hydro

The most durable gas chlorination equipment on the market…

PRODUCT CATALOG

HIGHEST QUALITY
FAST SERVICE
COMPLETE LINE

ProMinent®

CE

ISO 9001 Compliant

hydro INSTRUMENTS

Rev. 3/01

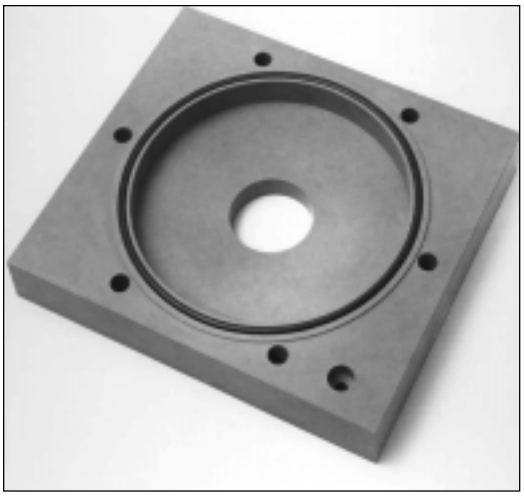
Principle of Operation

The purpose of the vacuum regulator is to reduce the gas pressure to a vacuum and ensure that it remains at a vacuum under all conditions. Gas pressure is reduced to a vacuum at the spring loaded, normally closed safety inlet valve. This valve is opened by the spring-opposed regulating diaphragm assembly, only when a vacuum is present inside the regulator. The vacuum is created by the Venturi nozzle in the ***Hydro*** ejector. Loss of vacuum in the regulator for any reason will cause the safety inlet valve to close, stopping the flow of gas into the system. In the event of leakage at the inlet safety valve the regulator is designed to allow the gas to exit through a separate vent line to a safe area, while not allowing a significant pressure to build up inside the ***Hydro*** equipment.

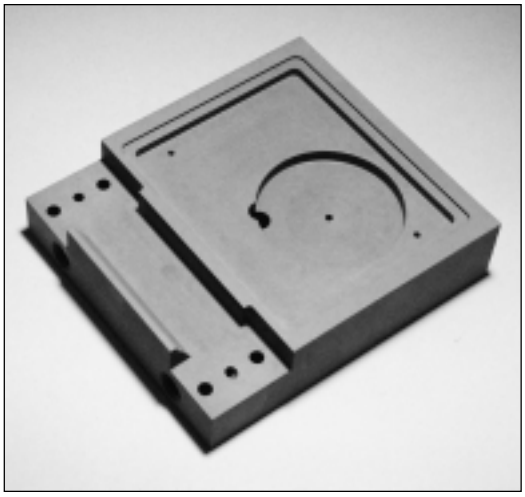
Superior Design

Our chlorinator is solid — ***Hydro*** machines parts from solid stock of only the finest materials. Parts are designed with generous wall thickness to prevent the cracking and warping common among our competitors' units. You can see and feel the difference with ***Hydro.***

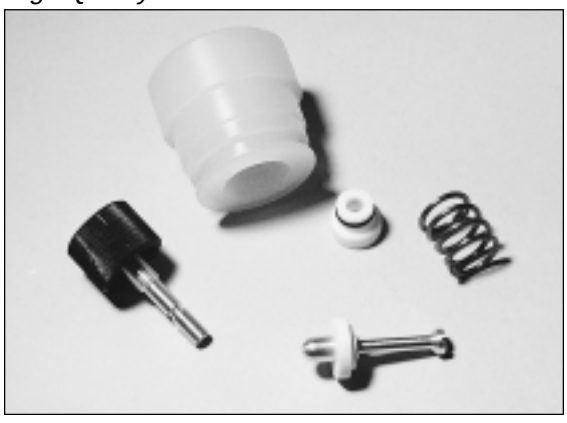
Chlorinator Back Body



Chlorinator Front Body



High Quality Parts



Capacities Available:

Chlorine and Sulfur Dioxide systems available in:

1.5, 4, 10, 25, 50, 100, 200, 250, 500, 1000 & 2000 PPD or 75, 200, 500 gr/hr; 1, 2, 4, 5, 10, 20, & 40 kg/hr.

Sizing should be based on maximum possible flow:

Imperial Units: (GPM) Flow x 0.012 x (PPM) Dosage = (PPD) Feed

Metric Units: (LPM) Flow x 0.060 x (PPM) Dosage = (gr/hr) Feed

Example:

Max Flow = 40,000 GPM Max Dosage = 3 PPM

40,000 GPM x 0.012 x 3 PPM = 1,440 PPD

Requires 2,000 PPD system.

Simplicity

Hydro equipment is designed with safety and simplicity as the paramount concerns. ***Hydro*** vacuum regulators have the fewest parts of all brands. ***Hydro*** systems are designed to use the least equipment required because excess equipment makes operation and maintenance more complex and therefore less reliable.

Convenience

Hydro values convenience for the operators. This is why we manufacture yoke bolts to the same head size as the standard cylinder valve heads. This allows the operator to use the popular Superior 635x3 twisted cylinder wrench for both the chlorinator and the cylinder. ***Hydro*** also supplies these wrenches with each vacuum regulator.

Model 500 Chlorinator with Superior wrench

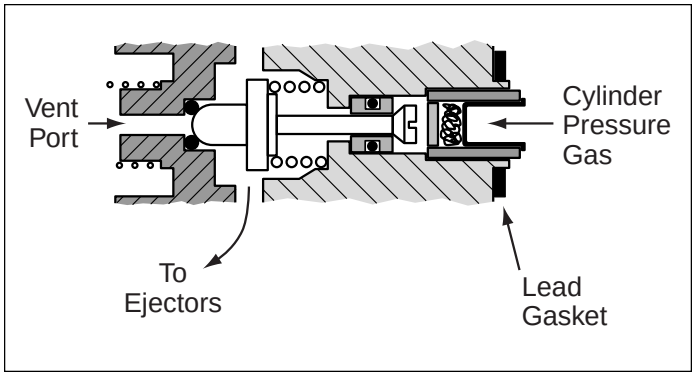
Model 500 Chlorinator

Direct Cylinder or Wall Mounting

Unique Design for Safety

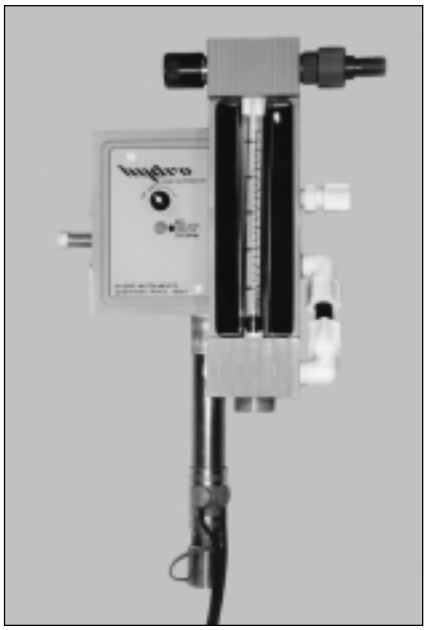
The most critical area of any vacuum regulator is the inlet safety valve assembly. Pressurized gas will always exist between the cylinder valve and the inlet valve. ***Hydro has the only unit that does not rely on any O-Rings to prevent this pressurized gas from leaking into the chlorine room!***

