



# Series 900 Vacuum Regulators with Integral Switchover

## Instruction Manual



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# Hydro Instruments

## Series 900 Vacuum Regulators with Integral Switchover

### 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 and ton containers must 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. In earthquake prone areas, ton containers can also be strapped to the floor to secure them in place.
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. Use fans to increase air flow past chlorine cylinders and ton containers if it is desired to increase the gas withdrawal rate.
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.
6. All chlorine gas installations should include chlorine gas leak detector systems for added safety.
7. Refer to Hydro Instruments Chlorine Handling Manual and other technical guides for more detailed guidance.  
Refer to the technical literature section of the Hydro Instruments website to obtain all such literature.

## IMPORTANT NOTE:

*Pressurized chlorine gas manifolds should be avoided when possible. These pressurized manifolds increase the risk of a pressurized chlorine gas leak. Hydro Instruments vacuum regulators are designed to mount directly onto the valve of chlorine cylinders and ton containers. **Direct cylinder or ton container 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 vacuum regulator, should the vacuum line be broken, if water is stopped for any reason, or if the vacuum regulator is physically damaged.
2. Choosing a **feed capacity:**

Vacuum regulator SIZE SHOULD BE ON MAXIMUM POSSIBLE FLOW.

*Imperial Units:*

$$\begin{array}{ccccccc} \text{GPM} & \times & 0.012 & \times & (\text{PPM}) \text{ Dosage} & = & \text{PPD} \\ \text{Gallons Per Minute} & & & & \text{Parts Per Million} & & \text{Pounds Per Day (Cl}_2\text{)} \end{array}$$

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

In this example a Hydro Instruments 50 PPD vacuum regulator would be adequate.

*Metric Units:*

$$\begin{array}{ccccccc} \text{M}^3/\text{HR} & & \times & & (\text{PPM}) \text{ Dosage} & = & \text{GR/HR} \\ \text{Cubic Meters Per Hour} & & & & \text{Parts Per Million} & & \text{Grams Per Hour} \\ (\text{Cl}_2) & & & & & & \end{array}$$

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 back pressures up to 300 Psig (20 bar) are available.

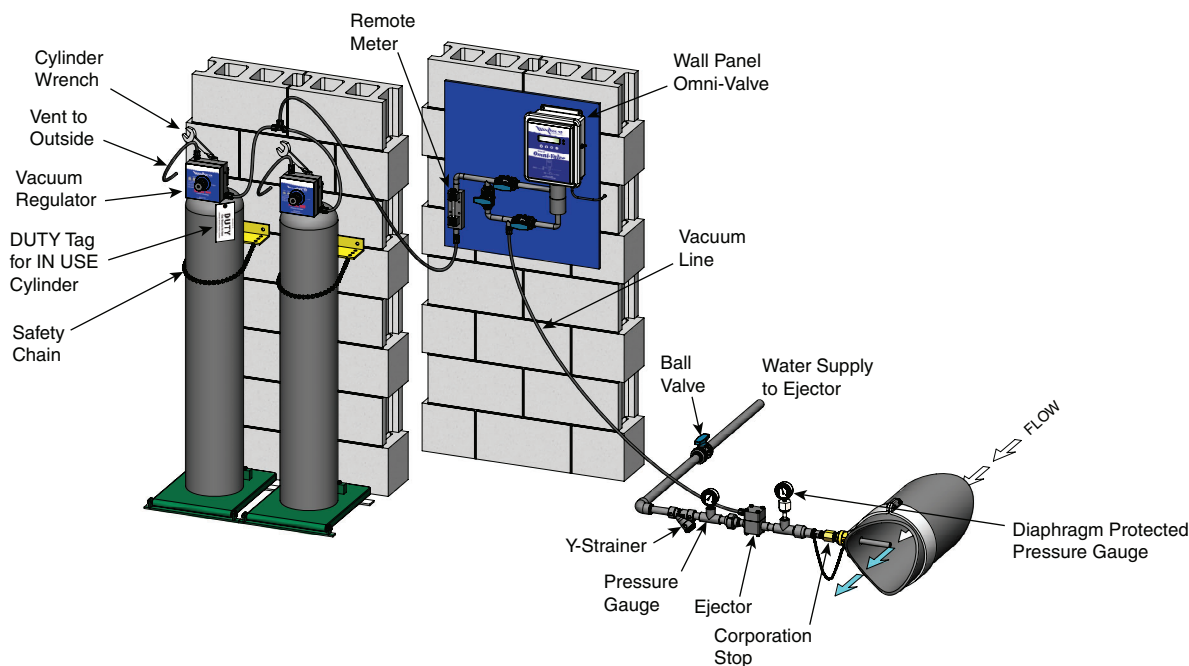
4. It is preferable to locate the ejector at the point of solution injection in order to minimize **solution lines**. Friction losses in the solution line will **increase the ejector back pressure**. To reduce the friction losses, increase the solution line internal diameter and limit the number of flow restrictions and turns. Also be sure that the solution line material is resistant to **the highly concentrated chlorine mixture**. **Avoid or minimize solution lines wherever possible.**
5. The only connection between the ejector and the vacuum regulator is the Hydro Instruments specified black polyethylene tubing which carries the vacuum (originating at the ejector) to the vacuum regulator, allowing the system to operate. Up to 100 feet of polyethylene tubing between vacuum regulator and ejector is standard. For longer distances consult Hydro Instruments and review the Vacuum Tubing and Piping (Gas) guide document.

## Torque Specifications

Item	Min. Inch/lbs.	Max. Inch/lbs.
Yoke bolts	20	25
Body bolts	20	25
Meter block bolts	20	25
Meter inlet plug	10	15
Meter dummy plug	7	10
Vacuum fittings	15	20
Item	Min. Foot/lbs.	Max. Foot/lbs.
Ton ironworks flange bolts	20	25
Ton ironworks closed yoke adapter	72	75
Yoke half-dog bolt	20	25

## SECTION III: SYSTEM INSTALLATION

FIGURE 1



*A Hydro Instruments installation injecting chlorine into a pipe line using city water.*

## (I) INSTALLATION OF HYDRO INSTRUMENTS EJECTOR (Refer to Figure 1)

1. Installation of HYDRO INSTRUMENTS EJECTOR:
  - a. Remove the diffuser from the ejector assembly and place four wraps of Teflon tape on diffuser threads.
  - b. **Do Not** install diffuser into pipe line when assembled with ejector.
  - c. Turn diffuser by hand into NPT threads of pipe line ( $\frac{3}{4}$ " or  $1\frac{1}{4}$ " NPT). Place wrench on diffuser and tighten **one half turn maximum**.
  - d. Reconnect diffuser to ejector making sure OH-BUN-214 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 Figure 1 and **Servicing Section in this Manual**).
    - a. Ejector should be installed down stream at a sufficient distance so that chlorinated water is not re-circulated through the booster pump. Pump suction should be 5 feet away from ejector injection point. On larger pipe diameters of 6 inches or greater a distance of 10 times the pipe diameter should be maintained so that chlorinated water is not recirculated through the booster pump.
    - b. On the water inlet side to the ejector nozzle the following should be installed: a water inlet valve, Y-strainer, and a pressure gauge. On the discharge side of the ejector a diaphragm protected pressure gauge appropriate for use with highly chlorinated water should be installed.
  - ii. Testing for sufficient pump pressure to operate ejector. Also checking that booster pump (if applicable) operating in the proper direction.

