METITO

Commitment to a Cleaner Environment

chlorination

- POTABLE WATER
- SEWAGE TREATMENT
- INDUSTRY WATER

Safe Technology for Suppliers of Safe Water

METITO organisation

Metito is an international group employing over 500 engineers throughout worldwide locations.

Metito manufactures and supplies, including installation, factory made plant, equipment and chemicals for treating industrial water, waste, sewage, ultrapure and potable water treatment and supply.

Founded in 1958, with modern technology and employing highly qualified personnel throughout all operations it is well established as a leader in the field of water and waste treatment.

METITO range of products also includes:

- **Reverse Osmosis systems for brackish water and seawater.**
- **Sewage treatment systems.**
- **Industrial water.**
- **Activated Carbon, Sand and Mixed Bed Filters.**
- **Chemicals to control fouling, corrosion, scaling.**
- **Demineralisers, Zeolite Softeners, Degassifiers.**
- **Swimming Pool main equipment and accessories.**
- **Elevated and Low Water Storage Tanks.**
- **Chemical Feeders, Dosing Pumps, Water and sewage Pumps.**
- **Constant Pressure Pumping Systems, Package and Custom Built Plants.**
- **Mobile and Containerised Units for De-salination, Process Waters, Irrigation, Drinking Supplies, Hospital Services, Military Requirements and many other needs.**

Introduction

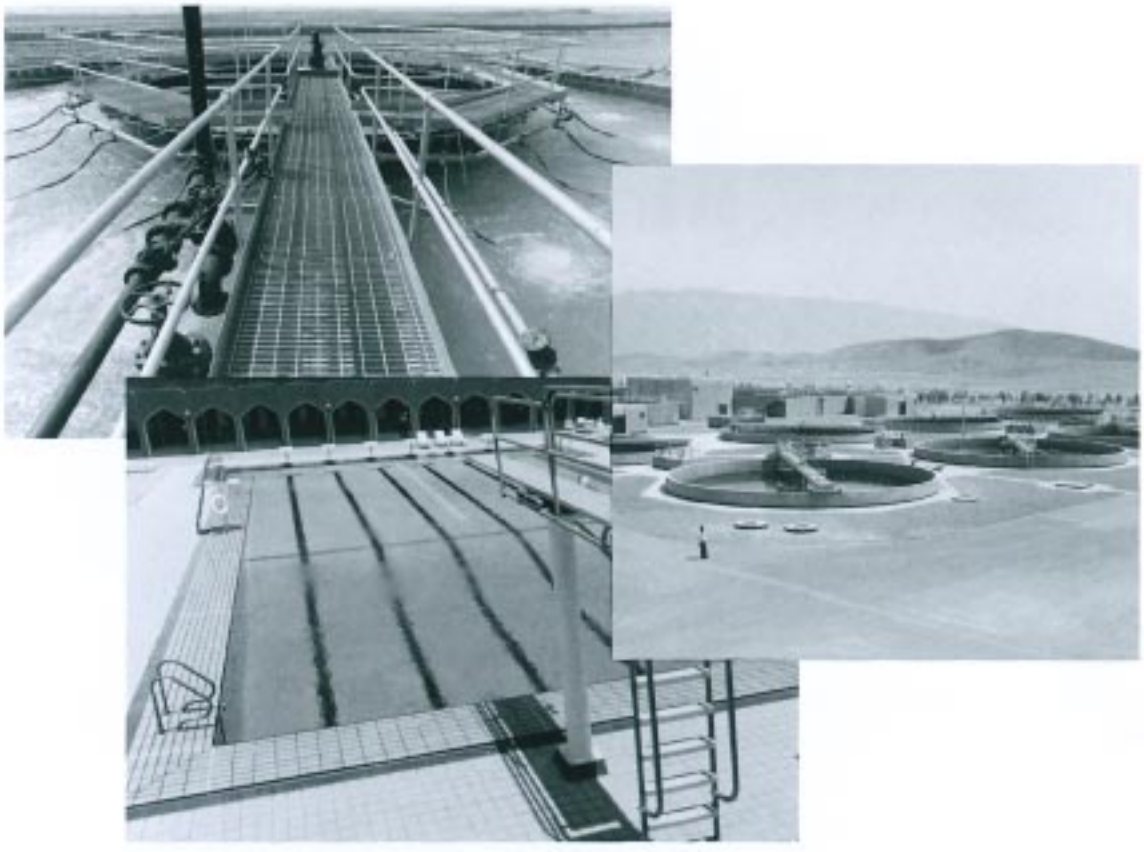
Chlorination is widely used for disinfecting water, far exceeding other methods for producing the world's supply of drinking water free of pathogenic organisms.

Most public utilities chlorinate before water is released into the distribution system, and in many countries, it is mandatory to add chlorine to the supply of drinking water. Other organizations such as World Health and the United Nations sponsor aid programs for new chlorinated water supplies, and during emergencies, relief agencies use chlorine to stop the spread of disease from contaminated water.

Chlorinating water has been, and remains significant in improving the health of the world's population since first used publicly in 1910. No other single factor has an equal record of protecting the number of people from the dangers of consuming unsafe water.

Chlorination will continue to remain an important part of everyday life, for without safe water most of us would suffer from disease and ill health. In maintaining this need, Metito works to provide safe chlorination technology to equally responsible suppliers of safe water.

It is a shared responsibility, respected by others for the benefit of many.



How chlorination works

Chlorine added to water forms an acid which is a biocide that in certain quantities and after sufficient time, destroys pathogenic organisms, making the water safe to drink.

Safe to consume

The chlorine in the water consumed by humans, converts to chlorides, or salts, not as foreign substances but as safe additions to natural occurrences.

