Gas Chlorination Systems
Series 800

Instruction Manual

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

E800 Rev. 12/1/2022

Hydro Instruments Gas Chlorination Systems
Series 800
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 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.
3. For best operation and safety, the **vacuum regulators and cylinder 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 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. ***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 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:

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 Hydro Instruments 50 PPD vacuum regulator would be adequate.

   Metric Units:

M^3/HR	x	(PPM) Dosage	=	GR/HR
Cubic Meters Per Hour		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 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.**

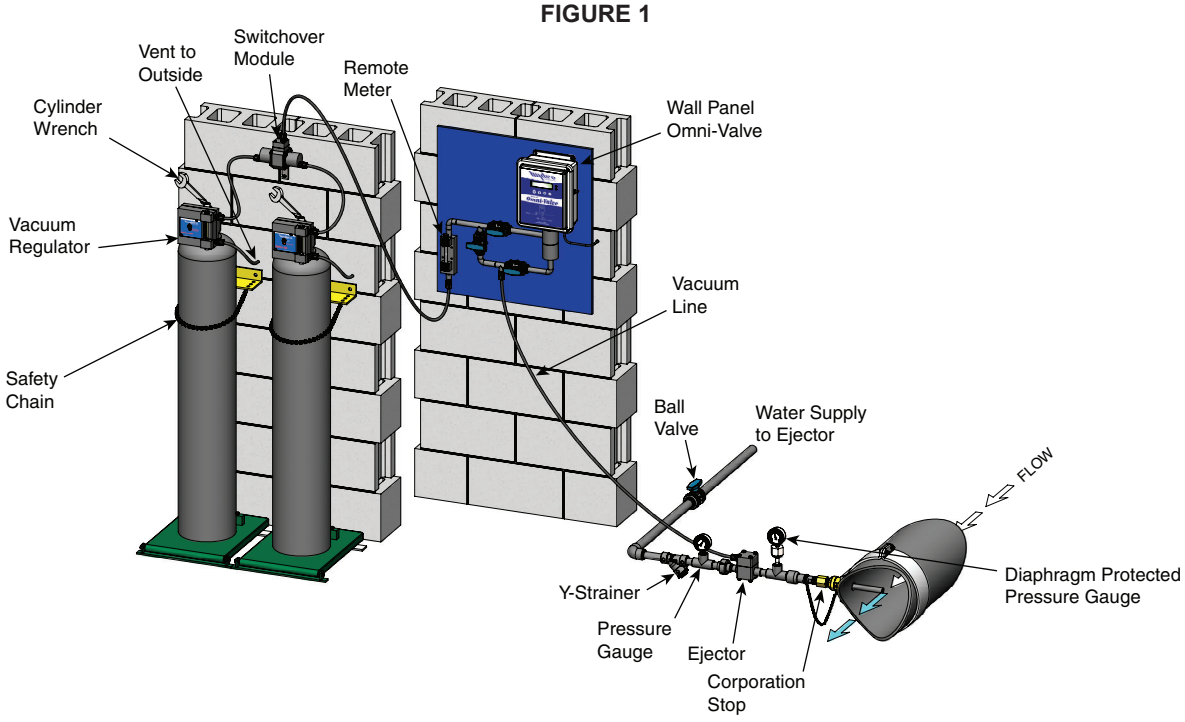
5. The only connection between the ejector and the vacuum regulator is the Hydro Instruments specified black polyethylene tubing which carries the vacuum (originating at the ejector) to the vacuum regulator, allowing the system to operate. Up to 100 feet of polyethylene tubing between vacuum regulator and ejector is standard. For longer distances consult Hydro Instruments and review the Vacuum Tubing and Piping (Gas) guide document.

Hydro Instruments
Gas Chlorination Equipment
Torque Specifications

Item	Min. inch•lbs.	Max. inch•lbs.
Yoke Bolts	20	25
Body Bolts	20	25
Meter Block Bolts	20	25
Vacuum Fittings	15	20
Inlet Plug	10	15
Dummy Plug	7	10
Item	**Min. foot•lbs.**	**Max. foot•lbs.**
Yoke Half Dog	20	25

SECTION III: SYSTEM INSTALLATION

FIGURE 1



A typical 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 (¾" or 1¼" 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)

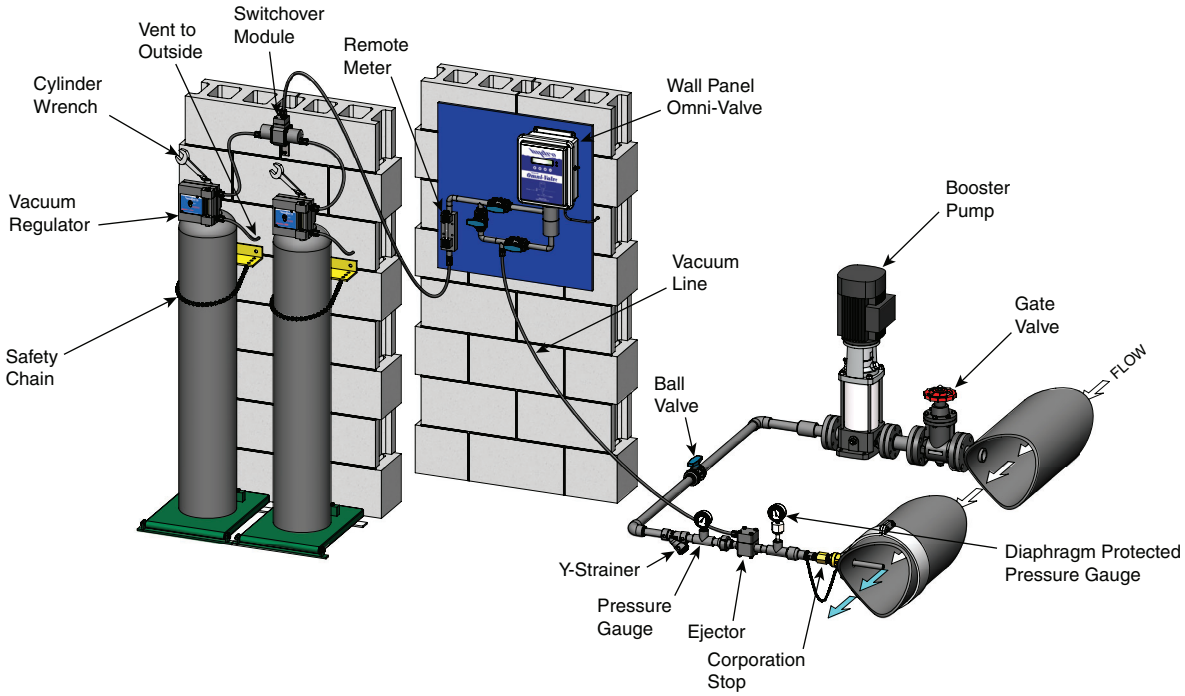
   Note 2: When chlorinating into a contact chamber a tee should be installed on the solution line with a vacuum breaker to prevent siphoning.
      a. If operating with city water pressure (no booster pump), open the water inlet valve to the ejector and feel for suction (with your finger) at the fitting 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 open until instructed to do so.

1. Make sure that a 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 all materials used for shipping purposes.
5. Place a new lead gasket over vacuum regulator inlet assembly.
6. 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.)