*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. Each ejector nozzle/diffuser combination has corresponding performance charts that indicate the required water flow and pressure required to operate at any given back pressure. If sufficient water flow and pressure are being supplied, then there should be a strong suction at the fitting on the top of the ejector. Feel for suction (with your finger) at the fitting on the top of the ejector if no vacuum gauge is available.
    - c. If the ejector has tested satisfactorily continue on to the next step (Mounting the Vacuum Regulator).

## (II) INSTALLATION OF HYDRO INSTRUMENTS VACUUM REGULATOR

*NOTE: The chlorine cylinder valve is still closed. Do not turn on until instructed to do so.*

1. Make sure that a safety chain is secured around chlorine cylinder or if using ton containers that the ton container is properly supported.
2. Remove the cylinder protection cap from the chlorine cylinder or ton container.

*IMPORTANT: If using ton containers, make sure that the valves on the ton container are vertically aligned and only connect to the top valve for gas withdrawal. See Figure 3.*
3. Examine the vacuum regulator for obvious damage.
4. Remove all materials used for shipping purposes.

*IMPORTANT: If it is a direct ton mounted vacuum regulator, make sure to evenly tighten the BTH-*

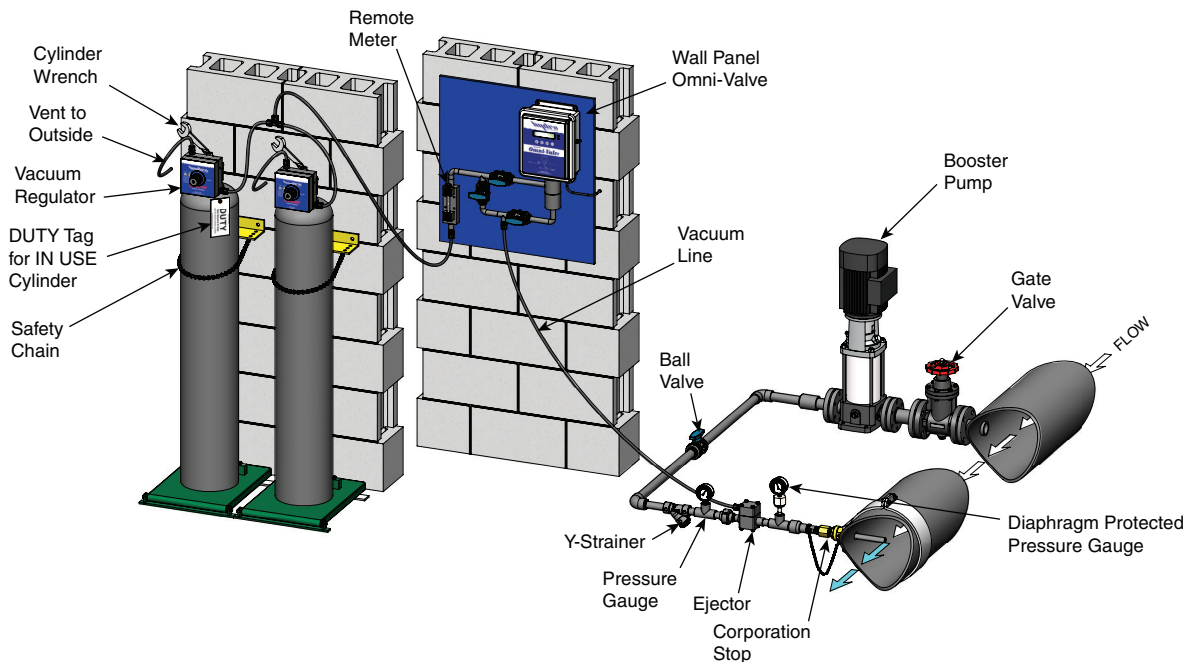
STA-139 bolts according to the label with red letters that is on the vacuum regulator.

- Place a new lead gasket over vacuum regulator inlet assembly.
- While placing lead gasket on vacuum regulator make sure that the filter material has not fallen out of inlet assembly. (This filter is necessary to remove particles that may precipitate out of chlorine.) Filters must be changed as necessary. Inspect the filters periodically and keep in mind that if vacuum level starts to increase or feed rate is restricted, then the filter might be clogged and in need of replacement.
- 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.**  
*IMPORTANT: Ton mounted vacuum regulators mount on the top valve only. They include a drip leg and heater. The heater must be plugged in and powered on at least 15 minutes prior to opening the ton container valve. The heater must always be powered on while in service. See Figure 3.*

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

- Series 900 automatic switchover systems use two vacuum regulators in tandem. The vacuum line coming from each Series 900 vacuum regulator should be tied together with a tubing tee before connecting to the remote meter.

FIGURE 2



*A Hydro Instruments installation injecting chlorine into a pipe line using a centrifugal pump. Note the location of gate and ball valves for easy Y-strainer cleaning and practical pump maintenance.*

*NOTE: Pump suction should be 5 feet away from ejector injection point. On larger pipe diameters of 6 inches or greater a distance of 10 times the pipe diameter should be maintained so that chlorinated water is not recirculated through the booster pump.*

*NOTE: Pump suction and ejector must be from the side of pipeline, not from top of the main.*

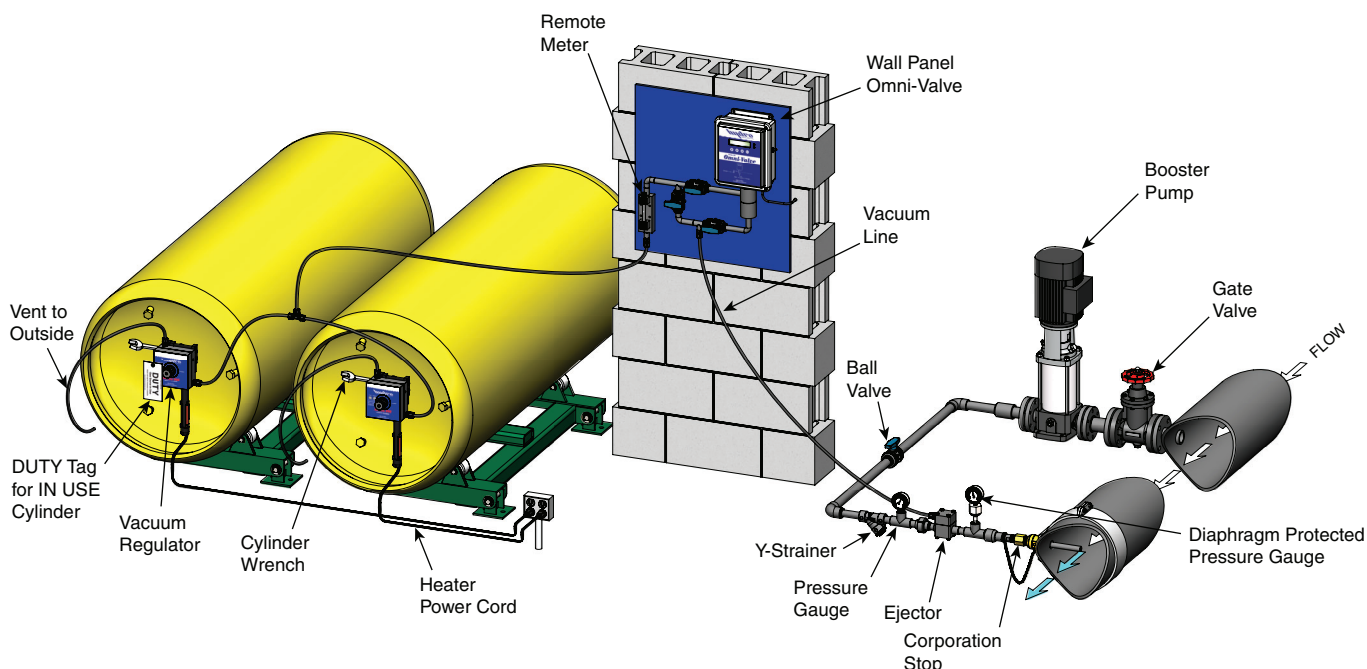
2. Connect vent tubing to second connector on the vacuum regulator and vent to safe area outside of building. (Place bug screen outside on end of vent tubing.)