Advantages

Chlorine is a safe disinfectant that is both economical and reliable to use. It leaves a trace amount in the water so that its effectiveness can be measured as well as remaining to combat further contamination. These benefits when added to its long record of success and easy access to scientific information makes chlorination the obvious choice of treatment.

Proper application of chlorine produces bacteria-free drinking water. It also reduces spoilage thereby increasing shelf life of vegetables, meat, poultry and other foods cleansed with water. Stops the spread of disease in swimming pools, controls slime and algae in cooling water and prevents many other problems caused by micro-organisms.

Chlorination uses five basic methods to treat water. By far the most common method uses **Chlorine (CL_2)** as gas held under pressure in cylinders. For safety reasons it is mixed under vacuum within an ejector to form a concentrated solution before dosing into the water to be treated.

The other forms of chlorine used in water treatment and described elsewhere are:

- **Chlorine dioxide (CLO_2)** is gas produced at its point of application by two reactive chemicals. Its disinfection power is not affected by pH and results in a neutral taste and odourless water making it suitable for particular applications.

- **Electrolytic sodium hypochlorite (ESH),** or referred to as on-site chlorination, is produced at the point of use from common salt by electrolyzing brine.
  Increasingly popular as an alternative to the other forms as it requires no chemicals or safety precautions.

- **Sodium hypochlorite (NaOCL)** is in liquid form and normally diluted with water before dosing with a metering pump. It is commonly used in colder climates as an alternative to gas.

- **Calcium hypochlorite $Ca(OCL)_2$** obtained in dry form and dissolved in water before dosing with a metering pump. It is used mainly in warmer climates as an alternative to sodium hypochlorite.

- Disinfectants such as ozone, ultra-violet, iodine, bromine, silver and others are also used. Whilst not as common as chlorine they play an important part, having benefits and advantages over the use of chlorine in certain applications.

Metito chlorination plants

Metito supplies chlorination equipment and plants for drinking water supplies, waste and sewage treatment, and industrial water treatment.

The scope of work covers the supply of standard equipment, and the design and supply of simple and complex installations from design stage through to commissioning. All work is carried out by experienced and qualified process engineers, aided by computerised technology and CAD design facilities. Advice is provided on any matter relating to safety and reliability as well as the control principles for specific enquires.

The scope includes large and small chlorinators, cylinders and drums, equipment for automatic control, standby facilities, health and safety protection, and chemical handling.

All chemical, mechanical and electrical equipment, including the construction of plant installed under the control of Metito, is in accordance with the standards set by **internationally recognized organizations**, and where specified, plant is handed over, ready-to-work complete with spares, piping and valve markings, warning labels, operating and maintenance instructions, testing and commissioning.

Internationally recognized organizations.

- **The Chlorine Institute.**
- **CGA** Compressed Gas Association.
- **BSI** British Standard Institution.
- **WHO** World Health Organization.
- **HSE** Health and Safety Executive.
- **NJHSCWA** National Joint Health and Safety Committee for the Water Service.
- **BITC** Bureau International Technique Chlore.
- **OSHA** Occupational Safety and Health Association.
- **DIN** Deutsche Industrie Normen.
- **AWWA** American Water Works Association.
- **NEMA** National Electrical Manufacturers Association.
- **IEC** International Electrical Committee.
- **TUV** Technisher Uberwachungs - Verein.
- **TRG** Technische Regein Gas.

Features:

- **Safety:**
  Electrical, chemical and mechanical risks are minimized by including assured degrees of protection.
- **Reliability:**
  Materials and construction conforms to internationally recognised standards for trouble free operation.
- **Economy:**
  Only necessary and reliable equipment is supplied, reducing maintenance and spares cost.
- **Reassurance:**
  Extensive experience and works worldwide underwrite confidence of design and ability to supply.

Typical enquiry information

The basis for achieving safe and reliable plant is providing good enquiry information as this enables the right equipment to be supplied and installed.

1	Treating:	Type of water - see Table 1 Method - see Table 1 Doserate - see Table 1	 mg/l
2	Size:	Chlorine flowrate for each dosing point. Pressure at point(s) of application. Water flowrate at point(s) of application. Number of dosing points. Geodetic difference - ejector/dosing point. Booster pumps required.	kg/h m head m^3/h m head yes/no
3	Chemical:	No. of drums/cylinders required. Time for supplier to refill. Size of outlet connection if supply is from existing drums.	 days
4	Chlorinator:	Preferred type if known. Type of automatic control	
5	Measurement:	Hand-held comparators. Laboratory test-kits On-line analysers.	
	Chlorine residuals:	Combined, free or total residual	
6	Safety:	Naturally ventilated. Mechanical ventilating. Personnel protection equipment. Leak detectors.	yes/no yes/no
7	Standby:	Chemical supply. Chlorinators. Pumps. Specify other equipment.	man/auto man/auto man/auto man/auto
8	Location:	Size of building. Proximity of nearest public building. District. Electricity supply.	
9	Operation:	Continuously/periodically. Purpose of plant. Manned or unmanned. Other.	

Treatment	Typical doserates in mg/l	
Water for drinking/ culinary purposes.	up to 5	Prechlorination
	up to 0.5	Postchlorination
	3 - 5	Taste and odour control
	2 - 10	Iron bacteria control
Oxidation	0.63 x Fe	Precipitation of iron
	1.3 x Mg	Precipitation of manganese
	2.1 x H_2S	Hydrogen sulphide odor control
	8.4 x H_2S	Hydrogen sulphide destruction
Pipes and Tanks	25 - 50	Disinfection before use
Waste Water	10 - 15	Raw sewage, also odour control
	8 - 10	Primary effluent, settlement
	3 - 10	Primary effluent, filters
	2 - 8	Activated sludge effluent
	2 - 5	Sand filter effluent, tertiary
	30 - 45	Septic tank effluent
	5 - 10	BOD reduction
Swimming pool	1 - 5	
Water		
• general	3 - 5	Algae & bacteria slime control
• cooling	5 - 15	Shock treatment
• cooling	3 - 5	Continuous treatment
• chilling	20	
• washdown	50	
• surface	1 - 10	Check water first
• well	1 - 5	

Table 1

Pre-chlorination:

Chlorine is added to oxidize constituents before other forms of treatment.