FIGURE 2



A typical 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.

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.

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.

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

1. The upper connector on right top of vacuum regulator is for vacuum line tubing to ejector.
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 AND SWITCHOVER MODULES (Refer to Figures 1 and 2)

1. **Switchover modules:** (Gas flow is from bottom/side to top from one side only at a time)
   Make vacuum tubing connections as shown in Figures 1 and 2.
2. **Remote Meters:** (Gas flow is from bottom to top through the tube)
   Make vacuum tubing connections as shown in Figures 1 and 2.

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 valve still closed, start the ejector booster pump and the meter tube ball should drop to the bottom within 30 seconds. At this time the feed rate adjustment valve should be open. If the ball continues to bounce there is a vacuum leak in the system. Check the lead gasket seal at the cylinder valve 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) the pin should be below the surface on the front surface of the Series 800 vacuum regulator.
   c. Turn off water supply to ejector.
   d. Wait 5 to 10 minutes with water supply off. The pin should remain below the surface of the vacuum regulator if the system is vacuum tight.
   e. If the system is vacuum tight proceed to the next step.
   f. Disconnect vacuum tubing at top of chlorinator to allow air to enter the system. Reconnect tubing.

SECTION V: START UP OF CHLORINATION

Material necessary: A small plastic squeeze bottle, ⅓ full of ammonia, for detecting chlorine leaks. When ammonia fumes contact chlorine gas a visible white smoke is produced.

1. Open chlorine cylinder valve ¼ turn and **close immediately.**
2. Squeeze ammonia bottle 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 ¼ turn, leave open, and **recheck for chlorine leaks.** (¼ turn open of the cylinder valve is all that's required. The reason we specify ¼ turn is that when you turn it off you know it should close with ¼ turn. In an emergency you can shut it off quickly and safely. The wrench stays on the cylinder valve while cylinder is open.)
4. 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.
5. 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

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

1. Close the chlorine cylinder valve while ejector is still operating.
2. Wait for ball to rest at bottom of meter tube and the pin to be below the surface on the front face of the vacuum regulator.
3. Shut down the water supply to the ejector.

SECTION VII: RATE VALVE OPERATION

Turn the rate valve counter-clockwise to open it completely. Further turns will completely remove the rate valve from the assembly, which will cause a loss of Cl_2 feed. ***(See Appendix for servicing instructions.)***

The O-ring seal for the rate valve is locked in place under the valve bonnet and does 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 VIII: 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 cylinder valve is open.
   d. Plastic squeeze bottle ⅓ 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.)
      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 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. (**Never** attempt to place cylinder in water as this will only increase the leak and the cylinder may float to the surface.) If Emergency Repair Kit A is available and personnel are trained to use it, then this can also be used to temporarily 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 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 valve provided that the red indicator is showing no chlorine pressure. (Red should be showing.)

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 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.
   b. Flow ball would be at zero and RED indicated on front of vacuum regulator.

APPENDIX A – SERVICING THE HYDRO INSTRUMENTS SYSTEM

SECTION A-1: VACUUM REGULATOR

(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 knob into 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 of the 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.

   NOTE: All other vacuum regulator repairs should be done by the factory or authorized repair personnel.

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 vacuum regulator inlet capsule assembly VRH-469-501. It is not recommended that the vacuum regulator inlet capsule assembly be disassembled by any untrained personnel because if it is not done properly then dangerous leakage of pressurized chlorine gas could result.*

SECTION A-2: 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 pipe line.
2. For 100 PPD or lower ejectors rotate the complete ejector body counter clockwise. 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.
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 OH-BUN-214 O-Rings the ejector can now be reassembled.

When reassembling the ejector 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 constructed 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. For gasket check valve ejectors, carefully remove the raised seat screw in the center top of the ejector body with a pair of pliers. Under this plug is a rubber gasket. Replace the seat if it is damaged or if the hole is plugged shut.
2. For gasket check valve ejectors, reinstall the seat screw tightening with pliers. Be careful not to over tighten using only reasonable force.
3. Remove the four bolts holding the ejector body together.
4. Inside you will find a diaphragm assembly and a spring.
5. 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.
6. Inspect the rubber diaphragm for holes or weak points.
   a. For O-ring check valves, inspect the OH-CEM-210 O-Ring. Replace if damaged.
7. Reassemble the diaphragm assembly, preferably with a new rubber diaphragm.
8. Install the assembly in the recess between the ejector body halves being careful to install the spring properly below the assembly.

SECTION A-3: SWITCHOVER MODULE

(I) OPERATION OF THE MODULE

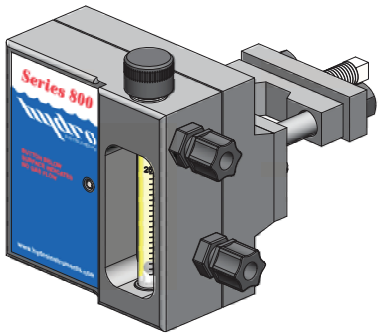
GENERAL: This device requires no outside setting or adjustment. The switchover module allows gas to flow from one of the two intake ports at a time, keeping the other sealed. It will continue to feed from first side until the vacuum level rises sufficiently (in the event of an empty cylinder or closing of the cylinder valve), at which time an internal spring loaded mechanism automatically switches to open the second intake port and to close the first intake port.

NOTE: *In low capacity systems where the feed rate is less than 10 PPD or the time between switching is more than two weeks, it is recommended that the module be "exercised" weekly. If the module is left in one position for long periods of time, it may have a tendency to stick in one position. To exercise the module it can be disconnected from both vacuum regulators with the ejector still connected and operating. Use a finger or thumb to close the open intake port of the module until it switches to feed from the other port. Repeat this process 5 to 10 times.*

(II) SERVICING THE MODULE

GENERAL: If the module does not operate correctly first try exercising it as described in the last paragraph. If this does not work the unit must be disassembled.

