ENCHLOR Inc. Gas Feed Systems Series E600 Instruction Manual

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All ENCHLOR Chlorination systems are carefully designed and tested for years of safe, accurate field service. All ENCHLOR Chlorination systems are chlorine tested, at customer specified conditions, prior to shipment. All ENCHLOR products are made of the finest materials. To ensure best operation, read these instructions carefully and completely and store them where all maintenance personnel will have access to them.

Each 6000 Series gas chlorination system consists of the following:

1. The vacuum regulators which mount on the chlorine cylinders.
2. A wall mounted flow meter with manual control valve.
3. The ejector, with nozzle and diffuser, mounts directly to the pipe line, tank, wet well, or to a solution line.
4. Standard accessories:
    a. Appropriate polyethylene tubing for vacuum lines.
    b. Ten lead gaskets for each vacuum regulator.
5. Additional parts available from any plumbing supply, or can be ordered through Enchlor.
    a. Pressure gauge.
    b. Water shut off valve.
    c. Y-type strainer.

Gas Chlorination Systems
Series 600
Operation & Maintenance Manual

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SECTION I: SAFETY INFORMATION

TAKE CARE WITH CHLORINE!

1. Always keep chlorine cylinders in an upright position with the valve cap screwed on tight before moving full or empty cylinders. Cylinders should be moved with care.
2. A safety chain must be placed around the cylinder and secured to a wall. Spare full cylinders should also be secured carefully.
3. For best operation and safety, the vacuum regulator and cylinders should be protected from the elements including direct sunlight.
4. Never place heaters or heat lamps directly on a cylinder.
5. Ammonia gas should NOT be stored or fed in the same room with chlorine. Contact of the gases may result in an explosive mixture.

IMPORTANT NOTE:

Take extreme caution when using chlorine gas manifolds. Manifolds contain pressurized chlorine gas there- by increasing the risk of a pressurized chlorine leak. Enchlor vacuum regulators are designed to mount directly onto the valve of chlorine and sulfur dioxide cylinders. Direct cylinder mounting is the easiest and safest configuration to operate and maintain. With this configuration, the chlorine gas flows under vacuum everywhere beyond the one pressure point at the chlorine cylinder valve.

SECTION II: DESIGN AND INSTALLATION NOTES

1. The “all vacuum” system means that system will shut off at the cylinder valve, should the vacuum line be broken, if water is stopped for any reason, or if the chlorination equipment is physically damaged.
2. Choosing the right feed rate capacity:

VACUUM REGULATOR SHOULD BE ON MAXIMUM POSSIBLE FLOW.

Imperial Units:

GPM x 0.012 x (PPM) Dosage = PPD

Gallons Per Minute Parts Per Million Pounds Per Day (Cl 2)

Example: 600 GPM x 0.012 x 3 PPM = 21.6 PPD

In this example a 50 PPD system would be appropriate.

Metric Units:

LPM x 0.0599 x (PPM) Dosage = GPH

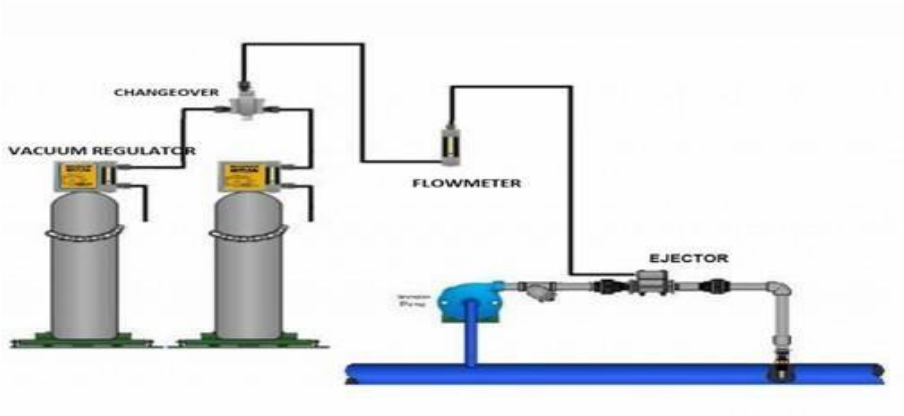
Liters Per Minute Parts Per Million Grams Per Hour (Cl 2)

3. TOTAL BACK PRESSURE is the pressure in the pipeline to be chlorinated plus the friction losses in the solution line between the ejector and the point of injection at the pipeline. Ejectors capable of operating with backpressures up to 140 Psig are standard. For higher backpressure consult factory.

4. It is preferable to locate the ejector at the point of solution injection in order to eliminate the need for solution lines. Friction losses in the solution line will increase the ejector backpressure. To reduce the friction losses, increase the solution line internal diameter and limit the number of flow restrictions and

turns. Also be sure that the solution line material is resistant to the highly concentrated chlorine mixture. Avoid solution lines wherever possible.

5. The chlorine gas is carried from the vacuum regulator to the ejector through the specified polyethylene tubing. Up to 25 feet of polyethylene tubing between vacuum regulator and ejector is standard. For longer distances consult factory.



A typical installation injecting chlorine into a pipe line using city water.

SECTION III: SYSTEM INSTALLATION

(I) INSTALLATION OF EJECTOR (Refer to Figures 1 and 2)

1. Installation of EJECTOR:

a. Remove the diffuser from the ejector assembly and place 2 wraps of Teflon tape on diffuser threads.

b. Do Not install diffuser into pipeline when assembled with ejector.

c. Turn diffuser by hand into NPT threads of pipeline (3/4" or 1 1/4" NPT). Place wrench on diffuser and tighten one half turn maximum.

d. Reconnect diffuser to ejector making sure appropriate O-rings are on each side of nozzle and diffuser.

2. Testing of ejector. (Note: The vacuum regulator should still be in the shipping case.)

i. Piping hook up to ejector (Refer to Figures 1 and 2 and Servicing Section in this Manual).

a. Ejector should be installed downstream at a sufficient distance so that chlorinated water is not re-circulated through the booster pump. (See Figure 2.)

b. On the water inlet side to the ejector nozzle the following should be installed: a gate valve, Y-strainer, and a pressure gauge.

ii. Testing for sufficient pump pressure to operate ejector. Also checking that booster pump (if applicable) operating in the proper direction. Refer to ejector performance charts and tables at end of this manual.

Note 1: Ejector must have some back pressure to prevent jetting. (Jetting causes loss of vacuum)

Note 2: When chlorinating into a contact chamber a tee should be installed on the solution line with a vacuum breaker to prevent siphoning.

a. If operating with city water pressure (no booster pump), open the water inlet valve to the ejector and feel for suction (with your finger) at the fitting on the top of the ejector.
b. If pump is operating in proper direction there should be a strong vacuum at the fitting on the top of the ejector. Feel for suction (with your finger) at the fitting on the top of the ejector.
c. If the ejector has tested satisfactorily continue to the next step (Mounting the Vacuum Regulator).

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(II)INSTALLATION OF VACUUM REGULATOR

NOTE: The chlorine cylinder valve is CLOSED. Do not open until instructed to do so.

1. See that safety chain is secured around chlorine cylinder.
2. Remove the cylinder protection cap from the chlorine cylinder.
3. Examine the vacuum regulator for obvious damage.
4. Remove masking tape used for shipping purposes.
5. Place lead gasket over vacuum regulator inlet assembly.
6. While placing lead gasket on vacuum regulator see that the filter has not fallen out of inlet assembly. (This filter is necessary to remove particles that will cause venting.) The filter should be inspected each time the cylinder is changed.
7. Mount vacuum regulator on cylinder valve being sure the yoke screw is backed out far enough for sufficient clearance. While tightening the yoke screw be certain that the lead gasket stays in place. Excessive tightening can damage gasket and/or yoke screw. DO NOT USE EXCESSIVE FORCE. See torque specifications below.

(III) CONNECTING VACUUM LINES BETWEEN VACUUM REGULATOR AND EJECTOR AND VACUUM REGULATOR VENT TO OUTSIDE (Refer to Figures 1 and 2)

1. The side connector of vacuum regulator is for vacuum line tubing to ejector. (Allow enough vacuum tubing for changing cylinders.)
2. Connect vent tubing to second connector on the vacuum regulator and vent to safe area outside of building. (Place bug screen outside on end of vent tubing.)

NOTE: Do Not connect vent lines from two vacuum regulators to one common vent. You must run separate vent lines to the outside, when using multiple vacuum regulators.

(IV) REMOTE METERS (Refer to Figure 2)

1. Remote Meters: (Gas flow is from bottom to top through the tube)

a. Connect the line in to the bottom tube connector to vacuum regulator .

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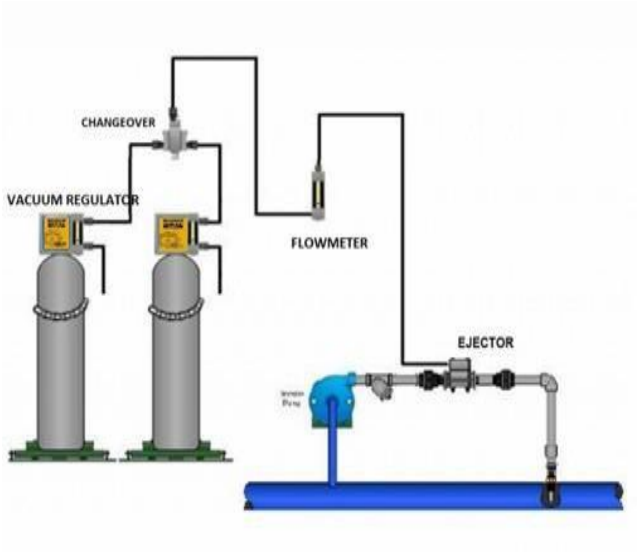
b. Connect the line out to the ejector to the topconnector.



A Switchover System injecting chlorine into a pipeline using aturbine positive displacement pump.
Pressure relief valve must discharge to a drain or outside of building. Note the by-pass piping from pump discharge through by-pass valve back to suction side of pump.
NOTE: By-pass valve must never be completely closed.
NOTE: Pump suction and ejector must be from the side of the pipeline, not from the top of the line.

SECTION IV: CHLORINATIONSYSTEM VACUUM TEST

1. Do Not open chlorine cylinder valve until vacuum test is satisfactorily completed.
a. Vacuum Test
With the chlorine cylinder still closed, start the ejector booster pump and the meter tube ball should drop to the bottom within about ten seconds. If the ball continues to bounce, there is either a leak at the lead gasket or a loose connection at the vacuum tube fittings or meter tube. (The tube fittings should be hand tight. It is not necessary to use pliers or a wrench on these fittings. If meter tube needs tightening, use a quarter and finger tighten inlet plug.) At this time the rate valve on the vacuum regulator should be open two or three turns.
b. If the ejector is operating properly (pulling sufficient vacuum) then the front bolts should bedepressed on both vacuum regulators.
c. Turn off water supply to ejector.
d. Wait 5 to 10 minutes with water supply off. The ball should remain still at the bottom of the meter tube.
e. If the system is vacuum tight proceed to the next step.
f. Disconnect vacuum tubing at the vacuum regulator to allow air to enter the system. Reconnect tubing.
g. Place one of the vacuum regulators in standby by turning the front knob two turns counterclockwiseand then returning it two turns clockwise. The front bolt should remain protruding per the diagram on the vacuum regulator.