Post-chlorination:

Chlorine is added to the water after other treatments and contains a residual for protection against recontamination.

Shock treatment:

Brief periods of high doses of chlorine are added for 30 minutes, one to four times daily to combat algae and molluscs accumulating in cooling water circuits.

Super-chlorination:

Chlorine is added to leave a high surplus after a long reaction time. It is often used with de-chlorination facilities for reducing the residual to acceptable levels. In this case it is known as super D chlorination.

Treating

The type of water obtained from Table 1 as well as the method of chlorination provides useful information concerning what ancillary items to include if analytical equipment is required. The desired residual will determine the range of the chlorine measurement system that may be needed and is information to be obtained and specified by the user of the plant. The number of separate streams being dosed should be stated together with their water flowrates.

Chlorinating wastewater and sewage for eventual surface water discharge should not be treated beyond the breakpoint release of free chlorine, but disinfected with chloramine (combined chlorine residual) in order to prevent the formulation of compounds that may effect the water for reuse as a potable supply.

Size

The chlorine flowrate should be stated if known or calculated as follows:

Flowrate ($kgCL_2/h$) =

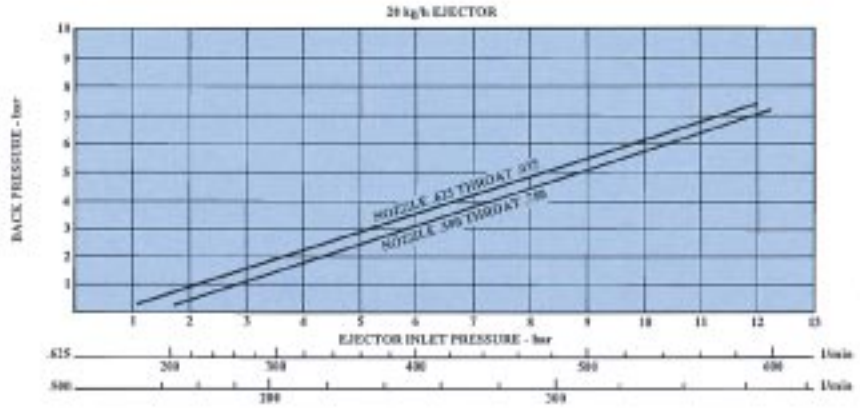
$$\frac{\text{water } (m^3/h) \times \text{doserate } (mg/l)}{1000}$$

The chlorine doserates in Table 1 can be used as reference values where no other information is available.

The chlorine flowrate should be based on the maximum expected water flow for any time at the dosing point and expressed in hourly units rather than the average or daily total.

It is recommended that approximately up to double the amount calculated is specified to allow for occasional higher dose rates.

A booster pump is required where no water supply at sufficient pressure and quantity is available to operate the ejector. Ejectors require an operating water supply higher than the pressure at the dosing point and at a flow not exceeding a chlorine to water concentration of 3500mg/l.



Typical Performance Graph of 20 kg/h Chlorine Ejector Showing Operating Water Supply for Given Back Pressure

Chemical

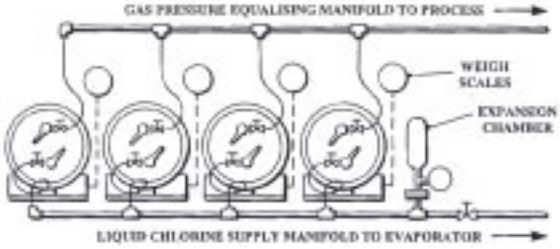
The time needed to replenish empty chlorine containers is significant on gas supplies because limited withdrawal rates from each container affects the economic aspects of a plant. 1% of the contents of the container is the maximum for continuous operation and to achieve a satisfactory relationship between the safety aspects, plant capital costs and rate of exchanging containers, the following is recommended.

1 No more than six one ton drums should be connected together discharging gas. This would provide 60kg/h of chlorine. Above this rate chlorine liquid should be drawn form a single container and a vaporizer installed.

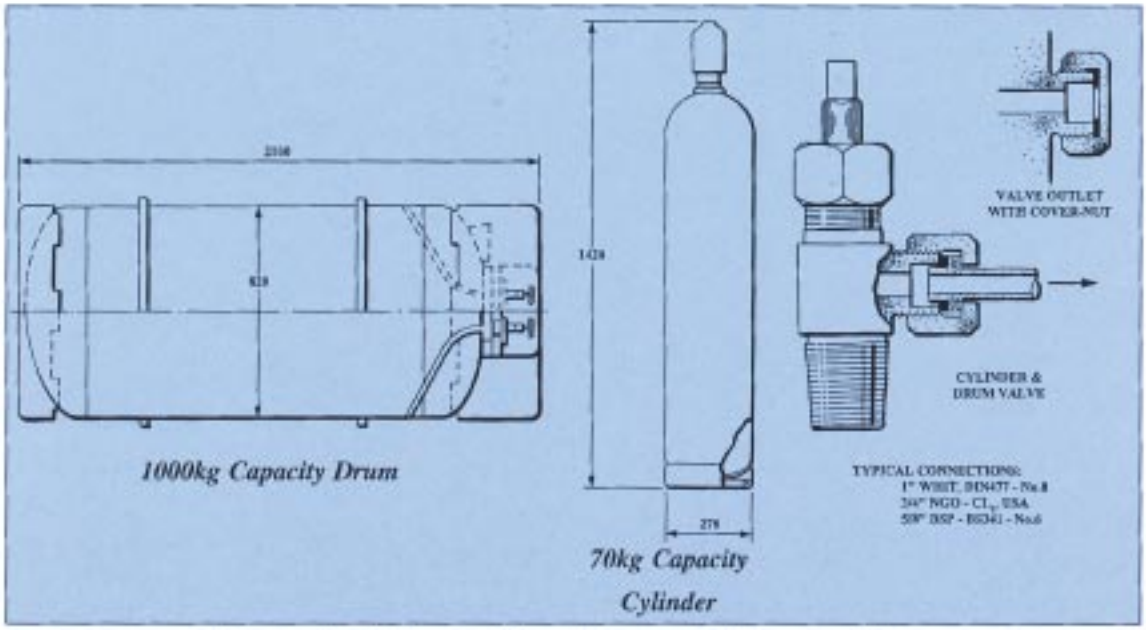
Note: Drums discharging **liquid chlorine** must not be connected in parallel unless provided with gas balancing and weighing facilities as precautions against over-expansion and rupture.

