APAC Bulk Diisocyanate and Polyol Safety Delivery Guideline

Covestro

Version 5, Mar2018

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Amendment descriptions	Amendment 1. Add option of bottom discharge ISO tank delivery for TDI 2. Update some format 3. Update some process from driver to receiver operator.	Amended on	Feb2017
Amendment descriptions	Update the latest version of "Guideline for Diisocyanate Storage Tank System" from CPI, AX-365 APRIL 2016	Amended on	Jun2017
Amendment descriptions	Change TDS to TLS	Amended on	Mar2018
Next review date or frequency	Feb 2019		

Contents

Chapter 1: Introduction

1.1 Purpose

These Guidelines have been prepared by Covestro, one of the leading suppliers of diisocyanate and polyol products, to recommend appropriately high levels of safety for the loading / unloading, transportation and storage of diisocyanate and polyol.

Whilst Polyol, pMDI, MDI is classified and regulated as hazardous only for use and TDI as hazardous for both use and transport, they can be handled and shipped safely provided that appropriate precautions are observed.

1.2 Safe Handling Precautions

- Polyol is Non-DG, however proper handling, use, storage, transfer, transportation, clean-up and disposal methods must be followed as per supplier MSDS and/or local regulations.
- Although Diisocyanate is hazardous material, the hazard may be minimized if appropriate precautions are observed. Storage and handling of Diisocyanate may be regulated by local laws to cover the release, clean-up, and waste disposal, and emissions during transfer, storage, and use. Individual countries may also have regulations that affect Diisocyanate transfer, storage and disposal.

1.3 Scope

These *Guidelines* take into account the offloading of Polyol & Diisocyanate in ISO tank trucks or bulk storage tanks. They cover most aspects of transport from loading to delivery point. Recommendations are denoted by the use of the word “should;” regulatory requirements are indicated by use of the word “must.”

1.4 Exceptions

These *Guidelines* do not deal with bulk movement of Polyol & Diisocyanate in ocean chemical tankers or inland waterway barges, or rail tank cars, or intermediate bulk containers (IBCs), or drums.

1.5 Interpretation Caveat

No part of these *Guidelines* may be interpreted in a way that would conflict with existing international and/or national legislation. Standards may change, and legal provisions always have

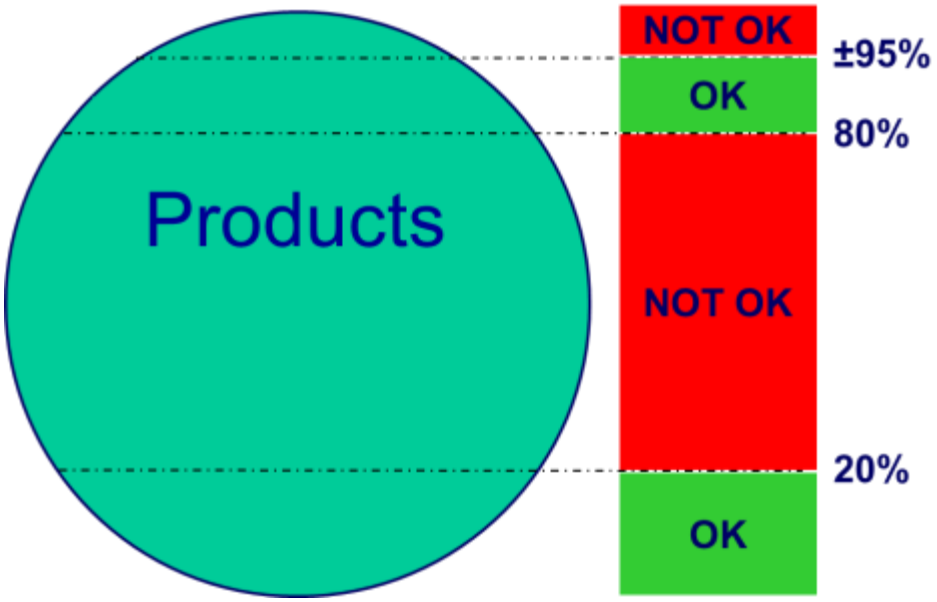
precedence over any part of these Guidelines. Consult with appropriate legal experts to verify applicable requirements.

Chapter 2: Properties, Hazards & Safety Information for Polyol & Diisocyanate

2.1 Typical Physical and Reactivity Data

Please refer to latest MSDS or Technical Date Sheet for detail information

2.2 Typical density and ISO tank filling percentage in volume.

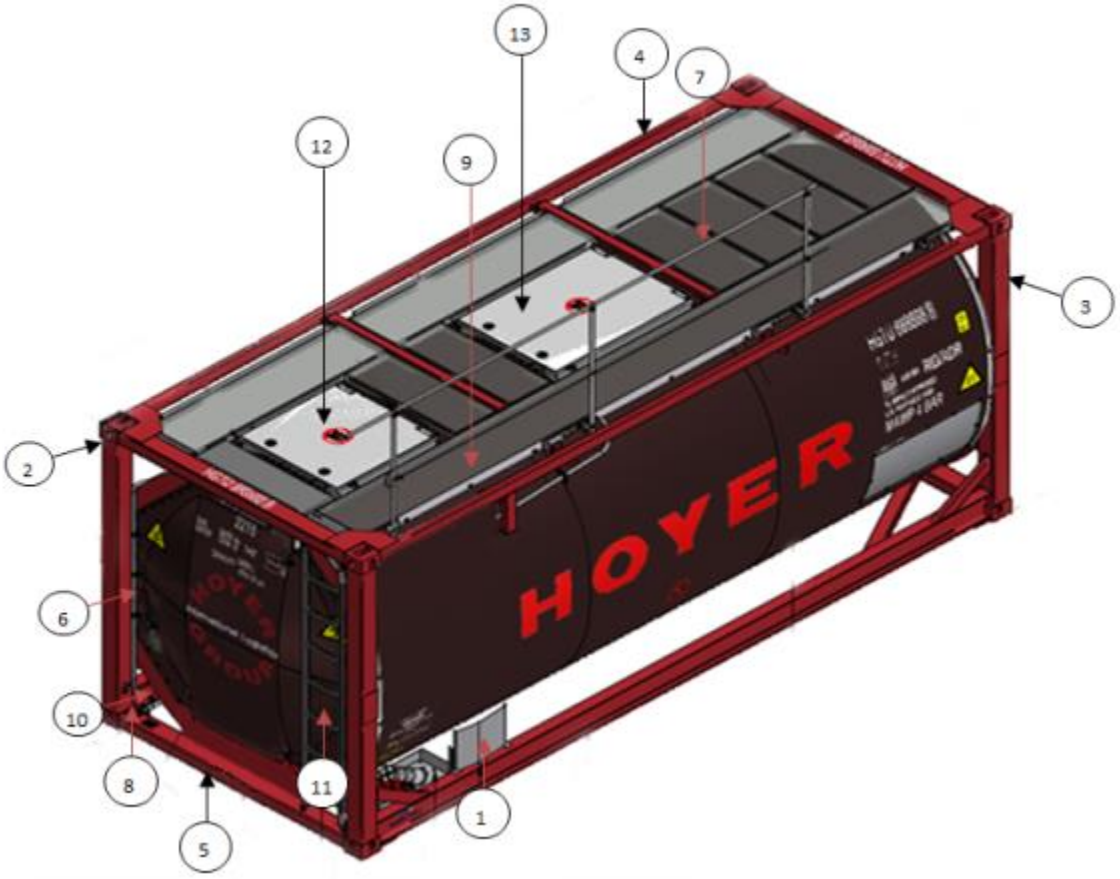
Product	ISO Tank Capacity (m3)	Density (g/cm3)	Degree of Filling in volume schematic diagram
PMDI	24	1.23~1.24	
TDI	24	1.22	
MMDI	21/24	1.18~1.21	
POLYOL	26	1.01	

Product filling degree conform ADR, reference ADR 4.3.2.2 Degree of filling 4.3.2.2.4
"Where shells are not divided by partitions or surge plates into sections of not more than 7,500 liters capacity, they shall be filled to not less than 80% or not more than 20% of their capacity".

