



# CHLORINE HANDLING INFORMATION PACK

Chlorine Safety for Customer

This customer chlorine handling information pack has been created to inform the customer in the safe handling and use of chlorine. The intentions of this pack is to act as a quick reference and has been written in a format that should cater for all facets of a chlorine process to help solve a problem or situation that might occur. This guide should at all times be with the Plant personnel, handling chlorine. This would reduce risk, costs and time; improve knowledge and quality of work performed.

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**CHLORINE HANDLING INFORMATION PACK**



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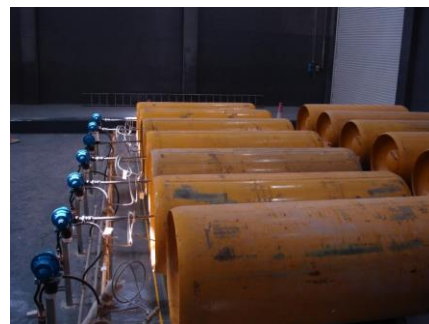
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**UN1017**

CAS NUMBER: 7782-50-5



**IMPORTANT:**

This document is intended to be a reference only. Although the information in the pack is drawn from resources believed to be reliable, the user should be aware that changing technology or regulations might require a change in the recommendations. It is therefore advised that additional guidance and information be obtained from the chlorine or equipment supplier, should the user of this guide be faced with abnormal or changing circumstances

## 1. INTRODUCTION

This customer chlorine handling information pack has been created to inform the customer in the safe handling and use of chlorine. The intentions of this pack is to act as a quick reference and has been written in a format that should cater for all facets of a chlorine process to help solve a problem or situation that might occur. This guide should at all times be with the Plant personnel, handling chlorine. This would reduce risk, costs and time; improve knowledge and quality of work performed.

### 1.1. DESCRIPTION OF CHLORINE

Chlorine is a hazardous chemical that can cause severe injury or in high concentration fatal, but if handled with care you will minimize the risk, if released to the atmosphere. When exposed to normal atmospheric pressure and temperature, liquid chlorine vaporises to chlorine gas. In shipping containers it is a liquefied gas under pressure.

Neither the gas nor the liquid is explosive or flammable; both react chemically with many substances. Chlorine is only slightly soluble in water. The gas has a characteristic odour and a greenish yellow colour and is about two and a half times as heavy as air.

Liquid chlorine is clear amber in colour and is about one and a half times as heavy as water. At atmospheric pressure, chlorine boils at -34°C (-29°F) and therefor in the liquid form can cause blisters and frostbite on skin contact. One volume of liquid chlorine expands to 360 times as chlorine gas.

Chlorine is only slightly soluble in water. Chlorine gas reacts with ammonia gas (vapour) to produce a dense white cloud of ammonium chloride. This property is used to detect chlorine leaks. Only ammonia vapour shall be used when testing for chlorine leaks.

#### Chlorine Characteristics

- ❖ Yellow/green gas or yellow/brown liquid
- ❖ Irritating eyes, nose, throat
- ❖ Use Gas mask, safety glasses
- ❖ CL<sub>2</sub> = Chlorine

#### External Uses of Chlorine

##### ❖ **Water Treatment**

- » Use for disinfecting drinking water, effluent water and swimming pool water.

##### ❖ **Paper Industries**

- » Bleaching paper pulp.

##### ❖ **Metallurgy**

- » In the purifying process of gold and platinum, chlorine gas is used to remove certain elements such as silver, zinc and iron.

## 2. GENERAL SAFETY REQUIREMENTS FOR CHLORINE

### 2.1. HANDLING CHLORINE CONTAINERS

- ❖ Use care in handling of all chlorine containers. Avoid all situations which will cause them to drop or be struck with force by any object. Never move chlorine containers without a safety protective cap in place.

- ❖ **Use the correct lifting equipment for portable gas containers**

- » Trolley for cylinders.

- » Lifting equipment for portable containers.
- » Avoid that no cylinder or drum being dropped especially when off-loading of portable gas containers.

