Vacuum Operated
Liquid Chemical Feed Systems

Instruction Manual

All Hydro Instruments Chemical Feed systems are carefully designed and tested for years of safe, accurate field service. All Hydro Instruments systems are tested 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.

The information contained in this manual was current at the time of printing. The most current versions of all Hydro Instruments manuals can be found on our website: **www.hydroinstruments.com**

Series LF Rev. 12/30/2022

Liquid Chemical Feed Systems
Operation & Maintenance Manual

Table of Contents

GENERAL NOTES

1. **Torque Specifications:** The following table is a guideline for servicing this equipment.

Torque Specifications

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

2. **Lubricant:** Hydro Instruments offers the use of fluorocarbon based lubricants. Such lubricant can be purchased from Hydro Instruments in 0.5 ounce portions under the part number 005-ORG. However, the user must evaluate whether fluorocarbon based lubricants are suitable for the chemical solution used in each application.

3. **Each system consists of a minimum of the following:**

   a. Model LFOV Wall Panel mounted Omni-valve, magnetic flow meter, and manual remote liquid flow meter.

   b. The ejector or other vacuum source that creates the vacuum to draw the liquid chemical into the water.

   c. At lease one check valve to prevent backflow of water into the chemical storage drum.

   d. Sufficient vacuum tubing or piping. See Hydro Instruments technical document for sizing liquid vacuum feed systems tubing and piping for guidelines.

   e. For smaller systems up to 10 GPH (38 LPH), an intake strainer, weight, and check valve assembly.

   f. Additional parts can be ordered through Hydro Instruments:
      - Secondary all-Teflon check valves.
      - Pressure and vacuum gauges.
      - Water and vacuum line valves.
      - Water inlet assemblies including Y-strainers
      - Repair kits, lubricant, and spare parts.
      - Injection quills and corporation stops.

SECTION I: SAFETY INFORMATION

FOLLOW SAFETY PRECAUTIONS WHEN HANDLING CHEMICAL SOLUTIONS!

1. Be sure to install an overflow pipe for each chemical storage drum and install the vent tubing from the OV-110 or OV-1000 Omni-Valve to drain or a containment vessel.
2. All chemical solutions should be treated as being hazardous materials that can cause injury and death if not handled properly. It is critically important to take all necessary precautions when handling. This manual is not intended to replace or limit safety procedures in your facility.
3. Safety procedures must be designed in accordance with all governmental regulations and national safety codes, after giving full consideration to the specific needs of the facility involved. Under no circumstances should the information in this manual be construed as substituting or superseding any local, state, or federal laws and regulations.
4. Hydro Instruments cannot anticipate the specific safety procedures required at every facility. Accordingly, Hydro Instruments does not guarantee that safety procedures designed in accordance with this manual will completely eliminate hazards and thus assumes no liability for accidents that may occur in your facility.
5. Read this entire manual and be fully familiar with your equipment and your entire system so that the safety procedures you establish will meet the needs of the employees in you facility. Reading only part of the manual will not help you analyze the needs of your facility. Contact your chemical supplier and relevant organizations to obtain MSDS sheets and more information.
6. All information in this manual was current at time of printing. Please note the date of printing and possible obsolescence of material as a result of scientific and medical developments after the date of publication. This applies to all materials you review in the course of developing safety procedures for use at your facility.

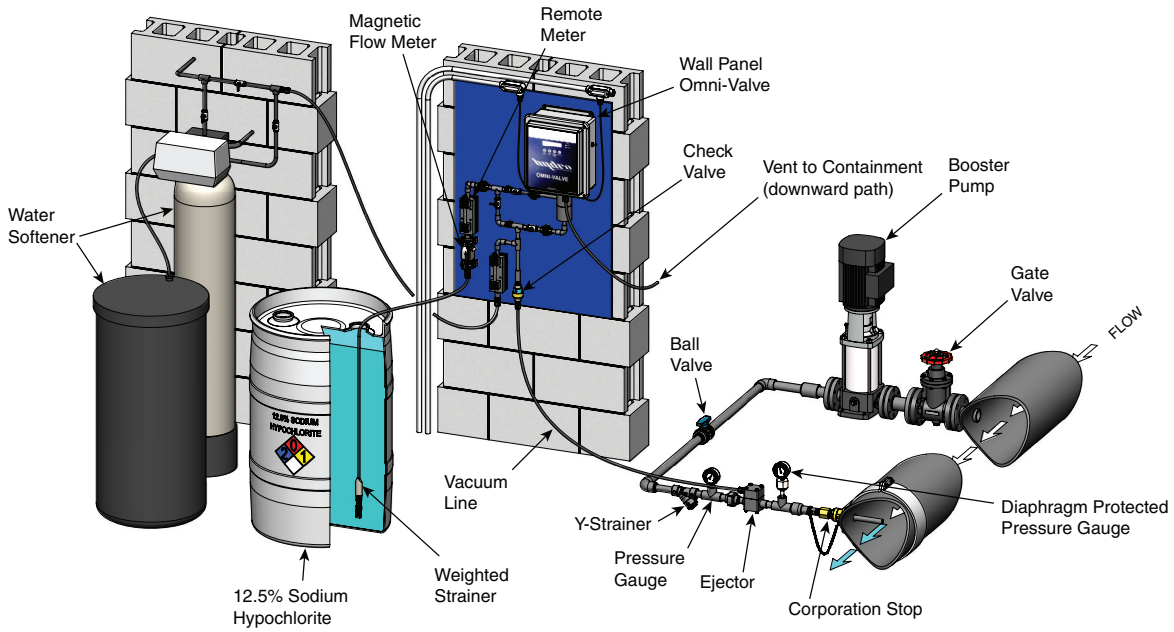
SECTION II: DESIGN AND INSTALLATION NOTES

1. **ALL VACUUM SYSTEM:** Chemical feed will be stopped should the vacuum line be broken or if the vacuum is lost for any reason. This assumes that chemical is taken from the top of the storage drum.
2. **TOTAL BACK PRESSURE** is the pressure at the downstream side of the ejector. This “total back pressure”
   is comprised of the pressure in the pipeline to be treated plus the friction losses (head 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. Refer to Hydro Instruments ejector and booster pump sizing guide and consult Hydro Instruments for such considerations.
3. **SOLUTION LINES:** It is preferable to locate the ejector at the point of solution injection in order to eliminate the need for solution lines. The reasons are as follows:
   a. Solution lines carry **highly concentrated chemical solution** that is under pressure. This presents the
      possibility of dangerous leaks and (for high pH chemicals) presents the possibility of clogging due to scaling.
   b. Friction losses in the solution line also **increase ejector back pressure.** To reduce friction losses, increase solution line diameter and reduce the number of flow restrictions and turns.
   c. If the system is being used to feed high pH chemical solutions such as sodium hypochlorite, then the process water hardness , feed rates and water flows must be evaluated to consider the possibility of scaling in the solution line. Various measures can be taken to mitigate such concerns

including dilution of the chemical solution (with softened water), over sizing the ejector, and additional carbon dioxide or acid injection.

4. **SCALING:** When feeding high pH chemical solutions into hard water, scaling must be considered and mitigated. Scaling and precipitation of minerals is a concern in the ejector and solution line when feeding high pH chemical solutions into hard water. If allowed to occur, scaling will eventually cause a loss of vacuum and chemical feed. If scaling occurs the solution line and ejector will need to be cleaned. If the process water has significant levels of calcium, magnesium, iron or other minerals then you should take steps to avoid this problem. Suggestions are as follows:
    a. **Dilution:** Using an oversized ejector will dilute the chemical concentration in the solution line and reduce the rate of precipitation and scaling. Often this is sufficient to avoid scaling. If the chemical solution is to be diluted prior to or during feeding, then dilution must be done with softened water or distilled water to prevent scaling inside the storage drum and feed equipment. If the chemical feed rate is above 1 GPH (4 LPH) then dilution can be done as per Figure 1A. If chemical feed rate will be below 1 GPH (4 LPH) then the solution will need to be diluted to increase feed rate above this threshold per Figure 1B. *(See Figures 1A and 1B)*
    b. **Water Softener:** If the ejector water supply is softened, this will generally avoid the problem altogether.
    c. **Acid Cleaning:** A bypass line can be installed to allow periodic feeding of muriatic acid through the ejector. This could be done as needed to remove scaling that builds up during chemical injection. Frequency and acid injection feed rate will depend upon the installation. *(See Figure 2)*
    d. **Flushing:** In such installations with hard water feeding high pH chemical solutions, it is recommended to set up system control so that each time the chemical feed shuts down, the chemical feed will first be closed, and then the booster pump will continue to run for about 5 to 10 minutes to clear all chemical out of the ejector and solution lines. This is done to avoid having high concentration chemical solution sitting in these pipelines for long periods of time which is the most likely time to create scaling.

FIGURE 1A: PRE INJECTION DILUTION WITH WATER SOFTENER



NOTE: For cases where the chemical feed rate is above 1 GPH a side stream of softened water could be injected as shown here to dilute prior to ejector entry.

5. **SOLUTION WITHDRAWAL:** Hydro Instruments recommends **withdrawal of chemical from the top of the storage drum.** Below are some **disadvantages of bottom feeding:**
    a. **Avoiding Storage Drum Leaks:** Drum fabricators recommend against installing bottom feed ports because they greatly increase the likelihood of drum leaks.
    b. **Chemical Withdrawal Line Leaks:** If the suction line carrying the chemical out of the storage drum is taken from the bottom, then at least some portion of that line will be under the hydrostatic pressure of the chemical in the drum. Therefore, if there is any break in this line, the chemical will leak out of the drum under gravity. This can be avoided by feeding from the top of the storage tank.
6. **FLEXIBLE TUBING LENGTH:** Refer to Hydro Instruments technical guide for sizing of tubing and