Formula for delivery quantity = Density X ISO tank capacity X Degree of filling

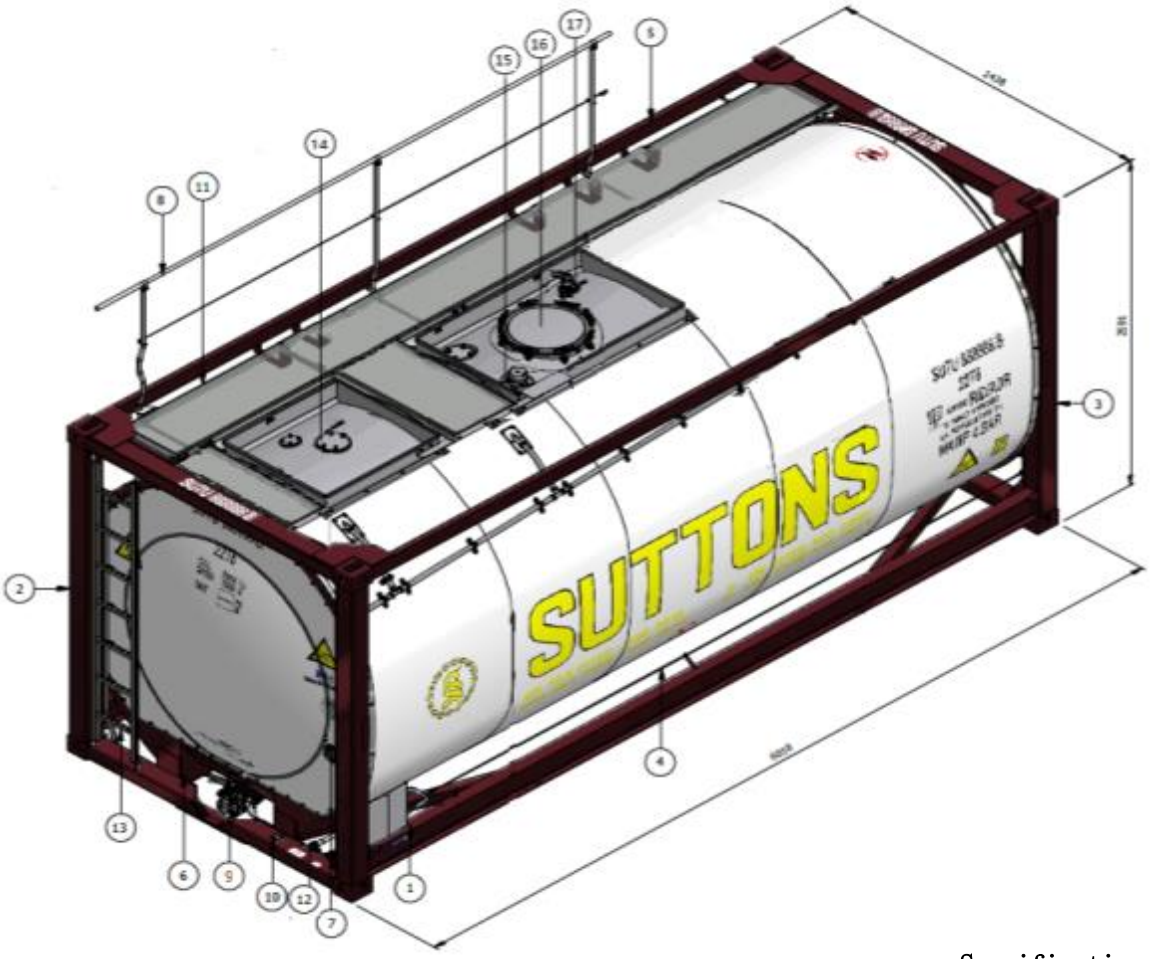
Chapter 3: ISO Tank Features

Picture 3.1 ISO Tank Features of T14



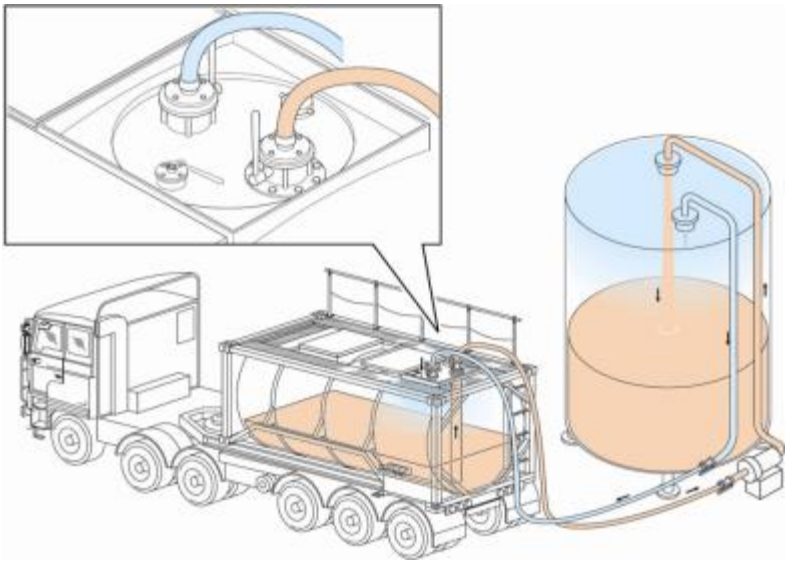
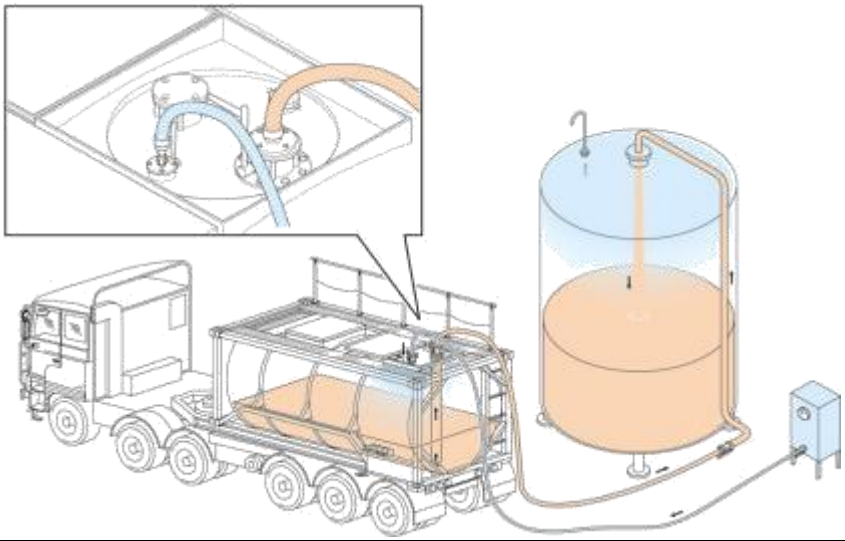
No.	Name	No.	Name		
01	Data/CSC plate	08	Grounding	Appearance	20’ ISO Tank
02	Tank rear end	09	Walkways	Length	6058mm
03	Tank front end	10	Steam heating system	Width	2438mm
04	Beam	11	Access ladder	Height	2591mm
05	Frame	12	Top discharge:	T-CODE	T14
			Top outlet & airline v/v	Volume	21000-23000L
06	Thermometer	13	Cover for manhole	Working Press	4 bar
07	Handrail			Testing Press	6 bar
				Max. Working Temp	120 ℃
				Discharge Mode	Top discharge

