

OPERATING THE TANK

Care must be taken in the handling and operation of tank containers to ensure the safety and security of potentially hazardous cargoes. Seaco can offer advice on all aspects of tank operations.

SAFETY

Tank containers must be operated responsibly during loading, discharge, storage and transport to ensure the safety of workers, the general public and the environment.

It is essential to ensure:

- The tank is of the correct type.
- A pre-trip mechanical condition inspection has been completed.
- The interior and exterior are clean.
- The tank is marked with the correct identification and hazard warning labels.
- The gross weight of the tank, vehicle and handling equipment is not exceeded.
- The tank is filled correctly and the ullage (free space in loaded tank) complies with the regulations.
- All operations are completely supervised by qualified personnel and the personnel in charge are in possession of written instructions detailing the relevant safety requirements and emergency procedures.
- The loading or discharge equipment (hoses, couplings, gauges, pumps, compressors etc) are in good order and suitable for the product to be handled.
- The gas or air supply used for loading, discharge or blanketing will not contaminate the cargo.

COMMON DANGERS

Seaco tanks are extremely safe for all modes of transport and provide secure and robust cargo containment in transit. The greatest risk of cargo spillage or damage to the tank or its fittings occurs during loading and discharge. Some common dangers to be avoided include:

FLASH SPILL

What can cause it?

Opening manhole or hose connection when tank is pressurised. May result in 'flash spill' of product and lid or cover being thrown.

How can I prevent it?

Examine pressure gauge if fitted and relieve any pressure before opening manlid or hose connection by careful opening of the airline valve. Take care not to vent off dangerous vapours into the atmosphere



ASPHYXIATION/ POISONING

What can cause it?

Entering a tank which is oxygen depleted or has a contaminated atmosphere. May cause poisoning or asphyxiation.

How can I prevent it?

Check cleaning certificate and last cargo. Check tank atmosphere with appropriate analyser before entry. If necessary, carry out gas-freeing procedure. A second person should be stationed outside the manhole with a lifeline to the person in

the tank.



HOSE WHIPLASH

What can cause it?

Disconnection of hose when the tank is pressurised, could cause injury to operatives.

How can I prevent it?

Ensure that tank and hose are de-pressurised before disconnection.



CHEMICAL REACTION/ PRODUCT CONTAMINATION

What can cause it?

Tank and fittings not efficiently cleaned of previous product or moisture; product loaded in uncleaned tank; incorrect cleaning agent used. May result in contamination of new cargo, violent chemical reaction, crusting/congealing of residues in tank and fittings, or damage to tank lining.

How can I prevent it?

Ascertain previous product carried. Check cleanliness of tank before loading. Check cleaning agent compatibility before use.



ACCIDENT CARGO DISCHARGE

What can cause it?

Careless opening of outlet valve or disconnection of hose from tank containing cargo or leakage via incorrect fittings or hose. May result in a chemical reaction, toxic or inflammable fumes or other potential dangers to personnel and equipment.

How can I prevent it?

Check if cargo is present before opening valves or disconnecting fittings. Check that hoses and fittings are correct for a particular tank.



OVERPRESSURE

What can cause it?

Excessive operating pressure resulting in rupture of hoses or tank or release of cargo through the pressure relief valves, with possible risk of injury and spillage.

How can I prevent it?

Note the maximum working pressure marked on the tank and ensure that it is not exceeded.



EXCESSIVE STEAM PRESSURE

What can cause it?

Excessive pressure introduced into heating system. May damage tank or rupture hose causing failure of heating and escape of steam, or contamination or escape of cargo.

How can I prevent it?

Do not exceed the maximum working pressure of the heating system marked on tank.



VACUUM COLLAPSE (IMPLOSION)

What can cause it?

Vacuum created in tank during pumping out, or as a result of tank cooling after cleaning, or after discharge of heated cargo. Could result in damage to tank shell.

How can I prevent it?

Ensure that tank is vented (via manhole or airline) during cargo discharge or after cleaning or discharge of heated cargo. If a vacuum valve is fitted check that it operates freely.

Note: Special precautions should be taken when handling hazardous cargo to guard against venting of harmful vapours.



HOSES KINKED OR FLATTENED

What can cause it?

Hoses unable to pass air or liquid. Could cause over-pressure or vacuum collapse.

How can I prevent it?

Hoses should be periodically tested before use and correctly laid out before fitting. Wheeled equipment should be

prevented from entering area where hoses are crossing the ground.



HEAT DAMAGE TO EMPTY TANK

What can cause it?

Heating tank prior to cargo loading, exceeding maximum design temperature of shell. Could cause deformation/damage to shell and fittings.

How can I prevent it?

Limit pre-heating temperatures such that the shell or heater tubes do not exceed the maximum product temperature indicated on the data plate.

Care should be taken not to overheat small quantities of cargo, especially cargo residue.



CARGO VAPOUR EXPLOSION

What can cause it?

Naked light or electrical spark in presence of cargo vapours during loading/discharge or in presence of cargo leakage may cause fire or explosion.

How can I prevent it?

