



chlorinators incorporated

1044 SE Dixie Cutoff Road, Stuart, Florida 34994 USA

Phone: (772) 288-4854 Fax: (772) 287-3238

www.regalchlorinators.com Email: chlorinc@aol.com

REGAL Gas Chlorinator, Sulphonator, and Ammoniator Systems

Chlorinator Models 216, 226, 256, and 2107

Sulphonator Models 716, 726 and 756 • Ammoniator Model 316

INTRODUCTION

This instruction book provides installation, operational, and maintenance instructions for Chlorinators Incorporated (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 Incorporated. 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 Incorporated.
- 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 2.2.11 OF THIS BULLETIN.
 - Check for Ammonia gas leaks by using moist litmus paper, Sulfur Dioxide fumes or, strong Chlorine Bleach fumes. SEE PARAGRAPH 2.2.11 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 Incorporated that the sulfur dioxide cylinders/containers be maintained in a temperature controlled environment (room) of a 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 INCORPORATED ONE (1) YEAR LIMITED WARRANTY

Chlorinators Incorporated (hereinafter called "C.I.") 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 C.I. This represents the entire agreement between C.I. and Buyer (also referred to as "end-user") and shall apply unless modified in writing and signed by a C.I. 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 C.I.'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 Incorporated's warranties, or assume their own responsibility.

The following states C.I.'s 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 C.I.'s 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. C.I. assumes no liability for such recommendations and advice, and they are not to be construed as constituting any warranty, expressed or implied.

TERM OF WARRANTY

C.I. 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 C.I. 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 Incorporated 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 Incorporated 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 C.I.'s option, either repair or replacement of any unit which is received by C.I. at its plant in Stuart, Florida (shipping charges prepaid by buyer), within the time period set forth above and which is found by C.I. to be defective by reason of manufacture.

Notwithstanding the foregoing, C.I. 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 C.I. be liable to Buyer for consequential or accidental damages of any kind, even if C.I. 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 Incorporated factory in Stuart, Florida.

EXCLUSIONS

The following are considered external environmental factors beyond the control of C.I., 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-C.I. 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 C.I. officer, it is understood that this is the only written warranty given by C.I. for the systems and components stated.

The dealers or representatives of C.I. may not make verbal representations that add, modify or change the written warranties contained herein or change the extent and nature of C.I.'s liability. In no event shall C.I. 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 Incorporated, 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. _____

CONTENTS

1.0 INSTALLATION

- 1.1 Handling of Cylinders/Containers
- 1.2 Mounting the Vacuum Regulators
- 1.3 Installation of Ejector
- 1.4 Piping of Ejector
- 1.5 Installation of the Pressure Relief (VENT) Valve
- 1.6 Installation of the Remote Metering Panel Assembly

2.0 START-UP

- 2.1 Check Ejector
- 2.2 Check Vacuum Regulators

3.0 SHUT-DOWN

IMPORTANT:

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



CHLORINATORS INCORPORATED
1044 SE Dixie Cutoff Road
Stuart, FL 34994-3436



4.0 TROUBLE HINTS

- 4.1 Gas Pressure Leak
- 4.2 Loss of Gas Feed
- 4.3 Sticky Ball in Metering Tube
- 4.4 Water in System Components — FLOODING
- 4.5 Vacuum Leaks
- 4.6 Failure to Repeat Set Feed Rate.
- 4.7 Icing of the Metering Tube — LIQUID

5.0 SERVICE / DISASSEMBLY

- 5.1 High Pressure Ejector Check Valve to 500 PPD - Cleaning and Replacing
- 5.2 Optional Low Pressure Ejector Check Valve to 500 PPD - Cleaning and Replacing
- 5.3 Optional High/Low Ejector Check Valve to 100 PPD - Cleaning and Replacing
- 5.4 Optional Dual Check Valve Ejector to 500 PPD - Cleaning and Replacing
- 5.5 Ejector Check Valve 1000/2000 PPD Cleaning and Replacing
- 5.6 Cleaning/Inspection of Ejector Nozzle to 500 PPD
- 5.7 Cleaning/Inspection of 1000/2000 PPD Ejector Nozzle
- 5.8 Cleaning Manual Rate Adjustment Valve and Metering Tube to 100 PPD
- 5.9 Cleaning Manual Rate Adjustment Valve and Metering Tube @ 250 and 500 PPD
- 5.10 Cleaning Manual Rate Adjustment Valve and Metering Tube @1000/2000 PPD
- 5.11 Cleaning the Safety Shut-Off Valve Plug and Seat
- 5.12 Disassembly of the Vacuum Regulator Body

6.0 PARTS LIST

SEE PARTS LIST DRAWING INDEX

7.0 EJECTOR NOZZLE REQUIREMENTS

- 7.1 Application Bulletin No. 1002
- 7.2 Application Bulletin No. 1009

8.0 GAS FEED SYSTEM

Theory of Operation & Flow Schematic

9.0 VACUUM LINE SIZE REQUIREMENTS

PARTS LIST DRAWING INDEX SECTION 6.0

Drawing No. A-816/A-826/A-856	Chlorinator (Vacuum Regulator) Parts List to 500 PPD
Drawing No. A-716/A-726/A-756	Sulphonator (Vacuum Regulator) Parts List to 500 PPD
Drawing No. A-817	Ammoniator (Vacuum Regulator) Parts List to 100 PPD
Drawing No. A-2817	Chlorinator (Vacuum Regulator) Parts List @ 1000/2000 PPD
Drawing No. A-920/A-922/A-925 E-225/E-227/E-525	Chlorine Service Ejector Assembly (High Pressure) Chlorine Service Check Valve Assembly (High Pressure)
Drawing No. A-950/A-949	Chlorine Service Dual Check Valve Ejector Assembly to 500 PPD
Drawing No. A-921/A-923/A-926 A-300/A-320/A-350	Chlorine Service Ejector Assembly (Low Pressure) Chlorine Service Check Valve Assembly (Low Pressure)
Drawing No. A-927/A-927A A-301/A-301A	Chlorine/Ammonia Service Ejector Assembly (High/Low Pressure) Chlorine/Ammonia Service Check Valve Assembly (High/Low Pressure)
Drawing No. A-920S/A-922S/A-925S E-225S/E-227S/E-525S	Sulfur Dioxide Service Ejector Assembly (High Pressure) Sulfur Dioxide Service Check Valve Assembly (High Pressure)
Drawing No. A-921S/A-923S/A-926S A-300S/A-320S/A-350S	Sulfur Dioxide Service Ejector Assembly (Low Pressure) Sulfur Dioxide Service Check Valve Assembly (Low Pressure)
Drawing No. A-920A E-225A	Ammonia Service Ejector Assembly (High Pressure) Ammonia Service Check Valve Assembly (High Pressure)
Drawing No. A-921A A-300A	Ammonia Service Ejector Assembly (Low Pressure) Ammonia Service Check Valve Assembly (Low Pressure)
Drawing No. A-2920/A-2922	Chlorine Service Ejector Assembly @ 1000/2000 PPD
Drawing No. A-2000	Chlorine Service Check Valve Assembly @ 1000/2000 PPD
Drawing No. A-255/A-255S/A-255A	Remote Meter Panel Parts List to 100 PPD
Drawing No. A-7500	Remote Meter Panel Assembly 10 to 500 PPD
Drawing No. A-2551/A-2552	Remote Meter Panel Parts List @ 1000/2000 PPD
Drawing No. A-300-V1/V2/V3 A-300A-V1 A-300S-V1/V2/V3	Standby Pressure Relief (VENT) Valves (CL ₂) to 500 PPD Standby Pressure Relief (VENT) Valve (NH ₃) to 100 PPD Standby Pressure Relief (VENT) Valve (SO ₂) to 500 PPD
Drawing No. A-300-V4	Standby Pressure Relief (VENT) Valve (CL ₂) @ 1000/2000 PPD
Data Sheet No. 2005	Vacuum Regulator Dimensions
Data Sheet No. 2006	Ejector Dimensions
Data Sheet No. 2007	Remote Meter Panel Dimensions
Data Sheet No. 2008	Switchover Pressure Relief (VENT) Valve

IMPORTANT

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

REGAL Automatic Switchover Gas Feed Systems are vacuum operated solution feed types. The system’s two vacuum regulators are 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 regulators mount to the valve by means of a positive, heavy duty yoke clamp and are sealed against leakage by a lead gasket. The vacuum regulators have a built-in spring opposed diaphragm regulator and safety shut-off valve to maintain the proper operating vacuum levels in the system.

A highly efficient water powered, vacuum producing ejector containing a back flow check valve is close coupled with the solution diffuser in systems to 500 PPD. Above 500 PPD, the solution diffuser is by others. A wall mounted metering panel assembly with manual rate adjustment valve is furnished to allow precise adjustments of gas feed rate. A pressure relief (VENT) valve is mounted in the line between the vacuum regulators and the metering panel assembly to relieve any gas pressure that may enter the system.

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. Two (2) vacuum regulators with built-in automatic switchover mechanisms.
2. One ejector assembly with back flow check valve, nozzle, and diffuser (when supplied).
3. One pressure relief (vent) valve with wall mounting bracket.
4. One remote metering panel assembly with manual rate adjustment valve for wall mounting.
5. 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, hoods and/or valve outlet cap nut are in place.

- 1.1.2 Locate the cylinders/containers 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 REGULATORS

- 1.2.1 Remove the valve protection hood from the cylinders or the “dome” cover from the containers.
- 1.2.2 Remove all shipping tape from the vacuum regulators DO NOT REMOVE the high efficiency filter that is inserted in the vacuum regulator inlets.
- 1.2.3 If 150 lb. cylinders are being used, unscrew the cap nut from the cylinder valves. Unscrew the yoke screw until the sliding bar can be pushed all the way back. Place a new 1/16” thick lead gasket over each vacuum regulator’s inlet. NEVER REUSE A GASKET. Use a new one every time the regulators are removed from a cylinder.

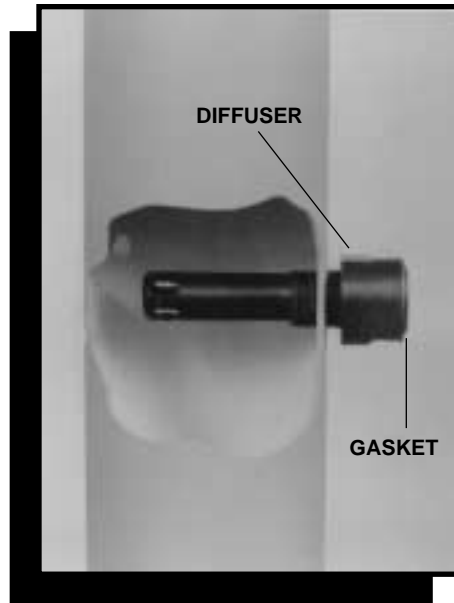
Mount the vacuum regulators on the cylinder valves by:

- a. placing the yoke over the valve,
 - b. engaging the vacuum regulator inlets properly with the valve outlets, and
 - c. carefully tightening the yoke clamping screws, using the integral tightening handles to compress the lead gaskets. Excessive tightening can squeeze the lead gaskets out of the joint and cause a leak and/or damage to the equipment. (Photo 1.1)
- 1.2.4 If ton containers are being used, a REGAL TAY-200 Ton Container Adapter Assembly **MUST** be used with each vacuum regulator. THE VACUUM REGULATORS MOUNT TO THE VALVE OF THE TAY-200’S.

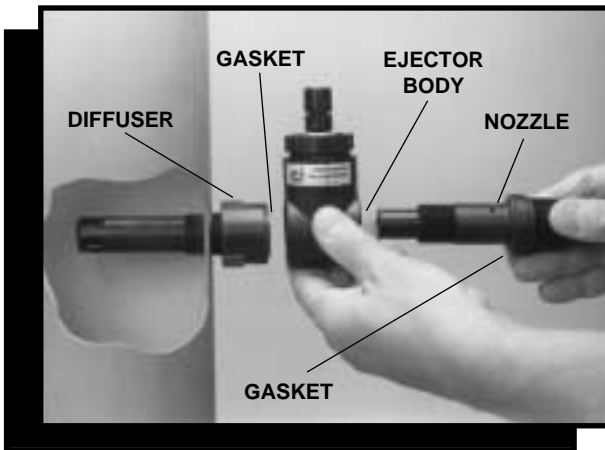
Rotate the containers until the two outlet valves are aligned vertically. This allows gas to be withdrawn from the top valve, and liquid from the bottom valve. **CONNECT TO THE TOP VALVE FOR GAS USE.**
 - a. Unscrew the cap nut covering the top valve outlets.
 - b. Remove any dirt that may be in the valve outlets or on the gasket sealing surfaces.
 - c. Remove all shipping tape from the vacuum regulator inlets. DO NOT REMOVE the filters that are inserted in the vacuum regulator inlets.
 - d. Unscrew the yoke screws of the TAY-200 adapters until the sliding bars can be pushed all the way back.



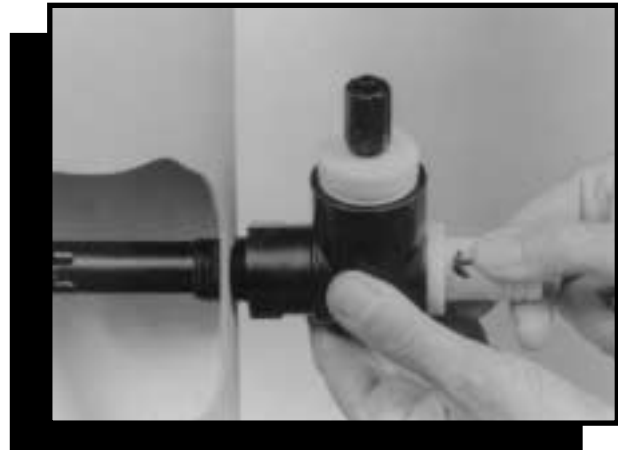
1.1



1.2



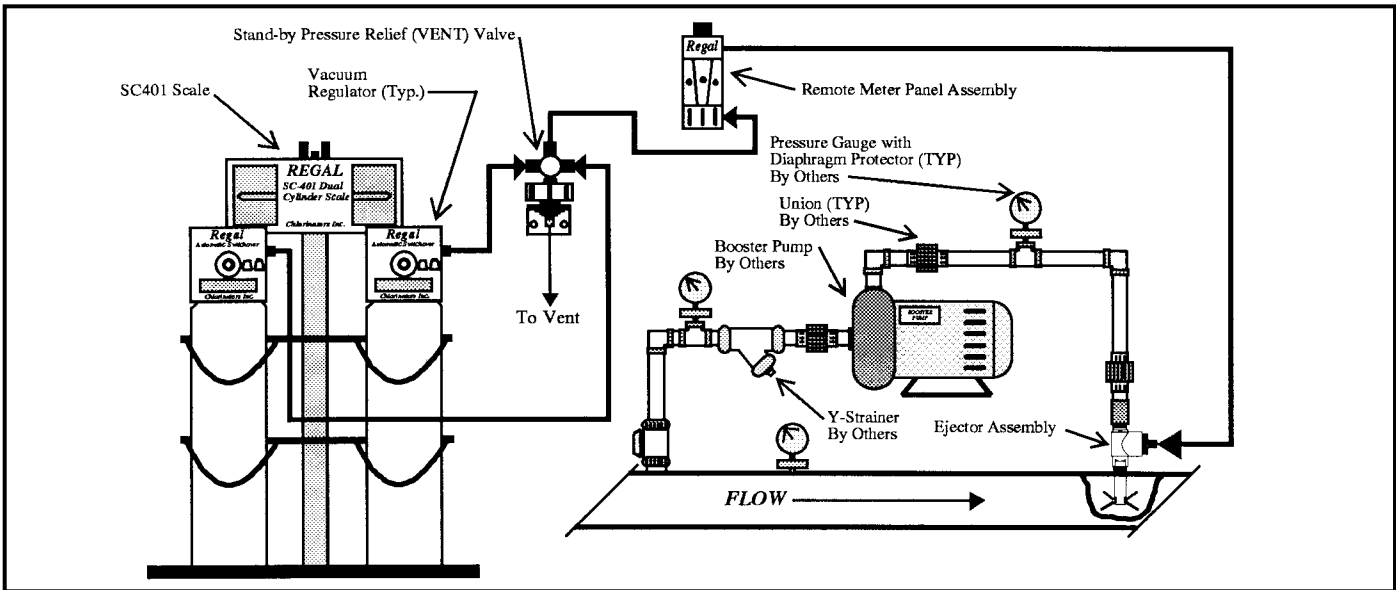
1.3



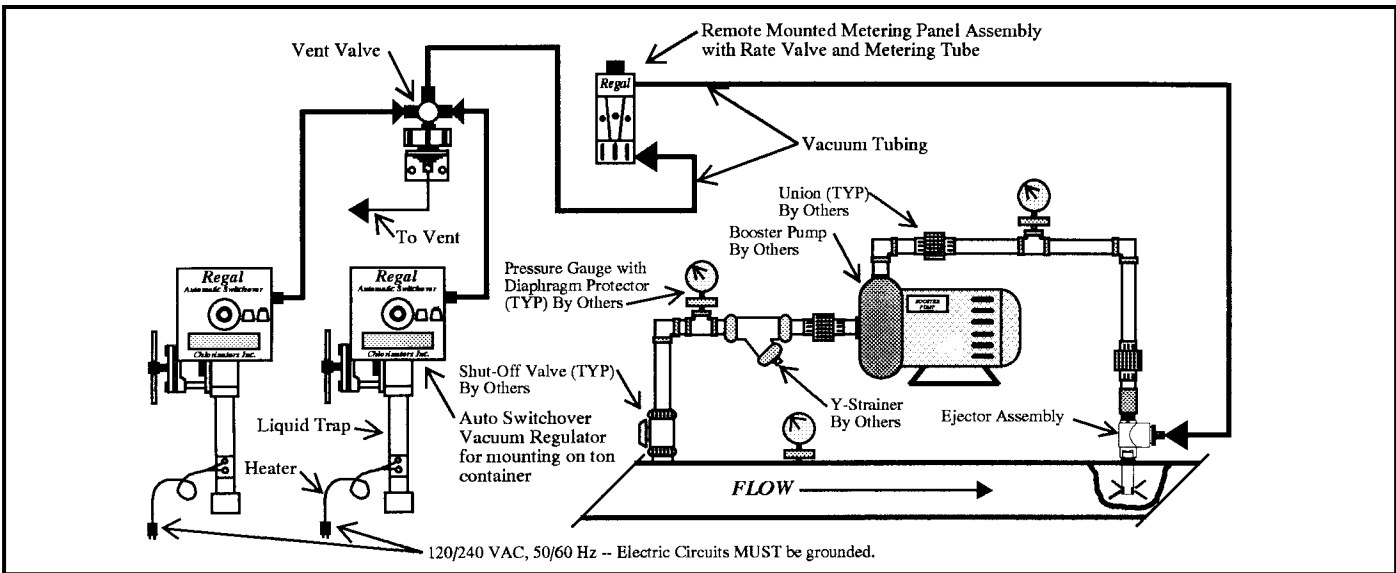
1.4



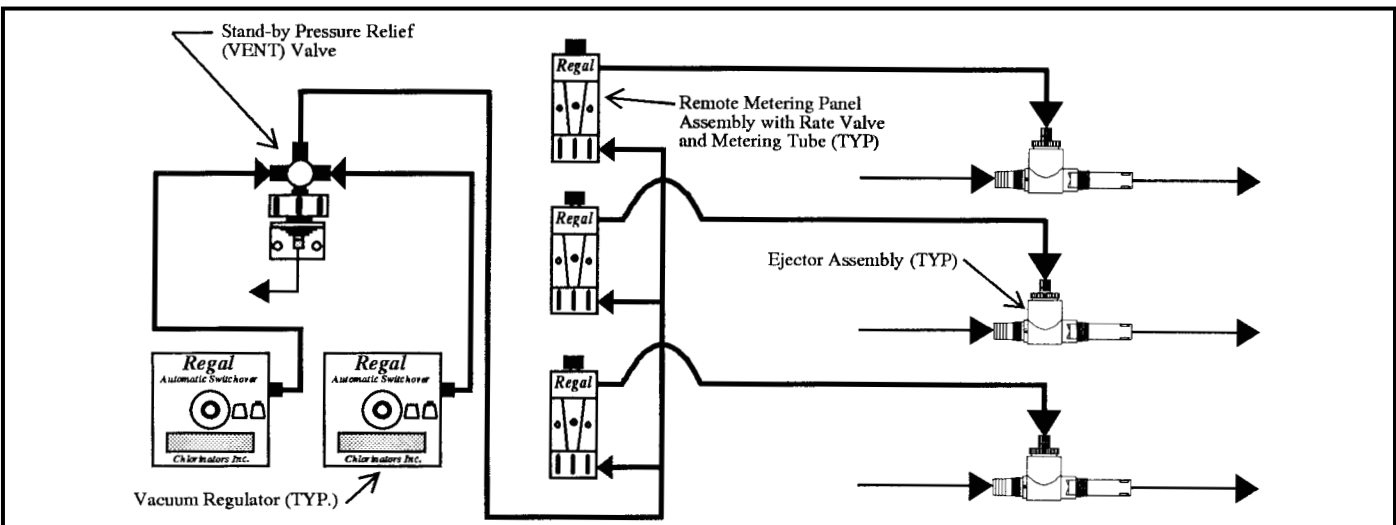
1.5



Drawing 1
 Typical installation of basic Model 216 type system.