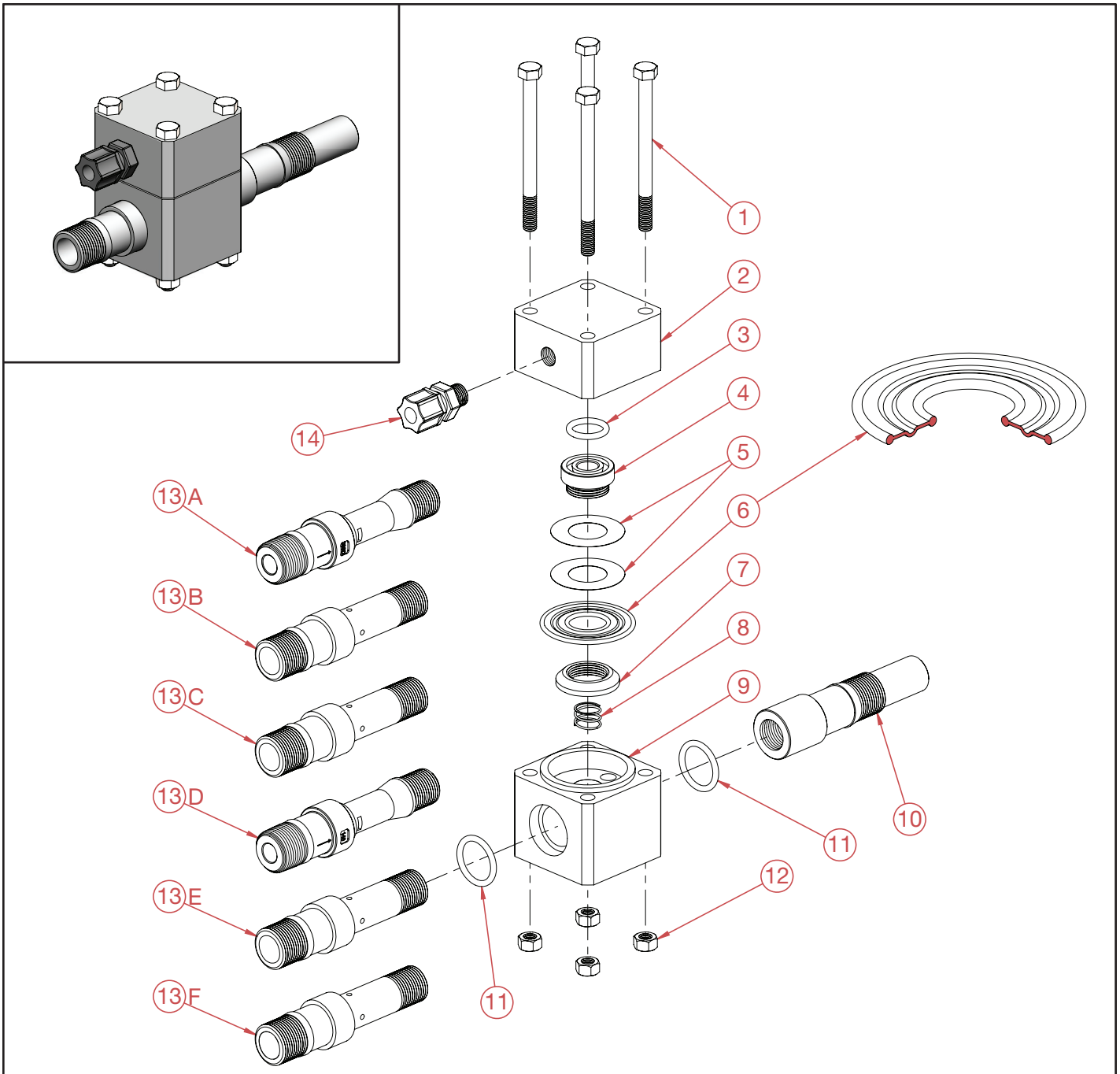
1. Remove the four screws that secure the top cap onto the main body.
2. Remove the four screws that secure each of the side caps onto the main body.
3. Remove the diaphragm assemblies and the toggle mechanism noting their orientations for reassembly.
4. Inspect the guide pin to ensure that it is free of dirt or burrs. If not clean and polish it with alcohol until it is able to slide freely.
5. Inspect the O-Ring seats on the diaphragm assemblies. Ensure that they are free of any residue and should be cleaned with alcohol being careful not to scratch them.
6. Replace the O-Rings unless they are less than 12 months old and unless they are in perfect condition.
7. Inspect the diaphragms to ensure that they are free of tears or holes. If they are not in good condition, they should be replaced.
8. Reassemble the module in reverse order.



VACUUM REGULATOR

Date: 2022-12-01-v1
EXPLODED VIEW
Dwg. No. VRH-800-CL2, EXP

Item No.		Description	Quantity	Part No.
1		Rate Valve Assembly, 25 PPD	1	RVH-665-003
2		Rate Valve Assembly, 100 PPD	1	RVH-665-002
3		Rate Valve Stem & Knob, 25 PPD	1	RVH-400-101
4		Rate Valve Stem & Knob, 100 PPD	1	RVH-665-100
5		Valve Bonnet	1	RVH-349-100
6		Bonnet Plug	1	PLH-430-100
7	PM	O-Ring	3	OH-VIT-112
8	PM	O-Ring	2	OH-VIT-008
9		Rate Valve Sleeve, 25 PPD	1	RVH-350-101
10		Rate Valve Sleeve, 100 PPD	1	RVH-350-100
11A	PM	Meter Gasket, 4 & 10 PPD	2	GAH-VIT-101
11B	PM	Meter Gasket, 25 PPD	2	GAH-VIT-102
11C	PM	Meter Gasket, 50 & 100 PPD	2	GAH-VIT-103
12A		Meter Tube, 4 PPD	1	MTH-108-004
12B		Meter Tube, 10 PPD	1	MTH-108-010
12C		Meter Tube, 25 PPD	1	MTH-108-025
12D		Meter Tube, 50 PPD	1	MTH-108-050
12E		Meter Tube, 100 PPD	1	MTH-108-100
13		Front Body	1	VRH-822-100
14	PM	3/8" Tubing Connector	2	BKF-64
15	PM	Sealing Diaphragm	1	DIH-102-500
16		Guide Pin	1	VRH-153-100
17		Seal Cover	1	VRH-351-100
18		Relief Spring (Tantalum)	1	SPH-100-000
19		Vent Spring Retainer	1	VRH-352-100
20		Seal Cover Screws (1/4-20 x 3/8") PVC	3	BTH-STA-157
21		Diaphragm Front Plate	1	VRH-325-100
22	PM	Diaphragm	1	DIH-108-100
23	PM	O-Ring	1	OH-VIT-028
24		Diaphragm Back Plate	1	VRH-328-100
25	PM	O-Ring	1	OH-VIT-009
26		O-Ring	1	OH-VIT-324
27		Flow Tube	1	VRH-162-500
28	PM	O-Ring	1	OH-VIT-012
29		Back Body	1	VRH-198-200
30		Screw, 1/4-20 x 1 1/4"	6	BTH-STA-130
31		Yoke Assembly	1	VRH-365-200
32		Retainer Clip	1	VRH-142-500
33		Inlet Valve Capsule Assembly	1	VRH-469-501
34		Screw, 1/4-20 x 2 1/4"	2	BTH-STA-129
35		Vent Plug	1	VRH-111-500
36		Spring Retainer	1	VRH-183-500
37		Spring Holder (Chlorine) Silver	1	VRH-113-500
38		Inlet Spring (Tantalum)	1	SPH-104-000
39	PM	O-Ring	1	OH-VIT-212
40	PM	Adapter Seal Plug	1	VRH-182-500
41		Inlet Adapter (Hastelloy C)	1	VRH-141-501
42	PM	Valve Seat	1	VRH-110-500
43	PM	O-Ring	1	OH-VIT-011
44		Inlet Valve Stem (Chlorine) Silver	1	VRH-112-500
45	PM	Filter Stop	1	VRH-184-500
46	PM	Inlet Screen	1	VRH-101-500
47	PM	Filter Pad	1	VRH-457-500
48	PM	Teflon Filter (100 PPD max)	1	VRH-456-100
49		Lead Gasket	1	GAH-LED-111
PM		Part and Maintenance Kit	1	KTH-100-VR8N