Strictly observe the 'no naked light' rulings in the vicinity of tanks. Ensure good earth connection has been made to the tank during loading/discharge. Check tools and clothing (especially boots) for spark risk.



TANK OVERHEATING

What can cause it?

Exceeding operating temperature, may damage the tank shell, insulation and fittings.

How can I prevent it?

Do not exceed the maximum operating temperature indicated on the tank. Check that the temperature gauge is in working order.



PRODUCT HANDLING

The manufacturers of the product should be contacted for advice and information concerning the appropriate safety standards for product handling. Required protective clothing may consist of part or all of the following depending on the hazard.



Body protection, apron, trousers or suit



Boots, clogs or overshoes



Gloves



Eye protection, visor or glasses



Safety helmet and/or hood



Vapour mask or breathing apparatus

Protective clothing must be resistant to the type of product being handled.

HANDLING AND SECUREMENT

Strict procedures must be following in handling tanks, in both full and empty states as well as during transportation.

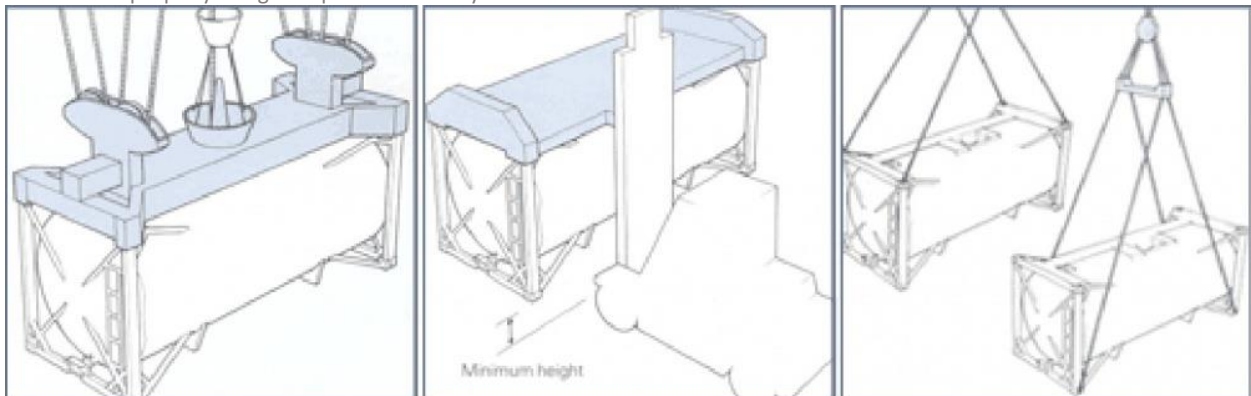
LOADED TANKS

Loaded tank containers may **ONLY** be lifted by a TOP SPREADER attached either to a sidelif truck, a gantry crane or container-handling vehicle such as a straddle carrier.

Extreme caution must be exercised when handling loaded containers by a sidelif truck fitted with a top lift attachment, as the change in centre of gravity due to cargo surge may result in instability of the vehicle. The tank container should be moved when suspended at the lowest practical height.

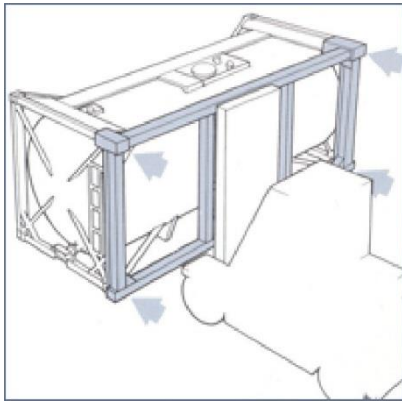
While ISO standards do not permit containers to be lifted by angled slings from the top corner castings, most Seaco's tanks are designed and tested to be lifted from both the top and bottom corner castings. When lifting from the top castings, the angle of the slings should not be less than 50 degrees to the horizontal. When connected to the bottom corner castings the slings must be not less then 45 degrees.

Care must be taken to ensure that the slings do not touch the tank during lifting. For safe and efficient handling of containers a properly designed spreader is always recommended.



EMPTY TANKS

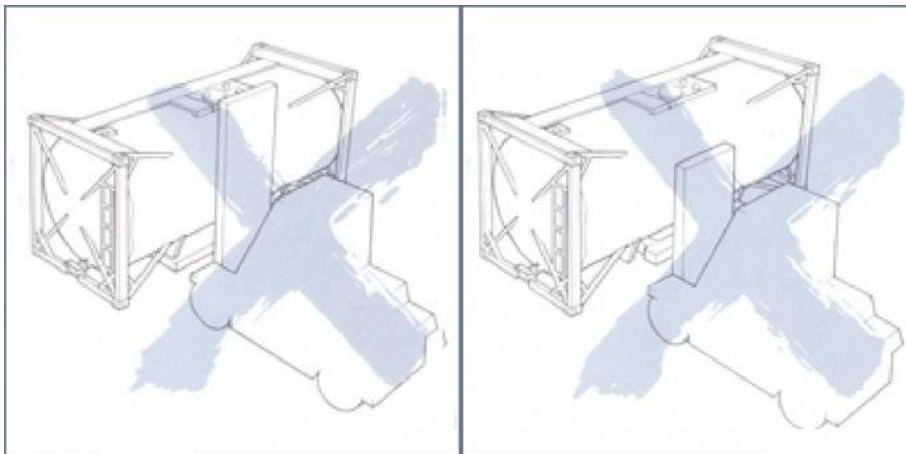
Empty tank containers may be lifted by side connecting to the two top corners, provided that the lower transverse support frame contacts the bottom corner casting or the corner post.