Picture 3.2 ISO Tank Features of T11

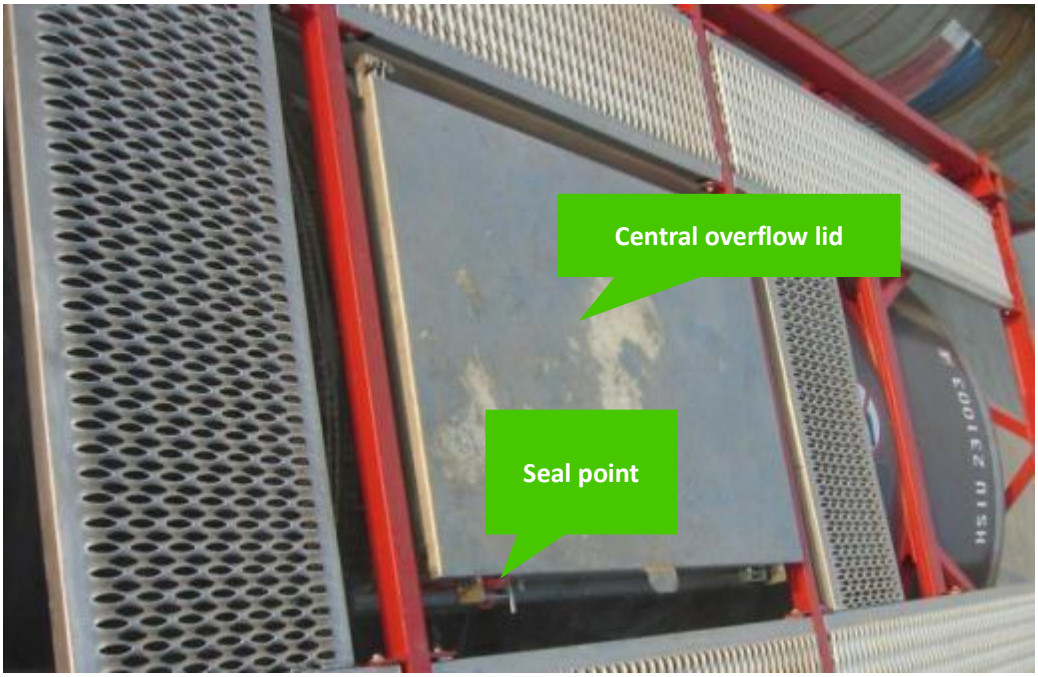


No.	Name	No.	Name	Specification	Features
01	Data/CSC Plate	10	Grounding	Appearance	20’ ISO tank
02	Tank Rear End	11	Walkways	Length	6058mm
03	Tank Front End	12	Steam heating system	Width	2438mm
04	Emergency shutdown line	13	Access ladder	Height	2591mm
05	Beam	14	Top discharge:	T-CODE	T11
			Top outlet & siphon	Volume	24000L
06	Bottom beam	15	PSV	Working press.	4 bar
07	Thermometer	16	Cover for manhole	Testing press.	6 bar
08	Handrail	17	Airline valve assembly	Max. Working temp.	130 ℃
09	Bottom discharge system			Discharge Mode	Bottom discharge

Chapter 4: ISO Tank Discharge Methods

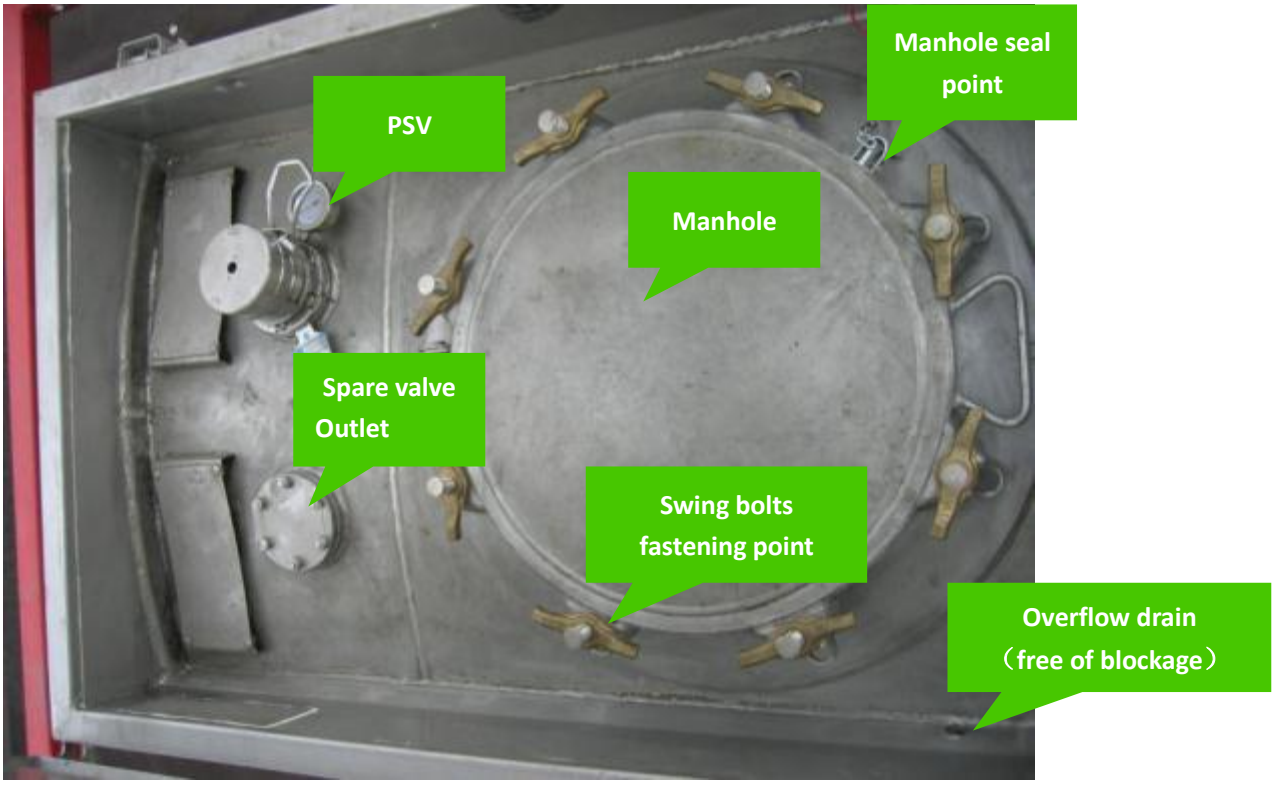
Suction discharge by customer liquid pump & vapor return **Preferred option!** Customer liquid pump is connected to the top or the bottom outlets, to pump the cargo to customer's storage tanks. Vapor return to ISO tank to replace the cargo being discharged. When using a high capacity pump it is recommended that a vacuum safety valve is incorporated in the suction line to protect the tank from vacuum collapse. As per COVESTRO standards, MMDI & HDI can be top discharged only, TDI is highly recommended to be top discharged, pMDI and POLYOL can be bottom discharged.	 **PPE (applicable for all discharge methods)** Always wear your PPE with a minimum of hard hat, safety glasses, safety shoes, gloves & overall. In case of TDI: wear full face mask during (dis)connecting.
Pressure discharge by customer's nitrogen or dry air The cargo is discharged through the top or bottom outlets by top pressure in the ISO tank by customer's nitrogen or dry air (-40C dew point). The maximum working pressure of the tank must under no circumstances be exceeded. As per COVESTRO standards, it is strongly recommended to use suction pump with vapor return for bottom discharge unloading.	

