

ProMinent Gas Chlorination



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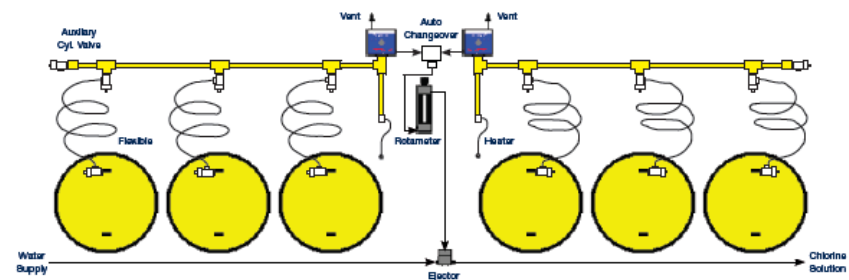
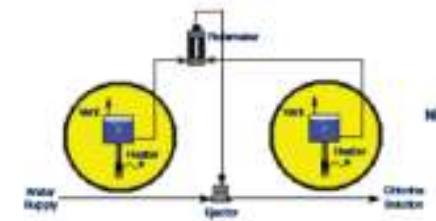
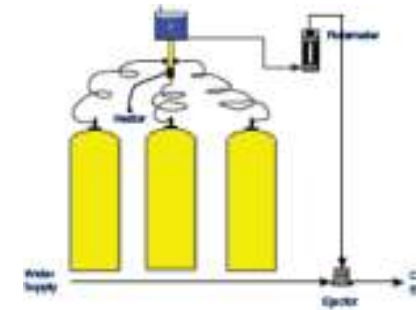
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Introduction

Gas chlorine has been used for many years as a means of sterilising water for drinking, and for preventing slime build up in pipes, cooling towers etc. There are of course many other ways to achieve the above.

Chlorine is also available as sodium hypochlorite, as a 12.5% liquid, and as calcium hypochlorite, in tablet and granular forms.

Gas Cl_2 is considered the most dangerous form of chlorine, however there have been no deaths in Australia. A Cl_2 leak is very obvious, and because it is seen as dangerous most people take the necessary care.



