

Quality People. Building Solutions.

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Date: 11/9/2023
Return Request: 11/19/2023
Project: UCA Snow – Fine Arts Center
Supplier: Fluid Solutions
Manufacturer: Grundfos
Submittal: Hydronic Specialties
Submittal Number: 23 21 14-01
Drawing # and Installation: Mechanical Drawings

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Notes:

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CSUSA PROJECT NO.

23-2020

chowell@comfortar.com

**Project Name: Snow Fine Arts HVAC
Upgrades**

Reviewer Name: Dakota Ellis

Date: 11/10/2023

Submittal #: 19

Company Name: Wagner General Contractors,
Inc.

Status: Reviewed

This review is only for general conformance of the project and general compliance. Contractor is responsible for all dimensions and fabrication to be confirmed and correlated at the job site.



SERVICE

TYPE: INSTRUCTIONS FOR REPLACING
EXPANSION TANK BLADDER

MODELS: GNLA 1000 TO GNLA 15000
Submittal Sheet No. N-7421 Date: 2-20

BLADDER REMOVAL

Tank Preparation

- Remove any air from the air charge valve
- Remove bottom drain to evacuate water that escaped to the tank air side
- Remove tank top cover
 - Attached to cover is diffuser, $\frac{3}{4}$ " brass barb fitting, and dip tube hose
 - Inspect all components for integrity for reuse
- Remove water inside bladder with sump or other means
- Remove bladder and inspect for potential failure mode
- Lay tank on its side if possible

INSPECT INTERIOR

Use Strong Trouble Light to Verify

- No sharp or rough edges
- No weld pinholes on openings or seams
- No dirt or foreign debris (remove if found)

BLADDER INSTALLATION

Preparation

- Check replacement bladder for defects
- Lay bladder with collar neck facing floor
- Roll bladder from both sides

Top Flange

- Insert bladder
- Push in until collar is against weld neck
- Fold both collar ends (bladder reinforced area) into flange
- Use rubber mallet if needed until collar is flush with flange
- Make sure dip tube hose is securely fastened to brass fitting
- Feed dip tube hose into bladder (open bladder if necessary)
- Bolt on and tighten down top flange
- Apply thread tape and sealant to 1" sq. hd. plug and reattach to tank drain

Pre-charge

- Pre-charge to required system pressure
- Test for leaks at bottom drain, top 1" NPT air-side connection and top cover using soapy water

PARTS LIST

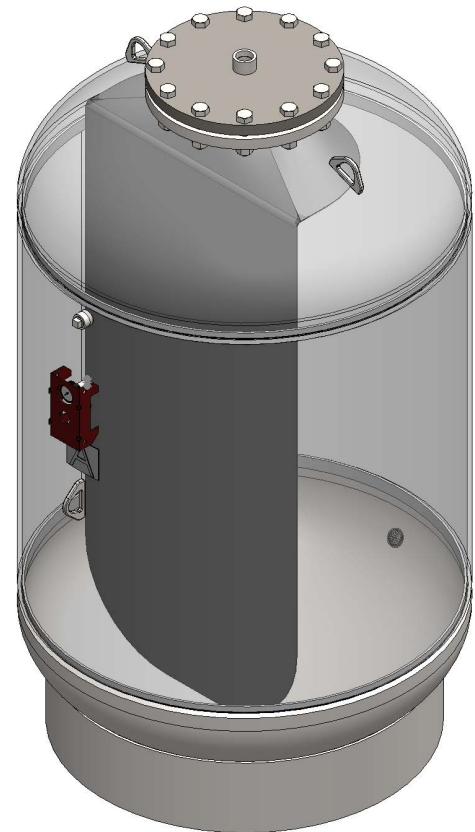
Bladder

$\frac{3}{4}$ " male brass fitting

$\frac{3}{4}$ " rubber hose (cut to proper length)

(8) bolts (SA-193-B7)

(8) UNC hex head nuts (SA-194-2H)

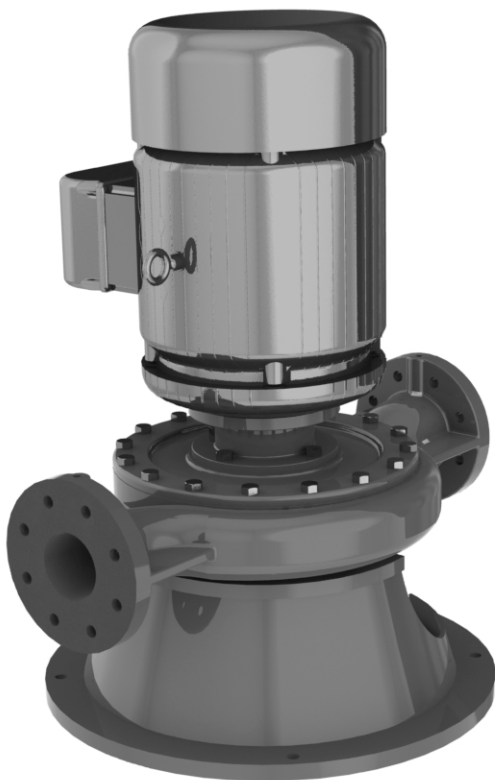


VL, VLS

Vertical inline centrifugal pumps

Installation and operating instructions

VL



VLS



Original installation and operating instructions.

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1. Symbols used in this document

The following symbols may be used in this document.

**Warning**

If these safety instructions are not observed, it may result in personal injury.

**Warning**

If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.

**Warning**

When pumping hazardous liquids, special attention must be paid to the risk of personal injury.

**Warning**

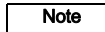
The surface of the product may be so hot that it may cause burns or personal injury.

**Warning**

The sound pressure level is so high that hearing protection must be used.

**Caution**

If these safety instructions are not observed, it may result in malfunction or damage to the equipment.

**Note**

Notes or instructions that make the job easier and ensure safe operation.

2. Terms and conditions of sale

2.1 The contract

The Contract shall be comprised of the following terms, together with such terms and conditions as are set forth in Seller's written proposal or quotation (the "Quotation"), including any documents, drawings or specifications incorporated therein by reference, and any additional or different terms proposed in Buyer's purchase order (the "Purchase Order") that are accepted by Seller in writing, which together shall constitute the entire agreement between the parties, provided, however, that preprinted terms on Buyer's purchase order or invoice shall not apply and Seller gives notice of objection to such terms. An offer by Seller in its Quotation that does not stipulate an acceptance date is not binding. This Contract shall be deemed to have been entered into upon written acknowledgment of the Purchase Order by an officer or authorized representative of Seller, which may not be modified, supplemented, or waived except in a writing executed by an authorized representative of the party to be bound.

2.2 Price

The price quoted in the Quotation shall be the Purchase Price unless otherwise agreed in the Purchase Order. The Purchase Price for equipment shall include packing for shipment. Field Services shall be provided at Seller's standard rates. All other costs, including packing for storage, freight, insurance, taxes, customs duties and import/export fees, or any other item not specified in the Contract, shall be paid by Buyer unless separately stated in the Quotation and included in the price quoted. Any sales, use, or other taxes and duties imposed on the transaction or the equipment supplied shall be paid or reimbursed by Buyer.

2.3 Payment terms

Payment shall be due within 30 days of the date of Seller's invoice in U.S. funds unless otherwise agreed. If Buyer does not observe the agreed dates of payment, Buyer shall pay interest to Seller on overdue amounts at a rate that is the higher of: 9 % per annum or a rate 5 % in excess of the rate borne from time to time by new issues of six-month United States Treasury bills. Seller shall be entitled to issue its invoice for the Purchase Price for equipment upon the earlier of shipment, or notice to Buyer that Seller is ready to ship, and for services, upon completion. If the Purchase Price exceeds \$250,000 USD, Buyer shall pay the Purchase Price in Progress payments as follows: Fifteen percent (15 %) upon submittal of general arrangement drawings, thirty five percent (35 %) after receipt of first Bowl Casting, twenty percent (20 %) after first case/bowl hydro test or bowl machining and thirty percent (30 %) after notification of ready to ship.

2.4 Acceptance and inspection

All equipment shall be finally inspected and accepted by Buyer within 14 days after delivery or such other period of time as is agreed in the Purchase Order. Buyer shall make all claims (including claims for shortages), excepting only those provided for under the warranty clause contained herein, in writing within such 14-day period or they are waived. Services shall be accepted upon completion. Buyer shall not revoke its acceptance. Buyer may reject the equipment only for defects that substantially impair its value, and Buyer's remedy for lesser defects shall be in accordance with section 10, Warranty. If tests are made by Buyer to demonstrate the ability of the equipment to operate under the contract conditions and to fulfill the warranties in section 10, Buyer is to make all preparations and incur all expenses incidental to such tests. Seller will have the right of representation at such tests at its expense, and the right to technically direct the operation of the equipment during such tests, including requiring a preliminary run for adjustments.

2.5 Title and risk of loss

Full risk of loss (including transportation delays and losses) shall pass to Buyer upon delivery, regardless of whether title has passed to Buyer, transport is arranged or supervised by Seller, or start-up is carried out under the direction or supervision of Seller. Delivery shall be ex works, INCOTERMS 2000. Loss or destruction of the equipment or injury or damage to the equipment that occurs while the risk of such loss or damage is borne by Buyer does not relieve Buyer of its obligation to pay Seller for the equipment.

2.6 Patent or trademark information

If the equipment sold hereunder is to be prepared or manufactured according to Buyer's specifications, Buyer shall indemnify Seller and hold it harmless from any claims or liability for patent or trademark infringement on account of the sale of such goods.

2.7 Changes

Buyer may request, in writing, changes in the design, drawings, specifications, shipping instructions, and shipment schedules of the equipment. As promptly as practicable after receipt of such request, Seller will advise Buyer what amendments to the Contract, if any, may be necessitated by such requested changes, including but not limited to amendment of the Purchase Price, specifications, shipment schedule, or date of delivery. Any changes agreed upon by the parties shall be evidenced by a Change Order signed by both parties.

2.8 Cancellation or termination

Buyer shall have the right to cancel the Contract upon 15 days' prior written notice to Seller, and Seller shall stop its performance upon the receipt of such notice except as otherwise agreed with Buyer. If Buyer cancels the Contract, it shall pay: (a) the agreed unit price for equipment or components completed and delivered, (b) additional material and labor costs incurred, and for engineering services supplied by Seller with respect to the canceled items, which shall be charged to Buyer at Seller's rates in effect at the time of cancellation, but which shall not exceed the contract price for such items, and (c) such other costs and expenses, including cancellation charges under subcontracts, as Seller may incur in connection with such cancellation or termination.

2.9 Delivery and delays

Seller shall use its best efforts to meet quoted delivery dates, which are estimated based on conditions known at the time of quotation. Seller shall not be liable for any nonperformance, loss, damage, or delay due to war, riots, fire, flood, strikes or other labor difficulty, governmental actions, acts of God, acts of the Buyer or its customer, delays in transportation, inability to obtain necessary labor or materials from usual sources, or other causes beyond the reasonable control of Seller. In the event of delay in performance due to any such cause, the date of delivery or time for completion will be extended to reflect the length of time lost by reason of such delay. Seller shall not be liable for any loss or damage to Buyer resulting from any delay in delivery.

2.10 Warranty

Seller warrants that the equipment or services supplied will be free from defects in material, and workmanship for a period of 12 months from the date of initial operation of the equipment, or 18 months from the date of shipment, whichever shall first occur. In the case of spare or replacement parts manufactured by Seller, the warranty period shall be for a period of six months from shipment. Repairs shall be warranted for 12 months or, if the repair is performed under this warranty, for the remainder of the original warranty period, whichever is less. Buyer shall report any claimed defect in writing to Seller immediately upon discovery and in any event, within the warranty period. Seller shall, at its sole option, repair the equipment or furnish replacement equipment or parts thereof, at the original delivery point. Seller shall not be liable for costs of removal, reinstallation, or gaining access. If Buyer or others repair, replace, or adjust equipment or parts without Seller's prior written approval, Seller is relieved of any further obligation to Buyer under this section with respect to such equipment or parts. The repair or replacement of the equipment or spare or replacement parts by Seller under this section shall constitute Seller's sole obligation and Buyer's sole and exclusive remedy for all claims of defects. SELLER MAKES NO OTHER WARRANTY OR REPRESENTATION OF ANY KIND WITH RESPECT TO THE EQUIPMENT OR SERVICES OTHER THAN AS SPECIFIED IN THIS SECTION 10. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED. For purposes of this Section, the equipment warranted shall not include equipment, parts, and work not manufactured or performed by Seller. With respect to such equipment, parts, or work, Seller's only obligation shall be to assign to Buyer any warranty provided to Seller by the manufacturer or supplier providing such equipment, parts or work. No equipment furnished by Seller shall be deemed to be defective by reason of normal wear and tear, failure to resist erosive or corrosive action of any fluid or gas, Buyer's failure to properly store, install, operate or maintain the equipment in accordance with good industry practices or specific recommendations of Seller, or Buyer's failure to provide complete and accurate information to Seller concerning the operational application of the equipment.

2.11 Technical documents

Technical documents furnished by Seller to Buyer, such as drawings, descriptions, designs and the like, shall be deemed provided to Buyer on a confidential basis, shall remain Seller's exclusive property, shall not be provided in any way to third parties, and shall only be used by Buyer for purposes of installation, operation and maintenance. Technical documents submitted in connection with a Quotation that does not result in a Purchase Order shall be returned to Seller upon request.

2.12 Limitation of liability

Seller shall in no event be liable for any consequential, incidental, indirect, special or punitive damages arising out of the Contract, or out of any breach of any of its obligations hereunder, or out of any defect in, or failure of, or malfunction of the equipment, including but not limited to, claims based upon loss of use, lost profits or revenue, interest, lost goodwill, work stoppage, impairment of other equipment, environmental damage, nuclear incident, loss by reason of shutdown or nonoperation, increased expenses of operation, cost of purchase of replacement power or claims of Buyer or customers of Buyer for service interruption whether or not such loss or damage is based on contract, tort (including negligence and strict liability) or otherwise. Seller's maximum liability under this Contract shall not exceed the Purchase Order amount of the equipment or portion thereof upon which such liability is based. All such liability shall terminate upon the expiration of the warranty period, if not sooner terminated.

2.13 This company is an equal opportunity employer

This agreement incorporates by reference applicable provisions and requirements of Executive Order 11246 and FAR Section 52.222- 26 (covering race, color, religion, sex and national origin); the Vietnam Era Veterans Readjustment Assistance Act of 1974 and FAR Section 52.222-35 (covering special disabled and Vietnam era veterans); and the Rehabilitation Act of 1973 and FAR Section 52.222- 36 (covering handicapped individuals). By acceptance of this agreement Buyer certifies that it does not and will not maintain any facilities in a segregated manner, or permit its employees to perform their services at any location under its control where segregated facilities are maintained, and further that appropriate physical facilities are maintained for both sexes. Buyer agrees that it will obtain a similar certificate prior to award of any nonexempt lower-tier subcontracts.

2.14 Law and arbitration

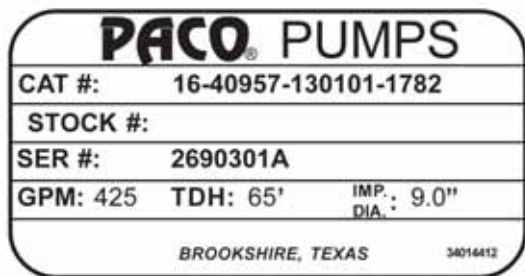
The Contract shall be governed by the law of the State of Texas. Any disputes arising out of this Contract shall be resolved by informal mediation in any manner that the parties may agree within 45 days of written request for mediation by one party to the other. Any dispute that cannot be resolved through mediation shall be resolved by binding arbitration conducted in English in Portland, Oregon under the Commercial Rules of the American Arbitration Association except as otherwise provided in this section. The arbitration shall be conducted by three arbitrators chosen in accordance with said Rules. The arbitrators are not entitled to award damages in excess of compensatory damages. Judgment upon the award may be entered in any court having jurisdiction.

3. Installation - mechanical

Read these instructions thoroughly before installing and operating your PACO Vertical In-line Centrifugal Pump. Successful operation depends on careful attention to the procedures described in the first four sections of this manual. Keep this instruction manual handy for future use.

3.1 Pump identification

All PACO pumps are identified by catalog and serial numbers. These numbers are stamped on the pump nameplate (fig. 1) affixed to each pump volute casing, and should be referred to in all correspondence with the Company.



TM05 4873 2612

Fig. 1 Sample nameplate

The first digits in the Catalog Number (preceding the first hyphen) are known as the Product Code. The Product Code may be 2 or 3 digits in length. This installation and Operation Manual applies to the following Product Codes. NOTE: Hyphens may not appear on the name plate.

Product code	Description
16	Paco type VL, in line Centrifugal pump
17	Paco type VLS, in line Centrifugal pump (split coupled)

3.2 Receiving

Check pumping unit for shortage and damage immediately upon arrival. Pump accessories when required are packaged in a separate container and shipped with the unit. If equipment is damaged in transit, promptly report this to the carrier's agent. Make complete notations on the freight bill to speed satisfactory adjustment by the carrier. Unload and handle the unit with a sling.



Warning

Do not lift pump assembly by motor eye bolts alone. Motor eye bolts are not designed to support weight of entire pump assembly.

3.3 Temporary storage

If pump is not to be installed and operated soon after arrival, store it in a clean, dry area of moderate ambient temperature. Rotate the shaft by hand monthly to coat bearings with lubricant to retard oxidation and corrosion. Follow motor manufacturer's storage recommendations where applicable.

3.4 Location

Locate the pump as close to the suction supply as possible. Use the shortest and most direct suction piping practical. Refer to section 3.10 *Suction (inlet) piping*. Locate the pump below system level wherever possible. This will facilitate priming, assure a steady liquid flow, and provide a positive suction head. Make sure sufficient NPSH (Net Positive Suction Head) is provided at the suction end by considering the pump's location in relation to the entire system. Available NPSH must always equal or exceed required NPSH specified on the pump performance curve. Always allow sufficient accessibility for maintenance and inspection. Provide a clear space with ample head room for use of a hoist strong enough to lift the pump/motor assembly. Make sure a suitable power source is available for the pump motor. Electrical characteristics should match those specified on the motor data plate, within the limits covered in sections 4. *Installation - electrical* and 5. *Operation*. Avoid pump exposure to sub-zero temperatures to prevent pump liquid from freezing. If freezing conditions exist during shutdown periods, see sections 5.7 *Short duration shutdown* and 5.8 *Extended period shutdown* for specific recommendations.

3.5 Mounting of pump

PACO In-line centrifugal pumps may be mounted on the equipment room floor, or suspended in the piping, depending on the size and configuration of the pump. The following instructions shall apply:

3.6 Floor mounted pumps (VL, VLS)

Pumps mounted on equipment room floors should be permanently installed on a firm, concrete foundation, mounting pad or spring isolation base of sufficient size to dampen any vibration and prevent any deflection. Suitable anchor bolts shall be used to secure the pump assembly to the pad or floor.

3.7 Suspended pumps (VL, VLS)

PACO In-line Centrifugal pumps, when properly supported, may be suspended in system piping. Pipe supports must be used on piping immediately adjacent to the pump. Pipe supports must be adequately sized to support the weight of pump and piping, full of liquid, and shall be designed to eliminate transmission of noise or vibration. PACO In line pumps are designed to be mounted in horizontal pipe runs with motor positioned vertically upward.

3.8 Suspended pumps (VL only)

Pumps with motor frame sizes of 256JM/JP or smaller may be mounted in vertical pipe runs (risers) or in horizontal pipe runs with motors mounted horizontally. Consult PACO Factory for suitability of mounting with larger motors. In no case shall motors be mounted vertically downward (upside down, with motor positioned below the pump).

3.9 Piping - general

Do not use pump as a support for piping! Use pipe hangers or other supports at proper intervals to provide complete piping support near the pump.

Caution

Both suction and discharge piping should be independently supported and properly aligned so that no strain is transmitted to the pump when flange bolts are tightened. Make sure piping is as straight as possible, avoiding unnecessary bends and fittings. Where necessary, use 45 ° or long-sweep 90 ° pipe fittings to decrease friction loss. Where flanged joints are used, make sure that inside diameters properly match and mounting holes are aligned. Do not spring or force piping when making any connections!

3.10 Suction (inlet) piping

The sizing and installation of suction piping is particularly important. It must be selected and installed in a manner that minimizes pressure loss and permits sufficient liquid flow into the pump during starting and operation. Many NPSH problems can be traced directly to improper design of suction piping systems. Observe the following precautions when installing suction piping: Suction piping should be as direct as possible, and ideally the length should be at least ten times the pipe diameter. Short suction piping can be the same diameter as the suction opening. Longer piping should be one or two sizes larger (depending on length), reducing to the diameter of the pump suction opening. Use an eccentric reducer, with the eccentric side down (fig. 2) when reducing the pipe diameter to the diameter of suction opening.