Picture 4.1 Central overflow lid



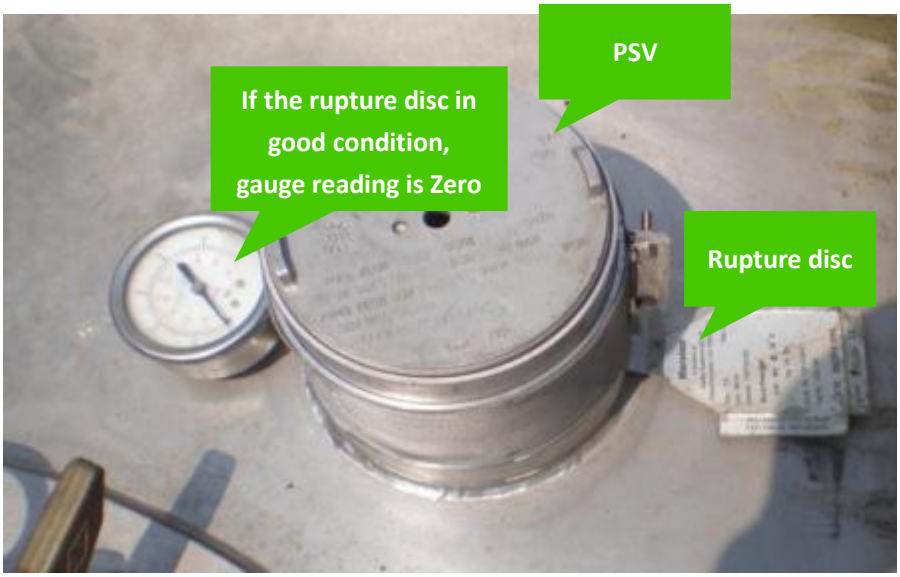
Picture 4.2 Central overflow lid

Unathorized opening of manhole cover is not allowed.