SECTION V: START UP OF CHLORINATION

Material necessary: A small plastic squeeze bottle, 1/3 full of household ammonia, for detecting

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chlorine leaks. When ammonia fumes contact chlorine gas a visible smoky vapor is produced. (Wipe up any splashed liquid ammonia.)

1. Open chlorine cylinder valve 1/4 turn and close immediately.
2. Squeeze ammonia bottle at gasket and yoke assembly area: if no vapor appears the seals are tight and it is OK to proceed to the next step.
3. Open chlorine cylinder valve 1/4 turn, leave open, and recheck for chlorine leaks. (1/4 turn open of the cylinder valve is all that's required. The reason we specify 1/4 turn is that the valve can be closed with only 1/4 turn. In an emergency you can shut it off quickly and safely. The wrench stays on the cylinder valve while cylinder is open.)
4. Place one vacuum regulator in standby. This is done by turning the reset knob two turns counterclockwise and then returning it two turns clockwise. The front bolt should remain protruding per the diagram on the vacuum regulator.
5. Turn on water supply or booster pump to ejector and set rate valve to desired flow rate. Read flow rate at center of ball on meter tube scale.
6. Rate valve is not a shut off valve: it is a flow rate control only. To shut off chlorine feed close the chlorine cylinder valve.

SECTION VI: SHUT DOWN PROCEDURE

1. Close both chlorine cylinder valves while pump is still running.
2. Wait for ball to rest at bottom of meter tube and the front bolt to be below the surface.
3. Break vacuum by removing the tubing at one of the vacuum regulators and reattach. (Repeat at least 2 times for more complete removal of gas from the system.)
4. Shut down the water supply to the ejector.

This procedure of shut down must be followed before a vacuum regulator is removed from a cylinder. NOTE: After installing the vacuum regulator with a new lead gasket on a new cylinder, the vacuum tubing should be removed to allow air to enter the system and break the vacuum. Not releasing vacuum and turning on cylinder will slam the diaphragm forward and could cause damage to the diaphragm assembly. You can also accomplish breaking the vacuum by turning the rate valve out of the bonnet. Either way is acceptable.

SECTION VII: CHANGING CYLINDERS

When one cylinder is empty, and the system has switched to feed from the other cylinder then the empty cylinder must be replaced, and that vacuum regulator must be placed in standby mode.

1. Tightly close the valve of the empty chlorine cylinder. Follow all applicable guidelines in changing chlorine cylinders.
2. After replacing the empty with a full cylinder, inspect the vacuum regulator, the vacuum regulatorfilter and (using a new lead gasket) mount the vacuum regulator on the full cylinder.
3. Turn the front knob two turns counterclockwise and then return two turns clockwise to place the vacuum regulator in standby. The front bolt should remain protruding per the diagram on the vacuum regulator.

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SECTION VIII: RATE VALVE OPERATION

Turn the rate valve counterclockwise to open it completely. Further turns will completely remove the rate valve from the flow meter tube, which will cause a loss of Cl2 feed. (See Appendix for servicing instructions.)
The O-ring seals for the rate valve are locked in place under the valve bonnet and do not come out when the rate valve is pulled out of the bonnet.
PREVENTATIVE MAINTENANCE NOTE: Rate valves which are not exercised frequently may experience a buildup of a white powdery substance which precipitates out of the chlorine gas. In order to avoid this, buildup, which can cause the rate valve to become stuck in place, it is recommended that the rate valve be periodically exercised. See Appendix for rate valve maintenance instructions.

SECTION IX: TROUBLESHOOTING

(I) PRESSURIZED LEAKS

1. Pressurized chlorine leaks are a safety hazard to life and equipment and should be correctedimmediately. When searching for this type of leak there are basic safety rules to follow.

a. Air breathing pack should be readily available, and personnel should know how to use it properly.
b. Exhaust fan switch should be located near outside entrance with alternate outside switch
c. Chlorine cylinder wrench should remain on the cylinder whenever cylinder is open.
d. Plastic squeeze bottle 1/3 full of household ammonia.
e. Buddy system used (two people capable of operating system).

2. If a leak is detected the following should be checked first:

a. The lead gasket between the chlorine cylinder valve and the vacuum regulator inlet assembly.
i. Tighten the half dog screw on the vacuum regulator yoke assembly which is used to secure the inlet assembly to the chlorine cylinder valve.
ii. Always use a new lead gasket.
b. Chlorine cylinder valve packing.
i. Tighten the cylinder valve with care, not excessively! Close the valve if problem persists and notify your chlorine supplier.
ii. If valve is the problem try to move cylinder with a high degree of safety to an outside location.
c. Chlorine leaking out the vent due to the inlet safety shut off valve having dirt on the valve seat.
i. Close the chlorine cylinder valves.
ii. Wait until the metering ball drops to zero on the flow tube.
iii. Turn off water supply to ejector.
iv. Now remove the leaking vacuum regulator from the cylinder valve.
v. See Appendix for inlet safety shut off valve servicing instructions.
vi. After servicing and remounting chlorinator with a new lead gasket, pull a vacuum test before youopen the chlorine cylinder valve. See Section IV: “Chlorination System Vacuum Test”.

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(II) NO CHLORINE FEED

Possible causes:

1. No vacuum being produced by ejector.

a. Remove poly tubing from ejector fitting and place your finger on it; you should feel a strong suction.

b. If you feel no suction (vacuum) check in this order:

i. Nozzle (See Appendix): Turn off water supply and remove nozzle from ejector.

(1) It may be clogged or damaged by a stone or other foreign matter. Flush out or run pipe cleaner through carefully.

(2) If there is a build-up of rust, iron, or manganese, place the nozzle in a Muriatic acid for five minutes and rinse with water. If you see a black syrup substance you may find it necessary to clean the nozzle on a preventative maintenance schedule.

ii. Inlet Water Supply. Check that it is sufficient. Refer to nozzle curves in back of manual.

iii. Reduced city water pressure.

iv. Y strainer needs cleaning.

v. Booster pump cavitating (lost its prime).

vi. Booster pump insufficient boost due to wear or single phasing due to loss of one leg of power.

vii. Booster pump may have flooded suction.

2. Chlorine flow blocked at vacuum regulator inlet assembly.

a. The Inlet filter could be clogged.

3. Out of Chlorine.

a. The scale would read 150 lbs. lighter than when cylinder was new.

b. Meter tube ball would be at zero.

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APPENDIX A – SERVICING THE SYSTEM
SECTION A-1: VACUUM REGULATOR

1. Follow the usual shut-down procedure carefully before removing any vacuum regulator from the gasbottle.
2. Make certain that the switchover mechanism indicated the regulator is in the “IN USE” position.
3. Using a 5/32" Allen-wrench, remove the socket head cap screw (BTE-511-500) and Kynar washers
4. Unscrew the reset knob (VRE-541-500) from the front body.
5. Remove the two yoke screws (BTE-STA-125) and pull the yoke assembly out of the vacuumregulator back body.
6. Unscrew the body bolts (BTE-STA-129 & BTE-STA-124) from the back body and pull the back body away from the front body until they separate.
7. Using a pair of pliers and being careful to only grip the smooth portion of the shaft, remove the guide pin (VRE- 546-500) from the diaphragm assembly by turning clockwise.
8. To disassemble the diaphragm, grasp the front and rear plates and turn them apart (they are threaded together with normal, right-hand thread and may require the aid of a vice to disassemble).
9. Inspect all O-rings and replace if necessary.
10. Replace the guide pin (VRE-546-500).
11. After inspection and replacement of all necessary parts, reassemble the unit in reverse order.

SECTION A-2: INLET ASSEMBLY

WARNING: If the vacuum regulator leaks gas out the vent or any other place on the body the problem is most likely caused inside the yoke assembly. It is recommended that the yoke assembly be disassembled by a person experienced in Chlorine Vacuum Regulator maintenance because if it is notdone properly dangerous leakage of pressurized gas could result.

1. Remove the inlet assembly from the yoke plate by slipping off the PVC retainer clip (VRE-142-500)that holds it to
the yoke.
2. Remove the inlet filter material from the inlet capsule (VRE-141-501).
3. Disassemble the inlet assembly using a small flat-head screwdriver to hold the inlet valve (VRE-112-500) and a pair of pliers (and a protective cloth) to grip the vent plug (VRH-111-500) to unscrew these two parts. Take care as this assembly is under spring tension and small parts may be difficult to find if dropped.
4. Unscrew the seal plug (VRE-182-500) from the inlet capsule.
5. Remove the valve seat (VRE-110-500) from the inlet capsule by simply pushing the exposed threaded portion up through the inlet capsule. Note that the O-ring ORE-VIT-011 is attached to this seat.
6. Clean the inlet capsule, inlet spring (SPE-104-100) and inlet valve using a soft cloth or plasticcleaning pad. Do not use steel wool or other metal cleaning sponges on the inlet valve.
7. Using all new O-rings and new parts as needed, reassemble in reverse order.

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SECTION A-3: REMOTE METER

(I) CLEANING THE RATE VALVE

1. Unscrew the rate valve knob and stem (by hand) completely out of the top meter block.
2. In low capacity systems (10 PPD or below) check to see if the point of the valve stem is broken or bent. If it is damaged it must be replaced.
3. Replace O-Rings on the rate valve stem.
4. Lubricate the new O-Rings lightly with Flourolube grease before replacing the rate valve and knobinto the top meter block.

(II) CLEANING THE METER TUBE

1. While holding the glass meter tube (to prevent it from falling) unscrew the inlet plug at the base ofthe bottom meter block, until the meter tube can be removed.
2. Remember to be careful not to lose the stops or ball in the following steps.
3. Remove the white stops at either end of the tube (you could use a paper clip).
4. Soak the tube in warm water with a cleaner like lime away or Muriatic Acid. Also, brush the inside of the tube with a pipe cleaner.

NOTE: Always follow safety precautions with Muriatic Acid and other chemicals.

5. Dry the meter tube and reinstall the ball and stops.
6. It is recommended that new meter tube gaskets be used when reinstalling the meter tube.
7. Remove the inlet plug completely and inspect the O-Rings. If it has been more than 12 months since they were changed or if there is any noticeable damage, the O-Rings should be replaced.
8. Reinstall the inlet plug, meter gaskets and meter tube, making sure to center the tube on the top and bottom meter gaskets.
9. Tighten the inlet plug with reasonable force to make a seal. Do not use excessive force.

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SECTION A-4: EJECTOR/CHECK VALVE ASSEMBLY

(I) LOSS OF VACUUM AT THE EJECTOR: If vacuum is lost at the ejector and water supply is sufficient,then the nozzle is most likely clogged, broken or loose. Before working on the ejector, it must first be isolated so that water will not leak when the ejector is removed.

1. First detach the intake side (nozzle) of the ejector from the pipeline.
2. For 3/4" line size ejectors rotate the complete ejector body counterclockwise. This loosens the threaded portion of the nozzle from the diffuser. It also eliminates the need for pliers on the nozzle which could damage the plastic. For 11/4" line size ejectors remove the two flanges to remove the ejector.
3. Inspect the nozzle for:
   Pipe scale, stones, dirt, etc...
   Build-up of iron, manganese, calcium, etc...
4. The nozzle should be soaked and brushed with warm water mixed with a cleaner like Muriatic Acid.NOTE: TAKE CARE NOT TO SCRATCH OR ATTEMPT TO MODIFY THE ORIFICE IN ANY WAY.