Drawing 2
 Auto Switchover Vacuum Regulators with TAY-200 Ton Container Adapters



Drawing 3
 Multi-Point Application

- e. Place a NEW lead gasket over the inlet adapter of each 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.
 - f. 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.
- 1.2.5 If manifold mounted, mount the vacuum regulators to the appropriate valves of the manifolds by following the steps outlined in 1.2.2 above.
- 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. (Photo 1.8).

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/cm²). 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 Incorporated be consulted regarding installation details in systems over 100 psig (7 kg/cm²).
- Ejectors of 1000/2000 PPD are designed to withstand static back pressures up to 70 psig (4.9 kg/cm²). 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 Incorporated be consulted regarding installation details in systems over 50 psig (3.5 kg/cm²).
- 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 1.2).

- 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 COUNTERCLOCKWISE 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.

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

- 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.



1.6



1.7



1.8

- 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.

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 stop type diffusers, ball valves, etc., can be furnished as required.

1.4 PIPING OF EJECTOR (See Drawing 1 or 2)

- 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 INSTALLATION OF THE PRESSURE RELIEF (VENT) VALVE

(See Drawing 1, 2 or 3)

- 1.5.1 The pressure relief (vent) valve is furnished with a bracket for wall mounting. Choose a location near the vacuum regulators and mount this component to the wall using appropriate fasteners.
- 1.5.2 For 500 PPD and below systems, use Drawing #1 as a guide, and connect an appropriate length of the proper size vacuum tubing from the "vacuum" tube fitting of each vacuum regulator to the inlet cross located on top of the pressure relief (vent) valve assembly.
 - a. Connect an appropriate length of the proper size vacuum tubing to the bottom "VENT" tube fitting of the pressure relief (vent) valve and route to a safe location outside the building. The end of this tubing should point down to prevent rain water from entering, and should be screened to keep insects from getting in and building nests.
- 1.5.3 For 1000/2000 PPD systems, connect the appropriate lengths of 1" minimum rigid SCH. 80 PVC pipe from the vacuum unions located on the side of each vacuum regulator to the 1" PVC tee provided.
 - a. Connect a length of 5/8" flexible vacuum tubing from the top tube fitting of the pressure relief (vent) valve assembly to the tube fitting installed in the 1" PVC tee provided.

- b. Connect another length of 5/8" vent tubing to the bottom tubing connector of the pressure relief (vent) valve and route this tubing to a safe location outside the building. The end of this tubing should point down to prevent rain water from entering and should be screened to keep insects from getting in and building nests.

1.6 INSTALLATION OF THE REMOTE METERING PANEL ASSEMBLY

(See Drawing 1, 2 or 3)

- 1.6.1 The metering panel assembly which includes the metering tube and the manual rate adjustment valve, is designed for wall mounting using appropriate fasteners.
- 1.6.2 On 500 PPD and below systems, connect suitable length of the appropriate size vacuum tubing from the remaining tube fitting of the inlet cross of the pressure relief (vent) valve, to the bottom "inlet" fitting of the remote metering panel assembly.
 - a. Connect the top "outlet" tube fitting of the remote metering panel assembly to the vacuum fitting of the ejector assembly using an additional length of the correct size vacuum tubing.
- 1.6.3 On 1000/2000 PPD systems, connect a suitable length of 1" SCH. 80 PVC pipe from the outlet opening of the 1" PVC tee to the bottom "inlet" union of the remote metering panel assembly.
 - a. Connect from the top "outlet" 1" union of the remote metering panel assembly to the 1" vacuum union of the ejector using the correct length of 1" SCH. 80 PVC pipe.
- 1.6.4 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.

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 REGULATORS

(See Photo 1.6)

NOTE: If the REGAL Switchover Vacuum Regulators are mounted on REGAL TAY-200 Ton Container Adapter Assemblies, OPEN the valve on each TAY-200 Assembly 1/4 – 1/2 turn.

- 2.2.1 Make sure the knobs on both vacuum regulators are in the “ON” position, by turning them clockwise until they bottom out. DO NOT FORCE THE KNOBS.
- 2.2.2 With the cylinder/container/manifold valves closed, turn on the water supply to the ejector if it is not already on.
- 2.2.3 Turn the rate valve on the remote metering panel assembly counterclockwise a few turns.
- 2.2.4 The ball or float in the metering tube should remain at the bottom of the tube. If it does not, or if it bounces up and down, there is either a leak at the lead gasket where one of the vacuum regulators connects to the cylinder/container/manifold valve, or there may be a leak or loose connection elsewhere in the system. Check and correct.
- 2.2.5 Close the ejector water supply valve to stop operation of the ejector.
- 2.2.6 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.
- 2.2.7 Set one of the vacuum regulators to “STAND-BY” by turning the “RESET” knob counterclockwise approximately 1 1/4 turn until you feel the detent mechanism engage. Then turn the “RESET” knob clockwise to the “ON” position until the knob contacts the regulator housing. DO NOT FORCE THE KNOB. The top of the screw in the center of the knob should project above the knob approximately 1/4”, indicating this regulator is now in the “STAND-BY” mode.
- 2.2.8 Set the second vacuum regulator to the “IN-USE” position by leaving its “RESET” knob in the “ON” position.

2.2.9 Make sure that a lead gasket was installed at all valves, unions and flexible connection points, as well as at the vacuum regulator inlets.

2.2.10 Open the valve of one cylinder/container 1/4 turn and close immediately.

2.2.11 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.

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.

2.2.12 Check the “VENT” outlet for gas pressure leaks. If a leak at this point is detected, the inlet valve on one of the vacuum regulators is not sealing properly, due to dirt or impurities, and must be cleaned before proceeding. See Section 4.1.3 & 5.12.

2.2.13 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.

2.2.14 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).

3.0 SHUT-DOWN

3.1 SHUT OFF THE GAS CYLINDER/CONTAINER VALVE(S) LEAVING THE EJECTOR OPERATING.

3.1.1 The screws in the center of each vacuum regulator “RESET” knob should pull down below (or even with) the top of the knob. The float in the remote metering panel assembly should remain at the bottom of the metering tube. This may take a minute or two, depending on chlorinator capacity to remove all of the gas from the lines.

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.

3.2 SHUT OFF THE WATER LINE SUPPLY VALVE OR BOOSTER PUMP TO THE EJECTOR

- 3.2.1 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 system components unless they are to be cleaned throughout or they have been 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 TROUBLE SHOOTING 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.

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 inlet capsule seal (adapter face seal). Gas leaking out between the back body and the yoke assembly, or from the space between the front and back bodies 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 of 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/containers and/or icing of cylinder/containers could also result in a loss of gas feed.

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 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 & 5.0 for instructions on cleaning and drying of the individual system components) 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.

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 and 5.5.
- d. Remove the vacuum regulator from the cylinder/container/manifold valve. Carefully follow instructions in Section 5.0 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. In a perfectly tight system, the top of the screw in the center of the "RESET" knob on each vacuum regulator remains below the surface of the knob.

If a leak exists in the system, the diaphragm assemblies will move forward causing the screw head to RETURN LEVEL with the surface of the reset knob. (Usually a 5 to 10 minute check is all that is needed.)
- 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. These 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 at inlet capsule.
 2. Back body inlet seal.
 3. 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:
 - a. Cleaning the rate adjustment valve as outlined in Section 5.8, 5.9 or 5.10.
 - b. 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 over fill 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:

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

- a. Shut off the cylinder/container/manifold valves.
- b. Leave the ejector running and pulling vacuum.
- c. Remove the vacuum regulator from the cylinder/ container/manifold valve.
- d. Quickly remove the vacuum tubing from the "vacuum" outlet on the vacuum regulators and observe that the head of the screws in the center of the reset knobs are even with the tops of the reset knobs. The reset knobs MUST be bottomed out.
- e. 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.

- f. Shut off the ejector.
- g. 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.
- h. 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.

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 Incorporated themselves.

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 recessed screw in the center of the knob, 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 sever injuries or death could occur.

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:
- Close the cylinder/container/manifold valve(s) before working on any system component.
 - Shut off the water supply to the ejector and the water pressure in the main.
 - Remove vacuum tubing from the fitting on top of the ejector assembly.
 - Unscrew the **check valve seat** from the **ejector body** using pliers if necessary.
 - Carefully lift the edge of the **check valve** (Photo 5.1) and inspect.
 - 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.
 - Make sure the **check valve seat** is screwed completely into the **ejector body**. USE NO TOOLS. HAND TIGHTEN ONLY.
 - Pressurize the ejector and cycle several times before reconnecting the vacuum tubing to make sure the **check valve** is sealing properly.
 - If wear or damage is noted, the **check valve** must be replaced. If the **check valve** needs to be replaced, proceed as follows:
 - 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.
 - Examine the **check valve seat** sealing surface for deposits, and clean with denatured alcohol.
 - 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.

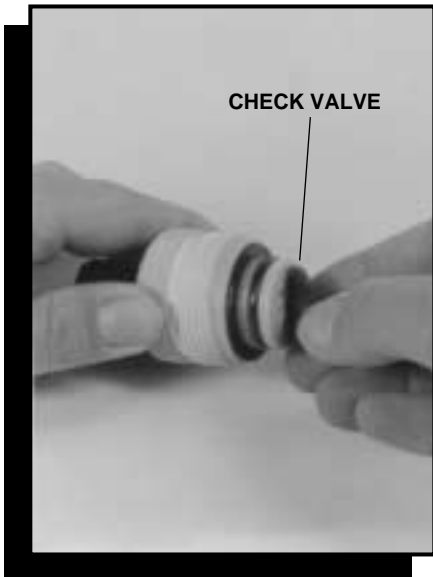
- Wet the tip of the new **check valve** with a very light film (make shiny only) of Vaseline or Dow Corning DC33. Put the tip of the **check valve** in the “center” **check valve seat** hole and, using the handle of a screwdriver or other rounded object, push against the center of the **check valve**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

- 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.
- Screw the **check valve seat** clockwise into the ejector body. Use no tools. Hand tighten only.
- Pressurize the ejector and cycle several times before reconnecting the vacuum tubing to ensure that the check valve is sealing properly.

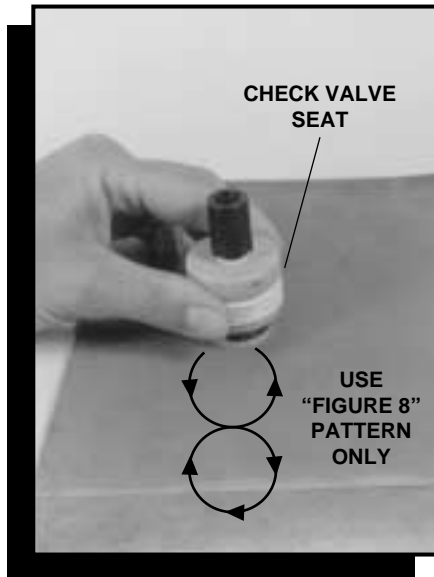
5.2 OPTIONAL LOW PRESSURE EJECTOR CHECK VALVE TO 500 PPD-CLEANING AND REPLACING

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

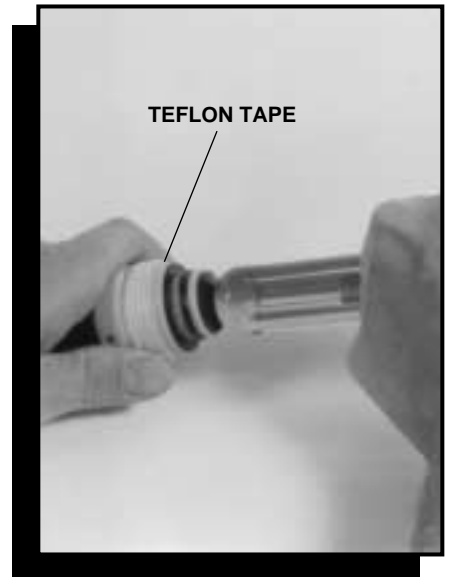
- 5.2.1 To remove and clean the check valve, proceed as follows:
- Close the cylinder/container/manifold valve(s) before working on any system component.
 - Shut off the water supply to the ejector and the water pressure in the main.
 - Remove the vacuum tubing from the fitting on top of the ejector assembly.
 - 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.
 - 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**.
 - The **diaphragm** is made from a special corrosion resistant plastic. Inspect it carefully for nicks or cuts. Replace as necessary.
 - 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.
 - Reassemble by reversing steps “a” through “d” above.



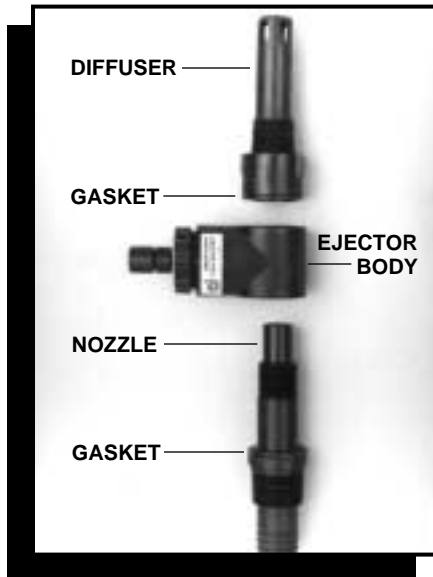
5.1



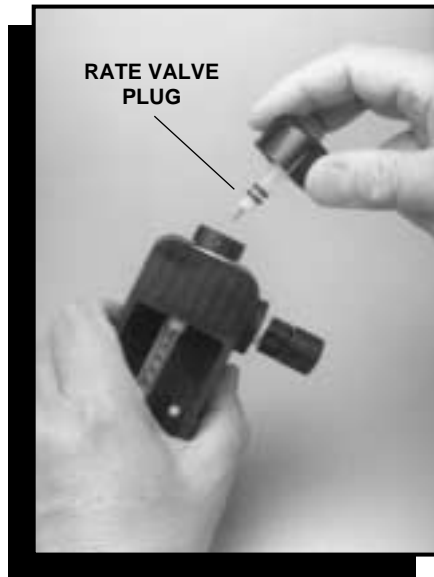
5.2



5.3



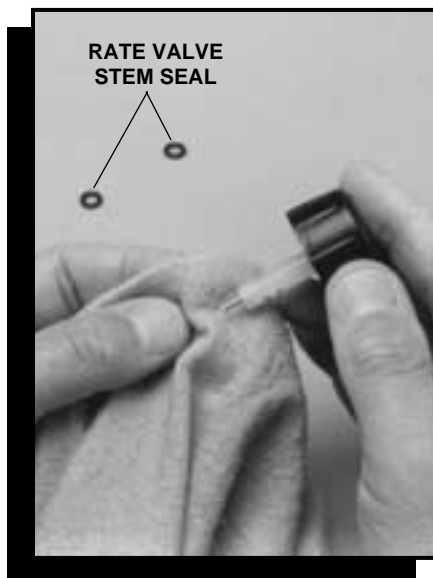
5.4



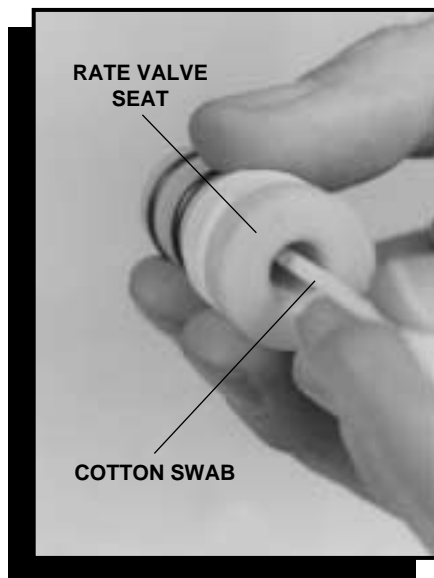
5.5



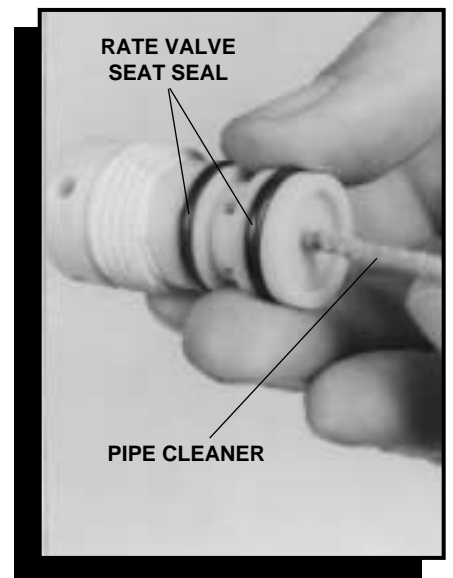
5.6



5.7



5.8



5.9

5.3 OPTIONAL A-927 HIGH/LOW EJECTOR CHECK VALVE TO 100 PPD - CLEANING & REPLACING

(See Parts Drawing A-927/A-927A)

5.3.1 The high/low check valve assembly is installed in the ejector assembly to prevent water from backing into the system when the ejector is shut off. If flooding has occurred or maintenance is due, 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 (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. Grasp the outer edges of the **check valve**, E-250, and apply a steady pulling force until the "umbrella" shaped stem "pops" free. Be certain it is completely removed.
- f. Examine the **check valve seat** sealing surface for deposits, and clean with denatured alcohol.
- g. 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.
- h. Using a new E-250, 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.**
- i. Using a "spanner" wrench in the holes located in the underside of the **outlet body**, unscrew the **outlet body** form 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 all parts or replace as necessary. Always use a new **check valve seal o-ring**.

