

EZ-Tray Air Stripper

Patent No. 5518668

System Operation & Maintenance Manual

P/N 95168 5/6/15



Service Department Phone and Special Precautions _____	1
Basic System Description _____	2-6
Equipment Setup _____	7-9
Startup _____	10-14
System Shutdown Procedure _____	15
Tray Removal (for strippers with hinged doors) _____	16
Tray Removal (for strippers without hinged doors) _____	17
Tray and Downcomer Weights _____	18
Cleaning Instructions _____	19-22
Troubleshooting _____	23-26
QED Warranty _____	27-28

Figures

Figure 1: General Drawing of E-Z Tray Air Stripper _____	29
Figure 2: Typical Tray Drawing _____	30
Figure 3: Typical Blower Piping _____	31
Figure 4: Typical Gravity Discharge Piping _____	32
Figure 5: Gauge/Pressure Switch Diagram _____	33

Optional Tools

Delatching Tool Instructions _____	34
Knob Removal Tool _____	35
Split Tray Removal Tool _____	36

Appendix A

Disinfection Procedure _____	38
NSF Spare Parts _____	39

Other Manuals Included (In Order of Appearance):

1. New York Blower Manual
2. G&L Pump Manual
3. Dwyer Gauge Manual
4. Gem Sensors Float Switch Manual

Thank you for relying on QED Environmental Systems to handle your water treatment needs. After reading the 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 the QED Operation and Maintenance Manual First!

The manual will assist you in 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.

Note for drinking water applications

Prior to shipping preparation, QED has sprayed the interior surfaces of this EZ Tray stripper with dilute chlorinated water. It is the responsibility of the customer (system operator) to carry out any final cleaning and disinfection procedures prior to using the stripper for drinking water production.

Warning!

Air discharge and demister assembly is NOT designed to support discharge stack piping. Discharge stack must be supported by other means.

EZ-Tray™ systems are fabricated from rugged stainless 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 (" wc). The gauge is connected to the system via tubing that is attached to a pressure port on the air stripper sump. The air tubing from 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 demister pad is to remove entrained water droplets that would have blown through the discharge stack. It is possible, though unlikely, that the demister pad may become plugged or fouled. If this occurs the demister pad is easily removed. Disconnect the vent line, take off the demister cap, and remove the demister. The demister pad can be cleaned with a pressure washer or replaced with a new one.

Gaskets (Standard)

Various 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 air tight seal between the front hatch and aeration trays, and a felt gasket is located on the underside of each aeration tray and a gasket is used under each downcomer flange. 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 air flow 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 or 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 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 air flow 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 air flow 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 the frequency of cleaning required to minimize 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) must be properly supported to avoid over-stressing the blower housing. Silencers exposed to high wind velocities must 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 (FPM), 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, 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 ground water 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 consists of a “turbine style” 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 on 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. Install throttle valves on the discharge lines for adjusting water flow rate. The valve should be throttled back until the motor draws “full-load amps” (refer to the current rating on the nameplate).

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 Precautions" at the beginning of the "Equipment Setup" 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 from which its cord emerges.

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 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 sure 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 Precautions" at the beginning of "The Equipment Setup" 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 stripper 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 a range of 0-140° 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.

Special Precautions!

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 side walls 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 and installation of the equipment. The aeration trays must be level for proper operation.

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 practices and 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 practices and 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). Make sure all fittings and hose clamps are tight and secure.

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 practices and 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, and to prevent damage to top of air stripper housing.

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.

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, 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. 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.
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 air flow 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 Flow Rate.

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 flow rate at the anticipated water flow rate for the system.

Blower throttling is not always possible at unattended and/or intermittent operation sites when the system restarts. Our testing shows that the new seal pots maintain seal water for up to 10 minutes once they are filled. If your system frequently shuts down for longer than 10 minutes, or you’ve experienced water blow off on start-up, we’ve created plastic insert pans that sit in the seal pots and ensure that the pot will maintain its water seal.

QED's recommendation is to use the pans on systems that operate intermittently and/or systems where an operator is not present on start up to throttle the blower at the beginning until the seal pots have filled. Reference **Figure 2**.

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 air flow 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. These 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 flow rates. The table assumes there is no additional pressure from equipment downstream of the air stack. If down stream equipment adds back pressure, these values may not be accurate.

Typical Sump Operating Pressures (Approximate*)

1 Tray System	4-6" wc
2 Tray System	8-12" wc
3 Tray System	12-18" wc
4 Tray System	16-24" wc
5 Tray System	20-30" wc
6 Tray System	24-36" wc

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 DOWN STREAM 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 or Process 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 air flow for the system’s anticipated influent water flow rate; however, the air flow through the air stripper upon initiating “full operation” will be greater until water builds up on the trays. If this increased air flow is a concern, it is advised to close the damper slightly to throttle the air flow 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.

Installation and Start-up Checklist

Please follow the procedures below during installation and start-up to confirm that your E-Z Tray air stripper is installed and begins proper operation during start-up. If the QED air stripper is integrated as part of an equipment package sold by a third-party, please refer to operating guides, control logic and equipment cut-sheets as provided by the manufacturer.

Installation task:

DATE:

CHECKED BY:

- 1) Inspect air stripper for any defects or damage
 - i.Shell
 - ii.Trays
 - iii.Gaskets
 - iv.Site tube
 - v.Door
 - vi.Demister cone / demister element
 - vii.Magnahelic gauge

- 2) Verify that air stripper skids are installed / anchored on level surface

- 3) Confirm electrical supply (voltage, phase) defined in approval

- 4) Confirm rotation of blower / pump motors

Start-up task / checklist

Task

- 1) Verify system conforms with recommended installation guidelines

- 2) Confirm trays / down-comers are properly installed in air stripper

- 3) "Prime" air stripper sump with fresh water

- 4) Confirm air stripper door knobs are tightened to recommended torque

- 5) Confirm ball valve on sump drain is closed

- 6) Confirm all plumbing connections are tight / sealed

- 7) "Bump" blower motor & confirm proper rotation

- 8) Confirm motor rotation & prime for discharge pumps (if included) _____
- 9) Set blower throttle to "1/4" open _____
- 10) Initiate liquid flow _____
- 11) Allow tray levels to fill with water _____
- 12) Start pressure blower (must come up to speed) _____
- 13) Verify froth level (water / air mixture) on trays (4 – 6" maximum) _____
- 14) Verify differential pressure across air stripper sump _____
 - a. ~24" WC during clean start-up (open blower throttle to proper operating pressure)
 - b. ~36" WC when fouling
- 15) Measure liquid level in sump from site tube _____
- 16) Confirm absence of air / water bypassing on trays _____

Please contact QED Environmental Systems (1-800-684-2026) if you have any questions regarding air stripper start-up or proper operating conditions. Please refer to the identification number on the unit when contacting for assistance.

Shutdown Step 1. Shut Water Off

Shut off the water feed to the system.

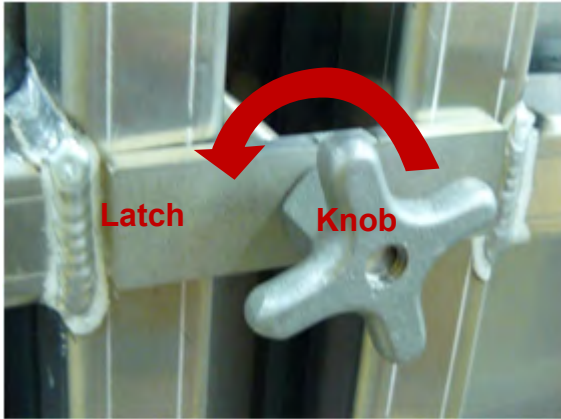
Shutdown Step 2. Wait 5 Minutes Before Blower Shut Off

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

Shutdown Step 3. Shut Power Off

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

Caution: *If proper shutdown 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.*



1. Loosen the door knobs by turning them counterclockwise.



2. Remove the knobs and latches from the bolts above and below the door.



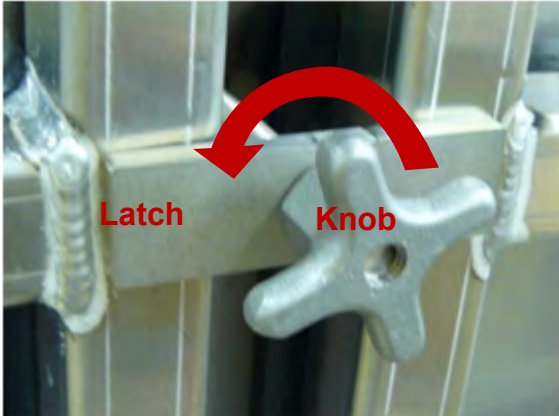
3. Loosen the side knobs until the latches can be rotated to the vertical position. The knobs and latches can be left in place on the two outside door sides. The knobs and latches must be completely removed from all of the door sides in the middle of the stripper. Swing the hinged doors open to gain access to the trays.



4. Remove the trays starting with the top tray and working down. Each downcomer will need to be raised to allow enough clearance to slide the tray out. The downcomer will need to be completely removed on the bottom-most tray. If “seal pots” (shallow black plastic pots) are being used at the base of the downcomers, gently raise the front end of the “seal pot” to pour the water out of it prior to sliding the tray out. Emptying the “seal pots” prevents water from splashing onto personnel.



5. Pull the tray straight out and remove it for cleaning. QED can provide specialty tools that make tray removal easier. After cleaning the trays and the other internal surfaces of the stripper, replace everything in reverse order.



1. Loosen the door knobs by turning them counterclockwise.



2. Remove the knobs and latches from the bolts above and below the door.



3. Loosen the knobs on the sides of the door until the latches can be rotated to the vertical position.



4. Slide the door slightly to the left, turn it on an angle and remove the door by pulling it outward. The knobs may need to be turned to the "X" position to provide enough clearance for door removal.



5. Remove the trays starting with the top tray and working down. Each downcomer will need to be raised to allow enough clearance to slide the tray out. The downcomer will need to be completely removed on the bottom-most tray. If "seal pots" (shallow black plastic pots) are being used at the base of the downcomers, gently raise the front end of the "seal pot" to pour the water out of it prior to sliding the tray out. Emptying the "seal pots" prevents water from splashing onto personnel.



6. Pull the tray straight out and remove it for cleaning. QED can provide specialty tools that make tray removal easier. After cleaning the trays and the other internal surfaces of the stripper, replace everything in reverse order.

Standard Trays	Tray Only (Lbs.)	Tray with Short Downcomer (Lbs.)	Tray with Bottom Downcomer (Lbs.)
4 Series	19	24	30
6 Series	24	30.5	37.5
8 Series	32	38.5	45.5
12 Series	46.5	54.5	63.5
16 Series	32	38.5	45.5
24 Series	46.5	54.5	63.5
36 Series	46.5	54.5	63.5
48 Series	46.5	54.5	63.5
72 Series	46.5	54.5	63.5
96 Series	46.5	54.5	63.5

Split Trays

12 Series Front	27	35	44
12 Series Back	25		

Downcomers

4 Down	5
4 Down Bottom	11
6 Down	6.5
6 Down Bottom	13.5
12 Down	8
12 Down Bottom	17

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 ground water 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 down time and allow the maintenance personnel to clean the trays at their convenience.

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.

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 washer. 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. Inspect the air stripper for any damage and repair as necessary.
3. Aeration tray integrity. Inspect trays for structural damage.
4. Inspect the internal piping (typically PVC piping) and replace as necessary.

E-Z Tray Air Stripper Cleaning Solutions

While pressure washing is often effective at removing scales and other solids from around stripper tray sieve holes, sometimes the scale is tightly adhered and requires a chemical solution to soften and/or re-dissolve the solids. Care needs to be exercised in selecting cleaning chemicals to avoid damage to the stripper metal enclosure.

General Precautions – Use adequate personal protection and recommended procedures when handling cleaning chemicals (eye shields, gloves of appropriate resistance, vented area, etc.)

Citric Acid – QED's general recommendation is the use of a dilute citric acid solution for scale cleaning. Dilute citric acid can be used with the standard 304 stainless steel used in the E-Z Tray systems and additionally with both 316 stainless steel and marine grade aluminum versions. Citric is also safe to use with the HDPE E-Z Stacker.

Citric acid can be purchased in power or granular form and is added to water to create a cleaning solution. A solution of 20-30% can be made by using the following weight to volume guide –

Citric Solution	Ratio (gm/ml)	Ratio (lbs/gal)
20%	250 gm / 1000ml	2 lbs / 1gal
30%	430 gm / 1000ml	3.6 lbs / 1gal

Other Acids – For more aggressive scales stronger acid solutions may be tested. The following is a general guide for dilute solutions in the 10-20% range. It is suggested that a small area be tested with the acid solution to evaluate effectiveness and observe any impacts on the stripper materials. **Do not use hydrochloric (muriatic) acid on stainless steel.**

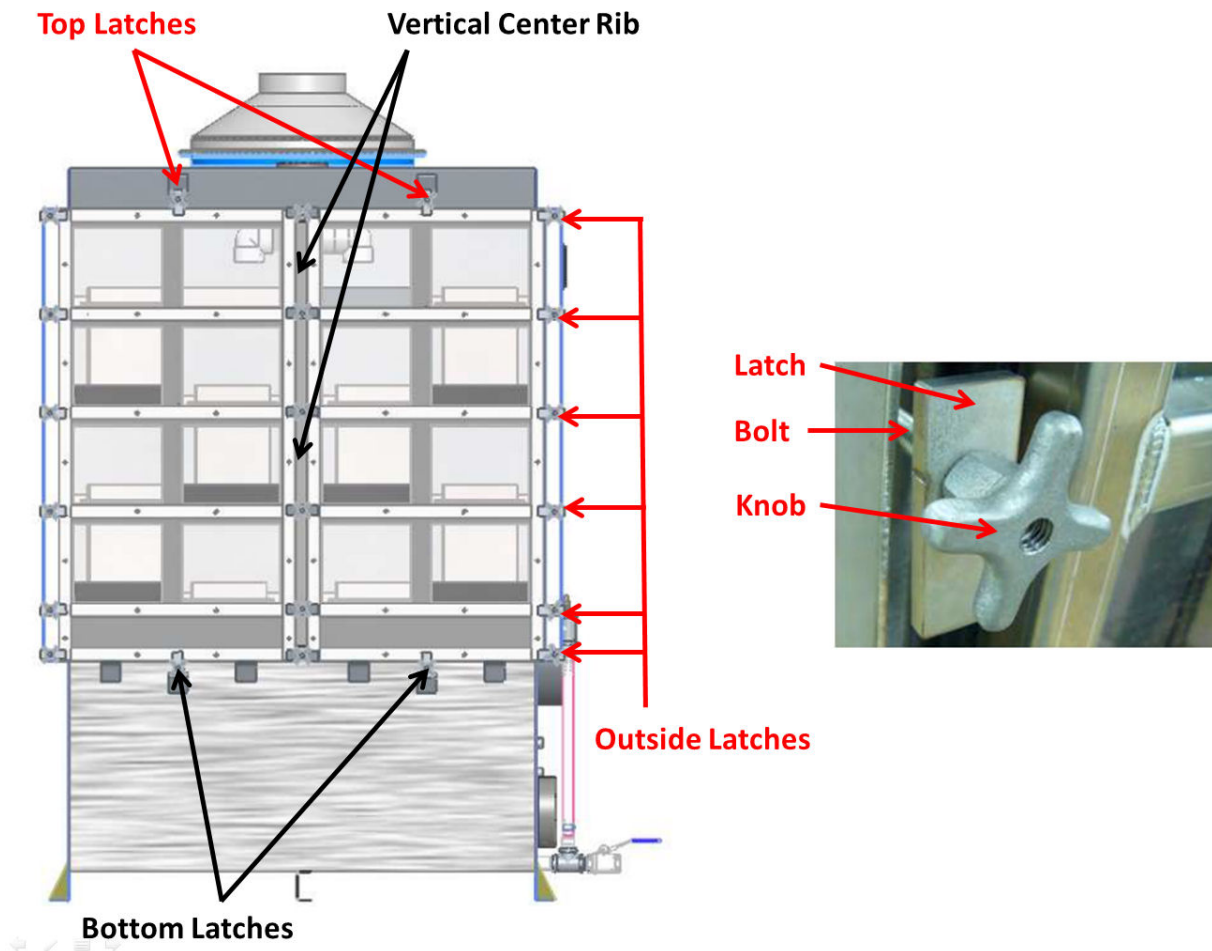
304 stainless steel (standard E-Z Tray) – Solutions of nitric or phosphoric acid can be used.