FIGURE 1B: DILUTION OF CHEMICAL SOLUTION WITH SOFTENED WATER

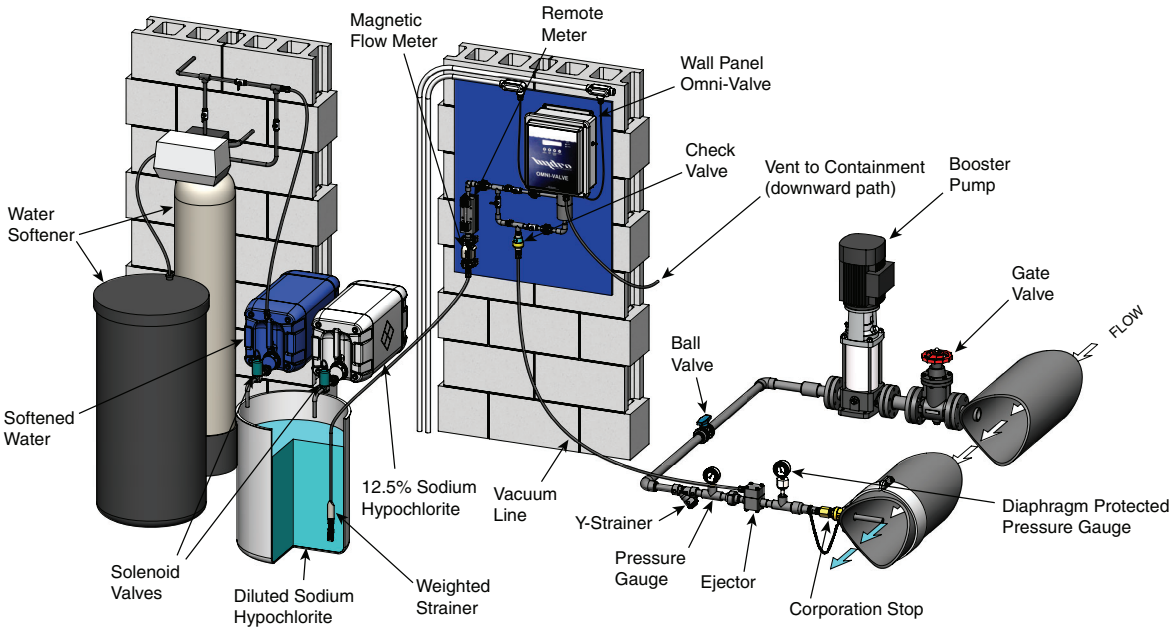
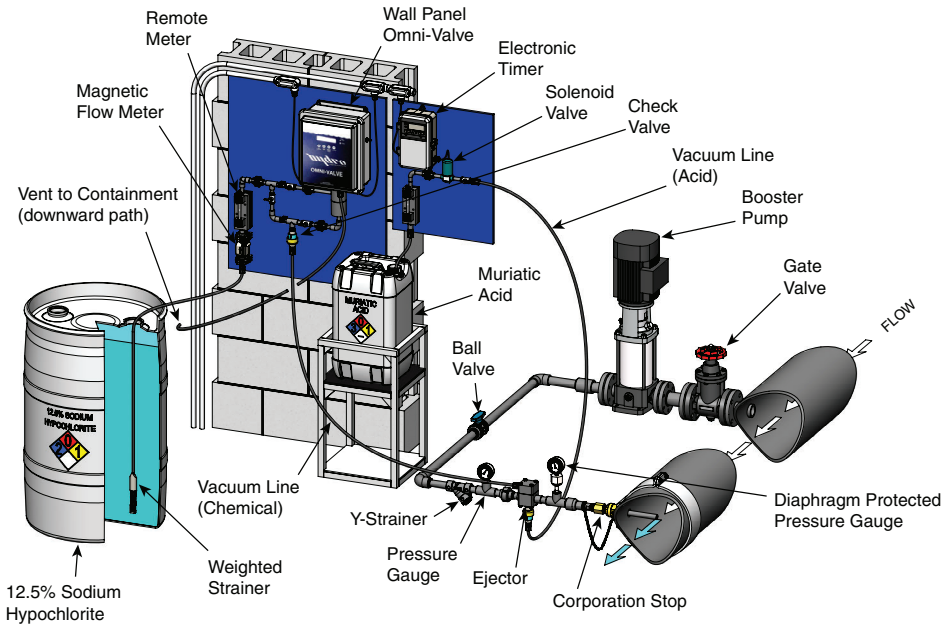


FIGURE 2: MURIATIC ACID INJECTION



piping in liquid vacuum feed systems. For longer distances consult the factory.

7. **CHEMICAL SOLUTION LIFT:** There is a limitation to the height through which the chemical can be lifted. We recommend that a height of one building story (or about 15 feet) be used as the practical limit for systems with feed rates above 1 gallon/hour (24 gallons/day). For feed rates below 1 gph, the limit is estimated at 8 feet.

   Notes: The theoretical limit is less than 14.7 psia × 2.31 = 33.95 feet. However, in reality friction losses and
   especially the rate control valve restriction will significantly lower this value. (It should be noted that lift capability is proportional to the feed rate. This is because the rate valve creates a greater restriction for lower feed rates.)

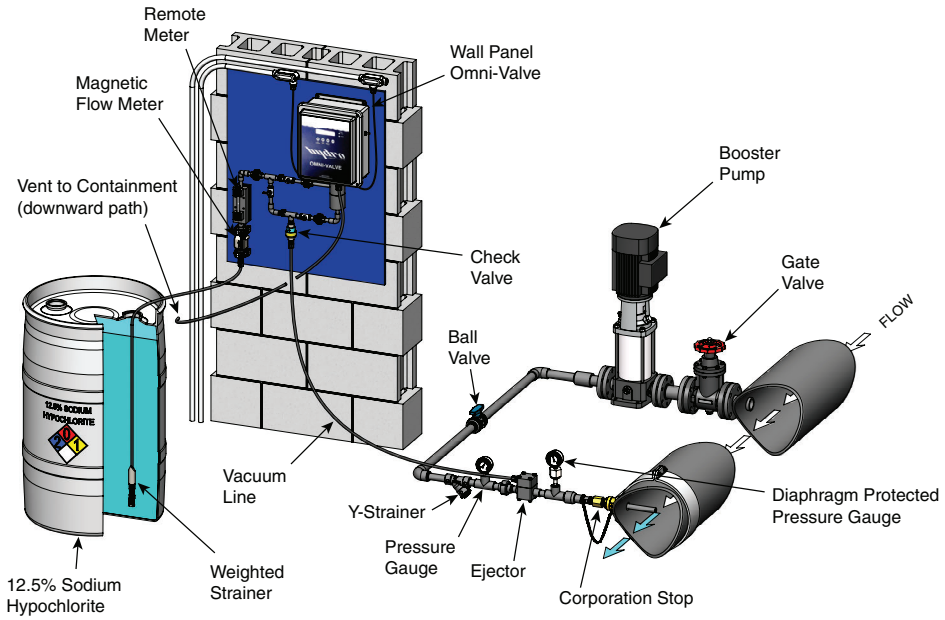
SECTION III: SYSTEM INSTALLATION

(I) INSTALLATION OF EJECTOR (EJ-1000, EJ-5000 and EJ-5000-375 Ejectors – Refer to Figure 3)

1. Installation of 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 3PS-214 O-Rings are on each side of nozzle and diffuser.

2. Testing of ejector:
   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 chemical is not re-circulated through the booster pump. *(Note: A minimum distance of 10 pipe diameters is recommended.)*

FIGURE 3: TYPICAL INSTALLATION



* Vacuum tubing or piping is recommended to exit from the top of the storage drum whenever possible. The Remote Meter should be mounted at a higher level. The tubing should travel only upwards or horizontally in order to allow any bubbles to travel toward the Remote Flow Meter.

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.

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 injecting 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 block of the ejector.

b. If using a booster pump, the system and booster pump must be designed to satisfy the performance chart for the particular ejector and nozzle/diffuser being used. Feel for suction (with your finger) at the fitting on the top block of the ejector.

c. If the ejector has tested satisfactorily continue on to the next step.

(II) INSTALLATION OF 2" FLANGED EJECTOR (EJH-2000-CL2 Ejector – Refer to Figure 3)

1. Installation of EJH-2000-CL2 Ejectors:
   a. The water inlet and outlet connections are 2" flanged, four bolt, 150 lb., Van Stone style in Schedule 80 PVC.
   b. The shorter end is the water inlet (nozzle side) and the longer end is the chlorinated solution outlet.
   c. Install both flanges carefully with new RH-308-000 gaskets from Hydro Instruments.
2. Testing of ejector. *(Note: The vacuum regulator should not be connected and the chlorine container valves should remain closed.)*
   i. Piping hook up to ejector (Refer to Figure 3):
      a. Ejector should be installed down stream at a sufficient distance so that chlorinated water is not re-circulated 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.

   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 injecting 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 hand) at the gas intake of the ejector.
      b. If using a booster pump, the system and booster pump must be designed to satisfy the performance chart for the particular ejector and nozzle/diffuser being used. Feel for suction (with your hand) at the gas intake of the ejector.
      c. If the ejector has tested satisfactorily continue on to the next step (Installation of LFOV liquid vacuum feed panel.).

   iii. Installation of LFOV liquid vacuum feed panel.
      a. Install the LFOV panel on the wall in an accessible location at eye level. Minimize the

distances to the storage drum and the ejector as much as possible, but if necessary, it is better to accept a longer distance to the ejector with vacuum tubing/piping rather than running a long solution line from the ejector to the injection point.

b. Connect the tubing/piping from the chemical storage drum (top outlet) to the inlet port of the LFOV panel and connect the LFOV panel outlet to the ejector inlet.

c. Connect the vent port of the OV-110 or OV-1000 to the drain using suitable plastic tubing.

d. Connect any signal cables from water flow meters, residual chlorine analyzers, etc. to the OV-110 or OV-1000 in accordance with the relevant OV-110 or OV-1000 instruction manuals.

SECTION IV: START UP

1. Turn on water supply or booster pump to ejector. The feed rate can be manually adjusted on the OV-110/OV-1000 controller or automatically controlled by the OV-110/OV-1000. The Omni-Valve will display the mag meter real time chemical feed rate and the flow meter tube will also give a visual indication of feed rate. Read flow rate at center of ball on meter tube scale.
2. The manual rate valve and Omni-Valve are not shut off valves: they are flow rate control valves. **To shut off chemical feed stop the water flow to the ejector. Further, upon shut down ball valves must be closed to isolate the chemical solution from the water piping system.**

SECTION V: SHUT DOWN PROCEDURE

1. In any installation where a siphon could occur upon shut down, it is required that siphon breakers and/or anti-siphon ejectors must be used. Further, upon shut down ball valves must be closed to isolate the chemical solution from the water piping system.
2. Close suitable ball valve(s) to isolate the chemical solution from the feed system. Allow the ejector to continue to operate long enough to evacuate all chemical from the system piping and the solution line piping. Shut down the water supply to the ejector. If the system will be shut down for any prolonged period of time, then it is recommended to also close ball valves to prevent the possibility of water flowing back into the Omni-Valve and other chemical feed system equipment.
3. When injecting high pH chemical solutions into hard water, see section II.4 for further suggestions.
4. When injecting relatively viscous chemical solutions like Alum, it is recommended to have two feed systems in a duty standby arrangement. Further, when the duty system finishes feeding one batch of chemical, control should be arranged to shut off chemical supply valves and immediately feed water through the LFOV panel and ejector to clean out the system and prevent the viscous chemical solution from sitting in the system during standby when it would be very easy for it to solidify and clog.

SECTION VI: MANUAL AND AUTOMATIC RATE VALVE OPERATION

The LFOV panel is intended to automatically adjust Omni-Valve v-notch position as needed to maintain the chemical solution magnetic flow meter reading at the desired flow rate. The Omni-Valve is performing set point control of the v-notch position in order to maintain the magnetic flow meter reading at the desired feed rate. Therefore, no calibration is required for the LFOV panel system.

The system also is generally provided with a manual rate control valve. This manual rate control valve should be left in the fully open position, but can be used as a temporary back up if necessary in times of

repair or service to the magnetic flow meter or the Omni-Valve.