## 2.2. **STORAGE OF CHLORINE**

- ❖ Store chlorine cylinder and portable tanks, full or empty, in clean, well-ventilated areas.
- ❖ Do not store near elevators, gangways or ventilation systems. Avoid subsurface storage areas.
- ❖ Storage temperatures should not exceed 55°C (130°F).
- ❖ Segregate from other compressed gas containers.
- ❖ Do not store near –
  - » turpentine
  - » ether
  - » hydrocarbons, e.g. oil
  - » other flammable materials
  - » anhydrous ammonia or
  - » finely divided metals, etc.
- ❖ Keep area free of rubbish to avoid fire hazard.
- ❖ Store full containers so that access, daily inspection, removal, etc. can be accomplished with a minimum of handling.
- ❖ Keep full and empty containers separated.
- ❖ Store containers so that usage can be affected on a first in first out basis.

**IMPORTANT:** - Always store chlorine cylinders in an upright position and portable tanks on their sides.  
- Leak tests must be carried out on “full” and “empty” portable gas containers.

### ***Storage of Portable Tanks***



## 3. HANDLING CHLORINE EMERGENCIES LEAKS

### 3.2. **HANDLING A CHLORINE INCIDENT**

- ❖ Why it is important that you understand how to handle a chlorine incident?
  - » It is important to understand that it might be needed to handle a small or large chlorine leak.

### 3.2.1. **Handling a Chlorine Incident**

When chlorine is set free into the atmosphere it is regarded as a chlorine incident (leak), this must at all times be prevented.

The following actions are to be taken, step-by-step to control the chlorine leak and stop the leak quickly and effectively.

- ❖ Call for assistance.
- ❖ Put safety equipment in a clean area, free of chlorine.
- ❖ Have an assistant standby outside the contaminated area.
- ❖ Close the chlorine cylinder valve to stop the chlorine leak in to the atmosphere. Ensure the valve is in a closed position.
- ❖ Determine wind direction; evacuate the area upwind from the leak as per **Evacuation Procedure 2.2.3**
- ❖ If in the vicinity of buildings, workplace, house or vehicle the following can be used:
  - » Put wet cloth, handkerchief or towel over your nose to breath.
  - » The wet towel can be used to close vents in office or doors.
  - » Switch off the air conditioners.
  - » When travelling in your vehicles switch off the air conditioner – this is to prevent chlorine gas from entering.
- ❖ Test with ammonia solution where the problem occurred.
- ❖ If the situation is not under control, seal off container with "Emergency Kit".
- ❖ NCP should be notified of the incident and the cause thereof.

### 3.2.2. **Evacuation Procedure**

- ❖ The need to evacuate the area will depend on the distance from the leak, concentration and the wind direction. If necessary, people in the vicinity (area) must be evacuated side-ways (90°) from the direction of the wind and then upwind of the leak, keep moving until they can no longer smell chlorine gas. However, it is important to remember that those inside buildings at a higher level will not be safe because local air currents will affect the movement of the gas which will in any event eventually disperse upwards in the atmosphere.
- ❖ Where chlorine levels are high, those without safety clothing and equipment should be advised to breathe through a wet cloth or handkerchief placed over both nose and mouth. Breaths taken should be slow and shallow and evacuation should begin immediately.

### 3.2.3. **Chlorine Incident Investigation**

All chlorine incidents must be investigated and the relevant questionnaires/reports compiled (refer 2.3.2 on Call-out Procedures). Its objectives will be:

- ❖ To ensure the avoidance of similar incidents in the future.
- ❖ An assessment of the effectiveness of the mutual (joint) assistance provided.

Documentation in the above situation must be very carefully completed and filed for future reference.

### 3.2.4. Fires

- ❖ Very seldom you will be faced with a situation whereby chlorine containers are threatened by fire. Your function will be to immediately disconnect all containers and remove them and any other containers from the fire zone. Where containers cannot be removed from the fire, zone water must be applied constantly in order to keep them cool. In the event that it should become dangerous to personally apply water to containers in the danger zone and the Fire Department is present, a "monitor" can be put in position on its tripod and it will provide a fine spray of water to the containers. **NB** all unauthorized persons must be kept at a safe distance.
- ❖ Chlorine containers that come into contact with excessive (great) heat for any period of time will explode. In the case of an explosion the gas will burn away immediately but there will be considerable danger to by-standers from metal "shrapnel" (splinters).
- ❖ Finally, if water has to be applied to chlorine containers you must make sure (if at all possible) that this water is kept away from any chlorine leaks. As mentioned previously, when chlorine comes into contact with water, hypochlorous acid is formed which will corrode (eat away) most metals, making any leak worse.