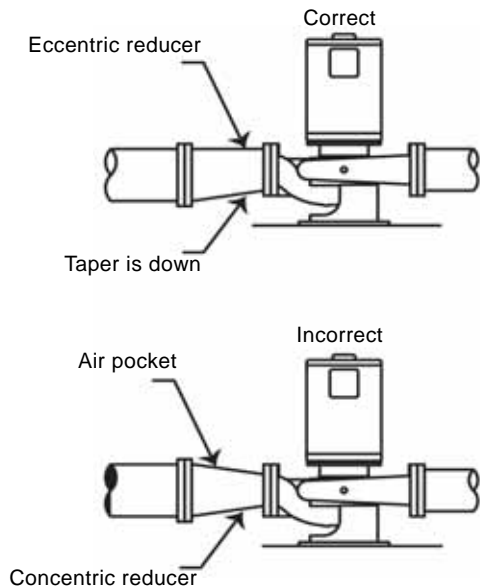


Fig. 2 Eccentric reducer usage

At no point should suction piping be smaller in diameter than the pump suction opening. Avoid any high points, such as pipe loops (fig. 3), that may create air pockets and throttle the system or produce erratic pumping.

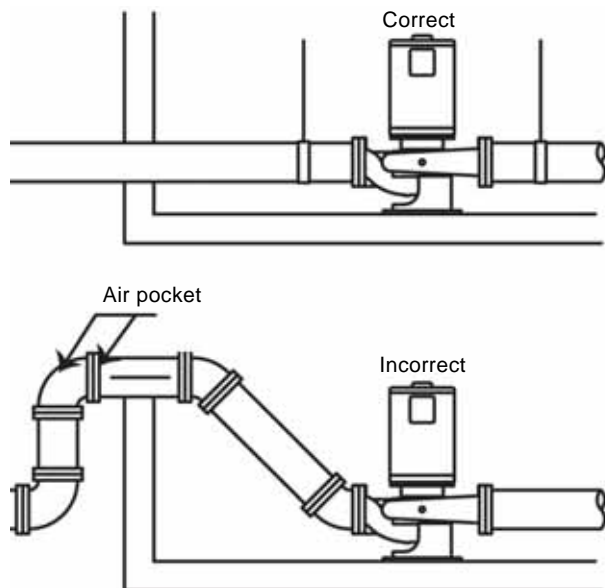


Fig. 3 Eccentric reducer usage

Install a valve in the suction line to isolate the pump during shutdown and maintenance, and facilitate pump removal. Where two or more pumps are connected to the same suction line, install a valve for each pump to isolate pump from the line. Valves should always be installed in positions that avoid air pockets. Globe valves should not be used, particularly when NPSH is critical. During pumping operation, valves on suction line must always be at FULL OPEN. Properly sized pressure gauges can be installed in gauge taps on pump suction and discharge nozzles. Gauges enable the operator to monitor pump performance and determine that the pump conforms to the parameters of the performance curve. If cavitation, vapor binding, or other unstable operation occurs, pressure gauges will indicate wide fluctuation in suction and discharge pressures. Gauge cocks are recommended for use with pressure gauges, to protect gauges from constant wear and vibration when not in use.

3.11 Discharge (outlet) piping

Short discharge piping can be the same diameter as the pump discharge opening. Longer piping should be one or two sizes larger depending on length. An even gradient is best for long horizontal runs of discharge piping. Install a valve near the discharge opening to prime and start the pump. The discharge gate valve is also used to isolate the pump during shutdown, maintenance, and facilitate pump removal. Any high points in discharge piping may entrap air or gas and thus retard pump operation.

3.12 Shaft sealing - general comments

PACO Type VL and VLS pumps are equipped with mechanical shaft seals.

3.13 Mechanical seals

PACO mechanical seals are matched to conditions for which the pump was sold. Unlike packing, mechanical seals require no field adjustments. Observe the following precautions to avoid seal damage and obtain maximum seal life: Do not exceed temperature or pressure limitations for the mechanical seal used.

Caution *Do not run the pump dry or against a closed valve! Dry operation will cause seal failure within minutes.*

Clean and purge suction piping in new installations before installing and operating pump. Pipe scale, welding slag and other abrasives can cause rapid seal failure.

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4. Installation - electrical



Warning

Use only qualified electricians for electrical installation and maintenance.

Refer to manuals provided with electrical accessory components and disconnect power supply as recommended for servicing.



Warning

Never do maintenance work when the unit is connected to power.

4.1 Motor, general

The motor control circuit must have the following components in order to comply with the National Electrical Code Motor Disconnecting Device: A motor disconnecting device must be:

- installed that it is capable of disconnecting both the controller (motor starter) and the motor from their source of power.
- The disconnecting device must be located so that the controller (motor starter) can be seen from the disconnecting means.
- In all cases, the distance from the disconnecting device to the controller must be less than 50'.

In most installations the disconnecting device will be a circuit breaker or fusible disconnect switch. Motor short circuit and ground fault protection: Short circuit and ground fault protection are usually provided by means of a circuit breaker or fusible disconnect switch. The selection of the size of the circuit breaker or fuse must be in accordance with Section 430-52 and Table 430-152 of the National Electrical Code. Motor controller with running over-current protection (magnetic starter) must be installed in accordance with applicable local and state electrical codes in addition to the National Electrical Code. Make sure the motor is properly mounted for easy access to conduit connections, grease fittings and drains. Motor may be rotated upon the bracket of volute casing to achieve a satisfactory position. Starting and overload control devices should match electrical characteristics of motor. For safety and convenience these devices may require installation some distance from the pump. Always follow control manufacturer's instructions for proper installation and connection. Grease lubricated motors are fully lubricated at time of manufacture and do not require further lubrication if prompt installation follows. If motor has been in local storage for six months or longer, refer to section [6.1 Motor lubrication](#) and lubricate before starting.

4.2 Installation wiring



Motor wiring to be performed by trained, qualified electricians only. Proper electrical lock-out procedures must be used whenever working on equipment.

Mount the control panel or motor starter(s) in close proximity to the pump to provide convenient control and ease of installation. Wire panel or starter(s) to motor(s) and pilot device(s): Wires to each motor must be sized for at least 125 % of the motor nameplate full load amps. AWG #16 Type THW stranded wire is recommended for wiring of pilot devices (float switches). Check incoming power source to ensure that it is the same as the voltage and phase of the motors. Verify that the starters are suitable to operate the pump motors on voltage and phase that is available.

5. Operation

5.1 Priming

The PACO in-line centrifugal pumps are not self priming, and must be completely primed (filled with liquid) before starting. If the pump will operate with a positive suction head, prime by opening the suction valve and allowing liquid to enter pump casing. Open all air vents at the high points of pump and piping to ensure air is forced from pump by liquid. Disconnect the recirculation line at the seal housing and bleed completely of all air. Re-connect the line prior to start-up. Rotate the shaft by hand to free entrapped air from impeller passageways. If pump has a suction lift, priming must be accomplished by other methods. The use of foot valves or ejectors, or manual filling of the pump casing and suction line with liquid are possible methods suggested for this purpose.

Caution

Never run the pump dry in the hope that it will prime itself! Serious damage to the mechanical seal will result.

5.2 Pre-start checklist

Make the following inspections before starting your PACO in-line centrifugal pump: Make sure all wiring connections to the motor (and starting device) match the wiring diagram and produce clockwise rotation as viewed from the end of the motor. If the motor has been in storage for an extended length of time, either before or after installation, refer to motor instructions before starting. Check voltage, phase, and line circuit frequency with the motor data plate. Turn rotating element by hand to make sure it rotates freely. Tighten plugs in gauge and drain taps. If pump is fitted with pressure gauges, keep gauge cocks closed when not in use. Check suction and discharge piping for leaks, and make sure all flange bolts are securely tightened.

5.3 Motor rotation

Caution

Verify driver rotation prior to startup and operation. Failure to do so can result in serious damage to pump and driver if rotation is wrong.

After the unit has been wired and checked to insure that all components in the system (disconnect device, magnetic starters, pilot devices and motors) are properly connected, check motor rotation as follows: For 3 phase units only-momentarily energize the motors to ensure that the rotation is correct as indicated by the arrow cast into the pump volute. If rotation is incorrect, interchange two wires at the motor starter terminals T1 and T2.

Caution

The pumps must not be operated while dry. Energize motors only momentarily to determine proper rotation.

5.4 Starting the pump

1. Install coupling guard on split coupled units.
2. Fully open gate valve (if any) in suction line, and close gate valve in discharge line.
3. Fill suction line with liquid and completely prime pump.
4. Start the motor (pump).
5. Immediately make a visual check of pump and suction piping for pressure leaks.
6. Immediately after pump reaches full operating speed, slowly open the discharge gate valve until complete system flow is achieved.
7. Check discharge piping for pressure leaks.
8. If pump is fitted with pressure gauges, open gauge cocks and record pressure reading for future reference. Verify that the pump is performing in accordance with parameters specified on performance curve.
9. Check and record voltage, amperage per phase, and kilowatts, if a wattmeter is available.

5.5 Voltage regulation

The motor will operate satisfactorily under the following conditions for voltage and frequency variation, but not necessarily in accordance with the standards established for operation under rated conditions: The voltage variation may not exceed 10 % above or below rating specified on the motor data plate. The frequency variation may not exceed 5 % above or below motor rating. The sum of the voltage and frequency variations may not exceed 10 % above or below motor rating, provided the frequency variation does not exceed 5 %.

5.6 Pump shutdown

The following shutdown procedures will apply in most normal shutdowns for the PACO in-line pump. If pump will be inoperative for an extended length of time, follow storage procedures in Section IC. Always close the discharge gate valve before stopping pump. Close valve slowly to prevent hydraulic shock. Cut power to motor.

5.7 Short duration shutdown

For overnight or temporary shutdown periods under nonfreezing conditions, the pump may remain filled with liquid. Make sure the pump is fully primed before restarting. For short or frequent shutdown periods under freezing conditions, keep fluid moving within pump casing and insulate or heat pump exterior to prevent freezing.

5.8 Extended period shutdown

For long shutdown periods, or to isolate the pump for maintenance, lock-out power to pump and close suction gate valve. If no suction valve is used and the pump has positive suction head, drain all liquid from suction line to terminate liquid flow into pump suction nozzle. Remove plugs in pump drain and vent taps, as required, and drain all liquid from the pump volute casing. If freezing conditions will exist during long shutdown periods, completely drain the pump and blow out all liquid passages and pockets with compressed air. Freezing of pump liquid can also be prevented by filling the pump with antifreeze solution.

6. Maintenance

Warning

Do not attempt any maintenance, inspection, repair or cleaning in the vicinity of rotating equipment. Before attempting any inspection or repair on the pump, the driver controls must be in the "OFF" position, locked and tagged to prevent injury to personnel performing service on the pump. Inspection, maintenance and repair should be performed by trained, qualified personnel only.



6.1 Motor lubrication

To lubricate the motor while running or at rest, remove grease drain plug (if any) and filler plug on grease fitting. Grease with clean lubricant until grease appears at drain hole or along motor shaft. One-half to one cubic inch of grease is sufficient for motors 5 hp and under, with proportionately more grease for greater hp motors.

Recommended lubrication periods				
Motor rpm	Motor hp	Operating conditions		
		Standard	Severe	Extreme
1750 and below	10-40	1-3 yrs	6 mo - 1 yr	6 mo - 1 yr
	50-150	1 yr	3 mo	6 mo
Above 1750	200 and Up	1 yr	3 mo	6 mo
		1 yr	3 mo	3 mo
		1 yr	3 mo	3 mo

6.1.1 Standard conditions

Eight hours per day operation, normal or light loading, clean air, 100 °F, maximum ambient temperature.

6.1.2 Severe conditions:

Continuous 24-hour operation, shock loading or vibration, poor ventilation, 100-150 °F, ambient temperature.

6.1.3 Extreme conditions

The following are considered Extreme conditions: Continuous operation, heavy shock or vibration, dirt or dust in air, extreme ambient temperature.

To lubricate motor while running or at rest, remove grease drain plug (if any) and filler plug on grease fitting. Grease with clean lubricant until grease appears at drain hole or along motor shaft.

One-half to one cubic inch of grease is sufficient for motors 5 hp and under, with proportionately more grease for greater hp motors. Most fractional and some integral frame motors have "sealed-for-life" bearings, and do not require further lubrication throughout motor life. Always follow motor manufacturer's lubrication instructions, and periodically check grease fittings and drain plugs for leaks. If lubricating instructions do not accompany motor, refer to the following table for recommended lubrication periods.

Recommended bearing Grease for pumps	
Manufacturer	Lubricant
Shell	Dolium
Exxon	Polyrex
Chevron	SRI Grease NLGI 22
	Black Pearl NLGI 2
Phillips	Polytrac
Texaco	Polystar RB

This table lists recommended types of grease for both pump and motor lubrication. These types have all been thoroughly tested and should be used whenever possible.

Caution

Do not lubricate with lithium based grease. Equipment damage will result.

7. Disassembly

7.1 Preparation for disassembly

Warning



Turn off power, lock-out electrical breaker and provide appropriate "Do Not Operate" or equivalent signage prior to any work on equipment. Verify all power is off at pump using appropriate electrical instrumentation. Work should be performed only by qualified and trained personnel.

Complete disassembly instructions are outlined below. Proceed only as far as required to perform the maintenance work needed. Close valves on suction and discharge side of pumps and drain pump, taking precautions as necessary based on fluid being pumped. Flush, if necessary. Allow adequate working area around pump for maintenance or disassembly.

7.2 Seal replacement (VL)

1. Complete preparations noted in section [7.1 Preparation for disassembly](#), above.
2. Unscrew tubing connector from pipe tee of Air Vent assembly (15A) if equipped.
3. Remove Casing Bolts (8B).
4. Back-pull rotating assembly away from Volute (1A). Make sure external wiring will not be torn from motor leads before pulling.
5. Remove Volute Gasket (11A) from outer face of back plate/ bracket, and discard. New sealing gaskets should always be used whenever pump is reassembled.
6. For replacement of Wear Ring (4A), refer to section [7.5 Wear ring replacement](#) at this time.
7. For replacement of Seal, Sleeve or for general disassembly, continue with the following instructions
8. Impeller removal procedures vary depending on motor type. Follow appropriate instructions as follows:

Impeller removal- fractional horsepower motors

Impeller (3A) is threaded on to fractional horsepower (56J) motor shaft. Loctite is applied to impeller threads during factory assembly. If adhesive shear strength is too great for disassembly with ordinary hand tools parts must be heated by torch and disassembled while hot. Apply torch heat to impeller eye when unscrewing threaded impellers, axially along shaft sleeve exterior to loosen for removal. Holding power of Loctite decreases as temperature rises, and compound completely decomposes at temperatures above 650 °F. Impeller must be unscrewed, while preventing motor shaft rotation by utilizing a large screwdriver securely in slot at back end of motor shaft while unscrewing impeller.

Caution

Do not insert screwdriver between impeller vanes to prevent rotation. Use strap wrench around the impeller or shaft to prevent rotation.

Impeller Removal- Integral Horsepower Motors:

Impeller (3A) is keyed onto integral horsepower (JM & JP) motor shaft. Slide impeller axially off of shaft. If impeller can not be removed by hand, additional leverage may be necessary. Using a gear puller or two pry bars, position the tongs in close proximity to impeller vanes and carefully apply smooth, even force to the impeller. Excessive force will distort and damage the impeller.

1. Remove and discard spring and retainer from seal assembly (14A).
2. Remove seal head assembly manually from Shaft Sleeve (5A). Water-soluble lubricant may be applied to shaft to ease removal of Shaft Seal (14A). Pull seal head assembly manually from shaft, using slight twisting motion (as necessary) to loosen bellows from shaft sleeve.
3. Remove and discard seal seat from Bracket (21A). Thoroughly clean the inside cavity of bracket or cap.
4. For replacement of Shaft Sleeve (5A), refer to section [7.4 Sleeve Replacement \(VL\)](#) at this time.
5. Interior surface of bellows on new seal head is coated with bonding agent that adheres to motor shaft. When old seal head is removed, bonding agent no longer exists and bellows may crack or split during removal. Installation of new mechanical seal is always recommended if it becomes necessary to remove existing seal from shaft.
6. Clean and lubricate shaft sleeve (shaft on 56J motors) with water-soluble lubricant and make sure no sharp edges exist which could cut bellows of new seal.
7. Press new seal seat firmly into bracket or cap. Avoid direct contact of seal face with metallic or abrasive objects and wipe clean after installation to ensure abrasive-free sealing surface.
8. Slide new seal head assembly onto shaft by applying even pressure to base of assembly. Make sure sealing faces fit snugly.
9. See Reassembly instructions, section [7.6 Reassembly of pumps](#).

7.3 Seal replacement (VLS)

1. Complete preparations noted.
2. Remove coupling guard (34F).
3. Remove coupling bolts (8E). Pry apart the coupling halves (23D), remove keys (12B) and set aside.

Note

Mark or measure the original position of the pump coupling on the motor side.

4. Unscrew tubing connector from pipe tee of air vent assembly. Pipe dope is applied to threads during factory assembly, and resulting bond may retard but will not prevent manual disassembly.
5. Remove seal cap bolts and slide seal cap (2N) up shaft to remove.
6. Remove seal head assembly manually from shaft (6A). Water-soluble lubricant may be applied to shaft to ease removal of shaft seal (14A). Pull seal head assembly manually from shaft, using slight twisting motion (as necessary) to loosen bellows from shaft.

7. Remove and discard seal spring and retainer.
8. remove and discard seal seat from seal cap (2N) and thoroughly clean the inside cavity of seal cap.
9. Interior surface of bellows on new seal head is coated with bonding agent that adheres to motor shaft. When old seal head is removed, bonding agent no longer exists and bellows may crack or split during removal. Installation of new mechanical seal is always recommended if it becomes necessary to remove existing seal from shaft.
10. Clean and lubricate shaft (6A) with water-soluble lubricant and make sure no sharp edges exist to cut or scratch bellows of new seal.
11. Press new seal seat firmly into seal cap. Avoid direct contact of seal face with metallic or abrasive objects and wipe clean after installation to ensure abrasive free sealing surface.
12. Slide new seal head assembly onto shaft by applying even pressure to base of assembly.
13. Install seal cap (2N) down shaft.
14. See reassembly instructions.

7.4 Sleeve Replacement (VL)

1. Remove impeller key (12A) from shaft (integral horsepower motors only)
2. Sleeves are bonded to shaft using Loctite. Loctite adhesive compound is a liquid resin that produces a tough bond when applied to threaded and close-fitting connections during assembly. It is used by PACO on shaft sleeves to secure sleeve to shaft.
3. Apply light torch heat axially along shaft sleeve exterior to break the Loctite bond and loosen sleeve for removal. Excessive heating is not necessary, and should be avoided to protect bearings. Remove sleeve.
4. Wipe or brush clean all adhesive surfaces before reapplying Loctite. Use LocQuic Primer or equivalent for preparation of surface. LocQuic Primer is a degreasing agent recommended for use in preparing mating surfaces for Loctite application. Do not use gasoline or other petroleum products for cleaning, because an oily surface will remain. Assemble shaft sleeves with twisting motion to ensure an even hold, and always make sure sleeve is firmly in place against shaft shoulder. Allow a few minutes for Loctite to bond prior to completing assembly.

7.5 Wear ring replacement

1. Complete preparations
2. Back-pull rotating assembly,
3. It may be necessary to remove volute (1A) from piping, to facilitate easy access to interior of volute. If necessary, remove flange bolts at piping.
4. To remove worn Case Wear Ring (4A), drill two holes slightly smaller than width of ring into exposed edge of ring. Once holes are drilled, a chisel may be used to completely sever ring at holes and break ring into two halves for easy removal.
5. Clean the ring cavity in the volute prior to installing wear ring to ensure a properly aligned fit.
6. To reassemble, press fit new wear ring squarely into volute casing cavity. Ring may be tapped into place to make sure it is completely impressed into cavity.

Caution

Do not use metal tooling against wear ring surfaces. Use only rubber, rawhide, wood or other soft material to prevent damage to ring.

7.6 Reassembly of pumps

1. Clean all parts prior to reassembly, ensuring all contacting surfaces and threads are free of debris. Reassemble pump by following the above instructions in reverse. Inspect and ensure the following:
 - All mechanical seal components and shaft sleeve must be in good condition or leakage may result.
 - Replacement of complete seal assembly is recommended.
 - Appropriate Loctite is used in re-assembly of shaft sleeves.
 - Appropriate Loctite is used in re-assembly of threaded impellers.
2. Re-install coupling guards on coupled pumps.