316 stainless steel – Solutions of nitric, phosphoric or sulfuric acid can be used.

Marine grade aluminum – Solutions of phosphoric acid can be used.

HDPE (E-Z Stacker) – Solutions of nitric, phosphoric or sulfuric acid can be used.

1. Apply a dab of PTFE grease to the ends of each bolt. Verify that the knobs spin freely on the bolts.
2. Position the top and bottom latches, and lightly tighten the knobs. This takes most of the "bow" out of the door and sets the door position.
3. Position the latches, and lightly tighten the knobs on the vertical center rib, working from bottom to top.
4. Position the outside latches, and lightly tighten the outside knobs, working from bottom to top.
5. Repeat the tightening sequences in steps 2-4 above until adequate sealing pressure is achieved (15 to 25 ft-lbs of torque).



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. Push reset button in. Reasons for tripping: incorrect line voltage, motor wired incorrectly, loose wire connections, 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. See blower manual for more details. Call QED.

Problem 2. Discharge 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 free moving and floating on the water.

Clean all deposits from float. Replace float as necessary.

Normal Operation - Water Level in Sump is Okay

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

Allow water level to decrease until pump turns off.

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

Problem 3. Discharge 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 contactor overload relay.

Push reset button in. Reasons for tripping: incorrect line voltage, motor wired incorrectly, inadequate ventilation, obstruction in piping, 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 discharge 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, or obstruction.

Problem 4. Low Air Pressure in Stripper Tank

Blower Damper Closed

Visually check position of damper near discharge 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

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 in Automatic Mode

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 front cover and visually inspect holes.

For iron fouling, clean out unit with a 1000 PSI pressure washer. For scaling, scrape or tap 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.

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 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, immiscible phases or other Henry's constant altering water additions present in the water.
6. Each influent contaminant does not exceed 25% of its maximum solubility under modeled conditions.

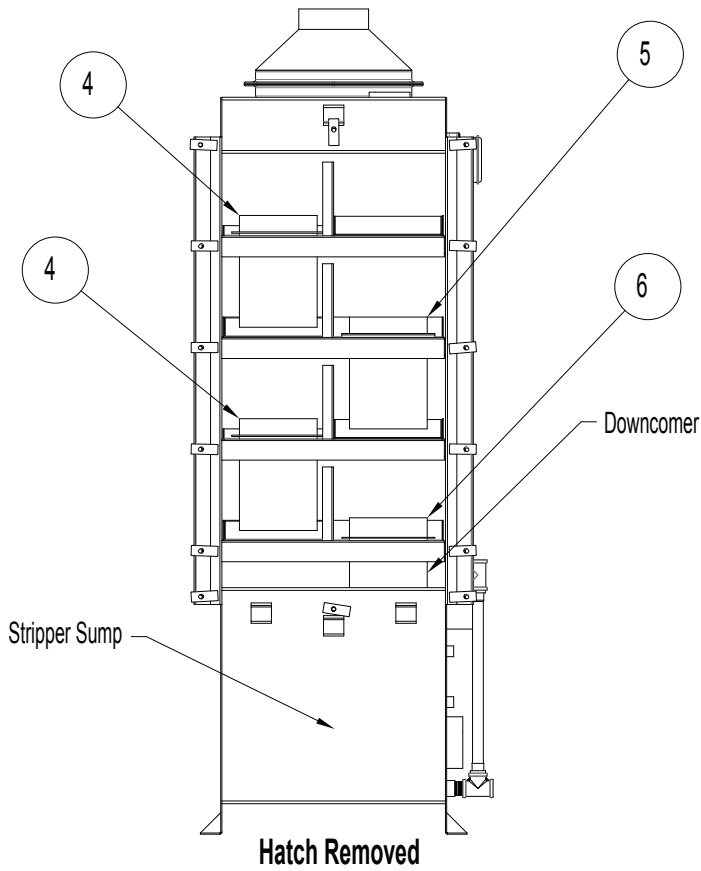
QED shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the consent of QED. If any product covered hereby is actually defective within the terms of this 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 \$750/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.

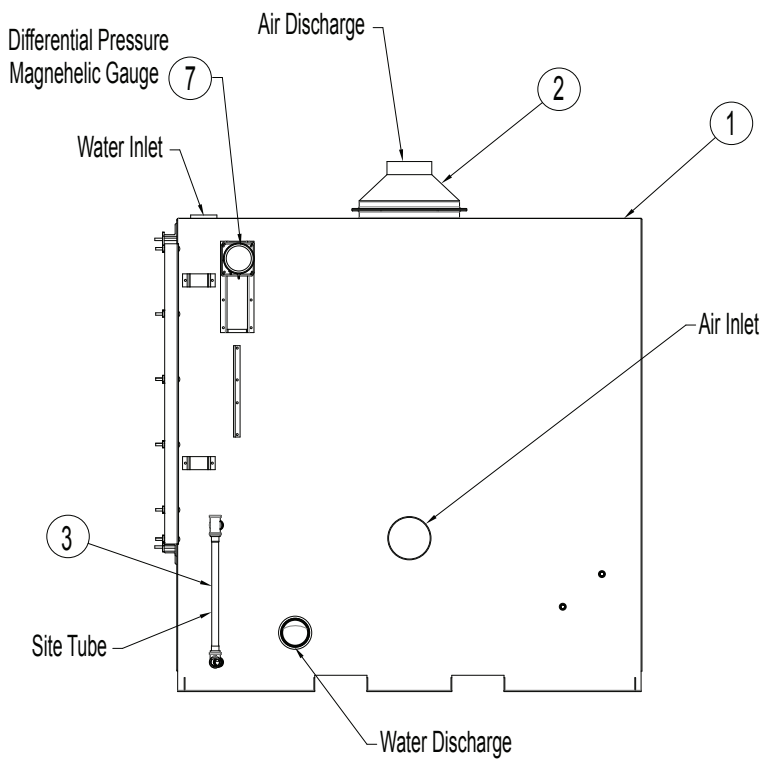
The original Purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. You may secure performance of obligations hereunder by contacting the Customer Service Department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

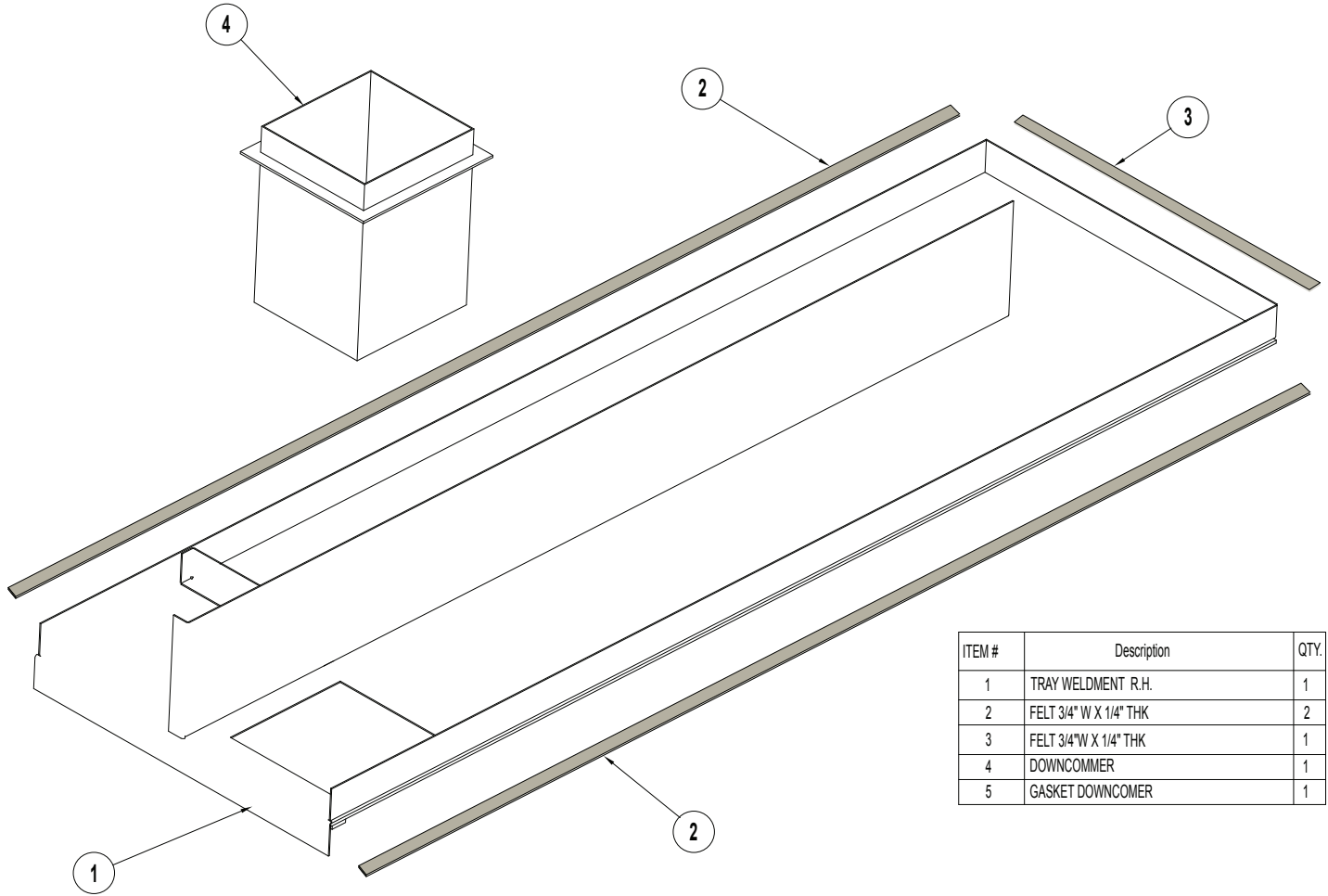
1. Identify the product or system involved by job number or QED order number.
2. Specifying where, when, and from whom the product was purchased.
3. Describing the nature of the defect or malfunction covered by this warranty.
4. If applicable, send the malfunctioning component, after receiving a Return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

QED Environmental Systems Inc.
2355 Bishop Circle West
Dexter, MI 48130
Attn: RAC Number
(RAC provided by QED Service Dept.)

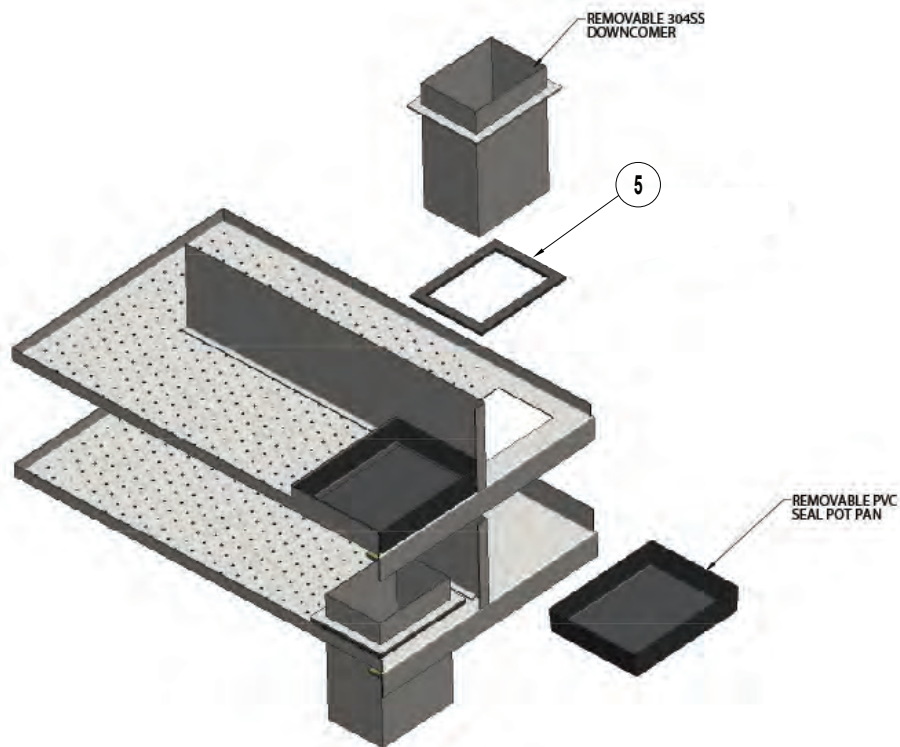


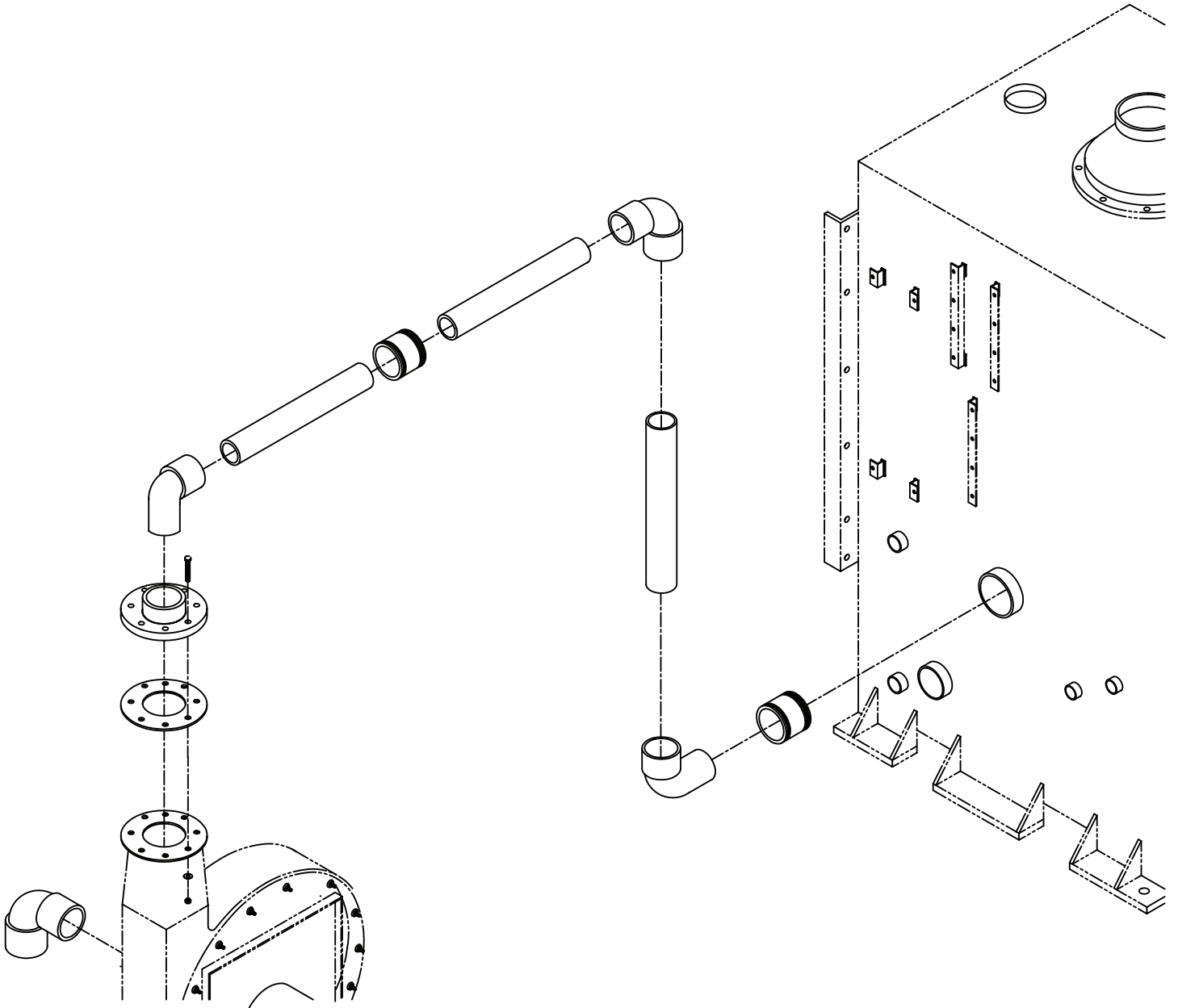
ITEM NO.	Description	QTY.
1	EZ TRAY AIR STRIPPER	1
2	DEMISTER HOUSING	1
3	SIGHT TUBE	1
4	TRAY L.H.	2
5	TRAY R.H.	1
6	TRAY R.H. BOTTOM	1
7	GAUGE MAGNEHELIC	1

