



Vacuum Fed Sodium Hypochlorite - A Responsible Disinfection Choice

The Chemical Itself

Chlorine gas disinfection causes numerous risks and restrictions. Organizations and associations from the Clean Air Act to OSHA and the Universal Fire Code have regulated the use and storage of chlorine to the point that alternatives have been a major objective of every water disinfection effort for the past 20+ years. One result is the movement away from chlorine gas to the use of liquid sodium hypochlorite (NaOCl). As an aqueous solution, NaOCl is less hazardous and easier to store and handle than chlorine gas. Although NaOCl requires more storage space than gaseous chlorine, it can be handled more easily and it creates fewer maintenance problems than other disinfectants, such as ultraviolet or ozone disinfection. It also provides the residual so highly desired from gas disinfection. Furthermore, it offers these advantages at a capital cost that is up to 50% below these alternatives.

Commercial grade NaOCl is corrosive, relatively unstable, and very caustic. Personnel who handle NaOCl need to take the same precautions as they would for any caustic material. NaOCl emits oxygen when it degrades, but it will react to most acidic materials, which will combine to release chlorine gas. In case of an NaOCl spill, the material can be easily diluted with water and will naturally degrade to oxygen and salt, usually within 72 hours.

The Delivery System

Currently, there are two techniques used to feed NaOCl. Traditionally, metering pumps of either the diaphragm or peristaltic type have been used, but there has been a growing interest in the last several years in vacuum dosing.

Pumps. Pumps have been the initial method of dosing NaOCl, but experience has identified a number of constraints to this technology.

- Pumping a liquid requires that the lines throughout the system are pressurized, so pumping NaOCl can be dangerous to personnel in the case of a line break.
- Diaphragm pumps are prone to gasification, which will form a vapor lock, and eventually cause crystallization, which will jam the operating mechanism in the pump's wet end.
- Suction piping should be kept short in order to guard against gasification. This requires that NaOCl solution tanks are in the same enclosed area of the pump and inside the plant – not the best place for such a caustic material.
- All dosing pumps, either diaphragm or peristaltic in design, must be continuously checked for crystallization within the wetted parts. These flexible parts can split and cause contamination of the environment and danger to personnel.

Pumps are the least expensive method of feeding NaOCl though, unless the cost considerations of personnel safety, maintenance, cleanup, repair and possible spill alleviation are taken into consideration.



Vacuum Feed Systems. Vacuum dosing is similar to the process used to feed gaseous chlorine, ammonia and sulfur dioxide, and recent advances have improved on that technology. Basically, in a vacuum feed system, a properly sized and placed ejector or induction mixer produces the required vacuum to draw the NaOCl through the dosing system. The caustic flow is then metered, using a V-notch rate valve controlled by an electronic flow sensor, into the feed-water. There is never high pressure in the caustic lines, nor is there a requirement for a vacuum regulator in the feed line.

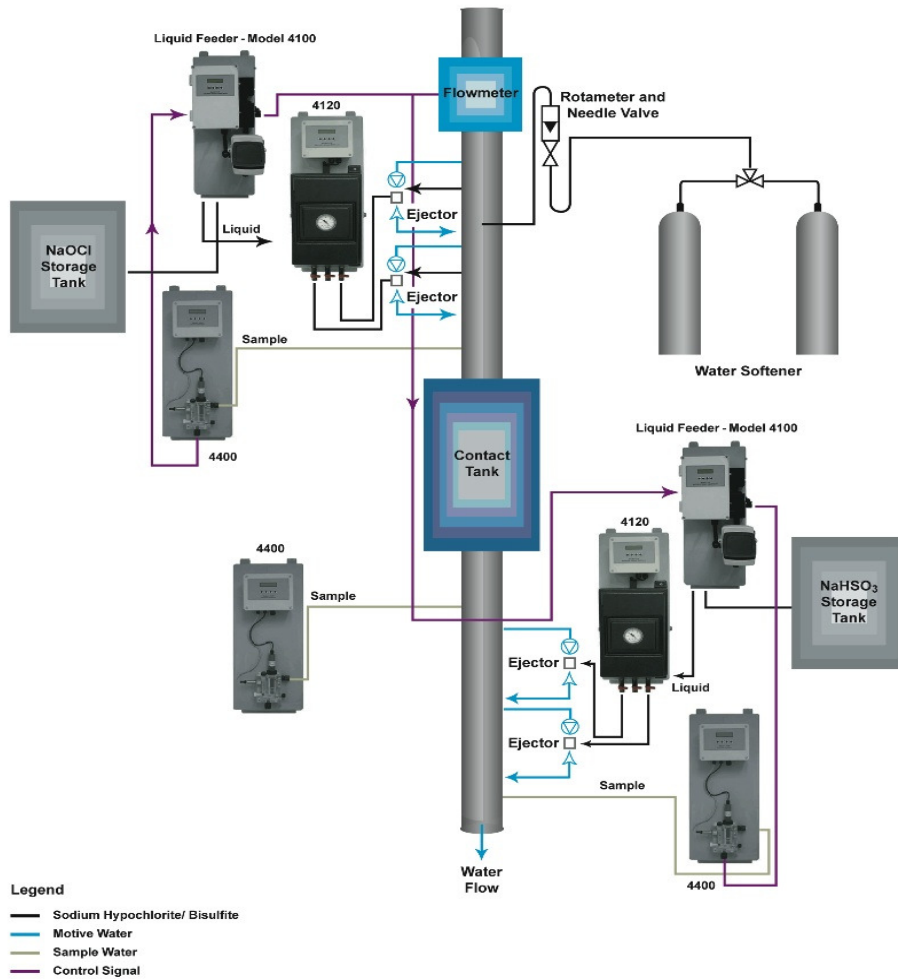
Advantages of the vacuum feed system (Reliant Water Technologies Model 4100) are:

- Increased operator safety compared to pressure systems
- A wide range of flow – 3 to 20,000 GPD
- High accuracy - +/-2% of actual feed
- 100:1 turndown ratio
- No air binding possible
- Caustic storage and ejectors can be located outside of the disinfection building
- No pressurized neat caustic lines
- Few moving parts, thus less maintenance and down time

One inherent disadvantage of the vacuum system is the potential for scaling at the contact point between the chemical and the motive water in the injector. This can be avoided by accounting for the scaling potential during the design phase. Water softeners can be installed ahead of the injector to completely eliminate this problem, or various automatic injector switchover schemes can be included in the design of the vacuum feed system. (See the attached system layout).

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A Typical **RELIANT** Liquid Dosing System



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