

Wallace & Tiernan[®]

an EVOQUA brand

V10K V-NOTCH SULFONATOR

BOOK NO. WT.025.100.021.UA.IM.0614

W3T109613

**V10K
V-NOTCH
SULFONATOR**

BOOK NO. WT.025.100.021.UA.IM.0614

V-10K V-NOTCH SULFONATOR

EQUIPMENT SERIAL NO. _____

DATE OF START-UP _____

START-UP BY _____

Prompt service available from nationwide authorized service contractors.

ORDERING INFORMATION

In order for us to fill your order immediately and correctly, please order material by description and part number, as shown in this book. Also, please specify the serial number of the equipment on which the parts will be installed.

WARRANTY

Seller warrants for a period of one year after shipment that the equipment or material of its manufacture is free from defects in workmanship and materials. Corrosion or other decomposition by chemical action is specifically excluded as a defect covered hereunder, except this exclusion shall not apply to chlorination equipment. Seller does not warrant (a) damage caused by use of the items for purposes other than those for which they were designed, (b) damage caused by unauthorized attachments or modifications, (c) products subject to any abuse, misuse, negligence or accident, (d) products where parts not made, supplied, or approved by Seller are used and in the sole judgment of the Seller such use affects the products' performance, stability or reliability, and (e) products that have been altered or repaired in a manner in which, in the sole judgment of Seller, affects the products' performance, stability or reliability. **SELLER MAKES NO OTHER WARRANTY OF ANY KIND, AND THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS OF THE MATERIAL OR EQUIPMENT FOR ANY PARTICULAR PURPOSE EVEN IF THAT PURPOSE IS KNOWN TO SELLER.** If Buyer discovers a defect in material or workmanship, it must promptly notify Seller in writing; Seller reserves the right to require the return of such defective parts to Seller, transportation charges prepaid, to verify such defect before this warranty is applicable. In no event shall such notification be received by Seller later than 13 months after the date of shipment. No action for breach of warranty shall be brought more than 15 months after the date of shipment of the equipment or material.

LIMITATION OF BUYER'S REMEDIES. The **EXCLUSIVE REMEDY** for any breach of warranty is the replacement f.o.b. shipping point of the defective part or parts of the material or equipment. Any equipment or material repaired or replaced under warranty shall carry the balance of the original warranty period, or a minimum of three months. Seller shall not be liable for any liquidated, special, incidental or consequential damages, including without limitation, loss of profits, loss of savings or revenue, loss of use of the material or equipment or any associated material or equipment, the cost of substitute material or equipment, claims of third parties, damage to property, or goodwill, whether based upon breach of warranty, breach of contract, negligence, strict tort, or any other legal theory; provided, however, that such limitation shall not apply to claims for personal injury.

Statements and instructions set forth herein are based upon the best information and practices known to Evoqua Water Technologies, but it should not be assumed that every acceptable safety procedure is contained herein. Of necessity this company cannot guarantee that actions in accordance with such statements and instructions will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.



725 Wooten Road
Colorado Springs, Co 80915

INTRODUCTION

This manual includes a description of the Evoqua Water Technologies V10K Type V-Notch Gas Feeder (Sulfur Dioxide) with installation, operating and maintenance procedures. This equipment is designed to control and meter the flow of gas under vacuum and to mix the gas with water.

The complete gas feeder system consists of the control unit, an injector and a vacuum regulator. Instructions for the vacuum regulator, optional vacuum switch and optional automatic control (positioner & controller) are provided in separate instruction books supplied with those units.

For swimming pool, water park, or similar non-residential recreational applications, contact your Evoqua Water Technologies Representative for information concerning specific systems designed for such use.



WARNING: HAZARDOUS GAS IS PRESENT IN THIS EQUIPMENT DURING NORMAL OPERATION. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT, READ THIS INSTRUCTION BOOK BEFORE CONNECTING THIS EQUIPMENT TO A VACUUM SUPPLY OF GAS. OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BE RESTRICTED TO TRAINED, QUALIFIED PERSONNEL WHO ARE COMPLETELY FAMILIAR WITH THESE INSTRUCTIONS. CONSULT FACTORY FOR APPLICATIONS AGAINST A NEGATIVE HEAD (PARTIAL VACUUM) OR A POSITIVE BACK-PRESSURE OF LESS THAN 1.0 PSI (28 INCHES OF WATER) IN THE SOLUTION DISCHARGE LINE.

More information may be given in this book than applies to a particular installation and the reader should determine and disregard that which does not apply.

NOTE: When ordering material always specify model and serial number of apparatus.

V-10K V-NOTCH SULFONATOR

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VERY IMPORTANT SAFETY PRECAUTIONS

This and the following pages titled “Very Important Safety Precautions” provide, in brief, information of urgent importance relative to safety, installation, operation, and maintenance of this equipment.

WARNING

TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, OBSERVE THE FOLLOWING: THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED AND SERVICED ONLY BY TRAINED, QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THIS INSTRUCTION BOOK.

HAZARDOUS GAS IS PRESENT IN THIS EQUIPMENT DURING NORMAL OPERATION. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT, READ THIS INSTRUCTION BOOK AND THE APPROPRIATE GAS MANUAL BEFORE CONNECTING THIS EQUIPMENT TO VACUUM A SUPPLY OF GAS. OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BE RESTRICTED TO TRAINED, QUALIFIED PERSONNEL WHO ARE COMPLETELY FAMILIAR WITH THESE INSTRUCTIONS.

TURN OFF THE GAS SUPPLY AT THE CONTAINER VALVE, WAIT UNTIL THE SUPPLY VACUUM GAUGE READS FULL SCALE AND THE ROTAMETER FLOAT RESTS ON THE BOTTOM STOP, AND THEN TURN OFF THE INJECTOR WATER SUPPLY BEFORE PERFORMING ANY DISASSEMBLY OPERATIONS FOR TROUBLESHOOTING PURPOSES.

DO NOT OPEN THE GAS SUPPLY CONTAINER VALVE MORE THAN ONE COMPLETE TURN. THIS WILL PERMIT MAXIMUM DISCHARGE AND CAN ALSO BE TURNED OFF QUICKLY IN CASE OF A GAS LEAK.

THE GAS CONTROL UNIT MUST BE CONNECTED TO A VACUUM GAS SUPPLY ONLY. DO NOT OPEN THE CYLINDER OR DRUM VALVE UNTIL THE SYSTEM HAS BEEN FULLY INSTALLED AND THE PRE-START CHECKS HAVE BEEN CARRIED OUT.

ESCAPED GAS MUST BE EXHAUSTED TO OUTSIDE ATMOSPHERE. THE EXHAUST SYSTEM MUST TERMINATE IN AN AREA WHERE GAS FUMES CANNOT CAUSE INJURY TO PERSONNEL OR PROPERTY DAMAGE. DO NOT TERMINATE THE EXHAUST SYSTEM AT A LOCATION ROUTINELY USED BY PERSONNEL, SUCH AS WORK AREAS OR PATHWAYS NOR NEAR WINDOWS OR VENTILATION SYSTEM INTAKES.

ALL CLEANING SHOULD BE CARRIED OUT IN AN OPEN AREA OR IN A WELL-VENTILATED ROOM.

DO NOT USE WOOD ALCOHOL, ETHER, PETROL OR PETROLEUM DISTILLATES.

DO NOT USE HYDROCARBONS OR ALCOHOLS BECAUSE RESIDUAL SOLVENT MAY REACT WITH THE GAS. SOLVENTS CAN PRODUCE SERIOUS PHYSIOLOGICAL EFFECTS UNLESS USED IN STRICTEST COMPLIANCE WITH THE SOLVENT MANUFACTURER’S SAFETY RECOMMENDATIONS.

WHEN USING HYDROCHLORIC ACID, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE ACID MANUFACTURER/SUPPLIER.

SPRING IS IN A COMPRESSED CONDITION. DISASSEMBLE CAREFULLY TO PREVENT FORCEFUL EJECTION OF PARTS AND POSSIBLE SEVERE PERSONAL INJURY.

V-10K V-NOTCH SULFONATOR

VERY IMPORTANT SAFETY PRECAUTIONS (CONT'D)

USE ONLY EVOQUA WATER TECHNOLOGIES LISTED PARTS EXCEPT FOR COMMERCIALY AVAILABLE PARTS THAT ARE IDENTIFIED BY COMPLETE DESCRIPTION ON PARTS LIST. THE USE OF UNLISTED PARTS CAN RESULT IN EQUIPMENT MALFUNCTIONS HAVING HAZARDOUS CONSEQUENCES.

DO NOT DISCARD THIS INSTRUCTION BOOK UPON COMPLETION OF INSTALLATION. INFORMATION PROVIDED IS ESSENTIAL TO PROPER AND SAFE OPERATION AND MAINTENANCE.

ADDITIONAL OR REPLACEMENT COPIES OF THIS INSTRUCTION BOOK ARE AVAILABLE FROM:

Evoqua Water Technologies
725 Wooten Road
Colorado Springs, CO 80915
Phone: (800) 524-6324

NOTE

Minor part number changes may be incorporated into Evoqua Water Technologies products from time to time that are not immediately reflected in the instruction book. If such a change apparently has been made in your equipment and does not appear to be reflected in your instruction book, contact your local Evoqua Water Technologies sales office for information.

Please include the equipment serial number in all correspondence. It is essential for effective communication and proper equipment identification.

VERY IMPORTANT SAFETY PRECAUTIONS - SULFUR DIOXIDE

This and the following pages titled “Very Important Safety Precautions” provide, in brief, information of urgent importance relative to safety in the installation, operation, and maintenance of this equipment.

WARNING

TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, OBSERVE THE FOLLOWING:

THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED, AND SERVICED ONLY BY TRAINED, QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THIS INSTRUCTION BOOK AND THE SULFUR DIOXIDE GAS HANDLING MANUAL.

EXPOSURE TO SULFUR DIOXIDE GAS IN LOW CONCENTRATION PRODUCES AN IRRITATING EFFECT ON THE MUCOUS MEMBRANES OF THE EYES, NOSE, THROAT, AND LUNGS. EXPOSURE TO HIGHER CONCENTRATION PRODUCES A SUFFOCATING EFFECT.

DO NOT TOLERATE ANY SULFUR DIOXIDE LEAKS. SULFUR DIOXIDE LEAKS NEVER GET BETTER. SULFUR DIOXIDE LEAKS ALWAYS GET PROGRESSIVELY WORSE IF THEY ARE NOT PROMPTLY CORRECTED. IT IS RECOMMENDED PRACTICE TO HAVE AN APPROVED GAS MASK AVAILABLE WHEN MAKING LEAK CHECKS.

AS SOON AS THERE IS ANY INDICATION OF THE PRESENCE OF SULFUR DIOXIDE IN THE AIR, TAKE IMMEDIATE STEPS TO CORRECT THE CONDITION.

IMPORTANT INFORMATION RELATED TO SAFETY OF SULFUR DIOXIDE EQUIPMENT INSTALLATIONS IS PROVIDED IN THE SULFUR DIOXIDE GAS HANDLING MANUAL. IN THE INTEREST OF SAFE OPERATIONS, AND TO AVOID THE POSSIBILITY OF PERSONAL INJURY, THIS INFORMATION MUST BE READ, UNDERSTOOD, AND PRACTICED BY EQUIPMENT OPERATORS AND THEIR SUPERVISORS.

AT TIME OF INITIAL INSTALLATION, WHEN SULFUR DIOXIDE SUPPLY LINES HAVE BEEN DISCONNECTED FOR ANY REASON, AND ON A ROUTINE DAILY BASIS, THOROUGHLY CHECK ALL JOINTS, CONNECTIONS, AND EQUIPMENT FOR POSSIBLE LEAKS, AND IMMEDIATELY CORRECT ANY THAT MAY BE FOUND.

WHEN ANY CONNECTION IS BROKEN EVEN FOR A SHORT TIME, IMMEDIATELY PLUG THE RESULTANT OPENINGS WITH A RUBBER STOPPER OR EQUIVALENT TO PREVENT THE ENTRANCE OF MOISTURE. MOISTURE MUST BE EXCLUDED FROM ANY PART OF THE EQUIPMENT THAT IS NORMALLY EXPOSED TO DRY SULFUR DIOXIDE ONLY. WHILE DRY SULFUR DIOXIDE IS NON-CORROSIVE, MOIST SULFUR DIOXIDE IS EXTREMELY CORROSIVE TO MANY COMMON METALS, SUCH AS BRASS, COPPER, OR STEEL.

THE TWO MOST COMMON CAUSES OF SULFUR DIOXIDE PIPING LEAKS ARE:

1. RE-USE OF GASKETS. THIS SHOULD NEVER BE DONE. ALWAYS HAVE AN ADEQUATE SUPPLY ON HAND AND ALWAYS USE NEW GASKETS OF THE CORRECT MATERIAL AND SIZE AS IDENTIFIED ON THE EQUIPMENT PARTS DRAWINGS.
2. IMPROPERLY MADE-UP THREADED PIPE JOINTS. JOINTS SHOULD BE MADE UP USING A SUITABLE THREAD DOPE OR FLUOROCARBON PLASTIC TAPE.

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VERY IMPORTANT SAFETY PRECAUTIONS - SULFUR DIOXIDE (CONT'D)

USE ONLY EVOQUA WATER TECHNOLOGIES LISTED PARTS, EXCEPT FOR THOSE COMMERCIALY AVAILABLE PARTS THAT ARE IDENTIFIED BY COMPLETE DESCRIPTION ON PARTS LIST. THE USE OF UNLISTED PARTS CAN RESULT IN EQUIPMENT MALFUNCTIONS, AND CAUSE POSSIBLE SEVERE PERSONAL INJURY.

EXCEPT IN CASES OF LEAK DETECTION OR CALIBRATION ADJUSTMENTS, THE SULFUR DIOXIDE GAS SUPPLY MUST BE SHUT OFF AT THE GAS SUPPLY CONTAINER(S) AND THE SULFUR DIOXIDE GAS IN THE SYSTEM MUST BE COMPLETELY EXHAUSTED BEFORE SERVICING THE EQUIPMENT.

DO NOT DISCARD THIS INSTRUCTION BOOK UPON COMPLETION OF INSTALLATION. INFORMATION PROVIDED IS ESSENTIAL TO PROPER AND SAFE OPERATION AND MAINTENANCE.

ADDITIONAL OR REPLACEMENT COPIES OF THIS INSTRUCTION BOOK ARE AVAILABLE FROM:

Evoqua Water Technologies
725 Wooten Road
Colorado Springs, CO 80915
Phone: (800) 524-6324

NOTE

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Please include the equipment serial number in all correspondence. It is essential for effective communication and proper equipment identification.

V-10K V-NOTCH SULFONATOR



PROTECT YOUR EQUIPMENT INVESTMENT

MINIMIZE DOWNTIME

**ORDER A PREVENTIVE MAINTENANCE KIT NOW ...
KEEP ONE ON HAND**

Quality Equipment	+	Preventive Maintenance	=	Dependable Operation Minimum Downtime
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There's no question about it.

Equipment that is properly maintained is dependable equipment.
It will give optimum performance with minimum unscheduled downtime.

Evoqua Water Technologies manufactures quality equipment designed for performance and reliability. Each product is carefully tested and inspected before shipment to ensure that it meets our high standards.

Our equipment is engineered for easy maintenance. To ensure maximum service life and minimize unscheduled repairs, we recommend a program of regular preventive maintenance, as described in the Service section of this book. To support this program, we developed standard parts kits. These kits can also be used for minor emergency repairs to minimize downtime.

We recommend that these kits be available in your stock at all times. When the complete kit or any of its parts are used, the kit should be replaced immediately.

Preventive maintenance kits may be ordered directly from the company that supplied your equipment, or they may be ordered directly from Evoqua Water Technologies. For ordering numbers, refer to the parts list at the rear of this book.

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PREVENTIVE MAINTENANCE SCHEDULE AND RECORD OF PERFORMANCE

This equipment should receive preventive maintenance on a one (1) year cycle.* It is recommended that the following table be used to plan, schedule, and record this important work.

Date of Installation	
-----------------------------	--

Preventive Maintenance Log	
Schedule Date	Date Performed

***NOTE:** This is the recommended cycle. Your local operating conditions may call for more frequent preventive maintenance.



PROTECT YOUR EQUIPMENT INVESTMENT

MINIMIZE DOWNTIME

**ORDER A PREVENTIVE MAINTENANCE KIT NOW ...
KEEP ONE ON HAND**

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REGIONAL OFFICES

INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION

Direct any questions concerning this equipment that are not answered in the instruction book to the Reseller from whom the equipment was purchased. If the equipment was purchased directly from Evoqua Water Technologies, Colorado Springs, CO contact the office indicated below.

UNITED STATES

725 Wooten Road
Colorado Springs, CO 80915
TEL: (800) 524-6324

CANADA

If the equipment was purchased directly from Evoqua Water Technologies, Canada, contact the nearest office indicated below.

ONTARIO

Evoqua Water Technologies Ltd.
2045 Drew Road
Mississauga, Ontario
L5S 1S4
(905) 944-2800

QUEBEC

Evoqua Technologies des Eaux Itee
505 Levy Street
St. Laurent, Quebec
H4R 2N9
(450) 582-4266

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SECTION 1 - TECHNICAL DATA

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V-10K V-NOTCH SULFONATOR

1.1 Technical Data

Versions:

200 or 475 ppd (3/4" or 1" injector, respectively)
manual or automatic
wall or panel mounted
5" or 10" flowmeter

1.2 General Data

Accuracy	±4% of indicated flow
Operation Temperature	10 - 131°F (-12 - 55°C)
Operating Water Pressure at the Injector:	300 psi (21 bar) maximum at 35 - 100°F (2 - 38°C) 150 psi (10 bar) maximum at 130°F (55°C) maximum (linearly derated from 100°F)
Pressure (at point of application):	75 psi maximum with flexible polyethylene pipe for the solution line. 160 psi maximum with high pressure hose or rigid pipe.
Operating Vacuum:	10-15" Water (H ₂ O), (green band on vacuum supply gauge)
Feed Range:	Manual: 20 to 1 for any one rotameter Automatic: 10 to 1 for any one V-notch plug
Airborne Noise Emission:	Does not exceed 70dB (A)
Dimensions:	See mounting drawing
Weight:	Manual wall mount: 5.5 lb. (2.5 kg.) Automatic panel mount: 20 lb. (9 kg.)

1.3 Dosage Range

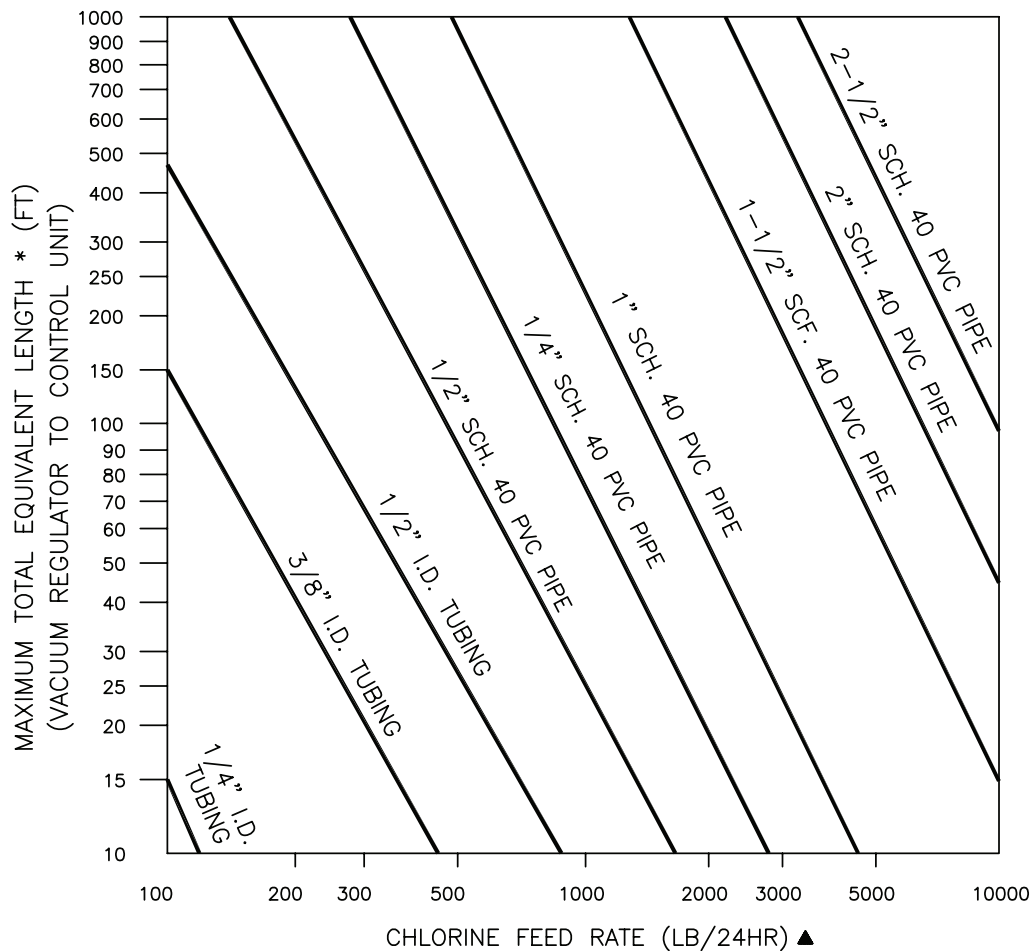
The V-notch plug unit for manual operation covers the dosage range of 0-200ppd or 0-475ppd.

The automatic V-notch plug covers the ranges of each rotameter.

The flowmeter is selected according to the desired dosage range of 3 to 475lb/24hr:

3 ppd	100 ppd
10 ppd	150 ppd
20 ppd	200 ppd
30 ppd	250 ppd
50 ppd	300 ppd
75 ppd	400 ppd
	475 ppd

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APPROXIMATE FRICTION LOSS IN PVC PIPE
FITTING IN EQUIVALENT FEET OF PIPE:

NOMINAL PIPE SIZE, IN.	1/2	3/4	1	1-1/2	2	2-1/2
TEE, SIDE OUTLET	4	5	6	8	12	15
90° ELBOW	1-1/2	2	2-3/4	4	6	8
45° ELBOW	3/4	1	1-3/8	2	2-1/2	3

NOTE:

* TOTAL EQUIVALENT LENGTH = PIPE LENGTH PLUS EQUIVALENT LENGTH FOR EACH FITTING. SEE TABLE ABOVE. 1.) WITH AUTOMATIC SWITCHOVER VACUUM REGULATORS, USE THE LENGTH OF THE LONGER OF THE TWO VACUUM LINES, NOT BOTH, TO DETERMINE TOTAL LENGTH. 2.) TO KEEP THE PRESSURE LOSS WITHIN PERMISSIBLE LIMITS, A COMBINATION OF PIPE SIZES MAY BE USED. IF THIS IS DONE, FOR A GIVEN FLOW, THE LOSS THROUGH EACH FOOT OF 1/2" SCH. 40 PVC PIPE IS EQUIVALENT TO THE LOSS THROUGH : A.) 3FT. OF 3/4" SCH. 40 PVC PIPE; B.) 8 FT. OF 1" SCH. 40 PVC PIPE; C.) 45FT. OF 1-1/2" SCH. 40 PVC PIPE; D.) 122 FT. OF 2" SCH. 40 PVC PIPE; E.) 248 FT. OF 2-1/2" SCH. 40 PVC PIPE.

▲ FOR GASES OTHER THAN CHLORINE, USE THE FOLLOWING APPROXIMATE CONVERSIONS:

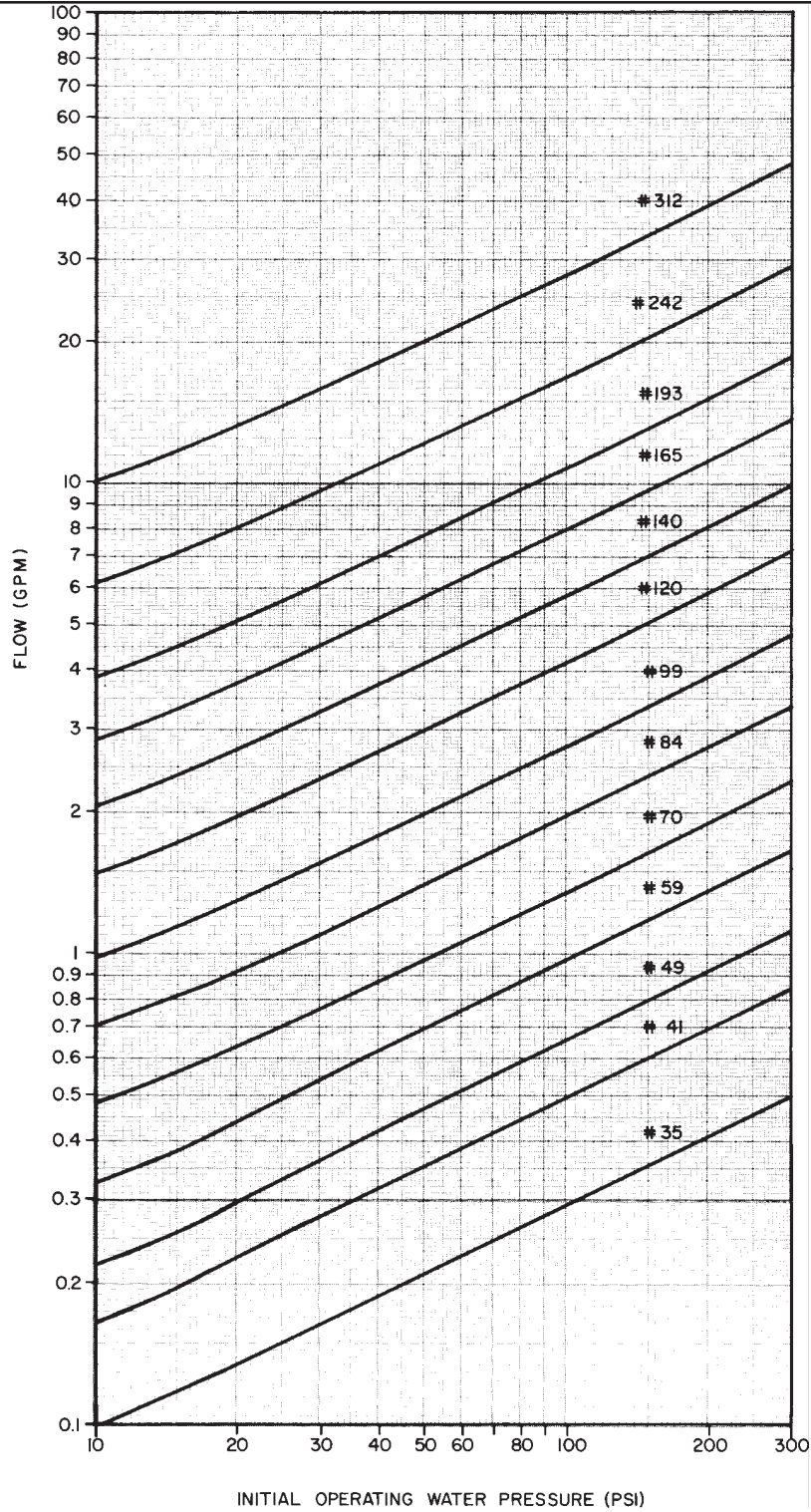
CHLORINE FEED RATE = SULFUR DIOXIDE FEED RATE (LB/24HR.)
= 2.1 X AMMONIA FEED RATE (LB/24HR.)
= 1.3 X CARBON DIOXIDE FEED RATE (LB/24HR.)

VACUUM LINE LENGTH LIMITS - PERFORMANCE
Used In Remote Vacuum Gas Feeders

25.052.190.030

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NOTE: NO SAFETY FACTOR INCLUDED.

INJECTOR OPERATING WATER - PERFORMANCE
Fixed Throat Injectors

910.200.196.020

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SECTION 2

SECTION 2 - INSTALLATION

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WARNING: THIS CONTROL UNIT IS DESIGNED TO OPERATE UNDER VACUUM ONLY. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, DO NOT CONNECT TO A SOURCE OF GAS UNDER PRESSURE.

2.1 Unpacking

Unpack the equipment in a clean, dry area, preferably at the installation site. Check all items against the packing list to ensure that nothing is discarded with the packing materials.

To prevent damage during shipment the flowmeter is packed separately. Handle this glass tube very carefully.

NOTE: Do not discard or remove this instruction book when the installation is completed.

2.2 Location Requirements

- Unauthorized persons must be excluded from the installation.
- Adequate access should be available to permit ease of operation, routine maintenance and service. The gas control unit should be mounted with the rotameter at a height suitable for reading.
- Position of the equipment in the gas storage and operation room must correspond to local regulations.

Select a site that will meet the following requirements:

- An adequate supply of clean water is required to operate the injector. Install the solution discharge line to the point of application as directly as possible. A short run with a minimum of fittings is desirable (most direct route).
- Locate gas supply containers so as to require a minimum of handling. Support in such a manner as to prevent their being knocked over.
- Both in operation and in storage give the container the protection measures described in the Gas Handling Manual (at the rear of this book).

2.3 Gas Control Unit

Mount the gas control unit on a vertical surface, wall, etc. with the flowmeter at a height suitable for reading. See Figure 2.1.

- Gas feeder (manual) without panel
 - a. Provide mounting holes in the locations and sizes shown.

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- b. Remove the cover of the control unit. The control unit has three holes for mounting.
- c. Level the control unit (rotameter) before final tightening.
- d. After the control unit has been leveled and tightened, replace cover.

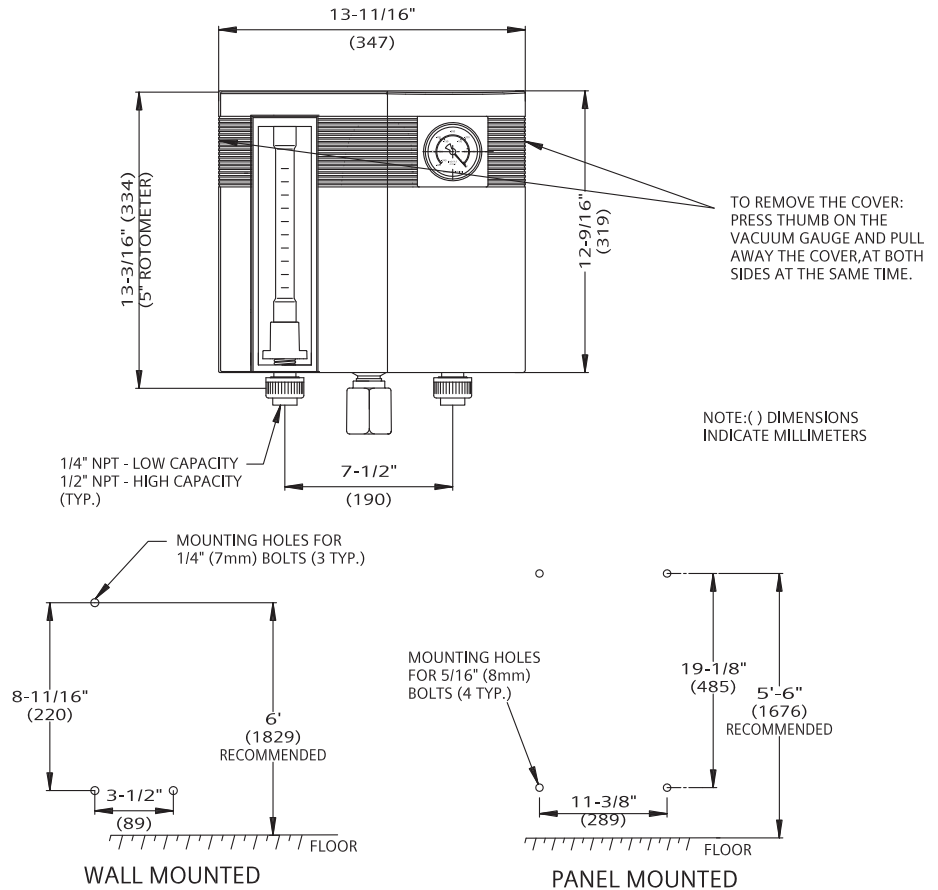


Figure 2.1

- Gas feeder with panel
- a. Provide mounting holes in the locations and sizes shown.
 - b. Remove the cover of the control unit. The panel has four holes for mounting.
 - c. Level the control unit (rotameter) before final tightening.
 - d. After the control unit has been leveled and tightened, replace cover.

NOTE: If the control panel is being bolted to an uneven wall, shims must be added behind bolt hole pads to prevent the control panel from twisting when the bolts are tightened.



CAUTION: The axis of the rotameter in the control unit must be vertical in its mounted position. Use a weighted string or spirit level to check this.

Make the tube lines from the vacuum regulator to the control panel, and from all control units to injectors, as short as practicable. Select the control panel location to achieve this. See Dwg. 25.052.190.030 for maximum permissible lengths of tubing.

2.4 Rotameter

For protection in shipment, the rotameter and associated parts are separately packaged. Assemble and install as shown on Dwg. 25.100.150.010.

2.5 Injector

The injector is a key component, as it must develop the vacuum that makes the rest of the components work. It may be installed so that the tailway discharges either horizontally or vertically upward.

NOTE: Avoid any downward discharge because air or gas bubbles may accumulate and become trapped in the tailway, interfering with its hydraulic operation.

The injector diaphragm check valve will provide the greatest security against leakage if the injector is installed so that it is self-draining. This can be accomplished by observing the following:

- If the fixed throat injector discharges horizontally, the diaphragm should be in a horizontal plane above the nozzle and tailway.
- If the fixed throat injector discharges vertically upward, the connection to the control unit should be vertically upward.
- In all cases, the tubing from the control unit should enter the injector from above.

The nozzle (with stamped number) and tailway (with stamped letter) are supplied loose. Place the O-rings on both and apply Halocarbon grease.

When assembling nozzle and tailway into the injector body pay attention to the flow direction. (Nozzle is placed first in the water flow path.)

NOTE: 1) Do not cut off any portion of the tailway. To do so would interrupt flow in the pressure-recovery zone and prevent normal performance.

