Chlorine Containers

Safety Manual

Safe Handling & Maintenance

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Safe Handling & Maintenance

An ISO 9001:2015 Unit

Contents

Illustrations :

Section I

Properties of Chlorine

1. Chlorine Gas is nearly colourless in low concentration. As the concentration increases, it takes on a greenish yellow hue. It has a pungent and irritating odour.

2. Liquid chlorine is amber in colour.

3. Chlorine is only slightly soluble in water, approximately 1% at 9.4 Deg.C. Below 9.4 Deg.C chlorine combines with water, forming crystalline hydrate known as "Chlorine Ice". This property of chlorine to form solid hydrate with chilled water is quite useful in tackling emergencies connected with spillage of liquid chlorine.

4. Liquid chlorine is a skin irritant and can cause severe damage to body tissues. It vaporizes rapidly to gaseous form at normal atmospheric pressure and temperature conditions.

5. Liquid chlorine is 1.5 times heavier than water.

6. Gaseous chlorine is 2.5 times heavier than air, and therefore tends to settle down near ground level.

7. Chlorine gas is a respiratory irritant. Inhaling gas in low concentration causes coughing, tears, a running nose and breathing difficulties.

8. Neither liquid nor gaseous chlorine is explosive or flammable but both react chemically with many organic and inorganic substances such as ether, turpentine, ammonia, hydrocarbons, finely divided metals etc.

9. Chlorine does not burn but supports combustion.

10. The volume of liquid chlorine increases with increasing temperature. Precautions must be taken to preclude build up of excessive pressure in containers by ensuring vapour space for expansion of liquid chlorine.

11. One volume of liquid chlorine vapourises into about 458 volumes of gas at 0 Deg.C and 1 atmospheric pressure.

12. Chlorine gas is highly corrosive to most metals in the presence of moisture due to formation of Hydrochloric acid and Hypochloric acid.

Section II

Handling and Transportation of Containers

1. Ton containers should be handled with suitable lifting, clamp or chain slings in combination with a hoist or crane having at least 2-Ton capacity (Refer figure 1). Containers should not be lifted with rope slings, chains or magnetic devices. Lifting clamps should be either rubber lined or wooden/rubber block should be used between lifting hook and container shell, to avoid dent marks on the surface.

2. Containers being trucked should be carefully choked, clamped or otherwise suitably supported to prevent shifting and rolling during transportation (Refer figure 2).

3. Containers can be unloaded manually by slowly rolling down from the truck or Freight Container through a slanted ramp. Unloading should be started in numerical order as shown in Figure 2a & 2b.

4. Containers should not be permitted to drop and no object should be allowed to strike them with force.

5. The containers should not project beyond the sides or ends of the vehicle in which they are transported.

6. The vehicle carrying filled or partially filled containers should be covered by tarpaulins as direct exposure to sun can raise container temperature much beyond the safe limits.

7. The vehicle in which containers are kept should not carry inflammable items including oil, paints, grease etc.

8. Do not roll containers on rough surfaces to avoid damage to the paint or surface of container.

9. Both valves of the container should be sealed with cap nuts and valve protection hood should be secured in position.

10. In case the driver of the vehicle detects any leakage on his way, he must take the vehicle to an open and isolated area to minimise the hazards associated with chlorine leakage.

11. An emergency kit should preferably be available with every vehicle used for transporting containers. As a minimum requirement an emergency kit must contain one set of valve and surface leak arrestor assembly and personal protection equipment such as Gas Masks with Canister, Apron, Hand Gloves and Gas tight goggles.

Section III

Storage of Containers

1. Containers should be stored under cover and preferably kept in shade.

2. Containers whether empty or full should be stored in a dry, well-ventilated area protected from external heat sources such as steam pipes or exhaust from compressors etc. Full and empty containers require separate storage space. Do not store containers near gangways, elevators or ventilating system.

3. No chemical or fire hazardous material should be stored near used or filled containers, nor should these be transported together.

4. Compressed gas containers of other liquefiable gases should be stored separately. No turpentine oil, kerosene, diesel, cooking gas, ether, anhydrous ammonia, gunny sacks, hydro carbons or other inflammable materials should be stored nearby.