5. Using two new ORE-BUN-121 O-rings the ejector can now be reassembled.

When reassembling 3/4" line size ejectors the nozzle and diffuser should be screwed together hand tight leaving the ejector body 90 degrees to the left of its final position. Once the nozzle and diffuser are hand tight, the ejector can then be turned the final 90 degrees.

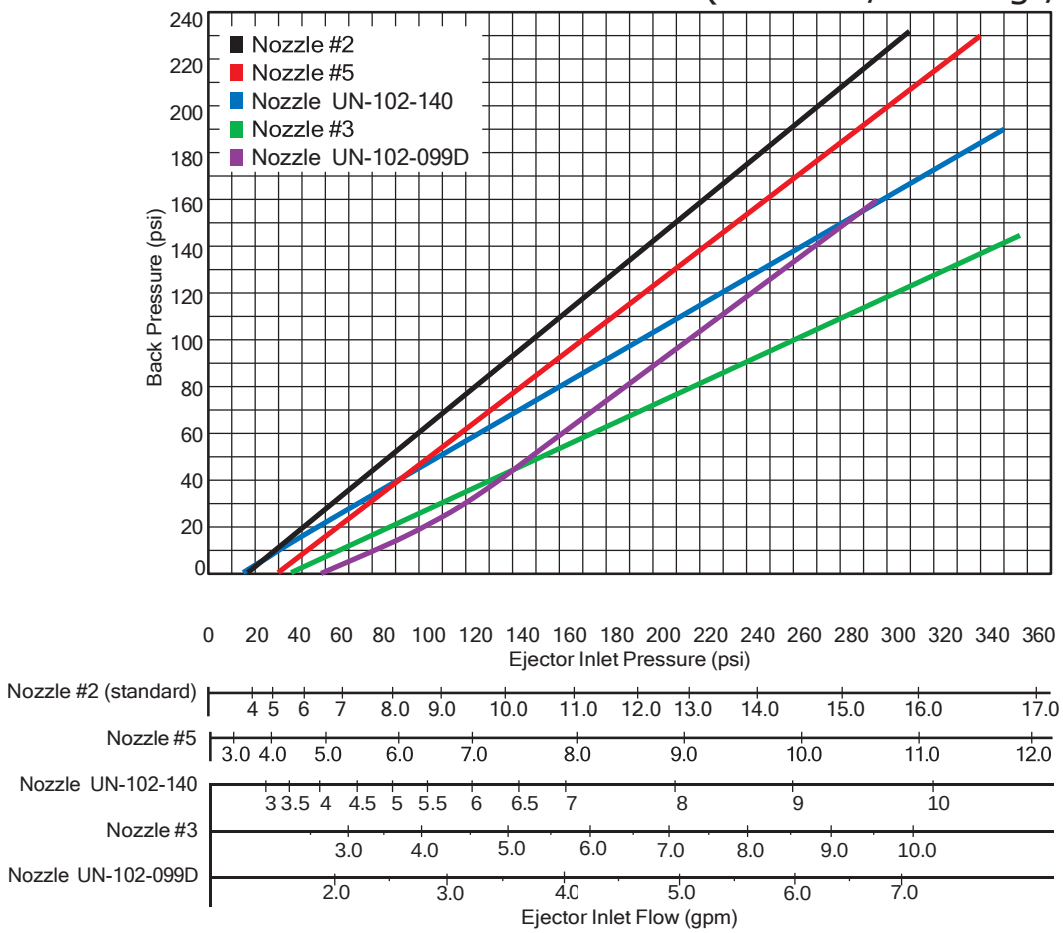
WARNING: Do not use excessive force in tightening the nozzle, diffuser and ejector assembly. The ejector is con- structed of PVC and excessive force can break the parts.

(II) SERVICING THE EJECTOR CHECK VALVE ASSEMBLY: If water leaks back into the system, this means that the ejector check valve has failed. This could be caused by incorrect assembly, a failed gasket, O-Ring or diaphragm, or foreign material lodged in the check valve.

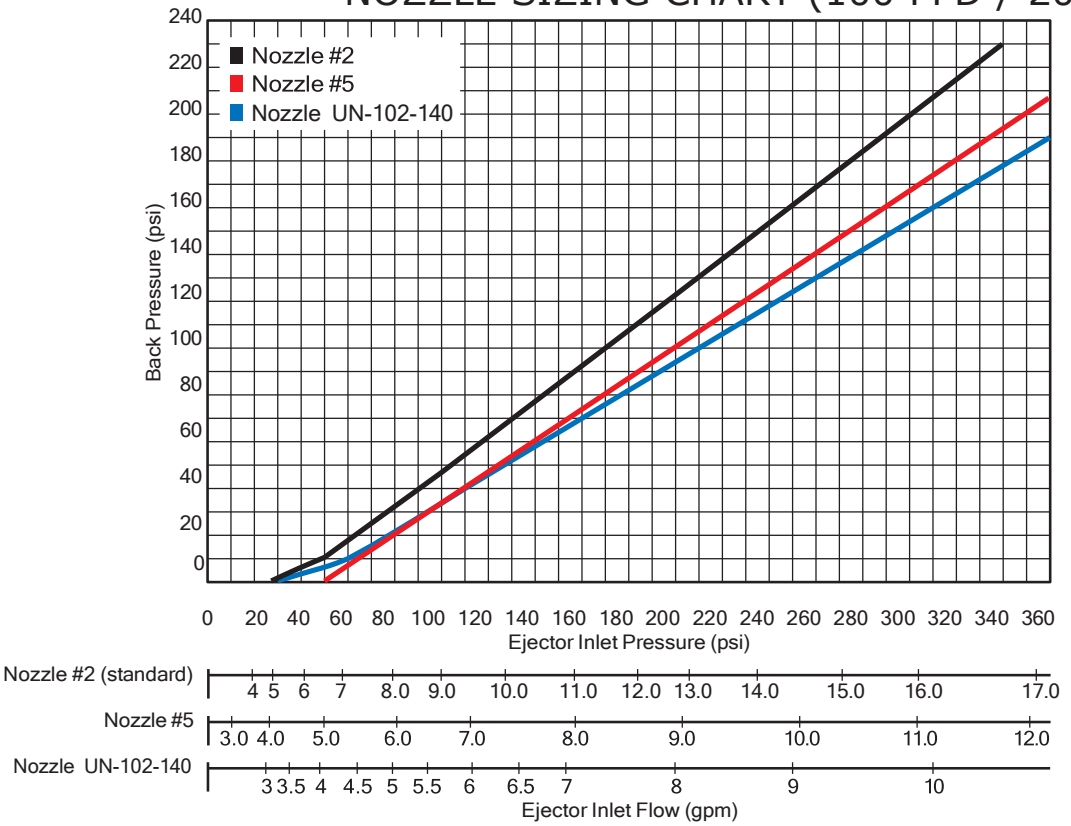
1. Remove the four bolts holding the ejector body together.
2. Inside you will find a diaphragm assembly and a spring.
3. The diaphragm assembly can usually be unscrewed by hand. If it is too tight, carefully try large jaw pliers or a vice. Note that a plastic support diaphragm is on the top side of the rubber diaphragm. The purpose is to protect the softer rubber diaphragm in installations with high pressure.
4. Inspect the rubber diaphragm for holes or weak points.
5. Inspect the ORE-CEM-210 O-Ring. Replace if damaged.
6. Reassemble the diaphragm assembly, preferably with a new rubber diaphragm, DIE-104-500.
7. Install the assembly in the recess between the ejector body halves being careful to install the springproperly below the assembly.

Note: Pressure combinations that plot below the line for any given nozzle are acceptable for operating that nozzle at the stated chemical feed rate for that chart. Pressure combinations that fall above the line for any given nozzle are not acceptable.

NOZZLE SIZING CHART (50 PPD / 1000 gr/hr)



NOZZLE SIZING CHART (100 PPD / 2000 gr/hr)



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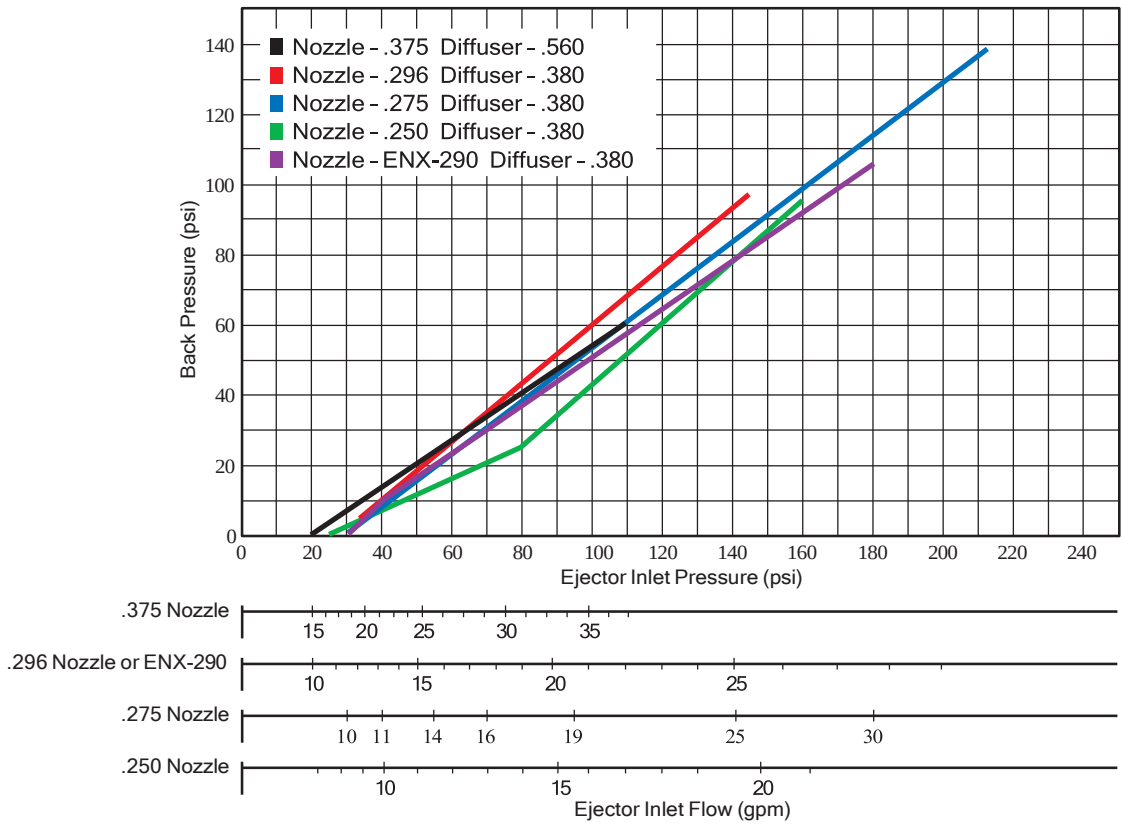
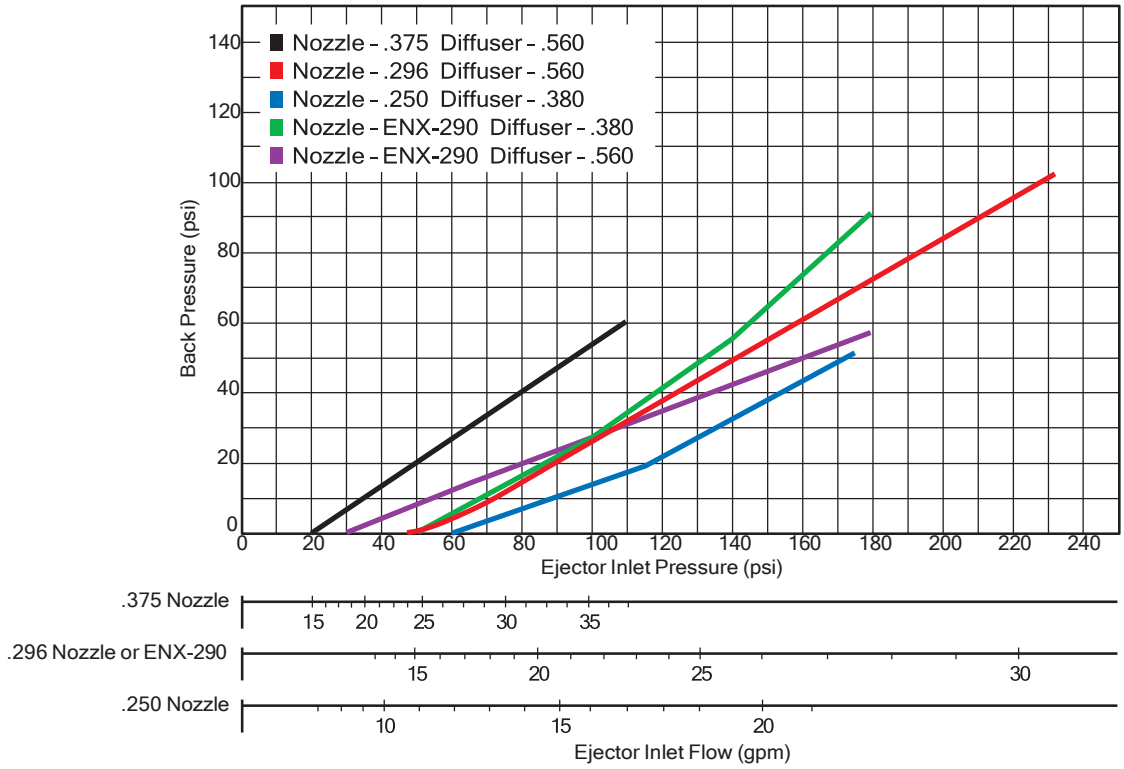
NOZZLE SIZING CHART (250 PPD / 5 kg/hr)



