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: Griswold
Submittal: Hydronic Piping (Valve Packages)
Submittal Number: 23 21 13-02
Drawing # and Installation: Mechanical Drawings

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H+N Architects
1009 Main Street
Conway, AR 72032
501-327-7525

ENGINEER
Pettit & Pettit
201 E. Markham St. #400
Little Rock, AR 72201
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Notes:

Project Name: Snow Fine Arts HVAC Upgrades

Reviewer Name:	Dakota Ellis
Date:	11/10/2023
Submittal #:	18
Company Name:	Wagner General Contractors, Inc.

Status: Reviewed

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

CSUSA PROJECT NO.
23-2020
chowell@comfortar.com

GRUNDFOS

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, ¾" 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

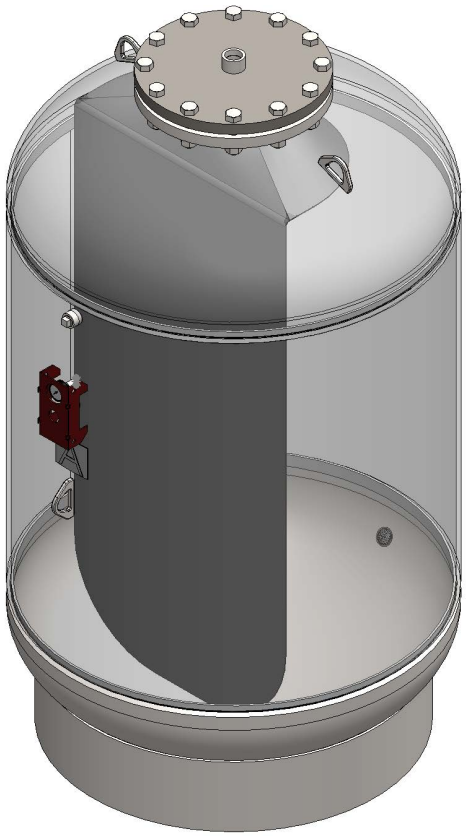
- Check replacement bladder for defects
- Lay bladder with collar neck facing floor
- Roll bladder from both sides

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

¾" male brass fitting

¾" rubber hose (cut to proper length)

(8) bolts (SA-193-B7)

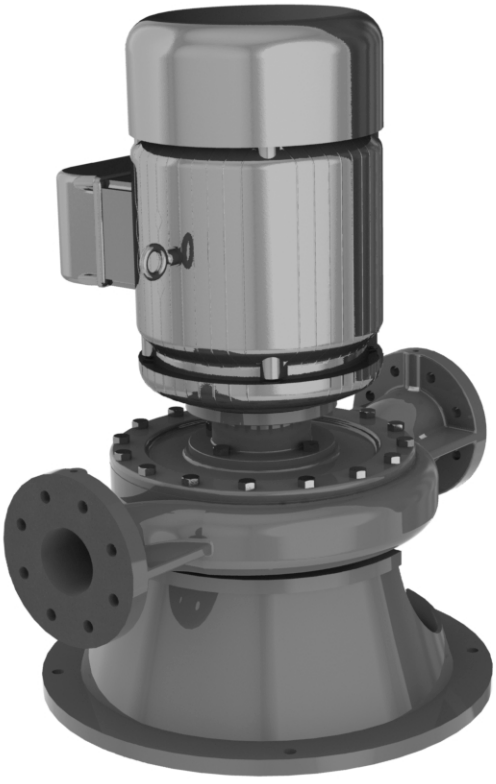
(8) UNC hex head nuts (SA-194-2H)

VL, VLS

Vertical inline centrifugal pumps

Installation and operating instructions

VL



VLS

be
think
innovate

GRUNDFOS

Original installation and operating instructions.

CONTENTS

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

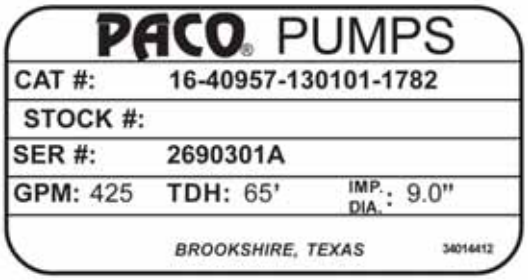
The Contract shall be governed by the law of the State of Texas. Any disputes arising out of this Contract shall be resolved by informal mediation in any manner that the parties may agree within 45 days of written request for mediation by one party to the other. Any dispute that cannot be resolved through 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

Caution

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.

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.

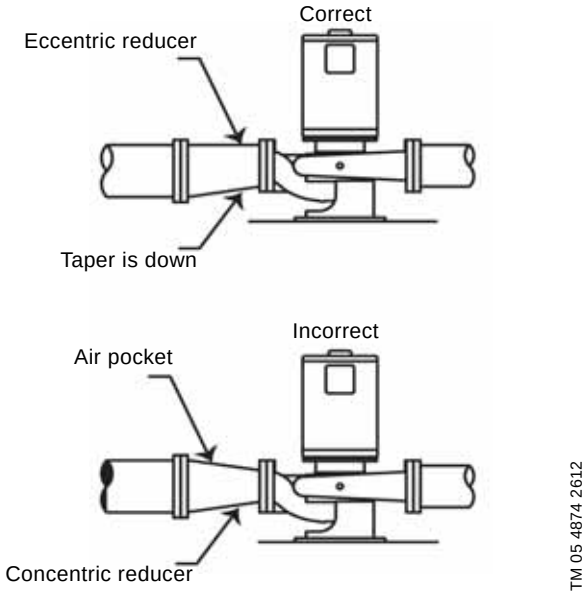


Fig. 2 Eccentric reducer usage

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.

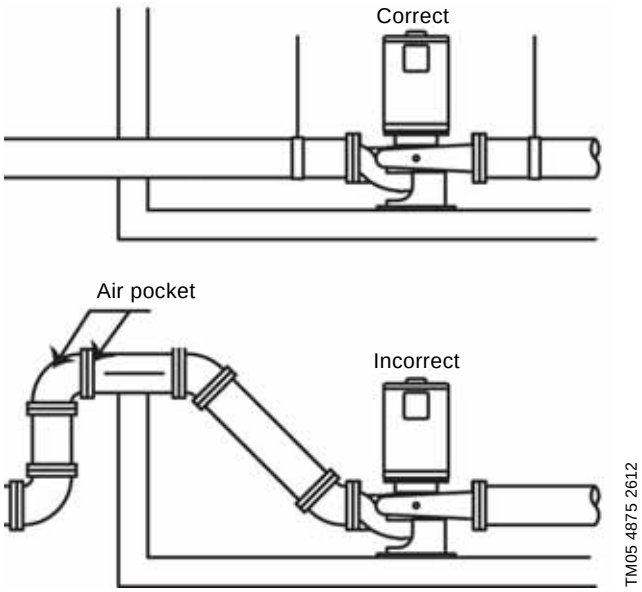


Fig. 3 Eccentric reducer usage

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.

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 a 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 yr	3 mo	6 mo
	50-150	1-3 yrs	6 mo - 1 yr	6 mo - 1 yr
	200 and Up	1 yr	3 mo	6 mo
Above 1750	All hp	1 yr	3 mo	6 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

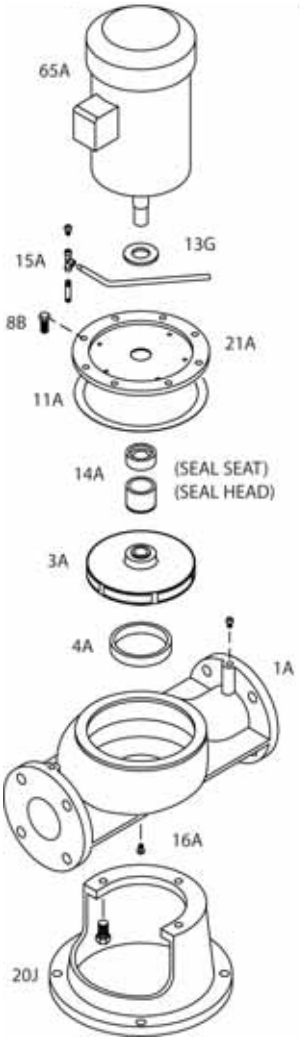
Type VLS pump is a split coupled pump. Coupling guard must be reinstalled and in place prior to operation.

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)

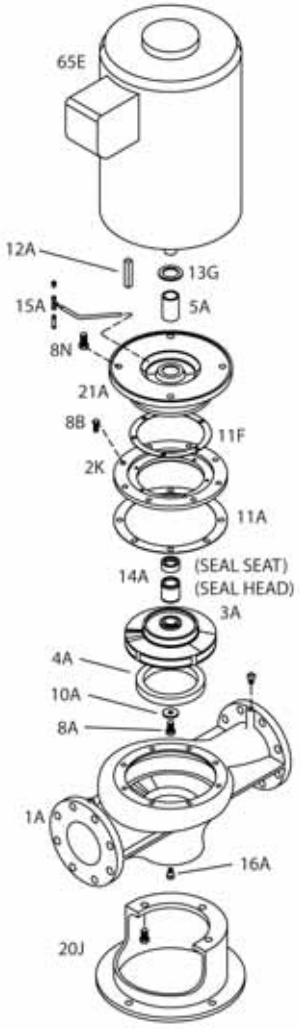


TM05 4877 2612

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)

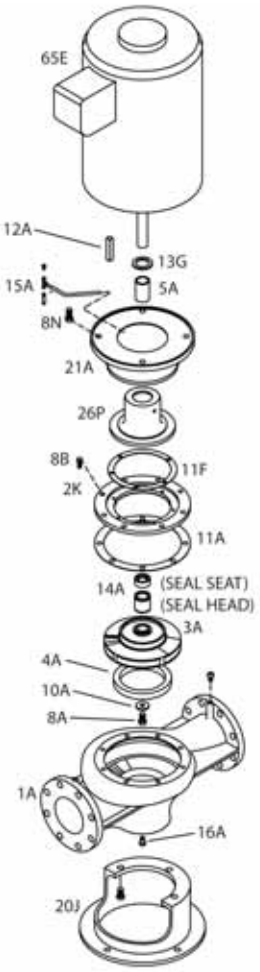


TM05 4878 2612

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)

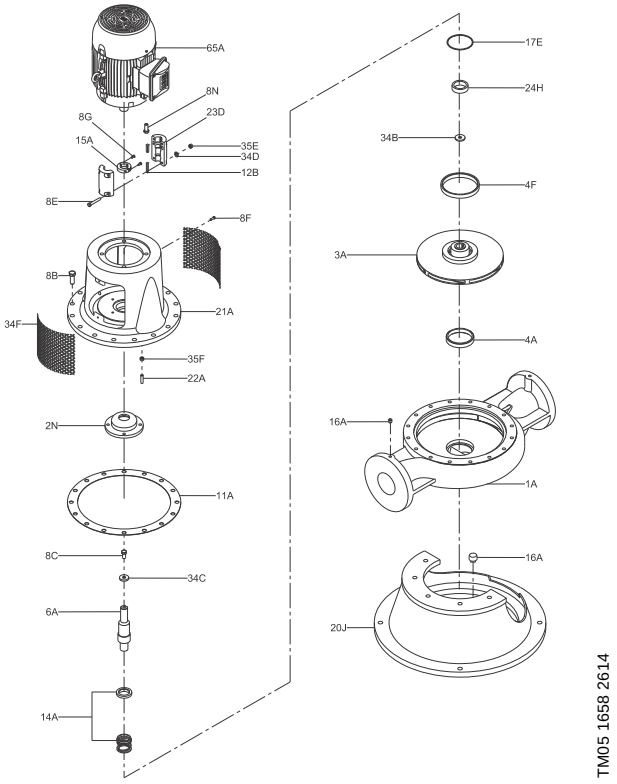


TM05 4879 0213

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

1. The pump has not been properly bled of air.
2. The pump suction line has not been completely primed.
3. 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.
4. The fluid pumped contains too much entrained air or gas.
5. There are air pockets in the suction line.
6. An entry of air has suddenly occurred in the suction line.
7. An entry of air past the shaft seal into the pump has occurred.
8. The inlet of the suction line is insufficiently submerged.
9. The suction valve is closed or only partially open.
10. The suction strainer is clogged with dirt or debris.
11. The foot valve is clogged or undersized.
12. Little or no cooling fluid supplied to the shaft seals.
13. The lantern ring is not positioned opposite the flushing inlet thereby restricting fluid flow.
14. Pump drive rotational speed too low.
15. Pump drive rotational speed too high.
16. Pump rotation wrong or impeller installed backwards.
17. Total head of installation (back pressure) higher than rated total head of the pump.
18. Total head of installation (back pressure) lower than rated total head of the pump.
19. Density of fluid pumped differs from that specified when the pump was purchased.
20. Viscosity of fluid pumped differs from that specified when the pump was purchased.
21. The pump is operating at too low a rate of flow. The discharge valve may be throttled too much.
22. If pumps are operating in parallel, the pump characteristics may not be suitable for parallel operation.
23. The impeller may be clogged with debris.
24. The impeller may be damaged.
25. The casing and impeller wear rings may be excessively worn.
26. There may be internal leakage from the discharge to the suction compartments as the result of internal gasket failure.
27. There may be a misalignment of the pump shaft.
28. The shaft may chatter because it is bent.
29. The pump may run rough due to improper balancing of the impeller.
30. The shaft may not be running due to worn bearings.
31. The impeller may be rubbing against the inside of the case.
32. The concrete pad might not be of sufficient size to provide pump stability.
33. The pump may have become misaligned during installation.
34. The operating conditions of the installation do not agree with the data specified when the pump was purchased.
35. The shaft seal may be incorrectly installed, or the stuffing box has not been packed correctly.
36. The shaft sleeve may be scored or pitted in the region of the packing due to dirt or abrasive matter in the flushing fluid.
37. Excessive tightening of the packing gland may block the flushing port thereby diminishing the sealing fluid flow.
38. 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.
39. The mechanical seal may have been damaged by running dry.
40. 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