Warning

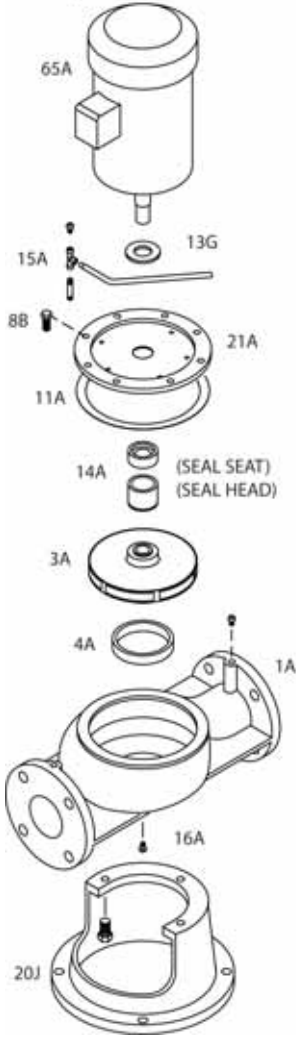
Type VLS pump is a split coupled pump. Coupling guard must be reinstalled and in place prior to operation.

8. Ordering parts

PACO's commitment to state-of-the-art pump design and quality manufacturing assures maximum user benefits with optimum equipment life at lower cost. PACO's commitment to their customers continues through an extensive service organization. Highly trained technicians can assist customers with initial startup, troubleshooting, repair, and system analysis. PACO maintains an extensive stock of replacement parts and parts kits for our most popular model pumps. Shipment of these parts is normally made within three days after receipt of an order. On larger pumps, where it is impractical for our factory to inventory low usage parts, replacement parts are normally manufactured and shipped within 15 working days of receipt of an order. In order to reduce pump repair time and shorten inconvenient pump service interruptions, it is suggested that the pump user stock spare parts. For suggested spare parts see Replacement Parts Guide A3b.2, and contact your local PACO Sales Representative (see back cover for the number of your nearest PACO sales office). Since spare parts requirements and quantities vary for specific pump constructions, allow your PACO Representative to help in defining your spare part requirements. To ensure that the proper replacement parts are ordered for your particular pump model, when you call: Identify all pertinent data from the pump name plate (see Pump Identification). This should always include the pump Catalog or Model Number, and the pump Serial Number. For replacement impellers, also include from the nameplate the operating conditions (GPM and TDH) and the impeller diameter. Identify all parts by item number and description as indicated by the appropriate assembly drawing in this manual, for your particular pump model.

9. Exploded views

9.1 Type VL, 56J fractional hp motor (less than 1 hp)

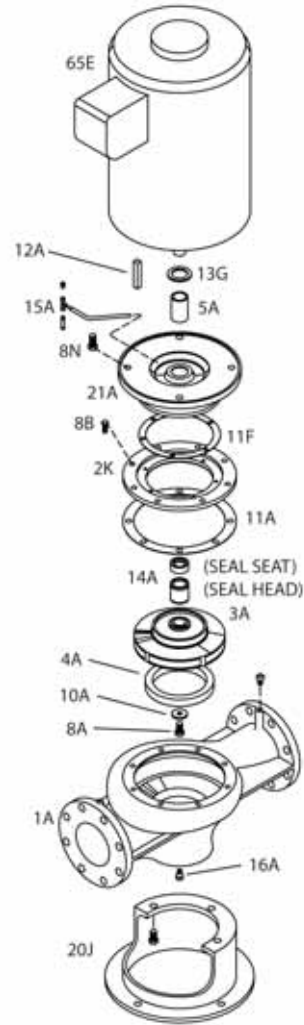


TM05 4877 2612

Pos.	Description
1A	Volute
3A*	Impeller
4A*	Case wear ring
8B	Volute capscrew
11A*	Volute gasket
13G	Slinger
14A*	Seal assembly
15A	Recirc tubing
16A	Pipe plug
20J	Cast iron stand
21A	Motor bracket
65A	Motor, 56J frame

* Recommended spare parts

9.2 Type VL-JM, integral hp motor (1 hp or greater)

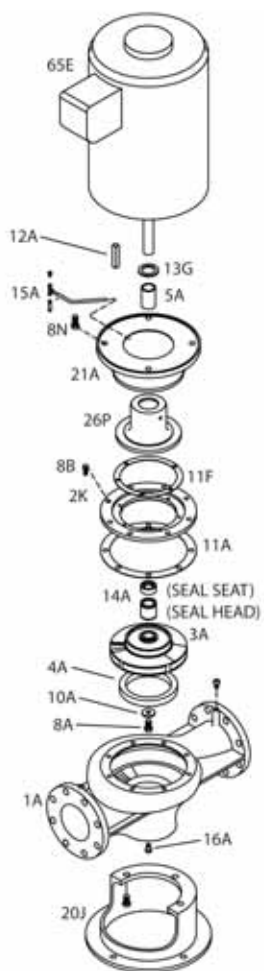


TM05 4878 2612

Pos.	Description
1A	Volute
2K	Back plate
3A*	Impeller
4A*	Case wear ring
5A*	Shaft sleeve
8A*	Impeller screw
8B	Volute screw
8N	Motor screw
10A*	Impeller washer
11A*	Volute gasket
11F*	Bracket gasket
12A*	Impeller key
13G	Slinger
14A*	Seal assembly
15A	Recirc tubing
16A	Pipe plug
20J	Cast iron stand
21A	Motor bracket
65E	Motor, JM frame

* Recommended spare parts

9.3 Type VL-JP, motor (packed pumps)

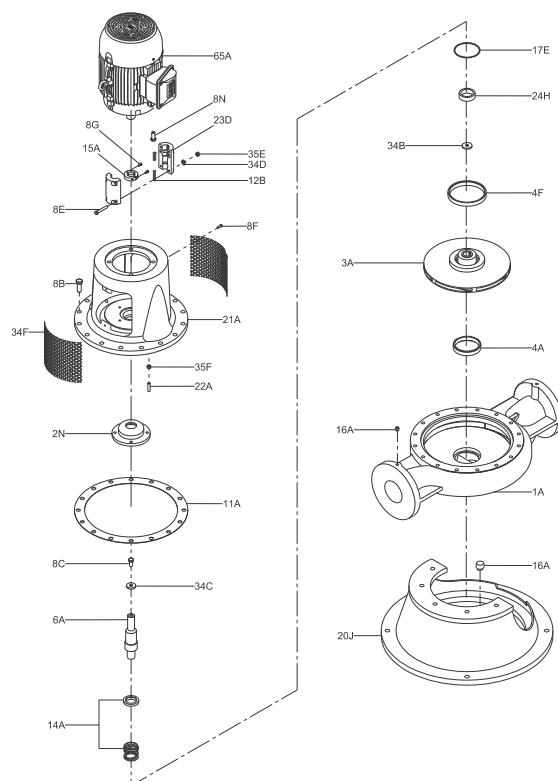


TM05 4879 0213

Pos.	Description
1A	Volute
2K	Back plate
3A*	Impeller
4A*	Case wear ring
5A*	Shaft sleeve
8A*	Impeller screw
8B	Volute screw
8N	Motor screw
10A*	Impeller washer
11A*	Volute gasket
11F*	Bracket gasket
12A*	Impeller key
13G	Slinger
14A*	Seal assembly
15A	Recirc tubing
16A	Pipe plug
20J	Cast iron stand
21A	Motor bracket
26P	Seal cap
65E	Motor, JM frame

* Recommended spare parts

9.4 Type VLS, cross section and parts list



TM05 1658 2614

Pos.	Description
1A	Volute
2N	Seal cap
3A*	Impeller
4A*	Case wear ring
4F	Balance ring
6A	Pump shaft
8B	Volute screw
8C	Pump shaft screw
8E	Coupling screw
8F	Coupling guard screw
8G	Locating ring screw
8N	Motor screw
11A*	Volute gasket
12B	Coupling key
14A*	Seal assembly
15A	Locating ring
16A	Pipe plug
17E	Seal cap o-ring
20J	Cast iron stand
21A	Motor bracket
22A	Seal cap studs
23D	Coupling halves
24H	Bushing
34B*	Impeller washer
34C	Pump shaft washer
34D	Coupling Washer
34F	Coupling guard
35E	Coupling Nut
35F	Seal cap nut
65A	Motor

* Recommended spare parts

10. Troubleshooting

10.1 Cause codes

Symptoms	Cause code
Pump does not deliver any liquid at start-up	1*2*3*4*5*6*7*8*9*10*11*14*16*17*22*23*24*34
Pump stops delivering liquid after start-up	2*3*4*5*6*7*8*9*10*11*12*13*22*23*24*34
Pump overheats and/or ceases to deliver liquid	1*3*9*10*11*21*22*27*29*30*31*33*34*40*41
Insufficient flow rate	2*3*4*5*6*7*8*9*10*11*14*16*17*20*21*22*23*24*25*26*34
Excessive flow rate	15*18*20*34
Discharge pressure is too high	4*14*16*18*20*22*23*24*25*26*34
Shaft seal leaks appreciably, or the packing leaks excessively	27*28*29*30*33*34*35*36*39
Shaft seal or packing fails prematurely	12*13*27*28*29*30*33*34*35*36*37*38*39
Pump uses too much power	15*16*18*19*20*23*25*27*28*31*33*34*35*37*38
Pump runs rough and noisily	2*3*4*5*6*7*8*9*10*11*15*17*18*21*23*24*27*28*29*30*31*32*33*34*40

10.2 Possible causes

- The pump has not been properly bled of air.
- The pump suction line has not been completely primed.
- The suction head (NPSHR) required by the pump is too high, or the net positive suction head available (NPSHA) at your facility is too low.
- The fluid pumped contains too much entrained air or gas.
- There are air pockets in the suction line.
- An entry of air has suddenly occurred in the suction line.
- An entry of air past the shaft seal into the pump has occurred.
- The inlet of the suction line is insufficiently submerged.
- The suction valve is closed or only partially open.
- The suction strainer is clogged with dirt or debris.
- The foot valve is clogged or undersized.
- Little or no cooling fluid supplied to the shaft seals.
- The lantern ring is not positioned opposite the flushing inlet thereby restricting fluid flow.
- Pump drive rotational speed too low.
- Pump drive rotational speed too high.
- Pump rotation wrong or impeller installed backwards.
- Total head of installation (back pressure) higher than rated total head of the pump.
- Total head of installation (back pressure) lower than rated total head of the pump.
- Density of fluid pumped differs from that specified when the pump was purchased.
- Viscosity of fluid pumped differs from that specified when the pump was purchased.
- The pump is operating at too low a rate of flow. The discharge valve may be throttled too much.
- If pumps are operating in parallel, the pump characteristics may not be suitable for parallel operation.
- The impeller may be clogged with debris.
- The impeller may be damaged.
- The casing and impeller wear rings may be excessively worn.
- There may be internal leakage from the discharge to the suction compartments as the result of internal gasket failure.
- There may be a misalignment of the pump shaft.
- The shaft may chatter because it is bent.
- The pump may run rough due to improper balancing of the impeller.
- The shaft may not be running due to worn bearings.
- The impeller may be rubbing against the inside of the case.
- The concrete pad might not be of sufficient size to provide pump stability.
- The pump may have become misaligned during installation.
- The operating conditions of the installation do not agree with the data specified when the pump was purchased.
- The shaft seal may be incorrectly installed, or the stuffing box has not been packed correctly.
- The shaft sleeve may be scored or pitted in the region of the packing due to dirt or abrasive matter in the flushing fluid.
- Excessive tightening of the packing gland may block the flushing port thereby diminishing the sealing fluid flow.
- Packing material may have become wedged or extruded between the shaft and the bottom of the stuffing housing due to excessive clearance on the packing backup washer.
- The mechanical seal may have been damaged by running dry.
- There may be excessive axial thrust (side loading) due to improper impeller central alignment.

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High Performance Air & Dirt Separators
Manual # 9636-1230 Rev. A

Operation & Maintenance Manual

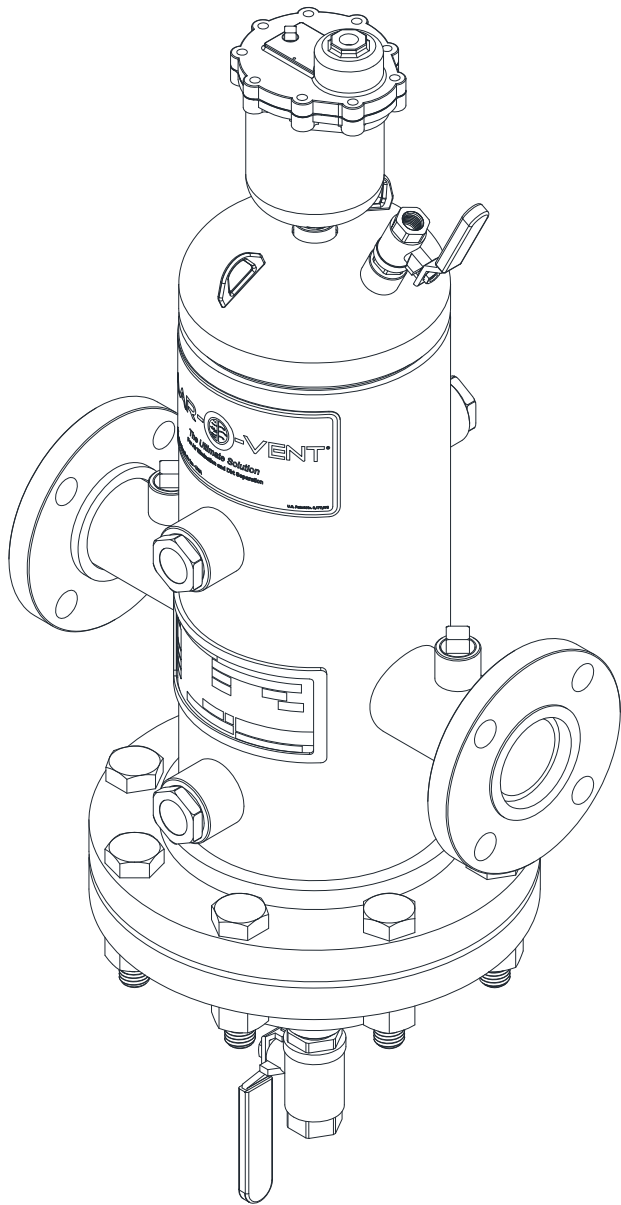


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Section 1 General Product Information

1.1 Overview

The *Aar-O-Vent*® is another product in the long line of innovations. It has been carefully assembled and factory tested to provide years of trouble-free service. This manual provides information to install, operate, service and maintain the *Aar-O-Vent*. Multiple *Aar-O-Vent* models are covered (Figure 1-1). There are three main types of *Aar-O-Vent*: Air Separator (Air Only), Dirt Separator (Dirt Only), and combination Air & Dirt Separator.

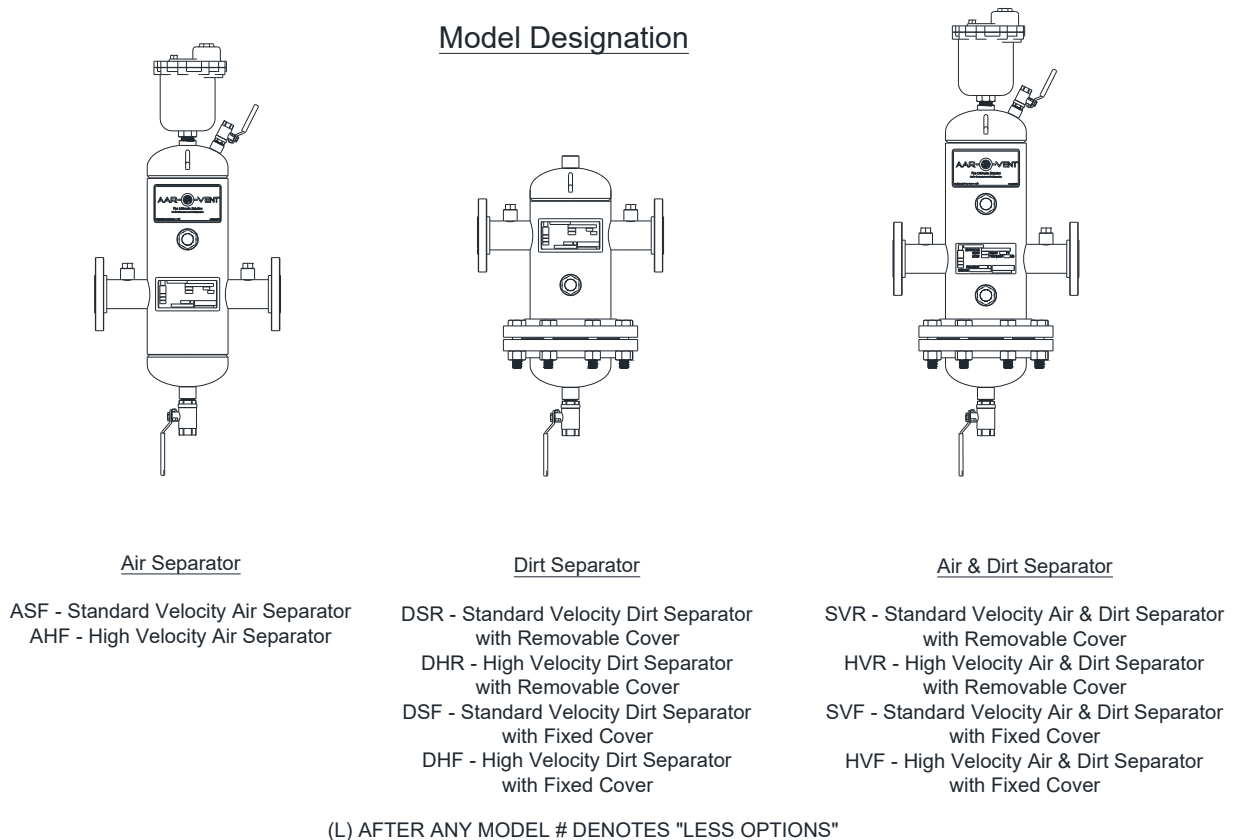


Figure 1-1 Overview

Section 2 Safety Information/Warnings

2.1 Safety Information and Warnings

Every practical safety feature has been incorporated into the design and manufacture of the *Aar-O-Vent*. If questions are not answered by this manual, or if specific installation, operation, and/or maintenance procedures are not clearly understood, contact your local representative before proceeding. Personnel must, at all times, observe all safety regulations while performing maintenance or repairs.

All installation, operation, and maintenance procedures should be performed by qualified, experienced and well trained personnel. The potential exists for severe personal injury if proper procedures are not followed.



Depending on the size of *Aar-O-Vent*, the bundle can be quite heavy. It is recommended that supports be used when removing the head and bundle. Once all bolts have been removed from the head, the head and bundle are free to drop. Risk of severe personal injury and/or property damage may occur if the bundle and head are not supported.



5" and larger *Aar-O-Vents* have lift lugs to aid in lifting and locating the unit. The lift lugs are not intended to be used to support the *Aar-O-Vent* during operation. Adequately sized and spaced supports/hangers should be used to prevent damage or strain on the system piping.



The *Aar-O-Vent* is not designed to be used as a make-up water inlet point. Using any of the connections for make-up water would impede proper operation and void the warranty.



System water over 100°F can be very hazardous. Keep flow away from the body when flushing the unit. Failure to do so could result in serious bodily injury or property damage.

Section 3 Component Identification and Information

3.1 Component Identification

The following paragraphs contain functional descriptions for each of the major components of *Aar-O-Vent*. This manual provides information for multiple *Aar-O-Vent* models. All the components listed have the same functional purpose in each model.