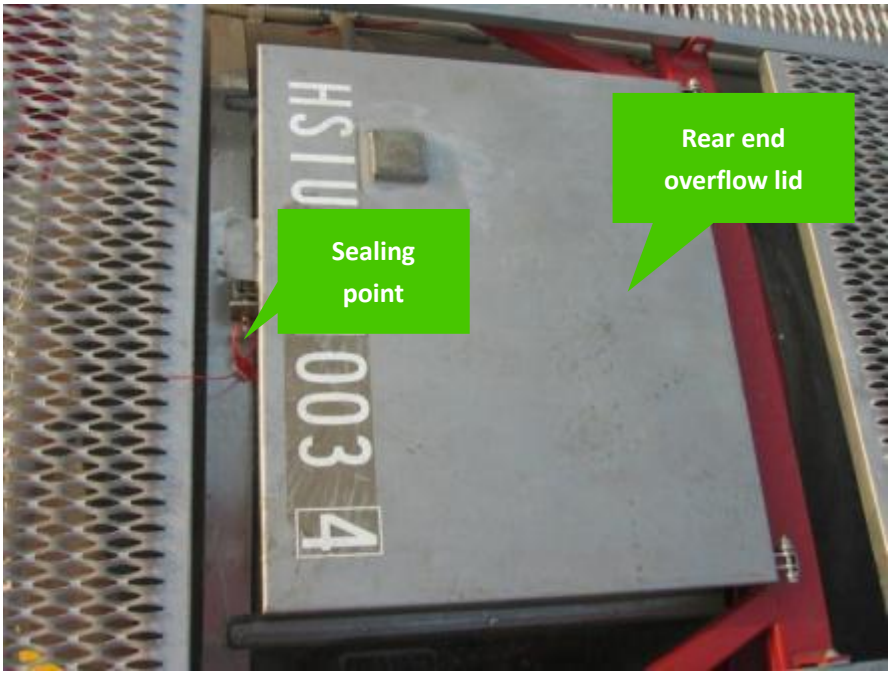


Picture 4.3 PSV

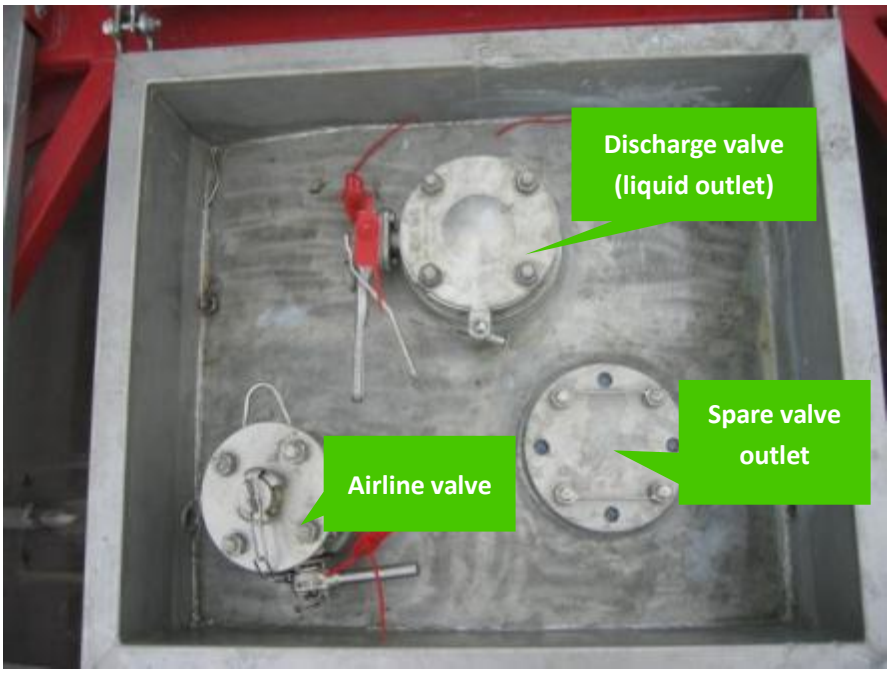
PSV Setpoint 4.4 Bar。



Picture 4.4 Rear end overflow lid

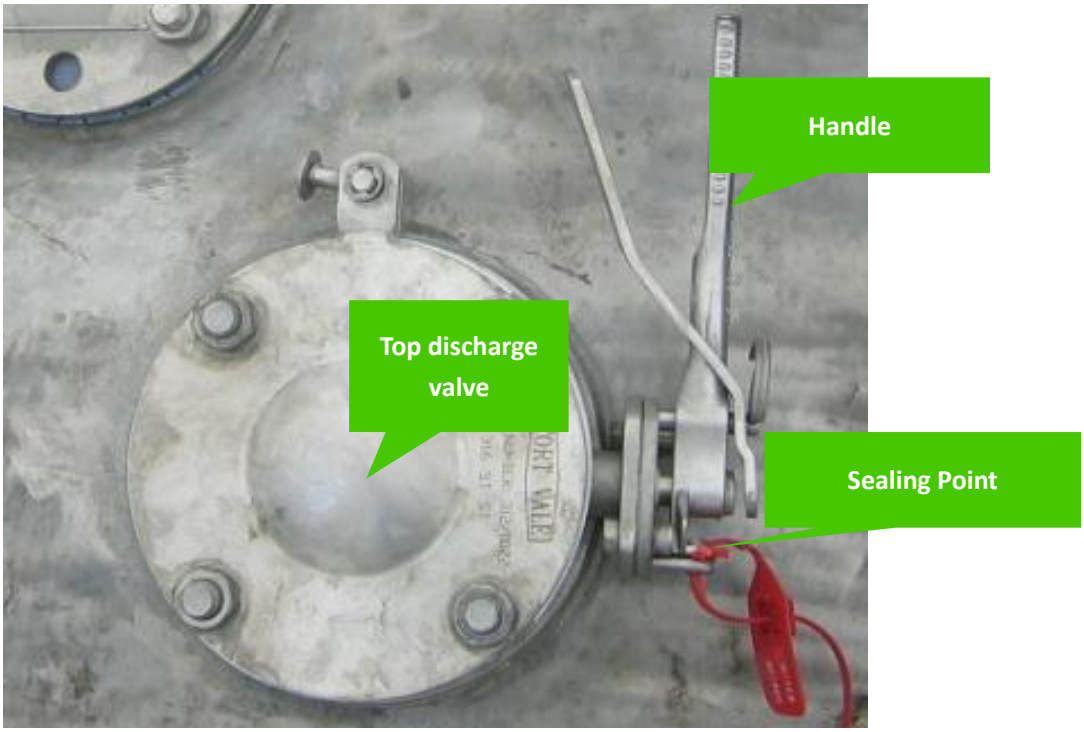


Picture 4.5 Rear end overflow box



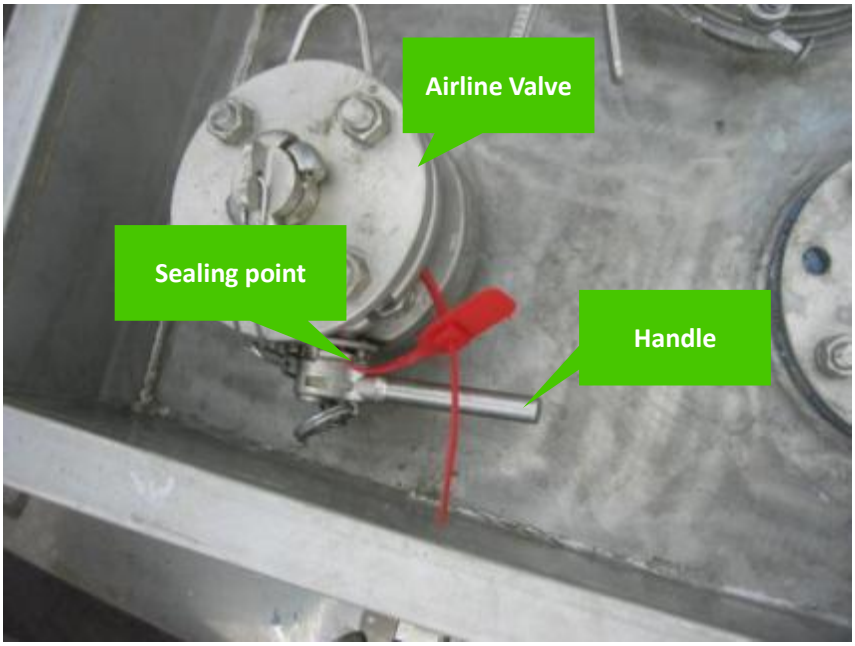
Picture 4.6 Top Discharge Valve (liquid outlet)

DN80 (3") flange butterfly valve + siphon tube, 4 X M16 bolts, sealed with blind.

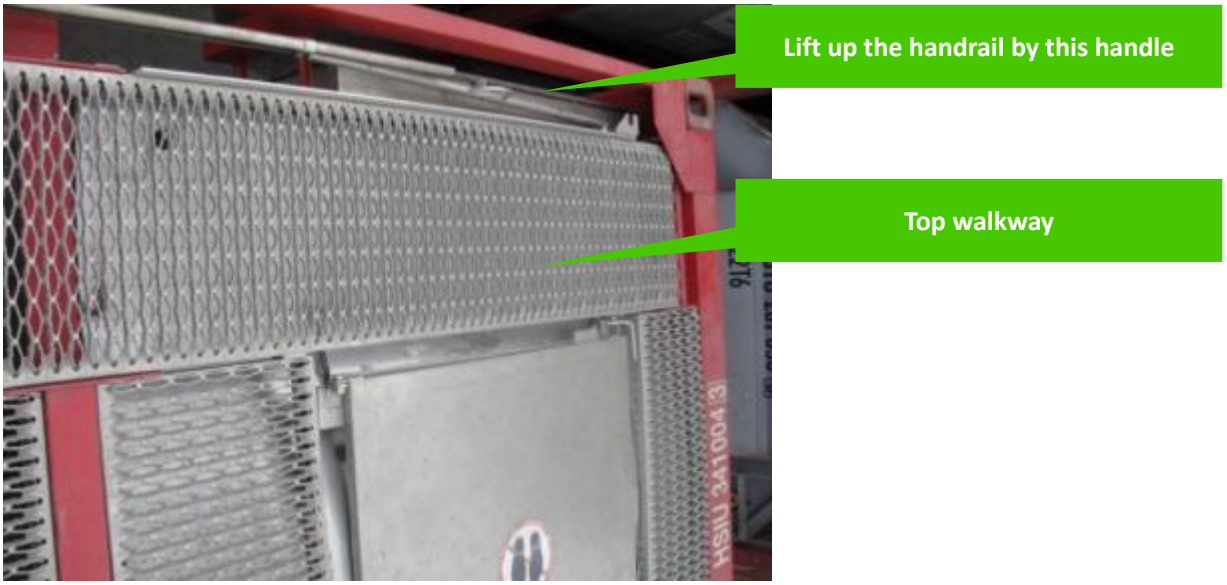


Picture 4.7 Top Vapour Return Valve

DN40 (2") flange ＋ ball valve, 4 X M16 bolts, sealed with blind.