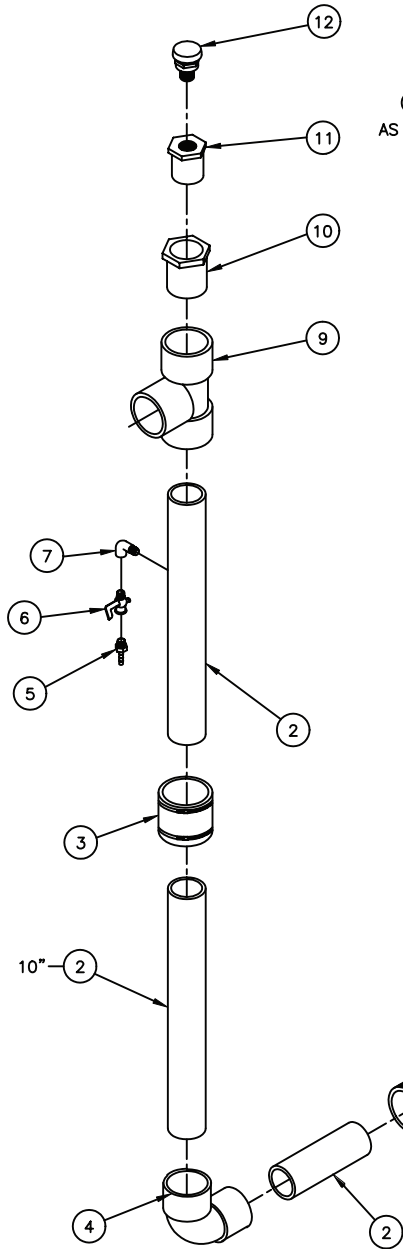




ITEM #	Description	QTY.
1	TRAY WELDMENT R.H.	1
2	FELT 3/4" W X 1/4" THK	2
3	FELT 3/4" W X 1/4" THK	1
4	DOWNCOMMER	1
5	GASKET DOWNCOMER	1

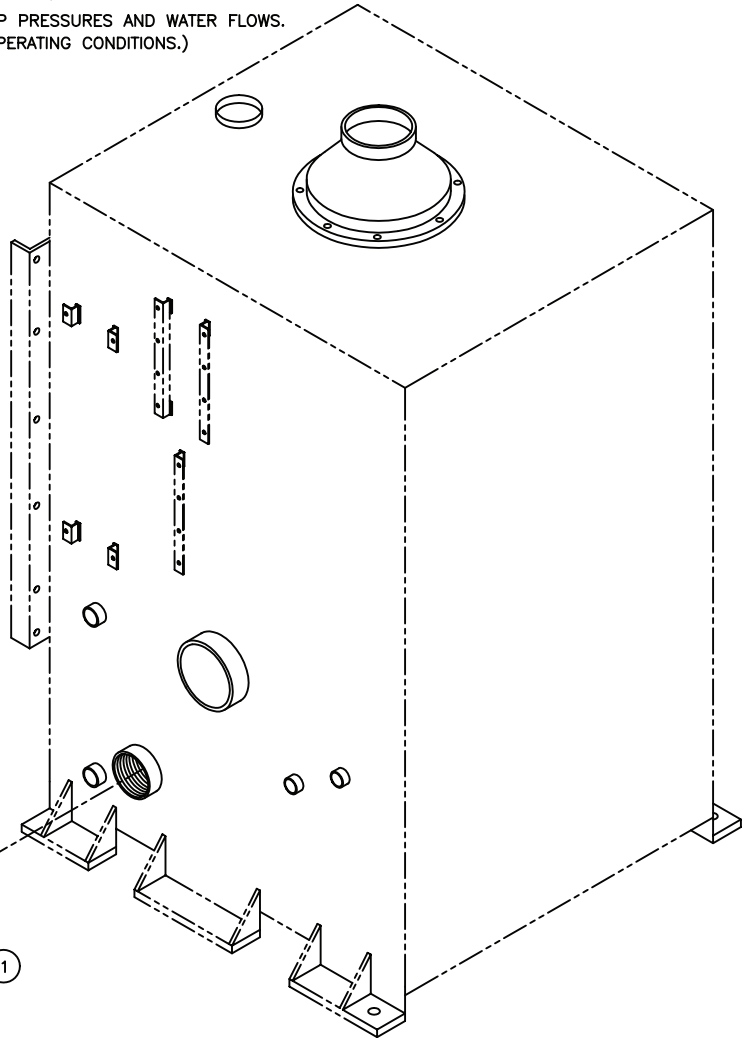




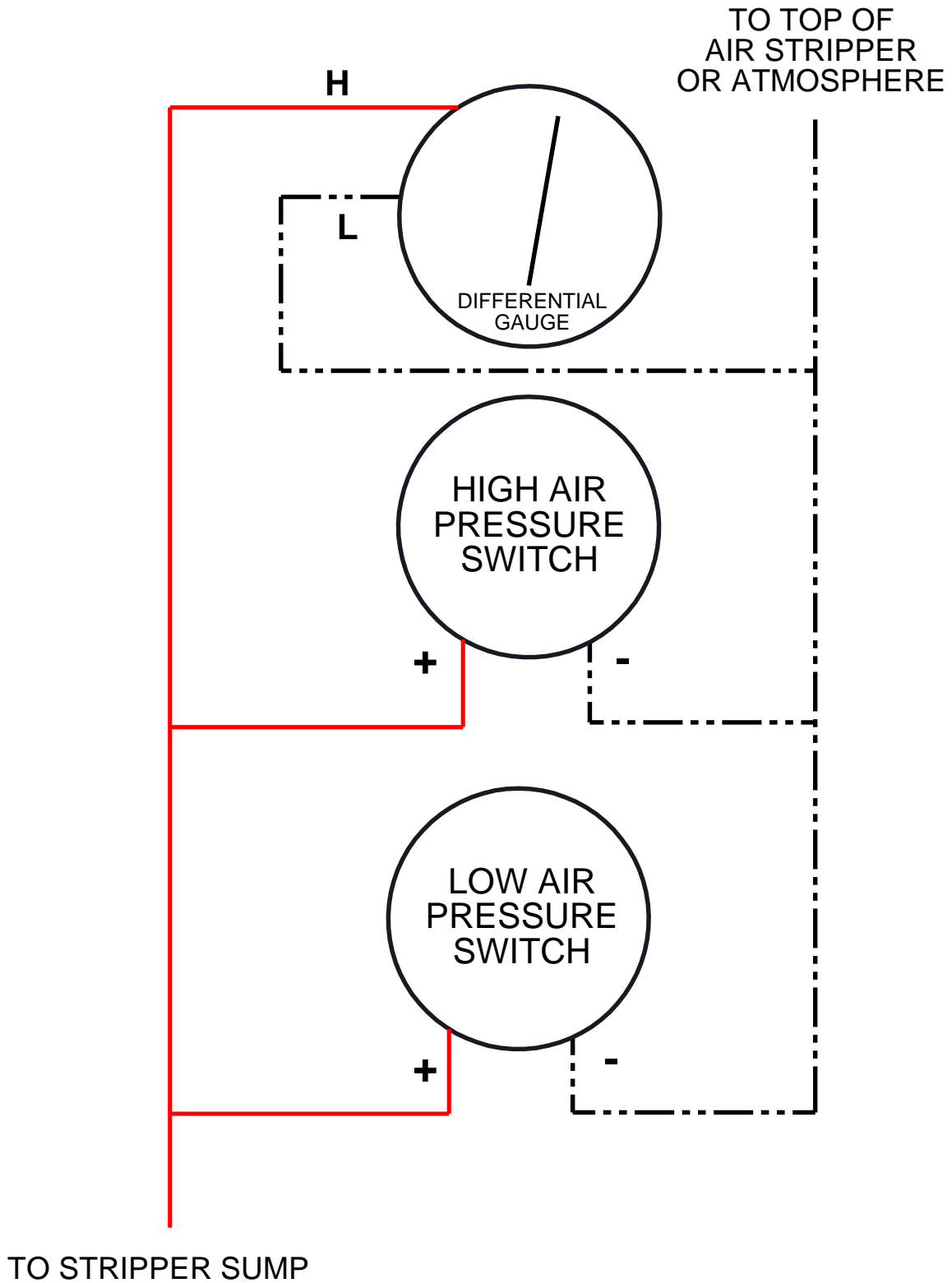


NOTE:
1. CENTER LINE OF WATER OUT (ITEM 1)
TO CENTER LINE OF DRAIN CONNECTOR
(ITEM 9) TO BE 27" - 6 TRAY
18" - 4 TRAY

(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	TBD	PIPE, PVC SCH 80	
1	1	ADAPTER, PVC SCH 80	
ITEM	QTY	DESCRIPTION	PART #
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS		DRAWN BY MEB	DATE 10/29/99
TOLERANCES .000+/-01 FRACT +/-1/64 .000+/-005 ANGLES +/-1/2		CHECKED BY	DATE
OTHER TOLERANCES AS SPECIFIED		APPROVED BY	DATE
EZ-TRAY (24.X)		MFG. APPROVAL	
NEXT ASSY		MATERIAL	
USED ON		FINISH	
		SCALE N.T.S.	SHEET 1 of 1
		<p>QED ENVIRONMENTAL SYSTEMS INC. 6155 JACKSON ROAD, ANN ARBOR, MI.</p> <p>TITLE GRAVITY DRAIN ASSEMBLY/BOM/KIT</p> <p>DRAWING NUMBER eztravdis REV</p>	



AIR STRIPPER GAUGE AND PRESSURE SWITCH CONNECTION DIAGRAM (Optional)

The Tray Delatcher is a very useful tool to use to loosen the trays from their supports. To do this follow these simple steps:

1. Use proper personal protective equipment, such as gloves and safety glasses
2. Open the access hatches (doors) to gain access to the tray areas



3. Grasp the Tray Delatcher Tool on the long side with both hands.



4. Position the Tray Delatcher Tool under the outer edge of the tray.



5. Firmly push down on the Tray Delatcher Tool.

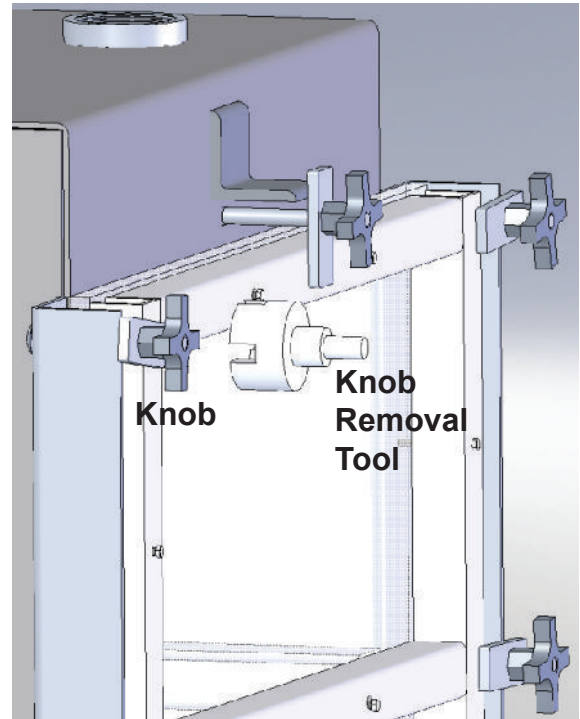
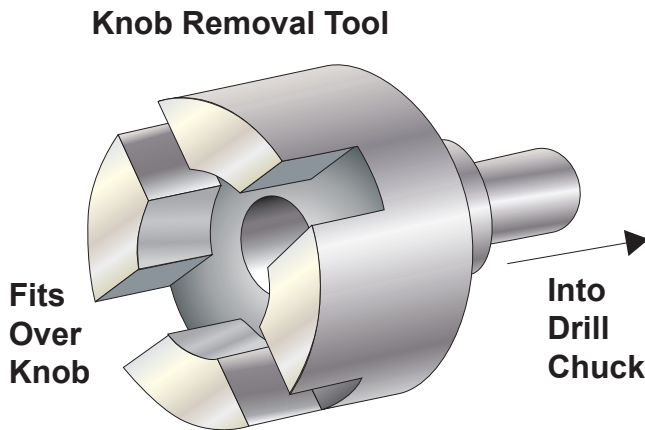


6. The tray will loosen and move outward toward the hatch (door) opening.

From here, you can pull out the trays, downcomers, and seal pot pans by hand, as necessary for maintenance, etc.

Note: The Tray Delatcher Tool is not needed for tray insertion. Simply slide them until the sealing surface (outer edge) of the tray is flush with the other housing surfaces. This is important to obtain proper sealing of the hatch / door.

Operation Instructions and Safe Use Tips



KNOB REMOVAL:

1. Use a power drill with reverse settings and preferably use one that has variable speeds and adjustable torque settings.
2. Keep in mind that drive tools such as these have a lot of power and torque. Refer to, understand, and follow all safety precautions and operating instructions of such power tools prior to use.
3. Install Knob Removal Tool in appropriate drill chuck and tighten securely.
4. Set torque setting on highest setting (if equipped).
5. Set rotation of drill to counterclockwise rotation.
6. Place tool over each knob, being certain that the tool is squarely on the knob.
7. Begin by operating drill as you normally would and spin off each knob. Work from the bottom of each access door up, and leave one knob at the top of each access door on so that the door will not fall off suddenly.
8. If stuck or stubborn knobs cannot be loosened using this method, use a wrench first and loosen slightly. If rust or corrosion is present or suspected, spray each knob /stud with a light penetrating oil first and let set for some time prior to removal.

KNOB INSTALLATION:

1. Be sure all knobs are started on each stud by hand prior to using tool.
2. Set drill to clockwise rotation.
3. Set torque setting (if equipped) to approximately 50% of maximum torque.
4. Using the same tool, alternate from side to side, top to bottom, and diagonally to provide even sealing pressure across entire door surface. Be careful not to over tighten any knob, which could cause damage to the access door and /or damage (strip) the internal threads of the Knob.
5. If knobs are not tight enough to provide adequate sealing pressure, increase torque setting of drill slightly to add tightening torque and repeat as necessary. If knobs are still not tight enough at maximum drill torque, use a wrench to tighten.



1. Remove access doors / hatches as you normally would to gain access to the internal tray areas of the air stripper.



2. Pull out the front tray while slightly lifting up on the downcomer (of the tray being removed) in order for the downcomer to clear the seal pot pan area of the tray below.