## 4. EMERGENCY CALL-OUT PROCEDURES

### 4.2. CHLORINE INCIDENT CALL-OUT PROCEDURES

In order to ensure that you act in a totally professional manner when reporting a chlorine incident, you will need to familiarise yourself thoroughly with the Chlorine Call-out Procedures detailed in 2.3.3 Complaints registered.

#### 4.2.1. Introduction

Chlorine Suppliers have strict procedures for dealing with chlorine incident call-outs. The Emergency Control Centre must receive all telephone calls from clients regarding chlorine incidents. They will record the necessary information and contact the relevant personnel. The Proto Team will be sent out to deal with the chlorine incident.

#### 4.2.2. Call-out Procedure

- ❖ When the switchboard receives any telephone call from the client regarding a chlorine incident, they will immediately put the call through to the Emergency Control Centre.
- ❖ When the Emergency Control Centre receives the above call they will take down all details regarding the incident on the Chlorine Incident Information Questionnaire.

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**Direct Emergency Number:**

***(supplier's emergency number)***

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#### 4.2.3. Complaints Registered

**Although Chlorine Suppliers strive for zero complaints**

- ❖ All complaints received are registered in a database and investigated by the Customer Complaint process. The outcome of the Customer Complaint, actions are implemented to prevent reoccurrences and the customer being informed by letter of the outcome to the complaint.
- ❖ The "**Red Sticker**" **Faulty Chlorine Cylinder/Drum** must be attached to the drum or cylinder on a clean surface to make sure it sticks on. This will help to identify and point out that there is a problem with a drum or cylinder when it arrives at premises of the Chlorine Supplier. This could also speed up the process for investigation on customer complaints.
- ❖ The stickers are obtainable from Chlorine Suppliers. Please contact your Chemical Supplier agent for assistance.

- ❖ Transporters and Proto Team members must have the red stickers in their vehicle for identification purposes and marking of portable gas containers.
- ❖ Definition for a customer complaint – any situation that cannot be controlled by your standard operating procedures or process and assistance is required or defect on a portable gas container deemed as a customer complaint or message.

**Copy of Red Sticker**

| <b>Cylinder / Tank Fault</b> |                    |
|------------------------------|--------------------|
| <b>Number:</b> _____         | <b>Date:</b> _____ |
| <b>Reason:</b>               |                    |
| <b>Send From:</b>            |                    |

**5. FIRST AID**

**5.2. INTRODUCTION**

Chlorine is a hazardous chemical that, when released into the atmosphere, can cause severe injury or death (i.e. on contact through exposure and respiration). If chlorine is inhaled the victim could become unconscious. Chlorine can cause severe injury to the eyes. Skin contact can result in severe blistering.

- ❖ In most situations where first aid is necessary as a result of exposure to a chlorine leak there will be qualified Emergency Services personnel to render this first aid.
- ❖ However, there may be times that you will have to render first aid and then you should know what to do and what not to do. It may be required from you to render first aid to victims who have been exposed to a chlorine leak.

**5.3. RENDERING (GIVING) FIRST AID**

- ❖ You must ensure firstly that you yourself do not become a casualty by wearing the appropriate (suitable) safety clothing and equipment (either a full face mask or a B.A. set). You must take prompt action to remove the exposed person(s) from the contaminated (danger) area. Act with firmness and constantly reassure the victims who will be experiencing high levels of stress and anxiety. It is important that nothing be given by mouth if the person(s) is unconscious or convulsing (having a fit).
- ❖ There are four situations which may require treatment:
  - » Skin contact
  - » Eye contact
  - » Mild inhalation
  - » Severe inhalation

We shall now look at the procedure to be followed in each situation:

**5.3.1. Skin Contact**

Chlorine can have the following effects on the skin:

- ❖ Corrosive damage and
- ❖ Frostbite on exposure to escaping compressed liquid.

Application of First Aid

- ❖ If frostbite has not occurred, flush contaminated skin with copious amounts of running water for 20 minutes.
- ❖ If frostbite has occurred, seek medical attention immediately. Do not rub the affected areas or flush them with water.

5.3.2. **Eye Contact**

Chlorine can have the following effects on the eye:

- ❖ Burning sensation
- ❖ Lacrimation
- ❖ Corrosive damage
- ❖ Freezing on exposure to escaping compressed liquid

Application of First Aid

- ❖ If the tissue is frozen, seek medical attention immediately.
- ❖ If the tissue is not frozen, flush eyes immediately with copious amounts of water under low pressure for 15 to 20 minutes. Hold eyelids apart to ensure complete irrigation of all eye and lid tissues. Do not attempt chemical neutralisation of any kind.