5. Containers should not be stacked or racked more than one high. Storage should be arranged to facilitate moving and frequent inspection with minimum disturbance.

6. The storage area should be free from flooding and water stagnation to minimise external corrosion. If standing water cannot be avoided, suitable platforms or supports should be provided to avoid contact with water and sludge.

Section IV

Operating Containers

1. Containers should not be modified or altered or repaired by the user under any condition.

2. Do not change the colour of paint of the container.

3. Container should not be filled with any gas other than that for which it is specifically permitted.

4. Oil, Grease on inside of finished containers and all particles of grit, fillings or other matters which may have collected inside the container during manufacture or heat treatment or testing should be removed completely before first filling.

5. Before each filling, check that the container's interior is absolutely dry. Also inspect the internal surface of the container for corrosion or scale by inserting a 12-Volt bulb through an inspection opening. Corrosion will contaminate chlorine when filled into the container.

6. Operator handling partially filled or fully filled containers must wear face mask, hand gloves and gum boots.

7. Check and clean coupling threads thoroughly & replace gaskets (if applicable) before fitting plugs or valves with the containers. Also avoid over tightening of valves or plugs as this may cause damage to the threads.

8. The external surface of the container should be periodically inspected to check for any dents, heavy pitting, bulging, leaks and exposure to fire.

9. Containers normally should be emptied in the gas phase and set in a horizontal position. Valves in a vertical plane will deliver gas from the upper valve and liquid from the lower valve. When emptied in liquid phase a vaporizer may have to be used.

10. Ensure that water or any other liquid is not sucked back due to pressure gradients. Atleast 5 kg. of chlorine should be left in the container before sending it for re-filling. An inside pressure of up to 0.5 kg/cm^{2}g of chlorine in the container is recommended to avoid back flow of any liquid from the system.

11. The rate of delivery of gaseous chlorine should not be increased by spraying hot water. For increasing discharge rate, use forced circulation of room temperature air around the container.

12. Every container must be emptied of its residual gas by venting. Vented out gas must be neutralised by absorption in limewater.

13. Valves should be opened one complete turn (counter clockwise) by rotating spindle with a hand wheel, wrench or spanner. Three complete turns fully open the valve. Further turning serves no useful purpose and may seriously damage the valve. If the valve is difficult to open, the gland nut may be loosened a bit. If valve cannot be opened because of a tight valve spindle, rotate the container by 180 Deg. and try second valve to withdraw gaseous chlorine.

14. Never force connections that do not fit. Use only approved equipment to effect a valve opening or closure. Never use a hammer for this purpose, nor apply excessive force than what is required for opening or closing valve/adopter.

15. Usage of pipe wrench or improper sized spanner should be avoided, as this would cause damage to the valve spindle leading to leakages.

16. When container is empty, the valves should be closed by rotating the spindle clockwise and tested for leaks. If no leak is evident, the valve outlet cap and valve protection hood should be fitted. If leakage occurs, the open end should be plugged immediately to prevent entry of moisture and other impurities, which might form corrosive or explosive mixture (Hydrochloric acid and hypochlorous acid).

17. The container valve should not be used for controlling the flow of chlorine as frequent operation may damage the valves.

18. To find leak, tie a cloth to the end of a stick; soak the cloth in strong aqueous ammonia solution and hold it close to the suspected area. A white cloud of ammonium chloride will result if there is any chlorine leakage. All chlorine users must ensure that they have "Ammonia Torch" ready and handy.

19. Whether the container is empty or filled, the outlet cap (or adopter cap) must be secured and tightened properly to avoid rusting of the threaded portion due to moisture pick up. Use proper sized screw spanner for tightening and loosening valve outlet cap and gland nut.

20. Always keep valve protection hood in place (except when containers are being emptied) so as to protect valves from picking up moisture from the environment.

21. For proper connection between the container valve (mounted with clamp and adopter) and the process pipeline, annealed copper flexible tubing capable of withstanding a working pressure up to 35.2 kg/cm^{2}g should be used. Rubber tubes shouldn't be used as they get damaged fast in chlorine service. A new gasket should be used each time a connection is made between the valve outlet and the piping system.

22. Containers should be used in the order in which they are received and should be emptied within 4 weeks of receipt.

23. If a container has lost its tare weight by more than 5%, it is recommended to withdraw from service and destroy. (Please follow the local regulations).

