

EZ-Stacker Air Stripper

Operation & Maintenance Manual

P/N 95165 □□□0□3



QED Environmental Systems

2355 Bishop Circle West Dexter, MI 48130 Phone: 800-624-2026 Fax:734-995-1170

IMPORTANT—PLEASE READ

Thank you for choosing QED treatment equipment to handle your air stripping needs. This manual contains information relating to equipment commonly ordered as part of a QED stripper system. This manual is generic, and your specific order may not include all the equipment listed within this manual. Upon receipt of this equipment, it is important for the customer to do the following:

1. Inspect all the pieces of equipment shipped to verify the order is complete,
2. Confirm that vendor-specific instructions are included for each piece of equipment,
3. Remove any additional instructions that have been included in this manual which are not part of your specific sales order. This will avoid future confusion.

A specific example of this relates to the transfer pumps. This manual includes operation and maintenance instructions for centrifugal transfer pumps, although sometimes pumps are not part of the customer's specific order. Upon inspection of equipment, if the customer finds that pumps are not part of their order, the pump instructions should be removed from this manual. The other pieces of equipment should similarly be inspected and checked that the associated instructions are included in this manual, and any non-relevant instructions are removed.

Should you have any questions about your QED equipment, please contact the QED Service Department at 1-800-624-2026 or 734-995-2547. Thank you for your order and good luck with startup.

QED EZ-Stacker™ Operations and Maintenance Manual

Introduction

This manual contains instructions for installing, start-up and operation of a QED EZ-Stacker™ Air Stripper for the treatment of dissolved-VOC-contaminated waters. The EZ-Stacker™ Air Stripper is a sieve tray type of stripper which accomplishes mass transfer by creating a large amount of fine air bubbles into which volatile organics are stripped. Efficient stripping with this type of a unit is affected by:

- Water temperature-- higher temperature allows better stripping
- Specific compound being stripped--higher Henry's Law constant equals better stripping
- Air to water ratio--the higher the air to water ratio (air flow for a given water flow) the better the stripping
- Stripper efficiency--certain design elements, such as tray design affect stripping efficiency
- Surfactants (soaps, cleaning agents, etc.) and oil/grease can negatively impact stripping efficiency

From an operation standpoint the single most important factor is ensuring that the recommended amount of clean air is flowing through the stripper. Air flow is most affected by tray fouling (typically with precipitated iron oxides) which creates back pressure on the blower and causes it to operate at a lower air flow point on its curve. Maintaining clean trays and using the excess capacity on the blower can help control fouling conditions. Occasional gasket replacement can be anticipated depending on the frequency of stripper disassembly and reassembly. The stripper blowers and any transfer pumps should be regularly maintained based upon the manufacturer's maintenance schedule. All other stripper components are largely maintenance free. Please refer to Figure 1 at the end of this manual for understanding terminology.

Installation

Installing Skid Mounted Systems

Complete skid mounted systems arrive at your site as shown in Figure 1. A system of this type is mounted, piped and optionally wired at the factory. All components and functions are 100% wet checked.

Influent piping. Connect system influent piping to the influent feed pump or directly to the stripper at the piping connection located on the top of the stripper. Factory piped influent feed pump systems use flexible pressure hose between the pump and the stripper influent piping connection and includes a check valve to prevent air backup into a transfer tanks or oil water separator. If the stripper

influent is plumbed directly on site, a flexible hose connection is recommended to ease stripper disassembly and reassembly during use.

Effluent piping. Factory piped effluent discharge pump systems use flexible pressure hose between the stripper discharge piping connection, located at the bottom of the stripper sump and the effluent discharge pump. Factory installed gravity discharge piping connects at the same discharge point on the stripper sump and utilizes a gravity drain kit which includes a siphon break and water head seal. If the stripper is plumbed on site connect the discharge pump to the stripper sump at the discharge connector. Gravity drain piping should be a minimum of 2-3" in diameter (depends on the model) and designed as shown in Figures 4 or 5.

Blower piping. *Important! Total sump pressures should never exceed 50" WC! This will void QED Warranty.* The blower piping that connects the blower to the air stripper are typically of an inverted-U shape, with a high leg to reduce the chance of flooding the blower in the event of an unforeseen flood condition.

On EZ-2.xP models, QED typically use regenerative blowers sized so that they do not require much, if any, throttling of the airflow. Regenerative blowers are limited in the amount of throttling that can be applied, since added backpressures may cause the blower motor to run above full-load-amp condition and cause the blower motor to overheat. If customer is installing their own piping kit on an oversized regenerative blower, it is recommended that an air dilution/bleed valve be installed in the blower piping to provide flexibility in controlling airflow.

Stripper Air Discharge Stack. The stripper discharge pipe is located on top of the air stripper and is 4" or 6" in diameter (depending upon model). The wider section of the discharge porting contains the demister element which removes entrained water droplets from the air exiting the stripper. Coalesced water droplets collect on the demister and then fall back into the stripper top tray. Piping or ducting for the stripper discharge stack should be of equal diameter or larger to avoid creating excess back pressure on the stripper blower. A flexible coupling, such as a Fernco brand, is recommended to connect the discharge pipe to the stripper air discharge stack to ease unit disassembly for cleaning. It is also important to pipe the air stripper air discharge such that it is not in proximity with the air stripper blower inlet; this minimizes the risk of sending already-contaminated air back into the air stripper and reducing stripper performance.

Sensors. Normal sensors used with this type of air stripper include a sump high level alarm float sensor, sump low air pressure sensor and optional discharge pump on-off float sensor. If these sensors are supplied with the stripper they will be installed in the stripper sump and piping. Often the system control panel must be mounted in a remote location from the stripper (in cases where the location is classified as an explosion hazard area.) If the panel is to be remotely-mounted a licensed electrician should hook the stripper sensors up to the panel. It is

important that these sensors be tested prior to operating the stripper. A frequent cause of improperly operating systems are float sensors which act in the opposite sense of that which the control panel expects (normally-open vs. normally-closed). It is also important to conform to electrical code requirements for classified areas; sensors may require intrinsically safe barriers.

Installing Bare Stripper Sump and Tray Systems

Bare stripper sump and tray systems are provided in cases where the contractor will mount the stripper to a user supplied skid or concrete pad. These systems are supplied with a second gasket compression ring that anchors the gasket compression rods at the bottom of the stripper. The bottom gasket compression ring has tabs protruding around its circumference which allow mounting of the ring to a skid or concrete pad.

If the blower is purchased from the factory it is recommended that the blower piping package also be purchased. If the contractor is supplying their own blower it must meet the typical performance specifications listed below to achieve the desired contaminant removals. If the air stripper is built to non-standard parameters, the performance specifications below may not apply.

<u>Air Flow:</u>	140 cfm (for EZ-2.xP) or 280 cfm (for EZ-4.xP) at maximum system back pressure
<u>Pressure:</u>	Sufficient to overcome tray, piping and air treatment process back pressures at a flow rate of 140cfm. <i>Important! Total sump pressures should never exceed 50" WC! This will void QED Warranty.</i>
<u>Tray Back Pressures</u>	16-20"H ₂ O for 4-trays; 24-30"H ₂ O for 6-trays (assuming no add'l pressure from equipment downstream of air stack).

The blower piping should include a high leg which acts to reduce the risk of flooding the blower if the high sump level sensor was to malfunction in the stripper sump. See Figures 2 and 3 (for models EZ-2.xP and EZ-4.xP, respectively) for examples of proper blower piping configurations.

The EZ-2.xP models typically use regenerative blowers sized so that they do not require much, if any, throttling of the airflow. Regenerative blowers are limited in the amount of throttling that can be applied, since added backpressures can cause the blower motor to run above full-load-amp conditions and overheat. If customer is installing their own piping kit on an oversized regenerative blower, it is recommended that an air dilution/bleed valve be installed in the blower piping to provide flexibility in controlling airflow. A throttle valve is shown in Figure 1; a dilution/bleed valve is not shown.

Influent and effluent piping and sensor hook-up should be as described in the section on skid mounted systems, above.

Startup

The EZ-Stacker™ stripper is designed to start up dry without priming the sealpot or throttling the blower. The stripper blower should be running before water is introduced to the stripper. Water flows into the top tray and proceeds tray by tray to the stripper sump. Stripper seal pots fill with water and allow complete start up during intermittent operation. IMPORTANT: Before starting the system verify correct blower motor rotation (plus any other motors within the treatment system).

Verify that the sump air pressure is 16-20" H₂O for 4-tray systems or 24-30" H₂O for 6-tray systems (it is normal to see lower sump pressures at the very start of operation before the seal pots and trays fill with water.) Sump pressures lower than these values may indicate either a blower throttle which is not sufficiently open or insufficiently-compressed tray seal gaskets. *If the system configuration includes additional backpressure (from vapor phase carbon, for example), the sump pressures will be greater than these values. it is important that the blower is sized to accommodate the added pressures, being careful that air stripper sump pressures never exceed 50" WC. Total sump pressures exceeding 50" WC will void QED Warranty!* Check the blower piping throttle valve and make sure the hold-down rods are tightened firmly, but not over tightened. The hold-down tensioning springs should be compressed to a length of 3-1/2 inches for proper gasket sealing.

Step by step startup includes:

1. Power the main control panel on.
2. Turn the blower on. For QED supplied control panels set the motor operation switch to AUTO.
3. Turn the stripper feed pump on (allow water to enter the stripper for gravity feed systems.) For QED supplied control panels set the motor operation switch to AUTO (some systems have a delay timer on the feed pump--check control panel documentation for details.)
4. Turn the discharge pump on. For QED supplied control panels set the motor operation switch to AUTO.
5. Open or close the blower air flow throttle and air dilution valve (if required) to produce a sump pressure reading of 16-20"H₂O for 4-tray systems or 24-30"H₂O for 6-tray systems (these are typical values, but these may differ depending whether any other pressures need to be accounted for. NOTE: It is normal to see

lower sump pressures at the very start of operation due to sealpots and trays filling with water.

Operation

Stripper operation is normally automatic. One option for QED supplied control panels is a blower time-out relay which continues to run the blower for several minutes after the feed pump stops. Continued blower operation insures that any residual water left on the stripper trays has sufficient time to strip before the blower shuts down. A time of at least 15 minutes is recommended. Strippers with start-stop cycles of more than 2-4 times per hour should be set to run continuously.

For sites with high dissolved iron content stripper cleaning may be required. Tray fouling is evidenced by increasing sump back pressure. Opening the blower air flow throttle will allow continued operation in some situations and will lengthen the time between tray cleanings. It is most important to maintain an air flow of 140cfm through the unit. If the stripper air flow decreases the stripping efficiency decreases. Below 100 cfm air flow the stripper will start begin to “weep” water through the tray holes from upper trays to lower trays before the water has had sufficient residence time for removal. If stripper performance falls off, check for tray fouling or a blower air flow throttle that is not opened sufficiently.

Maintenance

Tray fouling due to iron precipitation, solids loading, or bio-fouling is evidenced by increased sump pressures, decreased stripper performance (removal rates not being met) or noticeable discoloration on the trays. Stripper cleaning is required when trays are fouled.

Step by step cleaning includes:

1. Before working on any equipment lock-out power to the unit.
2. Disconnect the stripper discharge pipe from the stripper exhaust stack piping.
3. Unscrew the hold-down rod nuts (cranks) and remove the gasket hold-down ring.
4. Remove the stripper trays. Please note the tray seal pots will have some water remaining in them.
5. Using a pressure washer and medium bristle brush clean any residue from the trays surfaces, concentrating on the sieve holes. DO NOT USE SOAP or cleaning agents unless they will be thoroughly rinsed from the trays; soap residue can affect stripper performance.

6. For hard to remove scales and precipitates a dilute (5%-10%) muriatic acid and water solution can be used to rinse or soak the trays. Be certain to completely rinse the solution off the trays before reassembling the unit.
7. Reassemble the trays--note that they are numbered and that a mark is used to assist in proper alignment of the trays during reassembly. Check to make sure the gasket is still seated correctly and undamaged.
8. Reinstall the gasket hold-down ring and retension the hold-down rod nuts (cranks.) The hold-down tensioning springs should be compressed to a length of 3-1/2 inches for proper gasket sealing.
9. Reattach any pipe and exhaust stack connections.
10. Follow Start-Up instructions, above.

Other stripper maintenance items include:

1. Periodically check blower for vibration. Bearings may require eventual service or conditions of excessive motor start / stop cycles may lead to premature motor or blower failure.
2. Check gasket condition during disassembly for cleaning. The gasket is designed to allow numerous assembly and disassemblies before requiring replacement. Contact QED for information and pricing about gasket replacement kits.
3. The stripper demister element is essentially maintenance free, although dried inorganic residue can build up within the demister and affect demister operation. This condition is evidenced in water droplets not being removed by the demister and blowing out of the stripper exhaust stack--occasionally on start-up water is discharged from the stripper stack, which is normal. The demister may be cleaned with a dilute muriatic and water solution (5%-10%) as instructed for tray cleaning.
4. Solids may build up in the sump. These solids can be suctioned out during tray cleaning operations.
5. Periodically check the structural integrity of the stripper sump, trays and top. Check bulkhead nuts for snugness. Cracks or loose fittings will normally be evidenced by water leakage.