5.3.3. **Mild Inhalation (Breathing in of Gas)**

- ❖ The first step is to get the victim(s) out of the contaminated (danger) area, reassuring them constantly by explaining the various procedures to be used etc.
- ❖ The victim's reaction will be to panic because of the sensation or feeling of the closing of the throat and a feeling of suffocation (not being able to breath) similar to drowning.
- ❖ They must be told to breathe shallowly and slowly, and to resist the desire to cough. Contaminated clothing must then be removed and the victim kept upright in a comfortable position, warm and quiet.

5.3.4. **Severe Inhalation (Breathing in of Gas)**

- ❖ In severe cases the victim will have stopped breathing and also probably will have turned blue. Here too the first step is to remove the victim from the contaminated (danger) area, remove any contaminated clothing, secure an open airway and immediately begin artificial respiration.
- ❖ Artificial respiration must continue until either a doctor or Emergency Service Personnel arrive.

**6. SAFETY REQUIREMENTS**

**6.2. RESPONSIBILITIES IN THE EVENT OF AN EMERGENCY**

It shall be the duty of the person in charge of any premises where a chlorine system is installed to display conspicuous instructions for the operation of the system and the precautions to be observed in the case of breakdown or leakage as follows:

- ❖ Instructions for the operation of the system;
- ❖ Instructions for shutting down the system in the event of an emergency;
- ❖ Name and address of day and night telephone numbers for obtaining service from the chlorine supplier and relevant authorities.



### **6.3. GENERAL SAFETY REQUIREMENTS**

- ❖ All chlorine facilities shall have an ongoing safety programme in place, which shall comprise regular safety inspections (documented) and ongoing user (personnel) training programmes.
- ❖ Equipment shall be inspected and serviced at regular intervals by suitably qualified and experienced personnel at least once a year.
- ❖ All facilities that are situated near strategically sensitive areas (e.g. people or animals) shall have an early-warning gas detection system.
- ❖ With the above in mind, users of this code of practice shall ensure that the OHS Act is adhered to at all times regarding the design, maintenance and usage of chlorine facilities.

### **6.4. EMERGENCY ACTION PLAN**

A documented and displayed emergency action plan **must exist** to cover chlorine spillages and leaks and **must** contain at least the following:

- ❖ The names of key persons to be notified if chlorine spillage or leak occurs;
- ❖ A step-by-step description of the procedures to be followed by personnel in the immediate area of the chlorine leak or spillage;
- ❖ The first-aid procedure to be followed when personnel are exposed to chlorine gas.

## **7. SAFETY CLOTHING & EQUIPMENT**

### **7.2. PERSONAL PROTECTIVE EQUIPMENT (LIST OF MINIMUM REQUIREMENTS)**

- ❖ As per users risk assessment or code of practice requirements
  - » B.A. (self-contained breathing apparatus set)
  - » Chlorine Gas Suit
  - » Full Face Mask and respirator/s
  - » Safety Boots
  - » PVC Rubber Gloves
- ❖ Respirators and breathing apparatus shall be selected, used, inspected and maintained in accordance with the applicable regulations.
- ❖ Logbook of inspections, renewals or replacements shall be kept;
- ❖ With inspection intervals according to your procedures;
- ❖ Canisters and cartridges to be renewed when damaged or chlorine is smelled through equipment.

### **7.3. PROTECTIVE CLOTHING**

- ❖ Personal protective equipment shall be kept in an easily accessible, locked cabinet in the immediate vicinity of the plant.
- ❖ The cabinet shall not be situated in any room that contains chlorine.
- ❖ Cabinet clearly and suitably marked.

**8. EMERGENCY KITS “A” & “B”**

**8.2. INTRODUCTION**

When dealing with a problem relating to chlorine cylinders or tanks, you will require the “Emergency Kit “A” or “B”. This kit contains all the equipment needed to repair a leak effectively and for this reason you need to familiarise yourself with the content, uses and maintenance of the kit.

If not available the local Fire Department must have the “Emergency Kit “A” or “B” available for assistance.

| KIT A                                                                              | Cylinders (Arlec/Ilva) | Kit A                                                                               | Cylinders (Tenaris) | Kit B                                                                                | Tanks (Columbiano) |
|------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------|--------------------|
|  |                        |  |                     |  |                    |

**8.3. MAINTENANCE OF EMERGENCY KIT**

It is very important to maintain your emergency kit to ensure efficient sealing of a leak when necessary. The effectiveness of the items depends on the condition of the items when needed.