24. Apply paint on outside surface of the container periodically so as to improve the life of the container.

25. Keep all equipment, tools and implements, used in connection with chlorine handling and operations, free from oil, dirt and grit.

Section V

Recommended Practices to Prevent Corrosion on the Inside Surface of Chlorine Tonners

Chlorine is generally filled in a liquid state in Chlorine Tonners and can be withdrawn in liquid or gaseous states. Carbon Steel material is recommended by all renowned codes/standards as a suitable material of construction for 'Dry Chlorine'.

'Dry Chlorine' has no free water present i.e. water content remains dissolved in solution. Normally recommended moisture in Liquid Chlorine is < 11 ppm (by weight), and in Gaseous Chlorine is < 150 ppm (by weight).

Isgec recommends the following practices to prevent corrosion on the inside surface of Tonners due to water, moisture or other chemicals:

- In general, washing/cleaning of the Tonner is to be done every two years. In case, any foreign material like moisture, other chemicals, extra rust, or even vacuum is observed inside the Tonner, the Tonner must be washed/cleaned before the next filling. A record should be maintained of each Tonner in this regard.
- For washing/cleaning of the Tonner, use of steam is recommended so as to have the inside surface temperature in the range of 70-90 Deg.C during the washing process. Steam Washing should be followed by emptying the Tonner with dry air having moisture level < 40 ppm (-40 Deg.C Dew Point).
- Coupling threads must be thoroughly checked and cleaned with dry air/wire brush before fitting Plugs or Valves.
- After drying the Tonner, the Valve and Accessories should be fitted followed by Air Test for leakage check with soap solution at 7 Kg/Cm^2.
- Before filling, ensure that the interior surface is absolutely dry by using dry air. Further, inspect the internal surface of the Tonner for corrosion or scaling by inserting an LED light at 12 Volt supply through the transformer with adequate illumination through inspection opening. The Tonner is to be washed/cleaned if any abnormal things are observed as mentioned above.
- The withdrawal rate of Chlorine Gas should be nominal. If the withdrawal rate is higher, ice formation is observed. Soluble water in liquid Chlorine becomes free with fall in temperature. The same liquid Chlorine becomes wet under the conditions. When the temperature of the Tonner rises, Chlorine evaporates first and water becomes free which results in internal corrosion.
- All connections with Tonner should have neutralisation system and necessary safety equipment and reverse 'U' loop to arrest moisture to prevent back pressure.

- All types of Chlorine – Liquid, Dry, and Wet – behave differently and are not compatible with each other. All efforts should be made to avoid inter-mixing.
- It must be ensured that water or other chemicals are not sucked back in the Tonner due to pressure gradients. At least 5 Kg of Chlorine should be left in the Tonner before sending it for re-filling. An inside pressure of up to 0.5 Kg/cm^2 g of Chlorine in the Tonner is recommended to avoid backflow of any liquid from the system if there is no 'U' loop in the system. It must be ensured that pressure gauges on the Chlorine Header are calibrated regularly and a record is maintained under no 'U' loop conditions.
- Keep moisture away from all fittings and valves by blocking with taper Teflon plugs as moist Chlorine is extremely corrosive.

Section VI

Servicing of Valves

Container's Valve should preferably be removed, examined, reconditioned and retested during each filling as per following procedure :-

DESIGN FEATURES AND LIMITATIONS

The design is that of a 'packed' valve that use compressed packing to make a seal around the valve spindle/stem and at the valve body. The basic parts of the packed valve are the valve body, spindle, packing nut and packing that is located between the packing follower/ gland and the packing ring/collar. To ensure a good seal at the spindle, the packing nut is firmly tightened to compress the packing against the spindle. This results in high level of torque to operate the valve and therefore the valve design calls for a spindle key to operate the valve. This design as with most packed valve design, use metal to metal shutoff because of high torque that can be exerted with the wrench/Spindle key. However the length of the Wrench used with the valve must be the shortest that will do the job to avoid damage to the spindle or valve body seat. Hence adjustable wrenches or pliers are not recommended. This design is not recommended for high purity applications because of particulate generation from wear of packing and spindle against the valve seat and potential for inboard leakage under vacuum. Also it is important to tighten gland nut at a torque (Between 54-60 Nm) in case of gland leakage. In all circumstances, gland nut should be retightened after every 500 cycles.