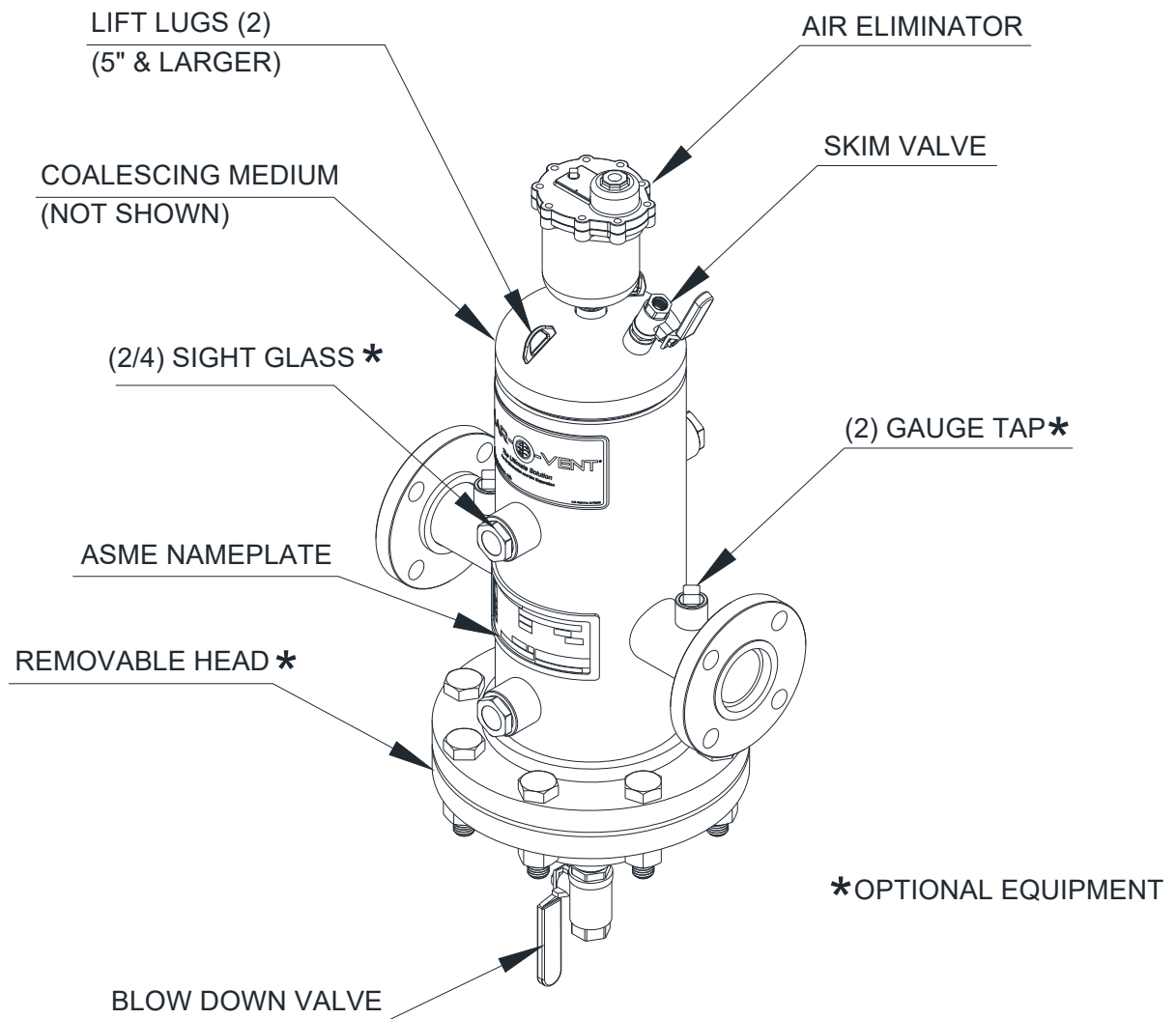


Figure 3-1 Components

3.1.1 Coalescing Medium

Each *Aar-O-Vent* model incorporates an all stainless steel coalescing medium often referred to as the bundle. This coalescing medium eliminates virtually any dirt particles, air bubbles and/or entrained air from the water by means of an air eliminator or blow down valve. This patented design resists corrosion and can be easily cleaned.

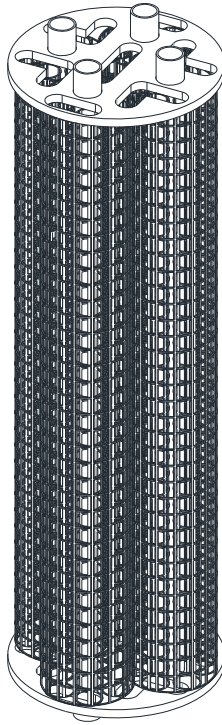


Figure 3-2 Coalescing Medium

3.1.2 Sight Glass (Optional)

One of the optional features offered with each *Aar-O-Vent* is sight glasses. Sight glasses allow the user to periodically check the coalescing medium for signs of dirt build-up.

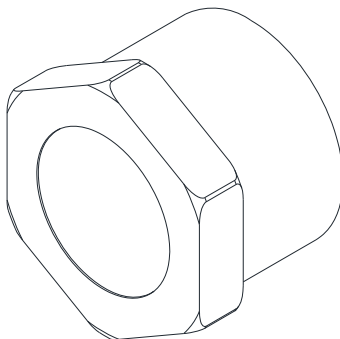


Figure 3-3 Sight Glass

3.1.3 Removable Head Option

The removable head option allows the user to easily remove the bundle for cleaning or inspection, available on all models.

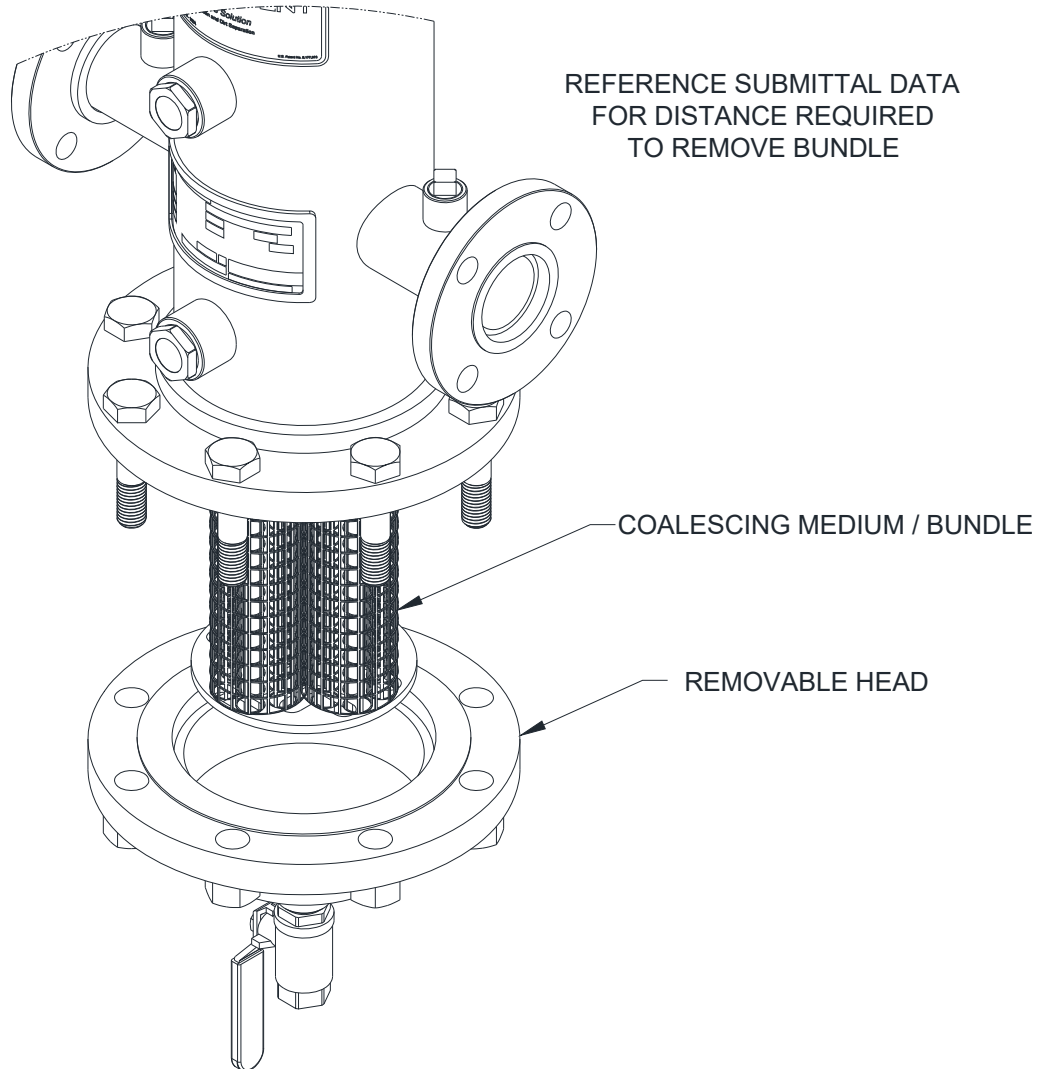


Figure 3-4 Removable Head Detail



Depending on the size of *Aar-O-Vent*, the bundle can be quite heavy. It is recommended that supports be used when removing the head and bundle. Once all bolts have been removed from the head, the head and bundle are free to drop. Risk of severe personal injury and/or property damage may occur if the bundle and head are not supported.

3.1.4 Model 720 Air Eliminator

The Model 720 Air Eliminator is a unique high capacity, air elimination device. It is designed to eliminate air as fast as it can be separated from liquid. The valve will not open if negative pressure occurs, preventing air from being drawn back into the system.

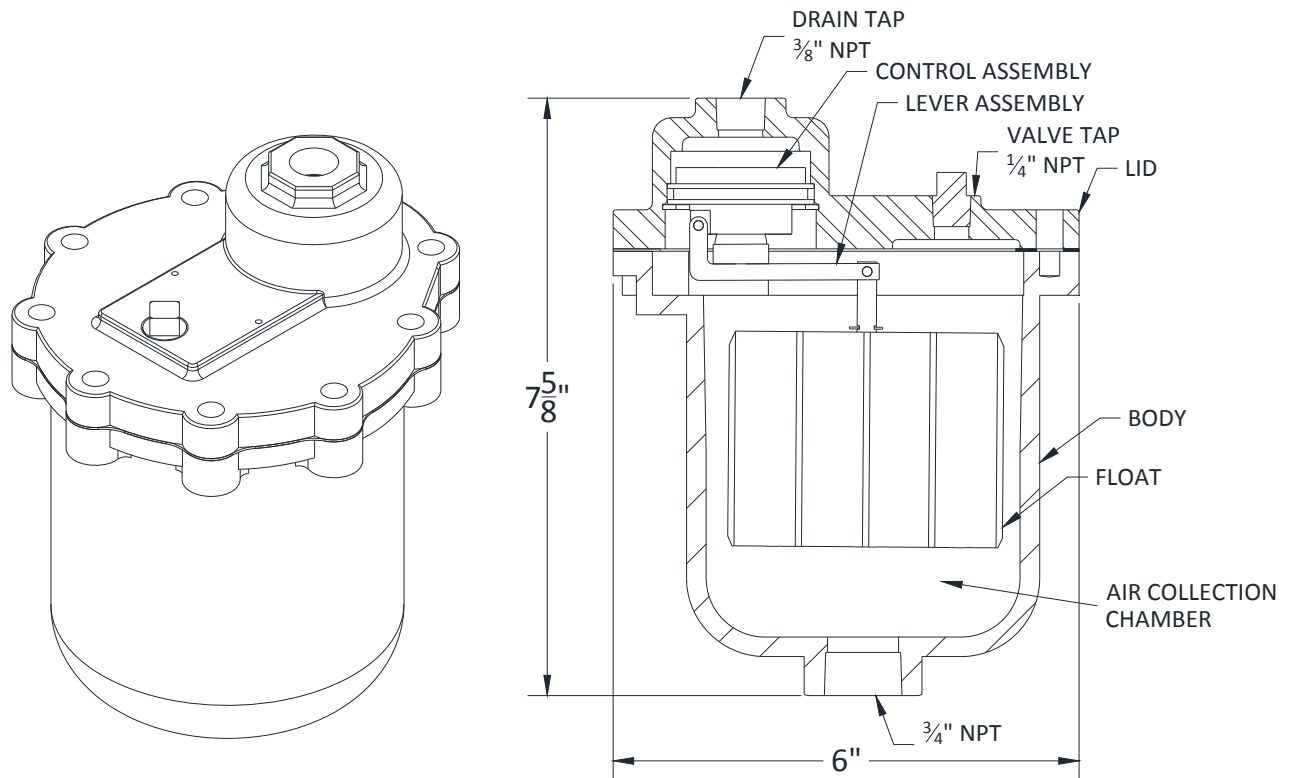


Figure 3-5 Air Vent

Air Eliminator Operation

The air eliminator is used on the *Aar-O-Vent* to remove unwanted air that could reduce system performance, increase operational cost, and support the damaging effects of corrosion.

The collection of air in the body of the air eliminator causes the float to drop allowing the air to be vented through an air eliminating orifice. As the liquid level rises in the air eliminator body, the float also rises shutting off the flow of vented air (Figure 3-5).

Section 4 Installation and Operation

4.1 Installation Tips

The following procedures are to aid the operator in installing the *Aar-O-Vent*. All procedures are to be performed by experienced, trained, and certified personnel only.



5" and larger *Aar-O-Vents* have lift lugs to aid in lifting and locating the unit. The lift lugs are not intended to be used to support the *Aar-O-Vent* during operation. Adequately sized and spaced supports/hangers should be used to prevent damage or strain on the system piping.

1. To protect the *Aar-O-Vent* during shipping, some of the components are shipped unattached in protective packaging. These components are to be installed on site. See Figure 3-1 for component locations.
2. The *Aar-O-Vent* should be located where it is easily accessible for inspection, service and repair.
3. A standard *Aar-O-Vent* should be installed in-line in the system piping, in a vertical position only. Adequately sized and spaced pipe supports/hangers should be used to prevent damage or strain on the system piping.
4. An *Aar-O-Vent* should be installed in a piping system at its lowest point of solubility. Typically the point of highest temperature and lowest pressure is the ideal location.
5. When placing the *Aar-O-Vent* with removable head in the system piping, be aware of the clearance required for bundle removal and cleaning. See Submittal Data for distance required to remove bundle.
6. When piping the unit into system piping, the pipe should be sized to allow adequate flow at a minimal head loss, and be, at minimum, the same size as the *Aar-O-Vent* connections. The use of elbows, tees or other restrictive fittings should be kept to a minimum.
7. Isolation valves are recommended to allow gasket changes and inspection of the bundle.
8. Expansion joints and or flex connectors are recommended to prevent pipe strain caused by thermal expansion or piping misalignment.
9. System by-pass piping is also recommended to better facilitate system service and maintenance.
10. The *Aar-O-Vent* will operate with flow entering the unit at either connection.

4.1 Installation Tips (Continued)

Using the figure below as reference only, note the steps outlined to install piping for the *Aar-O-Vent* (Figure 4-1).

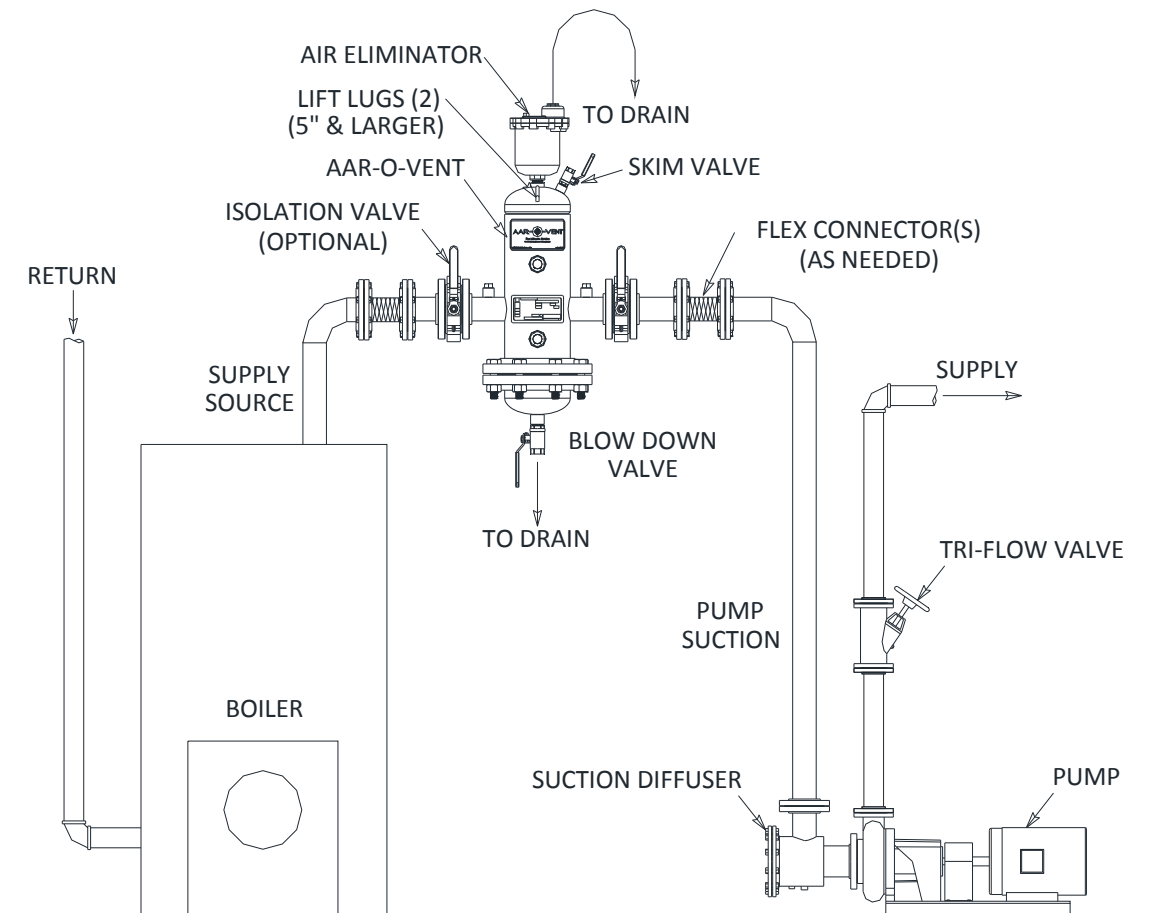


Figure 4-1 Typical Piping Diagram

1. Connect the supply source to one connection of the *Aar-O-Vent*.
2. Connect suction piping of the pump to the other connection of the *Aar-O-Vent*.
3. The air vent, the blow down valve and the skim valve should be run to an adequate drain.
4. Once all connections are made, allow the system to completely fill with water. Opening the skim valve will speed up this process.
5. After the unit is completely filled, the *Aar-O-Vent* is ready for operation.

4.2 Operation

Heating/cooling system efficiency and component life is greatly dependent on water quality. Air and dirt particles can cause pump cavitation, corrosion and increased component wear. In a closed loop system, the *Aar-O-Vent* eliminates air bubbles, entrained air and dirt particles quickly and easily.

Air Elimination:

The *Aar-O-Vent* in “Air Only”, “Dirt Only” and combination units “Air and Dirt”. The “Air Only” and “Air & Dirt” units are the only models that utilize the Model 720 air elimination device, air vent. They also have extra space in the top of the vessel for the collection of air. Outlined below is operational information on the air elimination feature of the *Aar-O-Vent*. Use Figure 4-2 for reference (“Air and Dirt” model shown).

- Large air bubbles in the system water enter the *Aar-O-Vent* and collide with the coalescing medium. They quickly rise to the top of the vessel and into the air elimination device.
- Micro bubbles coalesce and form larger bubbles. The larger bubbles then rise to the top of the vessel and into the air elimination device.
- Entrained air is pulled out of solution and forms micro bubbles. The micro bubbles coalesce forming larger bubbles. The larger bubbles rise to the top of the vessel and into the air elimination device.
- As air bubbles collect at the top of the vessel they create an air pocket. This pocket of air pushes the water level down inside the vessel. As the water level drops, the float inside of the air elimination device also drops releasing the air to atmosphere.
- The air elimination device releases air as fast as it can be separated. It will not allow air back into the system, even if a vacuum occurs.
- Once the air has been released, the water level will rise inside the vessel. This causes the float to rise and close the air elimination device.

This cycle will continue as new water is introduced into the system piping. With each pass of system water the *Aar-O-Vent* will eventually eliminate up to 99.7% of dissolved oxygen content in the system piping.



The *Aar-O-Vent* is not designed to be used as a make-up water inlet point. Using any of the connections for make-up water would impede proper operation and void the warranty.