3. Remove downcomer and then fully remove the front tray and set aside.



4. Grab Tray Remover Tool "T" Handle in your hand and position the "channel" or hook end in a vertical position.



5. Extend the Tray Remover Tool inside the Air Stripper housing and "hook" the channel end around the back of the divider (vertical upright part on each tray).



6. Firmly pull on Tray Remover handle and pull rear tray out towards front of Air Stripper access door / hatch opening.

7. Set Tray Remover Tool aside and pull towards you to remove each rear tray.

8. Repeat for all rear trays

NOTE: Tool is not necessary for re-insertion of any trays.

Appendix A:

Supplementary Materials for NSF/ANSI 61 Certified Air Strippers

Please note: Refer to the following materials if your E-Z Tray air stripper was purchased as NSF/ANSI 61 certified.

Air Stripper Disinfection

This E-Z Tray air stripper unit has been disinfected prior to shipping. A dilute solution of chlorine bleach is sprayed onto the interior surfaces of the unit, then the hatch, flanges, and pipe connections are sealed. In this procedure, the surface of the trays, the bottoms of the trays, the walls of the air stripper shell and the sump are sprayed with the disinfectant solution. This solution is permitted to stay in contact with the surface post application to permit adequate disinfection time.

This process is completed to mitigate the risk of any microbiological contaminant encountered during the fabrication process. The disinfectant solution is added at a concentration of ~ 1.5 oz. of chlorine bleach to 14 gallons of water.

While this procedure is completed prior to shipping the unit, it is recommended that a similar procedure be completed prior to start-up, especially if the interior of the unit is accessed during system assembly.

Post Cleaning Disinfection

After cleaning and maintenance is completed on the air stripper unit, the air stripper should be disinfected prior to being placed back into operation. A similar disinfectant solution and procedure as described above should be used to complete this task.

Recommended practices:

- Interior surface area of air stripper shell (walls, sump, roof) should be contacted with disinfectant
- Trays can be disinfected prior to storage (tray rack should also be contacted w/ disinfectant)
- Final disinfection should be completed with trays **installed** into air stripper
- Both top & bottom sides of trays should be contacted with disinfectant
- Seal pot pans should be disinfected
- Interior surface of doors should be disinfected prior to sealing
- Interior surfaces of gravity discharge vessel should be disinfected prior to re-starting system

Manufacturer's Spare Parts for NSF Certified Air Strippers

Part Number	Description
810011	DOOR 4 HIGH
810012	DOOR 6 HGH
810017	GASKET DOOR (req. 1 810050 per gasket)
810018	GASKET DEMISTER 24
810019	GASKET DEMISTER 36 & 48
810020	GASKET DEMISTER 72 & 96
810021	GASKET AIR INLET 36 & 48
810022	GASKET AIR INLET 72 & 96
810023	GASKET WATER CLEAN OUT COVER
810024	BARB HOSE 1/4" NPT X 3/16" T 304SS
810025	GASKET TRAY FELT (req. 2 810050 per roll)
810026	GASKET DOWNCOMER
810027	KNOB DOOR
810032	PAN SEAL POT
810041	DEMISTER 24
810042	DEMISTER 36 & 48
840043	DEMISTER 72 & 96
810049	TUBING 1"
810050	CAULK DOW 832

Please note: Components listed above are specific to NSF approved air strippers. Please contact QED Environmental systems with model information when requesting consumable parts. QED representatives will assist you in determining necessary quantities, as well as parts availability.

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.

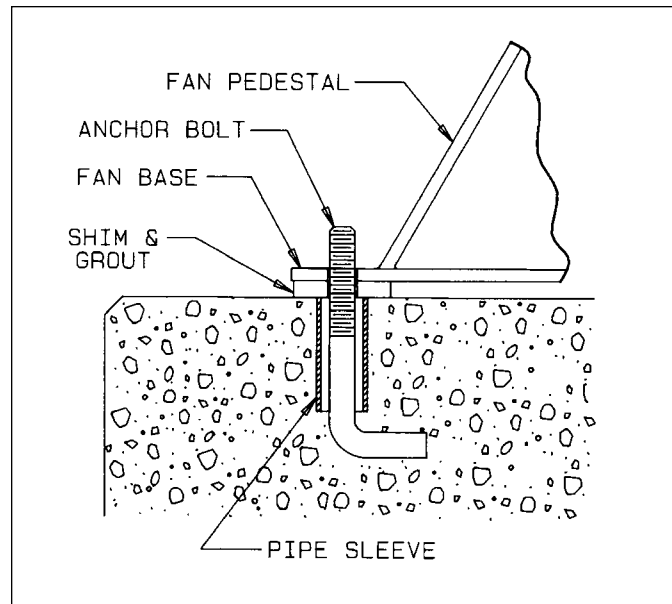


Figure 1

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.

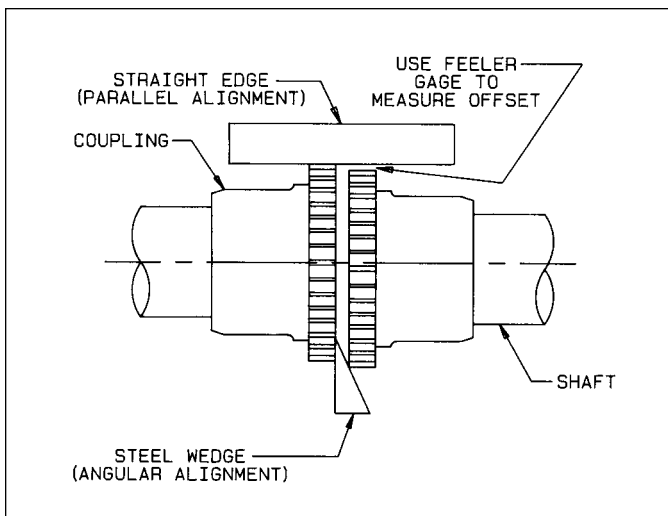


Figure 2

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:

1. TIGHTEN ALL SET SCREWS IN FAN WHEEL.
2. TIGHTEN ALL SET SCREWS IN BEARINGS.
3. REPEAT AFTER 8 HOURS OF OPERATION.
4. 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

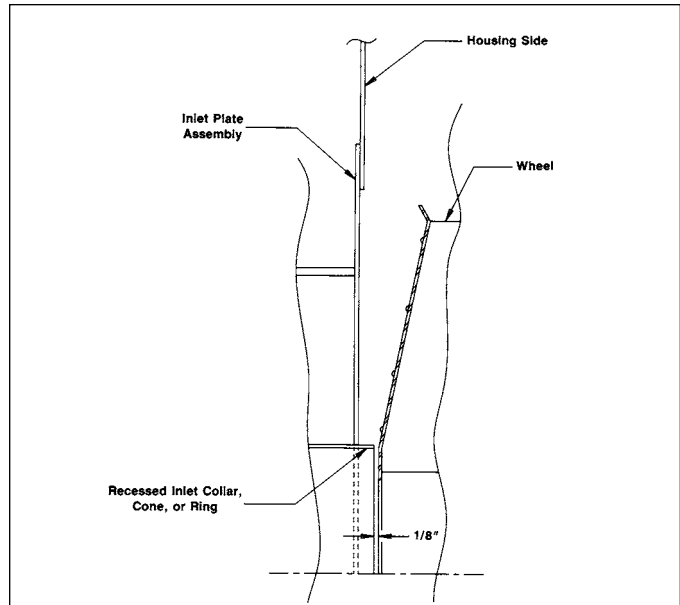


Figure 3

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
	6	4	4	2	2	1	1	1
1 11/16	6	6	4-6	4-6	2-4	2-4	2	1-2
	6	4	2	1	1	1	1-2	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>.

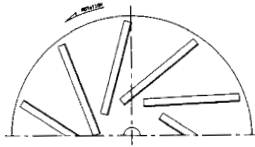
Example: Part required: Wheel/shaft assembly
 Shop/control number: B-10106-100
 Fan description: Size 2206A10 Pressure Blower
 Rotation: Clockwise
 Arrangement: 4

Suggested replacement parts include:

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

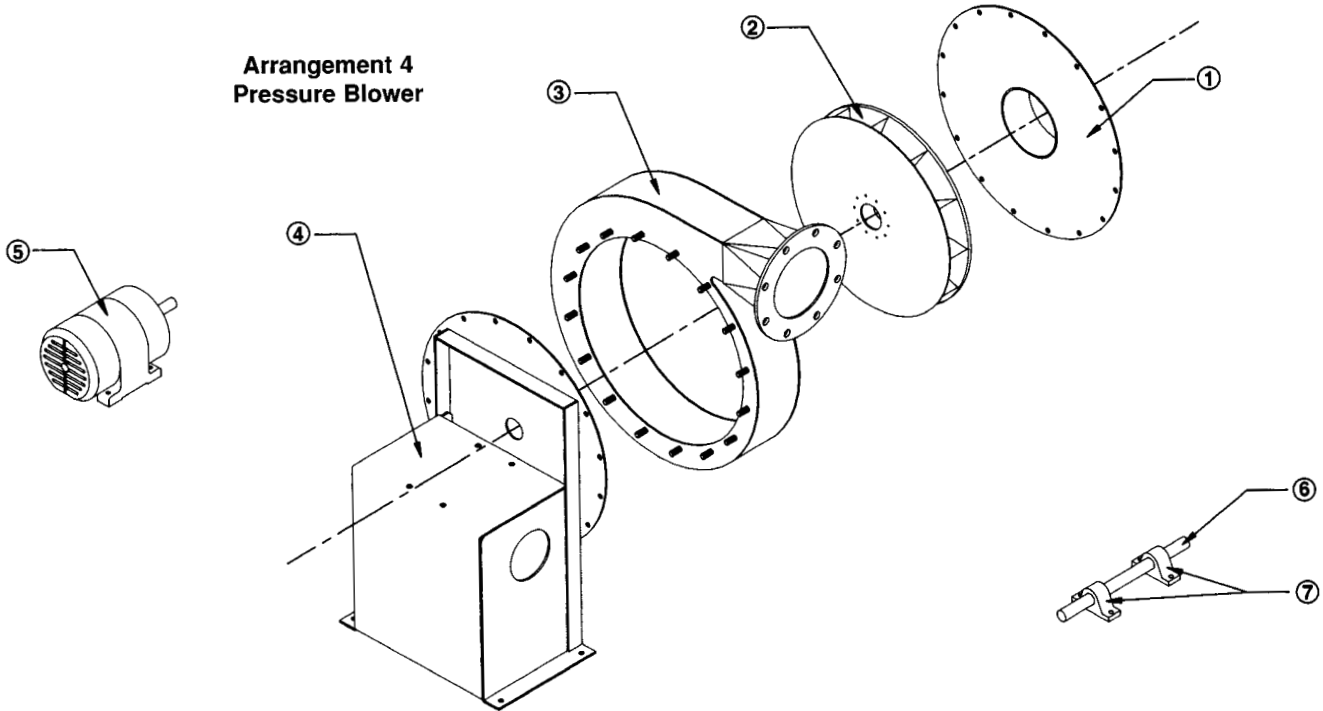
● For Arrangement 1/8 fan only.

SPECIFY ROTATION AS VIEWED FROM DRIVE SIDE

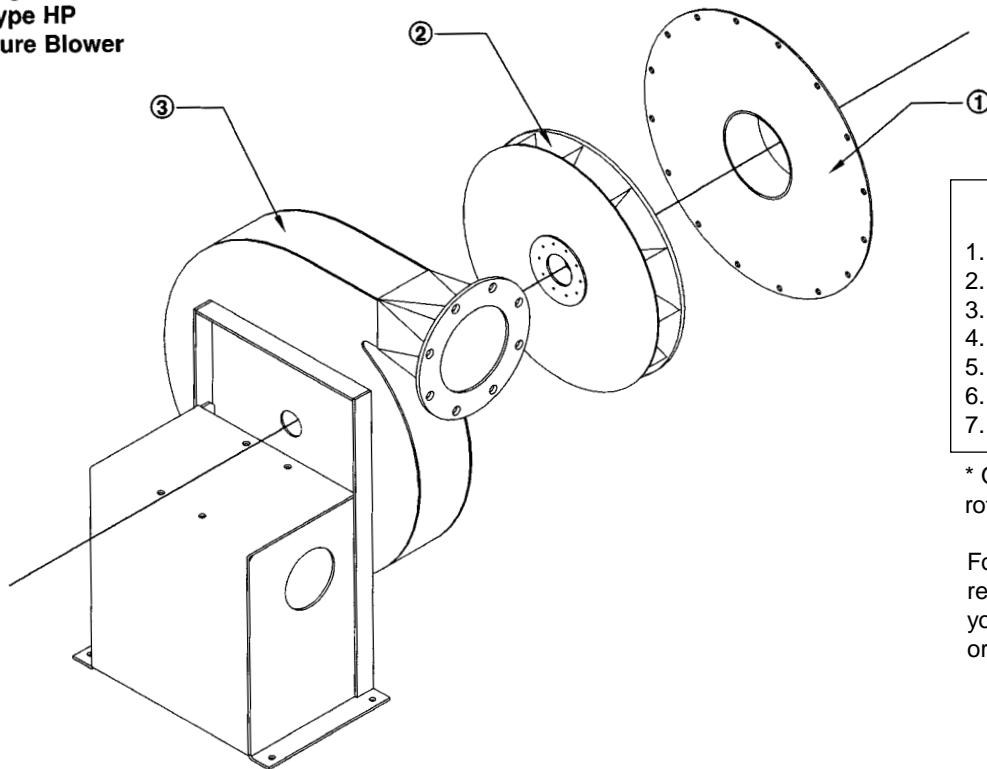


ARROW INDICATES COUNTER CLOCKWISE ROTATION

**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>.

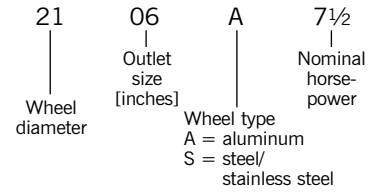
USING PERFORMANCE CURVES

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

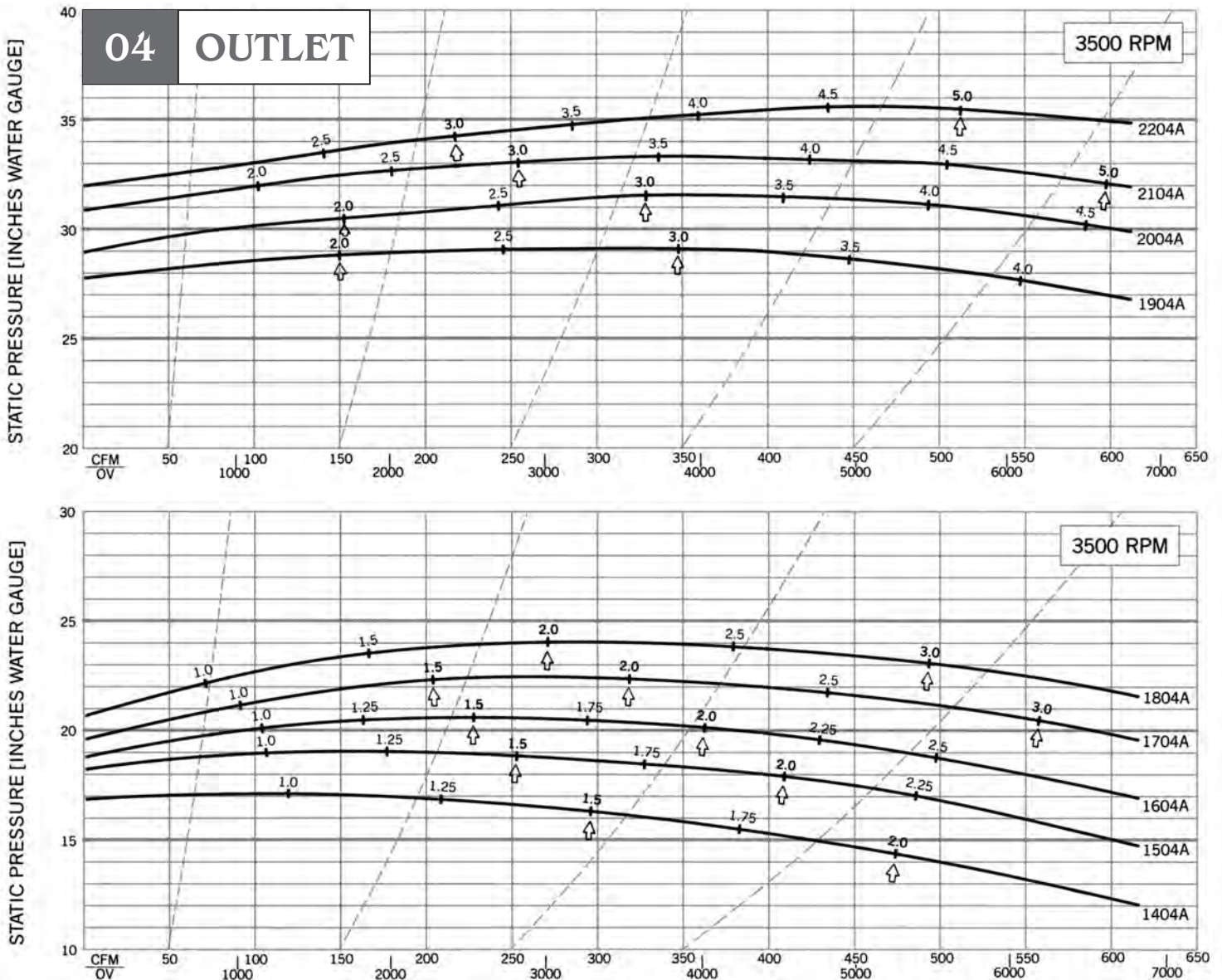
7-digit model number designates the wheel diameter, outlet size, wheel type, and nominal motor horsepower.
 Note: the last two digits showing motor horsepower are not required for Arrangement 1 Pressure Blowers.