The Hydro Instruments rate valve is designed to give full capacity before the black knob on the rate valve reaches the top of the bonnet (which occurs at the 7th turn). Just beyond this point, the chemical feed rate will experience a drop as an air passage is opened through the hole in the bonnet. Further turns will completely remove the rate valve from the flow meter tube, which will cause a loss of chemical feed. ***(See Appendix for servicing instructions.)***

Note: 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 materials which percipitate out of the chemical solution. 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 VII: TROUBLESHOOTING

(I) NO CHEMICAL FEED

Possible causes:

1. **No vacuum being produced by ejector.**
   a. Disconnect the tubing/piping from the 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 with a stone or other foreign matter. Flush out or run pipe cleaner through only. Take care not to scratch the orifice.
         (2) If there is a build-up of calcium, iron, or manganese, place the nozzle in a muriatic acid for five minutes and then rinse with water. If you see a black, syrup-like substance you may find it necessary to clean the nozzle on a preventative maintenance schedule.
      ii. **Diffuser and Solution Line:** Before reinstalling the ejector, inspect the diffuser and the solution line for any scaling/buildup. If significant scaling is found, it must be removed either physically or with acid. *(Also, see Section II.4 of this manual.)*
      iii. Inlet Water Supply. (Supply pressure has dropped.)
      iv. Y-strainer requires 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. **Vapor Lock.** (Vapor bubbles caught in the vacuum lines.) At chemical feed rates below 0.5 gph (12 gpd), vapor can become trapped between the chemical storage drum and the intake of the LFOV panel. This is because the vacuum is of relatively low strength since the rate valve is nearly closed. To avoid this problem:
   a. Ensure that the line carrying the chemical from the drum to the remote meter only travels upward. Any high points will trap vapor and could prevent chemical from feeding. *(See Figures 1A, 1B, 2, and 3)*
   b. Increase the size of the piping or tubing to reduce the effects of surface tension and viscosity.
   c. Dilute the chemical solution with distilled or softened water so that the feed rate will be higher

than 0.5 GPH (2 LPH) at all times.

3. **Debris in the chemical feed lines.** If any debris or particles are drawn into the vacuum system, they can form a blockage that will prevent or diminish chemical feed. The primary source of such blockages is in the rate valve. In the rate valve, all of the chemical must flow through a small orifice and particles can become trapped there. This problem occurs when using the manual rate valve. If using the mag meter controlled LFOV panel, the Omni-valve will always open the valve as needed to pass any debris that would otherwise clog the orifice. However, to avoid this problem in the future the following steps should be considered:
   a. Avoid debris in the chemical storage drum.
   b. Install additional filtration devices to the chemical induction line.
   c. Only operate in automatic or manual control method using the Omni-valve and mag meter so that the Omni-valve can automatically react to and clear debris blockages.

APPENDIX: SERVICING THE HYDRO INSTRUMENTS SYSTEM

This equipment should require little service when operated according to instructions. The following are recommended maintenance instructions.

Suggested Guidelines for Preventative Maintenance: See below for detailed instructions.

1. Service Omni-Valve and manual rate valve every 12 months.
2. Replace Rate Valve O-Ring every 12 months.
3. Service Flow Meter every 12 months.
4. Service Ejector every 12 months.
5. Replace vacuum tubing every 12-18 months.
6. Replace vacuum tubing fittings every 18-24 months.

CAUTION: Use all recommended precautions when using chemicals of any kind, including goggles, gloves, face shields, etc.

SECTION A-I: SERVICING FLOW METER ASSEMBLY (RML-10 and RML-28)

(Refer to appropriate parts diagram)

1. Disconnect the chemical drum from the remote meter.
2. Use ejector to remove solution from flow meter assembly.
3. Remove rate valve from bonnet. See Section III below for servicing rate valve and to remove bonnet and Rate Valve O-Ring.
4. Loosen the Inlet plug (FM-101A) about 2 to 3 turns being careful not to let the meter tube fall as it becomes loose. Remove the meter tube, being careful not to loose the top and bottom stops or the meter tube ball.
5. If there is any buildup in the tube, remove the stops and ball, then soak the tube in water with a cleaner (muriatic acid) until the material is sufficiently removed from inside the tube.

   NOTE: Always follow safety precautions with muriatic acid and other cleaners.
6. If the meter gaskets have not yet been changed then they can be turned over. If the meter gaskets have

been reused already then replace with new gaskets.

7. Remove the Inlet Plug completely from the Bottom Meter Block in order to change or re-lubricate O-Rings. Check O-Rings and if necessary replace them. Add some lubricant to the inside walls of the Meter Block where it contacts these O-Rings.
8. Replace the ball and stops in the tube and put the tube back into position by tightening the Inlet Plug. DO NOT OVERTIGHTEN.

SECTION A-II: SERVICING THE MANUAL RATE CONTROL VALVE AND THE OMNI-VALVE

(Refer to appropriate parts diagrams and Omni-Valve instruction manuals)

1. Disconnect the chemical drum from the remote meter.
2. Use ejector to remove solution from flow meter assembly.
3. Turn off water supply to ejector.
   a. Remove the RATE VALVE and cleanse of any debris.
   b. Place piece of tape or cloth around monel bonnet, grip firmly with pliers, and turn counterclockwise.
   c. Under bonnet is the Rate Valve O-ring. Remove and replace with new O-ring, seating with the (clean) eraser side of a pencil.
   d. Replace monel bonnet (turn snug) and install rate valve. DO NOT OVERTIGHTEN (can crack the block).
4. Refer to appropriate OV-110 or OV-1000 Omni-Valve instruction manuals for servicing instructions.

SECTION A-III: SERVICING EJECTOR NOZZLE (EJ-1000, EJ-5000 and EJ-5000-375 Ejectors)

(Refer to appropriate parts diagram)

1. Evacuate chemical from the vacuum tubing carefully before removing the tubing from the Ejector.
2. Isolate the Ejector from main water lines before removing from the pipe line.
3. Remove the Ejector unit from the pipe line.
4. Unscrew the Nozzle and Diffuser from one another.
5. For the EJ-1000, the Nozzle is the longer piece. For the EJ-5000 and over, the Nozzle is the smaller piece.
6. Inspect for obvious damage and that the nozzle is not clogged with particles or any kind of deposit.
   NOTE: Do not attempt to re-drill the hole in any way.
7. If there is any kind of buildup (Iron, Calcium, etc.) in the Nozzle, soak it a muriatic acid bath for at least 5 to 10 minutes or until it is clean.
   NOTE: Always follow safety precautions with Muriatic Acid and other cleaners.
8. It is recommended that the 3PS-214 O-Rings be replaced every 12-24 months or if they appear visibly deformed.
9. Reassemble the Ejector being careful to remember to use the Nozzle and Diffuser O-Rings.

SECTION A-IV: SERVICING EJECTOR CHECK VALVE ASSEMBLY (EJ-1000, EJ-5000 and EJ-5000-375 Ejectors)

(Refer to appropriate parts diagram)

1. Evacuate chemical from the vacuum tubing carefully before removing the black tubing from the Ejector.
2. Isolate the Ejector from main water lines before removing from the pipe line.
3. Remove the Ejector unit from the pipe line.
4. Remove the four bolts holding the two body parts together.
5. Lift the Top Body away from the Bottom Body.
6. The 3RS-203 O-Ring should be replaced. This is the seal for the check valve.
7. Inspect the SM-112 Diaphragm for damage (holes, excessive cracking, etc.). If necessary, unscrew the diaphragm nut and bolt, preferably using a Spanner wrench and tongue and groove pliers. Use care not to snap the nut.
8. Replace any parts necessary and reassemble.

SECTION A-V: SERVICING EJECTOR NOZZLE AND THROAT (EJH-2000-CL2 Ejector)

NOTE: Carefully follow shutdown procedures before performing this repair.

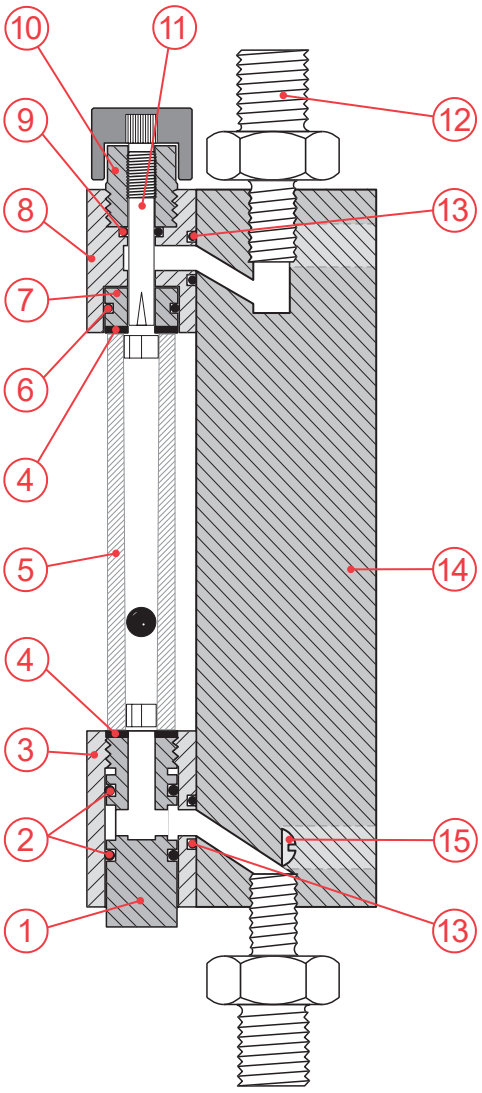
1. Be sure to isolate the ejector on both intake and outlet sides to prevent leakage of water or gases.
2. Disconnect the vacuum intake connection.
3. Disassemble both the intake and outlet water connection flanges and remove it from the water pipeline.
4. Remove the flanges from the Ejector Body EJH-169-000.
5. Unthread the nozzle and throat from the Ejector Body.
6. Slide the nozzle and throat out of their respective housings. Take care not to damage the threaded portion.
7. Inspect and clean the nozzle and throat interior. Soaking in Muriatic Acid is recommended if scale build-up
   is present. Replace them if necessary.

SECTION A-VI: SERVICING EJECTOR CHECK VALVE (EJH-2000-CL2 Ejector)

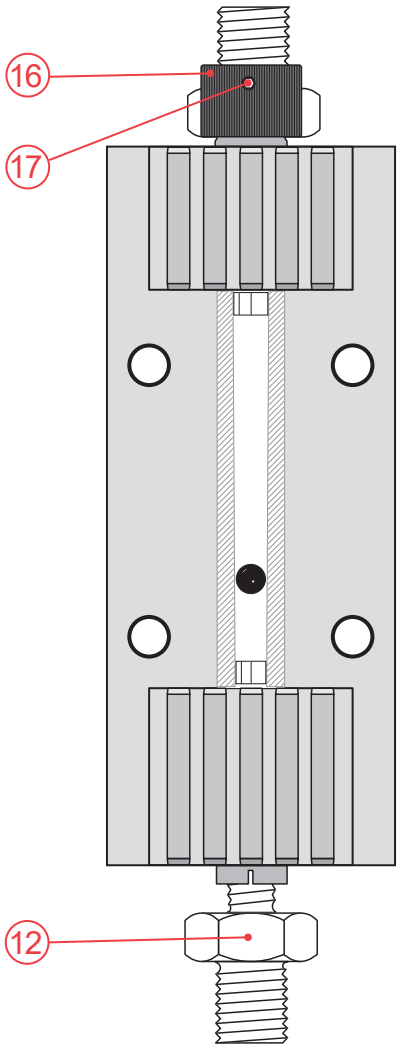
NOTE: Carefully follow shutdown procedures before performing this repair.