REMOVAL OF VALVES FROM CYLINDERS

Valve removal can be accomplished with either a manual, electric or hydraulic wrench. Remove valves from cylinders ensuring that the jaws gripping the valve fit properly over the wrenching flats on the valve without contacting the outlet, inlet or relief device on the valve. The valves should be removed slowly to prevent damage to engaged threads. Before removing the valves, it is important that the container is completely empty of gas, preferably vacuumized and secure to prevent toppling during valve removal. Valve inspection & reconditioning should be carried out by trained personnel familiar with valve design and performance requirements with proper tools & gadgets.

VALVE DISASSEMBLY

- Use recommended wrench with one end having 1¼" Open end Spanner to remove Outlet Cap & Packing Nut. Fit opposite end of the same spanner with size 3/8" square open to remove spindle along with other internal fitments of Packing Gland, Packing & Packing Collar.

- Do not remove Fusible Plug from body unless it is defective.

- Inspect individual components for structural cracks, gross corrosion & other significant damage.

- Inspect packing rings for wear and discard one or both rings if found in unusable condition.

CLEANING

- We strongly recommend to clean valve bodies and components which are observed 'green', likely Copper Chloride due moisture (especially in Chlorine service) either in the Chlorine or which has entered the system during connections and disconnections.

- The greenish layer of Copper Chloride or any other salt formation on threads of valve body and stem depending upon gas service can result in valve body becoming 'Jammed' resulting in high torque required to open/close the valve and/or improper fitting of the outlet cap.

- Use suitable cleaning procedures without damaging the valve components and threads. Suitable and recommended cleaning procedures may be more or more of the following.

  a) Steam cleaning (Should not be used for valves with fuse plugs)

  b) Detergent cleaning (Preferably in conjunction with steaming). – Also do not use ammonia solutions because they cause stress corrosion cracking in valve alloys.

  c) Mechanical – Powder driven brush, buffer wheel or bead blaster.

  d) Acid Bath – Use solvents in strict compliance with the manufacturers safety recommendations.

Regardless of the method used, care should be taken that these components remain within the dimensional specifications of this pamphlet after cleaning.

INSPECTION AND RECONDITIONING

- After cleaning, valve body & its components should be inspected again for cracks & wear. All components should meet the dimensional specifications of the drawings except those areas, which are allowed to be reconditioned & inlet thread which are deformed during valve installation, & cannot be regauged.

- The external threads on valve body (inlet, outlet, and packing nut end) should be examined for corrosive damage, heavy wear, and material loss. Rethreading dies can be used for outlet and packing nut threads to remove material buildup and re-died threads should be subsequently checked by Thread ring "Go" and gauges "Go" and "No Go"

- The valve outlet sealing face should be checked for nicks and crack and refaced if required. Repeated resurfacing will reduce the number of effective threads and may weaken the body.

- Inlet threads on used valves should be inspected visually & soft wire brushed to remove burrs & polish threads.

- The valve body internals should be inspected closely under a bright light, preferably with some magnification.

- The internal bores and threads should be inspected for gross corrosion and material loss. Inspection gauges should be used to check internal ACME thread. The gauges will indicate if the threads present are within specification. A visual inspection of the ACME thread is also required. The threads closest to the valve seat are the most susceptible to corrosion. Loss of these threads could lead to a loss of engagement when the valve is closed, resulting in a "spinner" (a valve with a stem unable to seal at the valve seat due to thread loss or deterioration). If a spinner condition is present, the valve body must be scrapped.

- The sharp edge of seat will become beveled with repeated closing requiring more and more torque to close the valve to make leak proof. It is advisable to recondition the seat area to restore sharp edge by refacing using reconditioning seat cutter. Care should be taken not to reseat valve body to a depth greater than 48 mm.

REASSEMBLY & REINSTALLATION

- Clean parts after reconditioning & assemble using Krytox GPL 225 or any other suitable compatible lubricant on the stem threads and stem shank using recommended spanners & torque wrenches as per GA drawing. Tighten the packing nut between 54-60 Nm and fuse plugs at 15 foot pounds (If present and required).