MALPRACTICE

On no account should a tank container be lifted by equipment contacting the tank shell, or any part of the frame other than the corner castings or corner post.

On no account should lifting forks or tines of a conventional forklift truck be used on any tank container. Contact between lifting equipment and the tank shell or its insulation may result in serious damage to the tank and the escape of cargo.

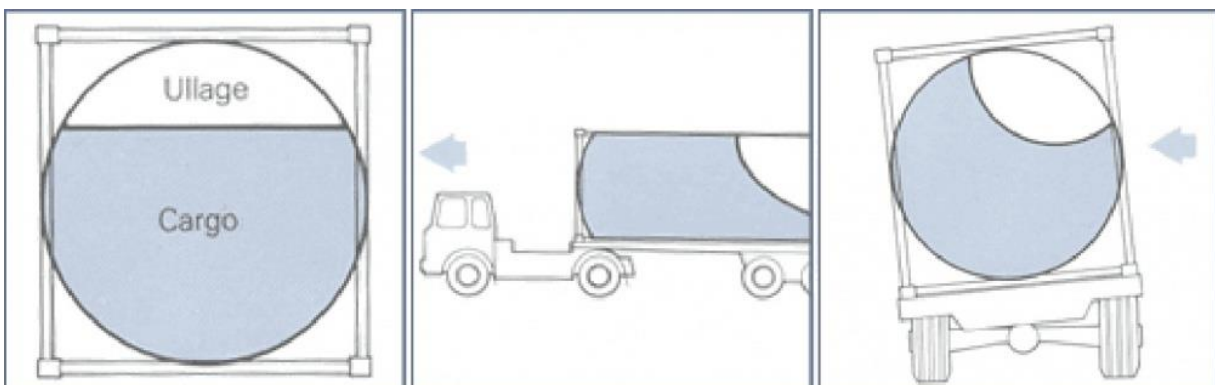


ULLAGE

Transporting by Road, Rail or Sea

Only vehicles constructed or specifically adapted for the carriage of ISO containers should be used.

Excessive cargo surge can affect vehicle stability. The maximum ullage permitted for a given product is controlled by the appropriate regulations.



For certain dangerous liquids definitive filling limits are specified. These rates are 97%, 95% or 90% according to the classification of the cargo or its vapour pressure, or whether the cargo is heated in transit. Up to a maximum 20% ullage is normally observed for non-classified products.

To calculate the maximum safe load:

$$V = \frac{A \times C}{100(1+Et)}$$

Where

V= volume of liquid to be loaded (gallons or litres)

C= Capacity of tank (gallons or litres)

A= Fill percentage required

E= Cubical expansion co-efficient of liquid

t= Rise in temperature of cargo during containment

This calculation neglects the volumetric expansion of the vessel due to the rise in temperature, however, for all normal purposes it will be adequate. For certain dangerous liquids definitive filling limits are specified by regulation.

Handling and securing on Road, Rail and Ship

It is recommended that all equipment used for handling and transporting tanks is designed specifically for use with ISO containers manufactured in accordance with ISO 668. Recommendations and regulations concerning maximum gross weights vary by country and state. Operators should note that many containers are designed for maximum gross weights in excess of those permitted by some regulations.

Handling and securement on board ship are detailed in the recommendations of ISO, DOT (blue book). Lloyds and CFR (USA).

STACKING

Most Seaco tanks are designed for nine-high stacking at 30,480Kg gross weight per unit.

The CSC plate fixed to the rear of the container states the maximum stacking weight permissible which may be stacked on top of the container. Nine-high stacking is only recommended for use in ship cell guides. Onshore stacking of containers should be undertaken with care and with due consideration for ground surface stability and local weather conditions, especially high winds.

LOADING AND DISCHARGE

The choice of method of loading and discharge will depend upon the relative position of the storage tanks and upon the hazard rating or nature of the cargo.

Cargoes which are not hazardous or noxious and which do not require protection from oxygen or water vapour may be loaded by any of the methods shown in the diagrams - see loading methods page.

Noxious or hazardous cargoes may need to be loaded and discharged through the top or bottom outlet. To create a totally closed system any air, gas or vapour displaced by the liquid must be returned to the storage tank through a vapour return line fitted between the airline connection and the storage tank.

Cargoes which must not be contaminated by oxygen or water vapour should be loaded through the top or bottom outlet. The tank should be purged of air before loading and the cargo should be carried under a blanket of inert gas.