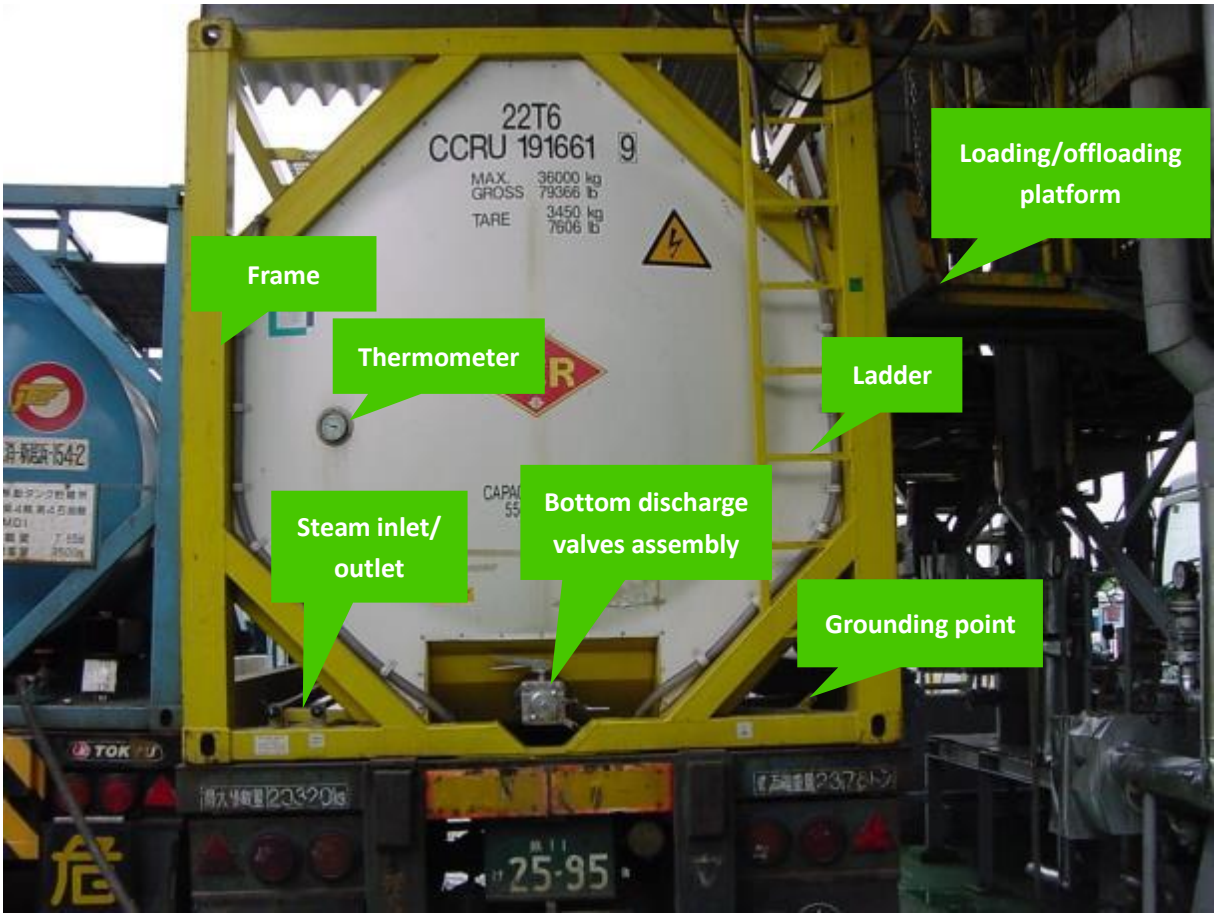
Picture 4.8 Top walkway with foldable handrail



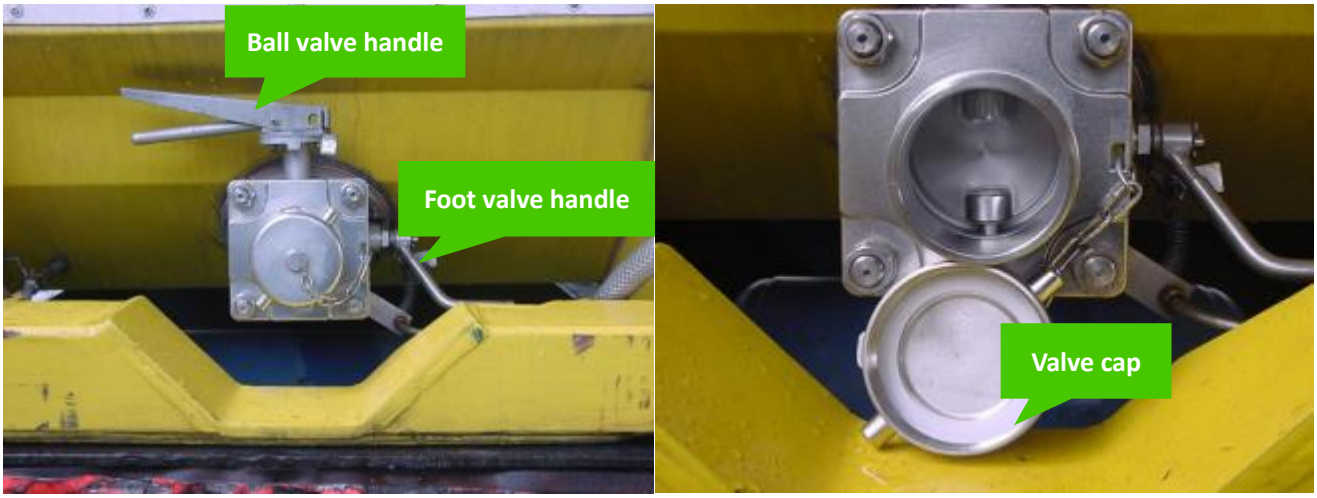
Note:

- Operator should lift the handrail, but not lean on it;
- Operator's Safety harness should be attached to higher hanging point;
- When opening/closing the valves, sitting down will be safer than standing on the top.