- j. Reassemble, using a spanner wrench in holes, located in underside of outlet body. Tighten outlet body and clamp ring.
- k. When reinstalling the **check valve assembly** in ejector, put a thin film of Vaseline or Dow Corning DC33 on the **seat o-ring** and **seat gasket** for lubrication. Use very sparingly (make it shiny only). **DO NOT USE ANY OTHER PETROLEUM BASED GREASES OR OILS.**
- l. Screw the **check valve assembly** clockwise into the ejector body. Use no tools. **Hand tighten only.**
- m. Pressurize the ejector and cycle on and off several times before reconnecting the vacuum tubing to ensure that the check valve is sealing properly. Follow start-up procedures in Section 2.0.

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:

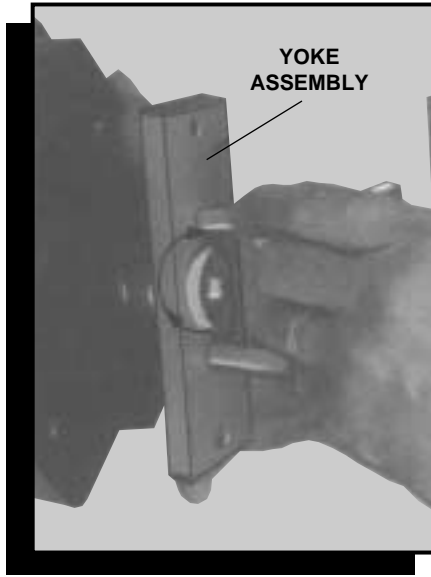
- 5.4.1 Shut off the water supply to the ejector and the water in the main.
- 5.4.2 Remove the vacuum tubing.

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

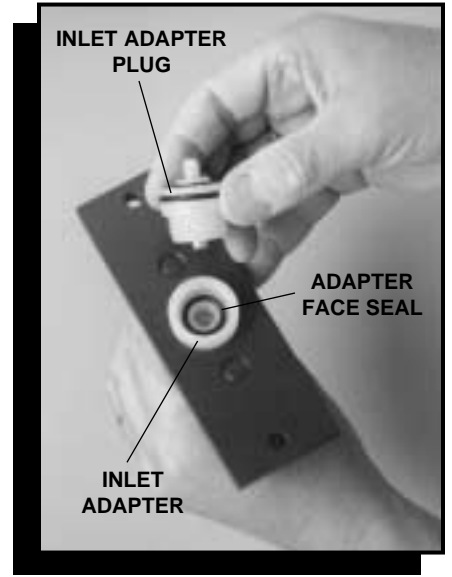
- 5.4.3 Unscrew (counter Clockwise) the complete A-949 Check Valve Assembly from Ejector body E-557. A properly sized wrench can be used on the machined "flats" of Bottom Body E-552 if necessary to loosen the ejector body. **DO NOT USE PLIERS.**
- 5.4.4 Make sure the o-ring S-413 located on Bottom Body E-552 is in good shape. Replace as necessary.
- 5.4.5 To gain access to the Check Valve Components unscrew (counter clockwise) 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.**
- 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:



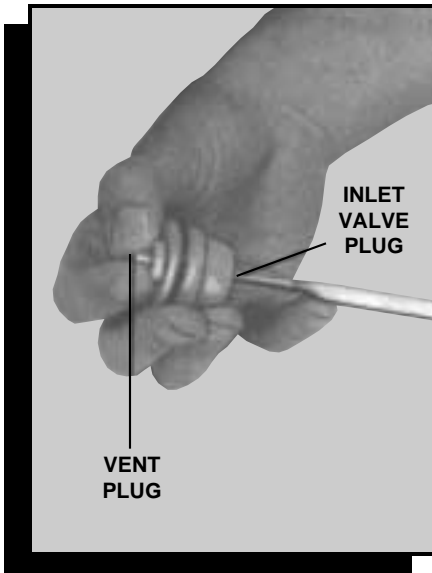
5.10



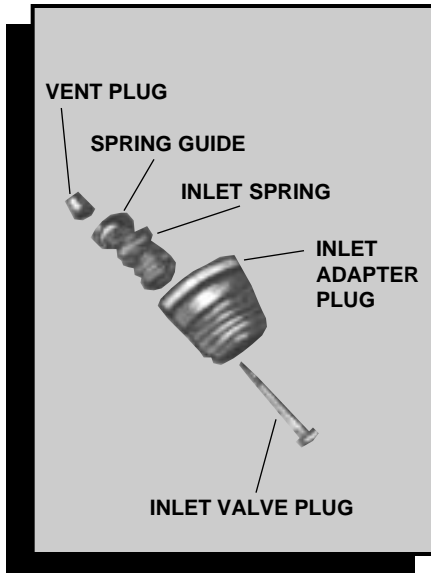
5.11



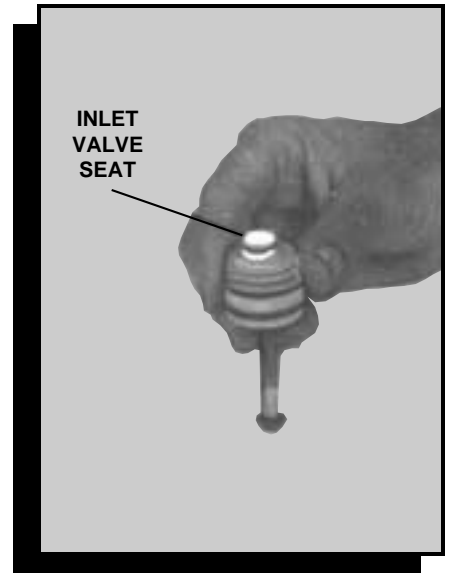
5.12



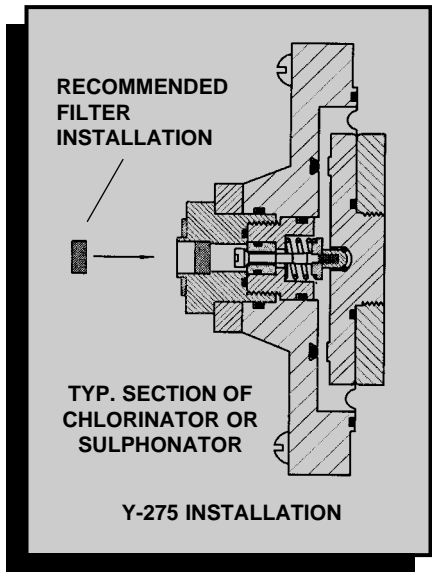
5.13



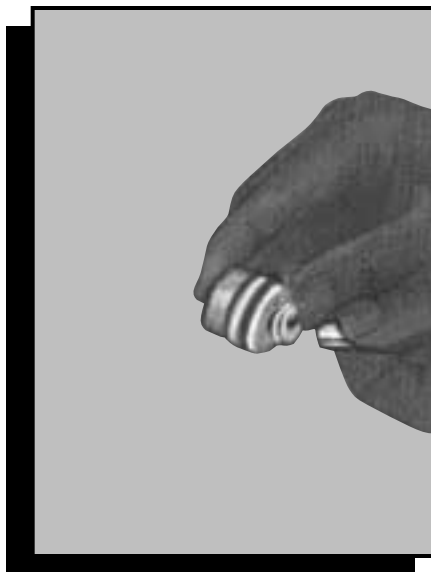
5.14



5.15



5.16



5.17



5.18

- a. Using Drawing A-950/A-949 as a guide, carefully unscrew (counter clockwise) 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 Poppet 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 1000/2000PPD - 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 (counter clockwise) the union ring and move the vacuum piping out of the way. Be careful not to lose the **vacuum union o-ring**.

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

- 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.

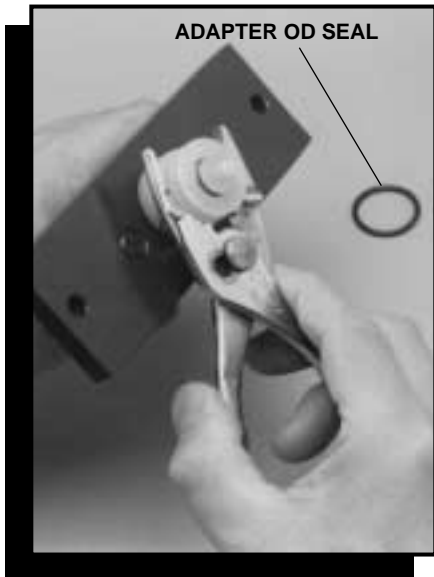
- 5.6.4 Unscrew the **nozzle** from the **ejector body**. Check the **gaskets** located in each side of the body and replace if necessary. (Photo 5.4).

- 5.6.5 Nozzle plugging can be caused by:

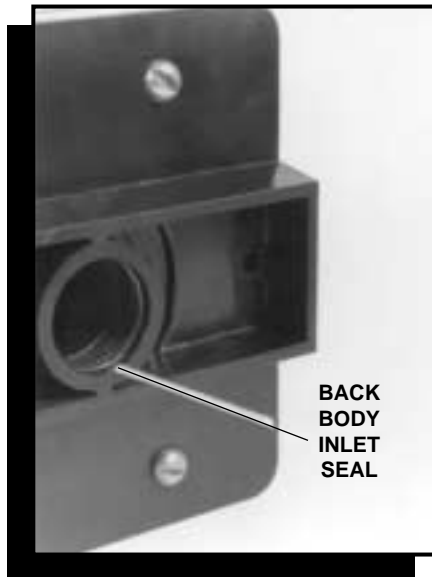
- a. A piece of foreign material (pipe sealer, stone, or dirt) lodging in the nozzle orifice. This can usually be blown out in the reverse direction. DO NOT USE SHARP TOOLS OR ALTER THE SIZE OF THE ORIFICE IN ANY WAY.

- 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.

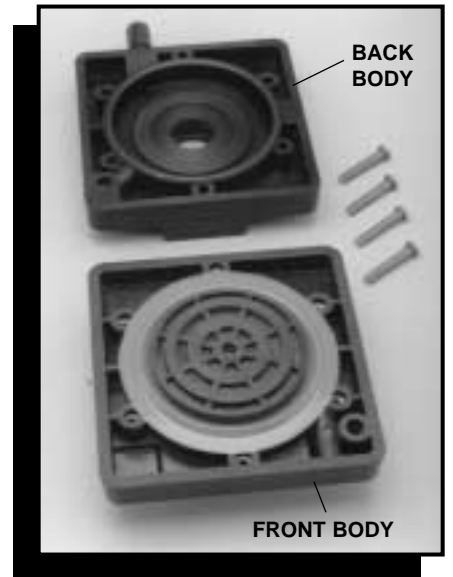
- c. Build-up of deposit. This could be a chemical build-up of iron, manganese, or some other material which usually can be removed by immersing the nozzle in muriatic acid and rinsing. CAUTION: READ ALL WARNING LABELS ON THE MURIATIC ACID CONTAINER,



5.19



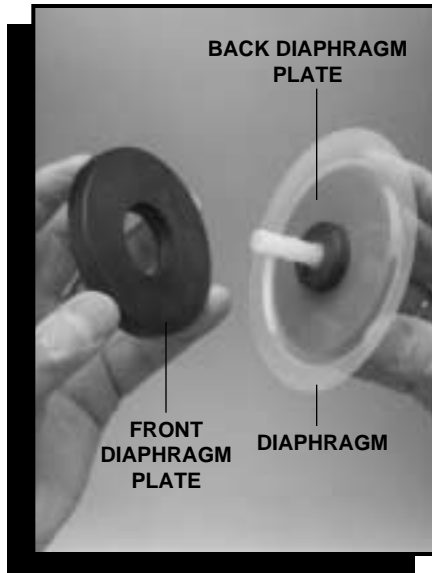
5.20



5.21



5.22



5.23



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**:
- 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 5.4).
 - Hold the **ejector body** against the **diffuser** at 1/8 turn counterclockwise from its final position. (Photo 1.3).
 - Screw the **nozzle** into the **diffuser** by hand until contact is made against both **gaskets**.
 - 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.**
 - 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:
- Close the manifold valve that the vacuum regulator is attached to before working on any system components.
 - 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.
 - Open the 1" **PVC vacuum union MS-19** by unscrewing (counter clockwise) the union ring and move the vacuum piping out of the way.

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

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

- 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.**
- 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.

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

- 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.**

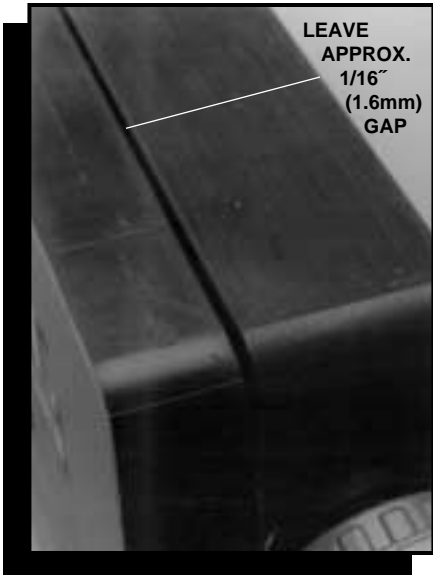
IMPORTANT: READ ALL WARNING LABELS ON MURIATIC ACID CONTAINER AND FOLLOW ALL SAFETY INSTRUCTIONS.

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

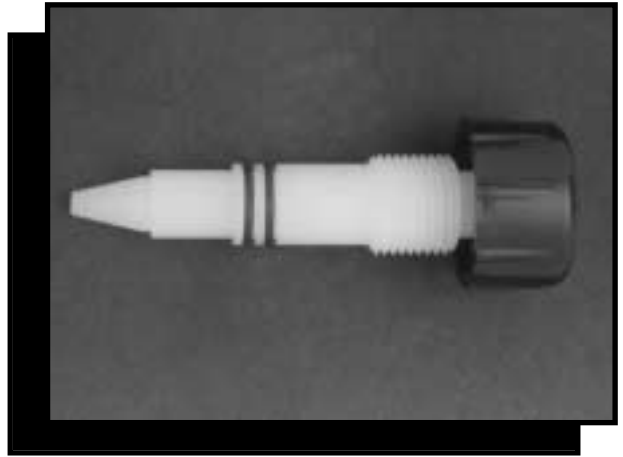
5.8 CLEANING MANUAL RATE ADJUSTMENT VALVE AND METERING TUBE ON SYSTEMS TO 100 PPD

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

- 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 hole 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**:
 - Clean the metal 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.**
 - 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**:
 - Use a cotton swab with a small amount of denatured alcohol to clean out the inside of the **rate valve seat** (Photo 5.8).
 - 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.
 - Clean the metering tube gasket surfaces with the alcohol soaked cotton swab.
 - Inspect and clean the **rate valve seat o-rings** with denatured alcohol. Replace if necessary.



5.28



5.29



5.30



5.31



5.32



5.33

- 5.8.6 To clean the metering tube:
- 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.**
 - 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.**
 - 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:
- 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.
 - Center the top of the **metering tube** under the **rate valve seat** and center the bottom over the hole in the lower gasket.
 - 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.
 - 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

(Refer to Drawing A-7500)

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

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.

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.

- 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.**

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.

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.

- 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 block**.
 - c. Clean or replace the two rate valve stem seals (Photo 5.29) 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.

- 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 block**, a cloth dipped in denatured alcohol can be carefully inserted through the orifice and gently moved back and forth. (Photo 5.30).

- 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.

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

- 5.10.2 To clean the **metering tube**, proceed as follows:
 - a. Unscrew or open the **1" 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 5.31).
 - 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. (Photo 5.32)
 - d. Clean the **glass tube** and the **metering tube float** with a soft cloth using denatured alcohol (Photo 5.33). **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:

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

- 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 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 COUNTER CLOCKWISE; doing so may unscrew the inlet safety capsule. (Photo 5.11)

5.12 DISASSEMBLY OF THE VACUUM REGULATOR BODIES

(See Drawing A-816, A-716, A-817 or A-2817)

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. The head of the reset screw must be in the "IN USE" mode (the reset screw head is even with the surface of the reset knob when the knob is resting against, or in contact with, the vacuum regulator front body). If the screw head is not in the "IN USE" mode, apply vacuum to the unit to pull the screw head even with the knob surface, or press the screw head against a hard surface to unlatch it.
- c. Remove the reset screw and plastic washer and turn the reset knob counterclockwise until it is removed from the front body.
- d. Remove the four screws that hold the body assembly together and separate the body halves (Photo 5.21).
- e. Grasp the diaphragm back plate and pull the diaphragm assembly out of the front body (Photo 5.22).
- f. Examine the diaphragm. It is normal for some wrinkles to be present. REGAL diaphragms are made of special, very tough, chemical 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, with care not to crush these plastic plates.
 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 regulator when installed.
- g. Clean the parts thoroughly with denatured alcohol.
- h. 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.
- i. Reassemble the diaphragm assembly making sure that the internal diaphragm seal o-ring is in its groove in the diaphragm back plate.
- j. Install the diaphragm on the diaphragm back plate make sure the "convolution" (raised area of the diaphragm) faces the back of the vacuum regulator. (Photo 5.23).
- k. Screw the diaphragm nut (with the flat side facing toward diaphragm) onto the diaphragm back plate and tighten by hand. (Photo 5.23).
- l. Check to be sure the spacer o-ring is installed in its recess in the center of the diaphragm back plate.
- m. Check to be sure the fixed poppet retainer (B-237) is screwed all the way down into the internal threads of front body (BA-225 or BA-715). The flange of the fixed poppet **MUST** be fully seated into the front body recess.
- n. While holding the diaphragm assembly in position, screw the reset knob onto the front body in a clockwise direction until the knob is bottomed out, and in contact with the face plate.
- o. Make sure washer (Z-247) is installed onto reset screw.
- p. Install the reset screw into center of knob and tighten until seated. **DO NOT OVERTIGHTEN THIS SCREW AS DAMAGE TO THE DETENT STEM (STRIPPING OF THE THREADS) MAY OCCUR.** (Photo 5.25).
- q. Turn reset knob counterclockwise until diaphragm assembly is centered and snug against front body.
- r. Place the back body on a flat surface, making sure the large diaphragm sealing o-ring is seated properly in its groove, and lower the front body with the diaphragm assembly installed onto the back body. (Photo 5.26).
- s. Grasp the entire unit and turn it over so the back body is on top and reassemble using the four 1 1/2" (38 mm) long screws. These screws should be screwed in until they just begin to tighten. (Photo 5.27)