Types of chlorine gas supply

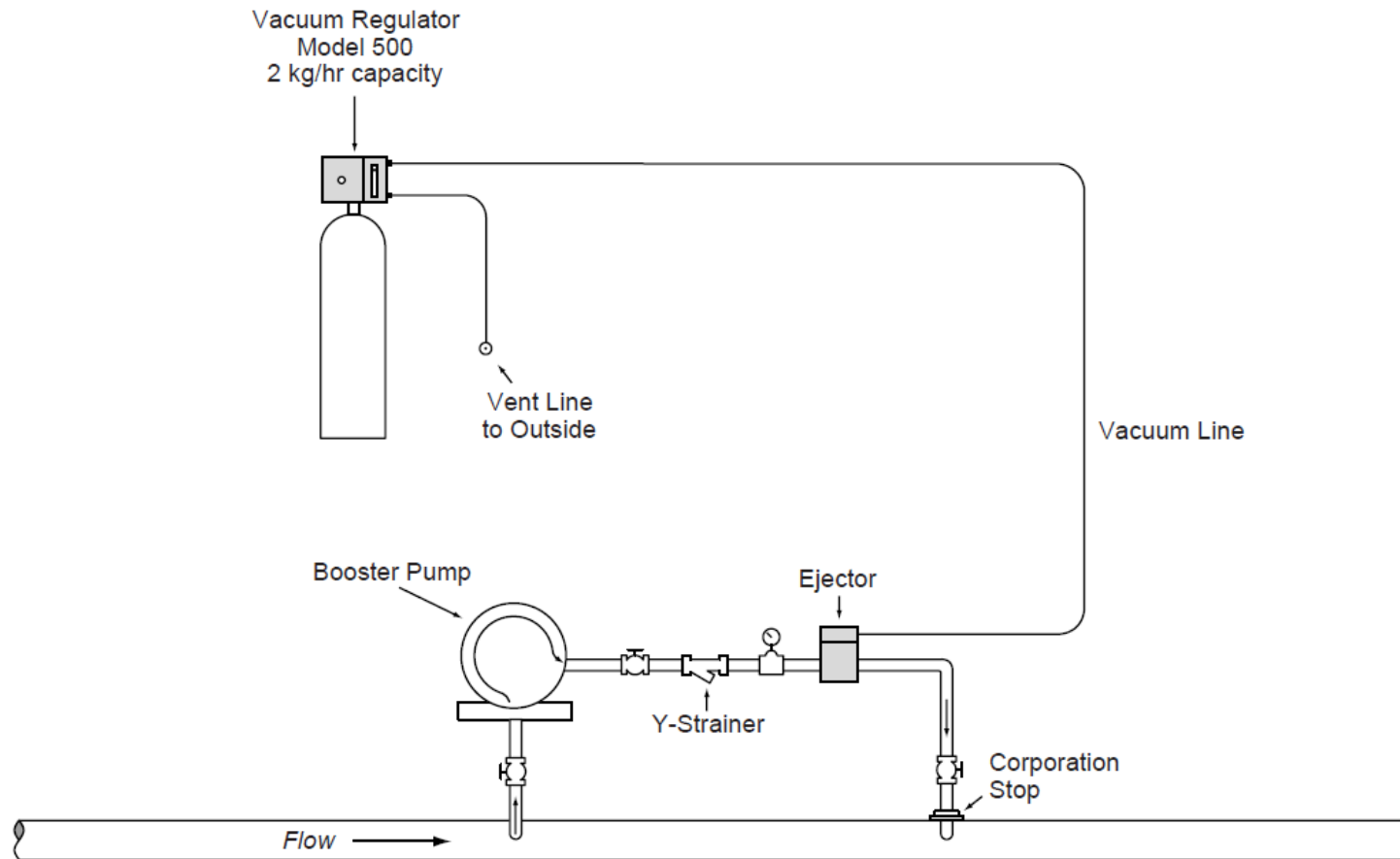


Bottle 70 kg



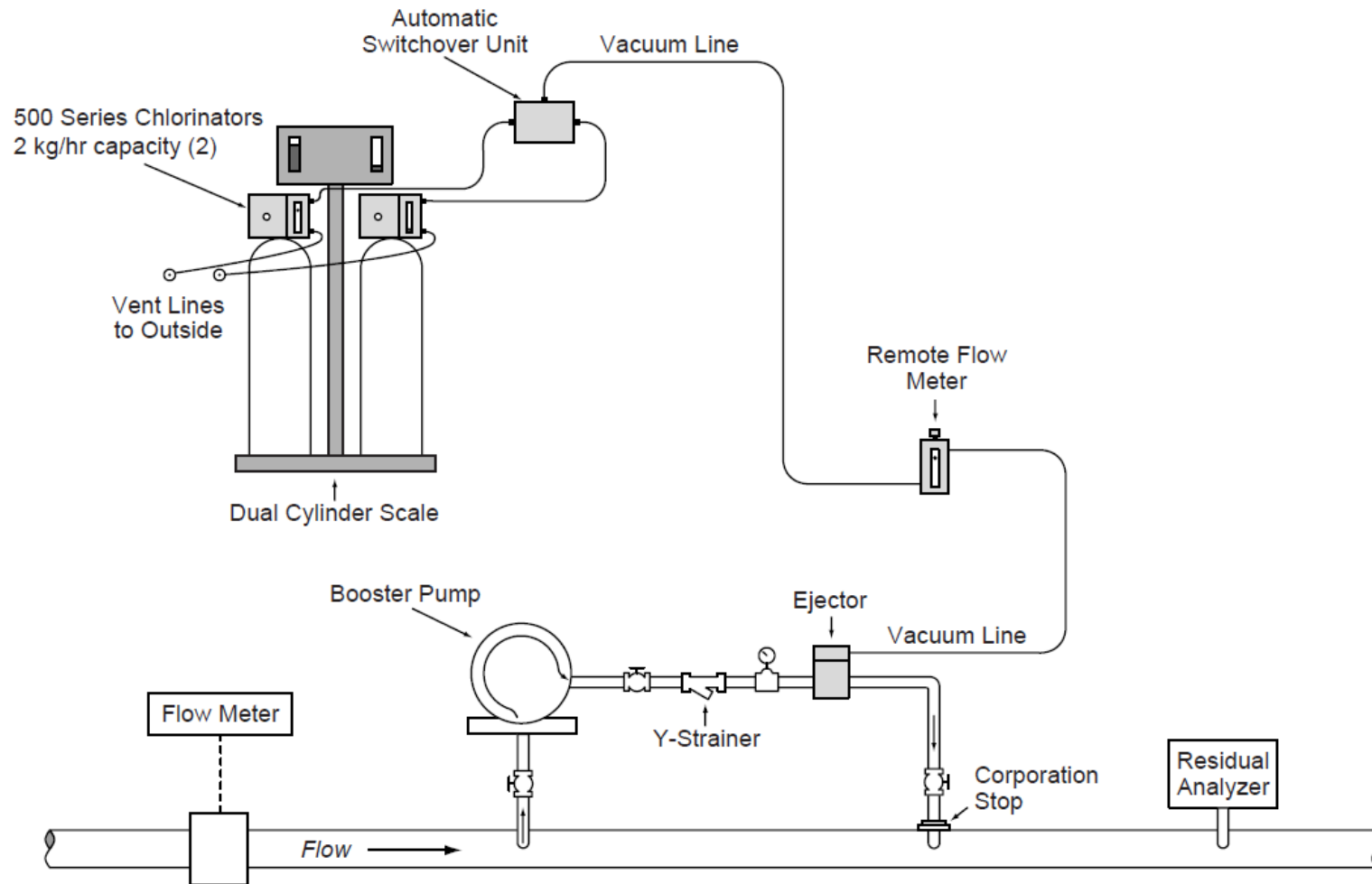
Drum 920 kg

Simple Manual Single Bottle System



System could be a single cylinder arrangement as shown above but cylinder would only last for a bit over 4 days.

Simple Manual Dual Bottle System

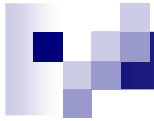


More suitable would be to have 2 cylinders with built-in auto changeover



Materials Used in our Systems

- Pressure Headers- Solid Drawn Seamless Mild Steel
- Flexible connections- Cadmium plated copper
- General Mounting Screws- Monel
- Drip Legs- Monel (Point of Interest)
- Washers - Lead - Fibre
- PRV- Silver \$\$\$\$
- Springs- Hastelloy C
- Main Bodies- PVC
- Vacuum Tube- EVA (Ethylene Vinyl Acetate) or PE
- Vacuum Pipe- PVC (PolyVinyl Chloride)
- O'rings- Viton®
- Others- Kynar®, PTFE



To decide what type of package might be best suited will be determined by a number of factors:

- Maximum expected dose rate
- For a potable water supply might be 2-5 mg/l
- For a waste water treatment might be 5-10 mg/l
- How often will the cylinders or drums need to be replaced
- What size building is available
- Road access to unload drums
- Will client accept a partial pressure system (when draw off rate exceeds that available from a single cylinder or drum)
- Rent costs of cylinders and drums
- What is the injection pressure
- Is there pressure water available or is a booster pump required
- How is chlorine dose rate to be controlled
- Manually set
- Flow paced using a chlorine rate control valve and flow meter
- Residual control (proportional or PID) using an analyser and Cl valve



Draw off Rates

Temperature °C	920 Kg Drum	70Kg Cylinder
5	1.6	0.4
10	3.0	0.7
15	5.0	1.2
20	7.0	1.7
25	9.0	2.3



Example

Requirement is to dose chlorine gas into a potable water supply of flow rate 100 l/second and to provide a dose rate of up to 4 mg/litre.

Injection pressure is 4 bar and system is to be flow paced in proportion to a 4-20mA signal. WTP operates for about 12 hours a day.

Flow rate		0.36	MI/hour
Dosing at 4 mg/l	=	1.44	kg/h

Over the 12 hours per day the chlorine usage would be 17.28 kg/h one cylinder only lasting 4 1/2 days at 4 mg/l.