Picture 4.9 Rear end of ISO tank of T11

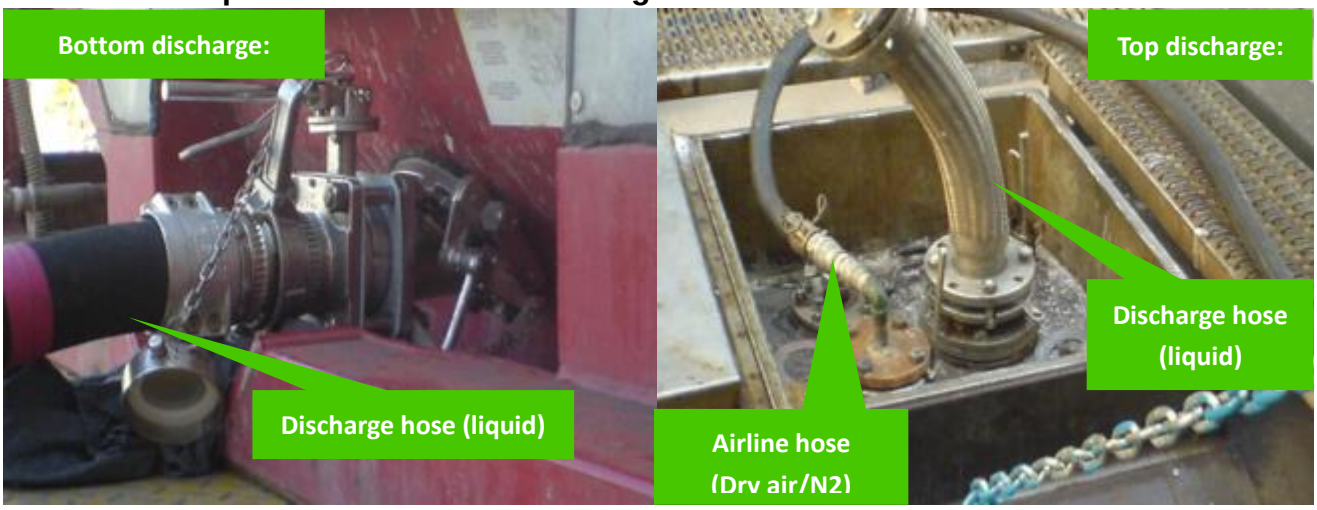


Picture 4.10 Bottom discharge valves assembly



Picture 4.11 T11 buttom discharge emergency shutdown system

Picture 4.12 Pipes connection for discharge



4.13 Bulk Diisocyanate delivery summary

Product	Type of ISO tank	ISO Tank Working press.	Bottom discharge	Top discharge	Other requirement
PMDI	T11	4bar	*Yes	*Yes	N2 is required
POLYOL	T11	4bar	Yes	No	N2 is not required
TDI	T14	4bar	**Yes	Yes	DG class 6.1 N2 is required
MMDI	T14	4bar	No	Yes	Temperature control*** and N2 are required

* Depends on loading plant ** China is performing trails for TDI bottom discharge deliveries

*** Refer to product data sheet for exactly temperature control requirement.

Chapter 5: PPE and Offloading Equipment

5.1 PPE for offloading:

Name	Picture	Remark
Safety helmet		Helmet should be under warranty; Put on helmet firmly, fasten mandibular belt to prevent helmet slipping off. (Refer instruction manual for details)
Goggle		Goggle should seal both eyes properly; lens should be maintained in good condition and keep clear all the time.
Air purifying respirator		Respirator should be equipped with appropriate cartridge(s),and has pressure tightness test procedure before put on; Cartridge(s) should have change-out schedule; (Refer instruction manual for details)
Chemical gloves		Reference: Butyl rubber - IIR: thickness > = 0.5 mm; Penetration time > = 480 minutes; Fluorinated rubber - FKM: thickness > = 0.4 mm; Penetration time > = 480 minutes.

Overall		Overall with anti-static function
Safety shoes		Chemical resistant safety shoes
Safety harness with falling arrestor		Working at height on the top of ISO tank: Must have a suitable suspension point for safety harness with falling arrestor; Before put on service, visual inspect for completion and try the locker 2 ~ 3 times. (Refer instruction manual for details)

5.2 Offloading equipment:

Name	Picture	Remark
Offloading platform		Top of ISO tank to ground is 4.1-4.2 meters, exceed the standards of working at height of 2 meters. Working platform with SOP is required for preventing falling accident.
Full containment		Containment should be sufficient to contain the spillage from the biggest bulk storage tank.
Illumination		For flammable product, ex-proof illumination should be installed.
Chocks		To immobilize the vehicle during offloading procedure.

Suitable Tool		For flammable product, ex-proof tools should be used.
Gasket	 PTFE gasket for flange or quick coupling  PTFE tape for BSP thread connection	 For above flange connection or Camlock quick coupling, PTFE gasket should be in good condition, such as flat, without burr\cut\bend etc.  For above BSP thread, inspect and clean the thread, apply appropriate PTFE tape before threading in.
Offloading pipe & connection (This is for top discharge only)		Vapor return line: 2" flange, 4 X M16 bolts connection. Liquid product discharge line: 3" flange, 4 X M16 bolts conncection.
Offloading pump		Seamless, magnetic driven pumps have a long history of leak free service with a variety of Polyol & Diisocyanate products. Either a centrifugal or positive displacement pump may be appropriate,

<table>
<tr><td></td><td></td><td>depending on the product involved.</td></tr>
<tr><td>Nitrogen suppler(bottle\ pipeline\vapor return)</td><td>  </td><td>• A source of Nitrogen or dry air, inert gas (-40°C/F dew point) is used in a diisocyanate tank's padding and blanketing system.
• Both dry air and nitrogen have been used successfully in many tanks. In applications sensitive to the presence of oxygen, nitrogen may be more appropriate than dry air.</td></tr>
<tr><td>Collection tray</td><td>  </td><td>To collect any spill from pipeline and/or valve assembling.</td></tr>
<tr><td>ER shower & eye wash</td><td>  </td><td>• ER shower & Eye wash should be easily accessible within 15 meters of offloading area.
• ER shower & Eye wash should be maintained properly.</td></tr>
<tr><td>Decontamination</td><td>  </td><td><table><tr><th>Formulation (weight or volume)</th><th>%</th></tr><tr><td>Sodium carbonate</td><td>5 - 10</td></tr><tr><td>Liquid detergent</td><td>0.2 - 2</td></tr><tr><td>Water</td><td>to make up to 100%</td></tr></table>Please also refer to the MSDS for more</td></tr>
</table>

		details on decontamination
Other ER equipment		One drum of sand with spade, one empty drum for collecting spillage.
Fire fighting		Recommendation for unloading area: One set of 35kg extinguisher on wheel, two set of 4kg portable extinguishers.

Chapter 6: ISO Tank unloading recommended Procedures

***Note:** * means the action might be conducted by receiver's operator, driver should follow receiver's instructions, but both parties should ensure safe operation and help to eliminate any incident related to bulk discharge.*

Receiver's operator	***Driver***
	1. Drives to the reception area
	2. Hands over all relevant documents to the operator. Documents may include: weighing ticket, delivery note, certificate of analysis and transport document etc. Shows his valid and suitable driver certificate.
3. Checks all relevant document with below key points: a. the product name; b. the delivery quantity; c. the vehicle number; d. ISO tank registration number; e. The driver license.	
4. Checks the weight to be unloaded on the unloading permit. **Makes sure that the reception tank can accommodate the load.**	
	5, Packs the ISO tank to discharge area,
6. a. Ensures wheels are blocked with two chocks. b. Connects the grounding cable with ISO tanks and grounding point in offloading bay.	6. a. Tilts the ISO tank backwards for better discharging process. b. shuts off the engine, applies the handbrake
7. Installs signs in front and behind the tanker indicating that a product transfer is taking place.	
8. **The receiver and the driver put on their individual protective equipment.**	