2) Do not overtighten the nozzle or tailway of the 3/4" injector. Thread shoulder to stop on the body. For 1" injector, hand tightening of the retaining nut is sufficient.

3) Rigid PVC pipe or Evoqua Water Technologies gas solution hose may be required between the injector discharge and the point of application. The size depends on the size of the throat and tailway used in the injector. Solution hose may be connected directly to the injector tailway. If rigid PVC pipe is used, a piece of straight pipe at least eight inches long should be coupled to the end of the injector tailway before any elbows, tees or Saunders valves are used. This will prevent any flow disturbances that could affect the hydraulic performance. Your dealer can provide whatever components are required.

4) For measuring the injector vacuum a 1/4" NPT connection is provided.



CAUTION: If a corporation cock is used, pull out stem to full length of chain before closing valve.

2.5.1 Installing 3/4" Fixed Throat Injector

To install the 3/4-inch fixed throat injector, proceed as follows:

- a. For main connection, install the injector tailway (beige color with letter designation) directly into a 3/4-inch NPT tap in a main which is eight inches or larger in size.



CAUTION: For proper dispersal of solution, the end of the tailway (beige) must extend into main, but not more than 1/3 the diameter of the main.

- b. If the main is smaller than eight inches, install the tailway in a tee, in a run or corner of main.
- c. Where the injector is to be some distance away from the point of application, use adapters to connect to pipe or corporation cock type main connections, check valves, etc. Your dealer can provide whatever components are required.
- d. Where the injector is not installed directly into the application main, wall mounting of the injector may be required. To install the injector on a suitable wall, use the bracket holes as the drilling template. Secure the injector to the wall.
- e. The injector nozzle (black color with number size designation) is designed to accept 3/4-inch polyethylene tubing or 3/4-inch threaded pipe connection. For pipe thread connection, cut off the serrated section with a hacksaw and bevel the sharp corners at the ID and OD. Ensure that the interior of the nozzle is free from burrs or chips before installing it in the injector.

NOTE: The polyethylene tubing is suitable for pressures up to 75 psi. Pressure in excess of 75 psi requires rigid pipe.

- f. The nozzle and the tailway are sealed to the injector body by means of O- rings. Hand tightening is sufficient. Do not use a wrench or attempt to tighten beyond that point where the shoulder on the fitting touches the body of the injector. If the injector is not oriented as desired when fully installed over the tailway, use a suitable tool to turn the tailway with respect to the main (or next fitting in the assembly) until the orientation is proper with the gas inlet side on top or most accessible face.
- g. Install connection to water supply or to a booster pump, if required. The water supply valve can be a manual valve or solenoid valve. A water supply strainer is recommended. The water supply must be reasonably clean. If the injector is to be operated using clarified effluent, such as in a sewage treatment plant, use larger sizes of nozzles and tailways to minimize the likelihood of plugging.

2.5.2 Installing 1" Fixed Throat Injector

To install the one-inch fixed throat injector, proceed as follows:

- a. Where the injector is to be some distance away from the point of application, use adapters to connect to pipe or corporation cock type main connections, check valves, etc. Your dealer can provide whatever components are required.
- b. Where the injector is not installed directly into the application main, wall mounting of the injector may be required. To install the injector on a suitable wall, use the bracket holes as the drilling template. Secure the injector to the wall.
- c. The injector water inlet is designed to accept one-inch threaded pipe.
- d. Install connection to water supply or to a booster pump, if required. The water supply valve can be a manual valve or a solenoid valve. A water supply strainer is recommended. The water supply must be reasonably clean. If the injector is to be operated using clarified effluent, such as in a sewage treatment plant, use larger sizes of nozzles and tailways to minimize the likelihood of plugging.

2.6 Point of Application

2.6.1 Main Connection

If the point of application is a pressurized main, a suitable pipe tap is required in the main to accommodate the solution tube, corporation stop or diffuser. The solution tube should project into the main, approximately $\frac{1}{3}$ to $\frac{1}{2}$ the diameter of the main. If the tube is too long, shorten it by sawing off a portion. If the main connection includes a corporation cock, shorten the safety chain an equal amount.

It is recommended that all solution delivery lines be fitted with a suitable valve and drain pipe to enable any pressure buildup to be safely released prior to maintenance work.

After the point of application a pipe length of at least 10 to 15 times the pipe diameter is necessary for a homogeneous mixing of the solution into the main water. After that, samples can be taken for residue control, etc.

2.6.2 Open Well

If the point of application is into a basin, channel, etc. with negligible pressure, the line need only be supported so that its free end is adequately submerged (a minimum of six feet) and located in a non-stagnant area that best promotes rapid and thorough mixing of the solution into the water.

2.7 Water Supply and Solution Discharge Line

The injector requires a supply of reasonably clean water. The water line should include a suitable shut-off valve and a strainer.

Each installation is assembled to suit the operating water characteristics. The pressure and quantity of water required depends on the operating conditions (backpressure and gas feed rate). If the operating conditions change, it may be necessary to change the nozzle/injector throat and/or tailway to obtain optimum efficiency.

NOTE: For intermittent start-stop operation, flexible polyethylene or rigid PVC pipe is recommended for a minimum of three feet immediately upstream of the injector. This should reduce corrosion of metal pipe and components (valves, pump impellers, etc.) caused by diffusion of solution during shut-down periods.

It is recommended that all solution delivery lines be fitted with a suitable valve and drain pipe to enable any pressure buildup to be safely released prior to maintenance work.

If plastic flexible pipe is used, install it securely with clamps at the injector and the application point.



CAUTION: In all cases the solution discharge line must be supported and protected to avoid mechanical damage or kinking between the injector and the point of application.

Rigid PVC pipe or Evoqua Water Technologies solution hose is required between the injector discharge and the point of application. The size depends on the size of the throat and tailway used in the injector. Solution hose may be connected directly to the injector tailway. If rigid PVC pipe is used, a piece of straight pipe at least eight inches long should be coupled to the end of the

injector tailway before any elbows, tees or Saunders valves are used. This will prevent any flow disturbances that could affect the hydraulic performance of tailway connections.

2.8 Gas Connection



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, THE GAS CONTROL UNIT MUST BE CONNECTED TO A VACUUM GAS SUPPLY ONLY. DO NOT OPEN THE CYLINDER OR DRUM VALVE UNTIL THE SYSTEM HAS BEEN FULLY INSTALLED AND THE PRE-START CHECKS HAVE BEEN CARRIED OUT.

To reduce the pressure from the gas tanks, regulating valves and a safety relief valve are necessary (see typical installation). A vacuum regulator is connected to the control unit inlet. Install the vacuum regulator as directed in separate instruction book.

2.8.1 Gas Suction Line

The diameter of the vacuum line between regulating valve, control unit and injector depends on the gas flow and the distance and must not exceed the distance as determined on Dwg. 25.052.190.030.

If necessary, any size tubing or pipe can be installed which will not give more than five inches of water differential between control unit and vacuum regulator at maximum gas feed rate. Note that the equivalent length of the fittings must be added to the tubing length to obtain the total equivalent length.

The piping must be sized as required to obtain a minimum of six inches of mercury vacuum at the control unit.

When using polyethylene tubing, do not install it in narrow, poorly vented protection pipes or in the ground to prevent the tubing from fast embrittling under the influence of gas.

For gas supply installation details refer to the separate instruction book provided with vacuum regulator.

2.8.2 Safety Relief Valve and Vent Line



CAUTION: To avoid possible equipment damage, a pressure relief valve is required in the gas feed system. If the vacuum regulator does not provide pressure relief, a pressure relief valve must be installed at the control unit or in the vacuum gas supply line.

A pressure relief valve must be installed in the gas feed system, either at the vacuum regulator, the control unit, or in the vacuum line between the regulating valve and control unit.

There must not be any isolating valve between the pressure relief valve and the vacuum regulator.

A vent line is required from the pressure relief valve to a point outside the building where an occasional discharge of gas will not be objectionable. The proper installation of this line is important. The gradient of the line must be continuous without traps and down toward outside atmosphere. Point the atmospheric end down and screen it against the entrance of foreign materials. Where traps are unavoidable or a down gradient is not possible, provisions for condensate removal must be installed at all low points (drip leg). Suitable support for the vent is required throughout its entire length.



WARNING: THE PRESSURE RELIEF VALVE MUST BE VENTED TO OUTSIDE ATMOSPHERE. THE VENT LINE MUST TERMINATE IN AN AREA WHERE GAS FUMES CANNOT CAUSE INJURY TO PERSONNEL OR DAMAGE. DO NOT TERMINATE THE VENT LINE AT A LOCATION ROUTINELY USED BY PERSONNEL, SUCH AS WORK AREAS OR PATHWAYS NOR NEAR WINDOWS OR VENTILATION SYSTEM INTAKES.

2.9 Drain

A floor drain is always desirable to facilitate injector service.

2.10 Electrical Connections

If the gas feeder is furnished with other accessories requiring a power supply or wiring to other equipment, appropriate wiring diagrams will be found in the instructions for the accessory items. See the INSTALLATION WIRING diagrams for the electronic controller connections in the separate instruction book.

NOTE: Field wiring must conform to local electrical codes.

2.11 Vacuum Alarm Switch

If a vacuum alarm switch has been ordered, see separate Instruction Book.

2.12 Interconnection of Components

With the control unit(s), injector(s) and vacuum regulator(s) in place, installing the interconnecting tubing and vent tubing completes a system. Support long runs of tubing or pipe in a suitable manner, using tube clips or ties appropriate to the site.

For each tubing end to be connected, begin by using a sharp knife to make a clean square cut at the end of the tubing. Proceed as follows:

- For 1/4" x 3/8" tubing and the Evoqua Water Technologies PVC tubing connector:

V-10K V-NOTCH SULFONATOR

- a. Slip a union nut over the tubing, threaded end facing the tubing end.
- b. Insert a common pencil into the end of the tubing to flare it outward slightly for easier installation on the half union.
- c. Press the tubing onto the tapered end of the half union, tilting and pushing by hand until the end of the tubing touches the shoulder at the base of the taper.
- d. Hold the tubing so the end remains in contact with the shoulder, while the thread is engaged and the union nut tightened.

NOTE: Finger tightening is sufficient. Do not use pliers or wrench.

- For tubing used with commercial connectors:
 - a. Slip a union nut with grab ring and support over the tubing, threaded end facing the tubing end.
 - b. Insert tubing end into connector.
 - c. Hand tighten nut.
- Install the following sections of tubing:
 - a. From the union on the right of the control unit to the union on the injector.
 - b. From the pressure relief valve (on the left of the control unit to the left of the rotameter, when installed at the control unit) to an outside point where an occasional odor will not be objectionable. Slope this section of tubing downward without traps to a point lower than the control unit. Do not run this end of the tube upward. Install the screen provided over the outer end of the tube to prevent insects from clogging it. Secure the screen with a clamp, wire or electrical tape.



WARNING: THE CONTROL UNIT MUST BE VENTED TO OUTSIDE ATMOSPHERE. THE VENT LINE MUST TERMINATE IN AN AREA WHERE GAS FUMES CANNOT CAUSE DAMAGE OR INJURY TO PERSONNEL. DO NOT TERMINATE THE VENT LINE AT A LOCATION ROUTINELY USED BY PERSONNEL, SUCH AS WORK AREAS OR PATHWAYS NOR NEAR WINDOW OR VENTILATION SYSTEM INTAKES.

- c. From the union on the left of the control unit below the rotameter to the vacuum regulator.

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TEMPERATURE AND PRESSURE:

PVC PIPE IS NOT RECOMMENDED FOR TEMPERATURES OVER 130°F OR BELOW 0°F, NOR FOR LINES THAT MAY BE EXPOSED TO PHYSICAL ABUSE (SEE MANUFACTURER'S RECOMMENDATIONS). ONE HUNDRED FEET OF PIPE WILL EXPAND OR CONTRACT APPROXIMATELY 0.7 INCHES FOR EVERY 10°F TEMPERATURE CHANGE. MANUFACTURER'S RECOMMENDED MAXIMUM WORKING PRESSURES SHOULD NOT BE EXCEEDED.

SUPPORT AND PROTECTION:

IT IS PREFERABLE TO SUPPORT HORIZONTAL OVERHEAD LINES WITH A CHANNEL OR ANGLE IRON PARALLEL TO THE PIPE. IF STRAP HANGERS ARE USED, SPACE THEM AT 2- TO 4-FOOT INTERVALS, AS RECOMMENDED BY THE PIPE MANUFACTURER. PIPE SHOULD NOT REST DIRECTLY ON RODS OR WIRES. PIPE MAY BE LAID UNDERGROUND WITH NO SPECIAL PRECAUTIONS OTHER THAN THOSE USED FOR IRON PIPE.

THREADING:

SCHEDULE 80 PVC PIPE CAN BE CUT AND THREADED WITH STANDARD PIPE TOOLS, EITHER HAND OR POWER DRIVEN. STANDARD DIES COMMONLY USED FOR METAL PIPE WILL PRODUCE SATISFACTORY THREADS, THOUGH A 5° NEGATIVE RAKE ANGLE IS PREFERRED. KEEP DIES CLEAN AND SHARP AT ALL TIMES. DIES THAT HAVE BEEN USED EXTENSIVELY FOR STEEL PIPE MAY NOT PRODUCE GOOD THREADS UNLESS RESHARPENED. USE NORMAL CUTTING SPEEDS; NO LUBRICANT OR CUTTING OIL IS REQUIRED. A TAPERED PLUG (AVAILABLE FROM THE MANUFACTURER, IF DESIRED) TAPPED FIRMLY INTO THE END OF THE PIPE PREVENTS DISTORTION OF THE PIPE AND DIGGING-IN BY THE DIE, AS WELL AS CORRECTS ANY SLIGHT OUT-OF-ROUND THAT MAY EXIST. TAKE CARE TO CENTER THE DIE ON THE PIPE AND ALIGN THE THREAD TO PREVENT REDUCING THE WALL EXCESSIVELY ON ONE SIDE. SCHEDULE 40 PVC CANNOT BE THREADED.

THREADED JOINTS:

THREADED JOINTS IN PVC PIPE REQUIRE MORE CARE THAN THOSE IN SIMILAR SIZE METAL PIPE. IF A NON-LUBRICATING THREAD COMPOUND IS USED, THE JOINT MAY FEEL TIGHT WHEN ONLY 2 OR 3 THREADS ARE ENGAGED. IF TEFLON TAPE OR SIMILAR LUBRICATING THREAD COMPOUND IS USED, THE JOINT MAY NOT FEEL TIGHT AT ALL, AND OVERTIGHTENING—RESULTING IN CRACKED FITTINGS OR STRIPPED THREADS—CAN EASILY OCCUR. CARE MUST BE TAKEN TO ENGAGE THE JOINED PARTS TO A NORMAL ENGAGEMENT OF 5 TO 7 TURNS AND NO MORE. STRAP WRENCHES ARE PREFERRED FOR ASSEMBLY, AS THE SHARP EDGES ON PIPE WRENCHES MAY SCORE AND WEAKEN THE PIPE.

FLANGED JOINTS:

FOR FLANGED JOINTS, USE A FULL-FACED RUBBER GASKET AND FLAT WASHERS UNDER BOLTS AND NUTS. TIGHTEN OPPOSITE FLANGE BOLTS TO COMPRESS THE GASKET TO A SLIGHT DEGREE, BUT DO NOT DISTORT THE FLANGE.

SOLVENT WELD OR CEMENT JOINTS:

ALWAYS USE CEMENT RECOMMENDED BY THE MANUFACTURER. ADD THINNER IF CEMENT THICKENS FROM EXPOSURE TO THE AIR.

1. CUT PIPE WITH ORDINARY HAND OR POWER SAW. MAKE A SQUARE CUT AND REMOVE BURRS.
2. CLEAN AND DRY OUTSIDE OF PIPE AND INSIDE OF FITTING.
3. APPLY A THIN COAT OF CEMENT TO INSIDE OF FITTING AND OUTSIDE OF PIPE. USE A NATURAL BRISTLE PAINT BRUSH. CEMENT TO BE WITHIN 1/4" BUT NOT CLOSER THAN 1/8" FROM END OF PIPE TO PREVENT INTERNAL BEAD FROM FORMING.
4. WHILE THE CEMENT IS STILL WET, STAB THE PIPE INTO THE FITTING AND GIVE 1/8 TURN.
5. AVOID ROUGH HANDLING FOR ONE HOUR. DEPENDING ON ATMOSPHERIC CONDITIONS, APPROXIMATELY 50% STRENGTH WILL BE ATTAINED IN 2 HOURS AND FULL STRENGTH IN 48 HOURS.

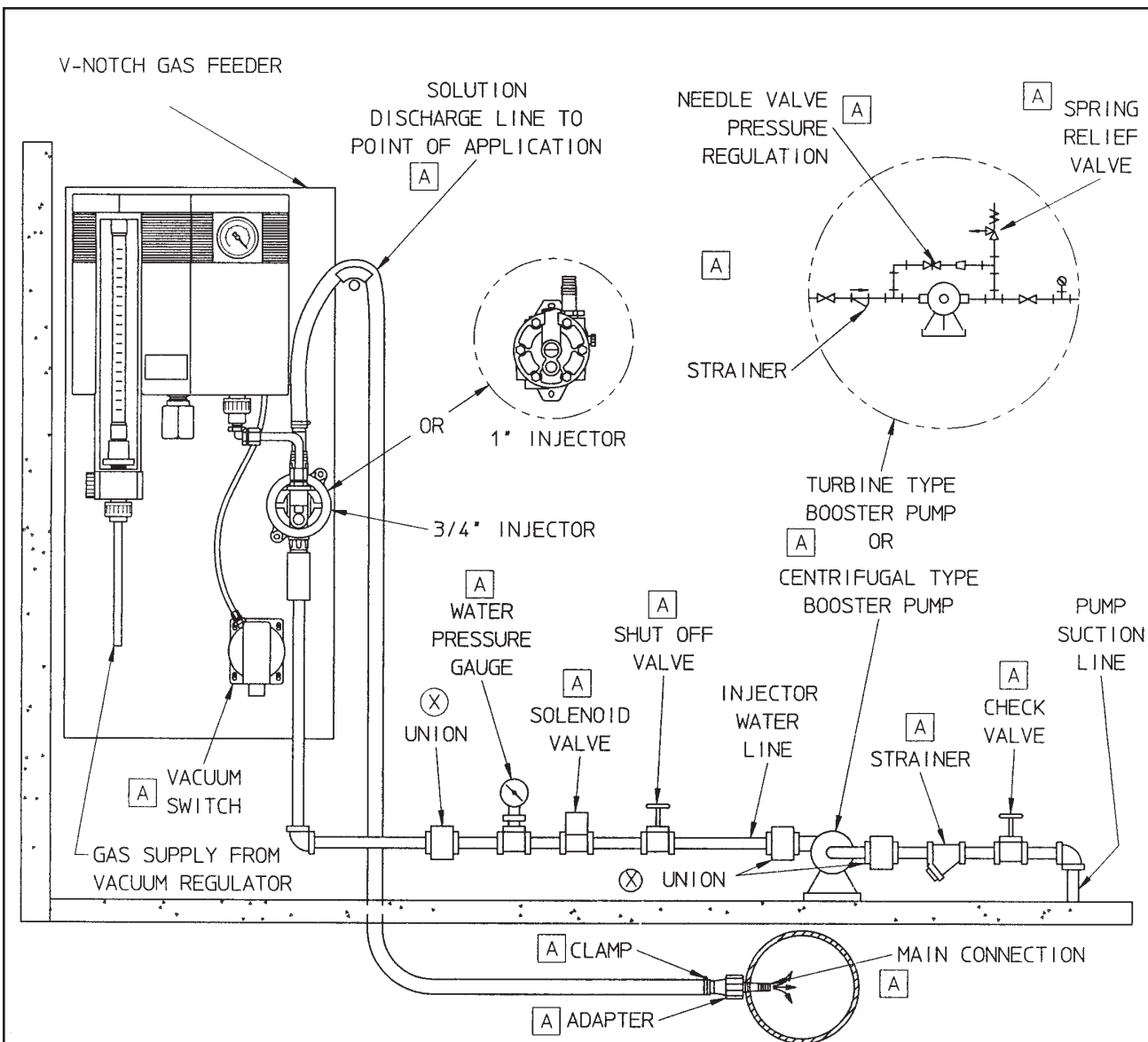
PIPE SIZE	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"
JOINTS PER PINT OF CEMENT	50	50	35	35	25	25	16	12

CEMENT AVAILABLE FROM EVOQUA WATER TECHNOLOGIES IN PINT CANS (U24647). ALSO AVAILABLE COMMERCIALY IN PINT, QUART AND GALLON CANS.

PVC PIPE - INSTALLATION
Fabrication and Installation

50.830.110.011
ISSUE 14 6-14

V-10K V-NOTCH SULFONATOR



NOTE: [A] ACCESSORY ITEM FURNISHED ONLY IF SPECIFICALLY LISTED IN QUOTATION.

(X) NOT FURNISHED BY EVOQUA WATER TECHNOLOGIES.

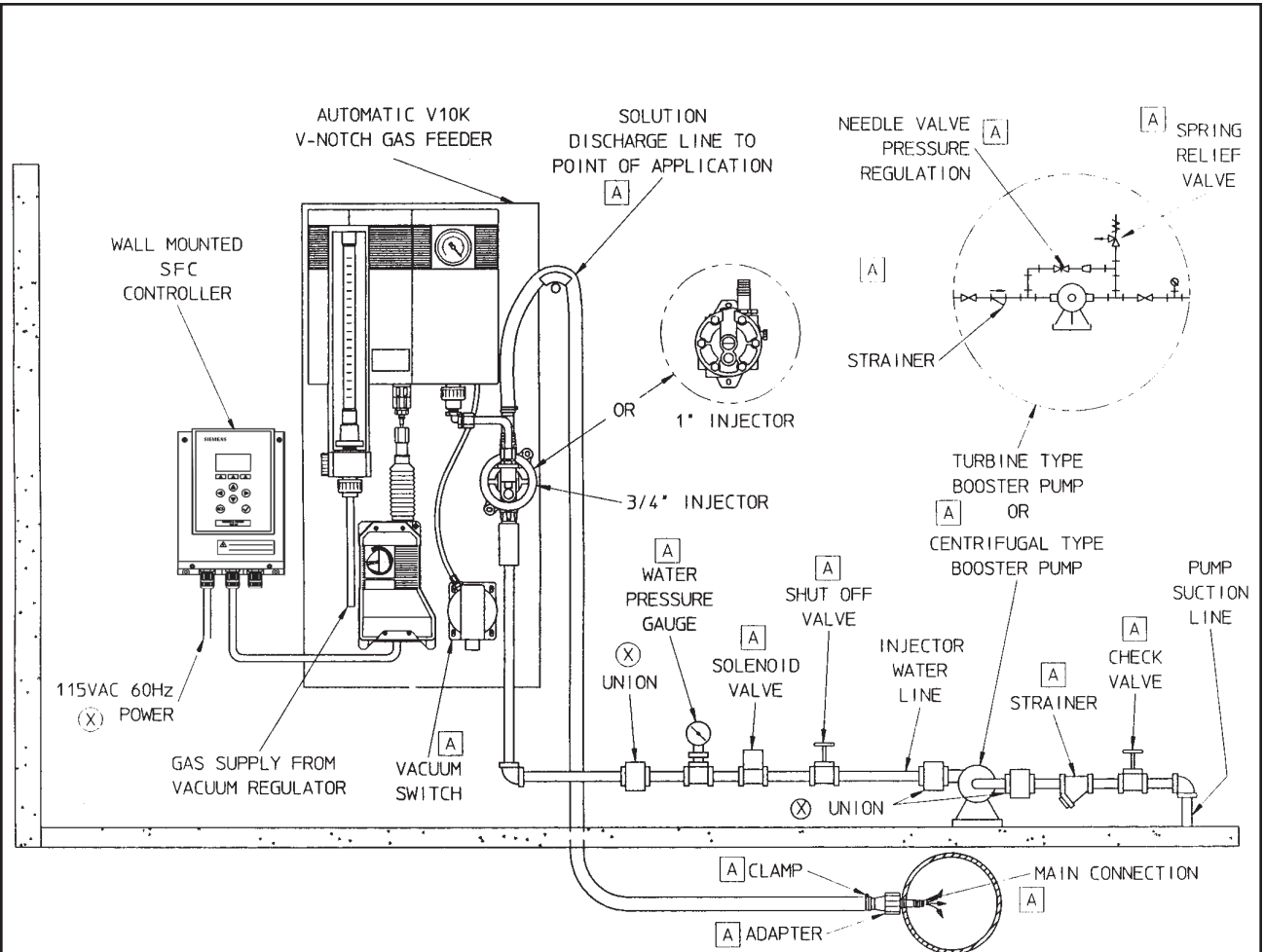
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

V10K V-NOTCH GAS FEEDER - TYPICAL INSTALLATION
Manual Arrangement

25.100.110.010

ISSUE 3 6-14

V-10K V-NOTCH SULFONATOR



NOTE: [A] ACCESSORY ITEM FURNISHED ONLY IF SPECIFICALLY LISTED IN QUOTATION.

(X) NOT FURNISHED BY EVOQUA WATER TECHNOLOGIES.

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

AUTOMATIC V10K V-NOTCH PANEL - TYPICAL INSTALLATION

25.100.110.020

ISSUE 3 6-14

V-10K V-NOTCH SULFONATOR

SECTION 3

SECTION 3 - OPERATION

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3.1 Intended Use

The V10k Gas Feeder is the central item of a disinfection system that doses gas under vacuum into a flow of water at rates ranging up to 475 ppd (215 kg/24hr). Other use is prohibited without permission from Evoqua Water Technologies.

3.2 Theory of Operation

The Evoqua Water Technologies V10k Gas Feeder is designed to control and indicate the rate of flow of gas under vacuum. It provides a simple means of setting the feed rate at any value within the range of the machine and mixes the gas with water.

Operating water passes through an injector to produce a vacuum that draws gas from the gas feeder. This gas mixes with the water flowing through the injector. A poppet check and diaphragm check are built into the fixed throat injector to prevent a backflow of water into the gas feeder should the injector water supply be shut off with pressure on the injector discharge, or should the injector discharge line be restricted. Proper operation of the injector is dependent on the inlet pressure being sufficiently higher than the discharge pressure. The differential regulating valve in the V10k control unit throttles the injector vacuum to maintain the proper operating vacuum on the downstream side of the V-notch variable orifice relative to the gas supply vacuum.

Gas under pressure enters the vacuum regulator. The gas pressure is reduced to less than atmospheric pressure as the gas passes through a valve seat that will not open unless an operating vacuum is produced by the injector. This provides a controlled vacuum on the upstream side of the V-notch variable orifice. In the extremely unlikely event that the valve passes gas under pressure, a pressure relief valve permits this gas to pass out the vent.

From the vacuum regulator, gas under a controlled vacuum passes through the rotameter (feed rate indicator) causing the float to indicate the rate of flow on an easily read scale. The rate of flow is controlled by the position of the V-notch variable orifice across which a constant differential at less than atmospheric pressure is maintained, by the combined operation of the differential regulating valve and the vacuum regulator.

In the event of gas supply exhaustion, the diaphragm check valve in the injector will close when the system reaches full vacuum.

If the operating water is shut off, the vacuum breaks down and the vacuum regulating valve interrupts the gas flow. In case of a leak in the tubing from the vacuum regulating valve to the injector or in the gas feeder, only air can enter into the system, but no gas can escape.

3.3 Control Possibilities

The gas flow is directly indicated on the flowmeter in ppd (pounds per day) or optional kg/24 hr. Within the feed range, every feed rate can be adjusted (475 ppd = maximum is 215 kg/24hr).

- Manual Adjustment

Manually: Adjustment of the feed rate is done manually.

Semi-Automatic: Adjustment of the feed rate is done by switching the injector on and off using a solenoid valve or booster pump.

- Automatic Adjustment

Automatically: Adjustment of the feed rate is done by an electric positioner activated by a controller.

Electric Manual: Adjustment of the feed rate is done by using the manual selection of the controller.

Manual: Pull out the knob on the positioner and turn to adjust the feed rate. To return to automatic control, push in the knob and slightly turn it until it snaps in.

The gas feeder can be fitted with different flowmeters and V-notch orifices. The dosage range can be changed by changing the flowmeter V-notch and, if necessary, the injector.

3.4 Preparation for Initial Operation



WARNING: HAZARDOUS GAS IS PRESENT IN THIS EQUIPMENT DURING NORMAL OPERATION. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT, READ THIS INSTRUCTION BOOK AND THE APPROPRIATE GAS MANUAL BEFORE CONNECTING THIS EQUIPMENT TO A SUPPLY OF GAS. OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BE RESTRICTED TO TRAINED, QUALIFIED PERSONNEL WHO ARE COMPLETELY FAMILIAR WITH THESE INSTRUCTIONS.

When all the connections in the Section 2 - Installation have been made, the following pre-start checks must be carried out before the system can be taken into operation.

3.4.1 Physical Check

- a. Ensure that the gas supply lines from the cylinder or ton containers are securely connected and that all valves in the system are closed.

- b. Check that the water inlet line from the source of supply to the injector is securely connected.
- c. Ensure the pressure relief vent line is securely connected to the pressure relief valve and that it is terminated correctly.
- d. Ensure the injector gas suction line is correctly fitted to the control unit gas outlet and to the injector.
- e. Check the solution line from the injector to the point of application.

3.4.2 Injector Vacuum and Leak Test

- a. Keep the valves on the gas supply tanks closed. Open the valves in the water supply line to the injector and at the point of application. Check for leaks. Ensure that there is water at the point of application ready for operation.
- b. Injector operating vacuum is indicated on the vacuum gauge of the control unit, the pointer should be full scale.
- c. Check that the flowmeter float remains at the bottom stop. Any movement of the float indicates an entrance of air in one of the following locations:
 - Through the pressure relief valve seat. This can be determined by holding a finger over the vent connection on the pressure relief valve. Refer to Section 4 - SERVICE for correction.
 - Through the O-ring on the bottom of the flowmeter or through cracks in the flowmeter at the ring gasket at the bottom of the rotameter. This can be corrected by proper lubrication of the O-ring with a thin film of Halocarbon grease and ensuring that the rotameter is seated on the O-ring.
 - Through the O-rings at the pipe connections or tubing connections.
 - Through any incorrectly cemented joints at any tubing connector or pipe fitting in the gas supply line. This may be corrected by tightening the connector or fitting, or by replacing any defective connector O-ring. Apply a thin film of Halocarbon grease to all O-rings before installing.
- d. Check the following to ensure all connections are tight:
 - The V-notch extension chamber through which the V-notch plug travels.
 - The gasket at the bottom of the differential regulating valve and pressure relief valve.
 - The connections of both ends of the plastic tubing on the gas discharge line to the injector.

NOTE: Vacuum leaks ahead of the rotameter (as listed in preceding step c) will result in errors in gas feed. Vacuum leaks after the rotameter (as listed in step d) may impair the performance of the injector.

3.4.3 Gas Supply - Checking for Leaks



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, DO NOT TOLERATE ANY GAS LEAKS. LEAKS ALWAYS GET PROGRESSIVELY WORSE AND MUST BE CORRECTED PROMPTLY.

After the vacuum regulator unit(s) is in place and before the gas tubing which will connect it to the control unit is installed, check for gas leaks as directed in the separate instruction book provided with the vacuum regulator.

3.5 Operating Procedure

3.5.1 Starting



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, DO NOT OPEN THE GAS SUPPLY CONTAINER VALVE MORE THAN ONE COMPLETE TURN. THIS WILL PERMIT MAXIMUM DISCHARGE AND CAN ALSO BE TURNED OFF QUICKLY IN CASE OF A GAS LEAK.

- a. Open the point of application and the injector operating water valves.
- b. Turn on the gas supply at the supply container valve and the vacuum regulator. If there are two units (automatic switchover system), turn on only the one on the supply container that is to be used first.
- c. Turn the feed rate adjuster knob counterclockwise (unscrew) to obtain maximum feed. The injector should develop a dynamic vacuum of at least six inches of mercury at maximum gas flow rate. If maximum indicated feed rate cannot be obtained:
 - (1) Ensure that no vacuum leaks exist. See Injector Vacuum and Leak Test.
 - (2) Refer to paragraph 4.9, Troubleshooting.
- d. Adjust the gas feed rate as desired. Rotation of the knob counterclockwise increases the feed rate.
- e. Check that the vacuum gauge pointer is in the green sector.
- f. If there are two vacuum regulators, turn on the gas supply at the second supply container valve and vacuum regulator.

3.5.2 Stopping - For Short Periods

Reduce the feed rate to zero or close the injector operating water valve.

3.5.3 Stopping - For Extended Periods

The following procedure must be carried out before any gas control unit servicing is undertaken.

- a. Turn off the gas supply at each supply container valve. Allow the control unit to operate until the flowmeter float remains on the bottom stop and the vacuum gauge reads full scale.
- b. Then, turn off the injector operating water.
- c. Shut off the vacuum regulator.

3.5.4 Winter Shut-Down

If the gas feeder is to be shut down for an extended period during freezing weather, the following procedure must be carried out:

- a. Operate the injector with the gas supply turned off at the supply container valve(s) until the vacuum supply gauge reads full scale and rotameter float settles on bottom stop.
- b. Shut off the water supply and drain the line to the injector.
- c. Drain the solution discharge line and prevent any water flow into discharge line.
- d. Drain any water in the injector.

NOTE: If the gas feeder is to be removed for storage, the gas inlet fitting and all gas lines should be sealed with rubber stoppers to prevent the entrance of atmospheric moisture during the storage period. If a pump is being used, follow pump manufacturer instructions for extended shut-down.

3.6 Intermittent Start-Stop Operation

Operation of the gas feeder in synchronism with a pump or other apparatus may be accomplished by installing an electrically operated solenoid valve in the injector water supply line and connecting it so the valve is open when the pump is running and closed when the pump is shut down.