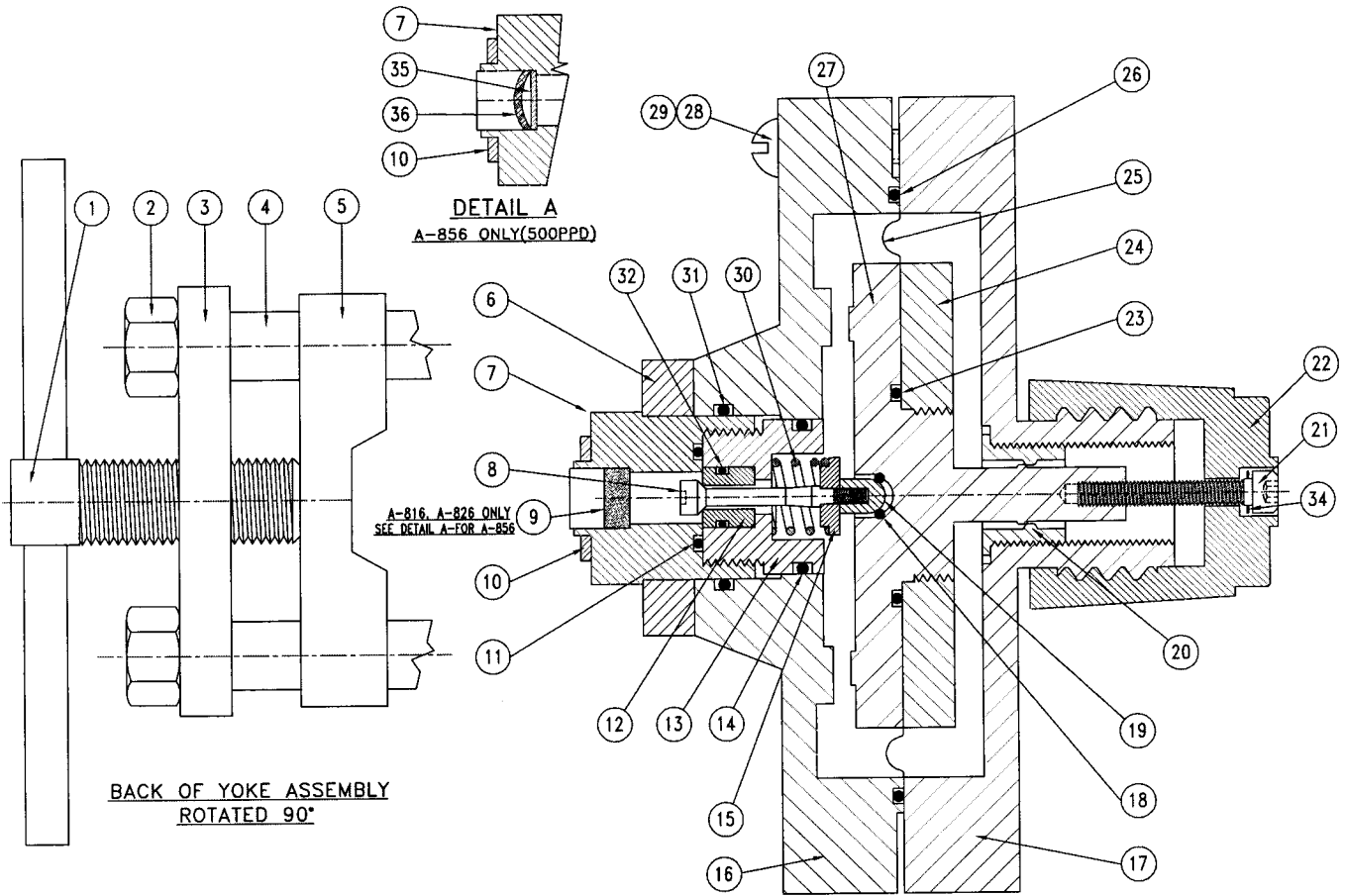
5.12.2 Replace the yoke assembly using the procedure described in Section 5.11.4, para. "l", turning it slightly **CLOCKWISE** as you insert it, and install two body screws (2 1/2" long).

5.12.3 Tighten all body 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.-lbs. of torque. **DO NOT OVERTIGHTEN.** Sealing is accomplished by the compression seal of the large o-ring between the bodies.

IMPORTANT: There should be a gap of approximately 1/16" (1.6 mm) between the two body halves (Photo 5.28). Do not attempt to close this gap by tightening the body screws.

Insert the center post of the diaphragm assembly into the front body (through the poppet retainer) and make sure the diaphragm outer circumference is seated flat against its front body sealing surface.

DRAWING NO. A-816/A-826/A-856
Automatic Switchover Chlorinator Parts List - Model 216/226/256



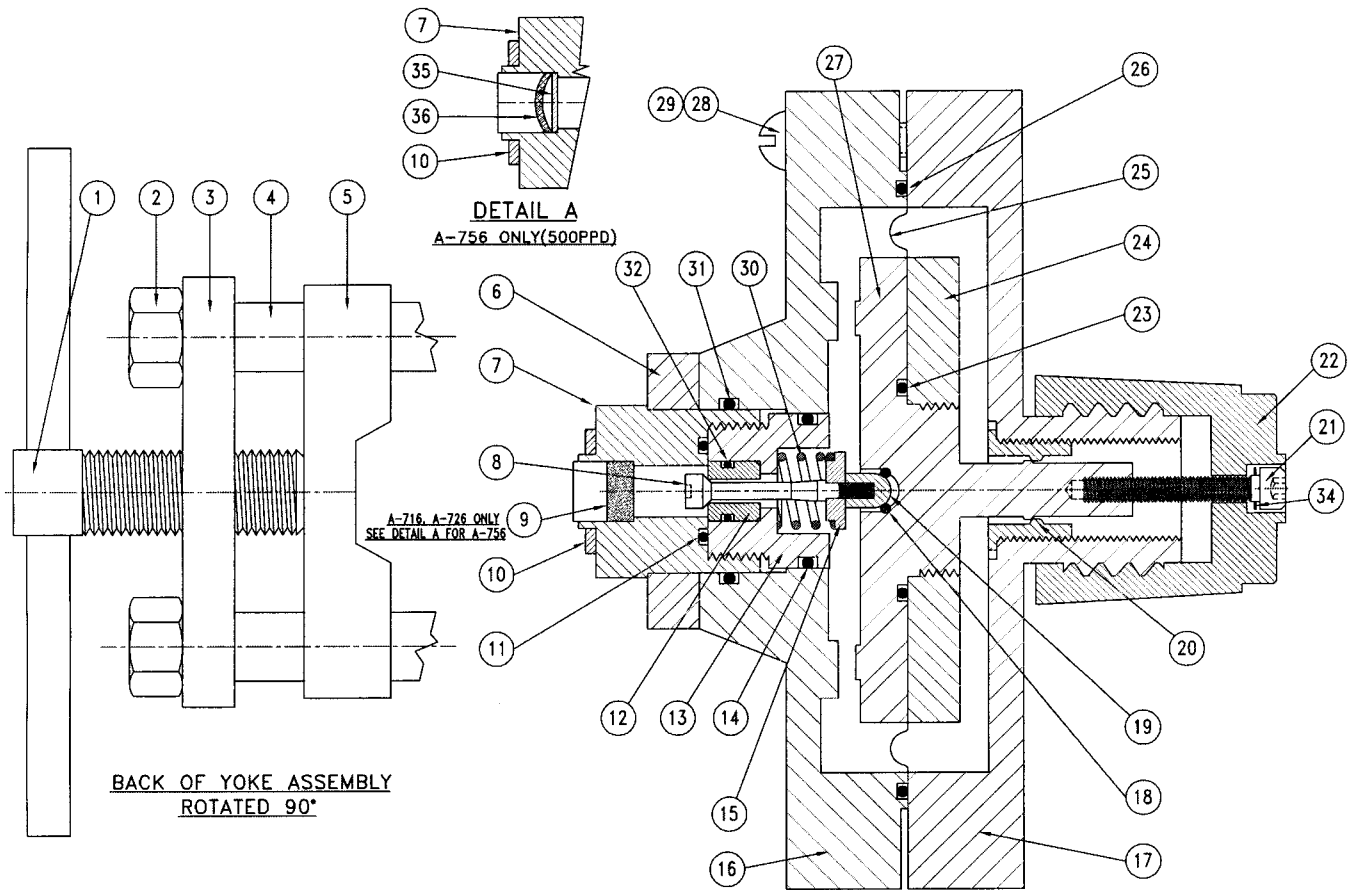
Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw
2	Z-210	2	Yoke Jam Nut
3	Y-210	1	Yoke Rod Bar
4	Y-220	2	Yoke Stud
5	Y-230	1	Yoke Slide Bar
6	Y-240 ***	1	Yoke Body Bar
7	Y-252 ***	1	Inlet Adapter
-	A-200	1	Yoke Assembly (Includes Ref No 1 thru 7 and Filter - See Note 7)
-	A-201		See Note 6
8	YV-230	1	Inlet Valve Plug
9	Y-275	1	Filter (See Note 7)
10	G-201	1	Lead Gasket
11	S-404	1	Adapter Face Seal
12	YV-210	1	Inlet Valve Seat
13	YV-220	1	Inlet Adapter Plug
14	S-406	1	Adapter O.D. Seal
15	YV-240	1	Spring Guide
16	BA-216 **	1	Back Body
17	BA-225	1	Front Body

Ref. No.	Part No.	Quantity	Description
18	S-401	1	Spacer "O" Ring
19	YV-250	1	Inlet Valve Nut
20	B-237	1	Fixed Poppet Retainer
21	Z-245	1	Reset Screw
22	B-235	1	Reset Knob
23	S-407	1	Diaphragm Plate Seal
24	BA-250	1	Diaphragm Front Plate
25	B-230	1	Diaphragm
26	S-408	1	Diaphragm Body Seal
27	BA-245	1	Diaphragm Back Plate
28	Z-220	4	Body Screw (1 1/2" Lgth.)
29	Z-230	2	Body Screw (2 1/2" Lgth.)
30	YV-260	1	Inlet Spring
31	S-413	1	Back Body Inlet Seal
32	S-402	1	Valve Seat Seal
33	Z-250 *	1	3/8" OD Tube Fitting (Not Shown)
34	Z-247	1	Washer
35	Y-270	1	Filter Support (See Note 7)
36	Y-276	1	Filter (See Note 7)

NOTES:

1. Include Chlorinator Serial Number and Capacity on Order.
- * 2. For A-816 (Model 216) to 100 PPD Use Z-250 (3/8" OD Tube Fitting).
- * 3. For A-826 (Model 226) at 250 PPD Use ZZ-260 (1/2" OD Tube Fitting).
- * 4. For A-856 (Model 256) at 500 PPD Use ZZ-271 (5/8" OD Tube Fitting).
- ** 5. For A-856 (Model 256) at 500 PPD Use BA-516 Back Body.
- *** 6. Y-240 and Y-252 only available assembled together = A-201 Assembly.
7. Y-275 Filter for A-816, A-826 Only. Y-276 Filter and Y-270 Filter Support for A-856 (See Det. A).

DRAWING NO. A-716/A-726/A-756
Automatic Switchover Sulphonator Parts List - Model 716/726/756



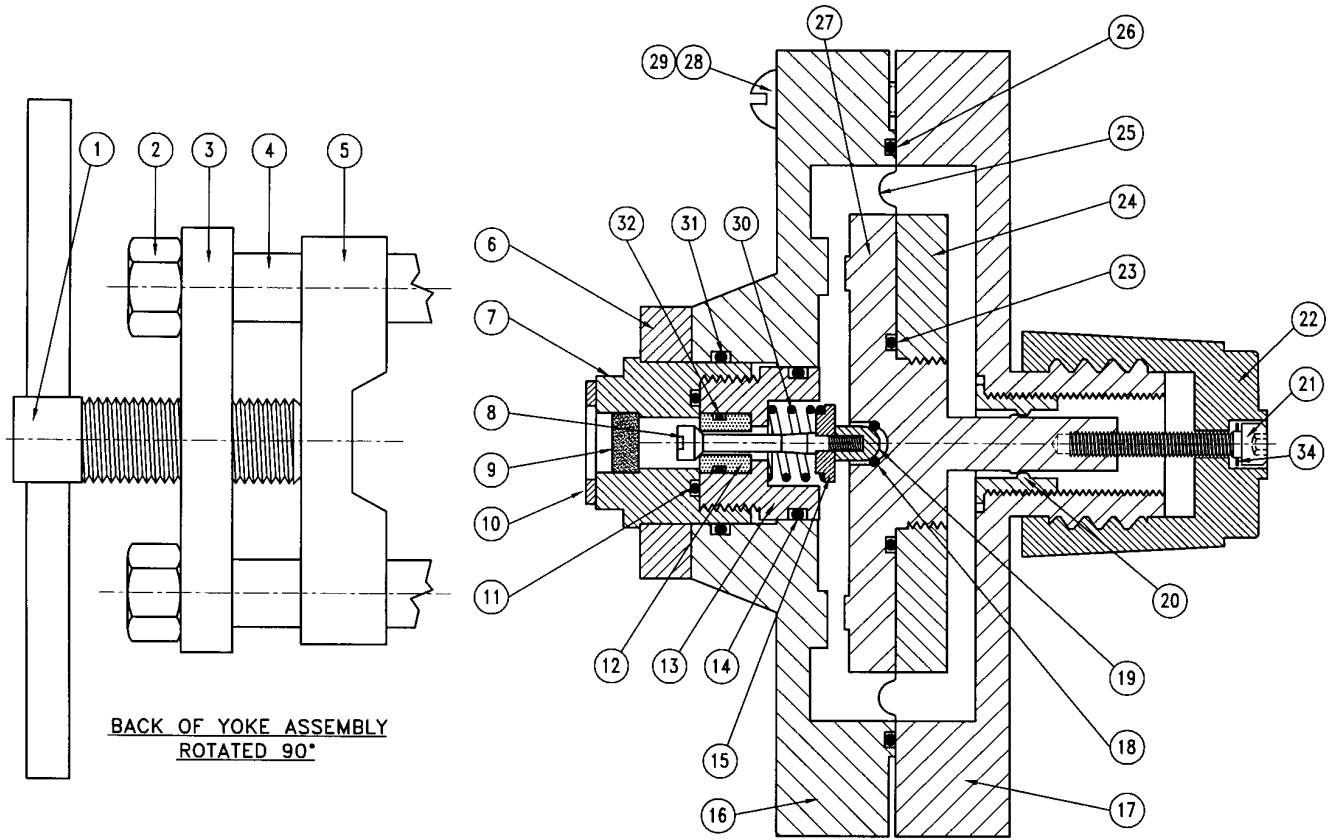
Ref. No.	Part No.	Quantity	Description	Ref. No.	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw	18	S-401	1	Spacer "O" Ring
2	Z-210	2	Yoke Jam Nut	19	YV-250	1	Inlet Valve Nut
3	Y-210	1	Yoke Rod Bar	20	B-237	1	Fixed Poppet Retainer
4	Y-220	2	Yoke Stud	21	Z-345	1	Reset Screw
5	Y-230	1	Yoke Slide Bar	22	B-235	1	Reset Knob
6	Y-240 ***	1	Yoke Body Bar	23	S-407	1	Diaphragm Plate Seal
7	Y-252 ***	1	Inlet Adapter	24	BA-750	1	Diaphragm Front Plate
-	A-200	1	Yoke Assembly	25	B-230	1	Diaphragm
(Includes Ref No 1 thru 7 and Filter - See Note 7)				26	S-408	1	Diaphragm Body Seal
-	A-201		See Note 6	27	BA-745	1	Diaphragm Back Plate
8	YV-232	1	Inlet Valve Plug	28	Z-221	4	Body Screw (1 1/2" Lgth.)
9	Y-275	1	Filter (See Note 7)	29	Z-231	2	Body Screw (2 1/2" Lgth.)
10	G-201	1	Lead Gasket	30	YV-261	1	Inlet Spring
11	S-404	1	Adapter Face Seal	31	S-413	1	Back Body Inlet Seal
12	YV-210	1	Inlet Valve Seat	32	S-402	1	Valve Seat Seal
13	YV-220	1	Inlet Adapter Plug	33	ZZ-250 *	1	3/8" OD Tube Fitting (Not Shown)
14	S-406	1	Adapter O.D. Seal	34	Z-247	1	Washer
15	YV-240	1	Spring Guide	35	Y-270	1	Filter Support (See Note 7)
16	BA-716 **	1	Back Body	36	Y-276	1	Filter (See Note 7)
17	BA-715	1	Front Body				

NOTES:

1. Include Sulphonator Serial Number and Capacity on Order.
- * 2. For A-716 (Model 716) to 100 PPD Use ZZ-250 (3/8" OD Tube Fitting).
- * 3. For A-726 (Model 726) at 250 PPD Use ZZ-260 (1/2" OD Tube Fitting).
- * 4. For A-756 (Model 756) at 500 PPD Use ZZ-271 (5/8" OD Tube Fitting).
- ** 5. For A-756 (Model 756) at 500 PPD Use BA-756 Back Body.
- *** 6. Y-240 and Y-252 only available assembled together = A-201 Assembly.
7. Y-275 Filter for A-716, A-726 Only. Y-276 Filter and Y-270 Filter Support for A-756 (See Det. A).