2 No more than six 70kg cylinders should be connected together. This would provide 4.0kg/h of chlorine. Above this rate, the supply should be taken from one or more one ton drums.

Chlorine plants must be installed in accordance with safety regulations. All persons charged with the responsibility for the design, construction, operation and maintenance of the plant must be aware of the regulations before commencing any work.



Gas Balancing & Weighers



1000kg Capacity Drum

70kg Capacity Cylinder

Standard cylinder and drum sizes and outlet connections.

Chlorinators

Chlorinators are available for cylinder mounting, wall fixing and floor standing range from 25g/h up to 160kg/h capacities.

Chlorinators comprises three basic items, a vacuum regulator which can be fitted remotely and more safely near the chemical containers, a control and flowmeter assembly, and an ejector also fitted remotely and more satisfactorily near the dosing point. Each item will vary in size according to the chlorine flowrate and each manufacturer incorporates different features relating to their particular design or application. Chlorinators supplied by Metito are vacuum operated, meet the safety and reliability requirements of the Internationally Recognized Organizations and are in common use in principle water authorities and general industries.

Chlorinators for gas systems are supplied with flowmeters having 1:20 turndown ratio for manual systems and 1:10 under automatic control. Chlorinators are supplied in various sizes and the nearest size to the requirement is usually supplied.

Chlorinators can be supplied to meet a preferred choice or required to match existing plant for the purposes of rationalising spare parts.

Automatic controlled chlorinators are required when either the flow changes or the quality of the water varies, or both, or where the doserate is required to be remotely controlled. Under these conditions, automatic control is more reliable and accurate than achieved manually, as it eliminates constant operator vigilance and the chances of human error. Automatic systems comprise both closed and open loop forms of control of the following types:

Residual:

The chlorine residual is maintained between high and low adjustable levels set on a residual controller. Used where the quality of water varies. Closed loop control.

Flow:

The chlorine doses linearly proportional to the water flow. Open loop control where the water flow changes.

Compound loop:

Combines flow and residual control into one system, with flow control being the more dominant and residual control acting to trim the dose.

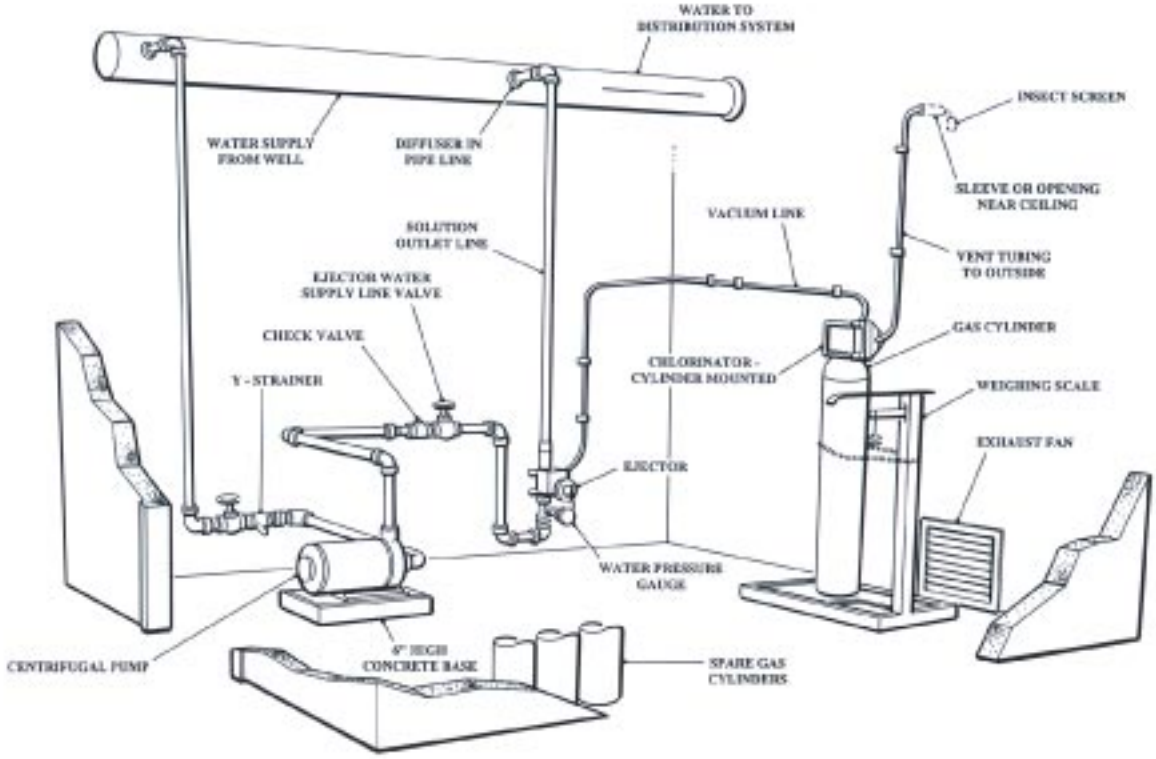
Stop/start:

Chlorine dosed at a pre-set rate into a fixed water flow, such as a pump stopping and starting. Open loop control.