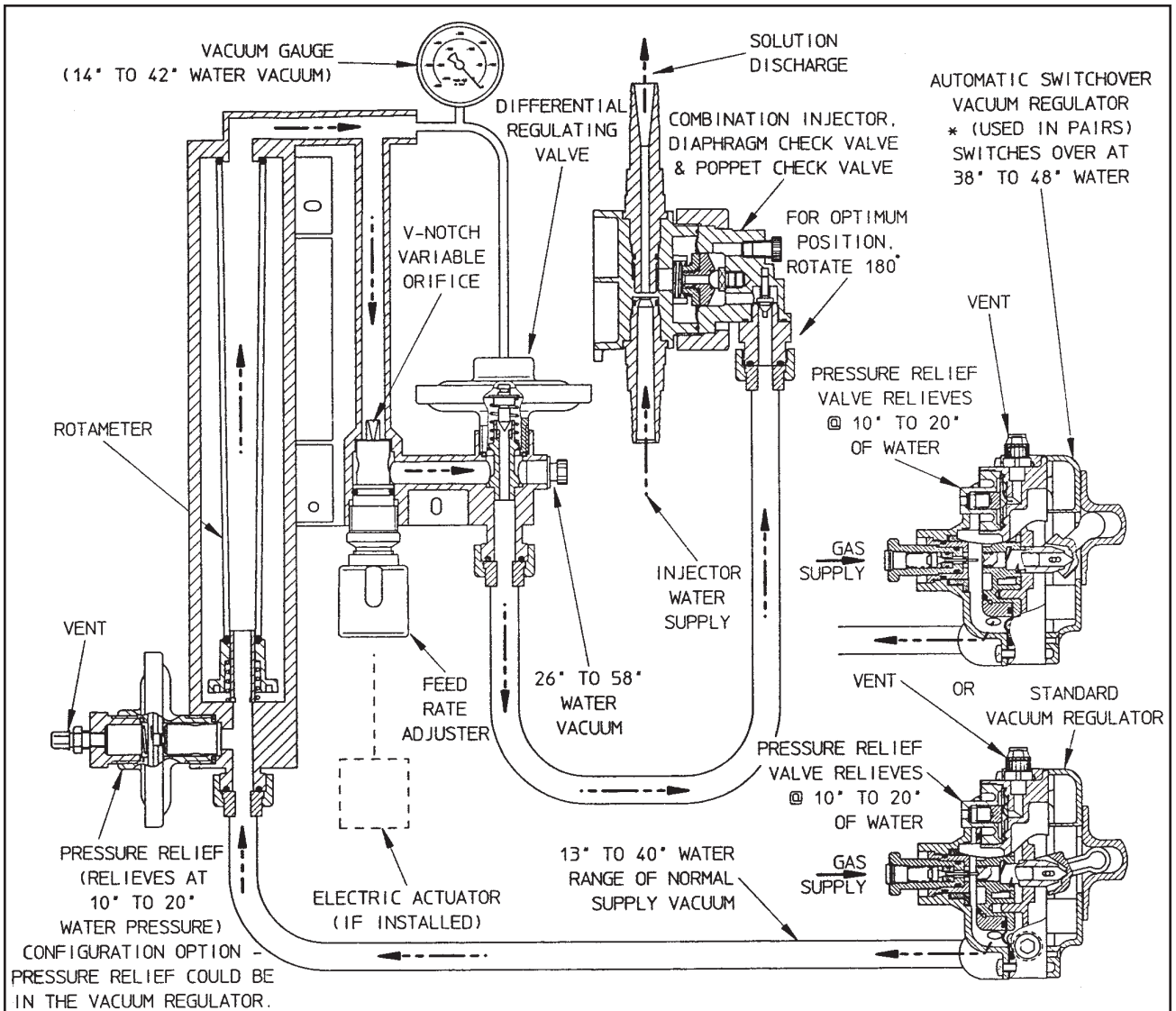
3.7 Automatic Operation

Refer to the automatic controller book for automatic operation.

3.8 Changing Gas Supply Containers

Refer to the separate instruction book provided with vacuum regulator for detailed instructions and precautions.

V-10K V-NOTCH SULFONATOR



NOTE: * SHOWN IN STANDBY POSITION.

**SERIES V10K V-NOTCH GAS FEEDER
- FLOW DIAGRAM**

25.100.185.010

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SECTION 4

SECTION 4 - SERVICE

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WARNING: HAZARDOUS GAS IS PRESENT IN THIS EQUIPMENT DURING NORMAL OPERATION. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT, READ THIS INSTRUCTION BOOK AND THE APPROPRIATE GAS MANUAL BEFORE CONNECTING THIS EQUIPMENT TO A SUPPLY OF GAS. OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BE RESTRICTED TO TRAINED, QUALIFIED PERSONNEL WHO ARE COMPLETELY FAMILIAR WITH THESE INSTRUCTIONS.

4.1 General



WARNING: EXCEPT WHEN DETECTING LEAKS OR MAKING CALIBRATION ADJUSTMENTS, TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, THE GAS SUPPLY MUST BE SHUT OFF AT THE GAS SUPPLY CONTAINER(S) AND THE GAS IN THE SYSTEM MUST BE COMPLETELY EXHAUSTED BEFORE BREAKING ANY CONNECTIONS AND SERVICING THE EQUIPMENT. TO DO THIS, TURN OFF THE GAS SUPPLY AT THE CONTAINER VALVE, WAIT UNTIL THE SUPPLY VACUUM GAUGE READS FULL SCALE AND THE ROTAMETER FLOAT RESTS ON THE BOTTOM STOP, AND THEN TURN OFF THE INJECTOR WATER SUPPLY.

NOTE: Refer to the automatic controller and the positioner Instruction Books for service instructions, if the automatic version is used.

Maintenance is simplified if certain general precautions are taken. These are usually easy to accomplish and will contribute to reducing maintenance costs by maintaining normal operating conditions. Before reassembling removed parts, apply Halocarbon grease U27546 to all ACME threads and Teflon tape to all tapered threaded joints.

4.1.1 Checking for Leaks



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY, IT IS GOOD PRACTICE TO HAVE AN APPROVED GAS MASK AVAILABLE WHEN MAKING LEAK CHECKS.

- SULFUR DIOXIDE LEAKS



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, DO NOT TOLERATE ANY LEAKS. THEY ALWAYS GET PROGRESSIVELY WORSE AND MUST BE CORRECTED PROMPTLY.

NOTE: For leak testing, use Evoqua Water Technologies U409 or Commercial 26° Baume' aqua ammonia. Household ammonia is not strong enough.

For checking leakage of sulfur dioxide gas at joints, valves etc., hold the moistened dauber of the ammonia close to the joint or suspected leakage area. If leakage exists, a white cloud will form. When a leak is found,

immediately shut off the gas supply and remove the escaped gas by ventilation. Continue injector operation until the supply vacuum gauge reads full scale and the rotameter float rests on the bottom stop to remove all gas from the equipment.



WARNING: ESCAPED GAS MUST BE EXHAUSTED TO OUTSIDE ATMOSPHERE. THE EXHAUST SYSTEM MUST TERMINATE IN AN AREA WHERE GAS FUMES CANNOT CAUSE INJURY TO PERSONNEL OR PROPERTY DAMAGE. DO NOT TERMINATE THE EXHAUST SYSTEM AT A LOCATION ROUTINELY USED BY PERSONNEL, SUCH AS WORK AREAS OR PATHWAYS NOR NEAR WINDOWS OR VENTILATION SYSTEM INTAKES.

Eliminate the leak before proceeding.

As a routine practice, check gas connections for leaks once a day. No gas odor should be around equipment except when a joint is temporarily opened.



WARNING: WHEN ANY CONNECTION IS BROKEN EVEN FOR A SHORT TIME, IMMEDIATELY PLUG THE RESULTANT OPENINGS WITH A RUBBER STOPPER OR EQUIVALENT TO PREVENT THE ENTRANCE OF MOISTURE. MOISTURE MUST BE EXCLUDED FROM ANY PART OF THE EQUIPMENT THAT IS NORMALLY EXPOSED TO DRY SULFUR DIOXIDE ONLY.

- WATER LEAKS

As a matter of routine maintenance, tolerate no water leaks. Repair all water leaks as soon as they are discovered.

4.1.2 Plastic Parts

Whenever threaded plastic parts are assembled, use Teflon tape on NPT (National Pipe Taper) threads and Halocarbon grease on straight and ACME threads to prevent the parts from “freezing” together. In general, do not use tools to make up plastic connections. Make this type of connection by hand only.

4.1.3 Inspection

After any disassembled parts are cleaned and prior to reassembly perform the following:

- a. Check for physical damage to removed parts (chipped, cracked, damaged threads, etc.). Replace damaged parts.
- b. Discard and replace all removed O-rings, seals, and gaskets.
- c. Check diaphragm for chafing or cracking. Replace damaged diaphragms.

4.2 Gaskets/O-Rings

Keep a supply of gaskets and O-rings so that gasketed joints can be maintained in proper condition. A regular replacement program for gaskets will do much to eliminate operating difficulties. The Preventive Maintenance Kit includes a set of gaskets.



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, NEVER REUSE GASKETS. ALWAYS REPLACE WITH A NEW GASKET OF THE PROPER SIZE AND MATERIAL AS IDENTIFIED ON THE EQUIPMENT PARTS DRAWING.

4.3 Dirty Water Strainer

A strainer is required in the water line ahead of the injector to avoid plugging of the injector throat ports by foreign material. If sufficient material is allowed to build up on the strainer surfaces, the resultant pressure drop across the strainer reduces the injector operating water pressure. If the pressure drop is excessive, the injector will not be able to induct the required gas flow. Regular periodic inspection and cleaning of the strainer will minimize this possibility.

4.4 Maintenance

Maintenance of a Series V10k Gas Feeder system consists of three periodically performed operations:

- Periodic Performance Checks to detect the onset of any deteriorating conditions before their progress leads to serious malfunction.
- Periodic Cleaning to remove contaminants and deposits brought to the control unit(s) by the gas flow and to the injector by the water flow.
- Periodic Preventive Maintenance to disassemble, inspect, clean and accomplish recommended parts replacement. Kits of replacement parts required for this periodic maintenance are available and are listed in Section 6, Preventive Maintenance Kits.

PROTECT YOUR EQUIPMENT INVESTMENT
MINIMIZE DOWNTIME
REORDER A PREVENTIVE MAINTENANCE KIT NOW
KEEP ONE ON HAND

NOTE: If the gas feeder is used seasonally or after a long-term shut-down, the preventive maintenance should be performed prior to startup.

4.5 Periodic Performance Checks

To assure that all elements of your system are functioning in a normal manner, it is recommended that the following checks be made at approximately three-month intervals. These checks are easy to perform and require no tools.

- a. With the gas turned on at the supply container valve and at the vacuum regulator, and with the injector operating, turn the V-notch plug clockwise and then counterclockwise to vary the feed of the gas feeder through its full range. The gas feeder should feed steadily and hold any rate set from the maximum of the rotameter down to 1/20th of maximum. The rotameter float should not stick or behave erratically at any point.
- b. With the injector still operating, turn off the gas at the supply container valve. In a few moments the supply vacuum gauge should read full scale and the indicator on the front of the vacuum regulator should move to the empty position. After initially rising, the rotameter float will sink lower and lower in the tube until finally it is resting on the bottom stop. Partially close the V-notch if necessary to prevent the float from bouncing violently and damaging the glass tube. An incorrect vacuum reading indicates inadequate injector vacuum or an air leak into the system. Failure of the float to settle down indicates an air leak somewhere upstream of the rotameter.
- c. When the vacuum gauge reads full scale and the rotameter float has settled down, turn off the injector operating water. A rapid decrease in vacuum indicates an air leak somewhere in the system.
- d. If the system is equipped with the automatic switchover vacuum regulator, operate the gas feeder with only one unit turned on. Turn on the second unit and then close the gas supply container valve on the container originally feeding. The vacuum level should momentarily increase and then decrease, and the gray knob on the front of the second unit should be observed to snap down as it assumes the feeding function. Repeat the procedure, reversing which unit is turned on first to check that the opposite one will also pull in automatically. If either unit does not switch on automatically refer to the vacuum regulator instruction book.
- e. Close the gas supply container valve. Shut off the injector and let normal backpressure remain. Remove the tubing from the connection at the injector. Note if any water drips from the end of the disconnected tubing (there should be none) and leave the tubing disconnected for approximately 10 minutes. Note if any water appears at the outer end of the connection fitting on the injector. If any water is seen, service the injector diaphragm check and poppet check.
- f. With the gas exhausted from the system, the injector shut off and the gas supply container valve closed, turn the vacuum regulator off. Remove the tubing from its connection on the unit. Open the gas container valve 1/8

turn, and use an ammonia dauber near the outlet of the unit to verify that the unit shuts off tightly (no white vapors). A slight trace of vapor at the moment of disconnection may be ignored, but any continuing vapor formation is an indication of gas passing the valve seat. If continuing vapor is observed, close the gas container valve, exhaust all gas as instructed in OPERATION - To Stop for Extended Periods, and service the unit stem and seat parts (refer to vacuum regulator instruction book).

4.6 Periodic Cleaning

To ensure that all elements of your system are free of contaminants, it is recommended that the following checks be made at the stated intervals.

Perform at intervals as tabulated below:

MAINTENANCE ITEM	WHEN TO PERFORM
Vacuum Regulator	Refer to separate instruction book.
Rotameter	When deposits are seen inside the glass tube or the float sticks in one place.
V-Notch Plug	At same time as rotameter.
Injector Nozzle and Tailway	Every six months.

NOTE: The actual frequency of cleaning will depend on calendar time, the feed rate and amount of gas fed, the care exercised in container changing, the source of the gas and the quality of the operating water. The above maintenance schedule provides recommended cleaning intervals. However, your own operating experience is the best guide to preventive maintenance and may result in significant variations from the recommended schedule.

If the flowmeter tube, float, V-notch plug or any valve seat becomes contaminated with impurities sometimes found in gases, it should be removed and cleaned.



WARNING: TO PREVENT POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, ALL CLEANING SHOULD BE CARRIED OUT IN AN OPEN AREA OR IN A WELL VENTILATED ROOM.

Most of the residue that accumulates can usually be removed with warm water and a detergent. Rubber parts should be cleaned only with warm water and a detergent.



WARNING: TO PREVENT POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, DO NOT USE WOOD ALCOHOL, ETHER, PETROL OR PETROLEUM DISTILLATES.

All traces of solvent and moisture must be removed from parts that come in contact with the gas before being returned to service. Do not use heat on plastic or hard rubber parts.

4.6.1 Cleaning Rotameter (See Dwg. 25.100.150.010)

If a milky white, powdery white, green slimy, or brown oily deposit is visible inside the rotameter tube or if the float has particles clinging to it or tends to stick to the tube wall at lower feeds, it is time to clean the rotameter. Proceed carefully to avoid dropping the glass tube or losing the float down a floor drain or grating. Have a clean cup (such as a coffee cup or a small beaker) and a pair of tweezers at hand before starting. Proceed as follows:

- a. Turn the knob on the vacuum regulator(s) to the OFF position. After the supply vacuum gauge reads full scale and the rotameter float rests on the bottom stop, turn off the injector operating water.
- b. Exert downward force on lower bell of rotameter with one hand. Use two fingers of other hand to swing the top of rotameter outward. Lift rotameter. Take care not to lose the end stops or the float. Discard the removed O-rings.
- c. Place the end stops and float into the cup mentioned above.
- d. Many (but not all) contaminants are soluble in water. Hold the tube end under running warm (110-125°F) water so that the water enters the tube at one end and exits at the other to flush out deposits. Alternately, soak the tube in a container of warm water for about 30 seconds. Then hold the tube (half full with water) with palms or stoppers capping the ends and shake vigorously endwise for a few seconds. Discharge the water and repeat until clean. A common pipe cleaner may be used to scrub the interior. A detergent will promote cleaning action.



WARNING: DO NOT USE HYDROCARBONS OR ALCOHOLS BECAUSE RESIDUAL SOLVENT MAY REACT WITH THE GAS. SOLVENTS CAN PRODUCE SERIOUS PHYSIOLOGICAL EFFECTS UNLESS USED IN STRICTEST COMPLIANCE WITH THE SOLVENT MANUFACTURER'S SAFETY RECOMMENDATIONS.

- e. Drain and let dry. Do not use a pipe cleaner as a drying tool because the lint from it will stick to the tube interior. Place the tube at an angle between a horizontal and a vertical surface (as between a shelf and a wall) with both ends open so air can flow through. Drying will be hastened by heat, as from a light bulb nearby. Do not blow through the tube as moisture from the breath will condense on the tube walls.
- f. To clean the float pour about an inch of warm to hot (130-150°F) water into the cup containing the float. Grasp the float with tweezers and shake it side to side while submerged for a few seconds. Release the float and pick it up again and repeat the action several times so all surfaces are washed. Hold the float with the tweezers, discard the wash water and repeat the above. A few drops of detergent will improve the process. Do not use your fingers to hold the float.



WARNING: DO NOT USE HYDROCARBONS OR ALCOHOLS BECAUSE RESIDUAL SOLVENT MAY REACT WITH THE GAS. SOLVENTS CAN PRODUCE SERIOUS PHYSIOLOGICAL EFFECTS UNLESS USED IN STRICTEST COMPLIANCE WITH THE SOLVENT MANUFACTURER'S SAFETY RECOMMENDATIONS.

- g. Allow the float to dry on a clean surface and then, with tweezers, place it in a clean dry cup.

NOTE: Do not attempt to dry the float with a rag or paper towel as electrostatic forces will make lint and other particles stick to the float.

- h. Clean stops with water and dry thoroughly before reassembly.



WARNING: DO NOT USE HYDROCARBONS OR ALCOHOLS BECAUSE RESIDUAL SOLVENT MAY REACT WITH THE GAS. SOLVENTS CAN PRODUCE SERIOUS PHYSIOLOGICAL EFFECTS UNLESS USED IN STRICTEST COMPLIANCE WITH THE SOLVENT MANUFACTURER'S SAFETY RECOMMENDATIONS.

- i. When tube, float, and stops are clean and dry, wipe a thin film of Halocarbon grease on the bottom O-ring and proceed with reassembly. Proceed to paragraph 4.6.2, Cleaning V-Notch Plug.

4.6.2 Cleaning V-Notch Plug

The same contaminants seen in the rotameter are in the gas stream flowing through the V-notch orifice and may also deposit at this point. When the rotameter is cleaned, clean the V-notch plug at the same time. If at any time float movement in the rotameter is not proportional to V-notch plug rotation (a sudden marked rise or drop for a small amount of plug turning), the V-notch plug requires cleaning.

- a. Turn the knob on the vacuum regulator(s) to the OFF position. After the supply vacuum gauge reads full scale and the rotameter float rests on the bottom stop, shut off the injector water supply.
- b. Manual: Remove the V-notch assembly completely from the control unit by unscrewing the extension chamber. Unscrew the adjusting knob completely and withdraw the V-notch plug.

Automatic: Put electric actuator in manual position as described in electric actuator book. Rotate knob to lower actuator shaft down as far as possible. Unscrew the clamping nut and push the V-notch up. Unscrew the V-notch plug chamber. Unscrew the V-notch plug. Reassemble in reverse order.

- c. Using running water or a cup full of water and a small, stiff brush (such as an old toothbrush), scrub out the V-notch groove and the shank of the plug.



WARNING: DO NOT USE HYDROCARBONS OR ALCOHOLS BECAUSE RESIDUAL SOLVENT MAY REACT WITH THE GAS. SOLVENTS CAN PRODUCE SERIOUS PHYSIOLOGICAL EFFECTS UNLESS USED IN STRICTEST COMPLIANCE WITH THE SOLVENT MANUFACTURER'S SAFETY RECOMMENDATIONS.

- d. Do not soak the plug in solvent. Do not use a knife or scraper or a file to clean out the groove. Dissolving action and scrubbing are all that is required.
- e. Dry the plug with a clean cloth or paper towel.
- f. Remove seal clamping screw. Clean and inspect orifice and O-rings and replace if necessary.
- g. Wipe a thin film of Halocarbon grease on the O-rings and the threads of the V-notch assembly. Reinstall it in the control panel and resume operation.

4.6.2.1 Zero Position of V-Notch Plug For Electric Control

When the electronic controller is receiving a zero flow signal, adjust lock nut and coupling screw until the V-notch is at its zero position, then tighten.

To determine this position, proceed as directed in preceding Step b. Automatic. With the V-notch plug and plug stem in the extension chamber and the orifice seated, move the plug stem in or out as required until the scratch line on the bottom of the plug is even with the bottom of the orifice as viewed through the holes in the extension chamber. Make a pencil line around the plug stem even with the bottom of the seal clamping screw. This pencil line may then be used as a zero reference when the parts are reassembled in the control unit and the linkage is adjusted to match the zero of the electric actuator.

4.6.3 Cleaning Injector Throat and Tailway

Water containing carbonates, manganese or iron will frequently leave a deposit in injector tailways. As this deposit increases in thickness it can become scaly and rough and adversely affect pressure recovery or increase backpressure so that the injector fails to develop adequate operating vacuum. If the upstream strainer becomes corroded or perforated and passes a small pebble or other tramped material, such particles can partially plug the throat and prevent adequate flow. Water containing suspended silt or sand particles can erode the opening in the throat. As this opening is enlarged, the water velocity decreases and the vacuum developed also decreased.

Deposits may be removed by immersing the throats in dilute (10%) hydrochloric acid, known commercially as muriatic acid.



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE WHEN USING HYDROCHLORIC ACID, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE ACID MANUFACTURER/SUPPLIER.

4.6.4 Cleaning 3/4" Fixed Throat Injector (Standard) (See Dwg. 25.200.002.010)

The check valve prevents water from the injector from being drawn back into the control unit and toward the vacuum regulator during the OFF period, by the vacuum prevailing at shut-down.

In continuous or nearly continuous operation, this valve is actuated very little, and the recommended annual check is principally to assure cleanliness. In automatic start-stop operation, the check valve can accumulate thousands of opening and closing cycles in six months or less and wear becomes a consideration in addition to clean surfaces. For either interval the procedure is as follows:

- Cleaning Injector Unit Diaphragm Backcheck.
 - a. Shut off injector operating water.
 - b. Take steps to prevent water from the point of application, flowing back toward the injector.
 - c. Unscrew gas line tubing nut and remove tubing.
 - d. Unscrew injector body union nut.
 - e. Unscrew valve stem in the center of the top of the upper body. Wipe the surface of the spherical tip of valve stem with a clean cloth or paper towel to remove any loose material. Soak briefly in 10% muriatic (hydrochloric) acid if there are any deposits that do not wipe away in plain water. If the spherical surface is indented, worn, eroded, or scratched, replace valve stem.



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE WHEN USING HYDROCHLORIC ACID, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE ACID MANUFACTURER/SUPPLIER.

- f. Using a blunt tool, remove the O-ring from the valve seat (diaphragm clamping screw). Discard the O-ring.
 - g. Reassemble the valve stem to the upper body and replace the valve seat O-ring and diaphragm clamping O-ring (outer) prior to assembling the injector body union nut.
- Cleaning Poppet Check
 - a. Unscrew the inlet adapter and discard O-ring.
 - b. Remove the poppet and remove the O-ring from the poppet. Discard the O-ring.
 - c. Replace the poppet O-ring.

- d. Replace the inlet O-ring. Wipe a thin film of Halocarbon grease on the O-ring before installing it.
- e. Reassemble the poppet and inlet adapter.

4.6.6 Cleaning 3/4" Fixed Throat Injector (Anti-Syphon) (See Dwg. 25.200.002.020)

The check valve prevents water from the injector from being drawn back into the control unit and toward the vacuum regulator during the OFF period, by the vacuum prevailing at shut-down.

In continuous or nearly continuous operation, this valve is actuated very little, and the recommended annual check is principally to assure cleanliness. In automatic start-stop operation, the check valve can accumulate thousands of opening and closing cycles in six months or less and war becomes a consideration in addition to clean surfaces. For either interval the procedure is as follows:

- Cleaning Injector Unit Diaphragm Backcheck.
 - a. Shut off injector operating water.
 - b. Take steps to prevent water from the point of application, flowing back toward the injector.
 - c. Unscrew gas line tubing nut and remove tubing.
 - d. Unscrew injector body union nut.
 - e. Unscrew valve stem in the center of the top of the upper body. Wipe the surface of the spherical tip of valve stem with a clean cloth or paper towel to remove any loose material. Soak briefly in 10% muriatic (hydrochloric) acid if there are any deposits that do not wipe away in plain water. If the spherical surface is indented, worn, eroded, or scratched, replace valve stem.



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE WHEN USING HYDROCHLORIC ACID, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE ACID MANUFACTURER/SUPPLIER.

- f. Use a blunt tool, and remove the O-ring from the valve seat (diaphragm clamping screw). Discard the O-ring.
 - g. Reassemble the valve stem to the upper body and replace the valve seat O-ring and diaphragm clamping O-ring (outer) prior to assembling the injector body union nut.
- Cleaning Poppet Check
 - a. Unscrew the inlet adapter and discard O-ring.

- b. Remove the poppet and remove the O-ring from the poppet. Discard the O-ring.
- c. Replace the poppet O-ring.
- d. Replace the inlet O-ring. Wipe a thin film of Halocarbon grease on the O-ring before installing it.
- e. Reassemble the poppet and inlet adapter.
- f. Proceed to paragraph c for anti-syphon portion of the injector.
- Cleaning Anti-Syphon Injector Lower Portion
 - a. Unscrew lower union nut and carefully remove bottom cap and take out diaphragm assembly. Clean off any deposits with warm (110-125°F) water. It is not necessary to disassemble the diaphragm unit to do this.
 - b. Clean O-ring groove on guide pins. Do not scrape with a knife blade or any such instrument. Only warm water (110-125°F) is permissible. Wipe a thin film of Halocarbon grease on the O-rings before installing them on the guide pins. Loosen screws 3/4 of a turn from their tight position, if disassembled.
 - c. Remove spring and wipe off any deposits found.
 - d. Reinstall spring and diaphragm assembly into bottom cap. Reassemble bottom cap to body with union nut.

4.6.7 Cleaning 1" Fixed Throat Injector (Standard) (see Dwg. 25.200.002.030)

- Cleaning Injector Unit Diaphragm Backcheck
 - a. Shut off injector operating water.
 - b. Take steps to prevent water from the point of application, flowing back toward the injector.
 - c. Unscrew stem in the center of the top of the injector. Remove and discard O-ring.
 - d. Wipe the surface of the spherical tip of stem with a clean cloth or paper towel to remove any loose material. Soak briefly in 10% muriatic (hydrochloric) acid if there are any deposits that do not wipe away in plain water. If the spherical surface is indented, worn, eroded or scratched, replace valve stem.



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE WHEN USING HYDROCHLORIC ACID, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE ACID MANUFACTURER/SUPPLIER.

- e. Wipe a thin film of Halocarbon grease on the O-ring before installing it on the stem.
- f. Look through the opening in the top of the injector with a flashlight and examine the conical hole and O-ring in diaphragm screw immediately below. If it is smooth and clean, merely reinstall the stem, making sure the large O-ring is under the head. If the conical hole and O-ring show film deposits, clinging particles, or a rough surface, disassemble the injector. Unscrew the gas line union nut and discard O-ring.
- g. Remove six bolts and lift off injector flange. Carefully remove the diaphragm assembly. Using a fine pointed tool, pierce the O-ring and remove it from the valve seat. Clean the conical hole in the diaphragm screw. Do not scrape with a knife blade or a tapered reamer. Scrub out with a cloth plug. Dissolve resistant deposit with 10% muriatic (hydrochloric) acid. It is not necessary to disassemble the diaphragm to do this.



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE WHEN USING HYDROCHLORIC ACID, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE ACID MANUFACTURER/SUPPLIER.

- h. Reassemble the valve stem to the upper body and replace the valve seat O-ring and diaphragm clamping O-ring (outer).
- i. Bolt the flange in place with six bolts.
- Cleaning Poppet Check
 - a. To clean poppet check unscrew adapter and remove O-ring. Discard the O-ring.
 - b. Remove poppet and remove O-ring. Discard the O-ring.
 - c. Clean threads and O-ring groove by soaking in warm water. Wipe a thin film of Halocarbon grease on the O-ring and threads.
 - d. Install a new O-ring on the poppet and insert the poppet into the holder.
 - e. Assemble the holder to the injector body. Do not use excessive force when tightening the adapter.
 - f. Replace the union nut O-ring before reconnecting the gas line.

4.6.8 Cleaning 1" Fixed Throat Injector (Anti-Syphon) (See Dwg. 25.200.002.040)

NOTE: When removing O-rings, use a blunt tool to pull them out. Do not damage the tightening surfaces. Apply a thin film of Halocarbon grease to the new O-rings and to the threads.

- a. Turn off the gas supply. Allow the gas feeder to run until the float drops and settles on the bottom stop.
- b. Drain the operation water tubes.
- c. Follow the directions in Cleaning One-Inch Fixed Throat Injector (Standard) for steps 3 through 9.
- d. Unscrew the clamping nut with the parts connected.
- e. Remove the poppet. Replace the O-ring.
- f. Remove the snap ring clip.
- g. Remove the clamping nut and spring.
- h. Remove the clamping washer and replace O-ring.
- i. Replace the diaphragm assembly. Assemble with clamping disc, clamping screw and spring. Secure with snap ring.
- j. Remove the plug and replace the O-ring.
- k. Press out the poppet seat. Replace the poppet seat along with the O-ring. Press in the new seat using a round rod or plastic tube (16 mm) with a flat front.
- l. Place the poppet into the guide and screw in the clamping nut with the assembled parts.
- m. Screw in the plug.
- n. Replace the O-ring in the gas inlet.
- o. Secure the tailway with the retaining nut and connect to the operation water tubing.
- p. Connect the gas line.
- q. Check for tightness and function.

4.7 Periodic Preventive Maintenance

Because of aging of elastomeric components and the desirability of checking internal zones for possible accumulations of deposits not seen in routine maintenance, it is recommended that at one-year intervals, each of the principal components of the system, be completely disassembled. Before starting the work, ensure that the recommended spare parts are on hand.

NOTE: If the gas feeder is used seasonally or after a long-term shutdown, the preventive maintenance should be performed prior to startup.

Disassembly and reassembly instructions necessary to install the maintenance kit parts are included in the kit(s).

Servicing of Evoqua Water Technologies equipment including installation of parts from maintenance kits should be restricted to trained, authorized personnel who are completely familiar with the entire contents of the equipment instruction book. The Evoqua Water Technologies sales office or the dealer from whom you purchased the equipment can provide the preventive maintenance kits or overhaul service.

4.8 Unscheduled Service

4.8.1 Auxiliary Cylinder Valve

See separate Instruction Book provided with Vacuum Regulator.

4.8.2 Supply Vacuum Gauge



CAUTION: Do not disassemble the diaphragm unit from the supply vacuum gauge.

4.8.3 Differential Regulating Valve (see Dwg. 25.152.001.011)

- Removal and Disassembly
 - a. Unscrew tubing union nut.
 - b. Unscrew plug (1). Remove and discard gasket (2).



WARNING: SPRING IS IN A COMPRESSED CONDITION. DISASSEMBLE CAREFULLY TO PREVENT FORCEFUL EJECTION OF PARTS AND POSSIBLE SEVERE PERSONAL INJURY.

- c. Unscrew and remove valve body (3). Remove and discard gasket (2).
- d. Push stem holder (4) out of diaphragm. Remove and discard O-ring (10).

- e. Unscrew and remove seat unit (8). Remove and discard gasket (7).
- Reassembly
 - a. The residue that accumulates on the valve seat can be removed with warm water and a detergent. Pipe cleaners or soft brushes may facilitate cleaning but wire brushes, scrapers and the like should be avoided as they will damage the parts.
 - b. Wipe a thin film of Halocarbon grease onto all O-rings before reassembling.
 - c. Apply a thin film of fluorocarbon oil (No. 6.3, Halocarbon Products) to gasket (7) before assembling.
 - d. Reassemble in the reverse order of disassembly.

4.8.4 Pressure Relief Valve (If Installed At Control Unit) (See Dwg. 25.100.001.040)



WARNING: SPRING IS IN A COMPRESSED CONDITION. DISASSEMBLE CAREFULLY TO PREVENT FORCEFUL EJECTION OF PARTS AND POSSIBLE SEVERE PERSONAL INJURY.

- Removal and Disassembly
 - a. Unscrew plug (6). Remove and discard gasket (1).
 - b. Unscrew and remove valve body (2). Remove and discard gasket (1).
 - c. Push stem (4) out of diaphragm. Remove and discard O-ring (3).
- Reassembly
 - a. Clean the residue that accumulates on the valve seat with warm water and a detergent. Pipe cleaners or soft brushes may facilitate cleaning but wire brushes, scrapers and the like should be avoided as they will damage the parts.
 - b. Wipe a thin film of Halocarbon grease onto all O-rings and gaskets before reassembling.
 - c. Reassemble in the reverse order of disassembly.

4.9 Troubleshooting

The following troubleshooting table is provided for determining and correcting most common troubles.

Table 4.1 - Troubleshooting

<p>Basic Instructions:</p> <ol style="list-style-type: none"> 1. Measure the vacuum over the full range of gas flow. (Low, half and full feed). 2. Compare what you measure with figures given below. If the figures are right, leave that component alone and check the next element. 3. Make additional checks (if necessary) to pin-point the problem. 4. Refer to detailed instructions for component disassembly and repair if this check list indicates such work is appropriate. <p>WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, TURN OFF THE GAS SUPPLY AT THE CONTAINER VALVE, WAIT UNTIL THE SUPPLY VACUUM GAUGE READS FULL SCALE AND THE ROTAMETER FLOAT RESTS ON THE BOTTOM STOP, AND THEN TURN OFF THE INJECTOR WATER SUPPLY BEFORE PERFORMING ANY DISASSEMBLY OPERATIONS FOR TROUBLESHOOTING PURPOSES. REFER TO OPERATION-STOPPING.</p>					
OPERATING SYMPTOMS	PROBABLE CAUSE	WHAT TO MEASURE	HOW TO MEASURE	TYPICAL VALUES FOR PROPER OPERATION	REMEDY
GAS FEEDER WILL NOT FEED AT ALL (NO ROTAMETER INDICATION) -OR- WILL NOT COME UP TO FULL FEED. (GAS SUPPLY TO GAS FEEDER IS ADEQUATE.)	Insufficient injector vacuum.	Injector vacuum	Connect vacuum gauge or mercury manometer to the plugged 1/4-inch port on front of injector. If no gauge or manometer is available, remove line from differential regulating valve to injector. Turn on water supply and place wet thumb over inlet to injector. Vacuum should pull thumb down firmly and raise a "bump" on thumb.	Requires six inches of mercury, minimum, for dynamic (gas flowing) conditions. With gas shut off, should see 25 to 28 inches of mercury static vacuum.	Remove throat and tailway and clean or (if necessary) replace. Clean Y-strainer in water line. Check solution discharge line for accumulation of foreign material, hose kinks, or partially closed valve. With gauges, measure operating water pressure and pressure at point of application. Compare with previous data. If system has a booster pump, check pump for wear, buildup of deposits and air leaks. If it is a new installation, ensure that there is no elbow or reducing coupling immediately downstream of injector tailway. Run full size pipe straight up at least 8" before any elbow or reducer, or use poly pipe and arrange in a smooth curve, up, over and down, as required.

