pump and incorporates it into an oil-sealed package that is extremely forgiving and has almost no oil blow-by as is typical with many of the competing units on the market.



Standard Specification:

- Heavy duty, long life pump head
- Integral Heat Exchanger with automated thermostatic bypass
- All oil recirculation hose made from factory hydraulic hose assemblies for long life
- High Temperature safety shutdown switch
- Low oil level safety shutdown switch
- Oil sealed for quiet, smooth, trouble free operation
- Oil discharge recirculation tank and oil mist elimination filters integral to tank.
- Filtration differential pressure gauge
- Integral oil recirculation control solenoid valve
- Seal Oil-Inland 99 liquid ring pump oil which exhibits excellent pump down and exceptional performance in the presence of water.
- Inlet check valve to prevent oil backflow during shutdowns
- Heavy duty painted steel frame with forklift provisions

Flow Curve

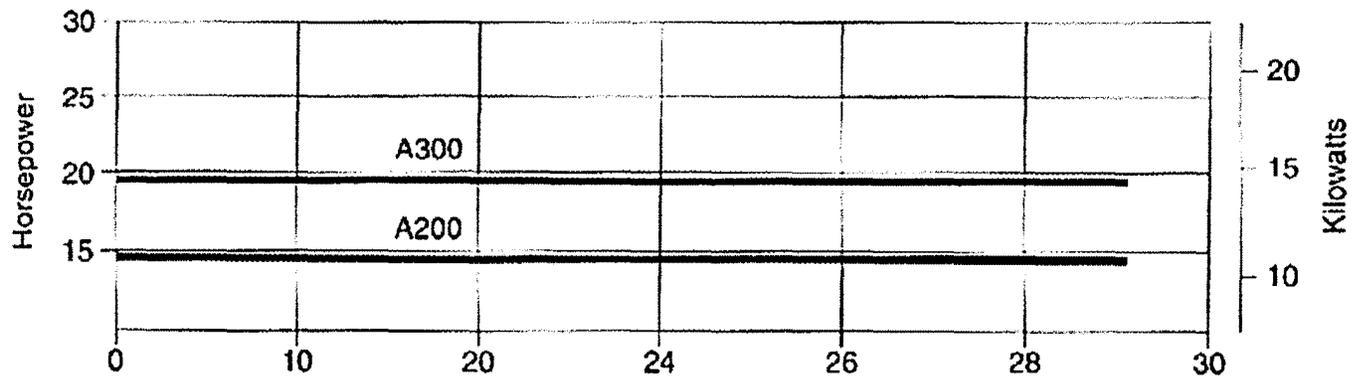
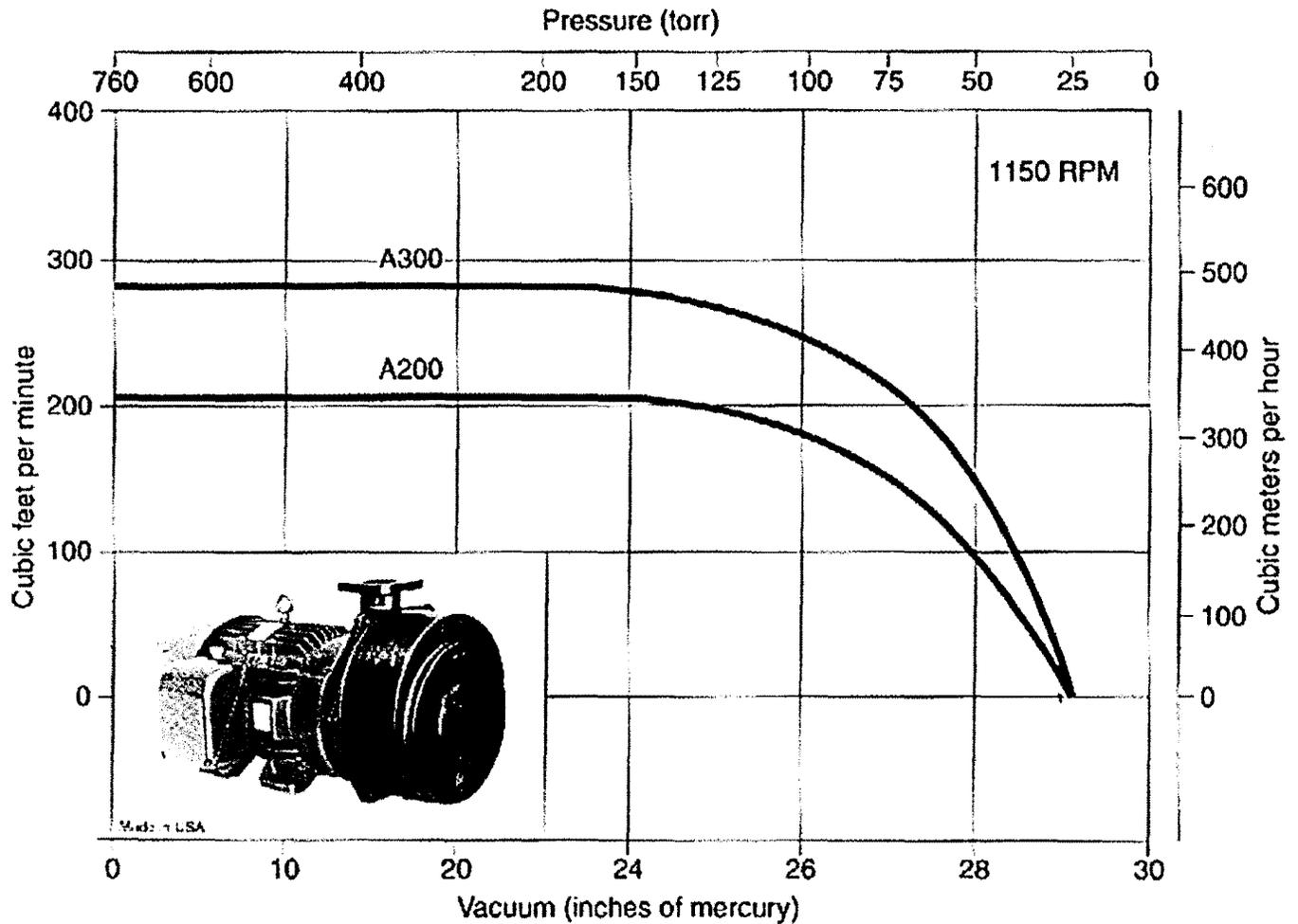


Options:

- Inland 98 Full Synthetic liquid ring pump oil for corrosive applications or where increased oil life and decreased pump wear is required
- High Level Oil switch which will shut down the liquid ring pump if overfilled or if too much water is ingested by the pumps
- Secondary downstream oil filtration for critical applications.

Model #	A75	A100	A130	A200	A300	A600
HP	5HP	7.5HP	10HP	15HP	20HP	40HP
Flow Rating@ 20" Hg (ACFM)	75	100	130	200	300	560
Dimensions	24"x48"	24"x48"	24"x60"	24"Wx64"L	24"Wx64"L	48"Wx72" L
Oil Capacity	10 gallons	10 gallons	12 gallons	14 gallons	14 gallons	30 gallons
Standard Conn.	2" NPT	2" NPT	2" NPT	3" NPT	3" NPT	6" FLANGE
Approx. Weight	500#	600#	750#	1200#	1400#	3000#

Dry air performance curves for Fluid-Vac[®] single stage vacuum pumps



Performance curves are based on dry air at 68°F (20°C), 60°F (15°C) seal water, and 29.92 inches of mercury (760 torr) barometric pressure.

Water Consumption: A200 6 - 8 gpm
A300 8 - 10 gpm

21 South Street, South Norwalk, CT 06854 (203) 853-7315 Fax (203) 866-8218

www.atlanticfluidics.com

atlantic fluidics®

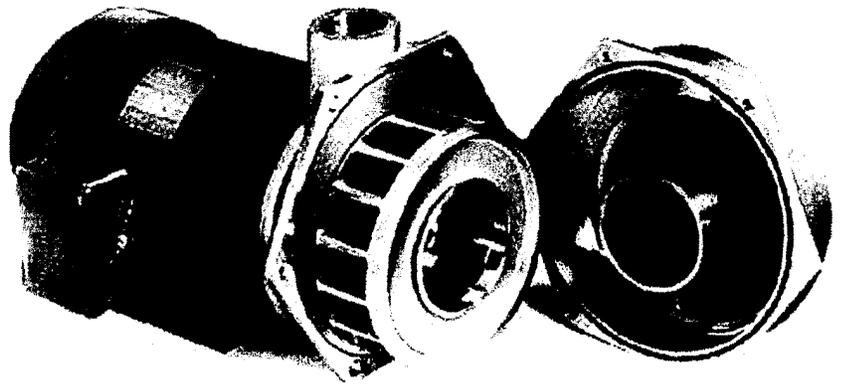
Axial Flow, Liquid Ring Vacuum Pumps

Models

Single Stage: A5 A10 A15 A20 A75 A100 A130 A200 A300

Two Stage: T0505 T1505 T2010 T7530 T10030

INSTALLATION OPERATION MAINTENANCE SERVICE MANUAL



WARNING

DO NOT OPERATE BEFORE
READING MANUAL.

ADVANCING THE STANDARDS IN VACUUM TECHNOLOGY



TUTHILL
Vacuum & Blower Systems

21 South Street
Norwalk, Connecticut USA 06854-2602
Tel 203 853-7315 800 825-6937 Fax 203 866-8218
E-mail: atlanticfluidics@tuthill.com

04/2003

<http://www.tuthillvacuum.com>

SAVE WATER, TIME AND MONEY WITH ATLANTIC FLUIDICS® SEALANT RECOVERY SYSTEMS

In applications where water is costly, scarce or unavailable, **atlantic fluidics®** Sealant Recovery Systems provide simple, compact and environmentally safe options for recirculating seal water and storing waste.

THE BASIC SYSTEM

The standard configuration for recirculating seal water is to pipe the pump discharge into a small separator tank where non-condensed gas is vented into the atmosphere and the water returned to the pump inlet. By having a tee connection in the inlet piping for the return (rather than through the separate seal water inlet), the pump will draw its own water requirement controlled by a flow restrictor in the return line.

The basic system offered by Tuthill Vacuum & Blower Systems is a completely self-contained pumping system that fits almost anywhere for intermittent or low vacuum use. The package includes a close-coupled pump, baseplate, and stainless steel separator tank with complete seal water and discharge piping.

HEAT EXCHANGERS

For continuous high vacuum use, a heat exchanger is recommended to counter the temperature rise from the heat of compression. Higher seal water temperatures will increase the partial vapor pressure inside the pump and limit high vacuum performance. Used in conjunction with water chillers, refrigeration units, fan coils or cooling towers, a properly sized heat exchanger will maintain seal water temperatures for maximum performance.

Depending on the heat to be removed and cooling system available on location, Tuthill Vacuum & Blower Systems will specify or furnish a heat exchanger sized for your application.

OTHER ALTERNATIVES

Among the other options for reusing liquid sealant are partial recirculation systems and specially packaged units using sealants other than water (i.e. oil, solvents, etc.). In a partial recirculation loop, a certain amount of make-up water is fed into the pump to minimize temperature rise yet allow for substantial water savings.

For sealants other than water, be sure to consult Tuthill Vacuum & Blower Systems for assistance with both the pump and recirculation sizing.

Tuthill Vacuum & Blower Systems invites you to inquire about specific, practical and inexpensive methods for reducing your operating costs and for saving that precious natural resource - water.

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INTRODUCTION

CONGRATULATIONS on your purchase of a new **atlantic fluidics**[®] axial flow liquid ring vacuum pump from Tuthill Vacuum & Blower Systems. Please examine the pump for shipping damage, and if any damage is found, report it immediately to the carrier. If the pump is to be installed at a later date make sure it is stored in a clean and dry location and make sure covers are kept on all openings. If pump is stored outdoors be sure to protect it from weather and corrosion.

atlantic fluidics liquid ring vacuum pumps are built to exacting standards and if properly installed and maintained will provide many years of reliable service. We urge you to take time to read and follow every step of these instructions when installing and maintaining your pump. We have tried to make these instructions as straightforward as possible as we realize getting any new piece of equipment up and running in as little time as possible is imperative to production.

WARNING: Serious injury can result from operating or repairing this machine without first reading the service manual and taking adequate safety precautions.

LIQUID RING VACUUM PUMPS- PRINCIPLE OF OPERATION

The liquid ring vacuum pump removes gases by means of an impeller rotating freely in an eccentric casing. The pumping is done by a liquid, usually water, that is fed into the pump and thrown by centrifugal force into a moving ring along the casing or cover wall.

When gas or vapor enters the suction port, it is trapped by the whirling impeller blades and a liquid piston that expands in the eccentric lobe of the casing. As the impeller rotates, the liquid is then pushed inward by the narrowing space between rotor and casing, compressing the trapped pocket of gas. Finally the compressed gas is released through a discharge port as the impeller completes the revolution.

The direct contact between the liquid ring and the gas makes the pump ideal for wet applications and for handling condensibles that are discharged with the gas and liquid. Unlike rotary vane and piston pumps, the operation of a liquid ring vacuum pump is nearly isothermal and without vibration. There is no oil to be changed or pollutant released into the environment. Because there are no valves and no rubbing parts, a liquid ring pump is virtually maintenance free.

With liquids other than water, vapor pressure in the pump can be reduced for high vacuum or compatibility achieved with specific process gases. In some cases, distillate or another fluid is introduced directly into the suction pump inlet and used as the liquid seal.

Liquid ring pumps are also commonly staged with positive displacement blowers, air and steam ejectors for greater capacity and/or deeper vacuum. Tuthill Vacuum & Blower Systems offers many such staged units, including its patented **atlantic fluidics** two-stage system with rotary blower, liquid ring back up and unique fluid coupling design.