NOZZLE SIZING CHART (500 PPD / 10 kg/hr)



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Nozzle Tables

50 PPD (1 Kg/hr)

Nozzle >	2		5		UN-102-140		3		UN-102-099D	
Ejector Backpressure	PSI @	GPM	PSI @	GPM	PSI @	GPM	PSI @	GPM	PSI @	GPM
0	16	4.0	30	4.3	15	2.8	35	2.3	48	1.9
10	25	5.0	43	4.8	28	3.5	55	2.9	70	2.4
20	40	5.8	55	5.1	48	4.1	75	3.5	92	2.8
30	50	6.3	69	5.4	64	4.5	95	4.1	110	3.2
40	65	7.1	81	6.0	82	5.3	120	4.8	124	3.5
50	80	8.0	95	6.6	100	5.7	141	5.4	137	3.7
60	90	8.6	109	6.8	120	6.3	162	6.0	151	4.0
70	105	9.1	120	7.2	132	6.5	183	6.6	164	4.3
80	115	9.6	134	7.6	150	6.9	205	7.3	178	4.6
90	127	10.0	147	7.8	170	7.4	226	7.9	191	4.8
100	139	10.4	160	8.1	185	7.8	247	8.5	205	5.1
110	152	10.8	173	8.4	202	8.2	268	9.1	218	5.4
120	165	11.3	188	8.7	221	8.5	290	9.8	232	5.7
130	176	11.8	200	9.0	239	8.8	-	-	245	5.9
140	189	12.2	213	9.2	255	9.1	-	-	259	6.2
150	200	12.7	226	9.5	273	9.4	-	-	272	6.5
160	216	13.3	240	9.8	290	9.7	-	-	286	6.8

100 PPD (2 Kg/hr)

Nozzle >	2		5		UN-102-140	
Ejector Backpressure	PSI @	GPM	PSI @	GPM	PSI @	GPM
0	25	5.0	50	5.1	30	3.3
10	50	6.7	65	5.4	59	4.3
20	65	7.3	80	6.1	79	5.0
30	75	8.0	95	6.5	95	5.6
40	89	8.6	110	7.0	110	6.0
50	104	9.0	125	7.2	126	6.4
60	118	9.3	139	7.4	145	6.9
70	131	9.9	155	7.9	160	7.2
80	142	10.5	170	8.3	180	7.5
90	155	11.0	185	8.7	195	7.9
100	170	11.5	200	9.0	210	8.2
110	180	11.9	213	9.3	229	8.5
120	194	12.7	228	9.5	243	8.9
130	208	13.2	244	9.9	260	9.2
140	222	13.7	260	10.2	279	9.5
150	235	14.2	275	10.4	295	9.8
160	250	14.5	291	10.8	310	10.0

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Nozzle Tables

250 PPD (5 Kg/hr)

Nozzle >	0.375		0.296		ENX-290		0.275		0.250	
Throat >	0.560		0.380		0.380		0.380		0.380	
Ejector Backpressure	PSI @	GPM	PSI @	GPM	PSI @	GPM	PSI @	GPM	PSI @	GPM
0	20	15.0	-	-	30	11.5	30	10.0	25	7.5
10	35	20.0	40	13.2	39	13.0	42	12.0	48	10.8
20	50	25.0	52	15.0	55	15.7	55	14.0	69	12.5
30	65	28.0	65	16.7	69	17.5	70	16.0	85	14.5
40	80	32.0	77	18.2	84	19.4	82	18.0	98	15.8
50	95	34.0	87	19.7	97	20.9	95	19.0	108	17.0
60	110	38.0	100	21.0	113	22.3	110	21.5	120	18.0
70	-	-	113	22.3	127	23.5	122	23.5	130	19.0
80	-	-	125	23.3	142	25.5	135	24.0	143	19.6
90	-	-	137	24.5	157	26.2	150	26.0	155	20.3
100	-	-	148	25.4	172	27.3	162	27.5	-	-
110	-	-	160	26.3	-	-	175	29.0	-	-
120	-	-	172	27.0	-	-	189	31.0	-	-
130	-	-	183	27.8	-	-	201	33.0	-	-
140	-	-	196	28.7	-	-	213	35.0	-	-
150	-	-	208	29.4	-	-	-	-	-	-
160	-	-	217	30.0	-	-	-	-	-	-

500 PPD (10 Kg/hr)

Nozzle >	0.375		0.296		ENX-290		ENX-290		0.250	
Throat >	0.560		0.560		0.560		0.380		0.380	
Ejector Backpressure	PSI @	GPM	PSI @	GPM	PSI @	GPM	PSI @	GPM	PSI @	GPM
0	20	15.0	48	14.5	30	11.0	50	15.0	60	12.0
10	35	20.0	72	18.3	52	15.5	67	17.5	90	15.0
20	50	24.9	90	20.6	80	19.3	85	20.0	117	17.5
30	64	27.2	105	22.2	107	22.4	104	22.1	135	19.3
40	80	31.0	123	24.2	132	25.3	118	23.6	154	20.5
50	96	34.0	140	25.5	160	26.5	132	25.1	172	22.0
60	110	37.0	160	26.7	-	-	145	25.8	-	-
70	-	-	175	27.4	-	-	157	26.5	-	-
80	-	-	192	28.5	-	-	168	27.0	-	-
90	-	-	210	29.2	-	-	179	27.7	-	-
100	-	-	229	30.5	-	-	-	-	-	-

Installing the SERIES 600 Vacuum Regulator:

1) Carefully inspect the cylinder valve outlet surfaces and vacuum regulator inlet capsule surfaces for damage or debris prior to installation.

2) Always use a new lead gasket when connecting the vacuum regulator to a chlorine cylinder valve.

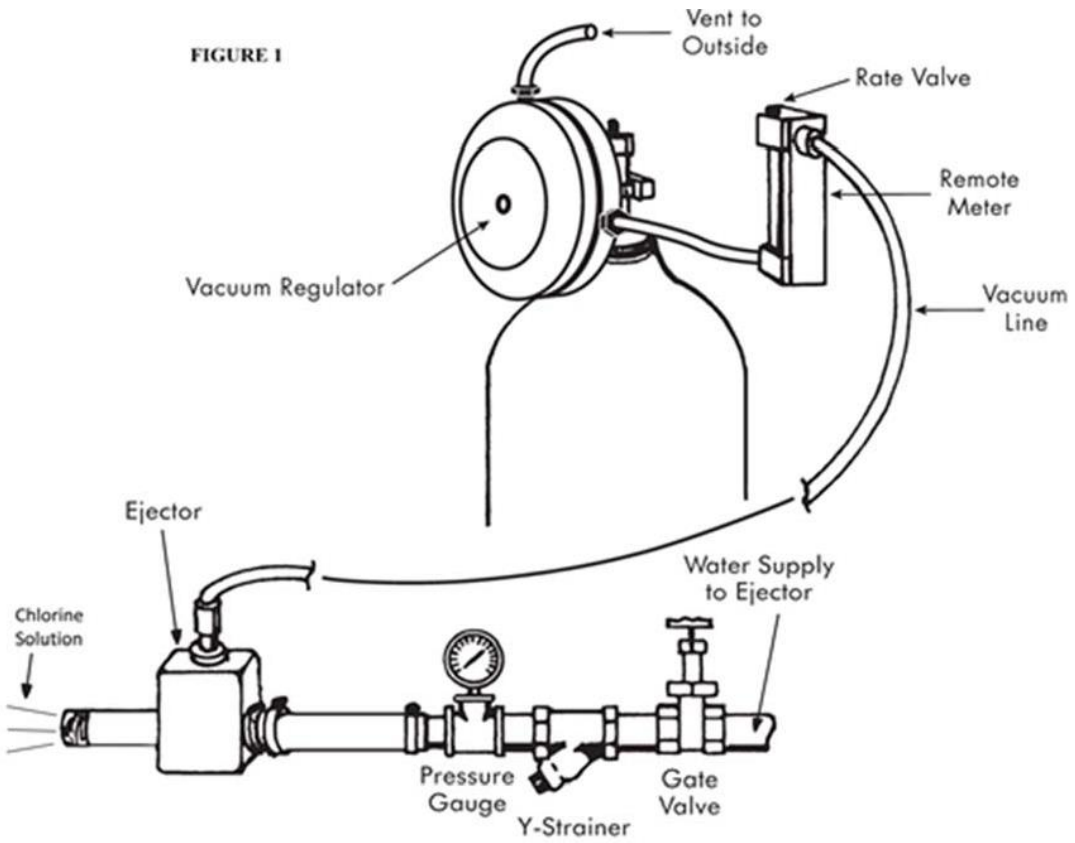
3) Holding the vacuum regulator upright, settle it over the cylinder valve and fit the inlet capsule into the cylinder valve outlet port.