Table 4.1 - Troubleshooting (Cont'd)

OPERATING SYMPTOMS	PROBABLE CAUSE	WHAT TO MEASURE	HOW TO MEASURE	TYPICAL VALUES FOR PROPER OPERATION	REMEDY
GAS FEEDER EITHER DOES NOT FEED AT ALL OR ONLY AT LOW RATES; REFUSES TO FEED AT HIGH RATES. INJECTOR VACUUM LEVEL IS CORRECT. ADEQUATE GAS IN CONTAINERS.	Clogged vacuum regulator -OR- clogged gas line will not let gas through fast enough to satisfy demand -OR- vacuum regulator not opening due to an air leak from a perforated diaphragm or a loose or defective gasketed joint.	Gas inlet vacuum.	Read vacuum gauge on control unit or connect a single leg water manometer in the vacuum line. Close gas supply container valve. Rotameter float should drop to bottom stop. If it does not, it indicates an air leak upstream of the rotameter. Remove vent line and close off pressure relief nipple with finger. If float then drops it indicates a defective diaphragm or the stem plug is not sealing. If it does not drop, a loose or defective gasketed joint in tubing or vacuum regulator is indicated.	13 to 40 inches of water vacuum.	Clean vacuum regulator. Clean gas supply line. Tighten gasketed joints or replace gaskets or diaphragm unit as indicated by tests at left.
GAS FEEDS NORMALLY AT HIGH RATES, BUT WILL NOT CONTROL AT LOW RATES.	Vacuum regulator not throttling sufficiently (held open by a particle of ferric chloride, rust, or dirt etc.); too much gas flowing.	Gas inlet vacuum. (Probably too low at low feed rates.)	Read vacuum gauge on control unit or connect a single leg water manometer in the vacuum line.	13 to 40 inches of water vacuum.	Clean vacuum regulator.

V-10K V-NOTCH SULFONATOR

Table 4.1 - Troubleshooting (Cont'd)

OPERATING SYMPTOMS	PROBABLE CAUSE	WHAT TO MEASURE	HOW TO MEASURE	TYPICAL VALUES FOR PROPER OPERATION	REMEDY
ROTAMETER FLOAT DOES NOT DROP ALL THE WAY TO THE BOTTOM STOP WHEN THE GAS IS SHUT OFF AT THE CONTAINER AND THE INJECTOR IS OPERATING.	Air leak upstream of rotameter -OR- dirty rotameter.	See if float is "alive" (i.e., spinning or free floating indicating air flow) or it drops to a constant point and is "dead" (indicating binding by dirt or foreign matter).	Visual appearance.	-	Check vacuum regulator diaphragms, including center seals. Check pressure relief diaphragm and seating surfaces. Clean the rotameter.
ROTAMETER FLOAT DOES NOT RISE AND FALL UNIFORM-LY IN PROPORTION TO V-NOTCH KNOB ROTATION BUT "JUMPS" UP OR DOWN SHARPLY WITH A SMALL CHANGE IN V-NOTCH SETTING.	Contamination in V-notch plug. V-notch orifice worn.	-	Visual	-	Remove V-notch assembly and clean V-shaped groove in V-notch plug. (A toothbrush and warm water are usually effective). CAUTION: Do not scrape or scratch groove with a sharp-edged tool. Replace orifice.
GAS FEEDS NORMALLY, BUT CONTAINER WEIGHT LOSS AS SHOWN BY SCALE IS LESS THAN THE ROTAMETER INDICATES MULTIPLIED BY TIME AT EACH SETTING	Air leak upstream of rotameter.	-	-	-	For air leaks, check: Pressure relief valve diaphragm and seating surface, vacuum regulator diaphragms, including center seals and tubing connectors.

Table 4.1 - Troubleshooting (Cont'd)

OPERATING SYMPTOMS	PROBABLE CAUSE	WHAT TO MEASURE	HOW TO MEASURE	TYPICAL VALUES FOR PROPER OPERATION	REMEDY
GAS FEEDER DOES NOT FEED. GAS SUPPLY IS NORMAL. V-NOTCH IS CLEAN. ROTAMETER IS CLEAN. INJECTOR VACUUM IS NORMAL. INJECTOR CHECK IS OPENING PROPERLY.	Differential regulating valve spring defective or inadvertently left out. Fails to lift unit stem out of seat so gas cannot flow to injector.	Regulated vacuum.	Connect a single leg manometer at the plug opening just below the differential regulating valve.	48 to 62 inches of water vacuum.	NOTE: The spring should be under the diaphragm. If defective, replace differential regulating spring.
GAS FEEDS NORMALLY, BUT CONTAINER WEIGHT LOSS AS SHOWN BY SCALE IS GREATER THAN THE ROTAMETER INDICATES MULTIPLIED BY TIME AT EACH SETTING.	Defective O-ring on differential regulating valve stem -OR- hole in diaphragm.	Regulated vacuum.	Same as above.	Same as above.	If gas flow is restricted due to impurities, clean gas line and/or vacuum regulator. If differential regulating spring, O-ring or diaphragm unit are defective, replace parts as necessary. NOTE: Gasket is required under diaphragm unit when reinstalled.

Table 4.1 - Troubleshooting (Cont'd)

OPERATING SYMPTOMS	PROBABLE CAUSE	WHAT TO MEASURE	HOW TO MEASURE	TYPICAL VALUES FOR PROPER OPERATION	REMEDY
V-NOTCH IS DIFFICULT TO TURN. WHEN FORCIBLY MOVED, AN AIR LEAK IS DETECTED.	Buildup of contaminant residue on V-notch plug shaft is binding in the seal - OR- has been forced past the seal, stretching it open.	No measurements required.	-	-	Remove entire V-notch assembly. Soak in warm water for about two minutes. Unscrew red knob until threads just disengage. Remove screw and washer which hold knob to V-notch shaft. Unscrew and remove seal clamp. Withdraw V-notch plug with seal and O-ring. Clean plug. Lubricate plug with a light film of Halocarbon grease. Reassemble all parts, tightening seal clamp just enough to give a smooth, firm, sliding grip on the plug. Replace seal if damaged. NOTE: Running plug up and down through its full range once a month will "wipe off" any beginning residue before it becomes a sticky or hard, resistant accumulation.
WATER IN VACUUM LINE FROM CONTROL UNIT TO INJECTOR.	Defective check valve(s) in injector.	-	Visual check.	-	Service injector check valves.
ODOR OF GAS AT PRESSURE RELIEF VENT.	Leaking regulating valve.	-	Smell odor.	-	Service vacuum regulator.

WARNING LABELS AND TAGS

The following warning labels and tag are attached to the equipment:

ACG4600: THIS UNIT IS DESIGNED TO OPERATE UNDER VACUUM ONLY. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO EQUIPMENT, DO NOT CONNECT TO A SOURCE OF GAS UNDER PRESSURE. SEE INSTRUCTION BOOK FOR FULL DETAILS BEFORE INSTALLATION.

AFM4995: INITIAL INSTALLATION & CHECK-OUT OF THIS EQUIPMENT MUST BE MADE FOLLOWING DETAILED INSTRUCTIONS CONTAINED IN THE EVOQUA WATER TECHNOLOGIES INSTRUCTION BOOK & SAFETY RELATED INFORMATION OBTAINED FROM YOUR GAS SUPPLIER. THESE CONDENSED OPERATING INSTRUCTIONS MAY THEN BE FOLLOWED FOR SUBSEQUENT GUIDANCE OF TRAINED EQUIPMENT OPERATORS.

L2709: HAZARDOUS CHEMICAL IS PRESENT IN THIS EQUIPMENT DURING NORMAL OPERATION. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DEATH, THE FOLLOWING PRECAUTIONS MUST BE OBSERVED:

1. When changing chemical supply containers, you must be completely familiar with your local plant operating and emergency procedures including the location and use of a gas mask for the gas you are using. Recommended emergency procedures can be obtained from your chemical or gas supplier, Compressed Gas Association, Inc., or similar organization.
2. Do not open the chemical supply container valve more than one complete turn. This will permit maximum discharge and can be turned off quickly in the event of a leak.
3. On a routine daily basis, starting at the chemical supply container(s), thoroughly check all joints, connections and equipment for possible leaks and immediately correct any found. Do not tolerate any leaks.
4. Chemical leaks never get better; they always get progressively worse, if they are not promptly corrected.
5. Never re-use gaskets in chemical piping systems. Always have an adequate supply on hand and always use new gaskets of the correct size and material as identified on the equipment parts drawings.
6. Except in cases of leak detection or calibration adjustments, the chemical supply must be shut off at the supply container valve(s) and the chemical in the system completely exhausted before servicing the equipment.

V-10K V-NOTCH SULFONATOR

WARNING LABELS AND TAGS (CONT'D)

7. It is recommended practice to have an approved gas mask available, which you have been trained to use, when making leak checks and when changing gas supply containers.
8. The Evoqua Water Technologies instruction book provided with this equipment furnishes complete and detailed instructions for its installation, operation and maintenance and must be referred to for that detailed information.
9. The Evoqua Water Technologies instruction book provided with this equipment also furnishes technical information on the characteristics, storage and handling of the chemical or gas being used, and must be referred to for that information. Contact your chemical or gas supplier, the Compressed Gas Association, Inc., or similar organization to obtain more detailed information.
10. Operation and maintenance of this equipment must be restricted to trained, qualified personnel who are completely familiar with these instructions.

DO NOT REMOVE THIS SIGN FROM THIS EQUIPMENT

AHS4646: HAZARDOUS GAS IS PRESENT IN THIS EQUIPMENT DURING NORMAL OPERATION. TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT, READ THE EVOQUA WATER TECHNOLOGIES INSTRUCTION BOOK AND THE APPROPRIATE GAS MANUAL BEFORE CONNECTING THIS EQUIPMENT TO A SUPPLY OF GAS. OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BE RESTRICTED TO TRAINED, QUALIFIED PERSONNEL WHO ARE COMPLETELY FAMILIAR WITH THESE INSTRUCTIONS.

AFM4634: TO AVOID POSSIBLE SEVERE PERSONAL INJURY FROM ELECTRICAL SHOCK TURN POWER OFF BEFORE SERVICING. KEEP COVER SECURELY TIGHTENED WHEN EQUIPMENT IS IN OPERATION. THIS ENCLOSURE IS NEMA 4X RATED. GASKET SEAL MUST BE MADE IN ORDER TO PROTECT THE INTERNAL COMPONENTS FROM MOISTURE AND FUMES.

ACG4653: METAL CONDUIT MUST BE BONDED TO GROUND. OTHERWISE, USE NONMETALLIC CONDUIT.

V-10K V-NOTCH SULFONATOR

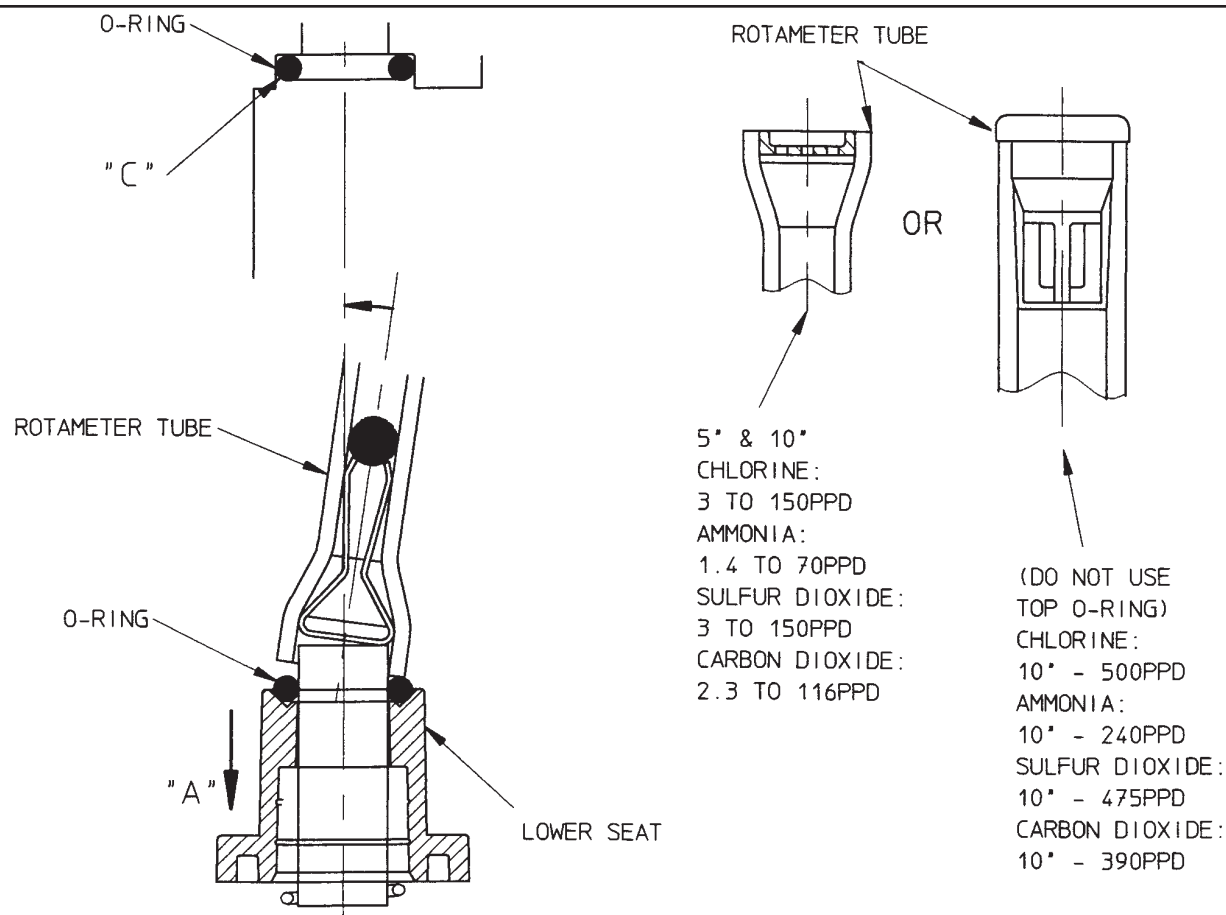
CAUTION LABELS AND TAG

The following caution labels and tag are attached to the equipment:

P4373: PULL OUT STEM TO FULL LENGTH OF CHAIN BEFORE CLOSING VALVE.

ADH4733: FOR CHLORINE, SULFUR DIOXIDE OR CARBON DIOXIDE USE ONLY.

V-10K V-NOTCH SULFONATOR



TO INSTALL ROTAMETER:

1. LUBRICATE O-RINGS WITH A LIGHT FILM OF HALOCARBON GREASE.
2. POSITION O-RINGS AS INDICATED. INSERT FLOAT AND STOPS IN ROTAMETER TUBE.
3. GRASP ROTAMETER BY THE TWO ENDS (HIGH VALUES OF THE SCALE ON TOP).
4. GUIDE LOWER END OF ROTAMETER WITH HAND "A" TO LOCATE ON O-RING.
5. EXERT DOWNWARD FORCE ON LOWER SEAT WITH TWO FINGERS OF HAND "A", TO COMPRESS SPRING. USE TWO FINGERS OF HAND "B" TO GUIDE TOP OF ROTAMETER INTO POSITION. ROTAMETER MUST TOUCH AT POINT "C" TO INSURE SEATING ON UPPER O-RING.
6. RELEASE DOWNWARD FORCE ON SPRING (HAND "A").
7. TURN THE TUBE UNTIL THE SCALE IS IN FRONT.

TO REMOVE ROTAMETER:

1. EXERT DOWNWARD FORCE ON LOWER ROTAMETER SEAT WITH HAND "A".
2. USE TWO FINGERS OF HAND "B" TO SWING TOP OF ROTAMETER OUTWARD.
3. LIFT ROTAMETER.

READ SCALE OPPOSITE CENTER OF BALL.

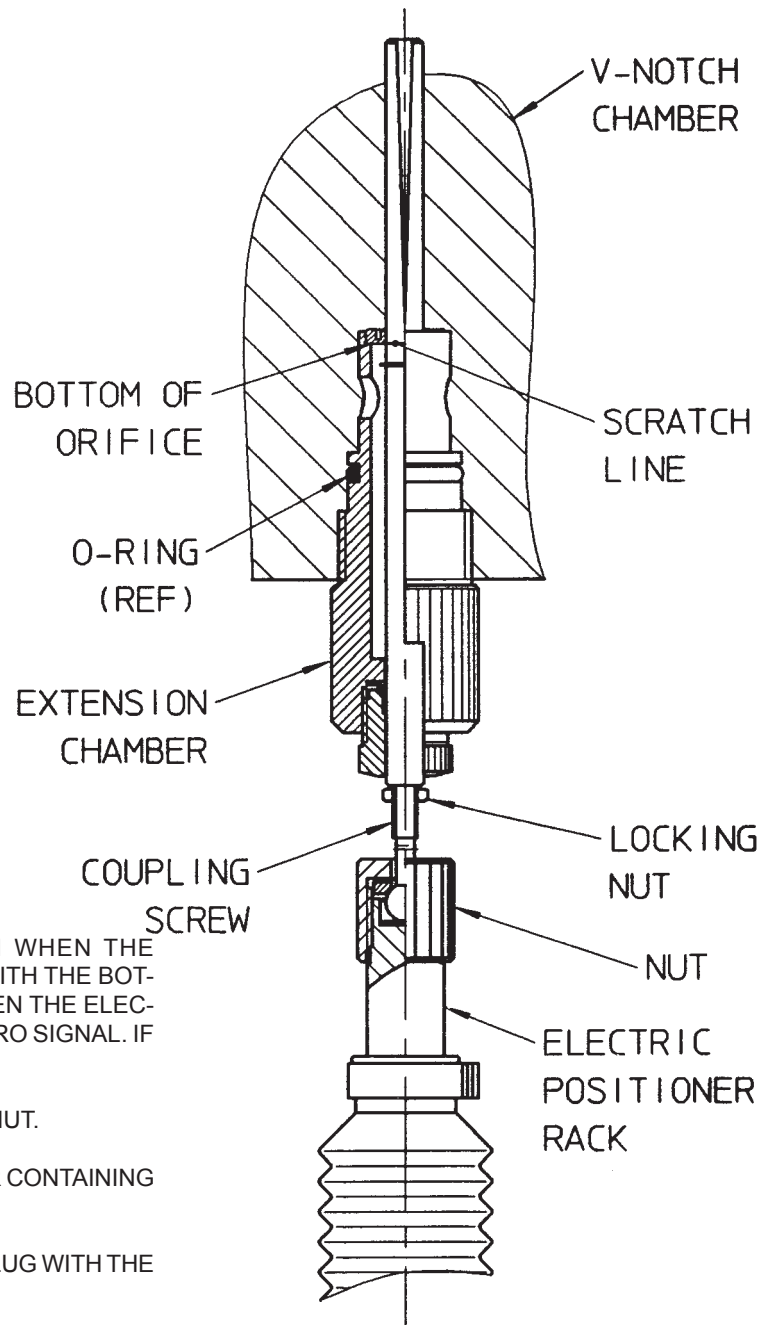
INSTALLATION AND REMOVAL OF ROTAMETER - SERVICE

Used In V10K V-Notch Gas Feeders

25.100.150.010

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V-10K V-NOTCH SULFONATOR



THE PLUG IS AT THE ZERO POSITION WHEN THE SCRATCH LINE ON THE PLUG IS IN LINE WITH THE BOTTOM OF THE ORIFICE. THIS RESULTS WHEN THE ELECTRONIC CONTROLLER IS RECEIVING A ZERO SIGNAL. IF ADJUSTMENTS ARE NECESSARY:

- A. RETRACT RACK AND THEN LOOSEN NUT.
- B. UNSCREW THE EXTENSION CHAMBER CONTAINING THE V-NOTCH PLUG AND ORIFICE.
- C. LINE UP THE SCRATCH LINE ON THE PLUG WITH THE BOTTOM OF THE ORIFICE.
- D. CAREFULLY REINSTALL THE EXTENSION CHAMBER INTO THE UNIT.
- E. LOOSEN LOCKING NUT AND SCREW COUPLING SCREW COMPLETELY IN.
- F. USE ELECTRICAL SIGNAL FROM CONTROLLER TO POSITION RACK AT ZERO FEED POSITION.
- G. ADJUST BALL AND SCREW FOR CORRECT ALIGNMENT BETWEEN THE ACTUATOR AND THE PLUG.
- H. ATTACH THE NUT AND TIGHTEN.

AUTOMATIC CONTROL UNIT - SERVICE
Zero Position of Plug

25.200.150.010

ISSUE 0 10-95

SECTION 5

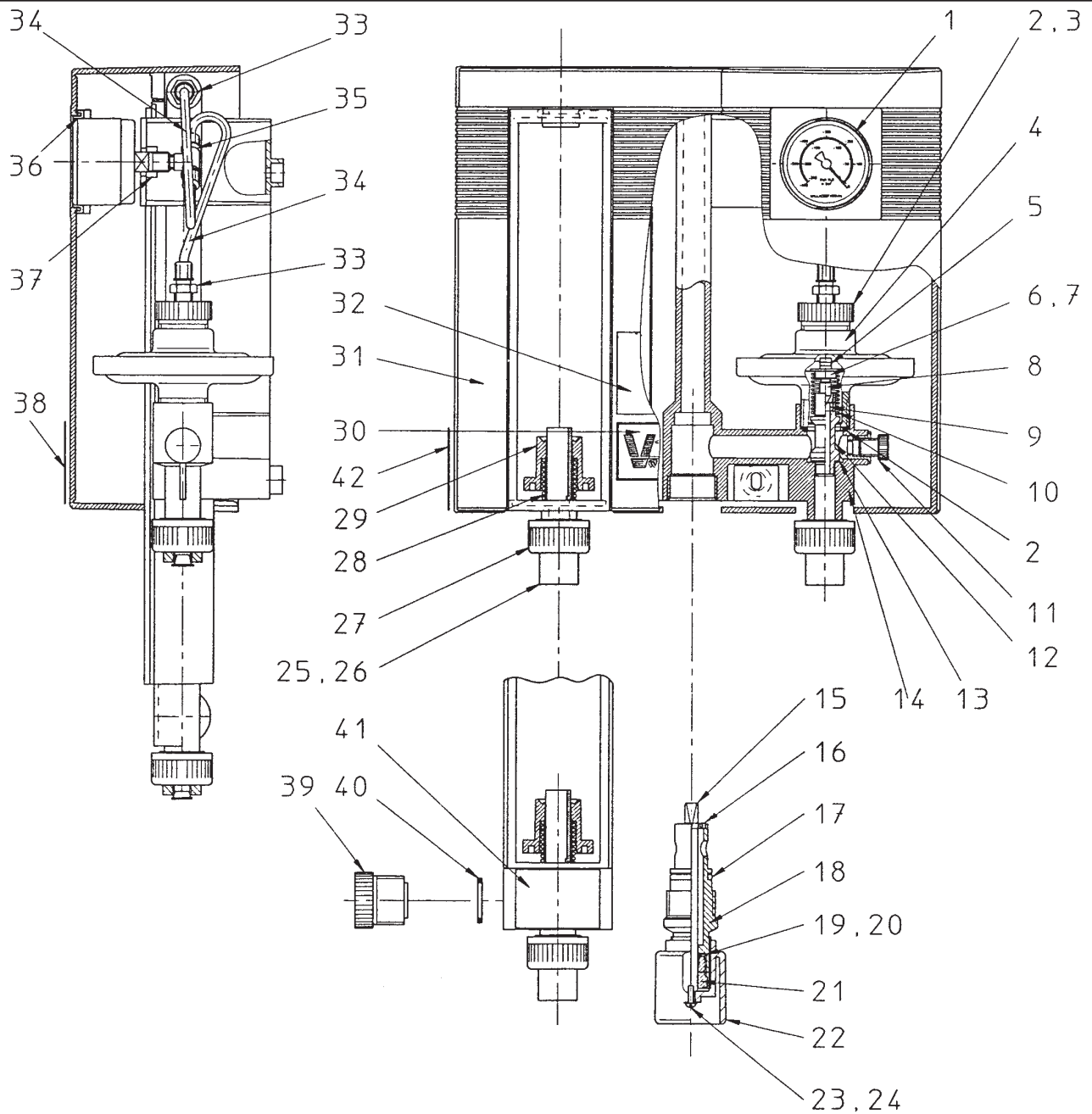
V-10K V-NOTCH SULFONATOR

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V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWG. 25.100.000.010B.

LOW CAPACITY: 5" - AKG 3147, 10" - APQ 5486

HIGH CAPACITY: 5" - AKG 3138, 10" - AIC 5481

CONTROL PANEL - PARTS

Automatic Arrangement

25.100.000.010A

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V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAC6494	1	VACUUM GAUGE
2	P44122	2	GASKET
3	PXA37688	1	PLUG
4	U26664	1	DIAPHRAGM UNIT
5	P44119	1	O-RING (009) HYPALON
6	P37656	1	STEM HOLDER
7	P37655	1	PIN
8	P38409	1	STEM
9	P37672	1	SEAT (LOW CAPACITY)
	OR		
	P38404	1	SEAT (HIGH CAPACITY)
10	P37653	1	SPRING
11	P31295	1	PLUG, 1/4" NPT
12	P37671	1	HOUSING
13	P37661	1	HOUSING SEAT GASKET
14	UXA96294	1	5" HEADBLOCK ASSEMBLY
	OR		
	UXA96295	1	10" HEADBLOCK ASSEMBLY
15	P38071	1	V-NOTCH (LOW CAPACITY)
	OR		
	P48127	1	V-NOTCH (HIGH CAPACITY)
16	P37657	1	ORIFICE
17	P44045	1	EXTENSION CHAMBER O-RING
18	P52146	1	EXTENSION CHAMBER
19	PXH26482	1	O-RING (012) HYPALON, 3/8" ID x 1/2" OD
20	P34530	1	SEAL
21	P37663	1	V-NOTCH SEAL SCREW
22	P96959	1	MANUAL KNOB
23	P35124	1	KNOB SCREW
24	P35121	1	WASHER
25	AIA4701	2	O-RING
26	ALI4188	2	ADAPTER (LOW CAPACITY)
	OR		
	AMK4218	2	ADAPTER (HIGH CAPACITY)
27	P100363	2	UNION NUT
28	P37880	1	ROTAMETER INLET SPRING
29	P96960	1	ROTAMETER BASE
30	P97018	1	LOGO
31	AAB8600	1	V10K COVER ASSMEBLY

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

LOW CAPACITY: 5" - AKG 3147, 10" - APQ 5486

HIGH CAPACITY: 5" - AKG 3138, 10" - AIC 5481

CONTROL PANEL - PARTS LIST

Automatic Arrangement

25.100.000.010B

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V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
32	ACG4600	1	WARNING LABEL (5" ONLY)
33	AAA1887	2	STRAIGHT FITTING
34	RP9024426	1.7FT	TUBING
35	AAA1884	1	TEE FITTING
36	P96962	1	VACUUM GAUGE GASKET
37	P97104	1	NUT
38	AHS4646	1	WARNING LABEL
39	RXA32525	1	PLUG (10" ONLY)
40	P44122	1	GASKET (10" ONLY)
41	ACG4600	1	WARNING LABEL (10" ONLY)
42	ADH4733	1	CAUTION LABEL
	OR		
	ACG4723	1	CAUTION LABEL (AMMONIA ONLY)
-	AFM4995	1	WARNING TAG (NOT SHOWN)
-	L2709	1	WARNING TAG (NOT SHOWN)

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

LOW CAPACITY: 5" - AKG 3147, 10" - APQ 5486

HIGH CAPACITY: 5" - AKG 3138, 10" - AIC 5481

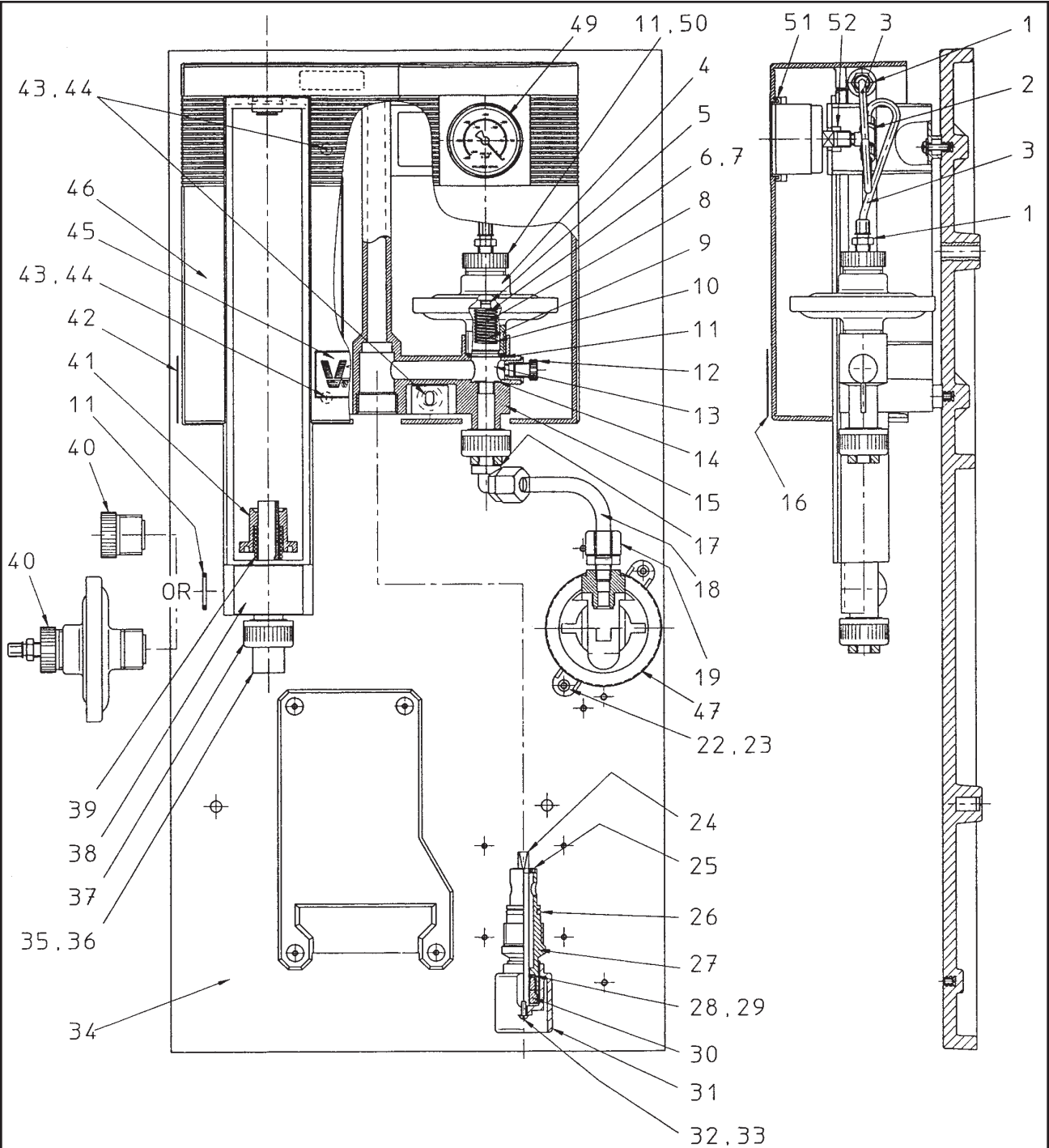
CONTROL PANEL - PARTS LIST

Automatic Arrangement

25.100.000.010C

ISSUE 0 10-08

V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWGS. 25.100.000.020C&D.

LOW CAPACITY: 10" - AKG 3130; HIGH CAPACITY: 10" - AMK 3120

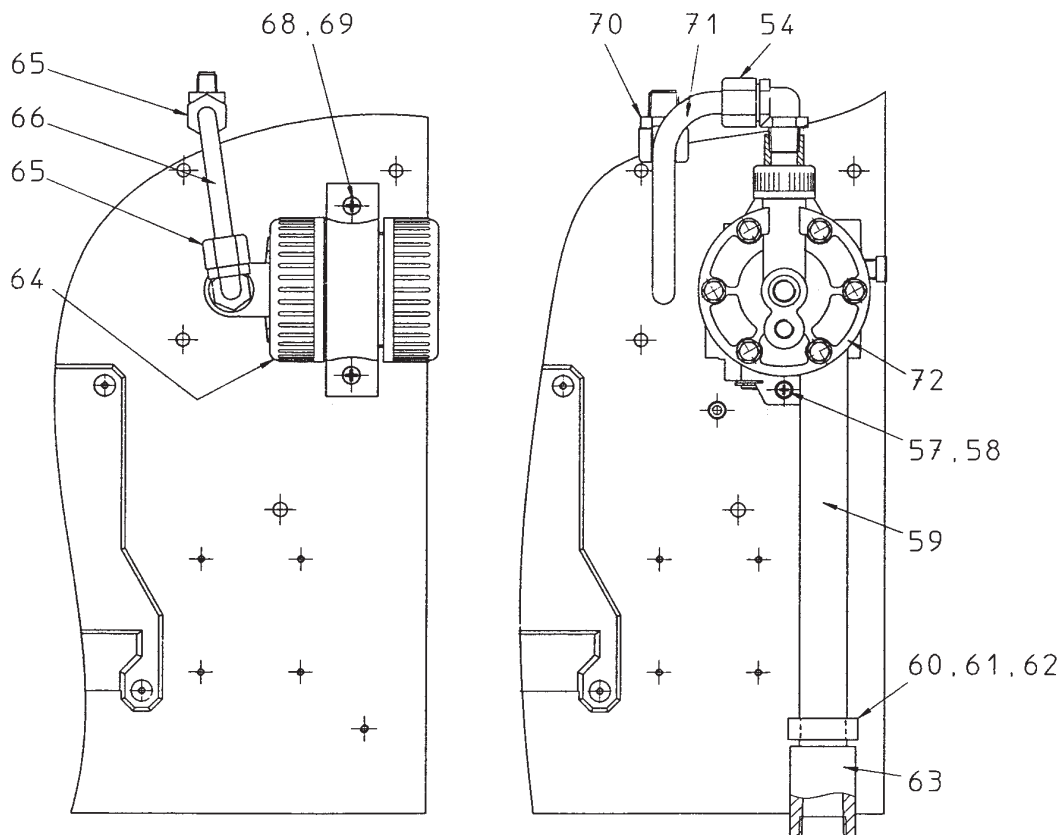
CONTROL PANEL - PARTS

Manual Arrangement

25.100.000.020A

ISSUE 1 3-96

V-10K V-NOTCH SULFONATOR



(3/4" ANTI-SYPHON
INJECTOR SHOWN)

NOTE: FOR PARTS LIST, SEE DWGS. 25.100.000.020C&D.