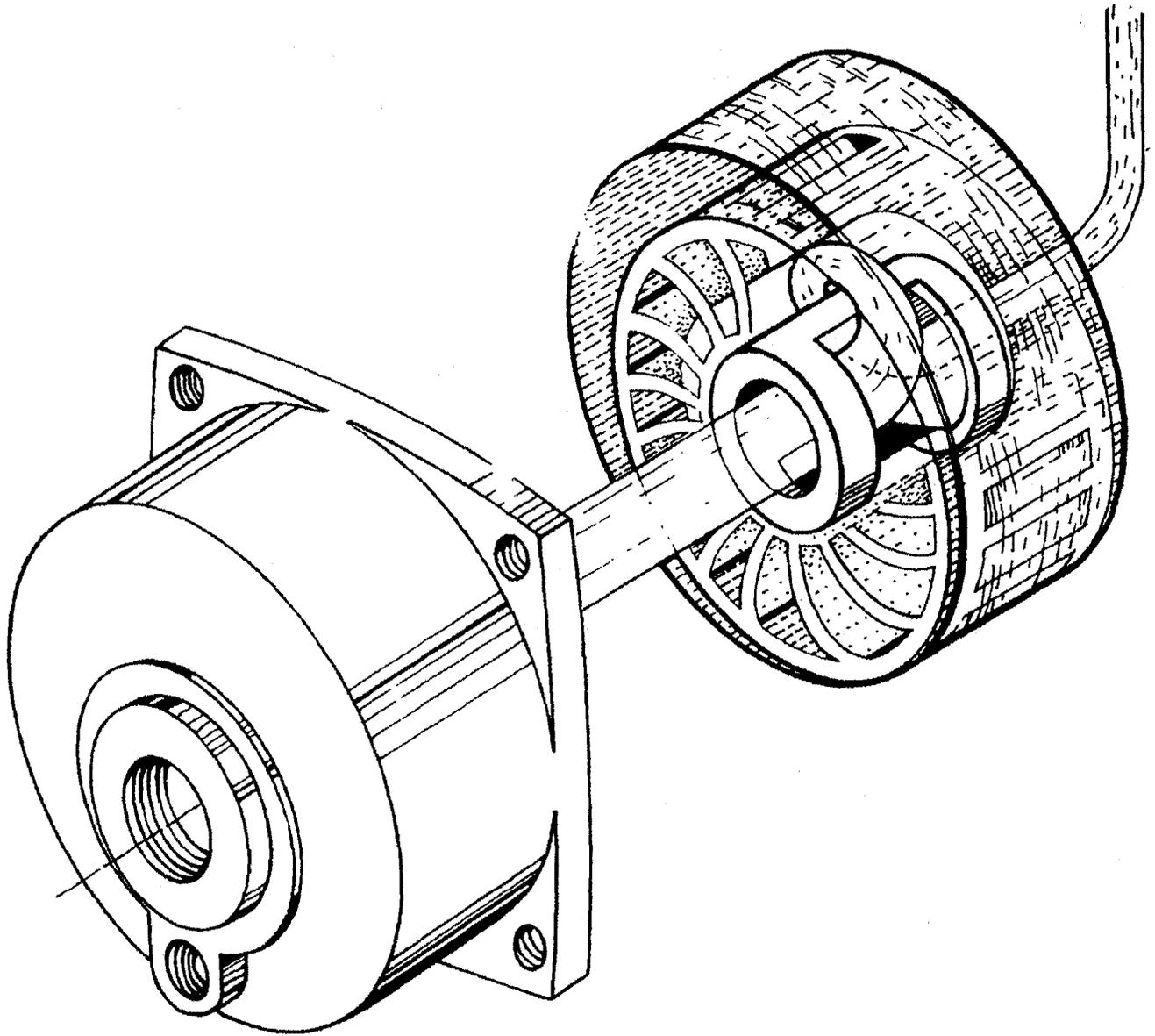
SPECIAL FEATURES

One of the distinguishing features on an **atlantic fluidics** pump is an axial flow design that permits the widest range and highest vacuum of any single-stage liquid ring pump. A fixed port cylinder concentric with the rotor bore directs the gas along the shaft axis, into the suction ports of the rotor, and finally back through the rotor and rear of the pump for discharge.

Because the gas flow is along the motor shaft (and not at right angles), the pump can start in a flooded state without damage and has excellent water handling capacity. The use of a shrouded rotor also increases pumping efficiency for high vacuum and low water consumption. The pump head, close-coupled to a NEMA C-face motor, is extremely compact and requires no interstage manifold as do older style radial flow pumps.

Further advantages to **atlantic fluidics** pumps include the use of modern O-Rings and mechanical Seals rather than gaskets and stuffing boxes, and a replaceable port cylinder for fast in-the-field repair. Available in all bronze, cast iron, stainless steel and other special materials.

atlantic fluidics® Axial Flow Design



WARRANTY

Please refer to the statement on page 14 of this manual for detailed warranty information.

SERVICE AND PARTS

atlantic fluidics® pumps are 100% designed and manufactured in the United States. All parts are maintained in inventory for immediate shipment from our factory in Norwalk, Connecticut. At the back of this manual is a list of parts and recommendations for spares to keep on hand. The reputation of TUTHILL Vacuum & Blower Systems is staked on fast service and practical assistance in designing vacuum systems for specific applications. Specializing in the liquid ring field, the company was created by and for ENGINEERS.

INSTALLATION

LOCATION

Because of its close-coupled design, an **atlantic fluidics**[®] pump is ideal for applications where space is critical. Its vibration-free operation permits direct bolting to the floor or mounting on a baseplate anywhere that is convenient for piping. The standard motors furnished by TUTHILL Vacuum & Blower Systems on **atlantic fluidics** are Totally Enclosed Fan Cooled (TEFC) suitable for areas where the motor may be exposed to water. Special motors are available for hazardous locations.

The pump needs no adjustment, alignment or coupling, guard, etc., and because the pump runs COOL, no special ventilation is necessary — or access for checking sight glasses and oil.

In choosing a location, the main consideration should be the pump's proximity to the vacuum system and convenience for draining discharge and piping the seal water.

GENERAL PIPING INSTRUCTIONS

The Inlet, Discharge and Seal Water Piping require observance of three basic rules:

- A. Piping must be free of all welding shot, slag and other foreign matter that could damage pump.
- B. Piping must be supported independently to avoid stress on pump casing.
- C. Pipe should be of the same diameter as the pipe connections on pump.

VACUUM INLET PIPING

Inlet piping is a simple matter of connecting the pump to the vacuum system. Models A5 and T0505 have a 3/4" NPT connection. Models A10, A15, A20, T1505 and T2010 have a 1" NPT connection on their covers for direct piping.

The larger pumps feature flange faces. An inlet check valve is recommended to prevent vacuum loss and backstreaming when the pump shuts down. Avoid using spring loaded valves not designed for vacuum service.

An optional vacuum gauge can be mounted between the pump and check valve to measure inlet vacuum.

DISCHARGE PIPING

Depending on the application, there are a number of ways to handle the discharged liquid and gas. If there are no pollutants, the simplest scheme is to discharge directly into a drain. An **atlantic fluidics** pump can carry up to a ten-foot discharge head provided the piping from that height is pitched toward a drain or other receptacle. **EXCESSIVE BACK PRESSURE CAN ADVERSELY AFFECT PUMP PERFORMANCE.**

A second method is to run the discharge through a mechanical separator removing water from the gas. Water contaminated by sanitary waste or noxious gas may be recirculated as seal water or discharged into a sanitary sewer or tank. The nature of the contaminant will determine how often recirculated water must be changed.

SEAL WATER PIPING

Unless liquid is pumped directly through the vacuum inlet connection, most applications require separate piping for seal water to enter the pump. The seal water inlet is located directly below the vacuum inlet on the pump's face.

Water, the most widely used liquid seal, can be piped directly from a tap or recirculated from a discharge separator tank. Be sure to specify if seal liquids other than water are to be used and Tuthill Vacuum & Blower Systems will make recommendations regarding compatibility of materials, power requirements, etc.

The following accessories are recommended:

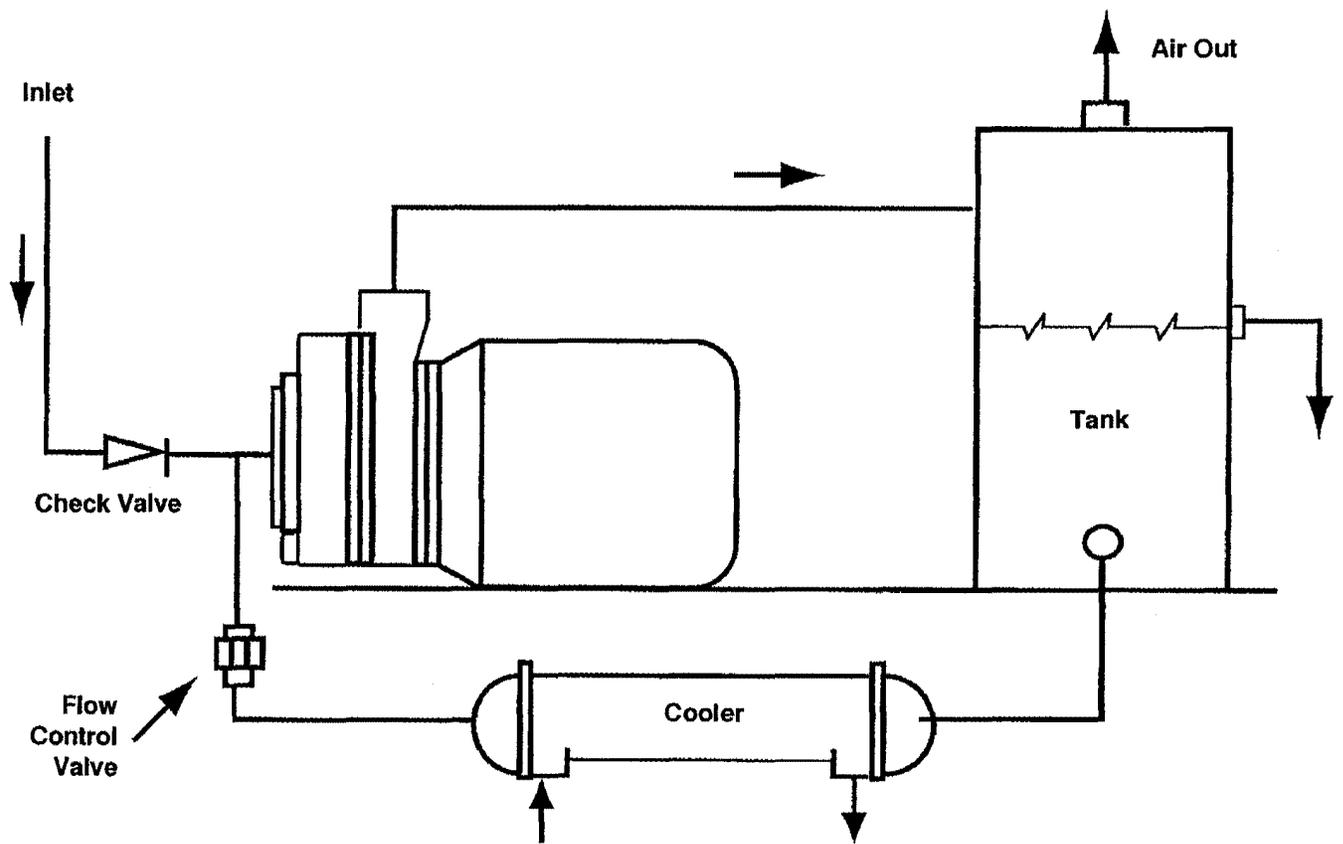
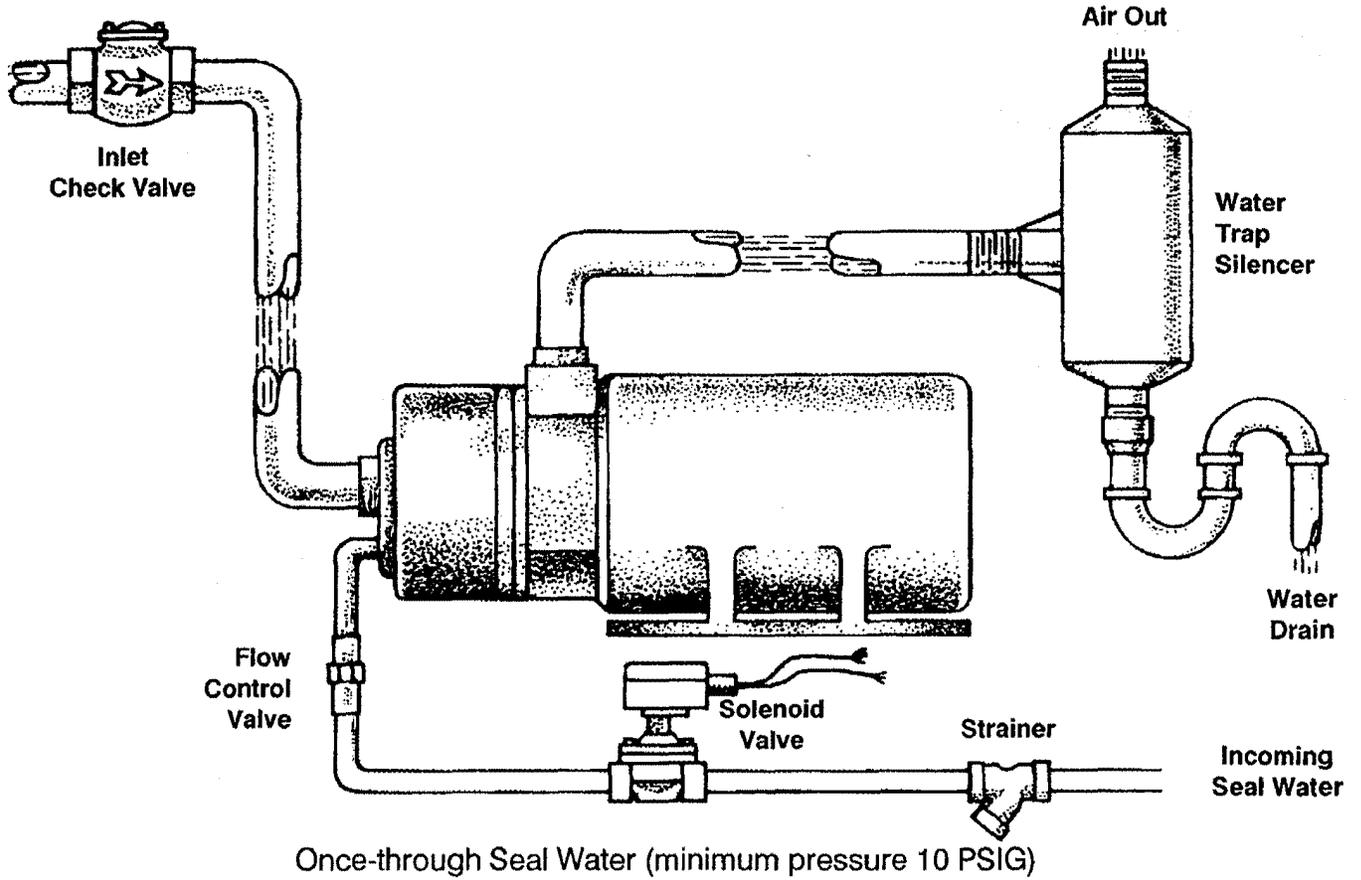
- A. Flow control valve (see Seal Water Requirements)
- B. Solenoid valve (to shut off water when pumping stops)
- C. Strainer (to prevent foreign matter from entering the pump)

For more information about recirculating seal water, consult Tuthill Vacuum & Blower Systems.

ELECTRICAL CONNECTIONS

Refer to the motor label or conduit box for correct wiring. Most motors are three phase and will be damaged if single phased. De-rating for 50 cycle operation at different voltages is possible if specified on motor label. Otherwise, refer questions to motor manufacturer or to Tuthill Vacuum & Blower Systems.

Be sure to jog motor before starting to insure correct wiring and rotation.



OPERATION

SEAL WATER REQUIREMENTS

atlantic fluidics® liquid ring pumps, because of their exclusive axial flow design, have the ability to handle large amounts of water and, unlike radial flow pumps, can start in a flooded state without damage. Seal water flow is not critical and the flow rates can be readily adjusted for a wide variety of applications.

For most applications, the optimum seal water rates are given below:

Single Stage Pump Model	Vacuum Range			Two Stage Pump Model	Vacuum Range All Ranges
	0-10" Hg (0 - 340 mbar g)	10-25" Hg (340 - 840 mbar g)	> 25" Hg (> 840 mbar g)		
A5	1.0 GPM (3.8 L/min)	1.5 GPM (5.7 L/min)	2.0 - 3.0 GPM (7.6 - 11.4 L/min)	T0505	2.0 - 3.0 GPM (7.6 - 11.4 L/min)
A10				T1505	
A15	1.5 GPM (5.7 L/min)	2.0 GPM (7.6 L/min)	2.0 - 3.5 GPM (7.6 - 13.2 L/min)	T2010	
A20	2.0 GPM (7.6 L/min)			2.5 GPM (7.6 L/min)	T7530
A75		3.0 GPM (11.4 L/min)	T10030		
A100			4.0 - 5.0 GPM (15.1 - 18.9 L/min)		
A130					
A200	3.0 GPM (11.4 L/min)	5.0 GPM (18.9 L/min)	6.0 - 8.0 GPM (22.7 - 30.3 L/min)		
A300	4.0 GPM (15.1 L/min)	6.0 GPM (22.7 L/min)	8.0 - 10.0 GPM (30.3 - 37.9 L/min)		

The water supply can be regulated by either a flow restrictor or manually by valve. The object is to balance performance against water consumption and power. **THE PUMP MUST NEVER RUN DRY.** The solenoid valve must be in an open position for pumping.