TESTING (After reconditioning and/or before filling)

- Connect the valve inlet to a source of oil-free dry air or nitrogen regulated to 50 Barg. Close to valve to check internal tightness at 12 Nm check for leakage from valve outlet for one minute by using Teepol HB7 or equivalent soap solution. This torque value may be higher for valves in Chlorine and other corrosive service but should not exceed 40 Nm under any circumstances. Repair the valves if necessary and retest and reject if leakage persists. Check external leakage by installing an outlet cap, open the valve, and test body integrity and possible gland leakage at 50 Barg pressure. In case of leakage, tighten gland nut between 54-60 Nm and recheck for external tightness. Dry valve before filling.

VALVE TIGHTENING TORQUE

We recommend use of PTFE thread sealant to tighten valve inlet on the cylinder coupling. The recommended valve tightening torque as per ISO 13341 on valves having inlet 25E to EN629-1 should be between is 200-300 Nm for fitting in Seamless steel cylinders. It is advisable to clean/tap cylinder coupling before valve fitment to avoid damage to the valve inlet and to facilitate sealing between the threads.

Section VII

Handling Emergencies

1. There are three potential source of leaks in a container as detailed below:-

   a) Exit Connection

   b) Stem

   c) Gland

2. Leaks around valve stem can be stopped by tightening the packing nut or gland. If this does not stop the leak, the container valve should be closed.

3. If chlorine is leaking as a liquid from container, turn container in such a way as to keep the leak at top so that only gas instead of liquid escapes. Only 1/15th as much chlorine in gas form will escape.

4. Leaking chlorine from containers may be absorbed in aqueous solution of caustic soda or soda ash. Caustic soda absorbs chlorine most readily. A suitable neutralization tank or pit to hold the solution should be provided in a convenient location. Chlorine should be passed into the solution through an iron pipe. The container should not be immersed in the solution.

5. Use emergency kit to stop leaks in the container and valves. All users and filling plants must posses at least one set of the emergency kit. After use, the kit should be thoroughly cleaned with alkaline solution and dried. To prevent corrosion, all parts should be properly oiled. Gaskets should be discarded after every use and replaced with new ones.

6. Provide breathing apparatus to the person handling chlorine. The breathing apparatus, when not in use, should be stored in air tight, glass fronted cases placed in prominent and accessible position. They must be inspected regularly and maintained in good order.

7. Anyone seriously exposed to chlorine gas should be moved at once to an uncontaminated area. If breathing has not ceased, the patient should be placed on his back with head and back elevated. He should be kept warm using blankets, if necessary.

8. Wear PVC gloves, gumboots and head masks for attending emergencies.

9. Water should never be used on a chlorine leak as it always makes the leak worse due to corrosive effect. In addition, heat supplied by even the coldest water to leaking container causes

10. For decontaminating chlorine, lime powder should be sprinkled on the floor.

11. A gas mask should be readily available for use in case of an emergency and should be worn when opening a valve or disconnecting piping system from valve outlet.

12. A chlorine detector should be installed near the chlorine usage area as they serve to warn the operator of a chlorine leak. They should be operated continuously and tested regularly. The detector system should activate the alarm at a concentration of 1-PPM chlorine in the atmosphere.

13. To know the wind direction, install "Wind-Cone" at prominent place. In case of a chlorine leakage, all persons working in the surrounding area must move away in the direction opposite to the wind flow.

14. An extraction fan must be installed at 1.5 feet above ground level to suck away chlorine gas in case of leak which being heavier than air will settle down. The fans must ensure withdrawal of gas away from the operator.

15. Only trained persons equipped with suitable gas masks and emergency kits should investigate leakage. No person should work alone on a chlorine leakage.

16. In the event of fire, container should be moved from the fire zone immediately as otherwise the surrounding heat will raise pressure inside the container because chlorine expands with rise in temperature.

17. In case of large accidental spillage of liquid chlorine, spray chilled water (below 10 Deg.C) on floor. A film of solid chlorine hydrate will be formed as top layer thus reducing the rate of evaporation from the spillage. Immediate steps must be taken to neutralize the spilled chlorine with sufficient quantity of caustic soda/soda ash or lime.