No Pressure Leak Path to the Room
Simple Design



Note: *Any leak will go to vent.*

Model 700 Chlorinator



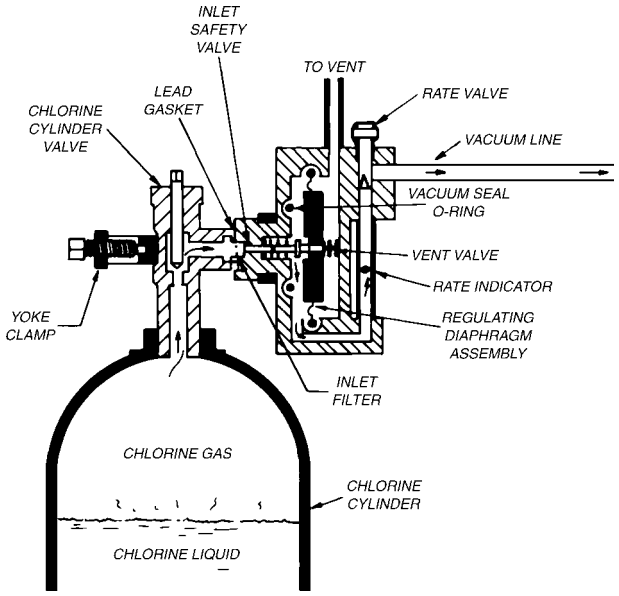
Direct Ton Cylinder Mounting

Direct Cylinder Mounting

The safest configuration is to mount the ***Hydro*** Vacuum Regulator directly to the valve on the gas cylinder. The use of pressurized manifolds should be avoided when possible because these manifolds present the possibility of a pressurized leak. If high feed rates require the use of more than one cylinder simultaneously, see the following page for a discussion of manifold systems.

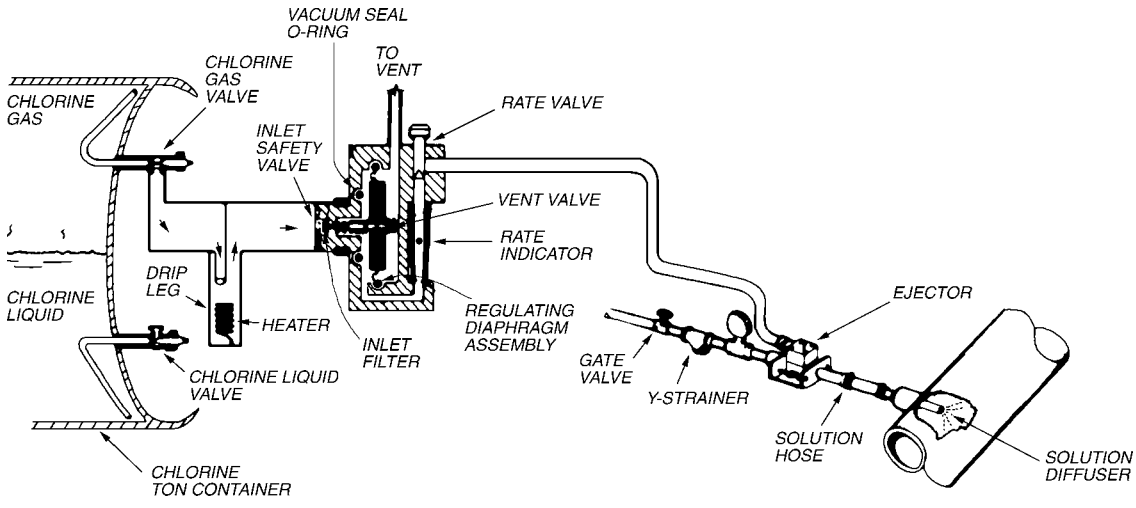
Upright Cylinder Mounting

This is the safest and most simple configuration for upright cylinders. The vacuum regulator is directly mounted on the cylinder valve. (See below)



Ton Cylinder Mounting

This configuration allows the safety of an all vacuum system for withdrawal rates of up to approximately 500 PPD (10 kg/hr). The direct ton cylinder mounting yoke incorporates a Monel drip leg and 25 watt heater to evaporate any liquid. The ***Hydro*** ton yoke includes an effective silver screen filter and only a single clamp seal at the cylinder valve. (See below)



Withdrawal Rate Limitations

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. The limitation varies with temperature, with the above estimates holding at 68˚F (20˚C). (Those estimates are per cylinder.) ***Note:*** *For short periods of time this limit can be greatly exceeded.*

Temperature Limitation

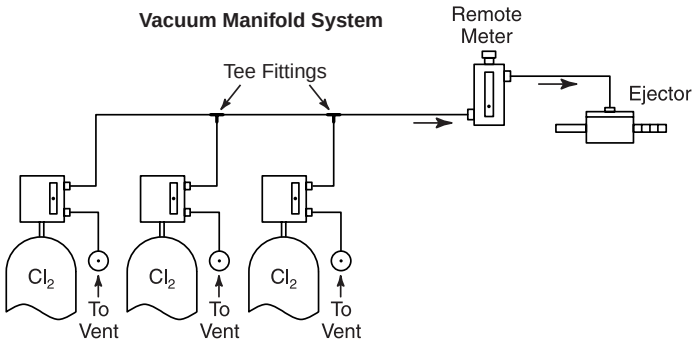
The pressure inside the cylinder is directly related to the cylinder temperature. As the temperature drops so does the pressure. If the pressure becomes too low vacuum regulators will eventually fail to operate. This occurs at a temperature of approximately 20˚F (-7˚C). ***Hydro*** recommends that cylinders be maintained at a minimum of 40˚F (5˚C) for proper operation. ***Hydro does not recommend directly heating the cylinders.*** Chlorine will combust with the cylinder walls at approximately 450˚F. Care must be taken to avoid heat concentration on cylinders.