**The following maintenance aspects need to be adhered to:**

- ❖ Store emergency kit in a cool, dry place away from sunlight and your chlorine installation.
- ❖ This will ensure that:
  - » It can be reached easily when needed and;

- » Exposure to chlorine that promotes rust is minimised.
- ❖ The following maintenance checks on the emergency equipment at least every 6 months:
  - » Bend the gaskets and replace if cracks are visible (light and temperature in time deteriorate gaskets).
  - » Ensure all threaded parts are compatible to their counterparts.
  - » Remove any rust from threads; never use any penetrating oil (e.g. Q20).
  - » Ensure kit is at all times complete.
  - » Record the maintenance check date and condition.

**8.4. INSPECTION RECORD (Example)**

| Date | Name of Inspector | Signature | Comments/Action |
|------|-------------------|-----------|-----------------|
|      |                   |           |                 |
|      |                   |           |                 |
|      |                   |           |                 |
|      |                   |           |                 |
|      |                   |           |                 |

**9. SAFETY AND WARNING SIGNS**

- ❖ The applicable approved, symbolic safety warning signs and emergency procedures as well as the Chlorine wallcharts must be displayed.
- ❖ A wind sock to be fitted in a conspicuous position.
- ❖ Self-contained breathing apparatus (BA-sets) should be strategically placed for easy access.

**10. TRANSPORTATION OF CHLORINE CONTAINERS**

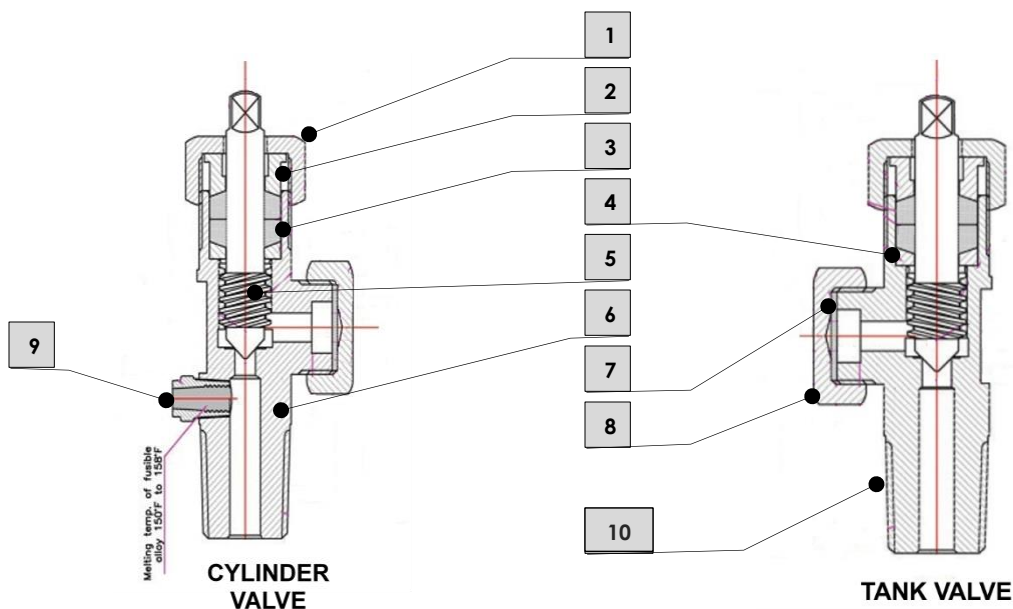
- ❖ Transportation shall be carried out in accordance with Chapter 8 of the dangerous goods regulations of the National Road Traffic Act, 1996 (Act 93 of 1996).
- ❖ In no instance shall containers be so loaded into a vehicle that they can bounce or strike other objects.
- ❖ There shall be no sharp projections on the inside of the loading space, and adequate measures shall be taken to prevent containers from falling off the vehicle.
- ❖ Cylinders being transported should be upright and securely fastened in place. Use elevator, crane or hoist equipment with a cradle or carrier to lift them.
- ❖ Never use a chain, rope sling or magnetic device to lift chlorine cylinders.
- ❖ Never lift them by means of the valve protection cap.
- ❖ Store chlorine cylinders in an upright position and secure properly.