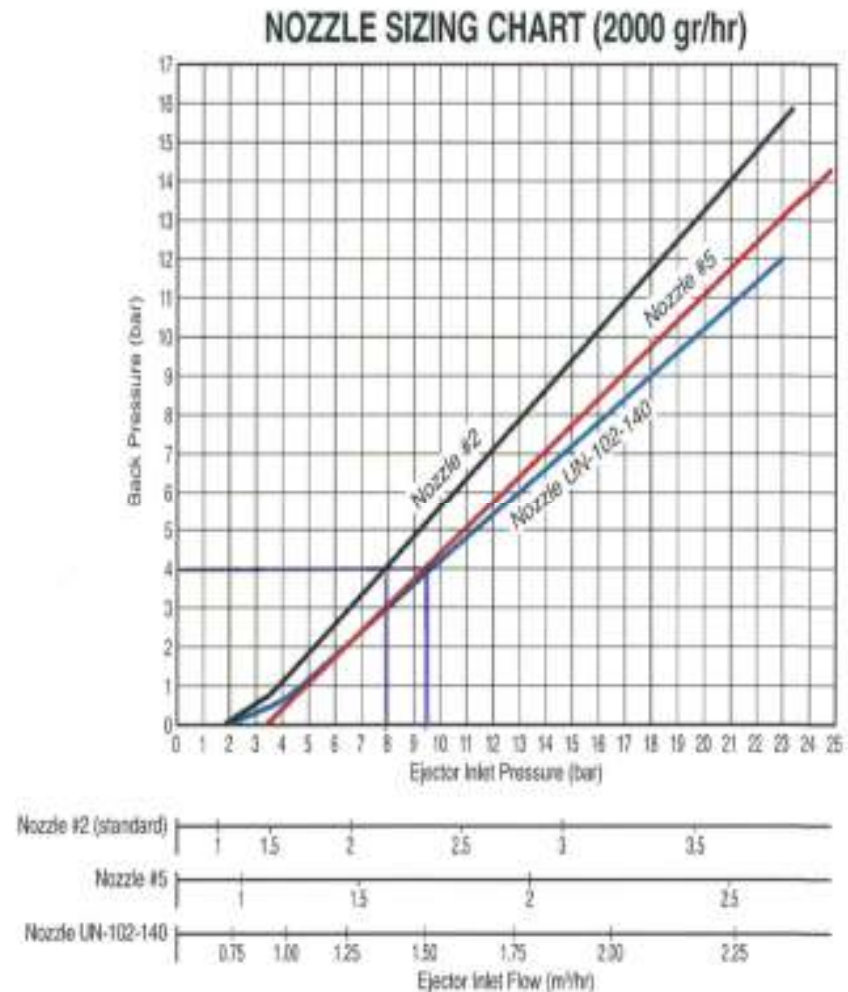


The injection pressure is 4 bar and the capacity required is 1.44 kg/hour.

From the graph using a No 2 nozzle we require 2,180 l/h at 8 bar.

Using a No 5 nozzle we require 1,750 l/h at 9.4 bar.

For the 8 bar injection and if the motive water is coming from the 4 bar mains, then the booster pump only has to provide 4 bar to add to the already 4 bar.



Chlorinators can be either "Remote Vacuum" where the vacuum regulators are mounted directly on the cylinder or drum or "Partial Vacuum" where the vacuum regulators are mounted on a pressurised header.

Remote vacuum is the safest arrangement, and a number of vacuum regulators can be manifolded to ensure sufficient on line storage. Most systems would include either a vacuum change over or motorised change over unit.



0-2 Kg/h Vacuum
Regulator
Cylinder Mounted



0-10 kg/h Vacuum
Regulator
Ton Mount



20-120 kg/h Vacuum
Regulator

Vacuum regulators should be connected directly to the cylinders or drums or to the header valve using lead gaskets.



When more than 10kg/hr is required to ensure equal draw down, a partial vacuum system could be used.

With this arrangement the following is required.

- a) Auxiliary chlorine valve. Preferred type has clamping arrangement. This valve is clamped to the top drum valve using a lead or fibre gasket.
- b) Copper flexible connections, with unions each end.
Connected with gaskets. Usually cad plated and normally replaced each 12 months or if any appearance of corrosion.

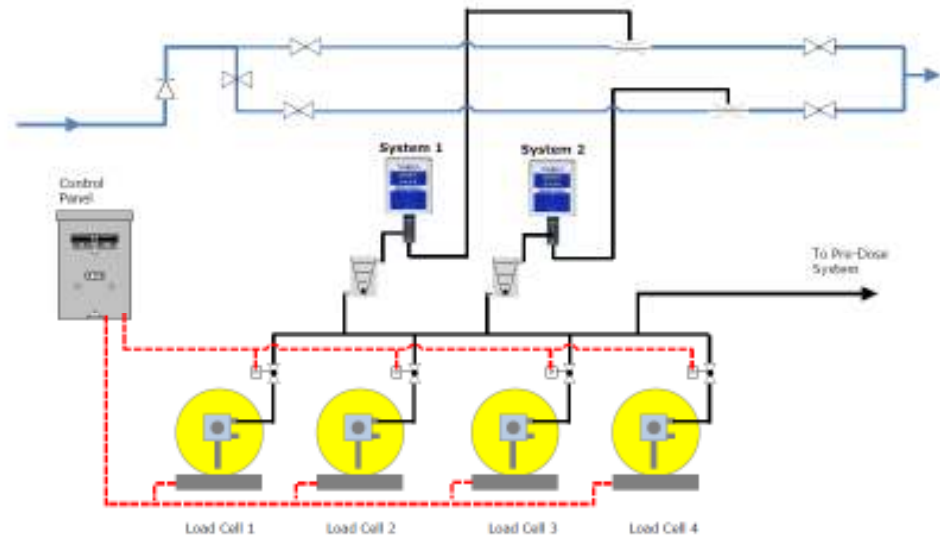


A decorative graphic consisting of a grid of colored squares in shades of blue, purple, and white, arranged in a pattern that suggests a stylized letter or logo.



Sequencing

Where the preference is for a full vacuum system with a vacuum regulator on each cylinder or drum and the requirement is for more than 2 kg/h when using cylinders and more than 10 kg/h when using drums, manifolding of vacuum regulators can lead to unequal draw down of gas. As an example a system with 2 plus 2 drums with auto changeover, when drawing more than 10 kg/h it will most likely be found that one drum will empty before the other and system will changeover to the standby drums leaving a drum not completely used.