STARTUP

Once the pump is fully piped and wired for operation, be sure no foreign matter may enter and possibly damage the pump. Check for welding shot, slag or other metal bits.

Before starting the pump, turn the motor shaft by hand to be sure it is free to rotate. On TEFC motors, you may turn the rear fan. It is normal for the rotor and port cylinder to be in rubbing contact. The parts will "wear in" after being put into service.

If a hard rub is experienced and the motor shaft will not turn, the pump should be checked internally for interference. As long as the shaft can be turned by hand, the pump is operable.

If the shaft is locked or cannot be rotated a full turn, take out the cover bolts and remove the cover/port cylinder assembly. Check for score marks, particulate matter, or other causes of interference. Clean up contact areas and reassemble the cover. Removal of the cover for inspection and clean up **does not** void the warranty.

A final check is to jog the motor, making sure water is introduced into the pump and that rotation is in accordance with the arrow cast on the pump face. If no flow of air or vacuum reading is immediately apparent, rewire the motor accordingly. **ROTATION SHOULD BE COUNTER-CLOCKWISE WHEN YOU ARE FACING THE PUMP INLET.**

The pump is now ready for operation.

STOPPING PUMP

Once the power is shut off, be sure water is stopped from entering the pump. A solenoid valve in the seal water line is recommended to shut off flow simultaneously with cessation of pumping.

An inlet check valve is recommended to prevent vacuum loss or back flow to the system.

MAINTENANCE

As a general rule, maintenance is not required for **atlantic fluidics**[®] pumps. Because there are no rubbing parts and with water acting as coolant and lubrication during pumping, wear is minimized. It is recommended that the motor bearings be greased periodically in accordance with NEMA recommendations. For further information refer to the Troubleshooting section below.

To prevent foreign matter from entering the pump, a strainer is recommended for the seal water line and the usual precautions taken in the pump inlet piping.

TROUBLESHOOTING

PUMP WILL NOT TURN ON STARTUP

- A. Check wiring and power to pump.
- B. Remove pump cover to check for anything that may be binding the rotor. Be sure that the rotor turns freely by hand. (See Startup section on page 8)
- C. On cast iron pumps, check for internal rust if pump has been left idle for a long period. Rust can build up to the point where internal clearances are closed. Remove rust and reassemble.
- D. In areas where there is hard water being fed into the pump, check for scale deposits that may hinder rotation. Scale should be removed by acidizing, but consult the factory for recommended procedures.
- E. If the motor fails to turn, be sure it isn't a motor problem. Burn-out may occur if a three-phase motor is single phased.

NO PUMPING ON STARTUP

- A. Check pump rotation. It may be rotating in reverse. Rewire motor to correct.
- B. Check seal water. Water must be fed continuously into the pump.

POOR PUMP PERFORMANCE; LOW VACUUM

- A. Check vacuum pump while running by sealing off inlet piping and reading vacuum at the pump suction. If high vacuum is achieved, look for leaks in the vacuum system. The pump capacity is a function of high vacuum performance and will conform to the published performance curve at standard conditions. High seal water temperatures will lower the vacuum because of the increase in vapor pressure. Altitude, barometric pressure, and gas temperature can also affect high vacuum performance.
- B. If high vacuum is not achieved on blank-off, the problem lies in the vacuum pump. Poor pump performance can be caused by the following:
 1. Pump may not be getting enough water. Adjust water supply and observe for change in the performance.
 2. Internal parts may be worn. Remove cover/port cylinder assembly and check for wear on the port cylinder, rotor and cover lands. Most wear will be limited to the port cylinder which should slide easily into the rotor bore. Replace port cylinder if necessary. You may also polish the port cylinder and rotor bore with a fine emery cloth for smooth fit.

PUMP UNUSUALLY NOISY

- A. Unusual continuing noise from the motor end is probably an indication that the motor bearings are bad. Remove cover and spin rotor by hand. You should be able to detect bearing noise. If indicated, replace motor bearings.
- B. Cavitation. The vacuum pump should not be operated on blank suction for any length of time. When liquid ring vacuum pumps are starved for air, cavitation is indicated by a rattling noise and vibration in the pump. Cavitation can be eliminated by providing a slight air bleed into the vacuum system.

HIGH AMPS

- A. Flooding the pump with too much water, particularly at low vacuum, can overload the motor. Adjust seal water supply.
- B. Internal rubbing of rotor with stationary parts can cause excessive loading. Shut off pump and rotate by hand (see Startup section on page 8) to see if rotor turns freely. Internal rubbing may be due to scale build-up, a galling foreign material or by misalignment of parts. (see Troubleshooting section on page 9; specifically, paragraphs titled "PUMP WILL NOT TURN ON STARTUP" & "POOR PUMP PERFORMANCE; LOW VACUUM".

SERVICE AND REPAIR

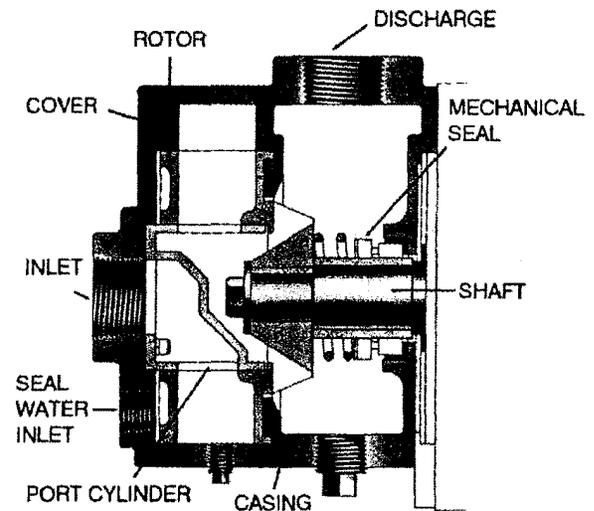
atlantic fluidics® liquid ring vacuum pumps are designed to minimize down time by allowing for fast in-the-field repair. Time and money-saving features include:

- Shaft mounted assembly for easy alignment and indicating.
- Modern O-rings and mechanical seals for practically zero leakage and easy replacement.
- Replaceable port cylinder that unscrews from cover and requires no special shimming or adjustment.
- Front end disassembly for fast access to major internal parts.
- American-made stock parts available for immediate shipment.

DISASSEMBLY OF PUMP

The pump may be disassembled while bolted to the baseplate by removing suction and seal water piping and working from cover to motor. Most repair work will not require full disassembly, but please refer to the exploded pump diagram in following these steps:

- A. Shut off all valves controlling flow of fluids to and from the pump casing. Disconnect external piping.
- B. Remove bolts connecting cover to casing. The cover and port cylinder assembly will slide straight outward. The port cylinder is dismounted from cover by removing three socket head cap screws.
- C. Remove hex head lock screw and washer from motor shaft. Use a bearing puller to remove rotor without damage to casing. Be sure to protect the threaded shaft bore.
- D. Slide shims and mechanical seal off shaft.
- E. Unbolt casing from motor face.
- F. Save any and all shims from shaft and casing assemblies for proper realignment.



Cutaway View

ASSEMBLY OF PUMP

Before assembling of the pump, carefully inspect all parts for signs of unusual wear, abrasion and corrosion. O-rings should be checked for cracks or brittleness and the carbon face of the mechanical seal examined for scratches.

Replace all parts as needed and proceed as follows:

STEP ONE: Casing, Sleeve and Seal Assembly

The mechanical seal is composed of a seal (8a), seal (8b), and spring (8c). The seat is a ceramic ring with a rubber boot that is pressed firmly into the rear of casing. Lubricant is recommended for ease in inserting rubber boot in the seal housing bore. **BE VERY CAREFUL NOT TO SCRATCH THE CERAMIC FACE DURING HANDLING AND INSERTION.**

Once the seal seat is in place, mount casing (1) on the motor face. The larger pump casings are mounted on four studs extending from motor face, while the smaller casings (Models A5, A10, A15, A20, T0505, T1505, T2010) are secured by four hex head bolts.

It is seldom needed to replace the shaft sleeve. It can usually be polished using fine emery cloth. If the sleeve is to be replaced slip the small O-ring (11) over shaft until it touches the shaft shoulder and place the sleeve/bushing (9) on top so that its chamfered end presses against O-ring.

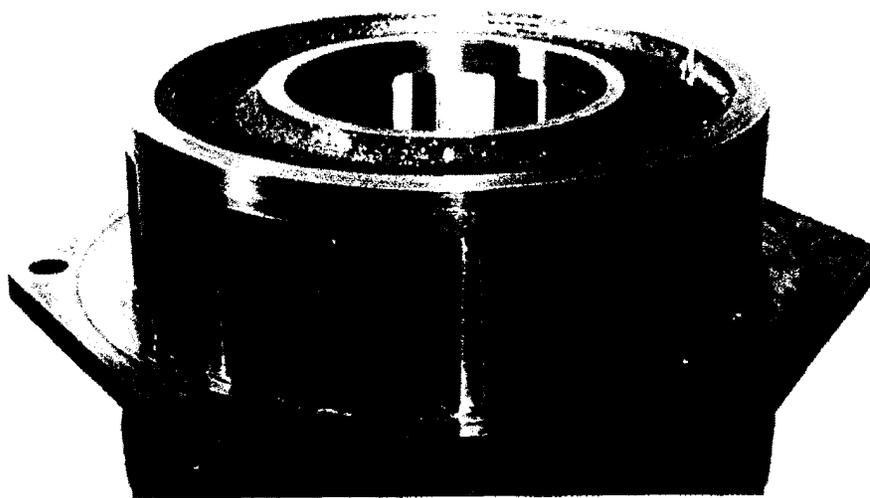
To complete the assembly, lubricate the sleeve so that the rest of the mechanical seal (#8b) can be pressed on with the carbon face in flat sliding contact with the ceramic seat. Again, **AVOID SCRATCHING OR TOUCHING THE CARBON FACE**. Proper tension between the seal faces is provided by the spring - leading to Step 2.

STEP TWO: Rotor Assembly and Alignment

The rotor is secured to the shaft by means of a key (15), a hex head lock screw (13), and a washer (14). In order for the rotor to turn freely, there must be some clearance between it and the casing. On Models A5, A10, A15, A20, T0505, T1505 and T2010, this clearance is established by adding washer shims (10) until no rub is felt between the back of the rotor and the casing face. On the Models A75, A100, A130, T7530, T10030, shims are used to position the rotor so that the casing face lines up with the inside wall of the rotor shroud. (See photograph below).

Be sure to use a bearing puller when removing rotor to add more shims. Avoid damage to the casing face and to the threaded shaft bore. Once secured, the rotor should spin freely without any interference or rub from the casing.

To ensure proper alignment, you may indicate the run-out on the front edge of the rotor. Using a dial indicator measure the run-out on the rotor. It should be within .003 - .005 inches (.08 - .13 mm). Tightening down the rotor is facilitated by using a long bolt and several washers before inserting the lock bolt.



STEP THREE: Port Cylinder Assembly and Cover

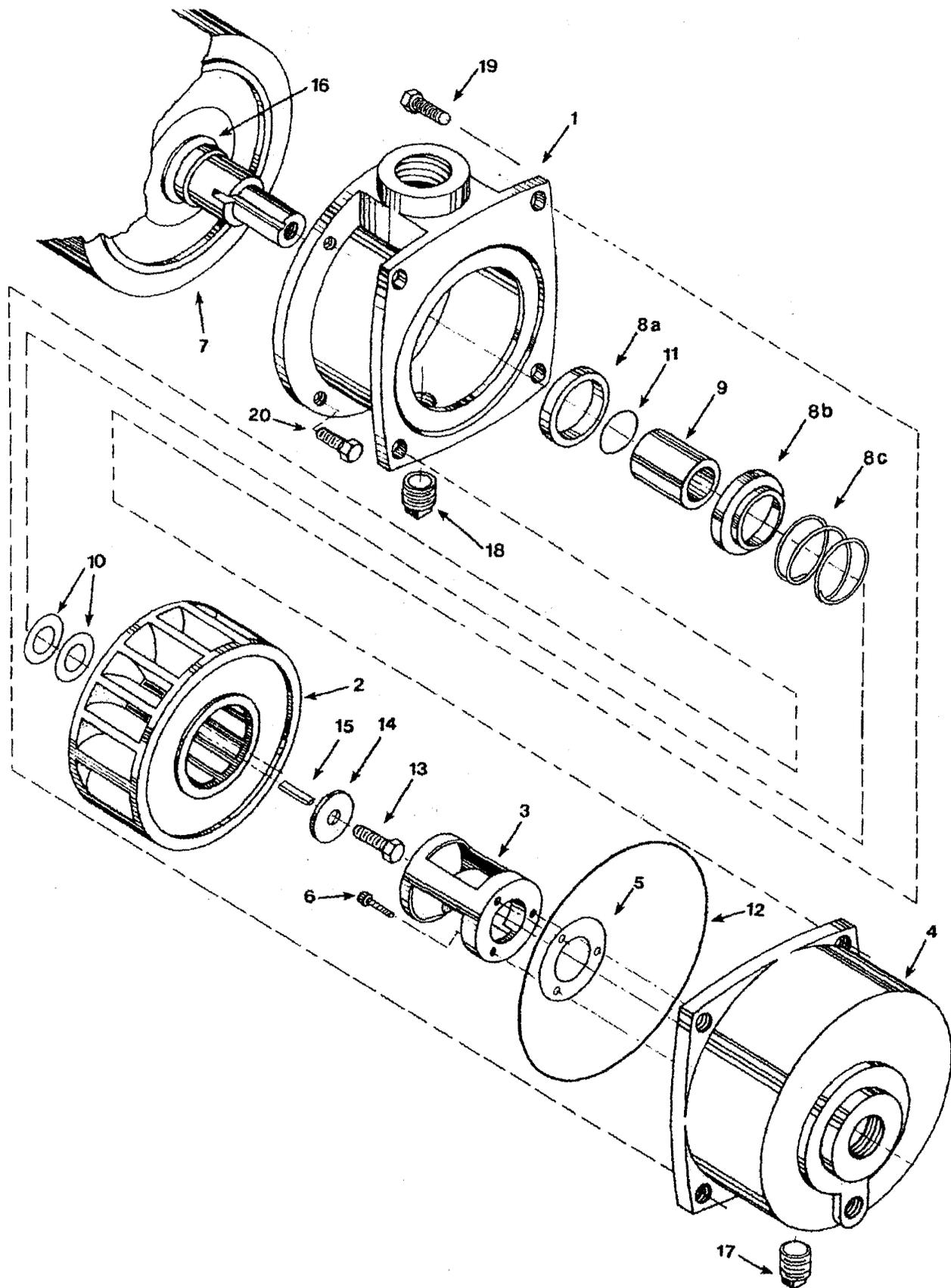
The port cylinder (3) is readily mounted on the cover (4) by three socket head cap screws with nylon patches (6). A fiber gasket (5) is used to seal the surface between the cover and port cylinder while the alignment of tapped holes insures correct placement.

The final assembly is to insert O-Ring (12) into the cover groove and then to slide the port cylinder/cover assembly into the rotor bore.