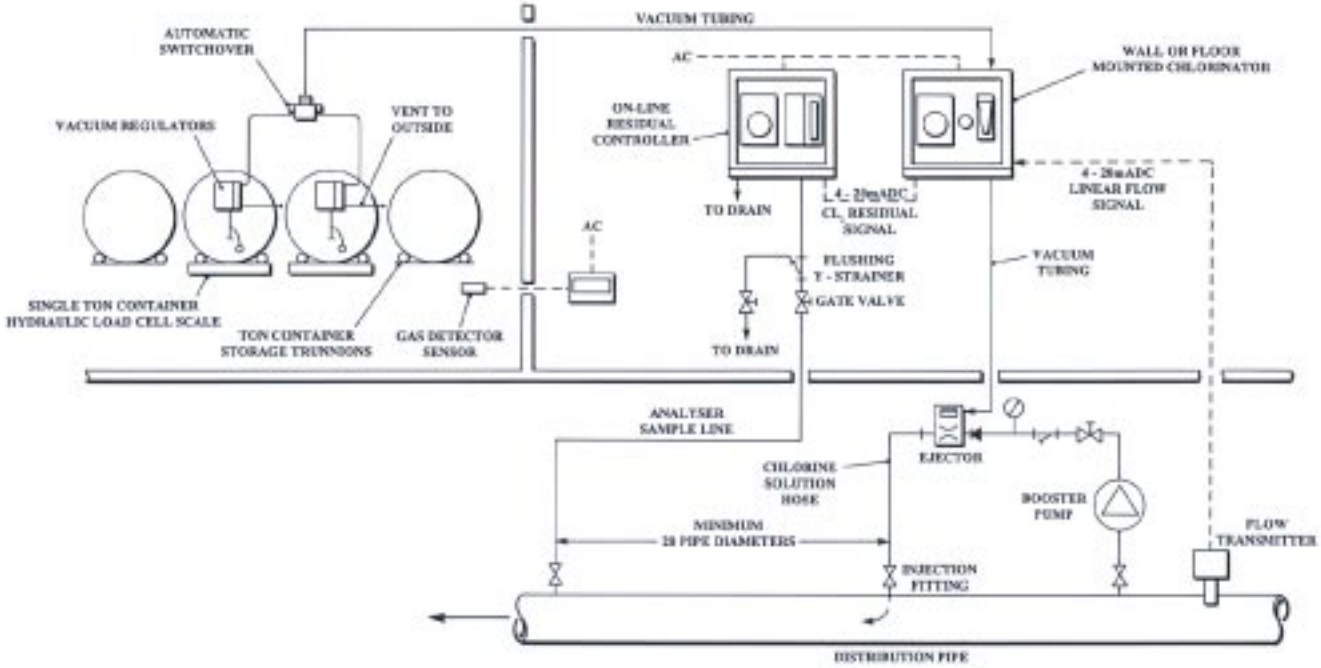
Step rate:

Similar to stop/start but into a series of fixed water flows.

Automatically controlled chlorinators include an electrically operated valve that will adjust the dose rate in relation to an incoming signal, and, or, a non-electrical variable regulator fed by a vacuum signal from a separate transmitter. When used separately, each device has a control range of 10:1, or 100:1 when combined.



Typical Installation of Small Chlorinator



Typical Diagram of Compound Loop Control

Measurement

A significant feature of chlorination is the ability to measure its residual. Equipment available uses a sample of the water, analyses the amount of chlorine present which can be compared against data in order for the chlorine dose to be adjusted accordingly.

Comparator:

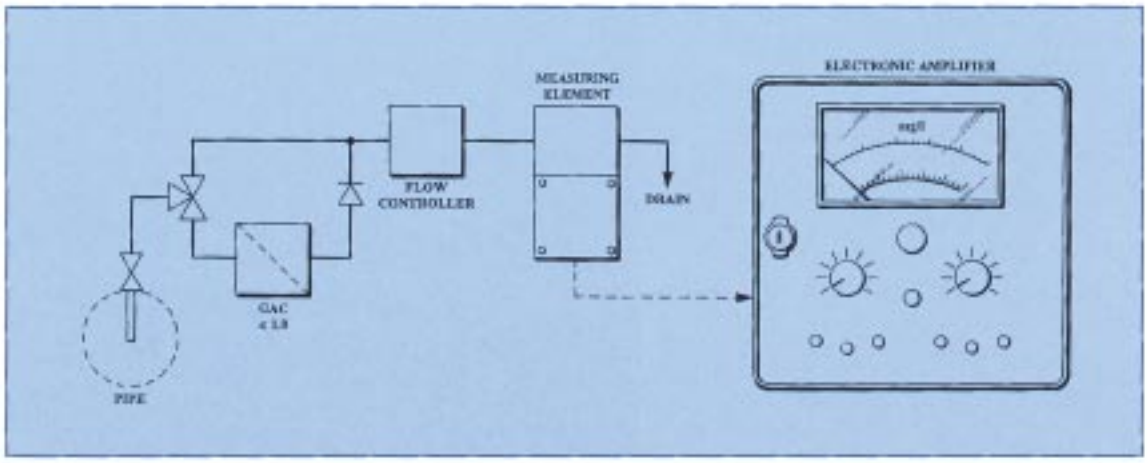
Hand-held or semi-portable types and always required for setting-up new plant, daily checks and during maintenance. Normally colorimetric, photometric or titration methods are used.

Laboratory equipment:

Required for more scientific and refined measurement purposes, with facilities for measuring other compounds.

