



## chlorinators

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### REGAL Gas Chlorinator, Sulphonator, and Ammoniator Systems

**Chlorinator Models 210, 210-1, 220, 220-1, 250, 250-1 and 2101**

**Sulphonator Models 710, 710-1, 720, 720-1, 750 and 750-1**

**Ammoniator Models 310 and 310-1**

## INTRODUCTION

This instruction book provides installation, operational, and maintenance instructions for Chlorinators (REGAL) Gas Chlorinators, Sulphonators, and Ammoniator Systems.

The systems described in this instruction bulletin have been designed for continuous, start-stop or automatic operation. These systems are composed of standard components and spare parts.

## IMPORTANT NOTES AND WARNINGS

- The entire contents of this instruction manual should be thoroughly reviewed and understood prior to installing and operating this equipment.
- Do not discard this instruction book upon completion of the installation. This book contains complete maintenance instructions, and includes spare parts lists. Replacement or additional manuals are available at a cost of \$5.00 each.
- To insure proper operation of this equipment, use only parts manufactured by Chlorinators. The use of non-REGAL parts in this equipment WILL void the REGAL warranty and result in a loss of REGAL's insurance coverage.
- Maintenance on REGAL Systems and System Components should be performed by competent personnel familiar with this type of equipment, such as authorized REGAL dealers or Chlorinators.
- This equipment is suitable for use only with the gases specified (DETERMINED BY THE SYSTEM OR SYSTEM COMPONENTS MODEL AND/OR PART NUMBER). DO NOT USE THIS EQUIPMENT WITH OTHER GASES. Such use can result in failures having hazardous consequences.
- This equipment may contain liquid or gas under high pressure. To prevent injury and/or equipment damage, close the supply cylinder/container valve(s) completely, and evacuate the complete system before disconnecting the gas supply or disassembling the units.
- Check for gas leaks daily. At the first indication of a leak or malfunction, shut off the gas supply and correct immediately. Chlorine, Sulfur Dioxide and Ammonia gas leaks MUST be corrected immediately upon detection as leaks ALWAYS get progressively worse.
  - Check for Chlorine and Sulfur Dioxide gas leaks using the vapors from a strong (commercial grade) ammonia solution. SEE PARAGRAPH 2.2.7 OF THIS BULLETIN.
  - Check for Ammonia gas leaks by using moist litmus paper, Sulfur Dioxide fumes or strong Chlorine Bleach fumes. SEE PARAGRAPH 2.2.7 OF THIS BULLETIN.
- Even if the Chlorine, Sulfur Dioxide, or Ammonia feed drops to zero as evidenced by the position of the ball float in the metering tube and/or a recessed status indicator pin and, even if the supply container(s) appear to be empty, SOME LIQUID CHEMICAL MAY STILL BE PRESENT. NEVER disconnect the chlorinator, sulphonator, or ammoniator vacuum regulator(s) from the cylinder/container/manifold valve(s) until ALL cylinder/container/manifold valves are FULLY CLOSED or a highly dangerous chemical leak causing severe injuries or death could occur.
- When ammonia gas is added to water as occurs in the ejector of an ammoniator, the pH of the water is raised. If the water being used to operate the ejector is hard water, the pH shift can have an extreme effect on the operation of the system and on the system maintenance requirements.
 

When the water contains hardness, increasing the pH decreases the solubility of the calcium and magnesium salts present. If the concentration of these salts is near their maximum solubility, increasing the pH will cause calcium and magnesium carbonates and hydroxides to precipitate. The harder the water, the more severe the problem becomes since there will be more precipitation for a given change in pH. Deposits will appear in the ejector throat and in the ammoniator solution line. Sometimes these deposits will shut down the system within a matter of a few hours or less. Following are recommendations of things that can be done to prevent or minimize these problems.

  - Use a water softener on the water line to the ejector to remove ALL of the hardness.
  - Keep the length of the ammoniator solution line as short as possible by locating the ejector at the point of ammonia application.
  - Oversize the ejector nozzle so that even if deposits occur, sufficient vacuum will still be produced. In this case, you are simply delaying the time until cleaning the nozzle is necessary.
  - Keep a spare nozzle for use during times when the original is being cleaned by soaking in muriatic acid.
- Sulfur dioxide presents a problem due to its inherently low vapor pressure at ambient temperature. Sulfur dioxide reaches 0 psig at approximately 14° F. In order for the sulfur dioxide feed equipment to operate properly, the vapor pressure of the sulfur dioxide should be at least 30 psig at the inlet of the sulphonator's vacuum regulator.
 

It is the recommendation of Chlorinators that the sulfur dioxide cylinders/containers be maintained in a temperature controlled environment (room) of at least 70° F.
- DO NOT** store or use chlorine and ammonia cylinders or containers in the same location as these two gases WILL form an explosive mixture.

## **CHLORINATORS ONE (1) YEAR LIMITED WARRANTY**

Chlorinators sets forth the following warranties with respect to its REGAL Gas Chlorinators, Gas Sulphonators, Gas Ammoniators, System Components and Sub-Assemblies. This warranty does not apply to the purchase of spare parts or other services performed by Chlorinators. This represents the entire agreement between Chlorinators and Buyer (also referred to as "end-user") and shall apply unless modified in writing and signed by a Chlorinators Officer, and this warranty and its intended terms shall supersede any prior negotiations, correspondence, understandings, or agreements, written or oral. The Buyer agrees to and accepts all terms of this warranty by its contracting for or acceptance of Chlorinator's products, and forms or other documents or statements issued by Buyer or any other person shall not modify or otherwise affect any of the following terms. Buyer should be aware that reseller must rely entirely upon Chlorinators warranties, or assume their own responsibility.

***The following states Chlorinators entire warranty and represents Buyer's exclusive remedy with respect to its product. Such warranties are expressly given in lieu of any other warranty, expressed or implied, including but not limited to those of merchantability and fitness for a particular purpose. This expressed warranty or any other warranty implied by law shall not cover defects due to accident, improper use, or non-compliance with Chlorinators operating and maintenance, assembly, installation manual and instructions.***

Recommendations and advice as to specifications, capabilities, design, installation, engineering, application, and use of products are provided as an accommodation and are intended only as suggestions. Chlorinators assumes no liability for such recommendations and advice and they are not to be construed as constituting any warranty, expressed or implied.

### **TERMS OF WARRANTY**

Chlorinators warrants its REGAL Gas Chlorinators, Gas Sulphonators, Gas Ammoniators, System Components and Sub-Assemblies for a period of one (1) year from date of shipment from Chlorinators. Date of shipment from the factory shall be determined solely on the basis of the chlorinator serial code stamped on the vacuum regulator back body. The serial number contains a date code. All serial numbers are also registered by Chlorinators as to date of shipment, model number, chlorine feed rate capacity and billing name. If the serial number is missing, defaced, changed, or in any way rendered unreadable, Chlorinators shall, at its option, have the right to declare the warranty void. If the serial number does not match the registered model number as to, but not limited to, such items as maximum chlorine feed rate, the same shall be applicable.

The warranty shall apply against material defects in components and workmanship occurring in the course of manufacture. Buyer's sole remedy for breach of said warranty shall be, at Chlorinators option, either repair or replacement of any unit which is received by Chlorinators at its plant in Stuart, Florida (shipping charges prepaid by buyer), within the time period set forth above and which is found by Chlorinators to be defective by reason of manufacture.

***Notwithstanding the foregoing, Chlorinators shall not be liable to Buyer for damages, including personal injury or death to any person or persons, or claims of any kind by a third party or property damage or loss of business or profits. In no event shall Chlorinators be liable to Buyer for consequential or accidental damages of any kind, even if Chlorinators was aware of the possibility of such damages. There are no remedies except those set forth. Further, that there are no other authorized warranty repair facilities other than those at the Chlorinators factory in Stuart, Florida.***

### **EXCLUSIONS**

The following are considered external environmental factors beyond the control of Chlorinators, and which may cause damage and/or need for service which will be specifically excluded from this warranty (i.e., not a material defect in components and workmanship occurring in the course of manufacture).

1. Impurities from gas supplies introduced onto sealing and metering surfaces or into any passageways.
2. "Flooding" of unit due to impurities and/or precipitants on ejector check valve sealing surfaces.
3. Introduction of liquified gas into the unit.
4. Physical damage due to force, dropping, misuse or other abuse.
5. Use with a material for which the unit is not specifically designed.
6. Use in an application beyond the rated feed rate capacity or pressures of the unit.
7. Any alteration of design, or use of non-Chlorinators manufactured parts.

The exclusions listed above are provided for purposes of clarification, and are not intended to, in any way, limit or eliminate other possible exclusions.

### **NO OTHER WARRANTIES**

Unless otherwise explicitly agreed in writing, and signed by a Chlorinators officer, it is understood that this is the only written warranty given by Chlorinators for the systems and components stated.

***The dealers or representatives of Chlorinators may not make verbal representations that add, modify or change the written warranties contained herein or change the extent and nature of Chlorinators liability. In no event shall Chlorinators be liable for direct, consequential, special, incidental or punitive damages of any kind with respect to the product, including but not limited to those which may allegedly arise out of breach of warranty, breach of contract, negligence, strict liability, or any other law, governmental regulation, or court decision, except as provided herein.***

## PRECAUTIONS FOR PERSONAL AND SYSTEM PROTECTION

1. Read these and all related instructions thoroughly and follow them carefully.
2. Make certain all required safety equipment is in place and operational.
3. Whether it is required or not, a gas mask (PRESSURE DEMAND TYPE AIR PACK) should be available in the immediate area of the gas feed equipment, and all operating personnel should be properly trained in its use. OPERATORS SHOULD NOT ENTER AREAS WHERE CHLORINE EXISTS, UNESCORTED.
4. Chlorine, Sulfur Dioxide, and Ammonia gas or the fumes from Chlorine, Sulfur Dioxide, and Ammonia solutions can be lethal in large enough doses. Always have a coworker observe from a safe location when you are working on any part or component of the gas feed system.
5. Avoid breathing the gas fumes of Chlorine, Sulfur Dioxide, and Ammonia solutions and AVOID contact with your skin. Work only in a well ventilated area.
6. Before working on the gas feed system, make certain that the cylinder/container/manifold valve(s) are shut off. If the cylinder/container/manifold valve(s) seem to be shut off, open them one quarter turn, and immediately close them again to make certain they are not frozen in the open position. If you cannot turn the valve(s) in either direction, ALWAYS ASSUME THEY ARE OPEN, and call your chemical supplier.
7. Do not use wrenches larger than the standard cylinder/container wrench (approximately 8" long) and DO NOT hit the wrench with a heavy object to open or close the valve.
8. Do not reuse lead gaskets. They may not seal properly thereby permitting the release of gas.
9. Use only lead gaskets. Other types may contract with temperature variations resulting in the escape of gas.
10. Check for gas leaks every time the vacuum regulator(s) are connected or remounted onto the cylinder/container/manifold valve.
11. The rate valve IS NOT a shut-off valve. To shut off the gas supply, CLOSE THE CYLINDER/CONTAINER/MANIFOLD VALVE(S).

### IMPORTANT:

Please mail or fax this registration form to establish your warranty.

### REGAL Registration Card

#### REGAL REGISTRATION CARD

**IMPORTANT:** To further establish your warranty and to enable us to contact you should the need arise, please fill out this card and return it promptly. Please do it now. Thank you.

Chlorinators, Stuart, FL is the only authorized Warranty Repair facility for REGAL Gas Chlorinators/Sulphonators.

#### PLEASE PRINT, THANK YOU

Chlorinator/Sulphonator Serial No.(s)\* 1. \_\_\_\_\_ 2. \_\_\_\_\_

\*Die stamped into side of back body on same side as vacuum/vent fitting(s)

Purchased From \_\_\_\_\_

Your Name \_\_\_\_\_ Title \_\_\_\_\_

Organization \_\_\_\_\_

Mailing Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone (\_\_\_\_\_) \_\_\_\_\_ Ext. \_\_\_\_\_

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### IMPORTANT:

Fill out and mail or fax the form on the reverse side to establish your warranty.



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Stuart, FL 34994-3436

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PLACE  
STAMP  
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### IMPORTANT

Before proceeding, read the “**IMPORTANT NOTES AND WARNINGS**” in front of this manual.

REGAL Gas Feed Systems are vacuum operated solution feed types designed for mounting directly to the cylinder valve of a 150 lb. cylinder or, to the top valve of a one ton container using a REGAL TAY-200 ton container adapter assembly or, to the valve of an approved gas manifold.

The vacuum regulator mounts to the valve by means of a positive, heavy duty yoke clamp and is sealed against leakage by a lead gasket.

The vacuum regulator has a built-in spring opposed diaphragm regulator and safety shut-off valve to maintain the proper operating vacuum levels in the system. Gas feed rate is manually adjusted.

A highly efficient water powered, vacuum producing ejector is close coupled with the solution diffuser in systems to 500 PPD. Above 500 PPD, the solution diffuser is by others. All REGAL ejectors contain a back flow check valve.

The REGAL Gas Feed System incorporates the very best available materials using the latest technology in design and construction. More than two dozen improvements have been made to reduce maintenance, simplify construction, and improve operation.

## GENERAL

Each system consists basically of standard system components plus necessary water supply piping, parts, and extra accessories that may be desired. The standard system package includes:

1. The vacuum regulator with built-in vent.
2. The ejector assembly with back flow check valve, nozzle, and diffuser (when supplied).
3. The remote metering panel assembly with manual rate adjustment valve (ONLY ON SYSTEMS REQUIRING REMOTE METERING PANEL ASSEMBLIES).
4. Standard accessories and spare parts.

## 1.0 INSTALLATION (See Drawing 1, 2 or 3)

### 1.1 HANDLING OF CYLINDERS/CONTAINERS

Chlorine, Sulfur Dioxide, and Ammonia gas is potentially dangerous. The following rules must always be adhered to:

- 1.1.1 Never move a cylinder/container unless the valve protection domes and/or hoods are in place.
- 1.1.2 Locate the cylinder/container where they will not be bumped or damaged.
- 1.1.3 A safety chain should be placed around cylinders and secured to a wall or support. Ton containers should be secured in position using trunnions or other similar devices.

- 1.1.4 As a rule of thumb, chlorine and ammonia cylinders and/or containers should be stored and used in an environment of 50° F minimum. Sulfur dioxide cylinders and/or containers should be stored and used in an environment of 70° F minimum.

### 1.2 MOUNTING THE VACUUM REGULATOR

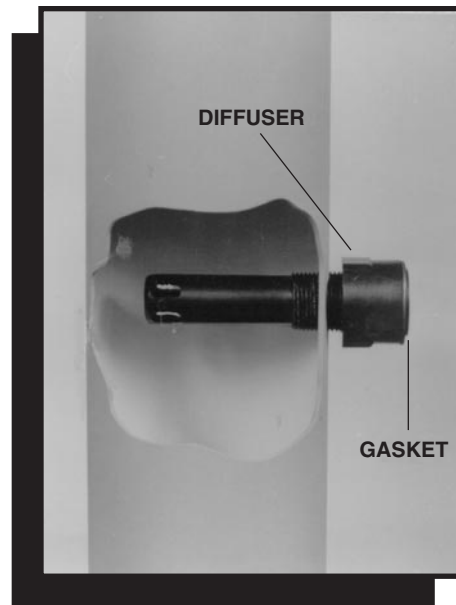
- 1.2.1 Remove the valve protection hood from the cylinders or the ton container.
- 1.2.2 If a ton container, rotate the container until the two outlet valves are aligned vertically. This allows gas to be withdrawn from the top valve and liquid from the bottom valve. **CONNECT TO THE TOP VALVE FOR GAS USE.**
- 1.2.3 Unscrew the cap nut covering the valve outlet.
- 1.2.4 Remove any dirt that may be in the valve outlet or on the gasket sealing surfaces.
- 1.2.5 Remove all shipping tape from the vacuum regulator's inlet. **DO NOT REMOVE** the filter that is inserted in the vacuum regulator's inlet.
- 1.2.6 If the vacuum regulator is cylinder mounted, unscrew the yoke screw until the sliding bar can be pushed all the way back. Place a new 1/16" thick lead gasket over the vacuum regulator's inlet. **NEVER REUSE A GASKET.** Use a new one every time the regulator is removed from a cylinder.

Mount the vacuum regulator on the cylinder valve by:

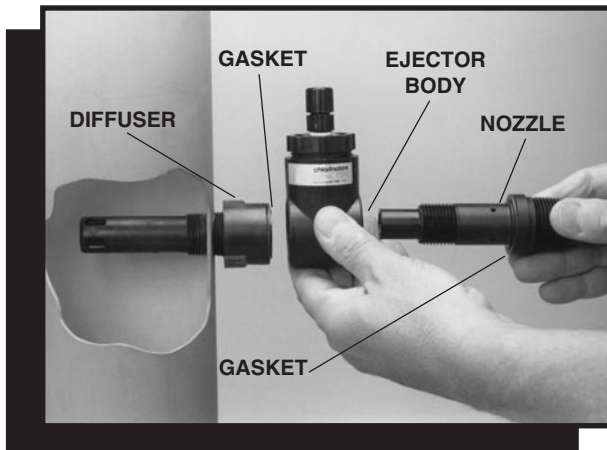
- a. placing the yoke over the valve,
  - b. engaging the vacuum regulator inlet properly with the valve outlet, and
  - c. carefully tightening the yoke clamping screw, using the integral tightening handle to compress the lead gasket. Excessive tightening can squeeze the lead gasket out of the joint and cause a leak and/or damage to the equipment. (Photo 1.1)
- 1.2.7 If container mounted, mount the vacuum regulator to the valve of a REGAL TAY-200 Ton Container Adapter Assembly by following the steps outlined in 1.2.6 above.
    - a. Unscrew the yoke screw of the TAY-200 adapter until the sliding bar can be pushed all the way back.
    - b. Place a NEW lead gasket over the inlet adapter of the TAY-200 and mount the TAY-200 with regulator installed to the top container valve **BEING CAREFUL TO ALIGN THE REGULATORS INLET PROPERLY TO THE VALVES OUTLET.** If not aligned properly, the inlet adapter **WILL BE DAMAGED.**
    - c. Carefully tighten the yoke clamping screw of the TAY-200, using the integral tightening handle to compress the lead gasket. Excessive tightening can squeeze the lead gasket out of the joint and cause a leak and/or damage to the equipment.



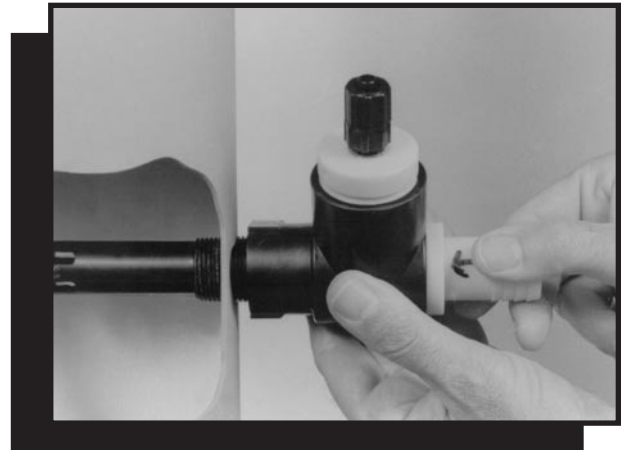
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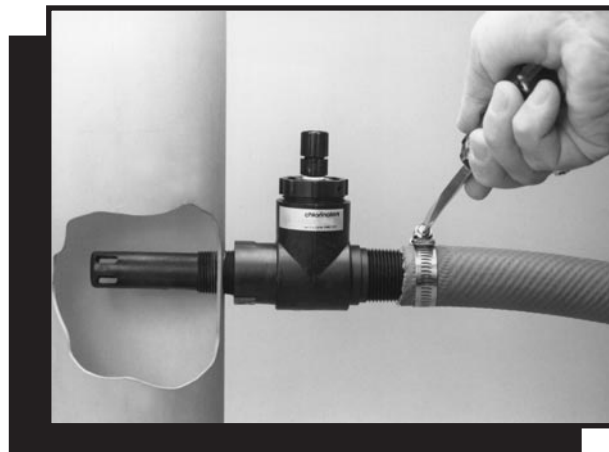
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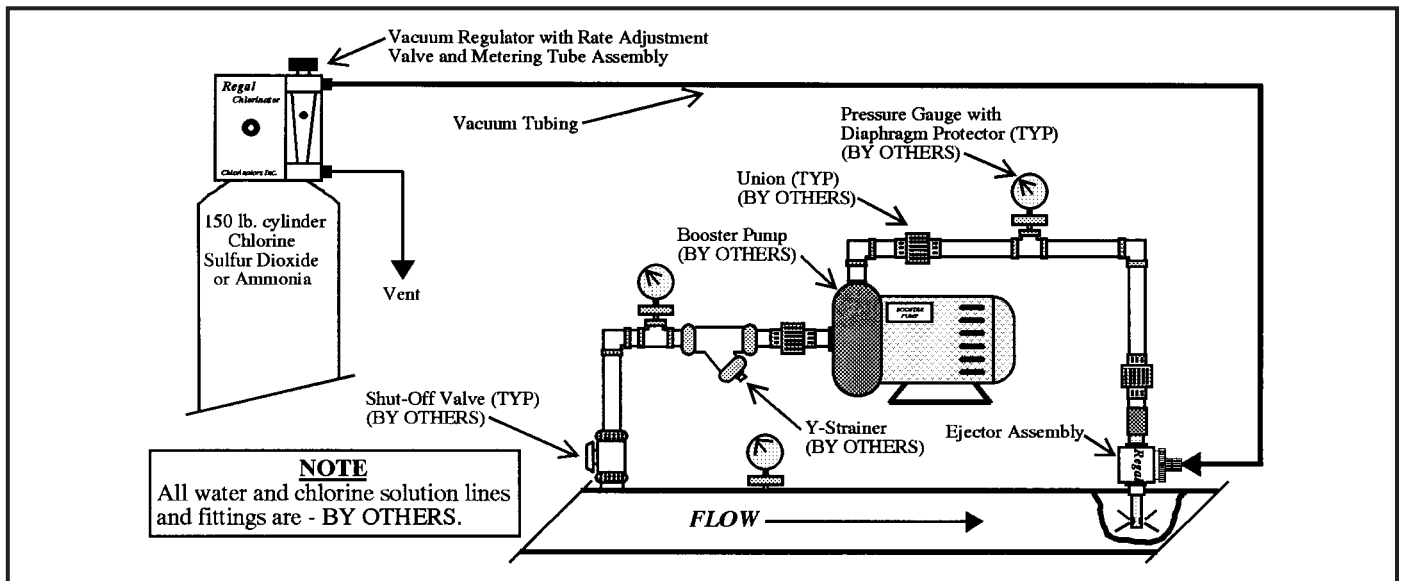
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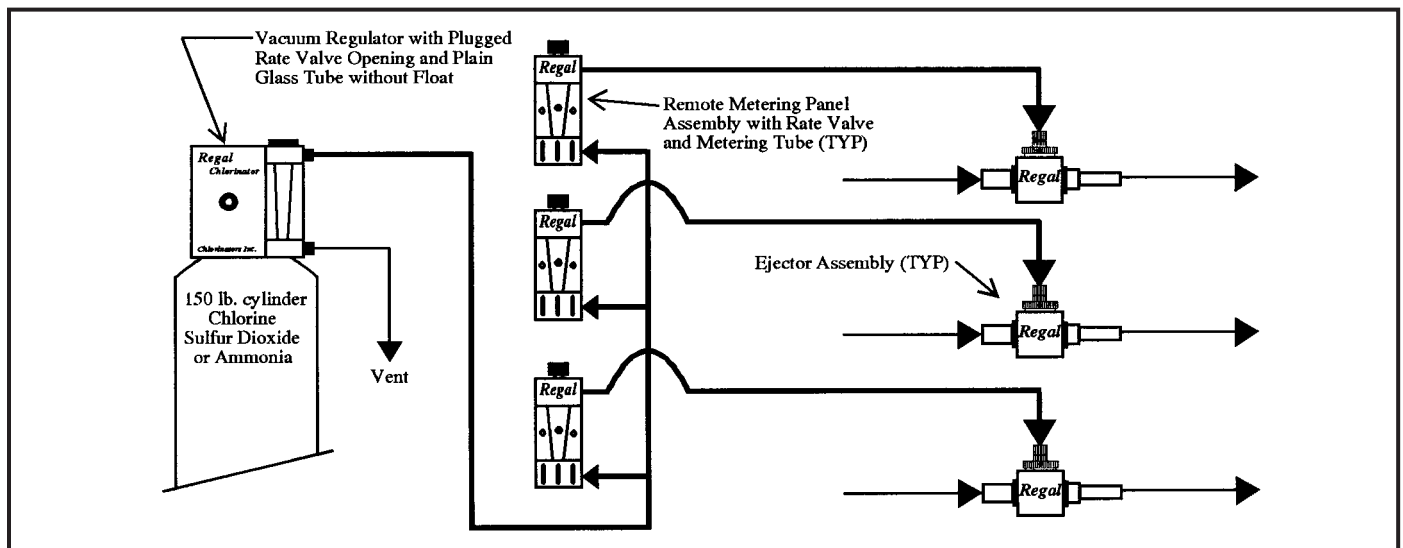
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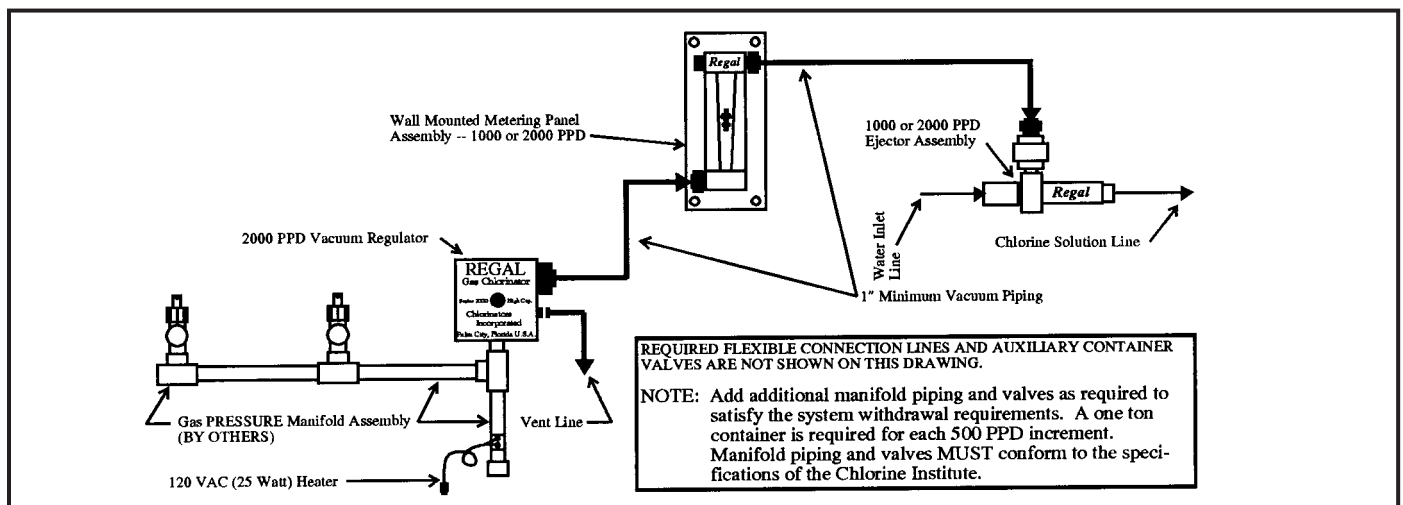
1.5



**Drawing 1**  
Typical installation of basic Model 210 type system.



**Drawing 2**  
Typical installation of a Multi-Point feed system. Ejectors installed as in Drawing 1.



**Drawing 3**  
Typical installation of a High Capacity Model 2100 system @ 1000/2000 PPD.



- 1.2.8 If manifold mounted, mount the vacuum regulator to the appropriate valve of the manifold by following the steps outlined in 1.2.6 above. (Photo 1.8).
- a. Using NEW lead gaskets and approved flexible connection lines, auxiliary container valves, etc., connect each flexible connection line, auxiliary container valve, etc. from each cylinder or TOP container valve to the remaining manifold valves.

### 1.3 INSTALLATION OF EJECTOR

- 1.3.1 The check valve in the ejector is designed so that the ejector may be installed in any position. The check valve assembly, components, and piping **MUST** be supported to prevent breakage due to water hammer, vibration, etc. A horizontal mounting of the ejector is preferred. **BE SURE THE PROPER CHECK VALVE IS USED TO MATCH THE SYSTEM APPLICATION PRESSURE.**
- 1.3.2 The point of injection should be carefully chosen so that the water pressure is as low as possible. Vacuum is created in the ejector by the nozzle - actually a precision designed venturi - so water pressure to the nozzle must be high enough to overcome the total back pressure and create a strong jet in the nozzle.
- 1.3.3 Ejectors to 500 PPD are designed to withstand static back pressures up to 200 psig (14.1 kg/cm<sup>2</sup>). However, due to possibilities of water line "hammer" in high pressure on-off systems, as well as special booster pump considerations, it is recommended that a factory representative, or Chlorinators be consulted regarding installation details in systems over 100 psig (7 kg/cm<sup>2</sup>).
- Ejectors of 1000/2000 PPD are designed to withstand static back pressures up to 70 psig (4.9 kg/cm<sup>2</sup>). However, due to possibilities of water line "hammer" in high pressure on-off systems, as well as special booster pump considerations, it is recommended that a factory representative, or Chlorinators be consulted regarding installation details in systems over 50 psig (3.5 kg/cm<sup>2</sup>).
- 1.3.4 Generally, the amount of water (GPM) required to operate the ejector depends on the gas feed rate (lb/24 hrs, gms/hr, or kg/hr). The higher the gas feed rate, the greater the water flow needed. Refer to Application Bulletins 1002 or 1009 in Section 7.0 of this manual.
- 1.3.5 Ejector water supply pressure must be greater than the pressure into which the gas solution is injected. The amount of pressure differential may vary with the particular application. Generally, the greater the pressure into which the gas solution will be injected, the greater must the differential pressure be. However, the minimum pressure differential and water flow for your installation should be determined prior to installation and start-up.

- 1.3.6 Follow these steps for installing ejectors up to 500 PPD with close-coupled diffusers.

- a. Unscrew the diffuser from the assembly. **DO NOT** install the diffuser when assembled as damage may occur.
- b. Put teflon tape on the 3/4" pipe threads and screw the diffuser into the pipe. These are high impact plastic parts but, as with all plastic pipe fittings, care should be exercised in tightening. Tighten carefully with a properly adjusted wrench. Make sure that the holes in the spray diffuser are in the main stream.

The end of an open end diffuser should not allow the strong solution to come in contact with any metal pipe or fittings as serious corrosion will occur (See Photo 1.5).

- c. Place a G-204 gasket into position on both the nozzle and the diffuser. Insert the nozzle through the check valve body (Photo 1.3) and screw into the diffuser until contact is made with both G-204 gaskets. Hold the check valve body against the diffuser at 1/8 turn **COUNTER-CLOCKWISE** from its final position (See Photo 1.4). At the same time, turn both the nozzle and the check valve body 1/8 turn clockwise to their final tightened position. The check valve may be installed in any position - up, down, or sideways.

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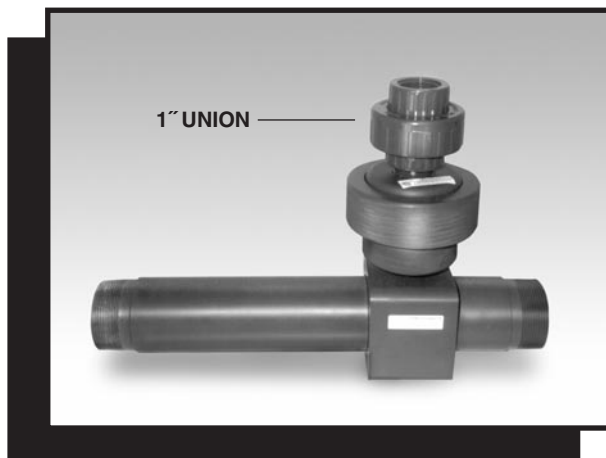
**NOTE:** A short length of hose is recommended between the ejector and rigid piping to absorb vibrations.

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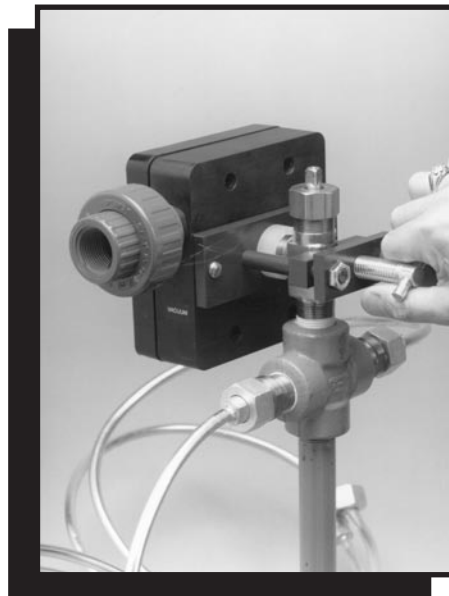
- 1.3.7 Follow these steps for installing ejectors of 1000/2000 PPD capacities. (See Drawing 3).
- a. The nozzle (water inlet) and throat (solution outlet) connections are 2" NPT for use with customer furnished fittings, flanges, unions, etc.
- b. The ejector's gas inlet is a 1" NPT PVC union.
- c. Use teflon tape on all threaded connections. Tighten threaded connections carefully, using properly sized wrenches, being careful not to over tighten, as damage to the parts could result. **MAKE SURE ALL RIGID PIPE RUNS ARE PROPERLY SUPPORTED.**
- 1.3.8 Other types of diffuser and ejector installations may be desired for certain applications.
- a. The ejector can be located near the other gas feed system components when required. A wall bracket can be provided for ejectors to 500 PPD. Various size adapters can be used on the solution outlet to accommodate hose or pipe.
- b. If the ejector is to be remotely installed with solution piping or hose running to the point of application, **BE CERTAIN TO CUT OFF THE TIP OF THE STANDARD DIFFUSER BEFORE INSTALLING INTO THE PIPE OR HOSE.** Failure to do this will result in excessive back pressure being created in the diffuser, preventing proper gas feed.



1.6



1.7



1.8

**WARNING:** The 500 PPD ejector nozzle (50X) extends beyond the ejector body and the end of the E-540 nozzle retainer. **DO NOT** cut off the end of the nozzle.

- c. The entire ejector assembly may be submerged in an open channel or tank.
- d. Corporation cock type diffusers, ball valves, etc., can be used as required if properly sized.

#### 1.4 PIPING OF EJECTOR (See Drawing 1 or 3)

- 1.4.1 For most installations, the ejector water supply line should be brought to within 3-5 feet of the nozzle with rigid PVC or iron pipe. A 1000/2000 PPD ejector will be directly connected to rigid PVC pipe on both sides.
- 1.4.2 A shut-off valve followed by a Y-strainer and the ejector is recommended to enable servicing when necessary.
- 1.4.3 A pressure gauge between the Y-strainer and the ejector is recommended.
- 1.4.4 For 500 PPD and below ejectors, connect a short length of hose between the end of the rigid incoming water line and the ejector nozzle. Clamp the hose securely at both ends with single or double hose clamps (Photo 1.5).