4) Using a 3/8" wrench, tighten the yoke assembly "half-dog" set screw so that the lead gasket is crushed between the valve and the inlet capsule.

5) Connect the vent and vacuum tubing to the regulator (these are labeled). See Figure 1.

NOTE: Vent tubing should always be connected and run to a safe location (outside of any building). A vent bug cap (provided with every Archer vacuum regulator) should be fitted over the end of vent tubing to prevent insects from entering the equipment.

FIGURE 1



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Operating the Series600 Vacuum Regulator:

1) Prior to placing the vacuum regulator into operation, it is important to carefully test the lead gasket seal. A small squeeze bottle (provided with every Archer vacuum regulator) should be partially filled with ammonia. Squeezing the bottle allows the ammonia fumes to be used to test for chlorine leaks. A leak is detected by a visible light gray / white gas cloud when the two fumes interact. To test for leaks, open the cylinder valve 1/3 turn and then close immediately. This pressurizes the lead gasket seal but ensures the full cylinder of chlorine is isolated during leak testing. Use ammonia fumes around the cylinder valve and lead gasket to check for any signs of leaking gas. If a leak is found, this must be addressed before placing the unit into operation.

2) After confirming no leaks exist, open the chlorine cylinder valve 1/3 of a turn. This is fully open and there is no need to open the valve further.

3) If the remote meter is not mounted on the Series 600, no further action is needed.

4) If the remote meter is installed on the Series 600, adjust the remote meter's rate valve knob until the desired feed rate is indicated on the graduated meter tube.

Maintaining the Series600:

Recommended Maintenance Frequency: Archer recommends yearly routine maintenance.

-Refer to the parts diagram when performing maintenance on the Series 600.

1) To disassemble, remove the two yoke screws and pull the metal yoke & inlet assembly out of the back of the vacuum regulator.

2) Remove the four body screws and separate the front and back bodies. The diaphragm assembly can then be removed by carefully pulling it straight out of the front body. Take care to not lose the vent spring, which is located between the diaphragm assembly and the front body.

3) The guide pin is threaded into the rear diaphragm plate and should not need to be removed during routine maintenance.

4) The rear diaphragm plate and front diaphragm plate are threaded together and can often be unscrewed by hand. If they will not unscrew by hand, it may be necessary to use a vice and / or channel locks. Unscrewing these two parts allows for the removal of the diaphragm.

5) Whenever routine maintenance is being performed, all parts should be thoroughly

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cleaned. It is recommended that all o-rings (with the exception of the OA-VIT-332) be replaced.

6) When reassembling, new o-rings should be given a thin film of the Fluorolube grease.

NEXT: The inlet assembly is a critical component in the safe function of the vacuum regulator. Improper handling or reassembly can result in dangerous leakage of chlorine gas.

Archer recommends that only trained personnel or those familiar with vacuum regulator maintenance service the inlet assembly. To service the inlet assembly:

1. Remove the two screws holding the metal yoke plate to the vacuum regulator body.

2. Grasp the metal yoke and with a slight turning motion pull it out of the back body.

3. Remove the OA-VIT-214 O-Ring from the Seal Plug.

4. Remove the Inlet Filter Holder (and/or the filter) from the Seal Adapter.

5. Using a short flat head screwdriver and a pair of pliers unscrew the YMA-100A Inlet Valve Stem from the VRA-601A Spring Retainer.
NOTE: Protect the VRA-601A Spring Retainer from the pliers with a cloth or paper. NOTE: This should be done with the Seal Plug installed in the Yoke Assembly unless the Yoke Assembly is being replaced.

6. Now the VRA-601A, YMA-100A and SPA-104 should be removed and cleaned.

NOTE: Especially clean the YMA-100A in the region where it meets the YPA-101A to form the seal. This surface should be polished as smooth as possible without scratching the surface.

7. Using a rod of 0.250" diameter, the YPA-101A Inlet Valve Seat can be pressed out of the Seal Plug from the spring side. The YPA-101A should be cleaned and carefully inspected for scratches or cuts especially where it is to seal with the YMA-100A.

NOTE: Sometimes the YPA-101A will be cut or deformed such that it cannot seal. If you perform this service and the Vacuum Regulator is still leaking to vent, then the YPA-101A should be replaced with a new one.

8. Clean the Seal Plug thoroughly before reassembling the unit in the following order:
   a. Lubricate O-Rings with Fluorolube™ grease.
   b. Insert the new or cleaned YPA-101A with O-Ring OA-VIT-010.
   c. Insert and retighten the YMA-100A, VRA-601A and SPA-104 as shown in the drawing. NOTE: DO NOT USE EXCESSIVE FORCE IN TIGHTENING the YMA-100A to the VRA-601A.
   d. Insert a new Filter Cartridge.
   e. Install a new OA-VIT-214 O-Ring on the Seal Plug.

-Should you have any questions during maintenance of your vacuum regulator, please contact your local service provider or Archer for support.

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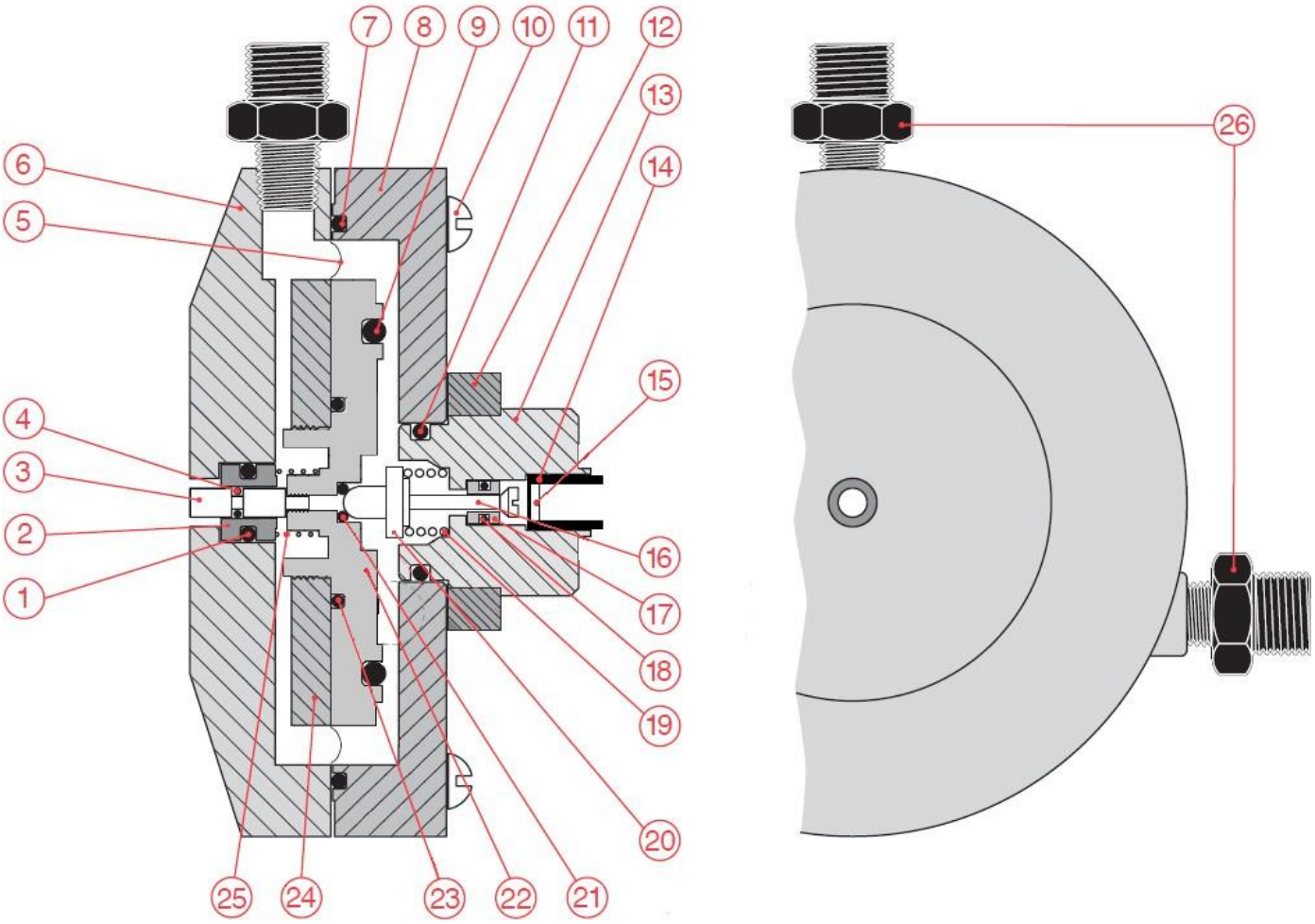
SIDE VIEW **FRONT VIEW (Partial)**



Item#	Qty.	Part #	Description	
1	1	OA- VIT- 014	O- Ring	
2	1	VRA- 104	Pin guide	
3	1	VRA- 600	Guide Pin	
4	1	OA- VIT- 006	O- Ring	*
5	1	DPA- 103	Double Diaphragm	*
6	1	FBA- 600	Front Body	
7	1	OA- VIT- 156	O- Ring	*
8	1	BBA- 600	Back Body – 250 PPD & below	
	1	BBA- 601	Back Body – 500 PPD	
9	1	OA- VIT- 332	O- Ring	
10	4	BTA- 413	Body Screws (Titanium)	
11	1	OA- VIT- 214	O- Ring	*
12	1	YA- 600	Yoke Assembly	
13	1	SAWS- US3	Seal Adapter	
		SAWS- US3M	Seal Adapter (Metal option)	

Item#	Qty.	Part #	Description	
14	1	KFA- 300	Filter Holder	
15	1	VRA- 5015	Filter (100 PPD)	*
	1	SA- 210, VRA- 455	Silver Screen & Floss > 100 PPD	
16	1	YMA- 100A	Inlet Valve	
17	1	YPA- 101A	Inlet Valve Seat	*
18	1	OA- VIT- 010	O- Ring	*
19	1	SPA- 104	Inlet Spring	
20	1	VRA- 601A	Spring Retainer	
21	1	OA- VIT- 009	O- Ring	*
22	1	VRA- 56A	Rear Diaphragm Plate	
23	1	OA- VIT- 029	O- Ring	*
24	1	VRA- 269	Front Diaphragm Plate	
25	1	SPA- 100	Vent Spring	
26	2	TCA- 64	¼" NPT x 3/8" tube 100 PPD	
	*			
	1	TCA- 84	¼" NPT x ½" tube 250 PPD	
	1	TCA- 108	½" NPT x 5/8" tube 500 PPD	