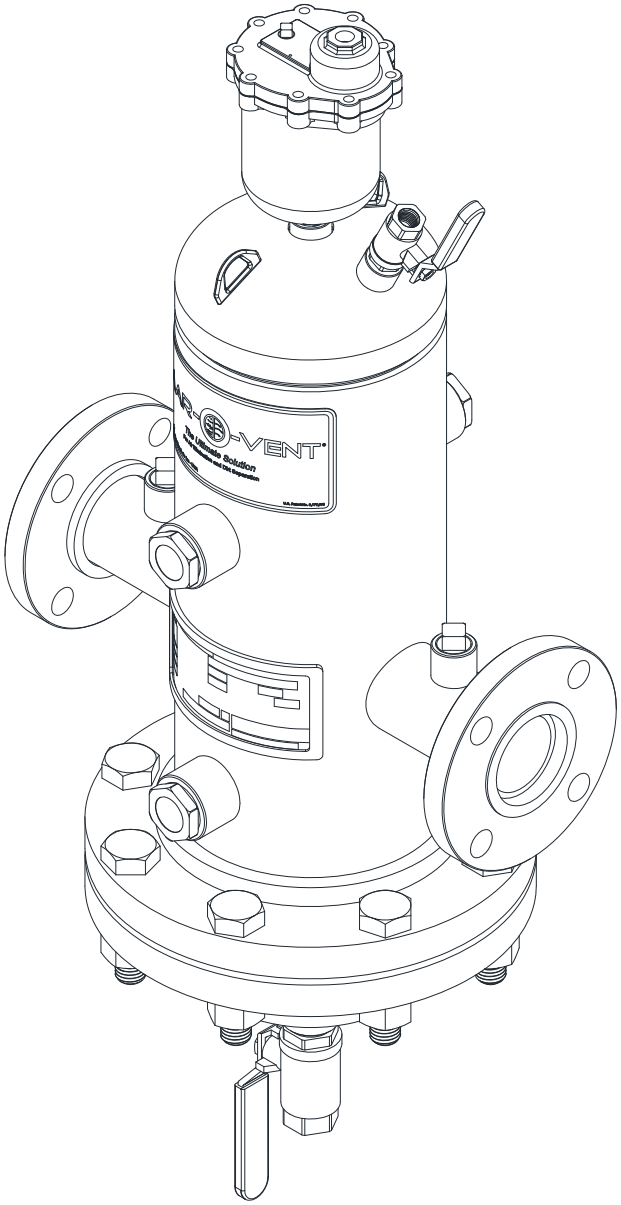
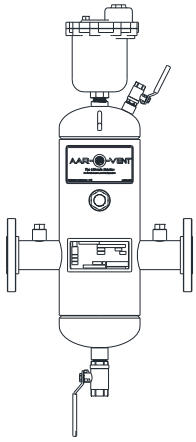


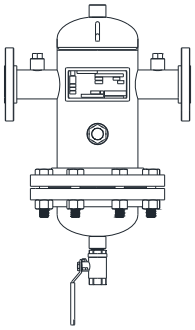
Table of Contents

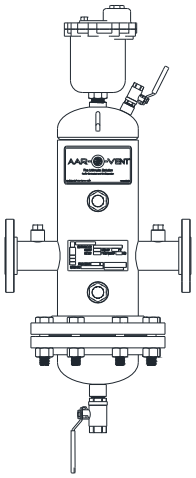
Section 1
General Product Information

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.







Model Designation

Air Separator

ASF - Standard Velocity Air Separator
AHF - High Velocity Air Separator

Dirt Separator

DSR - Standard Velocity Dirt Separator with Removable Cover
DHR - High Velocity Dirt Separator with Removable Cover
DSF - Standard Velocity Dirt Separator with Fixed Cover
DHF - High Velocity Dirt Separator with Fixed Cover

Air & Dirt Separator

SVR - Standard Velocity Air & Dirt Separator with Removable Cover
HVR - High Velocity Air & Dirt Separator with Removable Cover
SVF - Standard Velocity Air & Dirt Separator with Fixed Cover
HVF - High Velocity Air & Dirt Separator with Fixed Cover

(L) AFTER ANY MODEL # DENOTES "LESS OPTIONS"

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.

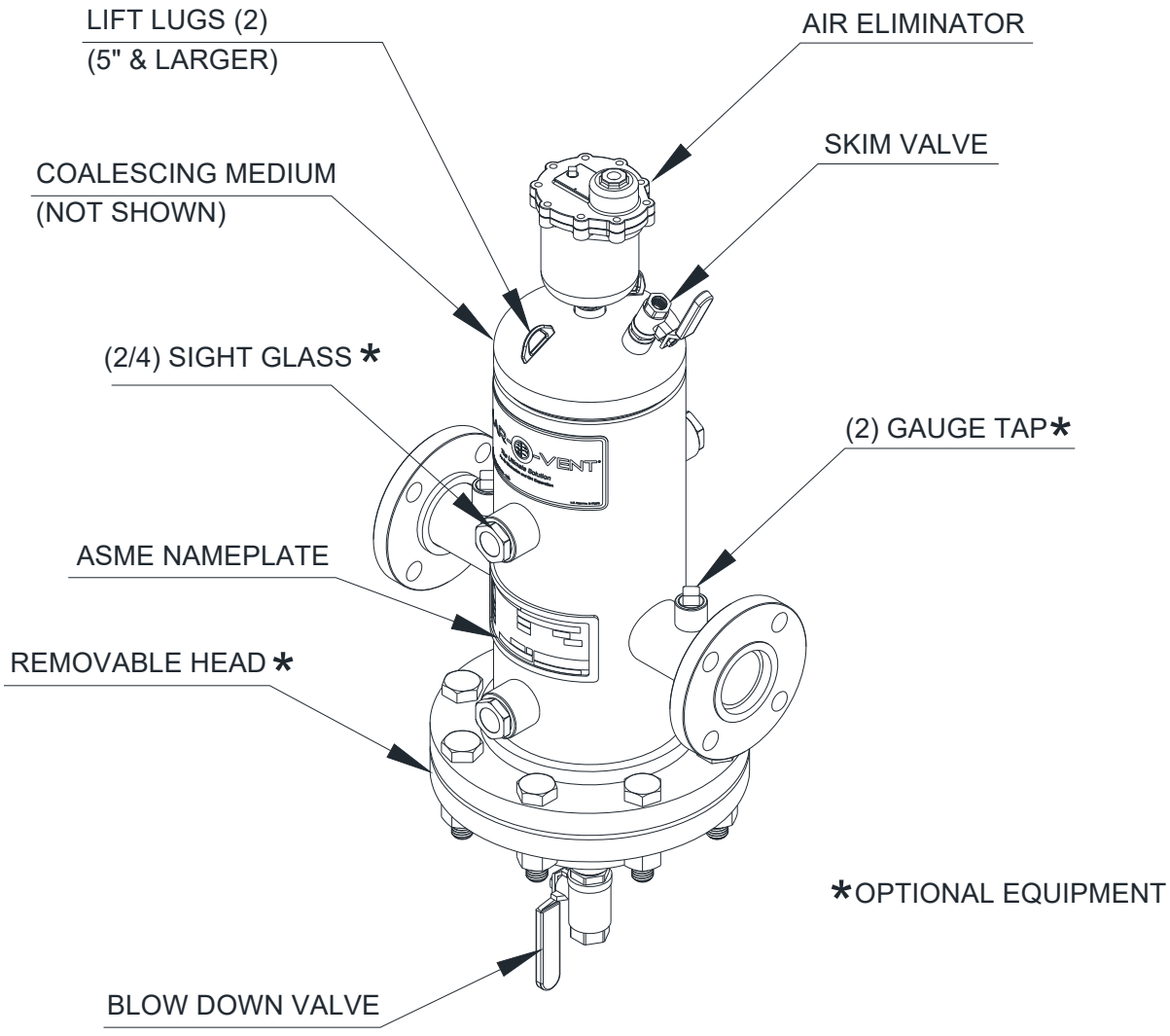


Figure 3-1 Components

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.

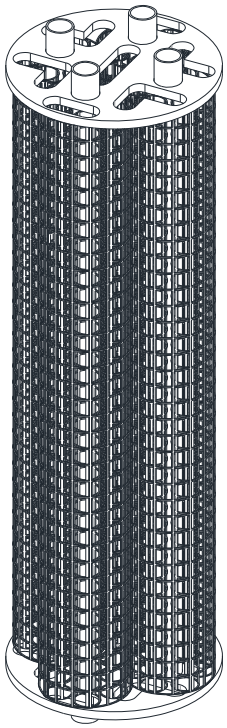


Figure 3-2 Coalescing Medium

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.

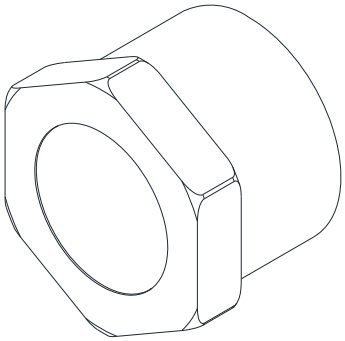


Figure 3-3 Sight Glass

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.

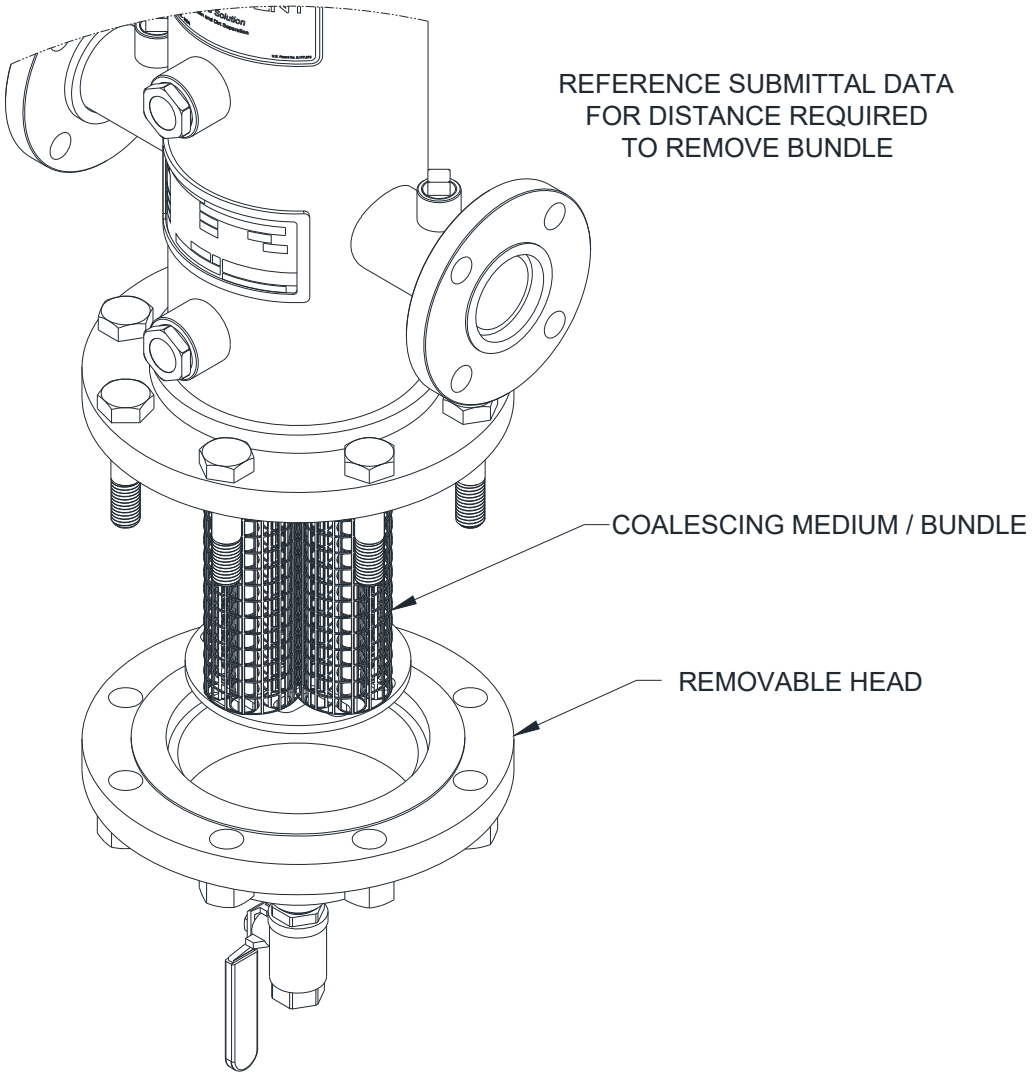


Figure 3-4 Removable Head Detail

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.