1. Remove the four bolts holding the two Check Valve Body parts together.
2. Lift the Check Valve Top Body away from the Check Valve Bottom Body.
3. The OH-CEM-214 O-Ring should be replaced. When installing a new OH-CEM-214, carefully ensure it is evenly seated in the groove. Lubricating the new OH-CEM-214 O-Ring with Fluorolube is recommended.
4. Inspect the DIH-116-000 Diaphragm for damage (holes, cracking, etc.). If necessary, unscrew the diaphragm nut and bolt, preferably using a Spanner wrench and tongue and groove pliers. Use care not to snap the nut.
   The DIH-116-000 should be replaced every 12 to 24 months.
5. Replace the spring only if it is damaged.
6. Replace any parts necessary and reassemble.

SIDE VIEW



FRONT VIEW



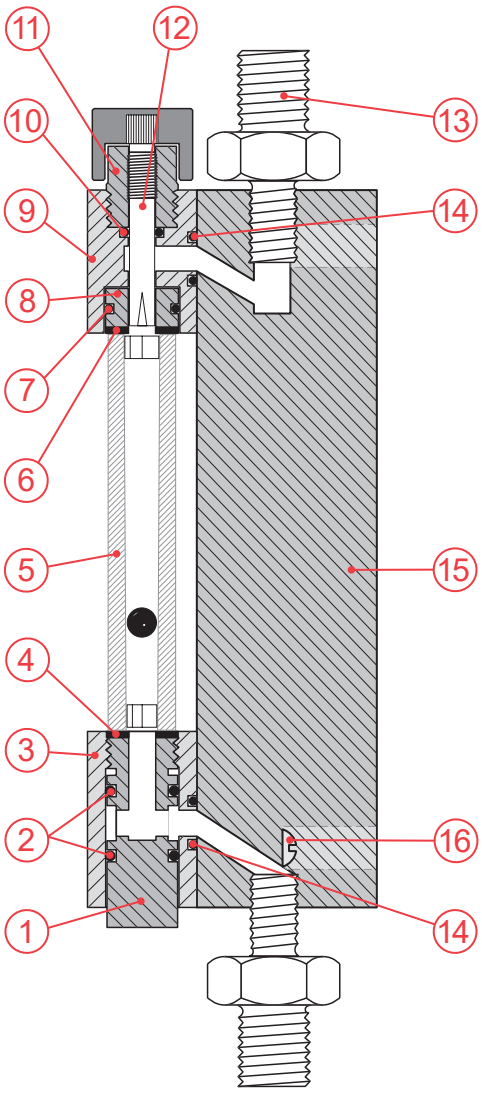
Item No.	Description	Quantity	Part No.
1	Inlet Plug	1	FM-101A
2	O-Ring	2	OH-VIT-112
3	Bottom Meter Block	1	FM-103
4	Meter Gaskets (0.5 up to 10 GPH)	2	MG-001-025
5	Flow Meter (0.5 GPH)	1	MTB-11-L-0005
5	Flow Meter (1 GPH)	1	MTB-11-L-001
5	Flow Meter (4 GPH)	1	MTB-11-L-004
5	Flow Meter (10 GPH)	1	MTB-11-L-010
6	O-Ring	1	OH-VIT-012
7	Rate Valve Seat	1	VT-104
8	Top Meter Block	1	FM-100B
9	O-Ring	1	OH-VIT-106

Item No.	Description	Quantity	Part No.
10	Valve Bonnet	1	VB-100C
11	Rate Valve	1	VP-103C-100
12	Vacuum Tube Fitting	2	10-6-4
13	O-Ring	2	OH-VIT-110
14	Back Body	1	RML-1-100
15	Remote Meter Block Screws (Monel)	4	#10-24 x 1-¼"
16	Rate Valve Knob	1	RV-100A
17	Rate Valve Knob Set Screw	1	#5-40 x ¼"

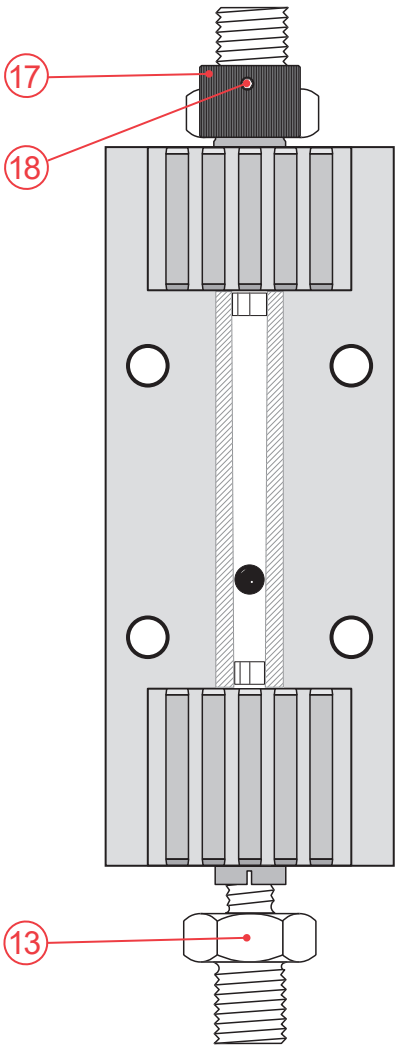
REMOTE FLOW METER

Date: 2022-12-30-v1
Scale: 75%
Dwg. No.: RML-10

SIDE VIEW



FRONT VIEW

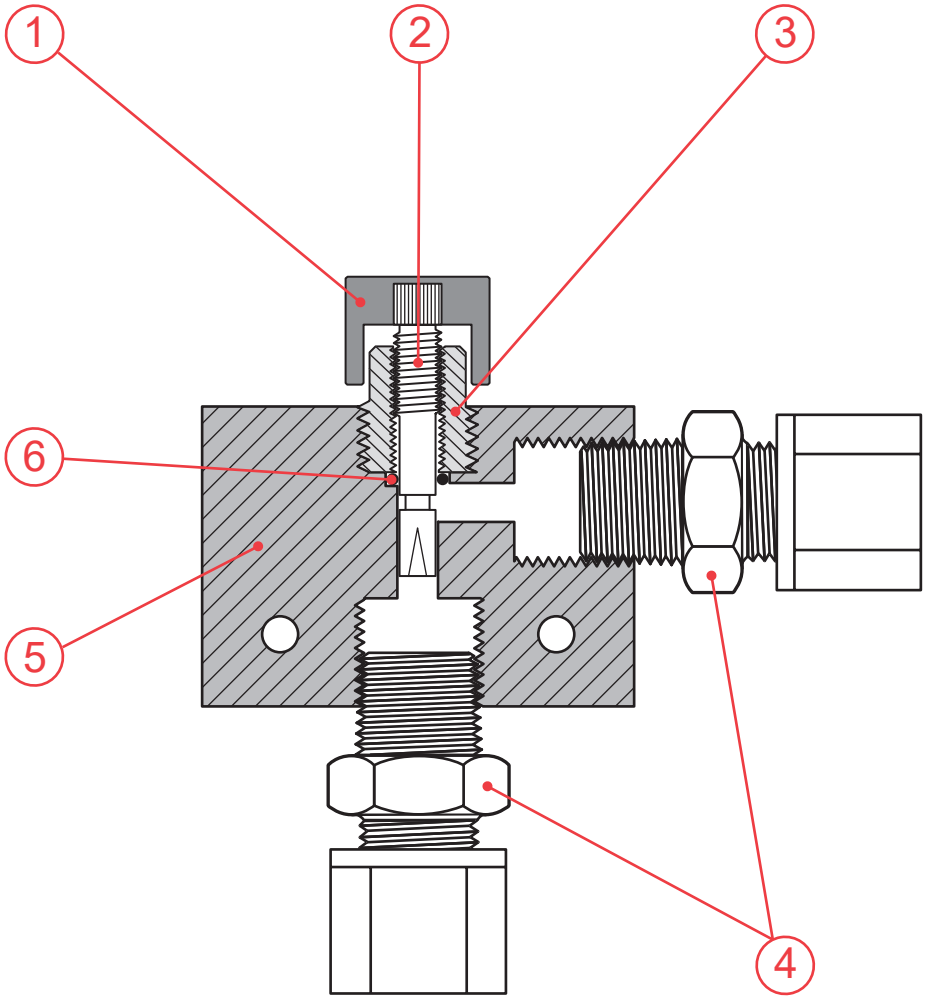


Item No.	Description	Quantity	Part No.
1	Inlet Plug	1	FM-101A
2	O-Rings	2	OH-VIT-112
3	Bottom Meter Block	1	FM-103
4	Bottom Meter Gasket	1	MG-001-025
5	Meter Tube	1	MTB-11-L-028
6	Top Meter Gasket	1	MG-001-025
7	O-Ring	1	OH-VIT-012
8	Rate Valve Seat (Teflon)	1	VT-104
9	Top Meter Block	1	FM-100B
10	O-Ring	1	OH-VIT-106

Item No.	Description	Quantity	Part No.
11	Valve Bonnet	1	VB-100
12	Rate Valve	1	VP-250
13	⅜" Tubing x ¼" NPT Tube Connector	2	10-6-4
14	O-Rings	2	OH-VIT-110
15	Back Body	1	RML-2-250
16	Remote Meter Block Screws (Monel)	4	#10-24 x 1-¼"
17	Rate Valve Knob	1	RV-100A
18	Rate Valve Knob Set Screw	1	#5-40 x ¼"