LOW CAPACITY: 10" - AKG 3130; HIGH CAPACITY: 10" - AMK 3120

CONTROL PANEL - PARTS

Manual Arrangement

25.100.000.020B

ISSUE 1 3-96

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA1887	2	STRAIGHT FITTING
2	AAA1884	1	TEE FITTING
3	RP9024426	1.7FT	TUBING
4	U26664	1	DIAPHRAGM UNIT
5	P44119	1	O-RING (009) HYPALON, 7/32" ID x 11/32" OD
6	P37656	1	STEM HOLDER
7	P37655	1	PIN
8	P38409	1	STEM
9	P37672	1	SEAT (LOW CAPACITY)
	OR		
	P38404	1	SEAT (HIGH CAPACITY)
10	P37653	1	SPRING
11	P44122	3	GASKET
12	P31295	1	PLUG, 1/4" NPT
13	P37671	1	HOUSING
14	P37661	1	SEAT GASKET HOUSING
15	UXA96295	1	10" HEADBLOCK ASSEMBLY
16	AHS4646	1	WARNING LABEL
17	AQA3847	1	TUBING CONNECTOR (1/2" OD x 1/4" NPT)
	OR		
	AWO3879	1	TUBING CONNECTOR (1/2" OD x 1/4" NPT) (FOR AMMONIA ONLY)
18	AAA1532	1	INJECTOR LINE
19	U24914	1	TUBING CONNECTOR
22	PXE96276	2	SCREW
23	P19888	2	WASHER
24	P38071	1	V-NOTCH (LOW CAPACITY)
	OR		
	P48127	1	V-NOTCH (HIGH CAPACITY)
25	P37657	1	ORIFICE
26	P44045	1	EXTENSION CHAMBER O-RING
27	P52146	1	EXTENSION CHAMBER
28	PXH26482	1	O-RING
29	P34530	1	SEAL, PTFE
30	P37663	1	V-NOTCH SEAL SCREW
31	P96959	1	MANUAL KNOB
32	P35124	1	KNOB SCREW
33	P35121	1	WASHER
34	PXB97066	1	PANEL
35	AIA4701	2	O-RING
36	ALI4188	2	ADAPTER (LOW CAPACITY)
	OR		
	AMK4218	2	ADAPTER (HIGH CAPACITY)

WHEN ORDERING MATERIAL, ALWAYS
SPECIFY MODEL AND SERIAL NUMBER OF
APPARATUS.

LOW CAPACITY: 10" - AKG 3130; HIGH CAPACITY: 10" - AMK 3120

CONTROL PANEL - PARTS LIST

Manual Arrangement

25.100.000.020C

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V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
37	P100363	2	UNION NUT
38	ACG4600	1	WARNING LABEL
39	P37880	1	ROTAMETER INLET SPRING
40	RXA32525	1	PLUG
	OR		
	AAA3365	1	PRESSURE RELIEF VALVE (SEE DWG. 25.100.001.040)
41	P96960	1	ROTAMETER BASE
42	ADH4733	1	CAUTION LABEL
	OR		
	ACG4723	1	CAUTION LABEL (AMMONIA ONLY)
43	PXF96220	3	HEADBLOCK SCREW
44	PXF92139	3	HEADBLOCK WASHER
45	P97018	1	LOGO
46	AAB8600	1	V10K COVER ASSEMBLY
47	AAA4310	1	3/4" INJECTOR (SEE SEPARATE DWG.)
49	AAC6494	1	VACUUM GAUGE
50	PXA37688	1	PLUG
51	P96962	1	VACUUM GAUGE GASKET
52	P97104	1	VACUUM GAUGE NUT
54	U24110	1	ELBOW TUBING CONNECOTR (5/8" OD x 1/2" NPT)
57	PXG96276	2	SCREW
58	P19888	2	WASHER
59	AAA1607	1	1" DIA. PIPE NIPPLE
60	UXC94333	1	1" DIA. PIPE CLAMP
61	AAA1613	1	SPACER
62	AAA2457	1	SCREW
63	P43468	1	1" PIPE COUPLING
64	AAA4307	1	3/4" ANTI-SYPHON INJECTOR (SEE DWG. 25.200.002.020A&B)
65	AQA3847	2	TUBING CONNECOTR (1/2" OD x 1/4" NPT)
	OR		
	AWO3879	2	TUBING CONNECOTR (1/2" OD x 1/4" NPT) (FOR AMMONIA ONLY)
66	AAA1535	1	INJECTOR LINE
68	PXE96276	2	SCREW
69	P19888	2	WASHER
70	U24102	1	STRAIGHT TUBING CONNECTOR (5/8" OD x 1/2" NPT)
71	AAA1556	1	INJECTOR LINE
72	AAA4316	1	1" INJECTOR (SEE SEPARATE DWG.)
	OR		
	AAA4313	1	1" ANTI-SYPHON INJECTOR (SEE SEPARATE DWG.)
-	AFM4995	1	WARNING TAG (NOT SHOWN)
-	L2709	1	WARNING TAG (NOT SHOWN)

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

LOW CAPACITY: 10" - AKG 3130; HIGH CAPACITY: 10" - AMK 3120

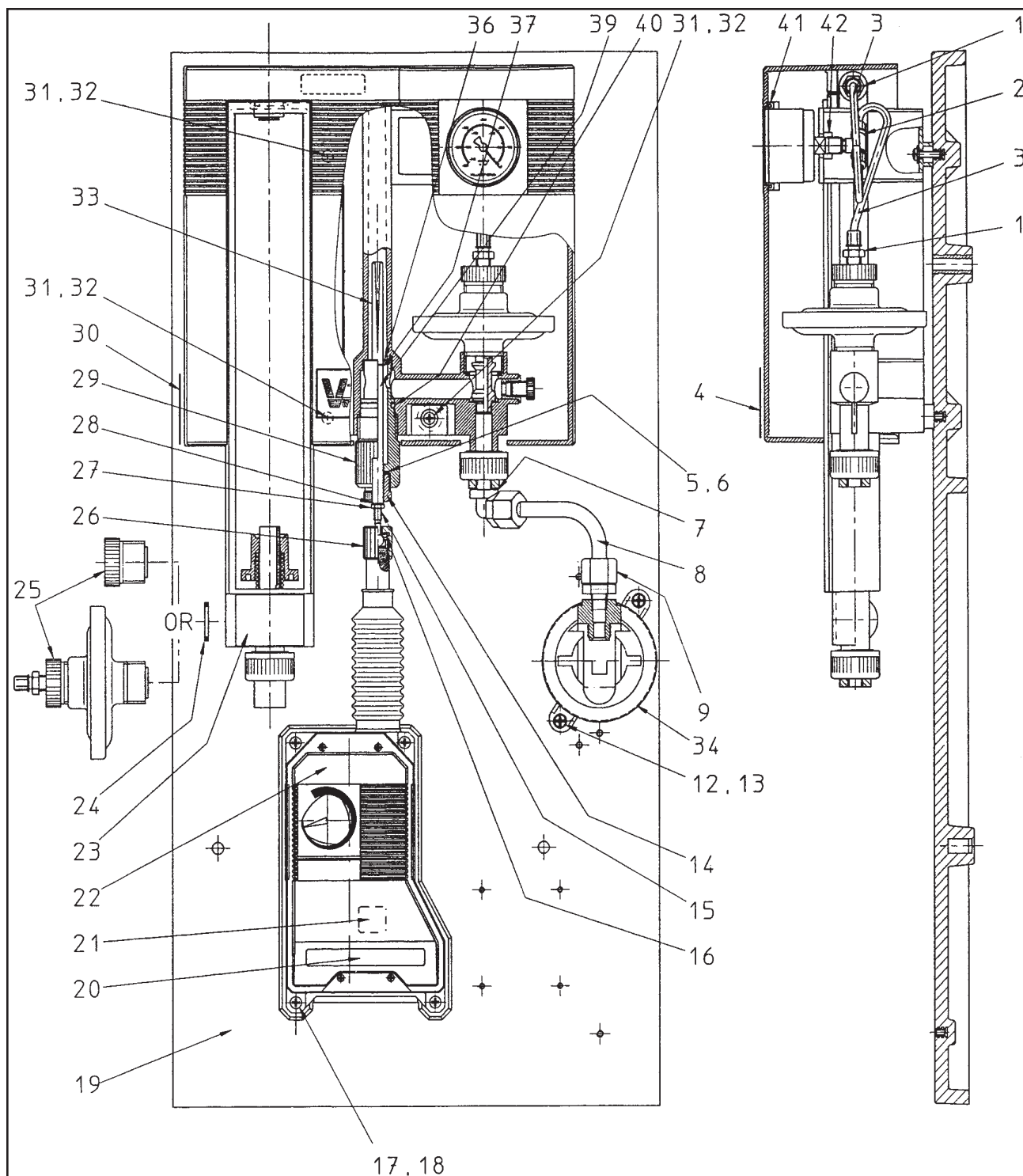
CONTROL PANEL - PARTS LIST

Manual Arrangement

25.100.000.020D

ISSUE 2 10-08

V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWGS. 25.100.000.030C-E.

LOW CAPACITY: 5" - AIC 3143, 10" - ALI 3125

HIGH CAPACITY: 5" - AKG 3134, 10" - ALI 3114

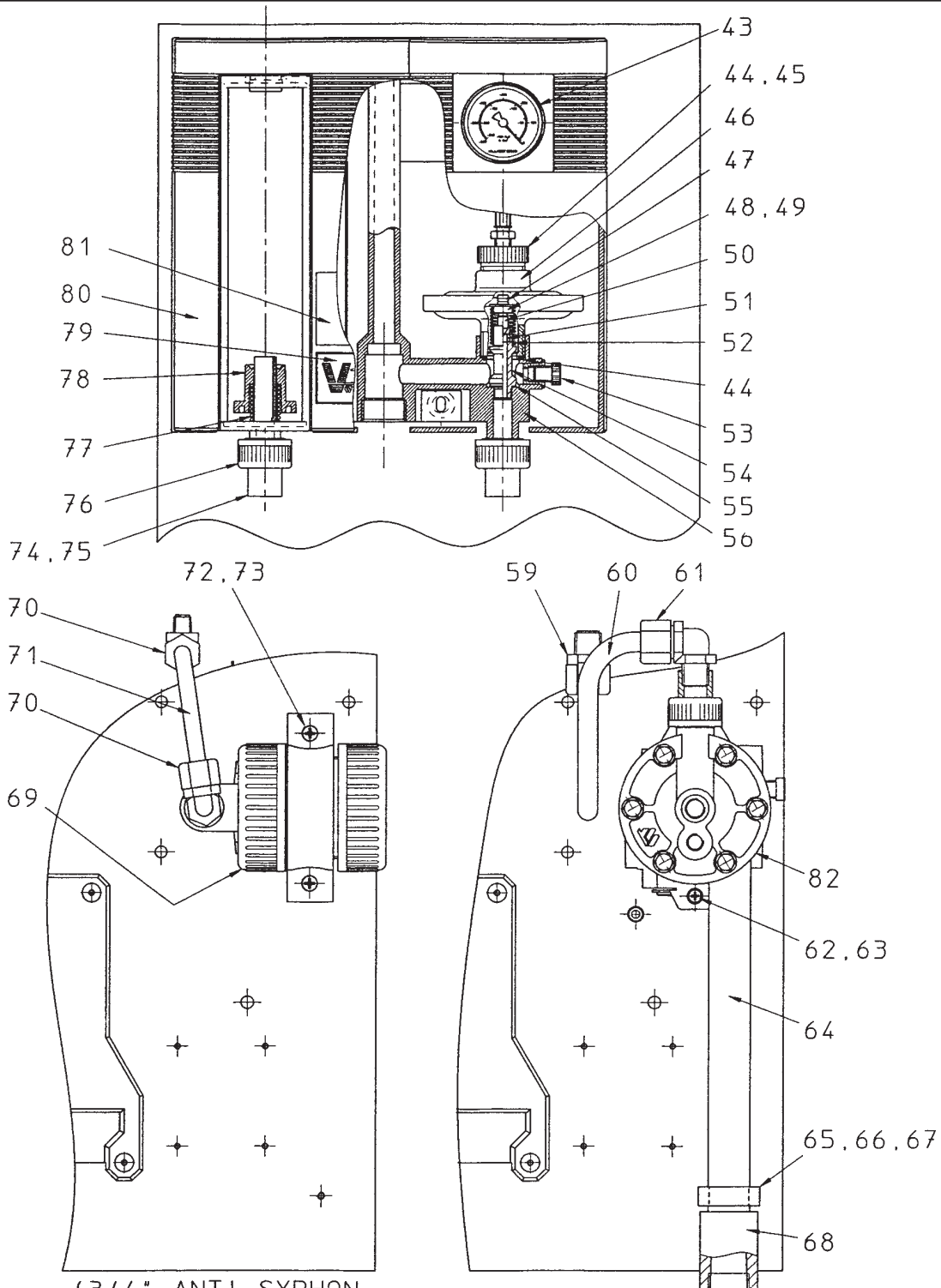
CONTROL PANEL - PARTS

Automatic Arrangement

25.100.000.030A

ISSUE 2 6-14

V-10K V-NOTCH SULFONATOR



(3/4" ANTI-SYPHON
INJECTOR SHOWN)

NOTE: FOR PARTS LIST, SEE DWGS. 25.100.000.030C-E.

LOW CAPACITY: 5" - AIC 3143, 10" - ALI 3125

HIGH CAPACITY: 5" - AKG 3134, 10" - ALI 3114

CONTROL PANEL - PARTS

Automatic Arrangement

25.100.000.030B

ISSUE 2 6-14

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA1887	2	STRAIGHT FITTING
2	AAA1884	1	TEE FITTING
3	RP9024426	1.7FT	TUBING
4	AHS4646	1	WARNING LABEL
5	PXH26482	1	O-RING (012) HYPALON, 3/8" ID x 1/2" OD
6	P34530	1	SEAL
7	AQA3847	1	TUBING CONNECTOR (1/2" OD x 1/4" NPT)
	OR		
	AWO3879	1	TUBING CONNECOTR (1/2" OD x 1/4" NPT) (FOR AMMONIA ONLY)
8	AAA1532	1	INJECTOR LINE
9	U24914	1	TUBING CONNECTOR
12	PXE96276	2	SCREW
13	P19888	2	WASHER
14	P37663	1	V-NOTCH SEAL SCREW
15	P97027	1	BALL AND SCREW
16	P97028	1	DISC
17	PXM96220	4	SCREW
18	P92697	4	WASHER
19	PXB97066	1	PANEL
20	AFM4634	1	WARNING LABEL
21	ACG4653	1	WARNING LABEL
22	UXB96285	1	AUTOMATIC POSITIONER (115V)
	OR		
	UXC96285	1	AUTOMATIC POSITIONER (230V)
23	ACG4600	1	WARNING LABEL (10" ROTAMETER ONLY)
24	P44122	1	GASKET (10" ROTAMETER ONLY)
25	RXA32525	1	PLUG
	OR		
	AAA3365	1	PRESSURE RELIEF VALVE (SEE DWG. 25.100.001.040)
26	P97026	1	CLAMP NUT
27	P16542	1	NUT
28	P16556	1	WASHER
29	P52146	1	EXTENSION CHAMBER
30	ADH4733	1	CAUTION LABEL
	OR		
	ACG4723	1	CAUTION LABEL (AMMONIA ONLY)
31	PXF96220	3	HEADBLOCK SCREW
32	PXF92139	3	HEADBLOCK WASHER
33	---	1	V-NOTCH PLUG (SEE DWG. 25.100.001.030)
34	AAA4310	1	3/4" INJECTOR (SEE SEPARATE INSTRUCTION DWG.)

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

LOW CAPACITY: 5" - AIC 3143, 10" - ALI 3125

HIGH CAPACITY: 5" - AKG 3134, 10" - ALI 3114

CONTROL PANEL - PARTS LIST

Automatic Arrangement

25.100.000.030C

ISSUE 2 10-08

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
36	P37657	1	ORIFICE
37	P36861	1	WASHER (TEFLON)
39	AAA4484	1	AUTOMATIC V-NOTCH STEM UNIT
40	P44045	1	EXTENSION CHAMBER O-RING
41	P96962	1	VACUUM GAUGE GASKET
42	P97104	1	VACUUM GAUGE NUT
43	AAC6494	1	VACUUM GAUGE
44	P44122	2	GASKET
45	PXA37688	1	PLUG
46	U26663	1	DIAPHRAGM UNIT
47	P44119	1	O-RING (009) HYPALON, 7/32" ID x 11/32" OD
48	P37656	1	STEM HOLDER
49	P37655	1	PIN
50	P38409	1	STEM
51	P37672	1	SEAT (LOW CAPACITY)
	OR		
	P38404	1	SEAT (HIGH CAPACITY)
52	P37653	1	SPRING
53	P31295	1	PLUG, 1/4" NPT
54	P37671	1	HOUSING
55	P37661	1	HOUSING SEAT GASKET
56	UXA96294	1	5" HEADBLOCK ASSEMBLY
	OR		
	UXA96295	1	10" HEADBLOCK ASSEMBLY
59	U24102	1	STRAIGHT TUBING CONNECTOR (5/8" OD x 1/2" NPT)
60	AAA1556	1	INJECTOR LINE
61	U24110	1	ELBOW TUBING CONNECTOR (5/8" OD x 1/2" NPT)
62	PXG96276	2	SCREW
63	P19888	2	WASHER
64	AAA1607	1	1" DIA. PIPE NIPPLE
68	UXC94333	1	1" DIA. PIPE CLAMP
66	AAA1613	1	SPACER
67	AAA2457	1	SCREW
68	P43468	1	1" PIPE COUPLING
69	AAA4307	1	3/4" ANTI-SYPHON (SEE SEPARATE INSTRUCTION DWG.)
70	AQA3847	2	TUBING CONNECTOR (1/2" OD x 1/4" NPT)
	OR		
	AWO3879	2	TUBING CONNECTOR (1/2" OD x 1/4" NPT) (FOR AMMONIA ONLY)
71	AAA1535	1	INJECTOR LINE
72	PXE96276	2	SCREW

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

LOW CAPACITY: 5" - AIC 3143, 10" - ALI 3125

HIGH CAPACITY: 5" - AKG 3134, 10" - ALI 3114

CONTROL PANEL - PARTS LIST

Automatic Arrangement

25.100.000.030D

ISSUE 2 10-08

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
73	P19888	2	WASHER
74	AIA4701	2	O-RING (211) HYPALON, 20.22 ID x 3.53 OD
75	ALI4188	2	1/4" ADAPTER (LOW CAPACITY)
	OR		
	AMK4218	2	1/2" ADAPTER (HIGH CAPACITY)
76	P100363	2	UNION NUT
77	P37880	1	ROTAMETER INLET SPRING
78	P96960	1	ROTAMETER BASE
79	P97018	1	LOGO
80	AAB8600	1	V10K COVER ASSEMBLY
81	ACG4600	1	WARNING LABEL
82	AAA4316	1	1" INJECTOR (SEE SEPARATE INSTRUCTION DWG.)
	OR		
	AAA4313	1	1" ANITOSYPHON INJECTOR (SEE SEPARATE INSTRUCTION DWG.)
-	AFM4995	1	WARNING TAG (NOT SHOWN)
-	L2709	1	WARNING TAG (NOT SHOWN)

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

LOW CAPACITY: 5" - AIC 3143, 10" - ALI 3125

HIGH CAPACITY: 5" - AKG 3134, 10" - ALI 3114

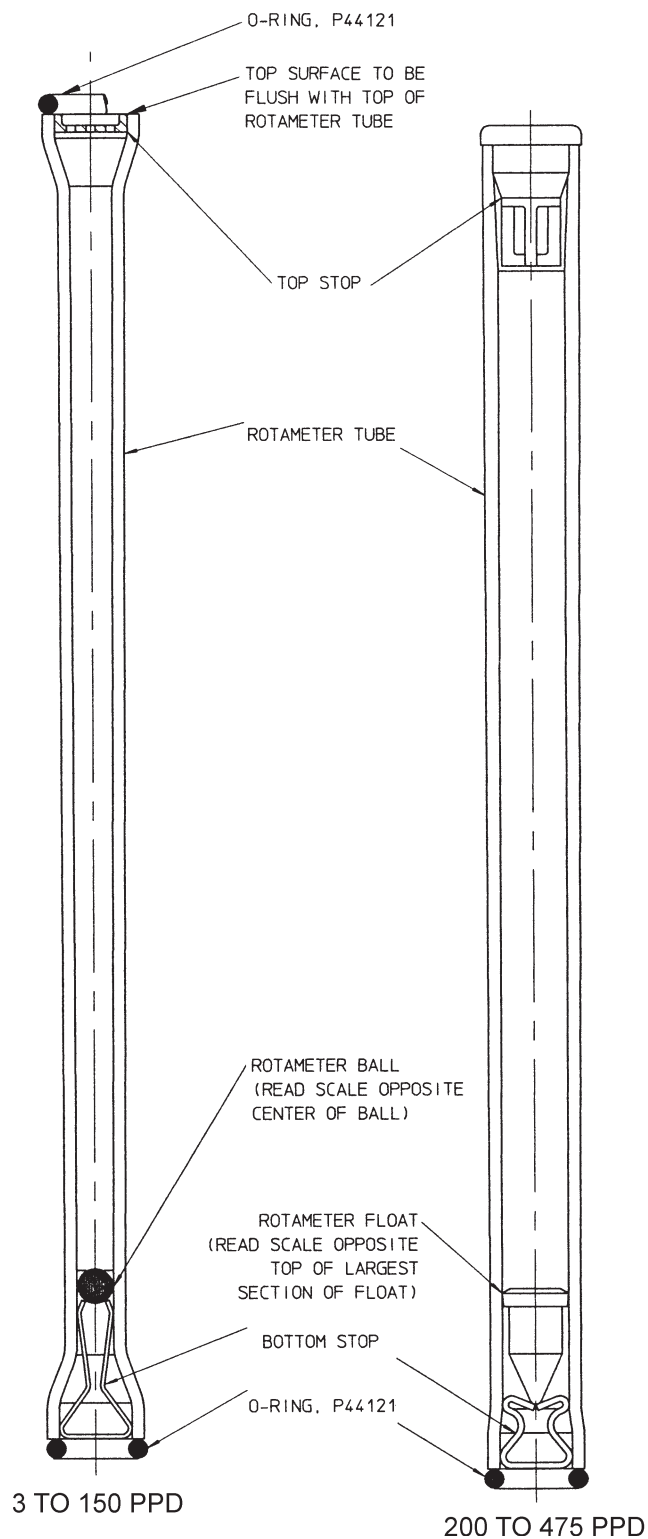
CONTROL PANEL - PARTS LIST

Automatic Arrangement

25.100.000.030E

ISSUE 0 10-08

V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWG. 25.100.001.085B.

V10K SULFONATOR - PARTS
5" & 10" Rotameter Components

25.100.001.085A

ISSUE 0 05-00

V-10K V-NOTCH SULFONATOR

5" ROTAMETER						
MAXIMUM CAPACITY LBS. PER 24 HRS.	COMPLETE UNIT	TUBE	FLOATS		STOPS	
			PART NUMBER	DESCRIPTION	TOP	BOTTOM
3	U 26243	P 54270	P 37702	1/8" DIA. RED BALL	P 41212	P 38131
10	U 26244	P 54272	P 37702	1/8" DIA. RED BALL	P 41212	P 38131
20	U 26245	P 54274	P 37703	5/32" DIA. RED BALL	P 41212	P 38131
30	U 26246	P 54276	NPXA 150	1/4" DIA. BLACK BALL	P 41212	P 38131
50	U 26247	P 54278	P 37705	1/4" DIA. RED BALL	P 41212	P 38131
75	U 26248	P 54280	P 37706	5/16" DIA. RED BALL	P 41212	P 38131
100	U 26249	P 54282	P 37706	5/16" DIA. RED BALL	P 41212	P 38131
150	U 26250	P 54284	P 37707	3/8" DIA. RED BALL	P 41212	P 38131
200	U 26251	P 54286	P 36376	9/16" DIA. GLASS FLOAT	AIC 5506	P 48140
250	U 26252	P 54288	P 36376	9/16" DIA. GLASS FLOAT	AIC 5506	P 48140
300	U 26253	P 54290	P 38256	5/8" DIA. GLASS FLOAT	AIC 5506	P 48140
400	U 26254	P 54292	P 38256	5/8" DIA. GLASS FLOAT	AIC 5506	P 48140
475	U 26255	P 54294	P 35103	11/16" DIA. CERAMIC FLOAT	AIC 5506	P 48140
10" ROTAMETER						
MAXIMUM CAP. LBS. PER 24 HRS.	COMPLETE UNIT	TUBE	FLOATS		STOPS	
			PART NUMBER	DESCRIPTION	TOP	BOTTOM
3	UXA 20990	PXB 44058	P 37702	1/8" DIA. RED BALL	P 41212	P 38131
10	UXB 20990	PXB 44059	P 37702	1/8" DIA. RED BALL	P 41212	P 38131
20	UXC 20990	PXB 44060	P 37703	5/32" DIA. RED BALL	P 41212	P 38131
50	UXN 20990	PXE 44063	NPXA 151	5/16" DIA. BLACK BALL	P 41212	P 38131
75	UXE 20990	PXC 44063	P 37706	5/16" DIA. RED BALL	P 41212	P 38131
100	UXF 20990	PXB 44064	P 37706	5/16" DIA. RED BALL	P 41212	P 38131
150	UXG 20990	PXB 44065	P 37707	3/8" DIA. RED BALL	P 41212	P 38131
200	UXH 20990	PXB 44066	P 36376	9/16" DIA. GLASS FLOAT	AIC 5506	P 48140
250	UXJ 20990	PXB 44067	P 36376	9/16" DIA. GLASS FLOAT	AIC 5506	P 48140
300	UXK 20990	PXB 44068	P 38256	5/8" DIA. GLASS FLOAT	AIC 5506	P 48140
400	UXL 20990	PXB 44069	P 38256	5/8" DIA. GLASS FLOAT	AIC 5506	P 48140
475	UXM 20990	PXB 48131	P 35103	11/16" DIA. CERAMIC FLOAT	AIC 5506	P 48140
<p>WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.</p> <p>V10K SULFONATOR - PARTS LIST 5" & 10" Rotameter Components</p> <p>25.100.001.085B ISSUE 0 05-00</p>						

V-10K V-NOTCH SULFONATOR



CAPACITY (LB/24 HR) ■				V-NOTCH PLUG				
Cl ₂	SO ₂	NH ₃	CO ₂	PART NO.	CODE LETTER	NO. OF GROOVES	SPRING	SEAT
3	3	1.4	2.4	PXA 39598	P	1	P 37700	P 37670
10	10	4.5	8	PXA 39598	P	1		
20	20	9	15	PXB 39598	Q	1		
30	30	14	24	PXC 39598	R	1		
50	50	24	35	PXD 39598	S	1		
75	75	35	58	PXE 39598	T	1		
100	100	45	75	PXF 39598	U	1		
150	150	70	116	PXG 39598	V	1		
200	200	95	150	PXH 39598	W	2		
250	250	120	200	PXJ 39598	X	2		
300	300	140	230	PXK 39598	Y	3		
400	400	190	300	PXL 39598	Z	4		
500	475	240	390	PXM 39598	AA	5		

NOTE: ■ Cl₂ - CHLORINE, SO₂ - SULFUR DIOXIDE, NH₃ - AMMONIA, CO₂ - CARBON DIOXIDE.

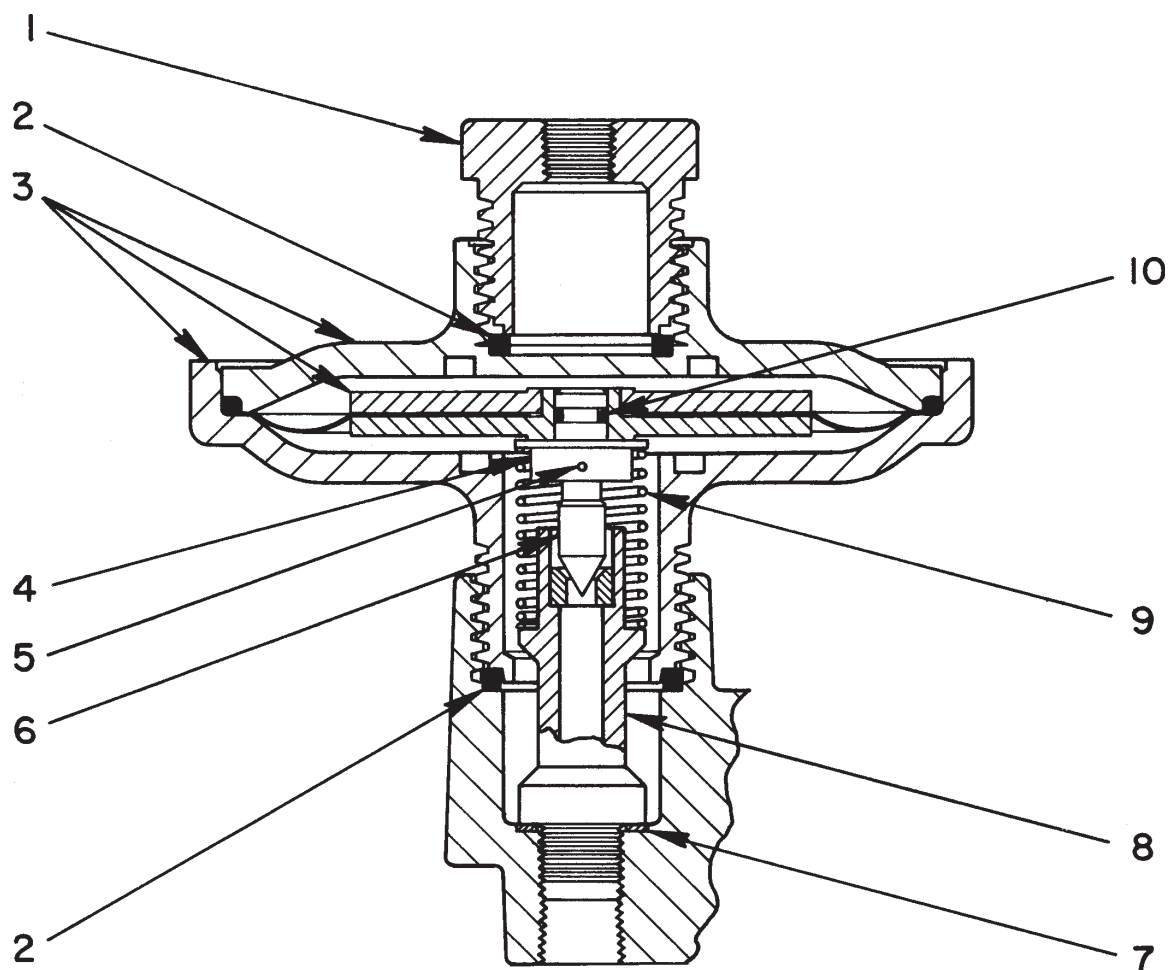
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

V-NOTCH PLUGS - PARTS
V10K Automatic Arrangement

25.100.001.030

ISSUE 1 3-96

V-10K V-NOTCH SULFONATOR



KEY NO.	PART NO.	QTY.	DESCRIPTION
1	PXA37688	1	PLUG (PVC)
2	P44122	2	GASKET (HYPALON) 1"ID x 1-1/4"OD
3	U26664	1	VALVE BODY
4	P37656	1	STEM HOLDER
5	P37655	1	PIN
6	P38409	1	STEM (PVC)
7	P37661	1	SEAT HOUSING GASKET (KOROSEAL)
8	U17642	1	SEAT UNIT (LOW CAPACITY 10 - 200 PPD)
	OR		
	U18075	1	SEAT UNIT (HIGH CAPACITY 250 - 500 PPD)
9	P37653	1	SPRING
10	PXA33051	1	O-RING (009) VITON 7/32"ID x 11/32"OD

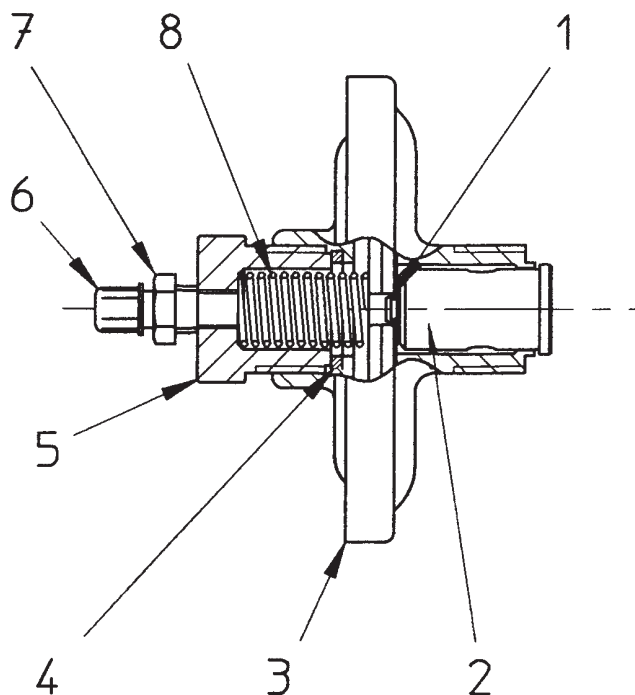
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