DRAWING NO. A-817

Automatic Switchover Ammoniator Parts List - Model 316 - 100 PPD (2000 Gm/Hr)

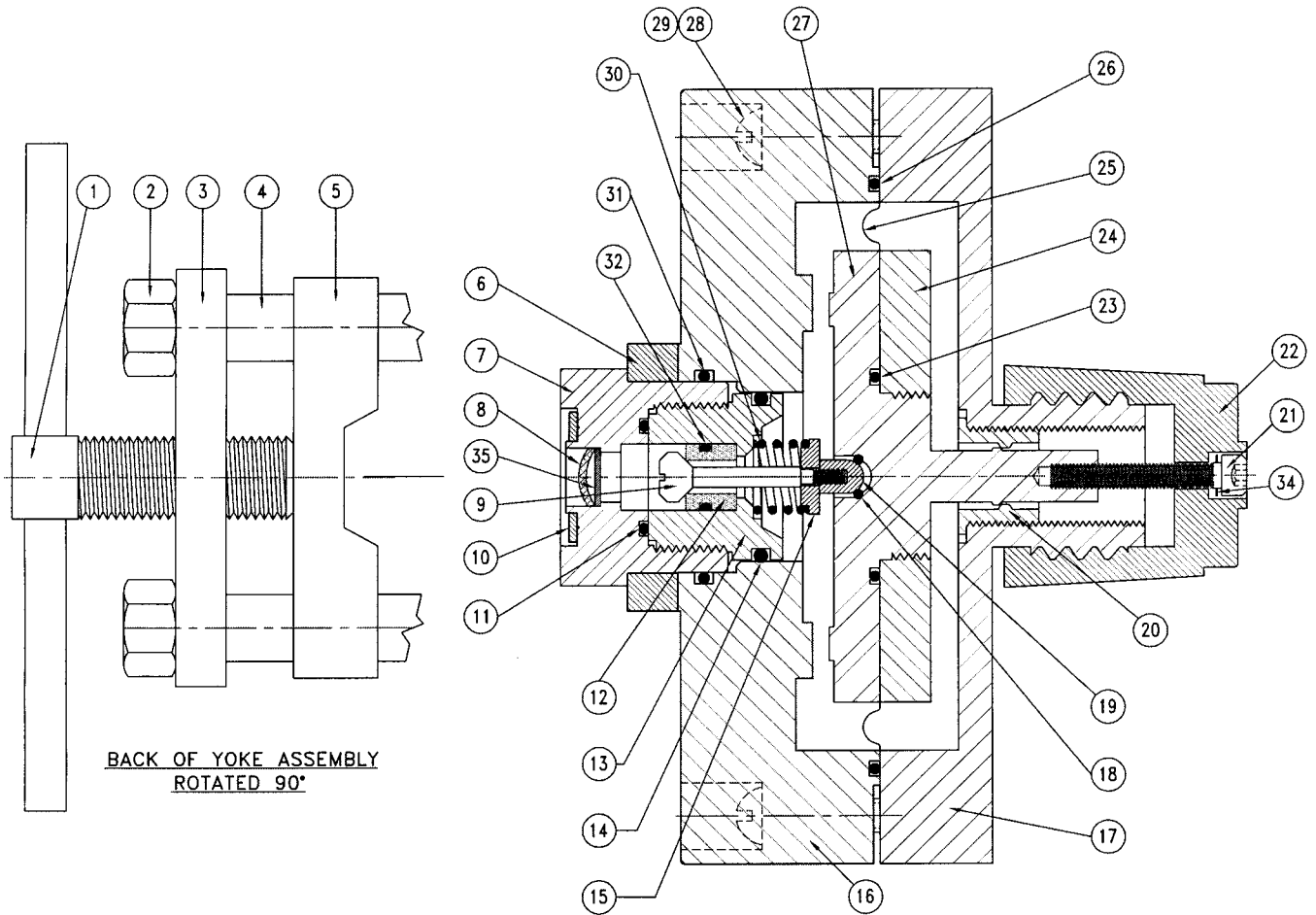


Ref. No	Part No.	Quantity	Description
1	Y-260	1	Yoke Screw
2	Z-210	2	Yoke Jam Nut
3	Y-212	1	Yoke Rod Bar
4	Y-222	2	Yoke Stud
5	Y-232	1	Yoke Slide Bar
6	Y-242	1	Yoke Body Bar
7	Y-352	1	Inlet Adapter
-	A-302	1	Yoke Assembly (Ref. No. 1 thru 7)
8	YV-231	1	Inlet Valve Plug
9	Y-275	1	Filter
10	G-201	1	Lead Gasket
11	SA-404	1	Adapter Face Seal
12	YV-210	1	Inlet Valve Seat
13	YVA-220	1	Inlet Adapter Plug
14	SA-406	1	Adapter O.D. Seal
15	YVA-240	1	Spring Guide
16	BA-216	1	Back Body
17	BA-225	1	Front Body

Ref. No	Part No.	Quantity	Description
18	SA-401	1	Spacer "O" Ring
19	YVA-250	1	Inlet Valve Nut
20	B-237	1	Fixed Poppet Retainer
21	Z-345	1	Reset Screw
22	B-235	1	Reset Knob
23	SA-407	1	Diaphragm Plate Seal
24	BA-250	1	Diaphragm Front Plate
25	B-230	1	Diaphragm
26	SA-408	1	Diaphragm Body Seal
27	BA-245	1	Diaphragm Back Plate
28	Z-221	4	Body Screw (1 1/2" Lgth.)
29	Z-231	2	Body Screw (2 1/2" Lgth.)
30	YV-261	1	Inlet Spring
31	SA-413	1	Back Body Inlet Seal
32	SA-402	1	Valve Seat Seal
33	Z-250	1	3/8" OD Tube Fitting (Not Shown)
34	Z-247	1	Washer

NOTES:

1. Include Ammoniator Serial Number and Capacity on Order.



Ref. No. Part No. Quantity Description

1	Y-260	1	Yoke Screw
2	Z-210	2	Yoke Jam Nut
3	Y-210	1	Yoke Rod Bar
4	Y-220	2	Yoke Stud
5	Y-230	1	Yoke Slide Bar
6	Y-2000	1	Yoke Body Bar
7	YA-2000	1	Inlet Adapter
8	Y-276	1	Filter
-	A-2001	1	Yoke Assembly (See Note 2)
-	A-2002	1	Inlet Valve Capsule Assembly (See Note 3)
9	YV-2002	1	Inlet Valve Plug
10	G-201	1	Lead Gasket
11	S-806	1	Adapter Face Seal
12	YV-2001	1	Inlet Valve Seat
13	YV-2000	1	Inlet Adapter Plug
14	S-415	1	Adapter O.D. Seal
15	YV-240	1	Spring Guide
16	BA-2000	1	Back Body

Ref. No. Part No. Quantity Description

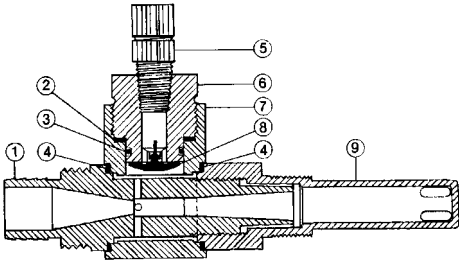
17	BA-225	1	Front Body
18	S-401	1	Spacer "O" Ring
19	YV-250	1	Inlet Valve Nut
20	B-237	1	Fixed Poppet Retainer
21	Z-245	1	Reset Screw
22	B-235	1	Reset Knob
23	S-407	1	Diaphragm Plate Seal
24	BA-250	1	Diaphragm Front Plate
25	B-230	1	Diaphragm
26	S-408	1	Diaphragm Body Seal
27	BA-245	1	Diaphragm Back Plate
28	Z-220	4	Body Screw (1 1/2" Lgth.)
29	Z-230	2	Body Screw (2 1/2" Lgth.)
30	YV-260	1	Inlet Spring
31	S-407	1	Back Body Inlet Seal
32	S-403	1	Valve Seat Seal
33	MS-19	1	1" NPT Union (Not Shown)
34	Z-247	1	Washer
35	Y-270	1	Filter Support

NOTES:

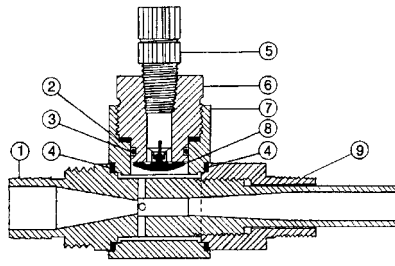
1. Include Chlorinator Serial Number and Capacity on Order.
2. A-2001 Yoke Assembly includes Ref. No. 1 through 8 and 35.
3. A-2002 Inlet Valve Capsule Assembly includes Ref. No. 9, 12 through 15, 19, 30, 32.

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

DRAWING NO. A-950/A-949 Ejector/Dual Check Valve Assembly (Optional) - Chlorine Service only



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)**

Ref. No.	Part No.	Quantity	Description
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)**

Ref. No.	Part No.	Quantity	Description
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)**

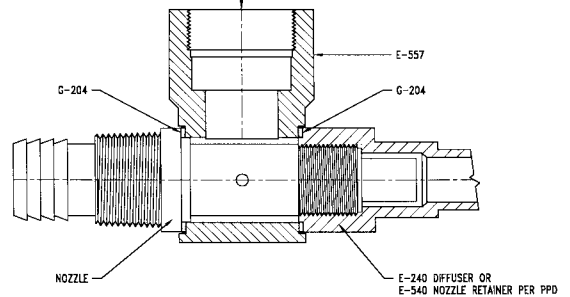
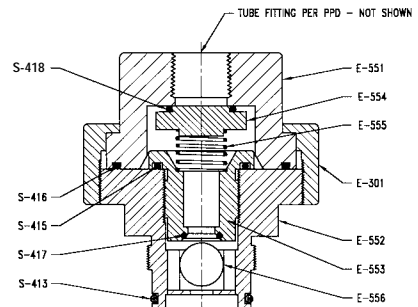
Ref. No.	Part No.	Quantity	Description
1	E-533 (50X)	1	Nozzle
2	G-203	2	Seat Gasket
3	S-405	1	Seat O-Ring
4	G-204	2	Body Gasket
5	ZZ-271	1	5/8" OD Tube Fitting
6	E-520	1	Check Valve Seat
7	E-210	1	Ejector Body
8	E-250	1	Check Valve
9	E-540	1	Nozzle Retainer

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

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-949 DUAL CHECK VALVE ASSEMBLY

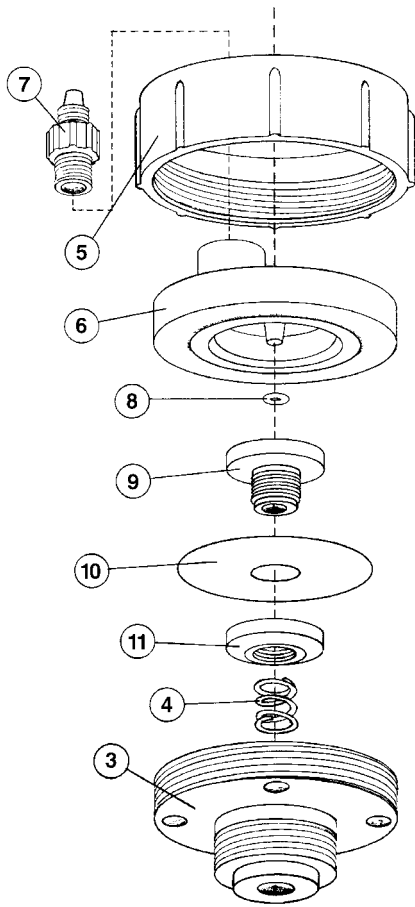


A-950 EJECTOR ASSEMBLY

Part No. Quantity Description

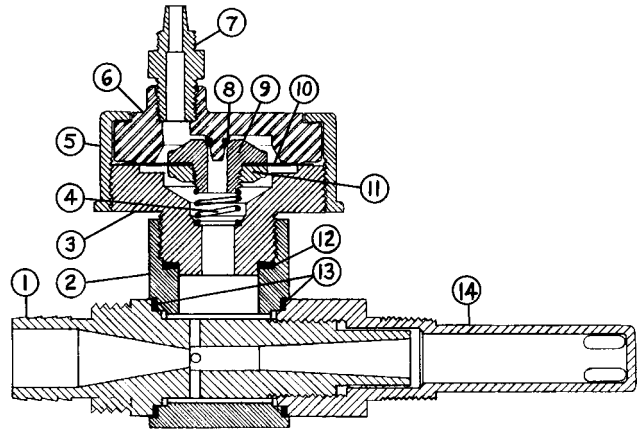
A-949	1	Dual Check Valve Assem.
E-557	1	Ejector Body
-	1	Nozzle - Sized Per PPD
-	1	Diffuser or Nozzle Retainer Per PPD
E-240	-	Diffuser (1.5 to 250 PPD)
E-540	-	Nozzle Retainer (500 PPD-50X Nozzle Only)
G-204	2	Gasket

**DRAWING NO. A-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)**

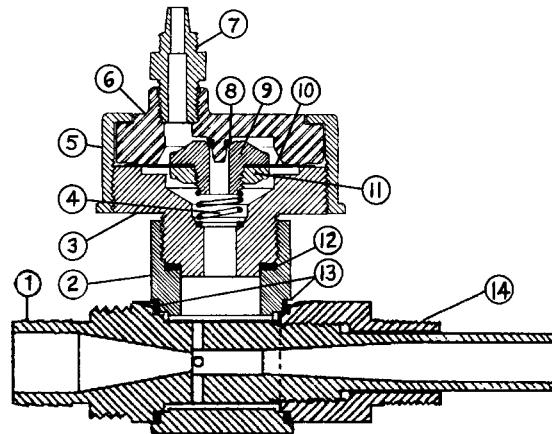


A-300 / A-320 / A-350
Low Pressure Check Valve Assembly

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.)

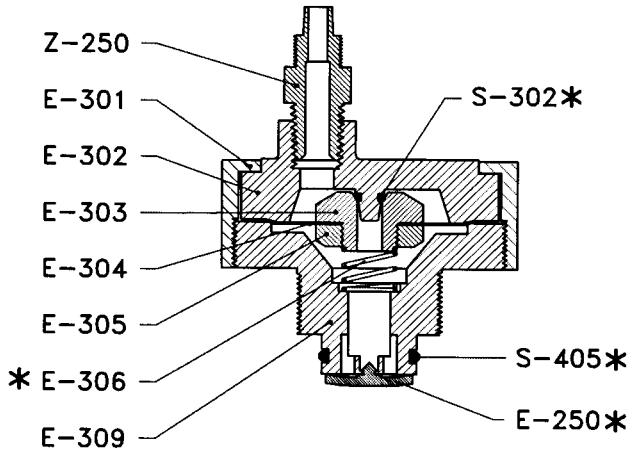


EJECTOR MODEL A-926 500 PPD (10 kg/hr.)

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)	Quantity	Description
Ref. No.	Part No.	Part No.	Part No.		
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-927/A-927A High/Low Pressure Ejector Assembly (Optional)
A-301/A-301A High/Low Pressure Check Valve Assembly
Chlorine/Ammonia Service - Max. Capacity: 100 PPD (2000GM/HR)**



HIGH/LOW CHECK VALVE ASSEMBLY

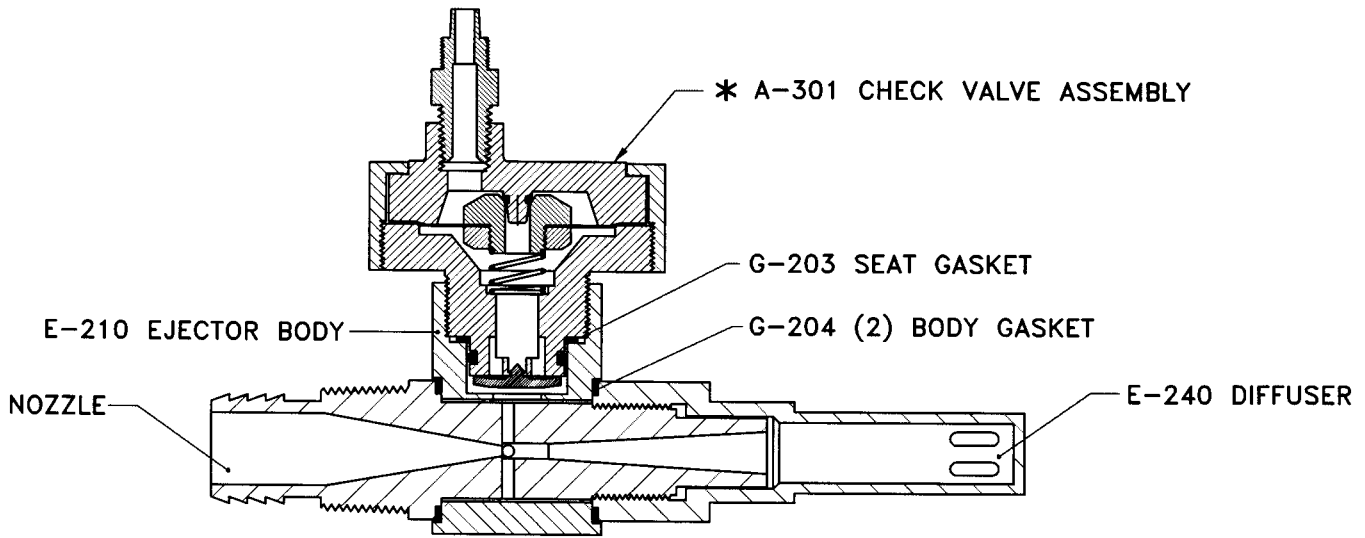
A-301 CHLORINE SERVICE

<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
E-301	1	Clamp Ring
E-302	1	Inlet Body
E-303	1	Diaphragm Bolt
E-304	1	Diaphragm
E-305	1	Diaphragm Nut
* E-306	1	Spring
E-309	1	Outlet Body
* E-250	1	Check Valve
* S-302	1	O-Ring
* S-405	1	O-Ring
Z-250	1	Tube Fitting (3/8" OD)

*** A-301A AMMONIA SERVICE**

Substitute the following parts

E-310	1	Spring
EA-250	1	Check Valve
SA-302	1	O-Ring
SA-405	1	O-Ring



HIGH/LOW EJECTOR ASSEMBLY - MAX. 100 PPD (2000GM/HR)

A-927 CHLORINE SERVICE

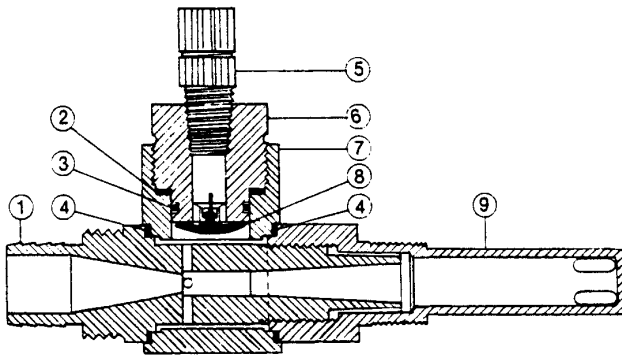
<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
* A-301	1	High/Low C.V. Assembly
E-210	1	Ejector Body
E-240	1	Diffuser
G-203	1	Seat Gasket
G-204	2	Body Gasket
	1	Nozzle per PPD

*** A-927A AMMONIA SERVICE**

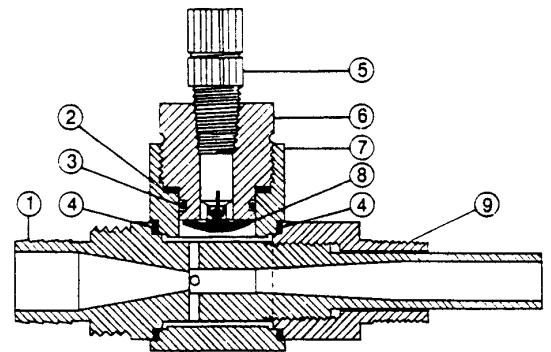
Substitute the following parts

A-301A	1	High/Low C.V. Assembly
--------	---	------------------------

**DRAWING NO. A-920S/A-922S/A-925S Ejector Assembly
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)**

Ref. No.	Part No.	Quantity	Description
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)**

Ref. No.	Part No.	Quantity	Description
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

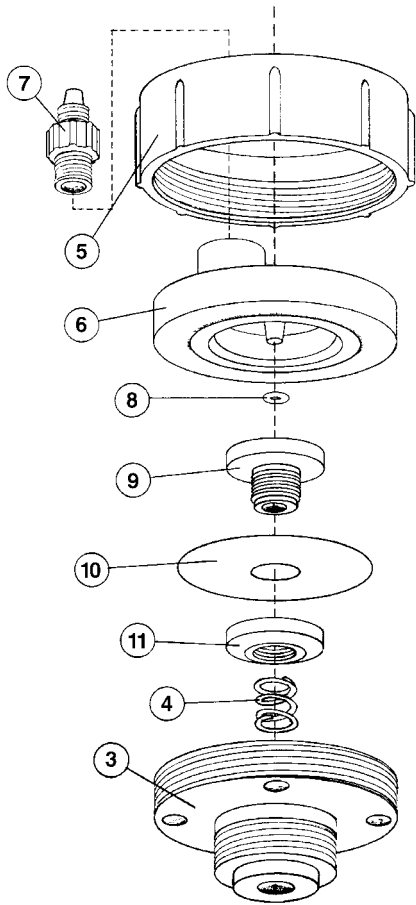
Ejector Assembly A-925S

**Check Valve Assembly E-525S Includes Ref. No. 2, 3, 5, 6, 8
Max. Capacity: 500 lbs./24 hrs. (10 kg/hr)**

Ref. No.	Part No.	Quantity	Description
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

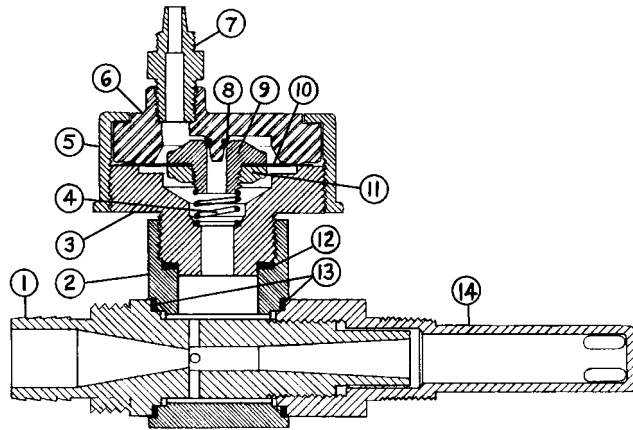
NOTE: Include Chlorinator Serial Number and Capacity and Size (OD) of Vacuum Tubing Being Used.