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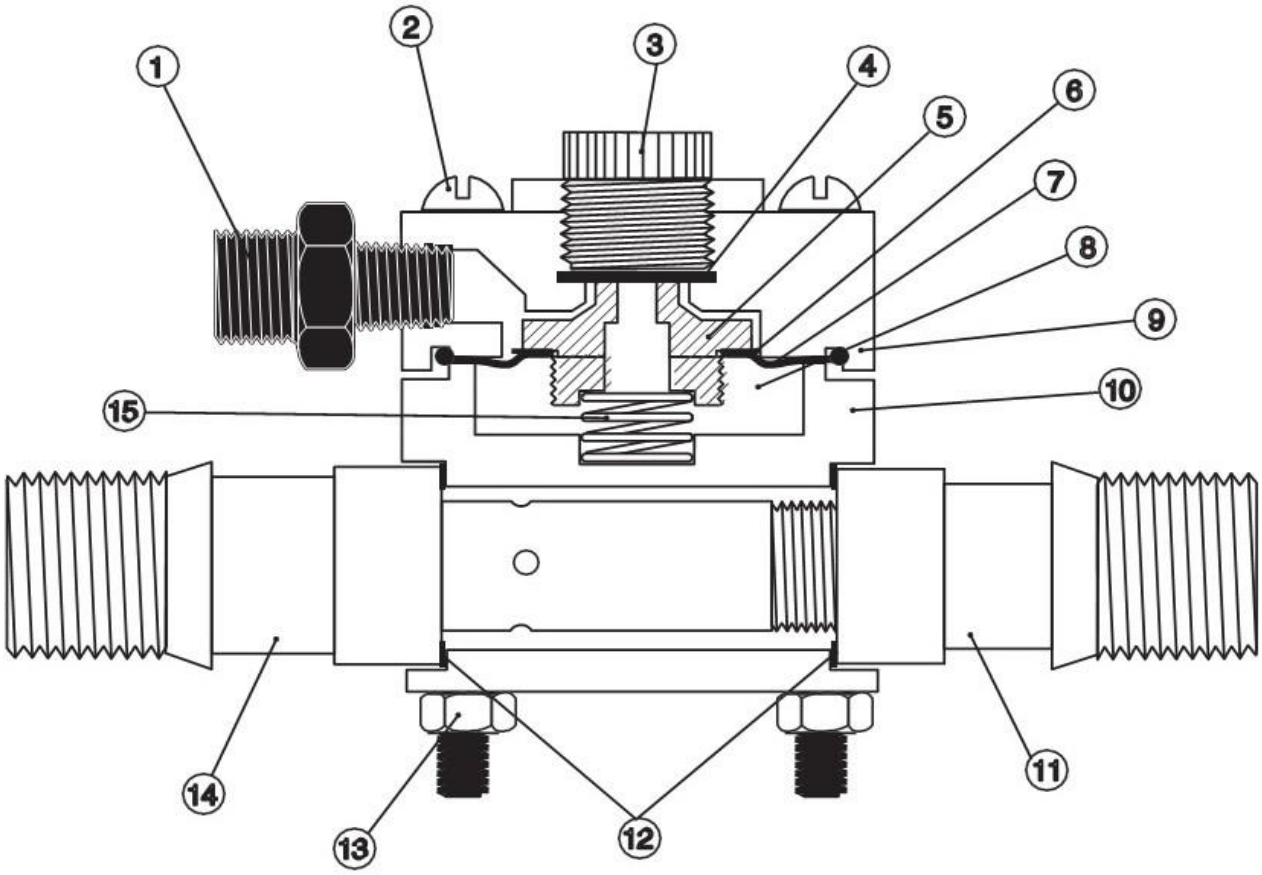

ITEM NO.	DESCRIPTION	QUANTITY	PART NO.
1	3/8" Tubing Connector	1	TCE-64
2	5/16 - 18 x 3 1/2" Bolt	4	BTE-135
3	Seat Plug	1	EJE-311
4	Valve Seat	1	GE-VIT-122
5	Diaphragm Bolt	1	EJE-206
6	Support Diaphragm	1	DIA-105
7	Diaphragm	1	DIA-104
8	Diaphragm Nut	1	EJE-146
9	Top Body	1	EJE-208-250
10	Bottom Body	1	EJE-153
11	Multi-Purpose Diffuser	1	EJE-982
12	O-Ring	2	OE-BUN-214
13	5/16 - 18 Nut	4	NTE-104
14	Nozzle	1	* See Note
15	Spring	1	SPE-106

***Note:** Available Nozzles:
#9 - ENA-015-156 (50 ppd std.)
#10 - ENA-012-191 (100 ppd std.)

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EJECTOR
Model: EJE-100-CL2

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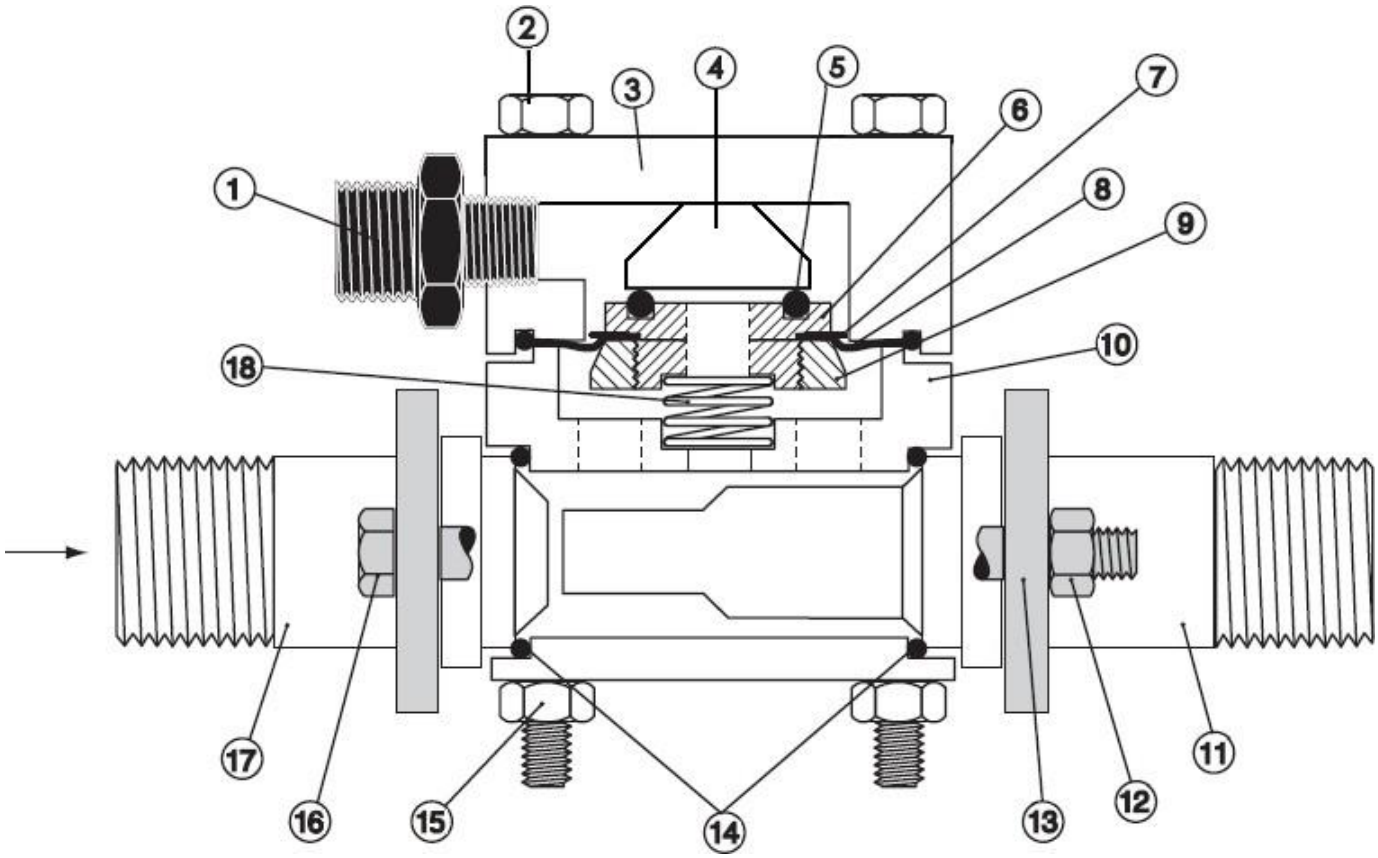

Item#	Qty.	Part #	Description	Item#	Qty.	Part #	Description
1	1	TCE-108	Tube Connector *½" NPT x 5/8" tube*	10	1	EJE-153	Bottom Body
2	4	BTE-136	5/16- 18 x 4" Bolt	11	1	*TTE-189-386	Throat
3	1	EJE-238-500	Top Body	12	2	NTE-106	3/8- 16 Nut
4	1	CVE-521	Valve Seat	13	2	EJE-136	Flange
5	1	OE-CEM-210	O- Ring	14	2	OE-BUN-214	O- Ring
6	1	EJE-236	Diaphragm Bolt	15	4	NTE-104	5/16- 18 Nut
7	1	DIA- 105	Support Diaphragm	16	2	BTE-145	3/8- 16 x 4- 1/2" Bolt
8	1	DIA- 104	Diaphragm	17	1	*TNE-187-300	Nozzle
9	1	EJE-146	Diaphragm Nut	18	1	SPE-106	Spring

***NOTE:** Several different nozzle / throat combinations are available to work within given hydraulic conditions. The above sizes are supplied as standard equipment.
Refer to nozzle sizing charts for correct sizing.

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EJECTOR
Model: EJE-250-CL2
Model: EJE-500-CL2

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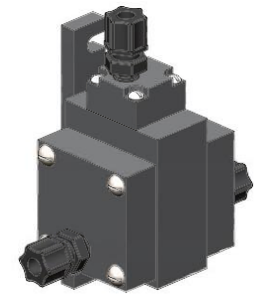
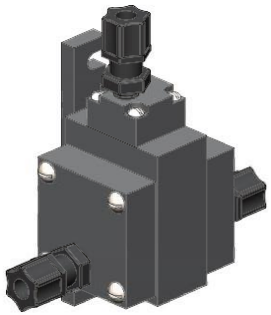
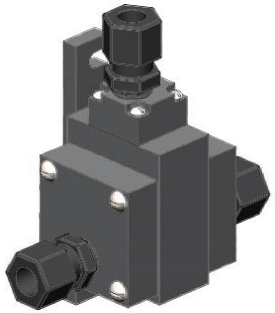