Cargoes which foam or are susceptible to oxidation should be loaded through the bottom outlet, or if this is not possible, through the top outlet and syphon pipe.

MEASUREMENT OF CARGO

The quantity loaded can be measured on a flow meter, by using a diprod, or by means of a weighbridge. With hazardous cargoes and 'closed system' loading, dip rods should not be used.

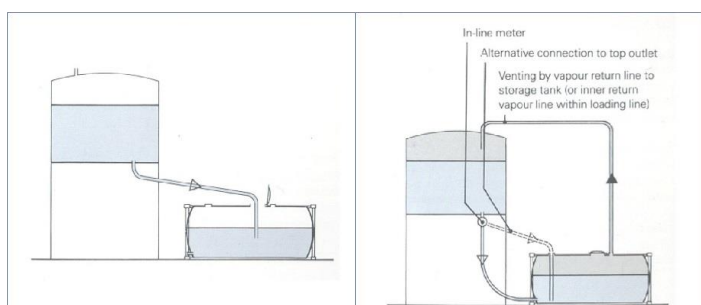
CHECK THE COMPLETE SYSTEM

All equipment from the main product storage tanks through to the tank container, including valves, hoses, pumps, gauges, connections, vapour return lines etc, should be regarded as a 'total system' exposed to the same cargo characteristics, (viscosity, corrosivity, temperature and pressures), and must be thoroughly checked for suitability and condition.

LOADING METHODS

GRAVITY LOADING

The cargo flows freely from an overhead storage tank through the manhole into the tank container. Gravity Loading may also be done using a 'Closed System' gravity loading through top or bottom outlets. The cargo flows into the tank container under gravity, the vapours are vented back to the storage tank via the airline connection.



Gravity loading through manhole

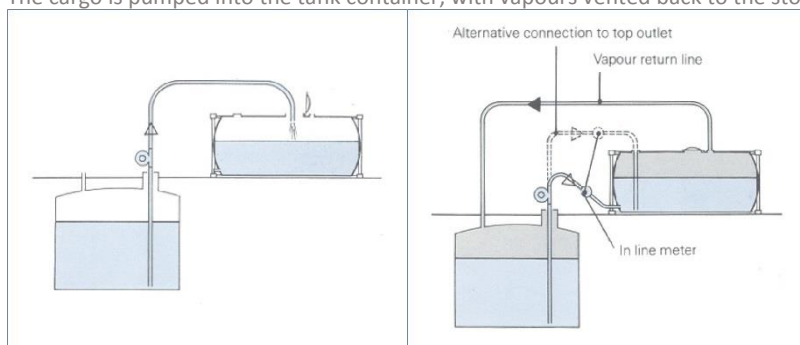
Closed system gravity loading

PUMPED LOADING

The cargo is pumped from the storage tank through the manhole into the tank container.

This may also be done using a 'Closed System' through top or bottom outlet.

The cargo is pumped into the tank container, with vapours vented back to the storage tank via the airline connection.

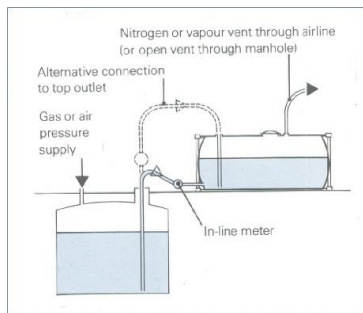


Pumped through manhole

Closed system pumped loading

PRESSURE LOADING THROUGH TOP OR BOTTOM OUTLET

The cargo is loaded by top pressure in the storage tank. For sensitive or hazardous cargo, vapours are vented via the airline connection to a vent tank or back to the storage tank.



Pressure Loading

DISCHARGE METHODS

GRAVITY DISCHARGE

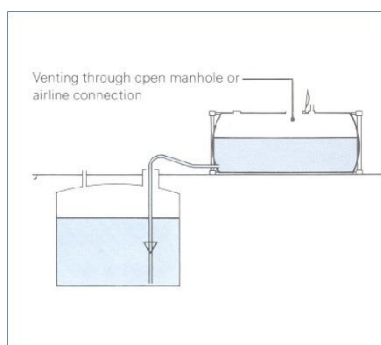
The cargo flows freely through the bottom outlet to low-level storage tanks. Ensure adequate venting to prevent damage caused by vacuum.

PRESSURE DISCHARGE

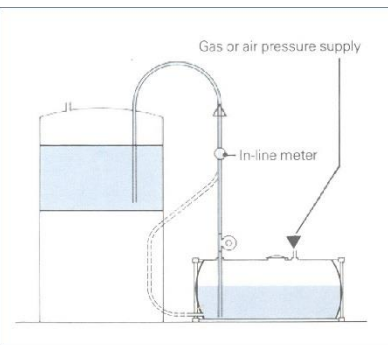
The cargo is discharged through the top or bottom outlet by top pressure in the tank container.

Products carried under an inert gas blanket are normally discharged using nitrogen or another inert gas as the pressure medium.

The maximum working pressure of the tank must under no circumstances be exceeded.