*NOTE: Vent lines should be lower than the vacuum regulator. Do not connect vent lines from multiple vacuum regulators into a common vent – vent lines must remain separate. If desired, vent lines can be terminated at a scrubber intake duct or a vent arrestor device.*

#### (IV) REMOTE METERS/WALL PANEL OMNI-VALVES (Refer to Figure 3)

1. **Remote Meters:** (Gas flow is from bottom to top through the tube)  
Make vacuum tubing connections as shown in figures 1, 2, and 3.

FIGURE 3



*A Hydro Instruments Switchover System injecting chlorine into a pipeline using a centrifugal pump.*

*NOTE: Pump suction and ejector must be from the side of the pipeline, not from the top of the line.*

## SECTION IV: CHLORINATION SYSTEM VACUUM TEST

1. **Do Not** open chlorine cylinder valve until vacuum test is satisfactorily completed.
  - a. Vacuum Test  
With the chlorine cylinder valves still closed, turn on the ejector water supply and/or booster pump. The meter tube float should drop to the bottom within 30 seconds. At this time the feed rate control valve should be open. If the float continues to bounce there is a vacuum leak in the system. Check the lead gasket seal at the cylinder valves and all tubing connections (The tube fittings should be hand tight. It is not necessary to use pliers or a wrench on these fittings).
  - b. If the ejector is operating properly (pulling sufficient vacuum) then the front bolts should be depressed 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 the vacuum tubing at one of the vacuum regulators to allow the vacuum to escape. Reconnect the tubing.

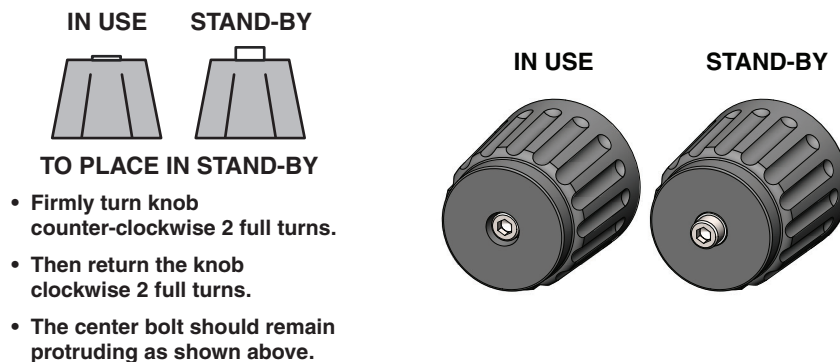
## SECTION V: START UP OF CHLORINATION

*Material necessary: A small plastic squeeze bottle, 1/3 full of ammonia, for detecting chlorine leaks. When ammonia fumes contact chlorine gas a visible white smoke is produced.*

**IMPORTANT:** If using direct ton container mounted vacuum regulators ensure that the BTH-STA-139 bolts were checked and tightened and that the heater was plugged in and allowed to heat up for at least 15 minutes prior to starting this procedure.

1. Open chlorine cylinder valve 1/4 turn and **close immediately**.
2. Squeeze ammonia fumes at gasket and yoke assembly area and around rate valve bonnet: if no smoke appears the seals are tight and it is OK to proceed to the next step. (Do not intentionally squirt liquid ammonia onto the lead gasket connection or elsewhere. If liquid ammonia does get onto the equipment, wipe it up using a dry towel.)
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 when you turn it off you know it should close with 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 counter-clockwise and then returning it two turns clockwise. The front bolt should remain protruding per the diagram

FIGURE 4



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 and at the top edge for machined floats.
6. Be aware that the 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/ton container valve.**

## SECTION VI: SHUT DOWN PROCEDURE

**IMPORTANT:** This procedure of shut down must be followed before a vacuum regulator is removed from a cylinder or ton container.

1. Close both chlorine cylinder valves while ejector is still operating.
2. Wait for the meter float to rest at the bottom of the meter tube and the bolts in the center of the reset knob to be sunken below the surface on both vacuum regulators. (See Figure 4)
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 off the water supply to the ejector.



*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 CYLINDER OR TON CONTAINERS

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

1. Tightly close the valve of the empty chlorine container. Follow all applicable guidelines in changing chlorine containers.
2. After replacing the empty with a full container, inspect the vacuum regulator, the vacuum regulator filter and (using a new lead gasket) mount the vacuum regulator on the full container.
3. Follow steps 1 through 3 in SECTION V START UP OF CHLORINATION to ensure there are no gas leaks before moving to step 4.
4. Turn the front knob two turns counter-clockwise 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. (See Figure 4.)
5. Move the "DUTY" tag as appropriate after changing container.

## SECTION VIII: RATE VALVE OPERATION

Turn the rate valve counter-clockwise to open it completely. Further turns will completely remove the rate valve from the flow meter tube, which will cause a loss of Cl<sub>2</sub> 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 build up of a white powdery substance which precipitates out of the chlorine gas. In order to avoid this build up, 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 corrected immediately. 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 an additional alternate outside switch appropriately located.
  - c. Chlorine cylinder wrench should remain on the cylinder valve whenever the valve 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. (*Do not use excessive force. See page 4 for torque specifications.*)

- ii. Always use a new lead gasket. It is recommended to obtain gaskets through Hydro Instruments to be certain of size and quality.
- b. Chlorine cylinder or ton container 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 container with a high degree of safety to an outside location. (**Never** attempt to place container in water as this will only increase the leak and the container may float to the surface.) If Emergency Repair Kit A or B is available and personnel are trained to use it, then this can also be used temporarily to stop the leak.
- 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 or ton container valve**.
  - ii. Wait until the metering ball drops to zero on the flow tube.
  - iii. Turn off water supply to ejector.
  - iv. Now remove the vacuum regulator from the cylinder or ton container valve.
  - v. See Appendix for inlet safety shut off valve servicing instructions.
  - vi. After servicing and remounting vacuum regulator with a new lead gasket, perform a vacuum test **before** you open the cylinder or ton container valve valve. **See “Chlorination System Vacuum Test”.**

## (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 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 with a stone or other foreign matter. Flush out or run pipe cleaner through only.
      - (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.**
    - 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 the cylinder was new or 2,000 lbs. lighter for ton containers.
  - b. Meter float would be at zero and center bolt would be depressed below the surface. (See Figure 4).