EXAMPLE



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.

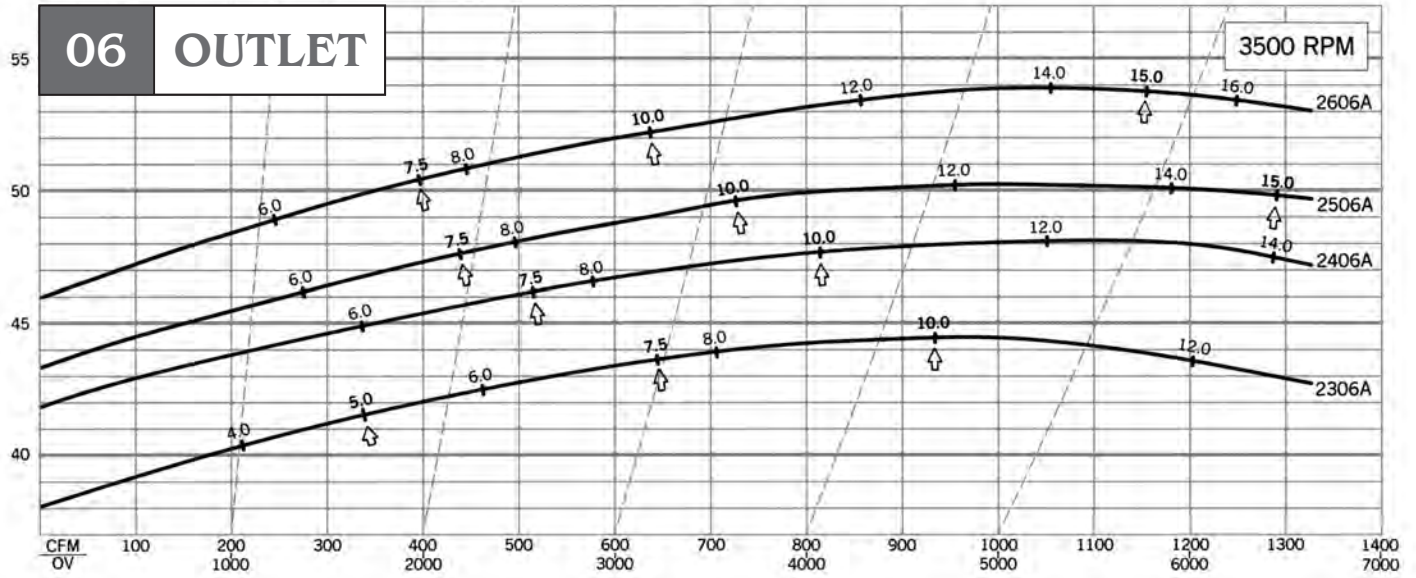
Note: The horsepower coverage of a given motor will increase 15% when a 1.15 service factor motor is utilized.



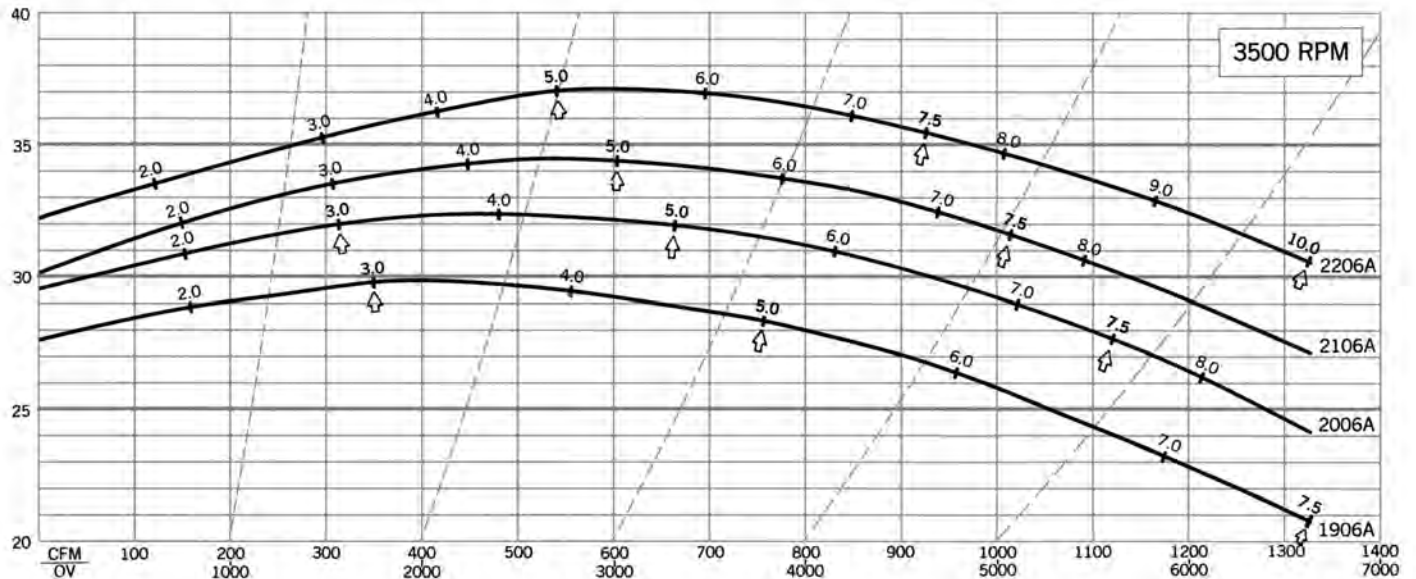
Performance shown is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include drive losses. Performance ratings do not include the effects of appurtenances in airstream.

STATIC PRESSURE [INCHES WATER GAUGE]

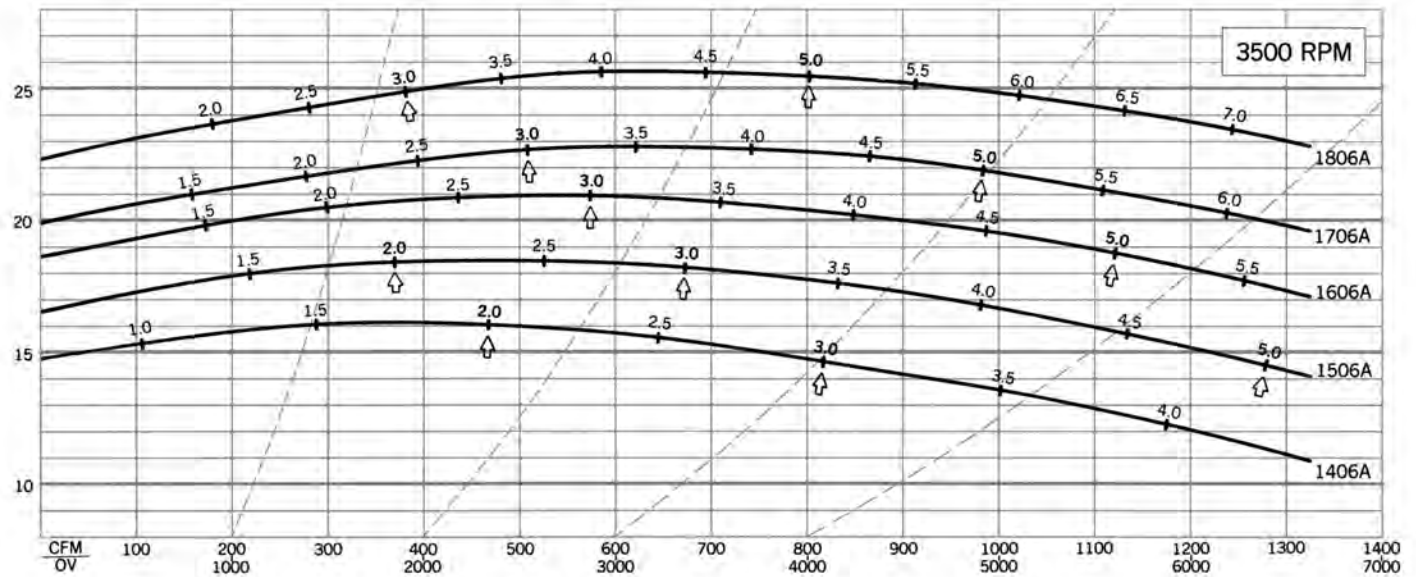
06 OUTLET



STATIC PRESSURE [INCHES WATER GAUGE]



STATIC PRESSURE [INCHES WATER GAUGE]

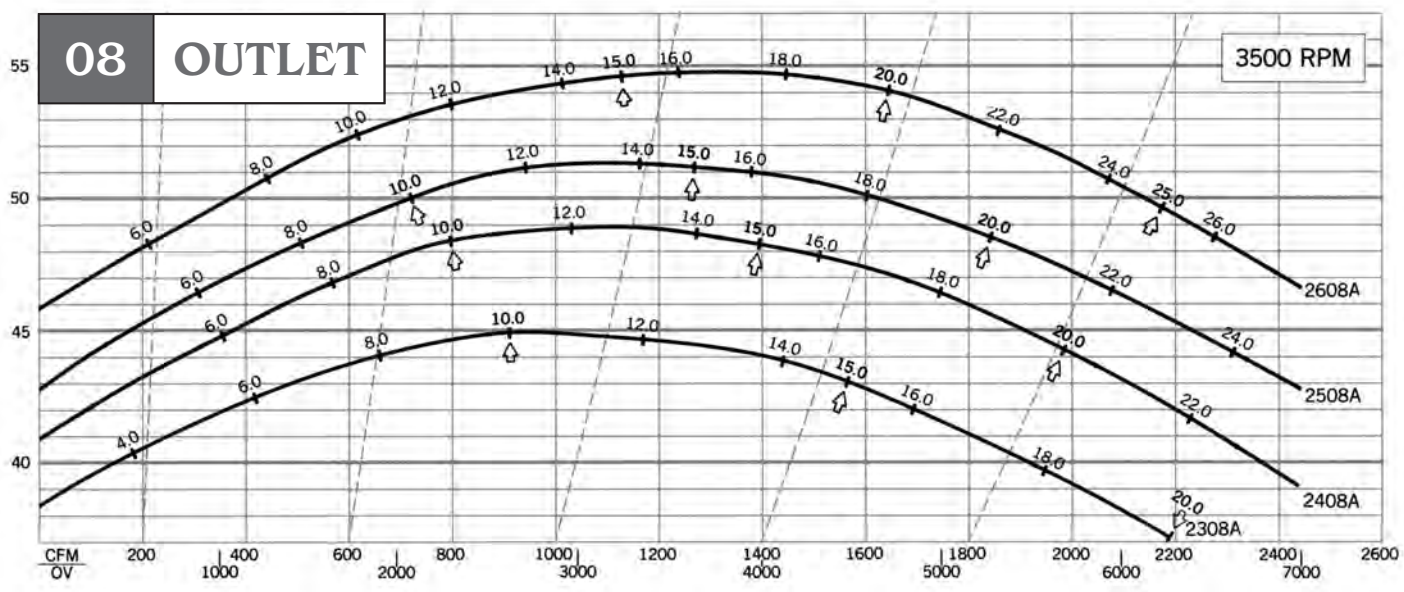


Performance shown is installation Type B: Free inlet, Ducted outlet. Power rating (BHP) does not include drive losses. Performance ratings do not include the effects of appurtenances in airstream.

STATIC PRESSURE [INCHES WATER GAUGE]