Manifold Systems

As the gas feed rate is increased it becomes more convenient and eventually necessary to withdraw gas from more than one cylinder simultaneously. The safe way to do this is by mounting a vacuum regulator on each cylinder and feeding them all together into a Vacuum Manifold. The alternative is to use a pressurized manifold system.

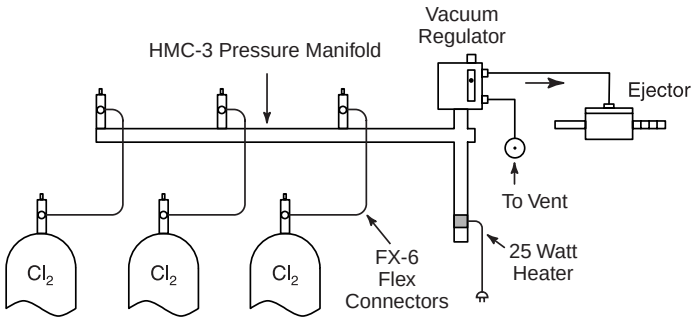
Vacuum Manifolds

This configuration brings the safety of the truly, all vacuum system to higher feed rates. The entire reasoning for the vacuum regulator design is that if there is a failure anywhere in the system it will not lead to a pressurized gas leak. ***Hydro*** keeps some vacuum manifolds in stock and also makes custom designs. However, a simple vacuum manifold can easily be created with tee fittings in the vacuum tubing.



Pressure Manifolds

Hydro Instruments makes no warranties of any kind for pressure manifolds. If these manifolds are not carefully monitored and periodically replaced, in time, the chlorine or sulfur dioxide will corrode through the pressurized pipes and flexible connectors and cause a pressurized leak. A system using such a manifold is not all vacuum and is significantly less safe than a comparable system with a vacuum manifold. ***Hydro*** does make two lines of pressure manifolds for stock and will also produce them for custom designs. ***Hydro*** also has a complete line of valves & accessories.

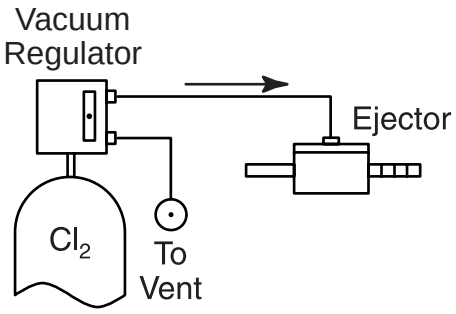


Modular Systems

Hydro gas chlorination equipment is designed to allow flexibility to form a variety of system configurations.

Single Cylinder Withdrawal

The most simple system includes one cylinder mounted vacuum regulator and one ejector. This provides withdrawal from one cylinder and one injection point.

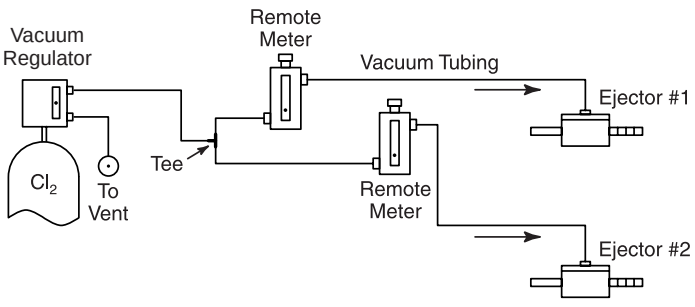


Multiple Cylinder Withdrawal

In the above systems, each vacuum regulator can be replaced by a vacuum or pressure manifold (see Manifold Systems).

Multiple Injection Points

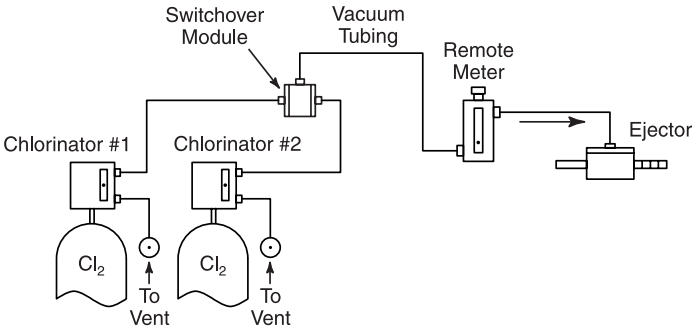
To have two or more injection points with the above systems, each feed point must have a remote flow meter and an ejector. The vacuum line is simply split with a tee to each injection point.

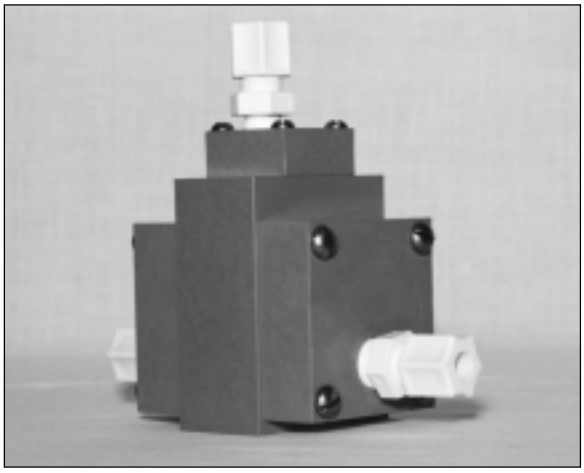


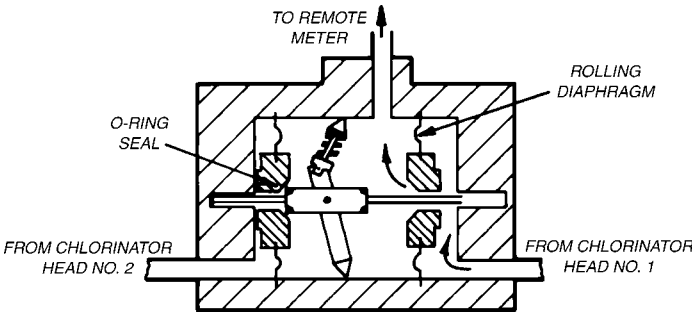
Automatic Switchover Systems

Hydro manufactures purely mechanical, vacuum operated switchover devices to cover the range up to 2,000 PPD (40kg/hr). The device will feed from one side until the cylinders become depleted causing the vacuum level to rise in the line. This increase in vacuum causes the device to switch to feed from the other side.