Cargo discharge through bottom outlet

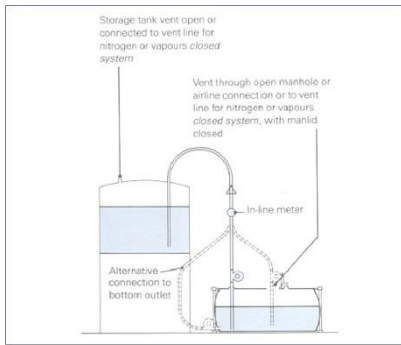


Cargo discharge through top outlet

PUMPED DISCHARGE

The suction side of a suitable pump may be connected to the top or the bottom outlets or to a hose via the manhole to pump that cargo to higher level storage tanks. Air or gas must be allowed into the tank container to replace the cargo being discharged. Depending on the nature of the cargo this can be achieved by opening the manlid or airline connection, or by connection to an inert gas supply.

When using a high capacity pump it is recommended that a vacuum safety valve is incorporated in the suction line to protect the tank from vacuum collapse.



Examples of pumped discharge

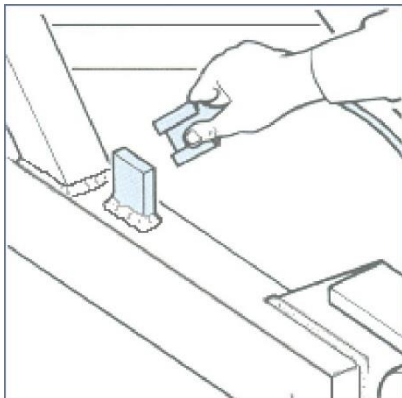
SAFETY POINTS DURING LOADING AND DISCHARGE

There will always be a pressure difference between a closed tank and the atmosphere. Valves must be opened carefully. Always relieve pressure before opening the manlid.

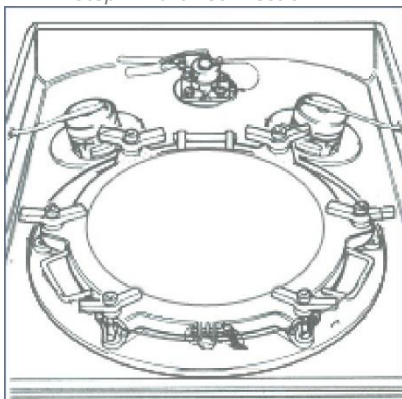
When using the bottom outlet always open or close the foot valve first.

Never enter a tank until all the safety recommendations have been complied with.

LOADING PROCEDURES



Step 4: Earth Connection



Step 7: manlid

- Step 1.** Ensure that the vehicle is securely braked, chocking wheels if necessary.
- Step 2.** Contact the local supervisor to ensure that the cargo is of correct specification and quantity.
- Step 3.** Where safety or fire fighting equipment is required, it should be positioned upwind of the tank.
- Step 4.** Make earth connection from tank earthing point to local earth positions.

Step 5. Check that the hose connections have the same thread or fitting as the tank connections. Ensure that the correct joint rings and gaskets are used and that they are compatible with the cargo.

Step 6. Check if a Cleanliness Certificate or Gas Free Certificate is required (depending on the previous cargo).

Step 7. Open manlid and examine tank/outlet valves for cleanliness.

Step 8. Check relief valves are in sound condition.

Note: For cargoes being carried under an inert gas blanket, see section on **Gas Blanketing**.

LOADING THROUGH MANHOLE

Step 1. Refer to section on **Loading Procedures**

Step 2. Check that all tank bottom valves are closed.

Step 3. Open manlid and insert hose into tank.

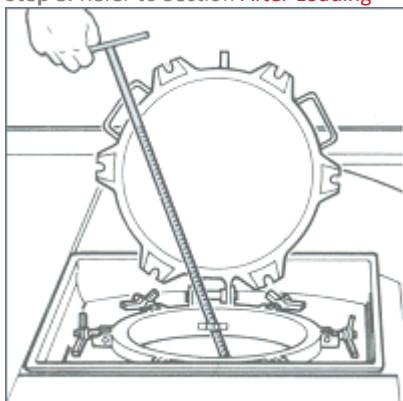
Step 4. Secure hose to stop possible whiplash.

Step 5. Load tank to required level. Check constantly for leaks in hoses and connections.

Step 6. Drain hose and remove from tank.

Step 7. Close manlid and tighten down.

Step 8. Refer to Section **After Loading**



Step 5. Load tank to required level

LOADING THROUGH TOP OUTLET

Step 1. Refer to section on **Loading Procedures**

Step 2. Check that all bottom valves are closed.

Step 3. Remove top outlet blank flange. Both hose coupling to top outlet flange.

Step 4. Connect vapour return line and open valve to vent tank.

Step 5. Load tank to required level. Check constantly for leaks in hoses and connections.

Step 6. Drain hose, close top outlet valve and remove hose from tank. Replace top outlet blank flange.

Step 7. Close airline valve, disconnect vapour return line and replace blanking cap.