Troubleshooting

Some common problems include:

1. *Leaks.* Leaks around trays or at the sump indicate an insufficiently compressed tray gasket. Make sure the hold-down tensioning springs are compressed to a length of 3-1/2 inches for proper gasket sealing. Also check for damaged gaskets (over compressed gaskets, cut gaskets, loose gaskets, etc.) Damaged gaskets

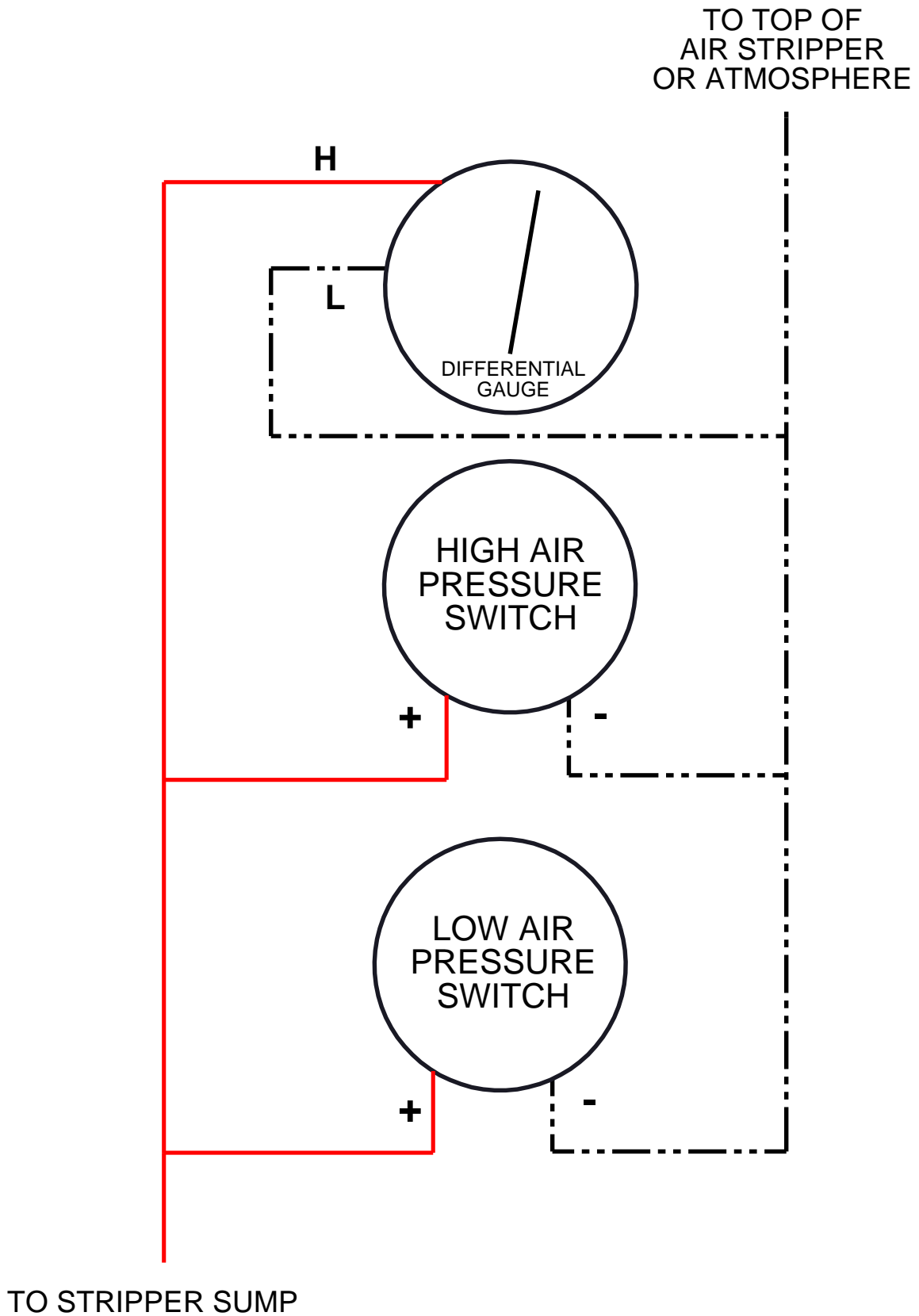
- should be replaced with new gaskets. Contact QED for information and pricing about gasket replacement kits. For leaks at fittings, check for fitting tightness.
2. *Stripper not meeting removal requirements.* Contaminated stripper air is the most common reason for poor stripping performance within the low-ppb concentration range--make sure that the stripper blower intake is drawing in clean, uncontaminated air. Check for sufficient air flow through the stripper. Check that trays are clean. Check that demister is not clogged or causing increased blower back pressure. Check any stripper air discharge treatment units for increased back pressure. Check that stripper influent flow or concentration has not increased beyond the design basis used to predict stripper performance. Make sure that the influent does not have surfactants (soaps, etc.), oils, grease, or other immiscible phases in the influent stream. Surfactants are evidenced by increased foaming through the stripper unit.
 3. *Sump pressure not at recommended levels.* Check sump pressure gauge tubing for accumulated water that could impair gauge performance. Check gaskets for damage and proper seating. Check for proper hold-down spring tensioning. Check blower piping connections for leakage. Check blower for proper rotation. Check design of gravity drain piping if piping is not QED-supplied. Check blower intake filter / silencer (if included) for clogging. Order new filter elements from QED.
 4. *Stripper cleaning frequency seems excessive.* At sites with high iron loading, consider iron sequestering agents or other technology which will reduce/prevent iron precipitation or allow for easier cleaning.

Please investigate all the above-mentioned items while troubleshooting. For additional problem solving assistance contact QED Service at:

Phone: 1-800-624-2026
FAX: 1-734-995-1170
24 Hour Service Hot Line: 1-800-272-9559

Please have the following information ready for the QED Service person:

1. Identify the product or system involved by QED order number.
2. Specify where, when, and from whom the product was purchased.
3. Describe the nature of the defect or malfunction.



AIR STRIPPER GAUGE AND PRESSURE SWITCH CONNECTION DIAGRAM (Optional)

QED TREATMENT EQUIPMENT WARRANTY

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

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

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

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

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

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

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

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

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

1. Current operating conditions do not differ from the previously-modeled conditions.
2. The system should be cleaned regularly to maintain system performance.

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

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

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

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

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

QED Environmental Systems Inc.
2355 Bishop Circle West
Dexter, MI 48130
Attn: R.A.C. No. (Return Authorization Code Number provided by QED Service Dept.)

Figure 1. Typical Configuration of EZ-Stacker 2 Series (actual configuration will vary)

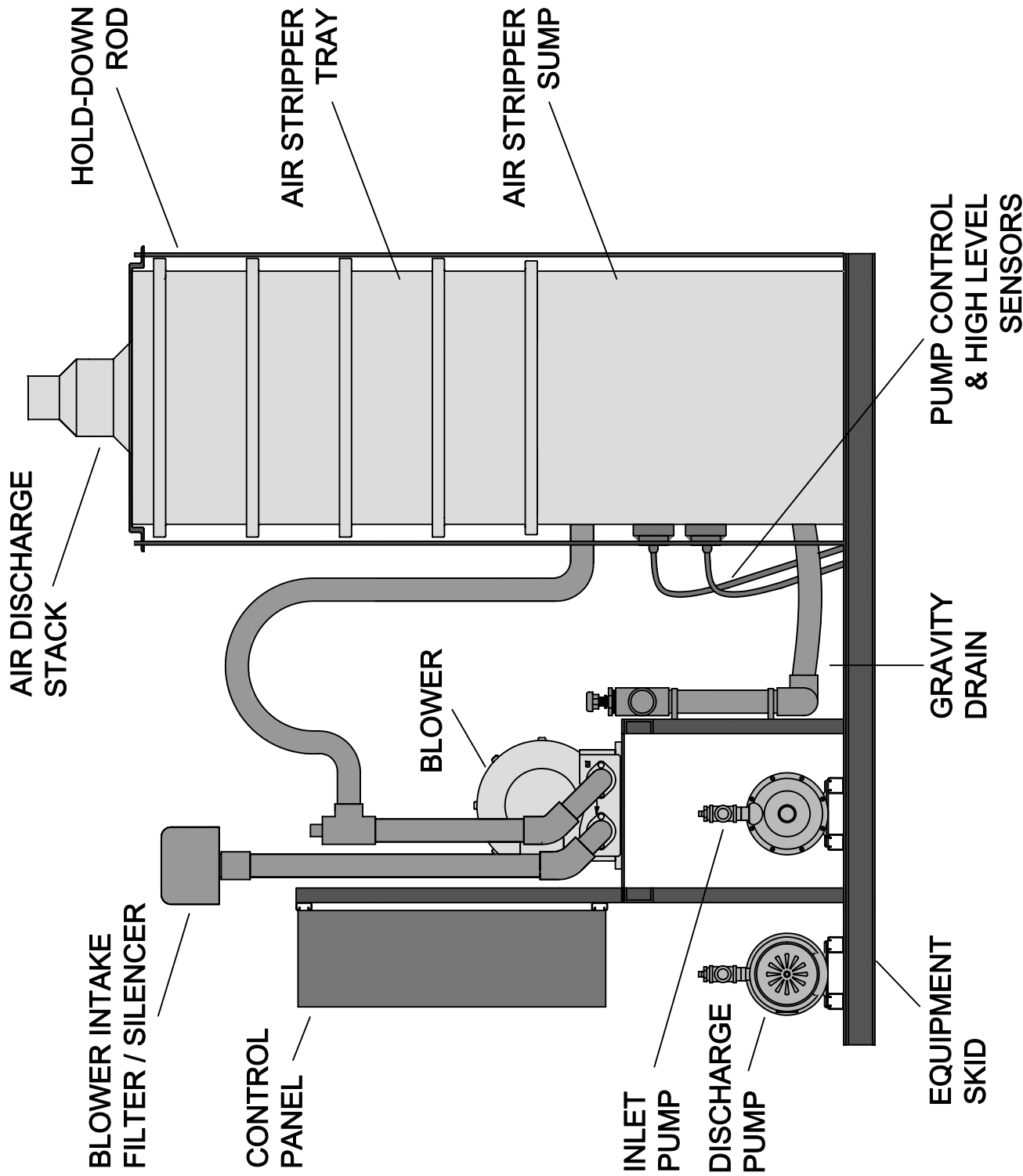
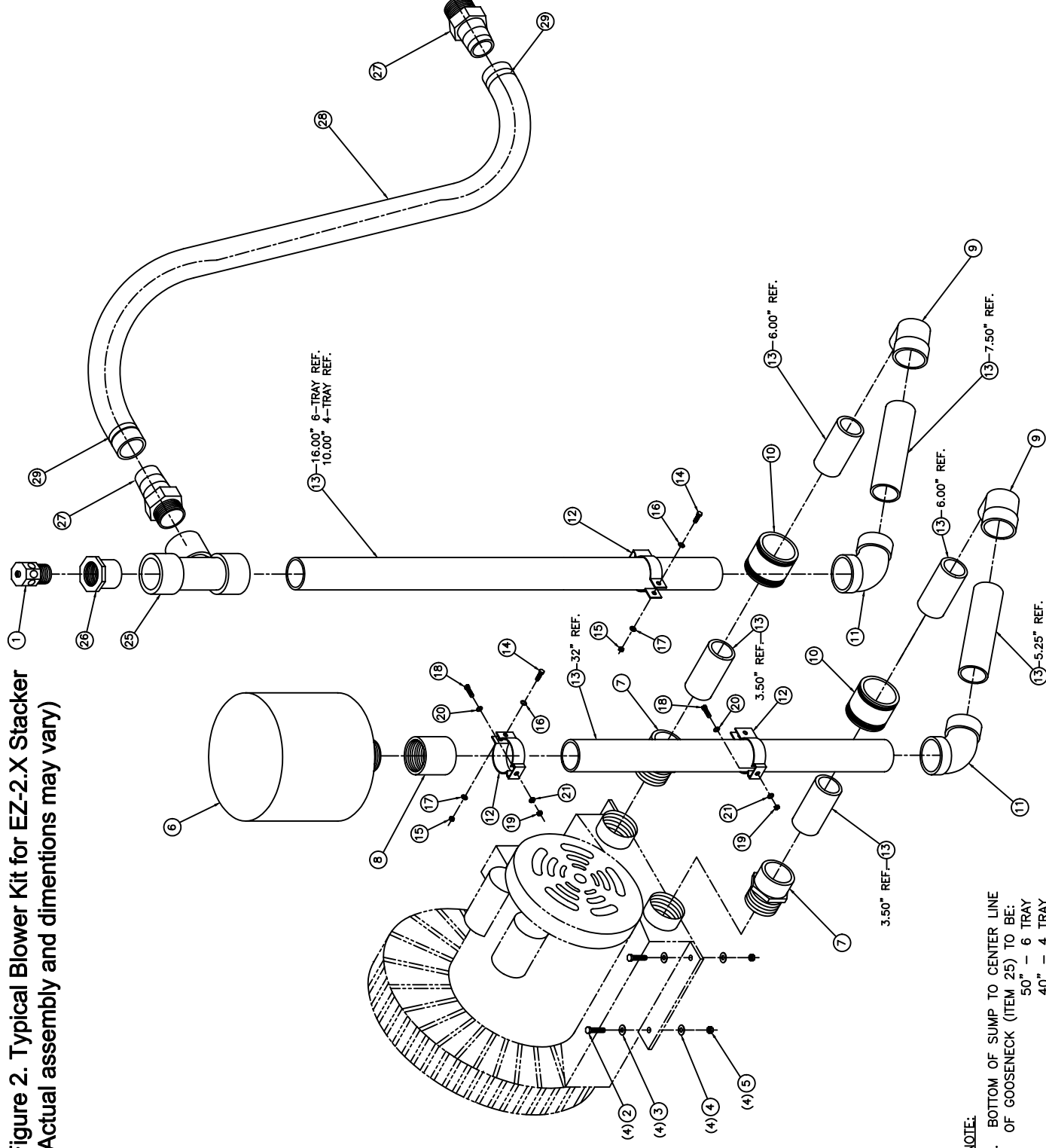


Figure 2. Typical Blower Kit for EZ-2.X Stacker
 (Actual assembly and dimensions may vary)