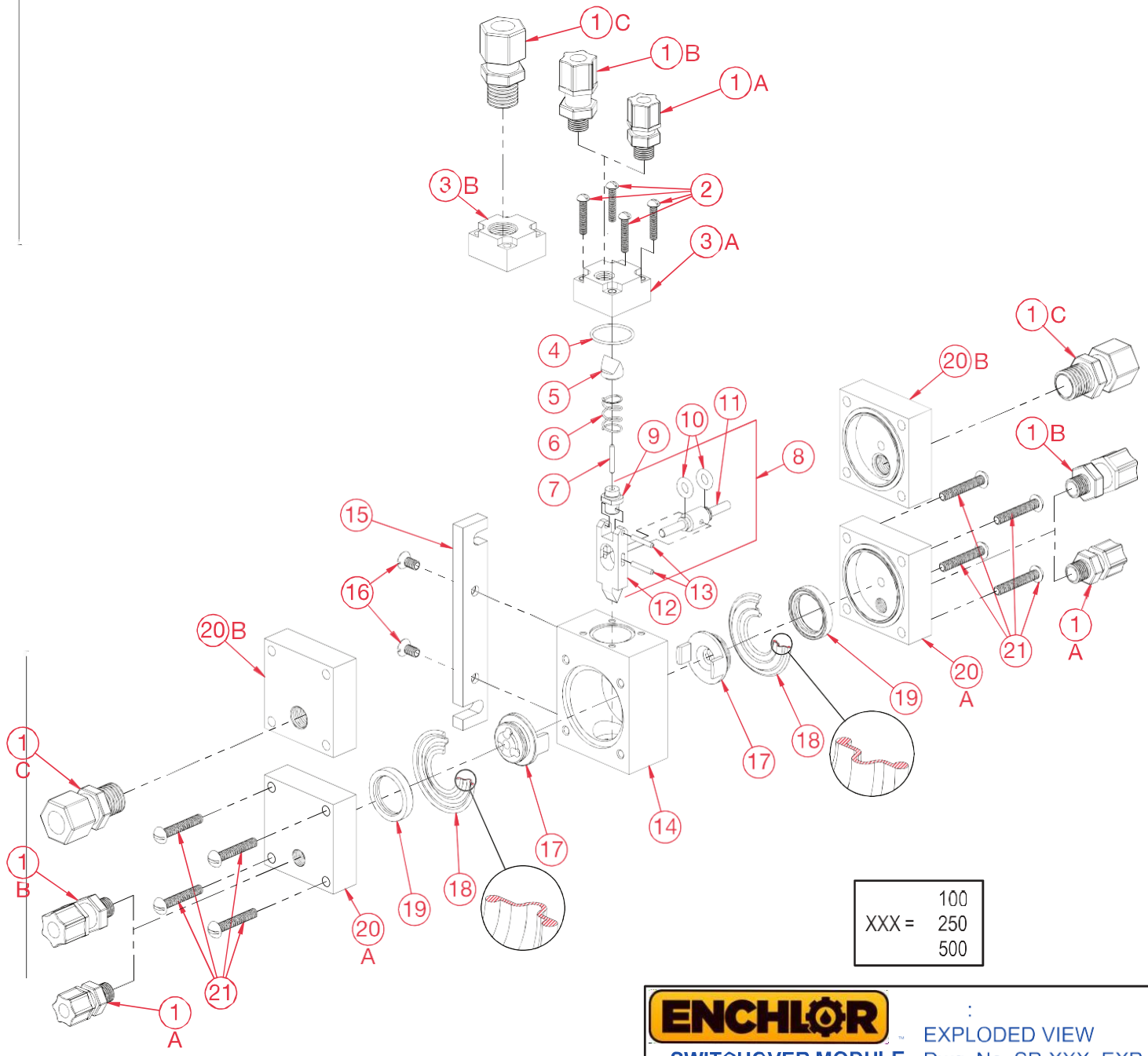
SP-100



SP-200



SP-500



XXX =	100
	250
	500

ENCHLOR™ SWITCHOVER MODULE

EXPLODED VIEW
Dwg. No. SP-XXX, EXP

Item No.	Description	Quantity	Part No.
1A	PM 3/8" Tube 1/4" NPT Tubing Connctor	3	BKF-64
1B	PM 1/2" Tube 1/4" NPT Tubing Connector	3	BKF-84
1C	PM 5/8" Tube 1/2" NPT Tubing Connector	3	BKF-108
2	#10-24 x 1" Top Cap screw (Monel)	4	#10-24 x 1"
3A	Top Cap (for SP-100 and SP-200)	1	SM-106-250
3B	Top Cap (for SP-500)	1	SM-106-500
4	PM O-Ring	1	OH-VIT-023
5	Spring Pin Guide	1	SM-104
6	Spring (Hastelloy)	1	YM-103-HC
7	Spring Guide Pin	1	SM-105
8	Toggle Assembly	1	SM-Assembly
9	* Spring Pivot	1	SM-103
10	PM * O-Ring	2	OH-VIT-203
11	* Valve Plug	1	SM-100
12	* Pivot Arm	1	SM-102
13	* Hinge Pin	2	SM-101
14	Center Body	1	SM-108
15	Mounting Bracket	1	SM-109
16	Mounting Bolt (Zinc-plated)	2	1/4-20 x 1/2"
17	Diaphragm Bolt	2	SM-110
18	PM Rolling Diaphragm	2	SM-112
19	Diaphragm Nut	2	SM-111
20A	End Cap (for SP-100, SP-200)	2	SM-107-250
20B	End Cap (for SP-500)	2	SM-107-500
21	1/4-20 x 1 1/2" End Cap screw (Monel)	8	1/4-20 x 1 1/2"

* Items 9, 10, 11, 12, and 13 are sold pre-assembled as the Toggle Assembly (Item 8), "SM-Assembly"

Item No.	Description	Quantity	Part No.
PM	Part & Maintenance Kit (100 PPD)	1	KT1-100-SOM
PM	Part & Maintenance Kit (250 PPD)	1	KT2-250-SOM
PM	Part & Maintenance Kit (500 PPD)	1	KT7-500-SOM

XXX = 100, 250, 500

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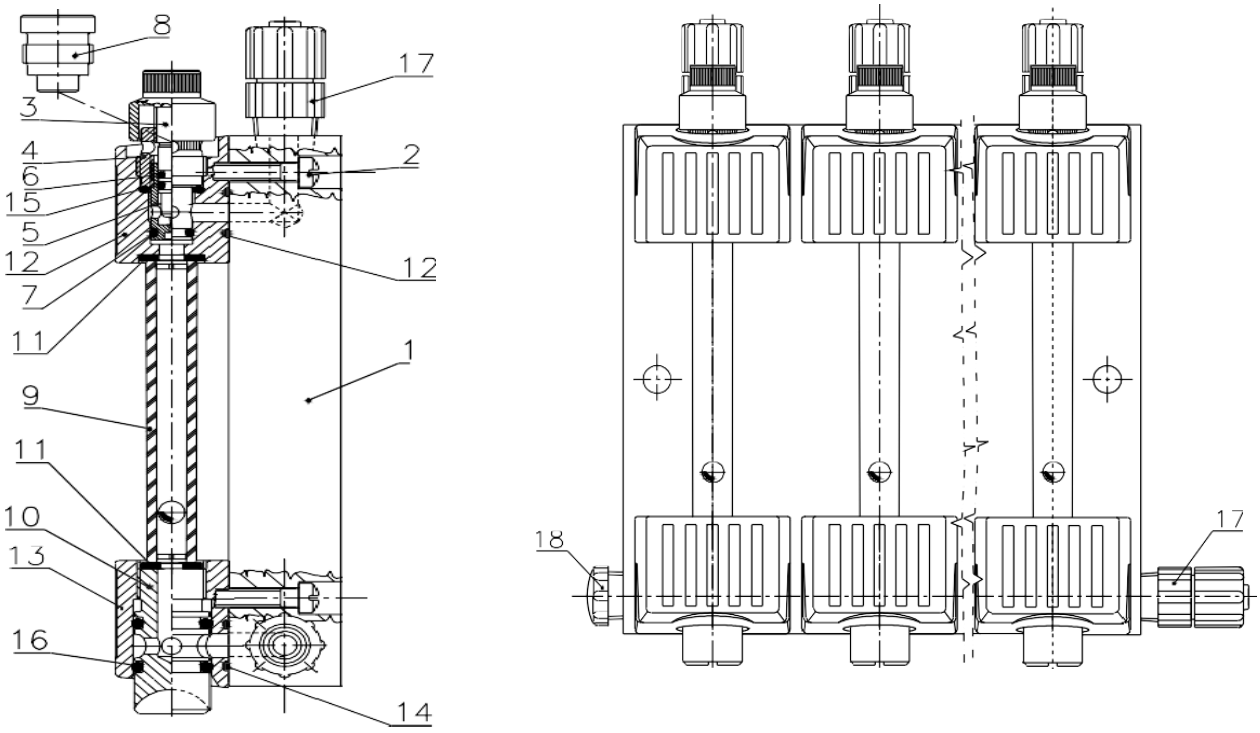
SWITCHOVER MODULE

BILL OF MATERIALS
Dwg. No. SP-XXX, BOM



Item#	Part #	Description	Item#	Part #	Description
1	U-248-X	Measuring panel X= number of flowmeters	10	U-140	Measuring inlet
2	N-126	Screw	11	*G-100-3 # G-100-4	Sealing
3	AX-287-3	Mounted valve pin	12	M-110	Flowmeter holder upper
4	X-285	Valve holder	13	M-166	Flowmeter holder lower
5	X-286-3	Valve	14	OV-11-012	O-ring
6	OV-11-006	O-ring	15	OV-11-110	O-ring
7	OV-11-010	O-ring	16	OV-11-112	O-ring
8	M-175	Threaded closing screw	17	F-100	Mounted pipe joint
9	*A-108-8 # A-108-9	Measuring tube			
Notes: * FOR 2 kg/h # FOR 5 kg/h ** not illustrated on the drawing					

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EXPLODED VIEW
100 PPD REMOTE METER Dwg. No. MPE-(100-250)-CL2

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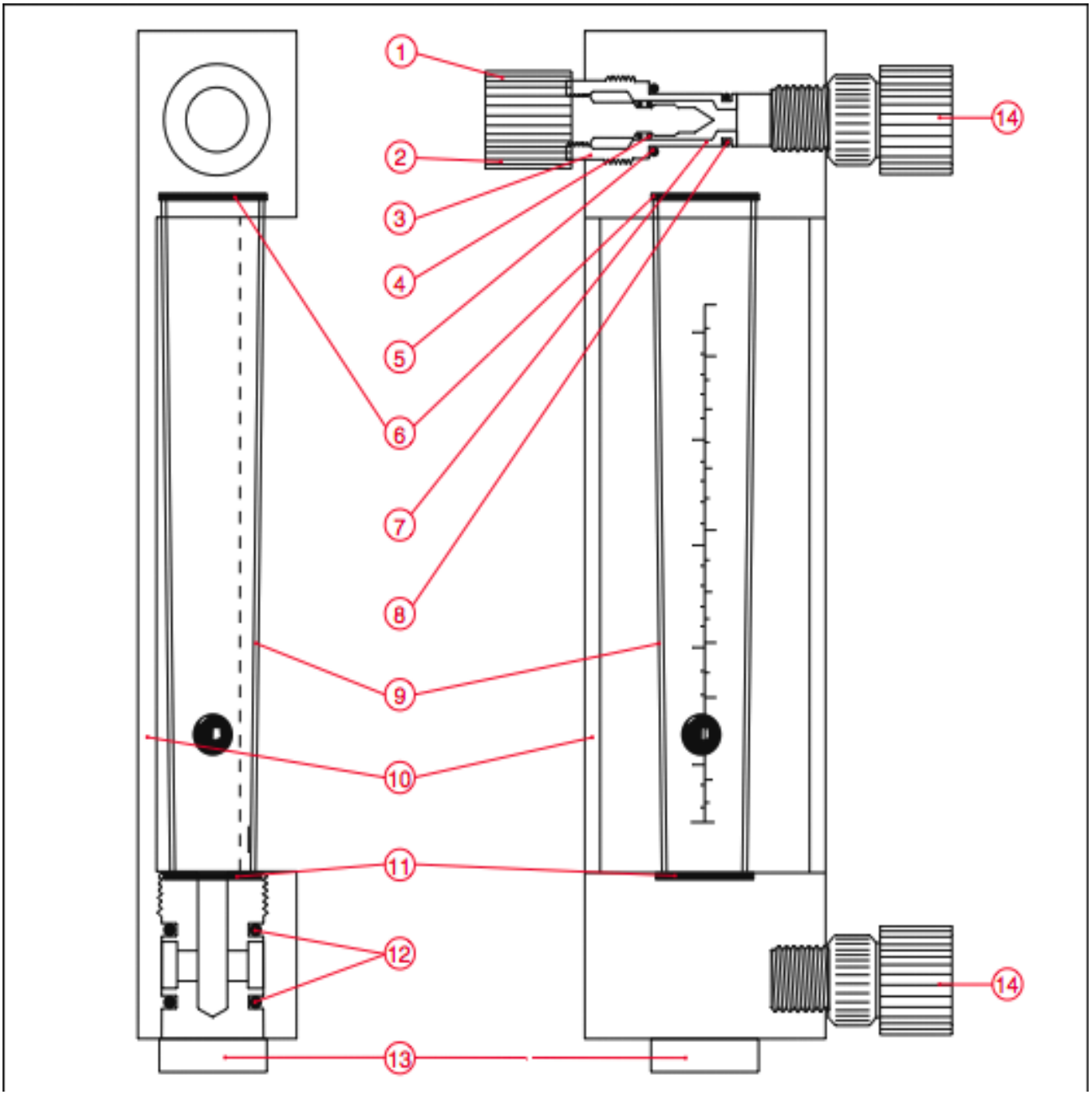