#### 1.5 CONNECTING VENT LINES

- 1.5.1 Every REGAL gas feed system incorporates a "vent" to allow pressurized gas an avenue of escape when necessary. Venting occurs when dirt or impurities enter the vacuum regulator inlet valve plug and seat area, preventing a bubble tight closure of the valve plug.
- 1.5.2 Appropriate size flexible tubing is used for all vent connections. Use enough length to allow movement of the vacuum regulators when necessary.
- 1.5.3 Route the tubing to a safe location outside the building. The end of the vent line should point down to prevent rain water from entering, and should be screened to keep insects from getting in and building nests.

#### 1.6 CONNECTING VACUUM LINES OR PIPING

- 1.6.1 On 500 PPD and below systems, flexible vacuum tubing is used to connect the various system components (Drawing #1 or #2).
  - a. Remove connector nuts from vacuum connections and slip onto tubing. Using appropriate lengths of tubing, push onto connectors and tighten connector nuts **HAND TIGHT**.
- 1.6.2 On 1000/2000 PPD systems 1" minimum Sch. 80 PVC pipe and fittings are used to connect the various system components (See Drawing No. 3).

#### NOTE:

- 1. When 500 PPD and below systems are supplied with a remote metering panel assembly or assemblies, the rate adjustment valve is removed from the vacuum regulator and replaced with a non-adjustable plug. The metering tube normally furnished in the vacuum regulator is replaced with a plain glass tube without a float.
- 2. The metering panel assembly, which includes the metering tube and the manual rate adjustment valve, is designed for wall mounting using appropriate fasteners.

- 1.6.3 Each additional point of application (all capacities) consists of an additional metering panel assembly with manual rate adjustment valve, and an additional ejector assembly. On capacities of 500 PPD and below, each additional feed point includes a length of flexible vacuum tubing and a tubing connector tee fitting (See Drawing No. 2).

#### 1.7 ADDITIONAL INSTALLATION SUGGESTIONS

- 1.7.1 Many operators find it convenient to install a hook on the wall behind the cylinders or alongside the containers. When changing cylinders/containers, the vacuum regulator can easily be hung on this hook.
- 1.7.2 An appropriate scale should be used to weigh the contents of the cylinders/containers to determine the amount of chemical remaining.

## 2.0 START-UP

#### 2.1 CHECK EJECTOR (See Photo 1.5 or 1.7)

- 2.1.1 The ejector assembly is the heart of the gas feed system. It creates the vacuum necessary to operate the remaining system components. Unless the ejector is creating a vacuum, the system **WILL NOT WORK**. To check ejector operation:
  - a. Remove the vacuum tubing from the ejector tubing connector or unscrew the 1" PVC union at the ejector vacuum connection.
  - b. With the booster pump running or the pressurized water supply connected, open the ejector water line supply valve and any other valves that may exist between the ejector outlet and the point of chemical application. The ejector should now be in operation and creating a strong vacuum.
  - c. Check for proper operation by placing your finger or hand over the vacuum connection opening. If there is no vacuum, refer to Section 7.0 and be certain there is enough supply pressure and the nozzle or piping is not plugged. Proper vacuum must exist before proceeding.

- d. Shut off the water supply to the ejector and make sure no water comes out of the vacuum connection opening. If water is observed leaking past the check valve, see Section 4.4 and correct before proceeding. Once the problem is corrected, cycle the ejector on and off a few times to make sure the check valve is tightly sealed. Water leaks at this point CANNOT be tolerated.
- e. Repeat this procedure for all ejectors present.
- f. Reconnect the vacuum tubing or piping and leave the ejector running. On 1000/2000 PPD ejectors, make sure the o-ring is not lost from the union connection.

## 2.2 CHECK VACUUM REGULATOR

(See Photo 1.1 or 1.6)

- 2.2.1 With the ejector operating and the gas cylinder(s)/container(s) still closed, the ball or float in the metering tube will remain at the bottom. If it does not, or if it bounces up and down, there is either a leak at the lead gasket where the vacuum regulator connects to the cylinder/container/manifold valve, or a loose connection in the system. Check and correct.
- 2.2.2 The supply indicator on the face of the vacuum regulator should be below the surface of the regulator body, indicating an "out of gas" condition.
- 2.2.3 Turn the rate valve on the vacuum regulator (or on the remote metering panel assembly) counter-clockwise a few turns, to be sure the float remains at the bottom of the metering tube.
- 2.2.4 Close the ejector water supply valve to stop operation of the ejector.
- 2.2.5 Disconnect the flexible vacuum tubing (or disconnect the 1" vacuum union) at the vacuum regulator to allow air to enter the system. Reconnect the vacuum line.
- 2.2.6 Open and immediately close the gas valve of the cylinder/container.
- 2.2.7 Chlorine and sulfur dioxide leaks are best located using a dauber moistened with commercial 26 degree Baume' aqueous ammonia (household ammonia is not strong enough). A white cloud will form at the site of any leak. A plastic squeeze bottle which directs ammonia vapors, NOT LIQUID, at the joint being tested may also be used.

Ammonia leaks are best located using moist litmus paper which turns color on exposure to ammonia fumes or by using sulfur dioxide or strong chlorine bleach fumes which both form a heavy white smoke when mixed with ammonia vapors.

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**NOTE:** If a pressure manifold system is being used, begin checking for leaks at the furthest cylinder/container connection. Check small sections of the manifold at a time until the entire manifold is found to be leak tight.

When a leak is detected the system must be depressurized before corrective action is taken.

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**NOTE:** If the REGAL Vacuum Regulator is mounted on a ton container using a REGAL TAY-200 Ton Container Adapter Assembly, OPEN the valve on the TAY-200 Assembly 1/4 - 1/2 turn and repeat steps 2.2.6 and 2.2.7.

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2.2.8 If no leaks were detected, open the gas cylinder/container/manifold valve(s) 1/4 turn, leave open and recheck for leaks one more time.

2.2.9 Turn on the water supply to the ejector(s) and adjust the gas feed rate to the desired setting.

---

**NOTE:** NEVER use the rate valve to shut off the gas supply. This valve is for adjusting the gas feed rate only. To shut off the gas supply, close the cylinder/container/manifold valve(s).

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## 3.0 SHUT-DOWN

### 3.1 Shut off the gas cylinder/container valves leaving all other gas pressure valves open.

- a. The ejector should be running. The "out of gas" indicator pin should be recessed below the surface of the vacuum regulator.
- 

**WARNING:** Even if the gas feed rate drops to zero as evidenced by the position of the ball or float in the metering tube and/or a recessed status indicator pin, and even if the supply container appears to be empty, SOME LIQUID CHEMICAL MAY STILL BE PRESENT.

NEVER disconnect the vacuum regulator from the cylinder/container/manifold valve until ALL cylinder/container/manifold valves are FULLY CLOSED or a highly dangerous chemical leak causing severe injuries or death could occur.

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### 3.2 Shut off the water line supply valve or booster pump to the ejector.

### 3.3 When changing the gas cylinders/containers, follow the procedure on the cylinder/container changing chart supplied with your REGAL gas feed system.

# Care and Maintenance of your REGAL Gas Feed System

## GENERAL

This section covers all phases of service on REGAL Gas Feed Systems. Normally it is not necessary to completely disassemble the systems components unless it is to be cleaned throughout, or has been severely flooded. **DO NOT DISASSEMBLE THE UNITS MERELY FOR THE SAKE OF DISASSEMBLY.**

All units have been factory tested and are in A1 condition when they are shipped. This text describes some of the things that can cause a REGAL gas feed system to stop working. Read it carefully and find out what the problem is, before attempting to correct it.

## 4.0 TROUBLESHOOTING HINTS

REGAL Gas Feed Systems will require minimum service if operated with reasonable care. Problems which could arise are listed below.

**IMPORTANT:** BEFORE PROCEEDING, READ THE "PRECAUTIONS FOR PERSONAL AND SYSTEM PROTECTION" AT THE FRONT OF THIS MANUAL.

### 4.1 GAS PRESSURE LEAK

There are four possible points of gas pressure leaks. These are rare, but if a gas leak is detected, it should be immediately located and stopped. Even small leaks can create a safety hazard and cause serious corrosion to equipment in the area.

#### 4.1.1 Cylinder/container/manifold valve packing.

The cylinder/container/manifold valves are high quality valves designed specifically for the gas service intended. Chemical suppliers should service these valves at each filling, and leakage at this point is unusual. Should a leak develop, tighten the valve packing nut without exerting excessive force. If this does not eliminate the leak, close the valve and call the chemical supplier.

#### 4.1.2 The lead gasket seal between the vacuum regulators and the cylinder/container/manifold valves.

A leak at this point could be caused by reusing a lead gasket, by dirt on the gasket surfaces, under or over tight connections, or by installation without a gasket, or the use of a "fiber" type gasket instead of lead. **ALWAYS USE A NEW LEAD GASKET.** Make certain the gasket and gasket surfaces are clean and smooth. Tighten clamps, but not excessively.

#### 4.1.3. Safety shut off inlet valve plug and seat – VENTING (Photo 5.14 & 5.15).

Gas leaking out of the vent is an indication of a leak at the inlet valve plug and seat. The usual cause is dirt on the valve seat. Test to make certain the problem is a leak at this point.

- Shut off water supply to ejector assembly.
- Submerge the end of the vent tubing in a glass of water. Continuous bubbling is an indication of a gas leak.
- Before removing the unit from the cylinder/container/manifold, close the cylinder/container/manifold valve, turn on the water supply, and allow the vacuum regulator to operate until the metering ball or float drops to the bottom (ZERO).

**NOTE:** A gas leak around the S-404 and S-406 o-rings could also result in a vent leak.

#### 4.1.4 Vacuum regulator adapter face seal S-404. Gas leaking out between the back body and the yoke assembly usually indicates a leak at the o-ring seal between the inlet valve capsule and the inlet adapter. The usual causes are listed below. See Section 5.12.

- Improper tightening of the inlet valve capsule after disassembly.
- Dirt or impurities on the o-ring or sealing surfaces.
- A leak around the S-404 and S-413 o-rings could result in a gas leak between the yoke body bar and the back body.

### 4.2 LOSS OF GAS FEED

#### 4.2.1 No vacuum. This can readily be checked by removing the gas line at the ejector vacuum inlet and holding your finger or hand over the opening. Suitable vacuum will exert a strong pull. If there is no vacuum, the ejector nozzle may be plugged. Refer to Section 5.6 or 5.7.

#### 4.2.2 Insufficient water pressure to operate the ejector. This can be readily checked as in 4.2.1 above.

#### 4.2.3 No gas supply. This should be obvious. When the gas supply becomes empty, the metering ball or float will not indicate above zero gas feed rate, and the supply indicator pin will be below the vacuum regulator face.

#### 4.2.4 Plugged inlet filter. Dirt from the cylinder/container may completely plug the high efficiency, porous filter. The filter may be removed for inspection and cleaning. See Section 5.11, "Cleaning Safety Shut-Off Valve and Seat."

#### 4.2.5 Poor air circulation around the cylinder/container resulting in low cylinder/container pressure and possible frost build-up.



## 4.3 STICKY BALL IN METER TUBE

### 4.3.1 Deposits

- a. The gas may contain traces of organic compounds which deposit on the ball or float or the inside of the glass tube. This deposit is often sticky, causing the ball or float to adhere to the surface of the glass, resulting in erratic operation. When this occurs, it is necessary to remove the flow meter tube assembly from the unit for cleaning. The cleaning procedure is outlined in Section 5.8, 5.9 or 5.10.
- b. The frequency of cleaning depends on a number of factors – notably the quality of the chemical and the operating temperature of the installation.

### 4.3.2 Moisture in the system.

- a. In the normal course of operation, moisture should not be present. However, it is possible when changing cylinders or containers, that very moist air could be drawn into the inlet or the vacuum regulators. This can cause the metering ball or float to become “sticky” particularly at the bottom (small end) of the tube.
- b. If the vacuum regulator has been previously “flooded” (See Section 4.4) it is possible that all moisture has not been removed from all gas passageways in the system.
- c. A severe vacuum leak can allow moist air to enter the system (See Section 4.4).

## 4.4 WATER IN SYSTEM COMPONENTS - “FLOODING”

- 4.4.1 During normal operation, vacuum is drawing gas through the system and water cannot enter. When the system is shut down and vacuum is lost, water is prevented from backing up by the check valve in the ejector assembly. Any water observed in the metering tube or any other system component indicates a failure of the check valve. If the check valve has failed:
  - a. Close the cylinder/container/manifold valve the vacuum regulator is attached to.
  - b. Shut off the water supply to the ejector and the water in the main, so there is no pressure in the ejector piping.
  - c. Remove the vacuum tubing or piping from the ejector and follow instructions for “Cleaning and Replacing the Ejector Check Valve,” Section 5.1, 5.2, 5.3, 5.4 or 5.5.
  - d. Remove the vacuum regulator from the cylinder/container/manifold valve. Carefully follow instructions in Section 5.12 to be sure all moisture is removed from ALL system components prior to reassemble and start-up.
  - e. If the system is using a remote metering panel assembly, remove the metering tube and follow instructions in Section 5.8, 5.9 or 5.10 “Cleaning Metering Tube.”

## 4.5 VACUUM LEAKS

- 4.5.1 For best operation, all parts of the system should be airtight, since vacuum leaks will permit air to enter. All units are vacuum tested at the factory prior to shipment, so a vacuum leak in a new unit is unlikely. Furthermore, it is very unusual for leaks to develop during operation unless the unit has been disassembled or physically damaged.
- 4.5.2 A simple test determines whether the system is free of vacuum leaks:
  - a. Operate the system at an arbitrary gas feed setting.
  - b. Shut off the cylinder/container/manifold valve that the vacuum regulator is attached to. IT IS ASSUMED THAT IT WILL SHUT TIGHTLY. A defective valve will give erroneous results.
  - c. The float or ball in the metering tube should drop to zero. This may take a minute or two depending upon capacity. If the ball or float does not drop to the bottom, this indicates a vacuum leak at some point in the system, usually between the vacuum regulator inlet and the metering tube.
  - d. When the ball or float drops to zero, shut off the ejector water supply. Note that the indicator pin in the center of the vacuum regulator body is recessed below the surface of the body, indicating an “out of gas” condition. With a perfectly tight system, this condition will remain. Usually a 5 to 10 minute check is all that is needed. If a leak exists in the system, the diaphragm assembly will move forward causing the indicator pin to reset with the tip protruding slightly.
- 4.5.3 The most common cause of vacuum leaks is improper assembly of the system components after they have been taken apart for servicing.
- 4.5.4 The most common points of leakage are:
  - a. Gas metering tube seals (o-rings or gaskets). Check to make sure the meter tube o-rings or gaskets are in good condition and properly installed. Metering tube gaskets can be reused, but they should be turned over.
  - b. Rate valve o-rings. Rate valve o-rings may become worn. Fouling of the surfaces might cause abrasion of the o-ring surface. Check and replace as necessary.
  - c. Sealing surface at main diaphragm. An imperfection or a speck of dirt on this surface during reassembly may cause a leak, but REGAL’s unique use of a compression sealing o-ring makes this unlikely.
  - d. Vacuum connections. Check all vacuum tubing and piping for leaks and cracks. On 1000/2000 PPD systems, make sure all union o-rings are in place.
  - e. Other possible, but less common points of leakage:
    1. O-ring in connecting passage of bodies.
    2. O-ring at inlet capsule.
    3. Vent seal on diaphragm plate.
    4. Back body inlet seal.
    5. Diaphragm plate seal.

## 4.6 FAILURE TO REPEAT SET FEED RATE

- 4.6.1 On start-up, a system with a dirty meter tube or rate adjustment valve may not repeat. This is particularly true of low capacity systems of 10 PPD or less. Correction of this situation can be accomplished by:
- Cleaning the rate adjustment valve as outlined in Section 5.8, 5.9 or 5.10.
  - Cleaning the metering tube as outlined in Section 5.8, 5.9 or 5.10. The frequency of cleaning depends on the quality of the gas chemical being used.
- 4.6.2 Failure to repeat may also occur if any of the system components have been flooded and moisture remains in the metering and rate adjustment area.

## 4.7 ICING OF THE METERING TUBE—LIQUID

- 4.7.1 If ice is observed forming on the metering tube assembly, it is a definite indication that LIQUID chemical has entered the vacuum regulator from the source of supply. While this is extremely rare, our experience has shown that suppliers have been known to overfill cylinders/containers from time to time. Also, if the cylinders are tipped over while the vacuum regulator is attached and operating, liquid could be drawn into the system.
- If manifold assemblies are being used, make sure the manifold contains a suitable liquid trap (drip leg) with an appropriate (WORKING) heater installed.
- 4.7.2 If the system has been subjected to liquid chemical, do the following:

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**IMPORTANT:** Before proceeding, read the “Precautions for Personal and System Protection” at the front of this manual.

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- Shut off the cylinder/container/manifold valves.
- Leave the ejector running and developing a vacuum in the system.
- Remove the vacuum regulator from the cylinder/container/manifold valve.
- Quickly remove the vacuum tubing from the vacuum regulator and observe that the supply indicator is above the surface.
- Reconnect the vacuum tubing or piping and open the rate adjustment valve to maximum. The system will now draw air into the vacuum regulator inlet, vaporizing any remaining liquid. Allow the system to draw air for several minutes.
- Shut off the ejector.
- Either OUTDOORS OR IN A WELL VENTILATED ROOM, follow instructions in Section 5.12, titled “Disassembly of vacuum regulator body.” Clean all parts with denatured alcohol, and replace any parts that show signs of liquid chemical attack.
- Reassemble and follow start-up procedure in Section 2.0.

## 5.0 SERVICE/DISASSEMBLY

### PREVENTIVE MAINTENANCE SCHEDULE REGAL SYSTEMS AND SYSTEM COMPONENTS

The best, most cost effective, and easiest way to assure that your gas feed system and equipment will provide continuous, dependable, trouble free operation, is to establish a PREVENTIVE MAINTENANCE SCHEDULE. This will assure minimum unscheduled down time. The maintenance schedule should be in writing and include as a minimum, the date of installation, the scheduled date of maintenance, the actual date the maintenance was performed, the parts used, and any applicable notes.

All REGAL products are engineered for easy maintenance and this manual provides step by step procedures to properly service and maintain each component within the system. It is your (the customer's) responsibility to establish and undertake a SCHEDULED MAINTENANCE PROGRAM.

To support this program, we have available a variety of “REPAIR KITS” containing the parts we feel you may need for minor emergency repairs. We recommend that these kits be available in your stock at all times. When this kit, or any parts are used, the kit should be replaced immediately. This manual contains complete parts lists for each system component. As such, you can order and stock additional parts as deemed necessary.

AT A MINIMUM, THIS EQUIPMENT SHOULD RECEIVE SCHEDULED MAINTENANCE AT LEAST ONCE A YEAR. Depending on the installation, application, location of components, quality of gas, etc., this equipment may need scheduled maintenance more than once a year. This is something that needs to be determined on a job by job basis.

Spare parts and/or repair kits may be ordered directly from the company who supplied your equipment, or they may be ordered directly from our inventory in Stuart, Florida.

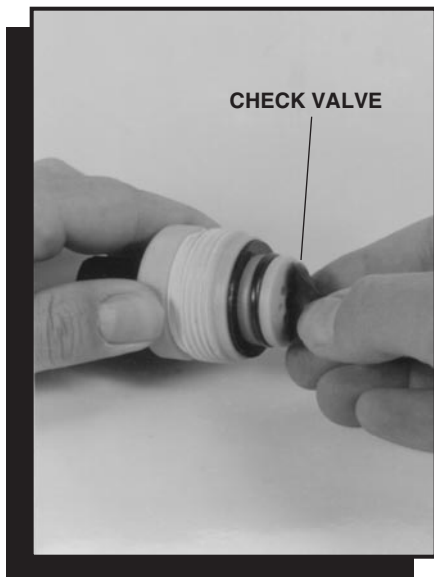
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**IMPORTANT:** Maintenance on REGAL Systems or System Components should be performed by competent personnel familiar with this type of equipment such as authorized REGAL Dealers or Chlorinators themselves.

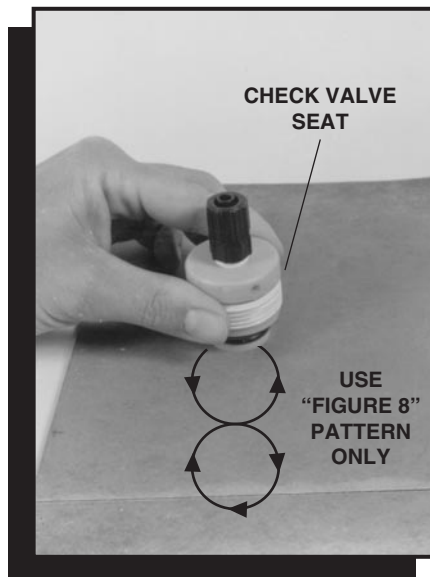
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**WARNING:** Even if the gas feed rate drops to zero as evidenced by the position of the ball or float in the metering tube and/or the supply indicator pin is below the surface of the head, and even if the supply container appears empty, SOME LIQUID CHEMICAL MAY STILL BE PRESENT.

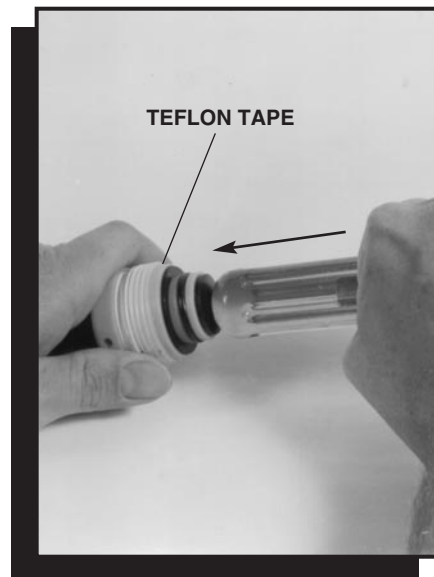
NEVER disconnect the vacuum regulator from the cylinder/container/manifold valve until ALL cylinder/container/manifold valves are FULLY CLOSED or a highly dangerous chemical leak causing severe injuries or death could occur.



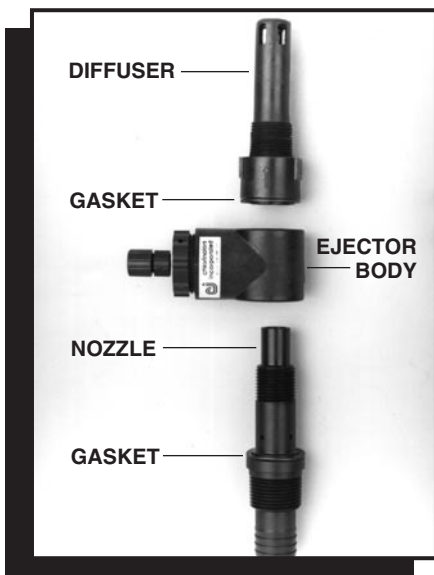
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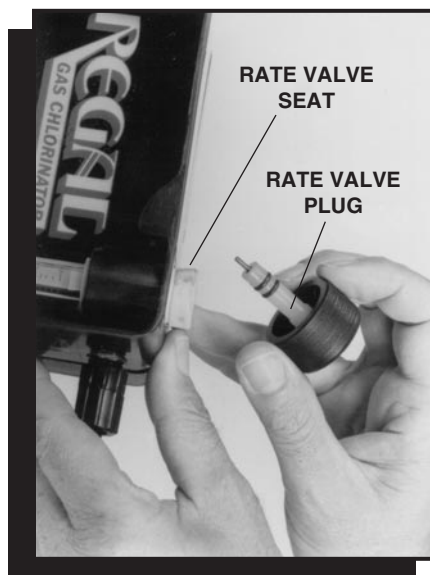
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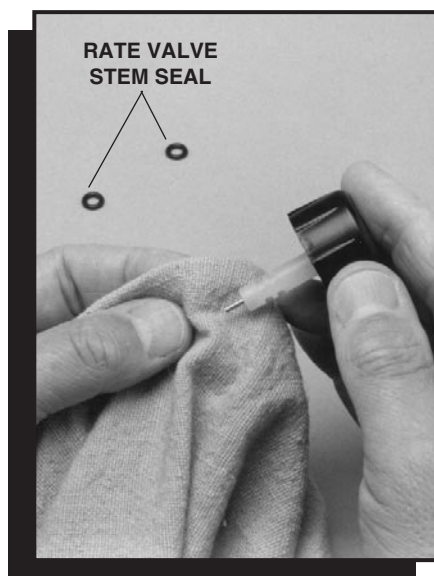
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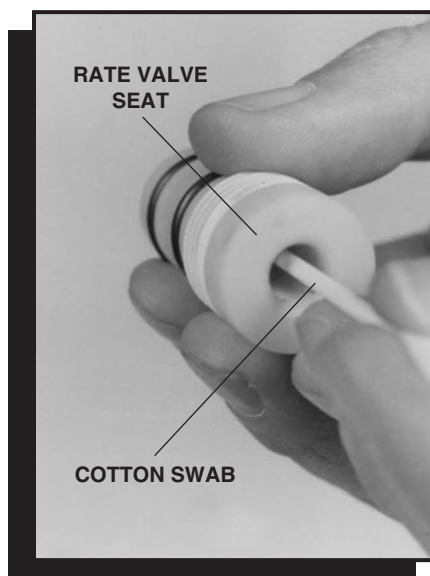
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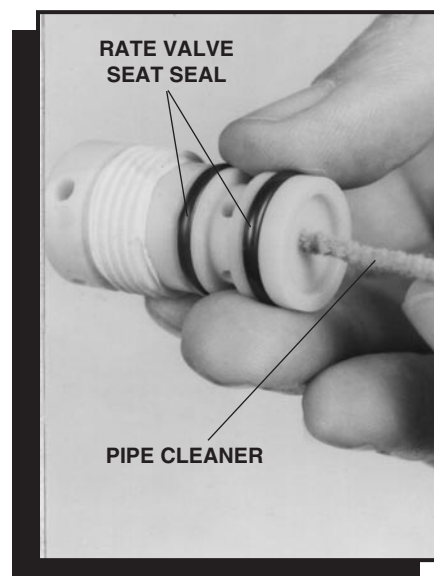
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## 5.1 HIGH PRESSURE EJECTOR CHECK VALVE TO 500 PPD - CLEANING AND REPLACING

(See appropriate Parts Drawing A-920/A-922/A-925, A-920S/A-922S/A-925S or A-920A)

5.1.1 A **check valve** is installed in the ejector assembly to prevent water from backing into the system when the ejector is shut off. The **check valve** design is such that it is extremely difficult for dirt to get under the valve, but it might, if large amounts of sand or other impurities are present in the water supply; and dirt could possibly enter from the gas side. To remove and clean the valve, proceed as follows:

- a. Close the cylinder/container/manifold valve(s) before working on any system component.
- b. Shut off the water supply to the ejector and the water pressure in the main.
- c. Remove vacuum tubing from the fitting on top of the ejector assembly.
- d. Unscrew the **check valve seat** from the **ejector body** using pliers if necessary.
- e. Carefully lift the edge of the **check valve** (Photo 5.1) and inspect.
- f. If the **check valve and seat** are in good condition, clean both the valve and the seating surface and reinstall the **check valve seat** into the **ejector body**. Use a thin film of Vaseline or Dow Corning DC33 on the **seat o-ring** and **seat gasket** as necessary. DO NOT USE ANY OTHER PETROLEUM BASED GREASES OR OILS.
- g. Make sure the **check valve seat** is screwed completely into the **ejector body**. USE NO TOOLS. HAND TIGHTEN ONLY.
- h. Pressurize the ejector and cycle several times before reconnecting the vacuum tubing to make sure the **check valve** is sealing properly.
- i. If wear or damage is noted, the **check valve** must be replaced. If the **check valve** needs to be replaced, proceed as follows:
  - 1) Grasp the outer edges of the **check valve** and apply a steady pulling force until the "umbrella" shaped stem "pops" free. Be certain it is completely removed.
  - 2) Examine the **check valve seat** sealing surface for deposits, and clean with denatured alcohol.
  - 3) Check the seat sealing surface with a straight edge to be certain it is completely flat. If the center is slightly raised, you will see light under the straight edge, or it will "rock" over the center. If the seat sealing surface is not flat, use a very fine sandpaper or emery cloth on a flat surface (e.g., plate glass) and gently move the check valve seat in a figure 8 pattern (Photo 5.2). Do not rub back and forth, or the seat will become distorted.

4) Wet the tip of the new **check valve** with a very light film (make shiny only) of Vaseline or Dow Corning DC33. Put the tip of the **check valve** in the "center" **check valve seat** hole and, using the handle of a screwdriver or other rounded object, push against the center of the **check valve** until the tip snaps into the seat (Photo 5.3). DO NOT TWIST THE **CHECK VALVE** OR DAMAGE MAY OCCUR.

- j. When reinstalling the **check valve seat**, put a thin film of Vaseline or Dow Corning DC33 on the **seat o-ring** and **seat gasket** for lubrication. DO NOT USE ANY OTHER PETROLEUM BASED GREASES OR OILS.
- k. Screw the **check valve seat** clockwise into the ejector body. Use no tools. Hand tighten only.
- l. Pressurize the ejector and cycle several times before reconnecting the vacuum tubing to ensure that the check valve is sealing properly.

## 5.2 OPTIONAL LOW PRESSURE EJECTOR CHECK VALVE TO 500 PPD - CLEANING AND REPLACING

(See appropriate Parts Drawing A-921/A-923/A-926, A-921S/A-923S/A-926S or A-921A)

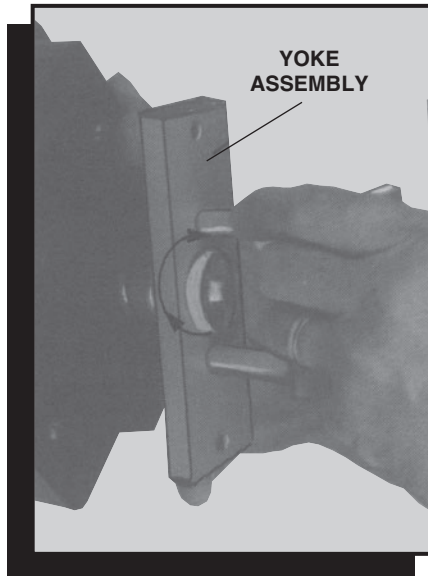
5.2.1 To remove and clean the check valve, proceed as follows:

- a. Close the cylinder/container/manifold valve(s) before working on any system component.
- b. Shut off the water supply to the ejector and the water pressure in the main.
- c. Remove the vacuum tubing from the fitting on top of the ejector assembly.
- d. Unscrew (counterclockwise) the entire **check valve assembly** out of the **ejector body**. Make sure the seat gasket remains in place and is in good condition. Replace if necessary.
- e. Using a "spanner" wrench in the holes located in the underside of the **outlet body**, unscrew the **outlet body** from the **clamping ring**. Do not lose the **spring** or the **diaphragm assembly**.
  - 1) The **diaphragm** is made from a special corrosion resistant plastic. Inspect it carefully for nicks or cuts. Replace as necessary.
  - 2) The check valve action is accomplished by the **diaphragm bolt** sealing tightly on the **o-ring** located in the center of the **inlet body** when the ejector is shut off. As such, the **diaphragm bolt** sealing surface and the **o-ring** must be free of dirt or impurities that may prevent an effective seal. Clean or replace as necessary.
- f. Reassemble by reversing steps "a" through "d" above.