DIFFERENTIAL REGULATING VALVE - PARTS

25.152.001.011

ISSUE 1 4-05

V-10K V-NOTCH SULFONATOR



KEY NO.	PART NO.	QTY.	DESCRIPTION
1	P 44119	1	O-RING (009) HYPALON, 7/32" ID x 11/32" OD
2	P 56827	1	STEM
3	U 26664	1	VALVE BODY
4	P 44122	1	GASKET (HYPALON) 1" ID x 1-1/4" OD
5	PXA 37688	1	PLUG (PVC)
6	PXB 39234	1	UNION NUT (PVC) 3/8" TUBE
7	P 39233	1	HALF UNION (PVC) 3/8" OD TUBING x 1/4" NPT
8	P 48661	1	SPRING

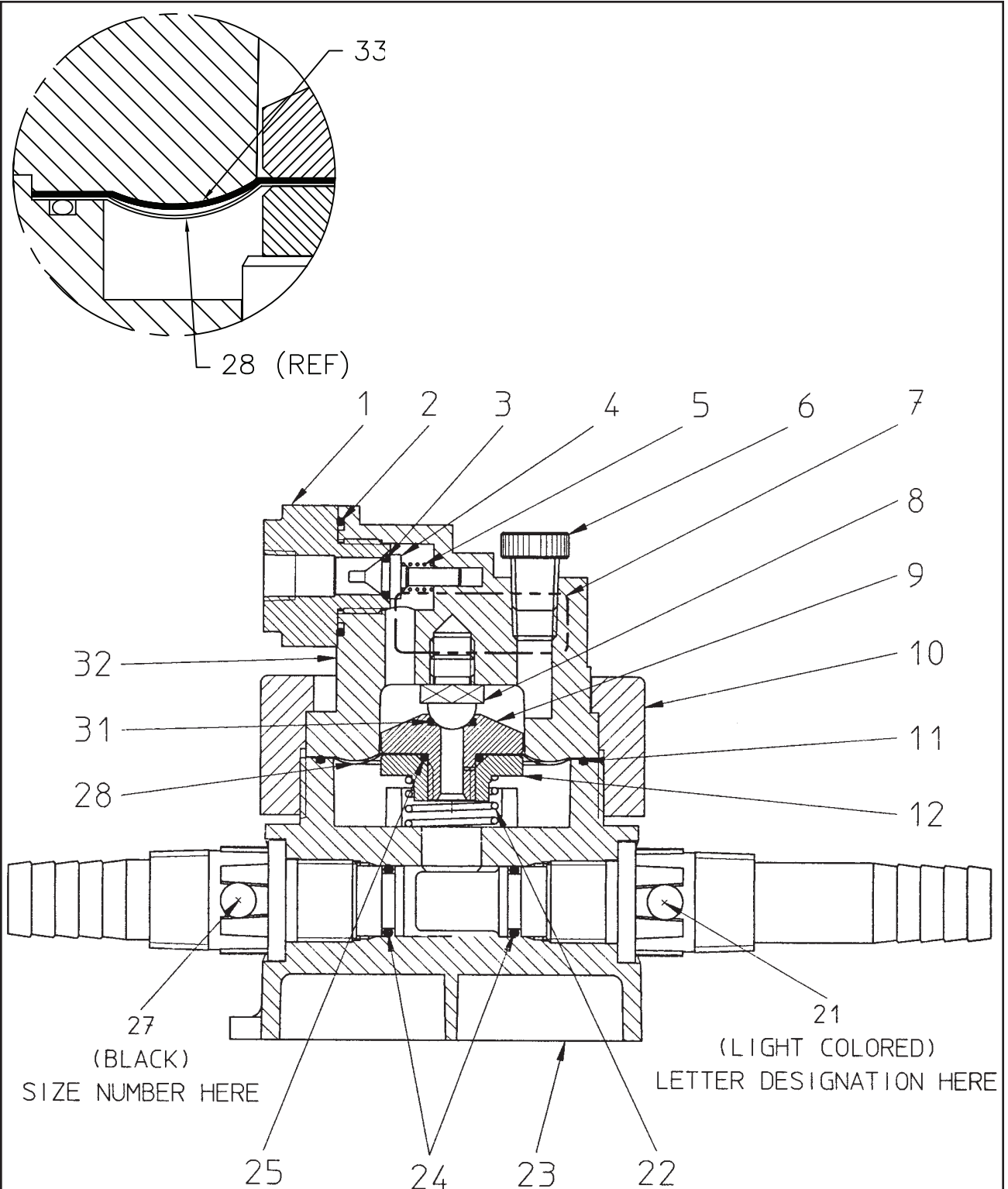
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

PRESSURE RELIEF VALVE - PARTS

25.100.001.040

ISSUE 1 8-08

V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWG. 25.200.002.010B.

AAA4310 3/4" STANDARD INJECTOR - PARTS

25.200.002.010A

ISSUE 2 5-04

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA1547	1	INLET/POPPET SEAT 1/4" NPT
2	PXA41332	1	O-RING (120) VITON, 1" ID x 1-3/16" OD
3	ANM3591	1	O-RING, POPPET
4	P97032	1	POPPET
5	P48655	1	SPRING, POPPET CK.
6	P31295	1	PLUG, 1/4 NPT
7	ADH4733	1	CAUTION LABEL
8	P97034	1	STEM
9	AAB4087	1	VALVE SEAT
10	P97164	1	UNION NUT
11	P94729	1	O-RING
12	AAB4090	1	NUT
21	(SEE TABLE)	1	TAILWAY
22	P48976	1	SPRING
23	P96972	1	LOWER BODY
24	PXA27409	2	O-RING (113) 9/16" ID x 3/4" OD
25	PXA26482	1	O-RING, DIAPH. CHECK
27	(SEE TABLE)	1	NOZZLE
28	P97063	1	DIAPHRAGM, TEFLON
31	P97342	1	O-RING, VITON
32	P96973	1	UPPER BODY
33	AAA4325	1	DIAPHRAGM, VITON

(21) TAILWAY	CODE
PXB 48962	B
PXC 48962	C
PXD 48962	D
PXE 48962	E
PXF 48962	F
PXG 48962	G
PXH 48962	H
PXJ 48962	J
PXS 48962	S

(27) NOZZLE	SIZE NO.
PXC 48961	70
PXD 48961	84
PXE 48961	99
PXF 48961	120
PXG 48961	140
PXH 48961	165
PXJ 48961	193
PXK 48961	242

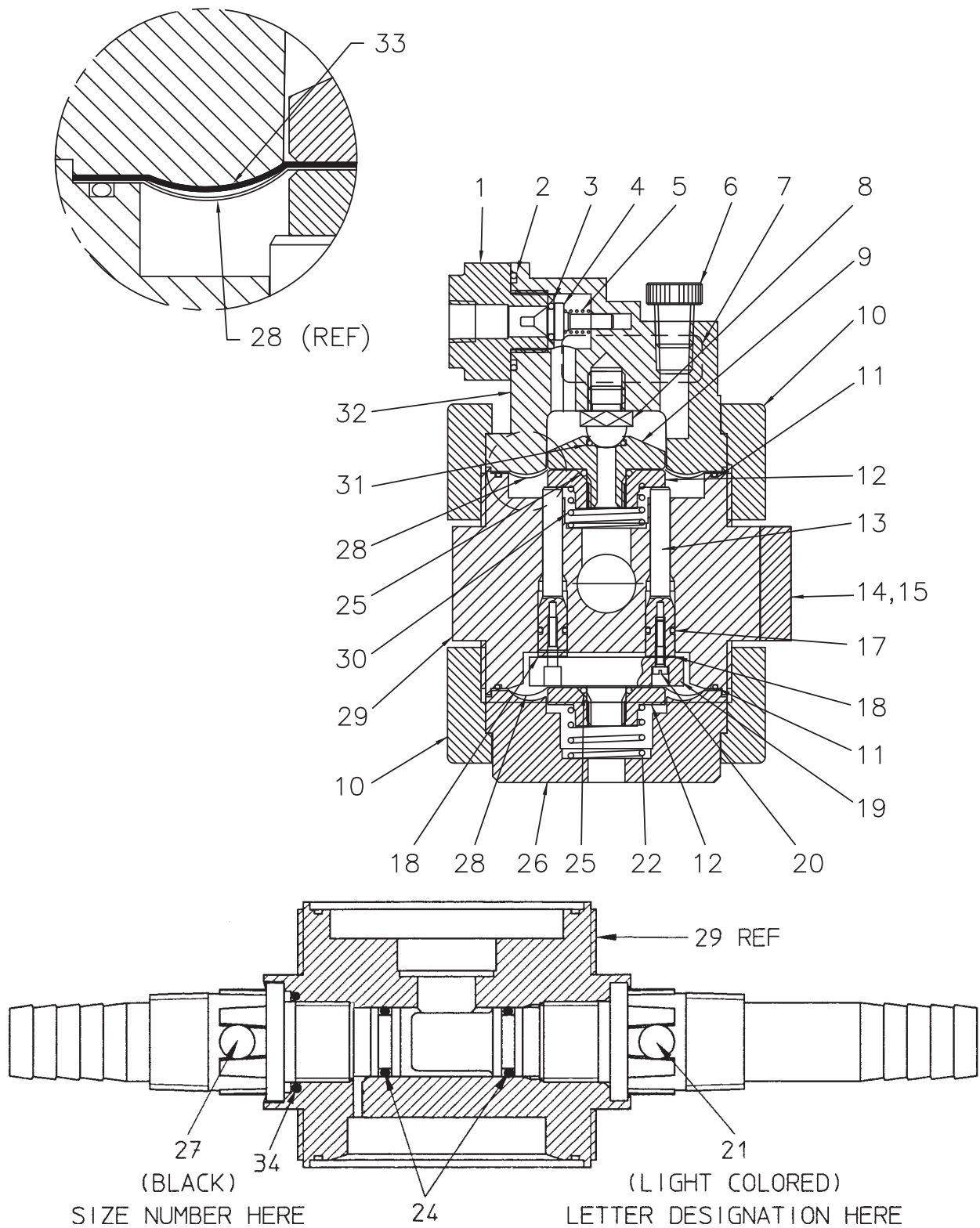
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

AAA4310 3/4" STANDARD INJECTOR - PARTS LIST

25.200.002.010B

ISSUE 4 4-05

V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWG. 25.200.002.020B.

AAA4307 3/4" ANTI-SYPHON INJECTOR - PARTS

25.200.002.020A

ISSUE 5 1-09

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA1547	1	INLET/POPPET SEAT 1/4" NPT
2	PXA41332	1	O-RING (120) VITON, 1" ID x 1-3/16" OD
3	ANM3591	1	O-RING, POPPET
4	P97032	1	POPPET
5	P48655	1	SPRING, CK. VALVE
6	P31295	1	PLUG, PVC, 1/4" NPT
7	ADH4733	1	CAUTION LABEL
8	P97034	1	VALVE STEM
9	AAB4087	1	VALVE SEAT
10	P97164	2	UNION NUT
11	P94729	2	O-RING
12	AAB4090	2	NUT
13	P97035	2	GUIDE PIN
14	P97038	1	BRACKET
15	P100178	2	SCREW, M6
17	PXA25900	2	O-RING (010) VITON, 1/4" ID x 3/8" OD
18	P52006	2	WASHER
19	P97037	1	BACKING PLATE
20	P33847	2	MACH. SCREW (SILVER) #4-36 x 19/32" LG.
21	(SEE TABLE BELOW)	1	TAILWAY
22	P97065	1	SPRING
24	PXA27409	2	O-RING (113) VITON, 9/16" ID x 3/4" OD
25	PXA26345	2	O-RING (112) VITON, 1/2" ID x 11/16" OD
26	P97036	1	END CAP
27	(SEE TABLE BELOW)	1	NOZZLE
28	P97063	3	DIAPHRAGM, TEFLON
29	P97058	1	MIDDLE BODY
30	P48976	1	SPRING
31	P97342	1	O-RING, VITON
32	P96973	1	UPPER BODY
33	AAA4325	1	DIAPHRAGM, VITON
34	PXA40040	1	O-RING (118) VITON, 7/8" ID x 1-1/16" OD

(21) TAILWAY	CODE
PXB 48962	B
PXC 48962	C
PXD 48962	D
PXE 48962	E
PXF 48962	F
PXG 48962	G
PXH 48962	H
PXJ 48962	J
PXS 48962	S

(27) NOZZLE	SIZE #
PXC 49042	70
PXD 49042	84
PXE 49042	99
PXF 49042	120
PXG 49042	140
PXH 49042	165
PXJ 49042	193
PXK 49042	242

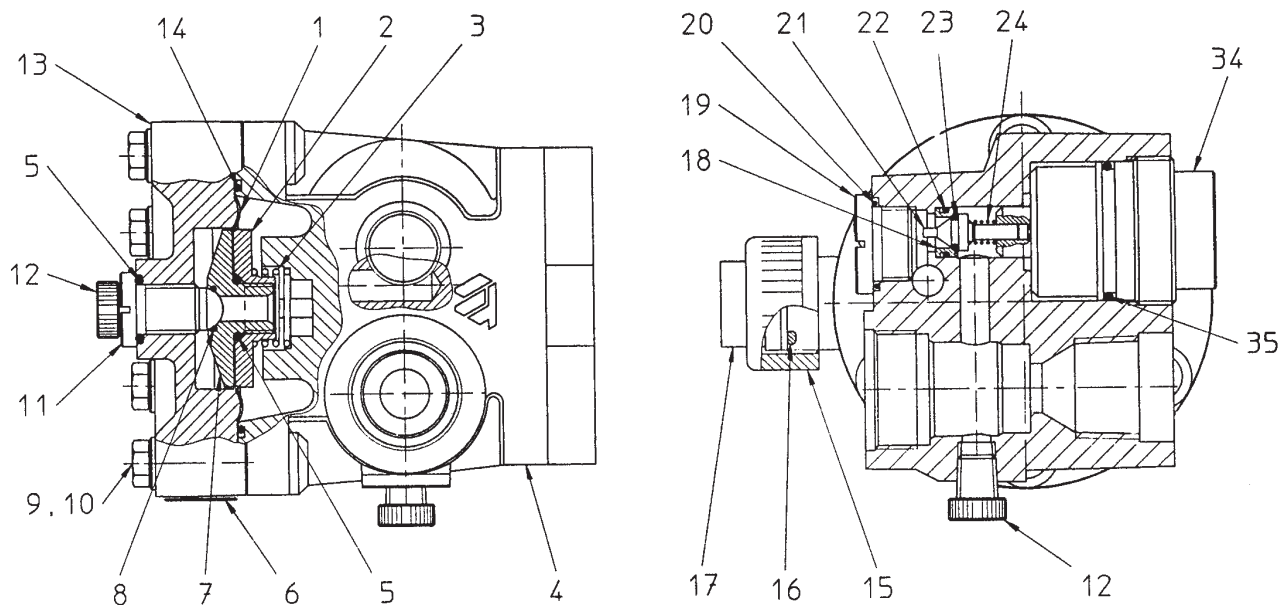
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

AAA4307 3/4" ANTI-SYPHON INJECTOR - PARTS LIST

25.200.002.020B

ISSUE 5 4-05

V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWG. 25.200.002.030B.

AAA4316 1" STANDARD INJECTOR - PARTS

25.200.002.030A

ISSUE 0 10-95

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	P97062	1	DIAPHRAGM
2	P97045	1	NUT
3	ANM4147	1	SPRING
4	P97042	1	LOWER BODY
5	PXA26784	2	O-RING (114) VITON, 5/8" ID x 13/16" OD
6	ADH4733	1	CAUTION LABEL
7	AAD2584	1	SEAT
8	P97342	1	O-RING (VITON) 11 MM
9	AAA1905	6	SCREW, MONEL
10	P97046	6	WASHER
11	P97048	1	VALVE STEM
12	P31295	2	PLUG, 1/4 NPT
13	P96971	1	UPPER BODY
14	P50524	1	O-RING (151) VITON, 3" ID x 3-3/16" OD
15	P100363	1	UNION NUT
16	PXA40575	1	O-RING (211) VITON, 13/16" ID x 1-1/16" OD
17	AMK421 8	1	ADAPTER, 1/2 NPT
18	P97040	1	SEAT, POPPET
19	P97050	1	PLUG
20	PXA39892	1	O-RING (119) VITON, 15/16" ID x 1-1/8" OD
21	P97032	1	POPPET
22	P97041	1	O-RING, SEAT
23	ANM3591	1	O-RING, VITON
24	P48655	1	SPRING, POPPET
34	P97049	1	GUIDE PLUG POP.
35	P 1 00448	1	O-RING, VITON

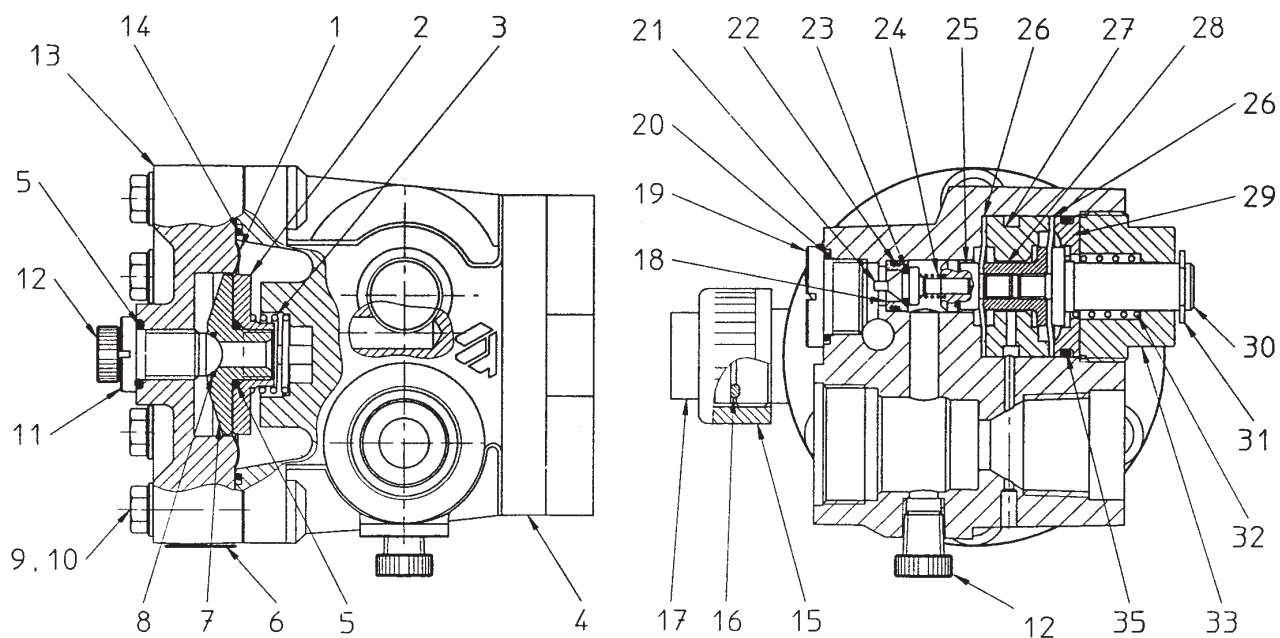
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

AAA4316 1" STANDARD INJECTOR - PARTS LIST

25.200.002.030B

ISSUE 1 8-08

V-10K V-NOTCH SULFONATOR



NOTE: FOR PARTS LIST, SEE DWG. 25.200.002.040B.

AAA4313 1" ANTI-SYPHON INJECTOR - PARTS

25.200.002.040A

ISSUE 0 10-95

V-10K V-NOTCH SULFONATOR

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	P97062	1	DIAPHRAGM
2	P97045	1	NUT
3	ANM4147	1	SPRING
4	P96970	1	LOWER BODY
5	PXA26784	2	O-RING (114) VITON, 5/8" ID x 13/16" OD
6	ADH4733	1	CAUTION LABEL
7	AAD2584	1	SEAT
8	P97342	1	O-RING (VITON) 11 MM
9	AAA1905	6	SCREW, MONEL
10	P97046	6	WASHER
11	P97048	1	VALVE STEM
12	P31295	2	PLUG, 1/4 NPT
13	P96971	1	UPPER BODY
14	P50524	1	O-RING (151) VITON, 3" ID x 3-3/16" OD
15	P100363	1	UNION NUT
16	PXA40575	1	O-RING (211) VITON, 13/16" ID x 1-1/16" OD
17	AMK4218	1	ADAPTER, 1/2 NPT
18	P97040	1	SEAT, POPPET
19	P97050	1	PLUG
20	PXA39892	1	O-RING (119) VITON, 15/16" ID x 1-1/8" OD
21	P97032	1	POPPET
22	P97041	1	O-RING, SEAT
23	ANM3591	1	O-RING, VITON
24	P48655	1	SPRING, POPPET
25	P97054	1	GUIDE BUSHING
26	P97061	2	DIAPHRAGM
27	P97053	1	NUT, COUPLING
28	P97052	1	SPACER
29	P97055	1	CLAMPING WASHER
30	P97056	1	UNION
31	PXG95967	1	SNAP RING
32	P97064	1	SPRING
33	P97051	1	CLAMPING NUT
35	PI 00448	1	O-RING, VITON

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

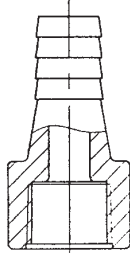
AAA4313 1" ANTI-SYPHON INJECTOR - PARTS LIST

25.200.002.040B

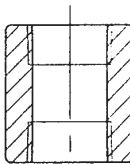
ISSUE 2 8-08

V-10K V-NOTCH SULFONATOR

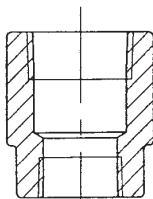
3/4" HOSE OR
FLEXIBLE PIPE
CONNECTION



P47206
3/4" PIPE X
3/4" HOSE
ADAPTER



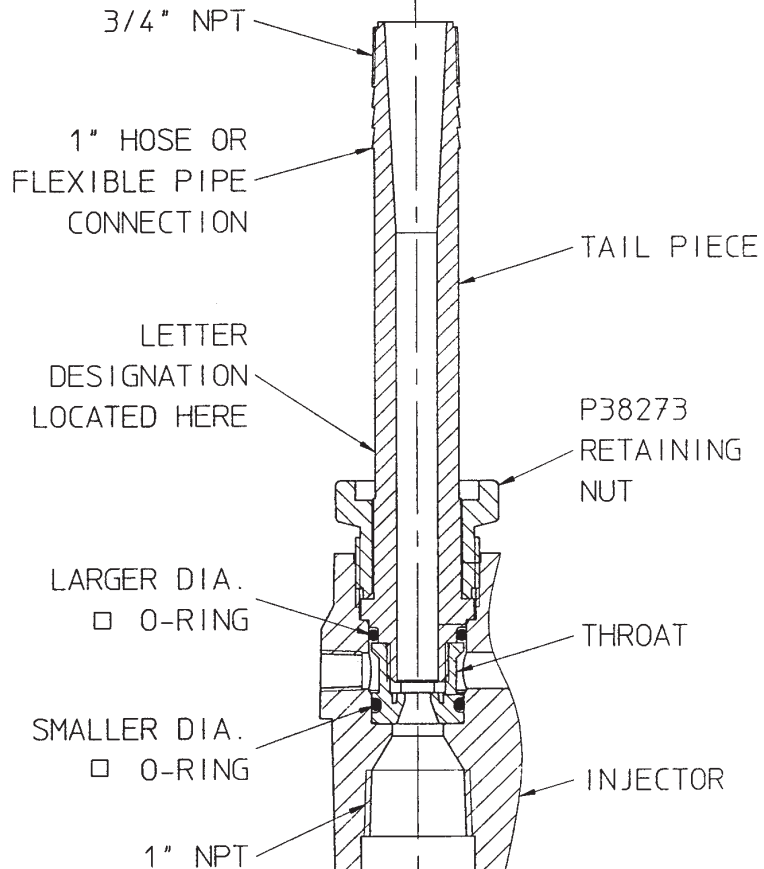
• P37599
3/4" PLASTIC PIPE
ADAPTER



• P39771
3/4" X 1"
PLASTIC PIPE
ADAPTER

OR

OR



SIZE NUMBER
LOCATED HERE



THROAT
(BOTTOM VIEW)

- SOLUTION HOSE MAY BE CONNECTED DIRECTLY TO THE INJECTOR TAILWAY. IF RIGID PVC PIPE IS USED, A PIECE OF STRAIGHT PIPE AT LEAST EIGHT INCHES LONG SHOULD BE COUPLED TO THE END OF THE INJECTOR TAILWAY BEFORE ANY ELBOWS, TEES, OR SIMILAR FLOW RESTRICTIONS ARE USED. THIS IS TO PREVENT ANY FLOW DISTURBANCES THAT COULD AFFECT THE HYDRAULIC PERFORMANCE OF TAILWAY CONNECTIONS.

NOTE: SIZE NUMBER STAMPED ON THROAT. LETTER DESIGNATION STAMPED ON TAILPIECE.
WHEN REORDERING O-RINGS MARKED □ SPECIFY U21275 FOR PAIR. NOT SOLD SEPARATELY.

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

PLASTIC 1" FIXED THROAT INJECTOR AND TAILWAY DETAILS - PARTS

25.200.003.010A

ISSUE 0 10-95

V-10K V-NOTCH SULFONATOR

THROAT		TAIL PIECE		3/4" HOSE OR FLEXIBLE PLASTIC PIPE	3/4" RIGID PIPE	1" HOSE OR FLEXIBLE PLASTIC PIPE	1" RIGID PIPE
SIZE	PART NO	LETTER DESIG.	PART NO.				
70	PXC50094	B	PXB50093	X	X	O	O
		C	PXC50093	X	X	O	O
99	PXE50094	C	PXC50093	X	X	O	O
		D	PXD50093	X	X	X	O
		E	PXE50093	X	X	X	O
120	PXF50094	D	PXD50093	X	X	X	X
		E	PXE50093	X	X	X	X
		F	PXF50093	X	X	X	X
140	PXG50094	E	PXE50093	X	X	X	X
		F	PXF50093	X	X	X	X
		G	PXG50093	X	X	X	X
165	PXH50094	F	PXF50093	X	X	X	X
		G	PXG50093	X	X	X	X
		H	PXH50093	X	X	X	X
193	PXJ50094	G	PXG50093	-	X	X	X
		H	PXH50093	-	-	X	X
		I	PXJ50093	-	-	X	X
242	P XK50094	H	PXH50093	-	-	X	X
		I	PXJ50093	-	-	X	X
		K	P XK50093	-	-	X	X
312	PXL50094	K	P XK50093	-	-	X	X
		L	PXL50093	-	-	X	X

ASSEMBLY NOTES: ASSEMBLE THROAT, TWO O-RINGS, AND TAILPIECE AS SHOWN, BEFORE INSERTING IN INJECTOR BODY.

ORDERING INFORMATION:

- X** STANDARD COMBINATION WHEN HYDRAULIC CONDITIONS PERMIT.
- O** NON-STANDARD COMBINATION, MAY BE USED IF REQUIRED.
- IF NO SYMBOL IS INDICATED, COMBINATION CANNOT BE USED.

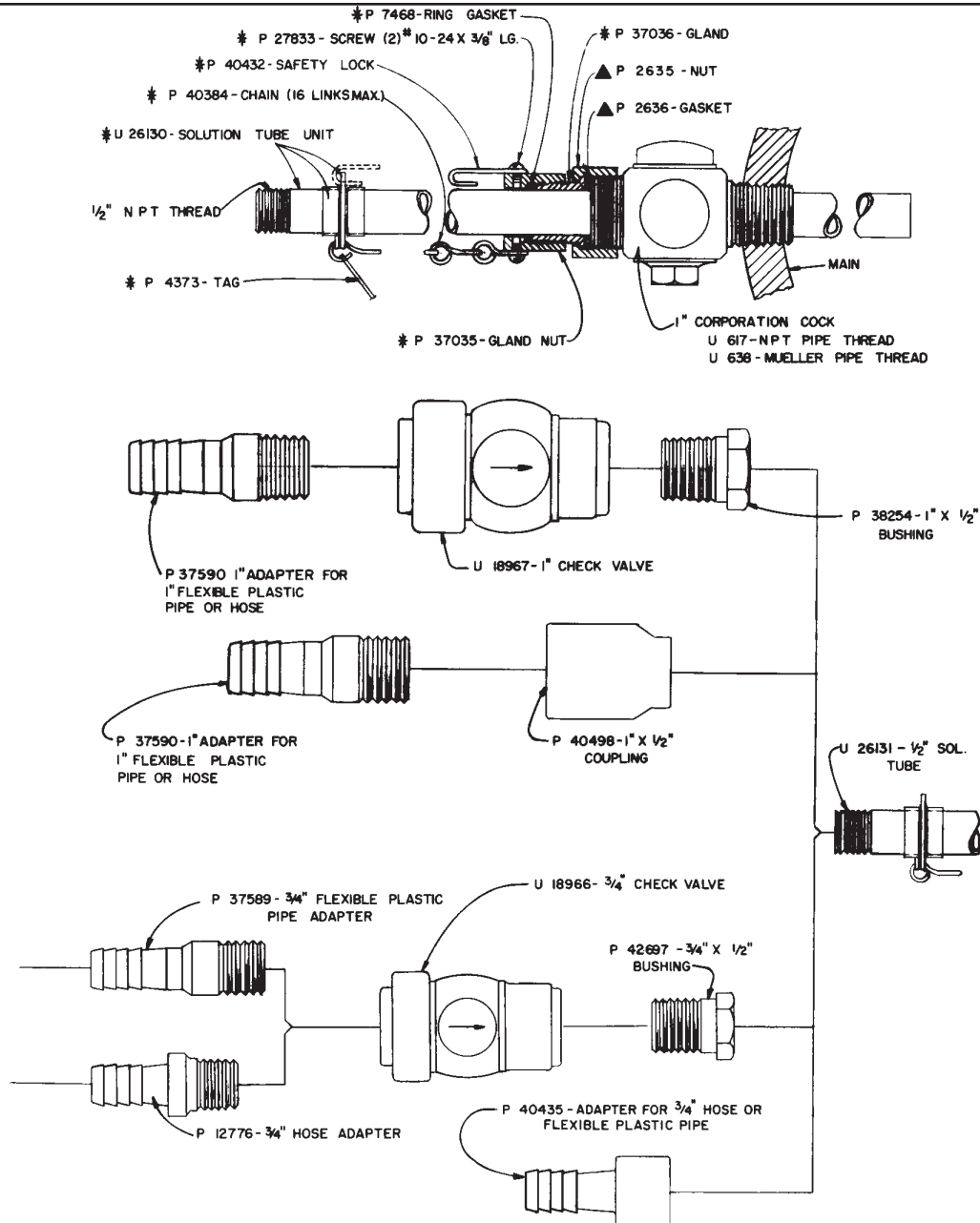
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

PLASTIC 1" FIXED THROAT INJECTOR AND TAILWAY DETAILS - PARTS LIST

25.200.003.010B

ISSUE 0 10-95

V-10K V-NOTCH SULFONATOR



NOTE: * PART OF SOLUTION TUBE U26131.

▲ PART OF CORPORATION COCK U617 OR U638.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO EQUIPMENT, DO NOT EXCEED WORKING PRESSURE OF HOSE OR FLEXIBLE PLASTIC PIPE. NEVER EXCEED 125 PSI AT 70° F. USE RIGID PIPE BETWEEN DISCHARGE AND MAIN CONNECTIONS WHEN PUMPING HAZARDOUS CHEMICALS.

CAUTION: FOR PROPER DISPERSION OF SOLUTION, THE END OF THE TUBE MUST EXTEND INTO THE MAIN, APPROXIMATELY 1/2 TO 1/3 THE DIAMETER OF THE MAIN. CUT OFF THE TUBE IF TOO LONG AND SHORTEN CHAIN AN EQUAL AMOUNT.