Residual analyser:

For continuous monitoring, or on-line measurement. Displays the residual on an indicator or recorder and supplied with re-transmission facilities.



On-Line Chlorine Residual Analyser

Chlorine residuals

The three types of chlorine residuals that can be measured either by hand or automatically with on-line control equipment are:

Free chlorine residual:

Excess of chlorine after the breakpoint condition is reached. The chlorine is free of ammonia and indicates that the water is also free of organisms. Always needed for drinking water.

Combined chlorine residual:

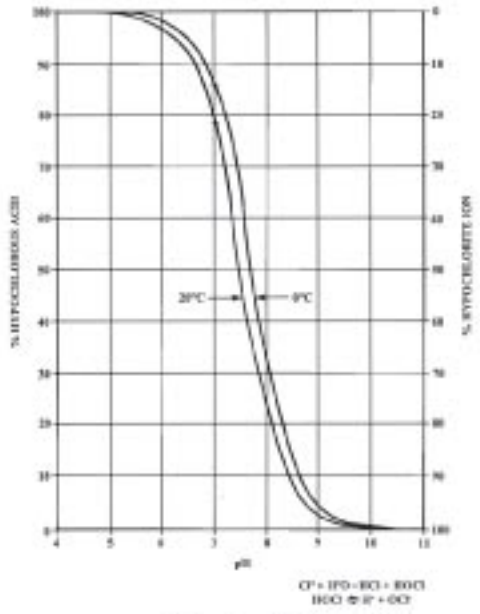
Chlorine is combined with ammonia and compounds up to the condition when the breakpoint is reached. The water may be partially sterilized and is of use for controlling weed, enzyme growth, waste and sewage treatment.

Total chlorine residual:

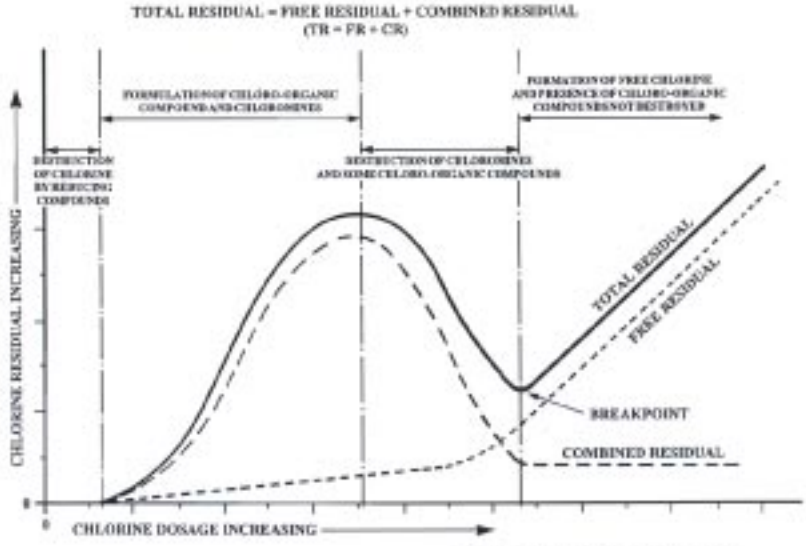
The sum of free and combined residuals. Mainly used for logistic purposes.

The term 'breakpoint' refers to the point at which complete oxidation of ammonia occurs. Adding amounts of chlorine to organic bearing water commence with the formation of chloramines, through a second and unstable reaction, and finally the breakpoint and release of free chlorine.

The factors affecting the germicidal efficiency of chlorine are temperature, contact time, quantity and pH, all of which must be taken into consideration within the design of the plant.



Free Available Chlorine



Breakpoint Chlorination

Standby equipment

Standby equipment is necessary where failure of chlorination would have serious effects, such as drinking water supplies. The assessment of what standby equipment to include should be judged on what effect the loss of chlorination would have and not the cost of providing it.

The principle effects being:

1 **Loss of treatment.**
2 **Risk to health.**

Either or both may be caused by:

a **Defect in the plant design.**
b **Defect due to incorrect maintenance.**
c **Defect due to incorrect operating procedure.**

The recommended practice, at least, is include automatic change-over equipment for providing a reserve supply of chlorine, as this is continuously drawn off and may empty before being replenished. Also, standby for critical equipment such as chlorinators and pumps or where spare parts are not readily available.

Standby equipment should be periodically brought into service as a check that it works correctly. It can be achieved by either a complete switchover or the duty and standby equipment working together each sharing the capacity. The second method having the advantage of keeping items such as motorised valves active in chlorinators and avoiding problems with fouling and binding.

Chlorine Information

Chlorine is a greenish yellow gas about 2½ times heavier than air, an acute irritant with an intense pungent smell noticable in very low amounts. High amounts are progressively more dangerous therefore safety precautions are needed. It is a strong oxidising agent, and when moist, corrosive to most common materials except glass, ceramic and certain plastics. Plant must be constructed in chlorine resistant materials.

Chlorine is held under pressure as liquid in strong steel cylinders, and discharges as gas when the uppermost valve is opened.

Density - Gas: 3.2 g/l
- Liquid: 1.46 kg/l

1 volume of liquid yields 457 volumes of gas
1 kg of liquid yields 0.315m³ of gas

Solubility in water:

Temperature °C	0	10	15	20	25
gram chlorine/100gram water	1.46	0.98	0.83	0.71	0.64

Below 9.6°C, saturated water forms chlorohydrate crystals.