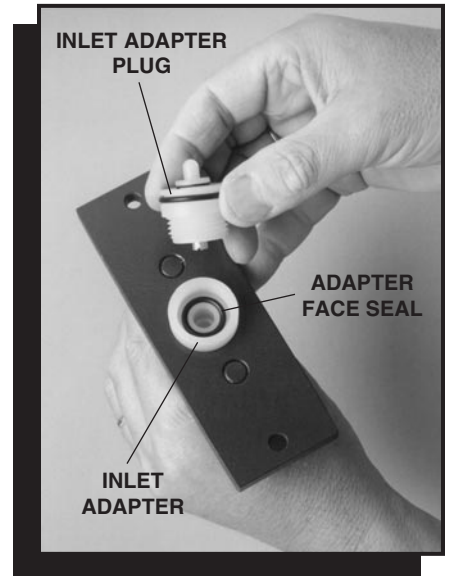




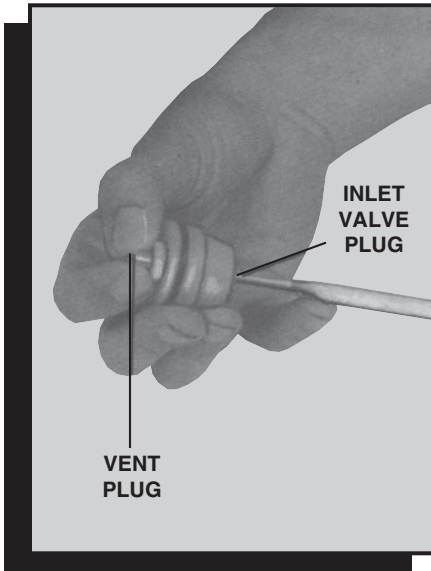
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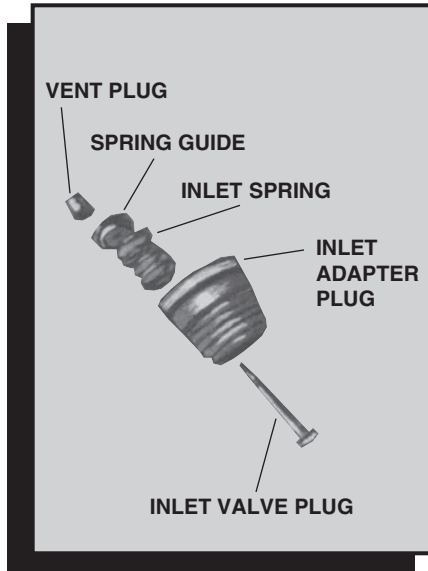
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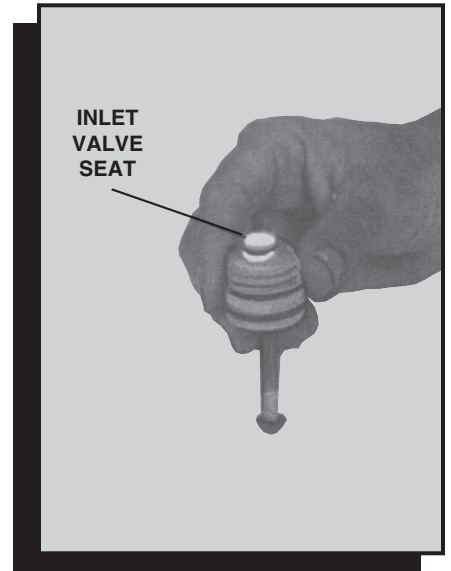
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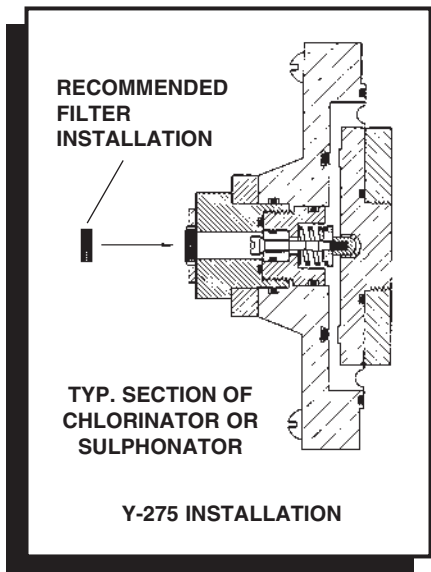
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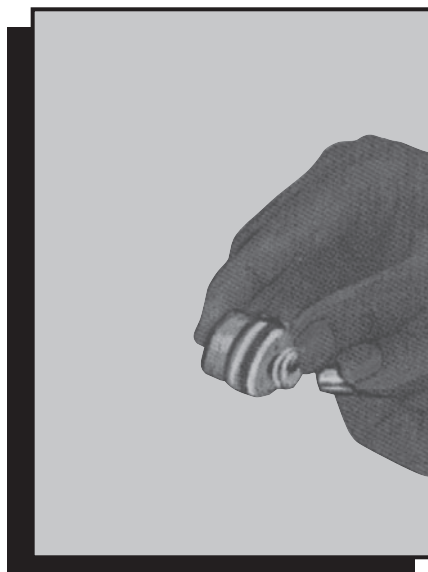
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### 5.3 OPTIONAL A-930 HIGH/LOW EJECTOR CHECK VALVE TO 100 PPD - CLEANING & REPLACING

(See Parts Drawing A-930/A-305)

5.3.1 The A-930 Ejector Assembly includes the A-305 Check Valve which is designed to prevent water from backing up into the system whenever there is a loss of vacuum. If flooding has occurred or when basic maintenance is due, proceed as follows:

- a. Close the cylinder/container/manifold valve(s) before working on any system component. Then shut off the water supply to the ejector and close any valves necessary to eliminate back pressure from the main water line.
- b. Remove the vacuum tubing from the fitting on top of the A-305 check valve and then unscrew (counterclockwise) the check valve from the Ejector Body (E-210). Make sure the seat gasket (G-203) is still in place on the bottom of the check valve. Inspect both the seat gasket (G-203) and o-ring (S-405) on the bottom of the check valve for any damage or deterioration. Replace if necessary.
- c. Remove the ball (E-556) from the ejector body. Use warm water and soap to remove any dirt and residual buildup on the ball to restore a smooth surface. Replace the ball if any noticeable pitting or scratching is present.
- d. Also check the o-ring (S-417) inside the bottom of the check valve that the ball seals against. If swollen, cracked, or noticeably worn, the o-ring should be replaced. To do so, take a fine pointed tool like a pin and press it carefully into the center of the rubber. Tilt the pin down slowly in line with (not perpendicular to) the o-ring groove. Be careful not to scratch or possibly break the plastic. Slowly lift the pin until the o-ring starts to come out of the groove and continue lifting until it is fully removed.
- e. Carefully clean the plastic in and around the o-ring groove. Place a new o-ring in the groove making sure it is fully seated.
- f. To service the inside of the Check Valve, a spanner wrench is needed. Place the pins of the wrench into the holes located on the underside of the outlet body (E-316). Unscrew the outlet body from the clamping ring (E-301) being careful not to lose the spring or diaphragm assembly.

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**NOTE:** A strap wrench may be required to hold the clamp ring firmly while turning the spanner wrench.

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- 1) The **diaphragm (E-304)** is made from a special corrosion resistant plastic. Carefully inspect it for holes or tears and replace if necessary.

- 2) The check valve action is accomplished by the **diaphragm bolt** (E-303) sealing tightly on the **o-ring** (S-302) located in the center of the **inlet body** (E-302). The **diaphragm bolt** sealing surface and the **o-ring** must be free of dirt and impurities that may prevent an effective seal. Clean all parts and replace if necessary.

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**IMPORTANT:** Always replace the S-302 check valve seal o-ring.

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- g. Reassemble by hand tightening the clamp ring to hold the inlet and outlet bodies in place, being careful to keep the spring and diaphragm assembly in proper alignment. Use the spanner wrench and strap wrench to securely tighten and seal the diaphragm in place. When reinstalling the A-305 check valve into the ejector body, put a very thin film of Vaseline or Dow Corning DC33 lubricant on the seat o-ring (S-405) and gasket (G-203). Use only enough to develop a shiny surface.
- h. Screw the **check valve assembly** clockwise into the ejector body. **Hand tighten only.**
- i. Before re-connecting the vacuum tubing to the ejector, refer to Section 2.0 and follow the steps required for proper startup of the system.

### 5.4 OPTIONAL DUAL CHECK VALVE EJECTOR TO 500 PPD

(See Drawing A-950/A-949)

The REGAL A-950 Dual Check Valve Ejector has a ball check valve as the primary check valve backed up by a spring loaded o-ring/poppet check valve. To service this check valve, proceed as follows:

5.4.1 Shut off the water supply to the ejector and the water in the main.

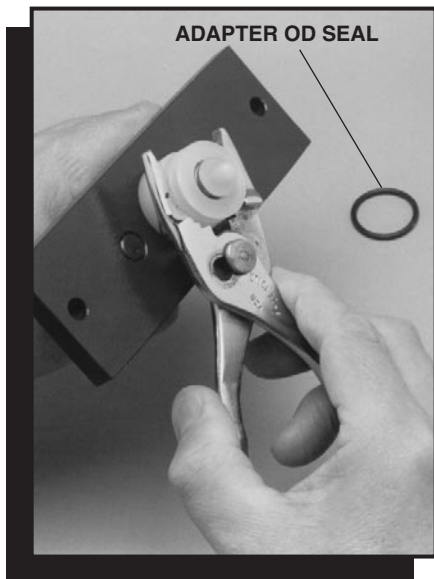
5.4.2 Remove the vacuum tubing.

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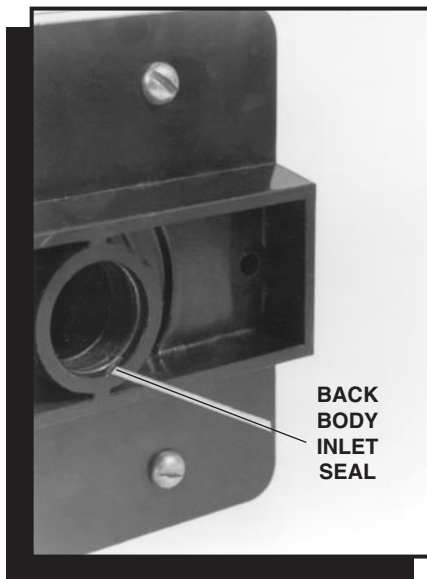
**NOTE:** CHLORINE GAS TRAPPED BETWEEN THE VACUUM REGULATOR AND EJECTOR MAY DISCHARGE INTO THE ATMOSPHERE WHEN THE VACUUM LINE IS DISCONNECTED.

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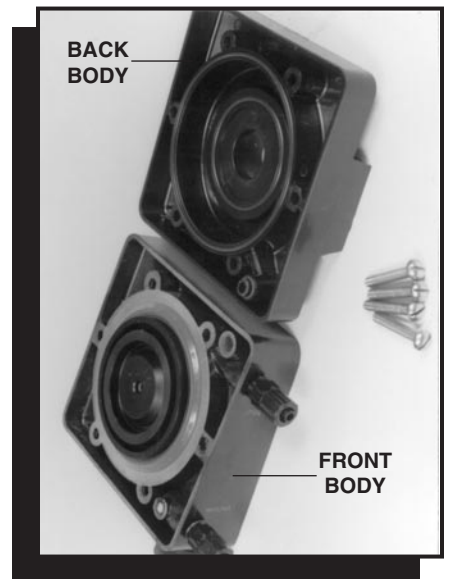
- 5.4.3 Unscrew (counterclockwise) the complete A-949 Check Valve Assembly from Ejector body E-557. A properly sized wrench can be used on the machined "flats" of Bottom Body E-552 if necessary to loosen the ejector body. **DO NOT USE PLIERS.**
- 5.4.4 Make sure the o-ring S-413 located on Bottom Body E-552 is in good shape. Replace as necessary.
- 5.4.5 To gain access to the Check Valve Components unscrew (counterclockwise) Clamp Ring E-301 from Bottom Body E-552 and lift the Top Body E-551 with the Clamp Ring off of the Bottom Body. **BE CAREFUL NOT TO LOSE POPPET E-554, SPRING E-555, OR O-RING S-416 AS THESE ITEMS CAN EASILY FALL OUT.**
- 5.4.6 Inspect the o-ring S-418 located on the E-554 Poppet and replace as necessary. **THIS IS THE SECONDARY CHECK VALVE SEAL AND MUST BE IN LIKE NEW CONDITION.**



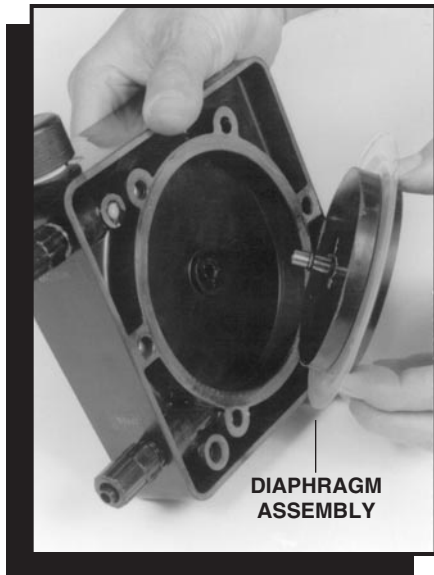
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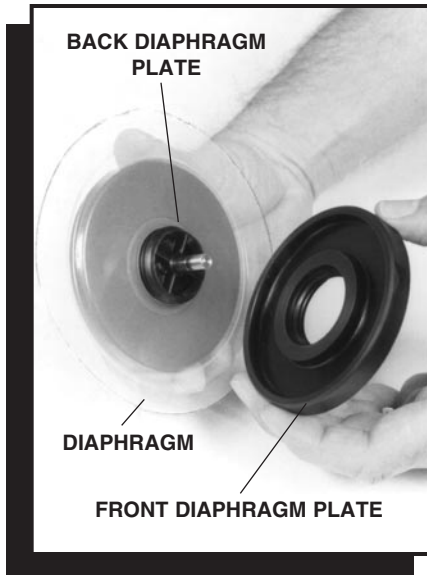
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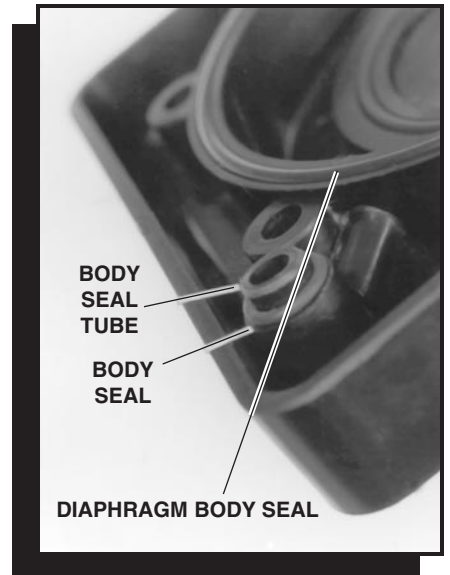
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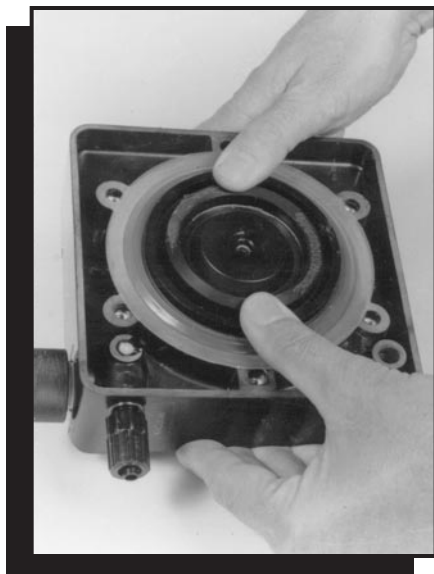
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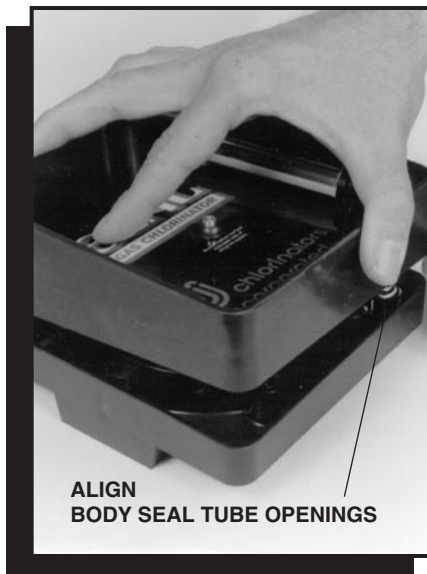
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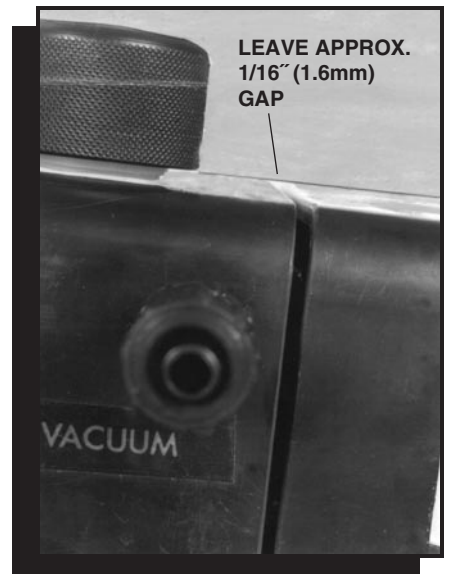
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5.4.7 Inspect and clean as necessary the flat surface inside Top Body E-551. Since this is the sealing surface for the S-418 sealing o-ring. **THIS SURFACE MUST BE CLEAN AND PERFECTLY FLAT.**

5.4.8 The primary check valve is located inside Bottom Body E-552. To gain access to the primary check valve, proceed as follows:

- a. Using Drawing A-950/A-949 as a guide, carefully unscrew (counterclockwise) the Spring/Ball Retainer E-553 from Bottom Body E-552. THE OUTER CIRCUMFERENCE OF THE SPRING/BALL RETAINER IS KNURLED TO MAKE IT EASIER TO UNSCREW.

**ONCE REMOVED, THE BALL E-556 IS FREE TO FALL OUT. BE CAREFUL NOT TO LOSE OR DAMAGE THE BALL.**

- b. Inspect the Ball E-556 and make sure it is free of all deposits, nicks, and pits. If in doubt, replace as necessary.
- c. Poppet E-553 contains two o-rings. The S-415 o-ring is a sealing o-ring and **MUST** remain in its groove when reassembling the check valve components. Inspect this o-ring for wear and replace as necessary.
- d. The second o-ring S-417 is a critical o-ring as it is the sealing surface for the primary check device (Ball E-556). This o-ring is located in an undercut groove at the base of Spring/Ball Retainer E-553.

If o-ring S-417 shows any signs of wear or, if o-ring S-417 is flattened due to the check action of Ball E-556, replace with a new one.

5.4.9 Clean all check valve parts with warm water and/or a mild solvent such as denatured alcohol.

5.4.10 Make sure all parts are thoroughly dry and all o-rings are in place and reassemble by reversing the steps outlined in Section 5.4.

## 5.5 EJECTOR CHECK VALVE 1000/2000 PPD - CLEANING OR REPLACING

(Refer to Drawing A-2920/2922)

### 5.5.1 A-2000 CHECK VALVE

A **check valve** is installed in the ejector assembly to prevent water from backing into the system when the ejector is shut off. The **check valve** design is such that it is extremely difficult for dirt to lodge under the valve, but it might, if large amounts of sand or other impurities are present in the water supply; and dirt could possibly enter from the chemical side. To remove and clean the valve, proceed as follows:

- a. Close the manifold valve that the vacuum regulator is attached to before working on any system components.
- b. Shut off the water supply to the ejector and the water pressure in the main.
- c. Open the 1" **PVC vacuum union** MS-19 by unscrewing (counterclockwise) the union ring and move the vacuum piping out of the way. Be careful not to lose the **vacuum union o-ring**.

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**NOTE:** CHLORINE GAS TRAPPED BETWEEN THE VACUUM REGULATOR AND EJECTOR MAY DISCHARGE INTO THE ATMOSPHERE WHEN THE VACUUM LINE IS DISCONNECTED.

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- d. Using Parts List Drawing A-2000 as a guide, unscrew **Clamp Ring** CV-2004 and lift the **Top Body** CV-2002 with **Clamp Ring** off **Bottom Body** CV-2001 and set aside. BE SURE NOT TO LOSE O-RING S-804.

- e. Carefully lift out **Poppet** CV-2003 and **Spring** CV-2005.

- f. **Poppet** CV-2003 contains an **o-ring** S-805 which is the **check valve seal**. THIS O-RING MUST BE IN PERFECT SHAPE, FREE OF NICKS, CUTS, ETC. IF NECESSARY, REPLACE IT WITH A NEW ONE.

IF O-RING S-805 SHOWS SIGNS OF BEING FLATTENED DUE TO THE ACTION OF THE NEW CHECK VALVE, REPLACE IT WITH A NEW ONE.

- g. Inspect the flat surface inside **Top Body** CV-2002 to be sure it is flat and clean. THIS IS THE SURFACE O-RING S-805 SEALS AGAINST.
- h. Clean all check valve parts with warm water or a mild solvent such as denatured alcohol and dry thoroughly.
- i. Reassemble the ejector check valve assembly by reversing steps "a" through "e."

## 5.6 CLEANING/INSPECTION OF EJECTOR NOZZLE TO 500 PPD

5.6.1 To remove the ejector nozzle for cleaning, the water pressure in the main must first be shut off unless the ejector was initially installed with a valve on the inlet side and a ball valve or corporation stop in the outlet, so that isolation of the ejector is possible.

- a. Close the cylinder/container/manifold valve(s) before working on any system component.

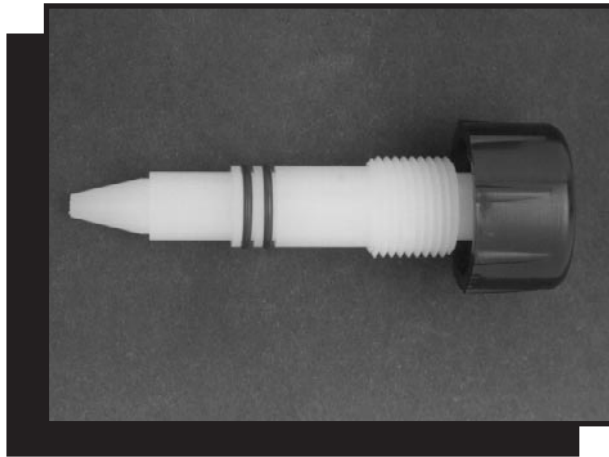
5.6.2 Remove the ejector supply hose and gas vacuum tubing from the ejector assembly.

5.6.3 Rotate the complete **ejector body** counterclockwise, making certain that the solution **diffuser** remains fixed in the solution piping or main (Photo 1.3).

5.6.4 Unscrew the **nozzle** from the **ejector body**. Check the **gaskets** located in each side of the body and replace if necessary (Photo 1.3).

5.6.5 Nozzle plugging can be caused by:

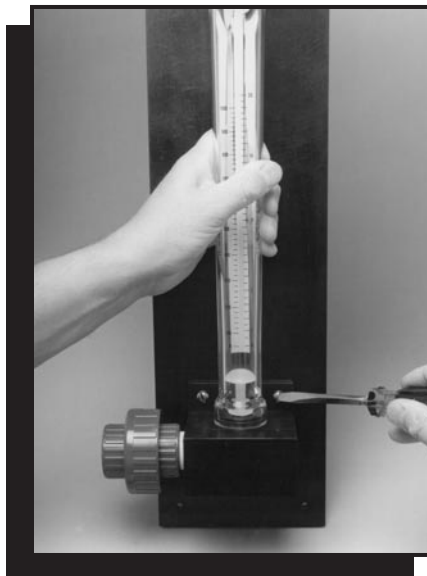
- a. A piece of foreign material (pipe sealer, stone, or dirt) lodging in the nozzle orifice. This can usually be blown out in the reverse direction. **DO NOT USE SHARP TOOLS OR ALTER THE SIZE OF THE ORIFICE IN ANY WAY.**
- b. Excess plastic pipe solvent or glue used during initial installation running into the orifice area of the nozzle. If this cannot be cleaned out easily, the nozzle may need to be replaced.



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- c. Build-up of deposit. This could be a chemical build-up of iron, manganese, or some other material which usually can be removed by immersing the nozzle in muriatic acid and rinsing. CAUTION: READ ALL WARNING LABELS ON THE MURIATIC ACID CONTAINER, AND AVOID SKIN CONTACT. It is recommended that safety goggles or face shield be used when working with any strong acid. Some waters are such that build-up of deposits can cause an ejector to become inoperative in a short period of time.

5.6.6 To reinstall the **nozzle**:

- a. Insert the **nozzle** through the **ejector body** and screw into the solution **diffuser**. Make sure the **gaskets** are in place and in good condition (Photo 1.3).
- b. Hold the **ejector body** against the **diffuser** at 1/8 turn counterclockwise from its final position (Photo 1.4).
- c. Screw the **nozzle** into the **diffuser** by hand until contact is made against both **gaskets**.
- d. Turn the **ejector body** and the **nozzle** at the same time, 1/8 turn clockwise to the final tight position (Photo 1.4). THE PARTS ARE PLASTIC, AND EXCESSIVE TIGHTENING MAY CAUSE BREAKAGE. DO NOT USE TOOLS.
- e. Reinstall the ejector supply hose and vacuum tubing (Photo 1.5).

5.6.7 Open all valves and check for proper operating vacuum.

## 5.7 CLEANING/INSPECTION OF 1000/2000 PPD EJECTOR NOZZLE

- 5.7.1 The ejector nozzle and throat thread into the ejector body. To inspect and clean these parts, proceed as follows:
- a. Close the manifold valve that the vacuum regulator is attached to before working on any system components.
  - b. Shut off the water supply pressure to the ejector, and close any valves in the chlorine solution line so as to isolate the ejector assembly.
  - c. Open the 1" **PVC vacuum union MS-19** by unscrewing (counterclockwise) the union ring and move the vacuum piping out of the way.

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**NOTE:** CHLORINE GAS TRAPPED BETWEEN THE VACUUM REGULATOR AND EJECTOR MAY DISCHARGE INTO THE ATMOSPHERE WHEN THE VACUUM LINE IS DISCONNECTED.

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Be careful not to lose the vacuum union o-ring.

- d. Open or disconnect the 2" unions, flanges, fittings, etc., holding the ejector assembly into the pipeline, and remove the ejector. WHEN REMOVING AND/OR INSTALLING THE COMPLETE EJECTOR ASSEMBLY, **BE CAREFUL NOT TO LOOSEN OR OVERTIGHTEN THE NOZZLE AND THROAT WHICH COULD CAUSE DAMAGE TO THESE PARTS AND/OR WATER LEAKS.**
- e. Carefully clean or remove any foreign material that may have accumulated in the ejector nozzle or throat area, being careful not to scratch or mar the nozzle orifice.

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**NOTE:** DO NOT USE SHARP TOOLS OR ALTER THE SIZE OF THE ORIFICE IN ANY WAY.

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- f. If chemical deposits have built up in the nozzle or throat area, immerse the part in muriatic acid. REMOVE ALL O-RINGS OR GASKETS FIRST.

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**IMPORTANT:** READ ALL WARNING LABELS ON MURIATIC ACID CONTAINER AND FOLLOW ALL SAFETY INSTRUCTIONS.

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- g. Reassemble by reversing steps "a" through "e."

## 5.8 CLEANING MANUAL RATE ADJUSTMENT VALVE AND METERING TUBE ON SYSTEMS TO 500 PPD (MODELS 210, 210-1, 220, 250, 720 AND 750 ONLY)

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**NOTE:** Close the cylinder/container/manifold valve(s) before working on any system component.

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- 5.8.1 Unscrew and remove the **rate valve plug** assembly from the top of the metering tube (Photo 5.5).
- 5.8.2 Insert the rate valve tool supplied with the gas feed system through the side holes in the top of the **rate valve seat**. While holding the **metering tube** with one hand, turn the seat counterclockwise until free of its threads. The **metering tube** can now be removed (Photo 5.6).
- 5.8.3 Grasp the **rate valve seat** and pull up while turning until it pops out.
- 5.8.4 To clean the **rate valve plug**:
  - a. Clean the silver tip and the plug shaft with lacquer thinner or acetone (Photo 5.7). DO NOT USE LACQUER THINNER OR ACETONE ON O-RINGS OR ANY OF THE ABS PARTS.
  - b. Examine the o-rings and make sure they are free of nicks and scratches. Clean them with a mild solvent, such as denatured alcohol. Replace if necessary. Use a light film of Vaseline or Dow Corning DC33 on the **o-rings** and **rate valve plug** threads.



5.8.5 To clean the **rate valve seat**:

- a. Use a cotton swab with a small amount of denatured alcohol to clean out the inside of the **rate valve seat** (Photo 5.8).
- b. If dirt or deposits have formed in the metering orifice of the **rate valve seat**, a pipe cleaner dipped in denatured alcohol can be carefully inserted through the orifice and gently moved back and forth (Photo 5.9). **Do not use lacquer thinner or acetone.**
- c. Clean the metering tube gasket surfaces with the alcohol soaked cotton swab.
- d. Inspect and clean the **rate valve seat o-rings** with denatured alcohol. Replace if necessary.

5.8.6 To clean the metering tube:

- a. Bend a paper clip or small wire, and pull out the float stops on each end of the glass **metering tube** (Photo 5.10). **MAKE SURE YOU DON'T LOSE THE METERING BALL.**
- b. Clean the glass tube with a pipe cleaner using denatured alcohol, and rinse. **DO NOT USE LACQUER THINNER OR ACETONE AS THESE CHEMICALS WILL REMOVE THE NUMBERED SCALE ON THE TUBE'S EXTERIOR.**
- c. Reinstall **ball float** and **float stops**.

5.8.7 Place teflon tape on threads of the **rate valve seat**, and apply a thin film of Vaseline or Dow Corning DC33 to the **o-rings**. Install the **rate valve seat** into the metering panel housing using a clockwise rotation until the threads engage.

5.8.8 Reinstall the **metering tube** as follows:

- a. The **metering tube gaskets** can usually be reused by turning them over. If damaged, replace them. Place one gasket on the **rate valve seat**, and one gasket on the recess of the **meter panel assembly** at the bottom of the metering tube area.
- b. Center the top of the **metering tube** under the **rate valve seat** and center the bottom over the hole in the lower gasket.
- c. Using the rate valve tool, tighten (clockwise) the **rate valve seat** while holding the **metering tube** in place with the numbers of the proper scale facing front. Be sure the tube is centered over the gasket holes.
- d. When the **metering tube** no longer can be easily rotated, tighten the **rate valve seat** another 1/4 to 1/2 turn. Do not over tighten.

5.8.9 Replace the **rate valve plug** assembly by placing it into the top of the **rate valve seat** and gently pushing down while rotating, until the o-rings pops into the seat and the threads can engage. Tighten down the rate valve a few turns.

## 5.9 CLEANING MANUAL RATE ADJUSTMENT VALVE AND METERING TUBE @ 250/500 PPD (MODELS 220-1, 250-1, 720-1 AND 750-1 ONLY)

(Refer to Drawing A-7500)

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**NOTE:** The REGAL Model 7500 Remote Meter Panel Assembly is furnished with the 250 PPD and 500 PPD REGAL systems noted above. It is an OPTION on REGAL systems @ 10 PPD to 100 PPD.

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Servicing of the #7500 remote metering panel assembly will generally be limited to cleaning of the glass rotameter tube and ball float which sometimes stick due to impurities within the chemical itself, and cleaning and/or replacement of the rate valve plug o-rings. To clean the rotameter tube assembly:

- 5.9.1 Using the chemical feed systems rate valve tool (or a nail), unscrew meter tube plug (#7505) counterclockwise one or more turns while holding the glass meter tube assembly (#7501-See Chart) with your other hand to protect the tube from damage due to dropping, etc.
- 5.9.2 Carefully lift the glass metering tube assembly out of the remote metering panel housing. **MAKE SURE YOU DON'T LOSE OR DAMAGE THE METERING BALL FLOAT.** Set the tube and float in a safe place. Also, make sure the top and bottom bushings and gaskets are not lost or damaged.
- 5.9.3 Bend a paper clip or small wire, and pull out the float stops on each end of the glass metering tube.
- 5.9.4 Clean the glass tube inside and out using denatured alcohol (or warm water) and rinse with clear water and dry thoroughly.

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**CAUTION:** DO NOT use lacquer thinner, acetone or other harsh solvents as these chemicals WILL remove the numbered scale on the exterior of the tube.

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- 5.9.5 Clean the ball float with denatured alcohol (or warm water), rinse and dry thoroughly.
- 5.9.6 Reassemble the tube, float and float stops. **MAKE SURE THE FLOAT NO LONGER STICKS INSIDE THE TUBE. REPEAT STEPS 5.9.3 THROUGH 5.9.6 AS NECESSARY.**

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**CAUTION:** Before unscrewing meter tube plug (#7505), unscrew the tube fitting from bottom block (#7503). While slowly unscrewing the meter tube plug, look into the fitting opening and using a small screwdriver, carefully push on the o-ring to prevent shearing on the inlet hole.

---

- 5.9.7 Unscrew meter tube plug (#7505) until it is free of its mating threads. Continue turning the plug counterclockwise while pulling down until the plug pops out of the bottom block (#7503).
- 5.9.8 If necessary, clean the plug with alcohol or warm water, rinse thoroughly and dry.
- 5.9.9 If the two (2) meter tube plug o-rings (S-406) show signs of wear, replace them with new ones. Use a light film of Vaseline or Dow Corning DC33 silicone grease on the o-rings.
- 5.9.10 The meter tube gaskets and top and bottom bushing gaskets (See chart for proper part numbers) can usually be reused by turning them over. If they appear to be damaged, replace them.
- 5.9.11 Unscrew rate valve plug assembly (#RV-831) by turning counterclockwise until it pops free. Clean the plug assembly and top block (#7504) as necessary.
- 5.9.12 Replace rate valve plug o-rings (S-403) as necessary. Apply a light film of Vaseline or Dow Corning DC33 Silicone grease to the o-rings and the rate valve plug threads.
- 5.9.13 Screw meter tube plug (#7505) into bottom block (#7503) until the threads engage with those of the bottom block.

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**CAUTION:** While slowly screwing the meter tube plug into the bottom block, look into the fitting opening and using a small screwdriver, carefully push on the o-ring to prevent shearing on the inlet hole.

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- 5.9.14 Place the top and bottom bushing gaskets (See chart for proper part numbers) in their respective recesses in the top and bottom blocks of the Remote Meter Panel Assembly.
- 5.9.15 Set the bottom bushing and the bottom meter tube gasket (See chart for proper part numbers) on top of the bottom bushing gasket.
- 5.9.16 Carefully place the top meter tube gasket and the top bushing (See chart for proper part numbers) on the top of the meter tube assembly and place the assembly into position in the Remote Meter Panel Assembly.
- 5.9.17 Using the rate valve tool (or a nail), tighten (clockwise) the meter tube plug until the meter tube assembly is snug and can no longer be rotated with your fingers. **DO NOT OVERTIGHTEN.**
- 5.9.18 Replace the rate valve plug assembly into the top block by gently pushing down while rotating, until the o-rings pop into the seat area and the threads can engage. Tighten down the rate valve a few turns.
- 5.9.19 Replace the tube fitting into the bottom block (#7503).

## 5.10 CLEANING MANUAL RATE ADJUSTMENT VALVE AND METERING TUBE - 1000/2000 PPD

(Refer to Drawing A-2551/A2552)

5.10.1 To clean the rate adjustment valve, proceed as follows:

- a. Close the manifold valve that the vacuum regulator is attached to before working on any system components.
- b. Unscrew the **rate valve plug** assembly from the **rate valve seat**.
- c. Clean or replace the two rate valve stem seals (Photo 5.28) as necessary. The shaft of the rate valve can be cleaned with warm soapy water, denatured alcohol, or lacquer thinner as needed.

---

**IMPORTANT:** Remove the two stem seals before using lacquer thinner. The two seals can be cleaned with denatured alcohol.

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- d. Examine the two seals and make sure they are free of nicks and scratches. Replace if necessary.
- e. Use a light film of Vaseline or Dow Corning DC33 on the o-rings and threads.
- f. If dirt or deposit have formed in the metering orifice of the **rate valve seat**, a cloth dipped in denatured alcohol can be carefully inserted through the orifice and gently moved back and forth (Photo 5.29).
- g. Reinsert the rate valve plug assembly with o-rings installed into the rate valve seat using firm pressure and a continual clockwise rotation of the plug assembly until the threads engage. The clockwise rotation prevents the o-rings from being damaged.

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**NOTE:** Do not simply press the rate valve plug assembly into the seat as this will damage the o-rings.

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5.10.2 To clean the **metering tube**, proceed as follows:

- a. Unscrew or open the **1" NPT PVC vacuum inlet union** at the **flow meter inlet block**. Do not lose the union o-ring.
- b. Remove the four mounting screws from the **base plate** while holding the **metering tube** securely in one hand (Photo 5.30 & 5.31).
- c. Carefully remove the **flow meter inlet block** and the **metering tube assembly** from the back panel and place them on a padded surface, being careful not to lose or damage the metering tube float.
- d. Clean the **glass tube** and the **metering tube float** with a soft cloth using denatured alcohol (Photo 5.32). **DO NOT USE LACQUER THINNER OR ACETONE, AS THESE CHEMICALS WILL REMOVE THE NUMBER SCALE ON THE TUBE EXTERIOR.**

- e. Rinse all parts in warm water, and dry thoroughly before reassembling.
- f. Clean top and bottom metering tube o-rings with denatured alcohol or warm soapy water. Dry thoroughly.
- g. Inspect, clean, or replace top and bottom metering tube o-rings as necessary.
- h. Reassemble metering tube assembly by reversing this procedure.

## 5.11 CLEANING THE SAFETY SHUT-OFF VALVE PLUG AND SEAT

The need for cleaning the safety shut-off inlet valve plug and seat is usually caused by a "VENTING" condition. Venting occurs when dirt or impurities enter the vacuum regulator inlet valve plug and seat area, thereby preventing a bubble tight closure of the valve plug. To disassemble, proceed as follows:

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**IMPORTANT:** CLOSE THE CYLINDER/CONTAINER/MANIFOLD VALVE(S) BEFORE WORKING ON ANY SYSTEM COMPONENT AND REMOVE THE VACUUM REGULATOR FROM THE CYLINDER/CONTAINER/MANIFOLD.