**10.2. OFF-LOADING PROCEDURE AT CUSTOMER PREMISES**

- ❖ The cylinders or tanks are to be off-loaded by driver in a designated off-loading area.
- ❖ The customers receiving qualified person is to ensure that the cylinder or tanks are moved from the designated off-loading area to the customer's safe storage area/building.
- ❖ Check if the dome caps are on the tanks.
- ❖ Check with ammonia or smell for chlorine leaks while the drums are still on the truck.
- ❖ Check if all documents are in order.
- ❖ Check if the tank numbers are correct.
- ❖ If all above are done and in order, proceed to off-load the truck.
- ❖ Avoid that no cylinder or tank being dropped, especially when off-loading of portable gas containers.
- ❖ Ensure you have your PPE with you at all times when handling chlorine.

**IMPORTANT:** It is not the responsibility of the vehicle driver or his assistant to off-load cylinders or tanks directly into customer's safe storage unless by prior agreement between the supplier and the customer.

**11. CHLORINE VALVE COMPONENTS**



| No. | COMPONENT      | MATERIAL | No. | COMPONENT         | MATERIAL   |
|-----|----------------|----------|-----|-------------------|------------|
| 1   | PACKING NUT    | BRASS    | 6   | VALVE BODY        | BRASS      |
| 2   | PACKING GLAND  | BRASS    | 7   | OUTLET CAP GASKET | LEAD       |
| 3   | PACKING        | PTFE     | 8   | OUTLET CAP        | BRASS      |
| 4   | PACKING COLLAR | BRASS    | 9   | FUSIBLE PLUG      | BRASS/LEAD |
| 5   | VALVE STEM     | MONEL    | 10  | INLET TREADS      | BRASS      |

**12. CHLORINE HANDLING**

| <b>QUICK STEPS TO PROBLEM SOLVING<br/>INDEX</b> |                                                               |
|-------------------------------------------------|---------------------------------------------------------------|
| <b>1.</b>                                       | <b>Leaking Cylinder / Drum</b>                                |
| <b>2.</b>                                       | <b>Detecting Chlorine Leaks on the System</b>                 |
| <b>3.</b>                                       | <b>Dealing with a Stuck Valve</b>                             |
| <b>4.</b>                                       | <b>Connecting and Disconnecting Cl<sub>2</sub> Containers</b> |
| <b>4.1</b>                                      | <b>Connecting Serpentine</b>                                  |
| <b>4.2</b>                                      | <b>Disconnecting Serpentine</b>                               |
| <b>5.</b>                                       | <b>Other Causes</b>                                           |
| <b>5.1</b>                                      | <b>Frosting up of Pipes and Containers</b>                    |
| <b>5.2</b>                                      | <b>Back Pressure</b>                                          |
| <b>5.3</b>                                      | <b>Liquefaction of Chlorine</b>                               |
| <b>5.4</b>                                      | <b>Problems with Moist Chlorine-Ferric Chloride Formation</b> |
| <b>5.5</b>                                      | <b>Additional Information Chlorine Gas</b>                    |
| <b>5.6</b>                                      | <b>Suspect Empty Drum</b>                                     |

| <b>1. Problem: Leaking Cylinder / Drum</b> |                                                                                                                                                                 |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ❖                                          | Test with ammonia.                                                                                                                                              |
| ❖                                          | Determine area where leak occurred.                                                                                                                             |
| ❖                                          | <b>Leaking at valve area:</b>                                                                                                                                   |
| »                                          | Remove yellow valve protection cap.                                                                                                                             |
| »                                          | Take valve spanner and ensure valve is in closed position by turning it in a clockwise direction.                                                               |
| »                                          | Remove brass valve end cap.                                                                                                                                     |
| »                                          | Wait a minute or two for the chlorine to disappear and then test with ammonia again.                                                                            |
| »                                          | If leak continues through the valve, replace the brass valve end cap with a new lead washer and tighten cap clockwise.                                          |
| »                                          | Replace yellow valve protection cap.                                                                                                                            |
| »                                          | Mark cylinder with red sticker or red paint as faulty.                                                                                                          |
| ❖                                          | Call Emergency Control Centre at ????????????                                                                                                                   |
| ❖                                          | Leaking at valve threads OR anywhere else on the cylinder, make us of Emergency "Kit" if available or contact your local Fire Department/Emergency Call Centre. |