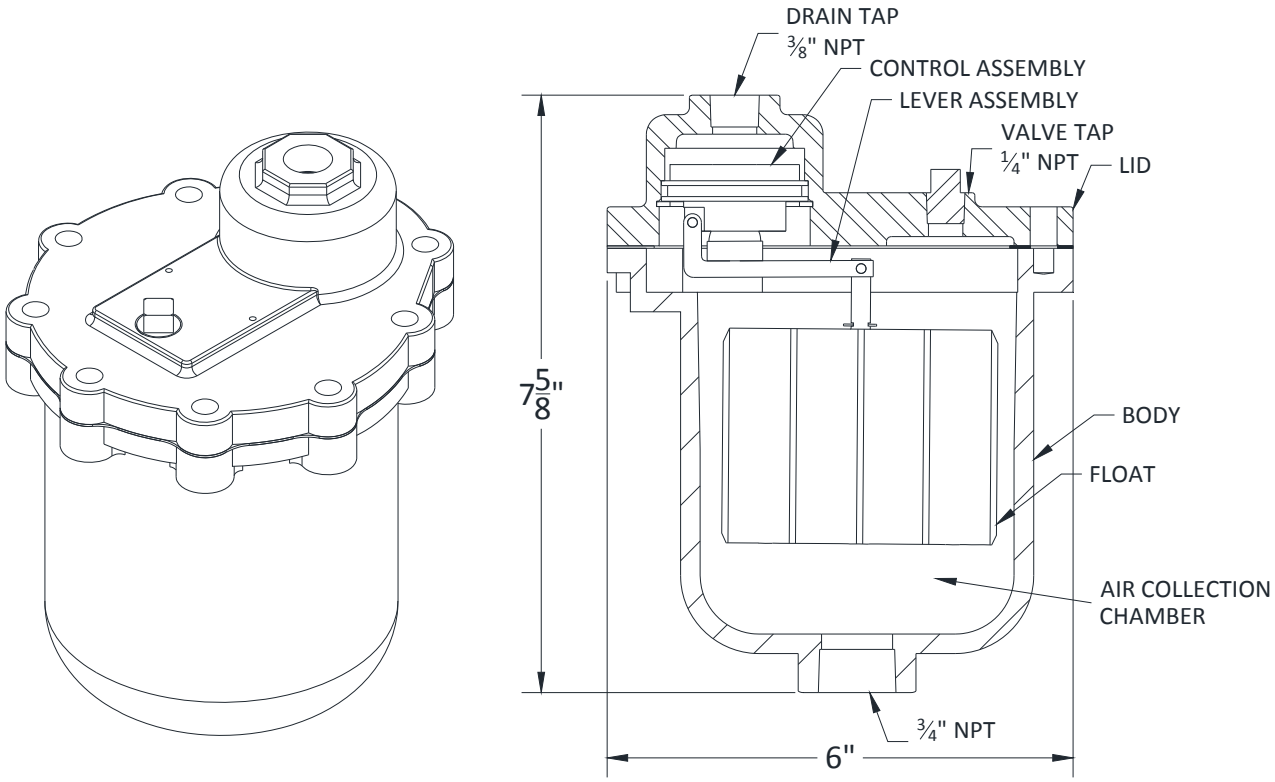


Figure 3-5 Air Vent

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).

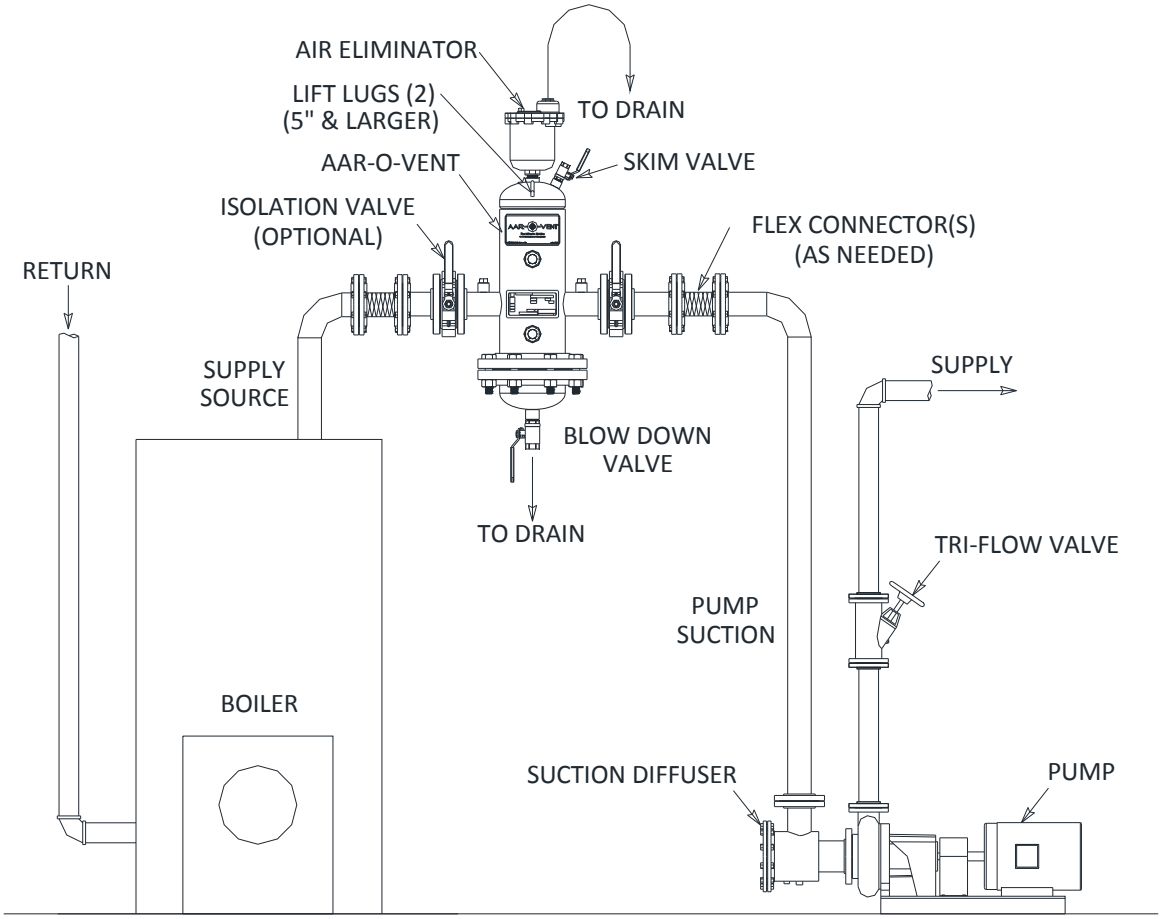


Figure 4-1 Typical Piping Diagram

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)

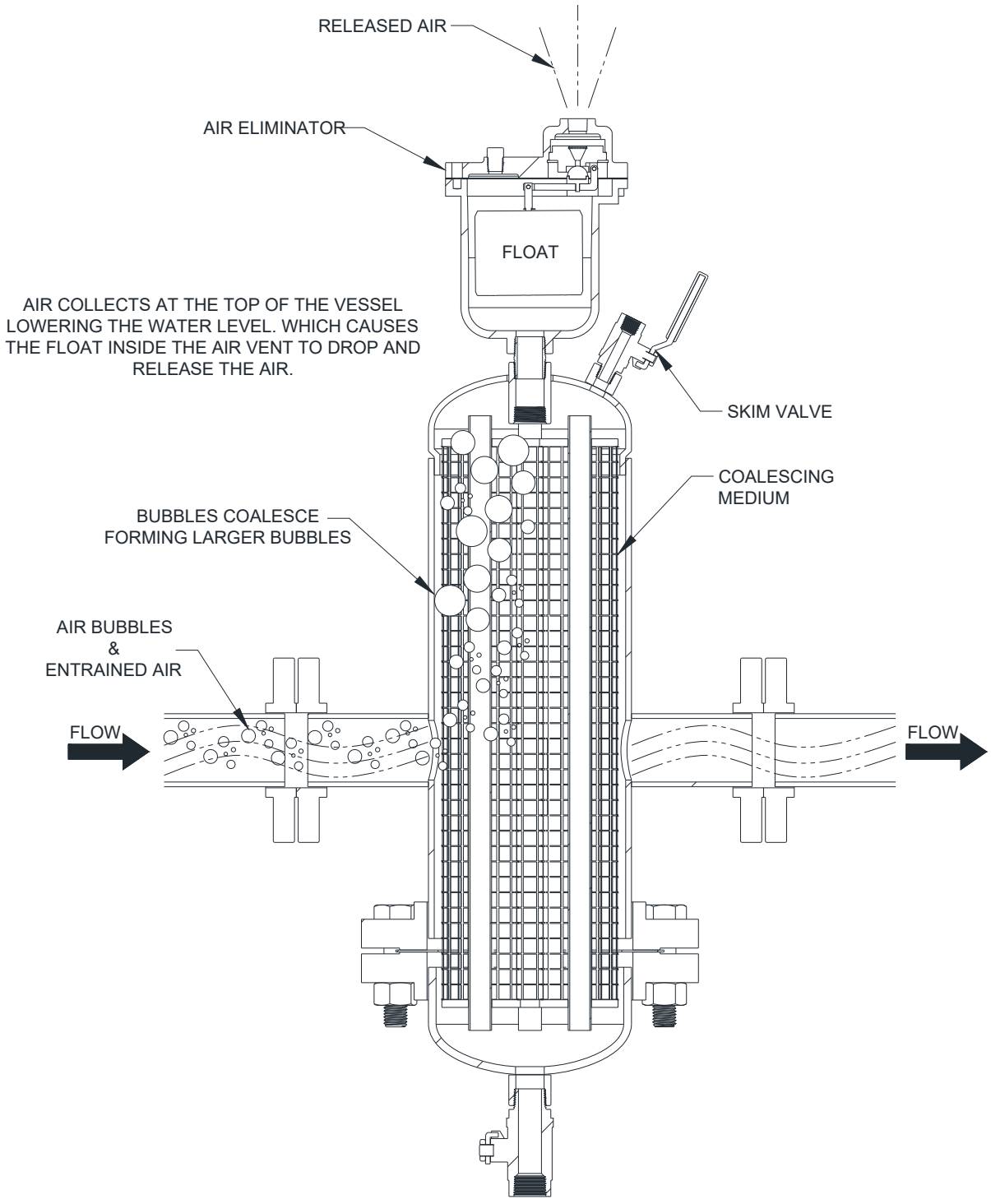


Figure 4-2 Operation (Air Elimination)

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)

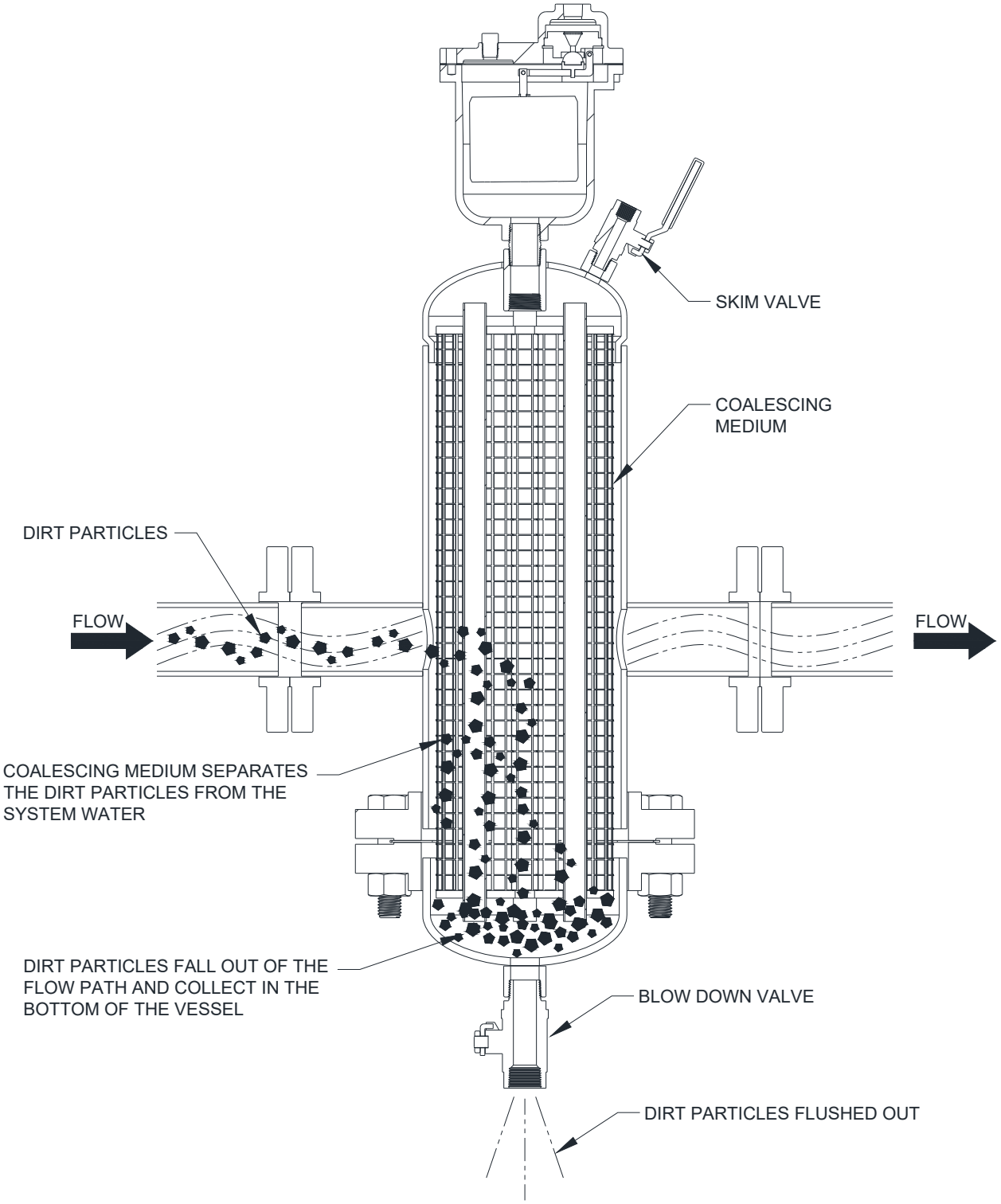


Figure 4-3 Operation (Dirt Elimination)

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.