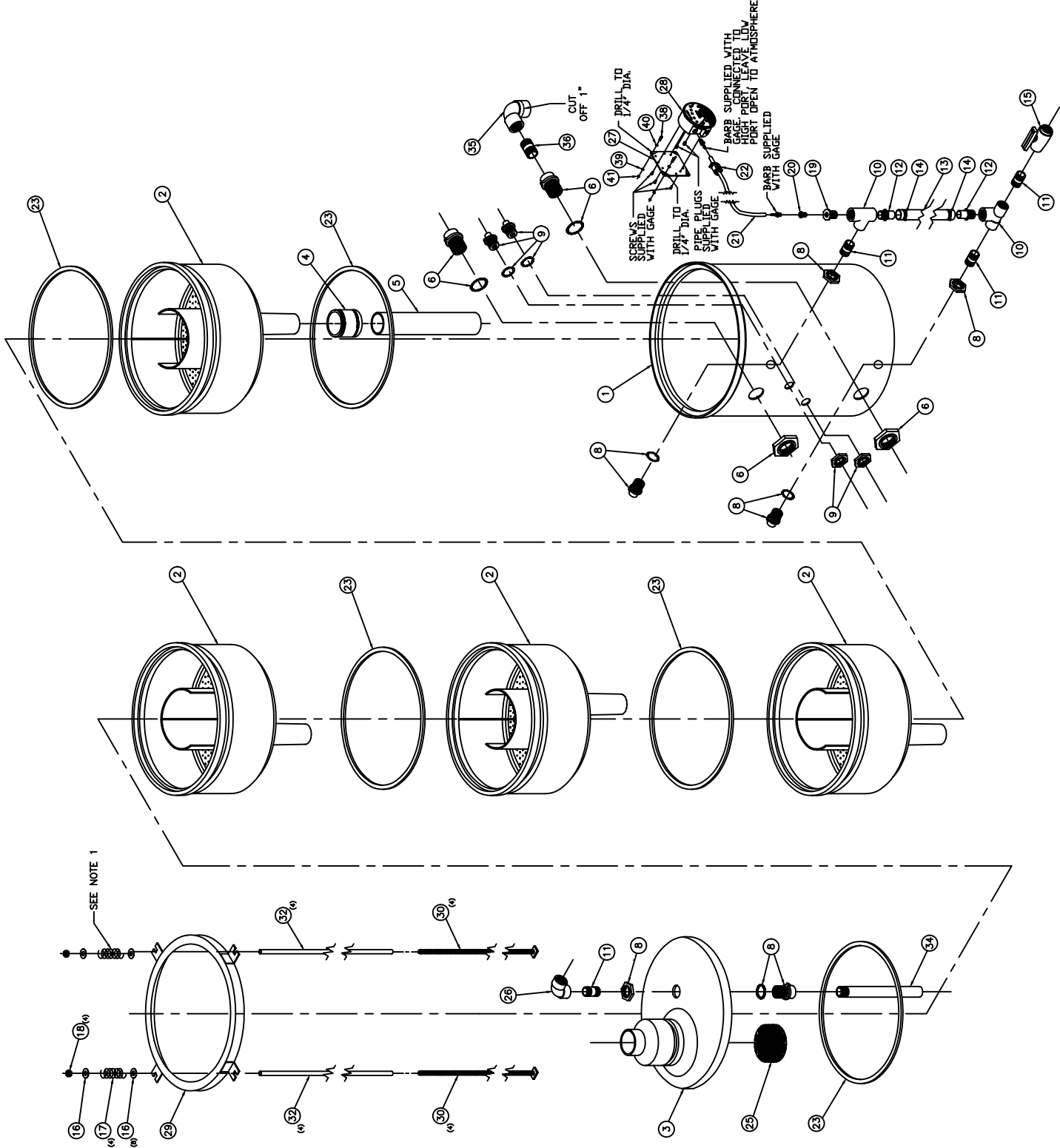
29	2	HOSE CLAMP*	805084
28	3	HOSE 2"	805204
27	2	HOSE BARB 2"	805071
26	1	REDUCING BUSHING 2" SOCKET X 1" THD	802051
25	1	TEE 2" SOCKET	802021
21	3	WASHER, LOCK FOR 1/4" BOLT	EXPENSED
20	3	WASHER FLAT FOR 1/4" BOLT	EXPENSED
19	3	1/4"-20 NUT	EXPENSED
18	3	1/4"-20 UNC X 1 1/4" LG. HEX BOLT	EXPENSED
17	2	WASHER LOCK FOR 5/16 BOLT	EXPENSED
16	2	5/16 WASHER FLAT FOR 5/16 BOLT	EXPENSED
15	2	5/16-18 NUT	EXPENSED
14	2	5/16-18 UNC .75 LG. HEX BOLT	EXPENSED
ITEM QTY		DESCRIPTION	PART #



13	TBD	PIPE 2" PVC REF.	802159
12	3	HANGER, 2" PIPE W/ 1/4"-20	805088
11	2	ELBOW, 45 DEGREE PVC 2" SOCKET	802038
10	3	FERNCO 2" COUPLER	802167
9	4	ELBOW, 90 DEGREE PVC 2" SOCKET	802030
8	1	ADAPTOR, 2" FPT X 2" SOCKET PVC	802009
7	3	ADAPTOR, 2" MPT X 2" SOCKET PVC	802046
6	1	FILTER, BLOWER INLET	805053
5	4	NUT, 1/2" - 13 UNC	EXPENSED
4	4	WASHERS, LOCK FOR 1/2" BOLT	EXPENSED
3	4	WASHERS, FLAT FOR 1/2" BOLT	EXPENSED
2	1	BOLTS HEX 1/2"-13 UNC X 1.50 LONG	EXPENSED
1	1	MUFFLER, AIR CONTROL	805233
ITEM QTY		DESCRIPTION	PART #

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE FINISH TOLERANCES	DRAWN BY	DATE	Q.E.D.
10X4/-0.008 ANGLES/-1/16" OTHER TOLERANCES AS SPECIFIED	KM	11-20-95	
EZ-STACER (2 SERIES)	CHECKED BY	DATE	ENVIRONMENTAL SYSTEMS INC.
MEET ASSTY	LN	12-5-95	
USED ON	APPROVED BY	DATE	TITLE
FINISH	MATERIAL		BLOWER KIT W/O BLOWER ASSEMBLY/BOM/KIT
SHEET 1	REV C		DRAWING NUMBER BLKIT2
OF 1			SCALE N.T.S.

NOTE:
 1. BOTTOM OF SUMP TO CENTER LINE OF GOOSENECK (ITEM 25) TO BE:
 50" - 6 TRAY
 40" - 4 TRAY



ITEM QTY	DESCRIPTION	PART #
41	NUT 1/4"	EXPENSED
40	WASHER, FLAT 1/4"	EXPENSED
39	WASHER, LOCK 1/4"	EXPENSED
38	BOLT, 1/4" HEX HD.	EXPENSED
37		
36	NIPPLE, CLOSE 2" PVC	802074
35	ELBOW 2" 90 DEGREE PVC THREADED	802034
34	PIPE 1" PVC 12.50 LG (THD. ONE END)	802162
33		
32	TUBING, NYLON 1/2" OD X 3/8" ID 68" LG	35097
31		
30	TIE ROD ASSEMBLY	804042
29	RING, TOP HOLD DOWN 27.63 OD	804040
28	MAGNEHELIC DIFFERENTIAL PRESSURE GAGE INCLUDES THE FOLLOWING: SCREWS, 6-32 RD. HD. (2) PIPE PLUG 1/8" (2) BARBS, 1/8" MPT X 3/16" BARB (2)	EZPGAUGE
27	BRACKET MOUNTING	805179
26	ELBOW 90 DEGREES PVC 1" MPT SCH 80	802037
25	DELUSTER 3 PADS OF 37/97 3.60 HIGH X 7.50 DIA.	804052
24		
23	GASKET, ROUND	804038
22	PINCH VALVE	36559
21	TUBING, CLEAR 5/16" O.D. X 3/16" I.D.	802248
20	REDUCER, BUSHING 1/4" X 1/8" BRASS	34103
19	REDUCER, BUSHING 1" X 1/4" BRASS	803054
18	NUT, 3/8-16 ZINC PLATED STEEL	805180
17	SPRING, NICKEL PLATED	805214
16	WASHER, FLAT 3/8 ZINC PLATED STEEL	805181
15	VALVE, BALL PVC 1" FPT X 1" FPT	802196
14	CLAMPS, HOSE 13/16 X 1 1/2"	805055
13	TUBING, CLEAR PVC 1" I.D. 3/16" WALL	802236
12	BARB, NYLON 1" MPT X 1" BARB	805020
11	NIPPLE, CLOSE PVC 1" SCH 80	802103
10	TEE, PVC 1" FPT SCH 80	802028
9	BULKHEAD FITTING (RAVEN) 1/2" FPT	802169
8	BULKHEAD FITTING (RAVEN) 1" FPT	802171
7		
6	BULKHEAD FITTING 2" FPT (RAVEN)	802174
5	PIPE, PVC 3" 17.50 LG REF.	802156
4	FERNCO 3" COUPLER	802166
3	TRAY, TOP	804067
2	TRAYS, WITH SECONDARY PARTS	804068
1	SUMP	804069

Q.E.D.
 ENVIRONMENTAL SYSTEMS INC.
 6155 JACKSON ROAD, ANN ARBOR, MI.

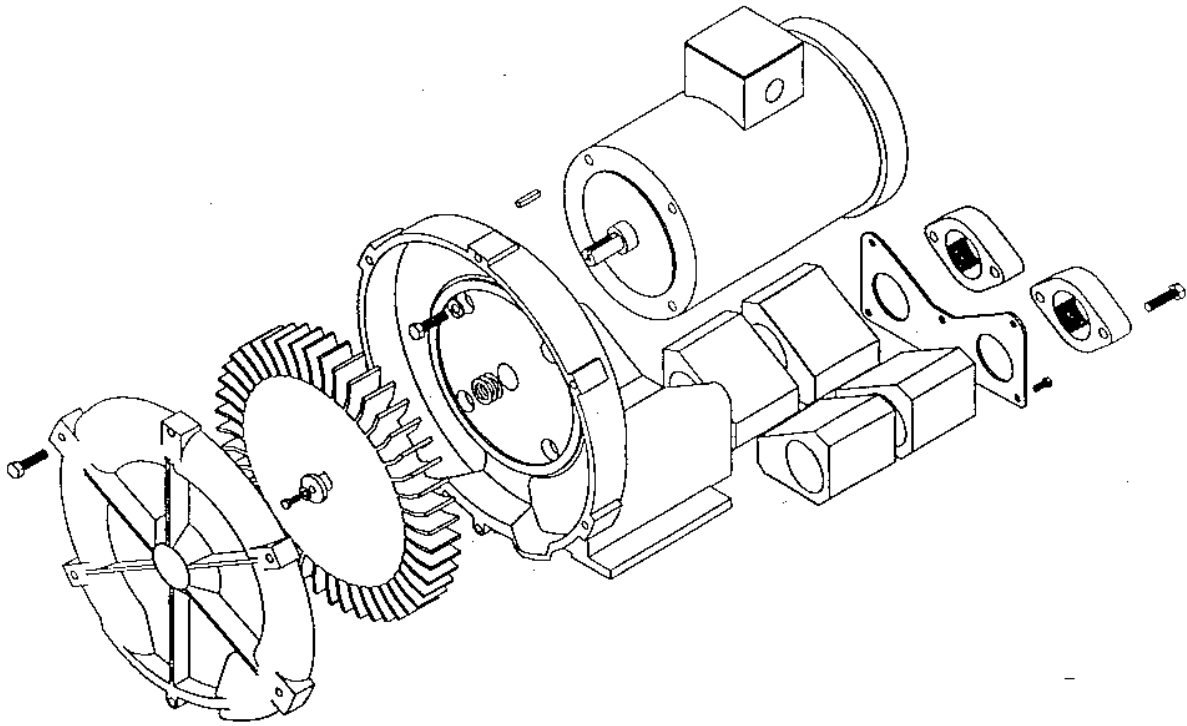
TITLE
 EZ-2.4 P
 ASSEMBLY/BOM/KIT
 DRAWING NUMBER EZ-2.4P
 SCALE N.T.S. SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND INCLUDE PLATING REMOVE ALL BURRS TOLERANCES UNLESS OTHERWISE SPECIFIED
 100% FOR WALKERS/40% FOR OTHER TOLERANCES AS SPECIFIED
 2.4 EZ STACKER
 NEXT ASY USED ON FINISH

DATE 11-14-95
 DRAWN BY KM
 CHECKED BY LN
 12-5-95
 APPROVED BY DATE
 MPT. APPROVAL
 MATERIAL

SERVICE AND PARTS MANUAL FOR BLOWER MODEL

**EN454 – EN656
DR404 – DR656**



Technical & Industrial Products
627 Lake Street, Kent, OH 44240 U.S.A.
Telephone: 330-673-3452 Fax: 330-677-3306
e-mail: info@ametekmd.com
internet: www.ametekmd.com

Your Choice. Our Commitment.™

WARRANTY, INSTALLATION, MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS



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e-mail: info@ametekmd.com web site: internet: www.ametekmd.com

1. **No Fault Policy** - AMETEK Rotron DR, EN and HiE regenerative direct drive blowers are guaranteed for one full year from the date of installation (limited to 18 months from the date of shipment.) to the original purchaser only. Should the blower fail, **regardless of the cause of failure**, we will at our option repair or replace the blower.
2. **Standard Policy** - AMETEK Rotron Minispiral, Revaflow, Multiflow, Nautilair, remote drive blowers, moisture separators, packaged units, CP blowers, Nasty Gas™ models and special built (EO) products are guaranteed for one full year from date of shipment for workmanship and material defect to the original purchaser only. Should the blower fail, we will evaluate the failure. If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.
3. **Parts Policy** - AMETEK Rotron spare parts and accessories are guaranteed for three months from date of shipment for workmanship and material defect to the original purchaser only. If failure is determined to be workmanship or material defect related we will at our option repair or replace the part.

Corrective Action - A written report will be provided indicating reason(s) for failure, with suggestions for corrective action. Subsequent customer failures due to abuse, misuse, misapplication or repeat offense will not be covered. AMETEK Rotron will then notify you of your options. Any failed unit that is tampered with by attempting repair or diagnosis will void the warranty, unless authorized by the factory.

Terms and Conditions - Our warranty covers repairs or replacement of regenerative blowers only, and will not cover labor for installation, outbound and inbound shipping costs, accessories or other items not considered integral blower parts. Charges may be incurred on products returned for reasons other than failures covered by their appropriate warranty. Out-of-warranty product and in warranty product returned for failures determined to be caused by abuse, misuse, or repeat offense will be subject to an evaluation charge. Maximum liability will in no case exceed the value of the product purchased. Damage resulting from mishandling during shipment is not covered by this warranty. It is the responsibility of the purchaser to file claims with the carrier. Other terms and conditions of sale are stated on the back of the order acknowledgement.

Installation Instructions for SL, DR, EN, CP, and HiE Series Blowers

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.
2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller

imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

- Support the Piping** - The blower flanges and nozzles are designed as connection points only and are not designed to be support members.

Caution: Plastic piping should not be used on blowers larger than 1 HP that are operating near their maximum pressure or suction point. Blower housing and nearby piping temperatures can exceed 200°F. Access by personnel to the blower or nearby piping should be limited, guarded, or marked, to prevent danger of burns.

- Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.
- Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Field representative will need to know the operating pressure/suction to properly diagnose the problem.
- Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

Note: Remote Drive (Motorless) Blowers - Properly designed and installed guards should be used on all belts, pulleys, couplings, etc. Observe maximum remote drive speed allowable. Due to the range of uses, drive guards are the responsibility of the customer or user. Belts should be tensioned using belt gauge.

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all standard models in the DR, EN, CP, and HiE series have sealed bearings that require no maintenance. Bearing should be changed after 15,000 to 20,000 hours, on average. Replacement bearing information is specified on the chart below.