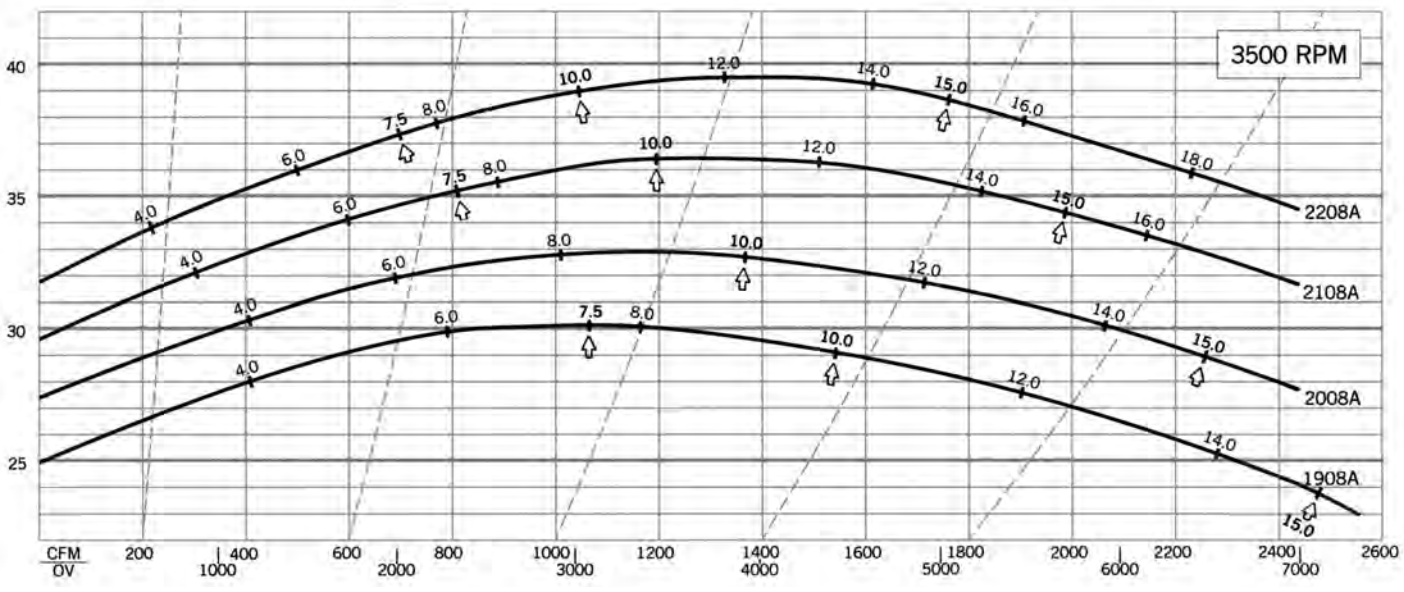
08 OUTLET

3500 RPM



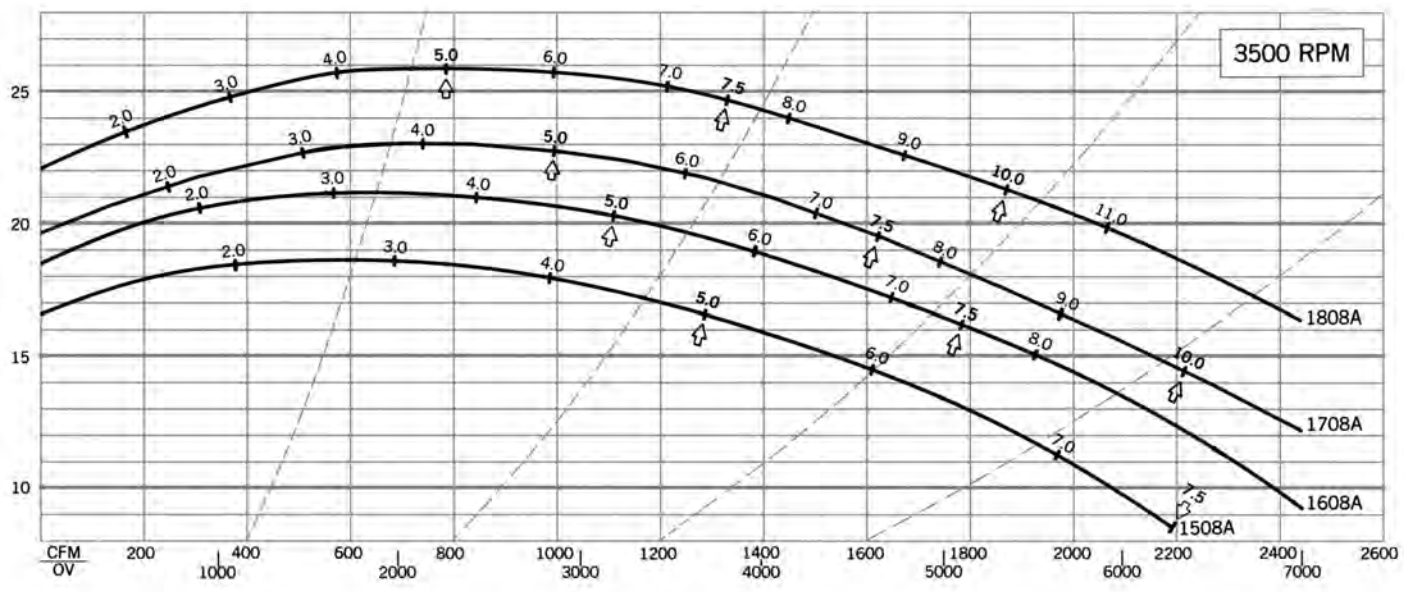
STATIC PRESSURE [INCHES WATER GAUGE]

3500 RPM



STATIC PRESSURE [INCHES WATER GAUGE]

3500 RPM



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.

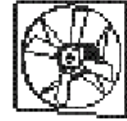
vi. These recommended safety practices were adopted by the AMCA International membership on April 28, 1996.



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



Uplblast 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

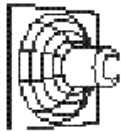
2.1.1 Protective devices are incorporated as standard construction on some types of fans but on many fans, these devices are offered as optional accessories. This is done because the need for the devices and the design required will frequently depend upon the type of system, fan location, and operating 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

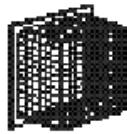
2.2.1 All fans have moving parts which require guarding in the same way as other moving machinery. Fans located less than seven (7) feet above the floor require special consideration. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards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

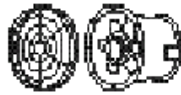
2.3.1 Axial and centrifugal fans are often connected directly to ductwork which will prevent contact with the internal moving parts; when an exposed inlet or outlet represents a hazard, a suitable guard should be installed.



*Centrifugal Fan
Protected by Ductwork*



*Inlet or Outlet Guard
on Centrifugal Fan*



*Guard for Axial Fan With
Non-Ducted Inlet or Outleg*

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

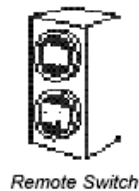
3.7.1 The hidden dangers associated with Special Purpose Fans used in special systems are covered in Section 6.

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 Assure 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.

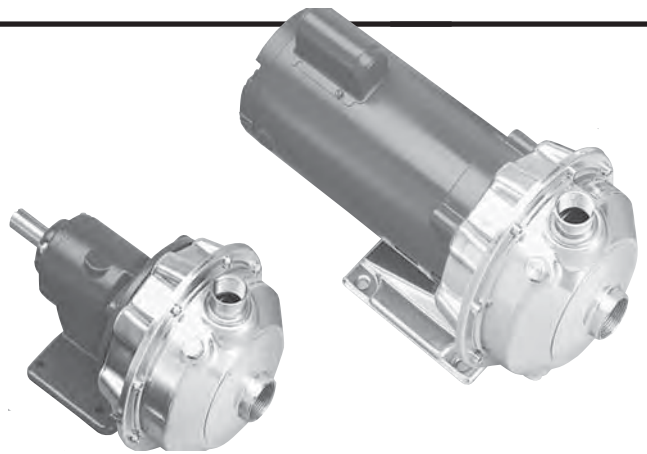
8.6 Under normal circumstances, handling clean air, the system should require cleaning only once a year. However, the fan and system should be checked at regular intervals to detect any unusual accumulation.

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.

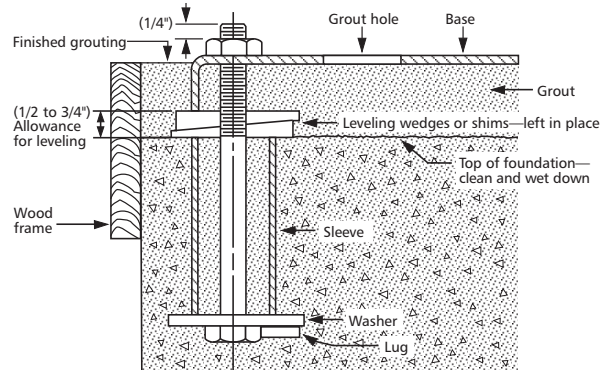


Figure 1

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.

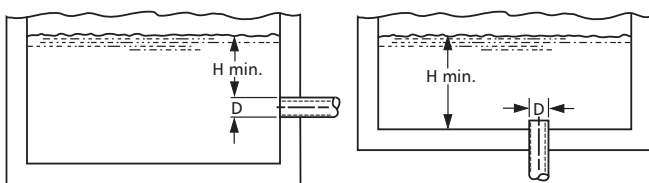


Figure 2

Figure 3

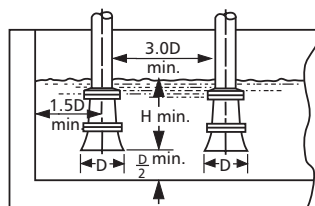


Figure 4

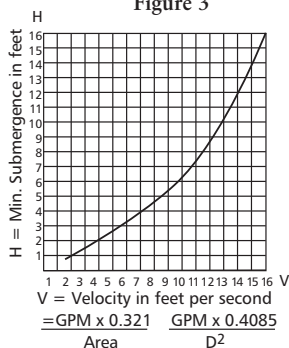


Figure 5

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.

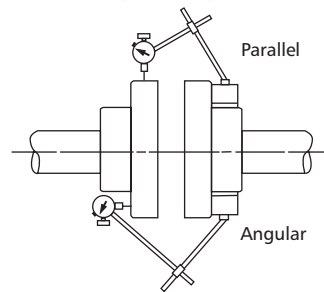


Figure 6

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)

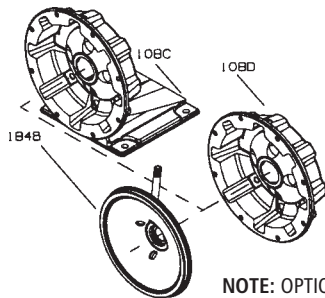
PROBABLE CAUSE:

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

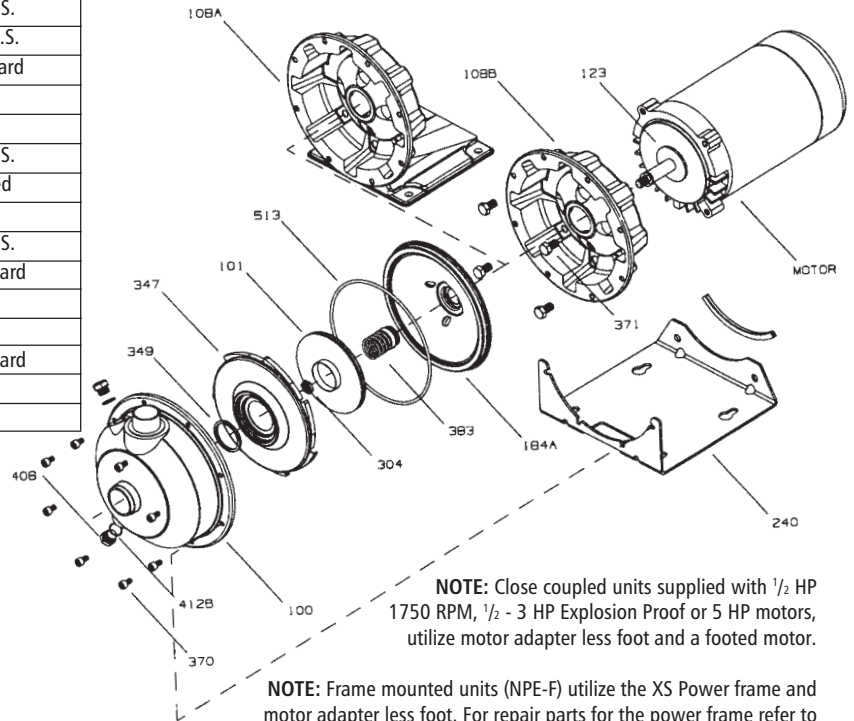
NPE Standard Repair Parts List

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	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton Standard
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton, standard
		EPR
		BUNA
		Viton, standard
513	O-Ring, casing	EPR
		BUNA
		BUNA

Item 383 Mechanical Seal (3/8" seal)				
Rotary	Stationary	Elastomers	Metal Parts	Part No.
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
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:

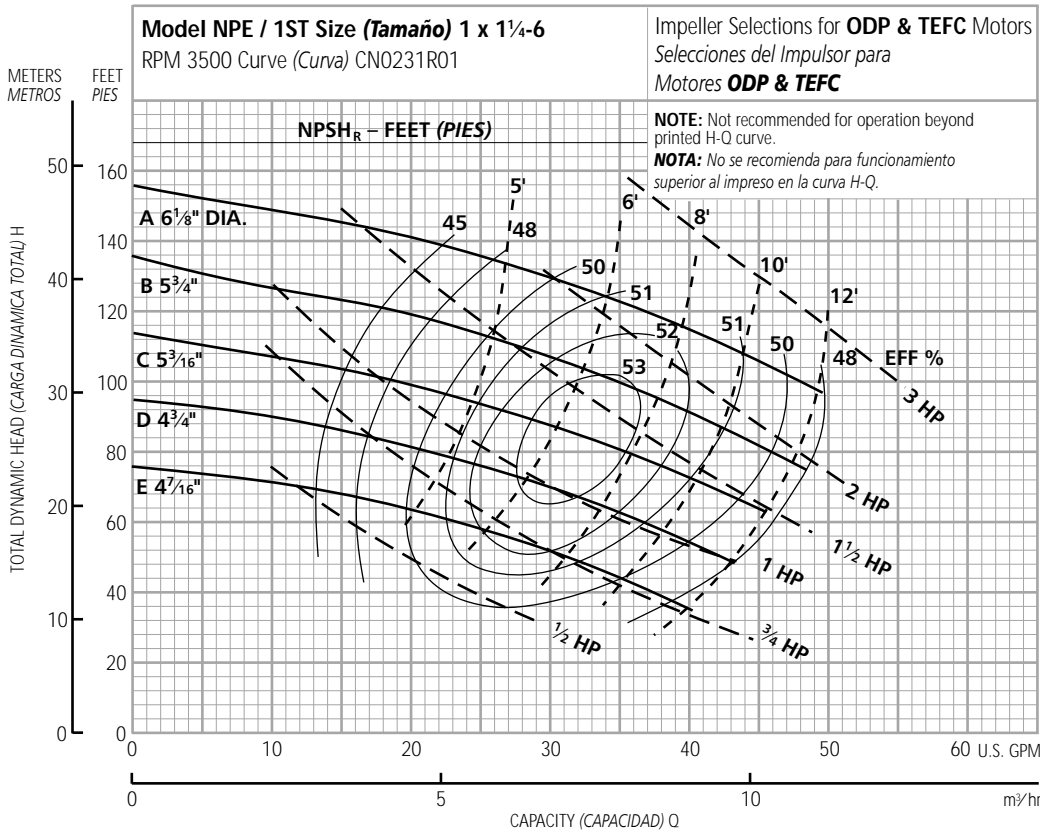
- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, 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.

Goulds Pumps and the ITT Engineered Blocks Symbol are registered trademarks and tradenames of ITT Industries.

Visit us at www.goulds.com

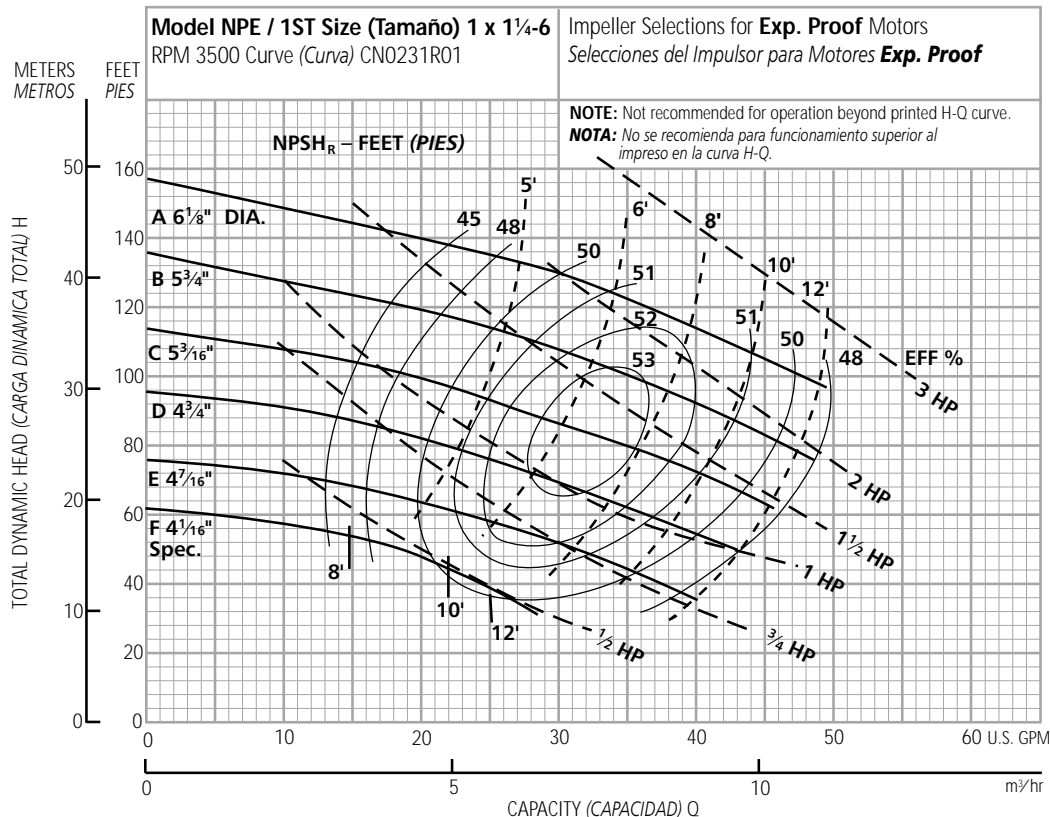
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
E	1/2	4 7/16"
D	3/4	4 3/4"
C	1	5 3/16"
B	1 1/2	5 3/4"
A	2	6 1/8"

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".