The surface where cover and casing meet will be sealed by the O-ring. In securing the cover to the casing, the cover bolts (19) must be drawn up uniformly. During tightening, the rotor should be turned by hand to insure easy rotation when the pump is fully assembled. Loosen the bolts and then tighten again if a hard rub is experienced. (Note that Models A75, A100 and A130 have two socket head bolts which should be used in the bottom cover holes).

After the drain plugs (17, 18) have been installed with Teflon® tape on the threads, the vacuum pump is ready for service.

EXPLODED VIEW



PARTS LIST (ALL MODELS)

ITEM NO.	DESCRIPTION	QTY	ITEM NO.	DESCRIPTION	QTY
1	Casing	1	11	O-ring, Shaft	1
2	Rotor	1	12	O-ring, Cover	1
3	Port Cylinder	1	13	Lock Bolt	1
4	Cover	1	14	Washer	1
5	Gasket	1	15	Key	1
6	Cap Screws	3	16	Slinger	1
7	Motor	1	17	Drain Plug, Cover	1
8	Mechanical Seal Assembly consisting of:	1	18	Drain Plug, Casing	1
8a	Seat	1	19	Cover Bolts, Hex Head	**
8b	Seal	1	19a	Cover Bolts, Socket Head	**
8c	Spring	1	20	Casing Bolts	**
9	Shaft Sleeve	1	20a	Casing Studs	**
10	Shim Set	1	20b	Casing Nuts	**

** - Quantity differs by model. See table below for quantities required.

ITEM NO.	A5-A20	A75-A130	A200-A300	T0505-T2010	T7530-T10030
19	4	4	6	—	—
19a	—	2	—	4	6
20	4	—	—	4	—
20a	—	4	4	—	4
20b	—	4	4	—	4

SERVICE PARTS RECOMMENDED TO KEEP ON HAND

ITEM NO.	DESCRIPTION	QTY
3	Port Cylinder	1
5	Gasket	1
8	Mechanical Seal Assembly	1
10	Shim Set	1
11	O-ring, Shaft	1
12	O-ring, Cover	1
13	Lock Bolt	1

Contact:

Parts Department

Tuthill Vacuum & Blower Systems – Atlantic Fluidics

21 South Street

Norwalk, CT 06854-2602

Tel: (203) 853-7315 or Toll Free: (800) 825-6937

Fax: (203) 866-8218

WWW: <http://www.tuthillvacuum.com>

E-mail: atlanticfluidics@tuthill.com

Service Parts can be ordered from our factory in Norwalk, Connecticut, USA for immediate shipment. All parts for **atlantic fluidics®** pumps are made in USA.

We are happy to assist you with any questions that may arise and to provide advice on applications for your **atlantic fluidics** pump. Please do not hesitate to contact us.

WARRANTY – VACUUM PRODUCTS

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Vacuum & Blower Systems (the seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation).

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

Product Type	Warranty Duration
New	15 months after date of shipment or 12 months after initial startup date, whichever occurs first
Repair	6 months after date of shipment or remaining warranty period, whichever is greater
Remanufactured	9 months after date of shipment or 6 months after initial startup date, whichever occurs first

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

December, 2002



VACUUM PUMP SUMP TANK & SEPARATOR

"VPST" Series 5HP to 60HP Tanks

APPLICATIONS

- Vacuum Pump Systems
- Vacuum Pump
 - Liquid Ring
 - Rotary Vane
 - Screw Technology
- Vacuum Furnaces & Ovens
- Vacuum Drying
- Vacuum Metallizing
- Vacuum Coating
- Heat Treating Equipment
- Routing Machines
- Hospital Vacuum Units
- Industrial Vacuum Processes

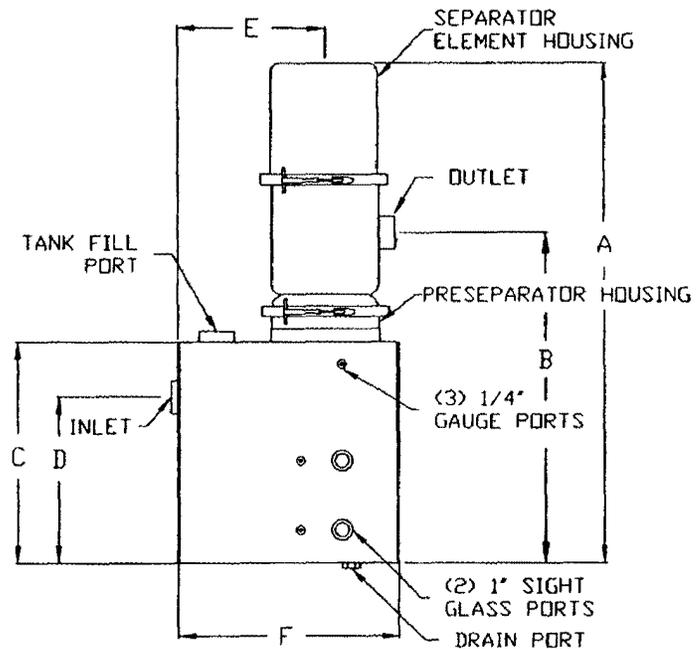
FEATURES & SPECIFICATIONS

- **Complete** Separator Package for Vacuum Pumps
 - Connects **DIRECTLY** on Discharge Without Need for other separator hardware
 - Simplifies system packaging by **Integrating** sump tank with separator
- Captures oil mist, fog, or smoke from exhaust on oil flooded vacuum pumps
- **Minimum** 99.97% D.O.P. on 0.3 μ m diameter particles
- Multiple Separation Stages
- Separator Baffle System for larger particles
- Pleated separator element provides increased surface area for low back pressure separation of ultra-fine oil mists
- Rugged carbon steel construction
- Temp (continuous): min 40°F (4°C) max 220°F (104°C)

OIL MIST EXHAUST FILTERS
HDL, SDL, EESV, EF, VPST Series

OPTIONS (Inquiries Encouraged)

- **SPECIALTY MEDIA** Available--
Higher Efficiency, Custom Media
- Special connections
- Specific Housing Construction



Dimension tolerance $\pm 1/8$ "

Tank Model No.	Suggested Vacuum Pump HP	FPT Inlet & Outlet	DIMENSIONS-inches						Nominal	
			A	B	C	D	E	F	SCFM Rating	Sump Capacity
VPST-PSG850-200HC	5 HP	2"	29 1/2	22 5/8	11 7/8	8	8 5/8	14	95	3.5 gal
VPST-PSG860-200HC	10 HP	2"	36 1/8	23 1/8	16	12	10 13/16	16 1/8	200	6 gal
VPST-PSG344-300C	25 HP	3"	47 13/16	32 5/16	20	15	20	27 3/4	400	12 gal
VPST-PSG474-400C	60 HP	4"	65 3/4	57 7/8	30	24	22	34	1000	35 gal

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E-mail: sales@solbergmfg.com • Web Site: www.solbergmfg.com

Model 1010

Three-Way Thermostatic Valve

1010	1" NPT
1110	3/4" NPT
1210	1/2" NPT
1010J8	1/2" SAE O-Ring
1010J12	3/4" SAE O-Ring
1010J16	1" SAE O-Ring

Fluid Power Energy (FPE) Thermostatic Valves utilize the principle of expanding wax, which in the semi-liquid state undergoes large expansion rates within a relatively narrow temperature range. The self-contained element activates a stainless steel sleeve, which directs flow. All FPE Thermostatic Valves are factory set at predetermined temperatures: no further adjustments are necessary. A wide range of temperatures are available for water and oil temperature control applications.

When used in a diverting application, on start-up the total fluid flow is routed back to the main system. As fluid temperature rises to the control range, some fluid is diverted to the cooling system. As fluid temperature continues to increase, more flow is diverted. When the thermostat is in a fully stroked condition, all fluid flow is directed to the cooling system. FPE Thermostatic Valves may also be used in a mixing application.

In a mixing application, hot fluid enters the "B" port and colder fluid enters the "C" port. The flows mix and the thermostat adjusts to reach the desired temperature, exiting the "A" port.

Standard FPE thermostatic valve housings are made from aluminum and grey iron castings, however, ductile iron, bronze, steel and stainless steel housings are available.

Optional 1010 features: High over temperature element, plated element. Other options available upon request.



Features

Wide Range of Temperatures

Heavy Duty

Self-Contained

Replaceable Element

Non-Adjustable

Rugged Construction

Tamper-Proof

Operate in Any Position

Available for Refrigeration Service



FLUID POWER ENERGY, INC.

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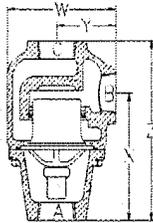
www.fpevalves.com



Model 1010

MODEL NUMBER	BODY MATERIAL (*)	NOMINAL PIPE SIZE	PRINCIPAL DIMENSIONS (UNITS in. & (mm))				MAX WIDTH IN THE OTHER PLANE	FLANGE DRILLING			NO. OF ELEMENTS	APPROX. SHIPPING WEIGHT	NOTES OR NUMBERED ENDNOTES
			"X"	"Y"	"W"	"Z"		NO. OF HOLES	DIA. OF HOLES	BOLT CIRCLE			
*1010	A, AL, B, D, S, SS	1" NPT	4 1/4 (107.95)	2 (50.80)	3 5/8 (92.08)	6 (152.40)	3 3/8 (85.73)	N/A	N/A	N/A	1	A=6.5#, AL=3# B=8.5#, D=6.5# S & SS=7#	
*1110	A, AL, B, D, S, SS	3/4" NPT	4 1/4 (107.95)	2 (50.80)	3 5/8 (92.08)	6 (152.40)	3 3/8 (85.73)	N/A	N/A	N/A	1	A=6.5#, AL=3# B=8.5#, D=6.5# S & SS=7#	
*1210	A, AL, B, D, S, SS	1/2" NPT	4 1/4 (107.95)	2 (50.80)	3 5/8 (92.08)	6 (152.40)	3 3/8 (85.73)	N/A	N/A	N/A	1	A=6.5#, AL=3# B=8.5#, D=6.5# S & SS=7#	
*1010J8	A, AL, B, D, S, SS	SAE 8 1/2"	4 13/32 (111.92)	2 3/16 (55.56)	3 7/8 (98.43)	6 11/32 (161.13)	3 3/8 (85.73)	N/A	N/A	N/A	1	A=6.5#, AL=3# B=8.5#, D=6.5# S & SS=7#	
*1010J12	A, AL, B, D, S, SS	SAE 12 3/4"	4 13/32 (111.92)	2 3/16 (55.56)	3 7/8 (98.43)	6 11/32 (161.13)	3 3/8 (85.73)	N/A	N/A	N/A	1	A=6.5#, AL=3# B=8.5#, D=6.5# S & SS=7#	
*1010J16	A, AL, B, D, S, SS	SAE 16 1"	4 13/32 (111.92)	2 3/16 (55.56)	3 7/8 (98.43)	6 11/32 (161.13)	3 3/8 (85.73)	N/A	N/A	N/A	1	A=6.5#, AL=3# B=8.5#, D=6.5# S & SS=7#	

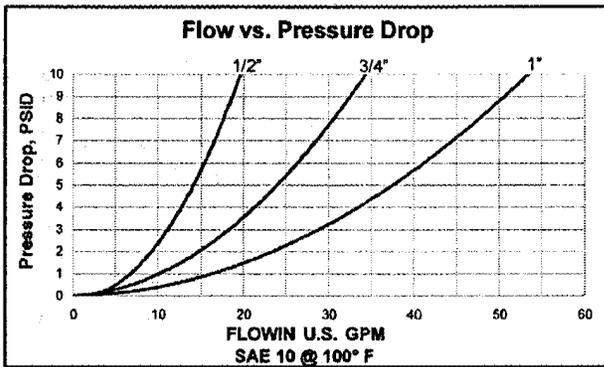
*(Replace * with body material type: A=Cast Iron, AL=Aluminum, B=Bronze, D=Ductile Iron, S=Steel, SS=Stainless Steel)



All models

PRESSURE RATINGS	
MATERIAL	PSI
A, AL, B	150
D	250
S, SS	500

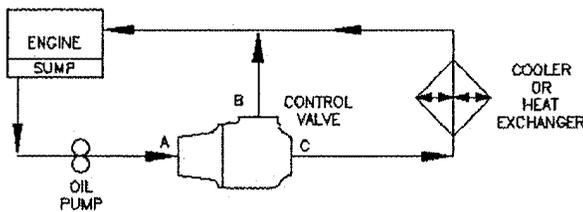
For port sizes not shown consult factory



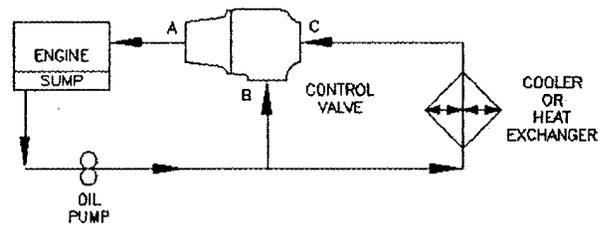
Recommended Pressure Drop is 2 to 7 PSI

PART #	DESCRIPTION
*1010	VALVE BODY (*See table for material)
*1020	VALVE COVER (*See table for material)
1080	GASKET (Older than 1979)
1572	O-RING (Standard material is Buna-N)
1071	LIP SEAL
1060-Temp	THERMOSTAT (Temp to follow dash)
1600	HEX BOLT
1601	LOCKWASHER
1590	NAMEPLATE
FPE Model 1000* Replacement Kit (Includes the following:)	
1572	O-RING (Standard material is Buna-N)
1071	LIP SEAL
1060-Temp	THERMOSTAT (Temp to follow dash)
(For Viton® (V) or Neoprene (E) O-Ring material, replace ** with V or E)	
<i>Viton® is a registered trademark of DuPont Dow Elastomers</i>	

APPLICATION CHARTS



DIVERTING SYSTEM



MIXING SYSTEM



FLUID POWER ENERGY, INC.

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FPE1010-050803

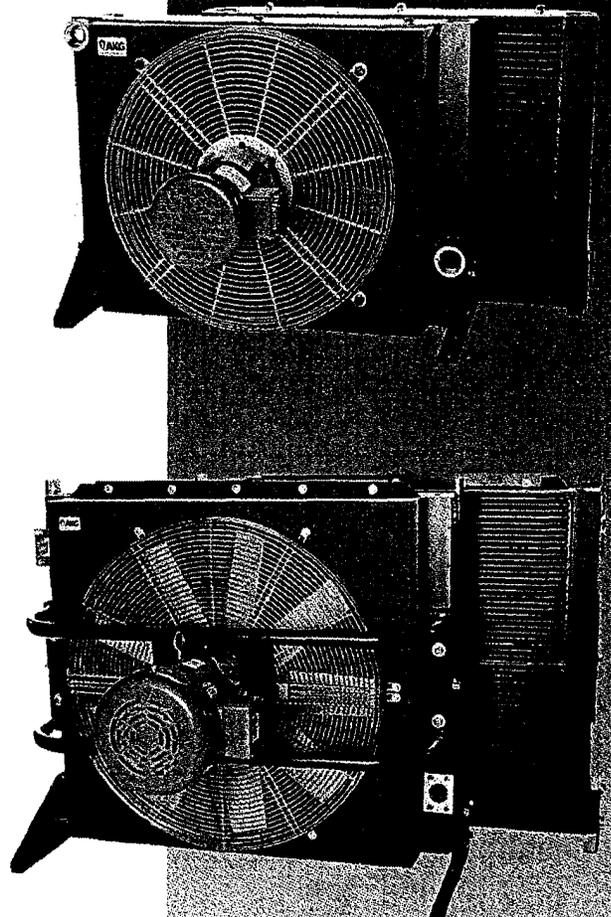
To Order

Specify Model Number, nominal temperature desired, and housing material. For Model coding information, visit our website or consult your factory representative.