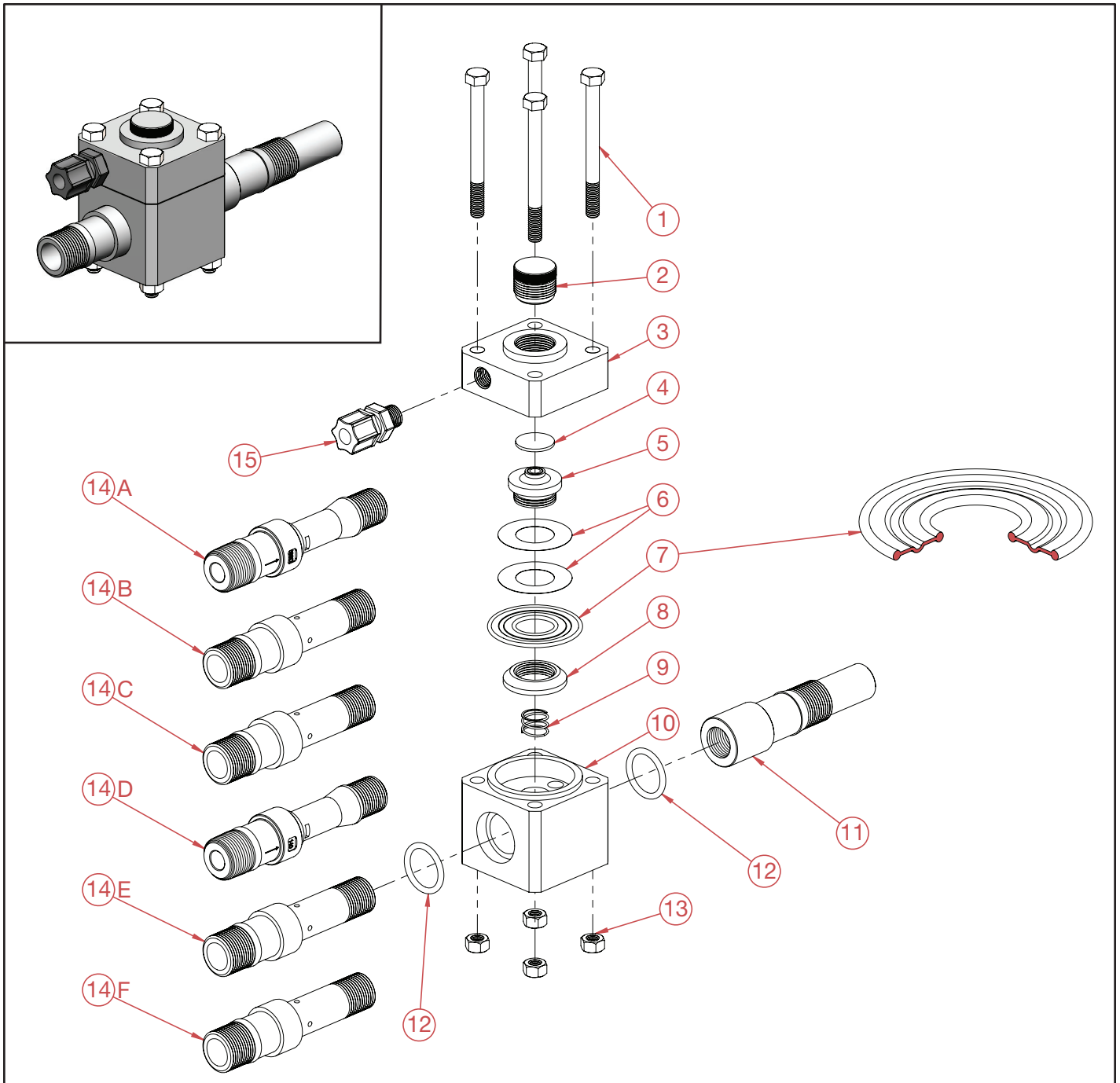


Item No.	Description	Quantity	Part No.
1	5/16-18 x 4" Bolt	4	BTH-STA-136
2	Top Body	1	EJH-237-250
3	PM O-Ring	1	OH-CEM-210
4	PM Diaphragm Bolt	1	EJH-236-500
5	PM Set of Two Support Diaphragms	1	DIH-105-500
6	PM Diaphragm	1	DIH-104-500
7	PM Diaphragm Nut	1	EJH-146-500
8	Spring	1	SPH-106-000
9	Bottom Body	1	EJH-153-500
10	Multi Purpose Diffuser	1	EJH-982-100
11	PM O-Ring	2	OH-VIT-214
12	5/16-18 Nut	4	NTH-STA-104

Item No.	Description	Quantity	Part No.
13 A	* Nozzle (50 PPD max.)	1	UN-102-099D
13 B	* Nozzle (25 PPD max.)	1	CNH-016-106
13 C	* Nozzle (50 PPD max.)	1	CNH-013-128
13 D	* Nozzle (100 PPD max.)	1	UN-102-140
13 E	* Nozzle (100 PPD max.)	1	CNH-015-156
13 F	* Nozzle (100 PPD max.)	1	CNH-012-191
14	PM 3/8" Tubing Connector	1	BKF-64
PM	Part and Maintenance Kit	1	KTH-100-EJO
*	Refer to nozzle sizing charts for correct sizing.		

EJECTOR (O-RING)