4.2 Operation (Continued)

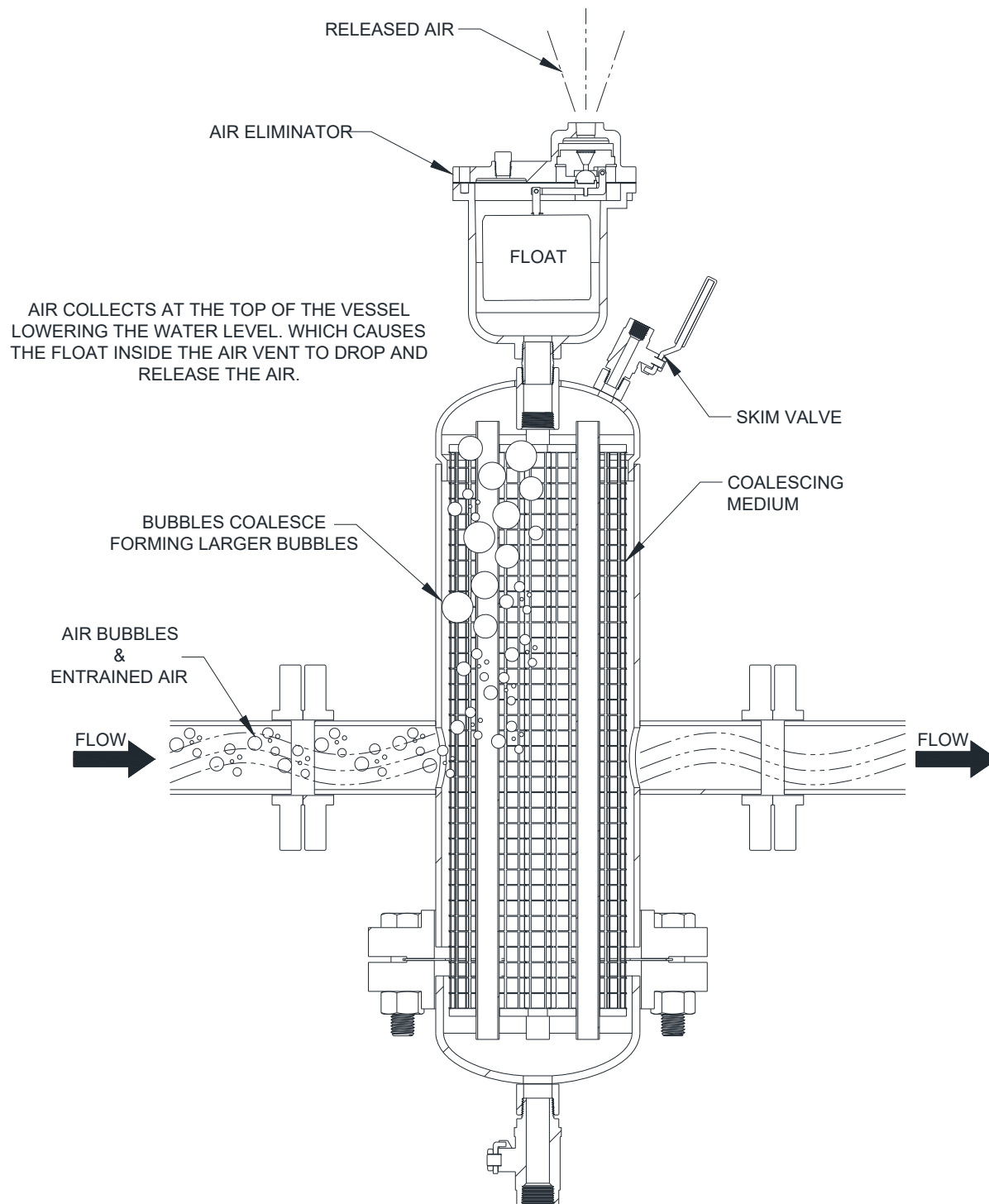


Figure 4-2 Operation (Air Elimination)

4.2 Operation (Continued)

Dirt Elimination:

The “Dirt Only” and “Air & Dirt” *Aar-O-Vent* models have extra space in the lower section of the vessel for collection of dirt particles. Outlined below is the operational information on the dirt elimination feature of the *Aar-O-Vent*. Use Figure 4-3 for reference (“Air and Dirt” model shown).

- Dirt particles in the system water enter the *Aar-O-Vent* and collide with the coalescing medium.
- The coalescing medium creates an area of less turbulence allowing the dirt particles to fall out of the flow path and to the bottom of the vessel.
- Dirt particles will continue to collect at the bottom of the vessel until they are flushed out through the blow down valve.
- Floating debris can be flushed out by opening the skim valve located on the top of the vessel.
- Should the need to clean the coalescing medium arise, the removable head provides ease of removal and cleaning.



Depending on the size of *Aar-O-Vent*, the head and bundle can be quite heavy. It is recommended that supports be used when removing the head/bundle. Once all bolts have been removed from the head, the head and bundle are free to drop. Risk of severe personal injury and/or property damage may occur if the bundle and head are not properly supported.

4.2 Operation (Continued)

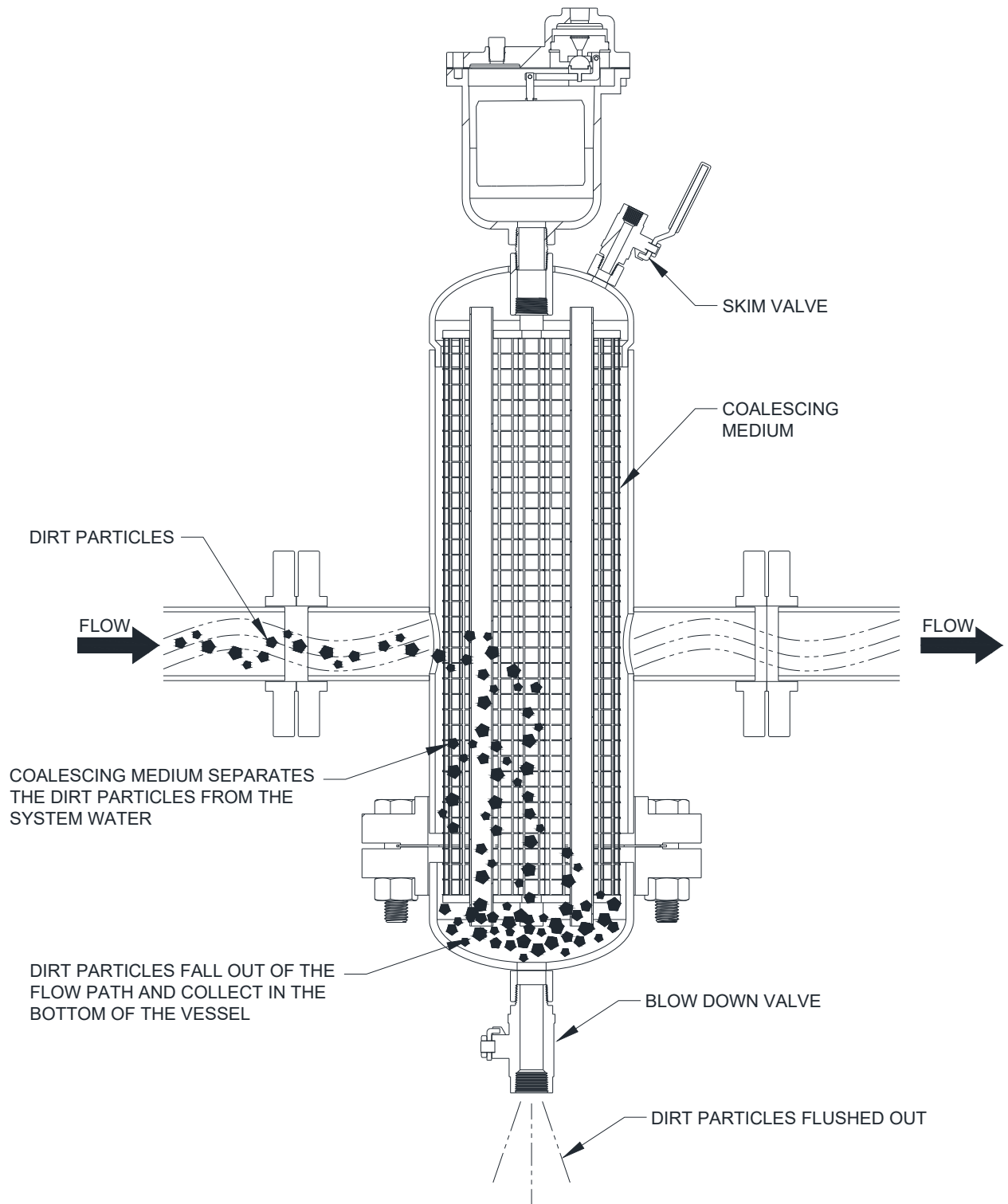


Figure 4-3 Operation (Dirt Elimination)

Section 5 Maintenance Information

5.1 Maintenance Information

The *Aar-O-Vent's* simple design allows for minimal maintenance. There are no moving parts other than the air elimination device itself.

- Routine flushing of the blow down valve and skim valve are recommended. Frequency of flushing is system specific based on water quality. A container or hose should be used to catch the sediment when flushing the valves, unless they are piped to an adequate drain.



System water over 100°F can be very hazardous. Keep flow away from the body when flushing the unit. Failure to do so could result in serious bodily injury or property damage.

- The coalescing medium (bundle) can be removed for cleaning as needed. A power washer or hose is sufficient. The stainless steel construction allows for ease of cleaning. A new gasket should be installed upon reassembly of the unit. Tighten all bolts in a criss-cross fashion, properly torqued. See chart below.



Depending on the size of *Aar-O-Vent*, the head and bundle can be quite heavy. It is recommended that supports be used when removing the head/bundle. Once all bolts have been removed from the head, the head and bundle are free to drop. Risk of severe personal injury and/or property damage may occur if the bundle and head are not properly supported.

- When replacing the gaskets and reassembling the unit, the bolts should be torqued incrementally to 30%, 60% and then 100% of the appropriate value shown in the chart below. They should also be torqued in a criss-cross pattern.

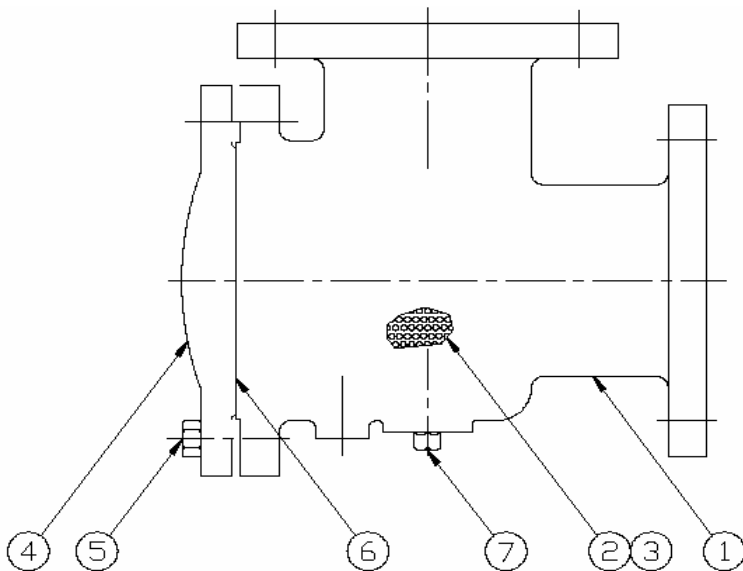
<u>Aar-O-Vent Connection size</u>	<u>Removable Head Size</u>	<u>Bolt Size</u>	<u>Number of Bolts</u>	<u>Torque Ft/Lb (150# Flgs.)</u>
2"	6"	3/4"	8	50
2.5"	6"	3/4"	8	50
3"	6"	3/4"	8	50
4"	8"	3/4"	8	50
5"	10"	7/8"	12	80
6"	12"	7/8"	12	80
8"	16"	1"	16	123
10"	20"	1 1/8"	20	195
12"	24"	1 1/4"	20	273

Installation:

1. Install Suction Diffuser in piping with proper flow direction as indicated on diffuser.
2. Provide appropriate clearance in back of diffuser for removal of strainer. (Refer to dimension "C" on other side.)
3. Install a support leg and foot using standard pipe (see dimension "G" on other side) on underside of strainer.
4. Flush system piping and operate pumps for initial circulation of system.
5. After initial system circulation is complete, remove and discard the temporary fine mesh strainer. Do not discard the permanent strainer.

Operation & Maintenance:

1. Periodically (dependent on system conditions) open the suction diffuser and clean debris from strainer basket. Inspect strainer for holes. Replace if damaged.
2. Inspect stabilizing vanes for wear, scale or contaminants. Clean with wire brush as necessary.
3. Inspect magnet (if so equipped) for metal particulates. Clean or replace as necessary.



Key No.	Description	Material
1	Body	Cast Iron
2	Strainer	304SS
3	Mesh Grid	304SS
4	Cover	Cast Iron
5	Cap Screw	Steel
6	O Ring	NBR
7	Plug	Malleable Iron

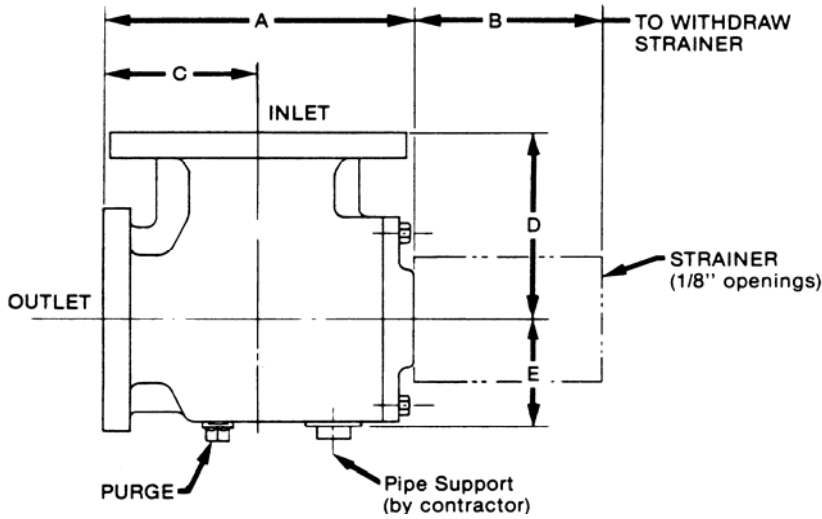
PRODUCT DESCRIPTION

For use on suction of centrifugal pump to save space, simplify piping and provide a uniform flow condition at the pump suction.

- Flanges are 125# ASA (flat face).

- Maximum working temperature is 300° F.

- Maximum working pressure is 175 PSI.



Model Number	125# ANSI		Strainer Open Area Sq. In.	Wgt. (lbs)	Dimensions							
	Inlet (pipe)	Outlet (pump)			A	B	C*	D	E	J	Purge	G
PSD2015-125	2	1 1/2	35	20	10.25	4.50	4.50	4.50	2.25	6.00	3/4"	1 1/4"
PSD2020-125	2	2	38	25	10.25	4.50	4.50	4.50	2.25	6.00	3/4"	1 1/4"
PSD2520-125	2 1/2	2	38	30	10.75	5.00	5.00	5.00	2.50	6.50	3/4"	1 1/4"
PSD2525-125	2 1/2	2 1/2	40	35	10.75	5.00	5.00	5.00	2.50	6.50	3/4"	1 1/4"
PSD3020-125	3	2	38	35	10.25	5.50	4.50	5.50	2.25	6.00	3/4"	1 1/4"
PSD3025-125	3	2 1/2	40	45	11.25	5.50	5.25	5.50	3.00	7.00	3/4"	1 1/4"
PSD3030-125	3	3	50	50	11.25	5.50	5.25	5.50	3.00	7.00	3/4"	1 1/4"
PSD4030-125	4	3	50	60	13.00	6.50	6.50	6.50	3.75	8.75	1"	1 1/4"
PSD4040-125	4	4	78	75	12.75	6.50	6.25	6.50	3.75	8.25	1"	1 1/4"
PSD5040-125	5	4	78	90	15.75	7.50	8.50	7.50	4.50	10.00	1"	1 1/4"
PSD5050-125	5	5	102	110	16.25	7.50	6.50	7.50	5.50	10.00	1"	1 1/4"
PSD6040-125	6	4	78	105	13.00	8.00	8.50	8.00	3.75	8.75	1"	1 1/4"
PSD6050-125	6	5	102	125	17.00	8.00	9.50	8.00	5.50	10.75	1"	1 1/4"
PSD6060-125	6	6	154	150	17.00	8.00	9.50	8.00	5.50	10.75	1"	1 1/4"
PSD8060-125	8	6	154	195	17.00	8.00	9.50	9.00	5.50	10.75	1"	1 1/4"
PSD8080-125	8	8	280	255	20.75	9.00	13.50	9.00	7.00	11.50	1 1/4"	2"
PSD1080-125	10	8	280	310	20.75	9.00	13.50	11.00	7.00	11.50	1 1/4"	2"
PSD1010-125	10	10	430	400	26.25	11.00	17.75	11.00	9.75	14.25	1 1/4"	2"
PSD1280-125	12	8	280	400	25.25	11.00	17.00	11.00	8.25	15.00	1 1/4"	2"
PSD1210-125	12	10	430	475	26.25	11.00	17.75	12.00	9.75	14.25	1 1/4"	2"
PSD1212-125	12	12	560	575	26.25	12.00	17.75	12.00	9.75	15.25	1 1/4"	2"

*Dimension "C" is space needed to withdraw the strainer from the housing.

REVIEW OF MECHANICAL SUBMITTALS

Project: UCA – Snow Fine Arts Center Renovation
Location: Univ. of Central Arkansas, Conway, AR
Date of Receipt: Monday, November 13, 2023
Date of Review: Tuesday, December 5, 2023
Reviewed by: Stephen Jewell
Email: sjewell@pettitinc.com

P&P Job No. 22-002

Signed: 

Checking is for conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

Item	Approval Status		Comments
Section 23 21 23 – Hydronic Pumps	Approved as Noted	○	<ul style="list-style-type: none"> - Pumps P-1A / P-1B have been selected for 68 deg. F operation but are the heating water system pumps. Verify pump P-1A / P-1B are still meeting pumping requirements at 180 deg. F. without exceeding the 10 HP motor capability prior to ordering. Verify pump seal is appropriate for 180 deg. F operation, provide correct seal as required. - Cover sheet states bronze impellers, pump data sheets indicates stainless steel impellers. - Verify motor voltage is appropriate for 208V / 3 phase operation, pump data sheets indicate 230V / 3 phase operation. - Provide air separators matching the sizes scheduled. - Water pressure reducing valve to be 1” size. - ASME pressure relief valve should be 1” to match rated boiler BTU ratings. Set for minimum 75 PSI to match submitted chart data.



Note:



SUBMITTAL DATA

Date: November 6, 2023
Project: UCA Snow Fine Arts
Contractor: Comfort Systems USA
Engineer: Pettit & Pettit Engineers

PUMPS & ACCESSORIES

P-1A, P-1B, P-2A, P-2B

Grundfos vertical in line split coupled pumps complete with bronze impellers, wear rings, coupling, coupling guard, mechanical seals, and premium efficient motors.