Aar-O-Vent Connection size	Removable Head Size	Bolt Size	Number of Bolts	Torque Ft/Lb (**150#** Flgs.)
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 OPERATION & MAINTENANCE
PACO SUCTION DIFFUSER
TYPE PSD, 125# & 250# FLANGED

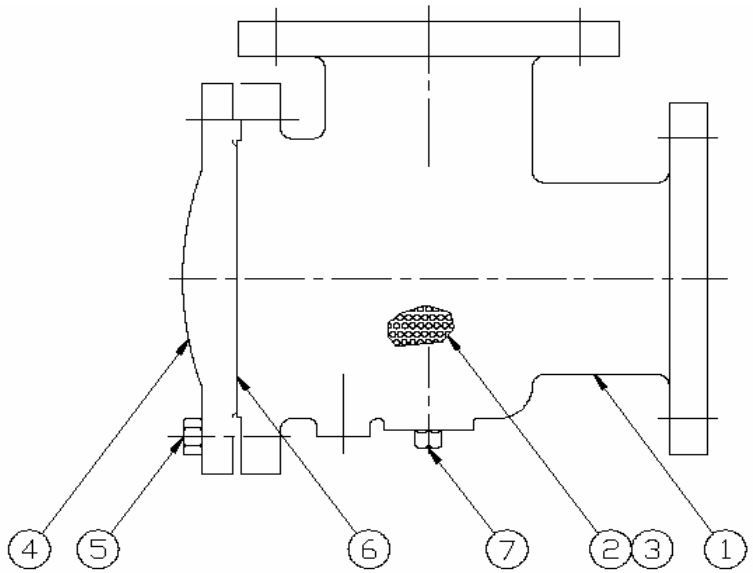
PACO PUMPS

Installation:

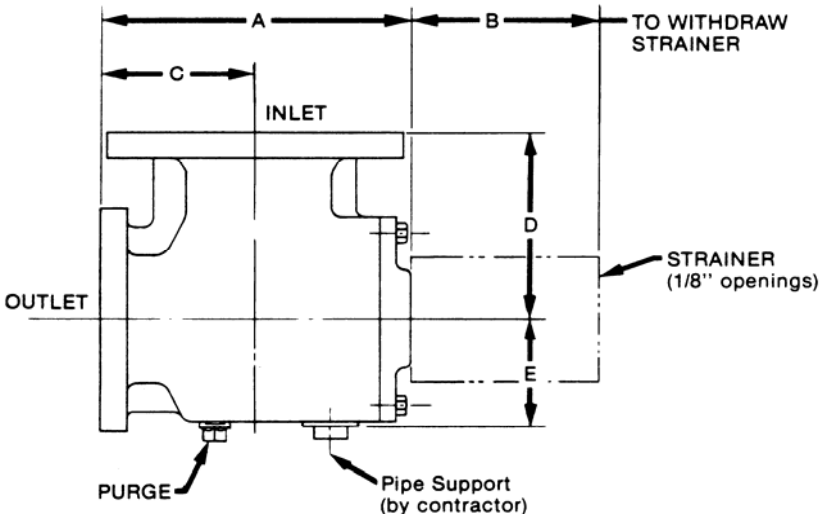
1. Install Suction Diffuser in piping with proper flow direction as indicated on diffuser.
2. Provide appropriate clearance in back of diffuser for removal of strainer. (Refer to dimension "C" on other side.)
3. Install a support leg and foot using standard pipe (see dimension "G" on other side) on underside 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 300º 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"	1¼"
PSD2020-125	2	2	38	25	10.25	4.50	4.50	4.50	2.25	6.00	3/4"	1¼"
PSD2520-125	2 1/2	2	38	30	10.75	5.00	5.00	5.00	2.50	6.50	3/4"	1¼"
PSD2525-125	2 1/2	2 1/2	40	35	10.75	5.00	5.00	5.00	2.50	6.50	3/4"	1¼"
PSD3020-125	3	2	38	35	10.25	5.50	4.50	5.50	2.25	6.00	3/4"	1¼"
PSD3025-125	3	2 1/2	40	45	11.25	5.50	5.25	5.50	3.00	7.00	3/4"	1¼"
PSD3030-125	3	3	50	50	11.25	5.50	5.25	5.50	3.00	7.00	3/4"	1¼"
PSD4030-125	4	3	50	60	13.00	6.50	6.50	6.50	3.75	8.75	1"	1¼"
PSD4040-125	4	4	78	75	12.75	6.50	6.25	6.50	3.75	8.25	1"	1¼"
PSD5040-125	5	4	78	90	15.75	7.50	8.50	7.50	4.50	10.00	1"	1¼"
PSD5050-125	5	5	102	110	16.25	7.50	6.50	7.50	5.50	10.00	1"	1¼"
PSD6040-125	6	4	78	105	13.00	8.00	8.50	8.00	3.75	8.75	1"	1¼"
PSD6050-125	6	5	102	125	17.00	8.00	9.50	8.00	5.50	10.75	1"	1¼"
PSD6060-125	6	6	154	150	17.00	8.00	9.50	8.00	5.50	10.75	1"	1¼"
PSD8060-125	8	6	154	195	17.00	8.00	9.50	9.00	5.50	10.75	1"	1¼"
PSD8080-125	8	8	280	255	20.75	9.00	13.50	9.00	7.00	11.50	1¼"	2"
PSD1080-125	10	8	280	310	20.75	9.00	13.50	11.00	7.00	11.50	1¼"	2"
PSD1010-125	10	10	430	400	26.25	11.00	17.75	11.00	9.75	14.25	1¼"	2"
PSD1280-125	12	8	280	400	25.25	11.00	17.00	11.00	8.25	15.00	1¼"	2"
PSD1210-125	12	10	430	475	26.25	11.00	17.75	12.00	9.75	14.25	1¼"	2"
PSD1212-125	12	12	560	575	26.25	12.00	17.75	12.00	9.75	15.25	1¼"	2"

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

pettitpettit
CONSULTING ENGINEERS, INC

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 14 – Hydronic Piping Specialties	Approved as Noted	o	- Provide with stainless steel ball and stem. - Automatic air vent shall be provided where required per details.

✓ ✗ o ✳

Note:

SUBMITTAL DATA

DATE: November 6, 2023

PROJECT: UCA Snow Fine Arts

CONTRACTOR: Comfort Systems USA

ENGINEER: Pettit & Pettit Engineers

GRISWOLD VALVE PACKAGES

*Pipe, 2-Way/3-Way ATC Valve (by others), and coil sizes will be coordinated in the field. We will coordinate actual sizes with approved equipment submittals before ordering.

*TBD - Incoming line sizes will also be coordinated with field conditions.

TAG	MODEL	Pipe Size	Coil Size	GPM	ATC Size
VAV	CPP2IRIS	¾"	TBD	As Scheduled	TBD
RHC-1	CPP2IRIS	Per Plans	TBD	As Scheduled	TBD
RTU-1 HW	CPP2IRIS	Per Plans	TBD	As Scheduled	TBD
AH-6 HW	CPP2IRIS	Per Plans	TBD	As Scheduled	TBD
RTU-1 CW	CPPAHU	Per Plans	TBD	As Scheduled	TBD
AH-6 CW	CPPAHU	Per Plans	TBD	As Scheduled	TBD

10350 Riverview Corporate Drive · Maumelle, AR 72113
Phone (501) 663-8886 · Fax (501) 663-8738
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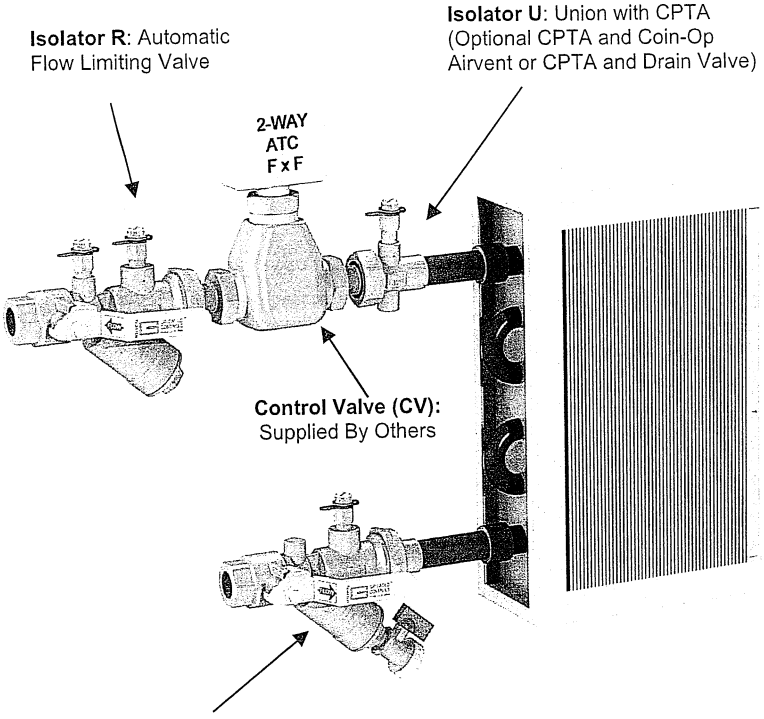

LINE TYPE:
- ❑ FNPT
- ❑ SWT
- ❑ QuickPress[1]

COIL TYPE:
- ❑ FNPT
- ❑ SWT ❑ MNPT
- ❑ QuickPress[1]

LINE SIZE:	COIL SIZE:	CV SIZE:
❑ 1/2"	❑ 1/2"	❑ 1/2"
❑ 3/4"	❑ 3/4"	❑ 3/4"
❑ 1"	❑ 1"	❑ 1"
❑ 1-1/4"	❑ 1-1/4"	❑ 1-1/4"
❑ 1-1/2"	❑ 1-1/2"	❑ 1-1/2"
❑ 2"	❑ 2"	❑ 2"

BALL & STEM:
- ❑ Nickel-plated brass ball & brass stem
- ❑ Stainless Steel ball & stem

COMPONENT OPTIONS:
- ❑ 1-1/2" Ext Kit ❑ 2" Ext Kit
- ❑ Strainer 20 Mesh ❑ Strainer 50 Mesh
- ❑ Isolator S 2nd CPTA ❑ Union Coin-Op

HOSE OPTIONS (FNPT COIL):
Swivel Type: ❑ MNPT ❑ SWT
Length: ❑ 12" ❑ 18" ❑ 24" ❑ 36"

CONTROL VALVE (CV):
- ❑ Customer Supplied and Installed CV
- ❑ Customer Supplied CV - Installed By Griswold Controls

SPECIFICATIONS

Isolator R: Forged brass (ASTM B283) automatic flow control valve assembly includes integrated isolation ball valve and stainless steel flow control cartridge. Cartridge can be removed for inspection, or can be replaced without disturbing piping connections. Valve housing includes field repairable dual Teflon and EPDM o-ring seal stem, with Nickel plated ball. Valve includes one fixed end connection and one union connection. Union end includes union nut and EPDM o-ring. Valve body has two ports with (1) Pressure/Temperature Test Valves, and (1) combination Pressure/Temperature Test Valves and manual air vent (**CPTA**). PSI/Temp Rating: 1/2"–1-1/2": 600WOG-400PSI/250°F. 1-1/2"L–3": 400WOG-275PSI/250°F

Isolator S: Ball valve and integrated strainer. Valve housing is forged brass with field repairable dual Teflon and EPDM o-ring seal stem. Strainer is 20 mesh Stainless Steel and can be removed from housing without disturbing pipe connections for inspection or replacement. Valve includes one fixed connection and one union connection. Union end includes union nut and EPDM o-ring. Body has one port with combination Pressure/Temperature Test Valves (**CPTA**). Assembly includes drain valve with 3/4" hose connection with cap. PSI/Temp Rating: 1/2"–1-1/2":600WOG-400PSI/250°F. 1-1/2"L–3":400WOG-275PSI/250°F

Union: Forged brass (ASTM B283) union. Union includes one fixed end (FNPT or SWT) connection and one union (MNPT) connection. Union end includes union nut and EPDM o-ring. Union body has one port with combination Pressure/Temperature Test Valves and manual air vent (**CPTA**). PSI/Temp Rating: 400PSI/250°F

Drain Valve: Brass housing, Nickel plated ball. 1/2"-1":1/2"UNFx3/4"NPSH. 1-1/4"-2":3/4"UNFx3/4" NPSH. Rated 300PSI/250°F

Combination Pressure/Test Valve & Manual Air Vent (CPTA): Brass Housing, EPDM Seal. Rated 1000PSI/350°F Pressure/Temperature Test Valve works in conjunction with valve body feature to function as Manual Air Vent. Requires both components to operate as manual air vent.