18. If liquid chlorine or chlorinated water has contaminated skin or clothing, emergency shower should be used immediately and affected areas washed with soap and water. Don't try to neutralize chlorine with chemicals. Also no ointment should be applied for 24 hours. Contaminated clothes should be removed immediately.

19. If eyes have been affected with liquid or gaseous chlorine, they should be flushed immediately with running water for atleast 15 minutes. The affected person should be immediately referred to a Doctor for further medical assistance.

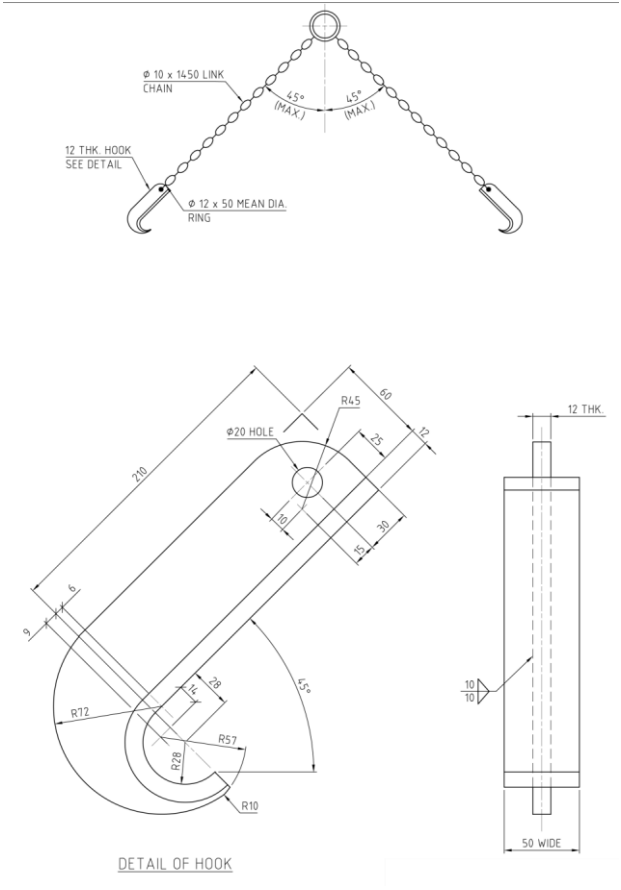

Fig 1: Lifting Chain for Handling Container

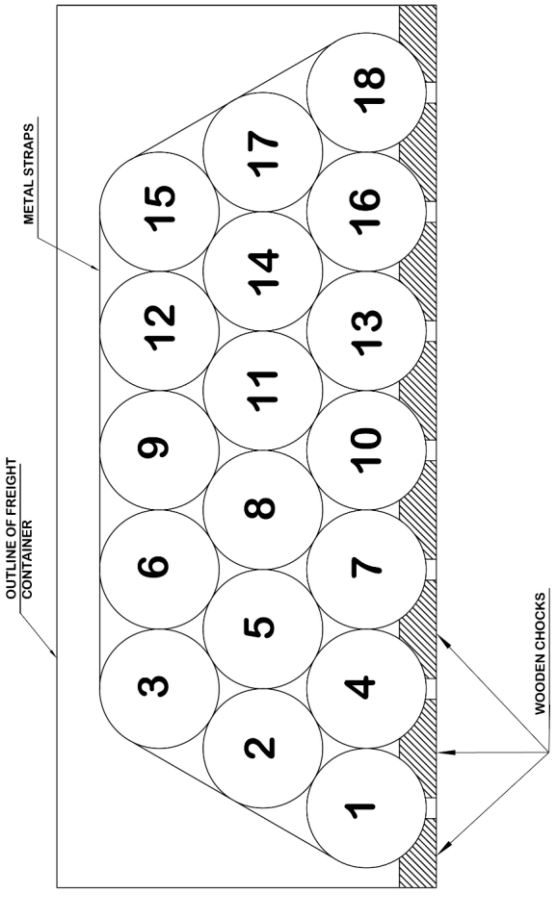

Fig 2: Loading of Containers in Marine Freight Container

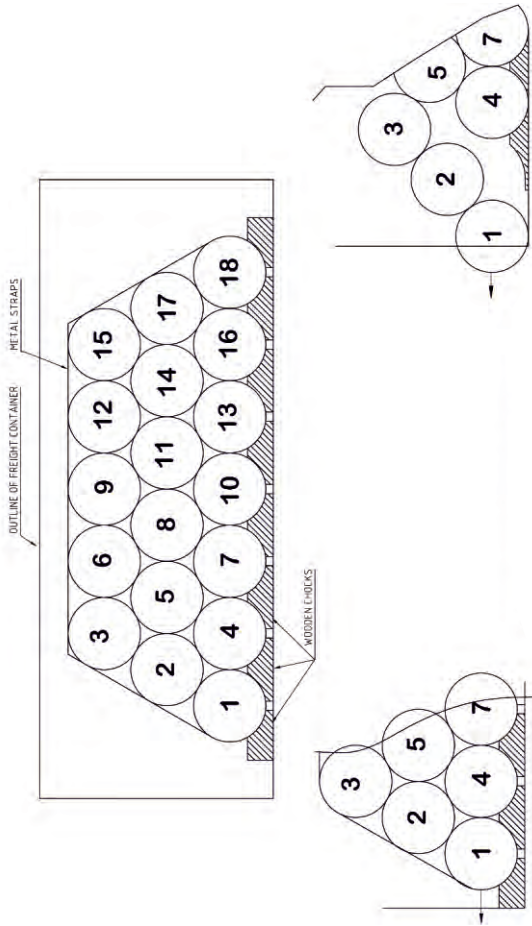

Fig 2(a): Loading/Unloading Container from Marine Freight Container

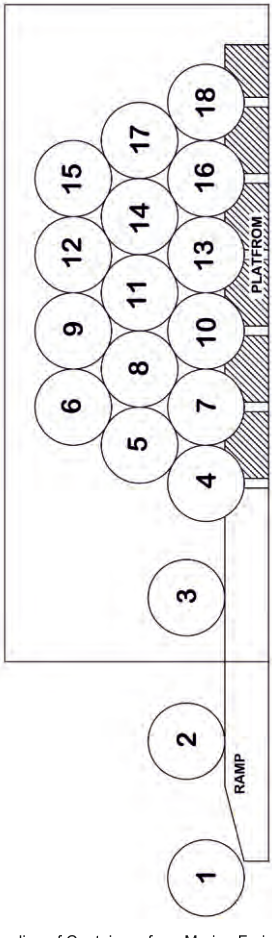

Fig 2(b): Unloading of Containers from Marine Freight Container

TROUBLESHOOTING & COMMON QUERIES

1. What are the symptoms of Chlorine Inhalation?

Chlorine gas is a respiratory irritant. Inhaling gas in low concentration causes coughing, tears, a running nose and breathing difficulties.

2. Why vapour space is needed?

The volume of liquid chlorine increases with increasing temperature. Precautions must be taken to preclude build up of excessive pressure in containers by ensuring vapour space for expansion of liquid chlorine.

3. How much crane capacity is required to lift Ton Container?