Safety Note: Unlike automatic switchover chlorinator systems, this design does not compromise the safety of the two port vacuum regulator design.





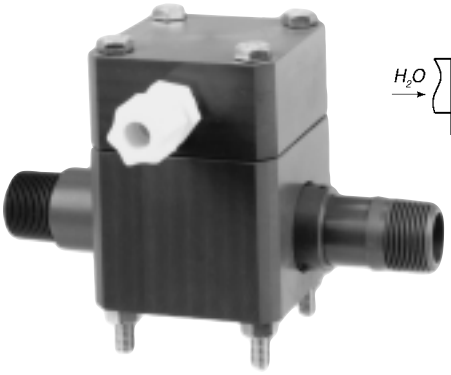


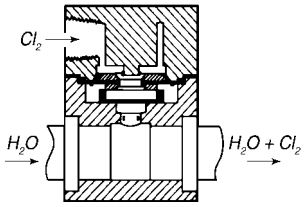
Principle of Operation

The ***Hydro*** ejector incorporates a Venturi nozzle to create the vacuum required to operate the vacuum regulators. Water is accelerated as it flows through the Venturi causing the pressure to fall to a high vacuum level. The pressure at the exit of the ejector is referred to as the back pressure. A range of nozzles are available to cover the gas feed range.

Simple, Durable Design

The ***Hydro*** ejector includes very few parts and is designed for simple repairs. Parts are machined from solid stock with heavy wall thickness for maximum reliability.





Requirements

For each installation there will be a maximum gas feed rate and a maximum water pressure that the ejector must work against. These two values must be provided in order to select the appropriate Venturi nozzle and in turn, to determine the required water supply pressure and flow rate. Nozzle performance charts are available from ***Hydro Instruments.***

Maximum Operating Pressures

The standard maximum operating back pressure is 100 psi (7 kg/cm2). A high pressure option is available to 300 psi (21 kg/cm2).

Available Diffusers

Hydro Instruments manufactures a variety of solution line diffusers with threaded and hose connections. ***Hydro*** also manufactures custom diffusers.

Backflow Protection

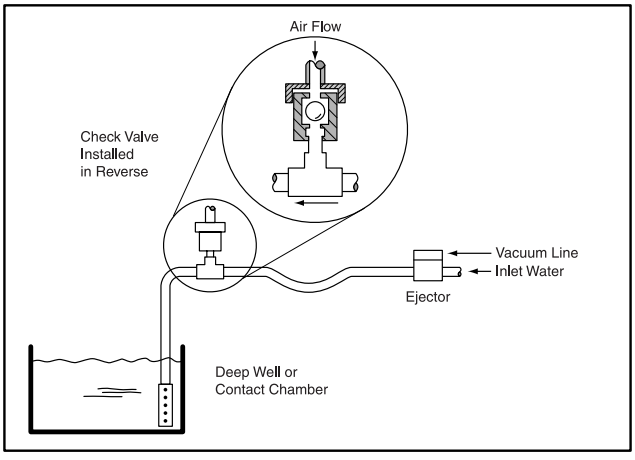
A spring loaded, normally closed check valve is incorporated in the ***Hydro*** ejector to prevent water from entering the gas handling equipment. This check valve will remain closed unless a vacuum is present inside the ejector. If two methods of backflow protection are desired, ***Hydro*** recommends the use of an additional external ball check valve.

Safety Note on Solution Lines

The line exiting the ejector contains a highly concentrated solution of both dissolved and gaseous Cl_2 or SO_2. These lines are also often pressurized. Solution lines present the possibility of a pressurized leak and should be minimized or eliminated for this reason.

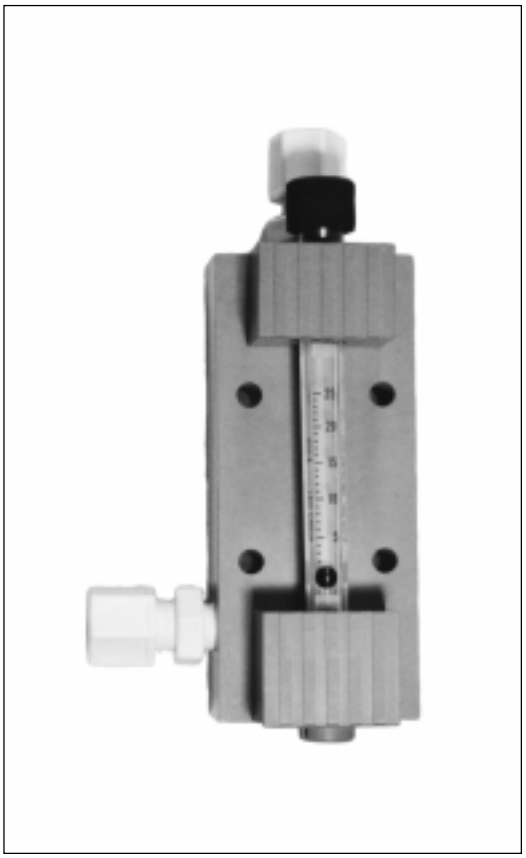
Anti-Siphon Consideration

In installations where a siphon could be created in the ejector piping, a siphon breaker should be installed in the line to prevent this from occurring. It is important to understand that such a siphon can create sufficient vacuum to operate the vacuum regulator and draw gas into the system.



Manual Feed Rate Control

The systems described above are purely mechanical and use manual feed rate control. Feed rate is monitored using a variable area flow meter tube. Feed rate control is effected by manually adjusting a variable area orifice rate valve. For systems up to 200 PPD our rate valves are the V-Notch type, while for higher capacity equipment ***Hydro*** uses a seatless rate valve design. In all cases, ***Hydro*** uses a solid silver rate valve with a Teflon seat.



Automatic Control

Hydro Autovalve CE

Description

The manual ***Hydro*** gas chlorination and sulfonation equipment can be automated by connecting a ***Hydro*** Autovalve in the vacuum tubing to the ejector. Existing systems can easily be automated with the addition of a ***Hydro*** Autovalve.

Application

For automated control of chlorine or sulfur dioxide feed rate. Control feed rate with the signal from a Flow Meter, Residual/ORP, or Compound Loop Control with both Flow and Residual/ORP.