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5.11.1 Remove the **two screws** holding the **yoke body bar** to the vacuum regulator body.

5.11.2 Pull the entire **yoke assembly** from the vacuum regulator body using a clockwise rotation. It should slip out relatively easily (Photo 5.11).

5.11.3 To disassemble the inlet capsule:

- a. Turn the **inlet adapter plug** counterclockwise. If the plug is tight use pliers, but be careful not to damage the **adapter plug o-rings**. The end of the valve plug is now exposed (Photo 5.12).
- b. Insert a screwdriver into the slot in the end of the **valve plug** and unscrew the bullet-shaped **vent plug**. This can often be unscrewed by hand (Photo 5.13). If pliers are necessary, make sure the rounded seat surface of the **vent plug** is not scratched.
- c. Remove the **inlet valve plug, inlet spring, and inlet spring guide** (Photo 5.14).
- d. Inspect the sealing surface of the **inlet valve seat**. This surface must be completely free of dirt, nicks, or scratches. A magnifying glass gives a good indication of the condition of the seat. Use a cotton swab dipped into lacquer thinner or denatured alcohol to carefully clean the seat. DO NOT attempt to clean the seat with a sharp tool. Replace the valve seat if it is not in perfect condition. Normally it will not be necessary to remove the valve seat from the **inlet adapter plug** unless it needs to be replaced. To remove, use one of the **vacuum regulator body bolts** inserted through the inlet spring side of the **adapter plug**. Place the head of the screw against a hard surface, and push firmly on the adapter until the valve seat pops free (Photo 5.15).

e. Immerse the **valve plug** and **vent plug** in lacquer thinner or alcohol. Usually, a deposit of crystalline organic material, or a hard varnish-like material, will form along the valve stem below the valve seating surface. Wipe the surfaces clean with a clean cloth, and inspect the tapered valve sealing surface and the rounded **vent plug** sealing surface. These surfaces must be completely free of dirt, nicks, and scratches.

f. Clean the **inlet adapter** before proceeding with assembly. A small tube or bottle brush with denatured alcohol works well here. Remove and inspect the **adapter face seal o-ring** before applying any cleaning agent to the adapter.

g. The **adapter face seal o-ring** and all other parts may be cleaned with a cloth dipped in denatured alcohol.

h. The inlet filter may be removed for inspection for dirt build-up and cleaning, by pushing a pencil eraser tip through the inlet adapter (Photo 5.16). Dirt and deposits can usually be removed by immersing the filter in muriatic acid, and then thoroughly rinsing in clear water. READ ALL LABELS ON THE ACID CONTAINER. AVOID SKIN CONTACT. DO NOT BREATHE VAPORS. SAFETY GOGGLES OR FACE SHIELD SHOULD BE WORN. Dry filter thoroughly with air hose or dryer.

5.11.4 To reassemble, proceed as follows:

- a. Replace the **filter** in the **inlet adapter**, using finger pressure.
- b. Replace the **inlet valve seat** and the **valve seat o-ring**, if they were removed from the adapter plug. A very light film of Vaseline or Dow Corning DC33 should be put on the o-ring, and the seat then slowly pushed into the adapter plug.
- c. Insert the **inlet valve plug** through the **valve seat**.
- d. Place the **inlet adapter plug** with **inlet valve stem** facing up on a smooth clean surface and proceed.
- e. Insert the **inlet spring** in the **inlet adapter plug** recess. Slip on the **spring guide** over the **inlet plug** and press down onto the spring so that the lip of the guide snaps into the center of the spring coil.
- f. Compress the **spring guide** and screw on the **vent plug** a few turns (Photo 5.17)
- g. Place a screwdriver in the **inlet valve plug** slot, hold the **vent plug** with the other hand, and screw down the **vent plug** until the **spring guide** bottoms on the shoulder of the **inlet valve plug**. The **spring** should compress until approximately 1/32" (1mm) of clearance is observed between the top to the **adapter plug** and the **spring guide** (Photo 5.18).
- h. Check alignment of **valve stem** assembly. It should appear straight when viewed from any angle.

- i. Place the **adapter face seal o-ring** into the groove in the **inlet adapter**.
- j. Place a very light film of Vaseline or Dow Corning DC33 on the threads of the **inlet adapter plug** assembly, and screw into the yoke assembly clockwise. Use pliers and tighten until you are certain the plug is bottomed. The plastic used in this plug is very strong; just be careful you do not damage the **adapter plug OD sealing o-ring** (Photo 5.19).
- k. Put a light film of Vaseline or Dow Corning DC33 on the **adapter plug OD sealing o-ring** and on the **back body inlet seal** (Photo 5.20).
- l. Insert the entire yoke assembly into the vacuum regulator body, using a slight clockwise rotation. DO NOT TURN THE YOKE ASSEMBLY COUNTERCLOCKWISE; doing so may unscrew the inlet safety capsule (Photo 5.11).

## 5.12 DISASSEMBLY OF THE VACUUM REGULATOR BODY

5.12.1 Normally it is not necessary to completely disassemble the vacuum regulators unless a thorough cleaning is needed, or parts need to be replaced. If disassembly is necessary, proceed as follows:

- a. Remove the yoke assembly as described in 5.11.1 and 5.11.2 above.
- b. Remove the four screws that hold the body assembly together and separate the body halves (Photo 5.21).
- c. Grasp the diaphragm back plate and pull the entire diaphragm assembly out of the front body. If the indicator seal o-ring is sticking in the front body, push on the end of the indicator pin with your finger, while pulling the diaphragm from the front body (Photo 5.22).
- d. Examine the diaphragm. It is normal for some wrinkles to be present. The diaphragm is made of special, very tough, chlorine resistant material. Should it be necessary to disassemble the diaphragm, proceed as follows:
  1. Grasp both the **front** and **back diaphragm plates** and unscrew them (Photo 5.23). If tight, use a strap wrench and vise, being careful not to damage them.
  2. The **diaphragm** can now be removed. Note the position of the "convolution" on the diaphragm. The raised portion should always face the back of the vacuum regulator.
- e. Clean the parts thoroughly with denatured alcohol.
- f. Carefully inspect all o-rings for damage or wear and replace them if necessary. All o-rings should receive a very thin film of Vaseline or Dow Corning DC33.

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**NOTE:** Excessive use of lubricants can cause additional service problems.

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5.12.2 Reassemble the unit using the reverse procedure, and check the following:

- a. Be certain the **diaphragm plate seal** o-ring is seated in its groove in the diaphragm back plate subassembly before reassembling the diaphragm components.
- b. Be certain that the **diaphragm body seal** o-ring and the **vacuum seal** o-ring are properly seated in their grooves in the back body. If in doubt, replace these o-rings.
- c. Be certain that the diaphragm assembly moves freely in the front body. Press it forward several times, to be certain it returns to "neutral" position (Photo 5.25).
- d. Place the back body on a table with the large **diaphragm body seal** o-ring in place, and lower the front body onto it (Photo 5.24)
- e. Grasp the entire unit, and turn it over so that the back body is on top, and reassemble the four 1 1/2" (38 mm) screws. These screws should be screwed in until they just begin to tighten. Tighten lower left hand screw first.

5.12.3 Replace the yoke assembly, by reversing steps 5.11.1 and 5.11.2. Use the two 2 1/2" long screws.

5.12.4 Tighten all screws in a criss-cross pattern until they are all snug. If you have access to a torque screwdriver calibrated in inch-pounds, tighten all screws to 20 in.-lb of torque. DO NOT OVERTIGHTEN. Sealing is accomplished by the **diaphragm body seal** o-ring between the bodies.

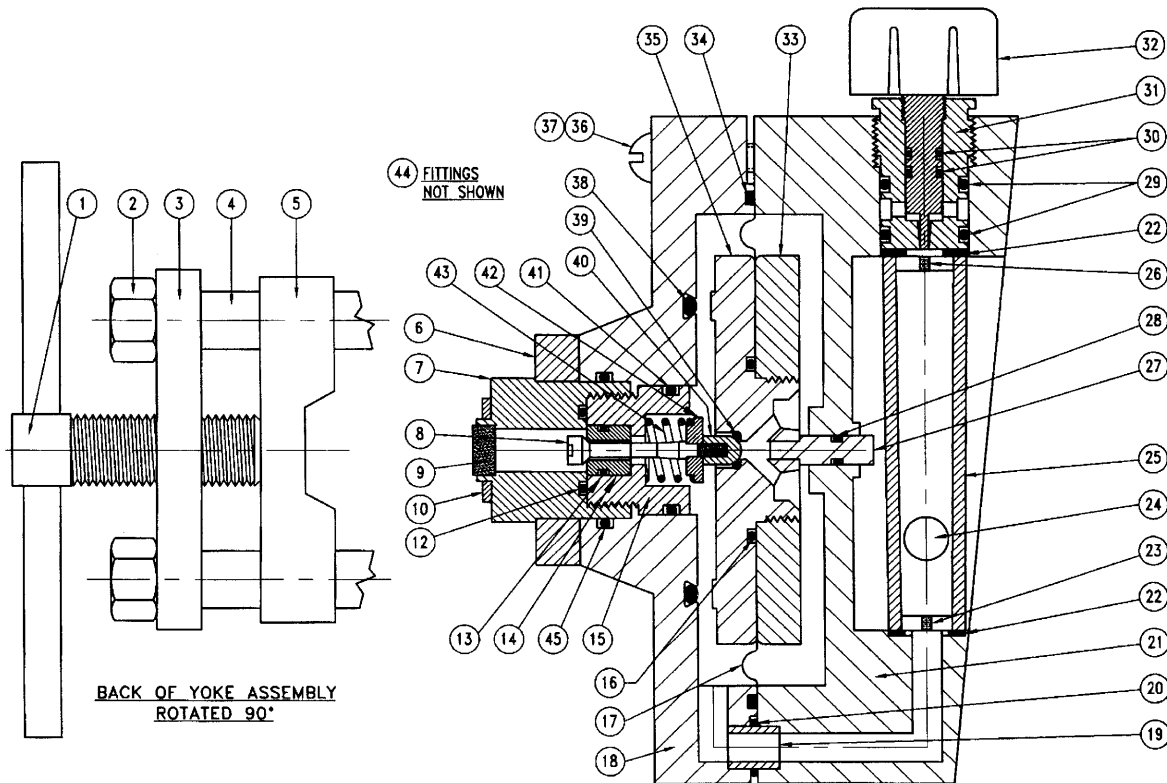
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THERE SHOULD BE A GAP OF APPROXIMATELY 1/16" (1.6MM) BETWEEN BODY HALVES. DO NOT ATTEMPT TO CLOSE THIS GAP BY TIGHTENING THE BODY SCREWS (PHOTO 5.27).

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**DRAWING NO. A-820**  
**Chlorinator Parts List - Model 210**  
**Max. Capacity: 100 PPD (2000 Gm./Hr.)**



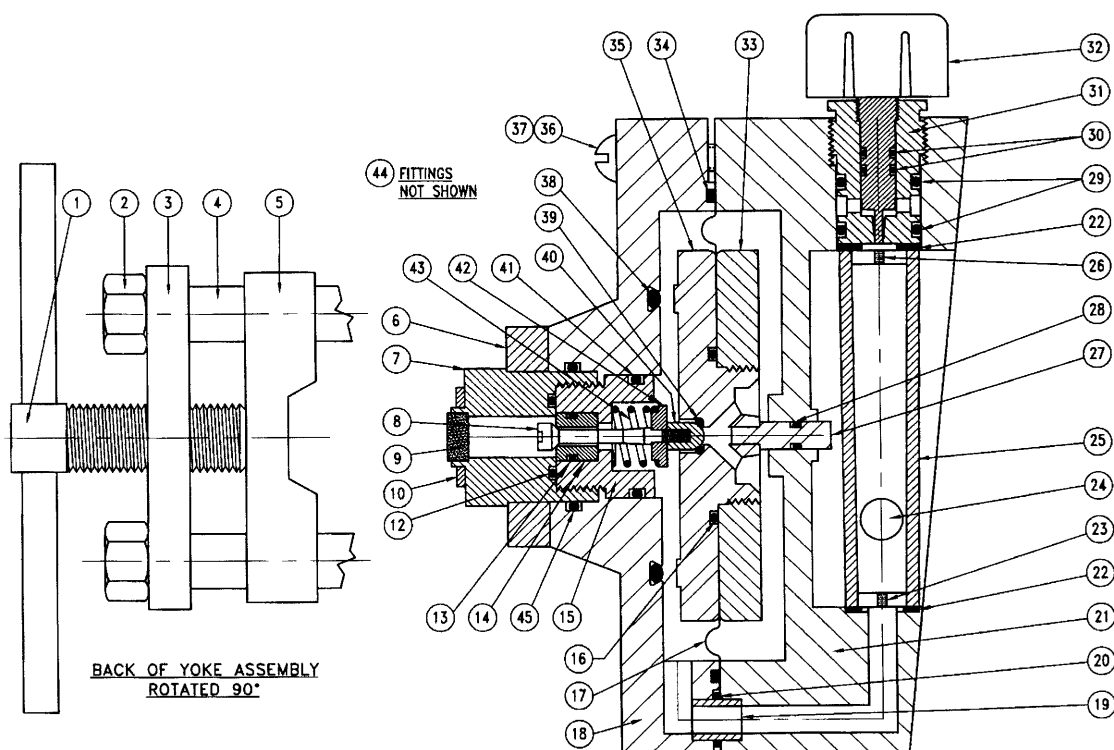
Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	25	-	1	Metering Tube
2	Z-210	2	Yoke Jam Nut	26	-	1	Upper Float Stop
3	Y-210	1	Yoke Rod Bar	-	A-210 *	1	Metering Tube Assem. (Includes Ref. No. 22 Thru 26)
4	Y-220	2	Yoke Stud	27	-	1	Indicator-Part of BA-241
5	Y-230	1	Yoke Slide Bar	28	S-301	1	Indicator Seal
6	Y-240 **	1	Yoke Body Bar	29	S-404	2	Rate Valve Seat Seal
7	Y-252 **	1	Inlet Adapter	30	S-302 *	2	Rate Valve Stem Seal
-	A-200	1	Yoke Assembly (Includes Ref. No. 1 thru 7)	31	RV-210 *	1	Rate Valve Seat
8	YV-230	1	Inlet Valve Plug	32	RV-220 *	1	Rate Valve Plug Assembly
9	Y-275	1	Filter	33	BA-250	1	Diaphragm Front Plate
10	G-201	1	Lead Gasket	34	S-408	1	Diaphragm Body Seal
12	S-404	1	Adapter Face Seal	35	BA-241	1	Diaphragm Back Plate (Includes Ref. No. 27)
13	S-402	1	Valve Seat Seal	36	Z-220	4	Body Screw 1 1/2" Lgth.
14	YV-210	1	Inlet Valve Seat	37	Z-230	2	Body Screw 2 1/2" Lgth.
15	YV-220	1	Inlet Adapter Plug	38	S-409	1	Vacuum Seal
16	S-407	1	Diaphragm Plate Seal	39	S-401	1	Vent Seal
17	B-230	1	Diaphragm	40	YV-250	1	Vent Plug
18	BA-210	1	Back Body	41	S-406	1	Adapter O.D. Seal
19	B-280	1	Body Seal Tube	42	YV-240	1	Spring Guide
20	S-403	1	Body Seal	43	YV-260	1	Inlet Spring
21	BA-220	1	Front Body	44	Z-250	2	Vacuum Fitting- 3/8" OD Tube x 1/4 NPT
22	G-202	2	Metering Tube Gaskets	45	S-413	1	Back Body Inlet Seal
23	-	1	Lower Float Stop				
24	-	1	Metering Float				

**NOTES:**

1. Include Chlorinator Serial Number and Capacity on Order.
- \* 2. For Model 210-1, Ref. No. 30, 31, 32 are Replaced by RV-211 Plug,  
A-210 Metering Tube Assembly is Replaced by Z-260 Plain Glass Tube.
- \*\* 3. Y-240 and Y-252 only available assembled together = A-201 Assembly.



**DRAWING NO. A-822**  
**Chlorinator Parts List - Model 220**  
**250 PPD (5000 Gm./Hr.)**



Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	25	-	1	Metering Tube
2	Z-210	2	Yoke Jam Nut	26	-	1	Upper Float Stop
3	Y-210	1	Yoke Rod Bar	-	A-220 *	1	Metering Tube Assem. (Includes Ref. No. 22 Thru 26)
4	Y-220	2	Yoke Stud	27	-	1	Indicator-Part of Ref. No. 35
5	Y-230	1	Yoke Slide Bar	28	S-301	1	Indicator Seal
6	Y-240 **	1	Yoke Body Bar	29	S-404	2	Rate Valve Seat Seal
7	Y-252 **	1	Inlet Adapter	30	S-302 *	2	Rate Valve Stem Seal
-	A-200	1	Yoke Assembly (Includes Ref. No. 1 thru 7)	31	RV-212 *	1	Rate Valve Seat
8	YV-230	1	Inlet Valve Plug	32	RV-222 *	1	Rate Valve Plug Assembly
9	Y-275	1	Filter	33	BA-250	1	Diaphragm Front Plate
10	G-201	1	Lead Gasket	34	S-408	1	Diaphragm Body Seal
12	S-404	1	Adapter Face Seal	35	BA-241	1	Diaphragm Back Plate (Includes Ref. No. 27)
13	S-402	1	Valve Seat Seal	36	Z-220	4	Body Screw 1 1/2" Lgth.
14	YV-210	1	Inlet Valve Seat	37	Z-230	2	Body Screw 2 1/2" Lgth.
15	YV-220	1	Inlet Adapter Plug	38	S-409	1	Vacuum Seal
16	S-407	1	Diaphragm Plate Seal	39	S-401	1	Vent Seal
17	B-230	1	Diaphragm	40	YV-250	1	Vent Plug
18	BA-210	1	Back Body	41	S-406	1	Adapter O.D. Seal
19	B-280	1	Body Seal Tube	42	YV-240	1	Spring Guide
20	S-403	1	Body Seal	43	YV-260	1	Inlet Spring
21	BA-222	1	Front Body	44	ZZ-260	2	Fitting - 1/2" OD Tube x 1/4 NPT
22	G-202	2	Metering Tube Gaskets	45	S-413	1	Back Body Inlet Seal
23	-	1	Lower Float Stop				
24	-	1	Metering Float				

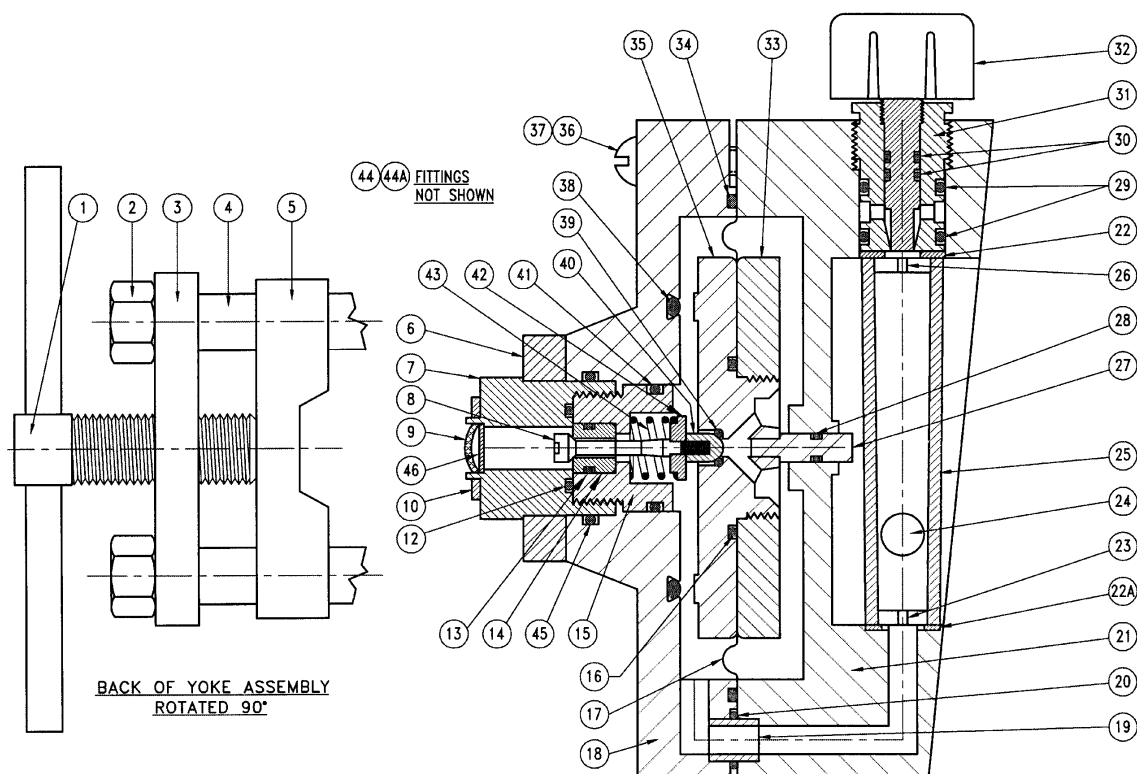
**NOTES:**

1. Include Chlorinator Serial Number and Capacity on Order.

\* 2. For Model 220-1, Ref. No. 30, 31, 32 are Replaced by RV-211 Plug,  
A-220 Metering Tube Assembly is Replaced by Z-260 Plain Glass Tube.

\*\* 3. Y-240 and Y-252 only available assembled together = A-201 Assembly.

**DRAWING NO. A-825**  
**Chlorinator Parts List - Model 250**  
**500 PPD (10 Kg./Hr.)**

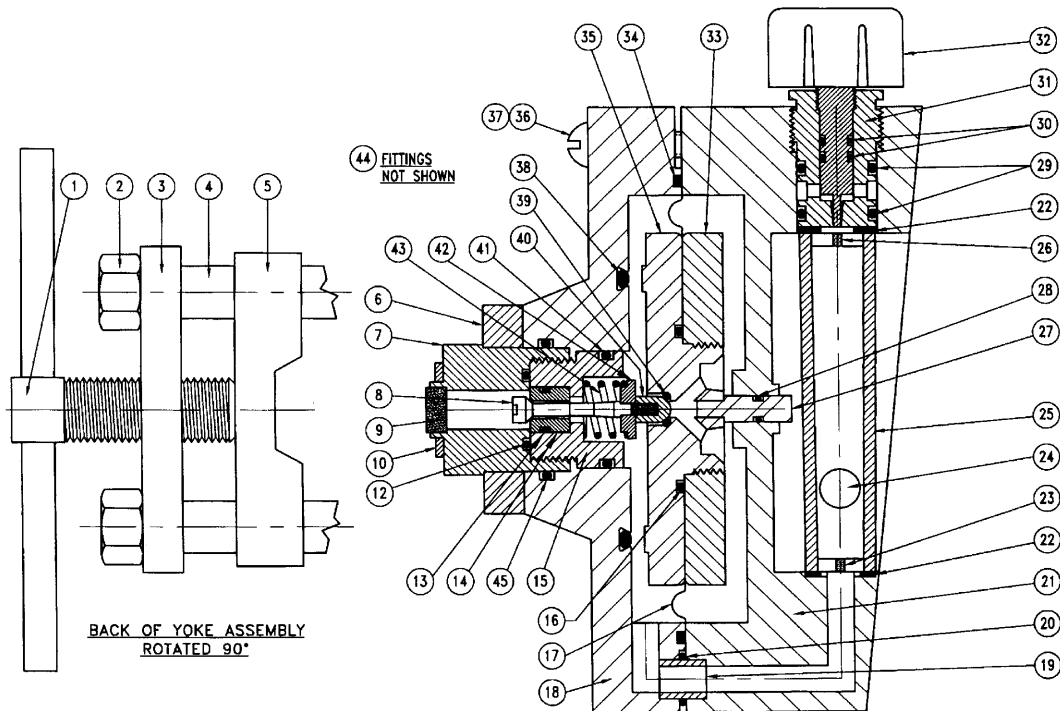


Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	25	-	1	Metering Tube
2	Z-210	2	Yoke Jam Nut	26	-	1	Upper Float Stop
3	Y-210	1	Yoke Rod Bar	-	A-510 *	1	Metering Tube Assem. (Includes Ref. No. 22 Thru 26)
4	Y-220	2	Yoke Stud	27	-	1	Indicator-Part of BA-241
5	Y-230	1	Yoke Slide Bar	28	S-301	1	Indicator Seal
6	Y-240 **	1	Yoke Body Bar	29	S-404	2	Rate Valve Seat Seal
7	Y-252 **	1	Inlet Adapter	30	S-302 *	2	Rate Valve Stem Seal
-	A-200	1	Yoke Assembly (Includes Ref. No. 1 thru 7)	31	RV-512 *	1	Rate Valve Seat
-	A-201		See Note 3	32	RV-520 *	1	Rate Valve Plug Assembly
8	YV-230	1	Inlet Valve Plug	33	BA-250	1	Diaphragm Front Plate
9	Y-276	1	Filter	34	S-408	1	Diaphragm Body Seal
10	G-201	1	Lead Gasket	35	BA-241	1	Diaphragm Back Plate (Includes Ref. No. 27)
12	S-404	1	Adapter Face Seal	36	Z-220	4	Body Screw 1 1/2" Lgth.
13	S-402	1	Valve Seat Seal	37	Z-230	2	Body Screw 2 1/2" Lgth.
14	YV-210	1	Inlet Valve Seat	38	S-409	1	Vacuum Seal
15	YV-220	1	Inlet Adapter Plug	39	S-401	1	Vent Seal
16	S-407	1	Diaphragm Plate Seal	40	YV-250	1	Vent Plug
17	B-230	1	Diaphragm	41	S-406	1	Adapter O.D. Seal
18	BA-210	1	Back Body	42	YV-240	1	Spring Guide
19	B-280	1	Body Seal Tube	43	YV-260	1	Inlet Spring
20	S-403	1	Body Seal	44	ZZ-271	1	Vacuum Fitting - 5/8" OD Tube x 3/8 NPT
21	BA-520	1	Front Body	44A	ZZ-270	1	Vent Fitting - 5/8" OD Tube x 1/4 NPT
22	G-502	1	Metering Tube Gasket (Upper)	45	S-413	1	Back Body Inlet Seal
22A	G-503	1	Metering Tube Gasket (Lower)	46	Y-270	1	Filter Support
23	-	1	Lower Float Stop				
24	-	1	Metering Float				

**NOTES:**

1. Include Chlorinator Serial Number and Capacity on Order.
- \* 2. For Model 250-1, Ref. No. 30, 31, 32 are Replaced by RV-714 Plug,  
A-510 Metering Tube Assembly is Replaced by A-511 Plain Glass Tube.
- \*\* 3. Y-240 and Y-252 only available assembled together = A-201 Assembly.

**DRAWING NO. A-710**  
**Sulphonator Parts List - Model 710**  
**Max. Capacity: 100 PPD (2000 Gm./Hr.)**

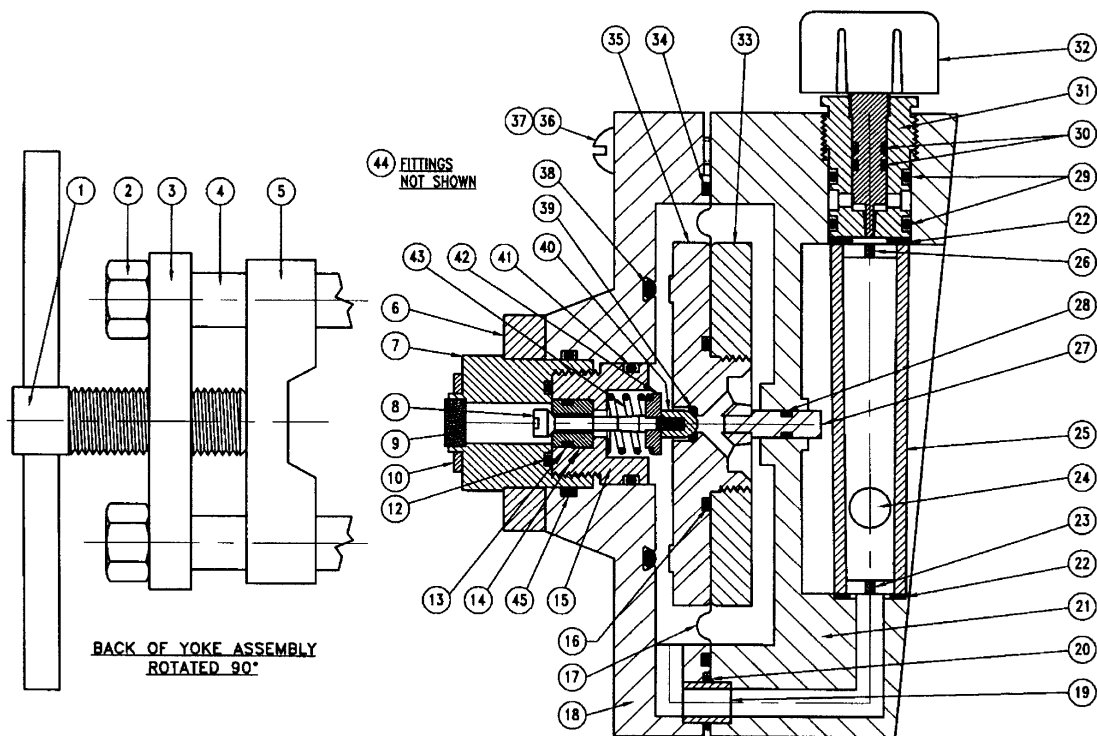


Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	24	-	1	Metering Float
2	Z-210	2	Yoke Jam Nut	25	-	1	Metering Tube
3	Y-210	1	Yoke Rod Bar	26	-	1	Upper Float Stop
4	Y-220	2	Yoke Stud	27	-	1	Indicator-Part of BA-241
5	Y-230	1	Yoke Slide Bar	28	S-301	1	Indicator Seal
6	Y-240 **	1	Yoke Body Bar	29	S-404	2	Rate Valve Seat Seal
7	Y-252 **	1	Inlet Adapter	30	S-302 *	2	Rate Valve Stem Seal
-	A-200	1	Yoke Assembly (Includes Ref. No. 1 thru 7)	31	RV-710 *	1	Rate Valve Seat
8	YV-232	1	Inlet Valve Plug	32	RV-220 *	1	Rate Valve Plug Assembly
9	Y-275	1	Filter	33	BA-750	1	Diaphragm Front Plate
10	G-201	1	Lead Gasket	34	S-408	1	Diaphragm Body Seal
12	S-404	1	Adapter Face Seal	35	BA-741	1	Diaphragm Back Plate (Includes Ref. No. 27)
13	S-402	1	Valve Seat Seal	36	Z-221	4	Body Screw 1 1/2" Lgth.
14	YV-210	1	Inlet Valve Seat	37	Z-231	2	Body Screw 2 1/2" Lgth.
15	YV-220	1	Inlet Adapter Plug	38	S-409	1	Vacuum Seal
16	S-407	1	Diaphragm Plate Seal	39	S-401	1	Vent Seal
17	B-230	1	Diaphragm	40	YV-250	1	Vent Plug
18	BA-710	1	Back Body	41	S-406	1	Adapter O.D. Seal
19	B-280	1	Body Seal Tube	42	YV-240	1	Spring Guide
20	S-403	1	Body Seal	43	YV-261	1	Inlet Spring
21	BA-720	1	Front Body	44	ZZ-250	2	Vacuum Fitting - 3/8" OD Tube x 1/4 NPT
22	G-202	2	Metering Tube Gaskets	45	S-413	1	Back Body Inlet Seal
23	-	1	Lower Float Stop				

**NOTES:**

1. Include Sulphonator Serial Number and Capacity on Order.
- \* 2. For Model 710-1, Ref. No. 30, 31, 32 are Replaced by RV-711 Plug.
- \*\* 3. Y-240 and Y-252 only available assembled together = A-201 Assembly.

**DRAWING NO. A-720**  
**Sulphonator Parts List - Model 720**  
**250 PPD (5000 Gm./Hr.)**



Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	24	-	1	Metering Float
2	Z-210	2	Yoke Jam Nut	25	-	1	Metering Tube
3	Y-210	1	Yoke Rod Bar	26	-	1	Upper Float Stop
4	Y-220	2	Yoke Stud	27	-	1	Indicator-Part of BA-241
5	Y-230	1	Yoke Slide Bar	28	S-301	1	Indicator Seal
6	Y-240 **	1	Yoke Body Bar	29	S-404	2	Rate Valve Seat Seal
7	Y-252 **	1	Inlet Adapter	30	S-302 *	2	Rate Valve Stem Seal
-	A-200	1	Yoke Assembly (Includes Ref. No. 1 thru 7)	31	RV-712 *	1	Rate Valve Seat
8	YV-232	1	Inlet Valve Plug	32	RV-222 *	1	Rate Valve Plug Assembly
9	Y-275	1	Filter	33	BA-750	1	Diaphragm Front Plate
10	G-201	1	Lead Gasket	34	S-408	1	Diaphragm Body Seal
12	S-404	1	Adapter Face Seal	35	BA-741	1	Diaphragm Back Plate (Includes Ref. No. 27)
13	S-402	1	Valve Seat Seal	36	Z-221	4	Body Screw 1 1/2" Lgth.
14	YV-210	1	Inlet Valve Seat	37	Z-231	2	Body Screw 2 1/2" Lgth.
15	YV-220	1	Inlet Adapter Plug	38	S-409	1	Vacuum Seal
16	S-407	1	Diaphragm Plate Seal	39	S-401	1	Vent Seal
17	B-230	1	Diaphragm	40	YV-250	1	Vent Plug
18	BA-710	1	Back Body	41	S-406	1	Adapter O.D. Seal
19	B-280	1	Body Seal Tube	42	YV-240	1	Spring Guide
20	S-403	1	Body Seal	43	YV-261	1	Inlet Spring
21	BA-722	1	Front Body	44	ZZ-260	2	Vacuum Fitting - 1/2" OD Tube x 1/4 NPT
22	G-202	2	Metering Tube Gaskets	45	S-413	1	Back Body Inlet Seal
23	-	1	Lower Float Stop				

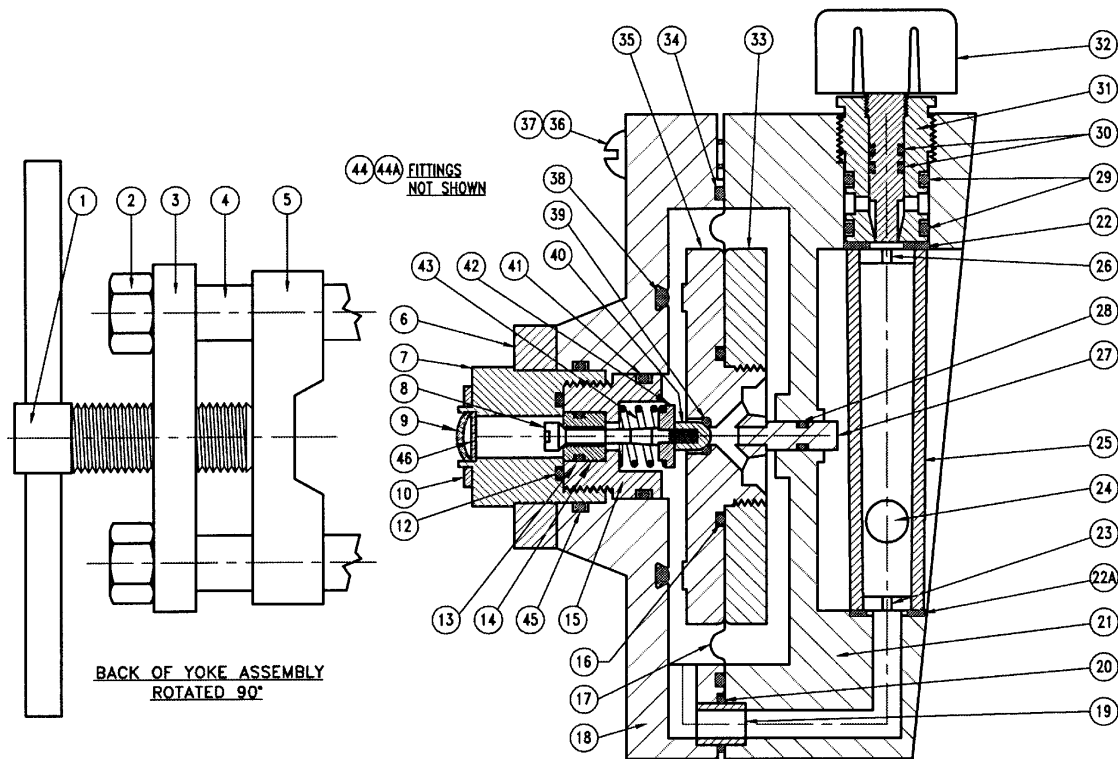
**NOTES:**

1. Include Sulphonator Serial Number and Capacity on Order.

\* 2. For Model 720-1, Ref. No. 30, 31, 32 are Replaced by RV-711 Plug.