# APPENDIX A – SERVICING THE HYDRO INSTRUMENTS SYSTEM

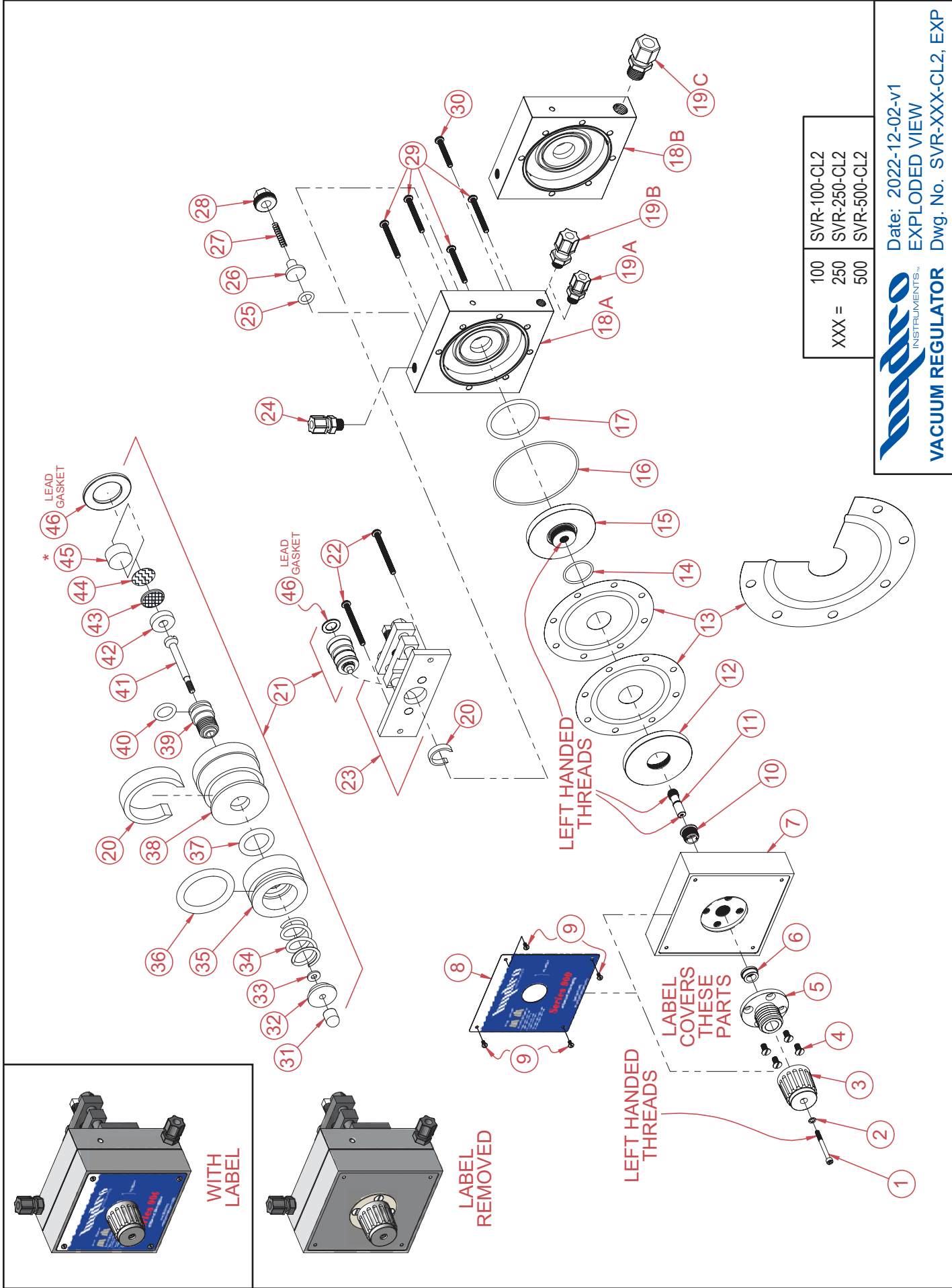
## SECTION A-1: VACUUM REGULATOR

1. Follow the usual shut-down procedure carefully before removing any vacuum regulator from the chlorine cylinder or ton container.
2. Make certain that the switchover mechanism indicated the regulator is in the “IN USE” position.
3. Using a  $\frac{5}{32}$ " Allen-wrench, remove the socket head cap screw (BTH-511-500) and Kynar washers (KW-900) by turning clockwise. **THIS BOLT HAS LEFT-HAND THREADS!**
4. Unscrew the reset knob (VRH-541-500) from the front body.
5. Remove the two yoke screws (BTH-STA-125) and pull the yoke assembly out of the vacuum regulator back body.
6. Unscrew the body bolts (BTH-STA-129 & BTH-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 (VRH-546-500) from the diaphragm assembly by turning clockwise. **THIS PIN HAS LEFT-HAND THREADS!**
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. Install O-rings, diaphragms and other spare parts supplied in the appropriate Part & Maintenance Kit.
10. After inspection and replacement of all necessary parts, reassemble the unit in reverse order.

## SECTION A-2: INLET ASSEMBLY

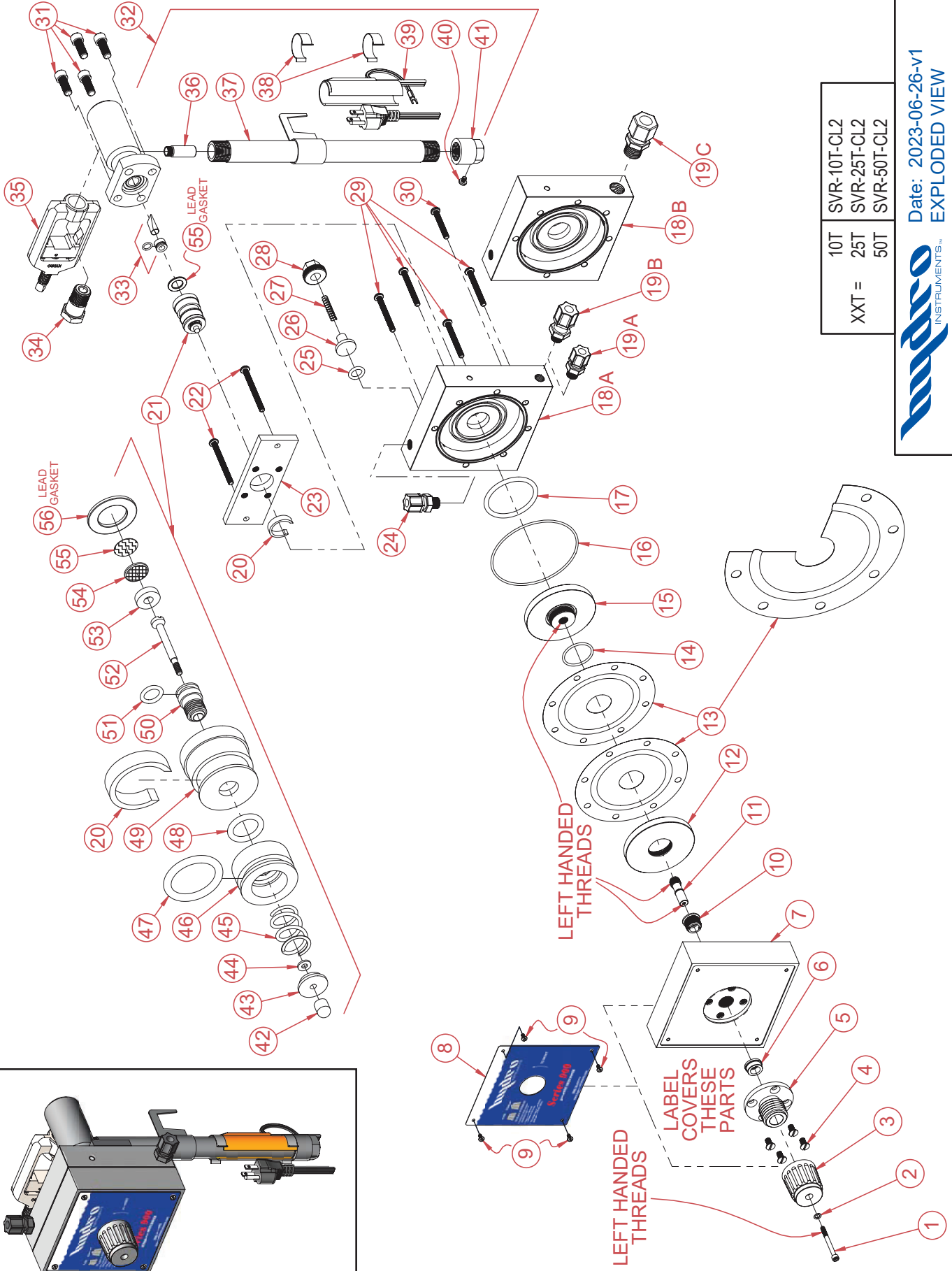
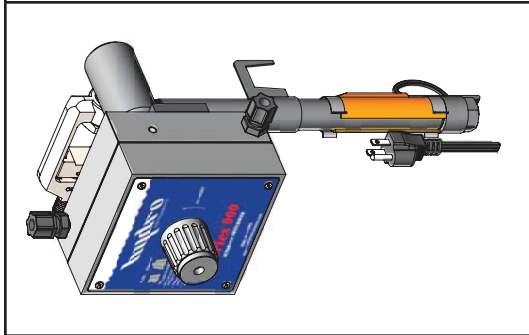
**WARNING:** *If the vacuum regulator leaks gas out the vent or any other place on the body the problem is most likely caused inside the yoke assembly. It is recommended that the yoke assembly be disassembled by a person experienced in Chlorine Vacuum Regulator maintenance because if it is not done properly dangerous leakage of pressurized gas could result.*