Physical Design

Hydro Autovalve carries the CE Mark. Enclosure is NEMA 4X rated. Microprocessor based controller is operated via keypad and alphanumeric, 2 line, 20 character, vacuum fluorescent display. Motion control is effected via a stepper motor and feed back potentiometer.

Operation & Control

Software offers flexibility and understandable options. Linearization can easily be carried out in the field.

SAFETY EQUIPMENT FROM HYDRO

Gas Leak Detectors

Chlorine, Sulfur Dioxide, Ammonia, Ozone, Hydrogen, and many other gases. ***Hydro Instruments*** is your source for a simple, reliable, and complete line of gas detection equipment.

Gas Masks & SCBAs

Self Contained Breathing Apparatus and canister type gas masks. ***Hydro Instruments*** carries a variety of high quality respiratory protection devices.

Pressure/Vacuum Gauges & Alarms

Water pressure gauges to diaphragm protected vacuum gauges for chlorine gas. High/Low Vacuum Alarms for chlorine lines are also available.

Emergency Repair Kits

Hydro carries Chlorine Institute emergency repair kits for ton or 150 lbs. (68 kg) cylinders.

Emergency Shut off Systems

Hydro handles emergency shut off systems for chlorine or sulfur dioxide systems. Shut your cylinder valves quickly and automatically in the event of a leak.

ACCESSORY EQUIPMENT FROM HYDRO

Cylinder Scales

Hydro handles mechanical, electronic, and hydraulic scales for 150 lbs. (68 kg) as well as ton chlorine or sulfur dioxide cylinders. Talk to ***Hydro*** about what scale fits your requirements the best.

Booster Pumps

Hydro will be pleased to help you size and select the booster pump that is optimum for your installation. We carry a variety of booster pumps to meet your individual requirements.

Handling Accessories

Chemical cylinders: ton and upright
Lifting bars
Roller trunnions
Cylinder valves, wrenches, and yoke adapters
Flexible connectors and manifolds
Chlorine manifold filters
Corporation stops & solution diffusers

Chlorine Residual Analyzers

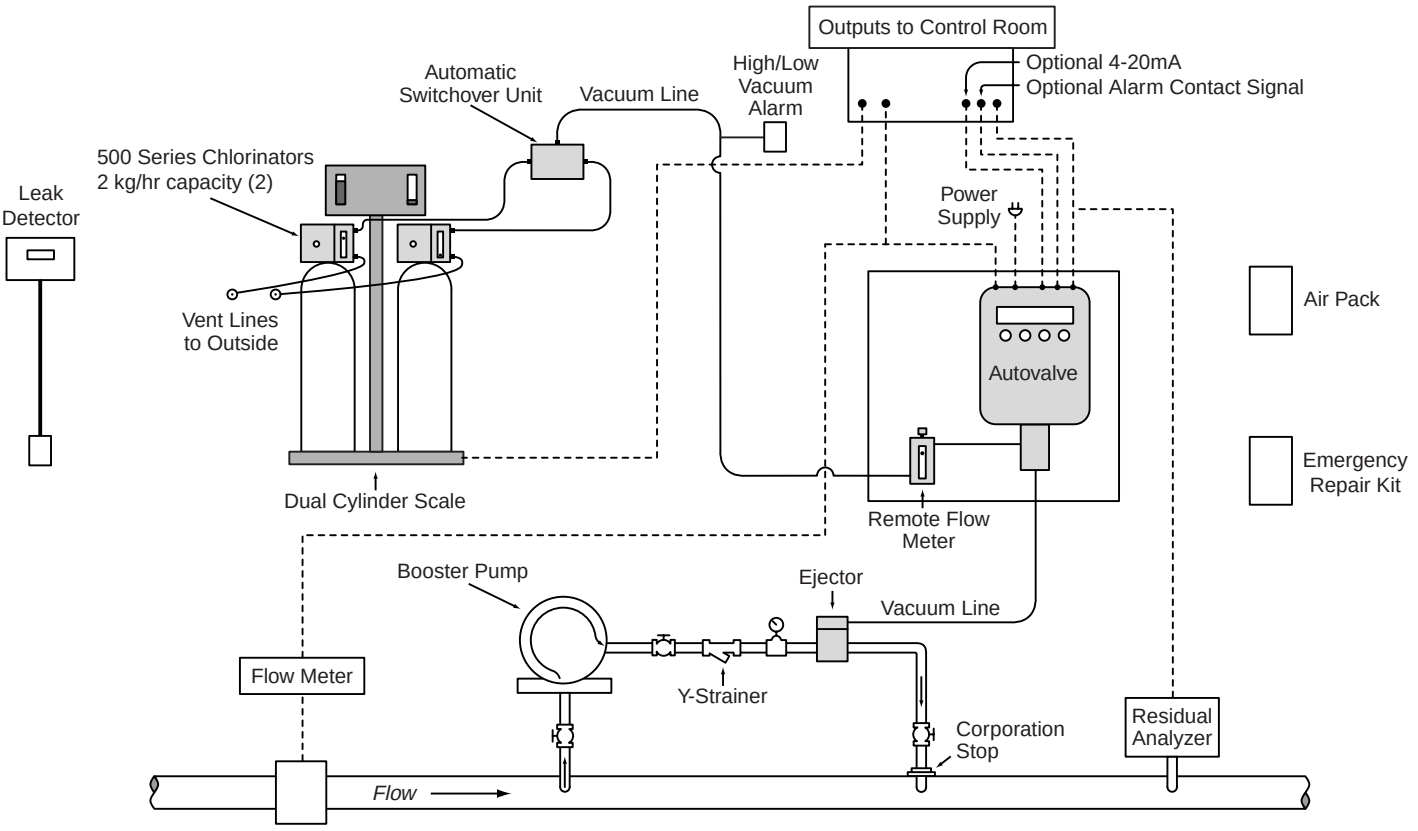
Hydro carries a variety of chlorine analyzers.

Chlorine Test Kits

Hydro also supplies a range of chemical test kits.