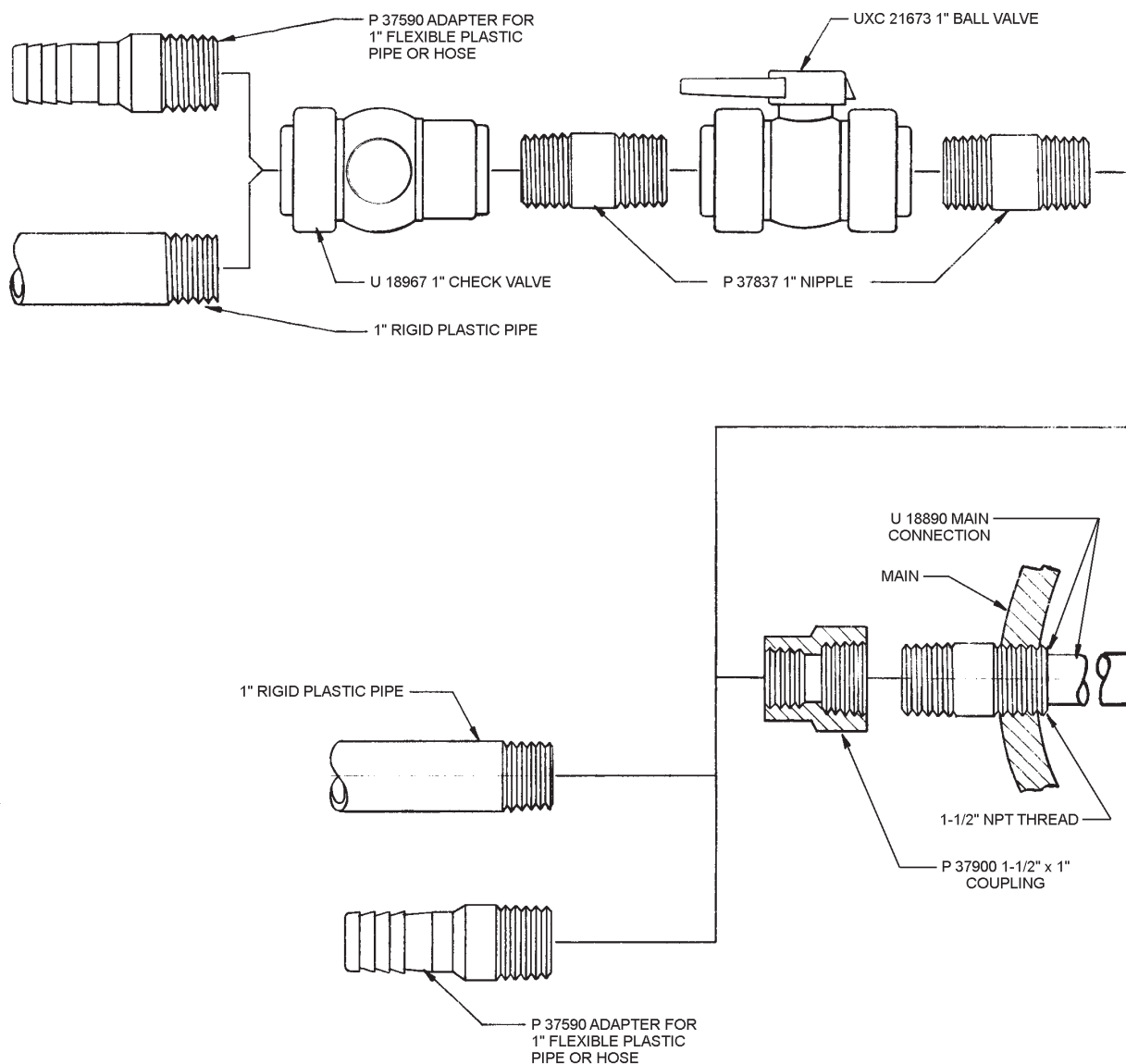
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

PLASTIC MAIN CONNECTION - PARTS
For 3/4" Or 1" Solution Lines With 1" Corporation Cock

50.845.06.011

ISSUE 14 2-93

V-10K V-NOTCH SULFONATOR



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO EQUIPMENT, DO NOT EXCEED WORKING PRESSURE OF HOSE OR FLEXIBLE PLASTIC PIPE. NEVER EXCEED 140 PSI AT 70° F. USE RIGID PIPE BETWEEN DISCHARGE AND MAIN CONNECTIONS WHEN PUMPING HAZARDOUS CHEMICALS.

CAUTION: FOR PROPER DISPERSION OF SOLUTION, THE END OF THE TUBE MUST EXTEND INTO THE MAIN, APPROXIMATELY 1/2 TO 1/3 THE DIAMETER OF THE MAIN. CUT OFF THE TUBE IF TOO LONG.

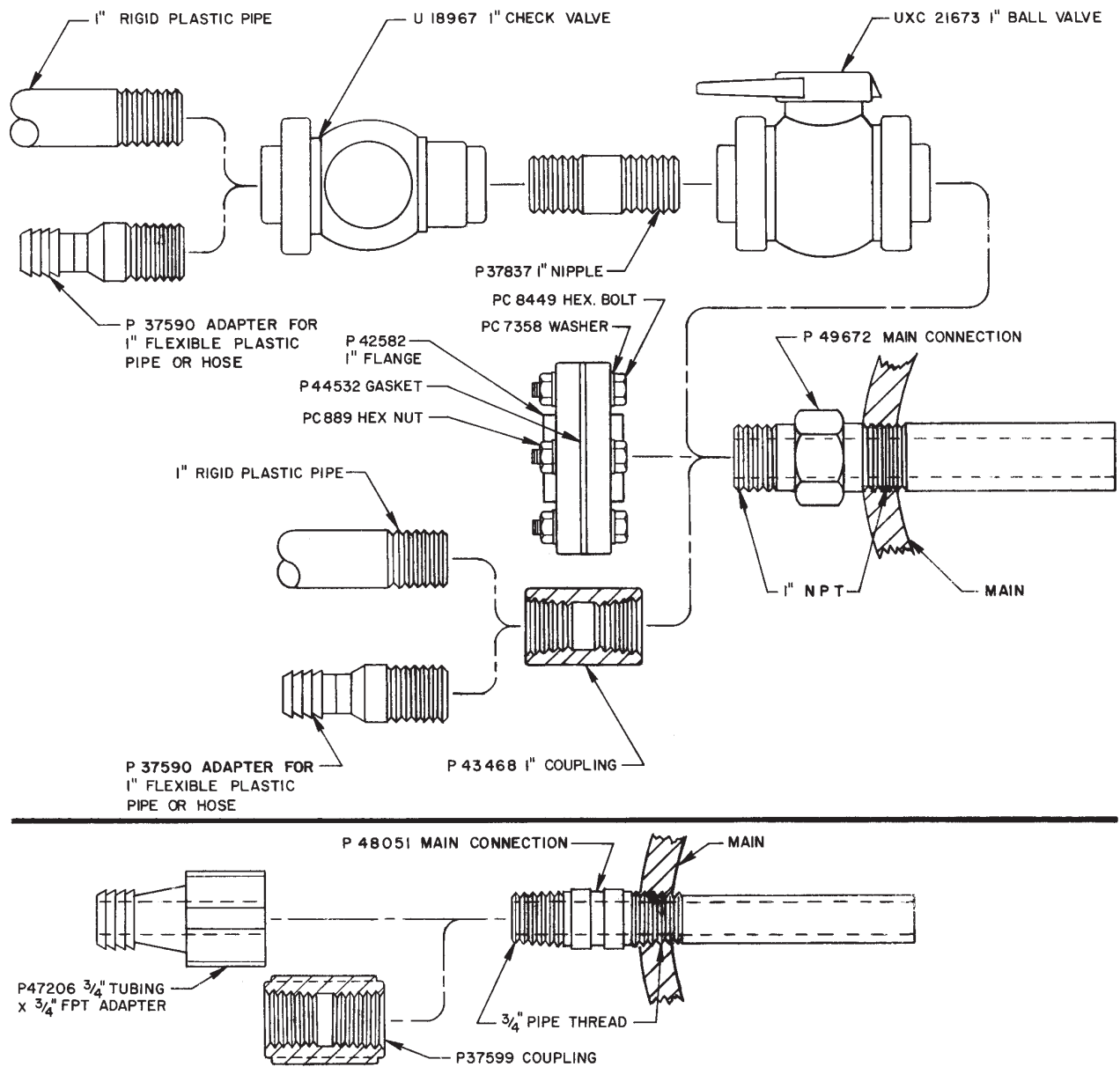
WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

MAIN CONNECTION - PARTS
For 1" Solution Line and 1-1/2" Main Connections

50.845.06.012

ISSUE 5 10-88

V-10K V-NOTCH SULFONATOR



WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO EQUIPMENT, DO NOT EXCEED WORKING PRESSURE OF HOSE OR FLEXIBLE PLASTIC PIPE. NEVER EXCEED 140 PSI AT 70° F. USE RIGID PIPE BETWEEN DISCHARGE AND MAIN CONNECTIONS WHEN PUMPING HAZARDOUS CHEMICALS.

CAUTION: FOR PROPER DISPERSION OF SOLUTION, THE END OF THE TUBE MUST EXTEND INTO THE MAIN, APPROXIMATELY 1/2 TO 1/3 THE DIAMETER OF THE MAIN. CUT OFF THE TUBE IF TOO LONG.

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

MAIN CONNECTION - PARTS

For 3/4" or 1" Solution Lines and 3/4" or 1" Main Connections

50.845.06.032

ISSUE 6 7-89

V-10K V-NOTCH SULFONATOR

SECTION 6

V-10K V-NOTCH SULFONATOR

SECTION 6 - PREVENTIVE MAINTENANCE KITS AND SPARE PARTS LIST

V10K V-NOTCH GAS FEEDER

DESCRIPTION	PART NO.
Preventive Maintenance Kit	AJA 4393
Preventive Maintenance Kit - 3/4" Injector	APQ 4389
Preventive Maintenance Kit - 1" Injector	AJE 4406
Preventive Maintenance Kit (3/4-inch Anti-Syphon Injector)	APP 4379
Preventive Maintenance Kit (one-inch Anti-Syphon Injector)	AJA 4403

ADDITIONAL SPARE PARTS

QUANTITY	DESCRIPTION	PART NO.
(Specify length)	Polyethylene Tubing, 1/2" x 5/8"	RP68 4503
(Specify length)	Polyethylene Tubing, 3/8" x 1/2"	RP68 4821
(Specify length)	Polyethylene Tubing, 1/4" x 3/8"	RP68 4818
(Specify length)	1-inch Flexible Plastic Pipe	RP68 4106
(Specify length)	3/4-inch Flexible Plastic Pipe	RP68 4105
1	Halocarbon Grease	U 27546

SECTION 7

**SULFUR DIOXIDE
HANDLING MANUAL**
(SO₂)

BOOK NO. WT.060.400.001.UA.IM.0614

REGIONAL OFFICES

INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION

Direct any questions concerning this equipment that are not answered in the instruction book to the Reseller from whom the equipment was purchased. If the equipment was purchased directly from Evoqua Water Technologies, Colorado Springs, CO contact the office indicated below.

UNITED STATES

725 Wooten Road
Colorado Springs, CO 80915
TEL: (800) 524-6324

CANADA

If the equipment was purchased directly from Evoqua Water Technologies, Canada, contact the nearest office indicated below.

ONTARIO

Evoqua Water Technologies Ltd.
2045 Drew Road
Mississauga, Ontario
L5S 1S4
(905) 944-2800

QUEBEC

Evoqua Technologies des Eaux Itée
505 Levy Street
St. Laurent, Quebec
H4R 2N9
(450) 582-4266

SULFUR DIOXIDE HANDLING MANUAL

WARNING: SULFUR DIOXIDE IS A HAZARDOUS CHEMICAL THAT CAN CAUSE INJURY AND DEATH IF NOT HANDLED PROPERLY. THIS MANUAL CONTAINS ONLY GENERAL INFORMATION ON THE PHYSICAL PROPERTIES, STORAGE, AND HANDLING OF SULFUR DIOXIDE. IT IS NOT INTENDED TO REPLACE OR LIMIT SAFETY PROCEDURES IN YOUR FACILITY.

SAFETY PROCEDURES IN AN INDUSTRIAL SETTING MUST BE DESIGNED IN ACCORDANCE WITH ALL GOVERNMENTAL REGULATIONS AND NATIONAL SAFETY CODES, AFTER GIVING FULL CONSIDERATION TO THE SPECIFIC NEEDS OF THE INDUSTRIAL FACILITY INVOLVED.

EVOQUA WATER TECHNOLOGIES CANNOT ANTICIPATE THE SPECIFIC SAFETY PROCEDURES REQUIRED IN EVERY INDUSTRIAL FACILITY. ACCORDINGLY, EVOQUA WATER TECHNOLOGIES DOES NOT GUARANTEE THAT SAFETY PROCEDURES DESIGNED IN ACCORDANCE WITH THIS MANUAL WILL COMPLETELY ELIMINATE HAZARD AND THUS ASSUMES NO RESPONSIBILITY FOR ACCIDENTS THAT MAY OCCUR IN YOUR FACILITY.

READ THIS ENTIRE MANUAL AND BE FULLY FAMILIAR WITH YOUR EQUIPMENT AND YOUR ENTIRE INDUSTRIAL SYSTEM SO THAT THE SAFETY PROCEDURES YOU ESTABLISH WILL MEET THE NEEDS OF THE EMPLOYEES IN YOUR FACILITY. READING ONLY PART OF THE MANUAL WILL NOT HELP YOU ANALYZE THE NEEDS OF YOUR FACILITY. CONTACT YOUR SULFUR DIOXIDE SUPPLIER, THE COMPRESSED GAS ASSOCIATION, OR A SIMILAR ORGANIZATION TO OBTAIN A MATERIAL SAFETY DATA SHEET (MSDS) AND MORE INFORMATION ON SULFUR DIOXIDE. INFORMATION IS AVAILABLE FROM: THE COMPRESSED GAS ASSOCIATION, INC., 4221 WALNEY ROAD, 5TH FLOOR, CHANTILLY, VA 20151-2923.

PLEASE NOTE THE PUBLICATION DATE AND POSSIBLE OBSOLESCENCE OF THIS MATERIAL AS A RESULT OF SCIENTIFIC AND MEDICAL DEVELOPMENTS AFTER THE DATE OF PUBLICATION. THIS APPLIES TO ALL MATERIALS YOU REVIEW IN THE COURSE OF DEVELOPING SAFETY PROCEDURE FOR USE AT YOUR FACILITY.

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1 INTRODUCTION

This manual discusses the characteristics, storage, and handling of sulfur dioxide used with Evoqua Water Technologies equipment. The principal use of sulfur dioxide with Evoqua Water Technologies equipment is as a dechlorinating agent in water treatment. It may also be used to remove dissolved oxygen or hydrogen sulfide, prevent the precipitation of iron, and in the treatment of toxic chromium wastes by reducing toxic hexavalent chromium to harmless trivalent chromium.

WARNING:

SULFUR DIOXIDE IS HAZARDOUS. TO AVOID SEVERE PERSONAL INJURY OR DEATH, READ THIS MANUAL AND THE SULFUR DIOXIDE SUPPLIER'S PRECAUTIONS BEFORE HANDLING OR CONNECTING SULFUR DIOXIDE TO EVOQUA WATER TECHNOLOGIES EQUIPMENT.

WHEN WORKING WITH SULFUR DIOXIDE:

ENSURE THAT APPROVED, SELF-CONTAINED BREATHING APPARATUS IS ALWAYS AVAILABLE AND THAT PERSONNEL ARE PROPERLY TRAINED IN ITS USE.

ENSURE THAT SAFETY EQUIPMENT, SUCH AS VENTILATION FANS AND BREATHING APPARATUS, IS INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

ENSURE THAT APPROPRIATE PLACARDS AND WARNING SIGNS ARE IN PLACE AND PROMINENTLY DISPLAYED IN THE AREAS WHERE THE GAS IS STORED.

IN CASES OF ACCIDENT:

USE SAFETY EQUIPMENT TO PROTECT THE RESCUER AND MOVE VICTIM TO FRESH AIR.

IF BREATHING HAS STOPPED, START ARTIFICIAL RESPIRATION IMMEDIATELY.

IF HEART HAS STOPPED, START CPR (CARDIOPULMONARY RESUSCITATION) IMMEDIATELY.

IN ALL CASES, OBTAIN MEDICAL ATTENTION AS SOON AS POSSIBLE.

TO AVOID ACCIDENTAL GAS RELEASE:

KNOWLEDGEABLE DESIGN PERSONNEL SHOULD OVERSEE AND APPROVE EQUIPMENT INSTALLATION AND SUITABILITY OF THE SYSTEM FOR WHICH IT IS INTENDED. QUALIFIED PERSONNEL SHOULD PERFORM PERIODIC INSPECTION TO ENSURE PROPER MAINTENANCE OF THE EQUIPMENT.

MONITOR SAFETY PROGRAMS AND CONDUCT PERIODIC TRAINING PROGRAMS, ESPECIALLY ON EMERGENCY SITUATIONS. SAFETY PROGRAMS ARE AVAILABLE FROM YOUR GAS SUPPLIER.

LOCAL LAWS:

UNDER NO CIRCUMSTANCES SHOULD THE INFORMATION IN THIS BOOK BE CONSTRUED AS SUBSTITUTING FOR OR SUPERSEDING ANY LOCAL, STATE, OR FEDERAL LAWS AND REGULATIONS CONCERNING THE STORAGE, HANDLING, OR USE OF SULFUR DIOXIDE.

2 TECHNICAL DATA AND CHARACTERISTICS OF SULFUR DIOXIDE

The following general information on sulfur dioxide may be useful in planning a sulfonator installation; however, a specific application may require more information than that included here. For further information, consult your sulfur dioxide supplier, the Compressed Gas Association, Inc., or a similar organization.

Sulfur dioxide in commerce is a liquefied gas under pressure. It is a clear, colorless liquid. The gas is colorless and has a strong, pungent odor. It is an irritant to the skin and respiratory system. In the moisture-free state at ordinary temperatures it is relatively non-corrosive. In the presence of moisture, however, it is highly corrosive. Accordingly, every precaution should be taken to avoid leaks, to stop them promptly if they occur, and to keep moisture out of valves, tubing, etc., not specifically designed to handle moist sulfur dioxide. Among the important physical properties of sulfur dioxide are:

Specific Gravity, Dry Gas
2.26 at 32° F and 1 atm referred to air.

Specific Gravity, Liquid
1.44 at 32° F and 23.7 psia.

Latent Heat of Vaporization
155.5 Btu per lb at 70° F.

Specific Volume, Dry Gas
1 lb = 5.9 cf at 70° F and 1 atm.

Specific Volume, Liquid
1 lb = 0.01162 cf at 70°F and 49.1 psia.

Weight, Dry Gas
1 cf = 0.1810 lb at 32° F and 1 atm.

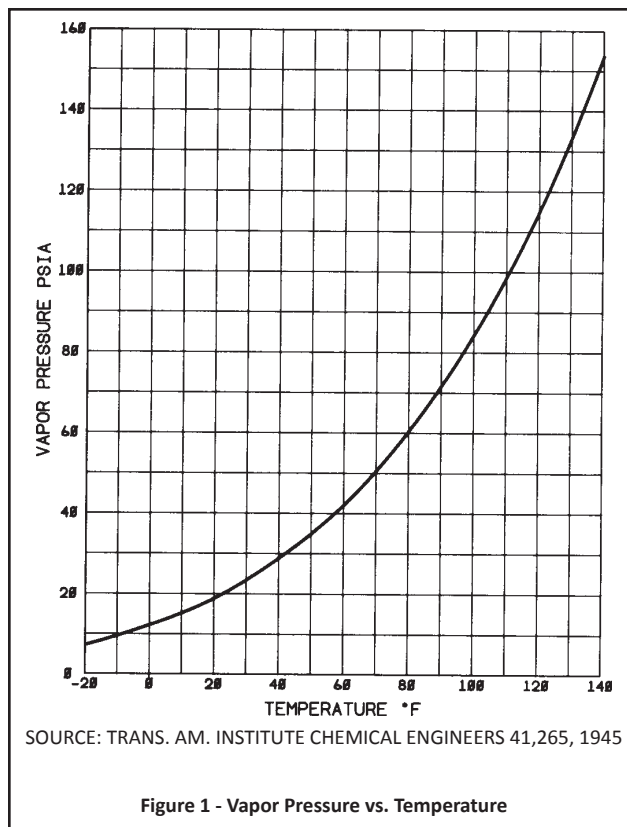
Weight, Liquid
1 cf = 89.77 lb at 30° F.

Solubility in Water
42.0 lbs/100 gals at 40° F and 1 atm.

Pressure vs Temperature
See Figure 1

3 SUPPLY CONTAINERS

Table 1 gives details on the supply containers most commonly used with Evoqua Water Technologies equipment.



Some large installations that would normally use single unit tank cars, but that are not serviced by railroad facilities, use tank motor vehicles (tank trailers) of varying capacity.

All supply containers must conform to appropriate Department of Transportation (DOT) and Canadian Transport Commission (CTC) regulations. It is the responsibility of the supply container manufacturer and the sulfur dioxide supplier to meet these requirements.

3.1 Maximum Gas Withdrawal Rates

In general, using a remote vacuum type sulfonator, the maximum sustained gas withdrawal rate at which sulfur dioxide may be taken from a 100- or 150-pound cylinder is 3/4 lb/24 hr/(°F-40). The corresponding rate for ton containers is about 6 lb/24 hr/(°F-40). At an assumed liquid temperature of 70°F (and using a remote vacuum type sulfonator), the above figures translate into 22.5 lbs/24 hrs for cylinders and 180 lbs/24 hrs for ton containers. These rates can be increased substantially for brief periods. Do not place containers in a water bath or apply direct heat in order to permit higher withdrawal rates.

It is not practical to withdraw sulfur dioxide as a gas from tank cars (or tank trailers).

TABLE 1 - SULFUR DIOXIDE SUPPLY CONTAINERS

TYPE OF CONTAINER	NEW WEIGHT	TARE WEIGHT	GROSS WEIGHT	OUTSIDE DIAMETER	LENGTH
CYLINDERS	150 lb	85 - 140 lb	235 - 290 lb	10¼" - 10¾"	4'5" - 4'8"
TON CONTAINER	2000 lb	1300 - 1650 lb	3300 - 3650 lb	2'6"	6'7¾" - 6'10½"
SINGLE UNIT TANK CARS	55 tons 90 tons	- -	- -	14'3" - 15'1" 14'11" - 15'1"	29'9" - 43'0" 45'8" - 47'2"

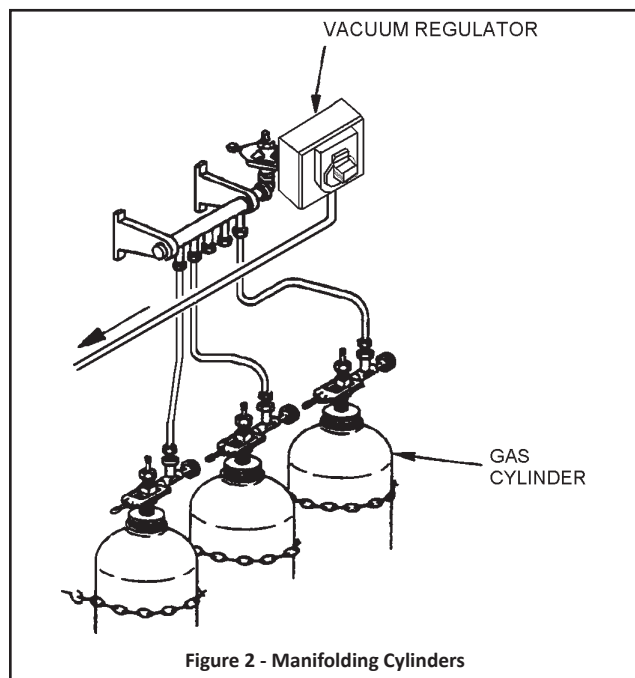
3.1.1 Manifolding For Gas Withdrawal

When higher gas withdrawal rates are required, cylinders or the gas valves (upper) of ton containers may be manifolded. A typical arrangement for manifolding cylinders is shown in Figure 2.

If cylinders or ton containers are manifolded, it is essential that all supply containers be at the same temperature to prevent the transfer of liquid sulfur dioxide from a warmer container to a cooler container, possibly resulting in a container becoming overfilled through reliquefaction of sulfur dioxide in the cooler container.

3.2 Maximum Liquid Withdrawal Rate

The generally accepted alternative to manifolding ton containers is to withdraw liquid sulfur dioxide from the lower valve and use an evaporator. By this means, a ton container can be emptied in approximately seven hours, which is equivalent to 7200 lbs/24 hrs.



Liquid can be withdrawn from tank cars by various methods. If necessary, contact your sulfur dioxide supplier or the Compressed Gas Association for recommendations and information.

3.2.1 Manifolding For Liquid Withdrawal

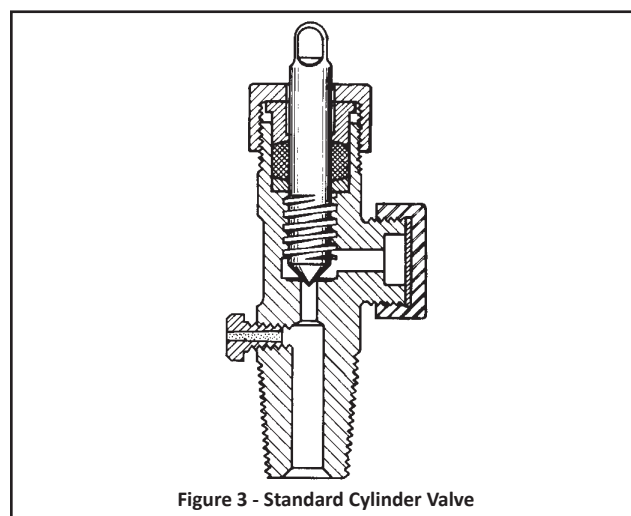
WARNING: DO NOT MANIFOLD TON CONTAINERS FOR SIMULTANEOUS LIQUID SULFUR DIOXIDE WITHDRAWAL. THIS MANIFOLDING CAN CAUSE OVERPRESSURIZATION AND RUPTURE.

3.3 Container Valves

Standard cylinder and ton container valves are identical in design, except that the cylinder valve includes a pressure relief device. A cylinder valve is shown in Figure 3 and a ton container valve in Figure 4.

See Figure 5 for captive yoke type auxiliary container valves.

Cylinders are equipped with one valve that is normally used for gas withdrawal. Ton containers are equipped with two valves, as shown in Figure 6.



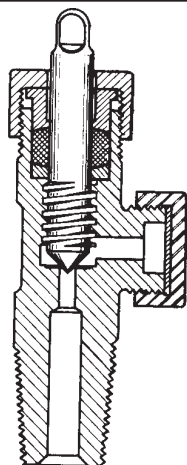


Figure 4 - Standard Ton Container Valve

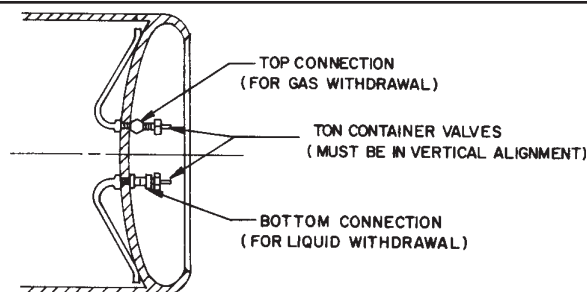
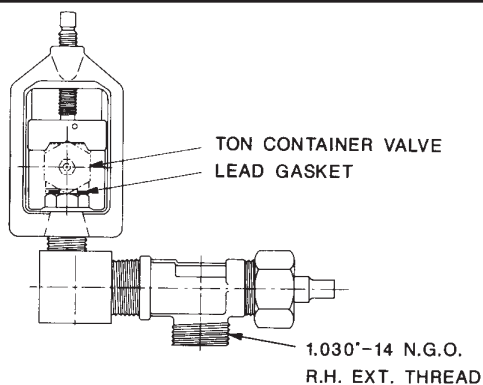
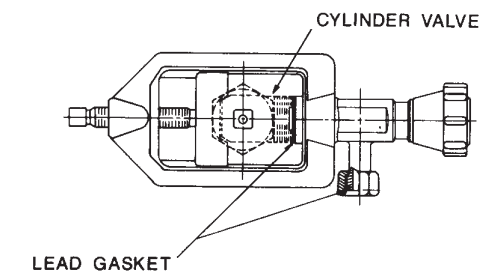


Figure 6 - Ton Container Valves



CAPTIVE YOKE AUXILIARY TON CONTAINER VALVE



CAPTIVE YOKE AUXILIARY CYLINDER VALVE

Figure 5 - Auxiliary Container Valve

The upper valve is used for gas withdrawal and the lower valve for liquid withdrawal.

Tank cars are equipped with four standard angle valves, as shown in Figure 7.

Outlet is one-inch female ANSI Standard taper pipe thread. The liquid withdrawal valves are located on the longitudinal center line of the tank car. The valves on the transverse

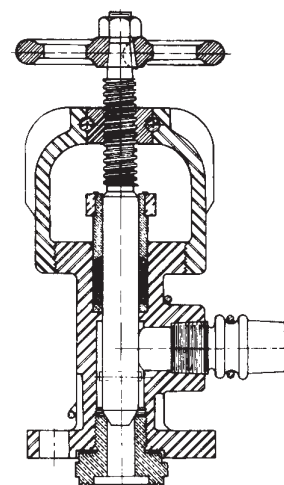


Figure 7 - Standard Angle Valve

center line are connected to the vapor space and are used to obtain sulfur dioxide gas under pressure for testing the piping or for air padding the tank car.

3.4 Pressure Relief Devices

All sulfur dioxide supply containers are equipped with some type of device for relief of pressure. Cylinder valves have a fusible metal plug screwed into the body of the valve, as shown in Figure 3. The fusible metal melts when the temperature increases to 157 to 170° F to relieve pressure and prevent rupture of the cylinder.

Ton containers are equipped with six fusible metal plugs (see Figure 8), three of which are in each end, spaced 120 degrees apart.

Some tank cars have an excess-flow valve (see Figure 9) located under each liquid valve. While this valve may close during a catastrophic pipe line failure, its main function is to close automatically if the angle valve is broken off in transit. Tank cars also have a pressure relief device (see Figure 10) located in the center of the manway. The relief level varies with the type of car or tank.

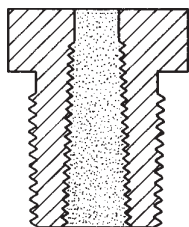


Figure 8 - Standard Fusible Plug For Ton Containers

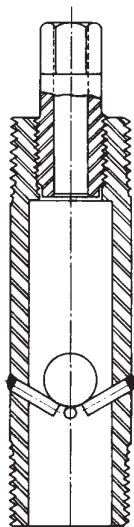


Figure 9 - Excess-Flow Valve

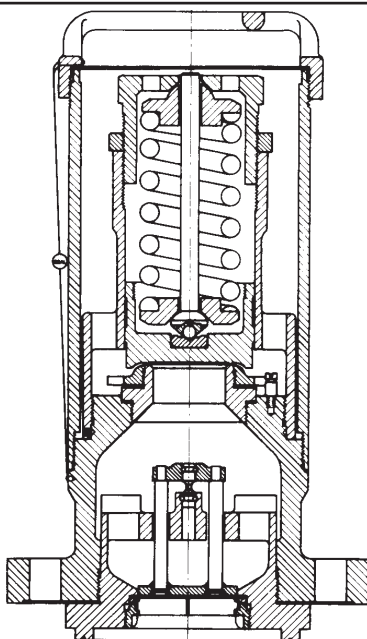


Figure 10 - Standard Safety Relief Device

3.5 Storage of Containers

Store sulfur dioxide containers of any type under cover and in cool, well ventilated locations protected from fire hazards and adequately protected from extreme weather conditions. During the summer months, full containers should be shielded from the direct rays of the sun, which might result in the build-up dangerous pressures (see Figure 1 and paragraph 3.3). If stored out of doors, keep containers in fenced-off areas for protection. Avoid storage in subsurface areas because sulfur dioxide is heavier than air and will not readily rise from subsurface locations should leaks occur. Do not store or use sulfur dioxide containers near other chemicals or gases.

WARNING: STORE CYLINDERS IN AN UPRIGHT POSITION. TO AVOID SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, CYLINDERS MUST BE SECURED IN SUCH A MANNER (E.G., WITH CHAIN) AS TO PREVENT THEIR BEING KNOCKED OVER. TON CONTAINERS MUST BE SECURED IN SUCH A MANNER (E.G., WITH CHOCKS) TO PREVENT THEIR ROLLING OUT OF PLACE.

Do not remove the protective cap or hood from cylinders or ton containers until they are ready to be put into actual use. Do not store containers in a heavily traveled area where physical contact damage could occur.

It is essential that areas used to house sulfur dioxide containers or equipment be continuously monitored for the presence of sulfur dioxide in the air. This may be a requirement of applicable laws and/or regulations.

When containers are moved from a storage area to an area where they will be used, allow sufficient time to stabilize the temperature, and therefore the pressure, of the container and the sulfur dioxide before it is used.

The sulfur dioxide inventory depends on local availability to a large extent. Consult with sulfur dioxide suppliers in the area, and observe other applicable laws and regulations.

When planning space for stored containers, sufficient space must be allowed for empty containers.

The best way to determine the amount of sulfur dioxide remaining in a container is to weigh the container continuously on a scale. This also makes it possible to record the amount of sulfur dioxide used. Portable or dormant scales in beam, dial, or digital types and with varying platform sizes are available.

WARNING: ALWAYS REMOVE WHEELS AND AXLES OF PORTABLE SCALES SO THAT THE SCALE CANNOT MOVE WHEN CYLINDERS ARE ON THE PLATFORM.

Preferably, scales for cylinders should be installed with their platform flush with the floor to eliminate the necessity of lifting the cylinders. Some low profile scales, such as the Evoqua Water Technologies Two-Cylinder Scale (platform 1-1/2 inch above floor), are low enough that cylinders can be placed on the scale without lifting. Others are installed with ramps. If scales are pit mounted, a trapped drain should be provided.

Scales for ton containers are usually installed above the floor since ton containers are usually handled by overhead conveyor. Many of these scales do not have platforms since the ton containers are usually supported by cradles or trunnions.

Special high capacity scales are provided at some installations using tank cars. These scales are usually pit mounted below the railroad siding with the dial or digital unit housed above ground beside the track.

Some of the dial or digital scales are equipped with loss-of-weight recording systems, providing a permanent record of sulfur dioxide usage.

3.6 Handling Containers

Always handle sulfur dioxide containers with utmost care. To prevent injury or damage, do not drop sulfur dioxide containers and do not permit containers to strike each other or other objects. To prevent damage to the valve, valve protecting caps or hoods must always be in place when containers are moved.

Handle cylinders with a simple two-wheel hand truck of the barrel pattern. Hand trucks should be well balanced and equipped with chains or clamps preventing the cylinders from falling off the truck.

WARNING: NEVER LIFT CYLINDERS BY THE VALVE PROTECTING HOOD. THE HOOD MAY SEPARATE FROM THE CYLINDER, CAUSING THE CYLINDER TO FALL.

Never lift cylinders by sling or magnetic devices. If lifting is necessary, use a specially designed cradle. Contact your sulfur dioxide supplier for recommendations or information.

When moving ton containers, due consideration must be given to the fact that the liquid in the container represents a live load in addition to the dead load of the container and the liquid. The most accepted way of moving ton containers is by overhead conveyor and lifting beam (see Figure 11).