Date: April 2017
EXPLODED VIEW AND BOM
Dwg. No. EJO-100-CL2

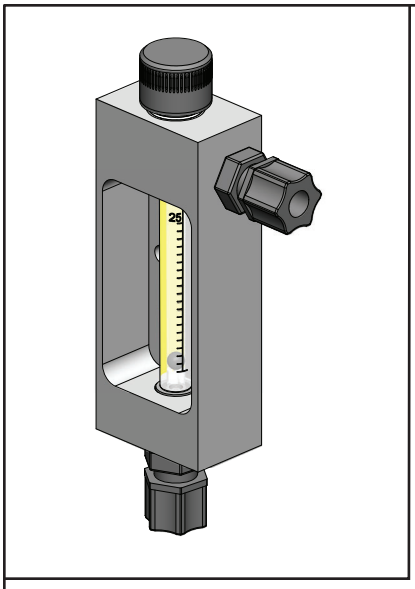


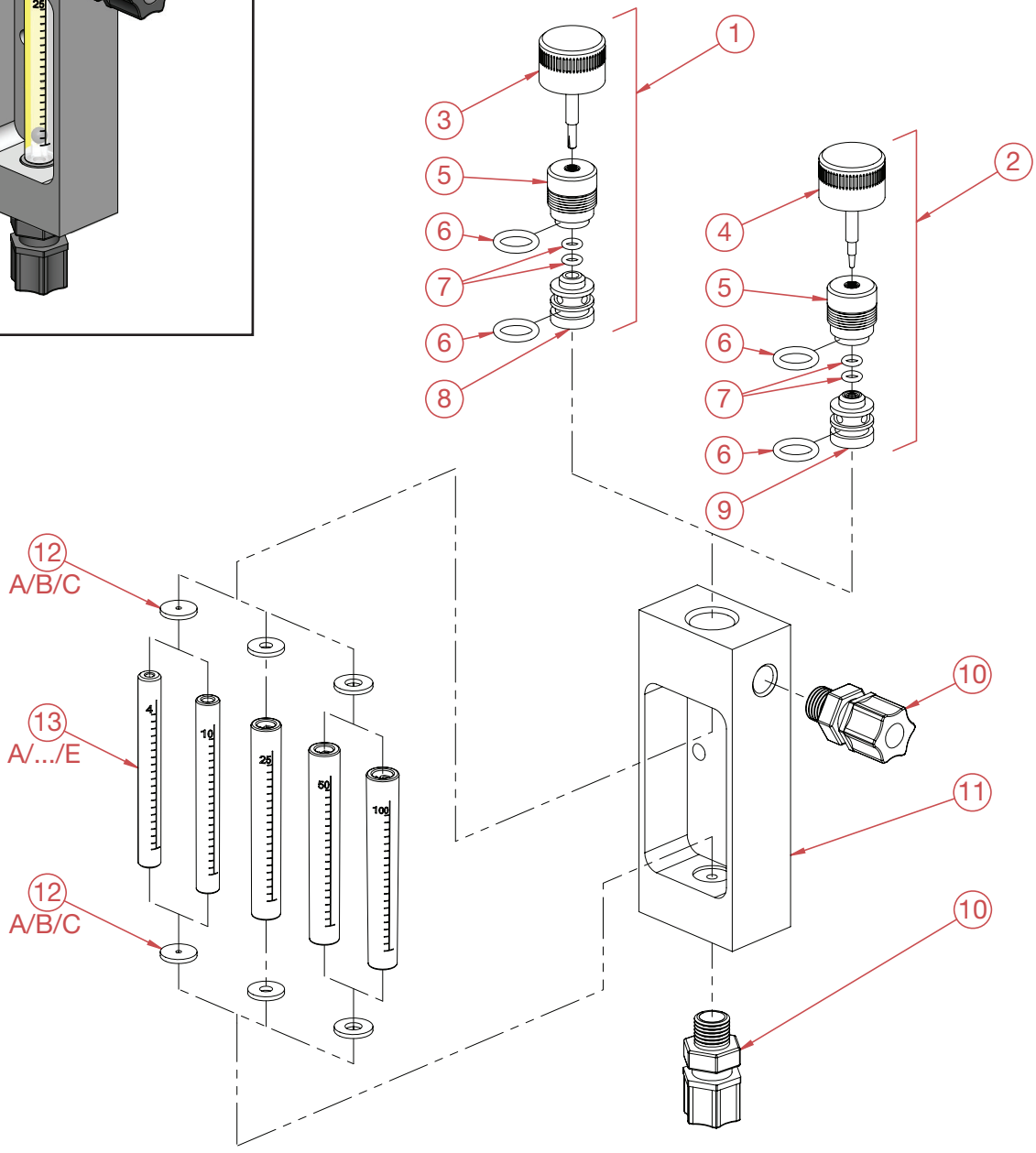
Item No.	Description	Quantity	Part No.
1	5/16-18 x 3½" Bolt	4	BTH-STA-135
2	Seat Plug	1	EJH-311-200
3	Top Body	1	EJH-208-200
4	PM Valve Seat	1	GAH-VIT-122
5	PM Diaphragm Bolt	1	EJH-206-200
6	PM Set of Two Support Diaphragms	1	DIH-105-500
7	PM Diaphragm	1	DIH-104-500
8	PM Diaphragm Nut	1	EJH-146-500
9	Spring	1	SPH-106-000
10	Bottom Body	1	EJH-153-500
11	Multi Purpose Diffuser	1	EJH-982-100
12	PM O-Ring	2	OH-VIT-214
13	5/16-18 Nut	4	NTH-STA-104

Item No.	Description	Quantity	Part No.
14 A	* Nozzle (50 PPD max.)	1	UN-102-099D
14 B	* Nozzle (25 PPD max.)	1	CNH-016-106
14 C	* Nozzle (50 PPD max.)	1	CNH-013-128
14 D	* Nozzle (100 PPD max.)	1	UN-102-140
14 E	* Nozzle (100 PPD max.)	1	CNH-015-156
14 F	* Nozzle (100 PPD max.)	1	CNH-012-191
15	PM 3/8" Tubing Connector	1	BKF-64
PM	Part and Maintenance Kit	1	KTH-100-EJS
*	Refer to nozzle sizing charts for correct sizing.		

EJECTOR (GASKET)

Date: April 2017
EXPLODED VIEW AND BOM
Dwg. No. EJH-100-CL2

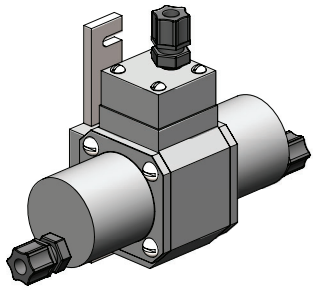




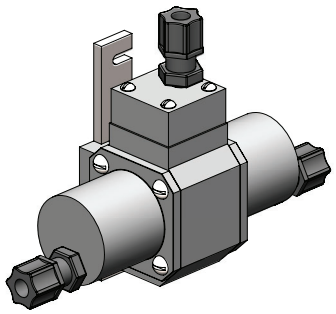
Date: March 2016
EXPLODED VIEW
REMOTE METER
Dwg. No. MPH-800-CL2, EXP

Item No.	Description	Quantity	Part No.
1	Rate Valve Assembly, 25 PPD	1	RVH-665-003
2	Rate Valve Assembly, 100 PPD	1	RVH-665-002
3	Rate Valve Stem & Knob, 25 PPD	1	RVH-400-101
4	Rate Valve Stem & Knob, 100 PPD	1	RVH-665-100
5	Valve Bonnet	1	RVH-349-100
6	PM O-Ring	2	OH-VIT-112
7	PM O-Ring	2	OH-VIT-008
8	Rate Valve Sleeve 25 PPD	1	RVH-350-101
9	Rate Valve Sleeve 100 PPD	1	RVH-350-100
10	PM ⅜" Tubing Connector	2	BKF-64
11	Meter Body	1	MPH-448-100
12A	PM Meter Gasket, 4 & 10 PPD	2	GAH-VIT-101
12B	PM Meter Gasket, 25 PPD	2	GAH-VIT-102
12C	PM Meter Gasket, 50 & 100 PPD	2	GAH-VIT-103
13A	Meter Tube, 4 PPD	1	MTH-108-004
13B	Meter Tube, 10 PPD	1	MTH-108-010
13C	Meter Tube, 25 PPD	1	MTH-108-025
13D	Meter Tube, 50 PPD	1	MTH-108-050
13E	Meter Tube, 100 PPD	1	MTH-108-100
PM	Part & Maintenance Kit	1	KTH-800-RMP