ProMinent Gas Chlorine Full Vacuum Sequence System

We now have two arrangements that ensure that all chlorine is withdraw

- Full Vacuum Sequencing using Weight (Using cylinder or drum scales)
- Full Vacuum Sequencing using Pressure (Using vacuum regulators with switch)

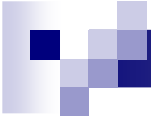
Sequencing for 6 Chlorine Drums



Above shows 3 Omni chlorine gas flow control valves duty, duty and standby with the 4th for CIP cleaning



Sequencing panel with vacuum solenoid valves

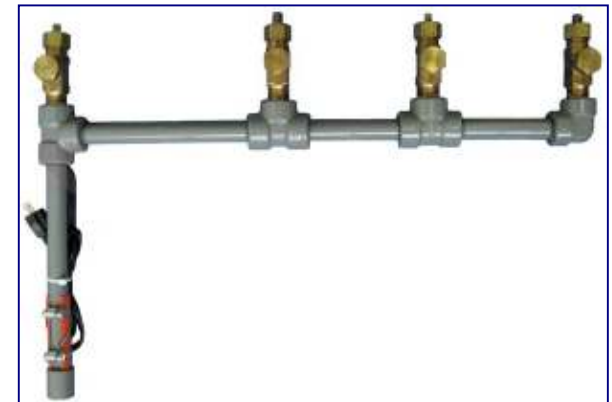


The chemical is mainly in the liquid phase inside a full cylinder. As gas is withdrawn, this liquid must evaporate. Evaporation withdraws heat from the surroundings, which has the effect of cooling the cylinder. At high enough feed rates, the cooling will be great enough that the cylinder temperature (and pressure) will continue to drop until the cylinder pressure is too low to allow the vacuum regulator to operate'

Note: For short periods of time this limit can be greatly exceeded



- c) Pipe header manufactured from solid drawn seamless mild steel with steam type elbows and tees. Where possible headers are tested for leaks and thoroughly dried prior to chlorine entry



- d) Header valve or isolation valve, to allow mounting of vacuum regulator.

Note that a drip leg with low wattage heater should form part of the header.