Recommended Installation

Model 502 (50 PPD or 1 kg/hr) with CLC control system



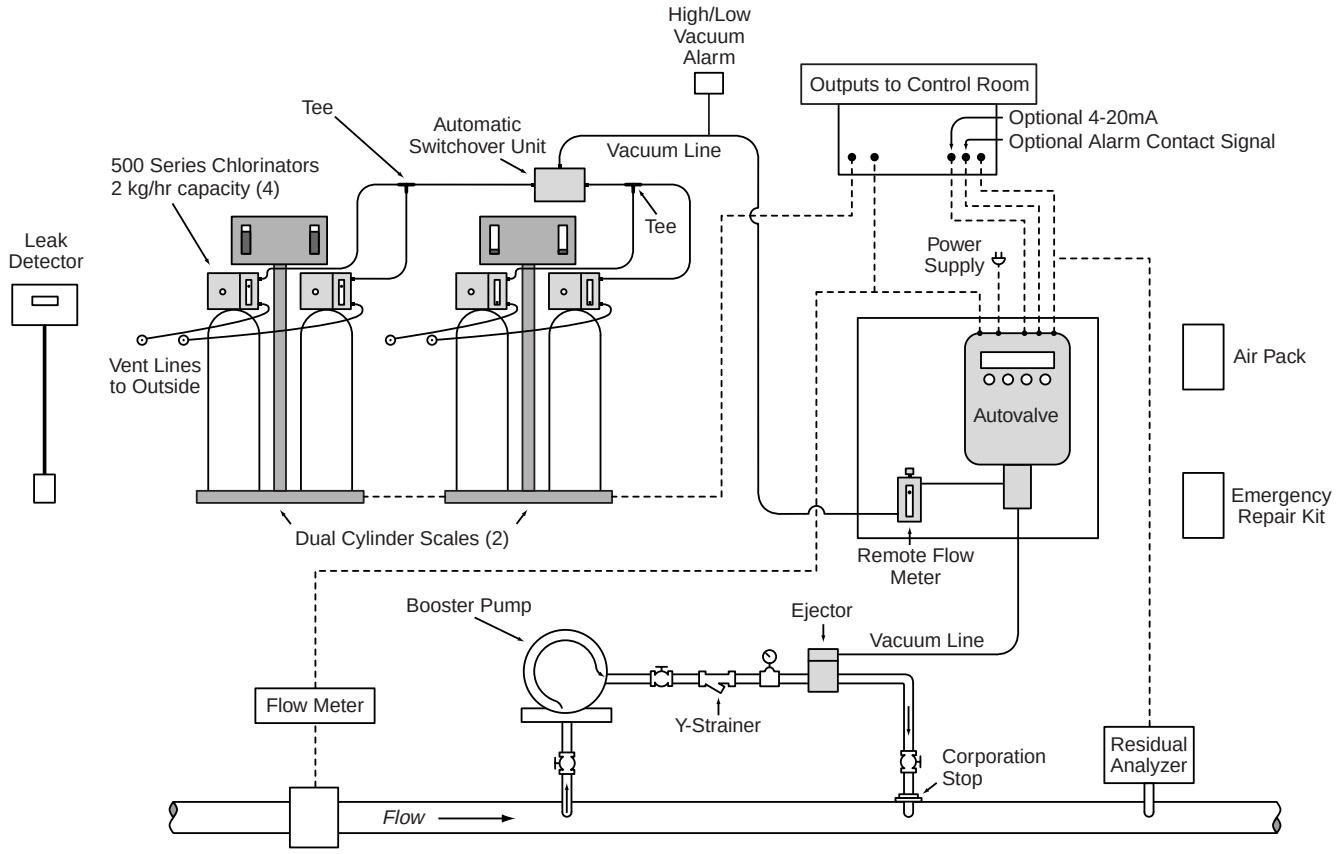
Hydro is your complete source for gas chlorination and sulfonation systems. Above we show the ***Hydro Instruments*** recommended installation for up to 50 PPD (1 kg/hr) with Compound Loop Control.

- **Gas Chlorination Equipment**
- **Automatic Pacing Valve (Compound Loop for Flow and Res/ORP)**
- **Cylinder Scales**
- **Leak Detectors**
- **Air Packs and Gas Masks**
- **Emergency Repair Kits**
- **High/Low Vacuum Alarms**
- **Residual Analyzer**
- **Booster Pump**

Note for Engineers:
Specifications are available from Hydro for a variety of Gas Chlorination and De-Chlor systems. Call or e-mail for a copy.

Recommended Installation

Model 504 (100 PPD or 2 kg/hr) with CLC control system



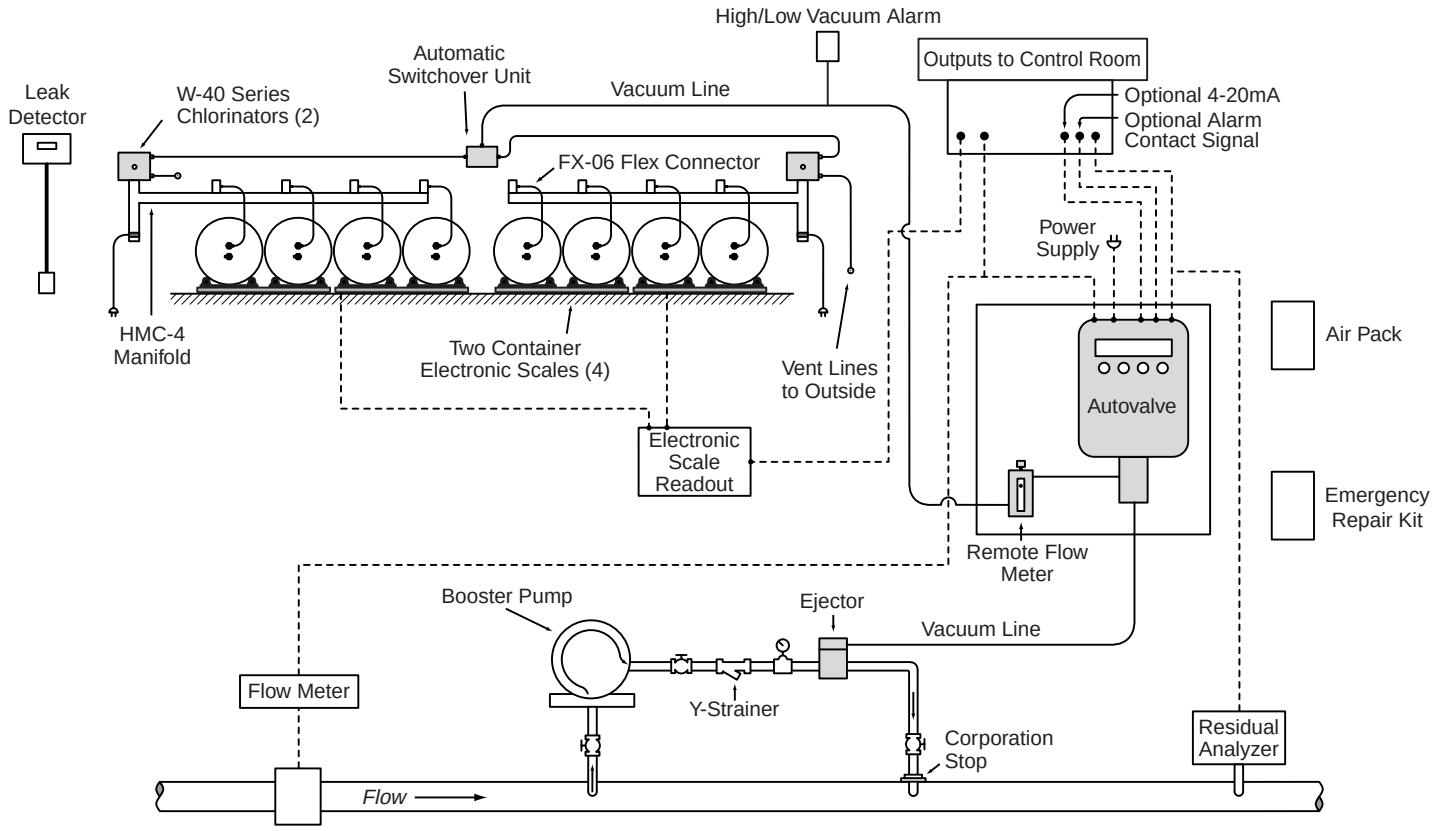
Hydro is your complete source for gas chlorination and sulfonation systems. Above we show the ***Hydro Instruments*** recommended installation for up to 100 PPD (2 kg/hr) with Compound Loop Control.