\*\* 3. Y-240 and Y-252 only available assembled together = A-201 Assembly..

**DRAWING NO. A-750**  
**Sulphonator Parts List - Model 750**  
**500 PPD (10 Kg./Hr.)**



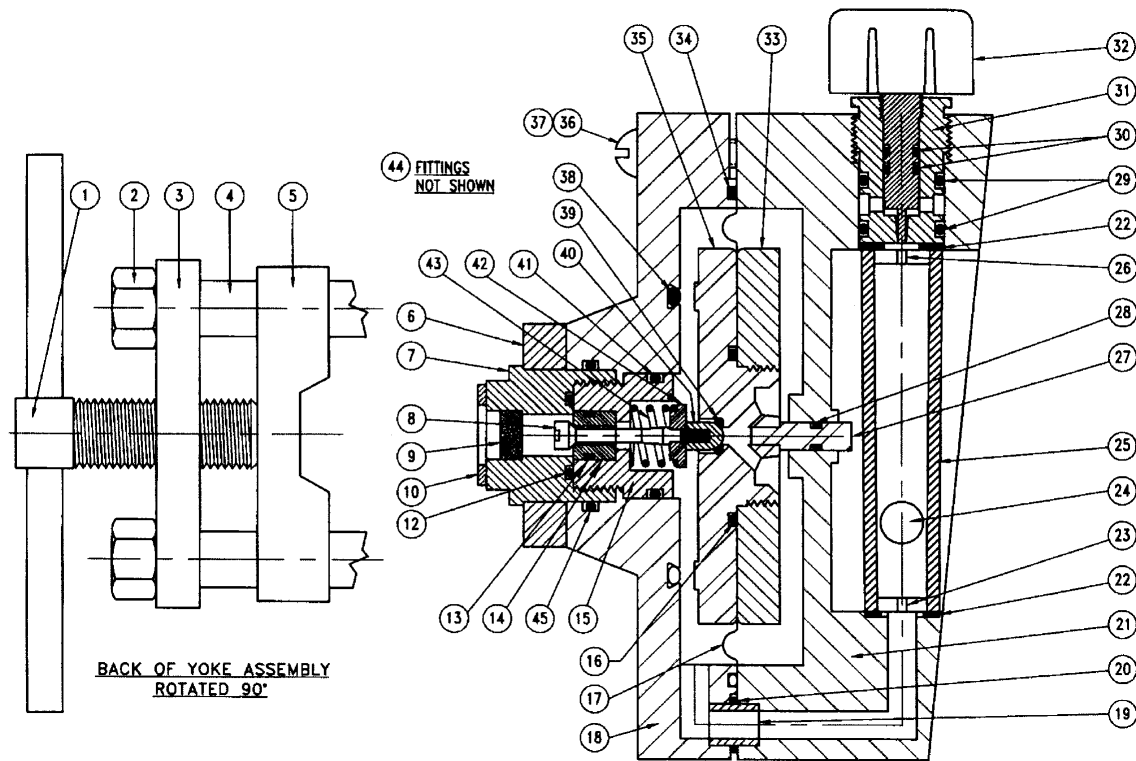
Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	25	-	1	Metering Tube
2	Z-210	2	Yoke Jam Nut	26	-	1	Upper Float Stop
3	Y-210	1	Yoke Rod Bar	27	-	1	Indicator-Part of BA-241
4	Y-220	2	Yoke Stud	28	S-301	1	Indicator Seal
5	Y-230	1	Yoke Slide Bar	29	S-404	2	Rate Valve Seat Seal
6	Y-240 **	1	Yoke Body Bar	30	S-302 *	2	Rate Valve Stem Seal
7	Y-252 **	1	Inlet Adapter	31	RV-512 *	1	Rate Valve Seat
-	A-200	1	Yoke Assembly (Includes Ref. No. 1 thru 7)	32	RV-520 *	1	Rate Valve Plug Assembly
-	A-201		See Note 3	33	BA-750	1	Diaphragm Front Plate
8	YV-232	1	Inlet Valve Plug	34	S-408	1	Diaphragm Body Seal
9	Y-276	1	Filter	35	BA-741	1	Diaphragm Back Plate (Includes Ref. No. 27)
10	G-201	1	Lead Gasket	36	Z-221	4	Body Screw 1 1/2" Lgth.
12	S-404	1	Adapter Face Seal	37	Z-231	2	Body Screw 2 1/2" Lgth.
13	S-402	1	Valve Seat Seal	38	S-409	1	Vacuum Seal
14	YV-210	1	Inlet Valve Seat	39	S-401	1	Vent Seal
15	YV-220	1	Inlet Adapter Plug	40	YV-250	1	Vent Plug
16	S-407	1	Diaphragm Plate Seal	41	S-406	1	Adapter O.D. Seal
17	B-230	1	Diaphragm	42	YV-240	1	Spring Guide
18	BA-710	1	Back Body	43	YV-261	1	Inlet Spring
19	B-280	1	Body Seal Tube	44	ZZ-271	1	Vacuum Fitting - 5/8" OD Tube x 3/8 NPT
20	S-403	1	Body Seal	44A	ZZ-270	1	Vent Fitting - 5/8" OD Tube x 1/4 NPT
21	BA-725	1	Front Body	45	S-413	1	Back Body Inlet Seal
22	G-502	1	Metering Tube Gasket (Upper)	46	Y-270	1	Filter Support
22A	G-503	1	Metering Tube Gasket (Lower)				
23	-	1	Lower Float Stop				
24	-	1	Metering Float				

**NOTES:**

1. Include Sulphonator Serial Number and Capacity on Order.
- \* 2. For Model 750-1, Ref. No. 30, 31, 32 are Replaced by RV-714 Plug.
- \*\* 3. Y-240 and Y-252 only available assembled together = A-201 Assembly.



**DRAWING NO. A-823**  
**Ammoniator Parts List - Model 310**  
**Max. Capacity: 100 PPD (2000 Gm./Hr.)**

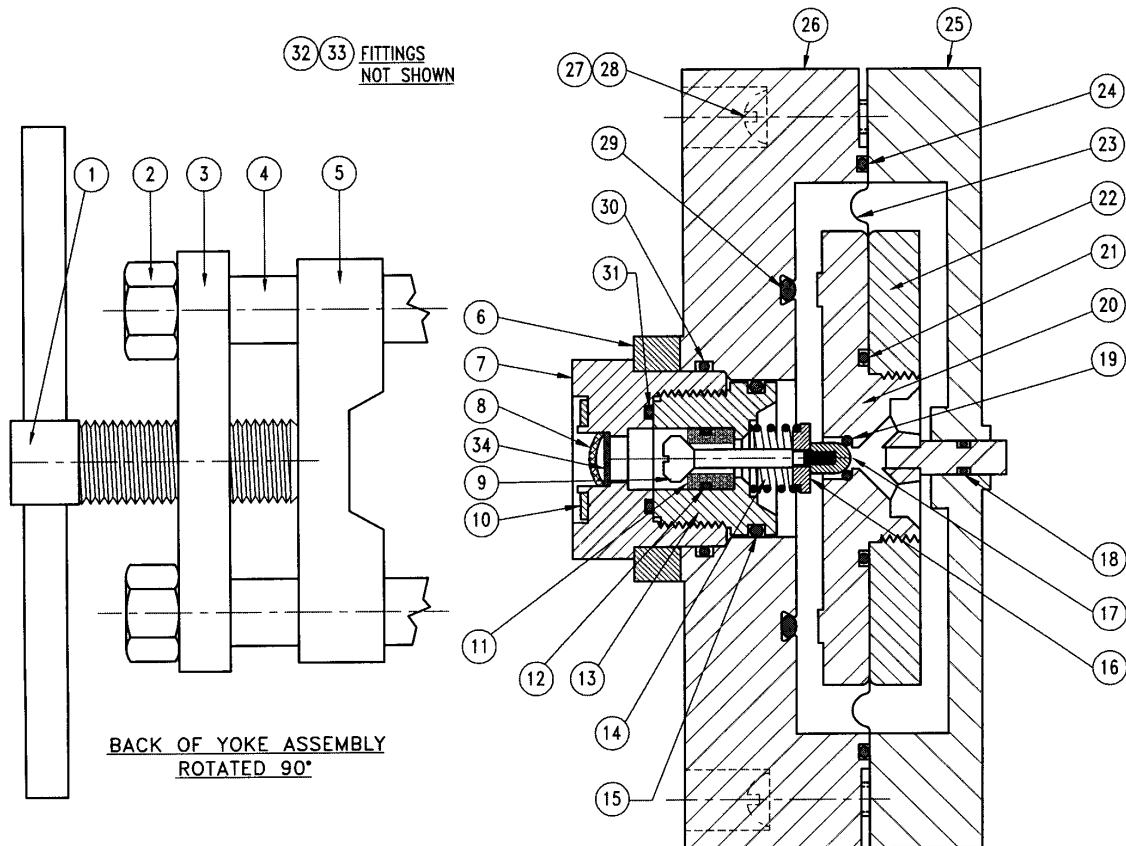


Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	25	-	1	Metering Tube
2	Z-210	2	Yoke Jam Nut	26	-	1	Upper Float Stop
3	Y-212	1	Yoke Rod Bar	-	A-310	1	Metering Tube Assem. (Includes Ref. No. 22 Thru 26)
4	Y-222	2	Yoke Stud	27	-	1	Indicator-Part of BA-241
5	Y-232	1	Yoke Slide Bar	28	SA-301	1	Indicator Seal
6	Y-242	1	Yoke Body Bar	29	SA-404	2	Rate Valve Seat Seal
7	Y-352	1	Inlet Adapter	30	SA-302	2	Rate Valve Stem Seal
-	A-302	1	Yoke Assembly (Includes Ref. No. 1 thru 7)	31	RV-212 *	1	Rate Valve Seat
8	YV-231	1	Inlet Valve Plug	32	RV-223	1	Rate Valve Plug Assembly
9	Y-275	1	Filter	33	BA-250	1	Diaphragm Front Plate
10	G-201	1	Lead Gasket	34	SA-408	1	Diaphragm Body Seal
12	SA-404	1	Adapter Face Seal	35	BA-241	1	Diaphragm Back Plate (Includes Ref. No. 27)
13	SA-402	1	Valve Seat Seal	36	Z-221	4	Body Screw 1 1/2" Lgth.
14	YV-210	1	Inlet Valve Seat	37	Z-231	2	Body Screw 2 1/2" Lgth.
15	YVA-220	1	Inlet Adapter Plug	38	SA-409	1	Vacuum Seal
16	SA-407	1	Diaphragm Plate Seal	39	SA-401	1	Vent Seal
17	B-230	1	Diaphragm	40	YVA-250	1	Vent Plug
18	BA-210	1	Back Body	41	SA-406	1	Adapter O.D. Seal
19	B-280	1	Body Seal Tube	42	YVA-240	1	Spring Guide
20	SA-403	1	Body Seal	43	YV-261	1	Inlet Spring
21	BA-220 *	1	Front Body	44	Z-250	2	Vacuum Fitting - 3/8" OD Tube x 1/4 NPT
22	GA-202 *	2	Metering Tube Gaskets	45	SA-413	1	Back Body Inlet Seal
23	-	1	Lower Float Stop				
24	-	1	Metering Float				

**NOTES:**

1. Include Ammoniator Serial Number and Capacity on Order.
- \* 2. For 50 PPD & 100 PPD Use the Following:  
 BA-320 Front Body  
 GA-502 (Upper) Metering Tube Gasket  
 GA-503 (Lower) Metering Tube Gasket  
 RVA-212 Rate Valve Seat

**DRAWING NO. A-2821**  
**Chlorinator Parts List - Model 2101**  
**1000/2000 PPD (20/40 Kg./Hr.)**

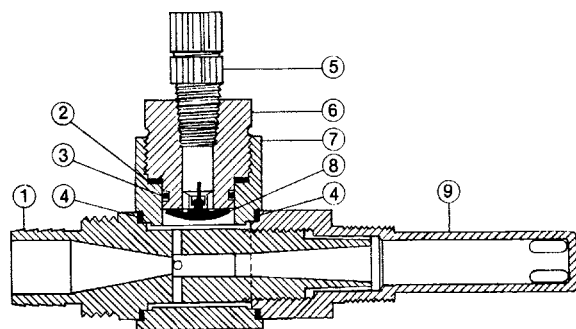


Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	18	S-301	1	Indicator Seal
2	Z-210	2	Yoke Jam Nut	19	S-401	1	Vent Seal
3	Y-210	1	Yoke Rod Bar	20	BA-241	1	Diaphragm Back Plate (Includes Ref. No. 18 & 19)
4	Y-220	2	Yoke Stud	21	S-407	1	Diaphragm Plate Seal
5	Y-230	1	Yoke Slide Bar	22	BA-250	1	Diaphragm Front Plate
6	Y-2000	1	Yoke Body Bar	23	B-230	1	Diaphragm
7	YA-2000	1	Inlet Adapter	24	S-408	1	Diaphragm Body Seal
8	Y-276	1	Filter	25	BA-820	1	Front Body
-	A-2001	1	Yoke Assembly (See Note 2)	26	BA-2000	1	Back Body
-	A-2002	1	Inlet Valve Capsule Assem. (See Note 3)	27	Z-220	4	Body Screw 1 1/2" Lgth.
9	YV-2002	1	Inlet Valve Plug	28	Z-230	2	Body Screw 2 1/2" Lgth.
10	G-201	1	Lead Gasket	29	S-409	1	Vacuum Seal
11	YV-2001	1	Inlet Valve Seat	30	S-407	1	Back Body Inlet Seal
12	S-403	1	Valve Seat Seal	31	S-806	1	Adapter Face Seal
13	YV-2000	1	Inlet Adapter Plug	32	MS-19	1	Vacuum Fitting - 1" NPT Union Assembly
14	YV-260	1	Inlet Spring	33	ZZ-270	1	Vent Fitting - 5/8" OD Tube x 1/4" NPT
15	S-415	1	Adapter O.D. Seal	34	Y-270	1	Filter Support
16	YV-240	1	Spring Guide				
17	YV-250	1	Vent Plug				

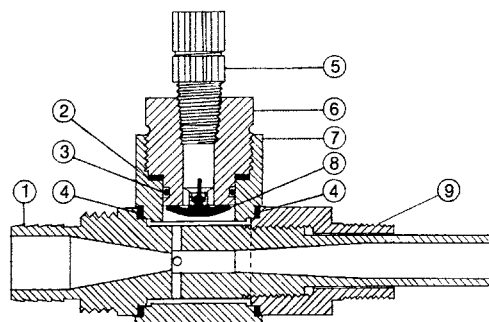
**NOTES:**

1. Include Chlorinator Serial Number and Capacity on Order.
2. A-2001 Yoke Assembly includes Ref. No. 1 through 8, 34.
3. A-2002 Inlet Valve Capsule Assembly includes Ref. No. 9, 11 through 17.

**DRAWING NO. A-920/A-922/A-925 Ejector Assembly (Standard)**  
**E-225/E-227/E-525 Check Valve Assembly Chlorine Service**  
**High Pressure - For Back Pressure Over 20 PSI (1.4KG/CM2)**



EJECTOR MODEL A-920  
EJECTOR MODEL A-922



EJECTOR MODEL A-925

**Ejector Assembly A-920**

**Check Valve Assembly E-225 Includes Ref. No. 2, 3, 5, 6, 8**

**Max. Capacity: 100 lbs./24 hrs. (2000 g/hr)**

<u>Ref. No.</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
1	E-230 (3A, 4A, 5A) E-234 (17A)	1	Nozzle
2	G-203	1	Seat Gasket
3	S-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	Z-250	1	3/8" OD Tube Fitting
6	E-220	1	Check Valve Seat
7	E-210	1	Ejector Body
8	E-250	1	Check Valve
9	E-240	1	Diffuser

**Ejector Assembly A-922**

**Check Valve Assembly E-227 Includes Ref. No. 2, 3, 5, 6, 8**

**Max. Capacity: 250 lbs./24 hrs. (5000 g/hr)**

<u>Ref. No.</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
1	E-234 (18A)	1	Nozzle
2	G-203	2	Seat Gasket
3	S-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	ZZ-260	1	1/2" OD Tube Fitting
6	E-222	1	Check Valve Seat
7	E-210	1	Ejector Body
8	E-250	1	Check Valve
9	E-240	1	Diffuser

**Ejector Assembly A-925**

**Check Valve Assembly E-525 Includes Ref. No. 2, 3, 5, 6, 8**

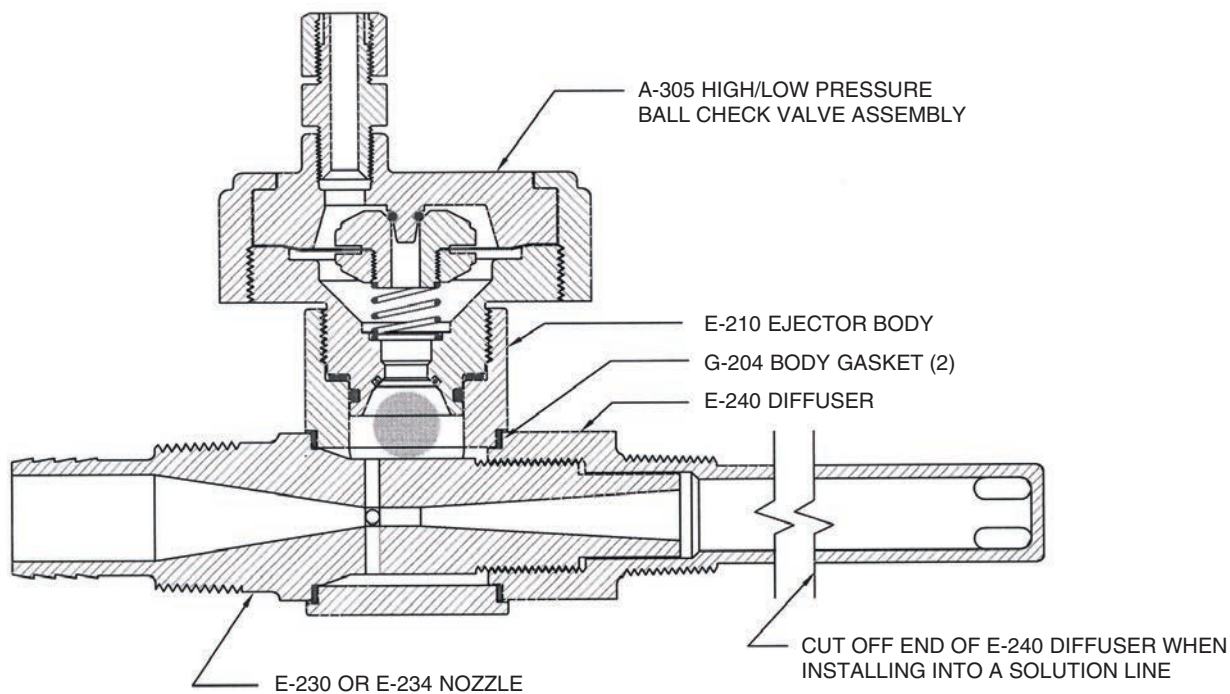
**Max. Capacity: 500 lbs./24 hrs. (10 kg/hr)**

<u>Ref. No.</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
1	E-533 (50X)	1	Nozzle
2	G-203	2	Seat Gasket
3	S-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	ZZ-271	1	5/8" OD Tube Fitting
6	E-520	1	Check Valve Seat
7	E-210	1	Ejector Body
8	E-250	1	Check Valve
9	E-540	1	Nozzle Retainer

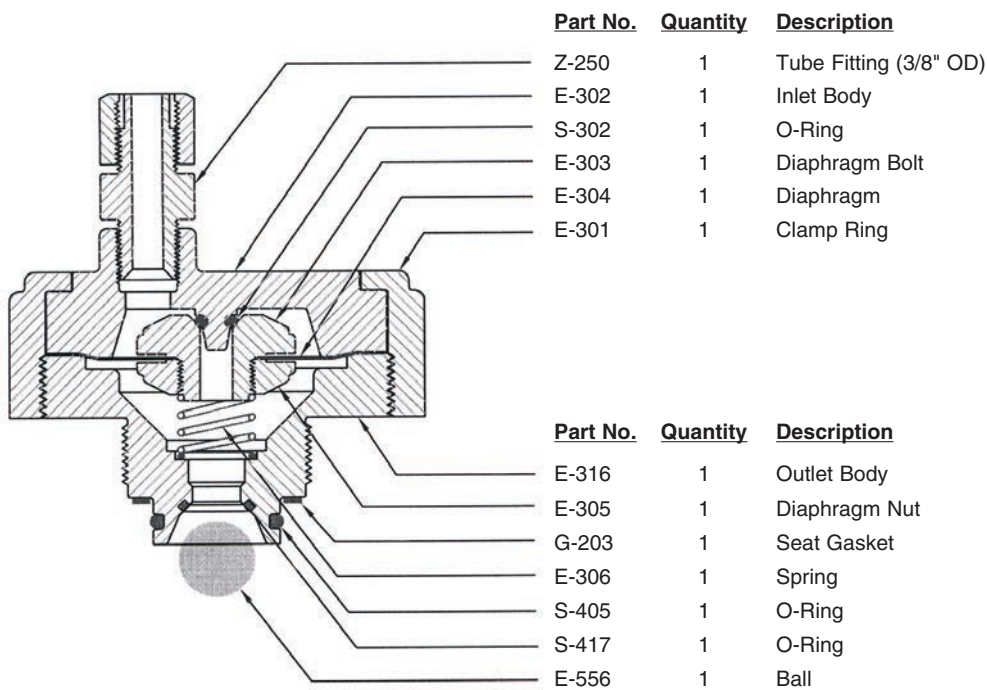
NOTE: Include Chlorinator Serial Number and Capacity and Size (OD) of Vacuum Tubing Being Used.

**DRAWING NO. A-930/A-305 High/Low Pressure Ejector Assembly (Optional)**  
**Chlorine Service - Max. Capacity: 100 PPD (2000 GM/HR)**

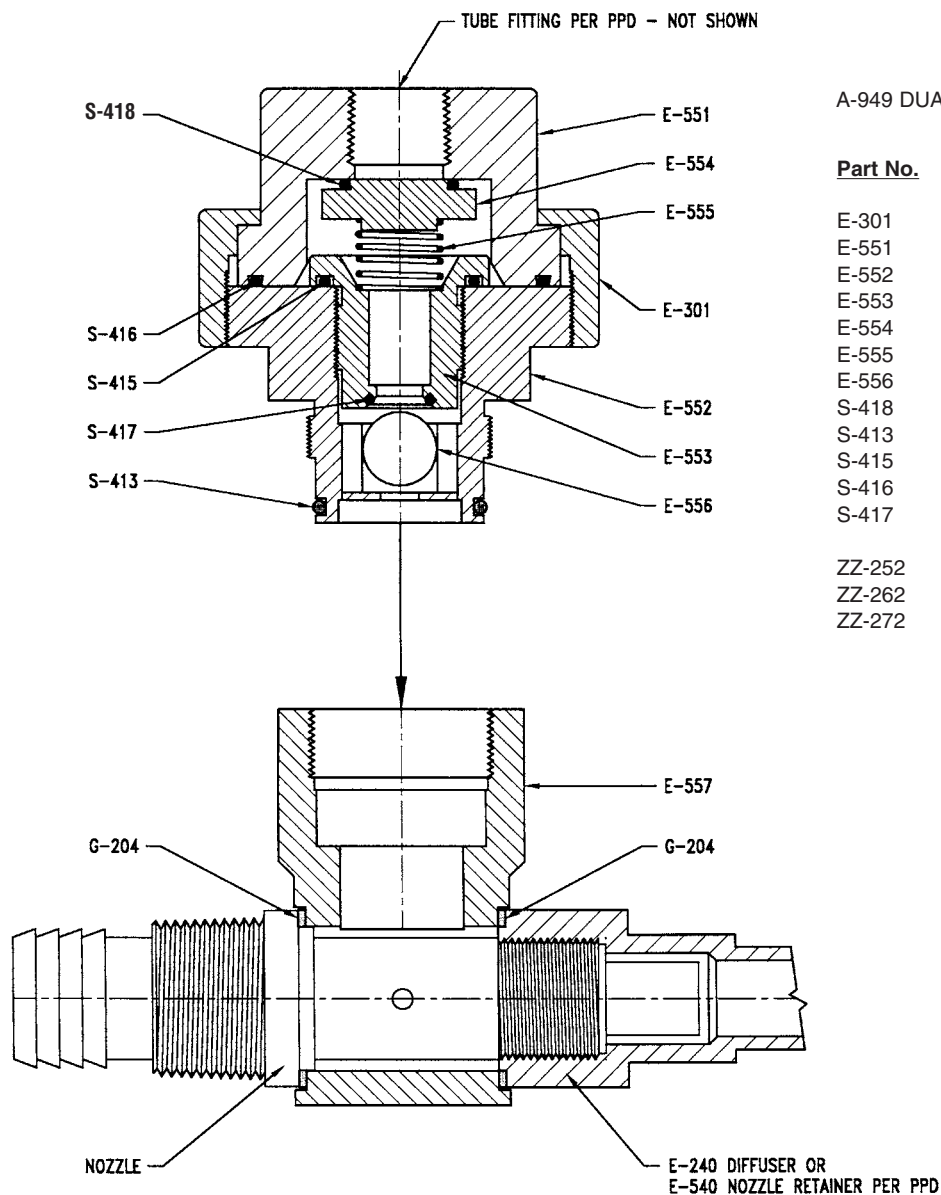
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**A-305 High/Low Pressure Ball Check Valve Assembly - 100 PPD (2000 GM/HR) Maximum**



**DRAWING NO. A-950/A-949 Ejector/Dual Check Valve Assembly (Optional)**  
**Chlorine Service Only**  
**Max. Capacity: Up to 500 PPD (10KG/HR)**



A-949 DUAL CHECK VALVE ASSEMBLY

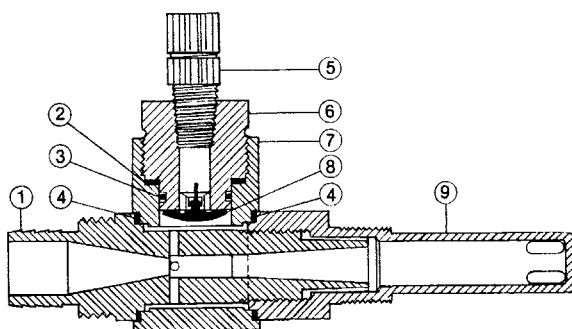
Part No.	Quantity	Description
E-301	1	Clamp Ring
E-551	1	Top Body
E-552	1	Bottom Body
E-553	1	Spring/Ball Retainer
E-554	1	Poppet
E-555	1	Spring
E-556	1	Ball
S-418	1	O-Ring
S-413	1	O-Ring
S-415	1	O-Ring
S-416	1	O-Ring
S-417	1	O-Ring
	1	Tube Fitting Per PPD
ZZ-252	-	3/8" OD Tube (to 100 PPD)
ZZ-262	-	1/2" OD Tube (250 PPD)
ZZ-272	-	5/8" OD Tube (500 PPD)

A-950 EJECTOR ASSEMBLY

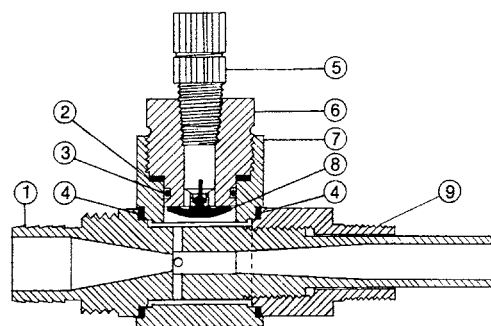
Part No.	Quantity	Description
A-949	1	Dual Check Valve Assem.
E-557	1	Ejector Body
-	1	Nozzle - Sized Per PPD
-	1	Diffuser or Nozzle Retainer Per PPD
E-240	-	Diffuser (1.5 to 250 PPD)
E-540	-	Nozzle Retainer (500 PPD-50X Nozzle Only)
G-204	2	Gasket



**DRAWING NO. A-920S/A-922S/A-925S Ejector Assembly (Standard)**  
**E-225S/E-227S/E-525S Check Valve Assembly Sulfur Dioxide Service**  
**High Pressure - For Back Pressure Over 20 PSI (1.4KG/CM2)**



EJECTOR MODEL A-920S  
EJECTOR MODEL A-922S



EJECTOR MODEL A-925S

**Ejector Assembly A-920S**

**Check Valve Assembly E-225S Includes Ref. No. 2, 3, 5, 6, 8**

**Max. Capacity: 100 lbs./24 hrs. (2000 g/hr)**

<u>Ref. No.</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
1	E-230 (3A, 4A, 5A) E-234 (17A)	1	Nozzle
2	G-203	1	Seat Gasket
3	S-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	ZZ-250	1	3/8" OD Tube Fitting
6	E-720	1	Check Valve Seat
7	E-710	1	Ejector Body
8	E-250	1	Check Valve
9	E-240	1	Diffuser

**Ejector Assembly A-922S**

**Check Valve Assembly E-227S Includes Ref. No. 2, 3, 5, 6, 8**

**Max. Capacity: 250 lbs./24 hrs. (5000 g/hr)**

<u>Ref. No.</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
1	E-234 (18A)	1	Nozzle
2	G-203	2	Seat Gasket
3	S-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	ZZ-260	1	1/2" OD Tube Fitting
6	E-722	1	Check Valve Seat
7	E-710	1	Ejector Body
8	E-250	1	Check Valve
9	E-240	1	Diffuser

**Ejector Assembly A-925S**

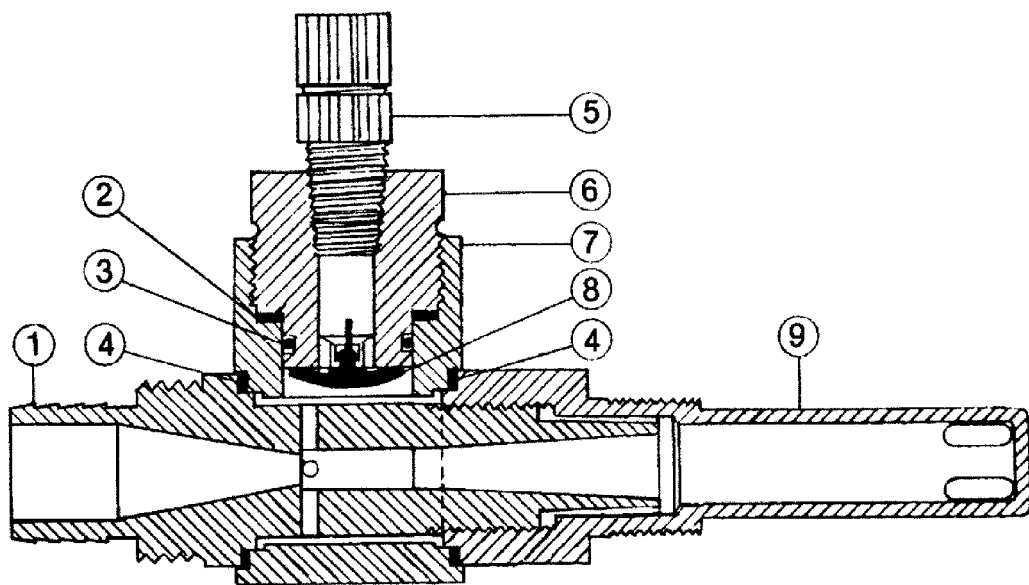
**Check Valve Assembly E-525S Includes Ref. No. 2, 3, 5, 6, 8**

**Max. Capacity: 500 lbs./24 hrs. (10 kg/hr)**

<u>Ref. No.</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
1	E-533 (50X)	1	Nozzle
2	G-203	2	Seat Gasket
3	S-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	ZZ-271	1	5/8" OD Tube Fitting x 3/8 NPT
6	E-725	1	Check Valve Seat
7	E-710	1	Ejector Body
8	E-250	1	Check Valve
9	E-540	1	Nozzle Retainer

NOTE: Include Sulphonator Serial Number and Capacity and Size (OD) of Vacuum Tubing Being Used.