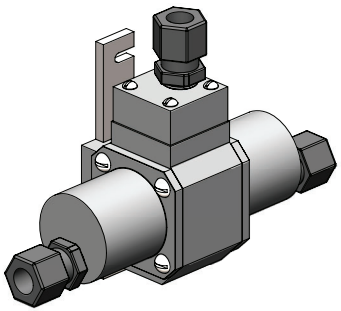
SOH-100-CL2

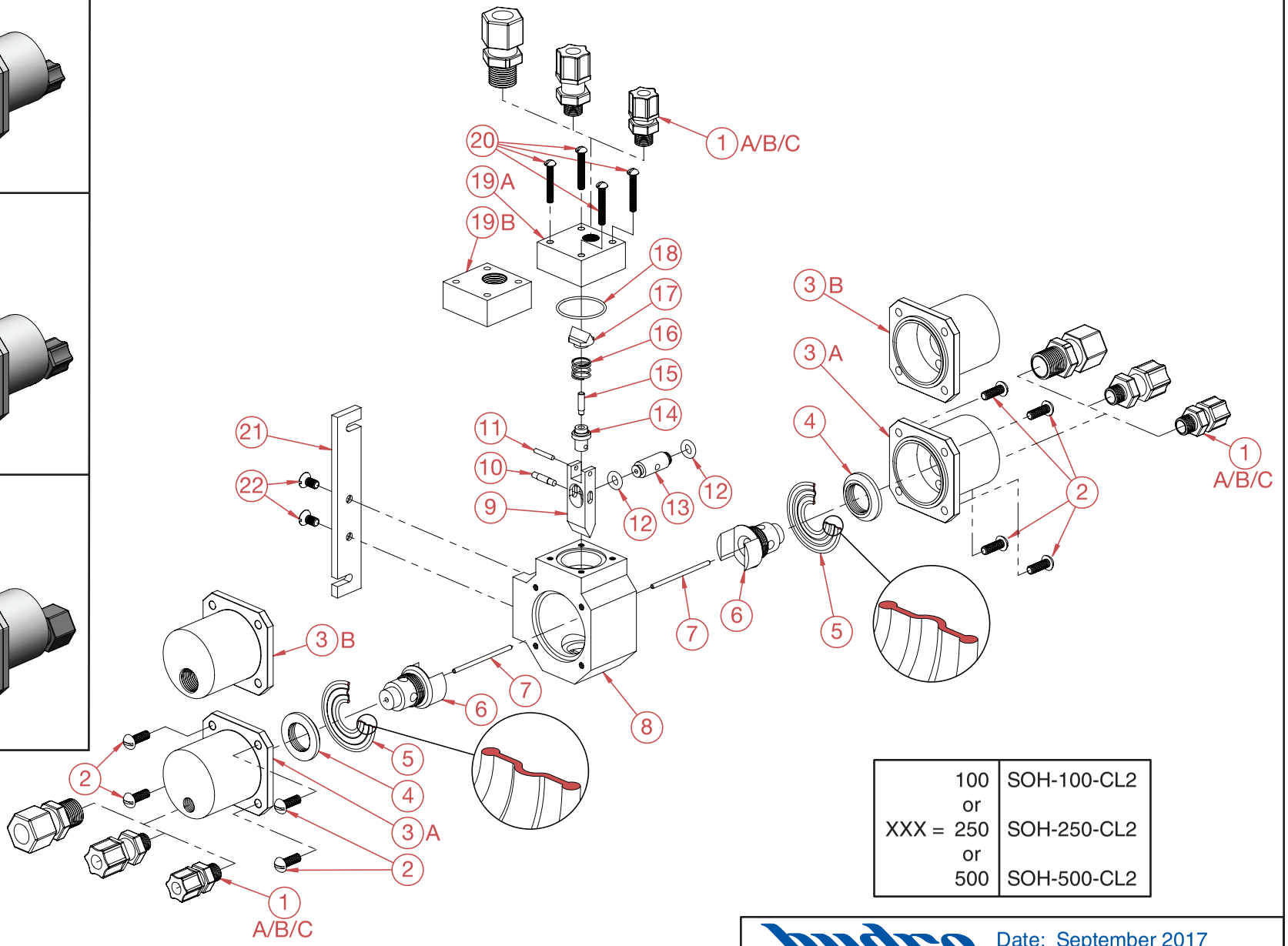


SOH-250-CL2



SOH-500-CL2





100	SOH-100-CL2
or	
XXX = 250	SOH-250-CL2
or	
500	SOH-500-CL2

hydro INSTRUMENTS™

SWITCHOVER MODULE

Date: September 2017
EXPLODED VIEW
Dwg. No. SOH-XXX-CL2, EXP

Item No.		Description	Quantity	Part No.
1A	PM1	3/8" Tubing Connector (100 PPD)	3	BKF-64
1B	PM2	1/2" Tubing Connector (250 PPD)	3	BKF-84
1C	PM3	5/8" Tubing Connector (500 PPD)	3	BKF-108
2		1/4-20 x 3/4" Bolt	8	BTH-STA-189
3A	*,**	End Body, 100 & 250 PPD	2	SOH-809-200
3B	***	End Body, 500 PPD	2	SOH-811-500
4		Diaphragm Nut	2	EJH-146-500
5	PM1,2,3	Diaphragm	2	DIH-104-500
6		Diaphragm Bolt	2	SOH-627-500
7		Guide Pin	2	SOH-196-500
8		Center Body	1	SOH-808-500
9		Toggle Spindle	1	SOH-751-500
10		Toggle Pin	1	SOH-168-500
11		Pin	1	SOH-176-500
12	PM1,2,3	O-Ring	2	OH-VIT-203
13		Valve Stud	1	SOH-628-500
14		Pin Pivot	1	SOH-513-500
15		Spring Pivot Pin	1	SOH-278-500
16		Spring	1	SPH-125-000
17		Spring Pivot	1	SOH-277-500
18	PM1,2,3	O-Ring	1	OH-VIT-028
19A	*,**	Toggle Cap, 100 & 250 PPD	1	SOH-810-200
19B	***	Toggle Cap, 500 PPD	1	SOH-812-500
20		10-24 x 1 1/4" Bolt	4	BTH-STA-151
21		Switchover Bracket	1	EA-SO-MBR
22		Switchover Bracket Screw (Countersunk)	2	1/4"-20 x 1/2"
PM1		Part & Maintenance Kit (100 PPD)	1	KTH-100-SOM
PM2		Part & Maintenance Kit (250 PPD)	1	KTH-250-SOM
PM3		Part & Maintenance Kit (500 PPD)	1	KTH-500-SOM
*		Only part of the SOH-100-CL2		
**		Only part of the SOH-250-CL2		
***		Only part of the SOH-500-CL2		

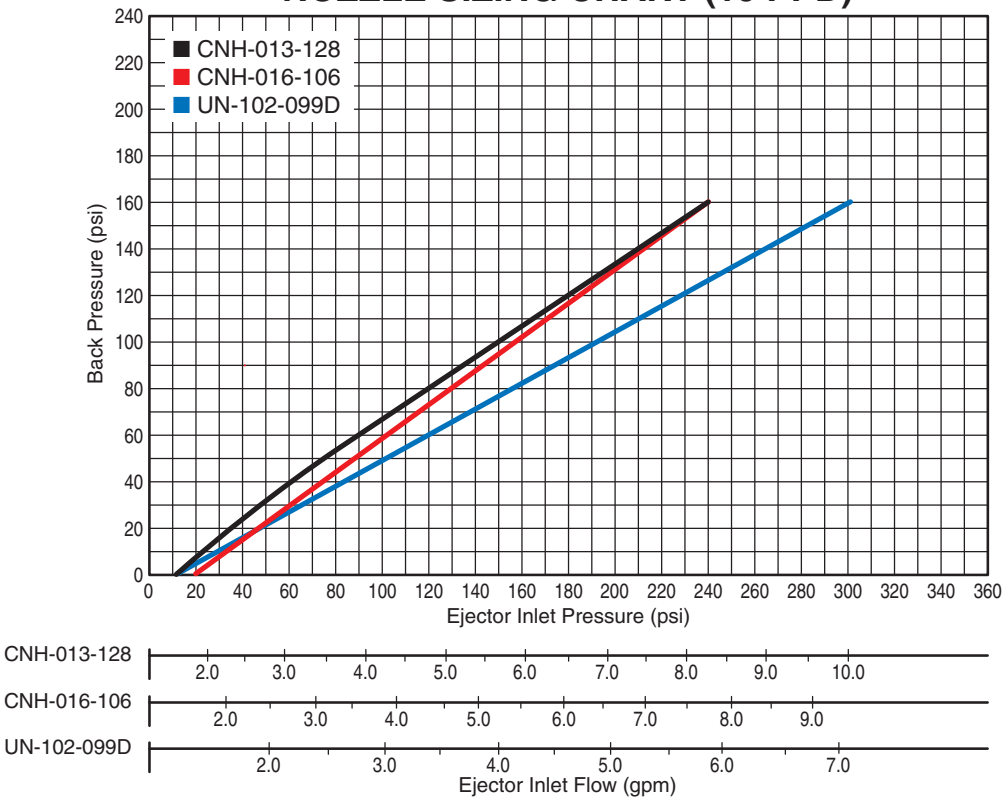
XXX =	100	SOH-100-CL2
	or	
	250	SOH-250-CL2
	or	
	500	SOH-500-CL2