Bearing Part Number	Size	Seal Material	Grease	Heat Stabilized
510217 510218 510219	205 206 207	Polyacrylic	Nye Rheotemp 500 30% +/- 5% Fill	Yes – 325 F
510449 516440 516648	203 202 307	Buna N	Exxon Polyrex Grease	NO
516840 516841 516842 516843 516844 516845 516846 516847	206 207 208 210 309 310 311 313	Buna N	Exxon Polyrex Grease	NO

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOES NOT TURN	Humming Sound	<ol style="list-style-type: none"> * One phase of power line not connected * One phase of stator winding open Bearings defective Impeller jammed by foreign material Impeller jammed against housing or cover ** Capacitor open 	<ol style="list-style-type: none"> Connect Rewind or buy new motor Change bearings Clean and add filter Adjust Change capacitor
	No Sound	<ol style="list-style-type: none"> * Two phases of power line not connected * Two phases of stator winding open 	<ol style="list-style-type: none"> Connect Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	<ol style="list-style-type: none"> Insufficient fuse capacity Short circuit 	<ol style="list-style-type: none"> Use time delay fuse of proper rating Repair
	Motor Overheated Or Protector Trips	<ol style="list-style-type: none"> High or low voltage * Operating in single phase condition Bearings defective Impeller rubbing against housing or cover Impeller or air passage clogged by foreign material Unit operating beyond performance range Capacitor shorted * One phase of stator winding short circuited 	<ol style="list-style-type: none"> Check input voltage Check connections Check bearings Adjust Clean and add filter Reduce system pressure/vacuum Change capacitor Rewind or buy new motor
	Abnormal Sound	<ol style="list-style-type: none"> Impeller rubbing against housing or cover Impeller or air passages clogged by foreign material Bearings defective 	<ol style="list-style-type: none"> Adjust Clean and add filter Change bearings
	Performance Below Standard	<ol style="list-style-type: none"> Leak in piping Piping and air passages clogged Impeller rotation reversed Leak in blower Low voltage 	<ol style="list-style-type: none"> Tighten Clean Check wiring Tighten cover, flange Check input voltage
<p>* 3 phase units ** 1 phase units *** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.</p>			

Blower Disassembly:

WARNING: Attempting to repair or diagnose a blower may void Rotron's warranty. It may also be difficult to successfully disassemble and reassemble the unit.

- 1) Disconnect the power leads. **CAUTION:** Be sure the power is disconnected before doing any work whatsoever on the unit.
- 2) Remove or separate piping and/or mufflers and filters from the unit.
- 3) Remove the cover bolts and then the cover. **NOTE:** Some units are equipped with seals. It is mandatory that these seals be replaced once the unit has been opened.
- 4) Remove the impeller bolt and washers and then remove the impeller. **NOTE:** Never pry on the edges of the impeller. Use a puller as necessary.
- 5) Carefully note the number and location of the shims. Remove and set them aside. **NOTE:** If the disassembly was for inspection and cleaning the unit may now be reassembled by reversing the above steps. If motor servicing or replacement and/or impeller replacement is required the same shims may not be used. It will be necessary to re-shim the impeller according to the procedure explained under assembly.

- 6) Remove the housing bolts and remove the motor assembly (arbor/.housing on remote drive models).
- 7) Arbor disassembly (Applicable on remote drive models only):
 - a) Slide the bearing retraining sleeve off the shaft at the blower end.
 - b) Remove the four (4) screws and the bearing retaining plate from the blower end.
 - c) Lift the shaft assembly far enough out of the arbor to allow removal of the blower end snap ring.
 - d) Remove the shaft assembly from the arbor.
 - e) If necessary, remove the shaft dust seal from the pulley end of the arbor.

Muffler Material Replacement:

- 1) Remove the manifold cover bolts and them manifold cover.
- 2) The muffler material can now be removed and replaced if necessary. On blowers with fiberglass acoustical wrap the tubular retaining screens with the fiberglass matting before sliding the muffler pads over the screens.
- 3) Reassemble by reversing the procedure.

NOTE: On DR068 models with tubular mufflers it is necessary to remove the cover and impeller accessing the muffler material from the housing cavity.

Blower Reassembly:

- 1) Place the assembled motor (assembled arbor assembly for remote drive models) against the rear of the housing and fasten with the bolts and washer.
- 2) To ensure the impeller is centered within the housing cavity re-shim the impeller according to the procedure outlined below.
- 3) If blower had a seal replace the seal with a new one.
- 4) Place the impeller onto the shaft making sure the shaft key is in place and fasten with the bolt, washer and spacer as applicable. Torque the impeller bolt per the table below. Once fastened carefully rotate the impeller to be sure it turns freely.
- 5) Replace the cover and fasten with bolts.
- 6) Reconnect the power leads to the motor per the motor nameplate.

Bolt Size	Torque
1/4-20	6.25 +/- 0.25
5/16-18	11.5 +/- 0.25
3/8-16	20.0 +/- 0.5
1/2-13	49.0 +/- 1
5/8 -11	90.0 +/- 2

Impeller Shimming Procedure:

WARNING: This unit may be difficult to shim. Extreme care may be exercised.

Tools Needed: Machinist's Parallel Bar
Vernier Caliper with depth measuring capability
Feeler gauges or depth gauge

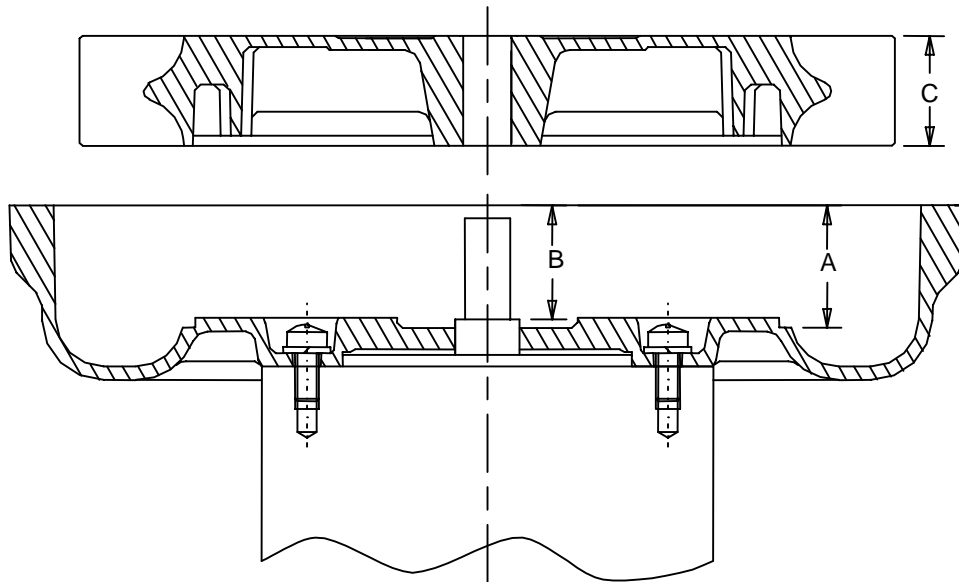
Measure the Following:

- Distance from the flange face to the housing (A)
- Distance from the flange face to the motor shaft shoulder (B)
- Impeller Thickness (C)

Measurements (A) and (B) are made by laying the parallel bar across the housing flange face and measuring to the proper points. Each measurement should be made at three points, and the average of the readings should be used.

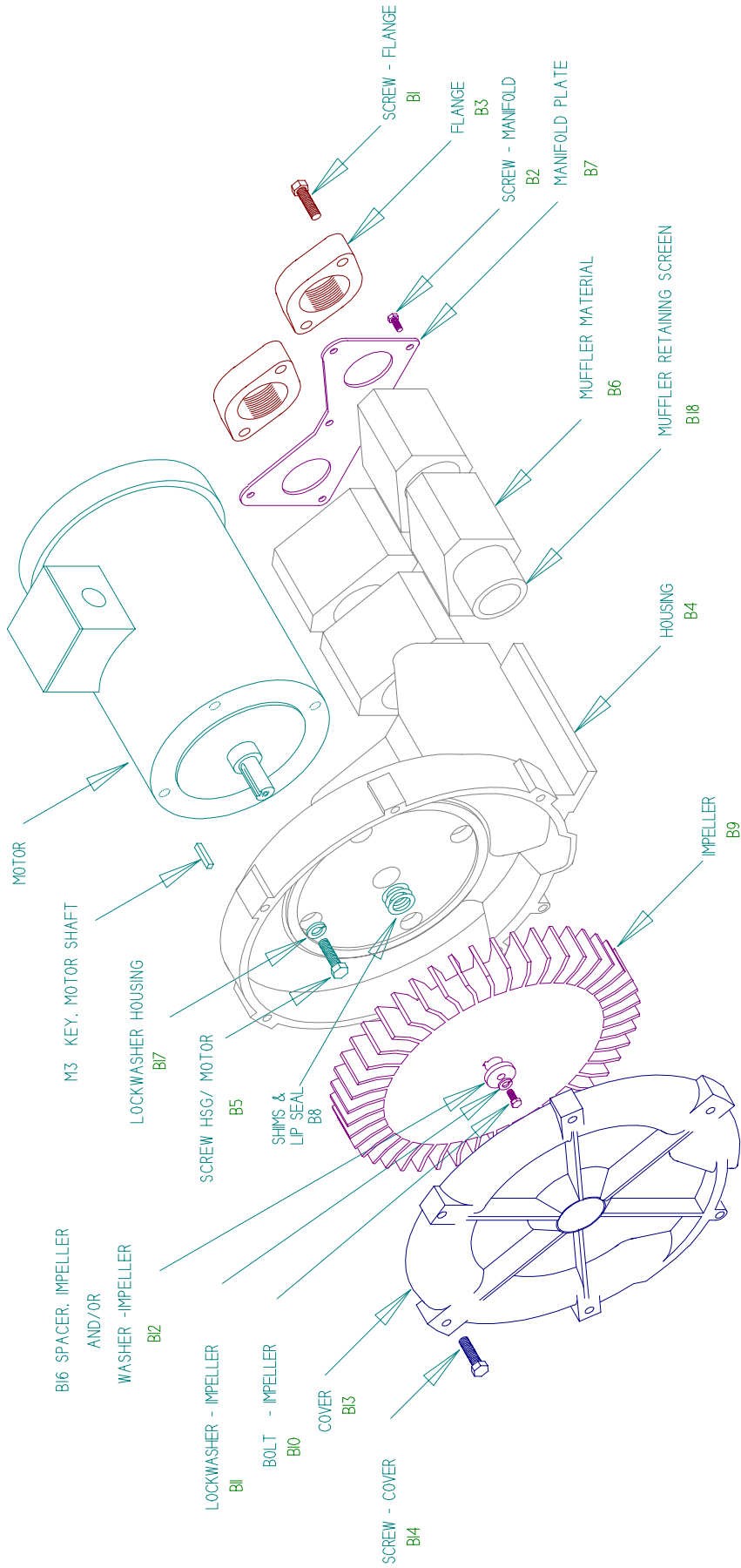
$$\text{Shim Thickness} = B - (A+C)/2$$

After the impeller installation (step #4 above) the impeller/cover clearance can be checked with feeler gauges, laying the parallel bar across the housing flange face. This clearance should nominally be $(A+C)/2$.



ASSEMBLY DIAGRAM

EN454 EN513 EN523 EN505 EN555 EN606 EN656



EN 454/513/523/505/555/606/656
Service and Parts Manual

Model:
 Part No.:

Parts Breakdown

EN454	EN454	EN513	EN523	EN505	EN555	EN606	EN656
038175	080487	038183	038223	038177	038045	038179	080058
038176	080488	038037	038184	038178		038222	080059
				038445		038437	080060
						038536	
						038538	

Item No.	Qty.	Req'd	Description	EN454	EN454	EN513	EN523	EN505	EN555	EN606	EN656
M3	1		Key Motor Shaft	510629	510629	510629	155099	510629	510629	510629	510629
B1	4		Screw, Flange	120162	120162	120162	120162	120162	120162	155095	120255
B2	6		Screw, Manifold	155496	155496 (10 pcs)	120214	120214 (10 pcs)	155170	155176	155176	155170
B3	2		Flange	510354	510354	510354	510354	510354	510354	511480	511480
B4	1		Housing	515737	551001	523419	523420	See Next Page	516721	See Next Page	550195
B5	4		Screw, Hsg/Motor	251791	155128	251791	251791	155128	251791	251791	251791
B6	4		Muffler Material	515743	515743	516560	516560 (6 pcs)	515743	515743	See Next Page	(10 pcs.) 551585
	2		Muffler Insert	Not Used	551006	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B7	1		Manifold Plate	516410	516410	529868	529868	517460	515482	516392	See Next Page
B8	*		Shim .002"	510356	510356	510356	500664	510356	510356	510356	510356
	*		Shim .005"	510357	510357	510357	500665	510357	510357	510357	510357
	*		Shim .010"	510358	510358	510358	500666	510358	510358	510358	510358
	*		Shim .020"	510359	510359	510359	500667	510359	510359	510359	510359
	*		Shim .030"	Not Used	Not Used	Not Used	510292	Not Used	Not Used	Not Used	Not Used
B9	1		Impeller	515675	551067	516557	(2 pcs) 516562	517433	516678	511272	550305
B10	1		Bolt, Impeller	120214	120214	120325	120214	120214	120214	120325	120325
B11	1		Lockwasher, Impeller	120203	120203	120203	120203	120203	120203	120203	120203
B12			Washer, Impeller	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1		Cover	517807	551065	516559	516559	517808	516675	511274	550249
B14	6		Screw, Cover	155236	155129	(8 pcs) 120255	(8 pcs) 155098	155236	(7 pcs) 155236	155236	(8 pcs) 155236
B16	1		Spacer, Impeller Bolt	510355	510355	510355	510355	510355	510355	510355	510355
B17			Lockwasher, Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B18	1		Screen, Muffler Retaining, Right (**)	510362	551087	511718	511718	See Next Page	510362	See Next Page	517436
	1		Screen, Muffler Retaining, Left (**)	510362	551087	511718	511718	See Next Page	510362	See Next Page	517436
B19			Bolt, Muffler Hsg/Hsg	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B20			Muffler Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
			Bolt, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
			Lockwasher, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
			Washer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
			Spacer, Motor/Muffler	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B23			Bolt, Mounting Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B24			Lockwasher, Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B25			Nut, Rail	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B26			Rail Mounting	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
	1		Lip Seal	516587	516587	516587	516587	516587	516587	516587	516587

*As needed **Viewed looking at inlet/outlet ports ***Not currently in production; superseded by model listed below