DRAWING NO. A-920A Ejector Assembly (Standard)  
E-225A Check Valve Assembly Ammonia Service  
High Pressure - For Back Pressure Over 20 PSI (1.4 KG/CM2)



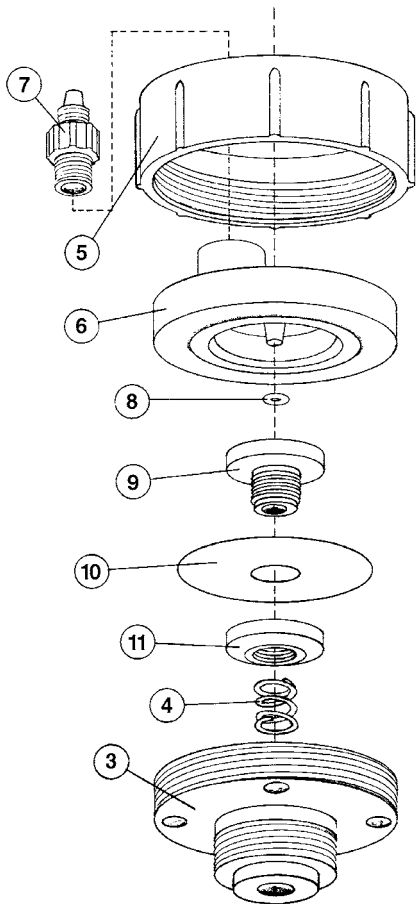
EJECTOR MODEL A-920A

Ejector Assembly A-920A  
Check Valve Assembly E-225A Includes Ref. No. 2, 3, 5, 6, 8  
Max. Capacity: 100 lbs./24 hrs. (2000 g/hr)

Ref. No.	Part No.	Quantity	Description
1	E-230 (3A, 4A, 5A) E-234 (17A)	1	Nozzle
2	G-203	1	Seat Gasket
3	SA-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	Z-250	1	3/8" OD Tube Fitting
6	E-222	1	Check Valve Seat
7	E-210	1	Ejector Body
8	EA-250	1	Check Valve
9	E-240	1	Diffuser

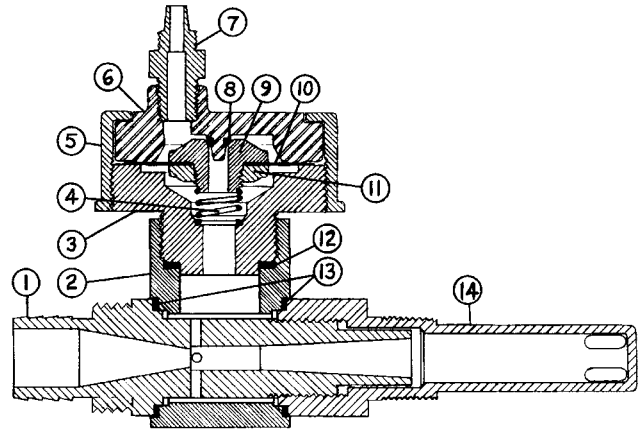
NOTE: Include Ammoniator Serial Number, Capacity and Size (OD) of Vacuum Tubing Being Used.

**DRAWING NO. A-921/A-923/A-926 Ejector Assembly (Optional)**  
**A-300/A-320/A-350 Check Valve Assembly Chlorine Service**  
**Low Pressure - For Back Pressure Up to 20 PSI (1.4KG/CM2)**

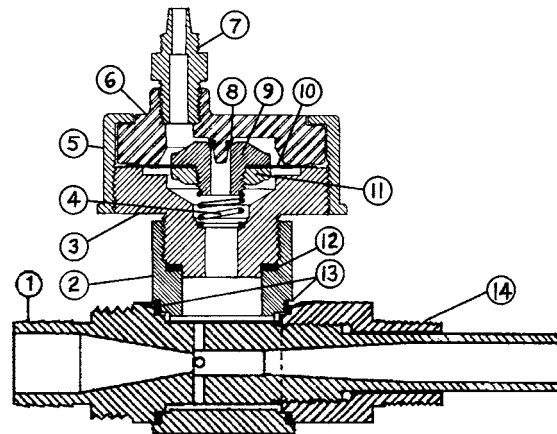


A-300/A-320/A-350  
Low Pressure Check Valve Assembly

A-300 up to 100 lbs./24 hrs.  
A-320 @ 250 lbs./24 hrs.  
A-350 @ 500 lbs./24 hrs.



EJECTOR MODEL A-921 100 PPD (2000 g/hr.)  
EJECTOR MODEL A-923 250 PPD (5000 g/hr.)

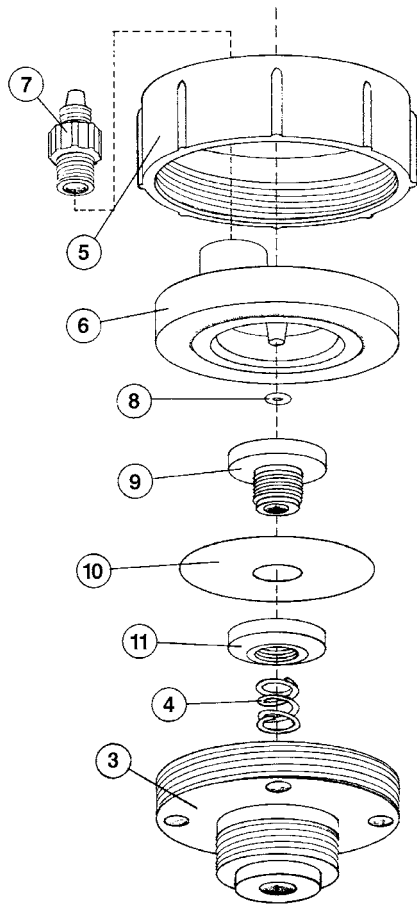


EJECTOR MODEL A-926 500 PPD (10 kg/hr.)

Ejector Assembly Max. Capacity	A-921 100 lbs./24hrs. (2000 g/hr)	A-923 250 lbs./24 hrs. (5000 g/hr)	A-926 500 lbs./24 hrs. (10 kg/hr)		
Ref. No.	Part No.	Part No.	Part No.	Quantity	Description
1	E-230 (3A, 4A, 5A) E-234 (17A)	E-234 (18A)	E-533 (50X)	1	Nozzle
2	E-210	E-210	E-210	1	Ejector Body
3	E-307	E-307	E-307	1	Outlet Body
4	E-306	E-306	E-306	1	Spring
5	E-301	E-301	E-301	1	Clamping Ring
6	E-302	E-302	E-302	1	Inlet Body
7	Z-250 (3/8" OD)	ZZ-260 (1/2" OD)	ZZ-270 (5/8" OD)	1	Tube Fitting
8	S-302	S-302	S-302	1	Check Valve Seal
9	E-303	E-303	E-303	1	Diaphragm Bolt
10	E-304	E-304	E-304	1	Diaphragm
11	E-305	E-305	E-305	1	Diaphragm Nut
12	G-203	G-203	G-203	1	Seat Gasket
13	G-204	G-204	G-204	2	Body Gasket
14	E-240	E-240	E-540	1	Diffuser/Nozzle Retainer

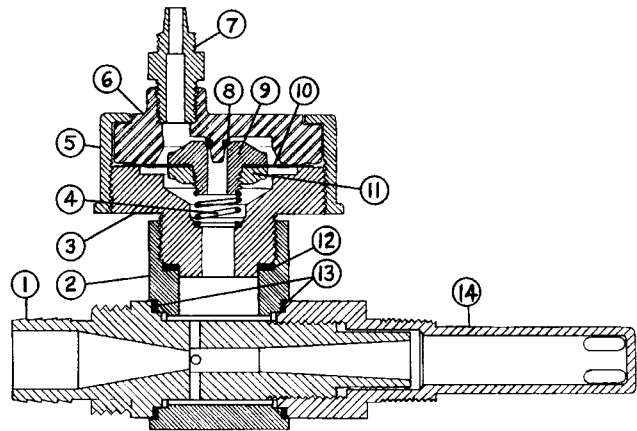
NOTE: Include Chlorinator Serial Number and Capacity and Size (OD) of Vacuum Tubing Being Used.

**DRAWING NO. A-921S/A-923S/A-926S Ejector Assembly (Optional)**  
**A-300S/A-320S/A-350S Check Valve Assembly Sulfur Dioxide Service**  
**Low Pressure - For Back Pressure Up To 20 PSI (1.4KG/CM2)**

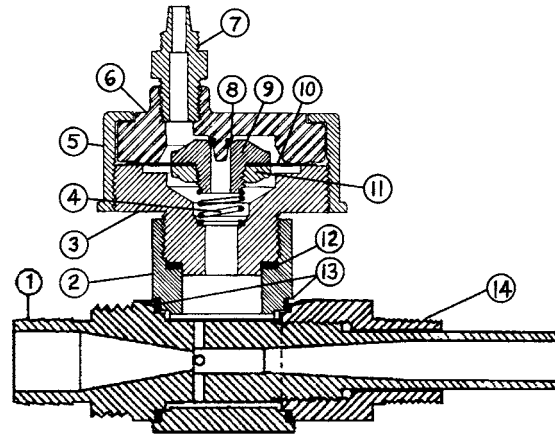


A-300S / A-320S / A-350S  
Low Pressure Check Valve Assembly

A-300S up to 100 lbs./24 hrs.  
A-320S @ 250 lbs./24 hrs.  
A-350S @ 500 lbs./24 hrs.



EJECTOR MODEL A-921S 100 PPD (2000 g/hr.)  
EJECTOR MODEL A-923S 250 PPD (5000 g/hr.)

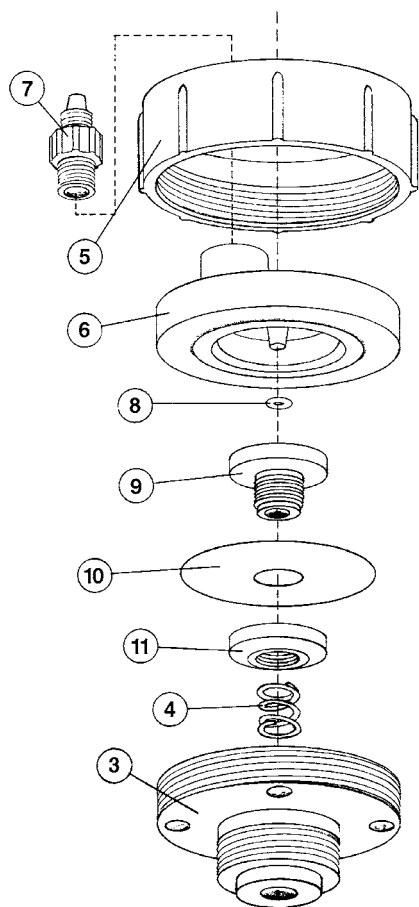


EJECTOR MODEL A-926S 500 PPD (10 kg/hr.)

Ejector Assembly Max. Capacity	A-921S 100 lbs./24hrs. (2000 g/hr)	A-923S 250 lbs./24 hrs. (5000 g/hr)	A-926S 500 lbs./24 hrs. (10 kg/hr)		
Ref. No.	Part No.	Part No.	Part No.	Quantity	Description
1	E-230 (3A, 4A, 5A) E-234 (17A)	E-234 (18A)	E-533 (50X)	1	Nozzle
2	E-710	E-710	E-710	1	Ejector Body
3	E-707	E-707	E-707	1	Outlet Body
4	E-310	E-310	E-310	1	Spring
5	E-301	E-301	E-301	1	Clamping Ring
6	E-702	E-702	E-702	1	Inlet Body
7	ZZ-250 (3/8" OD)	ZZ-260 (1/2" OD)	ZZ-270 (5/8" OD)	1	Tube Fitting
8	S-302	S-302	S-302	1	Check Valve Seal
9	E-703	E-703	E-703	1	Diaphragm Bolt
10	E-304	E-304	E-304	1	Diaphragm
11	E-705	E-705	E-705	1	Diaphragm Nut
12	G-203	G-203	G-203	1	Seat Gasket
13	G-204	G-204	G-204	2	Body Gasket
14	E-240	E-240	E-540	1	Diffuser/Nozzle Retainer

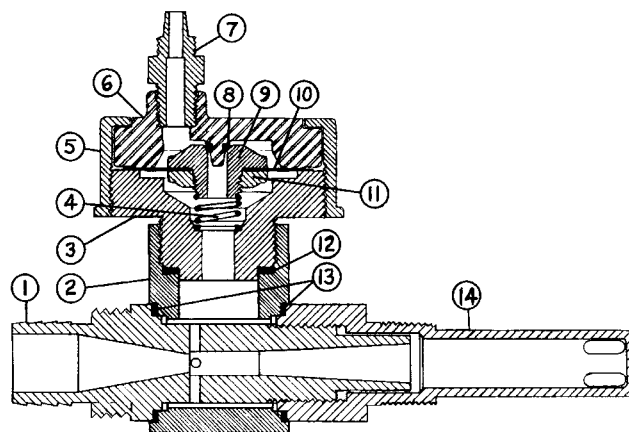
NOTE: Include Sulphonator Serial Number and Capacity and Size (OD) of Vacuum Tubing Being Used.

**DRAWING NO. A-921A Ejector Assembly (Optional)**  
**A-300A Check Valve Assembly Ammonia Service**  
**Low Pressure - For Back Pressure Up to 20 PSI (1.4 KG/CM<sup>2</sup>)**



**A-300A**  
**Low Pressure Check Valve Assembly**

A-300A up to 100 lbs./24 hrs.



**EJECTOR MODEL A-921A 100 PPD (2000 g/hr.)**

**Ejector Assembly**  
**Max. Capacity**

**A-921A**  
**100 lbs./24hrs. (2000 g/hr)**

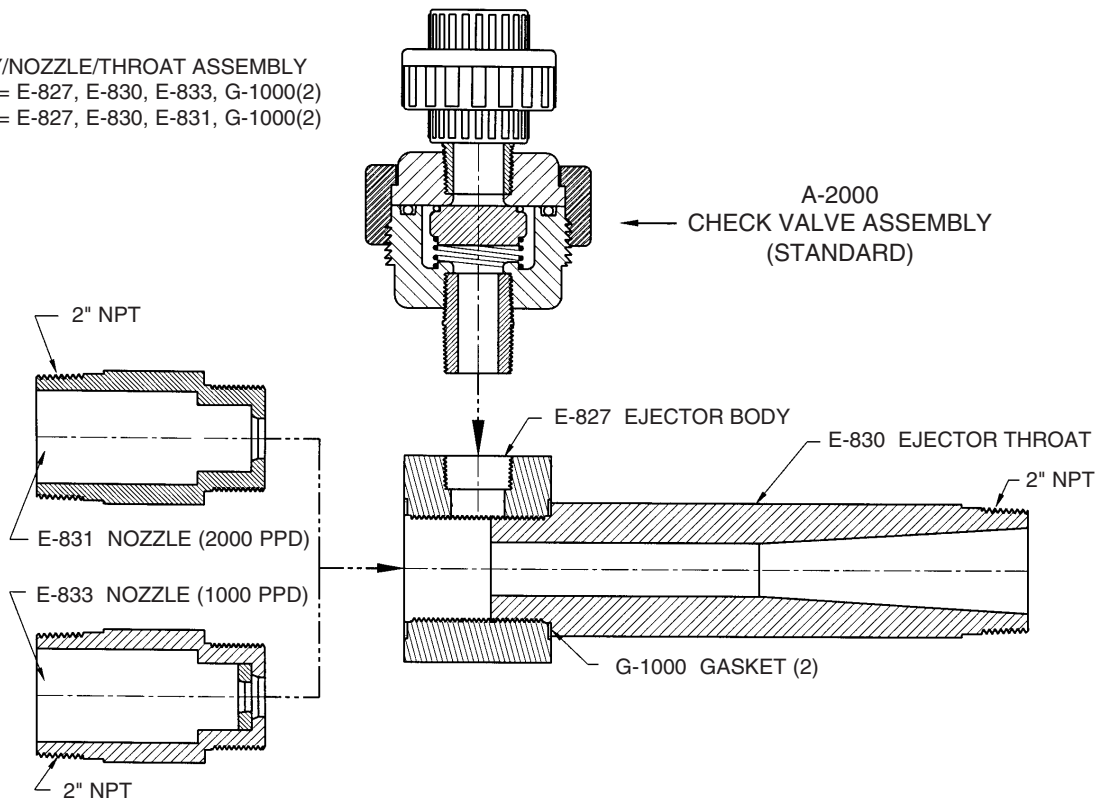
<u>Ref. No.</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
1	E-230 (3A, 4A, 5A) E-234 (17A)	1	Nozzle
2	E-210	1	Ejector Body
3	E-307	1	Outlet Body
4	E-310	1	Spring
5	E-301	1	Clamping Ring
6	E-302	1	Inlet Body
7	Z-250 (3/8" OD)	1	Tube Fitting
8	SA-302	1	Check Valve Seal
9	E-303	1	Diaphragm Bolt
10	E-304	1	Diaphragm
11	E-305	1	Diaphragm Nut
12	G-203	1	Seat Gasket
13	G-204	2	Body Gasket
14	E-240	1	Diffuser/Nozzle Retainer

NOTE: Include Ammoniator Serial Number and Capacity and Size (OD) of Vacuum Tubing Being Used.



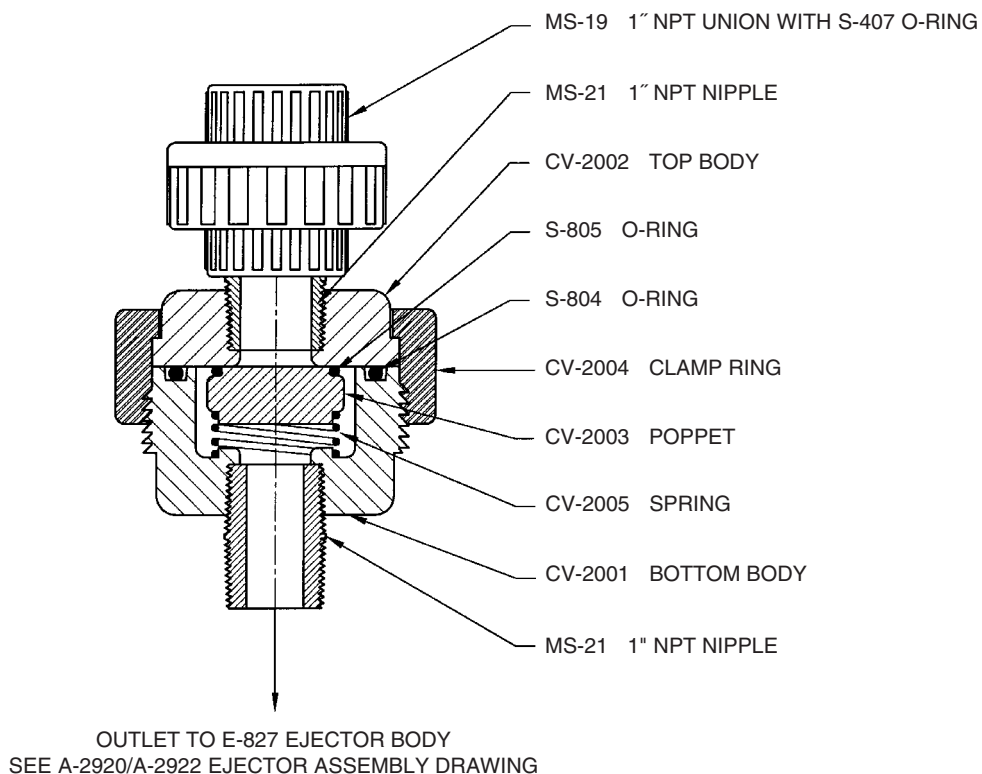
**DRAWING NO. A-2920/A-2922 Ejector Assembly**  
**1000 PPD (20KG/HR) / 2000 PPD (40KG/HR)**

EJECTOR BODY/NOZZLE/THROAT ASSEMBLY  
 E-840 (1000PPD) = E-827, E-830, E-833, G-1000(2)  
 E-841 (2000PPD) = E-827, E-830, E-831, G-1000(2)



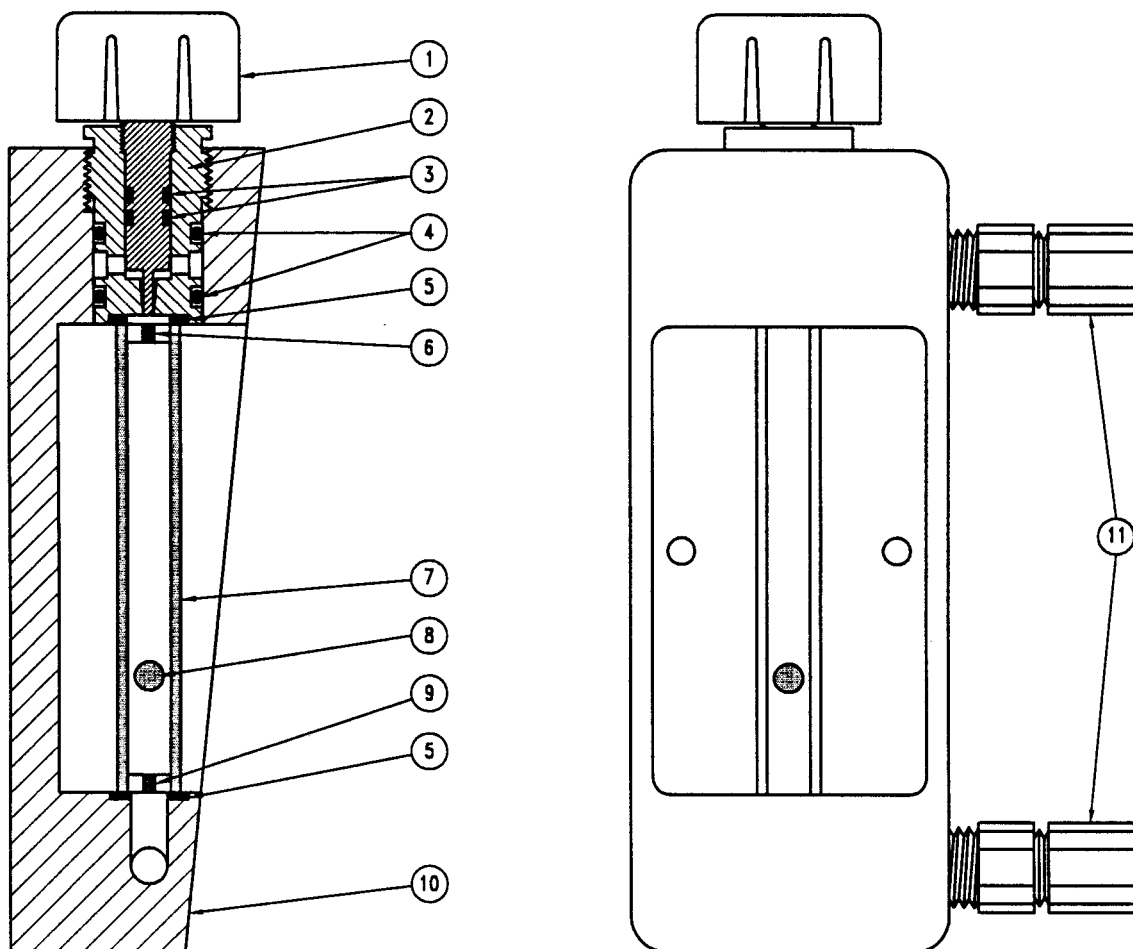
**DRAWING NO. A-2000 Check Valve Assembly**  
**1000 PPD (20KG/HR) / 2000 PPD (40KG/HR)**

A-2000 CHECK VALVE ASSEMBLY (STANDARD)



# DRAWING NO. A-255/A-255S/A-255A

## Chlorinator/Sulphonator/Ammoniator Remote Meter Panel Parts List - 100 PPD (2000 Gm/Hr)

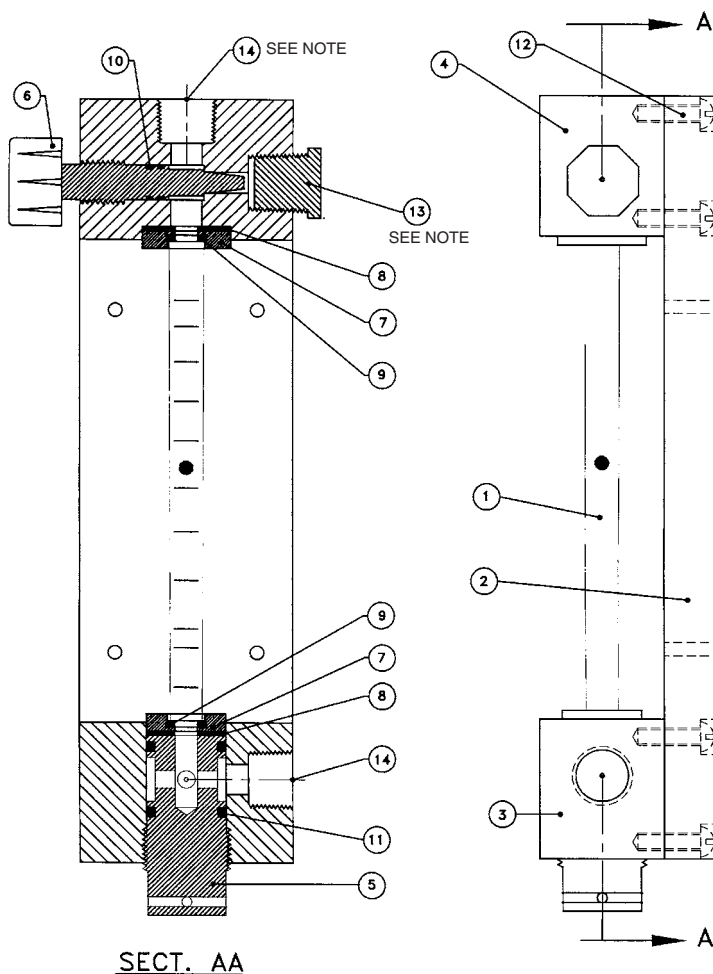


Ref. No.	A-255 4 to 100 PPD CL2 Part No.	A-255S 4 to 100 PPD SO2 Part No.	A-255A 4, 10, 25 PPD NH3 Part No.	A-255A 50, 100 PPD NH3 Part No.	Quantity	Description
1	RV-220	RV-220	RV-223	RV-223	1	Rate Valve Plug Assembly
2	RV-210	RV-710	RVA-212	RVA-212	1	Rate Valve Seat
3	S-302	S-302	SA-302	SA-302	2	Rate Valve Stem Seal
4	S-404	S-404	SA-404	SA-404	2	Rate Valve Seat Seal
5	G-202	G-202	GA-202	-	2	Metering Tube Gasket
5	-	-	-	GA-502 (Upper)	1	Metering Tube Gasket
5	-	-	-	GA-503 (Lower)	1	Metering Tube Gasket
6	-	-	-	-	1	Upper Float Stop
7	-	-	-	-	1	Metering Tube
8	-	-	-	-	1	Metering Float
9	-	-	-	-	1	Lower Float Stop
-	-	A-210	A-310	A-310	1	Metering Tube Assem. (Ref. No. 5 thru 9)
10	DA-255	DA-755	DA-255A	DA-255A	1	Remote Meter Body
11	Z-250	ZZ-250	Z-250	Z-250	2	Fitting - 3/8" OD Tube x 1/4 NPT

### NOTE:

Include Chlorinator, Sulphonator, or Ammoniator Serial Number and Capacity on Order.

**DRAWING NO. 7500**  
**Remote Meter Panel Assembly Parts List - 10 to 500 PPD**



**SECT. AA**

Ref. No.	Part No.	Quantity	Description
1	See Chart	1	Meter Tube Assembly
2	7502	1	Base Plate
3	7503	1	Bottom Block
4	7504	1	Top Block
5	7505	1	Meter Tube Plug
6	RV-831	1	Rate Valve Plug Assembly
7	See Chart	2	Top and Bottom Bushing
8	G-700	2	Top and Bottom Bushing Gasket
9	See Chart	2	Top and Bottom Meter Tube Gasket
10	S-403	2	Rate Valve Plug O-Ring
11	S-406	2	Meter Tube Plug O-Ring
12	Z-815	4	Screw, 1/4-20 x 1" Long
13	ZZ-278	1	Plug, 1/2" NPT
14	See Chart	2	Tube Fitting, Elbow (Not shown)

REF. NO.	10 PPD (200gms/hr)	25 PPD* (500gms/hr)	50 PPD (900gms/hr)	100 PPD (1900gms/hr)	250 PPD (5000gms/hr)	500 PPD (10kg/hr)
1	7501-10	7501-25	7501-50	7501-100	7501-250	7501-500
7	7521	7521	7522	7523	7509	7510
9	G-701	G-706	G-706	G-702	G-703	G-704
14	ZZ-275	ZZ-275	ZZ-275	ZZ-275	ZZ-276	ZZ-277

\*25 PPD – If purchased prior to January 2013, use Part #7522 and G-702

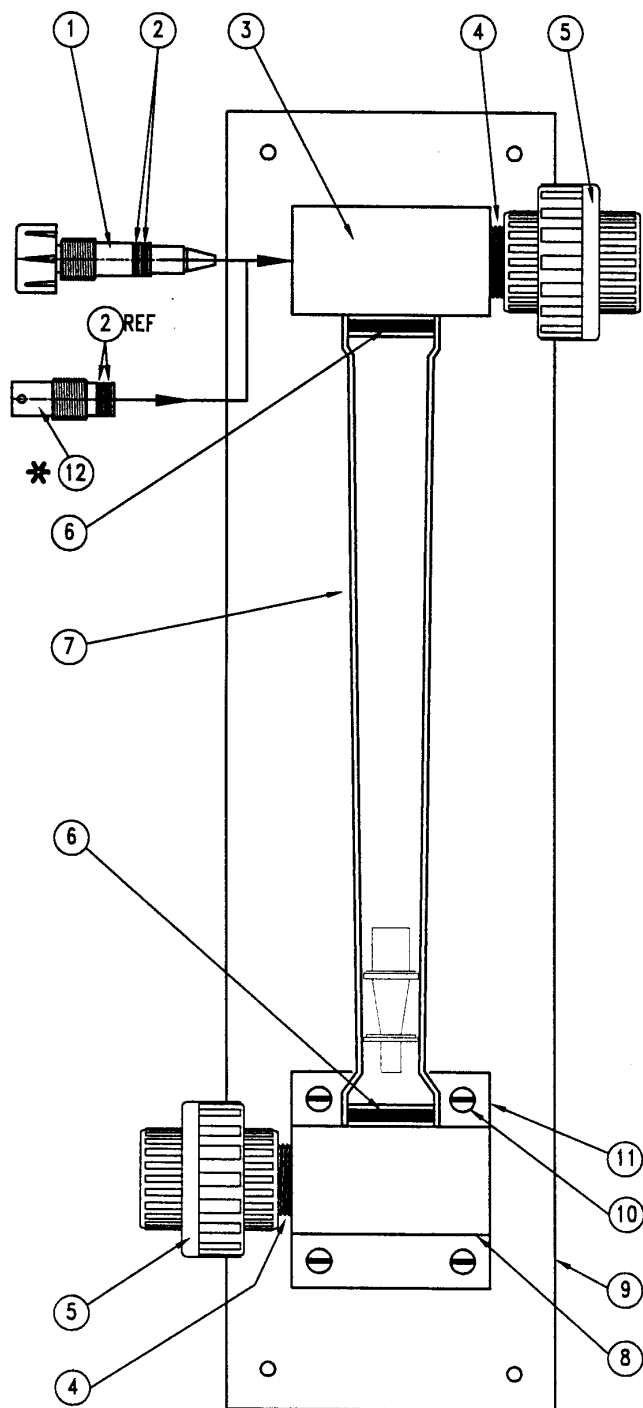
**NOTE:**

For Manual Control - ZZ-278 Plug on Top and Elbow Fitting on Side of 7504 Block.

For Automatic Control (Shown) - ZZ-278 Plug on Side and Elbow Fitting on Top of 7504 Block.

# DRAWING NO. A-2551/A-2552

## Chlorinator Remote Meter Panel Parts List - 1000/2000 PPD (20/40 Kg/Hr)



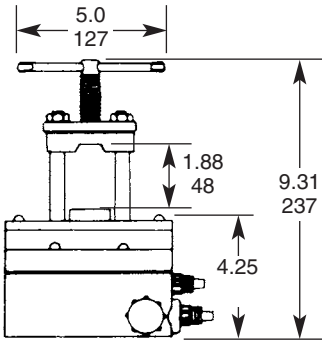
Ref. No.	Part No.	Quantity	Description
1	RV-825	1	Rate Valve Plug Assembly 1000/2000 PPD (20/40 Kg/Hr)
2	S-803	2	Rate Valve Stem Seal
3	RV-810	1	Rate Valve Seat Block
4	MS-21	2	1" NPT Close Nipple
5	MS-19	2	1" NPT Union
6	S-801	2	Metering Tube Seal
7		1	Metering Tube/Float Assembly
	A-2100		1000 PPD (20 Kg/Hr)
	A-2200		2000 PPD (40 Kg/Hr)
8	RV-814	1	Flow Meter Inlet Block
9	D-2000	1	Back Panel
10	Z-815	12	Mounting Screws For RV-810 & RV-814
11	D-2001	1	Base Plate for RV-814
12	RV-824 *	1	Rate Valve Seat Plug with (2) S-803 Seals

### NOTES:

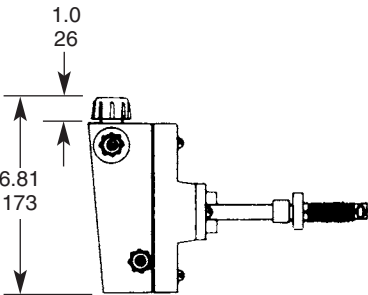
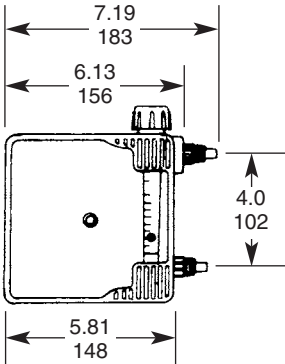
1. Include Chlorinator Serial Number and Capacity on Order.

\*2. RV-824 RV Seat Plug with (2) S-803 Seals Supplied with Smartvalve at 1000/2000 PPD Only.