- **Gas Chlorination Equipment**
- **Automatic Pacing Valve (Compound Loop for Flow and Res/ORP)**
- **Cylinder Scales**
- **Leak Detectors**
- **Air Packs and Gas Masks**
- **Emergency Repair Kits**
- **High/Low Vacuum Alarms**
- **Residual Analyzer**
- **Booster Pump**

Note for Engineers:
Specifications are available from Hydro for a variety of Gas Chlorination and De-Chlor systems. Call or e-mail for a copy.

Standard Installation

Model W-42 (2000 PPD or 40 kg/hr) with CLC control system



Hydro is your complete source for gas chlorination and sulfonation systems. Above we show the ***Hydro Instruments*** standard installation for 2000 PPD (40 kg/hr) with Compound Loop Control.

- **Gas Chlorination Equipment**
- **Automatic Pacing Valve (Compound Loop for Flow and Res/ORP)**
- **Cylinder Scales**
- **Leak Detectors**
- **Air Packs and Gas Masks**
- **Emergency Repair Kits**
- **High/Low Vacuum Alarms**
- **Residual Analyzer**
- **Booster Pump**

Note for Engineers:
Specifications are available from Hydro for a variety of Gas Chlorination and De-Chlor systems. Call or e-mail for a copy.

LIQUID CHLORINATION SYSTEM

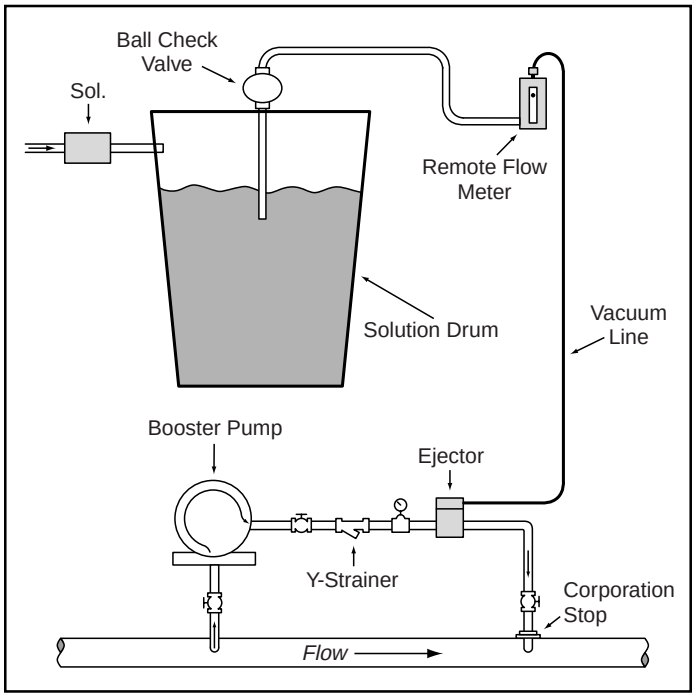
Feed hypochlorite or sodium fluoride solutions with a durable, simple and reliable ***Hydro Instruments Liquid Feed System.*** The equipment has been proven through 22 years of use in gas chlorination and sulfonation. Purely mechanical equipment and a minimal number of ruggedly designed parts assures durability, easy operation, and simplicity of repairs.

Operation

Water flow supplied to the venturi nozzle in the ***Hydro*** Ejector creates a vacuum which draws the liquid chlorine solution from the chemical storage drum. Solution feed rate is visually monitored and manually controlled by the rotameter type ***Hydro*** Remote Liquid Flow Meter with a silver V-notch rate valve in a Teflon seat. Creation of the vacuum is required to open the spring-opposed, positive shutoff check valve in the ***Hydro*** Ejector. This prevents backflow of water into the storage drum. A PVC ball check valve with Viton seals is added as a second mechanism to prevent backflow of water into the storage tank.

Safety

The ***Hydro Instruments*** Liquid Feed Systems offer the all vacuum design to the injection of liquid chlorine and fluorine solutions. Metering pumps pressurize the concentrated solution lines before the point of injection, which presents



the possibility of a solution leak. The ***Hydro*** system draws the solution through the lines under vacuum.

10 GPH Solution Feed Ejector Requirements

Hydro Nozzle #	Pressure (psi)	Back Press. (psi)	Water Flow (gph)
3	7	0	1.5
3	11	5	1.6
3	22	10	2.2
3	29	15	2.3
3	35	20	2.4
3	41	25	2.5
3	47	30	2.6
3	55	35	2.7
3	61	40	2.8

ISO 9001 Compliant

Simplicity

Feed rate is clearly indicated on the rotameter tube and controlled by turning the manual variable area orifice rate valve.

Durability

These components have been proven through 22 years of use in the chlorine gas industry. Only the finest materials are used and parts are designed for maximum durability.

Switching from a Gas System?

Switching from a chlorine gas system couldn't be easier. The existing ejector, booster pump, and injection plumbing is kept in place and the vacuum regulators are simply replaced with an inexpensive ***Hydro Instruments*** Remote Liquid Flow Meter.