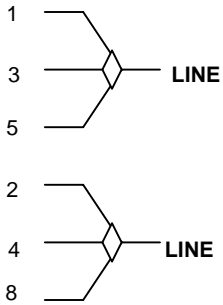
Model	Part No.	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bearing, Impeller End (M2)
EN454W58L	038175	515747	H + L			
EN454W72L	038176	515746	K + L			
EN454W58ML	080487	515747	H + L		510449	510217
EN454W72ML	080488	515746				
EN513W58L	038183	515747	H + L			
EN513W72L	038037	515746	K + L			
EN523M72L	038184	517675	K + L			
EN523M5L	038223	551373	M + L	B13 516555 1 pc Center Annulus	510217	510218
EN505AX58MIL	038177	510326	H + L			
EN505AX72MIL	038178	510325	K + L	B4 517419 B18 517435 2 pcs	510449	510217
EN505CJML	038445	529622	M + L	B4 529654 B18 517436 2 pcs		
EN555M72L	038045	516686	K + L		510449	510217
EN606M72L	038179					
EN606M5L	038222 **	516687	K + L	B4 511276 1 pc		
EN606M86L	038437	551366	M + L	B6 511285 4 pcs	510217	510218
EN606M72ML	038536	529630	N + L	B4 529790 1 pc	510449	510217
EN606M5ML	038538	516687	K + L	B6 529781 4 pcs		
EN656M86XL	080058	551366	M + L	B18 529782 2 pcs	510217	510218
EN656M72XL	080059	529630	N + L		510449	510217
EN656M5XL	080060	516687	K + L			
		551366	M + L	B7 Muffler extension 550253 1 pc	510217	510218

*As needed **Viewed looking at inlet/outlet ports ***Not currently in production; superseded by model listed below

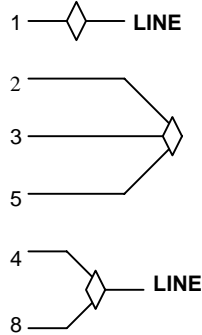
WIRING DIAGRAMS, XP MOTORS

H. 1Ø, 6 WIRE

115 VAC



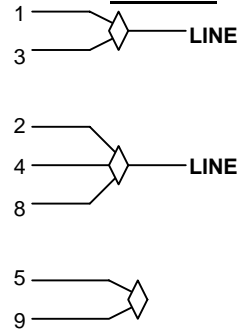
230 VAC



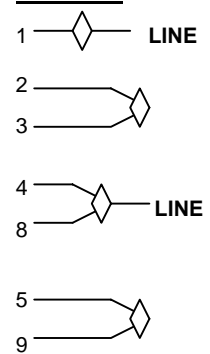
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

I. 1Ø, 7 WIRE

115 VAC



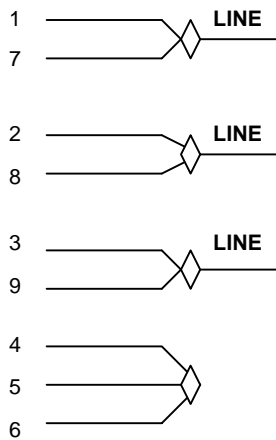
230 VAC



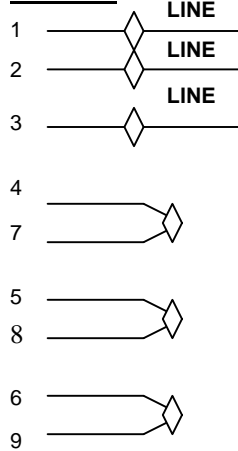
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

K. 3Ø, 9 WIRE

230 VAC

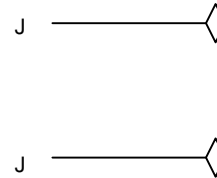


460 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

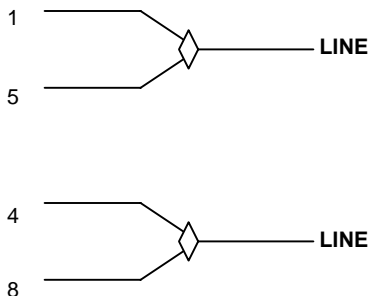
L. PILOT DUTY THERMAL OVERLOADS



HOOK J LEADS TO CONTROL CIRCUITRY

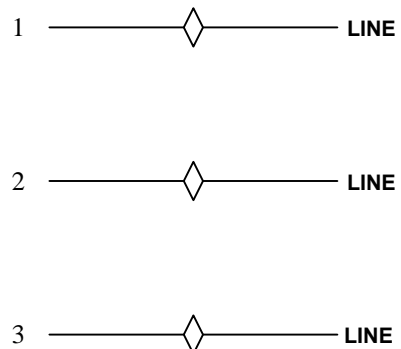
M. 1Ø 230 VAC

SINGLE VOLTAGE



INTERCHANGE LEADWIRES 5 & 8 TO REVERSE ROTATION

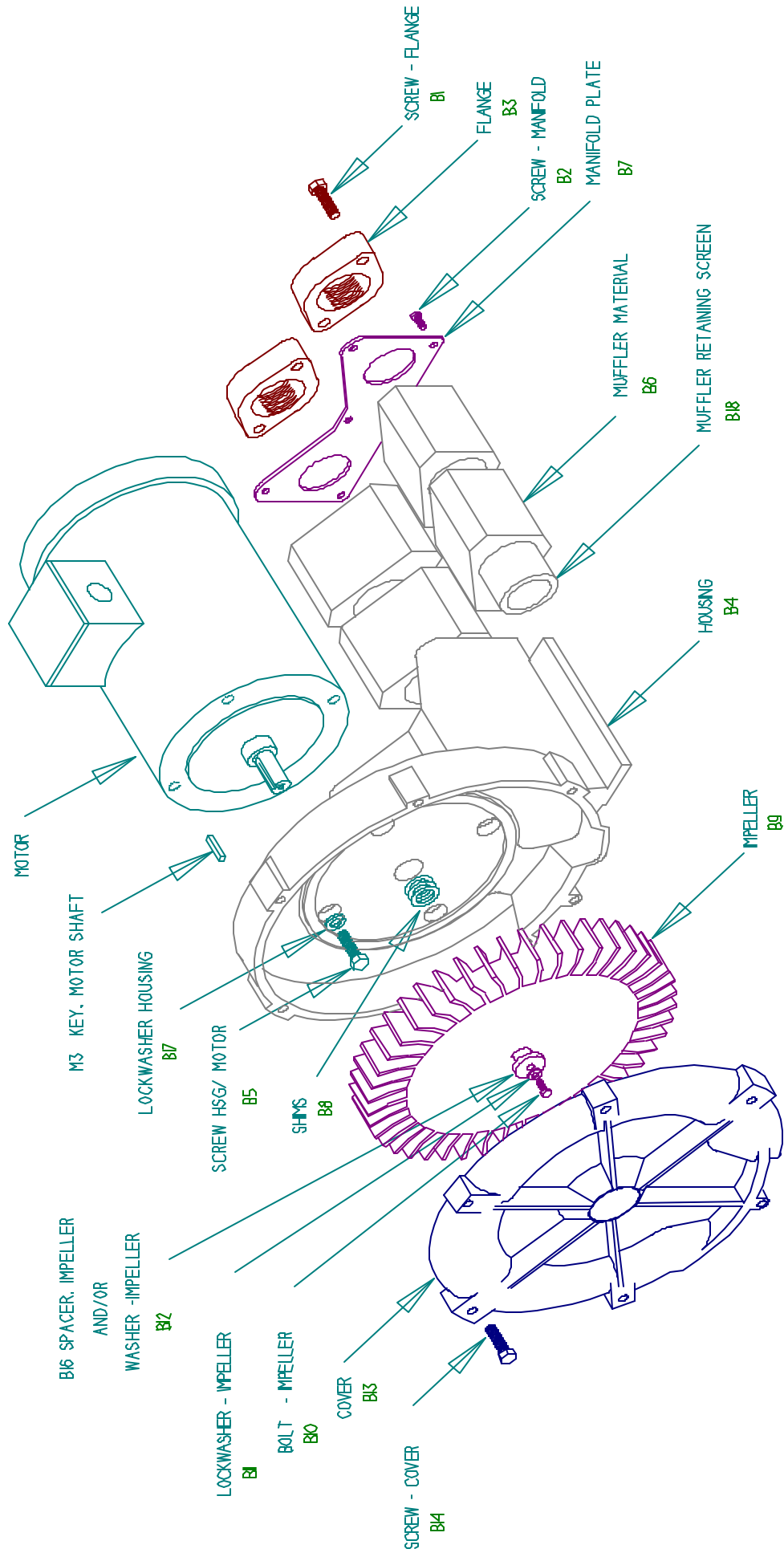
N. 3Ø 575 VAC



INTERCHAGE ANY TWO LEAD LINES TO REVERSE ROTATION

ASSEMBLY DRAWING

DR404 DR454 DR513
 DR523 DR505 DR555
 DR606 DR656



DR 404/454/513/523/505/555/606/656
Service and Parts Manual

Parts Breakdown

Model:
 Part No.:

DR404 DR454 DR454 DR523 DR505 DR555 DR606 DR656
 037406 036855 080480 037210 037542 037308 038526 080582
 037408 036856 080481 037211 037543 037306 038527 080583
 037407 036949 080482 037772 037544 037305 038530 080604
 038808 037545 037546 038529 080584
 080602
 080603

Item No.	Qty.	Description	DR404	DR454	DR454	DR513	DR523	DR505	DR555	DR606	DR656
M3	1	Key Motor Shaft	510629	510629	510629	510629	155099	510629	510629	510629	510629
B1	4	Screw, Flange	120162	120162	120162	120162	120162	120162	120162	120255	120255
B2	6	Screw, Manifold	155130	155477	155477 (10 pcs)	120214 (10 pcs)	120214	155130	155477	155477	155170
B3	2	Flange	510962	510354	510354	510354	510354	510354	510354	511480	511480
B4	1	Housing	517002	515737	551001	516552	516551	517419	516721	529790	550195
B5	4	Screw, Hsg/Motor	155128	251791	155128	251791	251791	155128	251791	251791	251791
B6	4	Muffler Material	(6 pcs) 517015	515743	515743	516560	516560 (6 pcs)	515743	515743	529781 (10 pcs)	551585
B7	1	Manifold Plate	517008	515744	515744	529888	529888	517458	517458	511284	Not Used
B8	*	Shim .002"	510356	510356	510356	510356	500664	510356	510356	510356	510356
	*	Shim .005"	510357	510357	510357	510357	500665	510357	510357	510357	510357
	*	Shim .010"	510358	510358	510358	510358	500666	510358	510358	510358	510358
	*	Shim .020"	510359	510359	510359	510359	500667	510359	510359	510359	510359
	*	Shim .030"	Not Used	Not Used	Not Used	Not Used	510292	Not Used	Not Used	Not Used	Not Used
B9	1	Impeller	516987	515675	551067	516557 (2 pcs)	516562	517433	516678	511272	550305
B10	1	Bolt, Impeller	120214	120214	120214	120325	120214	120214	120214	120325	120325
B11	1	Lockwasher, Impeller	120203	120203	120203	120203	120203	120203	120203	120203	120203
B12	1	Washer, Impeller	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1	Cover	516990	515702	551065	516559	516559	517431	516675	511274	550249
B14	6	Screw, Cover	155129	155236	155129 (8 pcs)	120255 (8 pcs)	155098	155236 (7 pcs)	155236	155236 (8 PCS)	155236
B16	1	Spacer, Impeller Bolt	510355	510355	510355	510355	510355	510355	510355	510355	510355
B17	4	Lockwasher, Housing	251787	251787	251787	251787	Not Used	251787	251787	251787	251787
B18	1	Screen, Muffler Retaining Right (**)	517016	510362	551006	511718	511718	See Next Page	510362	529782	517436
B19	1	Screen, Muffler Retaining Left (**)	517016	510362	551006	511718	511718	See Next Page	510362	529782	517436
B20		Bolt, Muffler Hsg/Hsg	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Muffler Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Lip Seal	Not Used	Not Used	Not Used	Not Used	516587	Not Used	Not Used	Not Used	Not Used

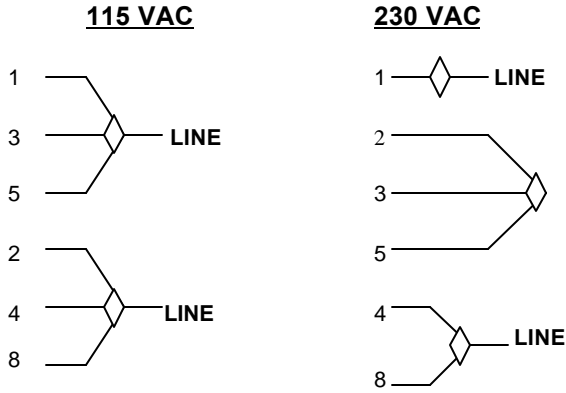
*As needed **Viewed looking at inlet/outlet ports

Model	Part #	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bearing, Impeller End (M2)
DR404AL72M	037406	510438	C			
DR404AL86M	037408	510700	G			
DR404AL58M	037407	510439	A			
DR454R72	036855	510317	C			
DR454R58	036856	510319	A			
DR454R86	036949	516034	G			
DR454CD72	038808	510763	C			
DR454R72M	080480	510317	C	Muffler - Liner (2 pcs) 551087		
DR454R58M	080481	510319	A			
DR454R86M	080482	516034	G			
DR513R72	037217	510317	C			
DR513R58	037209	510319	A			
DR513R86	037773	516034	G			
DR523K72	037210	516571	C			
DR523K58	037211	516572	A	B13A Center Annulus (1 pc) 516555		
DR523K86	037772	551131	G			
DR505CD58M	037546	510762	A	B18 R517436		
DR505CD72M	037545	510763	C	R517436		
DR505AS86M	037544	510701	G			
DR505AS72M	037543	510318	C	B18 R517435		
DR505AS58M	037542	510320	A	R517435		
DR555CK72	037308	510895	C			
DR555K72	037306	511306	C			
DR555K58	037305	511307	A	B2A Washer Manifold (6 pcs) 120222		
DR555CK86	037310	511305	G			
DR555K86	037309	516686	G			
DR606CK72M	038526	510895	C			
DR606K72M	038527	511306	C			
DR606K58M	038529	511307	A			
DR606CK86M	038530	511305	G			
DR606CK5M	038532	516848	F			
DR606D72M	030077	550689	C			
DR656CK72X	080582	510895	C			
DR656CK5X	080584	516848	F			
DR656CK86X	080583	511305	G			
DR656K72X	080602	511306	C	B7* Muffler Extension 550253		
DR656K58X	080603	511307	A			
DR656D72X	080585	550689	C			
DR656D86X	080604	550694	G			