28 GPH REMOTE METER

Date: 2022-12-30-v1
Scale: 75%
Dwg. No.: RML-28



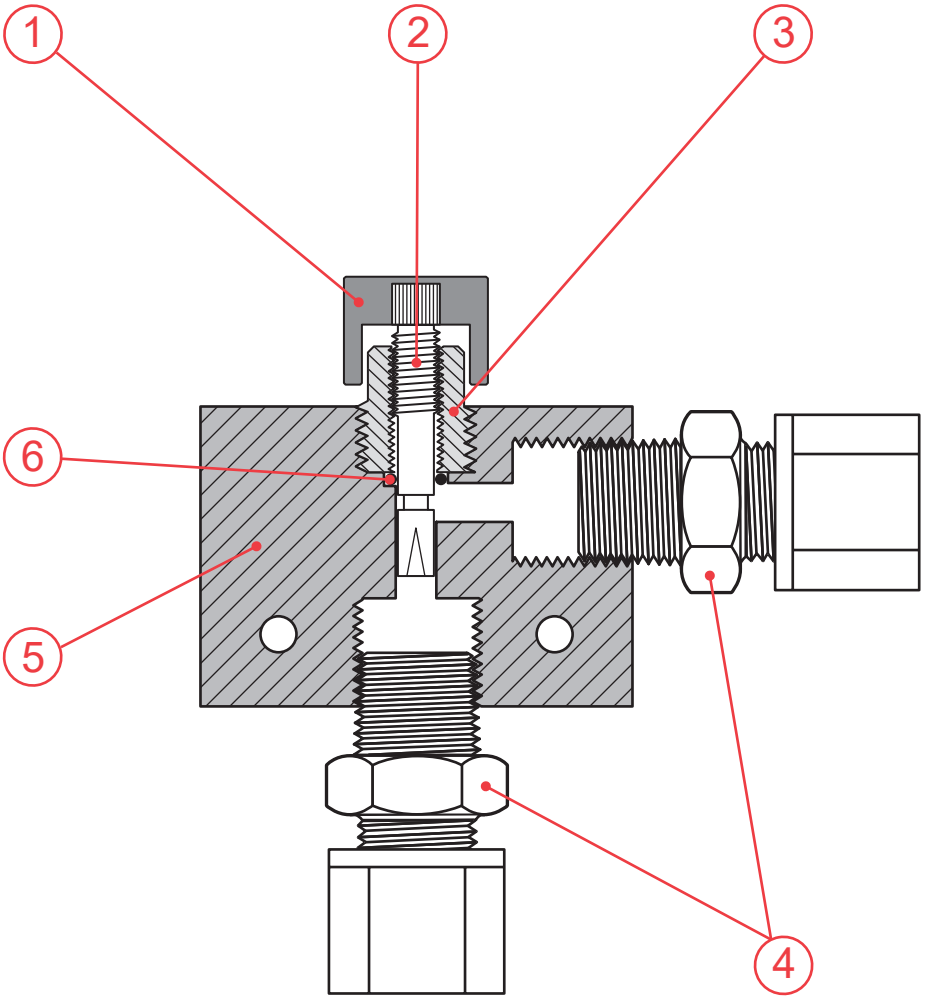
Item No.	Description	Quantity	Part No.
1	Rate Valve Knob	1	RV-100A
2	Rate Valve	1	VP-103C
3	Valve Bonnet	1	VB-100C
4	Vacuum Tube Fitting	2	10-6-6
5	Rate Valve Body	1	RML-B
6	O-Ring	1	OH-VIT-106

Capacity: 10 GPH (liquid) or 100 PPD (gas).

hydro INSTRUMENTS

RATE VALVE

Date: 2022-12-14-v1
Scale: 100%
Dwg. No. RCV-10



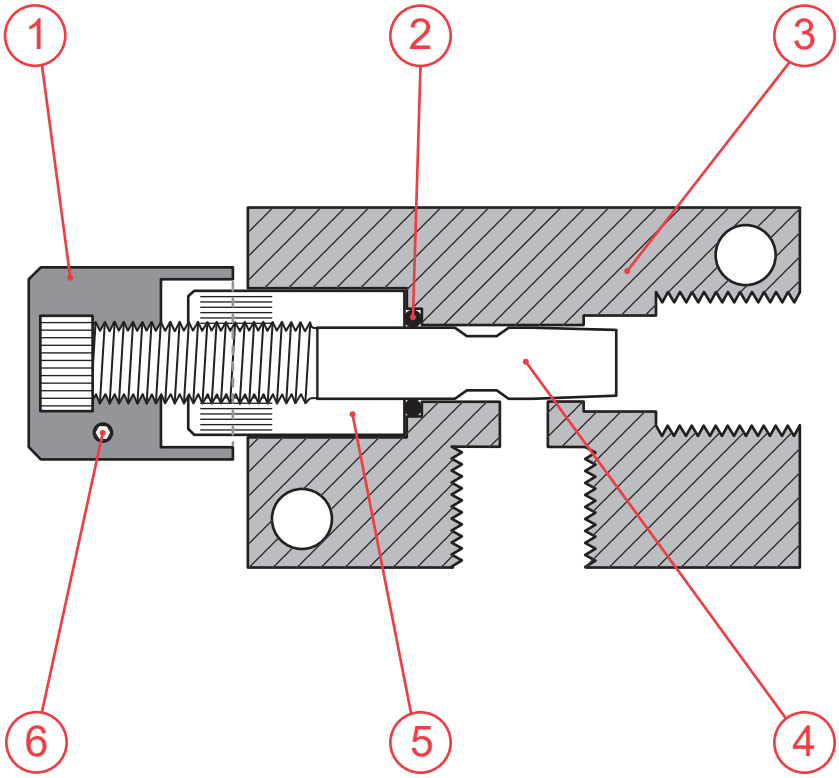
Item No.	Description	Quantity	Part No.
1	Rate Valve Knob	1	RV-100A
2	Rate Valve	1	VP-203C
3	Valve Bonnet	1	VB-100C
4	Vacuum Tube Fitting	2	10-6-6
5	Rate Valve Body	1	RML-B
6	O-Ring	1	OH-VIT-106

Capacity: 28 GPH (liquid) or 250 PPD (gas).

hydro INSTRUMENTS

RATE VALVE

Date: 2022-12-14-v1
Scale: 100%
Dwg. No. RCV-28



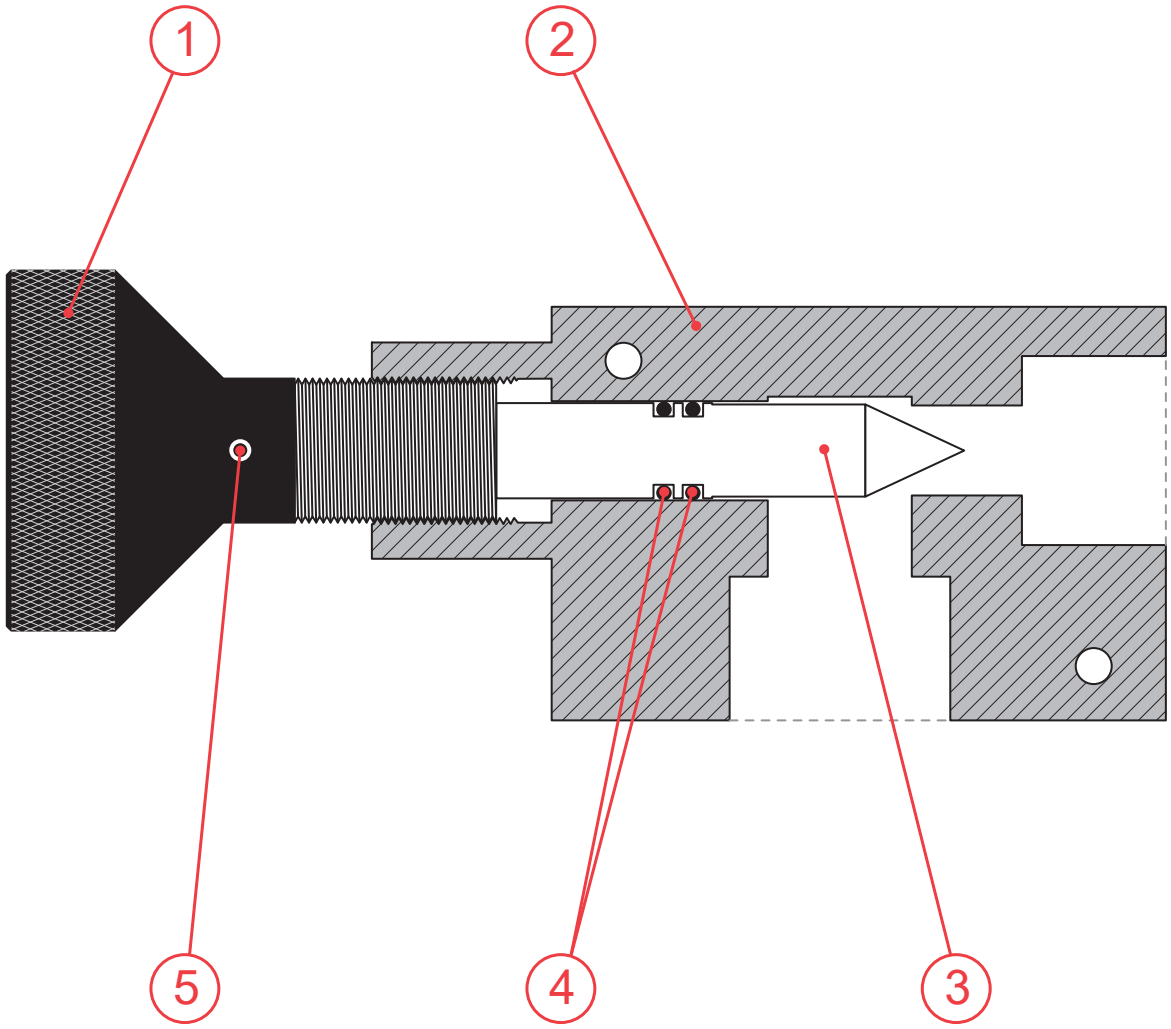
Item No.	Description	Quantity	Part No.
1	Rate Valve Knob	1	S496
2	O-Ring	1	OH-VIT-203
3	Rate Valve Body	1	RVB-700
4	Rate Valve	1	SA495
5	Valve Bonnet	1	S493
6	Rate Valve Knob Set Screw	1	#6-32 x 5/16"

Capacity: 240 GPH/4 GPM (liquid) or 500 PPD (gas).