1. Remove the inlet assembly from the yoke plate by slipping off the PVC retainer clip (VRH-142-500) that holds it to the yoke.
2. Remove the inlet filter material from the inlet capsule (VRH-141-501).
3. Disassemble the inlet assembly using a small flat-head screwdriver to hold the inlet valve (VRH-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 (VRH-182-500) from the inlet capsule.
5. Remove the valve seat (VRH-110-500) from the inlet capsule by simply pushing the exposed threaded portion up through the inlet capsule. Note that the O-ring OH-VIT-011 is attached to this seat.
6. Clean the inlet capsule, inlet spring (SPH-104-100) and inlet valve using a soft cloth or plastic cleaning 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.



Date: 2022-12-02-v1  
 EXPLODED VIEW  
  
 INSTRUMENTS  
 VACUUM REGULATOR Dwg. No. SVR-XXX-CL2, EXP

Item No.	Description	Quantity	Part No.	Item No.	Description	Quantity	Part No.
1	10-24 x 2" Socket Head Cap Screw	1	BTH-511-500	25	PM O-Ring (Vent Valve)	1	OH-CEM-207
2	PM Set of Two Teflon Washers	1	KW-900	26	Vent Cup	1	VRH-521-501
3	Vacuum Reset Knob	1	VRH-541-500	27	Vent Spring	1	SPH-520-000
4	Screws (1/4-20 x 1/2")	4	BTH-STA-100EC	28	Vent Cap	1	VRH-522-500
5	Vacuum Body Bolt	1	VRH-540-500	29	1/4-20 x 2 1/4" Bolt	4	BTH-STA-129
6	Pin Guide	1	VRH-544-500	30	1/4-20 x 1 3/4" Bolt	1	BTH-STA-124
7	Front Body	1	VRH-555-500	31	Vent Plug	1	VRH-111-500
8	Series 900 Front Plate	1	VRH-441-900-1	32	Spring Retainer	1	VRH-183-500
9	6-32 x 5/16" Screw (Nylon)	4	BTH-STA-127	33	Spring Holder	1	VRH-113-500
10	PM Collar	1	VRH-545-500	34	Inlet Spring	1	SPH-104-000
11	PM Guide Pin	1	VRH-546-500	35	PM Seal Plug	1	VRH-182-500
12	Diaphragm Front Plate	1	VRH-269-500	36	PM O-Ring	1	OH-VIT-212
13	PM Set of Two Diaphragms	1	DIH-106-500	37	PM O-Ring	1	OH-VIT-112
14	PM O-Ring	1	OH-VIT-126	38	Inlet Capsule	1	VRH-141-501
15	Diaphragm Back Plate	1	VRH-547-500	39	PM Valve Seat	1	VRH-110-500
16	PM O-Ring	1	OH-VIT-156	40	PM O-Ring	1	OH-VIT-011
17	O-Ring	1	OH-VIT-331	41	Inlet Valve	1	VRH-112-500
18A	Back Body (up to 250 PPD)	1	VRH-556-251	42	PM Filter Stop	1	VRH-184-500
18B	Back Body (up to 500 PPD)	1	VRH-556-501	43	PM Inlet Screen	1	VRH-101-500
19A	PM 1/4" NPT 3/8" Tube Tubing Connector (100 PPD assembly/kit)	1	BKF-64	44	PM Fiberglass Filter Pad	1	VRH-457-500
19B	PM 1/4" NPT 1/2" Tube Tubing Connector (250 PPD assembly/kit)	1	BKF-84	45	PM* Teflon Filter (100 PPD max)	1	VRH-456-100
19C	PM 1/2" NPT 5/8" Tube Tubing Connector (500 PPD assembly/kit)	1	BKF-108	46	Lead Gasket	1	GAH-LED-111
20	Retainer Clip	1	VRH-142-500	PM	Part & Maintenance Kit (100 PPD)		KT9-100-VRC
21	Inlet Valve Capsule Assembly	1	See Note	PM	Part & Maintenance Kit (250 PPD)		KT9-250-VRC
22	1/4-20 x 2 3/4" Back Plate Screw	2	BTH-STA-125	PM	Part & Maintenance Kit (500 PPD)		KT9-500-VRC
23	Yoke Assembly	1	VRH-346-500	*	Used in: SVR-100-CL2		
24	PM 1/4" NPT 3/8" Tube Tubing Connector	1	BKF-64	NOTE:	Inlet Valve Capsule Assembly (100 PPD)		VRH-469-501
					Inlet Valve Capsule Assembly (250 & 500 PPD)		VRH-469-501-1