Mardi WTP Wyong Council



Mardi WTP Wyong Council



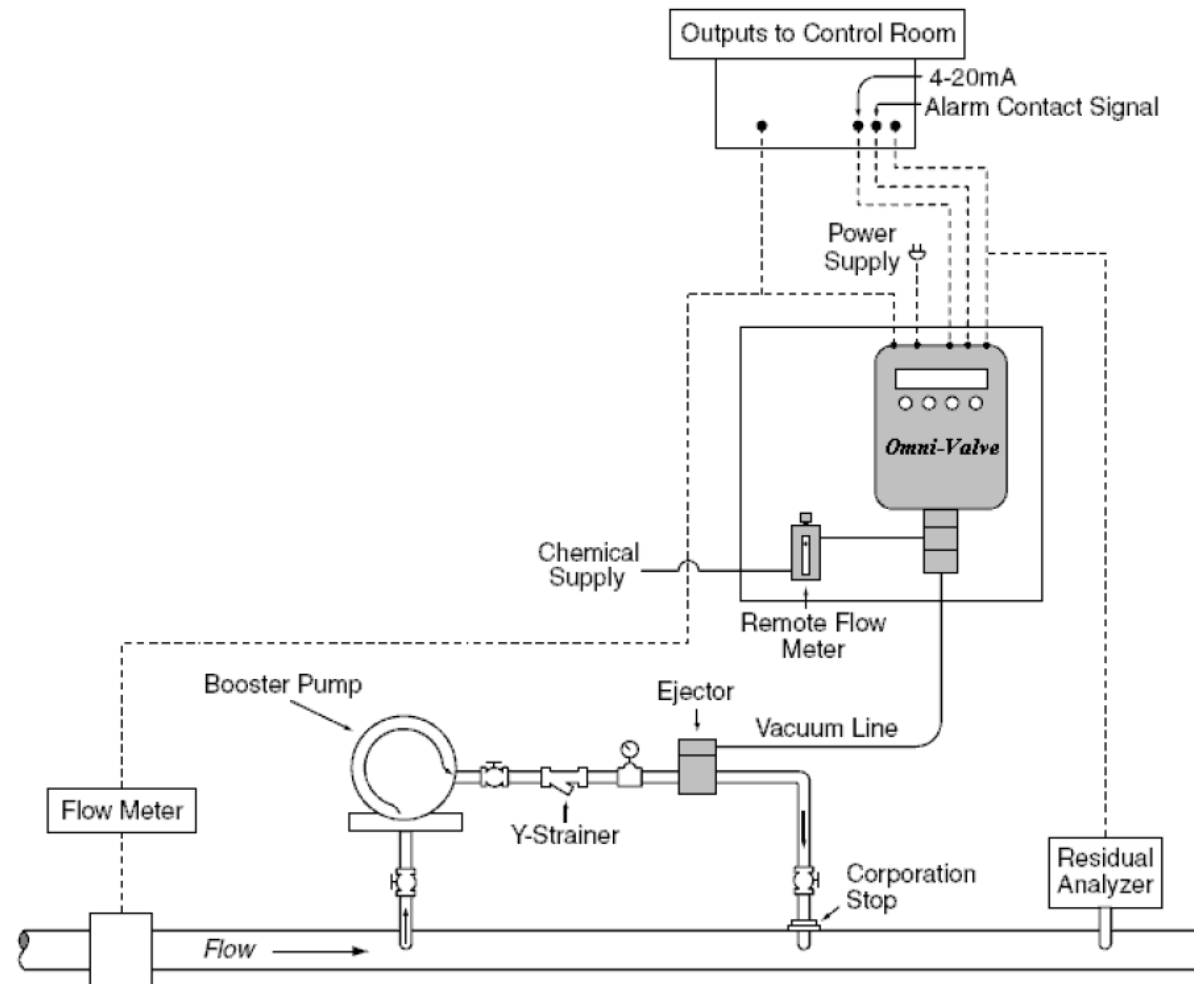
Mardi WTP Wyong Council

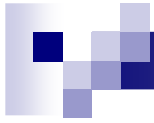




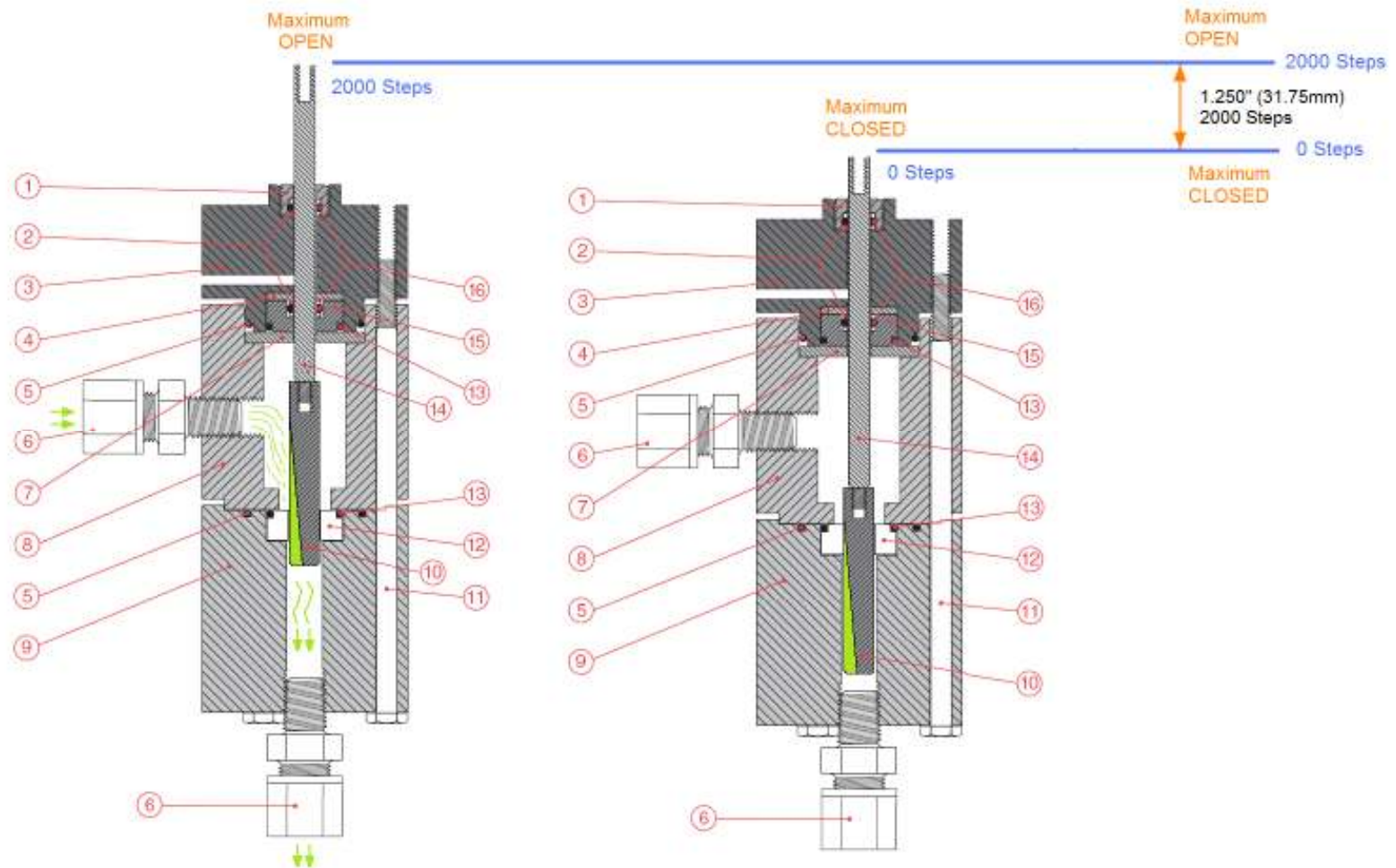
Drums on rails
Alternate is with overhead crane and lifting bar

Omni Valve





V-Notch Position



Installation

The rotameter and rate valve should be wall or panel mounted.

It is always advisable to have the ejector running before allowing gas into the vacuum regulators or the header. Ammonia solution should be used to check for leaks (leak forming a white cloud) whenever new cylinders or drums are connected.

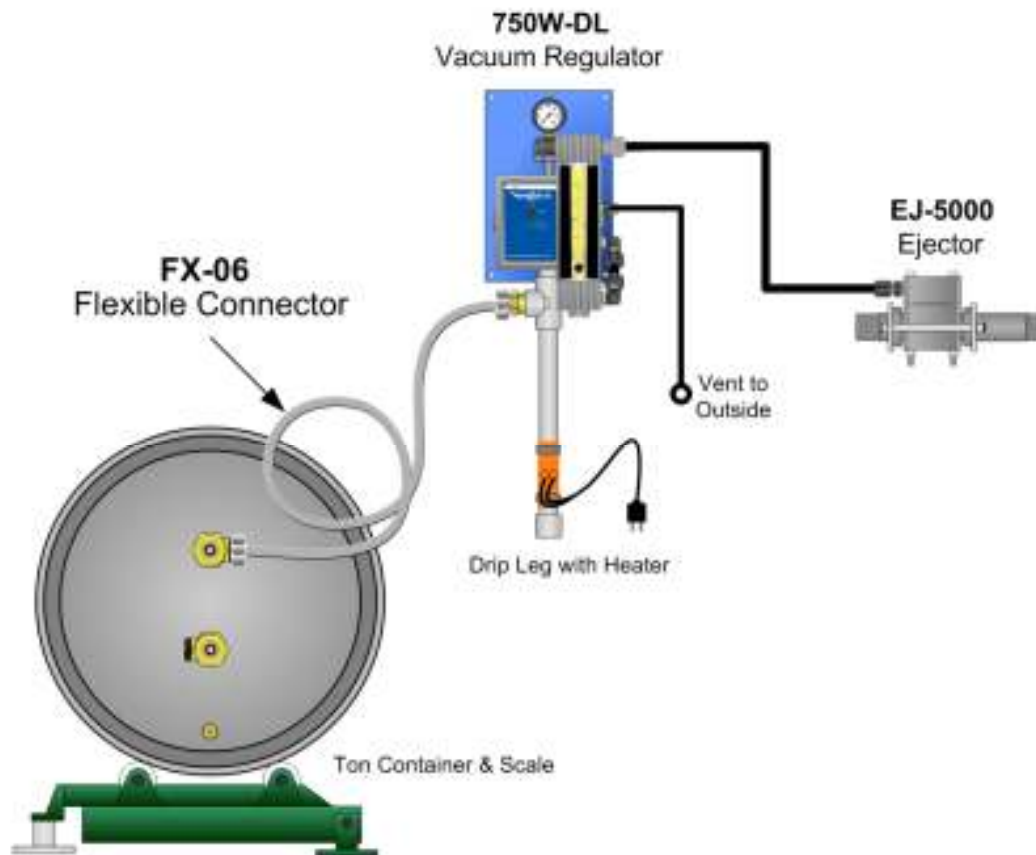
The valve on empty cylinder or drums must be fully closed to prevent moisture entry.