Item No	Description	Qty	Part No	Item NO	Description	Qty	Part No
1	Rate valve assembly,500 ppd	1	RVE-118-500	10	Meter Panel Body	1	MPE-259-500
2	Rate valve Plug ,500 ppd	1	RVE-651-500	11	Bottom Meter Gasket	1	GAE-VIT-115
3	Rate valve Bonnet ,500 ppd	1	RVE-224-500	12	O-RING	1	ORE-VIT-212
4	O-RING	1	ORE-VIT-010	13	Meter Inlet	1	MIE-232-500
5	O-RING	1	ORE-VIT-112	14	5/8 " Tubing Connector	2	TCE-110-500
6	Top Meter Gasket	1	GAE-VIT-116				
7	Rate valve Sleeve ,500 ppd	1	RVE-116-500				
8	O-RING	1	ORE-VIT-012				
9	Meter Tube , 500 ppd	1	MTE-129-500				

EXPLODED VIEW, BILL OF MATERIALS
500 PPD REMOTE METER
MPE -500-CL2, EXP

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Technical Data

Model Information Code

Model E6

Gas

- **C - Chlorine**
- **S - Sulfur Dioxide**
- **A - Ammonia**
- **CO2 - Carbon Dioxide**

Vacuum Regulator Mounting

1. **Direct cylinder or manifold mounted with rate valve**
2. **Ton mounted with rate valve**
3. **Direct cylinder or manifold mounted with remote mounted meter panel with rate valve**
4. **Ton mounted with remote meter**
5. **Two direct cylinder or manifold mounted vacuum regulators, automatic switchover module, and remote mounted meter panel with rate valve**
6. **Ton mounted with auto-switchover**

Available Gas Rotometers

1. **0.6 ppd (12g/h)**
2. **1.5 ppd (28g/h)**
3. **4 ppd (75 g/h)**
4. **10 ppd (200 g/h)**
5. **25 ppd (0.5 kg/h)**
6. **50 ppd (1.0 kg/h)**
7. **100 ppd (2.0 kg/h)**
8. **250 ppd (5.0 kg/h)**
9. **500 ppd (10.0 kg/h)**

Maximum Capacity

1. **100ppd**
2. **250ppd**
5. **500ppd**

Ejector Connections

Capacity	Connectio
100ppd	Nozzle 1” hose - 3/4” NPT combination Diffuser 1” hose - 3/4” NPT combination *available with #12,13,15 or 16 nozzle*
250ppd	Nozzle 1” hose - 3/4” NPT combination Diffuser 1” hose - 3/4” NPT combination *above available in #14 nozzle only*
250/500ppd	Nozzle 1-1/4” NPT Throat 1-1/4” NPT

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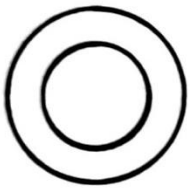
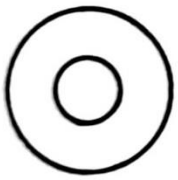
HOW TO CHOOSE LEAD GASKETS?



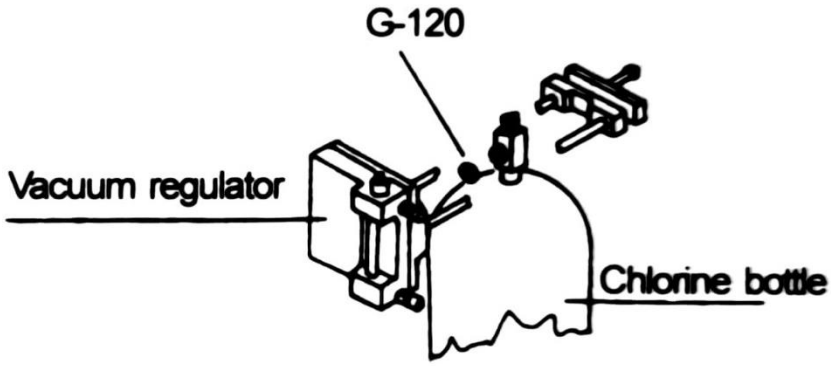
G-120

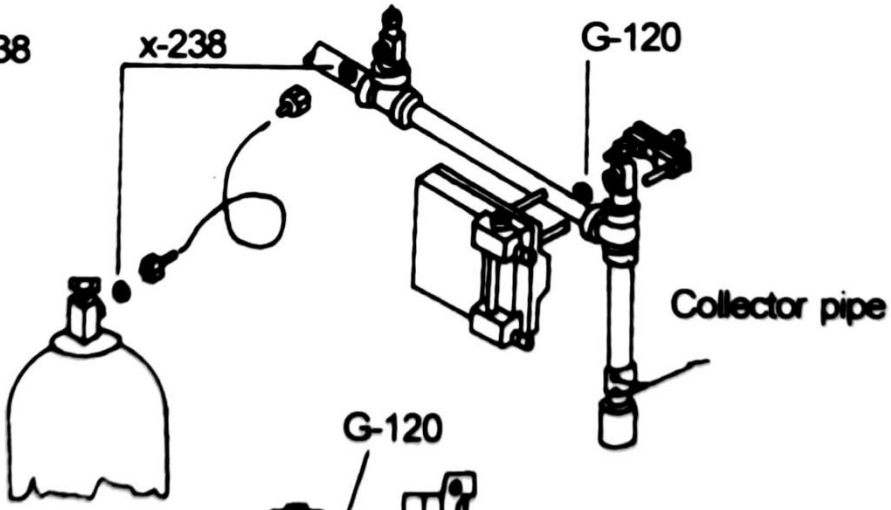
s = 1,5 mm

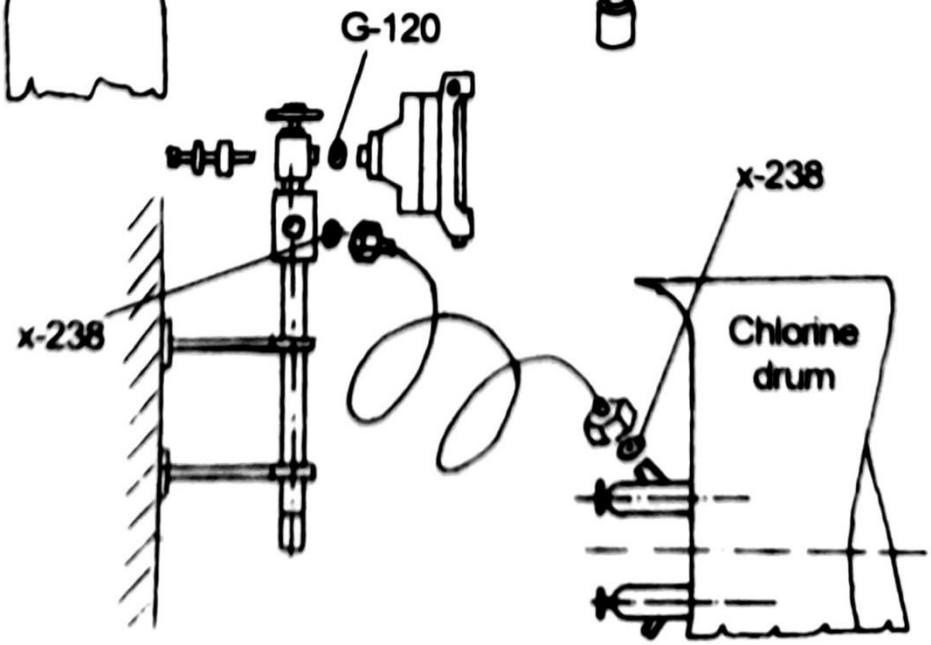


x-238

s = 3 mm



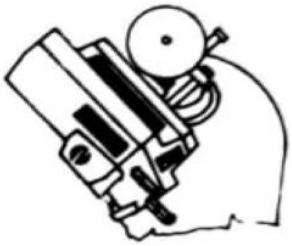


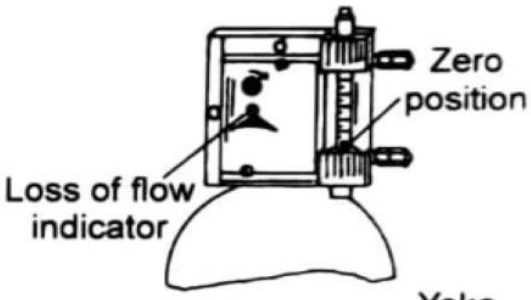


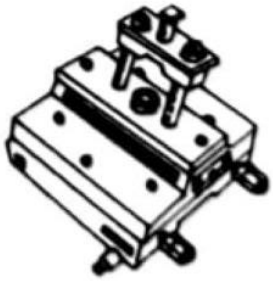
HOW TO CHANGE CHLORINE CYLINDER?

The chlorine bottle is empty, if the floating ball in the rotameter do not signalize the flow, and the loss of flow" indicator shows RED color. Please perform the changing procedure according to the following sketch!

1. Close the cylinder valve.
2. Make sure that the rotameter ball do not signalize any flow, and the loss of flow indicator window is showing RED color
3. Stop the injector by turning off the booster pump, and closing the ball valves
4. String the Yoke fixing screw and disconnect the Vacuum regulator from the cylinder valve
5. Change the chlorine bottle
6. Remove the old lead gasket, clean the contacting surfaces of the vacuum regulator and the cylinder valve
7. Insert a new lead gasket into the yoke and put the vacuum regulator back onto the full cylinder, don't tighten the yoke fixing screw too much!
8. Open the cylinder valve a little, than close it! The accidental leakage can be detected this way without further consequences, by the help ammonia soaked wool
9. If there is a leakage, eliminate it! (Repeat the process from No. 7)
10. If there is no leakage, than open the cylinder valve with max. % turn
11. Start the injector by turning on the booster pump and opening the ball valves







NOTE:

A. For detailed instructions please refer to the User Manual booklet

B. In case of a cylinder valve fault, please inform the company, responsible for charging the chlorine cylinder

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The manufacturing took place in Egypt under the manufacturing contract between us and the Water Technology Company in Egypt, through which it is requested

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