10T	SVR-10T-CL2
25T	SVR-25T-CL2
50T	SVR-50T-CL2

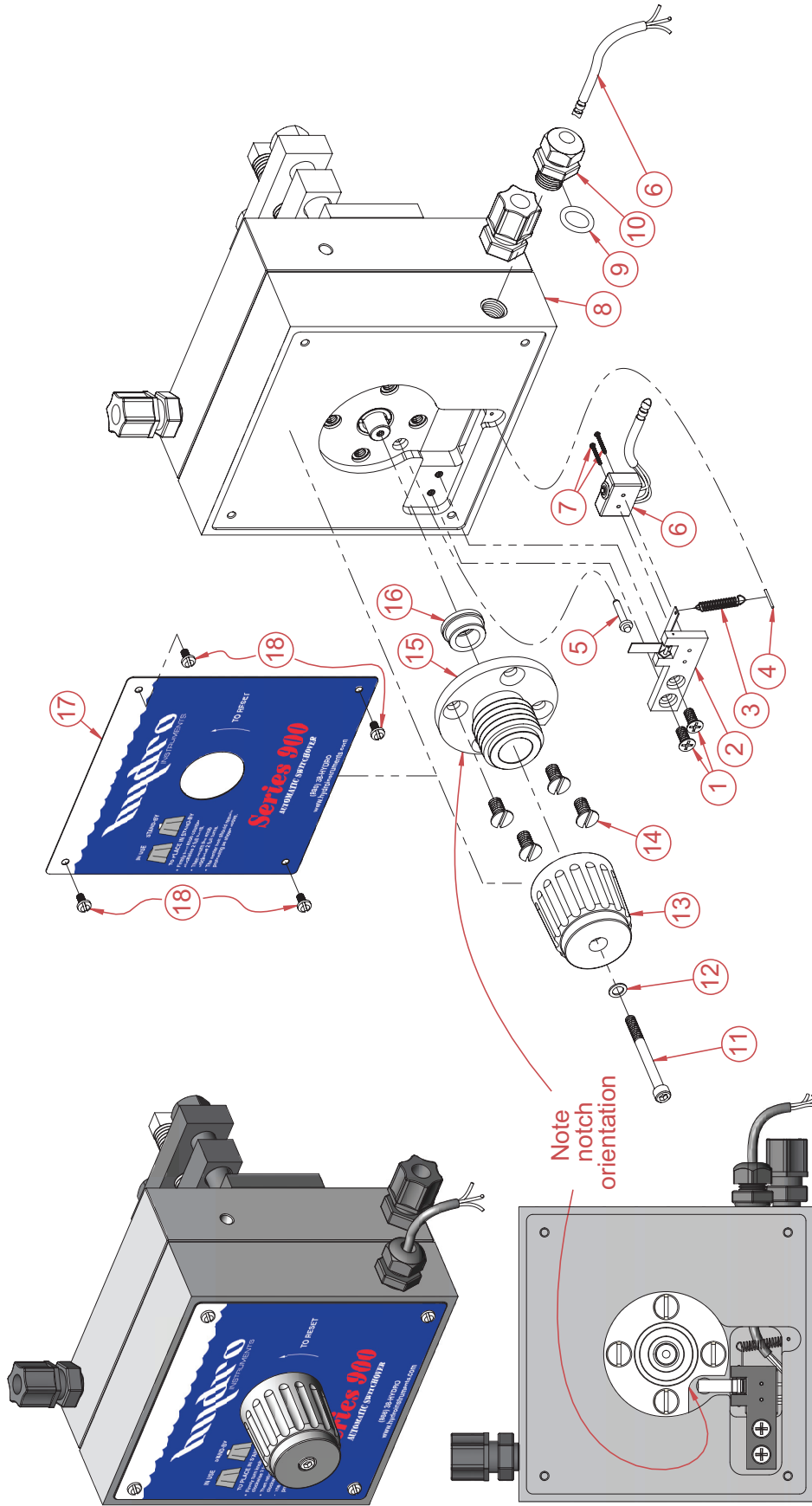

**VACUUM REGULATOR**

Date: 2023-06-26-v1  
 EXPLODED VIEW  
 Dwg. No. SVR-XXT-CL2, EXP

Item No.	Description	Quantity	Part No.	Item No.	Description	Quantity	Part No.
1	10-24 x 2" Socket Head Cap Screw	1	BTH-511-500	31	3/8-16 x 1" Socket Head Cap Screw	4	BTH-STA-139
2	PM Set of Two Teflon Washers	1	KW-900	32	Ton Inlet Assembly with Closed Yoke	1	VRH-738-501
3	Vacuum Reset Knob	1	VRH-541-500	33	PM Filter Assembly		
4	Screws (1/4-20 x 1/2")	4	BTH-STA-100EC		(includes holder, screen, and o-ring)	1	VRH-126-500
5	Vacuum Body Bolt	1	VRH-540-500	34	Closed Yoke Adapter	1	YAH-1300
6	Pin Guide	1	VRH-544-500	35	Assembled Closed Yoke Assembly	1	YAH-705
7	Front Body	1	VRH-555-500		(includes yoke frame, half dog, slide bar, and pin)		
8	Series 900 Front Plate	1	VRH-441-900-1	36	✓ Drip Tube	1	DT-112
9	6-32 x 5/16" Screw (Nylon)	4	BTH-STA-127	37	✓ Monel Drip Leg	1	DL-134
10	PM Collar	1	VRH-545-500	38	Heater Clamps	2	CLH-100-500
11	PM Guide Pin	1	VRH-546-500	39	Drip Leg Heater (25W, 115VAC)	1	HTH-111-115
12	Diaphragm Front Plate	1	VRH-269-500	39	Drip Leg Heater (25W, 230VAC)	1	HTH-111-230
13	PM Set of Two Diaphragms	1	DIH-106-500	39	Drip Leg Heater (25W, 24VDC)	1	HTH-111-024
14	PM O-Ring	1	OH-VIT-126	40	Ground Screw (Stainless)	1	#10-32 x 1/4"
15	Diaphragm Back Plate	1	VRH-547-500	41	✓ Drip Leg Cap	1	DCM-15
16	PM O-Ring	1	OH-VIT-156	42	Vent Plug	1	VRH-111-500
17	O-Ring	1	OH-VIT-331	43	Spring Retainer	1	VRH-183-500
18A	Back Body (up to 250 PPD)	1	VRH-556-251	44	Spring Holder	1	VRH-113-500
18B	Back Body (up to 500 PPD)	1	VRH-556-501	45	Inlet Spring	1	SPH-104-000
19A	PM 1/4" NPT 3/8" Tube Tubing Connector (100 PPD assembly/kit)	1	BKF-64	46	PM Seal Plug	1	VRH-182-500
19B	PM 1/4" NPT 1/2" Tube Tubing Connector (250 PPD assembly/kit)	1	BKF-84	47	PM O-Ring	1	OH-VIT-212
19C	PM 1/2" NPT 5/8" Tube Tubing Connector (500 PPD assembly/kit)	1	BKF-108	48	PM O-Ring	1	OH-VIT-112
20	* Retainer Clip	1	VRH-142-500	49	Inlet Capsule	1	VRH-141-501
21	Inlet Valve Capsule Assembly	1	VRH-469-501-1	50	PM Valve Seat	1	VRH-110-500
22	1/4-20 x 2 3/4" Back Plate Screw	2	BTH-STA-125	51	PM O-Ring	1	OH-VIT-011
23	Ton Yoke Plate	1	VRH-739-501	52	Inlet Valve	1	VRH-112-500
24	PM 1/4" NPT 3/8" Tube Tubing Connector	1	BKF-64	53	PM Filter Stop	1	VRH-184-500
25	PM O-Ring (Vent Valve)	1	OH-CEM-207	54	PM Inlet Screen	1	VRH-101-500
26	Vent Cup	1	VRH-521-501	55	PM Fiberglass Filter Pad	1	VRH-457-500
27	Vent Spring	1	SPH-520-000	56	PM Lead Gasket	1	GAH-LED-111
28	Vent Cap	1	VRH-522-500				
29	1/4-20 x 2 1/4" Bolt	4	BTH-STA-129	✓	Not Sold Separately		
30	1/4-20 x 1 3/4" Bolt	1	BTH-STA-124	PM	Part & Maintenance Kit (100 PPD)		KT9-100-VRT
				PM	Part & Maintenance Kit (250 PPD)		KT9-250-VRT
				PM	Part & Maintenance Kit (500 PPD)		KT9-500-VRT
				*	Part of VRH-469-501 Assembly		