Step 8. Refer to Section **After Loading**



Step 3. Top outlet blank flange

LOADING THROUGH BOTTOM OUTLET

Step 1. Refer to section on [Loading Procedures](#)

Step 2. Remove bottom outlet blank flange or cap, connect hose ensuring connection is correct and tight. Open valves.

Step 3. Connect vapour return line and open valve to vent tank.

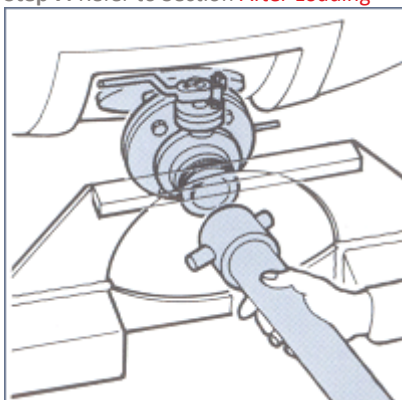
Step 4. Open valves. Load tank to required level. Check constantly for leaks in hoses and connections.

Step 5. Tanks with single bottom outlet valves:

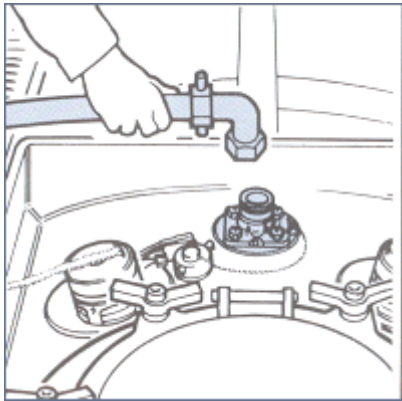
- Close valve and then drain hose.
- Disconnect hose and replace blanking cap
- Tanks with foot valve and external valve
- Close foot valve.
- Drain hose.
- Close external valve.
- Disconnect hose and replace blanking cap or flange. (This sequence is important to ensure that no product remains between foot valve and external valve).

Step 6. Close airline valve and disconnect vapour return and replace blanking cap.

Step 7. Refer to Section [After Loading](#)

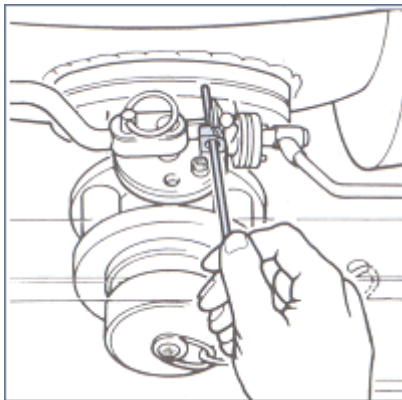


Step 2. Connecting Hose.



Step 3. Connect vapour return line.

AFTER LOADING



Step 5. Seal tank and fittings

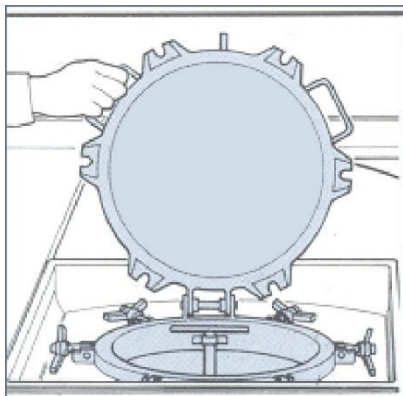
- Step 1.** Clean and stow the supply and return hoses, replacing caps and blanks.
- Step 2.** Ensure that all tank fittings are correctly closed and capped and any cargo spillage removed.
- Step 3.** Remove earth connection.
- Step 4.** Replace safety equipment.
- Step 5.** If required, seal tank and fittings in accordance with Customs requirements.
- Step 6.** Check that the tank container is properly labelled for the product loaded, and that any redundant labels have been removed.

DISCHARGE PROCEDURES

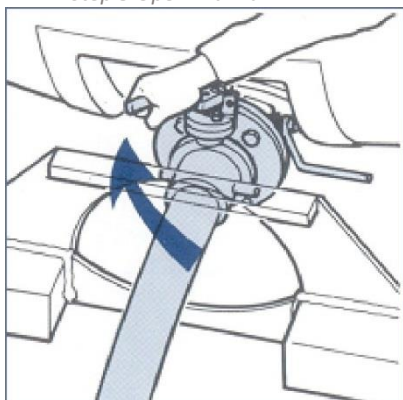
- Step 1.** Ensure that the vehicle is securely braked, chocking wheels if necessary.
- Step 2.** Contact the local supervisor to ensure that there is adequate space in the receiving tank. If product is already present in the receiving tank check that it is identical to the cargo being discharged.
- Step 3.** Where safety or fire fighting equipment is required, position it upwind of the tank.
- Step 4.** Make earth connection from tank earthing point to local earth positions.
- Step 5.** Check that the hose connections have the same thread or fitting as the tank connections. Ensure that the correct joint rings and gaskets are used, and that they are compatible with the cargo.
- Step 6.** Check appropriate facilities exist for the draining of hoses and valves.
- Step 7.** Check the setting of the valves to the receiving tanks.
- Step 8.** For discharge by pumping or by gravity ensure that the danger of implosion is avoided by opening the manlid (or airline valve to vapour return line if closed system is being used). Ensure that venting is not prevented by any solidified cargo in the airline or relief valves.
- Step 9.** For discharge with top pressure ensure a gauge is visible and in a serviceable condition to monitor the pressure applied.
- Step 10.** It will assist discharge through top or bottom outlet if the tank is sited to drain towards the rear.
- Step 11.** Notify the station supervisor when the tank is ready for discharge.