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)

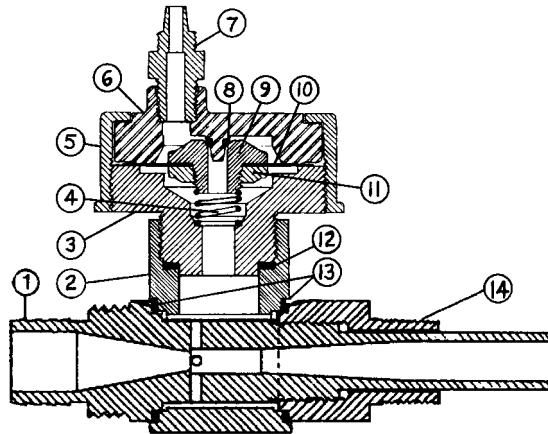


A-300S / A-320S / A-350S
 Low Pressure Check Valve Assembly

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.)



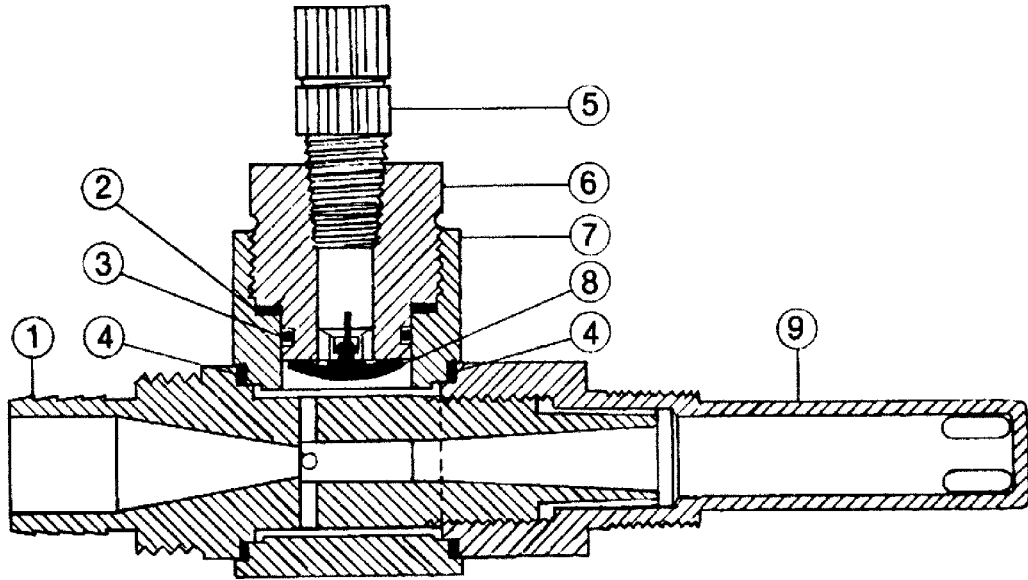
EJECTOR MODEL A-926S 500 PPD (10 kg/hr.)

Ejector Assembly	A-921S	A-923S	A-926S
Max. Capacity	100 lbs./24hrs. (2000 g/hr)	250 lbs./24 hrs. (5000 g/hr)	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-920A Ejector Assembly
E-225A Check Valve Assembly Ammonia Service
High Pressure - For Back Pressure Over 20 PSI (1.4 KG/CM²)



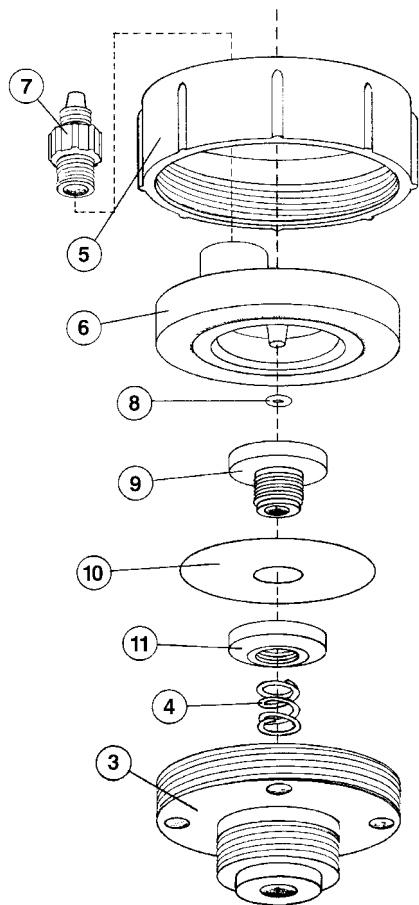
EJECTOR MODEL A-920A

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)

<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	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

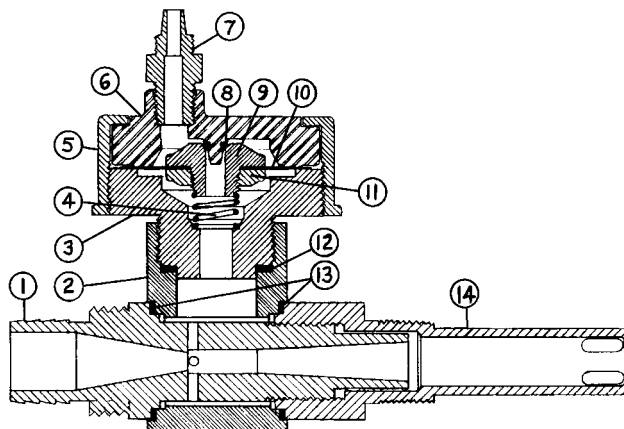
NOTE: Include Ammoniator Serial Number, Capacity and Size (OD) of Vacuum Tubing Being Used.

DRAWING NO. A-921A Ejector Assembly (Optional)
A-300A Check Valve Assembly Ammonia Service
Low Pressure - For Back Pressure Up to 20 PSI (1.4 KG/CM2)



A-300A
 Low Pressure Check Valve Assembly

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

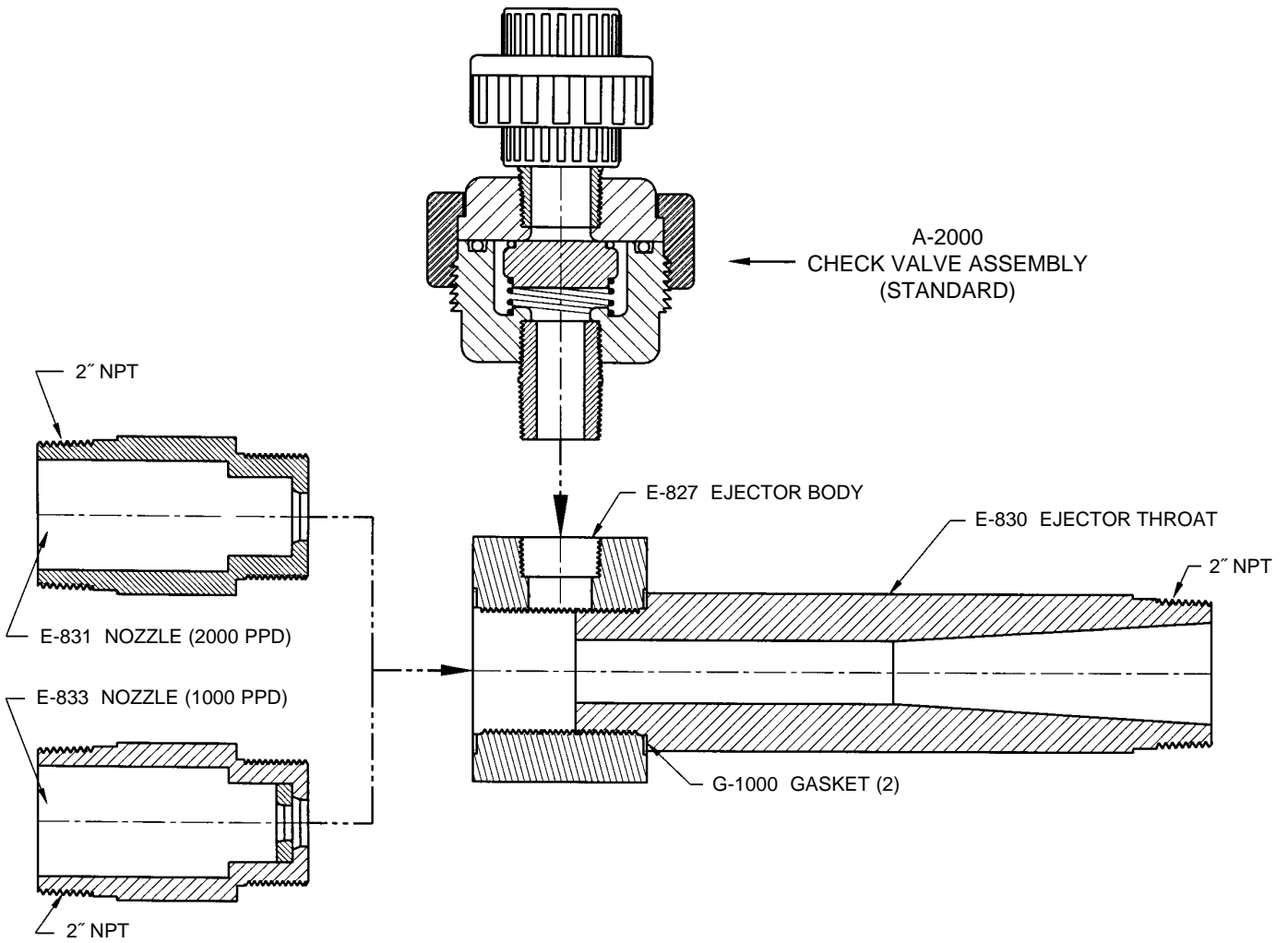


EJECTOR MODEL A-921A 100 PPD (2000 g/hr.)

Ejector Assembly Max. Capacity		A-921A 100 lbs./24hrs. (2000 g/hr)		
Ref. No.	Part No.	Quantity	Description	
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)

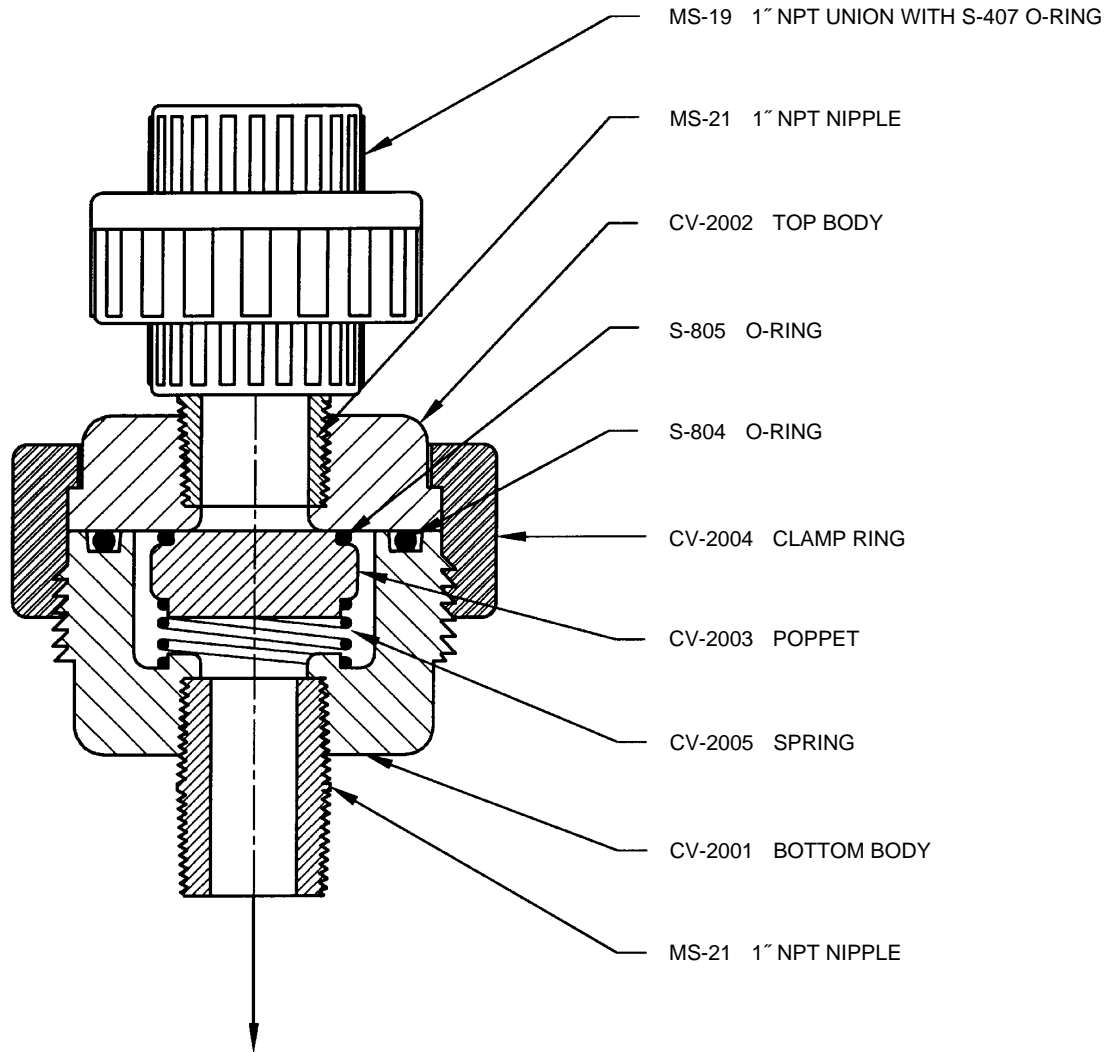


EJECTOR BODY/NOZZLE/THROAT ASSEMBLY
 E-840 (1000PPD) = E-827, E-830, E-833, G-1000(2)
 E-841 (2000PPD) = E-827, E-830, E-831, G-1000(2)

See A-2000 Check Valve Assembly Drawings for Part Numbers

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

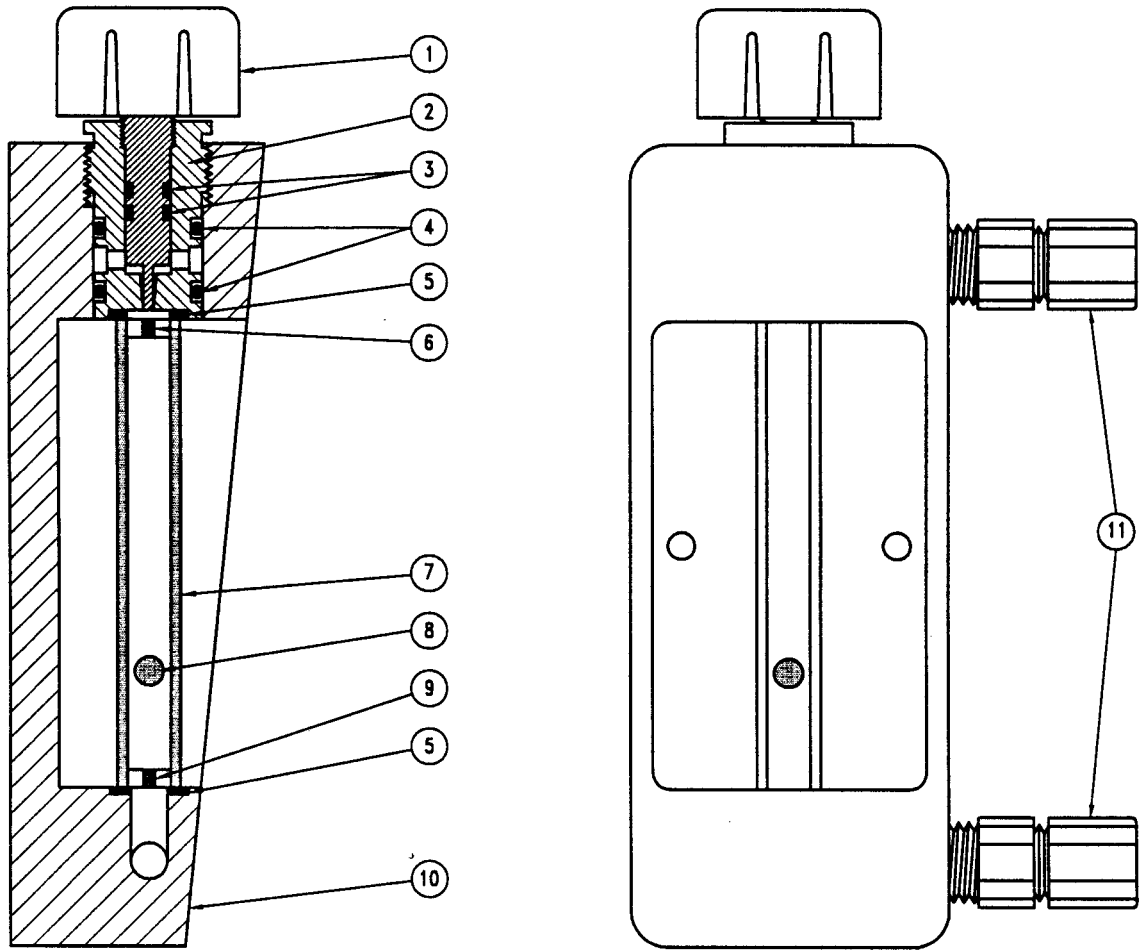
A-2000 CHECK VALVE ASSEMBLY (STANDARD)