NOTES

[1] QuickPress connections are compatible with popular press tools and are rated for maximum 200 PSI.

5/21
F-5426P

1700 Barranca Parkway, Irvine, CA 92606
(949) 559-6000 Fax (949) 559-6088
www.GriswoldControls.com

GRISWOLD CONTROLS
A FlowCon International/Griswold Controls LLC. Company

MODEL NUMBER SELECTION (R.)

Size	Model Number- FNPT Line	Model Number- SWT Line	Model Number- PRESS Line	Select Coil Size & Type[2] for Model Number	Select CV Size for Model Number
1/2"	CP2R0_E__B0	CP2R0_L__B0	CP2R0_2__B0	FNPT:(E=1/2,F=3/4) MNPT:(H=1/2, I=3/4) SWT: (K=3/8",L=1/2,M=3/4) PRESS:(2=1/2,3=3/4)	MNPT:(H=1/2)
3/4"	CP2R0_F__B0	CP2R0_M__B0	CP2R0_3__B0		MNPT:(1/2=H,I=3/4)
1/2"L	CP2R1_E__B0	CP2R1_L__B0	CP2R1_2__B0	FNPT:(E=1/2,F=3/4,G=1) MNPT:(H=1/2,I=3/4,J=1) SWT:(L=1/2,M=3/4,N=1) PRESS:(2=1/2,3=3/4,1=1)	MNPT:(H=1/2)
3/4"L	CP2R1_F__B0	CP2R1_M__B0	CP2R1_3__B0		MNPT:(1/2=H,I=3/4)
1"	CP2R1_G__B0	CP2R1_N__B0	CP2R1_1__B0		MNPT:(1/2=H,I=3/4,J=1)
1"L	CP2R2_G__B0	CP2R2_N__B0	CP2R2_1__B0	FNPT:(G=1,P=1-1/4,Q=1-1/2) MNPT:(J=1,S=1-1/4,T=1-1/2) SWT:(N=1,K=1-1/4,W=1-1/2) PRESS:(1=1, 4=1-1/4, 5=1-1/2)	MNPT:(1/2=H,I=3/4,J=1)
1-1/4"	CP2R2_P__B0	CP2R2_K__B0	CP2R2_4__B0		MNPT:(1/2=H,I=3/4,J=1,S=1-1/4)
1-1/2"	CP2R2_Q__B0	CP2R2_W__B0	CP2R2_5__B0		MNPT:(1/2=H,I=3/4,J=1,S=1-1/4,T=1-1/2)
1-1/2"L	CP2R3_Q__B0	CP2R3_W__B0	CP2R3_5__B0	FNPT:(P=1-1/4,Q=1-1/2,R=2) MNPT:(S=1-1/4, T=1-1/2,U=2) SWT:(K=1-1/4,W=1-1/2,Y=2) PRESS:(4=1-1/4, 5=1-1/2, 6=2)	MNPT:(S=1-1/4,T=1-1/2)
2"	CP2R3_R__B0	CP2R3_Y__B0	CP2R3_6__B0		MNPT:(S=1-1/4,T=1-1/2,U=2)

NOTES:

1. Standard CPPs include nickel-plated brass ball and brass stem. For optional Stainless Steel ball and stem change "CP" to "CS" in model number.
2. Insert PSID Code in 6th digit. Insert "0" for No-Cartridge option.
3. Insert Coil Size & Type in 8th digit.
4. Insert Control Valve (CV) Size in 9th digit.
5. Standard CPPs include (1) CPTA in Isolator S with 20 mesh strainer. For optional 2nd CPTA change "B" to "D" (20 mesh) or "G" (1 CPTA – 50 mesh) or "J" (2 CPTA – 50 mesh).
6. Optional Extension Kit- includes cap and tube for insulation around handle and appropriate number of extensions for PT/CPTA included in package. Change "0" to "1" for 1-1/2" extension option or "2" for 2" extension option.[3]
7. If Control Valve (CV) is installed at the factory by Griswold Controls add an "A" to end of model number.

FLOW RATES (+/-5%)

SIZE	IR MODEL NO. FOR REFERENCE	HEAD LOSS IN FEET[4]	PSID RANGE[5]	GPM
1/2", 3/4"	IR02__	7.4	2-32	0.25, 0.33, 0.50, 0.60, 0.75, 0.85, 1.00, 1.25, 1.50, 2.00, 2.50, 3.00
	IR04__	13.4	4-57	0.50, 1.00, 1.50, 2.00, 2.50, 3.00
1/2"L, 3/4", 1"	IR11__	3.5	1-14	0.33, 0.50, 0.67, 1.00, 1.33, 1.67, 2.00, 2.33, 2.67, 3.33, 4.00, 4.67, 5.00
	IR12__	7.4	2-32	0.55, 0.75, 1.00, 1.25, 1.50, 1.75, 2.00, 2.25, 2.50, 2.75, 3.00, 3.50, 4.00, 5.00, 6.00, 7.00, 8.00
	IR14__	13.4	4-57	0.75, 1.00, 1.33, 2.00, 2.67, 3.33, 4.00, 4.67, 5.33, 6.67, 8.00, 9.33, 10.00, 11.00
	IR18__	30.0	8-128	1.10, 1.50, 2.00, 3.00, 4.00, 5.00, 6.00, 7.00, 8.00, 10.0, 12.0, 14.0, 16.0
1"L, 1-1/4", 1-1/2"	IR21__	3.5	1-14	5.33, 6.00, 6.67, 7.33, 8.00, 8.67, 9.33, 10.00, 10.67, 11.33, 12.00, 12.67, 13.33, 14.00, 14.67
	IR22__	7.4	2-32	8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0
	IR24__	13.4	4-57	10.67, 12.00, 13.33, 14.67, 16.00, 17.33, 18.67, 20.00, 21.33, 22.67, 24.00, 25.33, 26.67, 28.00, 29.33
	IR28__	30.0	8-128	16.0, 18.0, 20.0, 22.0, 24.0, 26.0, 28.0, 30.0, 32.0, 34.0, 36.0, 38.0, 40.0, 42.0, 44.0
1-1/2"L - 2"	IR31__	3.5	1-14	12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38
	IR32__	7.4	2-32	18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57
	IR34__	13.4	4-57	24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76
	IR38__	30.0	8-128	36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114

NOTES

[2] Coil Type must be FNPT if hoses are required.
[3] Extension Option includes handle cover and accessory extensions for either 1-1/2" or 2" Insulation.
[4] Head Loss in Feet is provided for pump head calculations. (1 PSI = 2.307 Feet of Water)
[5] Systems with entrained air and fluid velocities less than 4FPS are susceptible to noise when using the 2-32 cartridge. If your system has entrained air and flowrates less than 2GPM please consider using the 4-57 cartridge.

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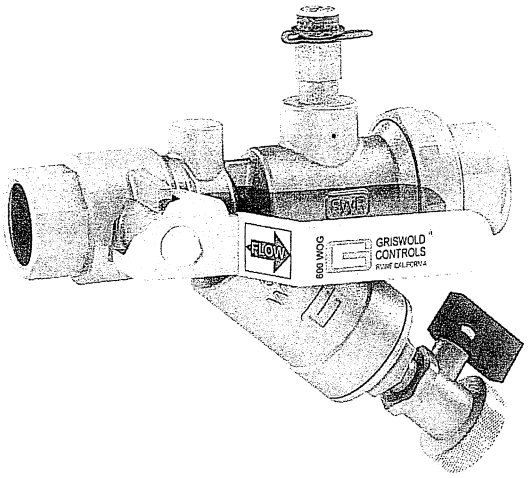
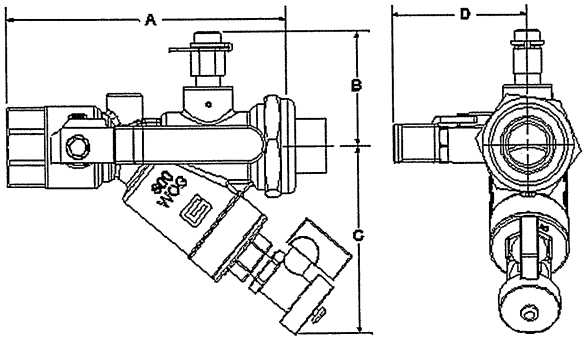


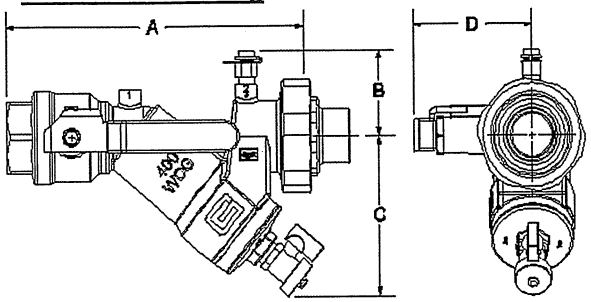
SPECIFICATIONS

PSI/Temperature Rating:	1/2"–1-1/2": 600 WOG 400 PSI / 250° F 1-1/2"L–3": 400 WOG 275 PSI / 250° F
Body Material:	1/2"–1-1/2": Forged Brass ASTM B283-06 1-1/2"L–3": Cast brass
End Connections:	Brass – NPT, Sweat, QuickPress[1], Grooved[2]
Ball Valve Seals:	Teflon
Union Seal:	EPDM O-Ring
Body Tappings[3]:	(3) Bosses for CPTAs and Drain Valve
Ball Valve:	Nickel-plated brass ball Optional: Stainless Steel ball
Field Repairable Stem:	Dual Teflon seals and EPDM O-ring
Strainer:	20 mesh stainless steel (optional 50 mesh)
Options:	Combination P/T Test Valve and Manual Air Vent (CPTA), Drain Valve, or 1/2" Bypass[4], Extension Option

1/2" – 1-1/2" Housing



1-1/2"L - 3" Housing



DIMENSIONS & WEIGHTS (NOMINAL)

All dimensions are for planning purposes only and may change without notice.

SIZE	A - FIXED END CONNECTION		UNION END CONNECTION[5]						B	C	D[6]	Cv[7]	WEIGHT (LBS.)
	FNPT	SWT	FNPT		MNPT		SWT						
1/2"	3.9	3.8	1/2":1.0	3/4":N/A[8]	1/2":1.0	3/4":1.2	3/8",1/2":0.8	3/4":1.1	1.9	2.9	0.5,1.5 2.2	4.7	0.9
3/4"	3.9	4.0											
3/4"L	5.4	5.4	1/2",3/4":1.0	1":N/A[8]	1/2"-3/4":1.0	1":1.4	3/8",3/4":1.0	1/2":0.7 1":1.3	2.2	3.6	2.6, 3.2	9.1	2.3
1"	5.4	5.6											
1-1/4"	7.6	7.7	1",1-1/4",1-1/2":1.7		1",1-1/4",1-1/2":1.7[9]		1",1-1/4":1.7	1-1/2":1.4	2.5	3.1	3.1, 3.7	24.6	5.0
1-1/2"	7.5	7.9											
1-1/2"L, 2"	9.3	9.8	1-1/4", 1-1/2":1.6	2": N/A[8]	1",1-1/4":1.8	1-1/2", 2":1.6	1-1/4",2":1.6	1-1/2":1.7	2.6	3.7	3.7, 4.3	35	8.8
2"L	10.9	11.2	2": 2.5		2": 1.6		2": 1.6		2.9	4.0	4.0, 4.6	60	12.4
2-1/2"	11.1	N/A	N/A[10]										
3"	11.3	N/A											

For QuickPress connections add 3.1" (1/2") 3.6" (3/4", 3/4"L), 4.1" (1"), to the FNPT length (A) listed for a valve.