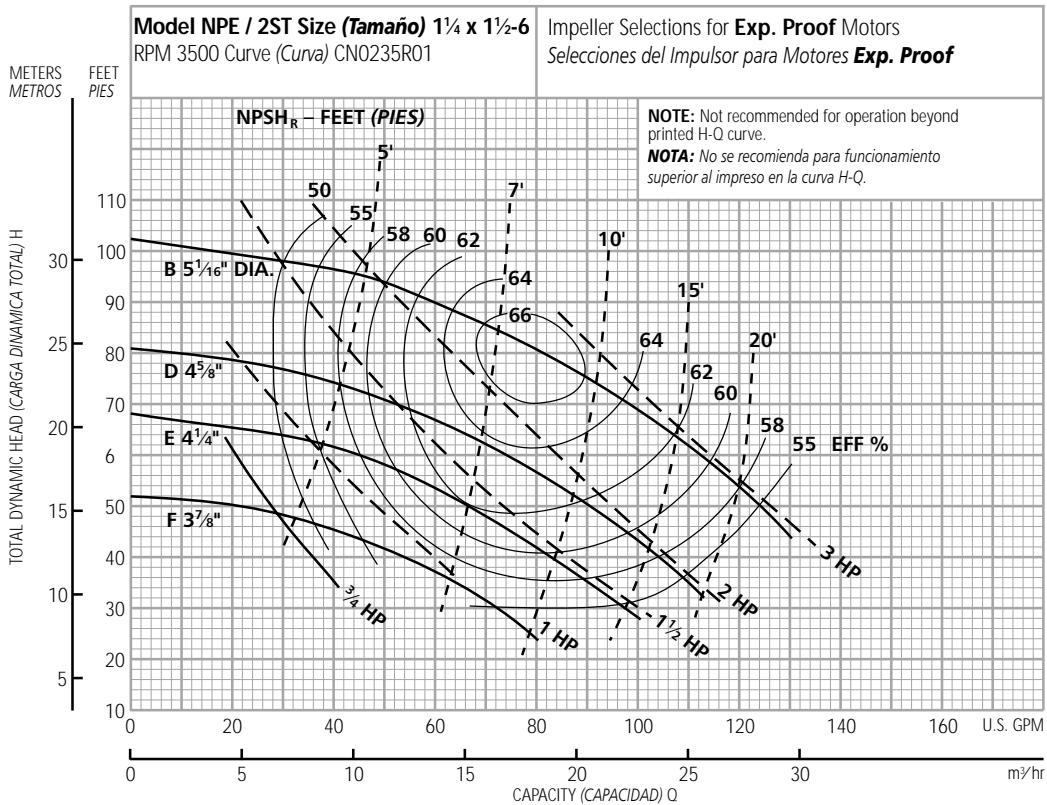
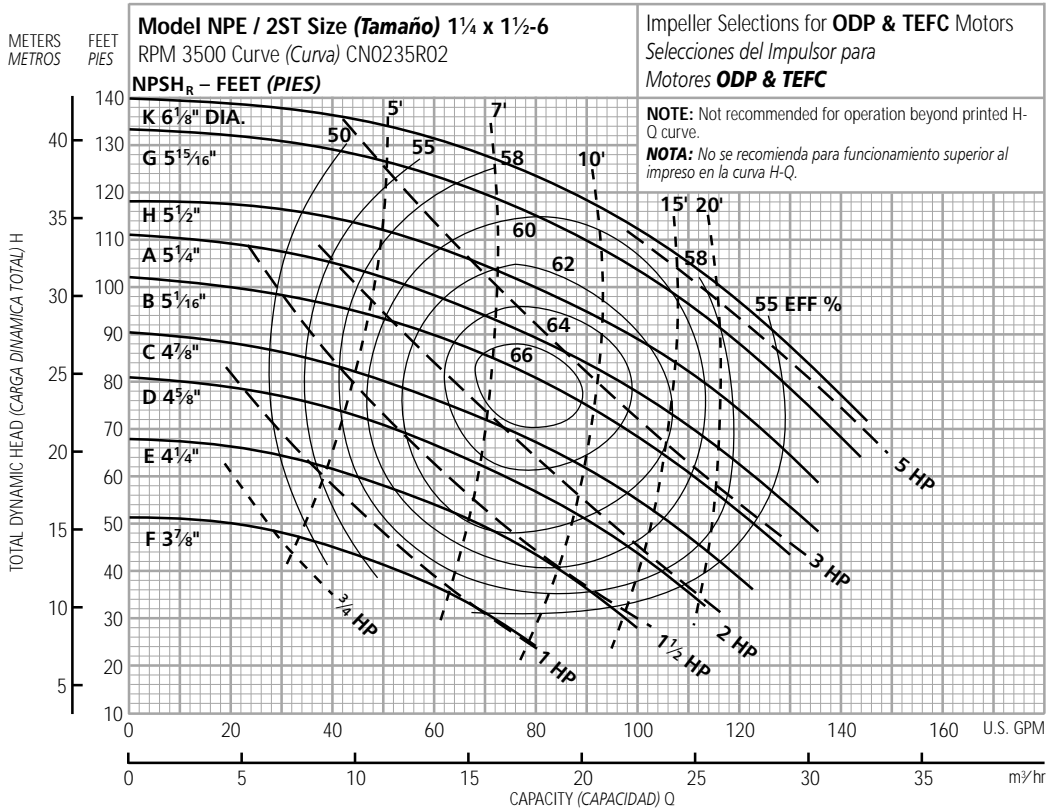


Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
F	1/2	4 1/16" spec.
E	3/4	4 7/16"
D	1	4 3/4"
C	1 1/2	5 3/16"
B	2	5 3/4"
A	3	6 1/8"

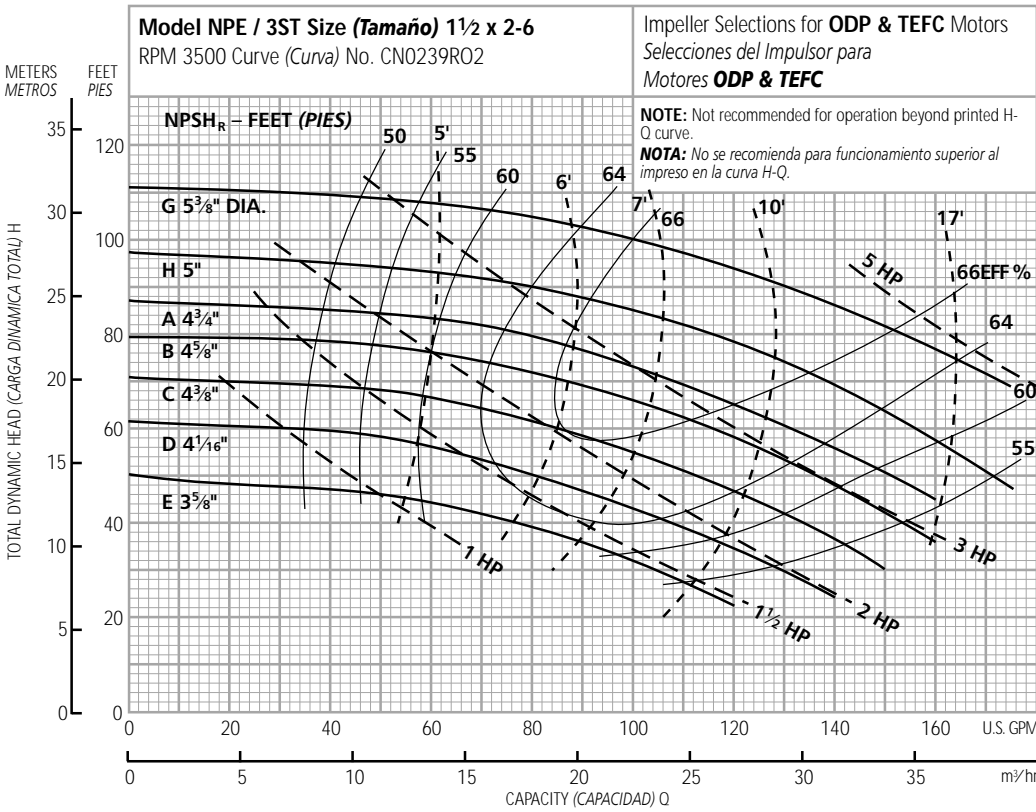
NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".

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



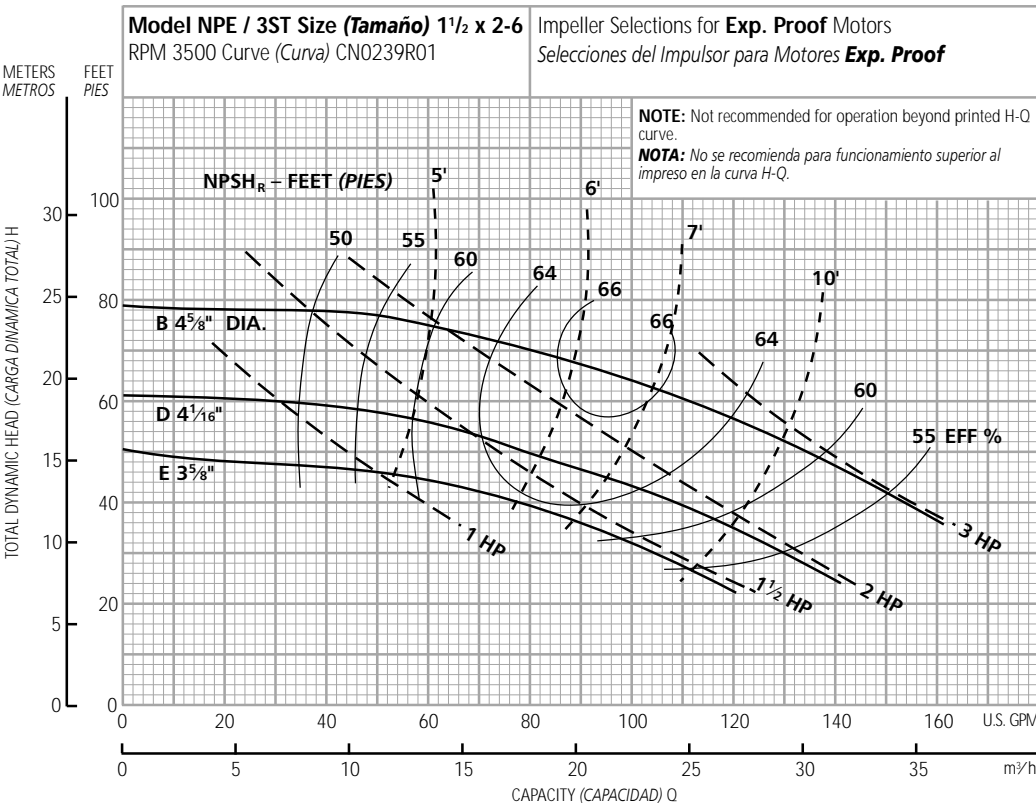
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
E	1	3⅝"
D	1½	4¼"
C	2	4⅜"
B	3	4⅝"
A	3	4¾"
H	5	5"
G	5	5½"

NOTE: Although not recommended, the pump may pass a 1⅜" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 1⅜".



Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
E	1½	3⅝"
D	2	4¼"
B	3	4⅝"

NOTE: Although not recommended, the pump may pass a 1⅜" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 1⅜".

Repair Parts

MODEL

NPE/NPE-F

TABLE OF CONTENTS

NPE END SUCTION

NPE Product Line Numbering System	1
NPE Seal Chart (Part of Numbering System)	1
Parts List	2
Optional Components	2
Pictorial Breakdown of Pump	3
Impeller Chart Standard Impeller by Impeller Code	4
Impeller Chart by Motor Size at 3500 RPM	4
Motor Chart	5

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 (5/8" 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 Diameter	1¼ x 1½-6 Diameter	1½ x 2-6 Diameter
K		6⅛	
G		5 ¹⁵ / ₁₆	5 ³ / ₈
H		5½	5
A	6⅛	5¼	4¾
B	5¾	5 ¹ / ₁₆	4 ⁵ / ₈
C	5 ³ / ₁₆	4 ⁷ / ₈	4 ³ / ₈
D	4¾	4 ⁵ / ₈	4 ¹ / ₁₆
E	4 ⁷ / ₁₆	4¼	3 ⁵ / ₈
F	4 ¹ / ₁₆	3 ⁷ / ₈	

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

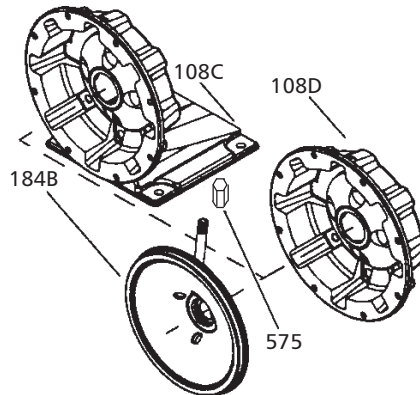
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

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	AISI 316L SS	1L81	1L82	1L83	1
101	Impeller		See Impeller chart on page 4			1
108A	Motor adapter with foot		1L80	1		
108B	Motor adapter less foot		1L87			
108C	Motor adapter with foot & flush		1L334			
108D	Motor adapter less foot with flush		1L335			
123	Deflector	BUNA-N	5K7		1	
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