OUTLET TO E-827 EJECTOR BODY
SEE A-2920/A-2922 EJECTOR ASSEMBLY DRAWING

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

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

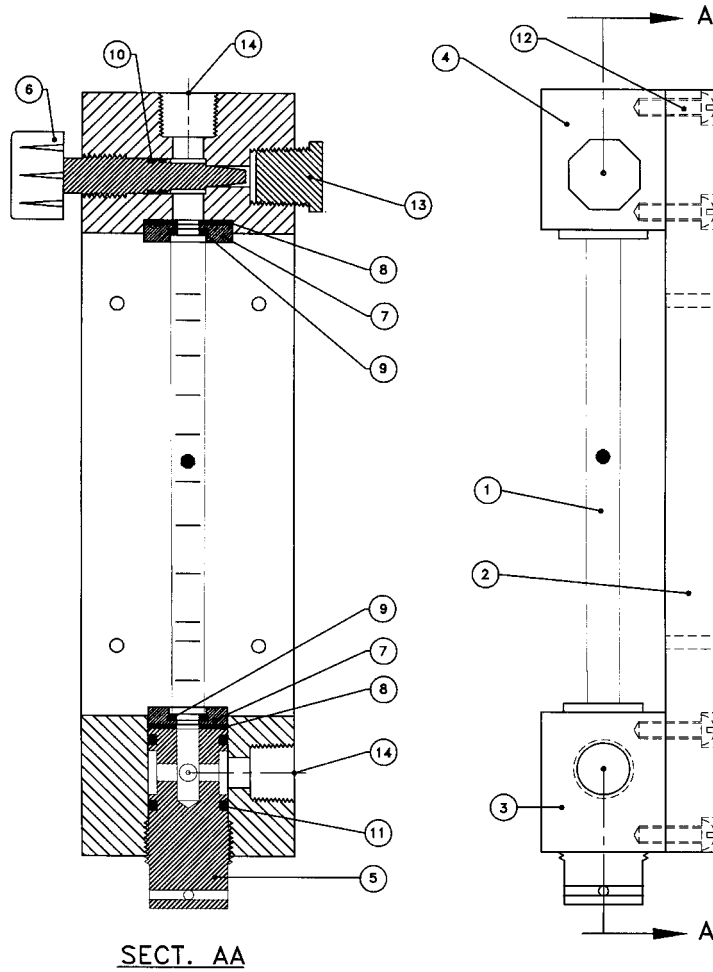


Ref. No.	A-255 4 to 100 PPD CL2 Part No.	A-255S 4 to 100 PPD SO2 Part No.	A-255A 4, 10, 25 PPD NH3 Part No.	A-255A 50, 100 PPD NH3 Part No.	Quantity	Description
1	RV-220	RV-220	RV-223	RV-223	1	Rate Valve Plug Assembly
2	RV-210	RV-710	RV-212	RVA-212	1	Rate Valve Seat
3	S-302	S-302	SA-302	SA-302	2	Rate 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-210	A-310	A-310	1	Metering Tube Assem. (Ref. No. 5 thru 9)
10	DA-255	DA-755	DA-255	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:

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

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



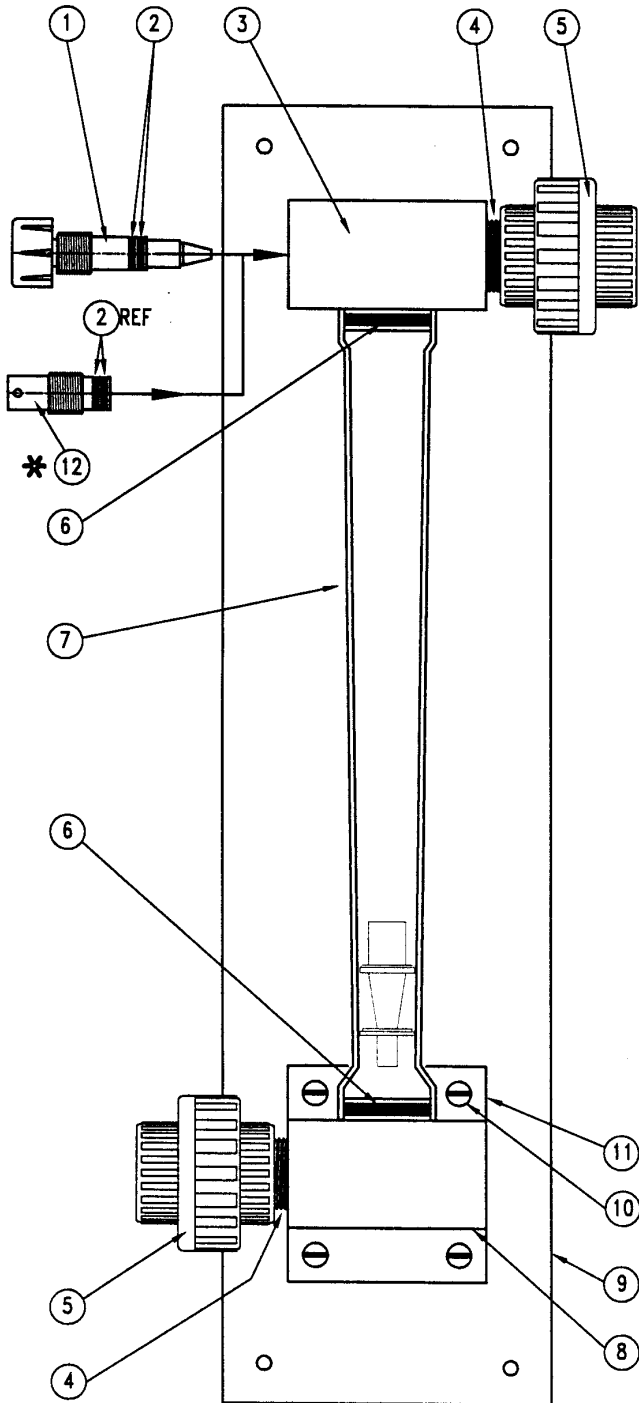
Ref. No.	Part No.	Quantity	Description
1	See Chart	1	Meter Tube Assembly
2	7502	1	Base Plate
3	7503	1	Bottom Block
4	7504	1	Top Block
5	7505	1	Meter Tube Plug
6	RV-831	1	Rate Valve Plug Assembly
7	See Chart	2	Top and Bottom Bushing
8	G-700	2	Top and Bottom Bushing Gasket
9	See Chart	2	Top and Bottom 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	7507	7508	7508	7508	7509	7510
9	G-701	G-702	G-702	G-702	G-703	G-704
14	ZZ-275	ZZ-275	ZZ-275	ZZ-275	ZZ-276	ZZ-277

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)

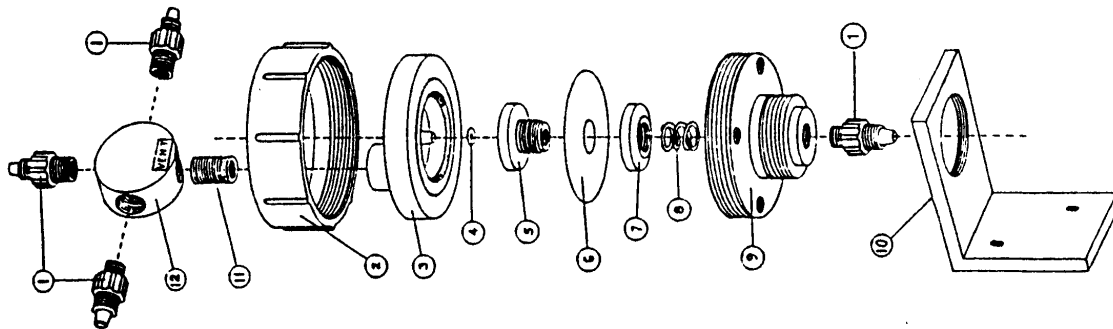


Ref. No.	Part No.	Quantity	Description
1	RV-825	1	Rate Valve Plug Assembly 1000/2000 PPD (20/40 Kg/Hr)
2	S-803	2	Rate Valve Stem Seal
3	RV-810	1	Rate Valve Seat Block
4	MS-21	2	1" NPT Close Nipple
5	MS-19	2	1" NPT Union
6	S-801	2	Metering Tube Seal
7		1	Metering Tube/Float Assembly
	A-2100		1000 PPD (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.

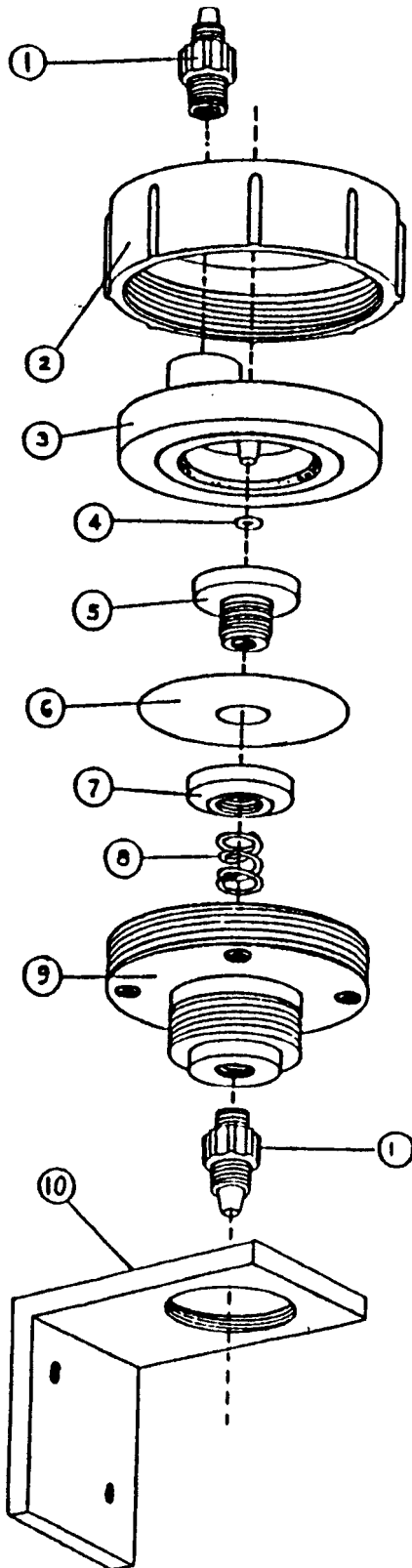
DRAWING NO. A-300-V1/-V2/-V3/A-300A-V1/A-300S-V1/-V2/-V3
Switchover Pressure Relief (Vent) Valve Parts List



Ref. No.	Part No.	A-300-V1 Chlorine 100 PPD (2000g/hr)	A-300-V2 Chlorine 250 PPD (5000g/hr)	A-300-V3 Chlorine 500 PPD (10kg/hr)	A-300A-V1 Ammonia 100 PPD (2000g/hr)	Assembly Max. Capacity
1	Z-250				Z-250	3/8" OD Tube Fitting
1	E-301	ZZ-260			E-301	1/2" OD Tube Fitting
1	E-302			ZZ-270	E-302	5/8" OD Tube Fitting
2	S-302			E-301	E-302	External Clamp Ring
3	E-303			S-302	SA-302	Inlet Body
4	E-304			E-303	E-303	Check Valve Seal
5	E-305			E-304	E-304	Diaphragm Bolt
6	E-306			E-305	E-305	Diaphragm
7	E-307			E-306	E-310	Diaphragm Nut
8	E-300			E-307	E-307	Spring
9	MS-11			E-300	E-300	Outlet Body
10	MS-14			MS-11	MS-11	Wall Mount Bracket
11				MS-14	MS-14	1/4" NPT PVC Nipple
12						1/4" NPT PVC Cross

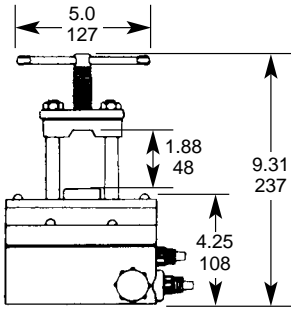
Ref. No.	Part No.	A-300S-V1 Sulfur Dioxide 100 PPD (2000g/hr)	A-300S-V2 Sulfur Dioxide 250 PPD (5000g/hr)	A-300S-V3 Sulfur Dioxide 500 PPD (10kg/hr)	Assembly Max. Capacity
1	ZZ-250				3/8" OD Tube Fitting
1	E-701		ZZ-260	ZZ-270	1/2" OD Tube Fitting
1	E-702			E-701	5/8" OD Tube Fitting
2	S-302			E-702	External Clamp Ring
3	E-703			S-302	Inlet Body
4	E-304			E-703	Check Valve Seal
5	E-705			E-304	Diaphragm Bolt
6	E-310			E-705	Diaphragm
7	E-707			E-310	Diaphragm Nut
8	E-300			E-310	Spring
9	MS-11			E-707	Outlet Body
10	MS-14			E-300	Wall Mount Bracket
11				MS-11	1/4" NPT PVC Nipple
12				MS-14	1/4" NPT PVC Cross

A-300V4 Pressure Relief (Vent) Valve Assembly

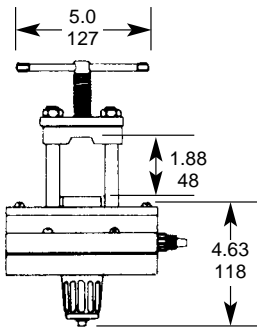
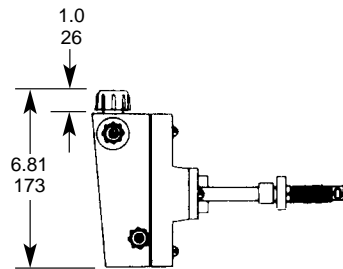
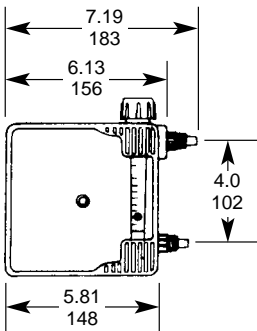


Ref. No.	Part No.	Quantity	Description
1	ZZ-270	2	5/8" Vacuum Tube Fitting w/cap
2	E-301	1	External Clamping Ring
3	E-302	1	Inlet Body
4	S-302	1	Check Valve Seal
5	E-303	1	Diaphragm Bolt
6	E-304	1	Diaphragm
7	E-305	1	Diaphragm Nut
8	E-306	1	Spring
9	E-307	1	Outlet Body
10	E-300	1	Wall Mount Bracket

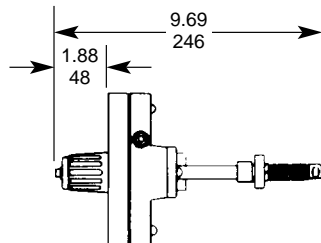
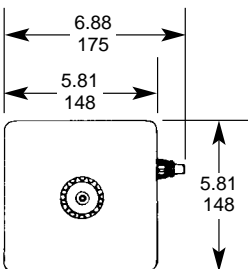
UP TO 500 PPD (10 Kg/Hr)



Vacuum Regulator
Cylinder or
Manifold Mounted*

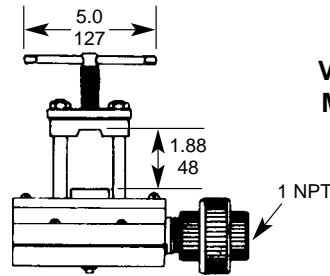


Automatic Switchover
Vacuum Regulator
Cylinder or
Manifold Mounted*

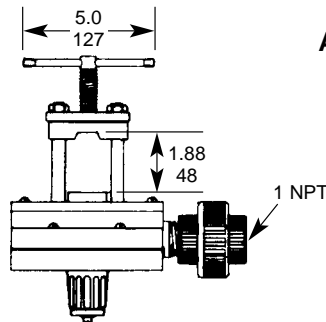
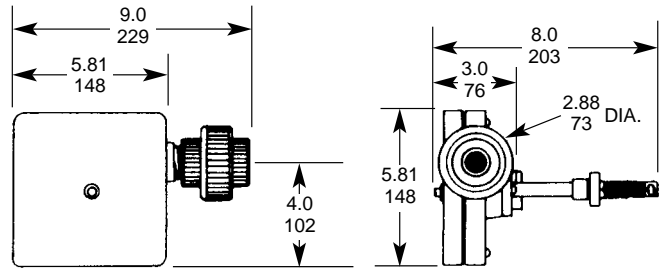


* May be mounted on TAY-200
Ton Container Adapter

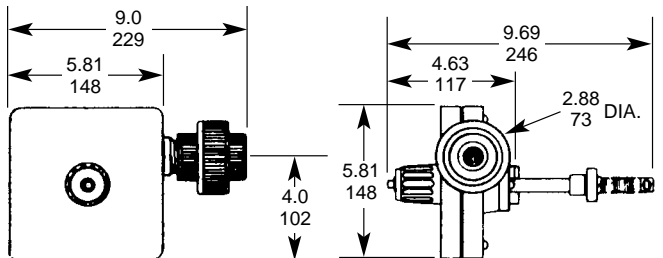
1000/2000 PPD (20/40 Kg/Hr)



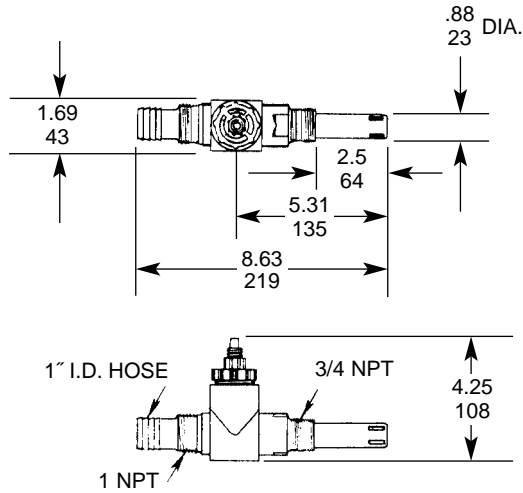
Vacuum Regulator
Manifold Mounted



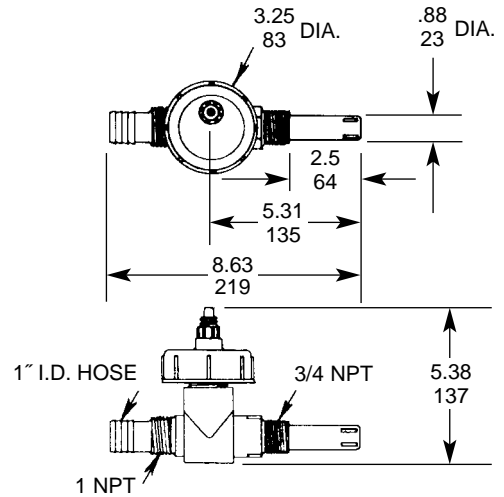
Automatic Switchover
Vacuum Regulator
Manifold Mounted



DIMENSIONS: INCHES
MILLIMETERS

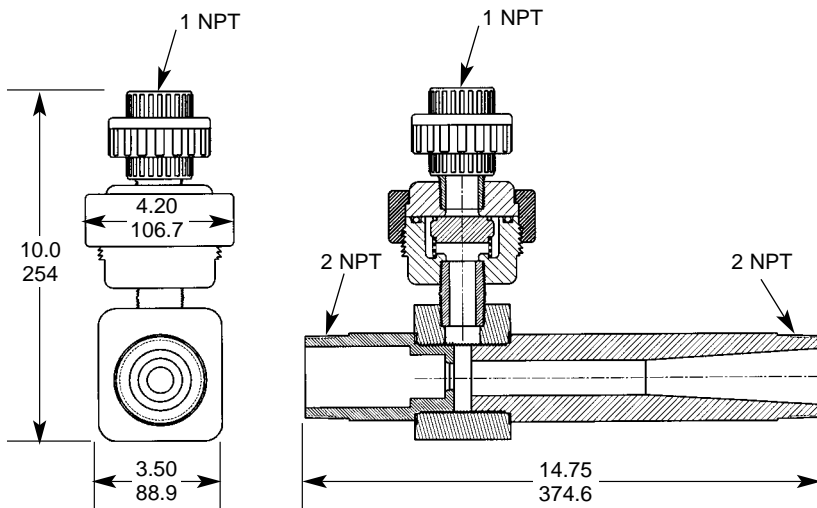


High Pressure
Up To 500 PPD (10 Kg./Hr.)