Hydro Instruments™

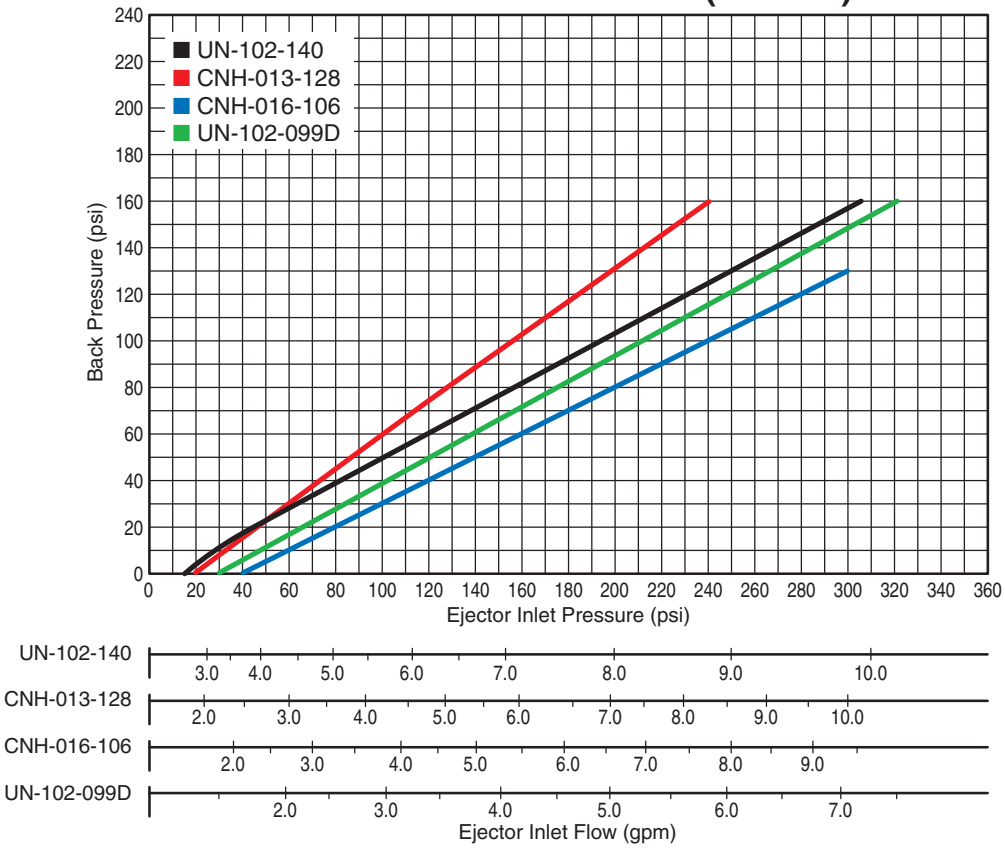
SWITCHOVER MODULE

Date: September 2017
BILL OF MATERIALS
Dwg. No. SOH-XXX-CL2, BOM

NOZZLE SIZING CHART (10 PPD)

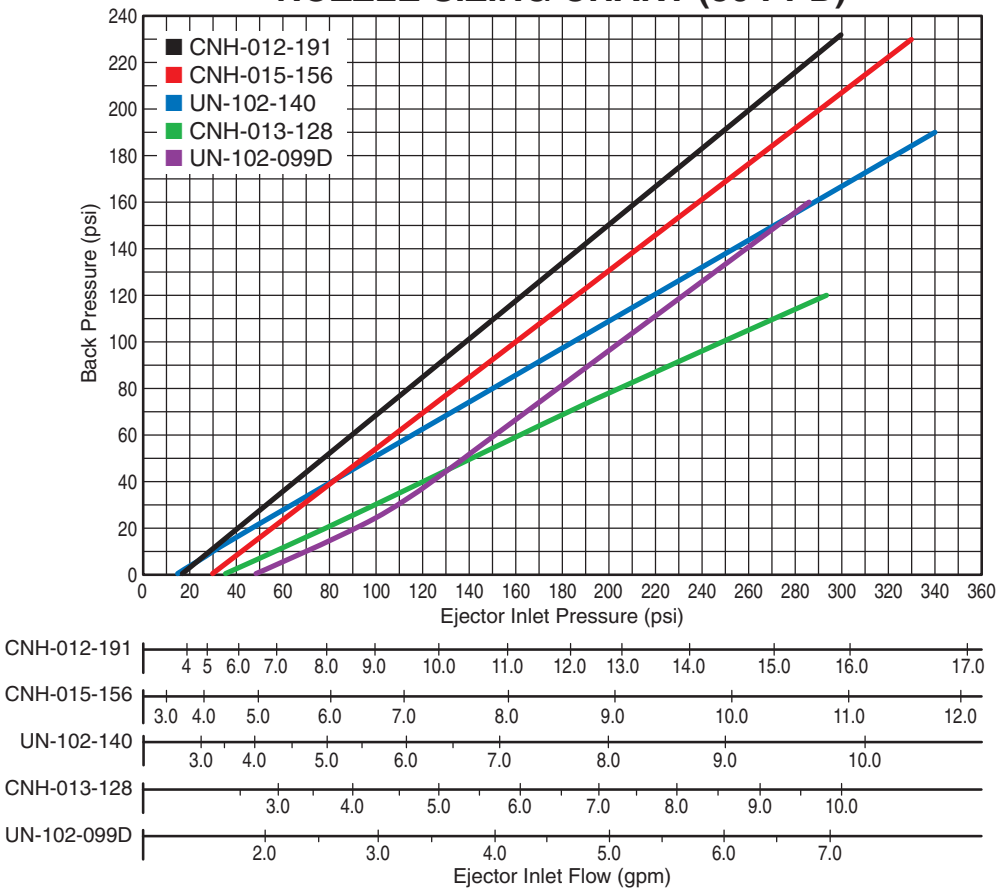


NOZZLE SIZING CHART (25 PPD)