**2. Detecting Chlorine Leaks on the System**

- ❖ Start with the valve on the drum or cylinder by using the ammonia squeeze bottle.
- ❖ Check the serpentine for cracks or holes by using the ammonia squeeze bottle.
- ❖ Check the Cl<sub>2</sub> valve on the main line by using the ammonia squeeze bottle.
- ❖ Check chlorinator and flow meters for any chlorine leaks.
- ❖ Follow the main line to the catch pot, check all the flanges and gaskets by using the ammonia squeeze bottle.
- ❖ Follow the whole system till the end.
- ❖ Once leak is detected, close the valve on the chlorine cylinder.
- ❖ Follow your procedure for maintenance and disconnecting the chlorine cylinder from the system.
- ❖ If the chlorine cylinder is found to be leaking follow procedure 1 as on previous page.

**3. Dealing with a Stuck Valve**

- ❖ Use chlorine valve spanner to open the valve.
- ❖ Hold spanner and hit the side of the spanner with the palm of your hand (use gloves for protection).
- ❖ Make sure that it is anti-clockwise.
- ❖ Repeat if not opening.
- ❖ Never use a hammer directly on the valve.
- ❖ If still stuck inform your Supervisor immediately.

**4. Connecting and Disconnecting Cl<sub>2</sub> Containers**

**Safety and Correct Tools;**

- ❖ Rubber gloves
- ❖ Ammonia
- ❖ Respirator (full face mask)
- ❖ Correct chlorine valve spanner
- ❖ Spanner "32"
- ❖ Lead washers

**Checks before Connecting Cl<sub>2</sub> Containers;**

- ❖ Check serpentine for sharp butts and holes.
- ❖ Check serpentine nut threads.
- ❖ Check outlet threads on valve.

**4.1. Connecting Serpentine ("Pigtail")**

- ❖ Clients to follow their own standard working procedure for connecting serpentine.
- ❖ Removed old lead washer.

- ❖ Place new lead washer into serpentine.
- ❖ Move the serpentine nut forward so that the lead washer seats into the nut.
- ❖ Manoeuvre the serpentine so that the nut is level with the outlet of the valve.
- ❖ Tighten the nut by turning the nut clockwise with hand until a solid seat position is obtained and lock nut with valve spanner.
- ❖ Open valve/s on chlorinator/manifold system as per clients operating procedure before opening chlorine valve on cylinder/drums.
- ❖ Test for chlorine leaks with ammonia by squirting ammonia gas from ammonia solution in squeeze plastic bottle with spout on all connections. **NEVER SQUIRT LIQUID AMMONIA SOLUTION ON EQUIPMENT.**
- ❖ Open valve on Cl<sub>2</sub> container by turning valve spindle anti-clockwise.
- ❖ Test for chlorine leaks with ammonia by squirting ammonia gas from ammonia solution in squeeze plastic bottle with spout on all connections.

#### 4.2. Disconnecting of Serpentine

- ❖ Close valve on Cl<sub>2</sub> container by turning valve spindle clockwise.
- ❖ Leave for one minute the close valve on system.
- ❖ Loosen serpentine nut.
- ❖ Test for chlorine leaks with ammonia by squirting ammonia gas form anhydrous ammonia solution in squeeze plastic bottle with spout on all connections

### 5. Other Causes

#### 5.1. Frosting up of Pipes and Containers

- ❖ The frosting up of pipes and containers is possible if large quantities of gaseous chlorine are removed from them over long periods at low temperatures and is not a safety risk. In normal use the rates of withdrawal from bottles and tanks shall not exceed 1% of the contents over a period of 1h (at ambient temperatures of 18°C to 20°C).

#### 5.2. Back Pressure (suck-back-reverse flow)

- ❖ If chlorine gas is being injected into a liquid, the liquid can be sucked back into the chlorine line and into the container from which the chlorine is being fed.
- ❖ If the liquid (e.g. water or moisture) flows back into the chlorine container; it combines with the chlorine to form a weak acid. This acid attacks the metal on the inside of the container forming dark/reddish sludge of Ferric Chloride.
- ❖ This happens when chlorine flow ceases, for example when
  - » The supply source runs empty
  - » The operator shuts off an incorrect valve
  - » An injector seat fails
- ❖ Suck-back has caused serious accidents and severe corrosion. The design of the system shall be such that suck-back is prevented.
- ❖ Safety devices to prevent chlorine suck-back
- ❖ Suck-back shall be prevented at all times, and to this end consideration shall be given to the

use of an additional check valve that shall be placed between the ejector and the vacuum regulator. However, where suck-back is a possibility the installation shall be protected by any one or a combination of

- » Non-return valves
  - » Flow interlocks
  - » Vacuum breaking devices
  - » Barometric loops
- ❖ A barometric loop is useful only when the chlorination vessel is at atmospheric pressure and the loop can extend more than 11m above the surface of the liquid.