Ton containers should be handled with suitable lifting, clamp or chain slings in combination with a hoist or crane having at least 2-Ton capacity (Refer figure 1). Containers should not be lifted with rope slings, chains or magnetic devices. Lifting clamps should be either rubber lined or wooden/rubber block should be used between lifting hook and container shell, to avoid dent marks on the surface.

4. How to unload containers manually from truck/Marine Freight Container?

Containers can be unloaded manually by slowly rolling down from the truck or Freight Container through a slanted ramp.

5. How to protect valves?

Both valves of the container should be sealed with cap nuts and valve protection hood should be secured in position.

6. Which accessories are required with Emergency Kit?

An emergency kit should preferably be available with every vehicle used for transporting containers. As a minimum requirement an emergency kit must contain one set of valve and surface leak arrestor assembly and personal protection equipments such as Gas Masks with Canister, Apron, Hand Gloves and Gas tight goggles.

7. How to avoid water contact during storage of containers?

The storage area should be free from flooding and water stagnation to minimise external corrosion. If standing water can not be avoided, suitable platforms or supports should be provided to avoid contact with water and sludge.

8. How to inspect & clean containers before refilling?

Oil, Grease on inside of finished containers and all particles of grit, fillings or other matters which may have collected inside the container during manufacture or heat treatment or testing should be removed completely before first filling.