A tapping for a pressure gauge should be installed between the booster pump and the ejector to measure the back pressure and also to measure the water pressure to the ejector. The gauge can be removed after testing.

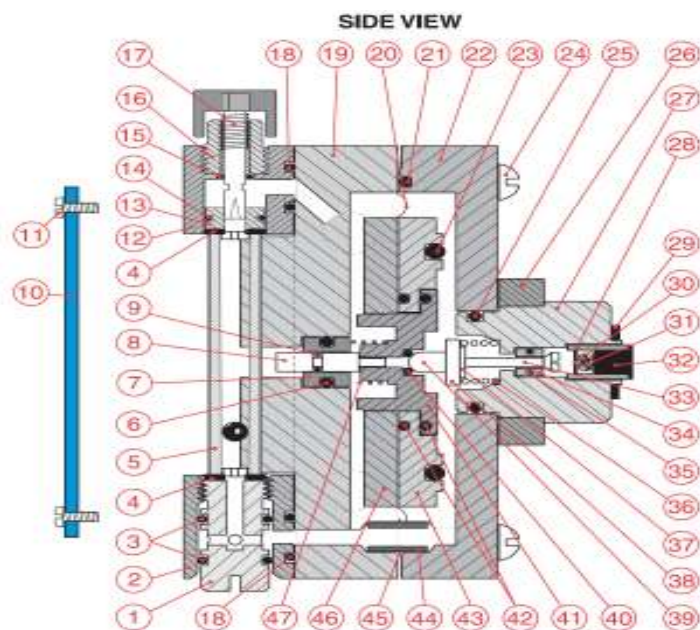
The injection point can be a withdrawable or fixed unit, both of which keep the chlorine solution away from the side walls of the pipe. The line between the ejector and the injection point must be in suitable plastic pipe and if a check valve is used it should be vertically mounted and without a spring. Also the pipe between the booster pump and ejector should be at least 2 meters long, (to stop highly chlorinated water seeping back to the pump)



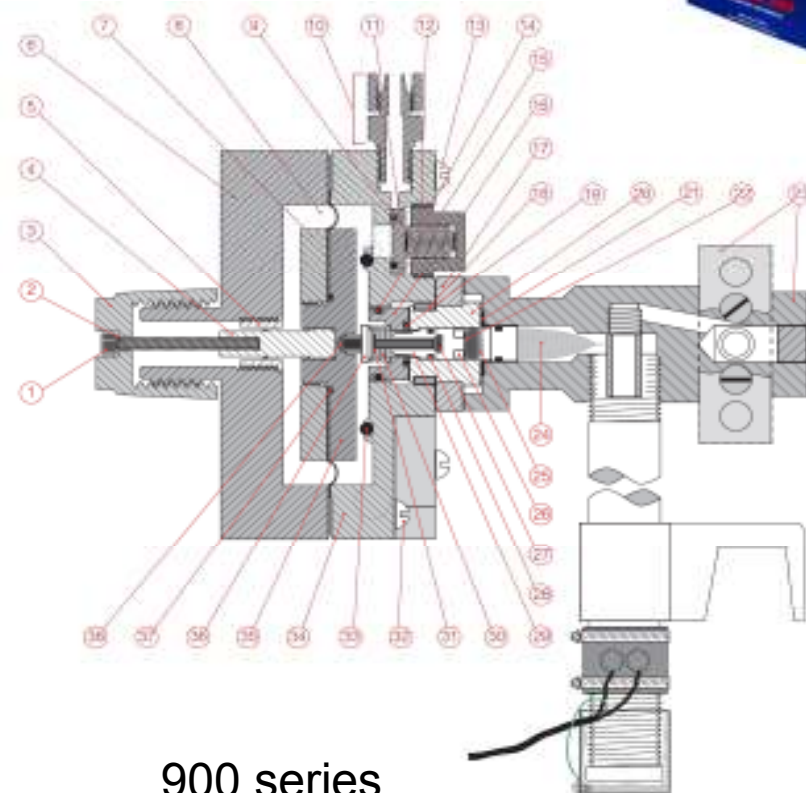
Note the two problems
Installation problem with the FX-06 flexible
No auxiliary valve on drum