hydro INSTRUMENTS

RATE VALVE

Date: 2022-12-14-v1
Scale: 100%
Dwg. No. RCV-240



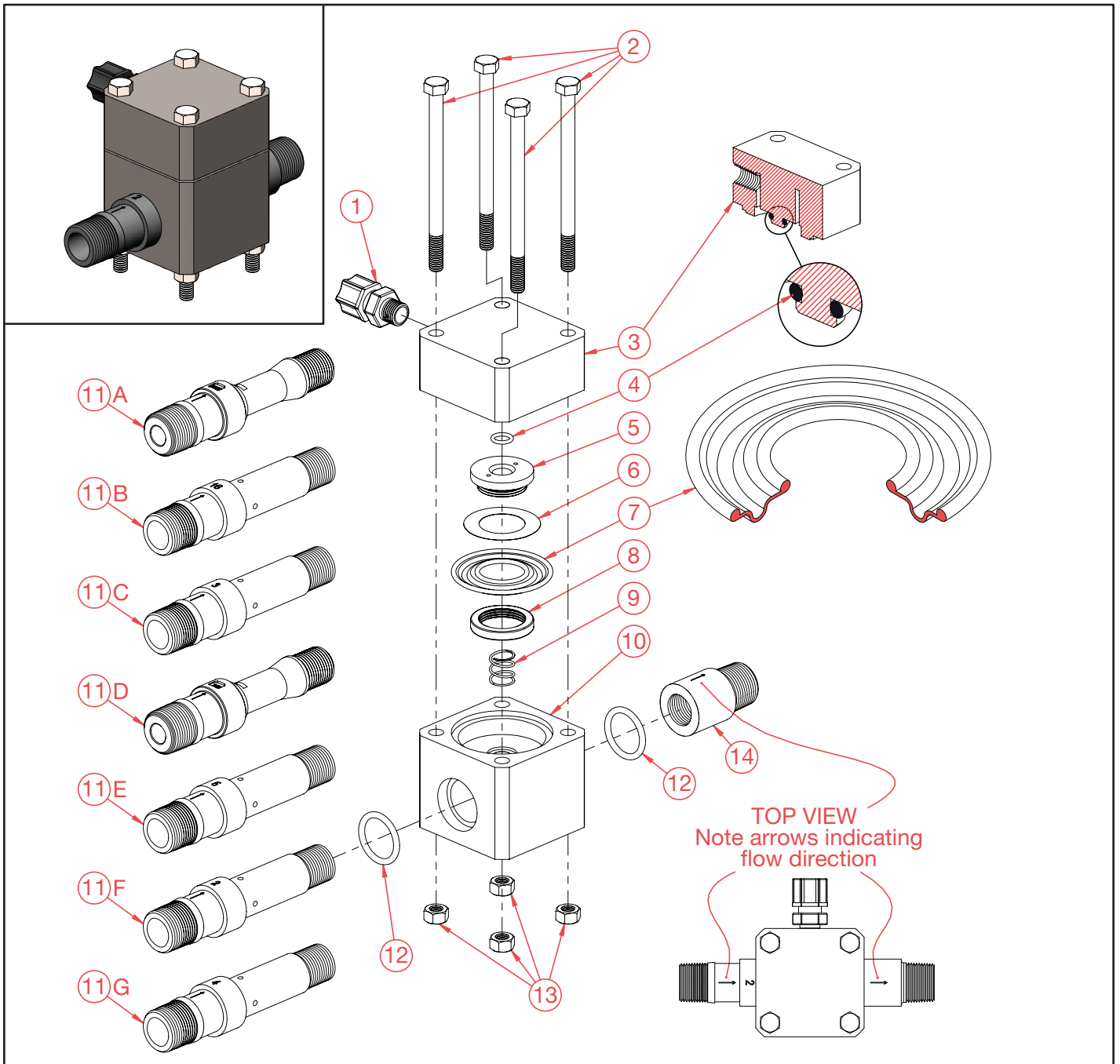
Item No.	Description	Quantity	Part No.
1	Rate Valve Knob	1	RVH-412-000
2	Rate Valve Body	1	RVB-3000
3	Rate Valve Stem	1	RVH-411-000
4	O-Ring	2	OH-VIT-112
5	Rate Valve Knob Set Screw	1	#6-32 x 5/16"

Capacity: 600 GPH/10 GPM (liquid) or 2000 PPD (gas).

hydro INSTRUMENTS

RATE VALVE

Date: 2022-12-14-v1
Scale: 75%
Dwg. No. RCV-600

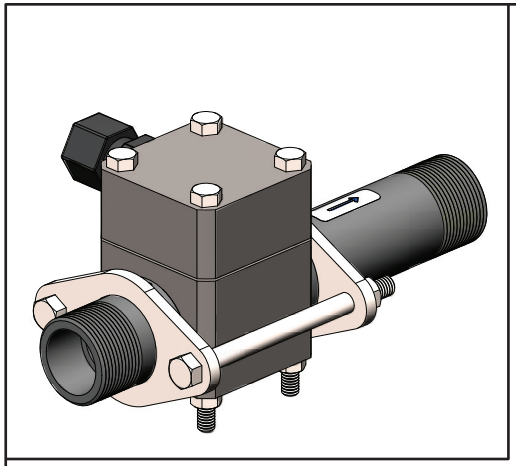


Item No.	Description	Quantity	Part No.
1	PM ¼" NPT ⅜" Tube Tubing Connector	1	BKF-64
2	Bolt 5⁄16-18 x 4½"	4	B-57
3	Top Body (250 PPD)	1	E-550-250
4	PM O-Ring	1	OH-VIT-203
5	PM Check Assembly Bolt	1	E-553
6	PM Set of Two Support Diaphragms	1	KY-1
7	PM Rolling Diaphragm	1	SM-112
8	PM Check Assembly Nut	1	E-552
9	Spring	1	S-145
10	Bottom Body	1	E-551
11 A	* Nozzle (50 PPD max)	1	UN-102-099D
11 B	* Nozzle	1	UN-101-16

Item No.	Description	Quantity	Part No.
11 C	* Nozzle (50 PPD max)	1	UN-101-3
11 D	* Nozzle (100 PPD max)	1	UN-102-140
11 E	* Nozzle (100 PPD max)	1	UN-101-5
11 F	* Nozzle (100 PPD max)	1	UN-101-2
11 G	* Nozzle	1	UN-101-4
12	PM O-Ring	2	OH-VIT-214
13	Nut 5⁄16-18	4	N-56
14	Diffuser (Threaded)	1	E-1063
PM	Part and Maintenance Kit	1	KT1-100-EJS
*	Refer to nozzle sizing charts for correct sizing.		

Hydro Instruments
EJECTOR

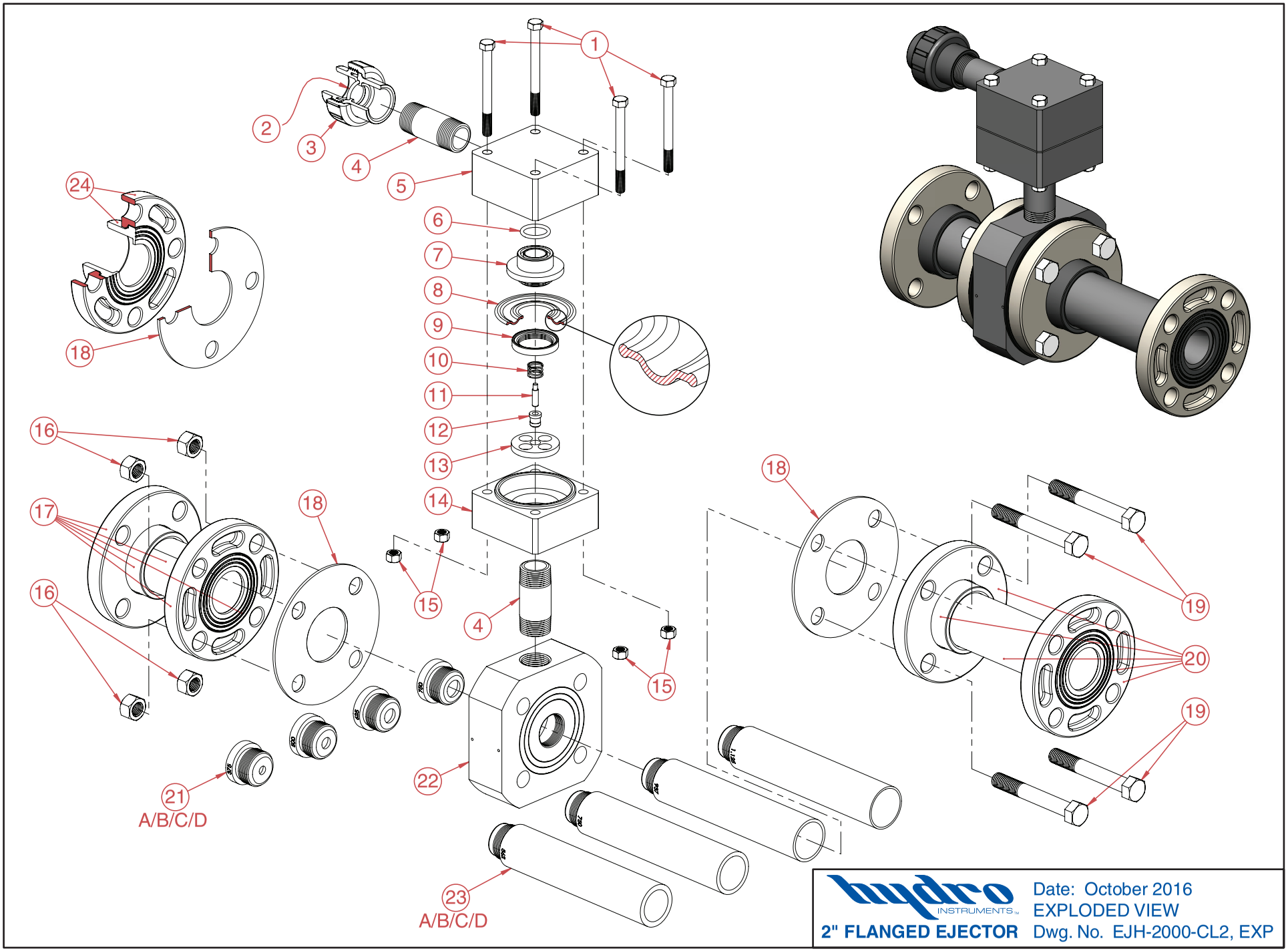
Date: 2022-12-15-v1
EXPLODED VIEW AND BOM
Dwg. No. EJ-1000



Date: 2022-12-15-v1
EXPLODED VIEW
EJECTOR Dwg. No. EJ-5000, EXP

Item No.	Description	Quantity	Part No.
1	PM ½" NPT ⅝" Tube Tubing Connector	1	BKF-108
2	Bolt 5/16-18 x 4½" (stainless)	4	B-57
3	Top Body (500 PPD)	1	E-550-500
4	PM O-Ring	1	OH-VIT-203
5	PM Check Assembly Bolt	1	E-553
6	PM Set of Two Support Diaphragms	1	KY-1
7	PM Rolling Diaphragm	1	SM-112
8	PM Check Assembly Nut	1	E-552
9	Spring	1	S-145
10	Bottom Body	1	E-551
11	Bolt ⅜-16 x 5" (stainless)	2	B-59
12	Nozzle/Diffuser Brackets	2	EJB-425
13A	* Nozzle – .250 (1¼" NPT)	1	EN-250
13B	* Nozzle – .290 (1¼" NPT)	1	ENX-290
13C	* Nozzle – .300 (1¼" NPT)	1	EN-296
13D	* Nozzle – .375 (1¼" NPT)	1	EN-375
14	PM O-Ring	2	OH-VIT-214
15	Nut 5/16-18 (stainless)	4	N-56
16A	* Throat – .380 (1¼" NPT)	1	EDT-380
16B	* Throat – .560 (1¼" NPT)	1	EDT-560
17	Nut ⅜-16 (stainless)	2	N-58
PM	Part & Maintenance Kit (500 PPD)	1	KT7-500-EJS

* Refer to nozzle sizing charts for correct sizing.