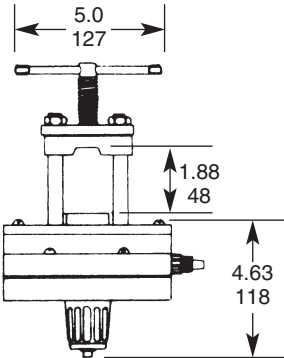




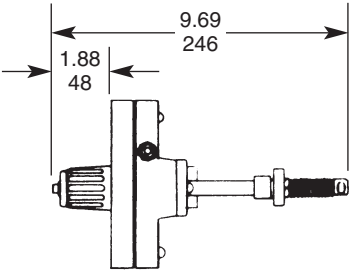
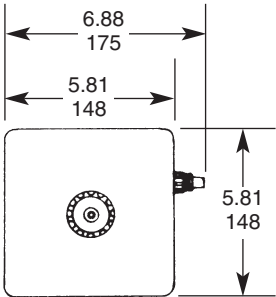
Vacuum Regulator  
Cylinder or Manifold Mounted\*



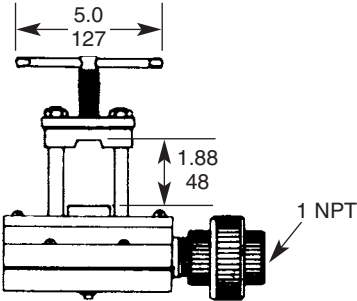
DIMENSIONS: INCHES  
MILLIMETERS



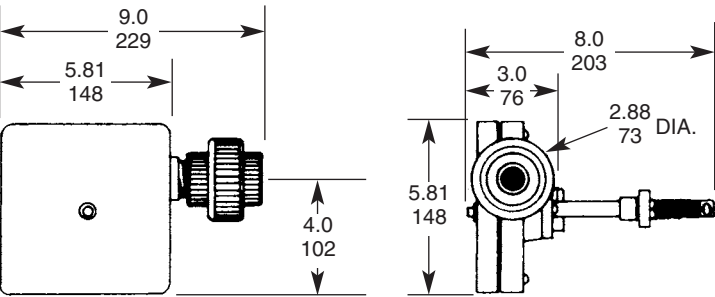
Automatic Switchover  
Vacuum Regulator  
Cylinder or Manifold Mounted\*



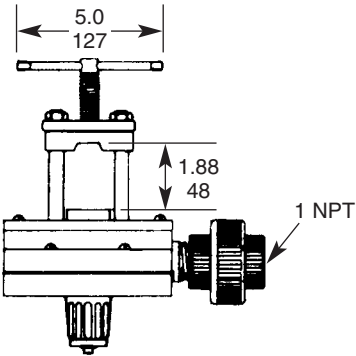
\* May be mounted on  
TAY-200  
Ton Container Adapter



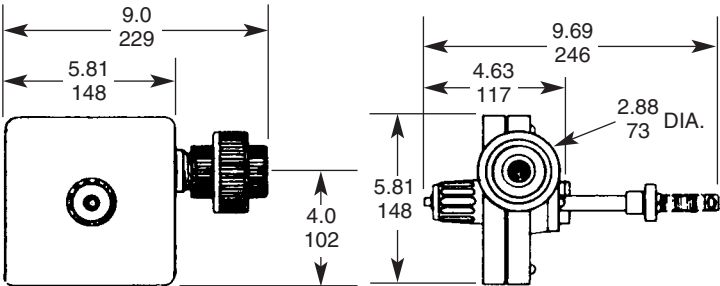
**Vacuum Regulator  
Manifold Mounted**

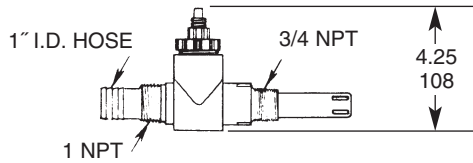
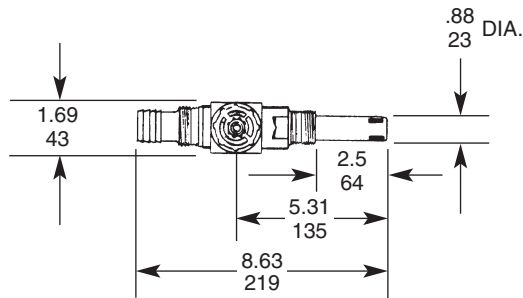


DIMENSIONS: INCHES  
MILLIMETERS

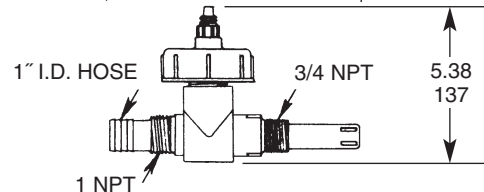
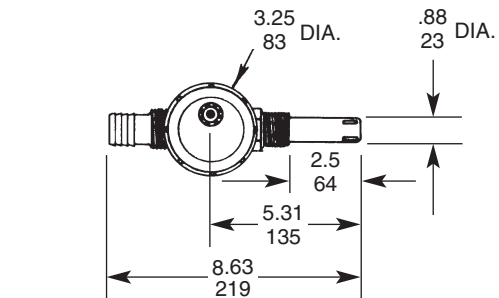


**Automatic Switchover  
Vacuum Regulator  
Manifold Mounted**



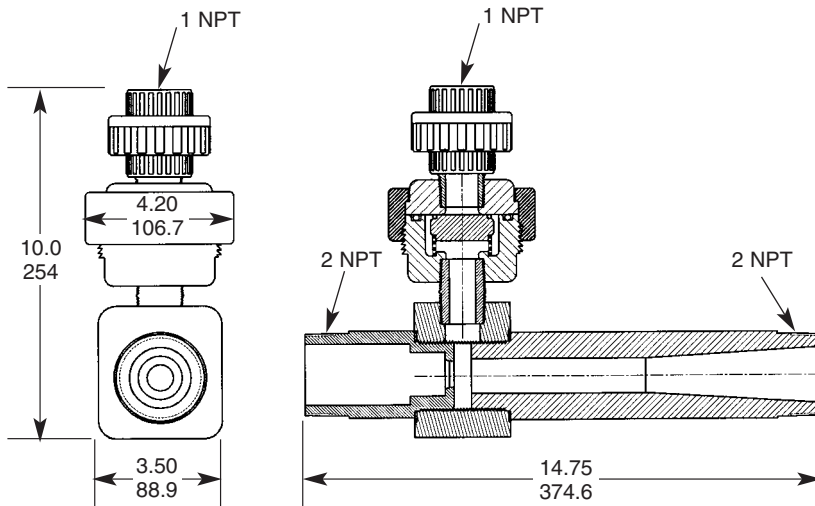


**High Pressure**  
**Up To 500 PPD (10 Kg./Hr.)**

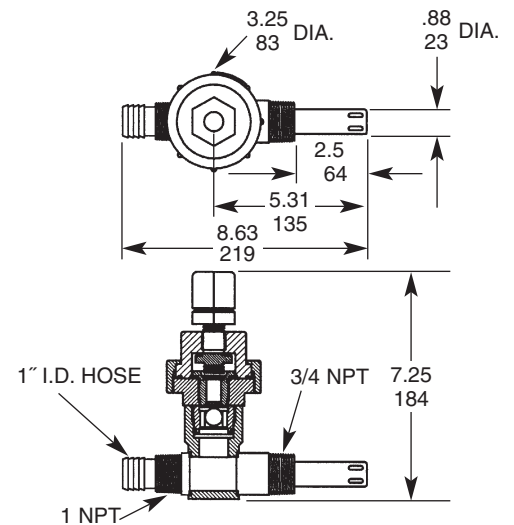


**Low Pressure**  
**Up To 500 PPD (10 Kg./Hr.)**

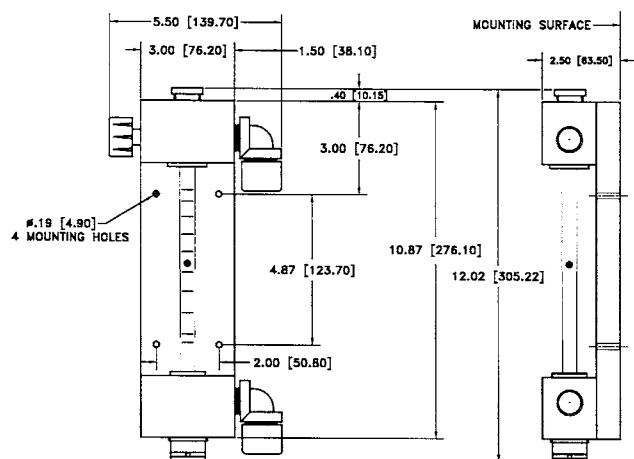
DIMENSIONS: INCHES  
MILLIMETERS



**1000/2000 PPD (20/40 Kg./Hr.)**

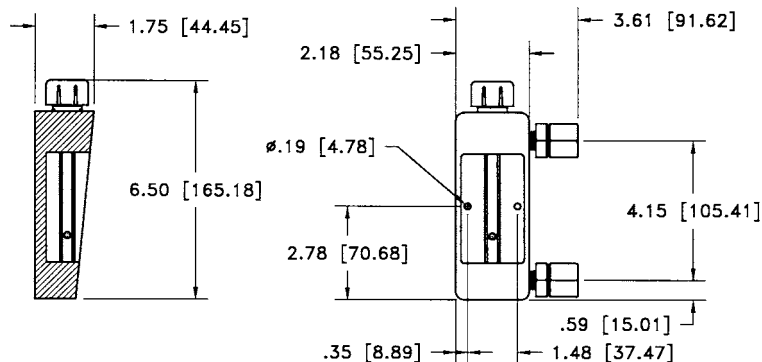


**A-950 Ejector Assembly**  
**A-949 Dual Check Valve**



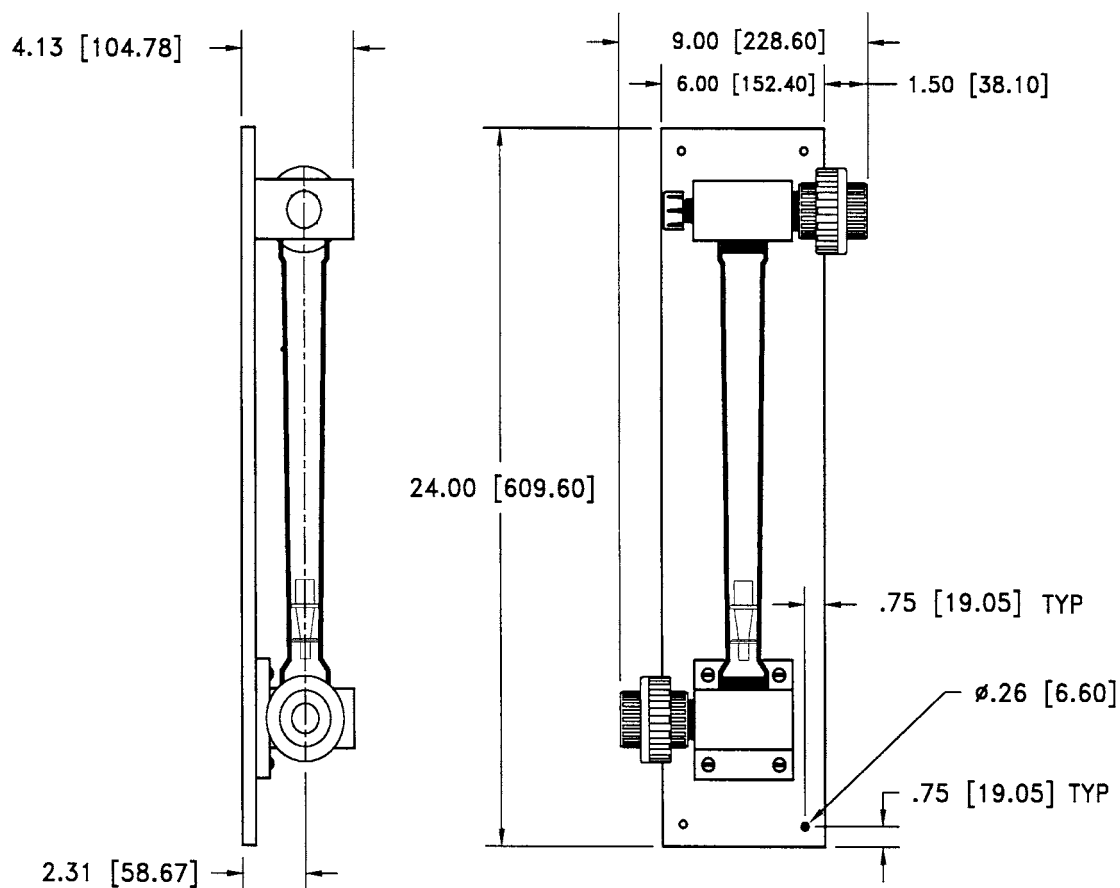
**7500**

10 PPD to 500 PPD (10 Kg./Hr.)



**A-255**

1.5 PPD to 100 PPD (2000 Gm./Hr.)



**A-2551/A-2552**

1000/2000 PPD (20/40 Kg./Hr.)

## Application Bulletin No. 1002

**IMPORTANT NOTE:** The following nozzle selection charts are for CHLORINATORS, SULPHONATORS and AMMONIATORS. When the ejectors are used on gases other than chlorine, beside material changes, a factor must be used to determine the equivalent chlorine capacity before using these charts.

Since the density of Sulfur Dioxide is essentially the same as chlorine, the nozzle sizing is the same and the charts can be used as printed.

For ammonia, multiply the capacity by 0.5 and size using the appropriate chlorinator chart.

### HYDRAULIC CONSIDERATIONS

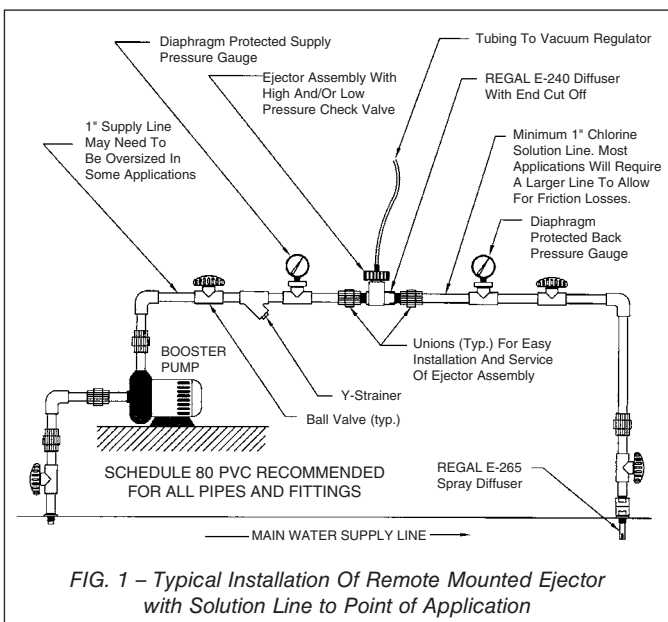
In order to achieve proper operation of the chlorinator, it is essential that you carefully identify and consider the various factors related to installation of the ejector. These hydraulic conditions (listed below) must be known in order to create sufficient vacuum to feed the desired amount of chlorine gas.

#### 1. BACKPRESSURE

- Backpressure is simply the total water pressure measured immediately downstream of the ejector outlet. In Figure 1, if a pressure gauge were to be installed between the ejector outlet and the water main, it would read the backpressure.
- Beware of "ASSUMING" the backpressure to be the same as the water system pressure. Pressures throughout a water system can vary greatly.
- Always consider the *maximum* backpressure.

#### 2. SUPPLY PRESSURE

- Supply pressure is the water pressure measured at the inlet of the ejector.
- A pressure gauge should be permanently installed in the ejector supply line, as close as possible to the ejector inlet.
- The required ejector supply pressure can be obtained from any source, as long as the minimum pressure and water flow are available (See Ejector Nozzle Requirements charts on the following pages). A booster pump must be added if necessary.



### 3. DIFFERENTIAL PRESSURE

- This is the difference in pressures between the ejector supply pressure and the backpressure. This is often referred to as the pressure "drop" across the ejector.
- The differential pressure required to properly operate the chlorinator at a particular chlorine feed rate, will vary as the backpressure increases or decreases. Generally, as backpressure increases, the required differential pressure will increase.
- Water "booster" pumps are commonly used to create a differential pressure by raising the system pressure and then passing the higher pressure water through the ejector and back into the system (See Fig. 1). However, a booster pump is not always necessary to obtain the required differential pressure.

### 4. FRICTION LOSS

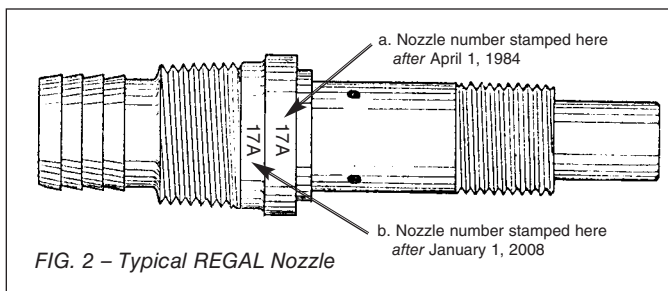
- Friction loss is a term used to describe RESISTANCE to water flowing through pipes, valves and fittings. In general, smaller pipe diameters, longer pipe length, and increased numbers of valves and fittings, will create more friction loss.
- In ejector installations, it is important to determine if any significant friction loss can occur:  
EJECTOR SUPPLY - friction loss on the water supply side of the ejector will result in *lower* water pressure available.  
BACKPRESSURE - friction loss between the ejector outlet and the point of chlorine solution injection, will create *higher* backpressure.
- Friction loss can be calculated from information found in standard books, such as Cameron's Hydraulic Data, or from tables published by pipe and fitting suppliers.

### HOW TO USE THE EJECTOR NOZZLE REQUIREMENTS CHART

The charts on the following pages represent minimum values (Ejector Supply Pressures and Water Flow Rates through the ejector) necessary to operate a REGAL Series 200 Gas Chlorinator at each maximum metering tube (rotameter) capacity, against specific backpressures.

#### THE NOZZLE (or Venturi)

The nozzle in your REGAL ejector is chosen to give you the widest range of serviceability in most standard applications at the maximum chlorine gas feed rate on the metering tube. Chlorinators has designed several different sizes of nozzles. Figure 2, below, shows the location of the stamped size designation:



#### STANDARD NOZZLE

The "Standard Nozzle" shown on each chart is the one which would be supplied with a REGAL Series 200 Gas Chlorinator based on the maximum capacity of the system. (EXAMPLE: a chlorinator with a maximum capacity of 25 PPD (500 gr./hr.) will normally be supplied with a size 5A nozzle).



## USING THE CHARTS

To find out what hydraulic conditions you need to operate the chlorinator, follow these steps:

1. a. Determine the maximum required feed rate for the system to be treated.
- b. Refer to the Maximum Chlorine Feed Rate Charts on the following pages. Select the chart for the feed rate that is next higher than your system's required maximum. Ideally, your system's requirement should be about 50% to 75% of the chlorinator's maximum feed rate. Do not select a chart for a feed rate that exactly matches your system's requirement. Use the next higher chart. With this approach, the metering ball should be in the upper half of the metering tube for most adjustments that you might have to make.

**IMPORTANT NOTE:** You may not need to feed the maximum rate of gas flow on the metering tube, but you should still use the values given for that maximum capacity.

2. Using the column headed "EJECTOR BACKPRESSURE" find the maximum backpressure for your system (see definition of "backpressure" on previous page) in English units of PSIG or Metric units of (kg/cm<sup>2</sup>).
3. Follow the backpressure line across to the first column under the heading "STANDARD NOZZLE," marked with an (\*).
4. Read the *required* minimum "EJECTOR SUPPLY PRESSURE" in PSIG or (kg/cm<sup>2</sup>) and immediately to the right of EJECTOR SUPPLY PRESSURE, read the *required minimum* "WATER FLOW RATE" in U.S. GPM or (liters/sec).
5. The difference between the Ejector Supply Pressure and the Backpressure is the required DIFFERENTIAL PRESSURE (see previous page).

Example: Using a water treatment system as in Fig. 1, with a pressure in the water main at the ejector of 60 PSIG maximum (4.21 kg/cm<sup>2</sup>) and a desired chlorine feed rate of 18 PPD.

- a. Use the 25 PPD chart.
- b. Under "EJECTOR BACKPRESSURE" locate 60 PSI (4.21 kg/cm<sup>2</sup>) and read across to the "STANDARD NOZZLE No. 5A\*" column.

- c. The EJECTOR SUPPLY PRESSURE must be at least 94 PSI (6.61 kg/cm<sup>2</sup>) and the nozzle will require at least 10.8 U.S. GPM (0.68 l/sec.) WATER FLOW.
- d. Therefore, the DIFFERENTIAL PRESSURE necessary is 34 PSI (2.40 kg/cm<sup>2</sup>) or 94 (6.61) minus 60 (4.21).
- e. In this example, a booster pump is used to take water from the system and raise (boost) the pressure at *least* 34 PSI (2.40 kg/cm<sup>2</sup>).

**NOTE:** However, if another, independent water source were available that could provide the ejector with at least 94 PSI (6.61 kg/cm<sup>2</sup>) pressure at 10.8 U.S. GPM (0.68 l/sec.) that water source could be used to operate the ejector without a booster pump.

## USING A NON-STANDARD NOZZLE

It may be necessary to use a nozzle which is not "standard" for the capacity of the chlorinator. This is usually caused when:

1. A REGAL Gas Chlorinator is replacing an older, existing gas chlorinator and available hydraulic conditions do not match the specifications for the "standard" REGAL nozzle.
2. Or, an existing booster pump is not capable of providing required water flow and/or pressure.
3. Or, the water supply and/or solution pipe may be too small compared to the flow rate for the standard nozzle. A different nozzle may require a lesser flow for a given capacity and therefore produce less friction.

In these cases, use the chart appropriate for the Maximum Chlorine Feed Rate. Find the EJECTOR BACKPRESSURE, and look across the nozzle columns to find EJECTOR SUPPLY PRESSURE and WATER FLOW RATE which the system can meet. Use the nozzle shown at the top of that column.

**NOTE:** If it does not appear that your application can meet the requirements shown, contact Chlorinators.

## REGAL EJECTOR NOZZLE REQUIREMENTS

**Maximum Chlorine Feed Rate — 4 PPD (75 Grams/Hr.)** See Note.

NOZZLE		Standard Nozzle No. 4A*		No. 3A		No. 5A		No. 17A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	7 @ 1.5	0.49 @ 0.09	5 @ 1.0	0.35 @ 0.06	7 @ 2.1	0.49 @ 0.13	6 @ 2.6	0.42 @ 0.16
10	0.70	18 @ 2.7	1.27 @ 0.17	20 @ 2.0	1.41 @ 0.13	18 @ 4.0	1.27 @ 0.25	19 @ 7.0	1.34 @ 0.44
20	1.40	33 @ 3.9	2.32 @ 0.25	37 @ 2.6	2.60 @ 0.16	33 @ 5.6	2.32 @ 0.35	35 @ 10.5	2.46 @ 0.66
30	2.10	47 @ 4.9	3.30 @ 0.31	49 @ 3.2	3.44 @ 0.20	46 @ 7.3	3.23 @ 0.46	55 @ 12.6	3.87 @ 0.79
40	2.81	64 @ 5.6	4.50 @ 0.35	66 @ 3.7	4.64 @ 0.23	63 @ 8.7	4.43 @ 0.55	74 @ 14.7	5.20 @ 0.93
50	3.51	81 @ 6.3	5.69 @ 0.40	81 @ 4.5	5.69 @ 0.28	77 @ 9.6	5.41 @ 0.61	90 @ 16.2	6.33 @ 1.02
60	4.21	96 @ 7.2	6.75 @ 0.45	97 @ 5.3	6.82 @ 0.33	91 @ 11.0	6.40 @ 0.69	104 @ 17.3	7.31 @ 1.09
70	4.92	109 @ 8.3	7.66 @ 0.52	111 @ 5.7	7.80 @ 0.36	108 @ 11.8	7.59 @ 0.74	122 @ 19.5	8.58 @ 1.23
80	5.62	126 @ 8.9	8.86 @ 0.56	125 @ 6.2	8.79 @ 0.39	122 @ 12.6	8.58 @ 0.79	137 @ 20.7	9.63 @ 1.31
90	6.32	140 @ 9.4	9.84 @ 0.59	139 @ 6.5	9.77 @ 0.41	137 @ 13.7	9.63 @ 0.86	155 @ 21.8	10.90 @ 1.38
100	7.03	154 @ 9.9	10.83 @ 0.62	151 @ 6.7	10.62 @ 0.42	150 @ 14.2	10.55 @ 0.90	173 @ 23.0	12.16 @ 1.45
110	7.73	173 @ 10.3	12.16 @ 0.65	166 @ 6.9	11.67 @ 0.44	168 @ 14.9	11.81 @ 0.94	190 @ 24.0	13.36 @ 1.51
120	8.44	188 @ 10.8	13.22 @ 0.68	182 @ 7.2	12.97 @ 0.45	184 @ 15.5	12.94 @ 0.98	209 @ 25.0	14.69 @ 1.58
130	9.14	204 @ 11.0	14.34 @ 0.69	196 @ 7.5	13.78 @ 0.47	199 @ 16.2	13.99 @ 1.02	228 @ 25.6	16.03 @ 1.61
140	9.84	220 @ 11.6	15.47 @ 0.73	211 @ 7.8	14.83 @ 0.49	213 @ 17.0	14.97 @ 1.07	245 @ 26.0	17.22 @ 1.64
150	10.55	235 @ 11.8	16.52 @ 0.74	225 @ 8.1	15.82 @ 0.51	220 @ 17.5	15.47 @ 1.10	263 @ 27.4	18.49 @ 1.73
160	11.25	245 @ 12.1	17.22 @ 0.76	—	—	242 @ 18.4	17.01 @ 1.16	284 @ 28.8	19.97 @ 1.82

\*Standard Nozzle Supplied with Chlorinator for Indicated Maximum Feed Rate. NOTE: GPM is U.S. Gallons. Metric is liters per sec. (l/sec.)

**Maximum Chlorine Feed Rate — 10 PPD (200 Grams/Hr.)** See Note.

NOZZLE		Standard Nozzle No. 4A*		No. 3A		No. 5A		No. 17A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	10 @ 1.7	0.70 @ 0.11	10 @ 1.4	0.70 @ 0.09	9 @ 2.3	0.63 @ 0.15	8 @ 3.0	0.56 @ 0.19
10	0.70	24 @ 3.3	1.69 @ 0.21	25 @ 2.3	1.76 @ 0.15	23 @ 4.5	1.62 @ 0.28	23 @ 7.3	1.62 @ 0.46
20	1.40	35 @ 4.3	2.46 @ 0.27	41 @ 2.9	2.88 @ 0.18	34 @ 6.2	2.39 @ 0.39	37 @ 10.6	2.60 @ 0.67
30	2.10	50 @ 5.0	3.52 @ 0.32	55 @ 3.5	3.87 @ 0.22	49 @ 7.7	3.44 @ 0.49	57 @ 12.8	4.01 @ 0.81
40	2.81	64 @ 5.7	4.50 @ 0.36	68 @ 3.9	4.78 @ 0.25	64 @ 8.8	4.50 @ 0.56	76 @ 14.9	5.34 @ 0.94
50	3.51	81 @ 6.6	5.69 @ 0.42	84 @ 4.3	5.91 @ 0.27	78 @ 9.7	5.48 @ 0.61	91 @ 16.4	6.40 @ 1.03
60	4.21	96 @ 7.2	6.75 @ 0.45	97 @ 4.6	6.82 @ 0.29	93 @ 10.8	6.54 @ 0.68	106 @ 17.9	7.45 @ 1.13
70	4.92	110 @ 8.0	7.73 @ 0.50	111 @ 5.0	7.80 @ 0.32	110 @ 11.7	7.73 @ 0.74	124 @ 19.7	8.72 @ 1.24
80	5.62	125 @ 8.6	8.79 @ 0.54	125 @ 5.8	8.79 @ 0.37	122 @ 12.7	8.58 @ 0.80	139 @ 20.9	9.77 @ 1.32
90	6.32	139 @ 9.2	9.77 @ 0.58	139 @ 6.4	9.77 @ 0.40	138 @ 13.7	9.70 @ 0.86	157 @ 22.0	11.04 @ 1.39
100	7.03	154 @ 9.7	10.83 @ 0.61	153 @ 6.7	10.76 @ 0.42	151 @ 14.3	10.62 @ 0.90	174 @ 23.2	12.23 @ 1.46
110	7.73	169 @ 10.2	11.88 @ 0.64	170 @ 7.1	11.95 @ 0.45	168 @ 14.9	11.81 @ 0.94	192 @ 24.2	13.50 @ 1.53
120	8.44	183 @ 10.6	12.86 @ 0.67	183 @ 7.4	12.86 @ 0.47	184 @ 15.9	12.94 @ 1.00	213 @ 25.2	14.97 @ 1.59
130	9.14	199 @ 11.3	13.99 @ 0.71	199 @ 7.7	13.99 @ 0.49	199 @ 16.3	13.99 @ 1.03	232 @ 26.2	16.31 @ 1.65
140	9.84	214 @ 11.5	15.04 @ 0.73	212 @ 7.8	14.90 @ 0.50	212 @ 17.2	14.90 @ 1.08	248 @ 27.1	17.43 @ 1.71
150	10.55	232 @ 11.9	16.31 @ 0.75	230 @ 8.0	16.17 @ 0.51	228 @ 17.5	16.03 @ 1.10	270 @ 28.3	18.98 @ 1.79
160	11.25	245 @ 12.4	17.22 @ 0.78	242 @ 8.3	17.01 @ 0.52	241 @ 18.2	16.94 @ 1.15	288 @ 29.1	20.25 @ 1.84

**Maximum Chlorine Feed Rate — 25 PPD (500 Grams/Hr.)** See Note.

NOZZLE		Standard Nozzle No. 5A*		No. 3A		No. 4A		No. 17A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	14 @ 3.1	0.98 @ 0.20	16 @ 1.7	1.12 @ 0.11	16 @ 2.4	1.12 @ 0.15	11 @ 3.4	0.77 @ 0.21
10	0.70	28 @ 5.4	1.97 @ 0.34	35 @ 2.7	2.46 @ 0.17	35 @ 3.3	2.46 @ 0.21	26 @ 7.5	1.83 @ 0.47
20	1.40	47 @ 7.5	3.30 @ 0.47	55 @ 3.5	3.87 @ 0.22	50 @ 4.9	3.52 @ 0.31	44 @ 10.8	3.09 @ 0.68
30	2.10	62 @ 8.6	4.36 @ 0.54	75 @ 4.0	5.27 @ 0.25	66 @ 5.9	4.64 @ 0.37	59 @ 12.9	4.15 @ 0.81
40	2.81	71 @ 9.2	4.99 @ 0.58	94 @ 4.5	6.61 @ 0.28	78 @ 6.5	5.48 @ 0.41	78 @ 15.1	5.48 @ 0.95
50	3.51	81 @ 9.9	5.69 @ 0.62	106 @ 4.9	7.45 @ 0.31	94 @ 7.1	6.61 @ 0.45	93 @ 16.8	6.54 @ 1.06
60	4.21	94 @ 10.8	6.61 @ 0.68	117 @ 5.2	8.23 @ 0.33	107 @ 7.6	7.52 @ 0.48	107 @ 18.2	7.52 @ 1.15
70	4.92	109 @ 12.1	7.66 @ 0.76	131 @ 5.5	9.21 @ 0.35	117 @ 8.1	8.23 @ 0.51	126 @ 20.0	8.86 @ 1.26
80	5.62	122 @ 12.7	8.58 @ 0.80	143 @ 5.8	10.05 @ 0.37	130 @ 8.6	9.14 @ 0.54	142 @ 21.0	9.98 @ 1.32
90	6.32	139 @ 13.8	9.77 @ 0.87	156 @ 6.0	10.97 @ 0.38	142 @ 9.2	9.98 @ 0.58	161 @ 22.2	11.32 @ 1.40
100	7.03	153 @ 14.4	10.76 @ 0.91	169 @ 6.3	11.88 @ 0.40	158 @ 9.8	11.11 @ 0.62	179 @ 23.5	12.58 @ 1.48
110	7.73	168 @ 15.0	11.81 @ 0.95	179 @ 6.5	12.58 @ 0.41	174 @ 10.3	12.23 @ 0.65	195 @ 24.5	13.71 @ 1.55
120	8.44	183 @ 15.9	12.86 @ 1.00	191 @ 6.6	13.43 @ 0.42	189 @ 10.8	13.29 @ 0.68	215 @ 25.5	15.11 @ 1.61
130	9.14	199 @ 16.3	13.99 @ 1.03	204 @ 6.9	14.34 @ 0.44	204 @ 11.3	14.34 @ 0.71	235 @ 26.5	16.52 @ 1.67
140	9.84	214 @ 17.0	15.04 @ 1.07	220 @ 7.1	15.47 @ 0.45	220 @ 11.6	15.47 @ 0.73	252 @ 27.3	17.72 @ 1.72
150	10.55	220 @ 17.5	15.47 @ 1.10	235 @ 7.4	16.52 @ 0.47	235 @ 11.9	16.52 @ 0.75	273 @ 28.5	19.19 @ 1.80
160	11.25	233 @ 18.4	16.38 @ 1.16	256 @ 7.7	18.00 @ 0.49	250 @ 12.4	17.58 @ 0.78	291 @ 29.4	20.46 @ 1.85

**Maximum Chlorine Feed Rate — 50 PPD (900 Grams/Hr.)** See Note.

NOZZLE		Standard Nozzle No. 17A*		No. 3A		No. 4A		No. 5A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	15 @ 5.0	1.05 @ 0.32	23 @ 2.2	1.62 @ 0.14	26 @ 3.4	1.83 @ 0.21	17 @ 3.8	1.20 @ 0.24
10	0.70	29 @ 7.8	2.04 @ 0.49	56 @ 3.5	3.94 @ 0.22	57 @ 5.5	4.01 @ 0.35	38 @ 6.6	2.67 @ 0.42
20	1.40	45 @ 11.0	3.16 @ 0.69	85 @ 4.3	5.98 @ 0.27	86 @ 6.9	6.05 @ 0.44	63 @ 8.6	4.43 @ 0.54
30	2.10	61 @ 13.0	4.29 @ 0.82	108 @ 4.8	7.59 @ 0.30	111 @ 7.8	7.80 @ 0.49	83 @ 10.0	5.83 @ 0.63
40	2.81	80 @ 15.3	5.62 @ 0.97	126 @ 5.4	8.86 @ 0.34	133 @ 8.9	9.35 @ 0.56	101 @ 11.2	7.10 @ 0.71
50	3.51	97 @ 17.0	6.82 @ 1.07	146 @ 5.8	10.26 @ 0.37	147 @ 9.5	10.33 @ 0.60	112 @ 12.5	7.87 @ 0.79
60	4.21	109 @ 18.5	7.66 @ 1.17	167 @ 6.2	11.74 @ 0.39	170 @ 10.0	11.95 @ 0.63	122 @ 12.8	8.58 @ 0.81
70	4.92	129 @ 20.3	9.07 @ 1.28	189 @ 6.5	13.29 @ 0.41	187 @ 10.3	13.15 @ 0.65	136 @ 13.6	9.56 @ 0.86
80	5.62	144 @ 21.3	10.12 @ 1.34	208 @ 6.8	14.62 @ 0.43	199 @ 11.0	13.99 @ 0.69	152 @ 14.3	10.69 @ 0.90
90	6.32	164 @ 22.5	11.53 @ 1.42	225 @ 7.2	15.82 @ 0.45	213 @ 11.4	14.97 @ 0.72	166 @ 15.0	11.67 @ 0.95
100	7.03	182 @ 23.7	12.79 @ 1.49	240 @ 7.6	16.87 @ 0.48	228 @ 11.6	16.03 @ 0.73	173 @ 15.3	12.16 @ 0.97
110	7.73	199 @ 24.7	13.99 @ 1.56	261 @ 7.9	18.35 @ 0.50	232 @ 12.0	16.31 @ 0.76	183 @ 15.9	12.86 @ 1.00
120	8.44	218 @ 25.9	15.33 @ 1.63	272 @ 8.3	19.12 @ 0.52	255 @ 12.5	17.93 @ 0.79	191 @ 16.1	13.43 @ 1.02
130	9.14	238 @ 26.9	16.73 @ 1.70	293 @ 8.5	20.60 @ 0.54	265 @ 12.6	18.63 @ 0.80	206 @ 16.7	14.48 @ 1.05
140	9.84	256 @ 27.7	18.00 @ 1.75	—	—	272 @ 12.8	19.12 @ 0.81	221 @ 17.4	15.54 @ 1.10
150	10.55	277 @ 28.9	19.47 @ 1.82	—	—	285 @ 13.1	20.04 @ 0.83	233 @ 18.0	16.38 @ 1.14
160	11.25	295 @ 29.8	20.74 @ 1.88	—	—	—	—	248 @ 18.5	17.43 @ 1.17

\*Standard Nozzle Supplied with Chlorinator for Indicated Maximum Feed Rate. NOTE: GPM is U.S. Gallons. Metric is liters per sec. (l/sec.)