*As needed **Viewed looking at inlet/outlet ports

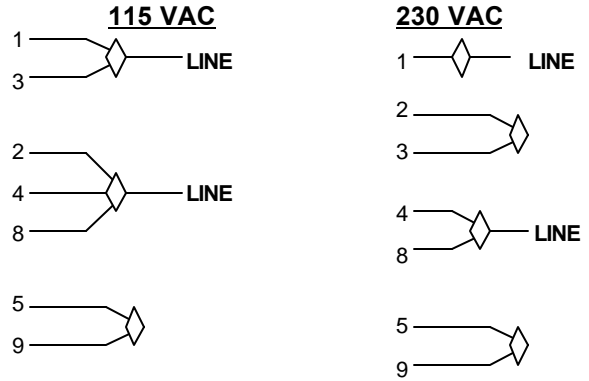
WIRING DIAGRAMS, TEFC and ODP MOTORS

A. 1Æ, 6 WIRE



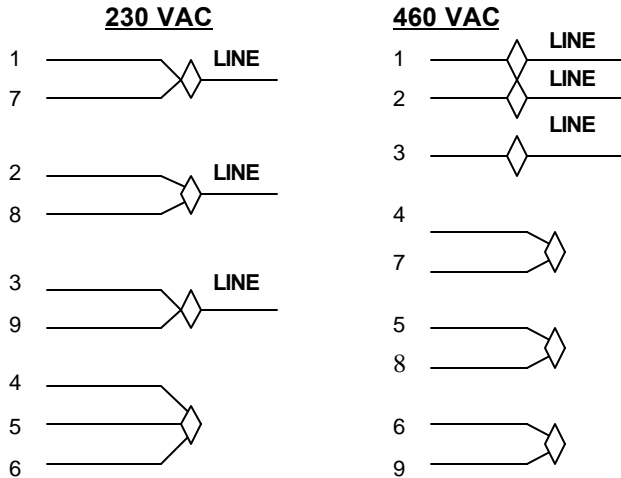
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

B. 1Æ, 7 WIRE



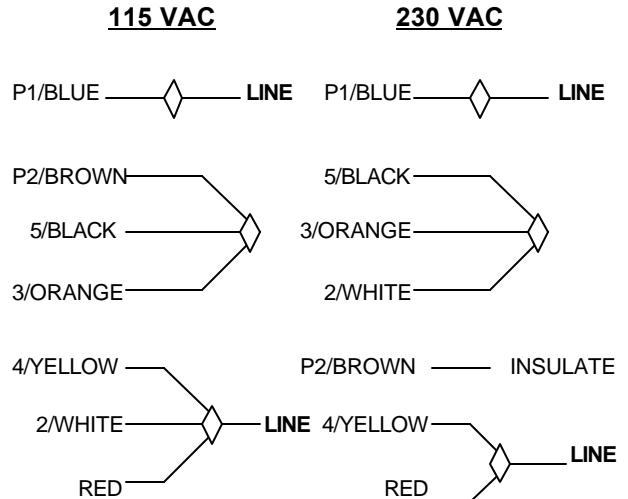
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

C. 3Æ, 9 WIRE



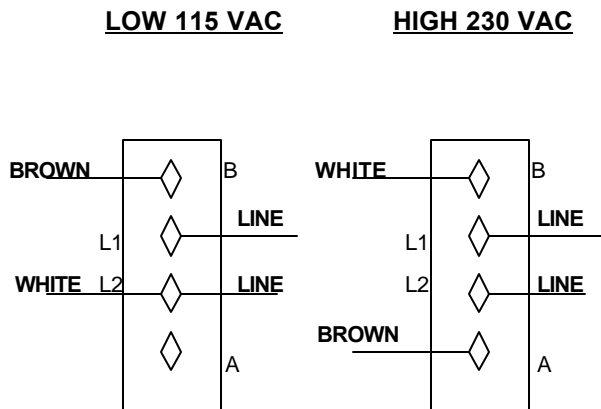
INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

D. 1Æ, EMERSON 1/8 HP MOTOR



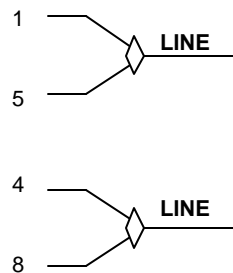
INTERCHANGE RED AND BLACK TO REVERSE ROTATION

E. 1Æ, SPA DUTY WITH TERMINAL STRIPS



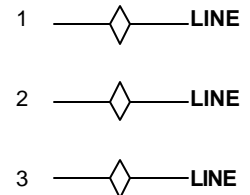
F. 1Æ, 230 VAC

SINGLE VOLTAGE



INTERCHANGE LEAD WIRES 5 & 8 TO REVERSE ROTATION

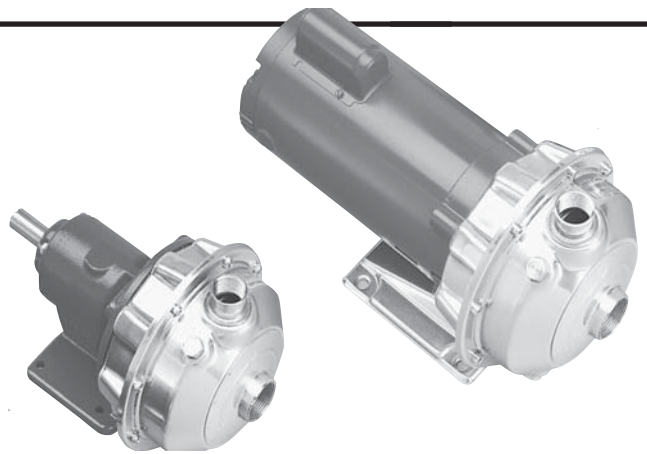
G. 3Æ, 575 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

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.

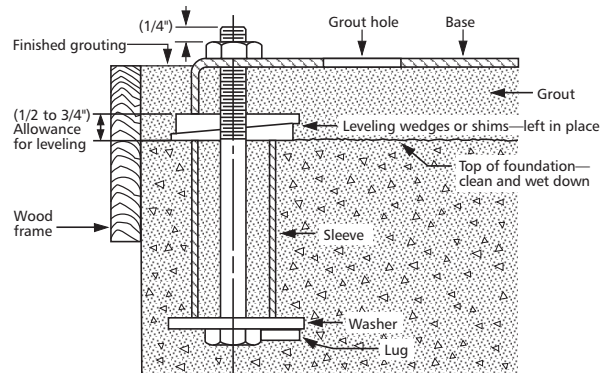


Figure 1

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.

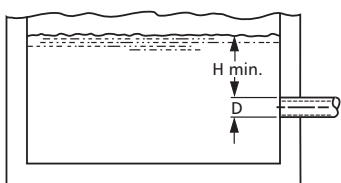


Figure 2

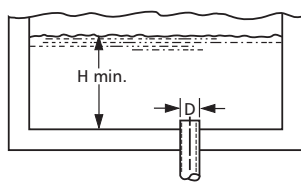


Figure 3

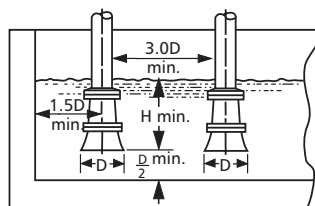


Figure 4

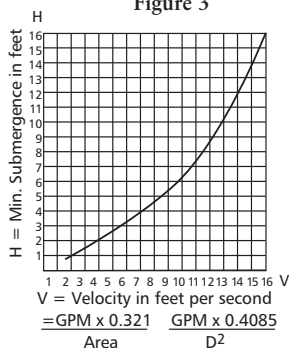


Figure 5

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.

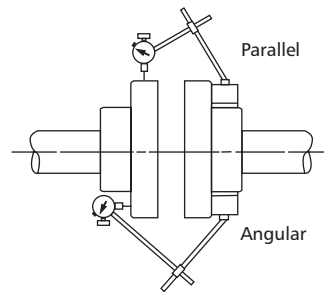


Figure 6

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)

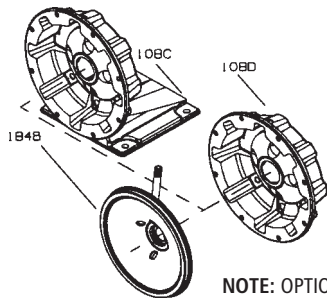
PROBABLE CAUSE:

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

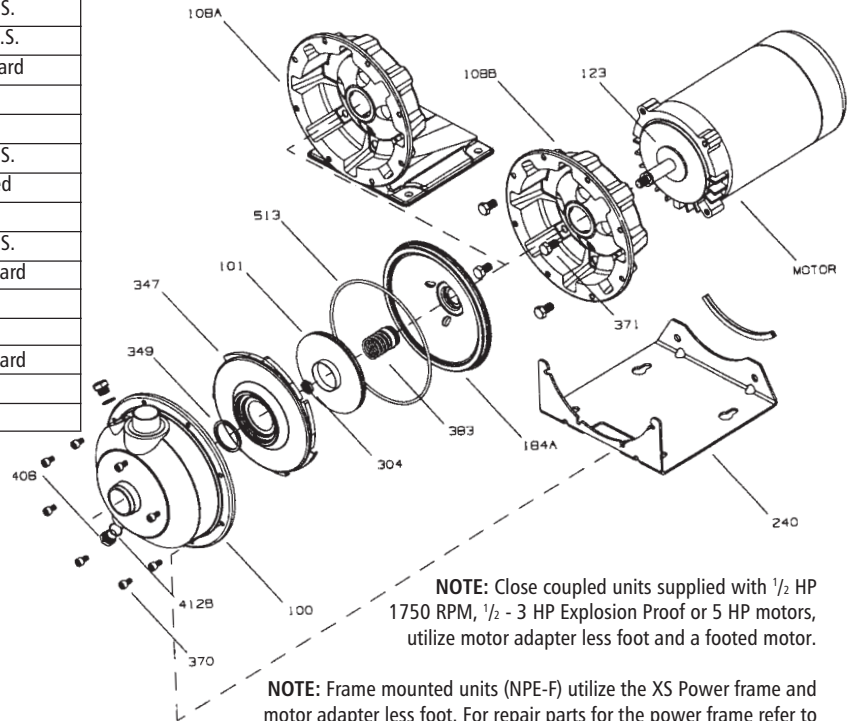
NPE Standard Repair Parts List

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:

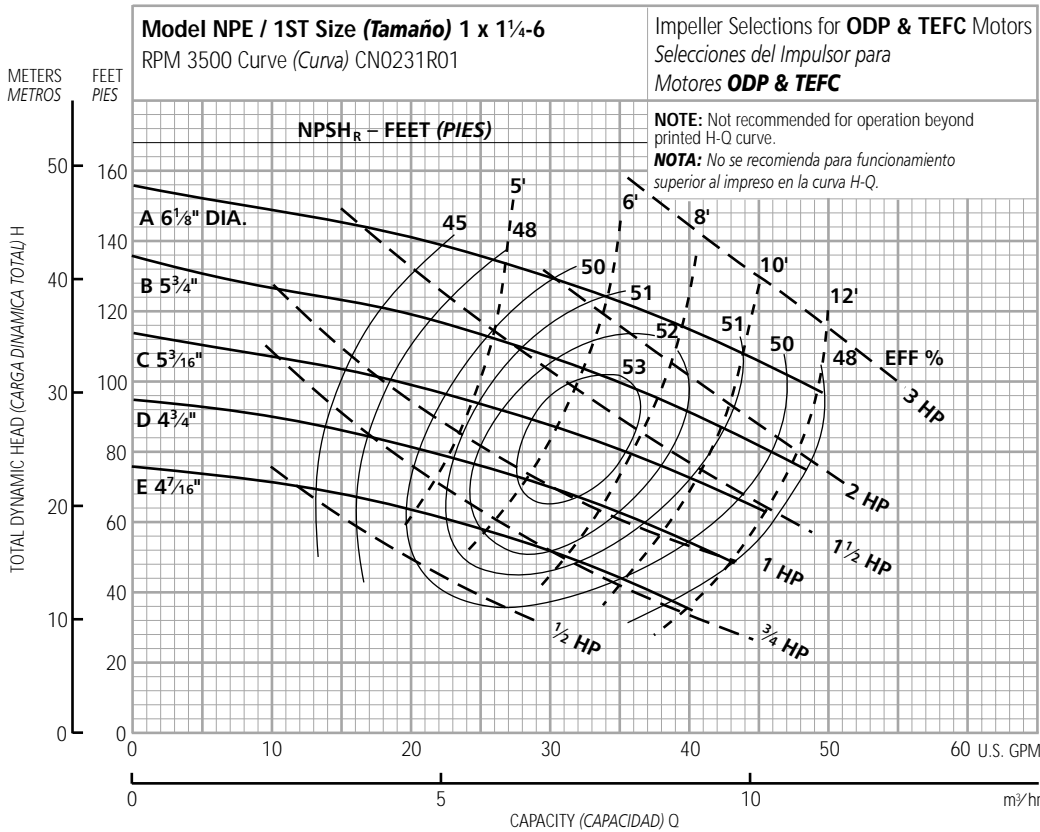
- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association,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

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Visit us at www.goulds.com

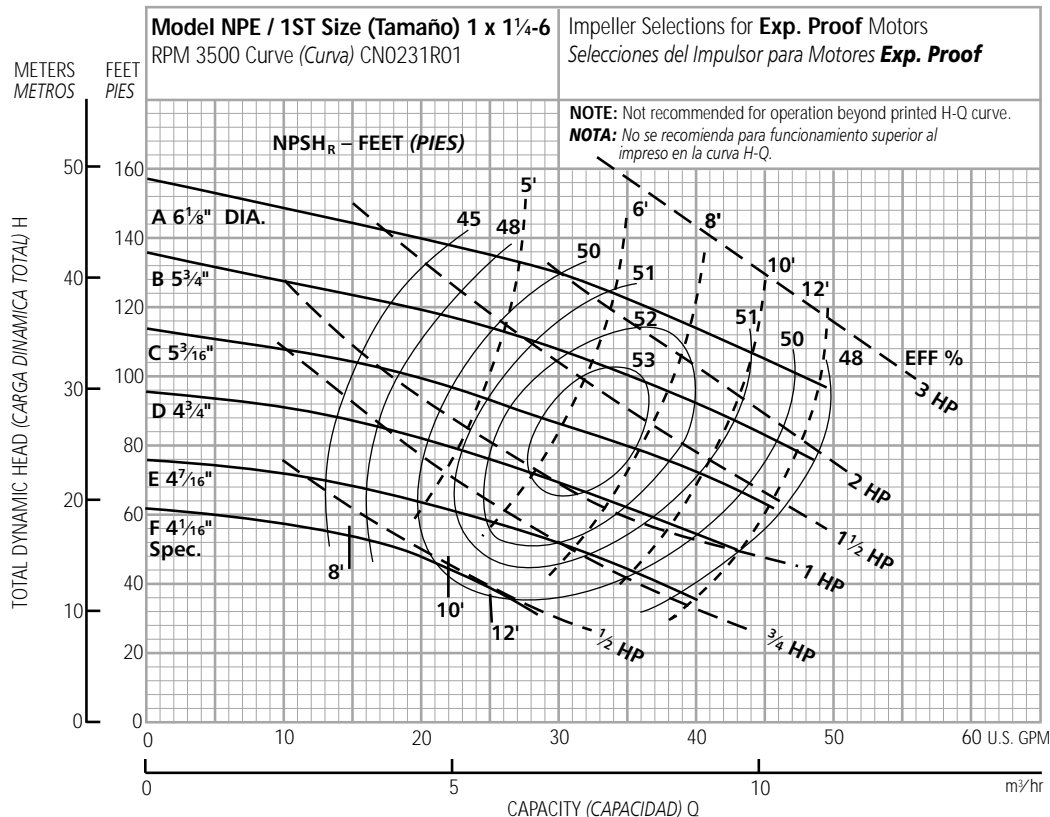
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



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".