High Performance Oil Coolers

- ▶ High Performance Model Series with Louvered Fin Design Provides High Heat Transfer Rates
- ▶ Standard Models with Higher Speed Fans for Compact, Most Economical Selection
- ▶ Low Noise Models with Slower Fan Speeds for Reduced Noise Levels and Lower Fan HP Requirements
- ▶ Competitive Pricing Deliveries From Stock

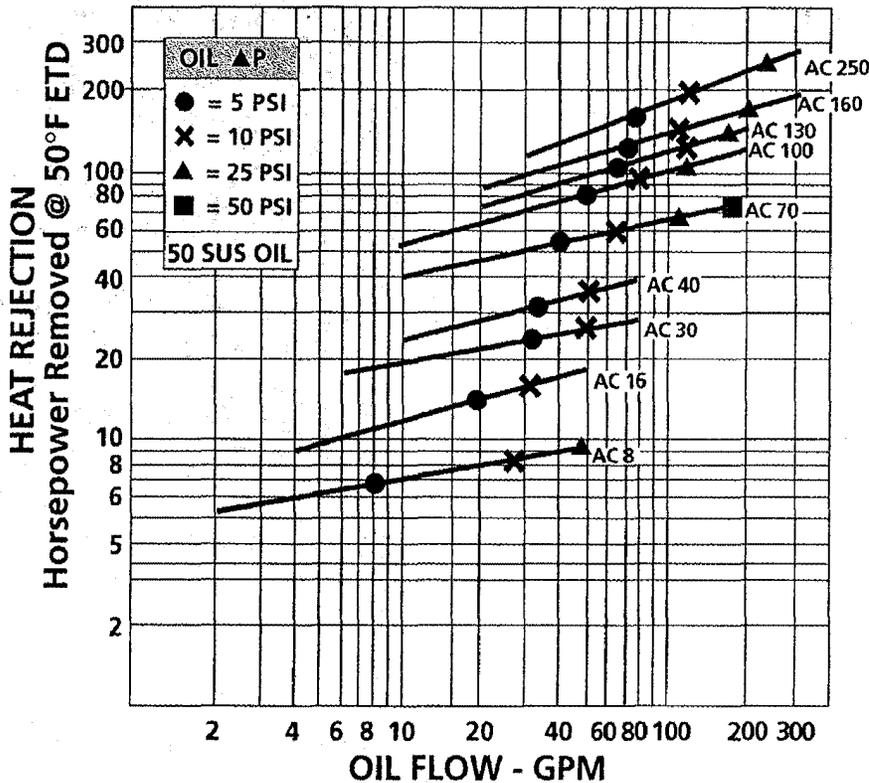


 **AKG THERMAL SYSTEMS, INC.**

BULLETIN ACB-2

Standard Models

STANDARD MODELS PERFORMANCE DATA



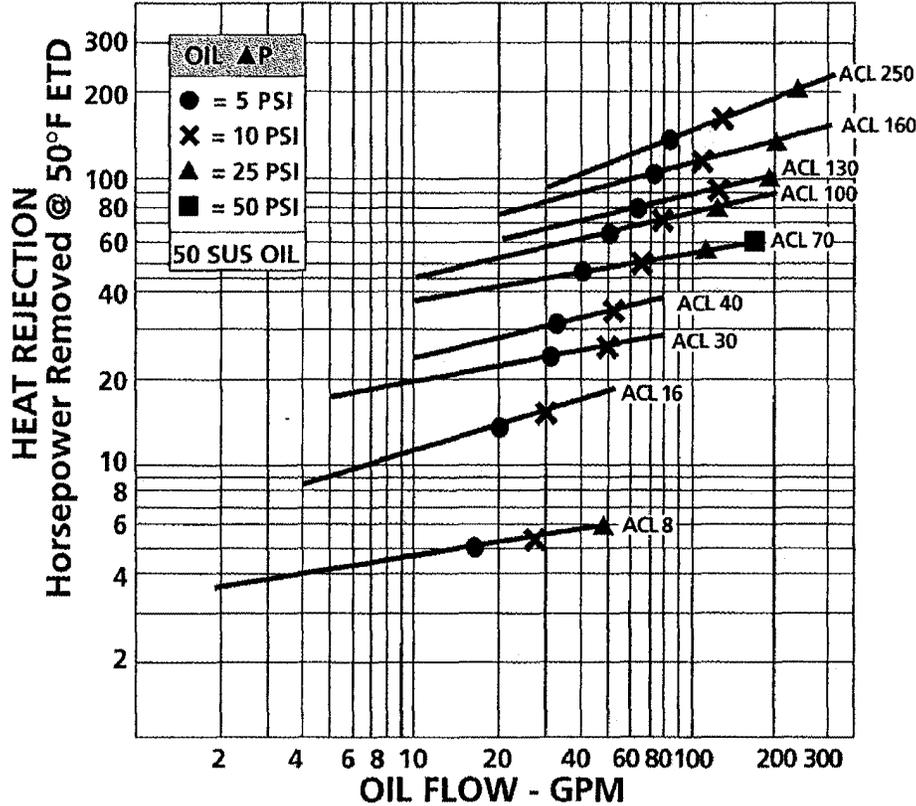
NOISE LEVELS dB A SCALE AT 1 METER	
Model	dB(A)
AC 8	80
AC 16	85
AC 30	85
AC 40	88
AC 70	93
AC 100	94
AC 130	96
AC 160	98
AC 250	101

ELECTRIC MOTOR DATA

Model Size	HP RPM	Motor Frame	SINGLE PHASE			THREE PHASE		
			Voltage	Hz	Full Load Amps 230 V.	Voltage	Hz	Full Load Amps 230V
AC 8	1/3 3250	IEC 63	115/230	60	2.6	208-230/460	60	1.2
						200/220	50	
						380/440	60	
AC 16	1/2 3250	IEC 71	115-208/230	60	3.4	208-230/460	60	2.0
						200/220	50	
						380/440	60	
AC 30	1/2 1725	NEMA 56C	115-208/230	60	4.4	208-230/460	60	3.4
						190/200 208/220	50	
						380/400 416/440	60	
AC 40	1 1725	NEMA 56C	115-208/230	60	6.4	208-230/460	60	6.2
						190/200 208/220	50	
						380/400 416/440	60	
AC 70	2 1725	NEMA 56C	115/230	60	10.0	208-230/480	60	13.4
						190/200 208	50	
						380/400 416	60	
AC 100	5 1725	NEMA 184TC	230	60	23.0	208-230/460	60	19.2
						190/200 208	50	
						380/400 416	60	
AC 130	7.5 1725	NEMA 213TC	Consult Factory	60	23.0	208-230/460	60	19.2
						190/200 208	50	
						380/400 416	60	
AC 160	7.5 1725	NEMA 213TC	Consult Factory	60	23.0	208-230/460	60	25.0
						190/200 208	50	
						380/400 416	60	
AC 250	10 1725	NEMA 215TC	Consult Factory	60	23.0	208-230/460	60	25.0
						190/200 208	50	
						380/400 416	60	

Low Noise Models

LOW NOISE MODELS PERFORMANCE DATA



NOISE LEVELS dB(A) SCALE AT 1 METER	
Model	dB(A)
ACL 8	62
ACL 16	65
ACL 30	72
ACL 40	74
ACL 70	79
ACL 100	80
ACL 130	85
ACL 160	88
ACL 250	90

ELECTRIC MOTOR DATA

Model Size	HP RPM	Motor Frame	SINGLE PHASE			THREE PHASE		
			Voltage	Hz	Full Load Amps 230 V.	Voltage	Hz	Full Load Amps 230V
ACL 8	1/4 1700	IEC 63	Consult Factory			230/460	60	1.0
						220-380/440	50	
ACL 16	1/4 1725	NEMA 56C	Consult Factory			230/460	60	1.4
						220-380/440	50	
ACL 30	1/2 1140	NEMA 56C	115-208/230	60	4.9	208-230/460	60	2.4
						190/200 208/220 380/400 416/440	50	
ACL 40	1/2 1140	NEMA 56C	115-208/230	60	4.9	208-230/460	60	2.4
						190/200 208/220 380/400 416/440	50	
ACL 70	3/4 1140	NEMA 56C	115/208/230	60	5.3	208-230/480	60	3.0
						190/200 208 380/400 416	50	
ACL 100	1.5 1140	NEMA 56C	Consult Factory			208-230/460	60	5.2
						190/200 208 380/400 416	50	
ACL 130	2.0 1140	NEMA 184TC	Consult Factory			208-230/460	60	7.6
						190/200 208 380/400 416	50	
ACL 160	5.0 1140	NEMA 215TC	Consult Factory			230/460	60	16.0
						380/400 416	50	
ACL 250	7.5 1140	NEMA 215TC	Consult Factory			230/460	60	23.0
						380/400 416	50	

Selection Procedures

The performance curves above are based on the following:

- 50 SUS Oil.
- 50°F Entering Temperature Difference (ETD)

If your application conditions are different, use the following selection procedure:

STEP 1. Determine the Heat Load

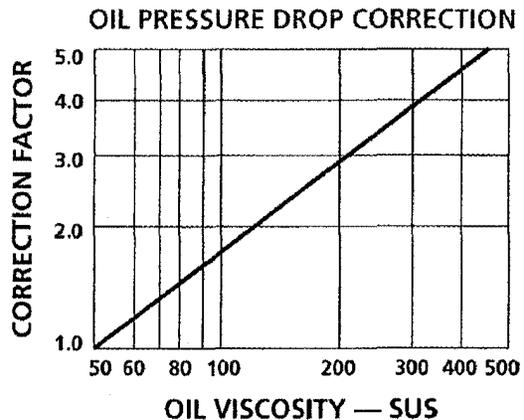
In most cases you can use 1/3 of the input horsepower.
Example: 30 HP Power Unit = 10 HP Heat Load

STEP 2. Determine the Actual ETD Desired

Entering OIL Temperature — Entering AIR Temperature = ETD
The entering oil temperature is the highest desired oil temperature. The entering air temperature is the highest anticipated ambient air temperature, plus any pre-heating of the air prior to its entering the cooler.

STEP 3. Calculate the Adjusted BTU/hr for Selection

$$\frac{\text{Horsepower}}{\text{Heat Load}} \times \frac{50}{\text{Desired ETD}} = \text{Horsepower For Use With Selection Chart}$$



STEP 4. Select The Model From The Curves

Read up from the GPM to the required heat rejection. Select any model on, or above this point.

STEP 5. Calculate Oil Pressure Drop

Find the oil pressure drop correction factor and multiply it by the oil pressure drop found on the performance curve.

Specifications

RATINGS:

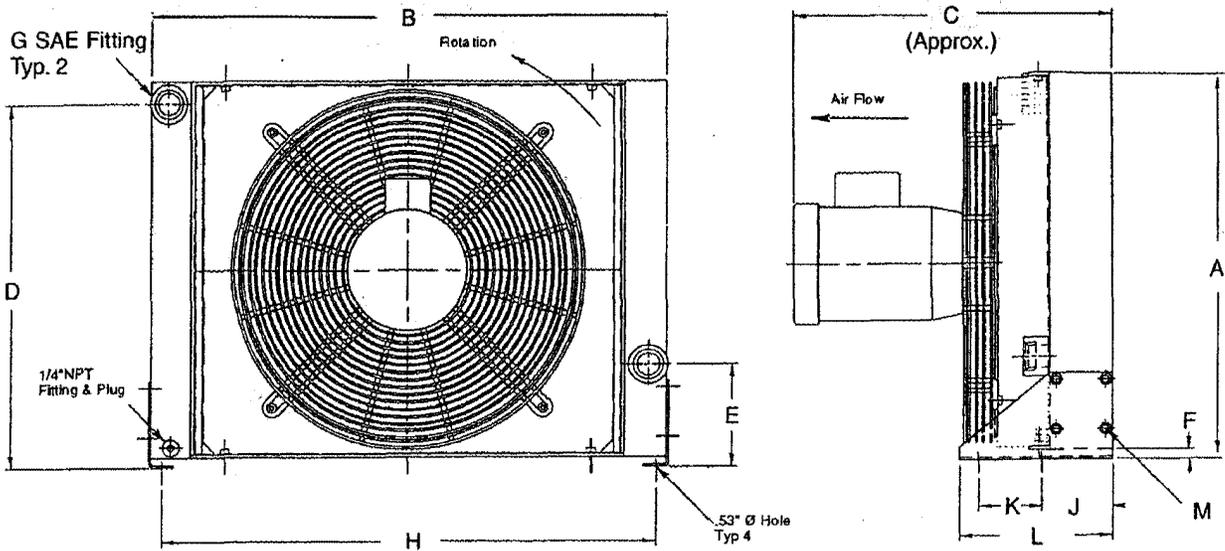
Maximum Working Pressure250 PSI
Maximum Working Temperature.....250 °F

MATERIALS:

Cooler.....Alumium	Fan Blade.....Polypropylene Blades Aluminum Hub
Shroud.....Powder Painted Steel	Mounting Brackets.....Powder Painted Steel
Fan Guard.....Zinc Plated Steel	

Electric motors are totally enclosed, and are not thermally protected.
Actual ratings vary with motor brand. Check motor nameplate for actual ratings.
Motor RPM is reduced by 1/6 for 50 Hz service.

Dimensions



MODEL	A	B	C (Approx.)	D	E	F	G	H	J	K	L	M	Approx. Weights	
													Net	Shipping
AC 8	12.44	15.75	14.72	11.30	3.27	0.55	#16 SAE 1 1/4-12	14.53	3.07	3.50	7.36	M8x10 Bolt (4 PL)	35	45
AC 16	16.26	19.88	15.59	15.08	3.35	0.59	UN-2B	18.66					45	55
AC 30	20.59	26.38	17.76	19.29	6.02	0.59	#20 SAE 1 1/2-12 UN-2B	25.20	4.17	3.74	9.02	M10x20 Bolt (8 PL)	90	125
AC 40	22.44	30.32	18.74	21.18				29.09					125	163
AC 70	28.27	37.01	22.60	20.47	9.92	2.09	2\"/> <td>37.48</td> <td rowspan="4">5.39</td> <td rowspan="4">7.87</td> <td rowspan="4">15.47</td> <td rowspan="4">M12x20 Bolt (8 PL)</td> <td>195</td> <td>240</td>	37.48	5.39	7.87	15.47	M12x20 Bolt (8 PL)	195	240
AC 100	37.40	40.95	24.76	29.69	9.02	0.59		41.42					350	405
AC 130	37.52	42.91	29.84	35.52	9.13	0.59		43.49					365	420
AC 160	44.09	48.82	30.28	34.72	11.02	0.65		49.29					480	545
AC 250	57.64	52.76	33.82	43.62	17.56	2.04	3\"/> <td>50.55</td> <td>7.80</td> <td>10.00</td> <td>20.00</td> <td>3/4 x 1 1/2 Bolt (8 PL)</td> <td>600</td> <td>688</td>	50.55	7.80	10.00	20.00	3/4 x 1 1/2 Bolt (8 PL)	600	688

- Dimensions are in inches.
- We reserve the right to make reasonable design changes without notice.
- Weights are in pounds.