Date: October 2016
EXPLODED VIEW
2" FLANGED EJECTOR Dwg. No. EJH-2000-CL2, EXP

Item No.	Description	Quantity	Part No.
1	⅜"-16 x 4" Long Hex Bolt	4	BTH-STA-158
2	PM O-Ring	1	OH-VIT-215
3	1" Union Assembly	1	U-4475
4	1" PVC Nipple x 3"	2	RH-306-000
5	Ejector Check Valve Top Body	1	EJH-168-000
6	PM O-Ring	1	OH-CEM-214
7	PM Diaphragm Bolt (2" Ejector)	1	EJH-162-000
8	PM Diaphragm	1	DIH-116-000
9	PM Diaphragm Nut (2" Ejector)	1	EJH-163-000
10	Spring (2" Ejector)	1	SPH-110-000
11	Guide Pin (2" Ejector)	1	EJH-140-000
12	Pin Guide (2" Ejector)	1	EJH-151-000
13	Spring Retainer (2" Ejector)	1	EJH-164-000
14	Ejector Check Valve Bottom Body	1	EJH-167-000
15	Nut, ⅜"-16	4	NTH-STA-146
16	Nut, ⅝"-11 Hex	4	NTH-STA-230
17	Nozzle Housing Assembly	1	RH-891-000
18	PM Gasket (2" Ejector) (two installed, two loose)	4	RH-308-000
19	Bolt, ⅝"-11 x 4½" Long	4	BTH-STA-156
20	Throat Housing Assembly	1	RH-890-000
21A	Nozzle (0.375" Orifice)	1	EJH-165-375
21B	Nozzle (0.500" Orifice)	1	EJH-165-500
21C	Nozzle (0.625" Orifice)	1	EJH-165-625
21D	Nozzle (0.750" Orifice)	1	EJH-165-750
22	Ejector Body (2" Ejector)	1	EJH-169-000
23A	Throat (0.562" Orifice)	1	EJH-166-562
23B	Throat (0.750" Orifice)	1	EJH-166-750
23C	Throat (0.937" Orifice)	1	EJH-166-937
23D	Throat (1.125" Orifice)	1	EJH-166-1125
24	Flange (2" Socket) (four installed, two loose)	6	RH-1221
PM	Part & Maintenance Kit	1	KTH-2000-EJS
*	Flanges are 2 inch, four bolt, 150 lb., S (Van Stone style) in Schedule 80 PVC.		

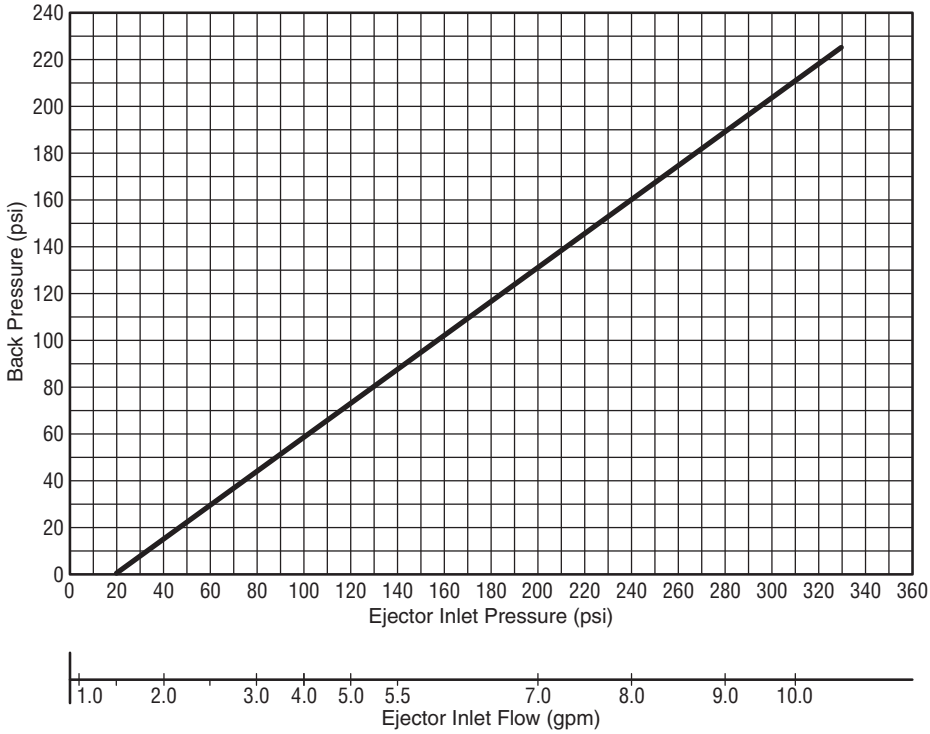
hydro INSTRUMENTS

2" FLANGED EJECTOR

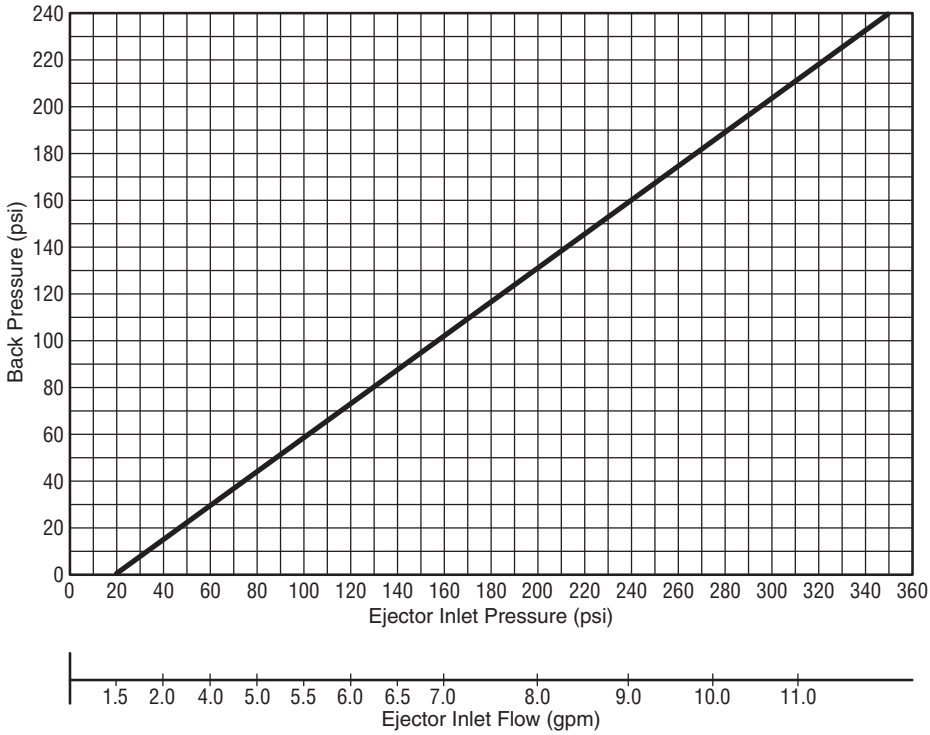
Date: October 2016
BILL OF MATERIALS
Dwg. No. EJH-2000-CL2, BOM

ALTERNATE NOZZLE SIZES

NOZZLE SIZING CHART (EJ-1000)
#3 Nozzle for 4 GPH



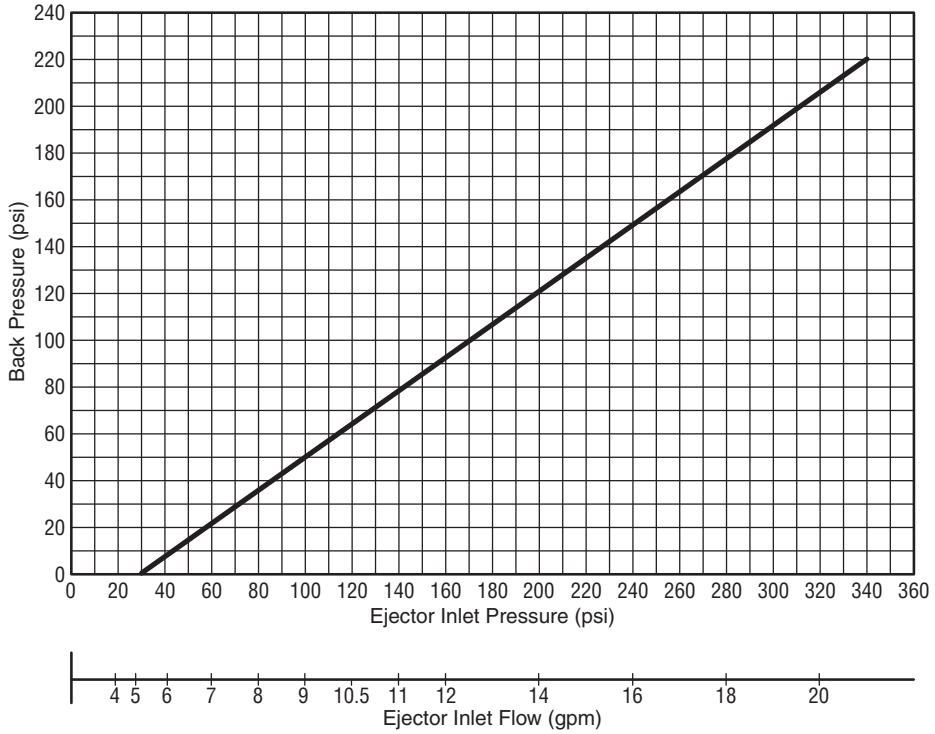
NOZZLE SIZING CHART (EJ-1000)
#5 Nozzle for 4 GPH



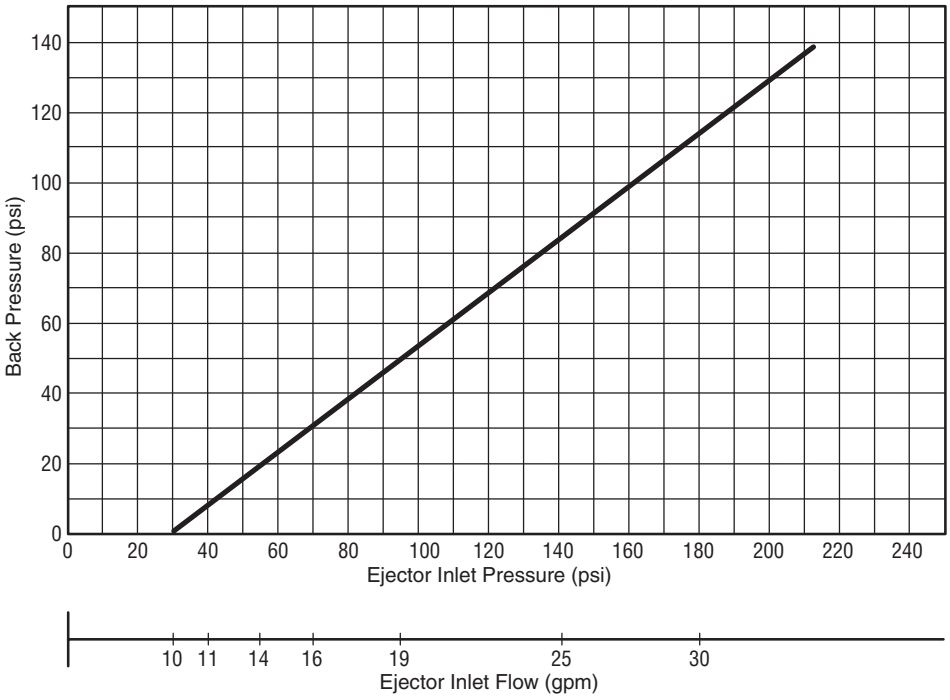
Note: Pressure combinations that plot below the line for any given nozzle are acceptable for operating that nozzle at the stated chemical feed rate for that chart. Pressure combinations that fall above the line for any given nozzle are not acceptable.