### 5.3. Liquefaction of Chlorine

- ❖ If chlorine installations have been competently designed, liquefaction of chlorine will normally not take place.
- ❖ However, liquefaction of chlorine can occur in chlorine gas lines that pass through areas where the temperature is below the temperature-pressure equilibrium point indicated by the vapour pressure curve.
- ❖ Reducing the pressure by means of a pressure-reducing valve can usually prevent liquefaction.

### 5.4. Problems with Moist Chlorine-Ferric Chloride Formation

- ❖ When maintenance is being performed, connections can be made or broken, resulting in possible exposure to moisture. This might result in the formation of ferric chloride. Under these conditions measures shall be taken to minimize the influx of moisture as far as possible. Ferric chloride appears as a bright yellow powder, which soon picks up moisture. As ferric chloride picks up moisture its colour changes, ultimately appearing as a brown, viscous liquid. If it is heated it can appear as reddish brown scale. Ferric chloride rapidly plugs chlorine lines and a build-up of ferric chloride in vaporizers reduces their efficiency.
- ❖ Severe corrosion will occur in these conditions and it will damage the equipment.

### 5.5. Additional Information Chlorine Gas

- ❖ Chlorine is only slightly soluble in water. Chlorine gas reacts with ammonia gas (vapour) to produce a dense white cloud of ammonium chloride. This property is used to detect chlorine leaks. Only ammonia vapour shall be used when testing for chlorine leaks.

### 5.6. Suspect Empty Drum – How to Test

- ❖ Chlorine not coming through when connecting up.
- ❖ Disconnect valve and turn drum around.
- ❖ Connect second valve and open valve.
- ❖ Check system if chlorine coming through.
- ❖ Check medal tag for filling dates.
- ❖ No chlorine coming through, disconnect and mark drum with a red sticker. Notify Chlorine Supplier



## **13. MAINTENANCE**

### **13.2. GENERAL**

To avoid damage to equipment and danger to persons, it is essential that the personnel to whom this duty is assigned carefully maintain chlorine parts.

- ❖ Automatic protective devices shall be checked regularly, and leakage and other faults shall be attended to immediately.
- ❖ When a dangerous leakage of chlorine has occurred, the area concerned shall be enclosed and personnel shall not be permitted to enter the enclosed area until it has been cleared by purging or ventilating.
- ❖ Procedures covering routine daily maintenance and preventative maintenance shall be formally documented. Maintenance of the installation shall be carried out by competent, well-trained personnel.
- ❖ Chlorine gas dosing equipment and apparatus, chlorine gas warning systems and sprinkler apparatus shall be serviced at least once a year.

### **13.3. EQUIPMENT MAINTENANCE**

To maintain the chlorine system functional and safe it is necessary to carry out regular planned maintenance inspections. Ensure that:

- ❖ All changes (including the removal and addition of components) are made in accordance with the standard.
- ❖ There is no leakage (with particular attention to valves, joints of all types, connections and areas of corrosion).
- ❖ Filters are in good condition and are not blocked (clean where necessary).
- ❖ Valves to be used in normal operation or in cases of emergency are accessible and are easy to operate.
- ❖ The setting and operation of regulators are satisfactory.
- ❖ Relief valves are checked for leak proof closure and proper working condition.
- ❖ There are legible warning notices.
- ❖ The piping and associated equipment are free from damage and are in a working order.

## **14. TRAINING**

### **Users of chlorine and chlorine apparatus shall:**

- ❖ Be educated in the required procedures and
- ❖ Always have escape-type respirators ready for immediate use
- ❖ All personnel involved in the operation and maintenance of chlorine installations shall have been instructed in the functioning of the installation, to ensure that they are fully conversant with the equipment concerned.
- ❖ All personnel operating chlorine cylinders or tanks must undergo the compulsory Chlorine Handling Training Course. This certificate is valid for two years. Bookings for this course can be made on telephone number 064 517 4920 during office hours.