NOTES

[1] QuickPress is available on ½" to 1" valves only. Connections are compatible with popular press tools and are rated for maximum 200 PSI.
[2] Grooved End connection is available on 2-1/2" and 3" valves only.
[3] Body Tappings for accessories are a leak proof metal to metal seal and do not require pipe dope or tape. Tape or dope should not be used.
[4] Bypass is only available on 1/2" to 1-1/2" valves.
[5] For overall length, add union end connection length to body length.
[6] Space Saver handle standard on 1/2"-3/4" valves. Standard handle on 1" to 3" valves and 1-1/2" extended handle in 1/2" to 3" is compatible with 1-1/2" insulation. Largest extended handle is compatible with 2" insulation.
[7] Cv's are based on a clean 20 mesh stainless steel strainer. When a 50 mesh screen is used, multiply PSID by 1.3.
[8] Tailpiece is not available for this size. Male tailpiece used with coupling.
[9] 1-1/4"–1-1/2" valves can also take 1/2"–3/4" MNPT tailpieces.
[10] 2-1/2" and 3" Valves are fixed end by fixed end connection. Union connection is not available.

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MODEL NUMBER SELECTION[11]

I S

Select a Housing Size (0=1/2"-3/4", 1=3/4"L-1", 2=1-1/4"-1-1/2", 3=1-1/2"L-2", 4=2"L-3")

Select an Accessory Package (B=CPTA & Drain Valve (20 mesh), C=CPTA, Drain Valve & Bypass (20 mesh)[12] D=(2) CPTAs & Drain Valve(20 mesh), E=Bypass Plug (20 mesh), G=CPTA & Drain Valve (50 mesh) H= CPTA, Drain Valve & Bypass (50 mesh))

Select Ball and Stem Package (P=Plated Ball, S=SS Ball and Stem)

Extension Option[13] (0=No, 1=1-1/2", 2=2")

T=Optional 3"x3" Aluminum Hanging I.D. Tag

	FIXED END OR UNION END[14] (No Union Tailpiece=Z)			UNION END ONLY[14]
Valve	Female Threaded	Female Sweat	QuickPress	Male Threaded
IS0	1/2"=E, 3/4"=F[15]	3/8"=K[16], 1/2"=L, 3/4"=M	1/2"=2, 3/4"=3	1/2"=H, 3/4"=I
IS1	1/2"=E[16], 3/4"=F, 1"=G[15]	3/8"=K[16], 1/2"=L[16], 3/4"=M, 1"=N	1/2"=2[16], 3/4"=3, 1"=1	1/2"=H, 3/4"=I, 1"=J
IS2	1"=G[16], 1-1/4"=P, 1-1/2"=Q	1"=N[16], 1-1/4"=K, 1-1/2"=W	N/A	1/2"=H, 3/4"=I, 1"=J, 1-1/4"=S, 1-1/2"=T
IS3	1-1/4"=P[16], 1-1/2"=Q, 2"=R[15]	1-1/4"=K[16], 1-1/2"=W, 2"=Y	N/A	1-1/4"=S , 1-1/2"=T, 2"=U
IS4[14] (Union)	2"=L	2"=Y	N/A	1-1/4"=S , 1-1/2"=T, 2"=U
IS4[14] (Fixed End)	2"=L, 2-1/2"=M, 3"=N[17]	N/A	N/A	N/A

NOTES

[11] Model no. and flow rate are indicated on label affixed to body.
[12] C option with bypass is only available for 1/2" to 1-1/2" size.
[13] Extension Option includes handle cover and accessory extensions for either 1-1/2" or 2" insulation.
[14] Select the Fixed End First and the Union End Second. For 2-1/2" and 3" size select a 2nd fixed end instead of a union end.
[15] Tailpiece is not available for this size. Male tailpiece used with coupling.
[16] Fixed end not available for this size. Union tailpiece only.
[17] For Grooved End option use MG=2-1/2" and NG=3".

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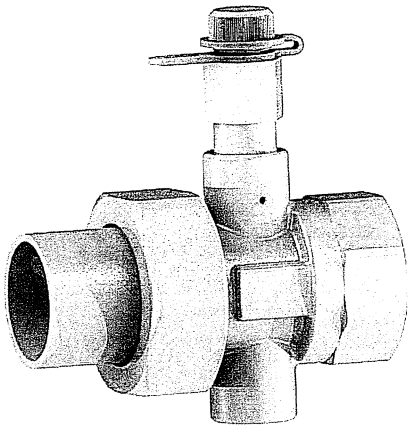
ISOLATOR UNION



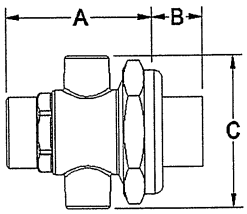
SPECIFICATIONS

PSI / Temperature Rating:	400 PSI / 250°F
Body Material:	Forged Brass ASTM B283-06
End Connections:	Brass – NPT, Sweat or QuickPress[1]
Union Seal:	EPDM O-ring
Body Tappings[2]:	(2) Bosses for CPTAs, Airvent. and Drain Valve
Options:	Combination P/T Test Valve and Manual Air Vent (CPTA), Drain Valve, Coin Operated Airvent, Extension Option

DIMENSIONS & WEIGHTS (NOMINAL)

All dimensions are for planning purposes only and may change without notice.

SIZE	A - FIXED END CONNECTION		B - UNION END CONNECTION[3]						C	WEIGHT (LBS.)
	FNPT	SWT	FNPT		MNPT		SWT			
3/8"	N/A	1.7	1/2":1.0	3/4":N/A[4]	1/2":1.0	3/4":1.2	3/8",1/2":0.8	3/4":1.1	1.2	0.3
1/2"	2.0	1.9								
3/4"	1.9	1.9								
1"	2.2	2.2	1/2",3/4":1.0	1":N/A[4]	1/2"-3/4":1.0	1":1.4	3/8",3/4": 1.0	1/2":0.7 / 1":1.3	2.0	1.1
1-1/4"	2.6	2.6	1",1-1/4",1-1/2":1.7		1",1-1/4",1-1/2":1.7[5]		1",1-1/4":1.7	1-1/2":1.4	2.7	2.4
1-1/2"	2.8	2.8								
2"	2.8	2.8	1-1/4", 1-1/2":1.6	2": N/A[4]	1",1-1/4":1.8	1-1/2", 2":1.6	1-1/4",2":1.6	1-1/2":1.7	3.4	3.2
2-1/2"	3.0	N/A	1-1/2" – 2-1/2": 1.2	3": 2.2	1-1/2"-2-1/2": 1.5	3": 2.5	2":2.0		3.7	5.1
3"	3.2	N/A								5.6



For QuickPress connections add 3.1" (1/2"), 3.6" (3/4"), 4.1" (1") to the FNPT length (A) listed for a valve.

MODEL NUMBER SELECTION

I U _____ _____ _____ _____ _____

Select a Housing Size (0=1/2"-3/4", 1=1", 2=1-1/4"-1-1/2", 3=2", 4=2-1/2"-3")

Select an Accessory Package (0=No Port, B=CPTA, C=CPTA & Drain Valve, D=Coin-Op Airvent, E=Coin-Op Airvent and CPTA)

Extension Option[6] (0=No, 1=1-1/2", 2=2")

	FIXED END OR UNION END[7] (No Union Tailpiece=Z)			UNION END ONLY[7]
Valve	Female Threaded	Female Sweat	QuickPress	Male Threaded
IU0	1/2"=E, 3/4"=F[4]	3/8"=K, 1/2"=L, 3/4"=M	1/2"=2, 3/4"=3	1/2"=H, 3/4"=I
IU1	1/2"=E[8], 3/4"=F[8], 1"=G[4]	3/8"=K[8], 1/2"=L[8], 3/4"=M[8], 1"=N	1/2"=2[8], 3/4"=3[8], 1"=1	1/2"=H, 3/4"=I, 1"=J
IU2	1"=G[8], 1-1/4"=P, 1-1/2"=Q	1"=N[8], 1-1/4"=K, 1-1/2"=W	N/A	1/2"=H, 3/4"=I, 1"=J, 1-1/4"=S, 1-1/2"=T
IU3	1-1/4"=P[8], 1-1/2"=Q[8], 2"=R[4]	1-1/4"=K[8], 1-1/2"=W[8], 2"=Y	N/A	1-1/4"=S , 1-1/2"=T, 2"=U
IU4	1-1/2"=Q[8], 2"=R[8], 2-1/2"=A, 3"=B	2"=Y[8]	N/A	1-1/2"=T, 2"=U, 2-1/2"=C, 3"=D

NOTES

[1] QuickPress is available on 1/2" to 1" valves. Connections are compatible with popular press tools and are rated for maximum 200 PSI.
[2] Body Tappings for accessories are a leak proof metal to metal seal and do not require pipe dope or tape. Tape or dope should not be used.
[3] For overall length, add union end connection length to body length.
[4] Tailpiece is not available for this size. Male tailpiece used with coupling.
[5] 1-1/4"–1-1/2" valves can also take 1/2"–3/4" MNPT tailpieces.
[6] Extension Option includes accessory extensions for either 1-1/2" or 2" insulation.
[7] Select the Fixed End First and the Union End Second.
[8] Fixed end not available for this size. Union tailpiece only.

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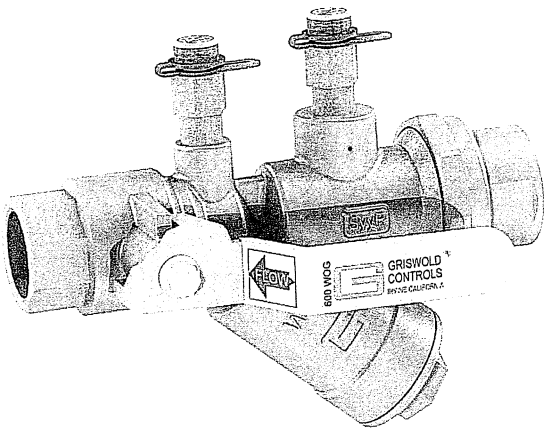
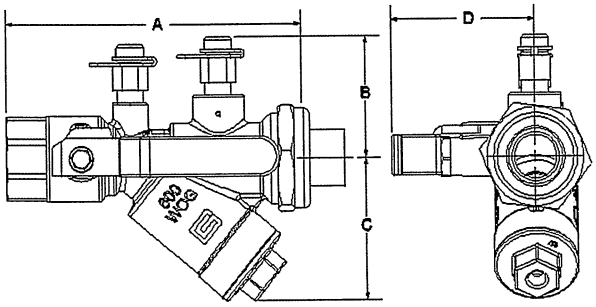
ACCESSIBLE CARTRIDGE



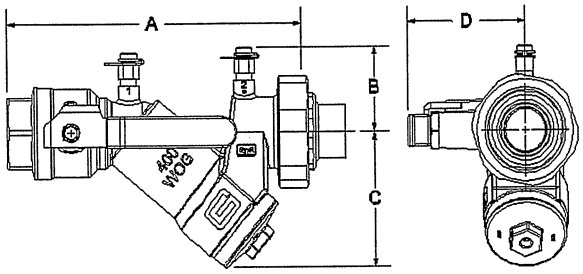
SPECIFICATIONS

PSI/Temperature Rating:	1/2"–1-1/2": 600 WOG 400 PSI / 250° F 1-1/2"L–3": 400 WOG 275 PSI / 250°F
Cartridge:	AISI Type 304 stainless steel AISI Type 17-7 PH stainless steel spring
Body Material:	1/2"–1-1/2": Forged brass ASTM B283-06 1-1/2"L–3": Cast brass
End Connections:	Brass – NPT, Sweat or QuickPress[1]
Ball Valve Seals:	Teflon
Union Seal:	EPDM O-Ring
Body Tappings[2]:	Two Combination P/T Test Valve and Manual Air Vent (CPTA)
Ball Valve:	Nickel-plated brass ball Optional: Stainless Steel ball
Field Repairable Stem:	Dual Teflon seals and EPDM O-ring

1/2" – 1-1/2" Housing



1-1/2"L – 3" Housing



DIMENSIONS & WEIGHTS (NOMINAL)

All dimensions are for planning purposes only and may change without notice.

SIZE	A - FIXED END CONNECTION		UNION END CONNECTION[3]						B	C	D[4]	Cv[5]	WEIGHT (LBS.)
	FNPT	SWT	FNPT		MNPT		SWT						
1/2"	3.9	3.8	1/2":1.0	3/4":N/A[6]	1/2":1.0	3/4":1.2	3/8",1/2":0.8	3/4":1.1	1.9	2.9	0.5,1.5 2.2	2.3	1.0
3/4"	3.9	4.0											
1/2"L	5.3	5.5	1/2",3/4":1.0	1":N/A[6]	1/2"-3/4":1.0	1":1.4	3/8",3/4": 1.0	1/2":0.7	1":1.3	2.2	3.6	1.6, 2.6, 3.2	10.9	2.3
3/4"L	5.4	5.4												
1"	5.4	5.6										2.6,3.2		
1"L	8.0	8.2	1",1-1/4",1-1/2":1.7		1",1-1/4",1-1/2":1.7[7]		1",1-1/4":1.7	1-1/2":1.4		2.5	3.1	3.1, 3.7	28.5	5.0
1-1/4"	7.6	7.7												
1-1/2"	7.5	7.9												
1-1/2"L	9.4	9.6	1-1/4", 1-1/2":1.6	2": N/A[6]	1",1-1/4":1.8	1-1/2", 2":1.6	1-1/4",2":1.6	1-1/2":1.7		2.6	3.7	3.7, 4.3	40	8.8
2"	9.3	9.8												
2"L	10.9	11.2	2": 2.5		2": 1.6		2": 1.6			2.9	4.0	4.0, 4.6	75	13.6
2-1/2"	12.1	N/A	N/A[8]											
3"	12.3	N/A												

For QuickPress connections add 3.1" (1/2", 1/2"L) 3.6" (3/4", 3/4"L), 4.1" (1") to the FNPT length (A) listed for a valve.