NS-4 Rev. 1/29/16

NOZZLE SIZING CHART (EJ-1000)
#2 Nozzle for 10 GPH

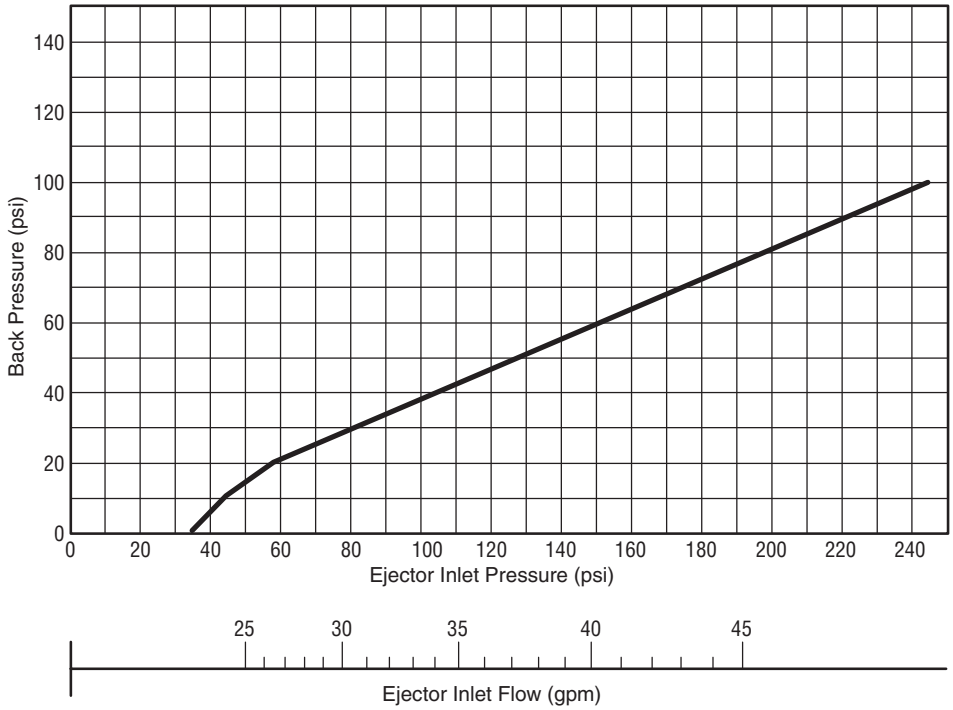


NOZZLE SIZING CHART (EJ-5000-296)
for up to 1 GPM (60 GPH)



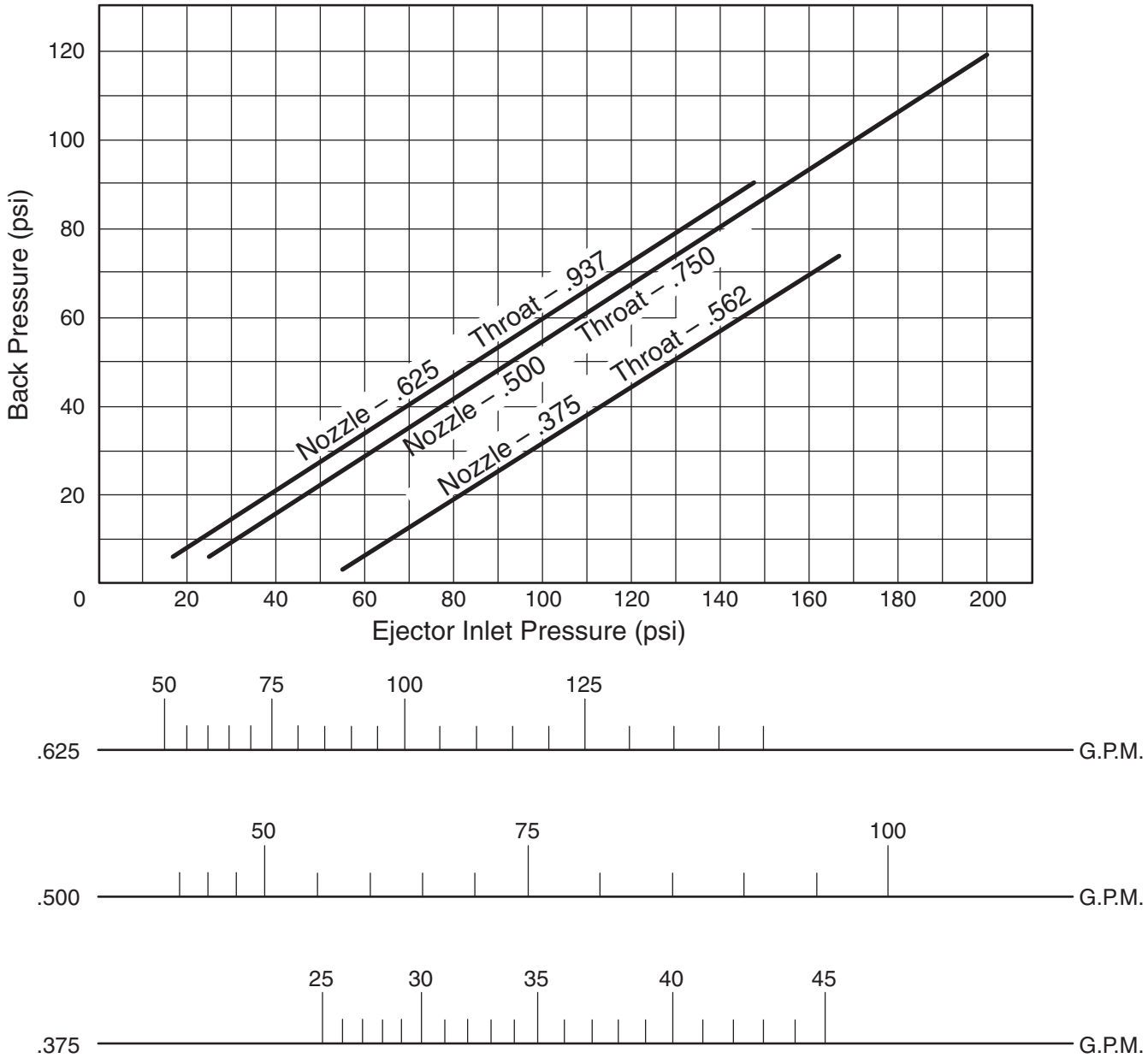
Note: Pressure combinations that plot below the line for any given nozzle are acceptable for operating that nozzle at the stated chemical feed rate for that chart. Pressure combinations that fall above the line for any given nozzle are not acceptable.

NOZZLE SIZING CHART (EJ-5000-375)
for up to 2 GPM (120 GPH)



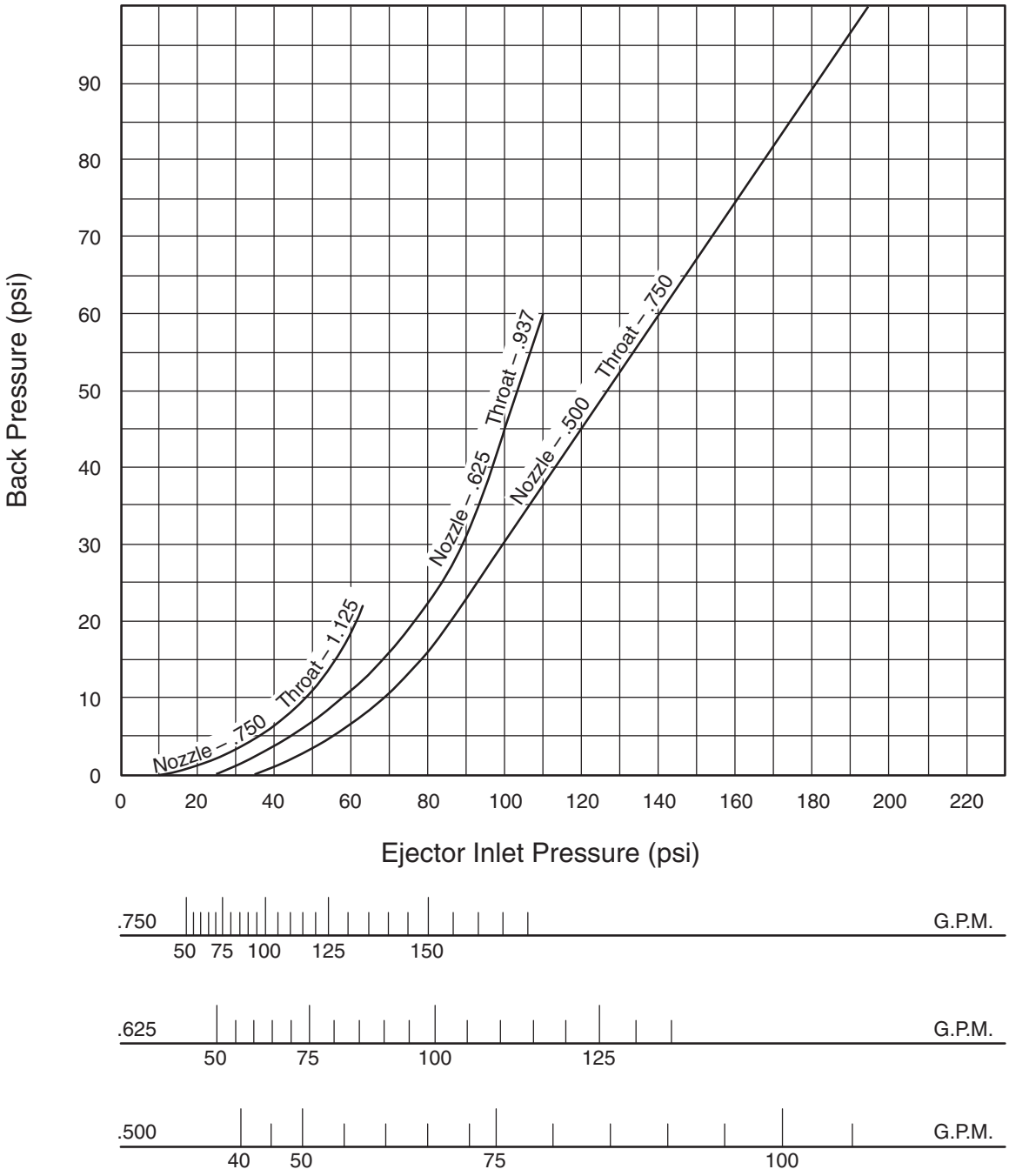
Note: Pressure combinations that plot below the line for any given nozzle are acceptable for operating that nozzle at the stated chemical feed rate for that chart. Pressure combinations that fall above the line for any given nozzle are not acceptable.

NOZZLE SIZING CHART
for 4 GPM (240 GPH)



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
for 10 GPM (600 GPH)



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.