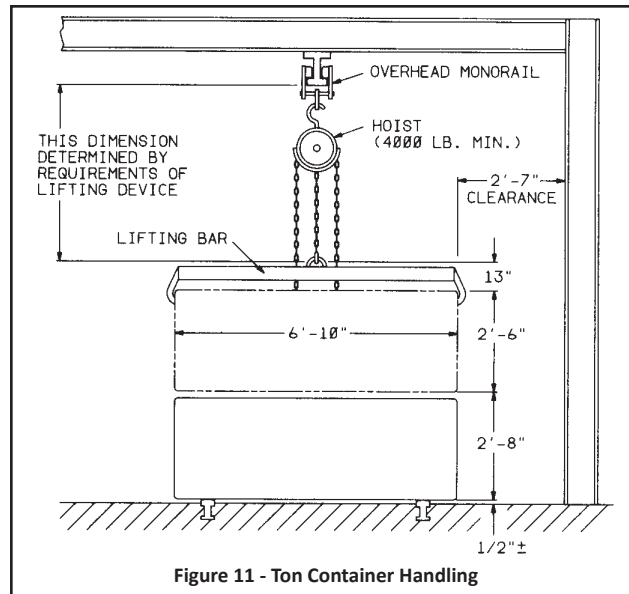


Figure 11 - Ton Container Handling

Rails or roller conveyors have also been used. Fork lift trucks, in addition to having adequate capacity, must have the containers restrained and be sufficiently stable to prevent tipping.

3.7 Using Containers

If containers have been stored in an area other than that in which they will be used, they should be allowed to stabilize at the new temperature before being used. Containers should always be used in the order in which they are received to avoid unnecessarily long storage and possible difficulty with valves that have not been opened or closed for too long a period.

WARNING: CYLINDERS ARE NORMALLY USED IN AN UPRIGHT POSITION FOR GAS WITHDRAWAL. TO AVOID SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, SUPPLY CYLINDERS MUST BE SECURED IN SUCH A MANNER (E.G., WITH CHAIN) AS TO PREVENT THEIR BEING KNOCKED OVER. TON CONTAINERS MUST BE USED IN A HORIZONTAL POSITION WITH THE TWO VALVES IN A VERTICAL LINE. TON CONTAINERS MUST BE SECURED IN SUCH A MANNER (E.G., WITH CHOCKS) TO PREVENT THEIR ROLLING OUT OF PLACE.

When withdrawing gas, connection is made to the upper valve (see Figure 6). Liquid withdrawal is accomplished by connecting to the lower valve.

It is recommended that special 3/8-inch square box wrenches, rather than adjustable wrenches, be used for opening container valves. Length of the wrench should not exceed eight inches. It is good practice to leave the wrench in place so the valve can be closed quickly in case of an emergency. Maximum discharge can be accomplished with one full turn

of the valve. Excessive force must not be used in opening valves. Never strike the wrench with anything other than the heel of the hand. Loosening the packing nut a maximum of one-half turn is acceptable, provided the packing nut is tightened after the valve is operated. Contact your sulfur dioxide supplier if these procedures do not permit operation of the valve.

Angle valves on tank cars must be opened fully to aid the operation of the excess-flow valve.

Always test for leaks before putting new containers in service. The system can be pressurized by opening the container valve and then closing it. The valve can be opened again after it is determined that there are no leaks.

WARNING: ALWAYS WEAR PROTECTIVE CLOTHING WHEN CHECKING FOR LEAKS. REFER TO “PERSONNEL SAFETY” FOR INFORMATION ON HEALTH HAZARDS AND SAFETY PRECAUTIONS.

It is not unusual during humid conditions for condensation to collect on the outside of the container. A build-up of frost on the container indicates that withdrawal rates are too high to permit the surrounding air to supply the heat necessary to evaporate the liquid sulfur dioxide. Increasing the circulation of room temperature air past the container may correct the condition. **Do not apply direct heat to the container in any way.** It may be necessary to shut off the container valve and permit it to warm up again before putting it back in service. After emptying the container, the valve must be closed before disconnecting to prevent the entry of moisture. After disconnecting, the valve cap and the valve protecting cap or hood must be replaced before the container is moved. Empty containers should be segregated from full containers and should be tagged.

Tank cars are unloaded by means of one of the liquid valves. One of the gas valves can be connected to the system to permit pressure testing with gaseous sulfur dioxide rather than liquid. The flexible connection used for tank car unloading must be designed for and installed in such a manner to allow for the significant increase in height as the car unloads. Tank car pressure may be inadequate to cause the sulfur dioxide to discharge at a satisfactory rate when unloading. Contact your sulfur dioxide supplier or the Compressed Gas Association for recommendations on compressors or air padding. It is essential that air padding pressure be kept as low as possible for satisfactory operation of the sulfur dioxide equipment, since excessive air padding pressures can have a negative impact on evaporator performance. The depletion of the liquid sulfur dioxide supply in the car is accompanied by a sharp drop in tank car pressure.

After the angle valve is closed and the discharge line emptied, the piping may be disconnected. The valve outlet plugs should be replaced and the discharge piping capped immediately.

4 PIPING

4.1 Piping Materials and Joints

If the sulfonator capacity is low enough, the vacuum regulator may be mounted directly on a cylinder or ton container valve, totally eliminating pressure piping. In this case, reference to the equipment instruction book provides all necessary details.

Pressure connections from all sulfur dioxide containers are normally made by means of flexible connections made of copper tubing. Use yoke type connections at container valves. The sulfonator or vacuum regulator instruction book should be referred to for details for use of flexible connections along with the required auxiliary cylinder or ton container valves, header valves, and auxiliary header valves (if required).

WARNING: ALWAYS REPLACE FLEXIBLE CONNECTIONS ANNUALLY (OR SOONER IF THERE IS EVIDENCE OF DETERIORATION).

The usual practice for sulfur dioxide liquid or gas pressure lines—at the commonly encountered pressures and temperatures at sulfonator installations—is for the use of 3/4- or 1-inch schedule 80 carbon steel seamless pipe with Class 3000 forged steel fittings; though two-bolt flanges (commonly referred to as oval ammonia unions) are often used. Both screwed and socket welded construction are common. Threaded joints should be made up using litharge and glycerine for permanent joints and white lead for others.

To facilitate maintenance, the number of line valves should be kept to a minimum. Insulation is required only in those cases where it is necessary to prevent sulfur dioxide gas lines from becoming chilled, or liquid lines from becoming overheated.

More complete details, along with ASTM and ANSI specifications, can be obtained by referring to Compressed Gas Association Pamphlet No. G-3 Sulfur Dioxide.

WARNING: TWO COMMON CAUSES OF SULFUR DIOXIDE PIPING LEAKS ARE:

1. RE-USE OF GASKETS. THIS SHOULD NEVER BE DONE. ALWAYS HAVE AN ADEQUATE SUPPLY ON HAND AND ALWAYS USE NEW GASKETS OF THE CORRECT MATERIAL AND SIZE AS IDENTIFIED ON THE EQUIPMENT PARTS DRAWING.

2. IMPROPERLY MADE-UP THREADED PIPE JOINTS.

4.2 Gas Piping Installation Requirements

Reliquefaction of a gas should be avoided. If liquid sulfur dioxide is carried downstream to the sulfonator or vacuum piping, it may soften the plastic components and affect their structural strength. Liquid can wash any collected contaminants into the vacuum regulator and can also cause erratic surging, freezing, and pressure release, which can damage the diaphragm and control valves. Cold conditions in a gas pipe line (cold to the touch; dripping of water condensed from the atmosphere; frost; ice) are an indication that liquid sulfur dioxide is present in the line and is flashing to gas. Refer to the proper guidelines that follow.

It is important to observe the correct temperature conditions in conducting sulfur dioxide gas under pressure from the location of the containers to the point of use. To avoid difficulty with reliquefaction of sulfur dioxide, pressure piping and control equipment receiving gas under pressure should be at a higher temperature than that of the sulfur dioxide containers. In general, a difference of 5° to 10° F is recommended.

Pitch pressure lines uphill from the gas source toward the sulfonators if possible.

Install a pressure reducing valve or the remote vacuum sulfonator vacuum regulator close to, but higher than, the source of gas. The use of a sulfur dioxide pressure reducing valve is also recommended in those localities where severe temperature changes are likely to be encountered during a 24-hour period.

It is preferable to run sulfur dioxide pressure gas lines overhead through relatively warm areas rather than along the floor or through basement areas where lower temperatures may be encountered. Do not run these gas lines along exterior walls that may be cold in winter months. Do not run pressure gas lines under windows from which cold air descends in winter months.

If the source of gas is one or more ton containers connected to a manifold, install a drip leg of one-inch schedule 80 seamless steel pipe, approximately 18 inches long, in a tee in the manifold with the lower end capped. Locate the drip leg immediately downstream of the last container connection to intercept the liquid that comes from the ton container's gas education tube when initially opened. Gas may be withdrawn from two or more containers simultaneously, provided all containers are at the same temperature. Refer to paragraph 3.1.

The installation of sulfur dioxide gas strainers in pipe lines upstream from pressure reducing valves or vacuum regula-

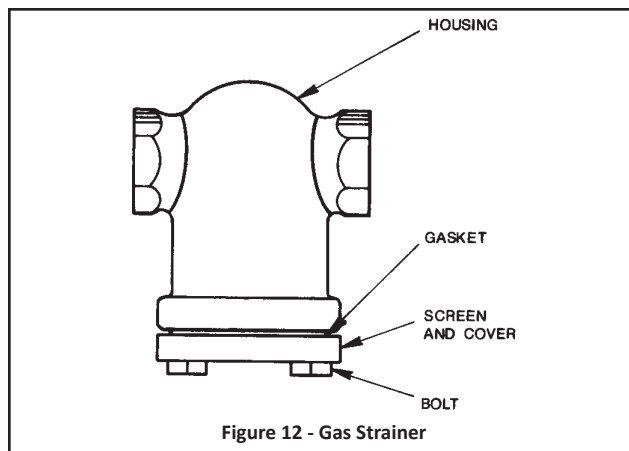


Figure 12 - Gas Strainer

tors is a common practice. These strainers can also serve as a trap for a small amount of liquid sulfur dioxide. Figure 12 illustrates a typical strainer.

4.3 Liquid Piping Installation Requirements

It is important to avoid conditions that will encourage vaporization. Thus liquid sulfur dioxide lines must be kept as cool as, or cooler than, the containers themselves by eliminating restrictive fittings and always operating with fully opened line valves. Avoid running liquid sulfur dioxide lines through overheated areas where gasification is likely.

Valves in liquid sulfur dioxide lines should be kept to a minimum. It is particularly important to avoid situations where it is easy to close two valves in a line thus trapping liquid that, upon an increase in temperature, will expand and develop higher than acceptable pressures.

A liquid line pressure relief system (which includes a rupture disc and an expansion chamber) is required where liquid may be trapped in the line or where it is necessary to run lines a considerable distance. The relief system is detailed in Figure 13. The expansion chamber provides an area for expansion in the event that valves at both ends of the line are closed. Relief system placement must be based not only on length of line but also placement of valves.

4.4 Pressure Relief and Vent Piping Requirements

All pressure relief vent line systems must be treated as though they contain sulfur dioxide. Use the same materials for pressure relief vent lines as used for sulfur dioxide gas piping, unless the vent line is a combination pressure relief/vacuum relief line, in which case the material must be suitable for moist sulfur dioxide gas (PVC or polyethylene tubing).

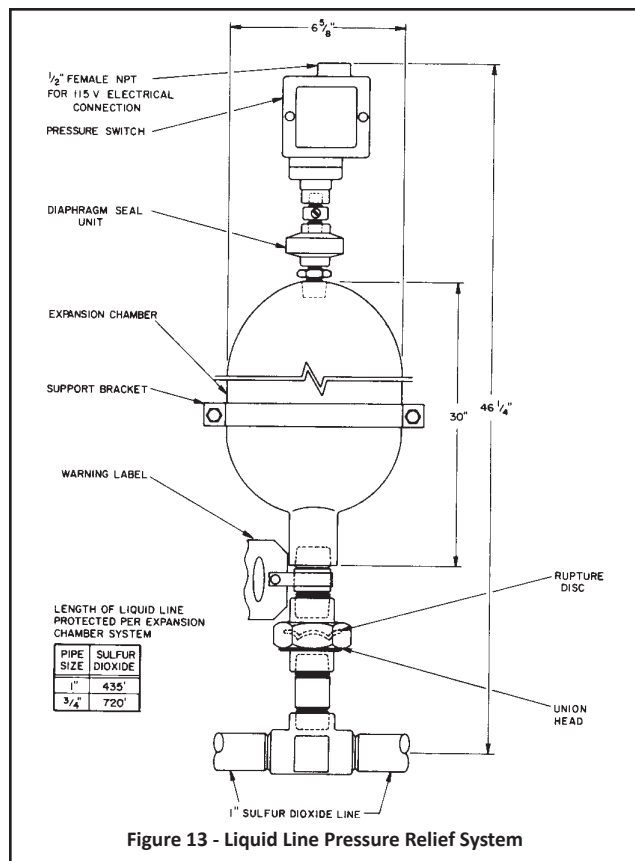


Figure 13 - Liquid Line Pressure Relief System

Vent lines must be run in such a way that moisture collecting traps are avoided. A continuous gradient is preferred. The ends of all vent lines must be turned down and screened.

Manifolding of vent lines is an acceptable practice provided only like vents are manifolded (i.e., evaporator water vapor vents must be separate from gas pressure reducing valve pressure vents, etc.). The interior cross sectioned area of a common vent or pressure relief line should be approximately equal to the sum of the cross sectional areas of the individual vent lines.

WARNING: THE VENT AND RELIEF LINES MUST TERMINATE IN AN AREA WHERE GAS FUMES CANNOT CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT. DO NOT TERMINATE THE VENT AND RELIEF LINES AT A LOCATION ROUTINELY USED BY PERSONNEL, SUCH AS WORKAREAS OR PATHWAYS, NOR NEAR ANY WINDOWS OR VENTILATION SYSTEM INTAKES.

4.5 Valves

Yoke type auxiliary cylinder, yoke type auxiliary ton container, and header valves are described adequately in the sulfonator or vacuum regulator instruction book.

Line valves are used to isolate alternate sources of supply (manifolded banks of ton containers or tank cars) or individual evaporators. Sufficient line valves should be provided for flexibility of system operation consistent with the recommended practice of eliminating redundant or unnecessary valves.

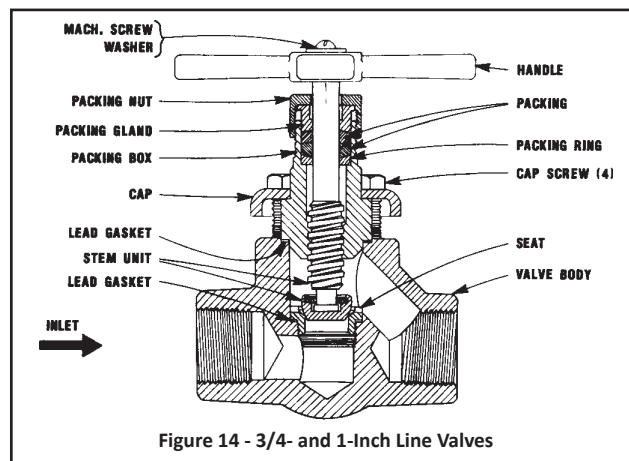


Figure 14 - 3/4- and 1-Inch Line Valves

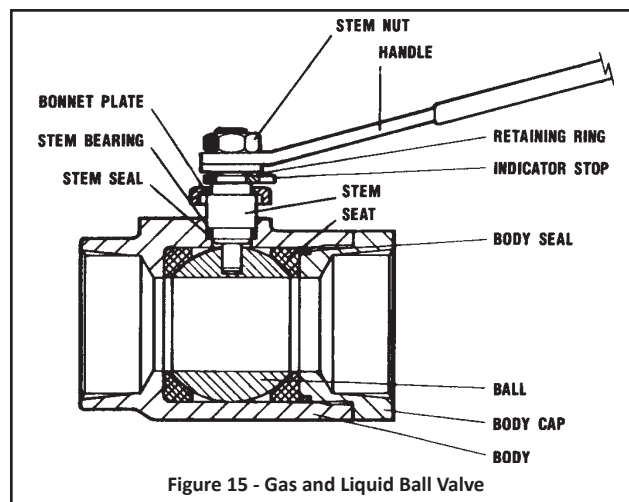


Figure 15 - Gas and Liquid Ball Valve

Valves are usually of approximately globe pattern, as shown in Figure 14, or ball type, as shown in Figure 15. Care should be taken that only valves designed by the manufacturer specifically for sulfur dioxide service are used. Ball valves must include a provision for venting the cavity in the closed position to the upstream side.

4.6 Pressure Gauges and Switches

Whenever pressure gauges and switches are used in sulfur dioxide liquid or gas lines, they must be of the type protected by a flanged diaphragm seal specifically designed for sulfur dioxide service to prevent the entry of sulfur dioxide into the gauge or switch mechanism. The fill material must be suitable for sulfur dioxide service. The connection between the seal and the gauge or switch must not be broken. If the

connection is inadvertently broken, the complete assembly must be discarded and replaced, unless it can be returned to the manufacturer for repair.

Frequently, valves are installed between sulfur dioxide lines and the gauge or switch diaphragm seal to permit removal without taking the line out of service.

A means of relieving the pressure in the isolated piping, gauge, or switch is strongly recommended.

WARNING: RELEASING EVEN A SMALL AMOUNT OF LIQUID SULFUR DIOXIDE IS DANGEROUS AND REQUIRES EXTREME CAUTION TO AVOID SEVERE PERSONAL INJURY. ALWAYS USE PROTECTIVE EQUIPMENT WHEN RELIEVING PRESSURE, EVEN IN ISOLATED SULFUR DIOXIDE GAS PIPING.

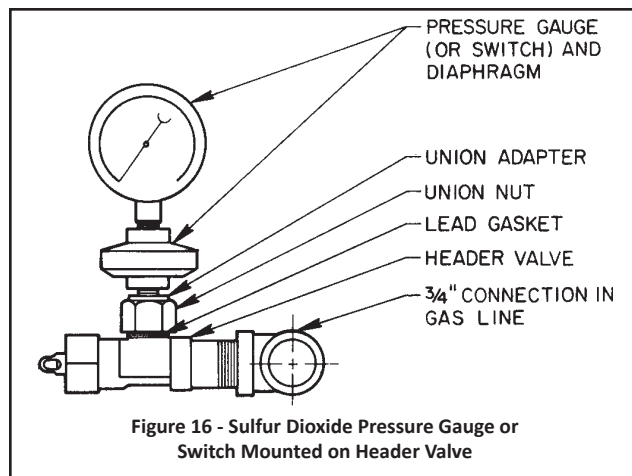


Figure 16 - Sulfur Dioxide Pressure Gauge or Switch Mounted on Header Valve

Since small size line valves for sulfur dioxide are not readily available, a header valve is often used, as shown in Figure 16.

4.7 Pressure Relief Devices

There are two types of pressure relief devices in use in sulfur dioxide piping systems. The first, as shown in Figure 13, is usually employed in liquid sulfur dioxide piping to protect the piping from rupture due to high pressure from thermal expansion of the liquid sulfur dioxide. It consists of a rupture disc that ruptures before the pipe line itself can rupture, an expansion chamber that allows for relief of the overpressure condition without releasing sulfur dioxide to the atmosphere, and a pressure switch to warn of disc failure.

The second type, as shown in Figure 17, is usually used in gas piping at the evaporator discharge. This system consists of a rupture disc that keeps sulfur dioxide out of the valve during normal operation, a pressure relief valve, and a pressure switch to warn of disc rupture.

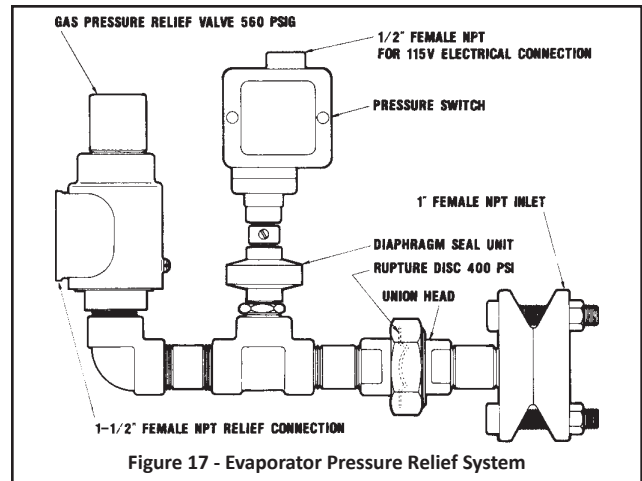


Figure 17 - Evaporator Pressure Relief System

WARNING: THE RELIEF LINE MUST TERMINATE IN AN AREA WHERE GAS FUMES CANNOT CAUSE DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL. DO NOT TERMINATE THE RELIEF LINE AT A LOCATION ROUTINELY USED BY PERSONNEL, SUCH AS WORK AREAS OR PATHWAYS, NOR NEAR WINDOWS OR VENTILATION SYSTEM INTAKES.

4.8 Preparation For Use

Normal plumbing practices will result in the entry of cutting oils, greases, and other foreign materials into the piping. In addition, the line will have been open to the atmosphere during construction allowing moisture to enter. It is therefore essential that all piping be thoroughly cleaned and dried prior to the exposure to sulfur dioxide.

WARNING: INCOMPLETE CLEANING CAN RESULT IN VIOLENT REACTIONS BETWEEN SULFUR DIOXIDE AND THESE MATERIALS.

Steam cleaning is an acceptable method for removal of the above materials.

Provisions must be made for removal of condensate and foreign materials.

After proper cleaning, all sulfur dioxide piping should be hydrostatically tested to one and one half times the expected maximum operating pressure. Prior to testing all gauges, switches, rupture discs, etc. which could be damaged during testing must be removed and connections plugged. Any moisture absorbing packing or gaskets left in the system during hydrostatic testing must be removed and replaced with new packing or gaskets. After hydrostatic testing, it is essential that all piping be thoroughly dried with inert gas (e.g. nitrogen) or dry air having a dew point of -40° F or be-

low. The dew point of the air or gas leaving the piping must be checked and drying continued until the dew point is at or below -40° F, which may require some time.

WARNING: MOISTURE MUST BE REMOVED FROM ANY PART OF THE EQUIPMENT WHICH IS NORMALLY EXPOSED TO DRY SULFUR DIOXIDE ONLY. WHILE DRY SULFUR DIOXIDE IS NONCORROSIVE, MOIST SULFUR DIOXIDE IS EXTREMELY CORROSIVE TO COMMON METALS, SUCH AS BRASS OR STEEL, POSSIBLY RESULTING IN A LEAK AND SEVERE PERSONAL INJURY. ALSO, IF WATER IS TRAPPED IN A SECTION OF PIPING OR EQUIPMENT, SUBSEQUENT HEATING OR FREEZING OF THE WATER MAY RESULT IN HIGH ENOUGH PRESSURE TO RUPTURE THE PIPING OR EQUIPMENT, POSSIBLY CAUSING SEVERE PERSONAL INJURY.

A very acceptable alternate to hydrostatic testing, if proper facilities do not exist for drying, is to test with nitrogen or dry air having a dew point of -40° F or below. The same provision of removing equipment that could be damaged by test pressure applies.

WARNING: TO AVOID SEVERE PERSONAL INJURY, BEFORE PLACING THE PIPING SYSTEM INTO SERVICE, PRESSURE TEST WITH SULFUR DIOXIDE GAS, NOT LIQUID. EACH VOLUME OF SULFUR DIOXIDE LIQUID THAT LEAKS AND THEN EVAPORATES RESULTS IN APPROXIMATELY 500 VOLUMES OF SULFUR DIOXIDE GAS.

The sulfur dioxide container valve should only be opened slightly during this phase of testing or preferably closed again after pressurizing the system. The piping should be tested in the smallest sections permitted by the existing valves to minimize the discharge of sulfur dioxide through any leaks.

WARNING: IT IS ESSENTIAL THAT PROPER BREATHING APPARATUS BE AVAILABLE BEFORE SULFUR DIOXIDE IS ADMITTED TO ANY PIPING SYSTEM OR EQUIPMENT. THIS APPARATUS WILL BE DISCUSSED FURTHER UNDER "PERSONNEL SAFETY".

Sulfur dioxide leaks are best located using a dauber moistened with commercial 26° Baume' aqueous ammonia (household ammonia is not strong enough) A white cloud will be formed at the site of any leak. A plastic squeeze bottle which directs ammonia vapor, not liquid at the joint being tested may also be used.

When a leak is detected the system must be depressurized before corrective action is taken. The best method of depressurizing the system is through one of the sulfonators. At least one sulfonator must be readily available for this purpose before testing with sulfur dioxide begins.

5 PERSONNEL SAFETY

5.1 General

Proper consideration of personnel safety begins with the provision of properly sized and arranged housing so that operating personnel have adequate room to perform their duties. It is preferable that any room used for sulfur dioxide storage or equipment have two doors which open outward and which are equipped with panic bars.

Rooms housing sulfur dioxide equipment, and sulfur dioxide containers that are "in service" or "in reserve", should be heated when the room temperature falls below 50° F. Comfortable working temperatures of 65° to 75° F are recommended for the sulfur dioxide equipment room. The temperature of the sulfur dioxide container room (if separate) should normally be 5° to 10° F lower. All common methods of heating are acceptable, provided that care is taken to prevent overheating of sulfur dioxide containers. Radiators should not be located adjacent to containers. If space heaters are used, the warm air should be deflected away from the containers. Outside windows should be located or screened so that the rays of the sun do not fall directly on sulfur dioxide containers.

Natural ventilation may be adequate for a small sulfonator installation in a separate building where windows and doors provide cross circulation. However, ventilation by means of a proper type electric fan is always recommended. In all cases installation must comply with appropriate regulations.

5.2 Health Hazards

Exposure to a sufficiently high concentration of sulfur dioxide can result in difficulty in breathing and if prolonged finally death through suffocation. Sulfur dioxide's strong pungent odor may result in detection at lower levels but most people will detect it by the time the concentration reaches 3 to 5 ppm. Concentrations of 5 ppm or more are so objectionable that only those who are unconscious or trapped will normally remain in the area. Increasing concentrations will produce eye irritation, coughing, throat irritation, and constriction of the chest.

Even concentrations below the threshold of smell can result in minor eye and throat irritation if the exposure is long enough. Liquid sulfur dioxide can cause burns and/or irritation when it is in contact with the skin or eyes.

Medical attention should be obtained immediately for personnel who had sufficient exposure to result in any symptoms beyond minor irritation. Properly trained and equipped first aid personnel are usually the first line of defense.

While waiting for their arrival, the exposed individual must be removed to a safe area and be placed in a comfortable position. If breathing has stopped artificial respiration must be started immediately.

If the exposed individual has difficulty breathing, oxygen should be administered only by those adequately trained in the procedure and the equipment used.

The proper procedure for emergency treatment of clothing or skin contaminated by sulfur dioxide is to flush the area with large quantities of water under a shower for at least 15 minutes. While still under the shower, affected clothing should be removed. No medical treatment or neutralization of the sulfur dioxide should be attempted except as directed by a physician.

Immediate flushing with tepid water should be administered if even small quantities of sulfur dioxide enter the eye or if the eye has been exposed to strong concentrations of sulfur dioxide. The eyelids must be parted and thorough flushing continued for at least 15 minutes. As mentioned previously for skin exposure no medical treatment or neutralization should be attempted except as directed by a physician.

The attending physician may wish to refer to a Material Safety Data Sheet on sulfur dioxide.

5.3 Safety Precautions

The first steps to be taken in providing proper safety precautions at any facility are the selection of safety equipment to be on hand, the proper location of the equipment and the training of all personnel in proper procedures to avoid unnecessary sulfur dioxide releases and to deal with releases that occur.

Proper respiratory equipment is essential for all facilities regardless of size. For maximum safety it is preferable to use air tank type pressure demand masks which have a self-contained air supply, and therefore are suitable regardless of sulfur dioxide concentration.

All respiratory equipment must meet the requirements of the National Institute for Occupational Safety and Health. Following the respiratory equipment manufacturer's recommendation regarding maintenance and periodic testing is essential. This equipment should be stored outside the area containing sulfur dioxide or sulfur dioxide equipment in a manner protecting it from damage of any kind and so as to be readily available.

WARNING: DO NOT LOCK CABINETS OR CLOSETS IN WHICH RESPIRATORY EQUIPMENT IS STORED, AS THE EQUIPMENT MUST BE READILY AVAILABLE.

All personnel with no assigned responsibility for dealing with a sulfur dioxide release should be instructed to leave the area. Those responsible for correcting the situation should don respiratory equipment before doing so.

Protective clothing is recommended for handling even routine operations involving sulfur dioxide. In the event of a substantial release, protective clothing is required. Anyone desiring further information on protective clothing should contact reputable manufacturers or suppliers of such equipment.

Safety shoes, hard hats and safety glasses should be used in accordance with standard plant practice.

Most leaks will occur in piping, valves, connections and the pressurized portions of sulfur dioxide equipment. These leaks will usually be eliminated by tightening packing, replacing gaskets or repairing the equipment.

WARNING: REPLACE FLEXIBLE CONNECTIONS ANNUALLY, OR SOONER IF THERE IS EVIDENCE OF DETERIORATION.

Emergency kits designed for use on sulfur dioxide cylinders or ton containers are available that can seal off most leaking areas of sulfur dioxide containers (i.e., valves, fusible plugs, or container wall). If these are on hand they must only be used by personnel thoroughly familiar with their use. The sulfur dioxide supplier should be contacted immediately for information, assistance, and advice on the disposition of the leaking container. The container should always be repositioned, if possible, so the leak is gas rather than liquid.

WARNING: NEVER UNDER ANY CIRCUMSTANCE SPRAY WATER ON A SULFUR DIOXIDE LEAK. THIS WILL ONLY MAKE IT WORSE.

Wall charts are available from most sulfur dioxide suppliers which provide much of the information contained in this manual.

5.4 Emergency Action Plans

The best emergency plan includes routine practices that are designed to minimize emergencies. Proper maintenance of all equipment associated with the storage, handling and use of sulfur dioxide in accordance with the manufacturer's instructions is essential.

All equipment and piping containing sulfur dioxide under pressure must be tested periodically for leaks following procedures covered in paragraph 4.8. Since it is not unusual for areas used for sulfur dioxide storage and sulfur dioxide equipment to be relatively unattended it is important for the air in these areas to be monitored continuously with sulfur dioxide detectors so that warning of leaks is given as early as possible. As with most emergencies the earliest detection helps to minimize the damage to equipment and personnel. In addition to warning of leaks when the areas are unattended sulfur dioxide detectors should warn of the presence of minor amounts of sulfur dioxide which may not be detected by personnel in the area.

Some sulfur dioxide leaks are minor but all require immediate attention.

In the event of a major release of sulfur dioxide there should be no delay in contacting the agency in the community which is responsible for handling hazardous material releases. Appropriate names and telephone numbers must be prominently posted.

The sulfur dioxide supplier is probably the best source of assistance for most sulfur dioxide users. If the supplier or the producer cannot provide adequate response then in the United States contact CHEMTREC (toll free 800-4249300) or in Canada contact CANUTEC (call collect 613-996-6666). These names and numbers must also be posted prominently.

The person responsible for making any of the calls listed above must be sure to give the agency contacted complete details including facility name, address, telephone number and the name(s) of personnel to contact for further information.

The description of the emergency should include size of container, corrective action already taken, local weather conditions, injuries, proximity to populated areas and directions for easiest access to the site.

It is vital that the emergency plan include use of the "buddy system", i.e., no personnel should be allowed to work alone in an area with a sulfur dioxide leak even if the second person is only standing by. As indicated earlier all personnel not involved in locating and correcting the leak should leave the area travelling in a crosswind direction to an area which is upwind and above the leak. Since it may not be possible for all personnel to be equipped with respiratory equipment they should be instructed to use a wet cloth or handkerchief over the nose and mouth while leaving the area.

A Material Safety Data Sheet for Sulfur Dioxide, available from the supplier, should be consulted in preparing an emergency plan. No emergency plan should be implemented until it is reviewed by the sulfur dioxide supplier and the agency in

the community having responsibility for hazardous material handling and disposal.

If it is apparent that fire will threaten or is present in a sulfur dioxide storage area it is preferable to remove the containers. If this is not possible the containers must be protected from the heat of the fire by spraying them with water. Do not spray water on any leaking container, however, since water will react with the sulfur dioxide forming acids which will make the leak worse.

5.5 Chemical Disposal Facilities

Part of the planning for emergencies entails provision for disposal of any released sulfur dioxide. In most cases little can be done about the sulfur dioxide already released to the atmosphere except to try to prevent its dissipation into areas where damage to equipment and personnel will result.

At some large installations scrubbers have been installed so that areas containing sulfur dioxide or sulfur dioxide equipment can be sealed off and the air removed to a process which will absorb the sulfur dioxide. The design of such a system is complex and should only be attempted by those thoroughly familiar with the process.

Absorption systems have been provided at some facilities to permit a leaking container to be emptied quickly if this is deemed essential. One pound of sulfur dioxide can be absorbed by 0.8 pounds of sodium hydroxide (caustic soda), 2.1 pounds of sodium carbonate (soda ash) or 1.4 pounds of calcium hydroxide (hydrated lime).

WARNING: TO AVOID SEVERE PERSONAL INJURY WHEN USING CORROSIVE CHEMICALS, OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE CHEMICAL MANUFACTURER/ SUPPLIER.

In each case one pound of the material should be dissolved in one gallon of water. Lime will actually be suspended in rather than dissolved in the water and requires constant agitation.

The tank and other equipment provided for an absorption system must be fabricated of materials suitable for the chemicals involved.

Provision must be made for dissolving the sulfur dioxide in the alkaline solution in such a way that the solution cannot be sucked back into the container.

Actually the safest way of disposing of the sulfur dioxide in the leaking container might be through the sulfur dioxide process particularly if the process can absorb the sulfur dioxide at higher than normal rates without creating damage.

SO₂ HANDLING MANUAL

It is not generally permissible to ship a container damaged by leak or fire if it contains sulfur dioxide. If for some reason this seems necessary the sulfur dioxide supplier must be contacted.