Concentrations in workplaces:

Harmless over 8 hour day:	less than 1.0 ppm
Detectable by smell:	1 - 4 ppm
Physiological irritation:	3 - 4 ppm
Progressively harmful:	15+ ppm

Neutralising agents:

Chlorinated water:

Absorption:-	Activated carbon
Hydrolise:-	Sulphur dioxide SO_2
Hydrolise:-	Sodium sulphite $Na_2S_2O_3$
Hydrolise:-	Sodium metabisulphite $Na_2S_2O_5$

Chlorine gas absorption:- Sodium hydroxide (15 - 20% w/v)
Chlorine gas absorption:- Calcium hydroxide

Safety

Personnel protection and plant equipment must be provided to prevent hazards to operating staff and the public in the event of chemical leak or spillage. In the main, the small amounts of leaks that occur, arise at the time of exchanging the cylinders or drums, and from poorly maintained equipment, and providing the equipment listed below is available, both can be classed as controllable leaks without risk to personnel on or off the site.

Plants storing less than 100kg of chlorine:

- Warning notices inside and outside.
- Gas mask with replacement filter mounted outside near entrance.
- Natural ventilation.
- Leak detector.

Additionally for plants storing over 100kg of chlorine:

- Mechanical ventilation.
- Compressed air breathing sets for 30 minutes service.
- Container emergency repair kit. Required where no agency for handling emergencies is available.
- Full protective suit worn over breathing set.

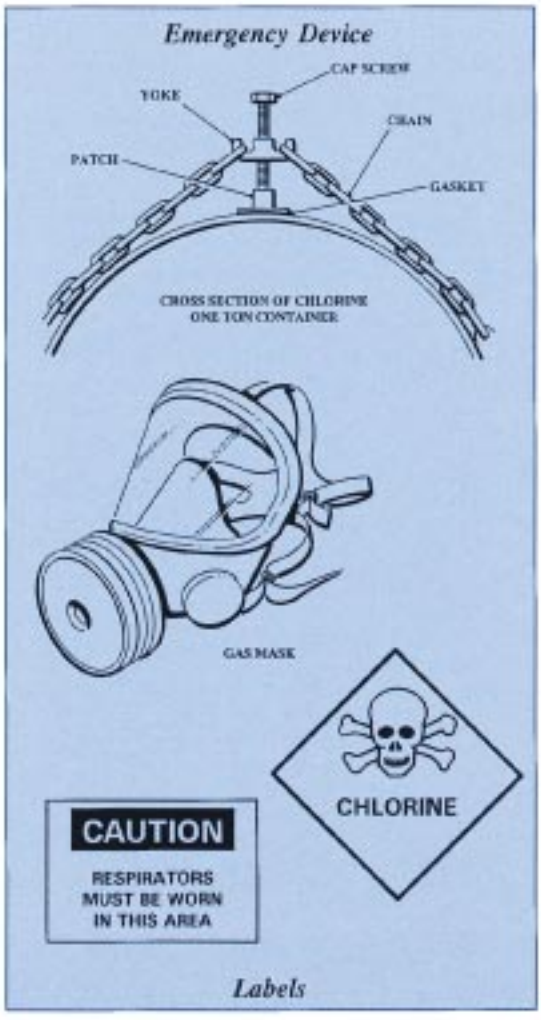
Additionally for certain plants:

- Neutralization or containment system where it is a mandatory requirement or plant owners preference.
- Spray mists for drenching room free of chlorine.

Shower and eyewashing should also be provided where easy access to these facilities is not available.

Operators must be trained in handling chlorine and the use of the safety equipment.

Various methods can be used for neutralizing or containing leaks, which are dependent on the amount of chlorine stored, the location and the degree of protection required. Metito can provide advice on the most suitable method for each particular application on request.



Plant location

Chlorination plant should be installed inside buildings designed for easy exchange of the chemical containers and safety. They must include the following points of consideration:

- Plant rooms containing either chlorine gas or liquid under pressure must not be intended for constant occupation by people and must be sealed against leaks into other rooms.

- Large rooms storing chlorine should preferably have two external walls with an outward opening escape door in each, sited in conjunction with walk-ways and fitted with panic bolts. Large doors required for drum handling should not be considered an escape door.
  Small cylinder storage rooms require only one escape door.

- The correct fire fighting equipment must be provided.

- Chlorine cylinders and drums must be protected from heat and direct sunlight.
  Where manifolded together, they must be of equal temperature.

- In pressure gas systems, the equipment should be at least 3°C warmer than the chlorine containers, with the containers stored in temperatures no less than 10°C or more than 35°C.

- For chlorine drum stores at least 5.0m room height is required to permit installation of lifting gear and overhead runway system.

- Adjacent occupied buildings must not be put at risk through leaks or the venting methods employed. Preferably with no less than 20m intervening space between.

- The size of building should allow for reserve containers to be stored for at least 24 hours in order to reach the same temperature as the duty and standby drums or cylinders.

Buildings housing chlorination plant are constructed in brick or concrete with the minimum use of inflammable materials. They should not contain other treatment chemicals but be used solely for storing chlorine.

Windows required for illumination should be wired glass, small, at high level and arranged to exclude direct sunlight from the plant where practical.

Normal painting on metal surfaces is sufficient to give protection against minor operational leaks.

The design of the building should allow for personnel to enter or leave easily and with sufficient room for carrying repair or emergency equipment.

Cylinder handling

Cylinder are normally moved by hand rolling on their bases or by a two wheeled trolley over long distances. Steps are inconvenient, therefore the building floor should be level with the outside or provided with a ramp. The cylinders should be secured by a clamp or chain either fixed to a wall or weigh scale where present.