NOTES

[1] QuickPress is available on 1/2" to 1" valves. Connections are compatible with popular press tools and are rated for maximum 200 PSI.
[2] Body Tappings for accessories are a leak proof metal to metal seal and do not require pipe dope or tape. Tape or dope should not be used.
[3] For overall length, add union end connection length to body length.
[4] Space Saver handle standard on 1/2"-3/4" valves. Standard handle on 1" to 3" valves and 1-1/2" extended handle in 1/2" to 3" is compatible with 1-1/2" insulation. Largest extended handle is compatible with 2" insulation.
[5] Cv's are based on housing without cartridge.
[6] Tailpiece is not available for this size. Male tailpiece used with ASME B16.15 Class 125 coupling.
[7] 1-1/4"–1-1/2" valves can also take 1/2"–3/4" MNPT tailpieces.
[8] 2-1/2" and 3" Valves are fixed end by fixed end connection. Union connection is not available.

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F-5386M

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MODEL NUMBER SELECTION[9]

I R

Select a Housing Size (0=1/2"-3/4", 1=1/2"L,3/4"L,1", 2=1"L-1-1/2", 3=1-1/2"L-2", 4=2"L-3")

Select a PSID control range: (1=1-14 or 1-20, 2=2-32 or 8-32, 4=4-57, 8=8-128)

Select Ball and Stem Package (P=Plated Ball, S=SS Ball and Stem)

Extension Option[10] (0=No, 1=1-1/2", 2=2")

T=Optional 3"x3" Aluminum Hanging I.D. Tag

	FIXED END OR UNION END[11] (No Union Tailpiece=Z)			UNION END ONLY[11]
Valve	Female Threaded	Female Sweat	QuickPress	Male Threaded
IR0	1/2"=E, 3/4"=F[12]	3/8"=K[13], 1/2"=L, 3/4"=M	1/2"=2, 3/4"=3	1/2"=H, 3/4"=I
IR1	1/2"=E, 3/4"=F, 1"=G[12]	3/8"=K[13], 1/2"=L, 3/4"=M, 1"=N	1/2"=2, 3/4"=3, 1"=1	1/2"=H, 3/4"=I, 1"=J
IR2	1"=G, 1-1/4"=P, 1-1/2"=Q	1"=N, 1-1/4"=K, 1-1/2"=W	N/A	1/2"=H, 3/4"=I, 1"=J, 1-1/4"=S, 1-1/2"=T
IR3	1-1/4"=P[13], 1-1/2"=Q, 2"=R[12]	1-1/4"=K[13], 1-1/2"=W, 2"=Y	N/A	1-1/4"=S , 1-1/2"=T, 2"=U
IR4[11] (Union)	2"=L	2"=Y	N/A	1-1/4"=S , 1-1/2"=T, 2"=U
IR4[11](Fixed End)	2"=L, 2-1/2"=M, 3"=N	N/A	N/A	N/A

FLOW RATES (+/-5%)

SIZE	MODEL NO.	HEAD LOSS IN FEET[14]	PSID RANGE[15]	GPM
1/2", 3/4"	IR02__	7.4	2-32	0.25, 0.33, 0.50, 0.60, 075, 0.85, 1.00, 1.25, 1.50, 2.00, 2.50, 3.00
	IR04__	13.4	4-57	0.50, 1.00, 1.50, 2.00, 2.50, 3.00
1/2"L, 3/4", 1"	IR11__	3.5	1-14	0.33, 0.50, 0.67, 1.00, 1.33, 1.67, 2.00, 2.33, 2.67, 3.33, 4.00, 4.67, 5.00
	IR12__	7.4	2-32	0.55, 0.75, 1.00, 1.25, 1.50, 1.75, 2.00, 2.25, 2.50, 2.75, 3.00, 3.50, 4.00, 5.00, 6.00, 7.00, 8.00
	IR14__	13.4	4-57	0.75, 1.00, 1.33, 2.00, 2.67, 3.33, 4.00, 4.67, 5.33, 6.67, 8.00, 9.33, 10.00, 11.00
	IR18__	30.0	8-128	1.10, 1.50, 2.00, 3.00, 4.00, 5.00, 6.00, 7.00, 8.00, 10.0, 12.0, 14.0, 16.0
1"L, 1-1/4", 1-1/2"	IR21__	3.5	1-14	5.33, 6.0, 6.67, 7.33, 8.0, 8.67, 9.33, 10.0, 10.67, 11.33, 12.0, 12.67, 13.33, 14.0, 14.67
	IR22__	7.4	2-32	8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0
	IR24__	13.4	4-57	10.67, 12.00, 13.33, 14.67, 16.00, 17.33, 18.67, 20.00, 21.33, 22.67, 24.00, 25.33, 26.67, 28.00, 29.33
	IR28__	30.0	8-128	16.0, 18.0, 20.0, 22.0, 24.0, 26.0, 28.0, 30.0, 32.0, 34.0, 36.0, 38.0, 40.0, 42.0, 44.0
1-1/2"L - 2"	IR31__	3.5	1-14	12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38
	IR32__	7.4	2-32	18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57
	IR34__	13.4	4-57	24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76
	IR38__	30.0	8-128	36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114

SIZE	MODEL NO.	HEAD LOSS IN FEET[14]	PSID RANGE	GPM			HEAD LOSS IN FEET[14]	PSID RANGE	HIGHER FLOW RATES/ NO INCREMENTS
				MIN.	INCREMENT	MAX			
2"L, 2-1/2", 3"	IR41__	3.5	1-20	14.0	2.0	60	9.2	4-20	90, 110, 130
	IR42__	7.4	2-32	17.5	2.5	75	18.4	8-32	110, 135, 160
	IR44__	13.4	4-57	23.33	3.33	100	NONE		
	IR48__	30.0	8-128	35.0	5.0	150			

NOTES

[9] Model no. and flow rate are indicated on label affixed to body.
[10] Extension Option includes handle cover and accessory extensions for either 1-1/2" or 2" Insulation.
[11] Select the Fixed End First and the Union End Second. For 2-1/2" and 3" size select a 2nd fixed end instead of a union end.
[12] Tailpiece is not available for this size. Male tailpiece used with ASME B16.15 Class 125 coupling.
[13] Fixed end not available for this size. Union tailpiece only.
[14] Head Loss in Feet is provided for pump head calculations. (1 PSI = 2.307 Feet of Water)
[15] Systems with entrained air and fluid velocities less than 4FPS are susceptible to noise when using the 2-32 cartridge. If your system has entrained air and flowrates less than 2GPM please consider using the 4-57 cartridge.

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F-5386M

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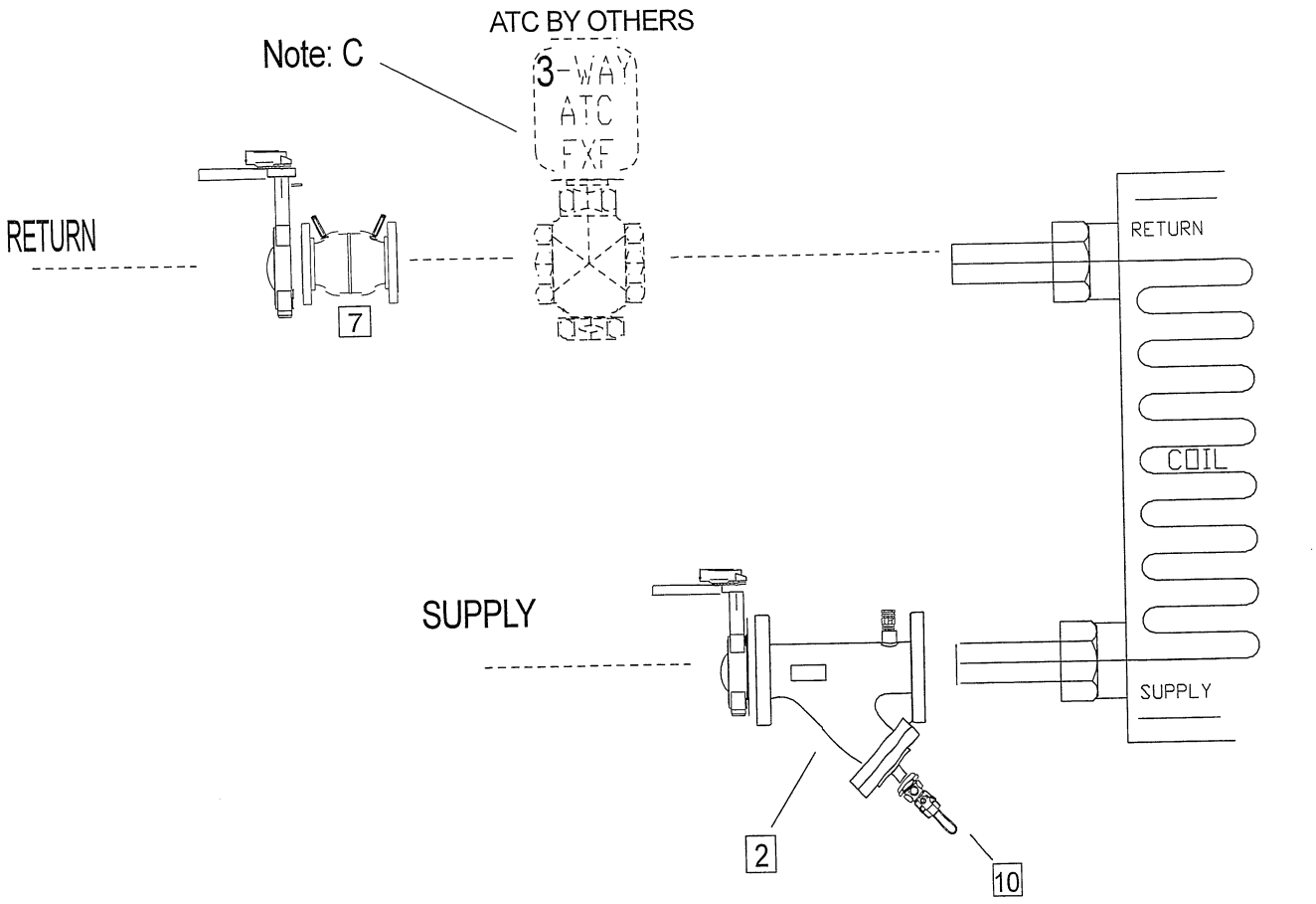
Air Handling Unit Packages



NOTES:

A. All piping, elbows, and tees are by others.

B. All PT's, and air vents will be provided with extensions.

C. ATC valve is provided & Installed by others.

LEGEND

1. Butterfly Valve
2. Strainer
3. Flanged Reducer
4. Flanged Tee
5. Threaded Flange (Typical) - Shipped Loose
6. Union
7. Manual Balance Valve
8. Automatic Flow Control
9. Accessory Flange
10. Drain Valve (Typical) w/ hose adapter- Shipped Loose
11. PT Port
12. Air Vent (Typical) - Shipped Loose
13. Shutoff Valve w/ Union End

Griswold Controls

Representative: Fluid Solutions, Inc.

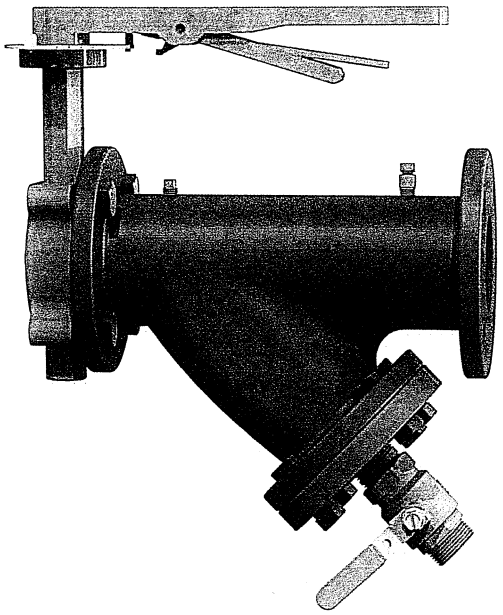
PROJECT:

ENGINEER:

TAG:

Fluid Solutions Incorporated

10350 Riverview Corporate Drive
North Little Rock, AR 72113
Phone: 501-663-8886 • Fax: 501-663-8738
www.fluidsolutionsinc.com



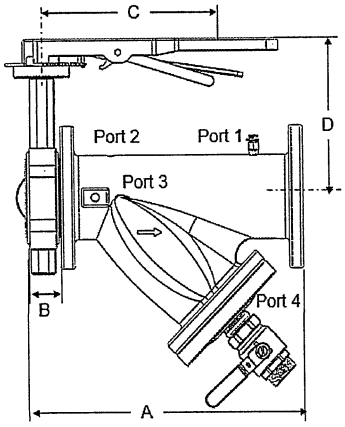
SPECIFICATIONS

PSI/Temperature Rating:	175 PSI / 150° F
Body Material:	Cast Iron ASTM A126 Class B
End Connections:	Flanges ANSI B16.1 Class 125
Body Tappings:	Port 1: 1/4" NPT with PT; Port 2: 1/4" NPT; Port 3: 3/4" NPT; Port 4: Ball Valve to be used as drain valve
Strainer:	Stainless steel 304 ASTM 167
Butterfly Valve:	Cast Iron ASTM A126 Class B EPDM, Aluminum bronze, stainless steel stem
Assembly:	Valve comes fully assembled. Mating flanges supplied by others.