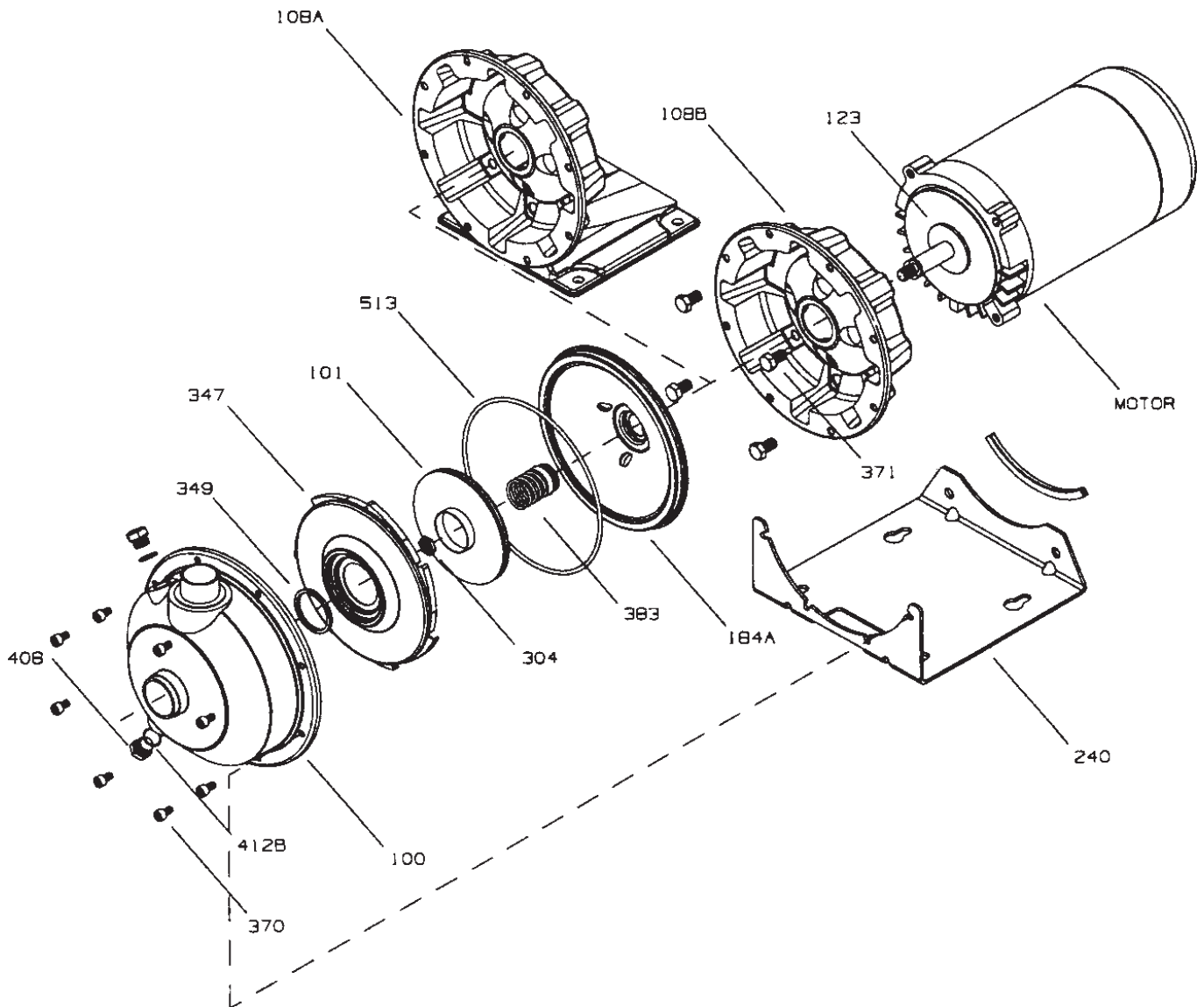


NOTE:

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 1¼-6		1¼ x 1½-6		1½ x 2-6			
	Diameter	Part No.	Diameter	Part No.	Diameter	Part No.		
K			6⅞	2L885				
G			5 ¹⁵ / ₁₆	2L700			5 ³ / ₈	2L702
H			5½	2L699			5	2L701
A	6⅞	2L47	5¼	2L48	4¾	2L49		
B	5¾	2L44	5 ¹ / ₁₆	2L54	4 ⁵ / ₈	2L58		
C	5 ³ / ₁₆	2L46	4 ⁷ / ₈	2L53	4 ³ / ₈	2L57		
D	4¾	2L42	4 ⁵ / ₈	2L52	4 ¹ / ₁₆	2L56		
E	4 ⁷ / ₁₆	2L45	4¼	2L51	3 ³ / ₈	2L55		
F	4 ¹ / ₁₆	2L59	3 ⁷ / ₈	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.	4 ⁷ / ₁₆			
		Imp. Code	E			
¾	D	Repair #	2L42	2L50		
		Dia.	4¾	3 ⁷ / ₈		
		Imp. Code	D	F		
1	E	Repair #	2L46	2L51	2L55	
		Dia.	5 ³ / ₁₆	4¼	3 ⁵ / ₈	
		Imp. Code	C	E	E	
1½	F	Repair #	2L44	2L52	2L56	
		Dia.	5¾	4 ⁵ / ₈	4 ¹ / ₁₆	
		Imp. Code	B	D	D	
2	G	Repair #	2L47	2L53	2L57	
		Dia.	6⅞	4 ⁷ / ₈	4 ³ / ₈	
		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.		5 ¹⁵ / ₁₆	6⅞	5 ³ / ₈
		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.	4 ⁷ / ₁₆	4 ¹ / ₁₆				
		Imp. Code	E	F				
¾	D	Repair #	2L42	2L45	2L50			
		Dia.	4¾	4 ⁷ / ₁₆	3 ⁷ / ₈			
		Imp. Code	D	E	F			
1	E	Repair #	2L46	2L42	2L51	2L50	2L55	
		Dia.	5 ³ / ₁₆	4¾	4¼	3 ⁷ / ₈	3 ⁵ / ₈	
		Imp. Code	C	D	E	F	E	
1½	F	Repair #	2L44	2L46	2L52	2L51	2L56	2L55
		Dia.	5¾	5 ³ / ₁₆	4 ⁵ / ₈	4¼	4 ¹ / ₁₆	3 ⁵ / ₈
		Imp. Code	B	C	D	E	D	E
2	G	Repair #	2L47	2L44	2L53	2L52	2L57	2L56
		Dia.	6⅞	5¾	4 ⁷ / ₈	4 ⁵ / ₈	4 ³ / ₈	4 ¹ / ₁₆
		Imp. Code	A	B	C	D	C	D
3	H	Repair #	2L47	2L47	2L48	2L54	2L49	2L58
		Dia.	6⅞	6⅞	5¼	5 ¹ / ₁₆	4¾	4 ⁵ / ₈
		Imp. Code	A	A	A	B	A	B
5	J	Repair #			2L700	2L885		2L702
		Dia.			5 ¹⁵ / ₁₆	6⅞		5 ³ / ₈
		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 ^①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
1/2	E04853S	10.0/5.0	16	E04821	6.2/3.1	21	BBC04825	6.2/3.1	47
3/4	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
1 1/2	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 ^①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
1/2	E04873	2.6/1.3	19	E04876	1.9/.95	18	BBC04875	1.9/.95	27
3/4	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
1 1/2	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			

① For vertical mounting order motor canopy separately - 9K272 for 1/2, 3/4 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 ^①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
1/2	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 ^①			Totally Enclosed, Fan Cooled			Explosion Proof		
	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)	Order No.	Max. Amps	Wt. (lbs.)
1/2	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).

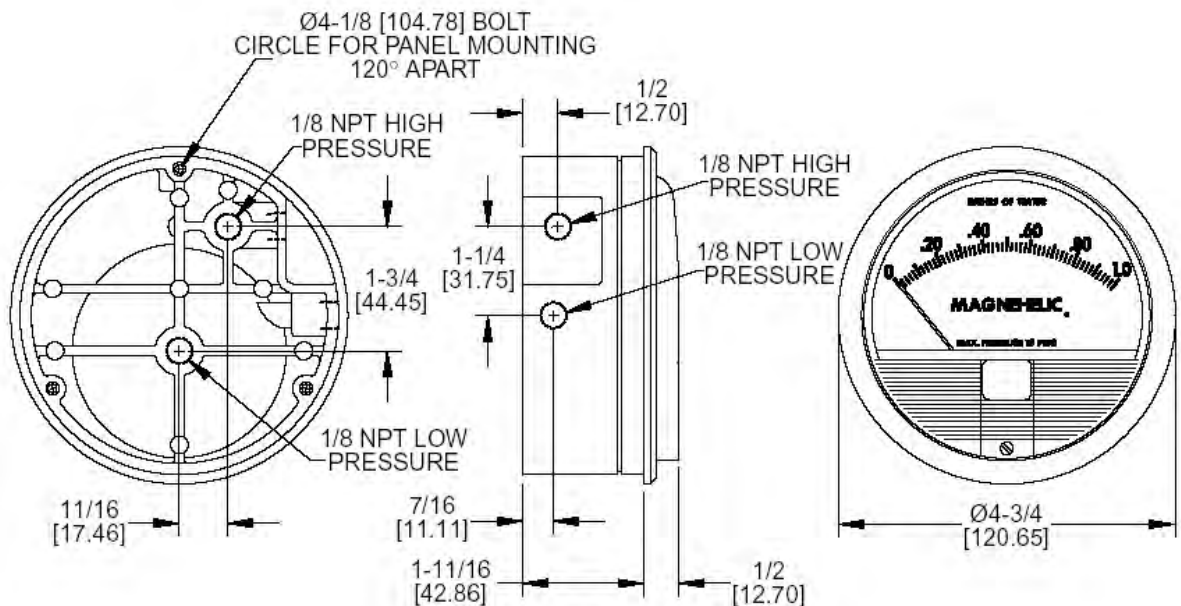
Standard gage accessories include two 1/8" NPT plugs for duplicate pressure taps, two 1/8" NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.



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.

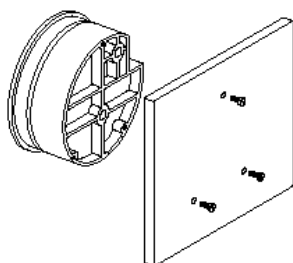


MAGNEHELIC® INSTALLATION

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.

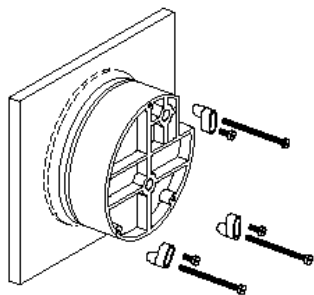
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions 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 disulphide 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.



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

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.

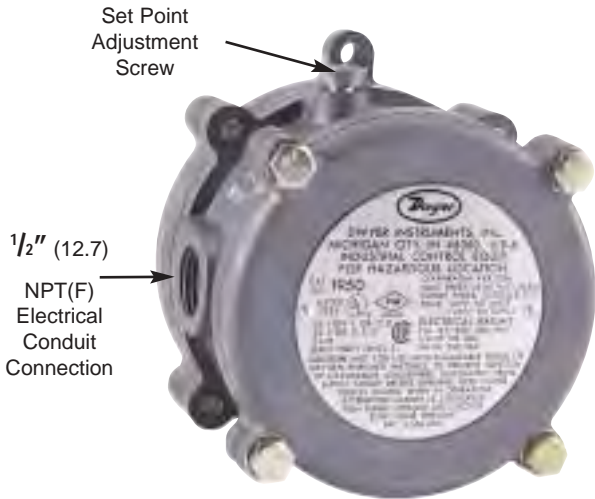
Diaphragm: Molded fluorosilicone rubber, 02 model: silicone on Nylon.

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 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.

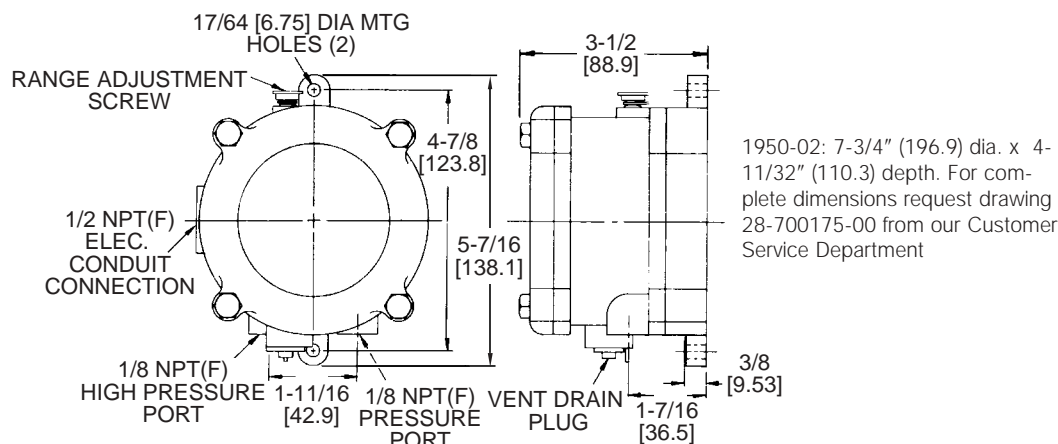
CAUTION

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®.

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.

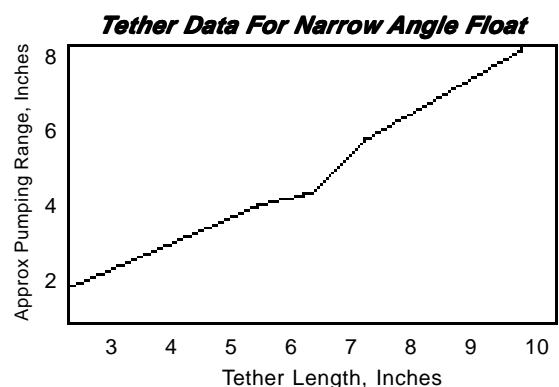
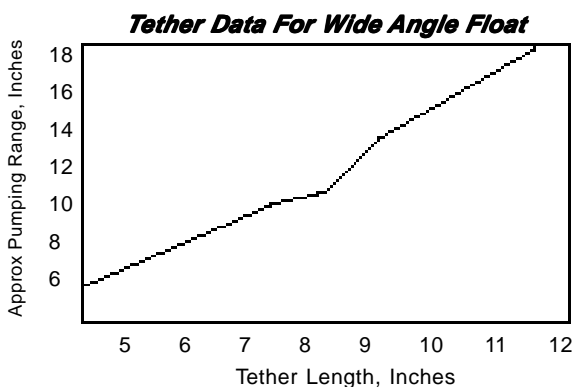
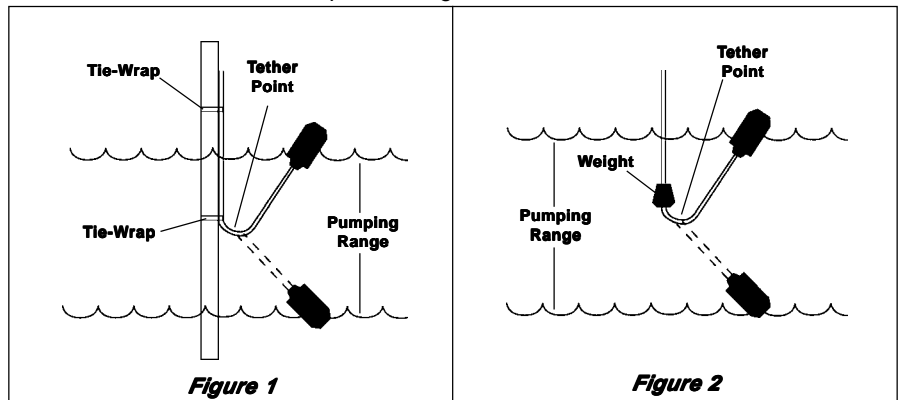
Tether-Weight (Fig 2)

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.

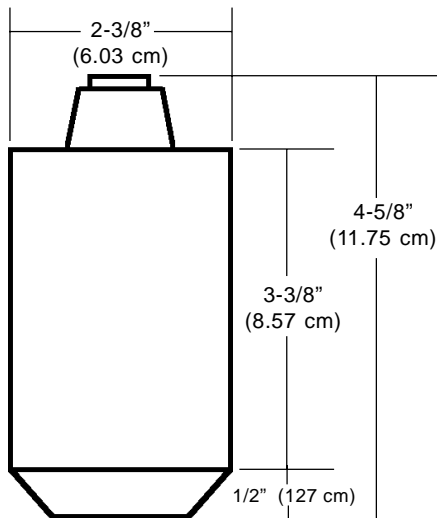
Determine tether point using charts below as a reference



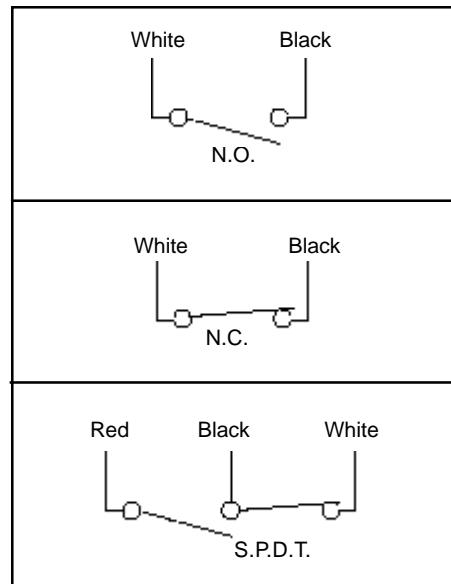
Notes:

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