Ordering Information



AC SERIES
Standard

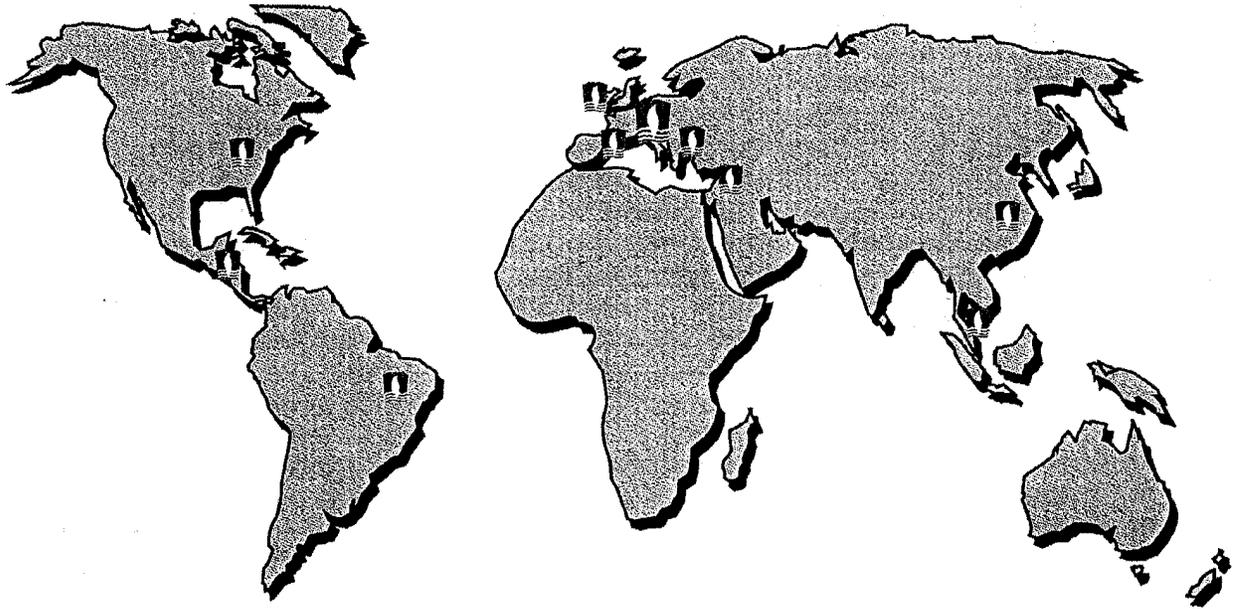
ACL SERIES
Low Noise

MODEL SIZE
SELECTED

MOTOR DATA
0=NO MOTOR
C=CORE ONLY
T= SINGLE PHASE
3=THREE PHASE
575=575 VOLT

CUSTOM FEATURE CODE
R=REVERSED AIR FLOW
AD=SAE TO NPT ADAPTORS INSTALLED
H=HERESITE COATING/CORE ASSEMBLY
CRN=CANADIAN REGISTRY, 250 PSI
CRS=CANADIAN REGISTRY, 150 PSI

AKG Worldwide



AKG has been manufacturing high quality coolers and cooling systems since 1919. We have grown to include 10 facilities with over 1400 employees to serve you.

Your Business Partner



AKG Worldwide

AKG is a complete single source supply for all of your cooling requirements. Choose from both standard and custom engineered products depending on your specific needs.



Partnership

AKG believes in solid long-term business relationships built on partnerships with its customers.



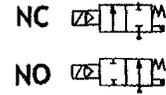
Customer

AKG places heavy emphasis on development of leading edge technologies, products and finding creative solutions to our customers individual requirements.

AKG Thermal Systems, Inc.
Mebane Industrial Park
809 Mattress Factory Road
P.O. box 189
Mebane, North Carolina 27302-0189
Tel.: (919) 563-4871
Fax: (919) 563-4917
Internet: akgts.com



Pilot Operated
General Service Solenoid Valves
 Brass or Stainless Steel Bodies
 3/8" to 2 1/2" NPT



2/2
SERIES
8210

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage.
- High Flow Valves for liquid, corrosive, and air/inert gas service.
- Industrial applications include:
 - Car wash
 - Laundry equipment
 - Air compressors
 - Industrial water control
 - Pumps

Construction

Valve Parts in Contact with Fluids		
Body	Brass	304 Stainless Steel
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

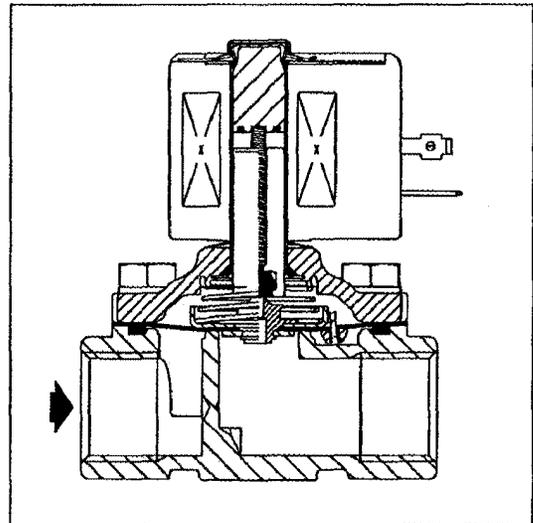
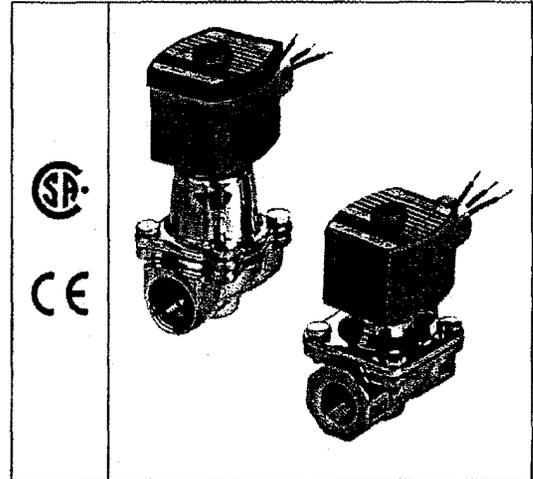
Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
	DC Watts	AC			General Purpose		Explosionproof	
		Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
H	30.6	-	-	-	-	74073	-	74073
F	40.6	-	-	-	-	238910	-	238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering. Other voltages available when required.

Solenoid Enclosures

Standard: Red-Hat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; Red-Hat - Type I.
Optional: Red-Hat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.
 (To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B57, 8210B58, and 8210B59. Valves not available with Explosionproof enclosures.)
 See *Optional Features Section* for other available options.



Nominal Ambient Temperature Ranges:

- Red-Hat II/ AC: 32°F to 125°F (0°C to 52°C)
- Red-Hat II DC: 32°F to 104°F (0°C to 40°C)
- Red-Hat DC: 32°F to 77°F (0°C to 25°C)
 (104°F/40°C occasionally)

Refer to *Engineering Section* for details.

Approvals:

CSA certified. Red-Hat II meets applicable CE directives.
 Refer to *Engineering Section* for details.

Specifications (English units)

Pipe Size (Ins.)	Orifice Size (Ins.)	Cv Flow Factor	Min.	Operating Pressure Differential (psi)						Max. Fluid Temp. °F		Brass Body			Stainless Steel Body			Watt Rating/Class of Coil Insulation ⊕		
				Max. AC			Max. DC			AC	DC	Catalog Number	Constr. Ref. No. ⊕	UL ⊕ Listing	Catalog Number	Constr. Ref. No. ⊕	UL ⊕ Listing	AC	DC	
				Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU											
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ⊕ Seating																				
3/8	3/8	1.5	⊕	150	125	-	40	40	-	180	150	8210G73 ⊕	1P	●	8210G36 ⊕	1P	●	6.1/F	11.6/F	
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G93	5D	○	-	-	-	10.1/F	11.6/F	
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G1	6D	○	-	-	-	6.1/F	11.6/F	
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G6	5D	○	-	-	-	17.1/F	-	
1/2	7/16	2.2	⊕	150	125	-	40	40	-	180	150	8210G15 ⊕	2P	●	8210G37 ⊕	2P	●	6.1/F	11.6/F	
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G84	5D	○	-	-	-	10.1/F	11.6/F	
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G87	7D	●	17.1/F	11.6/F	
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G2	6D	○	-	-	-	6.1/F	11.6/F	
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G7	5D	○	-	-	-	17.1/F	-	
1/2	5/8	4	5	300	300	-	300	300	-	180	125	8210G227	5D	○	-	-	-	17.1/F	40.6/H	
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G88	7D	●	17.1/F	11.6/F	
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G9	9D	○	-	-	-	6.1/F	11.6/F	
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G95	8D	○	-	-	-	10.1/F	11.6/F	
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G3	11D	○	-	-	-	6.1/F	11.6/F	
3/4	3/4	6	0	-	-	-	200	180	180	-	77	8210B26 ⊕ ‡	10P	-	-	-	-	-	30.6/H	
3/4	3/4	6	0	350	300	200	-	-	-	200	-	8210G26 ⊕ ‡	40P	●	-	-	-	-	16.1/F	-
1	1	13	0	-	-	-	100	100	80	-	77	8210B54 ‡	31D	-	8210D89	15D	-	-	30.6/H	
1	1	13	0	150	125	125	-	-	-	180	-	8210G54	41D	●	8210G89	45D	●	16.1/F	-	
1	1	13	5	150	150	100	125	125	125	180	150	8210G4	12D	○	-	-	-	6.1/F	11.6/F	
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G27 ‡	42P	●	-	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G78	3P	-	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B55 ‡	32D	-	-	-	-	-	30.6/H	
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G55	43D	●	-	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G8	16D	○	-	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B56 ‡	33D	-	-	-	-	-	30.6/H	
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G56 ‡	44D	●	-	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G22	18D	●	-	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	-	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																				
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G33	23D	●	-	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G11 ⊕ ⊗	39D	●	-	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G34	23D	●	-	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G30	37D	●	-	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G12 ⊕ ⊗	39D	●	-	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G35	25D	●	-	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G38	38D	●	-	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210G13	24D	●	-	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G13	46D	●	-	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B57 ⊕ ⊗	34D	●	-	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D14	26D	●	-	-	-	-	16.8/F	-
1	1	13	5	150	150	125	-	-	-	180	-	8210G14	47D	●	-	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B58 ⊕ ⊗	35D	●	-	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D18	28D	●	-	-	-	-	16.8/F	-
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G18	48D	●	-	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B59 ⊕ ⊗	36D	●	-	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D32	29D	●	-	-	-	-	16.8/F	-
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G32	49D	●	-	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210I03	30P	●	-	-	-	-	16.8/F	-
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	-	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210I04	27P	●	-	-	-	-	16.8/F	-
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	●	-	-	-	-	16.1/F	-

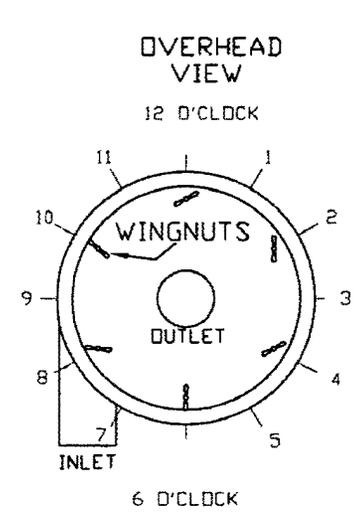
Notes: ⊕ 5 psi on Air; 1 psi on Water.
 ⊗ Valve provided with PTFE main disc.
 ⊕ Valve includes Ultem (G.E. trademark) piston.
 ⊕ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
 ⊕ Safety Shutoff Valve; ● General Purpose Valve.
 Refer to Engineering Section (Approvals) for details.

⊕ Valves not available with Explosionproof enclosures.
 ⊗ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
 ⊕ AC construction also has PA seating.
 ⊕ No disc-holder.
 ⊕ Stainless Steel disc-holder.
 ‡ Must have solenoid mounted vertical and upright.

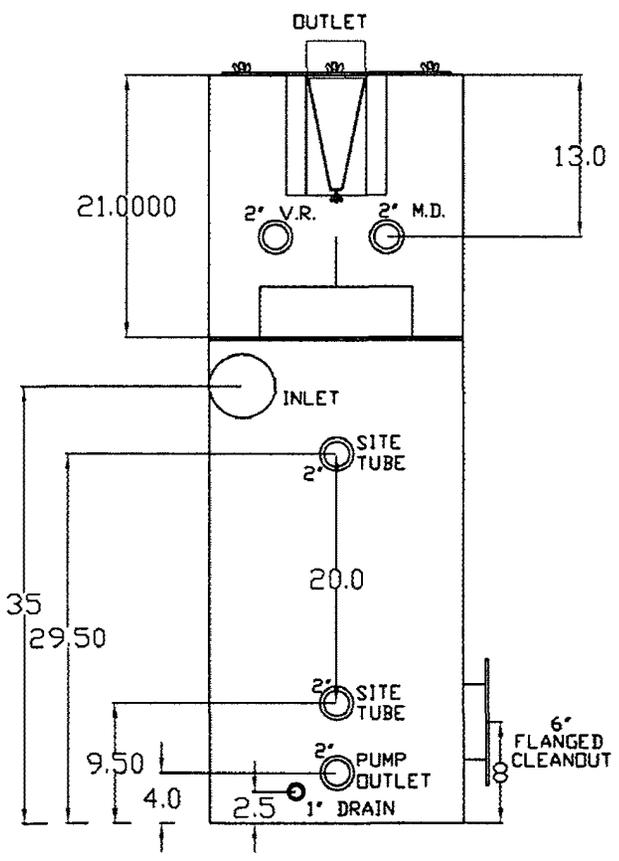
MODEL #	MAX AIR FLOW (SCFM)	DIAMETER (INCHES)	HEIGHT (INCHES)	LIQUID CAPACITY (GAL)
MS-30	300	14	48	15
MS-60	400	18	60	30
MS-80	500	20	60	40
MS-120	750	24	60	60
MS-200	1100	32	60	100

OPTIONAL FILTERS	
FILTER #	RATED FLOW (SCFM)
31P	195
231P	300
235P	570
245P	880
377P	1825

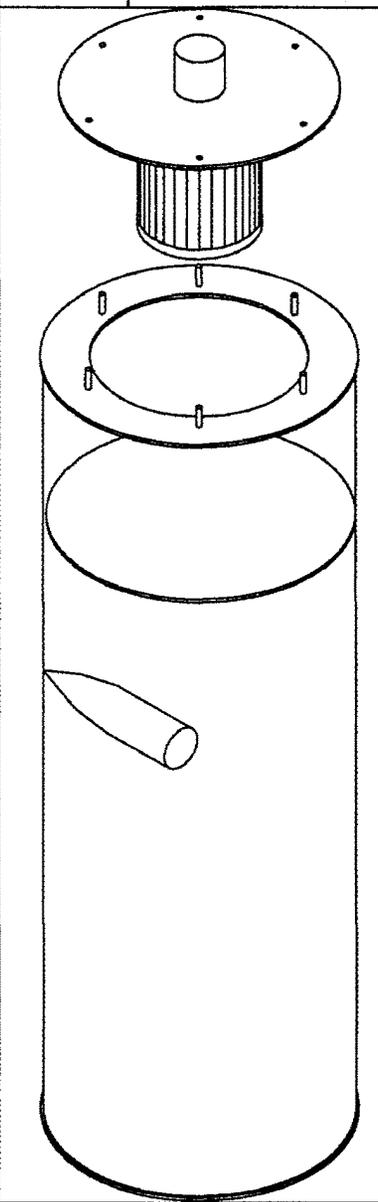
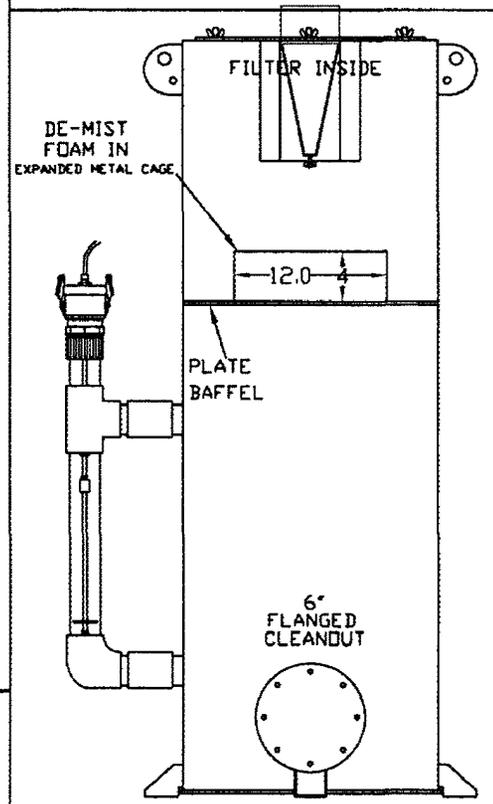
MS-30 NOT SHOWN - THE TANK USES AN EXTERNAL FILTER
 INLET AND OUTLET SIZES WILL BE CUSTOM SIZED FOR EACH JOB.