DIMENSIONS & WEIGHTS (NOMINAL)

All dimensions are for planning purposes only and may change without notice.

SIZE	A LENGTH	B[3]	C	D	HOLE Dia.	# OF HOLES	DRAIN SIZE	WEIGHT (LBS.)
2-1/2"	12.8	1.8	10.5	6.0	0.75	4	1"	57
3"	16.4	1.8	10.5	6.3	0.75	4	1"	86
4"	15.9	2.0	10.5	7.0	0.88	8	1-1/4"	90
5"	18.1	2.1	10.5	7.5	0.88	8	1-1/4"	150
6"	21.1	2.1	10.5	8.0	0.88	8	1-1/2"	196
8"	26.1	2.5	14.0	9.5	0.88	8	1-1/2"	245



MODEL NUMBER SELECTION

3 6 5 0 ___ B ___

Insert M=2-1/2", N=3", P=4", Q=5", R=6", S=8"

Add "W" for optional weldneck flanges

OPTIONS (ORDER AS SEPARATE LINE ITEMS, INSTALLED IN THE FIELD):

Pressure/Temperature Test Valve – 1/4": 6889
Manual Air Vent – 1/4": 738-01

NOTES

[3] B dimension does not include seat.

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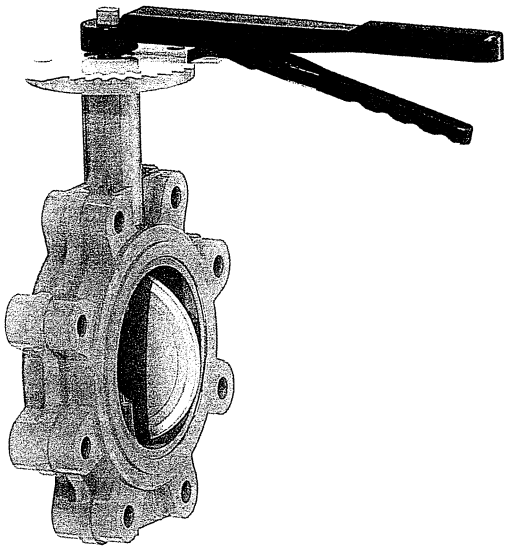


SPECIFICATIONS

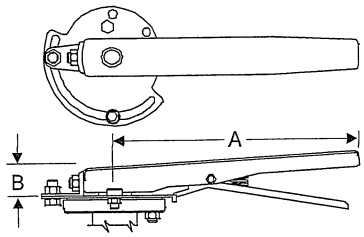
PSI/Temp Rating:	2-1/2" - 12": 200PSI/275°F 14" - 20": 150PSI/275°F
Body:	Ductile Iron
Disc:	Aluminum Bronze (Optional Stainless Steel Disc)
Shaft:	316/416 Stainless Steel
Bushing:	PTFE
Seat:	EPDM Standard
Key:	Carbon Steel
O-Ring:	NBR
Plate:	2-1/2" – 6": Infinite Adjustable[1]
Service:	Bi-directional or Dead End
Standard:	MSS-SP-67
Options:	Stainless Steel Plate to convert valve to outdoor use[2]

DIMENSIONS & WEIGHTS (NOMINAL)

All dimensions are for planning purposes only and may change without notice.

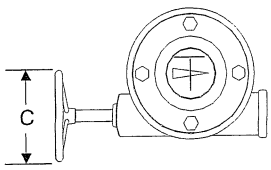
DIM	SIZE											
	2-1/2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"
A	6.9	7.1	7.9	8.4	8.9	10.3	11.5	13.3	14.5	15.8	16.6	18.9
B	5.5	6.0	7.5	8.5	9.5	11.8	14.3	17.0	18.8	21.3	22.8	25.0
C[3]	1.8	1.8	2.1	2.2	2.2	2.4	2.7	3.1	3.1	4.0	4.5	5.0
D	1.3	1.3	1.3	1.3	1.3	1.8	1.8	1.8	1.8	2.0	2.0	2.5
L	5.5	6.0	7.5	8.5	9.5	11.8	14.3	17.0	18.8	21.3	22.8	25.0
M	4	4	8	8	8	8	12	12	12	16	16	20
Weight	10	16	28	30	33	72	95	128	178	255	290	494

Infinite Adjustable Lever Handle

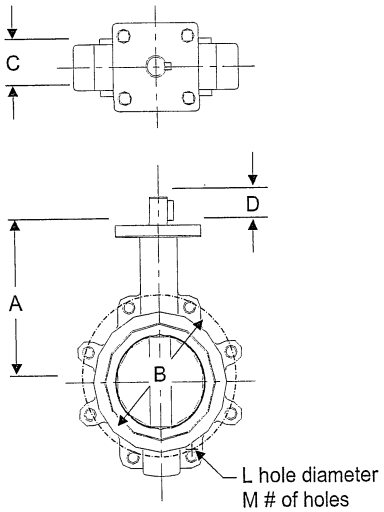


Size	Bore for Shaft	A	B
2-1/2"–3"	0.50	10.5	1.06
4"	0.63	10.5	1.06
5"–6"	0.75	10.5	1.06

Gear Operator



Size	C
8"-18"	11.8
20"	15.8



NOTES:

[1] Infinite Adjustable Plate not available on "MADE IN USA" butterfly valves or valves with Stainless Steel Disc

[2] Stainless Steel Plate for outdoor use compatible with Infinite Adjustable valves.

[3] C dimension does not include seat.

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F-4303E

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Cv VALUES - VALVE SIZING COEFFICIENTS

SIZE	Cv
2-1/2"	196
3"	302
4"	600
5"	1022
6"	1320
8"	2165
10"	3353
12"	5827
14"	7037
16"	10416
18"	12215
20"	15959

MODEL NUMBERS

HANDLE TYPE		INFINITE ADJUSTABLE HANDLE - BRONZE DISC	STANDARD HANDLE - STAINLESS STEEL DISC	GEAR/ HAND WHEEL – BRONZE DISC	GEAR/ HAND WHEEL – STAINLESS STEEL DISC
SIZE	2-1/2"	8278-28[4] / 8278-108[5]	8278-58	N/A	N/A
	3"	8278-29[4] / 8278-109[5]	8278-59	N/A	N/A
	4"	8278-30[4] / 8278-104[5]	8278-60	N/A	N/A
	5"	8278-31[4] / 8278-119[5]	8278-61	N/A	N/A
	6"	8278-32[4] / 8278-105[5]	8278-62	N/A	N/A
	8"	N/A	N/A	8278-55[4]	8278-63
	10"	N/A	N/A	8278-07	8278-127
	12"	N/A	N/A	8278-08	8278-129
	14"	N/A	N/A	8278-09	8278-128
	16"	N/A	N/A	8278-56	N/A
	18"	N/A	N/A	8278-57	N/A
	20"	N/A	N/A	8278-125	N/A

For outdoor use please order Stainless Steel plate as separate line item. Plate to be installed in the field on Infinite Adjustable Butterfly Option.[6]

2-1/2" - 3": MNP5080Q (Compatible with 8278-28, 8278-29)
4": MNP100Q (Compatible with 8278-30)
5" - 6": MNP100150Q (Compatible with 8278-31, 8278-32)

NOTES:

[4] Valve meets Buy American Act.
[5] 8278-104 thru 8278-119 are special order valves that meet MADE IN USA requirements. Handle is not infinite adjustable.
[6] Stainless Steel plate is not compatible with MADE IN USA valves or valves with Stainless Steel Disc.

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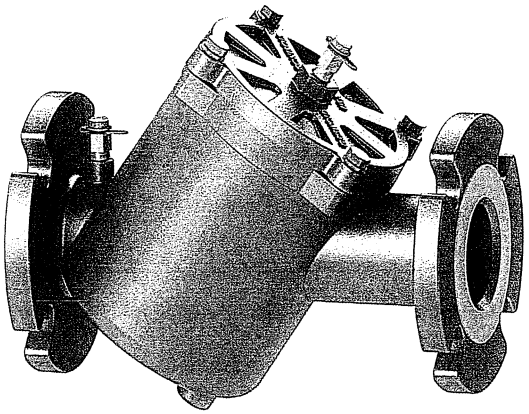
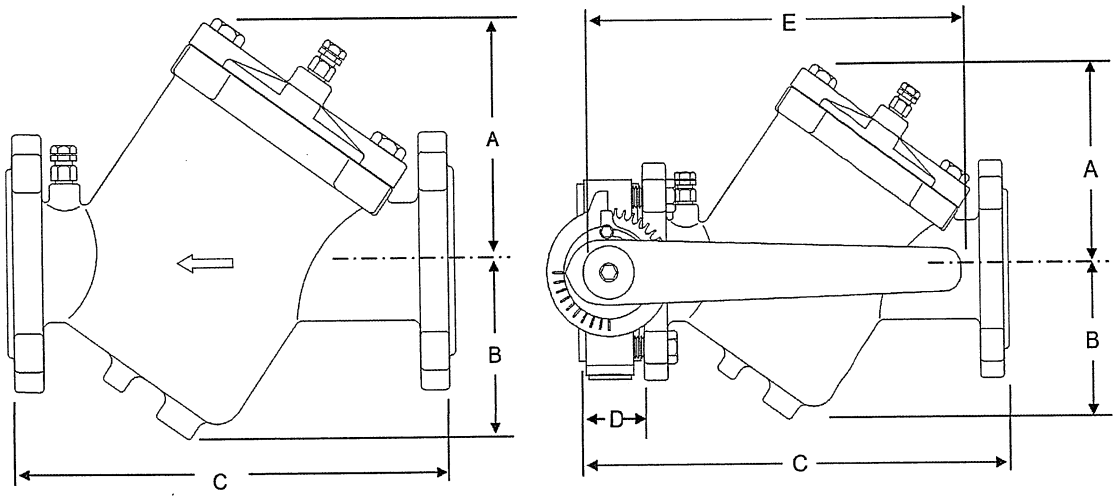
AUTOMATIC FLOW LIMITING 2-1/2" – 3" UNI-FLANGE VALVE

ACCESSIBLE CARTRIDGE



SPECIFICATIONS

PSI / Temperature Rating:	150 PSI / 275° F
Cartridge:	AISI Type 304 stainless steel AISI Type 17-7 PH stainless steel spring
Body Material:	Ductile Iron ASTM A536-80 Class 50-40-18
End Connections:	ANSI 150 Lb. Flanges 2-1/2" and 3"
Seals:	EPDM O-Rings
Body Tappings:	1/4" NPT with P/T test valves
Isolation Options:	Butterfly Valve



DIMENSIONS & WEIGHTS (NOMINAL)

All dimensions are for planning purposes only and may change without notice.

SIZE	MODEL NO.	A HEIGHT	B HEIGHT	C LENGTH	D	E	Cv[1]	WEIGHT (LBS.)
2-1/2", 3"	3UF_B_	5.3	4.3	11.9	N/A	N/A	119	28
2-1/2"	3UF_M_	5.3	4.3	13.6	1.8	10.7	119	40
3"	3UF_N_							

NOTES

[1] Cv measured without cartridge

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F-4205H

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FLOW RATES (+/-5%)

SIZE[2]	MODEL NO.	HEAD LOSS IN FEET[3]	PSID RANGE	GPM		
				MIN	INCREMENT	MAX
2-1/2", 3"	3UF1__	3.5	1-14	12.0	2.0	114.0
	3UF2__	7.4	2-32	18.0	3.0	171.0
	3UF4__	13.4	4-57	24.0	4.0	228.0
	3UF8__	30.0	8-128	36.0	6.0	342.0

MODEL NUMBER SELECTION[4]

3 U F _ _ _

Select a PSID control range: (1=1-14, 2=2-32, 4=4-57, 8=8-128)

Isolation Option: Insert "B" for None, "M" for 2-1/2" Butterfly, and "N" for 3" Butterfly

T = Optional 3"x3" Aluminum Hanging ID Tag

NOTES

[2] 2" Reducing flanges can be used. Consult your local pipe fitting supply house or contact the factory for assistance.

[3] Head Loss in Feet is provided for pump head calculations. (1 PSI = 2.307 Feet of Water)

[4] Model no. and flow rate are indicated on label affixed to body.

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F-4205H

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