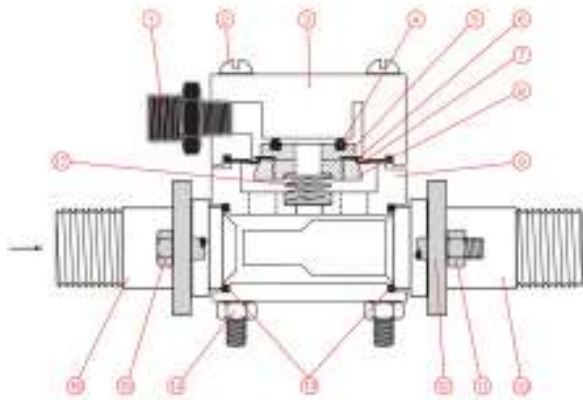
Vacuum Regulators



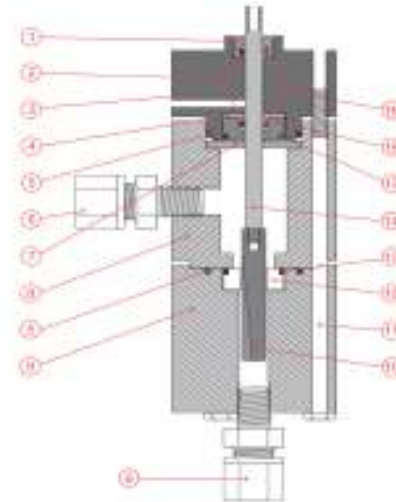
200, 500 & 700 series



900 series



900 series ejector



Omni-Valve



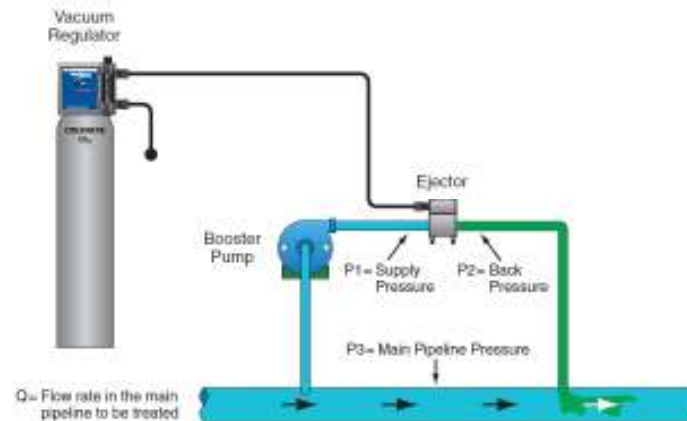
Rotameters



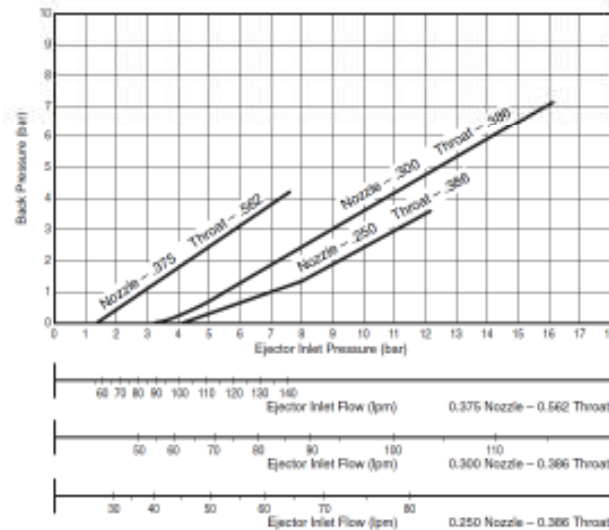
Leak Detector

Introduction:

Hydro Instruments offers a standard nozzle for each of our ejectors. However, we also offer alternate nozzle choices for each ejector. Each nozzle will have different operation requirements for water flow and pressure. Each installation will have different hydraulic conditions and the site specific conditions must be understood and considered when selecting the ejector and nozzle. A booster pump may or may not be required in order to operate the ejector.



NOZZLE SIZING CHART (10 kg/hr)





Vacuum Tubing and Piping

Gas Feed Rate	30 Meters.	60 Meters	90 Meters	150 Meters	300 Meters	450 Meters
1 kg/h	12x8	12x8	17x12	17x12	17x12	½" PVC
2 kg/h	12x8	17x12	½" PVC	½" PVC	¾"PVC	¾"PVC
5 kg/h	17x12	½"PVC	¾"PVC	¾"PVC	1" PVC	1" PVC
10 kg/h	½" PVC	¾"PVC	1" PVC	1" PVC	1-1/2" PVC	1-1/2" PVC
20 kg/h	1" PVC	1" PVC	1-1/2" PVC	1-1/2" PVC	1-1/2" PVC	1-1/2" PVC
40 kg/h	1" PVC	1-1/2" PVC	1-1/2" PVC	2" PVC	2" PVC	2" PVC
80 kg/h	1-1/2" PVC	1-1/2" PVC	2" PVC	2" PVC	2" PVC	3" PVC
120 kg/h	1-1/2" PVC	2" PVC	2" PVC	2" PVC	3" PVC	3" PVC



Digital Alarm Module:

NEMA 4X Enclosure	8" x 6" x 4"
Temperature Range	0°-50°C / 30°-122°F
Total Weight	7 lbs
Weight with Battery	9 lbs
Relays:	
Common AC Power Loss	5A SPDT
Common Sensor Failure	5A SPDT
Each Channel	
Low Alarm (Danger)	5A SPDT
High Alarm (Alarm)	5A DPDT
Audible Alarm	90dB
Power Requirement	120 V/240 V, 50/60 Hz
Power Consumption	20 W max.
Battery Back-Up (optional)	12 hours, 2.9 A•Hr, 12 VDC gel cell
External Acknowledge	Input Contact
Signal Output (optional)	RS232, 4-20 mA
Remote Acknowledge	Input Contact
Warranty	1 year limited

Note: Single and Dual sensor units will have a Low Alarm and High Alarm relay per sensor. Three and Four sensor units will only have a High Alarm relay per sensor.

Standard Gas Sensors:

Ammonia (NH ₃):	0-100 PPM
Chlorine (Cl ₂):	0-10 PPM
Chlorine Dioxide (ClO ₂):	0-10 PPM *
Ozone (O ₃):	0-10 PPM *
Sulfur Dioxide (SO ₂):	0-30 PPM
Hydrogen (H ₂):	0-200 PPM
Hydrogen Sulfide (H ₂ S):	0-100 PPM
Nitric Oxide (NO):	0-100 PPM *
Nitrogen Dioxide (NO ₂):	0-100 PPM
Oxygen (O ₂):	0-25%
Hydrogen Chloride (HCl):	0-10 PPM

*Note: Other ranges are available.
Consult the factory.*

Sensor:

Cable Type:	22 AWG shielded
Cable Length:	25 ft. std. (longer available)
Sensor Type:	Electrochemical
Includes shipping cap and calibration ports.	

Chlorine Leak Detector

Available with:

- Single Digital Sensor & Battery Back-up
- Dual Digital Sensors & Battery Back-up
- 4-20mA output **included** for up to 4 sensors
- Replacement Sensor Element only 0-10 ppm
- Replacement Sensor 1-10 ppm with enclosure

Features

- Up to 16 Digital Sensors of different types in any combination.
- Visual and audible alarm
- Individual sensor alarm relays
- Backlit Liquid Crystal Display (LCD).
- 12 Hour Battery Back-Up
- Isolated 4-20 mA Outputs.
- MODBUS communication
- Password Protection



ProGuard

Auto closing system for cylinders or drums. A regular check of the leak detector and the operation of the ProGuard including the battery backup of both units, should be undertaken. Cal hypo granules can be used to check the leak detector.