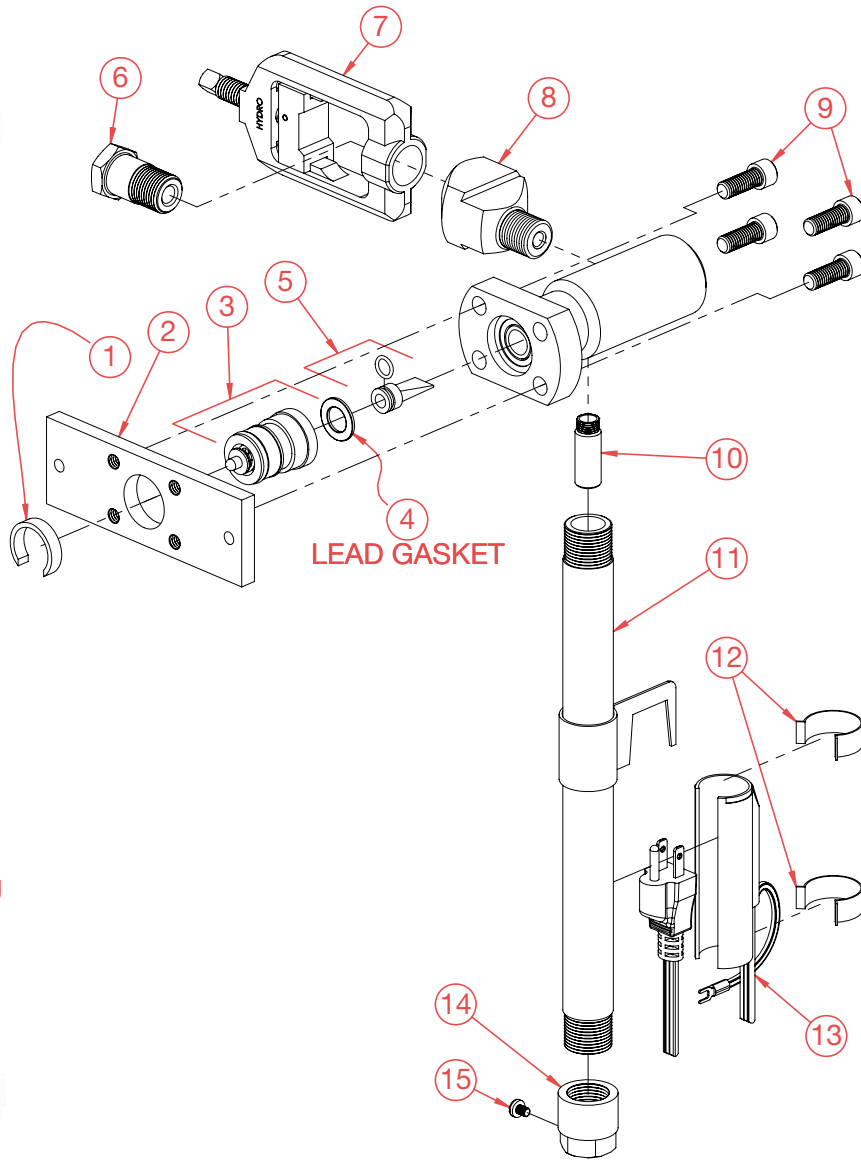
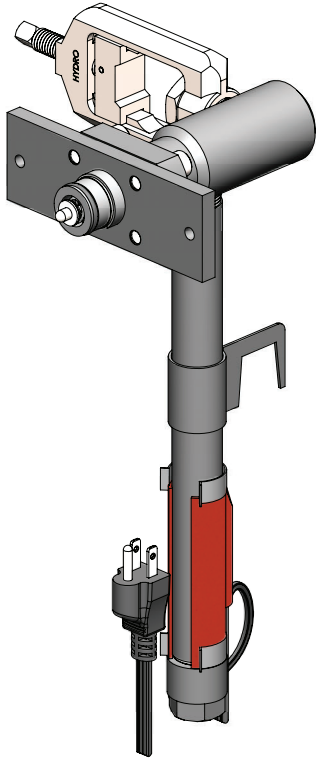
Date: 2023-06-26-v1  
 BILL OF MATERIALS  
 Dwg. No. SVR-XXT-CL2, BOM



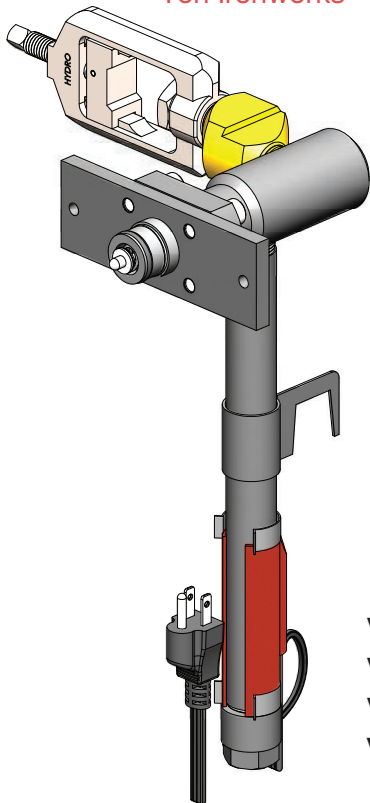


Item No.	Description	Quantity	Part No.
1	Lower Assembly Screw	2	BTH-STA-122
2	Switch Lever Assembly	1	VRH-243-500
3	Alarm Switch Spring	1	VRH-143-500
4	Pin	1	VRH-144-500
5	Alarm Switch Pin	1	VRH-549-MCR
6	Micro Switch	1	VRH-5615-500
7	Micro Switch Screw	2	BTH-STA-137
8	Front Body	1	VRH-555-MCR
9	O-Ring	1	OH-VIT-112
10	Liquid Tight Fitting	1	BLT-199
11	10-24 x 2" Socket Head Cap Screw	1	BTH-511-500
12	Teflon Washer (Set of Two)	1	KW-900
13	Vacuum Reset Knob	1	VRH-541-500
14	1/4-20 x 1/2" Screws (Monel)	4	BTH-STA-100EC
15	Vacuum Body Bolt	1	VRH-540-MCR
16	Pin Guide	1	VRH-544-500
17	Series 900 Face Plate	1	VRH-441-900-1
18	6-32 x 5/16" Screw (Nylon)	4	BTH-STA-127