- OUTLET _____
- MAN DL. _____
- VAC RL. _____
- SITE TUBE= _____
- PUMP OUTLET _____
- DRAIN _____
- CLEANDUT _____



FLOAT OPTIONS
 IN A 2' CLEAR PVC SITE TUBE
 THREE FLOAT STEM (ON/OFF/HL)
 SINGLE FLOAT STEM (HL)
 IN A 2' TEE FITTING WITH POLY TUBE
 DWYER L6 (HL)



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HIGH VAC
 MOISTURE
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SMALL COMPACT POLYESTER ELEMENTS

Up to 570 SCFM and Housings up to 3" NPT

FEATURES & SPECIFICATIONS

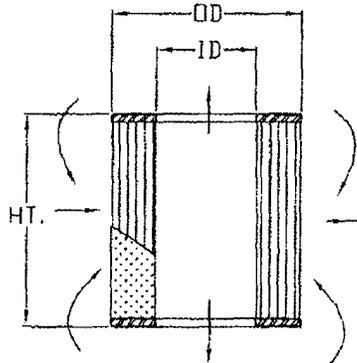
- 99%+ removal efficiency standard to 5 micron
- Pleated Media for **High Dirt Holding Capacity**
- Reinforced with epoxy coated steel wire on **Both** sides of the cloth
- Optimal surface area per given size
- Washable - lukewarm water & mild detergent
- Dust loading capacity is increased 40 - 50% with polyurethane prefilter
- Temp: (continuous):
min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential:
10"-15" H₂O Over Initial Delta P

ADVANTAGES

- Less maintenance
- More durable than paper media
- Moisture resistant
- Handles hot air and oil mist from unload cycle of reciprocating/piston compressor

OPTIONS (Inquiries Encouraged)

- Polyester - 1, 4, 25, & 100 micron
- Paper - 99% efficiency to 2 micron
- HEPA - 99.97% D.O.P. efficiency to 0.3 micron
- Stainless steel wire mesh
- High Temperature Nomex cloth- 99+% efficient
- Stainless Steel Nomex-Reinforced by stainless steel wire mesh & expanded metal
- Polypropylene - Food Grade available
- Activated carbon
- Inquiries Encouraged



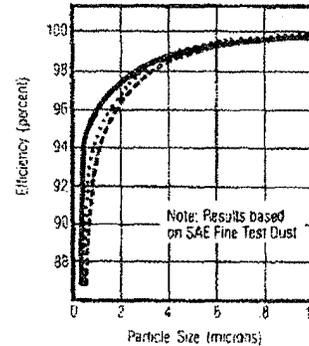
Dimension tolerance $\pm 1/8"$

Polyester Element	STD Endcap Features	DIMENSIONS - inches			Surface Area ft ²	Rated Flow SCFM
		ID	OD	HT		
15	M	3	4 3/8	2 5/16	0.50	35
19P®	M	3	4 3/8	4 3/4	1.5	100
31P	M	3 5/8	5 3/4	4 3/4	2.3	195
231P	M	3 5/8	5 3/4	9 1/2	4.5	300
825	TC	1 1/2	2 1/2	2 1/2	0.38	25
843	T	2 3/8	3 7/8	2 3/4	0.60	55
849	T	2 9/16	5	4 3/4	2.0	115
851	TR	3 1/2	5 7/8	8 3/4	4.5	290
879	TB	2 9/16	5	4 3/4	2.0	115
239	GBN	4 7/8	9 1/4	10	11.5	570

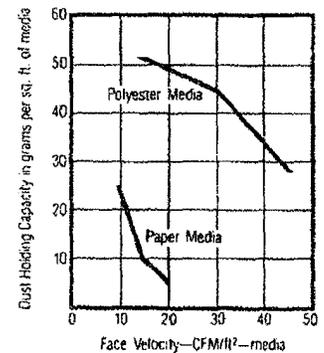
P = Polyurethane Prefilter Included

Particle Size vs. Filter Efficiency on polyester media at indicated face velocity:

- 15 cfm/ft² media —————
- 30 cfm/ft² media (dotted)
- 45 cfm/ft² media - - - - - (dashed)



Face Velocity vs. Dust Holding Capacity



- Legend
- B= Closed one end w/ Bolt hole, open on other end
 - C= Closed one end, open on other end
 - F= Felt gaskets on open end(s)
 - G= Galvanized metal endcaps
 - I= Injection molded santoprene
 - M= Molded plastioid
 - N= Neoprene gaskets on open end(s)
 - R= Mixed Rubber/cork gasket on open ends
 - T= Tin plated metal endcaps

REPLACEMENT ELEMENTS

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E-mail: sales@solbergmfg.com • Web Site: www.solbergmfg.com



COMPACT/BIG BOY POLYESTER ELEMENTS

Up to 6600 SCFM and Housings up to 12" Flg

FEATURES & SPECIFICATIONS

- 99%+ removal efficiency standard to 5 micron
- Pleated Media for **High Dirt Holding Capacity**
- Reinforced with epoxy coated steel wire on **Both** sides of the cloth
- Optimal surface area per given size
- Washable - lukewarm water & mild detergent
- Dust loading capacity is increased 40 - 50% with polyurethane prefilter
- Temp: (continuous):
min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential:
10"-15" H₂O Over Initial Delta P

ADVANTAGES

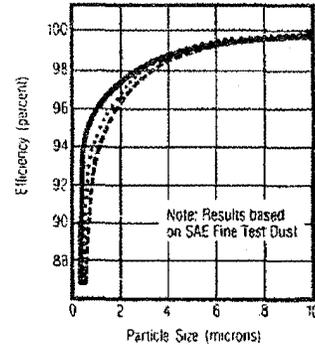
- Less maintenance
- More durable than paper media
- Moisture resistant
- Handles hot air and oil mist from unload cycle of reciprocating/piston compressor

OPTIONS (Inquiries Encouraged)

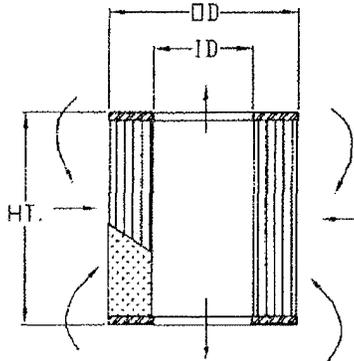
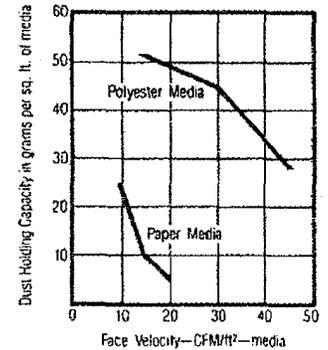
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- HEPA - 99.97% D.O.P. efficiency to 0.3 micron
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Particle Size vs. Filter Efficiency on polyester media at indicated face velocity:

15 cfm/ft² media —————
 30 cfm/ft² media
 45 cfm/ft² media - - - - -



Face Velocity vs. Dust Holding Capacity



Dimension tolerance ± 1/8"

Polyester Element	STD Endcap Features	DIMENSIONS - inches			Surface Area ft ²	Rated Flow SCFM
		ID	OD	HT		
35P	M	4 3/4	7 7/8	4 13/16	4.0	275
235P	M	4 3/4	7 7/8	9 5/8	8.3	570
335P	M	4 3/4	7 7/8	14 1/2	12	800
245P	GN	6	9 3/4	9 5/8	14	880
345P	GN	6	9 3/4	14 1/2	22.1	1100
275P	GN	8	11 3/4	9 5/8	19	1100
375P	GN	8	11 3/4	14 1/2	28	1500
377P	GN	9	14 5/8	14 1/2	50	1825
385P	GN	14	19 5/8	14 1/2	50	3300
485P	GN	14	19 5/8	21 1/2	75	4705
685P	GN	14	19 5/8	28 1/2	100	6600

P = Polyurethane Prefilter Included

Legend

- B= Closed one end w/ Bolt hole, open on other end
- C= Closed one end, open on other end
- F= Felt gaskets on open end(s)
- G= Galvanized metal endcaps
- I= Injection molded santoprene
- M= Molded plastisol
- N= Neoprene gaskets on open end(s)
- R= Mixed Rubber/cork gasket on open ends
- T= Tin plated metal endcaps

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REPLACEMENT ELEMENTS



SMALL COMPACT FILTER SILENCERS WITH STANDARD FILTER DESIGN

"FS" Series 1/2" - 3" MPT

APPLICATIONS

- Blowers-PD Type
- Blowers-Side Channel
- Compressor-Piston
- Compressor-Screw
- Construction/Contractor Industry
- Dental
- Engines
- Hydraulic Breathers - fine filtration
- Industrial & Severe Duty
- Medical
- Pneumatic Conveying Systems
- Sparging
- Waste Water Aeration
- Workshop

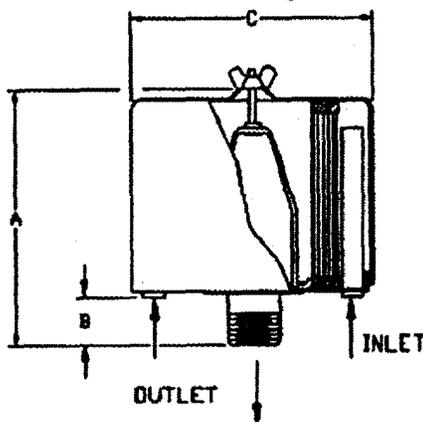
FEATURES & SPECIFICATIONS

- 99%+ removal efficiency standard: Paper = 2 micron, Polyester = 5 micron
- Filter change out differential: 10"-15" in. H₂O above initial Delta P
- Interchangeable elements: Polyester, Paper, HEPA
- Pressure drop graphs available upon request
- Tubular silencing design - tube is positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with powder coated finish or galvanized steel
- Fully drawn weatherhood - no welds to rust or vibrate apart
- Low pressure drop center bracket and outlet pipe design
- Temp (continuous): min -15° F (-26° C) max 220° F (104° C)
- Typical noise attenuation up to 25 dB's (due to the wide range of applications and machines these units are used on, a single graph is insufficient. Please inquire for your specific requirement)

OPTIONS

- 1/8" & 1/4" tap holes for differential pressure gauges
- Hot dipped galvanized housings
- Available in Stainless Steel
- Special connections, BSPT/Metric
- Epoxy coated housings
- Various elements available

Line Drawing



*All measurements are shown in American standards.

ADD - typically in stock

ADD - part normally requires lead time

Add To Order	Model Number	Element Type	Outlet in. NPT or FLG	Dim A in.	Dim B in.	Dim C in.	Rated Flow Piston SCFM	Rated Flow Screw Blower Fan SCFM	Element Parent Flow SCFM	Tube Count	Approx. Weight lbs.
ADD	FS-15-050	Polyester	0.5	4	1.5	6	10	10	35	1	1.8
ADD	FS-15P-050	Polyester	0.5	4	1.5	6	10	10	35	1	1.8
ADD	FS-15-075	Polyester	0.75	4	1.5	6	20	25	35	2	2
ADD	FS-15P-075	Polyester	0.75	4	1.5	6	20	25	35	2	2
ADD	FS-15-100	Polyester	1	4	1.5	6	25	35	35	3	2.1
ADD	FS-15P-100	Polyester	1	4	1.5	6	25	35	35	3	2.1
ADD	FS-19P-100	Polyester	1	6.63	1.5	6	35	55	100	3	3

ADD	FS-19P-125	Polyester	1.25	6.63	1.63	6.1	55	70	100	5	3.3
ADD	FS-19P-150	Polyester	1.5	6.63	1.5	6	70	85	100	5	3.5
ADD	FS-231-200	Polyester	2	12.25	2.25	10	135	135	300	7	14
ADD	FS-231P-200	Polyester	2	12.25	2.25	10	135	135	300	7	14
ADD	FS-31-200	Polyester	2	7.25	2.25	10	85	135	195	5	7.8
ADD	FS-31P-200	Polyester	2	7.25	2.25	10	85	135	195	5	7.8
ADD	FS-231-250	Polyester	2.5	12.5	2.5	10	195	195	300	9	14.5
ADD	FS-231P-250	Polyester	2.5	12.5	2.5	10	195	195	300	9	14.5
ADD	FS-31-250	Polyester	2.5	7.5	2.5	10	100	195	195	5	8.2
ADD	FS-31P-250	Polyester	2.5	7.5	2.5	10	100	195	195	5	8.2
ADD	FS-231P-300	Polyester	3	13	3	10	200	300	300	9	15
ADD	FS-14-050	Paper	0.5	4	1.5	6	10	10	35	1	1.8
ADD	FS-14P-050	Paper	0.5	4	1.5	6	10	10	35	1	1.8
ADD	FS-14-075	Paper	0.75	4	1.5	6	20	25	35	2	2
ADD	FS-14P-075	Paper	0.75	4	1.5	6	20	25	35	2	2
ADD	FS-14-100	Paper	1	4	1.5	6	25	35	35	3	2.1
ADD	FS-14P-100	Paper	1	4	1.5	6	25	35	35	3	2.1
ADD	FS-18P-100	Paper	1	6.63	1.5	6	35	55	100	3	3
ADD	FS-18P-125	Paper	1.25	6.63	1.63	6.1	55	70	100	5	3.3
ADD	FS-18P-150	Paper	1.5	6.63	1.5	6	70	85	100	5	3.5
ADD	FS-230-200	Paper	2	12.25	2.25	10	135	135	300	9	14
ADD	FS-230-200	Paper	2	12.25	2.25	10	135	135	300	9	14
ADD	FS-230P-200	Paper	2	12.25	2.25	10	135	135	300	9	14
ADD	FS-30-200	Paper	2	7.25	2.25	10	85	135	195	5	8.2
ADD	FS-30P-200	Paper	2	7.25	2.25	10	85	135	195	5	8.2
ADD	FS-230-250	Paper	2.5	12.5	2.5	10	195	195	300	9	14.5
ADD	FS-230P-250	Paper	2.5	12.5	2.5	10	195	195	300	9	14.5
ADD	FS-30-250	Paper	2.5	7.5	2.5	10	100	195	195	5	8.2
ADD	FS-30P-250	Paper	2.5	7.5	2.5	10	100	195	195	5	8.2
ADD	FS-30P-250	Paper	2.5	7.5	2.5	10	100	195	195	5	8.2
ADD	FS-230P-300	Paper	3	13	3	10	200	300	300	9	15

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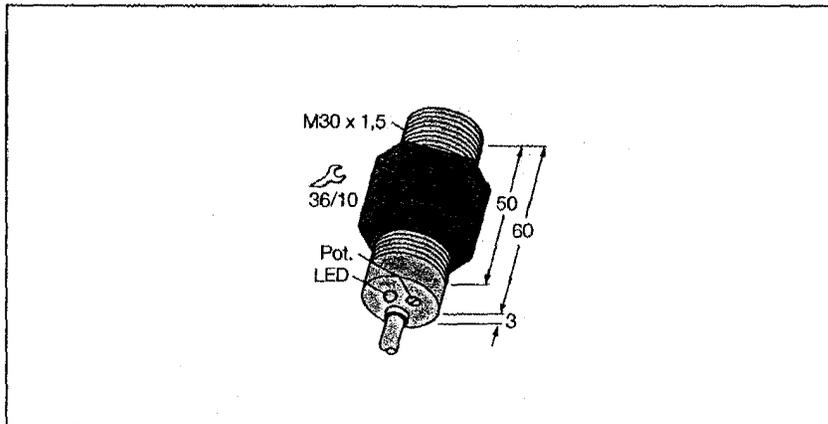
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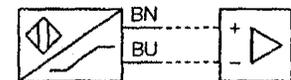
capacitive sensor

BC10-S30-Y1X



- ATEX category II 1 G, Ex Zone 0
- SIL2 according to IEC 61508
- threaded barrel, M30 x 1,5
- plastic, PA12-GF30
- fine adjustment via potentiometer
- 2-wire DC, nom. 8.2 VDC
- output according to DIN EN 60947-5-6 (NAMUR)
- cable connection

wiring diagram



Function principle

Capacitive proximity switches are designed for non-contact and wear-free detection of metal (electrically conductive) and non-metal (electrically non-conductive) objects.