NB. Two types available

- a) Pneumatic
- b) Electric



Accessories



Filter C-282



1.8m FX-06 & 1.2m FX-04
Flexible connections
for Drums & Cylinders, Tested.



HTS-1
Twisted Spanner



AD



Vertical Header



Chlorine manifold
Inline Strainer RH-6786



1214-B1
Chlorine Valve
for Horizontal Header



Auxiliary valve with
clamp

Accessories

Solenoid operated Chlorine Gas Valve

This can be used in the following gas chlorination areas;

- a) Pulse duration in pools.
- b) Auto change over in combination with hi-low vacuum switch.
- c) Sequencing in combination with either of the following;

- 1) Weight
- 2) Pressure
- or 3) Flow

For more information consult Sydney office

To suit 12 x 8 tube, 17 x 12 tube or 15 mm (nominal) PVC Pipe for use with vacuum regulators up to 10kg/hr.

for 12 x 8 EVA tube P120309091-12

for 17 x 12 EVA tube P120309091-17

Can be supplied as shown or with 90 degree elbows top and bottom or any combination of these, please specify when ordering.

Includes 24v AC 50 Hz power supply with 3 pin plug.

Replacement valve (including solenoid) 120309091.

Note: Can be controlled:

- a) By a switched 240 volt GPO.
- b) Through a volt free remote contact.





Check Valves for Gas Chlorine

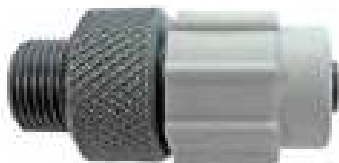
Bodies of PVDF (Kynar) and all wetted parts of PTFE

Description	Part No
Check Valve 1/4" FNPT 2,000 g/h	CHK-TFL-1/4
Check Valve 3/8" FNPT 5,000 g/h	CHK-TFL-3/8
Check Valve 1/2" FNPT 10,000 g/h	CHK-TFL-1/2
Adaptor 1/4" NPS M/M with O-Rings	PA24003231
Adaptor 3/8" NPS M/M with O-Rings	PA24003232
Adaptor 1/2" NPS M/M with O-Rings	PA24003233



Adaptors

15mm PVC Solvent Weld to 12 x 8 Tube
 15mm PVC Solvent Weld to 17 x 12 Tube
 15mm PVC Solvent Weld to 1/2" NPT



1/4" NPT O-Ring to 12 x 8 Tube
 3/8" NPT O-Ring to 12 x 8 Tube
 3/8" NPT O-Ring to 17 x 12 Tube
 1/2" NPT O-Ring to 17 x 12 Tube



Twin Bottle Scale & Control Unit

Drum scales also available



Special Notes

Filters should be cleaned or replaced as recommended.

Cylinders should be allowed to stand for some hours to allow impurities to settle before Cl_2 is withdrawn.

Always have spare teflon inlet valve available

Lead gaskets should only be used once, however may be reused with care.

It should be noted that all the Hydro O-rings are viton and have a life of some years.

It is not necessary to change these unless they appear damaged.

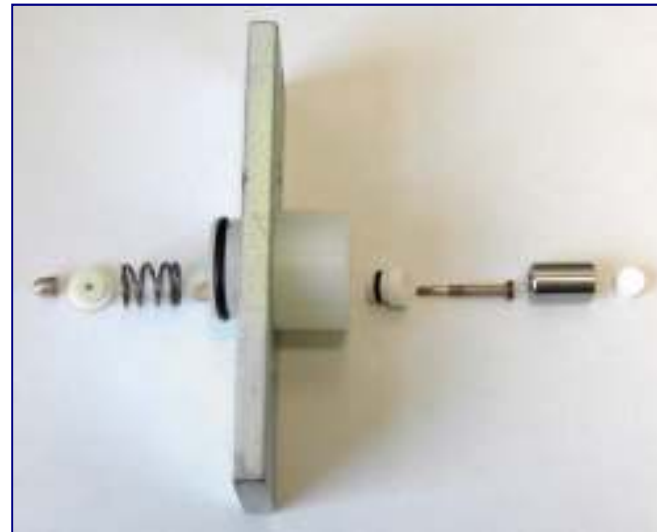
Ejector 'O' rings and seals should be replaced yearly.

Service

The most common problem is for the vacuum regulators to vent gas via the vent line to outside the plant room. It is a very simple procedure to clean the cl2 pressure to vacuum inlet valve which has a silver needle (this material is soft and requires care) seating into a Teflon seat. *Note: clean or replace seat as required*



900
Series



500
Series

When taken out of service, headers etc. must be sealed up **immediately** as corrosion starts within seconds.

Vacuum regulators that have drip legs **must** be sealed quickly. Vacuum regulators without drip legs should be sealed if to be transported



Service in most cases can be carried out on site by client or PFC provided an easy to follow set of instructions is available. Spare Teflon seats for all vacuum regulators should be carried or kept by client.



August 15, 2012

Proper Cleaning of Gas Chlorination Components

To ensure the longevity of your Hydro Instruments product(s) we recommend that they be routinely checked for cleaning and replacement of worn or damaged parts.

When servicing your Hydro Instruments gas chlorination equipment you may find it necessary to clean parts due to chemical precipitants or accumulation of some other foreign matter. When this circumstance presents itself please follow these guidelines to make sure those parts do not become damaged or disfigured:

1. Only use mild solvents such as: Soap & Water, Aqueous acid or Isopropyl alcohol.

NOTE: Never use harsh chemicals that can attack the material it's being used on. For example: Do not use acetone or cleaning agents containing acetone on plastic or rubber.

2. Use a soft, nonabrasive cloth to wipe away the accumulation of debris or chemical build up. This is especially true for parts that require a smooth surface to seal properly (i.e. the inlet valve stem or rate adjustment valve).
3. Make sure to only use new O-rings and gaskets when putting the product back together. Worn or compromised seals can be a hazard.

IMPORTANT: SOME CLEANING AGENTS MAY BE DANGEROUS IF MIXED TOGETHER OR MAY HAVE A REACTION WITH THE CHEMICAL THE PRODUCT IS USED TO FEED. ALWAYS MAKE SURE THAT PARTS ARE COMPLETELY CLEAN AND DRY BEFORE REASSEMBLY AND PUTTING THE PRODUCT BACK INTO USE.

