Dosing chlorine for cylinders

Safety for operators handling chlorine

Chlorine is a hazardous substance. In solution it is highly corrosive and splashes can cause burns and damage the eyes.

When handling concentrated chlorine solutions, appropriate precautions should be taken. Gloves should be worn and protective eye glasses are essential.

In the event of splashes and especially splashes to the eyes it is important immediately to rinse thoroughly with water.

All containers in which chlorine is stored should be labelled, identifying the contents and with a hazard warning in a form that is readily understood locally.

Storage sites for chlorine in any form should be secured against unauthorized access and especially against children

Vacuum-type gas chlorinators

A chlorine leak would be a hazard to equipment, to personnel and potentially to the public. In order to minimize the risk of and consequences of such a leak, the vacuum-type system has been developed.

A part of the water to be chlorinated is passed through an injector, either under its own pressure or via a booster pump. The injector is in essence a venturi (that is, a waisted section of pipe). Where the water passes through the constriction, its pressure falls below that of the atmosphere. At this point a smaller pipe is connected which runs to the chlorine cylinder and which therefore is subject to a vacuum. Should a leakage occur, it is more likely that air will be drawn into the system, diluting the chlorine, rather than chlorine escaping to cause damage and create a health risk.

A vacuum gas chlorinator is illustrated schematically in Figure 1

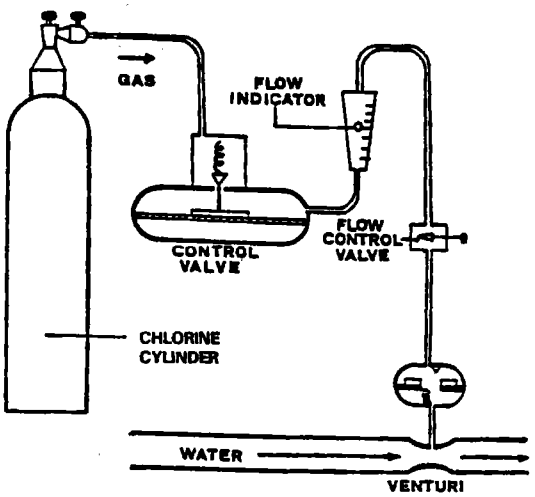

Figure 1. Vacuum gas chlorinator

As a safety measure, the system incorporates a check valve. In order for chlorine gas to flow, the vacuum must be sufficiently strong to overcome the spring in this check valve. If the vacuum is broken or severely reduced, then the check valve will stop the flow of chlorine gas. This spring is so set as to give a controlled constant pressure to the flow meter and control valve. A flow control valve and flow meter are incorporated in the system to enable monitoring and control of the supply of gas.

This system is suitable where chlorine demand does not vary much from day to day and where the water is either flowing at a steady rate or not at all, for instance from a borehole. It has the advantage that gas is delivered into the pipe under conditions which favour rapid dissolution.

Chlorinators used for dosing chlorine should be sized to match the hourly flow to be dosed. This is calculated by :

chlorine flow = water flow ´ chlorine dose
g/h m3/h mg/l

Some standard capacities of tanks and tare weights are shown in the table below. The last column indicates the range of daily flows which the chlorine contained in the cylinder could dose at 1 mg/l with a cylinder change every three months at the lower flow and every seven days at the higher flow.

Chlorine cylinders

minal chlorine capacity (kg)	Typical tare weight of cylinders (kg)	Range of daily water flow dosed at 1 mg/l (m3/day)	
71	70		100 000
43	40		60 000
33	35		50 000
4.5	9		650
1.5	5		200

Gas chlorination is generally not recommended for supplies of under ten cubic metres per day.

Installations where chlorine cylinders are stored

All installations in which chlorine cylinders are stored, handled or used should be specifically designed or adapted for this purpose. It is vital that they are well-ventilated and that air vents are included at floor level. This is because chlorine is heavier than air and sinks.

Persons entering a room in which chlorine gas has accumulated may collapse, thus exposing themselves to the high concentration of gas near the floor. For this same reason, cylinders should not be stored at low points where gas can accumulate. Figure 2 shows the correct way to store chlorine cylinders.

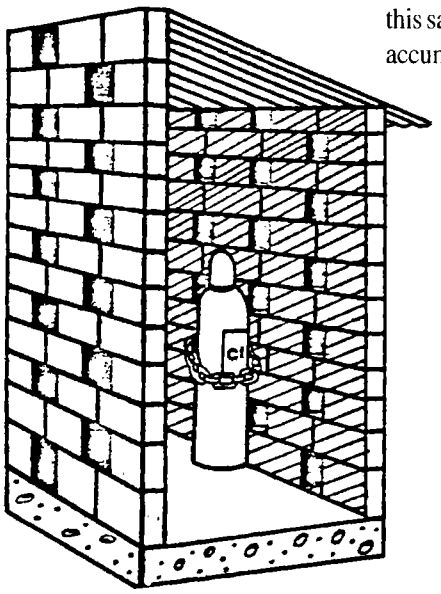

Figure 2. Storing chlorine cylinders

Operation and maintenance

Operation and maintenance of equipment for dosing of chlorine from cylinders should only be undertaken by fully trained and authorized personnel ; details are not provided here. In general, the following should be in place :

- A system for training and authorizing personnel to operate equipment of this type. No unauthorized personnel should be allowed to perform these tasks.
- Guidelines for operation and maintenance in written form, accessible to all staff expected to perform these tasks.
- A record of chlorine levels post-treatment and in distribution, and adjustments made.

When carrying out maintenance work on chlorine dosing equipment, make sure that safety equipment is ready before entering the chlorine area. Always carry out work on chlorine dosing equipment with someone watching you work in case of an accident. During maintenance, the following should be checked :

- Check to see if the cylinder needs changing.
- Check that all lines and equipment are clean.
- When connecting a new cylinder, always fit new gaskets. Spare gaskets should be kept in a dark, cool place to prevent deterioration.
- When a new cylinder is connected, open the valve slowly and check for leaks. Never leave the valve partially open for longer than one minute or it may block up. Open the valve fully as soon as you have checked for leaks.
- Adjust the chlorine flow rate according to the results of testing for chlorine residual (see Fact Sheet 2.17) in treated water leaving the plant.
- If " frost " appears on the valves or connections, there is a risk that chlorine may re-liquefy. The liquid chlorine may then block the supply line. Extreme care should be taken under these circumstances because if the liquid re-evaporates it can create sufficient pressure to cause the remaining chlorine to shoot out of a disconnected supply line. " Freezing " tends to occur when removal rates of chlorine are too high.
- Lubricate equipment if necessary.
- Keep a log of leaks, change of cylinders, repairs to equipment and lubrication of equipment.

When dosing equipment is not operating adequately

It is essential to be wearing protective clothing before repairing leaks in chlorine gas dosing equipment. It is possible to test for the site of a leak by using ammonia, if this is available. Soak a rag on the end of a stick in ammonia and hold it next to the pipes, cylinder and dosing equipment. A white cloud will show the site of a leak.