- 4 – Suction Diffusers
- 8 – Flexible Pump Connectors
- 2 – Expansion Tanks
- 2 – Air/Dirt Separators
- 2 – Pressure Reducing Valves
- 2 – Pressure Relief Valves

6815 Dewaffelbaker Dr., Maumelle, AR 72113

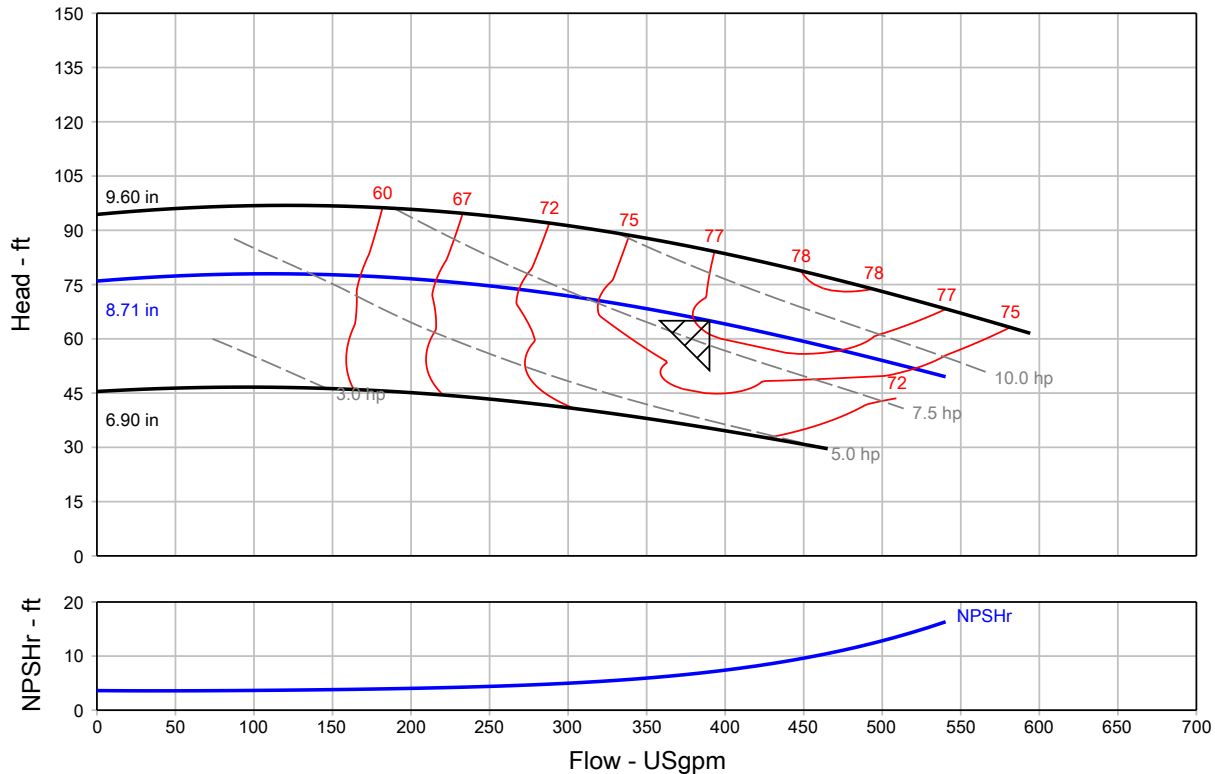
Phone (501) 663-8886 • Fax (501) 663-8738

www.fluidsolutionsinc.com

Pump Performance Datasheet

Customer :	Quote Number / ID :	110623
Customer ref. / PO :	Model :	40959 VLS
Tag Number : P-1A, 1B	Stages :	1
Service :	Based on curve number :	VLS_40959_4P Rev Aug21
Quantity : 2	Basic model number :	-
	Date last saved :	11/06/2023 1:52 PM

Operating Conditions		Liquid	
Flow, rated	: 390.0 USgpm	Liquid type	: Hot Water
Differential head / pressure, rated (requested)	: 65.00 ft	Additional liquid description	:
Differential head / pressure, rated (actual)	: 65.15 ft	Solids diameter, max	: 0.00 in
Suction pressure, rated / max	: 0.00 / 0.00 psi.g	Solids concentration, by volume	: 0.00 %
NPSH available, rated	: Ample	Temperature, max	: 68.00 deg F
Site Supply Frequency	: 60 Hz	Fluid density, rated / max	: 1.000 / 1.000 SG
		Viscosity, rated	: 1.00 cP
		Vapor pressure, rated	: 0.34 psi.a
Performance		Material	
Speed, rated	: 1760 rpm	Material selected	: Cast iron - 125#
Impeller diameter, rated	: 8.71 in		
Impeller diameter, maximum	: 9.60 in	Pressure Data	
Impeller diameter, minimum	: 6.90 in	Maximum working pressure	: 33.75 psi.g
Efficiency	: 77.20 %	Maximum allowable working pressure	: 175.0 psi.g
NPSH required / margin required	: 7.05 / 0.00 ft	Maximum allowable suction pressure	: 175.0 psi.g
nq (imp. eye flow) / S (imp. eye flow)	: 29 / 124 Metric units	Hydrostatic test pressure	: 263.0 psi.g
MCSF	: 132.3 USgpm		
Head, maximum, rated diameter	: 77.98 ft	Driver & Power Data (@Max density)	
Head rise to shutoff	: 16.87 %	Motor sizing specification	: Max power (non-overloading)
Flow, best eff. point	: 428.8 USgpm	Margin over specification	: 0.00 %
Flow ratio, rated / BEP	: 90.94 %	Service factor	: 1.00
Diameter ratio (rated / max)	: 90.73 %	Power, hydraulic	: 6.40 hp
Head ratio (rated dia / max dia)	: 76.97 %	Rated power (based on duty point)	: 8.29 hp
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00	Max power (non-overloading)	: 9.18 hp
Selection status	: Acceptable	Nameplate motor rating	: 10.00 hp / 7.46 kW
Energy Indexes			
PEI (CL)	: 0.96		
ER (CL)	: 4		

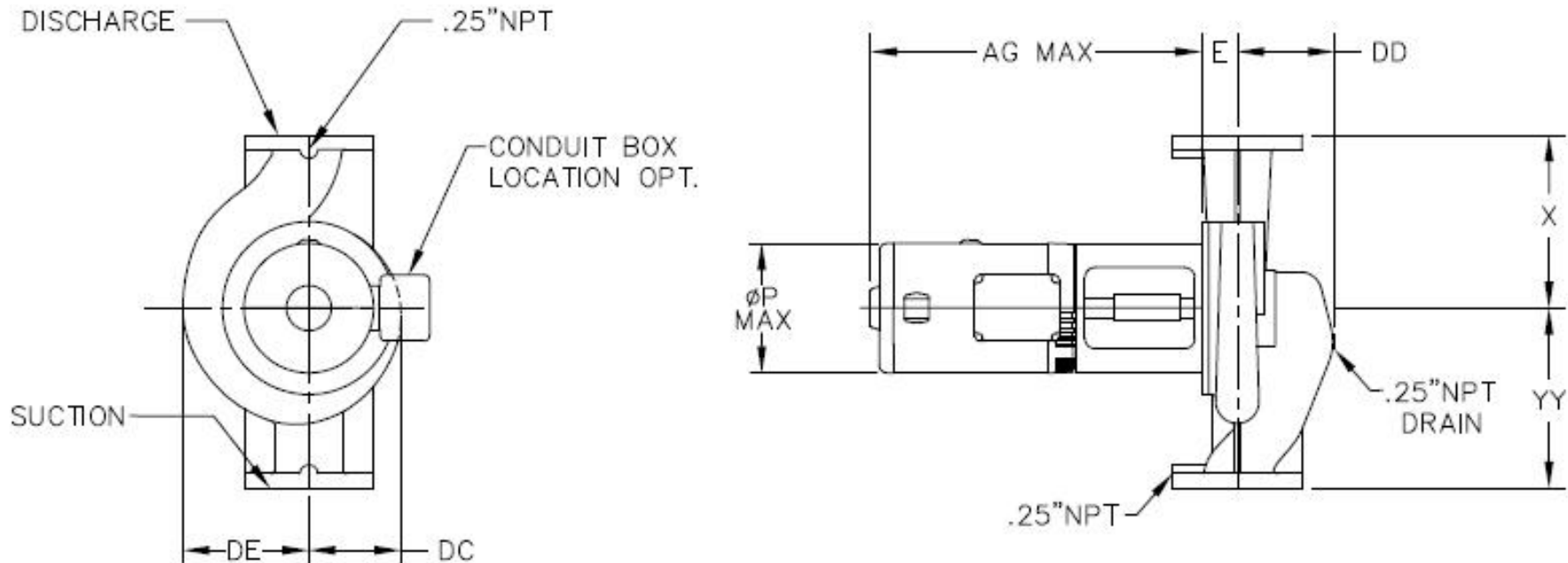


Construction Datasheet

Project name	: UCA Snow Fine Arts	Tag Number	: P-1A, 1B	
Consulting engineer	:	Service	:	
Customer	: FLUID SOLUTIONS INC	Model	: 40959 VLS	
Customer ref. / PO	:	Quantity	: 2	
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC	
Date last saved	: 11/06/2023 1:52 PM	Quoted By (Sales Engineer)	: James Dayer	
Construction		Motor Information		
Nozzle	Size (in.)	Nozzle Configuration	Pos'n	
Suction	4	125# ANSI	Side	
Discharge	4	125# ANSI	Side	
Orientation / Configuration	: Vertical		Manufacturer	: Baldor
Rotation	: Clockwise		Frame Size	: 215TC
Wear Ring Configuration	: Single - Case		Power	: 10.00 hp
Discharge Elbow Size	: -		RPM	: 1800 rpm
Subplate	: -		Enclosure	: ODP
Sump Depth (feet)	: -		Operating Power Supply	: 230/460/3/60
Bearing Frame	: -		Efficiency	: Premium
Bearing Frame Foot	: -		Service factor	: 1.15
Bearing Type (Radial/Thrust)	: In motor		Motor Application	: General Purpose
Bearing Lubrication	: Regreasable		Motor Options/Accessories	: -
Thrust Bearing	: -		Cord Length (feet)	: -
Intermediate Bearing	: -		Materials	
Lower Bearing	: -		Case	: Cast Iron, ASTM A48 - Class 30
Bearing Housing Accessories	: -		Motor Bracket	: Cast Iron, ASTM-A48, CL 30
PACO Construction code	: 17-40959-130268-1782P		Impeller	: Stainless Steel, AISI-304 (H304)
Baseplate, Coupling and Guard		Impeller Cap Screw and Washer	: Stainless Steel, AISI-303	
Baseplate	: Not Applicable		Impeller Key	: Stainless Steel, AISI 316
Drip Pan	: -		Case wear ring	: Tin Bronze, ASTM B584-90500 (B18)
Coupling	: Rigid, Axial Split Coupling (aluminum) RASC2		Impeller wear ring	: -
Guard	: OSHA Approved		Pump Shaft	: Stainless Steel, AISI-303
Seal & Packing Construction		Sleeve	: -	
Sealing Method	: Single Seal, Type 21		Line Shaft	: -
Seal Material	: Buna Carbon Ceramic SS-Spring and Hardware		Column	: -
Packing Gland	: -		Discharge Pipe	: -
Lantern Ring	: -		Discharge Elbow	: -
Recirculation Lines	: Nylon Tubing with Brass Fittings		Suction Elbow	: -
Weights (Approx.)		Subplate	: -	
Pump	: 497.0 lb		Hardware	: Steel, Grade 5
Baseplate	: -		O Rings	: Buna N
Driver	: 133.0 lb		Pump Coatings	: Standard Manufacturers Paint
Estimated Shipping gross weight	: 630.0 lb			

General Arrangement

Project name	: UCA Snow Fine Arts	Tag Number	: P-1A, 1B
Consulting engineer	:	Service	:
Customer	:	Model	: 40959 VLS
Customer ref. / PO	:	Quantity of pumps	: 2
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC
Date last saved	: 11/06/2023 1:52 PM	Quoted By (Sales Engineer)	: James Dayer



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Units	Frame	S x D (in.)	AG (Max)	DC	DD	DE	E	P (Max)	X	YY	Weight ea
inches	215TC	4 X 4	30.00	6.63	6.75	8.88	1.78	14.75	12.00	12.50	630.0
Conditions of Service				Motor Data							
Flow: 390.0 USgpm	Fluid: Hot Water	HP: 10	Encl: ODP	Phase: 3	Efficiency: Premium						
TDH: 65.00 ft	Temp.: 68.00 deg F	RPM: 1760 rpm	Hz: 60	Voltage: 230/460	S.F.: 1.15						

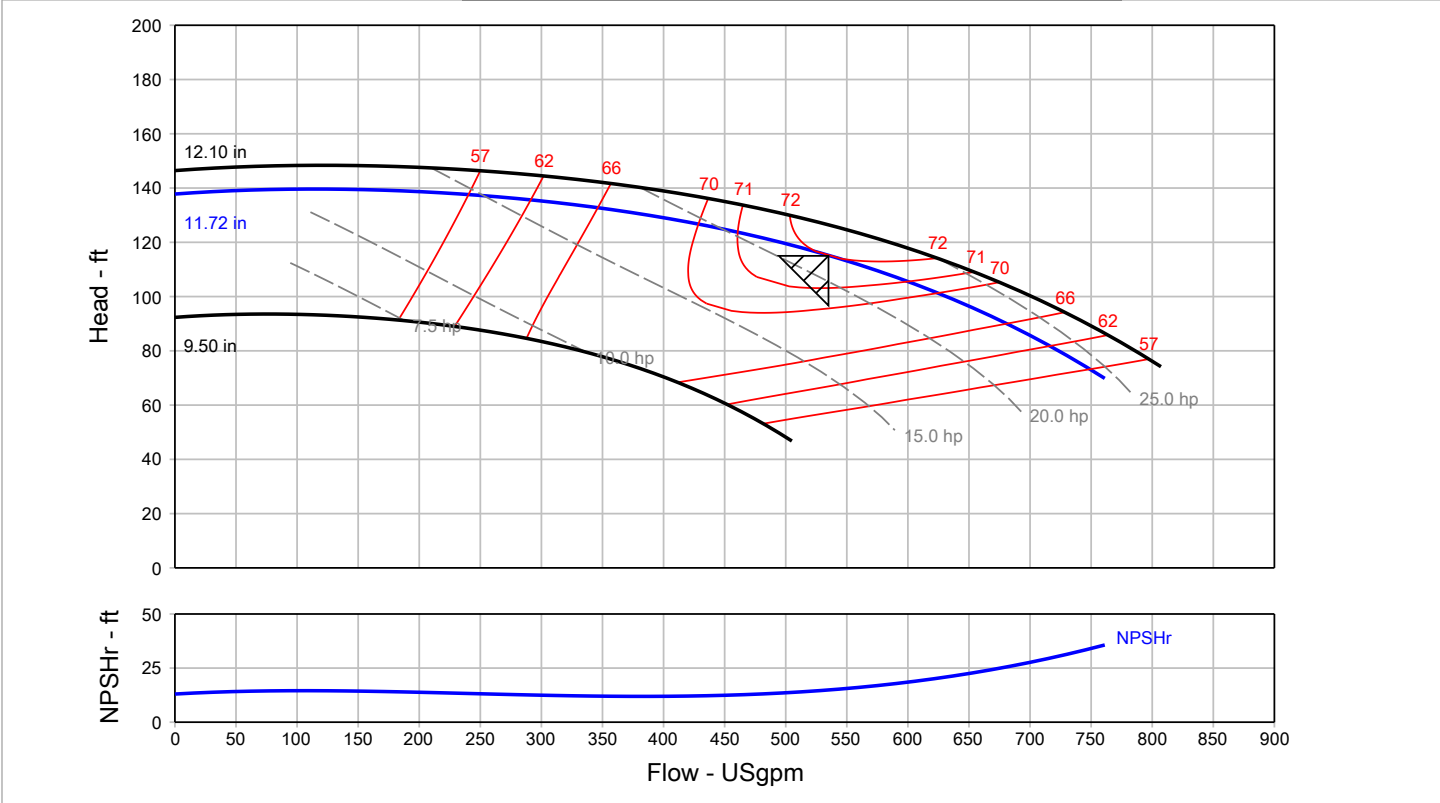
Pump Performance Datasheet

Customer :	Quote Number / ID :	110623
Customer ref. / PO :	Model :	40129 VLS
Tag Number : P-2A, 2B	Stages :	1
Service :	Based on curve number :	VLS_40129_4P Rev Aug21
Quantity : 2	Basic model number :	-
	Date last saved :	11/06/2023 1:58 PM

Operating Conditions		Liquid	
Flow, rated	: 535.0 USgpm	Liquid type	: Cold Water
Differential head / pressure, rated (requested)	: 115.0 ft	Additional liquid description	:
Differential head / pressure, rated (actual)	: 115.2 ft	Solids diameter, max	: 0.00 in
Suction pressure, rated / max	: 0.00 / 0.00 psi.g	Solids concentration, by volume	: 0.00 %
NPSH available, rated	: Ample	Temperature, max	: 68.00 deg F
Site Supply Frequency	: 60 Hz	Fluid density, rated / max	: 1.000 / 1.000 SG
		Viscosity, rated	: 1.00 cP
		Vapor pressure, rated	: 0.34 psi.a

Performance		Material	
Speed, rated	: 1760 rpm	Material selected	: Cast iron - 125#
Impeller diameter, rated	: 11.72 in		
Impeller diameter, maximum	: 12.10 in		
Impeller diameter, minimum	: 9.50 in		
Efficiency	: 72.02 %		
NPSH required / margin required	: 14.88 / 0.00 ft		
nq (imp. eye flow) / S (imp. eye flow)	: 22 / 99 Metric units		
MCSF	: 161.5 USgpm		
Head, maximum, rated diameter	: 139.6 ft		
Head rise to shutoff	: 19.61 %		
Flow, best eff. point	: 534.5 USgpm		
Flow ratio, rated / BEP	: 100.09 %		
Diameter ratio (rated / max)	: 96.86 %		
Head ratio (rated dia / max dia)	: 91.11 %		
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00		
Selection status	: Acceptable		

Energy Indexes	
PEI (CL)	: 1.00
ER (CL)	: 0



Construction Datasheet

Project name	: UCA Snow Fine Arts	Tag Number	: P-2A, 2B
Consulting engineer	:	Service	:
Customer	: FLUID SOLUTIONS INC	Model	: 40129 VLS
Customer ref. / PO	:	Quantity	: 2
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC
Date last saved	: 11/06/2023 1:58 PM	Quoted By (Sales Engineer)	: James Dayer

Construction				Motor Information	
Nozzle	Size (in.)	Nozzle Configuration	Pos'n	Manufacturer	: Baldor
Suction	4	125# ANSI	Side	Frame Size	: 284TC
Discharge	4	125# ANSI	Side	Power	: 25.00 hp

Orientation / Configuration	: Vertical	RPM	: 1800 rpm
Rotation	: Clockwise	Enclosure	: ODP
Wear Ring Configuration	: Single - Case	Operating Power Supply	: 230/460/3/60
Discharge Elbow Size	: -	Efficiency	: Premium
Subplate	: -	Service factor	: 1.15
Sump Depth (feet)	: -	Motor Application	: General Purpose
Bearing Frame	: -	Motor Options/Accessories	: -
Bearing Frame Foot	: -	Cord Length (feet)	: -

Materials	
Case	: Cast Iron, ASTM A48 - Class 30
Motor Bracket	: Cast Iron, ASTM-A48, CL 30
Impeller	: Stainless Steel, AISI-304 (H304)
Impeller Cap Screw and Washer	: Stainless Steel, AISI-303
Impeller Key	: Stainless Steel, AISI 316
Case wear ring	: Tin Bronze, ASTM B584-90500 (B18)
Impeller wear ring	: -
Pump Shaft	: Stainless Steel, AISI-303
Sleeve	: -
Line Shaft	: -
Column	: -
Discharge Pipe	: -
Discharge Elbow	: -
Suction Elbow	: -
Subplate	: -
Hardware	: Steel, Grade 5
O Rings	: Buna N
Pump Coatings	: Standard Manufacturers Paint

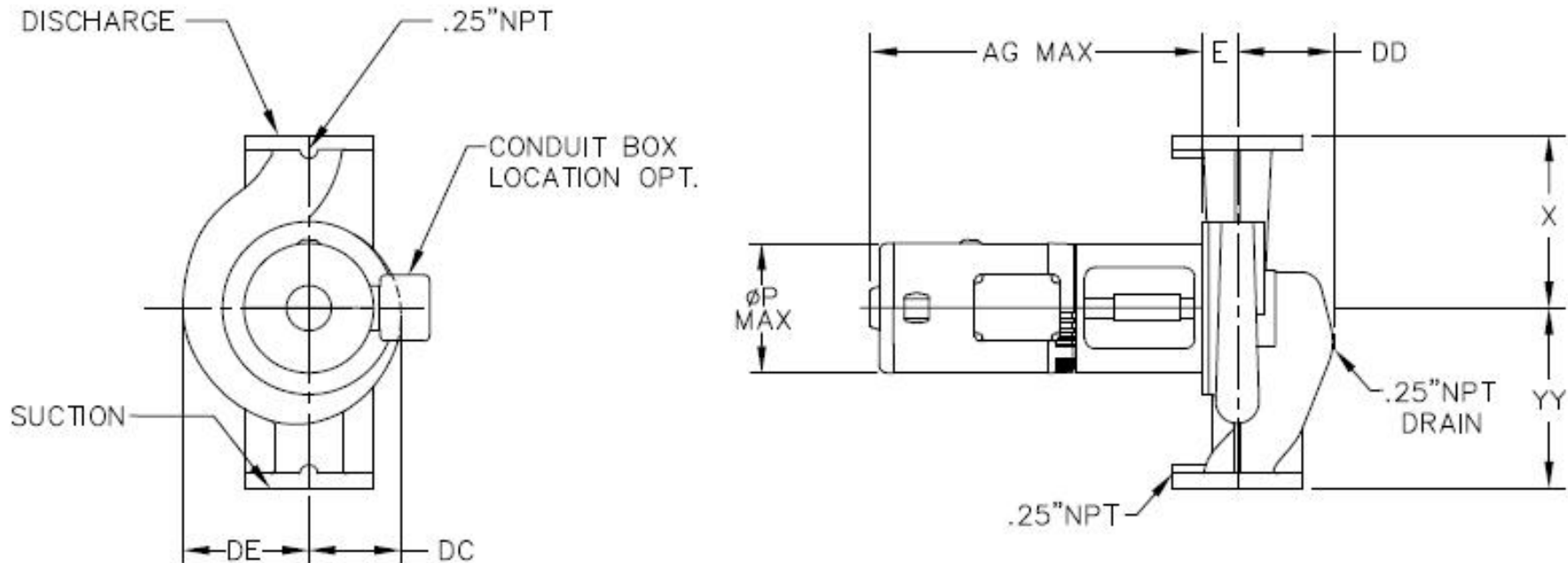
Baseplate, Coupling and Guard	
Baseplate	: Not Applicable
Drip Pan	: -
Coupling	: Rigid, Axial Split Coupling (aluminum) RASC5
Guard	: OSHA Approved

Seal & Packing Construction	
Sealing Method	: Single Seal, Type 21
Seal Material	: Buna Carbon Ceramic SS-Spring and Hardware
Packing Gland	: -
Lantern Ring	: -
Recirculation Lines	: Nylon Tubing with Brass Fittings

Weights (Approx.)	
Pump	: 362.0 lb
Baseplate	: -
Driver	: 330.0 lb
Estimated Shipping gross weight	: 692.0 lb

General Arrangement

Project name	: UCA Snow Fine Arts	Tag Number	: P-2A, 2B
Consulting engineer	:	Service	:
Customer	:	Model	: 40129 VLS
Customer ref. / PO	:	Quantity of pumps	: 2
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC
Date last saved	: 11/06/2023 1:58 PM	Quoted By (Sales Engineer)	: James Dayer



NOT FOR CONSTRUCTION, UNLESS CERTIFIED AND REFERENCED ON ORDER

Units	Frame	S x D (in.)	AG (Max)	DC	DD	DE	E	P (Max)	X	YY	Weight ea
inches	284TC	4 X 4	39.50	7.72	6.63	9.56	1.94	18.50	13.00	13.00	692.0
Conditions of Service			Motor Data								
Flow: 535.0 USgpm	Fluid: Cold Water	HP: 25	Encl: ODP	Phase: 3	Efficiency: Premium						
TDH: 115.0 ft	Temp.: 68.00 deg F	RPM: 1760 rpm	Hz: 60	Voltage: 230/460	S.F.: 1.15						

Project name	: UCA Snow Fine Arts	Tag Number	: Suction Diffuser
Consulting engineer	:	Service	: HW
Customer	: FLUID SOLUTIONS INC	Model	: SD4040-125
Customer ref. / PO	:	Quantity	: 2
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC
Date last saved	: 11/06/2023 2:05 PM	Quoted By (Sales Engineer)	: James Dayer

Construction

Nozzle	Size (in.)	Nozzle Configuration	Pos'n
Inlet	4	-	Top
Outlet	4	-	Side

Difuser Body	: Cast Iron, ASTM-A126, CL B
Hardware	: Steel, ASTM A-283C
Internal Magnet	: -
Strainer	: SS 304, ASTM-A240, 3.5MM Holes
Mesh Grid (Startup strainer)	: SS 304, ASTM-A240, (#20 Mesh)
Strainer Cover	: Cast Iron, ASTM-A126, CL B
O Rings	: EPDM
Coating	: Standard Manufacturers Paint
Construction Code/Part Number	: 96877830

Weights (Approx.)