Type	BC10-S30-Y1X
Ident-No.	20100
Rated operating distance S_n	10 mm, flush
Rated operating distance S _n	15 mm, non-flush
Hysteresis (switching distance)	1... 20 %
Temperature drift	± 20 %
Min. repeat accuracy	± 2 %
Operating temperature	-25 ... + 70 °C
Voltage	nom. 8.2 VDC
Current consumption (off-state)	≤ 1.2 mA
Current consumption (on-state)	≥ 2.1 mA
Max. switching frequency	≤ 0.1 kHz
Output function	2-wire, NAMUR
Approval according to	SIRA 00 ATEX 2069
Internal inductivity (L _i) / capacitivity (C _i)	220 nF / 0,28mH
Marking of device	Ⓔ II 1 G EEx ia IIC T6 (max. U _i = 15 V, I _i = 20 mA)
Housing style	threaded barrel; M30 x 1,5
Dimensions	63 mm
Housing material	plastic, plastic, PA12-GF20
Active face	plastic, plastic, PA12-GF20
Fixing torque of housing coupling nut	5 Nm
Wiring	cable
Cable	Ø 5.2, LfYY, PVC, 2 m
Cable cross section	2 x 0.34 mm ²
Vibration resistance	55 Hz (1 mm)
Shock resistance	30 x g (11 ms)
Degree of protection	IP67
Switching status indication	LED yellow

capacitive sensor

BC10-S30-Y1X

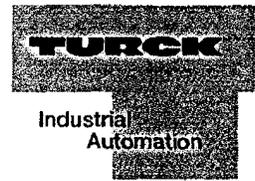


Accessories

Type code	Ident-No.	Short text	Dimension drawing
MAP-M30	6950013	mounting adapter; material: Polypropylene; sensor replacement with filled container possible (adapter remains in container during sensor replacement)	
BST-30B	6947216	fixing clamp with dead-stop; material: PA6	
QM-30	6945103	quick-mount fixing clamp with dead-stop; material: chrome-plated brass external thread M36 x 1,5.	
IM1-22EX-R	7541231	isolating switching amplifier, two channels; input for NAMUR signals; optional wire-break and short-circuit monitoring function; selectable normally open or normally closed performance; removeable terminal blocks; 18 mm wide; universal voltage supply unit	

• Edition: • 03.09.2005

capacitive sensor



BC10-S30-Y1X

Operating manual

Correct usage to the intended purpose

This device fulfils the directive 94/9/EC and is suited for use in explosion hazardous areas according to EN50014, EN50020 and EN50284. Further it is suited for use in safety-related systems, including SIL2 to IEC 61508. In order to ensure correct operation to the intended purpose it is required to observe the national regulations and directives.

Use in explosion hazardous areas

II 1 G (Group II, Category 1 G, electrical equipment for gaseous atmospheres).

Marking (see device or data sheet)

? II 1 G and EEx ia IIC T6 to EN50020 and EN50284

Installation / set-up

These devices may only be installed, connected and operated by trained and qualified staff. Qualified staff must have knowledge of protection classes, directives and regulations concerning electrical equipment designed for use in explosion hazardous areas, and, if necessary, of the regulations applicable to safety-related systems. Please verify that the classification and the marking on the device comply with the actual application conditions.

This device is only suited for connection to approved EExi circuits acc. to EN50014 and EN50020. Please observe the maximum admissible electrical values. After connection to other circuits the sensor may no longer be used in EExi installations. When interconnected to (associated) electrical equipment, it is required to perform the "Proof of intrinsic safety" (EN60079-14). When employed in safety systems to IEC 51408 it is required to assess the failure probability (PFD) of the complete circuitry.

Installation Notes / Mounting

Avoid static charging of cables and plastic devices. Please only clean the device with a damp cloth. Do not install the device in a dust flow and avoid build-up of dust deposits on the device. The devices and cables must be protected against mechanical damage and strong electro-magnetic fields. The pin configuration and the electrical specifications can be taken from the device marking or the technical data sheet. In order to avoid contamination of the device, please remove possible blanking plugs of the cable glands or connectors only shortly before inserting the cable or opening the cable socket.

Installation / service

Repairs are not possible. The approval expires if the device is repaired or modified by a person other than the manufacturer. The most important data from the approval are listed.

NON-HAZARDOUS LOCATION

HAZARDOUS (CLASSIFIED) LOCATION

Class I, Div. 1, Groups A,B,C,D; Class II, Div. 1, Groups E,F,G; Class III, Div. 1

Any FMRC Approved associated apparatus with Entity Concept parameters as follows:

$$V_{oc} \text{ or } V_t \leq 15V$$

$$I_{sc} \text{ or } I_t \leq 60mA$$

$$C_a \geq C_{cable} + 220nF$$

$$L_a \geq L_{cable} + 280\mu H$$

Turck Proximity Sensor Models: BCa-b-cdef Bia-b-cdef* BIM-b-cdef* MP-aD-cdef Nia-b-cdef* Sia-b-cdf

a = Sensing distance in millimeters b = Mechanical form
c = Output Y0, Y1 or 2Y0 d = LED, X or blank
e = Connector style -H1140, -H1141, -H1341, -V1331, -B1221 or blank
f = Options /S97, /S100 or blank

* Sensors with integral cable may include molded connector option.

Add suffix: -g-hjk-4.21T

g = Cable length (M) h = Connector angle, W (right angle) or R (straight)

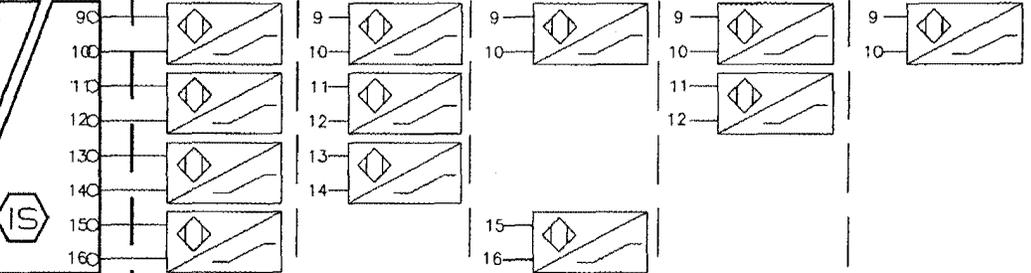
j = Connector gender K (female) or S (male)

k = Material K (nylon), V (SST) or blank (chrome-plated brass)

$$V_{max} = 15V, I_{max} = 60mA, C_i = 220nF, L_i = 280\mu H$$

MSa-bExO-cde

a = 1, 13, 14, 21, 22, 23 or 41
b = 11, 12, 21, 22, 23, 33, 42, 121 or 231
c = R, T or RT
d = /12VAC, /24VAC, /42VAC, /48VAC, /115VAC, /230VAC, /12VDC, /24VDC, /36VDC, /42VDC or 60VDC
e = /M18 or blank



Entity Parameters (per channel)

V _{oc} (V)	I _{sc} (mA)	C _a (uF) AB/CE/DFG	L _a (mH) AB/CE/DFG
10.8	13.8	2.5/7.5/20	185/650/1H

MK13-aNb-ExO/24VDCd
MK13-aPb-ExO/24VDCd
MK13-aPN-ExO/24VDCd
MK13-aR-ExO/cd
MK15-ePN-ExO/24VDCf

a = A, R, U or V
b = F or blank
c = 12VDC, 24VDC, 115VAC, OR 230VAC
d = /K06, /K15 or blank
e = A, R or U
f = /K11 or blank

MK1-22a-ExO/24VDCb

MK13-22a-ExO/24VDCb

a = AN, AP, RN, RP, UN or UP

b = K07 or blank

MK1-22ExO-Rc

MK13-aExO-bc

MK21-dExO-Rc

MK21-eExO-Rlc

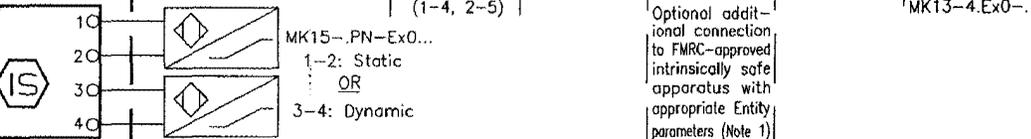
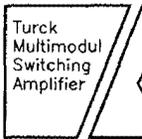
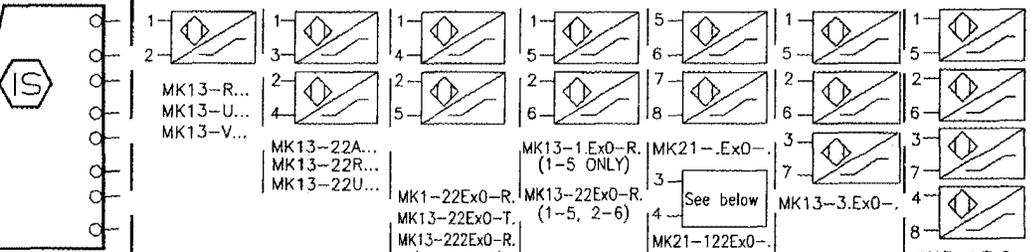
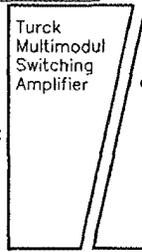
MK21-122ExO-Rf

a = 11, 12, 121, 22, 222, 33, or 451

b = R or T

c = /24VDC, /115VAC or /230VAC

d = 12, 121, or 122 e = 12 or 122 f = l or blank



Entity Parameters

Model	Terminals	V _{oc} (V)	I _{sc} (mA)	P _o (mW)	C _a (uF)		L _a (mH)	
					AB/CE/DFG	AB/CE/DFG	AB/CE/DFG	AB/CE/DFG
MK1-22-ExO/	1-3, 2-4	11.8	18	-	1.7/5.2/13	101/358/898		
MK1-22ExO-R/	1-4, 2-5	9.6	10.7	-	3.76/11.3/30.1	282/981/1H		
MK13-22-ExO/	1-3, 2-4	11.8	18	-	1.7/5.2/13	101/358/898		
MK13-...-ExO/	1-2	11.0	32.7	-	2.2/6.6/17.6	32/125/275		
MK13-1.ExO-R/	1-5	11.9	18.0	-	1.68/5.06/13.5	102/358/898		
MK13-1.ExO-T/	1-4	11.9	18.0	-	1.68/5.06/13.5	102/358/898		
MK13-22ExO-R/	1-5, 2-6	11.9	18.0	-	1.68/5.06/13.5	102/358/898		
MK13-22ExO-T/	1-4, 2-5	11.9	18.0	-	1.68/5.06/13.5	102/358/898		
MK13-22ExO-R/	1-4, 2-5	9.6	10.7	-	3.76/11.3/30.1	282/981/1H		
MK13-3.ExO- /	1-52-63-7	13.3	14.8	-	1.15/3.46/9.23	149/524/1H		
MK13-4.ExO- /	1-52-63-7-8	13.3	14.8	-	1.15/3.46/9.23	149/524/1H		
MK15-PN-ExO/	1-2, 3-4	14.1	21.7	-	1.0/3.0/8.0	75/275/600		
MK21-12.ExO-	5-6, 7-8	12.4	14.4	44	1.46/4.38/11.7	157/551/1H		

Notes:

1. The symbol designates any of the following:

* Turck NAMUR proximity sensors described above. The total cable capacitance and inductance must be limited to:

Model	C _{cable} AB/CE/DEF	L _{cable} AB/CE/DEF
All MS	2.2/7.2/19 (uF)	28/110/240 (mH)
MK1-..., MK13-...	0.9/3.2/9.0 (uF)	31/124/274 (mH)
MK15-...	0.78/2.7/7.7 (uF)	74/274/599 (mH)
MK21-...	1.24/4.1/11.4(uF)	156/550/1000 (mH)

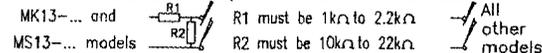
* Any FMRC-approved intrinsically safe apparatus with Entity Concept parameters:

$$V_{max} \geq V_{oc} \text{ or } V_t \quad I_{max} \geq I_{sc} \text{ or } I_t \quad C_i + C_{cable} \leq C_o \quad L_i + L_{cable} \leq L_a$$

The Entity Concept allows interconnection of intrinsically safe apparatus and associated apparatus not specifically examined in such combination as a system when the conditions above are met.

* Any simple apparatus. A simple apparatus is defined as a device that will neither generate nor store more than 1.2V, 0.1A, 20uJ, or 25mW.

2. When the field device is a contact closure, the connection should be made as shown below for proper performance.



MS13-... models R1 must be 1k to 22k R2 must be 10k to 22k

3. Any combination of up to 10 channels of the associated apparatus described above may be connected to simple apparatus in a hazardous (classified) location using a common return. R1, if used, must be rated 0.25W minimum if 3-10 channels are connected with a common return, the total cable inductance must be limited to the values in the table to the left. If 2 or more channels are connected with a common return, the total cable capacitance must be limited to 1.0uF/3.0uF/8.0uF (Groups AB/CE/DEF).

Groups	Channels									
	A,B (mH)	18	8	4.7	3	2	1.1	0.7	0.5	0.3
	C,E (mH)	67	32	18	12	9	6.8	5.3	4.2	3.4
	D,F,G (mH)	155	69	39	25	17	12	9.8	7.8	6.3

4. Wiring methods must be in accordance with the National Electrical Code, ANSI/NFPA 70, Article 504, and ANSI/ISA RP12.6.

5. Associated apparatus must not be connected to any device that uses or generates in excess of 250Vrms unless it has been determined that the voltage is adequately isolated from the associated apparatus.

6. If the electrical parameters of the cable are unknown, the following values may be used: Capacitance - 60pF/foot
Inductance - 0.2uH/foot