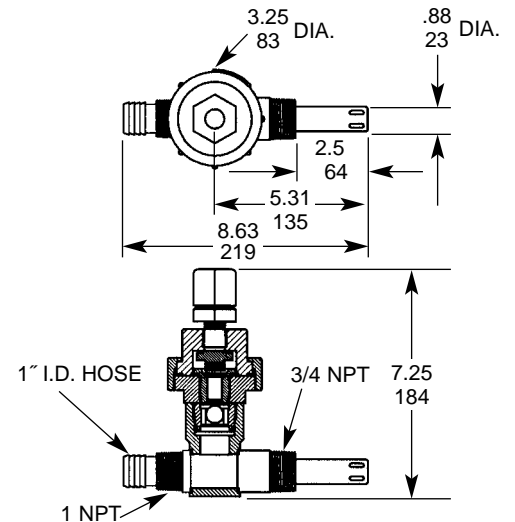


Low Pressure
Up To 500 PPD (10 Kg./Hr.)

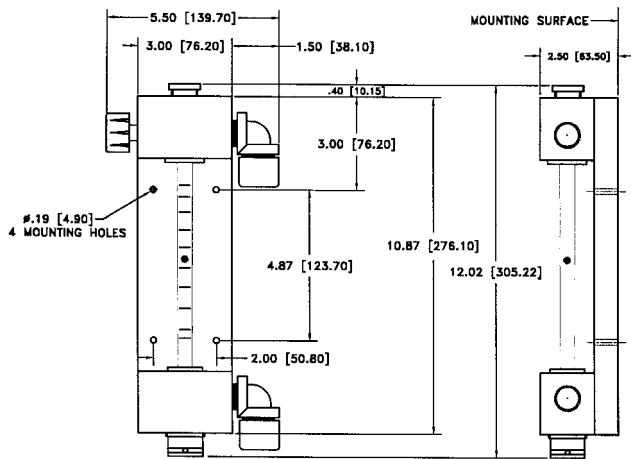
DIMENSIONS: INCHES
MILLIMETERS



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

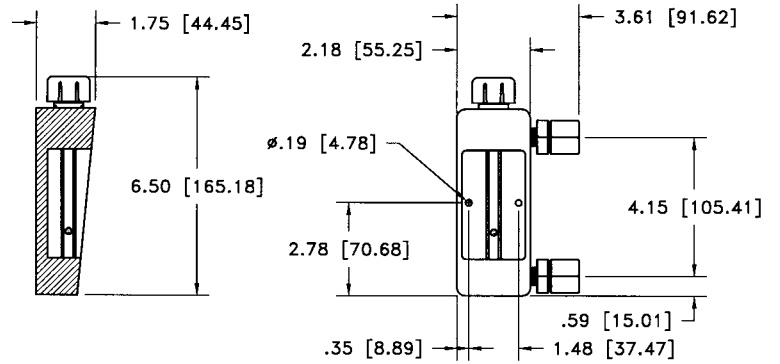


A-950 Ejector Assembly
A-949 Dual Check Valve



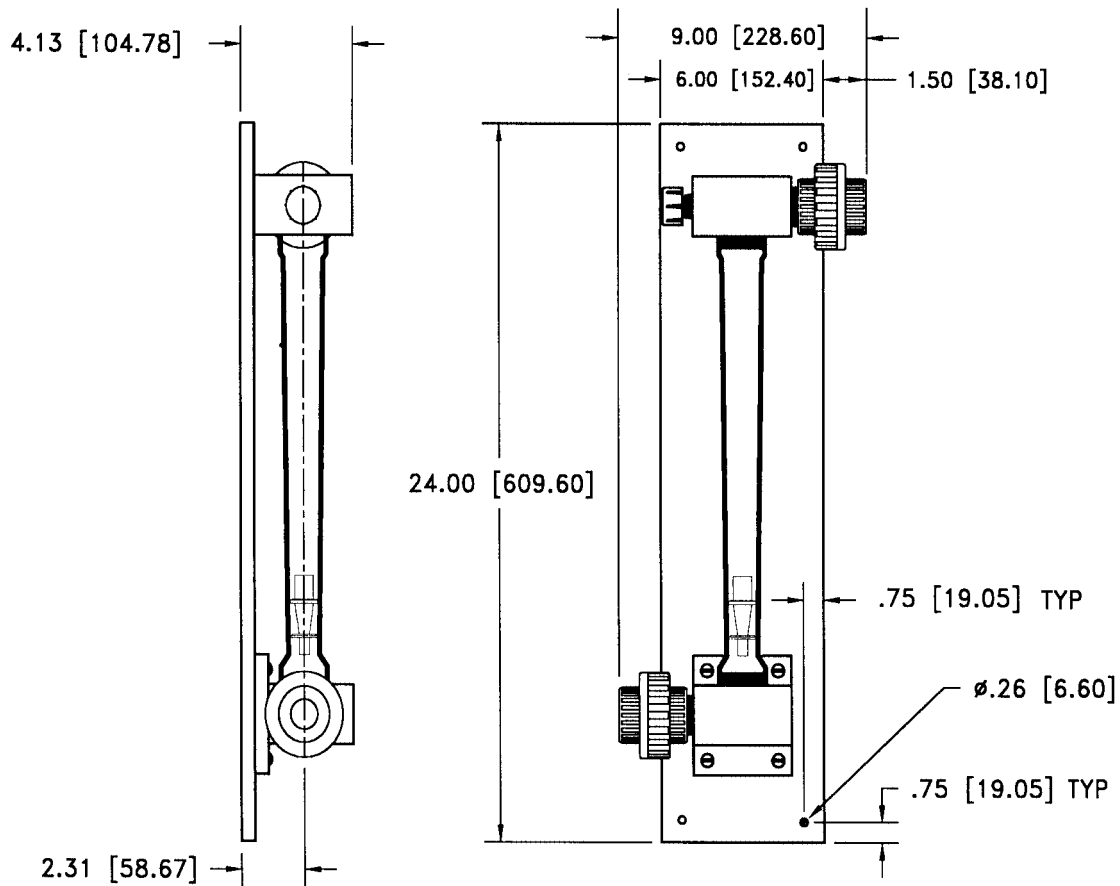
7500

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



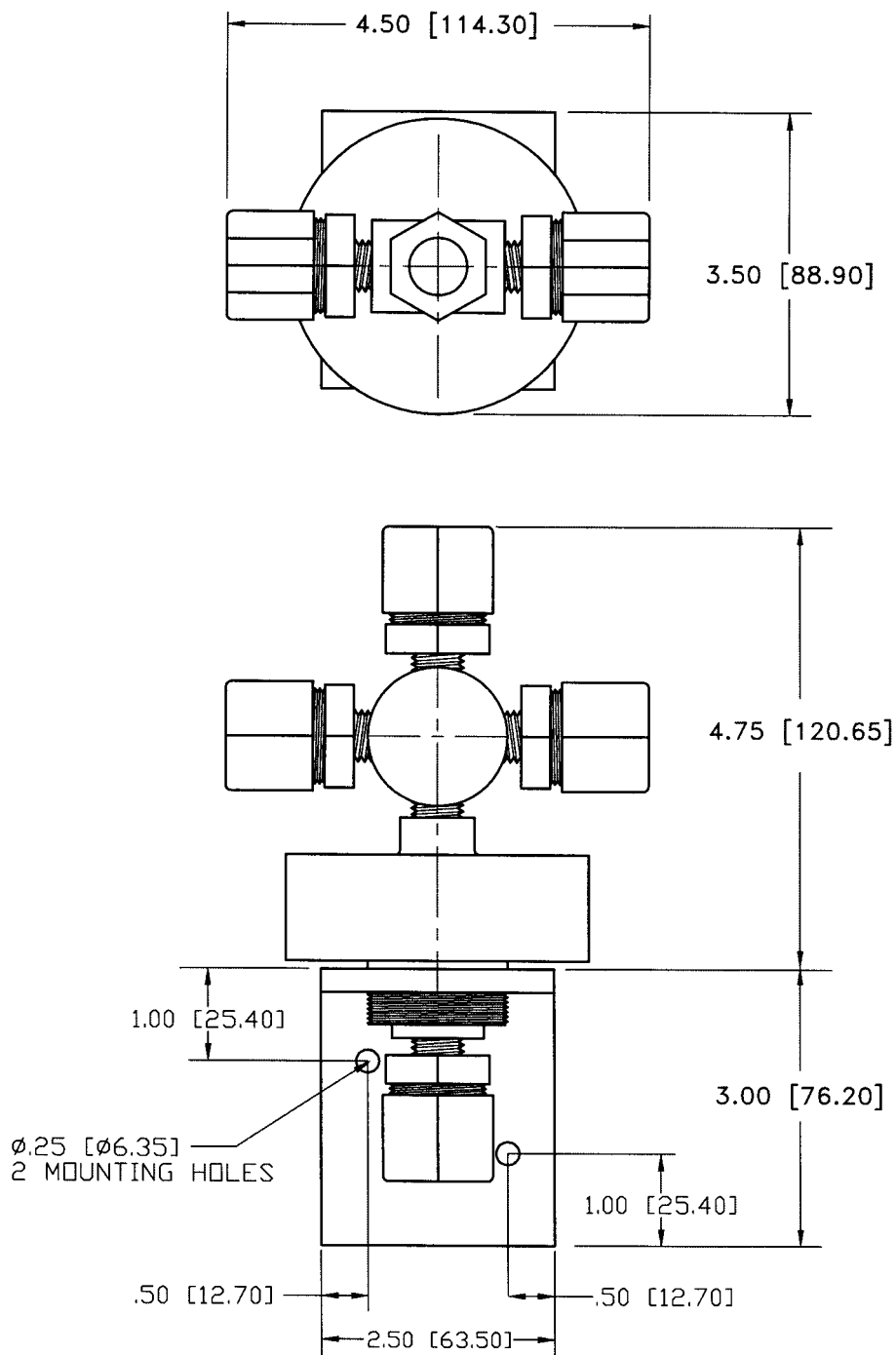
A-255

10 PPD to 100 PPD (10 Kg./Hr.)



A-2551/A-2552

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



7.0 EJECTOR ASSEMBLY REQUIREMENTS

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 absolutely essential that you carefully identify and consider the various factors related to installation of the ejector, that will result in creation of sufficient vacuum to feed the desired amount of chlorine gas. These factors are known as "hydraulic conditions," and some of the most important are as follows:

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 through out a water system can vary a great deal.
- Always consider the *maximum* backpressure.
- Use only pressure gauges which are known to be accurate.

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

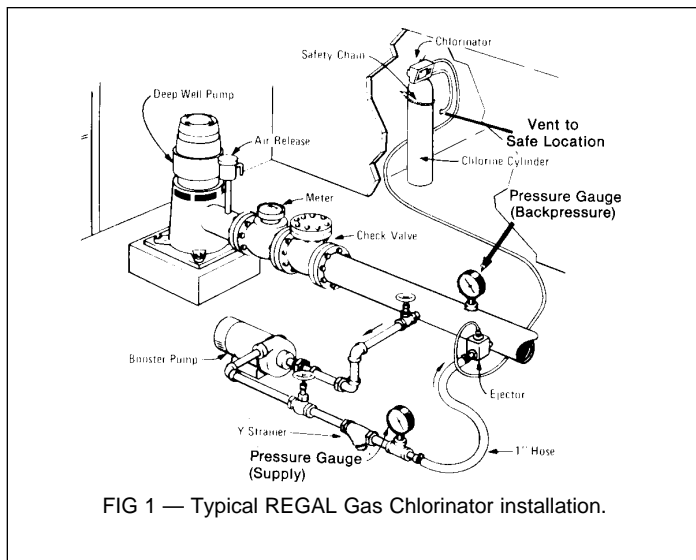


FIG 1 — Typical REGAL Gas Chlorinator installation.

in available (See Ejector Nozzle Requirements charts on the following pages). Where necessary, add a booster pump.

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 Inc. has designed several different sizes of nozzles. Figure 2, below, shows the location of the stamped size designation:

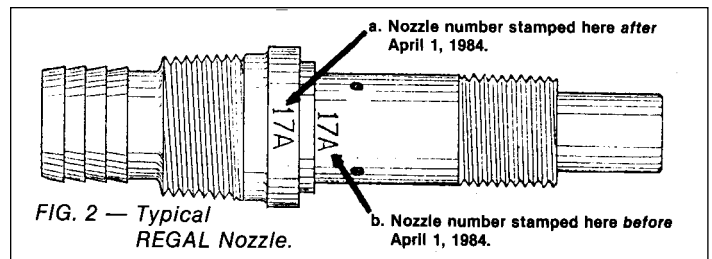


FIG. 2 — Typical REGAL Nozzle.

STANDARD NOZZLE

The "Standard Nozzle" shown on each chart, is the one which would normally be supplied with a REGAL Series 200 Gas Chlorinator of that particular maximum chlorine gas feed rate (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 of any adjustments that you might have to make. This is the ideal situation.

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/cm²).
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/cm²) 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/cm²) 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/cm²) and read across to the "STANDARD NOZZLE No. 5A*" column.

- c. The EJECTOR SUPPLY PRESSURE must be at least 94 PSI (6.61 kg/cm²) and the nozzle will require at least 10.8 U.S. GPM (0.68 l/sec.) WATER FLOW.
- d. The DIFFERENTIAL PRESSURE necessary, therefore, is 34 PSI (2.40 kg/cm²) or 94-60 (6.61-4.21).
- 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/cm²). Booster pumps take the incoming water pressure and ADD a certain amount of pressure.

NOTE: However, if another, independent water source were available that could provide the ejector with at least 94 PSI (6.61 kg/cm²) 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

Occasionally, 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 to be used which may not be capable of providing water flow and/or required pressure boost.
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 Incorporated.

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 ²	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ 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 ²	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ 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 ²	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ 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 ²	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ 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 ²	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ 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

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 ²	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ l/sec.	PSIG @ GPM	kg/cm ² @ 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 ²	PSIG @ GPM	kg/cm ² @ 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.)

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 ²	PSIG @ GPM	kg/cm ² @ 1/sec	PSIG @ GPM	kg/cm ² @ 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 ²	PSIG @ GPM	kg/cm ² @ 1/sec	PSIG @ GPM	kg/cm ² @ 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 AUTOMATIC SWITCHOVER SYSTEM

THEORY OF OPERATION

In all REGAL Gas Feed switchover systems, whatever the configuration or additional components involved, the system operates at less than atmospheric pressure (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, past the pressure relief (vent) valve, and then to the switchover vacuum regulators by the interconnecting tubing.

In the vacuum regulators, 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, past the pressure relief (**vent**) valve to the metering panel assembly, and finally to the ejector assembly.

The metering tube in the metering panel assembly 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.

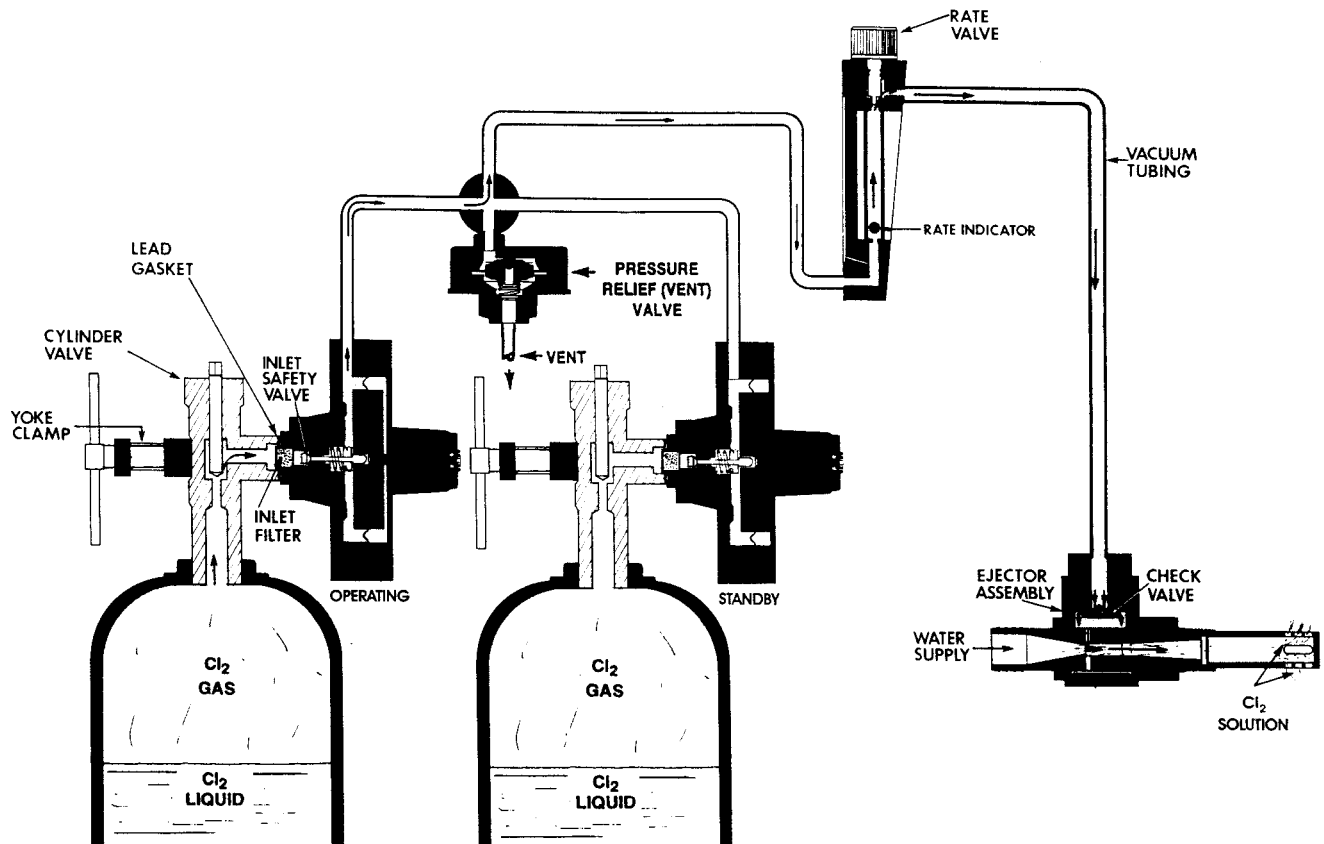
From the metering panel assembly, the gas flows through tubing to the ejector assembly. In the ejector, the gas passes through a check valve and then to the nozzle throat (highest vacuum area) where it mixes with and is dissolved in the water stream.

Should gas under pressure conditions ever enter the system components, the diaphragm valve located in the pressure relief (vent) valve unit will open allowing the gas to be "vented" to as safe an area as possible.

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.

Automatic switchover capability is provided by two vacuum regulators fitted with mechanical detents. One vacuum regulator feeds gas until the supply to which it is connected becomes empty. When this happens, the resulting rise of vacuum to higher than normal operating levels, provides sufficient force to unlatch the second vacuum regulator which then takes over the gas supply function and allows the operator ample time to change out the exhausted gas supply source.

REGAL GAS SWITCHOVER 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 incorporated**

1044 SE Dixie Cutoff Road, Stuart, Florida 34994 USA

Phone: (772) 288-4854 • Fax: (772) 287-3238 • www.regalchlorinators.com • Email: chlorinc@aol.com