Note: For cargoes being carried under an inert gas blanket, see section on Gas Blanketing.

GRAVITY DISCHARGE



Step 3 Open Manlid



Step 6 Drain hose

Step 1 Refer to section **Discharge Procedure**

Step 2 Remove bottom outlet blanking cap or flange and connect hose ensuring that the connection is correct and tight.

Step 3 Open manlid or airline to vent the tank or vent back to storage tank.

Step 4 Open outlet valves and commence discharge. Check constantly for leaks in hoses and connections.

Step 5 Drain tank.

Step 6 Tanks with single bottom outlet valves: Close valve and then drain hose. Disconnect hose and replace blanking cap or flange.

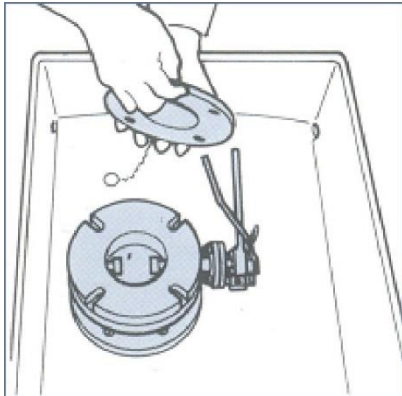
Tanks with foot valve and external valve: Close foot valve. Drain hose. Close external valve.

Disconnect hose and replace blanking cap or flange. (This sequence is important to ensure that no product remains between foot valve and external valve).

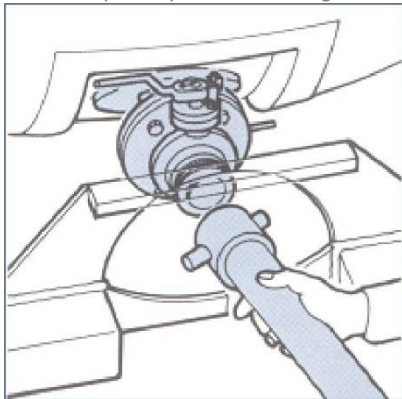
Step 7. Close manlid and tighten down or close airline connection and replace blanking cap.

Step 8. Refer to section **Procedure after discharge**.

PUMPED DISCHARGE



Step 2: Top outlet discharge



Step 2: bottom outlet discharge

Step 1. Refer to section **Discharge Procedure**.

Step 2. Top outlet discharge: Remove top outlet blank flange, bolt hose couplings to top outlet flange.

Bottom outlet discharge: Remove bottom outlet blanking cap or flange, connect hose ensuring that hose connection is correct and tight.

Step 3. Open manlid or airline connection to vent tank.

Step 4. Open tank outlet valve or valves and commence discharge. Check constantly for leaks in hose and connections.

Step 5. Drain tank.

Step 6. When discharging is complete follow these procedures;

Top outlet discharge:-

Drain hose; Close top outlet valve and remove hose from tank; Replace top outlet blank flange.

Tanks with single bottom outlet valves:-

Close valve and then drain hose; Disconnect hose and replace blanking cap or flange.

Tanks with foot valve and external valve:-

Close foot valve; Drain hose; Close external valve.

- Disconnect hose and replace blank cap or flange.

(This sequence is important to ensure that no product remains between foot valve and external valve).

Step 7. Close manlid and tighten down, or close airline connection, replacing blanking cap.

Step 8. Refer to section **Procedure after discharge**.

PRESSURE DISCHARGE

Step 1. Refer to section 'Before discharge'

Step 2. Top outlet discharge: Remove top outlet blank flange, bolt hose couplings to top outlet flange and open top outlet valve.

Note: The syphon tube extends to approximately 12mm from tank bottom at outlet end of tank, so that the minimum of cargo remains after discharge via top outlet.

Bottom outlet discharge: Remove bottom outlet blanking cap or flange, connect hose, ensuring that hose connection is correct and tight, open foot valve (if fitted) and open outlet valve.

Step 3. Connect airline and open airline valve (if fitted).

Step 4. Open tank outlet valve or valves and commence discharge. Check constantly for leaks in hoses or connection.

Step 5. Apply pressure until discharge is completed, (not exceeding tank and hose working pressure). Check constantly for leaks in hose or connections. Pressure will drop when discharge is complete.

Step 6. When discharge is complete, and hose line is empty, close airline valve, disconnect airline and replace blanking cap. Note: it is important to relieve any remaining pressure in the tank through the hose when noxious and hazardous vapours are present.

Step 7. For bottom outlet discharge follow these procedures:

- Tanks with single bottom outlet valve:- Close valve and then drain hose; Disconnect line and replace blanking cap or flange.
- Tanks with foot valve and external valve:-Close foot valve; Drain hose; Close external valve; Disconnect hose and replace blanking cap or flange.