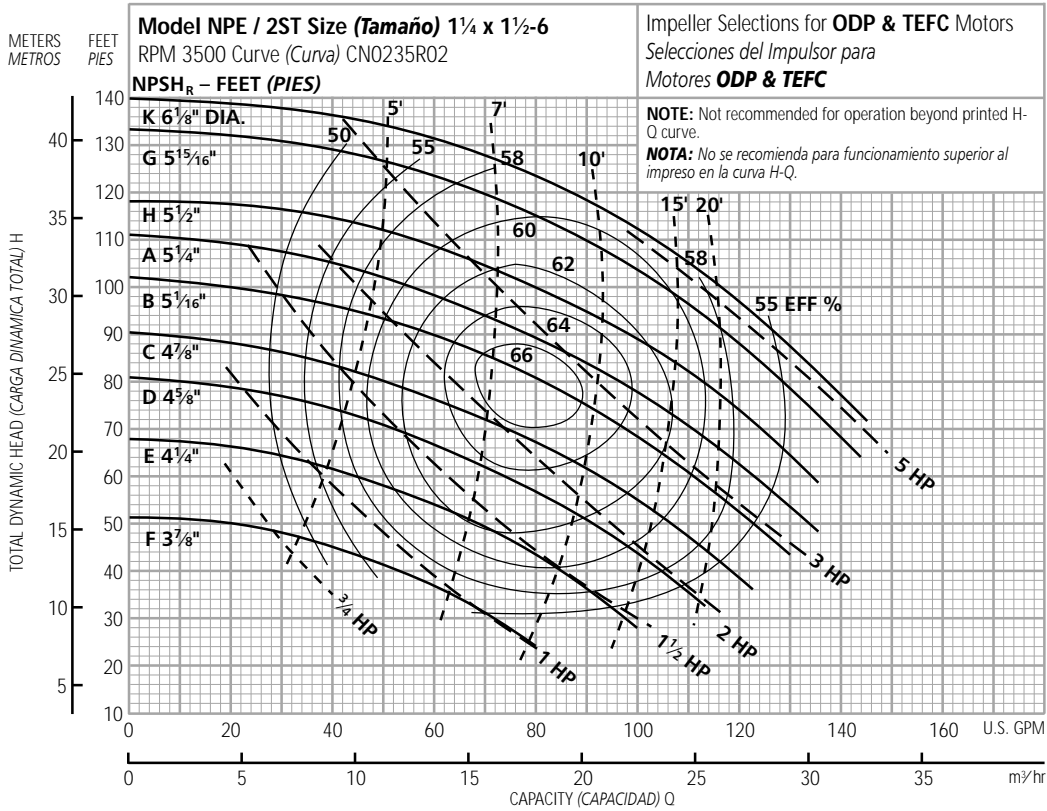


Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
F	1/2	4 1/16" spec.
E	3/4	4 7/16"
D	1	4 3/4"
C	1 1/2	5 3/16"
B	2	5 3/4"
A	3	6 1/8"

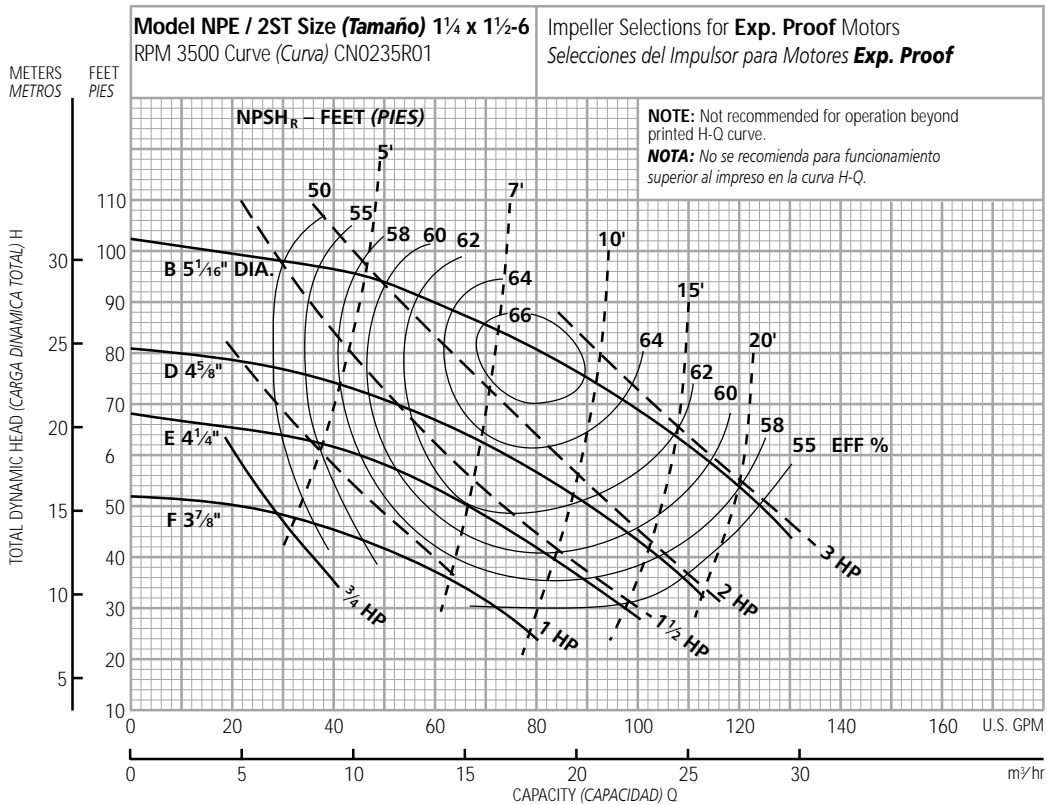
NOTE: Although not recommended, the pump may pass a 1/16" sphere.

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

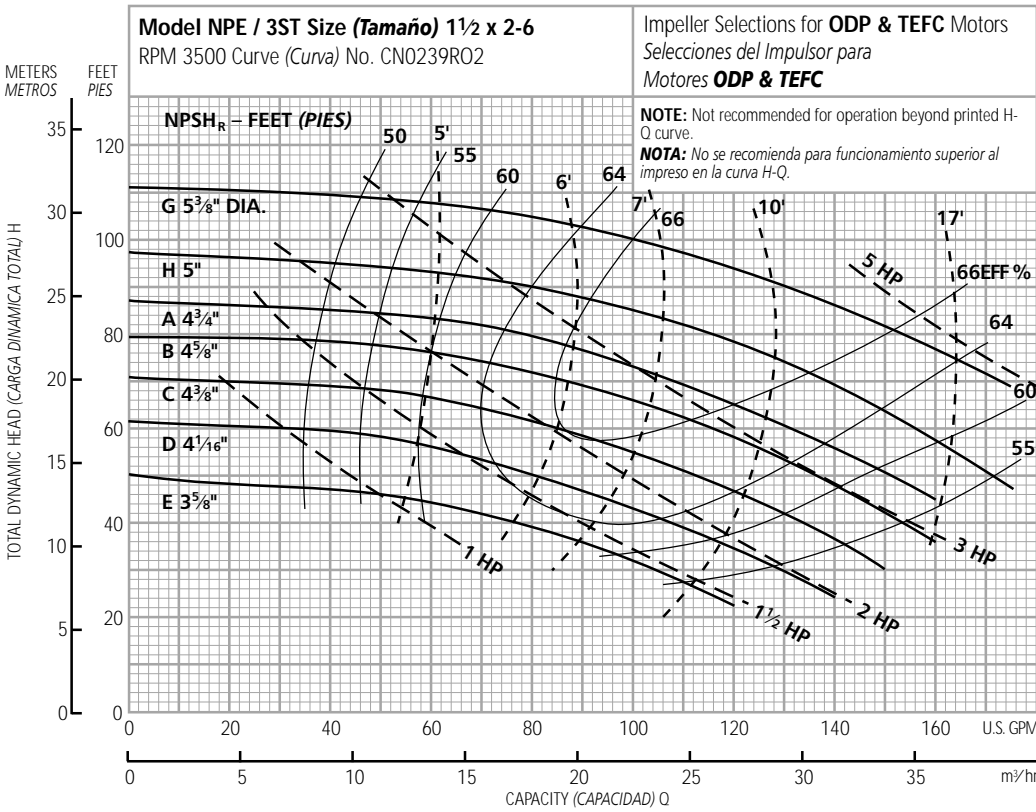


NOTE: Although not recommended, the pump may pass a 3/16" sphere.
NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".



NOTE: Although not recommended, the pump may pass a 3/16" sphere.
NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".

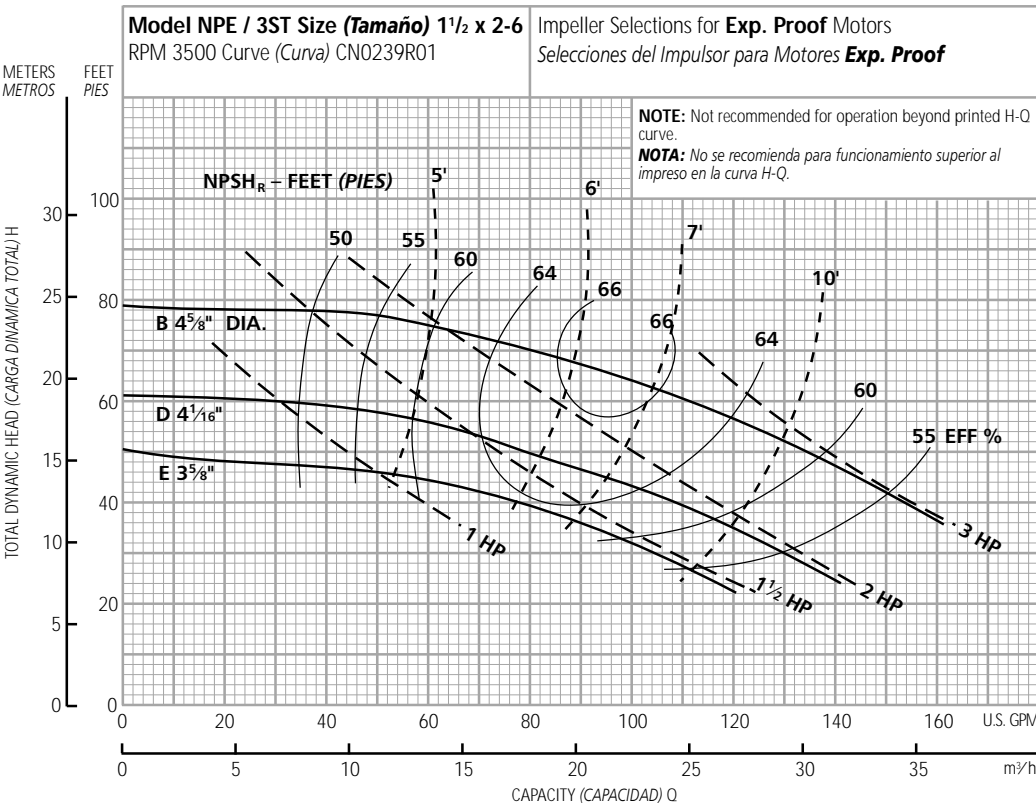
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



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

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Pictorial Breakdown of Pump	3
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Impeller Chart by Motor Size at 3500 RPM	4
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NOTE:

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

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

NPE/NPE-F NUMBERING SYSTEM

1 ST 2 C 1 A 4 F

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

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

21 Mechanical Seal (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

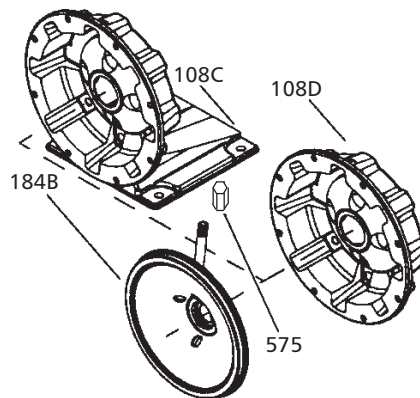
1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

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
		Viton standard	5K269	5K270		
		EPR	5K273	5K274		
349	Seal ring, guidevane	BUNA	5K271	5K272		1
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