# Maximum Chlorine Feed Rate — 100 PPD (2000 Grams/Hr.) See Note.

NOZZLE		Standard Nozzle No. 17A*		No. 3A		No. 4A		No. 5A		No. 18A	
EJECTOR BACK-PRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	23 @ 7.4	1.62 @ 0.47	59 @ 3.6	4.15 @ 0.23	50 @ 5.1	3.52 @ 0.32	27 @ 5.1	1.90 @ 0.32	19 @ 9.1	1.34 @ 0.57
10	0.70	43 @ 10.0	3.02 @ 0.63	100 @ 4.7	7.03 @ 0.30	108 @ 7.8	7.59 @ 0.49	57 @ 8.4	4.01 @ 0.53	35 @ 11.2	2.46 @ 0.71
20	1.40	57 @ 12.1	4.01 @ 0.76	148 @ 5.8	10.40 @ 0.37	165 @ 9.7	11.60 @ 0.61	93 @ 10.8	6.54 @ 0.68	50 @ 13.8	3.52 @ 0.87
30	2.10	70 @ 13.5	4.92 @ 0.85	188 @ 6.5	13.22 @ 0.41	213 @ 11.3	14.97 @ 0.71	119 @ 12.8	8.37 @ 0.81	64 @ 15.7	4.50 @ 0.99
40	2.81	84 @ 15.5	5.91 @ 0.98	242 @ 7.3	17.01 @ 0.46	251 @ 12.4	17.65 @ 0.78	143 @ 14.0	10.05 @ 0.88	76 @ 17.2	5.34 @ 1.08
50	3.51	101 @ 17.3	7.10 @ 1.09	268 @ 7.9	18.84 @ 0.50	285 @ 13.0	20.04 @ 0.82	169 @ 15.1	11.88 @ 0.95	90 @ 19.6	6.33 @ 1.24
60	4.21	113 @ 18.9	7.94 @ 1.19	—	—	—	—	188 @ 16.1	13.22 @ 1.02	106 @ 21.3	7.45 @ 1.34
70	4.92	132 @ 20.6	9.28 @ 1.30	—	—	—	—	202 @ 16.7	14.20 @ 1.05	120 @ 23.2	8.44 @ 1.46
80	5.62	146 @ 21.8	10.26 @ 1.38	—	—	—	—	220 @ 17.4	15.47 @ 1.10	137 @ 24.7	9.63 @ 1.56
90	6.32	167 @ 23.0	11.74 @ 1.45	—	—	—	—	236 @ 18.2	16.59 @ 1.15	153 @ 26.4	10.76 @ 1.67
100	7.03	185 @ 24.0	13.01 @ 1.51	—	—	—	—	261 @ 19.3	18.35 @ 1.22	168 @ 27.6	11.81 @ 1.74
110	7.73	202 @ 25.0	14.20 @ 1.58	—	—	—	—	279 @ 19.9	19.61 @ 1.26	183 @ 28.7	12.86 @ 1.81
120	8.44	220 @ 26.1	15.47 @ 1.65	—	—	—	—	295 @ 20.5	20.74 @ 1.29	202 @ 30.1	14.20 @ 1.90
130	9.14	241 @ 27.1	16.94 @ 1.71	—	—	—	—	—	—	218 @ 31.3	15.33 @ 1.97
140	9.84	260 @ 28.2	18.28 @ 1.78	—	—	—	—	—	—	235 @ 32.5	16.52 @ 2.05
150	10.55	281 @ 29.0	19.75 @ 1.83	—	—	—	—	—	—	251 @ 33.4	17.65 @ 2.11
160	11.25	298 @ 29.9	20.95 @ 1.89	—	—	—	—	—	—	272 @ 33.7	19.12 @ 2.13

# Maximum Chlorine Feed Rate — 200 PPD (4000 Grams/Hr.) See Note.

# Maximum Chlorine Feed Rate — 250 PPD (4900 Grams/Hr.) See Note.

NOZZLE		Standard Nozzle No. 18A*		No. 17A		No. 50X		Standard Nozzle No. 18A*		No. 50X	
EJECTOR BACK-PRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	26 @ 9.3	1.83 @ 0.59	27 @ 7.8	1.90 @ 0.49	22 @ 8.6	1.55 @ 0.54	50 @ 13.4	3.52 @ 0.85	27 @ 11.5	1.90 @ 0.73
10	0.70	51 @ 13.8	3.59 @ 0.87	58 @ 12.4	4.08 @ 0.78	34 @ 12.7	2.39 @ 0.80	70 @ 15.9	4.92 @ 1.00	37 @ 13.8	2.60 @ 0.87
20	1.40	67 @ 16.2	4.71 @ 1.02	80 @ 14.3	5.62 @ 0.90	47 @ 15.5	3.30 @ 0.98	92 @ 18.1	6.47 @ 1.14	49 @ 16.1	3.44 @ 1.02
30	2.10	83 @ 18.4	5.83 @ 1.16	96 @ 16.1	6.75 @ 1.02	67 @ 19.3	4.71 @ 1.22	103 @ 19.8	7.24 @ 1.25	68 @ 19.5	4.78 @ 1.23
40	2.81	97 @ 20.2	6.82 @ 0.27	107 @ 17.3	7.52 @ 1.09	88 @ 22.4	6.19 @ 1.41	118 @ 21.8	8.03 @ 1.38	89 @ 22.7	6.26 @ 1.43
50	3.51	110 @ 21.8	7.73 @ 1.38	123 @ 18.9	8.65 @ 1.19	109 @ 25.3	7.66 @ 1.60	130 @ 23.9	9.14 @ 1.51	109 @ 25.3	7.66 @ 1.60
60	4.21	124 @ 23.5	8.72 @ 1.48	138 @ 20.1	9.70 @ 1.27	130 @ 27.9	9.14 @ 1.76	143 @ 25.1	10.05 @ 1.58	130 @ 27.9	9.14 @ 1.76
70	4.92	135 @ 24.4	9.49 @ 1.54	147 @ 21.0	10.33 @ 1.32	148 @ 29.9	10.40 @ 1.89	158 @ 25.9	11.11 @ 1.63	148 @ 29.9	10.40 @ 1.89
80	5.62	147 @ 25.5	10.33 @ 1.61	163 @ 22.1	11.46 @ 1.39	169 @ 31.9	11.88 @ 2.01	172 @ 27.3	12.09 @ 1.72	169 @ 31.9	11.88 @ 2.01
90	6.32	160 @ 26.7	11.25 @ 1.68	176 @ 23.4	12.37 @ 1.48	192 @ 34.5	13.50 @ 2.18	183 @ 28.5	12.86 @ 1.80	192 @ 34.5	13.50 @ 2.18
100	7.03	173 @ 27.8	12.16 @ 1.75	193 @ 24.4	13.57 @ 1.54	210 @ 36.8	14.76 @ 2.32	195 @ 29.1	13.71 @ 1.84	210 @ 36.8	14.76 @ 2.32
110	7.73	190 @ 28.9	13.36 @ 1.82	209 @ 25.5	14.69 @ 1.61	228 @ 38.5	16.03 @ 2.43	211 @ 30.2	14.83 @ 1.91	228 @ 38.5	16.03 @ 2.43
120	8.44	207 @ 30.1	14.55 @ 1.90	228 @ 26.3	16.03 @ 1.66	—	—	214 @ 31.0	15.04 @ 1.96	—	—
130	9.14	222 @ 31.3	15.61 @ 1.97	245 @ 27.3	17.22 @ 1.72	—	—	238 @ 31.9	16.73 @ 2.01	—	—
140	9.84	239 @ 32.4	16.80 @ 2.04	267 @ 28.4	18.77 @ 1.79	—	—	253 @ 33.3	17.79 @ 2.10	—	—
150	10.55	255 @ 33.4	17.93 @ 2.11	288 @ 29.2	20.25 @ 1.84	—	—	272 @ 34.3	19.12 @ 2.16	—	—
160	11.25	275 @ 34.5	19.33 @ 2.18	306 @ 30.2	21.51 @ 1.91	—	—	288 @ 35.6	20.25 @ 2.25	—	—

# Maximum Chlorine Feed Rate — 500 PPD (10 Kg./Hr.) See Note.

NOZZLE		Standard Nozzle No. 50X*	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	72 @ 20.7	5.06 @ 1.31
10	0.70	89 @ 23.1	6.26 @ 1.46
20	1.40	97 @ 24.1	6.82 @ 1.52
30	2.10	105 @ 25.2	7.38 @ 1.59
40	2.81	113 @ 26.3	7.94 @ 1.66
50	3.51	125 @ 27.3	8.79 @ 1.72
60	4.21	138 @ 29.0	9.70 @ 1.83
70	4.92	155 @ 31.5	10.90 @ 1.99
80	5.62	173 @ 32.2	12.16 @ 2.03
90	6.32	192 @ 34.5	13.50 @ 2.18
100	7.03	210 @ 36.8	14.76 @ 2.32
110	7.73	228 @ 38.5	16.03 @ 2.43

\*Standard Nozzle Supplied with Chlorinator for Indicated Maximum Feed Rate. NOTE: GPM is U.S. Gallons. Metric is liters per sec. (l/sec.)

# Maximum Chlorine Feed Rate — 4 PPD (75 Grams/Hr.) See Note.

NOZZLE		No. 13A		No. 14A		No. 15A		No. 16A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	5 @ 1.0	.352 @ .063	4 @ 1.3	.281 @ .098	2 @ 1.9	0.14 @ .120	3 @ 2.2	.211 @ .139
10	0.70	22 @ 1.9	1.55 @ .120	18 @ 2.8	1.27 @ .212	24 @ 4.0	1.69 @ .252	20 @ 4.7	1.41 @ .297
20	1.40	32 @ 2.5	2.25 @ .158	31 @ 3.3	2.18 @ .250	41 @ 4.9	2.88 @ .309	36 @ 6.2	2.53 @ .391
30	2.10	46 @ 3.0	3.23 @ .189	47 @ 3.9	3.30 @ .295	58 @ 5.7	4.08 @ .360	56 @ 7.5	3.94 @ .473
40	2.81	61 @ 3.5	4.29 @ .221	62 @ 4.5	4.36 @ .341	74 @ 6.4	5.20 @ .403	74 @ 8.5	5.20 @ .536
50	3.51	77 @ 3.8	5.41 @ .240	77 @ 5.0	5.41 @ .379	91 @ 7.0	6.40 @ .442	87 @ 9.6	6.12 @ .606
60	4.21	90 @ 4.2	6.33 @ .259	92 @ 5.4	6.47 @ .409	107 @ 7.7	7.52 @ .486	104 @ 10.6	7.31 @ .669
70	4.92	106 @ 4.5	7.45 @ .284	106 @ 5.8	7.45 @ .439	124 @ 8.2	8.72 @ .517	120 @ 11.3	8.44 @ .713
80	5.62	120 @ 4.6	8.44 @ .290	120 @ 6.1	8.44 @ .462	141 @ 8.7	9.91 @ .549	138 @ 12.0	9.70 @ .757
90	6.32	134 @ 4.9	9.42 @ .309	135 @ 6.5	9.49 @ .492	158 @ 9.2	11.11 @ .580	155 @ 12.7	10.90 @ .801
100	7.03	149 @ 5.1	10.48 @ .322	150 @ 6.7	10.55 @ .508	173 @ 9.7	12.16 @ .612	171 @ 13.3	12.02 @ .839
110	7.73	162 @ 5.3	11.40 @ .334	164 @ 7.1	11.53 @ .538	188 @ 10.1	13.22 @ .637	188 @ 13.9	13.22 @ .877
120	8.44	178 @ 5.6	12.51 @ .353	179 @ 7.5	12.58 @ .568	205 @ 10.5	14.41 @ .662	205 @ 14.5	14.41 @ .915
130	9.14	192 @ 5.8	13.50 @ .366	192 @ 7.7	13.50 @ .583	222 @ 10.9	15.61 @ .688	221 @ 14.9	15.54 @ .940
140	9.84	207 @ 6.0	14.55 @ .379	208 @ 8.1	14.62 @ .614	238 @ 11.3	16.73 @ .713	238 @ 15.6	16.73 @ .984
150	10.55	222 @ 6.2	15.61 @ .391	223 @ 8.4	15.68 @ .636	255 @ 11.7	17.93 @ .738	254 @ 16.0	17.86 @ 1.01
160	11.25	236 @ 6.4	16.59 @ .404	237 @ 8.6	16.66 @ .652	270 @ 12.0	18.98 @ .757	270 @ 16.5	18.98 @ 1.04

# Maximum Chlorine Feed Rate — 10 PPD (200 Grams/Hr.) See Note.

NOZZLE		No. 13A		No. 14A		No. 15A		No. 16A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	10 @ 1.2	.703 @ .076	6 @ 1.7	.422 @ .107	4 @ 2.1	0.28 @ .132	5 @ 2.8	.352 @ .177
10	0.70	26 @ 2.3	1.83 @ .139	21 @ 2.7	1.48 @ .170	24 @ 3.8	1.69 @ .240	20 @ 4.9	1.41 @ .309
20	1.40	39 @ 2.7	2.74 @ .170	32 @ 3.3	2.53 @ .208	40 @ 4.8	2.81 @ .303	39 @ 6.7	2.74 @ .423
30	2.10	50 @ 3.1	3.52 @ .196	52 @ 4.0	3.94 @ .252	58 @ 5.7	4.08 @ .360	55 @ 7.8	3.87 @ .492
40	2.81	62 @ 3.5	4.36 @ .221	62 @ 4.5	4.78 @ .284	74 @ 6.3	5.20 @ .397	74 @ 9.0	5.20 @ .568
50	3.51	76 @ 3.8	5.34 @ .240	78 @ 5.0	5.91 @ .315	91 @ 7.0	6.40 @ .442	87 @ 10.2	6.12 @ .644
60	4.21	90 @ 4.2	6.33 @ .265	92 @ 5.4	7.03 @ .341	108 @ 7.6	7.59 @ .480	103 @ 11.2	7.24 @ .707
70	4.92	104 @ 4.5	7.31 @ .284	108 @ 5.8	8.16 @ .366	124 @ 8.2	8.72 @ .517	120 @ 11.8	8.44 @ .744
80	5.62	118 @ 4.8	8.30 @ .303	121 @ 6.1	9.28 @ .385	140 @ 8.7	9.84 @ .549	138 @ 12.6	9.70 @ .795
90	6.32	132 @ 5.1	9.28 @ .322	136 @ 6.4	10.48 @ .404	157 @ 9.2	11.04 @ .580	155 @ 13.2	10.90 @ .833
100	7.03	147 @ 5.3	10.34 @ .334	151 @ 6.8	11.39 @ .429	174 @ 9.7	12.23 @ .612	172 @ 13.8	12.09 @ .871
110	7.73	161 @ 5.5	11.32 @ .347	167 @ 7.1	12.51 @ .448	189 @ 10.1	13.29 @ .637	188 @ 14.5	13.22 @ .915
120	8.44	175 @ 6.0	12.30 @ .379	180 @ 7.4	13.57 @ .467	206 @ 10.5	14.48 @ .662	205 @ 15.0	14.41 @ .946
130	9.14	188 @ 6.2	13.22 @ .391	195 @ 7.7	14.69 @ .486	222 @ 10.8	15.61 @ .681	222 @ 15.6	15.61 @ .984
140	9.84	204 @ 6.4	14.34 @ .404	209 @ 8.0	15.82 @ .505	238 @ 11.3	16.73 @ .715	239 @ 16.2	16.80 @ 1.02
150	10.55	217 @ 6.6	15.26 @ .416	224 @ 8.3	16.87 @ .523	254 @ 11.6	17.86 @ .732	256 @ 16.7	18.00 @ 1.05
160	11.25	230 @ 6.8	16.17 @ .429	238 @ 8.6	18.00 @ .543	269 @ 12.0	18.91 @ .757	272 @ 17.2	19.12 @ 1.09

# Maximum Chlorine Feed Rate — 25 PPD (500 Grams/Hr.) See Note.

NOZZLE		No. 13A		No. 14A		No. 15A		No. 16A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	15 @ 1.6	1.05 @ .101	11 @ 2.2	.773 @ .139	6 @ 2.2	0.42 @ .139	7 @ 2.7	.492 @ .170
10	0.70	38 @ 2.7	2.67 @ .170	28 @ 3.0	1.97 @ .221	24 @ 3.8	1.69 @ .240	23 @ 5.0	1.62 @ .315
20	1.40	60 @ 3.3	4.22 @ .208	42 @ 3.7	2.95 @ .271	36 @ 4.6	2.53 @ .290	38 @ 6.1	2.67 @ .385
30	2.10	76 @ 3.6	5.34 @ .227	55 @ 4.2	3.87 @ .303	53 @ 5.4	3.73 @ .341	55 @ 7.5	3.87 @ .473
40	2.81	83 @ 4.0	6.19 @ .252	66 @ 4.9	4.64 @ .328	69 @ 6.1	4.85 @ .385	73 @ 8.6	5.13 @ .543
50	3.51	100 @ 4.4	7.03 @ .265	78 @ 5.2	5.48 @ .353	87 @ 6.8	6.12 @ .429	90 @ 9.5	6.33 @ .599
60	4.21	103 @ 4.4	7.80 @ .278	93 @ 5.7	6.54 @ .379	103 @ 7.4	7.24 @ .467	105 @ 10.3	7.38 @ .650
70	4.92	114 @ 4.6	8.44 @ .290	108 @ 6.1	7.59 @ .404	118 @ 8.0	8.30 @ .505	123 @ 11.2	8.65 @ .707
80	5.62	125 @ 4.8	9.35 @ .303	122 @ 6.5	8.58 @ .423	135 @ 8.5	9.49 @ .536	139 @ 12.0	9.77 @ .757
90	6.32	139 @ 5.4	10.05 @ .328	138 @ 6.8	9.70 @ .454	153 @ 9.0	10.76 @ .568	156 @ 12.6	10.97 @ .795
100	7.03	154 @ 5.6	10.83 @ .353	152 @ 7.3	10.69 @ .473	168 @ 9.5	11.81 @ .599	172 @ 13.2	12.09 @ .833
110	7.73	167 @ 5.8	11.74 @ .366	168 @ 7.7	11.81 @ .498	184 @ 9.8	12.94 @ .618	189 @ 13.9	13.29 @ .877
120	8.44	179 @ 6.1	12.58 @ .385	182 @ 7.9	12.80 @ .524	201 @ 10.3	14.13 @ .650	206 @ 14.4	14.48 @ .908
130	9.14	193 @ 6.3	13.57 @ .397	200 @ 8.3	14.06 @ .543	217 @ 10.8	15.26 @ .681	223 @ 15.0	15.68 @ .946
140	9.84	207 @ 6.5	14.55 @ .410	209 @ 8.5	14.69 @ .562	233 @ 11.2	16.38 @ .707	240 @ 15.6	16.87 @ .984
150	10.55	222 @ 6.7	15.61 @ .423	224 @ 8.8	15.75 @ .580	250 @ 11.5	17.58 @ .726	257 @ 16.1	18.07 @ 1.02
160	11.25	236 @ 6.9	16.59 @ .435	239 @ 9.1	16.80 @ .599	266 @ 11.8	18.70 @ .744	273 @ 16.6	19.19 @ 1.05

\*Standard Nozzle Supplied with Chlorinator for Indicated Maximum Feed Rate. NOTE: GPM is U.S. Gallons. Metric is liters per sec. (l/sec.)

## Maximum Chlorine Feed Rate — 50 PPD (900 Grams/Hr.) See Note.

NOZZLE		No. 13A		No. 14A		No. 15A		No. 16A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	29 @ 2.4	2.04 @ .151	10 @ 3.1	1.69 @ .196	13 @ 3.1	0.84 @ .196	13 @ 3.7	.914 @ .233
10	0.70	65 @ 3.5	4.57 @ .221	45 @ 4.2	3.16 @ .265	39 @ 4.8	2.74 @ .303	31 @ 5.8	2.18 @ .366
20	1.40	95 @ 4.1	6.68 @ .259	63 @ 4.8	4.43 @ .303	53 @ 5.5	3.73 @ .347	47 @ 6.9	3.30 @ .435
30	2.10	111 @ 4.6	7.80 @ .290	80 @ 5.4	5.62 @ .341	68 @ 6.1	4.79 @ .385	59 @ 7.7	4.15 @ .486
40	2.81	125 @ 4.9	8.79 @ .309	94 @ 5.8	6.61 @ .366	82 @ 6.7	5.77 @ .423	73 @ 8.6	5.13 @ .543
50	3.51	138 @ 5.5	9.70 @ .353	108 @ 6.2	7.59 @ .391	95 @ 7.4	6.68 @ .467	89 @ 9.6	6.26 @ .606
60	4.21	150 @ 5.7	10.55 @ .360	120 @ 6.5	8.44 @ .410	108 @ 7.9	7.59 @ .498	106 @ 10.4	7.45 @ .656
70	4.92	161 @ 5.9	11.32 @ .372	132 @ 6.8	9.28 @ .429	125 @ 8.4	8.79 @ .530	123 @ 11.2	8.65 @ .707
80	5.62	172 @ 6.1	12.09 @ .385	143 @ 7.2	10.05 @ .454	142 @ 8.9	9.98 @ .562	140 @ 12.1	9.84 @ .763
90	6.32	185 @ 6.2	13.00 @ .391	155 @ 7.4	10.90 @ .467	158 @ 9.4	11.11 @ .593	158 @ 12.7	11.11 @ .801
100	7.03	192 @ 6.4	13.50 @ .404	166 @ 7.6	11.67 @ .479	174 @ 9.8	12.23 @ .618	174 @ 13.3	12.23 @ .839
110	7.73	205 @ 6.5	14.41 @ .410	176 @ 7.9	12.37 @ .498	190 @ 10.3	13.36 @ .650	191 @ 13.9	13.43 @ .877
120	8.44	215 @ 6.6	15.12 @ .416	190 @ 8.1	13.36 @ .511	206 @ 10.7	14.48 @ .675	207 @ 14.6	14.55 @ .921
130	9.14	224 @ 6.8	15.75 @ .429	203 @ 8.4	14.27 @ .536	223 @ 11.2	15.68 @ .707	224 @ 15.1	15.75 @ .953
140	9.84	236 @ 7.0	16.59 @ .442	214 @ 8.6	15.05 @ .543	240 @ 11.5	16.87 @ .726	241 @ 15.6	16.94 @ .984
150	10.55	248 @ 7.1	17.44 @ .448	228 @ 8.8	16.03 @ .568	255 @ 11.7	17.93 @ .738	257 @ 16.1	18.07 @ 1.02
160	11.25	260 @ 7.2	18.28 @ .461	241 @ 9.2	16.94 @ .593	271 @ 12.2	19.05 @ .770	275 @ 16.6	19.33 @ 1.05

## Maximum Chlorine Feed Rate — 100 PPD (2000 Grams/Hr.) See Note.

NOZZLE		No. 13A		No. 14A		No. 15A		No. 16A	
EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate		REQUIRED Ejector Supply Pressure and Water Flow Rate	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.	PSIG @ GPM	kg/cm <sup>2</sup> @ l/sec.
0	0	55 @ 3.6	3.87 @ .227	48 @ 4.2	3.37 @ .265	31 @ 4.3	2.18 @ .271	22 @ 5.2	1.55 @ .328
10	0.70	102 @ 4.4	7.17 @ .278	76 @ 5.3	5.34 @ .334	58 @ 5.6	4.08 @ .353	49 @ 7.5	3.45 @ .473
20	1.40	136 @ 5.0	10.55 @ .315	100 @ 6.0	7.03 @ .379	75 @ 6.4	5.27 @ .404	69 @ 8.8	4.85 @ .555
30	2.10	162 @ 5.4	12.73 @ .341	118 @ 6.4	8.30 @ .404	92 @ 7.1	6.47 @ .448	85 @ 9.7	5.98 @ .612
40	2.81	181 @ 5.6	14.48 @ .353	136 @ 6.8	9.56 @ .429	108 @ 7.7	7.59 @ .486	101 @ 10.5	7.10 @ .662
50	3.51	198 @ 5.9	15.90 @ .366	153 @ 7.3	10.76 @ .461	122 @ 8.1	8.58 @ .511	116 @ 11.2	8.16 @ .707
60	4.21	216 @ 6.1	17.15 @ .385	168 @ 7.7	11.81 @ .486	136 @ 8.6	9.56 @ .543	128 @ 11.8	9.00 @ .744
70	4.92	230 @ 6.4	18.14 @ .404	185 @ 8.0	13.01 @ .505	151 @ 8.9	10.62 @ .562	139 @ 12.3	9.77 @ .776
80	5.62	244 @ 6.6	19.76 @ .416	201 @ 8.3	14.13 @ .524	165 @ 9.3	11.60 @ .587	150 @ 12.8	10.55 @ .808
90	6.32	258 @ 6.7	20.67 @ .429	213 @ 8.5	14.98 @ .536	180 @ 9.8	12.66 @ .618	164 @ 13.4	11.53 @ .845
100	7.03	269 @ 7.0	21.58 @ .435	222 @ 8.8	15.61 @ .555	193 @ 10.1	13.57 @ .637	180 @ 14.0	12.66 @ .883
110	7.73	—	—	232 @ 9.0	16.31 @ .568	207 @ 10.4	14.55 @ .656	195 @ 14.5	13.71 @ .915
120	8.44	—	—	247 @ 9.2	17.37 @ .580	221 @ 10.8	15.54 @ .681	212 @ 15.0	14.91 @ .946
130	9.14	—	—	260 @ 9.5	18.28 @ .599	236 @ 11.2	16.59 @ .706	227 @ 15.5	15.96 @ .978
140	9.84	—	—	273 @ 9.6	19.19 @ .618	250 @ 11.5	17.58 @ .726	245 @ 16.2	17.23 @ 1.02
150	10.55	—	—	284 @ 9.8	19.97 @ .637	265 @ 11.8	18.63 @ .744	261 @ 16.7	18.35 @ 1.05
160	11.25	—	—	295 @ 10.0	20.74 @ .662	281 @ 12.2	19.76 @ .770	278 @ 17.2	19.55 @ 1.09

\*Standard Nozzle Supplied with Chlorinator for Indicated Maximum Feed Rate. NOTE: GPM is U.S. Gallons. Metric is liters per sec. (l/sec.)



## 7.0 EJECTOR NOZZLE REQUIREMENTS

Application Bulletin No. 1009

### REGAL Series 2000 Gas Chlorinators

#### 1000 LBS/24 HRS. (20kg/hr)

EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure & Water Flow Rate			
		A-2920 EJECTOR - 0.563" (STD)		A-2922 EJECTOR - 0.750"	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ 1/sec	PSIG @ GPM	kg/cm <sup>2</sup> @ 1/sec
0	0.00	15 @ 34.5	1.05 @ 2.18	8 @ 46.0	0.57 @ 2.90
10	0.70	35 @ 43.7	2.43 @ 2.76	16 @ 65.6	1.13 @ 4.13
20	1.41	58 @ 52.9	4.04 @ 3.34	30 @ 84.0	2.10 @ 5.30
30	2.11	85 @ 62.1	5.98 @ 3.92	48 @ 98.9	3.40 @ 6.24
40	2.81	115 @ 71.3	8.08 @ 4.50	67 @ 112.7	4.69 @ 7.11
50	3.52	147 @ 82.8	10.35 @ 5.22	87 @ 126.5	6.14 @ 7.98
60	4.22	—	—	108 @ 136.9	7.60 @ 8.63
70	4.92	—	—	129 @ 149.5	9.05 @ 9.43

#### 2000 LBS/24 HRS. (40kg/hr)

EJECTOR BACKPRESSURE		REQUIRED Ejector Supply Pressure & Water Flow Rate			
		A-2922 EJECTOR - 0.750" (STD)		A-2920 EJECTOR - 0.563"	
PSIG	kg/cm <sup>2</sup>	PSIG @ GPM	kg/cm <sup>2</sup> @ 1/sec	PSIG @ GPM	kg/cm <sup>2</sup> @ 1/sec
0	0.00	41 @ 104.7	2.91 @ 6.60	41 @ 48.3	2.91 @ 3.05
10	0.70	48 @ 108.1	3.40 @ 6.82	78 @ 62.1	5.50 @ 3.92
20	1.41	58 @ 110.4	4.04 @ 6.96	102 @ 71.3	7.20 @ 4.50
30	2.11	68 @ 117.3	4.77 @ 7.40	124 @ 77.1	8.73 @ 4.86
40	2.81	81 @ 126.5	5.66 @ 7.98	146 @ 81.7	10.27 @ 5.15
50	3.52	97 @ 134.6	6.79 @ 8.49	—	—
60	4.22	113 @ 141.5	7.92 @ 8.92	—	—
70	4.92	130 @ 154.1	9.14 @ 9.72	—	—

## 8.0 REGAL GAS FEED SYSTEM

### THEORY OF OPERATION

In all REGAL Gas Feed systems, whatever the configuration or additional components involved, the system operates at less than atmospheric pressure (PARTIAL VACUUM).

The vacuum is produced in the ejector assembly (**a highly efficient water powered, vacuum producing device**) by forcing water through a highly efficient nozzle at high velocity. The vacuum produced is transmitted back to the meter panel assembly (**or directly to the vacuum regulator if there are no remote metering panel assemblies present**).

In the vacuum regulator, a diaphragm senses vacuum on one side and atmospheric pressure on the other side. The force produced by the diaphragm displaces a spring loaded valve (**inlet safety valve**) stem off a seat and permits gas to flow through the interconnecting tubing to the metering panel assembly (**if present**), and finally to the ejector assembly.

The metering tube located in the vacuum regulator (**or the metering panel assembly if present**) indicates the magnitude of the flow. An adjustable (**linear**) rate adjustment valve plug in a precision formed metering seat permits precise adjustments of gas feed rates.

From the vacuum regulator (**or the metering panel assembly if present**), the gas flows through tubing to the ejector assembly. In the ejector, the gas passes through a check valve and then to the nozzle throat (**highest vacuum area**) where it mixes with and is dissolved in the water stream.

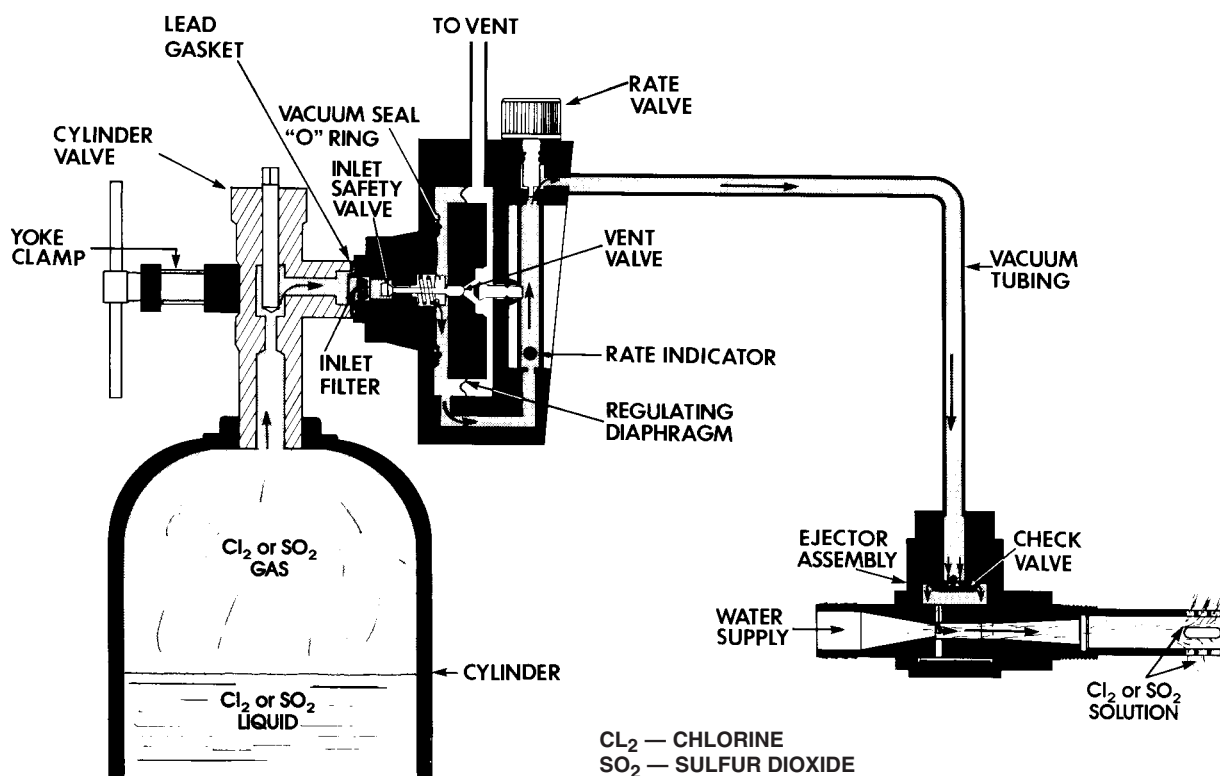
The vacuum regulator incorporates a pressure relief (vent) valve. Should gas under pressure conditions ever enter the system components, the diaphragm assembly will move forward, breaking the seal between the vent plug and the vent sealing o-ring. This allows the gas under pressure to be "vented" to as safe an area as possible.

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**NOTE:** FOR THIS REASON, THE VENT LINE MUST ALWAYS BE ROUTED TO A SAFE OUTSIDE AREA WITH THE END OF THE VENT LINE TURNED DOWN AND SCREENED.

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### REGAL GAS FEED SYSTEM FLOW DIAGRAM



## 9.0 VACUUM LINE SIZE REQUIREMENTS

MAXIMUM FEED RATE	VACUUM LINE LENGTH								
	30m 100´	60m 200´	100m 330´	300m 660´	30m 990´	400m 1310´	500m 1650´	700m 2300´	900m 2950´
50 ppd 1000 gr/hr	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"	3/4"
100 ppd 2000 gr/hr	3/8"	1/2"	5/8"	5/8"	3/4"	3/4"	3/4"	3/4"	3/4"
250 ppd 5 kg/hr	1/2"	5/8"	3/4"	3/4"	1"	1"	1"	1"	1"
500 ppd 10 kg/hr	5/8"	3/4"	1"	1"	1 1/4"	1 1/4"	1 1/4"	1 1/2"	1 1/2"
1000 ppd 20 kg/hr	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	2"	2"	2"
2000 ppd 40 kg/hr	1"	1 1/4"	1 1/2"	2"	2"	2"	2"	2"	2 1/2"

The data presented here is based upon calculations such that total system friction loss in piping does not exceed 5 inches water column. Line sizes up to and including 5/8" are flexible tubing. Line sizes over 5/8" are rigid pipe.

# chlorinators

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