Before each filling, check that the container's interior is absolutely dry. Also inspect the internal surface of the container for corrosion or scale by inserting a 12-Volt bulb through an inspection opening. Corrosion will contaminate chlorine when filled into the container.

9. How to increase discharge rate?

The rate of delivery of gaseous chlorine should not be increased by spraying hot water. For increasing discharge rate, use forced circulation of room temperature air around the container.

10. How to empty container in gas phase?

Containers normally should be emptied in the gas phase and set in a horizontal position. Valves in a vertical plane will deliver gas from the upper valve and liquid from the lower valve. When emptied in liquid phase a vaporizer may have to be used.

11. How to open valves?

Valves should be opened one complete turn (counter clockwise) by rotating spindle with a hand wheel, wrench or spanner. Three complete turns fully open the valve. Further turning serves no useful purpose and may seriously damage the valve. If the valve is difficult to open, the gland nut may be loosened a bit. If valve cannot be opened because of a tight valve spindle, rotate the container by 180 o and try second valve to withdraw gaseous chlorine.

12. How to detect suspected chlorine leakage?

To find leak, tie a cloth to the end of a stick; soak the cloth in strong aqueous ammonia solution and hold it close to the suspected area. A white cloud of ammonium chloride will result if there is any chlorine leakage. All chlorine users must ensure that they have "Ammonia Torch" ready and handy.

13. How much loss in tare weight is permitted?

If a container has lost its tare weight by more than 5%, it is recommended to withdraw from service and destroy. (Please follow the local regulations).

14. How to test valves?

Connect the valve inlet to a source of oil-free dry air or nitrogen regulated to 50 Barg. Close to valve to check internal tightness at 12 Nm check for leakage from valve outlet for one minute by using Teepol HB7 or equivalent soap solution. This torque value may be higher for valves in Chlorine and other corrosive service but should not exceed 40 Nm under any circumstances. Repair the valves if necessary and retest and reject if leakage persists. Check external leakage by installing an outlet cap, open the valve, and test body integrity and possible gland leakage at 50 Barg pressure. In case of leakage, tighten gland nut between 54-60 Nm and recheck for external tightness. Dry valve before filling.

15. What are the sources of leakage in container?

There are three potential source of leaks in a container as detailed below:-

a) Exit Connection

b) Stem

c) Gland

16. How to prevent chlorine leakage in liquid phase?

If chlorine is leaking as a liquid from container, turn container in such a way as to keep the leak at top so that only gas instead of liquid escapes. Only 1/15th as much chlorine in gas form will escape.

17. How to absorb leaking chlorine?

Leaking chlorine from containers may be absorbed in aqueous solution of caustic soda or soda ash. Caustic soda absorbs chlorine most readily. A suitable neutralization tank or pit to hold the solution should be provided in a convenient location. Chlorine should be passed into the solution through an iron pipe. The container should not be immersed in the solution.

18. How to stop leakage?

Use emergency kit to stop leaks in the container and valves. All users and filling plants must posses at least one set of the emergency kit. After use, the kit should be thoroughly cleaned with alkaline solution and dried. To prevent corrosion, all parts should be properly oiled. Gaskets should be discarded after every use and replaced with new ones.

19. How to handle person exposed to chlorine?

Anyone seriously exposed to chlorine gas should be moved at once to an uncontaminated area. If breathing has not ceased, the patient should be placed on his back with head and back elevated. He should be kept warm using blankets, if necessary.

20. Should water be used to stop chlorine leakage?

Water should never be used on a chlorine leak as it always makes the leak worse due to corrosive effect.

21. How to handle chlorine spilled on ground/floor?

In case of large accidental spillage of liquid chlorine, spray chilled water (below 10 Deg.C) on floor. A film of solid chlorine hydrate will be formed as top layer thus reducing the rate of evaporation from the spillage. Immediate steps must be taken to neutralize the spilled chlorine with sufficient quantity of caustic soda/soda ash or lime.

22. What to do if eyes have been exposed to chlorine?

If eyes have been affected with liquid or gaseous chlorine, they should be flushed immediately with running water for atleast 15 minutes. The affected person should be immediately referred to a Doctor for further medical assistance.

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