PROCEDURE AFTER DISCHARGE

Step 1. Check the tank is completely empty.

Step 2. Stow hoses, replacing caps and blanks.

Step 3. Ensure that all tank fittings are correctly closed and capped and any cargo spillage removed.

Step 4. Remove earth connection.

Step 5. Replace safety equipment.

Step 6. In the case of hazardous cargo, the tank must be regarded as dangerous until clean and gas free.

Step 7. Where cargo residue may spoil or may become corrosive to the tank in contact with the air or humidity, the nitrogen used to discharge the tank should remain in the tank until it is cleaned or reloaded with cargo.

Step 8. To prevent hardening of solvent soluble resins and paints, approximately 15 litres of solvent should be added to the tank and the tank should be maintained under pressure awaiting cleaning.

Step 9. To prevent drying out of latex and emulsions, the tank should be maintained under air pressure awaiting cleaning.

GAS BLANKETING

GAS BLANKETING AND LOADING UNDER A NITROGEN BLANKET

With certain products, the empty space in the tank container during loading and discharge and the ullage space during transit is filled with an inert gas, usually nitrogen. For pressure loading or discharge, inert gas is used as the propellant medium by which the pressure is applied. Before loading it is normally necessary to purge the tank of outside air.

Safety Note: Inert gases are normally non-toxic, but inhalation in confined spaces can cause asphyxiation. Tanks which have been purged of air should be fitted with a temporary seal and marked to indicate that the tank contains inert gas.

PREPARING THE TANK

Products carried under a gas blanket require the normal pre-trip checks to ensure that the tank container is suitable for the purpose. There should be an additional pressure check for tightness of all valves and fittings to ensure that no loss of the inert gas will occur during transportation.

The air inlet connection pipe should be fitted with a closing valve, and a 0-60 psi pressure gauge (0-4 bar) should be fitted between the shut-off valve and the tank, so that the pressure in the tank can be checked during transportation.

LOADING UNDER A NITROGEN BLANKET

NITROGEN QUALITY

NB: Where nitrogen is used to protect the tank and its contents from contamination by water, commercially pure nitrogen with a guaranteed maximum water content should be used.

PURGING THE TANK

Two methods of purging the tank of air are available to the tank user depending upon the equipment available:

- By pressure
- Mixing and venting

PURGING BY PRESSURE

Step 1. Close manlid and valves.

Step 2. Connect nitrogen supply to airline, or bottom outlet.

Step 3. Inject nitrogen until pressure in tank is 1.5 bar (21 psi).

Step 4. Release pressure in tank through top outlet. If top outlet is used to inject nitrogen, or if there is no top outlet, the pressure should be released by opening the airline or bottom outlet. The tank now contains 40% air and the amount of nitrogen used is 1.5 times the volume of the tank.

Repeat steps 3 and 4 as necessary:

After 2 purges the air content is 16%; oxygen content 4%; nitrogen consumed 3 volumes.

After 3 purges the air content is 6%; oxygen content is 1.5%; nitrogen consumed 4.5 volumes.

After 4 purges the air content is 2.5%; oxygen content is 0.5%; nitrogen consumed 6 volumes.

Step 5. Close all valves on tank.

PURGING BY MIXING AND VENTING

Step 1. Close manlid.

Step 2. Connect nitrogen supply to top outlet or bottom outlet.

Step 3. Open outlet not used in step 2 above (if top outlet is not fitted, open airline connection).

Step 4. Inject nitrogen until number of air changes required have been completed using a flow meter to measure the nitrogen used.

After 1 volume change the air content is 37%; oxygen content 10%; nitrogen consumed 1 volume.

After 2 volume changes the air content is 13%; oxygen content 3%; nitrogen consumed 2 volumes.

After 3 volume changes the air content is 5%; oxygen content 3%; nitrogen consumed 3 volumes.

After 4 volume changes the air content is 2%; oxygen content 0.4%; nitrogen consumed 4 volumes. Note: The effectiveness of this method depends upon the thorough mixing of the air in the tank with the incoming nitrogen. In practice it is not possible to achieve the theoretical percentages shown above and it is recommended that an oxygen analyser is used to confirm that the air content is sufficiently reduced.

Step 5. Close all valves on tank.

LOADING UNDER A NITROGEN BLANKET

Step 1. Purge the tank.

Step 2. Connect the product loading hose to the top or bottom hose connection.

Step 3. Pressurise hose.

Step 4. Open valves and commence loading.

Step 5. As cargo fills the tank the nitrogen pressure will rise.

Step 6. When the nitrogen pressure required for the cargo to be carried is reached, commence bleeding off the excess pressure by slightly cracking open the airline valve.

Step 7. The product quantity must be metered at the pump or bulk storage location. When the complete cargo is loaded, close the tank inlet valve or valves.

Step 8. Check that the correct nitrogen pressure has been maintained.

Step 9. Drain and remove the hose.

Step 10. Replace all blanking plates and dust caps.