Drum handling

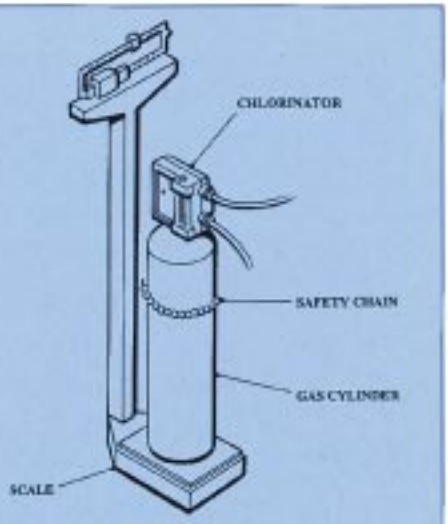
Equipment is required for handling drums comprising 2000kg SWL lifting beam, weigh scale and hoist together with a travelling block and overhead monorail extending outside over the supply vehicle. Normally an electric hoist and electric travelling block is used with a hoisting speed of 1-3m/min. and travel speed of 5-20m/min. Manual versions are also available.

For safety reasons the lifting height should provide at least 600mm man-clearance between the underside of the moving drum and the top of a fixed drum. Where the floor is level with the ground, 3m total lifting height is normally sufficient to load and unload drums from the supply vehicle through a 2.5m wide door opening. Where it is impractical to fit an overhead monorail within the building, the drums can be either wheeled out on rail bogies to an external lifting crane or by a specially adapted fork-lift truck.

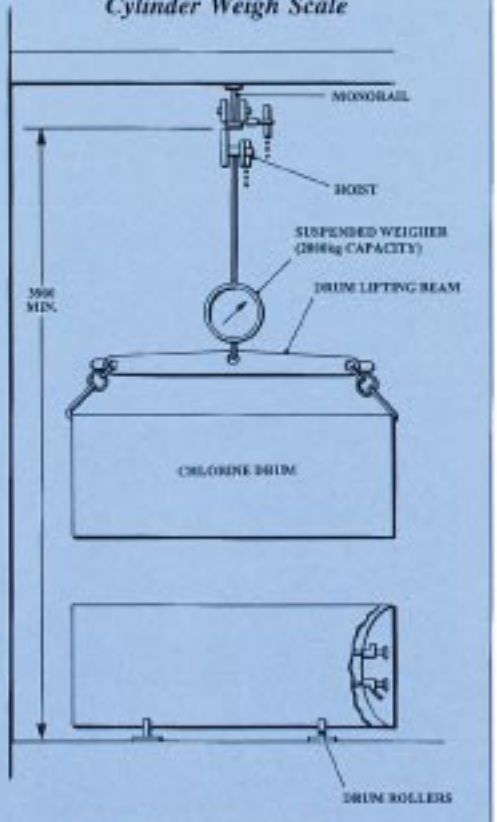
Duty and standby drums are supported on roller trunions, allowing rotation as it is essential to position the take-off valves one above the other before opening the top valve for gas withdrawal or the lower valve for liquid discharge.

Drains

Drains are required to handle water discharging from residual analysers, sampling taps, occasional spillages and at the bottom of trenchwork. A 100mm common drain gully is normally adequate for these purposes.



Cylinder Weigh Scale



Drum Handling Equipment

Electrical services

Electrical conduits, trunking and cable trays are normally surface mounted and taken from a single distribution board mounted near the access doorway. PVC cables and shrouded terminals should be used. Lighting should be provided within the room, and inside and outside over the access doors. Whilst no classified apparatus is necessary, sealed plastic switchgear housings to IP65 gives good protection against corrosion.

Operation

How the plant operates provides useful information concerning the type of ancillary equipment to provide. For instance an unmanned plant supplying drinking water should have means of re-transmitting its operating status to a central control point. Similarly a manned plant requires a high degree of personnel safety in order to protect the operator working inside.

Ancillary equipment should be kept to a minimum but sufficient to meet the requirements of the plant. Items such as isolating valves, gauges, strainers, etc., should be included so that equipment can be easily serviced. A good design philosophy is to install the necessary items in order to aim for speedy maintenance, reducing the downtime in chlorination.

Ventilation

Ventilation is required for all rooms where chlorine is stored or under pressure in order to protect the operators from the risk of leaks.

Small cylinder installations in completely enclosed rooms storing less than 100 kg of chlorine and up to 2m^2 floor area can be naturally ventilated using the escape door, larger rooms require mechanical ventilation with the air taken in at floor level and discharged to the outside at high level.

A fan should run continuously at 3 air changes per hour, increasing to 20 air changes in the event of a leak. With leaks in excess of 20ppm the fans should stop to avoid the uncontrolled discharge to atmosphere and the control undertaken manually.

A standby fan will double the rate where needed. Duty and standby fans should be operated by hand switches mounted inside and outside as well as automatically by a leak detector.

Neutralization and containment

With modern equipment and correctly trained operators the likelihood of serious leaks are minimal and with the exception of local mandatory requirements, these extra facilities are not normally necessary, adding only cost without established benefits. Most leaks, if at all, occur from valves or the pressure piping and both can be stopped quicker and with less discharge using the right procedure than achieved by either of the above methods. This technique is well proven and is adopted by most users of chlorine.

Metito Model CV, complete self-contained mobile chlorination vehicle for emergency or temporary disinfection purposes.

Chlorination control and measurement facilities

Chlorination plant installed in the U.A.E.

Sample of typical Metito Installations:

- **Oil Industry including:** *Aramco, Marathon, Shell, Mobil, Esso, Texaco, Iranian Oil.*
- **General Industries:** *British Aerospace, Pepsi-Cola, Alfa-Laval, Snamprogetti, General Tobacco, J & P, Daewoo, Hyundai, Mitsubishi, Sadelmi, Taylor Woodrow, McDermott, Bechtel, Brown and Root, Agiba.*
- **Public Services:** *Greater Cairo Water, KSA Ministry of Health, Kuwait Power, Municipalities of Tobruk and Tripoli, Bahrain Power Station, Bangladesh Railway.*
- **Others:** *Port Authorities, Government Works, Hospitals, USA Corps of Engineers, Defence Establishments, Hotels, Tourist Developments, Private & Public Swimming Pools.*

Commitment to a
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