Estimated Shipping gross weight	: 64.00 lb
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Grundfos Suction Diffusers



Description

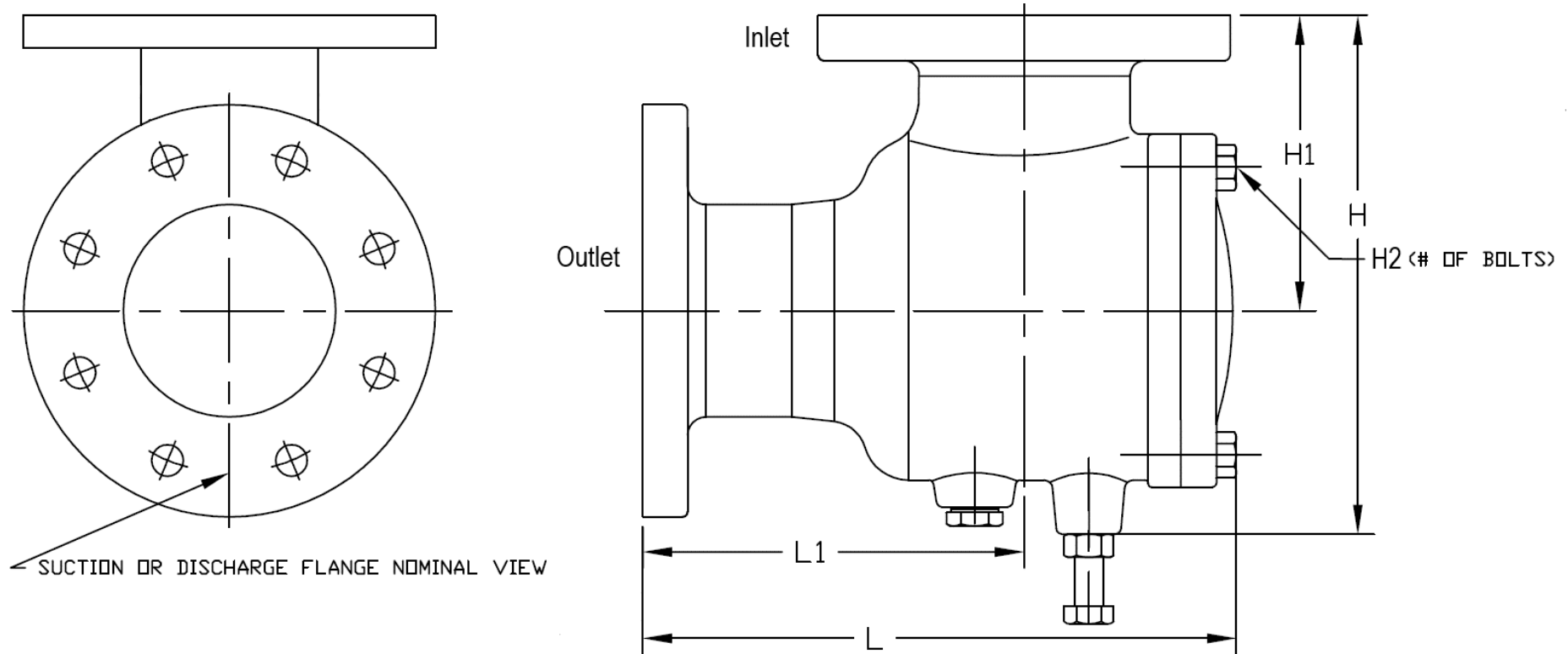
Grundfos Series SD, Suction diffuser provides and ensures a uniform flow pattern to the suction side of the pump ensuring a stable NPSH. Suction diffuser makes it possible to install the pump in a very narrow spacing as no long bends are necessary.

The suction diffuser incorporates a cylindrical strainer preventing impurities from entering the pump. Additional feature includes an adjustable support for mounting.

-

General Arrangement

Project name	: UCA Snow Fine Arts	Tag Number	: Suction Diffuser
Consulting engineer	:	Service	: HW
Customer	:	Model	: SD4040-125
Customer ref. / PO	:	Quantity of pumps	: 2
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC
Date last saved	: 11/06/2023 2:05 PM	Quoted By (Sales Engineer)	: James Dayer



NOT FOR CONSTRUCTION, UNLESS CERTIFIED AND REFERENCED ON ORDER

Units	Inlet (in)	Outlet (in)	Strainer Area (sq in)	L (in)	L1 (in)	H1 (in)	H (in)	H2 (qty)	Weight (lbs)
inches	4	4	78	12.90	8.30	6.50	11.40	6.00	64

Project name	: UCA Snow Fine Arts	Tag Number	: Suction Diffuser
Consulting engineer	:	Service	: CW
Customer	: FLUID SOLUTIONS INC	Model	: SD6040-125
Customer ref. / PO	:	Quantity	: 2
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC
Date last saved	: 11/06/2023 2:06 PM	Quoted By (Sales Engineer)	: James Dayer

Construction

Grundfos Suction Diffusers

Nozzle	Size (in.)	Nozzle Configuration	Pos'n
Inlet	6	-	Top
Outlet	4	-	Side

Difuser Body	: Cast Iron, ASTM-A126, CL B
Hardware	: Steel, ASTM A-283C
Internal Magnet	: -
Strainer	: SS 304, ASTM-A240, 3.5MM Holes
Mesh Grid (Startup strainer)	: SS 304, ASTM-A240, (#20 Mesh)
Strainer Cover	: Cast Iron, ASTM-A126, CL B
O Rings	: EPDM
Coating	: Standard Manufacturers Paint
Construction Code/Part Number	: 99329685



Weights (Approx.)

Estimated Shipping gross weight	: 120.0 lb
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Description

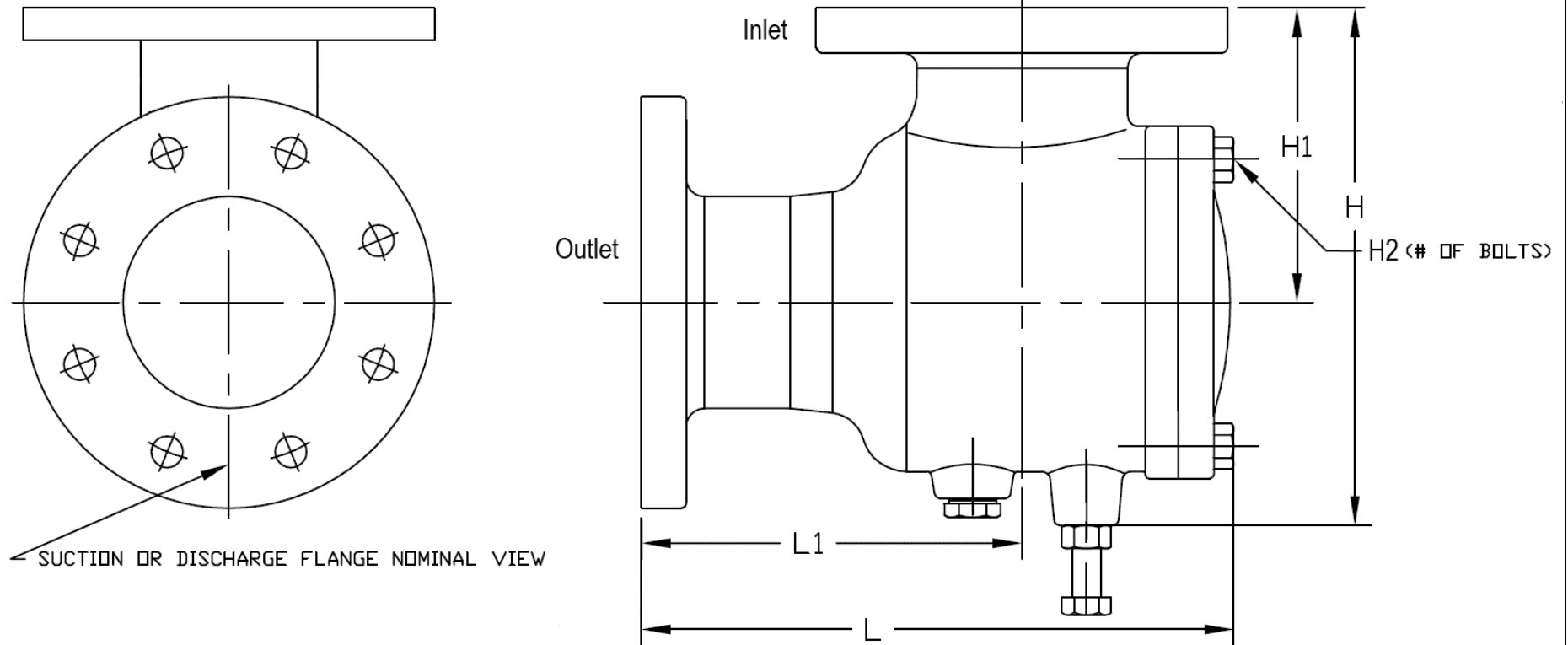
Grundfos Series SD, Suction diffuser provides and ensures a uniform flow pattern to the suction side of the pump ensuring a stable NPSH. Suction diffuser makes it possible to install the pump in a very narrow spacing as no long bends are necessary.

The suction diffuser incorporates a cylindrical strainer preventing impurities from entering the pump. Additional feature includes an adjustable support for mounting.

-

General Arrangement

Project name	: UCA Snow Fine Arts	Tag Number	: Suction Diffuser
Consulting engineer	:	Service	: CW
Customer	:	Model	: SD6040-125
Customer ref. / PO	:	Quantity of pumps	: 2
Quote Number / ID	: 110623	Quoted By (Sales Office)	: FLUID SOLUTIONS INC
Date last saved	: 11/06/2023 2:06 PM	Quoted By (Sales Engineer)	: James Dayer



NOT FOR CONSTRUCTION, UNLESS CERTIFIED AND REFERENCED ON ORDER

Units	Inlet (in)	Outlet (in)	Strainer Area (sq in)	L (in)	L1 (in)	H1 (in)	H (in)	H2 (qty)	Weight (lbs)
inches	6	4	78	15.40	10.10	8.00	13.90	6.00	120

TAG: AS-1

Standard Features

1. Air Vent
2. Flanged Connections
3. Blow Down Valve
4. Skim Valve
5. Removable or Fixed Head
6. ASME Nameplate
7. Sight Glass (4)*
8. Gauge Tap (2)*

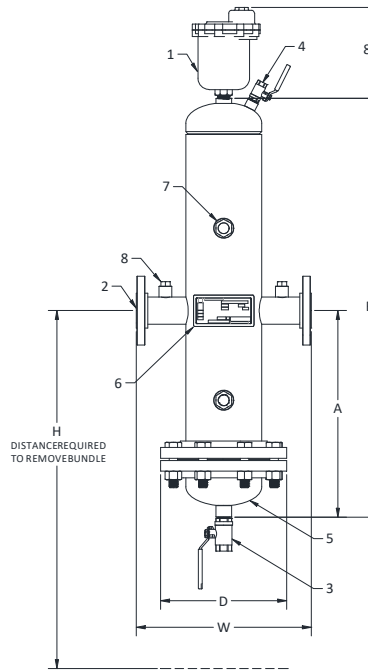
***Less Options:**

- Minus Sight Glass x4
- Minus Gauge Tap x2

MATERIALS OF CONSTRUCTION

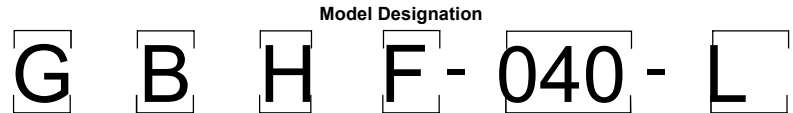
Coalescing Media	Stainless Steel
Shell	Carbon Steel
Blow Down Valve	Bronze
Skim Valve	Bronze
Air Vent	Thrush Model 720

NOTE: IF REQUIRED, THE LOWER HEAD AND COALESCING MEDIA ARE REMOVABLE FOR CLEANING ON THE 'R' TYPE HEAD.



MAXIMUM OPERATING CONDITIONS

Maximum Working Pressure (2"-12")	175 PSIG
Maximum Working Pressure (14"-24")	150 PSIG
Maximum Working Temperature	375° F



Grundfos **Separation Type**
A=Air Only
D=Dirt Only
B=Both Air and Dirt
4=Hydraulic Separator

Velocity
S=Standard Velocity
H=High Velocity

Head Type
R=Removable
F=Fixed

Connection Size
example: 025 = 2.5" or 100 = 10.0"

Options
W=with options
X=less options*

DIMENSIONS

MODEL	CONNECTION SIZE**	(INCHES)					FLOW (GPM)	WEIGHT (LBS.) GBHR	WEIGHT (LBS.) GBHF
		A	B	D	W	H			
GBH*-020-*	2"	18.00	36.50	11.00	15.25	44.50	105	125	
GBH*-025-*	2.5"	18.00	36.50	11.00	15.75	44.50	155	125	
GBH*-030-*	3"	18.00	36.50	11.00	20.25	44.50	225	150	
→ GBH*-040-*	4"	21.00	41.00	13.50	20.63	51.00	405	225	
GBH*-050-*	5"	28.00	57.00	16.00	27.75	71.00	630	410	
GBH*-060-*	6"	28.00	59.00	19.00	27.75	71.00	910	460	
GBH*-080-*	8"	37.25	73.50	23.50	33.63	91.50	1610	675	
GBH*-100-*	10"	44.00	87.00	27.50	37.50	110.00	2450	1000	
GBH*-120-*	12"	55.00	114.00	32.00	42.50	145.00	3500	1675	
GBH*-140-*	14"	58.00	118.00	35.00	45.00	143.00	4650	2170	
GBH*-160-*	16"	79.00	166.00	35.00	50.00	212.00	6050	2945	
GBH*-180-*	18"	82.00	169.00	41.62	56.00	213.00	7600	3900	
GBH*-200-*	20"	98.00	205.00	41.62	61.50	265.00	9400	5825	
GBH*-240-*	24"	109.00	222.00	55.00	72.00	284.00	13500	9070	

**ANSI B16.5 150 PSI FLANGE

DESIGNED AND CONSTRUCTED PER ASME SECTION VIII, DIV. 1

Job Name UCA Snow Fine Arts

Location _____

Engineer Pettit & Pettit Engineers

Architect _____

Sales Rep. Fluid Solutions

Contractor Comfort Systems USA

Model Number GBHF-040-L

Temperature _____

Capacity 405 GPM

Liquid _____

Notes _____

TAG: AS-2

Standard Features

1. Air Vent
2. Flanged Connections
3. Blow Down Valve
4. Skim Valve
5. Removable or Fixed Head
6. ASME Nameplate
7. Sight Glass (4)*
8. Gauge Tap (2)*

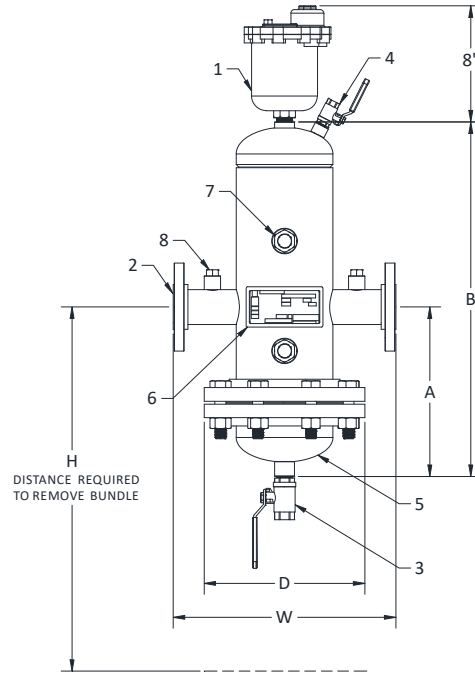
*Less Options:

- Minus Sight Glass x4
- Minus Gauge Tap x2

MATERIALS OF CONSTRUCTION

Coalescing Media	Stainless Steel
Shell	Carbon Steel
Blow Down Valve	Bronze
Skim Valve	Bronze
Air Vent	Thrush Model 720

NOTE: IF REQUIRED, THE LOWER HEAD AND COALESCING MEDIA ARE REMOVABLE FOR CLEANING ON THE 'R' TYPE HEAD.



MAXIMUM OPERATING CONDITIONS

Maximum Working Pressure (2"-12")	175 PSIG
Maximum Working Pressure (14"-24")	150 PSIG
Maximum Working Temperature	375° F

Model Designation

G **B** **S** **R** - **060** - **L**

Grundfos Separation Type Velocity Head Type Connection Size Options
 A=Air Only S=Standard Velocity R=Removable W=with options
 D=Dirt Only H=High Velocity F=Fixed or 100 = 10.0" X=less options*
 B=Both Air and Dirt
 4=Hydraulic Separator

DIMENSIONS

MODEL	CONNECTION SIZE**	(INCHES)					FLOW (GPM)	WEIGHT (LBS.) GBSR	WEIGHT (LBS.) GBSF
		A	B	D	W	H			
GBS*-020-*	2"	12.00	24.50	11.00	15.25	26.50	65	150	120
GBS*-025-*	2.5"	12.00	24.50	11.00	15.75	26.50	95	150	120
GBS*-030-*	3"	12.00	24.50	11.00	20.25	26.50	150	150	120
GBS*-040-*	4"	15.00	29.00	13.50	20.63	33.00	250	250	200
GBS*-050-*	5"	19.00	39.00	16.00	27.75	44.00	380	310	240
GBS*-060-*	6"	19.00	41.00	19.00	27.75	44.00	560	375	265
GBS*-080-*	8"	24.25	49.50	23.50	33.63	54.50	970	700	530
GBS*-100-*	10"	33.00	63.00	27.50	37.50	75.00	1510	1000	730
GBS*-120-*	12"	38.00	78.00	32.00	42.50	90.00	2130	1500	1110
GBS*-140-*	14"	43.00	94.00	35.00	45.00	104.00	2880	1950	1670
GBS*-160-*	16"	56.00	118.00	35.00	50.00	141.00	3760	2325	2045
GBS*-180-*	18"	55.00	121.00	41.62	56.00	138.00	4760	3250	2800
GBS*-200-*	20"	68.00	145.00	41.62	61.50	175.00	5880	4575	4125
GBS*-240-*	24"	73.00	150.00	55.00	72.00	175.00	8460	7250	6370

**ANSI B16.5 150 PSI FLANGE

DESIGNED AND CONSTRUCTED PER ASME SECTION VIII, DIV. 1

Job Name UCA Snow Fine Arts
 Location _____
 Engineer Pettit & Pettit Engineers
 Architect _____
 Sales Rep. Fluid Solutions
 Contractor Comfort Systems USA

Model Number GBSR-060-L
 Temperature _____
 Capacity 560 GPM
 Liquid _____
 Notes _____



SUBMITTAL

GNLA-SERIES

HVAC EXPANSION TANKS

Models: GNLA-35 to GNLA-800L

Rev: G1 3/25/2020

Job Name	UCA Snow Fine Arts	Submitted By	_____	Date	_____
Location	_____	Approved By	_____	Date	_____
Engineer	Pettit & Pettit Engineers	Order No.	_____	Date	_____
Contractor	Comfort Systems USA	Notes	_____		
Sales Rep.	Fluid Solutions	_____			

Description:

GNLA tanks are ASME removeable bladder type pre-charged HVAC expansion tanks. They are designed to absorb the expansion forces and control the pressure in heating/cooling systems. The system's expanded water (fully compatible with water/glycol mixtures) is contained in a full acceptance heavy-duty butyl bladder that prevents tank corrosion and waterlogging problems. All GNLA expansion tanks can be installed vertically or horizontally.