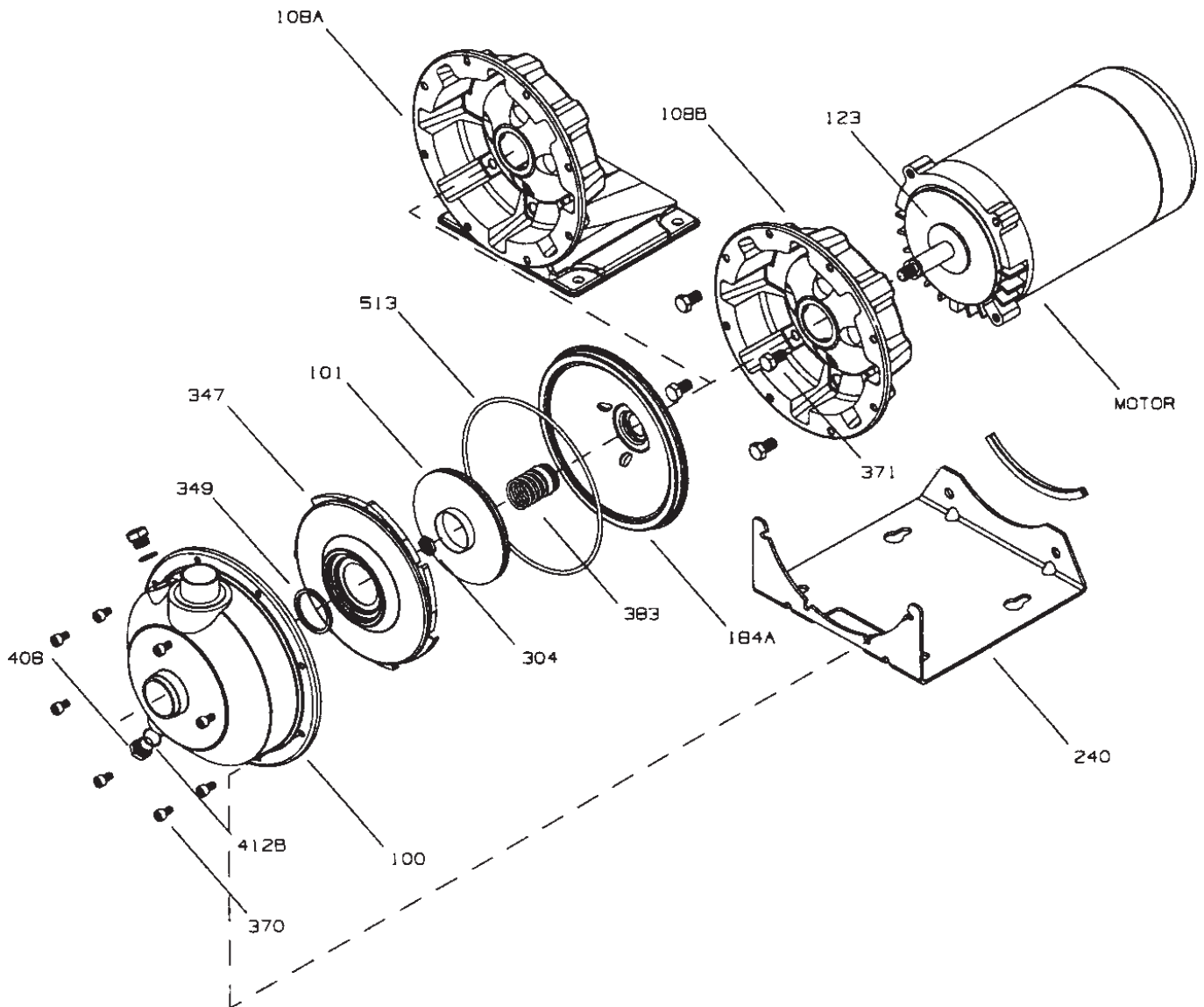


NOTE:

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.)
½	E04853S	10.0/5.0	16	E04821	6.2/3.1	21	BBC04825	6.2/3.1	47
¾	E05853S	14.0/7.0	19	E05821	8.8/4.4	24	BBC05825	8.8/4.4	41
1	E06853S	16.0/8.0	22	E06821	11.6/5.8	26	BBC06825	11.6/5.8	49
1½	E07858S	21.4/10.7	31	E07821	16.2/8.1	35	BBC07825	16.2/8.1	56
2	E08854	26.8/13.4	36	E08821	20.8/10.4	39	BBC08825	20.8/10.4	60
3	E09854	14.0	40	E09821	11.89	44			
5	E10754	14.4	55						

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

HP	Three-Phase, 60 Hz, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ^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.)
½	E04873	2.6/1.3	19	E04876	1.9/.95	18	BBC04875	1.9/.95	27
¾	E05873	3.4/1.7	19	E05876	2.3/1.15	21	BBC05875	2.3/1.15	30
1	E06873	4.2/2.1	22	E06876	3.2/1.6	21	BBC06875	3.2/1.6	30
1½	E07878	5.8/2.9	25	E07876	4.8/2.4	27	BBC07875	4.8/2.4	37
2	E08874	6.9/3.3	39	E08876	5.4/2.7	33	BBC08875	5.4/2.7	44
3	E09874	7.2/3.6	31	E09876	7.6/3.8	37			
5	E10774	7.2/14.4	50	E10876	6.2/12.4	48			

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

MODEL NPE 1750 RPM

HP	Single-Phase, 60 HZ, 115/230 V, 56J Frame								
	Open, Drip-Proof ^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.)
½	E04811	8.6/4.3	19	E04812	8.0/4.0	20	BBC04815	8.0/4.0	45

HP	Three-Phase, 60 HZ, 208-230/460 V, 56J Frame								
	Open, Drip-Proof ^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.)
½	E04831	3.76/4.0/2.0	20	E04832	1.77/1.6/.8	20	BBC04835	1.77/1.6/.8	45

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

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS



SPECIFICATIONS

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

Weight: 1 lb. 2 oz.

Finished: Baked dark gray enamel.

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

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

Pressure Rating: 15 PSI (0,35 bar)

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

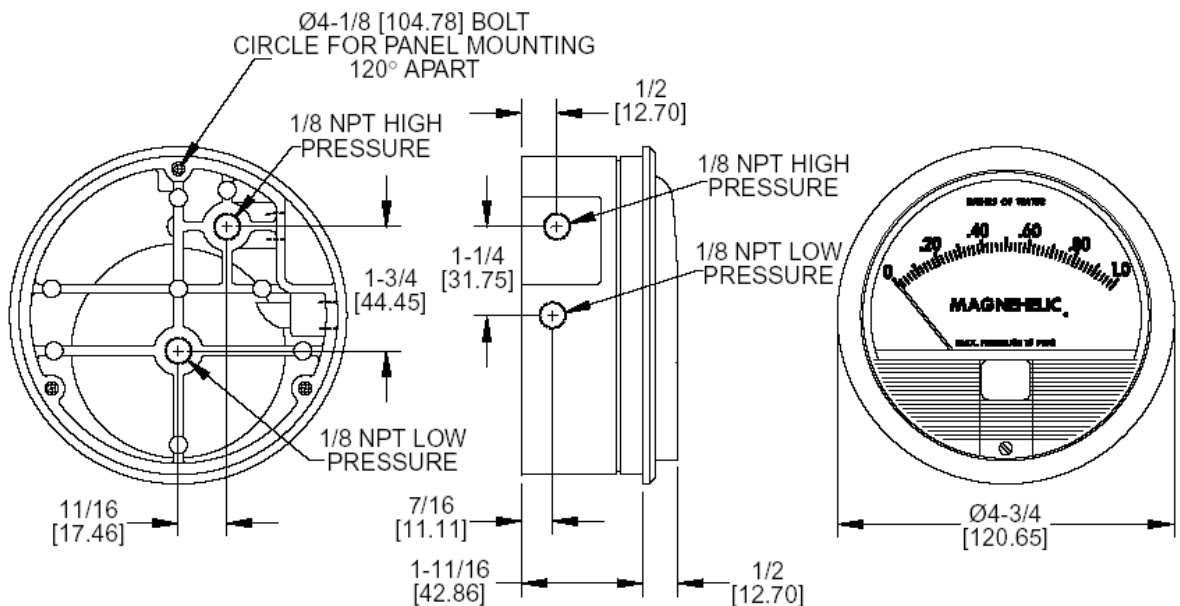
Standard gage accessories include two 1/8" NPT plugs for duplicate pressure taps, two 1/8" NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.



Caution: For use with air or compatible gases only.

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

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

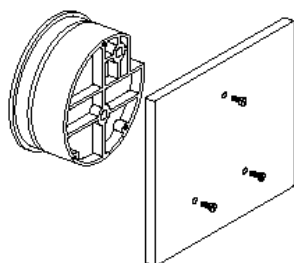


MAGNEHELIC® INSTALLATION

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

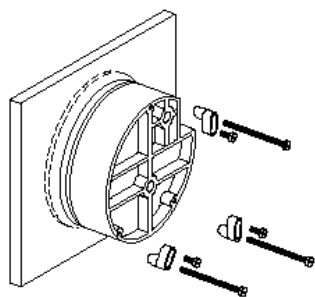
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions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

3. Surface Mounting



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

4. Flush Mounting



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

5. To zero the gage after installation

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

Operation

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

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

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

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

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

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

Ordering Instructions:

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

MAINTENANCE

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

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

Calibration:

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

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

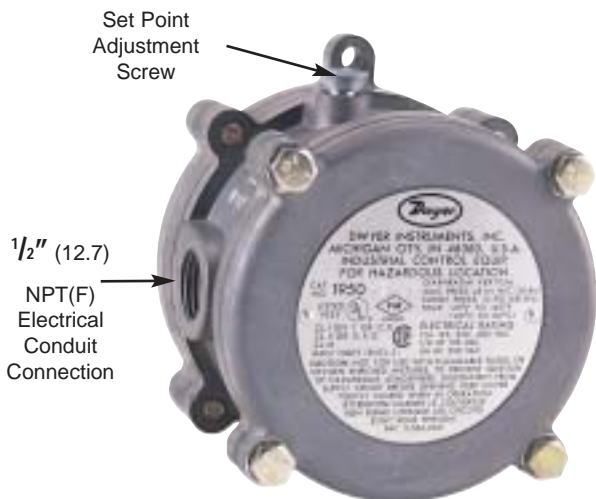
Diaphragm: Molded fluorosilicone rubber, 02 model: silicone on Nylon.

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.

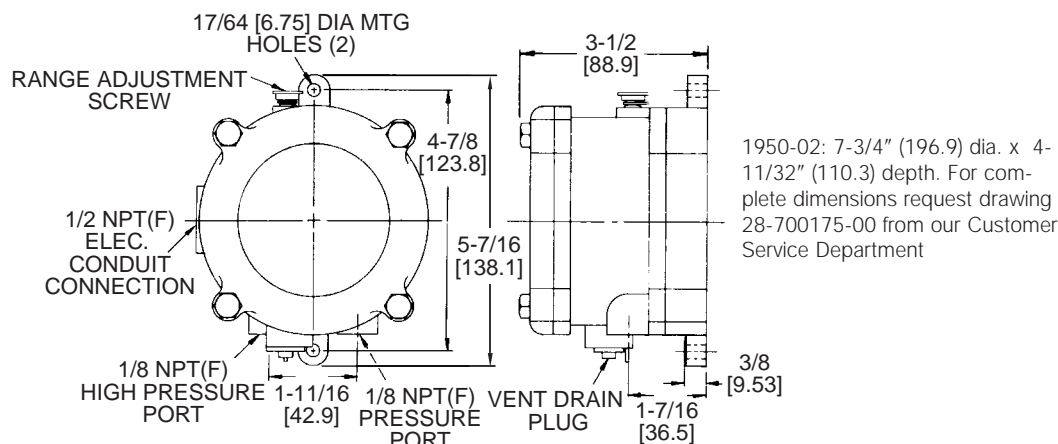
CAUTION

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.

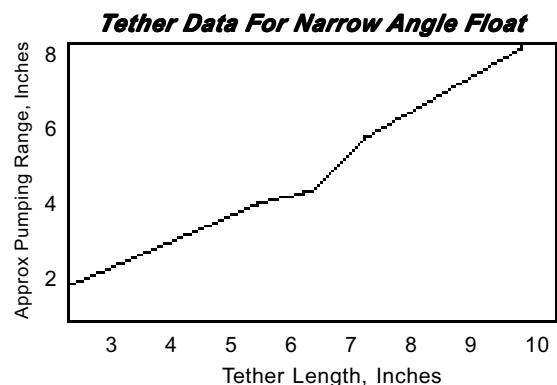
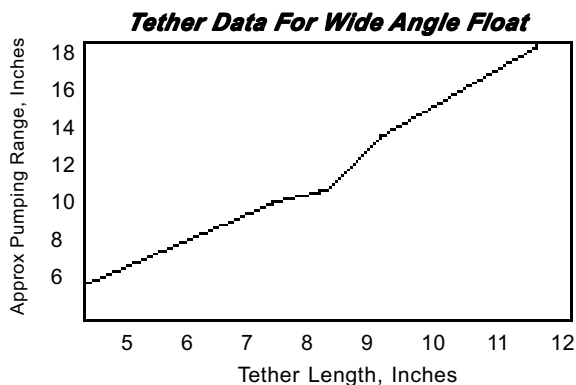
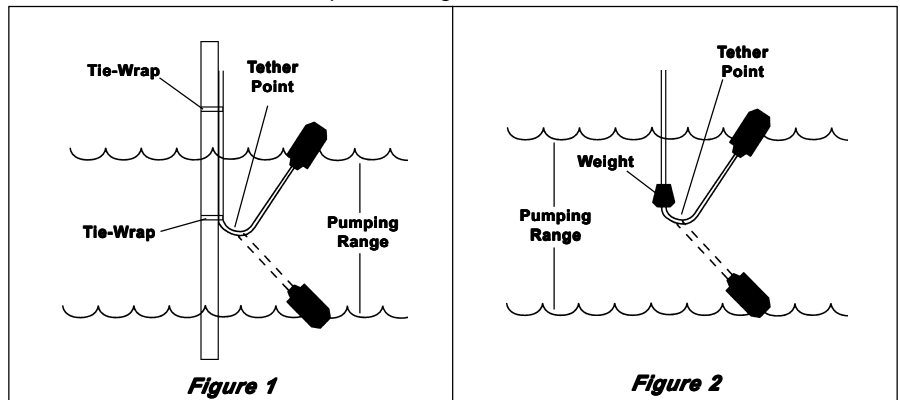
Tether-Weight (Fig 2)

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.

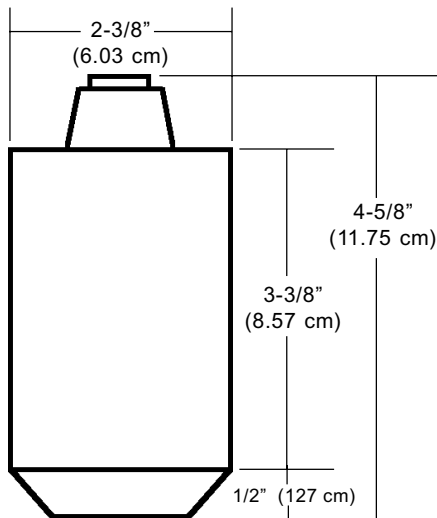
Determine tether point using charts below as a reference



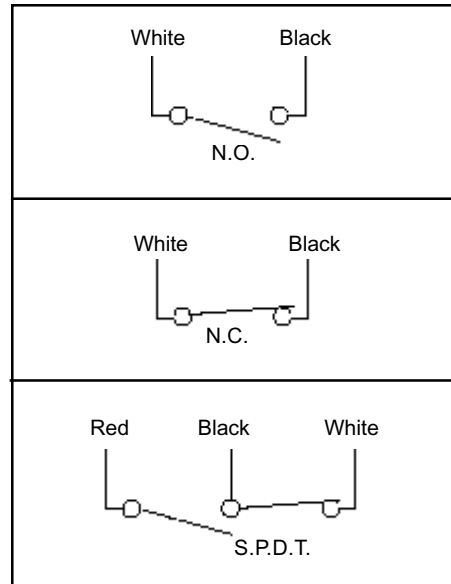
Notes:

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