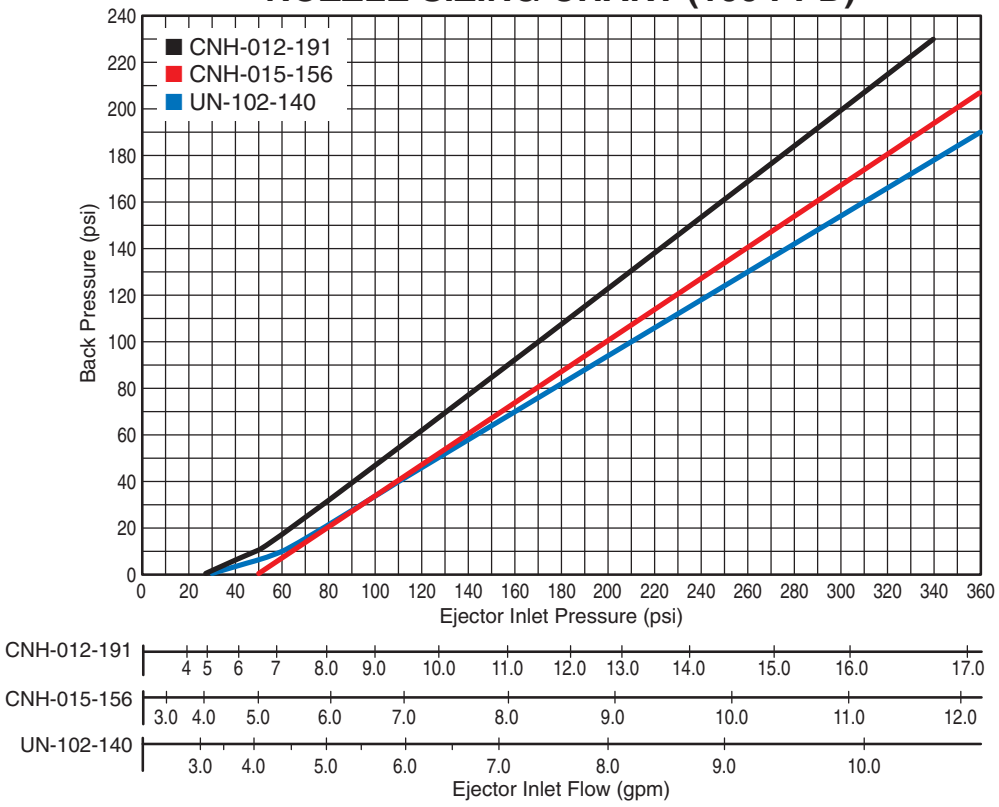


Note: Pressure combinations that plot below the line for any given nozzle are acceptable for operating that nozzle at the stated chemical feed rate for that chart. Pressure combinations that fall above the line for any given nozzle are not acceptable.

NOZZLE SIZING CHART (50 PPD)



NOZZLE SIZING CHART (100 PPD)



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 Tables NST-10-25

10 PPD (200 gr/hr)

Nozzle >	13		UN-102-099D		16	
Ejector Backpressure	PSI @ GPM		PSI @ GPM		PSI @ GM	
0	12	1.7	12	1.2	18	1.5
10	22	1.9	29	1.5	33	2.0
20	35	2.3	47	1.9	48	2.4
30	50	2.8	65	2.3	60	2.7
40	62	3.1	83	2.6	75	3.1
50	76	3.5	101	3.0	90	3.6
60	90	3.9	120	3.4	103	3.9
70	103	4.3	138	3.8	116	4.3
80	120	4.8	156	4.1	130	4.7
90	135	5.2	174	4.5	145	5.1
100	150	5.7	192	4.9	156	5.4
110	165	6.1	210	5.2	171	5.8
120	180	6.5	228	5.6	185	6.2
130	200	7.1	246	6.0	198	6.6
140	210	7.4	264	6.3	213	7.0
150	227	7.9	282	6.7	227	7.4
160	240	8.3	301	7.1	240	7.7

25 PPD (500 gr/hr)

Nozzle >	UN-102-140		13		UN-102-099D		16	
Ejector Backpressure	PSI @ GPM		PSI @ GPM		PSI @ GPM		PSI @ GPM	
0	15	2.5	20	1.9	30	1.5	40	2.2
10	26	3.0	35	2.3	47	1.9	60	2.7
20	45	3.8	47	2.7	65	2.3	80	3.3
30	63	4.5	60	3.0	84	2.6	100	3.8
40	82	5.2	73	3.4	102	3.0	120	4.4
50	101	5.7	90	3.9	120	3.4	140	5.0
60	119	6.3	100	4.2	139	3.8	160	5.5
70	138	6.6	115	4.6	157	4.1	180	6.1
80	156	7.0	130	5.1	175	4.5	200	6.6
90	175	7.4	143	5.5	193	4.9	220	7.2
100	194	7.9	155	5.8	212	5.3	240	7.7
110	212	8.3	170	6.2	230	5.6	260	8.3
120	231	8.7	185	6.7	248	6.0	280	8.9
130	249	9.0	198	7.0	267	6.4	300	9.4
140	268	9.4	212	7.5	285	6.8	-	-
150	287	9.6	226	7.9	303	7.1	-	-
160	305	9.9	240	8.3	321	7.5	-	-

Nozzle Tables NST-50-100

50 PPD (1 Kg/hr)

Nozzle >	12		15		UN-120-140		13		UN-102-099D	
Ejector Backpressure	PSI @ GPM		PSI @ GPM		PSI @ GPM		PSI @ GPM		PSI @ GPM	
0	16	4.0	30	4.1	15	2.8	35	2.3	48	1.9
10	28	5.0	41	4.7	28	3.2	55	2.9	70	2.4
20	40	5.8	55	5.1	48	4.0	80	3.6	92	2.8
30	53	6.8	69	5.7	64	4.5	100	4.2	110	3.2
40	65	7.4	81	6.1	82	5.2	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	115	6.0	162	6.0	151	4.0
70	102	9.1	120	7.2	132	6.5	183	6.7	164	4.3
80	115	9.6	134	7.6	150	6.9	205	7.3	178	4.6
90	128	10.0	147	7.8	170	7.4	226	7.9	191	4.8
100	140	10.4	160	8.1	185	7.8	247	8.5	205	5.1
110	151	10.8	173	8.4	202	8.1	272	9.2	218	5.4
120	164	11.3	188	8.8	221	8.5	293	9.8	232	5.7
130	175	11.8	200	9.0	239	8.8	-	-	245	5.9
140	190	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	212	13.3	240	9.8	290	9.7	-	-	286	6.8

100 PPD (2 Kg/hr)

Nozzle >	12		UN-120-140		15	
Ejector Backpressure	PSI @ GPM		PSI @ GPM		PSI @ GPM	
0	27	5.0	30	3.3	50	5.1
10	50	6.7	60	4.4	65	5.4
20	65	7.3	79	5.0	80	6.1
30	78	8.0	95	5.6	95	6.5
40	91	8.6	110	6.0	110	7.0
50	105	9.2	126	6.4	125	7.2
60	117	9.7	145	6.9	140	7.6
70	131	10.1	160	7.2	155	7.9
80	142	10.5	180	7.5	170	8.3
90	158	11.0	195	7.9	185	8.7
100	170	11.5	210	8.2	200	9.0
110	183	12.0	229	8.5	213	9.3
120	197	12.7	243	8.9	228	9.5
130	210	13.2	260	9.2	244	9.9
140	222	13.7	279	9.5	260	10.2
150	235	14.0	295	9.8	275	10.4
160	250	14.5	310	10.0	291	10.8