Construction:

Shell: Carbon Steel
 Heads: Carbon Steel
 Exterior: Carbocoat 140 - Harvester Red
 Interior: Heavy Duty Butyl Bladder

Design Parameters:

Maximum Design Pressure: 125 PSIG*
 Temperature Range: -20°F to 240°F

*150, 200 & 250 PSIG available

Model Number	Part Number	Tank Volume (Gallons)	Tagging Information	Quantity
GNLA-35	99397643	10		
GNLA-50	99397644	13		
GNLA-85	99397645	23		
GNLA-130	99397646	35		
GNLA-200	99397647	53		
GNLA-300	99397648	79		
GNLA-400	99397649	106		
GNLA-500	99397650	132	ET-1	
GNLA-600	99397651	158		
GNLA-800L	99397652	211		

Typical Specification

Furnish and install, as shown on plans, a _____ gallon _____" diameter X _____" (high) pre-charged steel HVAC expansion tank with heavy-duty butyl bladder. The tank shall have multiple water-side connections to eliminate stagnate water within the tank, a 0.302"-32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet system requirements, a pressure gauge, and bladder integrity monitor. The tank must be constructed in accordance with the most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code and rated for 125 psig.

Each tank shall be model number GNLA-_____ or approved equal.



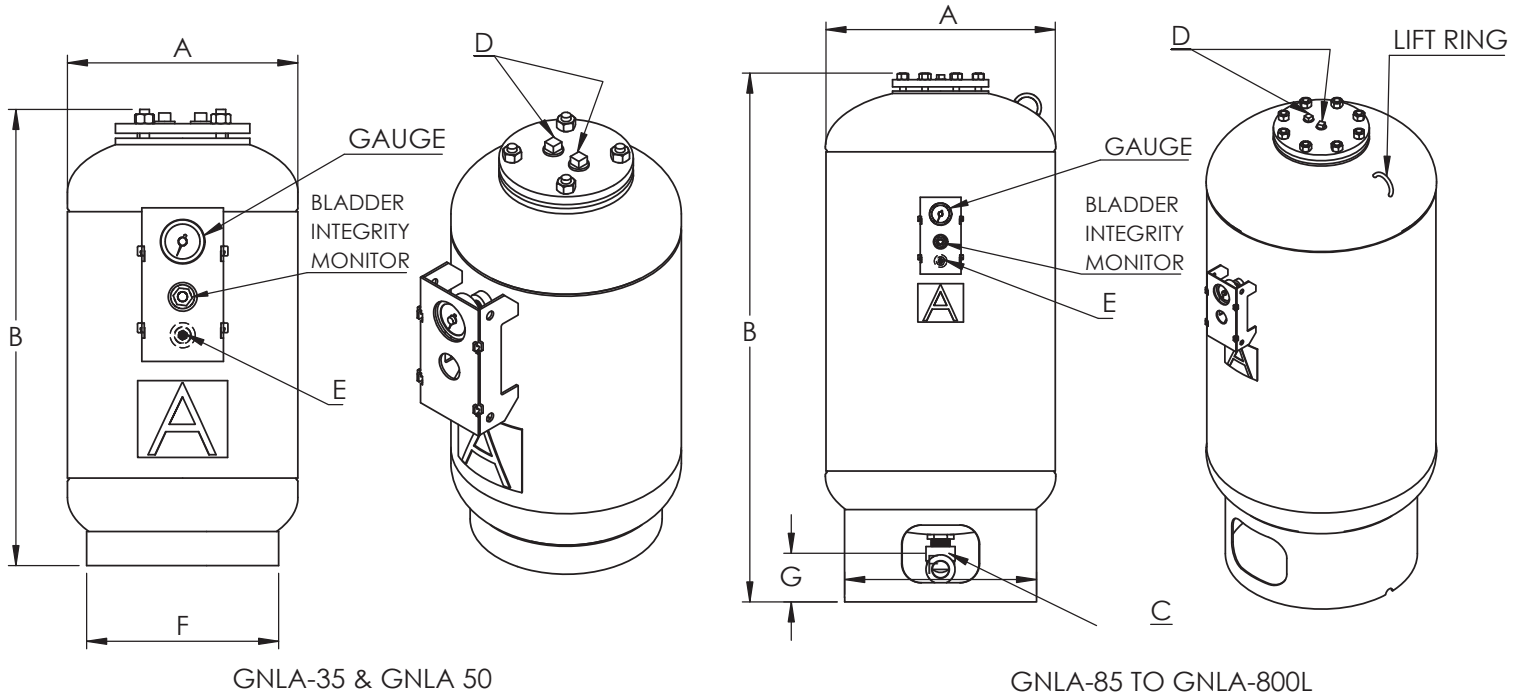
SUBMITTAL

GNLA-SERIES

HVAC EXPANSION TANKS

Models: GNLA-35 to GNLA-800L

Rev: G1 3/25/2020



Dimensions & Weights:

Model Number	Dimensions in Inches						Approx. Shipping Weight (lbs)	
	A	B	System Connection		Charging Valve	F		G
			C	D	E			
GNLA-35	12	23 1/2	-			10	-	40
GNLA-50	14	24				10	-	50
GNLA-85	16	37	1 NPT	3/4 NPT	0.302"-32NC	12	5 1/2	90
GNLA-130	20					16		125
GNLA-200	24	43	1 1/2 NPT	3/4 NPT	0.302"-32NC	20	5 1/4	210
GNLA-300		55						225
GNLA-400		49						300
→ GNLA-500	30	57	2 NPT			24		335
GNLA-600		65						360
GNLA-800L	32	76				28		475

Notes:

- Tanks are factory pre-charged at 40 psig and field adjustable.
- California code-sight glass is available upon request.
- Both top and bottom connections (C & D) access the bladder.
- Mounting clips are available upon request.



SUBMITTAL

GNLA-SERIES

HVAC EXPANSION TANKS

Models: GNLA-1000 to GNLA-15000

Rev. G1 3/26/2020

Job Name	UCA Snow Fine Arts	Submitted By	_____	Date	_____
Location	_____	Approved By	_____	Date	_____
Engineer	Pettit & Pettit Engineers	Order No.	_____	Date	_____
Contractor	Comfort Systems USA	Notes	_____		
Sales Rep.	Fluid Solutions	_____			

Description:

GNLA Tanks are ASME removable bladder type pre-charged HVAC expansion tanks. They are designed to absorb the expansion forces and control the pressure in heating/cooling systems. The system's expanded water (fully compatible with water/glycol mixtures) is contained in a full acceptance heavy-duty butyl bladder that prevents tank corrosion and waterlogging problems. All GNLA expansion tanks can be installed vertically or horizontally.

Construction:

Shell: Carbon Steel
 Heads: Carbon Steel
 Exterior: Carbocoat 140 - Harvester Red
 Interior: Heavy Duty Butyl Bladder

Design Parameters:

Maximum Design Pressure: 125 PSIG*
 Temperature Range: -20°F to 240°F

*150 PSIG and up are available

Model Number	Part Number	Tank Volume (Gallons)	Tagging Information	Quantity
GNLA-1000	99397653	264	ET-2	
GNLA-1200	99397654	317		
GNLA-1400	99397655	370		
GNLA-1600	99397656	422		
GNLA-2000	99397657	528		
GNLA-2500	99397658	660		
GNLA-3000L	99397659	792		
GNLA-3000S	99397660	792		
GNLA-4000	99397661	1056		
GNLA-5000	99397662	1320		
GNLA-7500	99397663	1980		
GNLA-10000	99397664	2640		
GNLA-15000	99397665	3963		

Typical Specification

Furnish and install, as shown on plans, a _____ gallon _____" diameter X _____" (high) pre-charged steel HVAC expansion tank with heavy-duty butyl bladder. The tank shall have an NPT water side system connection, a 0.302"-32 charging valve connection (standard fire valve) to facilitate the on-site charging of the tank to meet system requirements, a pressure gauge, and bladder integrity monitor. The tank must be constructed in accordance with the most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code and rated for 125 psig.

Each tank shall be model number GNLA-_____ or approved equal.

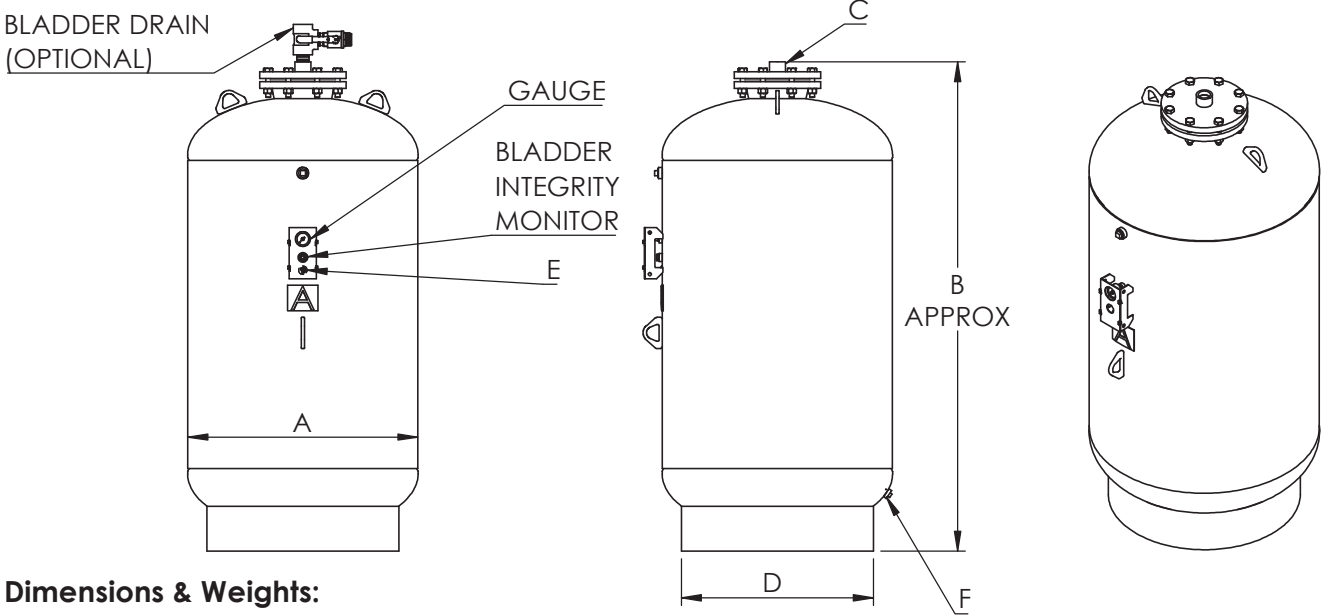
SUBMITTAL

GNLA-SERIES

HVAC EXPANSION TANKS



Models: GNLA-1000 to GNLA-15000
 Rev. G1 3/26/2020



Dimensions & Weights:

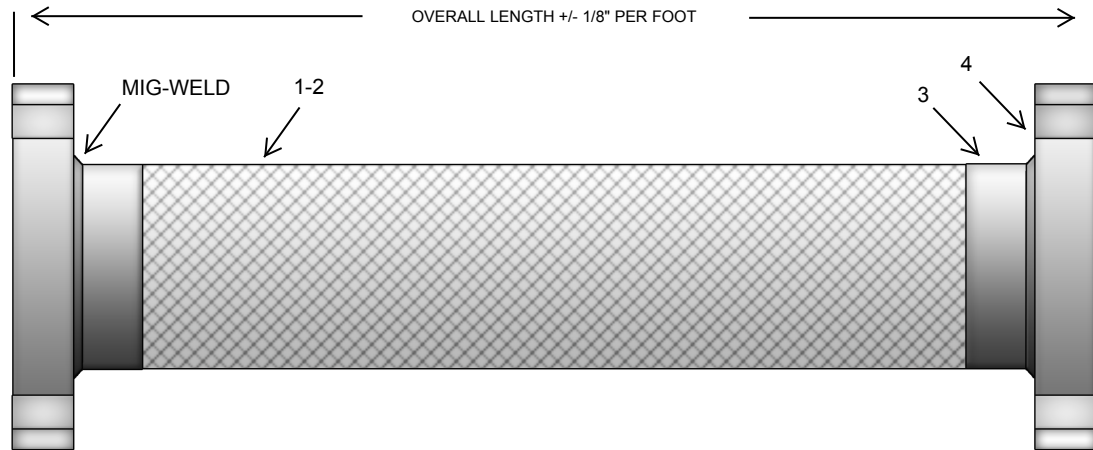
Model Number	Dimensions in Inches						Approx. Shipping Weight (lbs)
	A	B	System Connection	D	Charging Valve	Plug	
			C		E	F	
→ GNLA-1000	36	76	1 1/2 NPT	30	0.302"-32NC	3/4 NPT	552
GNLA-1200		88					679
GNLA-1400		100					688
GNLA-1600	74	42		1046			
GNLA-2000	86			1150			
GNLA-2500	104			1444			
GNLA-3000L	60	124	2 NPT	54		3/4 NPT	1658
GNLA-3000S		83					1868
GNLA-4000		105					2238
GNLA-5000	128	3 NPT	66	1 NPT			2617
GNLA-7500	131						3768
GNLA-10000	162						4628
GNLA-15000	233				5925		

Notes:

- Tanks are factory pre-charged at 40 psig and field adjustable.
- California code-sight glass is available upon request.
- Mounting clips are available upon request.
- Bladder drain is available upon request.
- Tanks installed horizontally must have the system connection below the horizontal centerline of the tank.
- Plug (F) is on the air side of the tank. Do not remove.

PUMP FLEXIBLE CONNECTORS

TCHS - FLG



MATERIALS

- #1-2 HOSE: T-321 STAINLESS STEEL HOSE 1-LAYER T-304 BRAID
- #3 BRAID BAND: T-304 STAINLESS STEEL
- #4 END FITTING: CARBON STEEL PLATE FLANGES 150# DRILL

QTY	MODEL NUMBER	SIZE	OAL	MAX O.D.	WRK. PSIG	MAX TEST	@ TEMP.	LATERAL OFFSET	WT. LBS.
	TCHS-150-FLG	1 1/2"	9"	1.91"	370	555	70° F	1/16"	7
	TCHS-200-FLG	2"	9"	2.46"	370	555	70° F	1/16"	9
	TCHS-250-FLG	2 1/2"	9"	3.45"	400	600	70° F	1/16"	12
	TCHS-300-FLG	3"	9"	4.01"	288	431	70° F	1/16"	13
	TCHS-400-FLG	4"	9"	5.03"	250	375	70° F	1/16"	18
	TCHS-500-FLG	5"	11"	6.10"	200	300	70° F	1/16"	25
	TCHS-600-FLG	6"	11"	7.15"	220	330	70° F	1/16"	28
	TCHS-800-FLG	8"	12"	9.44"	215	323	70° F	1/16"	52
	TCHS-1000-FLG	10"	13"	11.49"	200	350	70° F	1/16"	65
	TCHS-1200-FLG	12"	14"	13.51"	160	240	70° F	1/16"	105
	TCHS-1400-FLG	14"	14"	15.67"	150	225	70° F	1/16"	115
	TCHS-1600-FLG	16"	14"	17.31"	110	165	70° F	1/16"	235

TEMPERATURE DERATING FACTORS: MULTIPLY X WRK. PSIG

200° F	250° F	300° F	350° F	400° F	500° F	600° F	700° F
0.94	0.92	0.88	0.86	0.83	0.78	0.74	0.7

DRAWN BY:

DRAWING NUMBER:

REV:

SIGNATURE:

DATE:

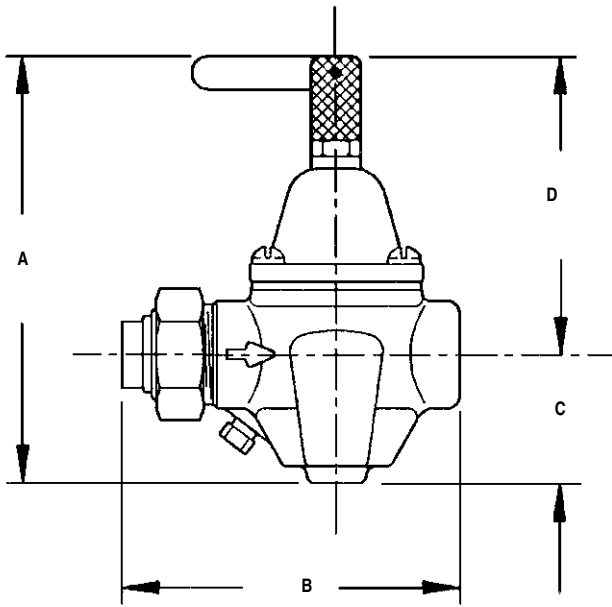
PO NUMBER:

PROJECT:

CUSTOMER:

NOTES:

Water Pressure Reducing Valve



Model WPR0050

Features:

- Reduces city water pressure to desired system pressure
- Automatically feeds water when pressure in a system drops below the setting of the valve
- Brass or bronze construction
- Easily and quickly serviced without removing valve from line
- Integral strainer
- Adjustable pressure range of 10-70 psig; factory set at 45 psig
- Maximum working pressure of 400 psig
- Maximum operating temperature of 180°F

Dimensions:

Model	Material	Size	A	B	C	D	Wt. (lbs.)
WPR0050	Bronze	1/2" NPT	5.40	4.31	1.05	4.35	2.5
WPR0075	Bronze	3/4" NPTF	5.40	4.47	1.05	4.35	2.5
WPR0110	Bronze	1" NPTF	5.40	5.17	1.05	4.35	2.5

Dimensions are subject to change without notice, please confirm actual dimensions with factory at time of order.

JOB NAME _____
 LOCATION _____

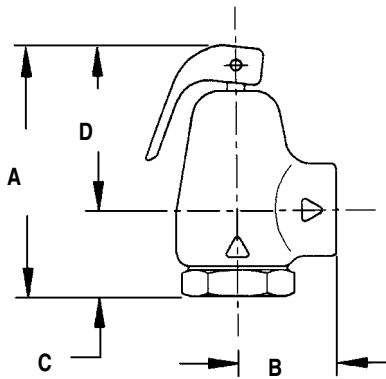
 CONTRACTOR _____
 CONTRACTOR P.O. NO. _____

ITEMS	QUANTITY
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



1005 E. Houston
 Broken Arrow, OK 74012
 Toll Free: 866-204-5229
 PH: 918-317-0401
 FAX: 918-317-0407
 www.wheatleyhvac.com
 e-mail: sales@globalflowproducts.com

ASME Relief Valve



Features:

- Relieves pressure in hot water heating systems
- Eight available pressure settings as listed below. Please specify with order.
- Test lever standard on all models
- ASME listed, rated and stamped
- Bronze body, heat resistant silicone seat disc, stainless steel springs and NPT end connections

ASME Relief Capacities at Standard Settings—BTU/hr. Steam Relief

Setting	3/4"	1"	1 1/4"	1 1/2"	2"
30 PSI	717,400	1,025,000	1,704,000	2,085,000	3,902,000
35 PSI	800,100	1,143,000	1,900,000	2,325,000	4,352,000
45 PSI	965,600	1,380,000	2,293,000	2,806,000	5,252,000
50 PSI	1,048,300	1,498,000	2,490,000	3,047,000	5,701,000
75 PSI	1,461,900	2,090,000	3,472,000	4,249,000	7,951,000
100 PSI	1,875,500	2,680,000	4,454,000	5,451,000	10,200,000
125 PSI	2,289,100	3,271,000	5,437,000	6,653,000	12,450,000
150 PSI	2,702,700	3,862,000	6,419,000	7,855,000	14,700,000

Dimensional Data:

Model	Size	A	B	C	D	Weight (lbs.)
RV0075	3/4"	5"	1 1/2"	1 3/4"	3 1/4"	1.25
RV0100	1"	5 9/16"	1 5/8"	1 1/8"	4 7/16"	2.25
RV0125	1 1/4"	7 3/8"	2 1/16"	1 1/2"	5 7/8"	3.25
RV0150	1 1/2"	7 1/2"	2 15/32"	1 5/8"	5 7/8"	4.37
RV0200	2"	9 7/8"	3"	2 7/8"	7"	9.00

Dimensions are subject to change without notice, please confirm actual dimensions with factory at time of order.

JOB NAME _____
 LOCATION _____

 CONTRACTOR _____
 CONTRACTOR P.O. NO. _____

ITEMS	QUANTITY
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



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