**Ton Ironworks**



**Actuator Mounting  
Ton Ironworks**




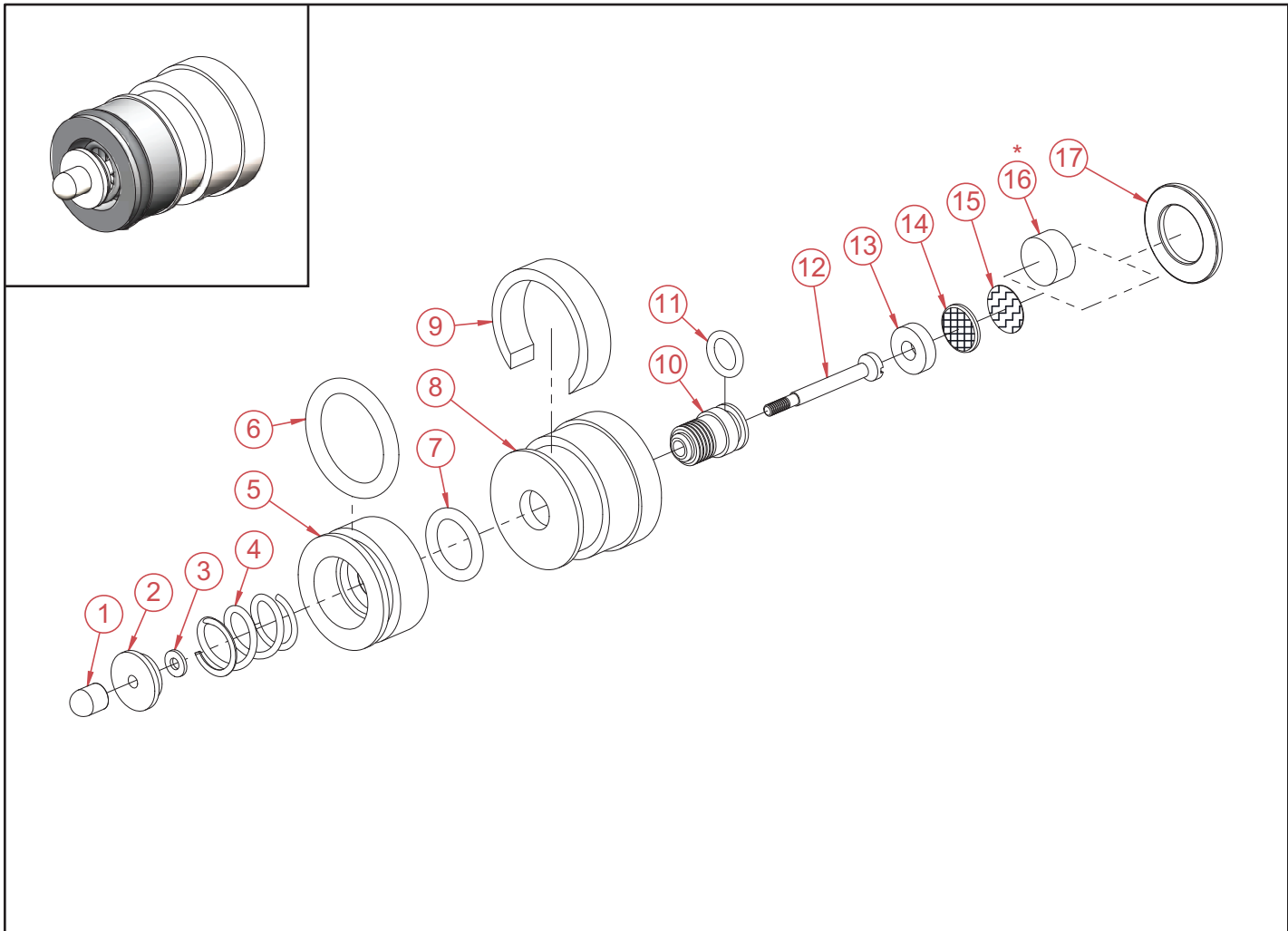
Part Number
VRH-738-501
VRH-999-500
VRH-738-501-AW
VRH-999-500-AW

With Seal Plug Assembly	Actuator Mounting
No (excludes items 1, 2, 3, 4, 9, and 13)	No (excludes item 8)
Yes	No (excludes item 8)
No (excludes items 1, 2, 3, 4, 9, and 13)	Yes (includes Item 8)
Yes	Yes (includes Item 8)



Date: 2023-05-17-v2  
**EXPLODED VIEW**  
 Dwg. No. VRH-999-500, EXP

Item No.	Description	Quantity	Part No.
1	* Retainer Clip	1	VRH-142-500
2	Ton Yoke Plate	1	VRH-739-501
3	Inlet Valve Capsule Assembly	1	VRH-469-501-1
4	<sup>PM</sup> Ton Ironwork Inner Lead Gasket	1	GAH-LED-111
5	<sup>PM</sup> Filter Assembly (includes holder, screen, and o-ring)	1	VRH-126-500
6	Closed Yoke Adapter (Monel)	1	YAH-1300
7	Assembled Closed Yoke Assembly (includes yoke frame, half dog, slide bar, and pin)	1	YAH-705
8	** Eccentric Extender ½" MNPT x ½" FNPT (Bronze) (only included in actuator mounting configurations)	1	YAH-319
9	⅜-16 x 1" Socket Head Cap Screw	4	BTH-STA-139
10	✓ Drip Tube	1	DT-112
11	✓ Monel Drip Leg	1	DL-134
12	Heater Clamps	2	CLH-100-500
13	Drip Leg Heater (25W, 115VAC)	1	HTH-111-115
13	Drip Leg Heater (25W, 230VAC)	1	HTH-111-230
13	Drip Leg Heater, New Zealand (25W, 230VAC)	1	HTH-111-230-NZ
13	Drip Leg Heater (25W, 24VDC)	1	HTH-111-024
14	✓ Drip Leg Cap	1	DCM-15
15	Ground Screw (Stainless)	1	#10-32 x ¼"
✓	Not Sold Separately		
*	Part of VRH-469-501 Assembly (Item 3)		
**	Eccentric Extender is only used in actuator mounting configurations.		
<sup>PM</sup>	Part & Maintenance kits for ton mounting vacuum regulators using the VRH-999-500 or VRH-738-501:		
	Series 300		
	VRH-10T-CL2		KTH-100-VRT
	VRH-25T-CL2		KTH-250-VRT
	VRH-50T-CL2		KTH-500-VRT
	Series 900		
	SVR-10T-CL2		KT9-100-VRT
	SVR-25T-CL2		KT9-250-VRT
	SVR-50T-CL2		KT9-500-VRT
	<b>Part Number</b>	<b>With Seal Plug Assembly</b>	<b>Actuator Mounting</b>
	<b>VRH-738-501</b>	No (excludes items 1, 2, 3, 4, 9, and 13)	No (excludes item 8)
	<b>VRH-999-500</b>	Yes	No (excludes item 8)
	<b>VRH-738-501-AW</b>	No (excludes items 1, 2, 3, 4, 9, and 13)	Yes (includes Item 8)
	<b>VRH-999-500-AW</b>	Yes	Yes (includes Item 8)
	 Date: 2023-05-17-v2 <b>BILL OF MATERIALS</b> Dwg. No. VRH-999-500, BOM TON IRONWORKS ASSEMBLY		



Item No.	Description	Quantity	Part No.
1	Vent Plug	1	VRH-111-500
2	Spring Retainer	1	VRH-183-500
3	Spring Holder	1	VRH-113-500
4	Inlet Spring	1	SPH-104-000
5	Seal Plug	1	VRH-182-500
6	O-Ring	1	OH-VIT-212
7	O-Ring	1	OH-VIT-112
8	Inlet Capsule	1	VRH-141-501
9	Retainer Clip	1	VRH-142-500
10	Valve Seat	1	VRH-110-500
11	O-Ring	1	OH-VIT-011
12	Inlet Valve	1	VRH-112-500
13	Filter Stop	1	VRH-184-500
14	Inlet Screen	1	VRH-101-500
15	Fiberglass Filter Pad	1	VRH-457-500
16	* Teflon Filter (100 PPD max)	1	VRH-456-100
17	Lead Gasket	1	GAH-LED-111

\* Used in VRH-469-501: Non-ton mounting vacuum regulators, 100 PPD Cl<sub>2</sub> and smaller.



INLET VALVE CAPSULE ASSEMBLY

Date: 2020-11-11-v1  
 EXPLODED VIEW AND BOM  
 Dwg. No. VRH-469-501  
 VRH-469-501-1