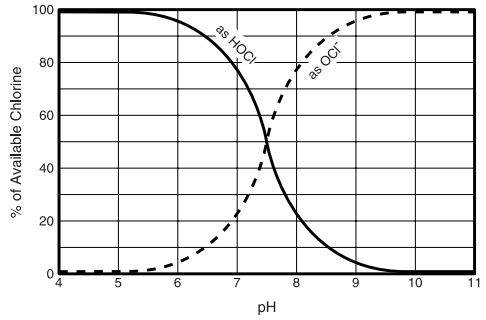
Formation of Free Residual Chlorine

- HOCl and OCl^- make up free chlorine residual.

$$Cl_2 + H_2O = HOCl + H^+ + Cl^-$$

- Hypochlorite Ion (OCl^-) and Hypochlorous Acid (HOCl).
- HOCl 80 times stronger bacteriocide than OCl^-.
- Concentration dependent on pH of water as shown below.

$$HOCl \leftrightarrows OCl^- + H^+$$



⇒ Result: As pH is reduced from 9 to 6 the free chlorine residual becomes ~80 times more effective as a bacteriocide.

Chlorine and Ammonia (NH_3) (Combined Residual)

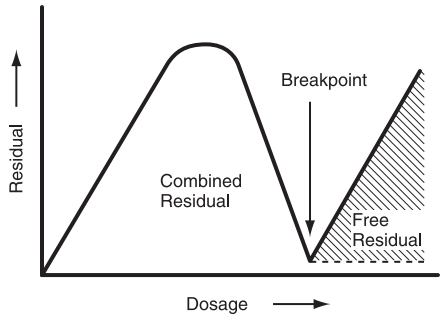
Free residual quickly reacts with ammonia to form combined residual. Possible reactions forming combined chlorine residual:

$NH_3 + HOCl \rightarrow H_2O + NH_2Cl$ (Monochloramine)

$NH_3 + 2HOCl \rightarrow 2H_2O + NHCl_2$ (Dichloramine)

$NH_3 + 3HOCl \rightarrow 3H_2O + NCl_3$ (Nitrogen Trichloride)

Breakpoint chlorination: The breakpoint is reached when all ammonia has been reacted into combined residual and further dosing with chlorine will result in the formation of free residual.



Dechlorination with Sulfur Dioxide (SO_2)

$SO_2 + H_2O \rightarrow H_2SO_3$ (forms Sulfurous Acid)

(Free)
$HOCl + H_2SO_3 \rightarrow HCl + H_2SO_4$

(Monochloramine)
$NH_2Cl + H_2SO_3 + H_2O \rightarrow NH_4Cl + H_2SO_4$

(Dichloramine)
$NHCl_2 + 2H_2SO_3 + 2H_2O \rightarrow NH_4Cl + HCl + 2H_2SO_4$

(Nitrogen Trichloride)
$NCl_3 + 3H_2SO_3 + 3H_2O \rightarrow NH_4Cl + 2HCl + 3H_2SO_4$

Vapor Pressure of Liquid Chlorine

(cylinder pressure vs. temperature)

Temperature		Pressure	
°F	°C	Psig	kg/cm²
-29.29	-34.05	0	0
-10	-23.33	8.29	0.57
0	-17.78	13.81	0.95
20	-6.67	27.84	1.92
40	4.44	46.58	3.21
60	15.56	70.91	4.89
80	26.67	101.76	7.02
100	37.78	140.20	9.67
120	48.89	186.95	12.89
140	60.0	243.33	16.78
160	71.11	310.35	21.40
180	82.22	389.17	26.84
200	93.33	480.97	33.17
220	104.44	587.13	40.49

Dosage

The amount of chlorine put into water or sewage – expressed in parts per million (PPM) or milligrams per liter (mg/L).

Demand

The amount of chlorine required to react with the organic and inorganic substances and to kill the bacteria contained in the water supply.

Effluent

The liquid discharge of a treatment plant or of a piece of equipment or tank within the plant.

B.O.D.

Biochemical Oxygen Demand, referring to the required amount of oxygen necessary for the chemical and biological oxidation of waterborne substances in a specific time, under specific conditions.

PPD

Pounds Per Day, referred to pounds of chlorine per day required to do a specific job (expressed in the metric system as Grams Per Hour = gr/hr, referring to the grams of chlorine per hour required to do a specific job).

PPM

Parts Per Million, referring to pounds of chlorine per million pounds of water (expressed in the metric system as Milligrams Per Liter = mg/L, referring to milligrams of chlorine per liter of water). PPM and mg/L are numerically identical measurements.

Back Pressure

The line pressure in a pipe into which chlorine is to be injected plus the pressure drop in the solution line from the ejector to the point of application.

Combined Chlorine Residual

That portion of the total residual chlorine remaining in the chlorinated water or waste at the end of a specified contact period, which will react chemically and biologically as chloramines or organic Cl.

Chlorine Residual

Available chlorine remaining after the reaction interval and still available to combat the more resistant organisms and to safeguard against any later contamination.

Free Available Chlorine

That portion of the total residual chlorine remaining in the chlorinated water or waste at the end of a specified contact period, which will react chemically and biologically as hypochlorous or hypochlorite ion.

Represented by

ProMinent Fluid Controls Pty Ltd

Head Office: Unit 4, 4 Narabang Way
BELROSE NSW 2085
(PO Box 85, BELROSE WEST NSW 2085)
Ph: (02) 9450 0995 Fx: (02) 9450 0996
Email: sales@prominentfluid.com.au

QLD Office: 1048-1054 Beaudesert Road
COOPERS PLAINS QLD 4108
Ph: (07) 3246 5200 Fx: (07) 3246 5225
Email: pfcqld@prominentfluid.com.au

VIC Office: Unit 2, 88 Star Crescent
Hallam VIC 3803
Ph: (03) 8795 7430 Fx: (03) 8795 7431
Email: pfcvic@prominentfluid.com.au

Distributors Throughout Australia & New Zealand

WA: Ph: (08) 9458 9555 Fx: (08) 9350 6192 **TAS:** Ph: (03) 6244 7575 Fx: (03) 6244 7576 **NT:** Ph: (08) 8947 1008 Fx: (08) 8947 1009
SA: Ph: (08) 8275 8000 **NEW ZEALAND:** Ph: (64) 9571 3131 Fx: (64) 9571 2002 Email: sales@pumpengineersb.co.nz

ProMinent®

INSTRUMENTS