Receiver's operator	*Driver*
9. Tells the driver where to find: - the safety shower and eyewash - the fire extinguisher - the emergency stop button - the telephone and briefs the onsite ER procedures	9. Shows the receiver the location /operation of the emergency shut off line on ISO tank (for bottom unloading valve only).
10. Installs the gangway providing safe access to the top of the vehicle. Alternatively, prepares the fall arrest system for use.	
11. Opens the lid of the spillage tray of the vehicle.	
12. Removes blind flanges or caps from the outlets to be connected.	
13. c. Checks that site equipment – e.g. product hose, vapor return or nitrogen/air pressure line, couplings, gaskets and seals – is in good condition, fit for purpose and carry out a visual check on the internal cleanliness. d. Carries out a visual check on the **cleanliness** and correct functioning of the vehicle valves.	
14. FOR PUMP DISCHARGE ONLY:	
14a. With a vapor return line	
a. Installs the vapor return line connection to the storage tank. b. Ensures valves on the vapor return line are open. c. Ensures the pump versus vapor flow capacity is such that the pressure in the transport tank is never below atmospheric conditions. d. Installs the vapor return line connection to the vehicle	
14b. If no vapor return line exists	
a. Ensures the dry air / nitrogen flow capacity is such that the pressure in the transport tank is never below atmospheric conditions. b. Connects and opens the tanker air vent to the receiver's dry air / nitrogen supply	

Receiver's operator	*Driver*
15. FOR PRESSURE DICHARGE ONLY:	
a. Ensures the dry air / nitrogen supply is free of impurities, especially water, rust, etc. b. Ensures the dry air pressure does not exceed two (2) bars. C. Connects the dry air / nitrogen (for MDI monomer nitrogen is preferred) to the vehicle.	
16. Checks the presence and state of the couplings and gaskets and connects the unloading arm or flexible hose.	
17. If the product conforms to its specification, starts the unloading procedure.	
18. Opens the hose or unloading arm valve and ensure the valves and connection are in good way.	
19. Takes a sample if required, but only from the fixed sample point on discharge line or the storage tank.	
20. TOP DISCHARGE BY PUMP:	
a. Opens the valve on the receiver's line. b. Opens the tanker outlet valve. c. Start the pump at low speed, ensure no leakage occur, speed up to design speed. (if technical speed control option is available)	
21. TOP DISCHARGE BY PRESSURE:	
a. Opens the dry air / nitrogen supply valve. b. Opens the vehicle dry air / nitrogen inlet valve. c. Opens the valve on the receiver's line when pressure has built up in the tanker. d. Opens the tanker outlet valve.	
22. Observes and controls the transfer including the product level in the reception tank. If any anomaly linked to product discharge is detected, the receiver must: - immediately stop the discharge - inform management and seek instructions - record the incident in the register of events	

Receiver's operator	*Driver*
At the End of the Transfer Operation:	
23. TOP DISCHARGE BY PUMP:	
a. When ISO tank is almost empty, the offloading pipe becomes lighter & vibration with a sudden pressure drop occurs, in that case, lifts up the hose in a way so as to provide gravity flow to the pump, enhancing hose drainage. b. Closes the valve on the receiver's line. c. Stops the pump. d. Shuts off the tanker connections.	For Diisocyanate, checks the ISO tank pressure to ensure the pressure in ISO tank is over 0.2 bars.

24. TOP DISCHARGE BY PRESSURE:	
a. Closes the dry air / nitrogen supply valve. b. Disconnects the dry air / nitrogen supply line. c. Allows the tanker to decompress via the receiver's cargo line to a maximum of 0.3 bars. d. Closes the valve on the receiver's line. e. Shuts off the tanker connections.	Check the ISO tank pressure to ensure the ISO tank for Diisocyanate with dry air/ nitrogen up to 0.2 bars.
25. Disconnects the unloading arm or flexible hose and drains the residue into a safe container; the hose and arm should then be capped and stowed away safely in a dry place.	Checks and ensures all the hoses have been removed;
26. Refits the caps / blind flanges on the vehicle connections.	Checks and ensures all the caps/blind flanges have been refitted.
27. Withdraws the gangway and locks it in the upper position or stows away the fall arrest system.	
28. a. Disconnects grounding cable. b. Takes away the spillage tray. c. Withdraws all chocks. d. Checks the driver to sign Transport documentation e. Authorizes the driver to leave the unloading area.	Before leaving unloading area, checks and ensures a. No spillage on the ISO tank. b. Discharge valve has been closed and seal. c. All Chocks and grounding cable have been taken away.
29. Sign the Delivery Order and vehicle check list, Both leave the discharge area.	
30. a. Measures the product level in the reception tank. Closes all reception circuits. b. Checks and sign the DO.	30. a. Drives to Weight Bridge again. b. Sign the DO and vehicle checklist. c. Drive away from customer.

Chapter 7: Emergency Response

For First aid, Fire-fighting, Spill procedures and Waste disposal guidelines, kindly refer to latest MSDS

Guidelines for Diisocyanate Storage Tank Systems

AX-365, APRIL 2016

Purpose

The following guidelines have been developed to describe possible equipment options for storage tank systems intended for diisocyanate product service, specifically Monomeric Methylene Diphenyl Diisocyanate (MMDI), Polymeric Methylene Diphenyl Diisocyanate (PMDI) and Toluene Diisocyanate (TDI). Each item on this reference table is more fully described in the subsequent text. This reference table is not meant to be all-inclusive and may not cover all the legal requirements for storage tanks at a particular facility or operation. Consult your supplier for additional information. Consider each item and refer to the accompanying text for discussion. Use of this reference table is not a substitute for the thorough review of the equipment guidelines for diisocyanate storage tanks found in the body of this document.

American Chemistry Council | Center for the Polyurethanes Industry

	Product		
	MMDI	PMDI	TDI
1. Impervious Spill Containment	▲	▲	▲
2. Material of Construction			
Unlined Carbon Steel	■	▲	▲
Lined Carbon Steel	■	■	■
Stainless Steel	■	■	■
3. Tanks: General			
Above Ground	▲	▲	▲
Safe Access to Top of Tank	●	●	●
Adequate Tank Capacity	▲	▲	▲
4. Pressure/Vacuum Rating			
Known Working Pressure Rating and Vacuum Rating	▲	▲	▲
API or ASME Rated	●	●	●
5. Dry Air or Nitrogen Pad	▲	▲	▲
6. Venting	▲	▲	▲
7. Pressure/Vacuum Protection			
Primary Vacuum Protection	▲	▲	▲
Secondary Vacuum Protection	●	●	●
Primary Pressure Protection	▲	▲	▲
Secondary Pressure Protection	●	●	●
8. Level Indicator	▲	▲	▲
9. Level Alarms			
Low-Alarm	●	●	●
High-Alarm	●	●	●
10. High-Level Switch			
Independent of level indication system	●	●	●
Terminates flow into tank	●	●	●
11. Temperature Control	▲	▲	▲
Temperature Indicator	▲	▲	▲
Low Temperature Alarm	●	●	●
High Temperature Alarm	●	●	●
Insulation	▲	■	■
12. Agitation/Re-circulation			
Tank Agitator	■	■	■
Tank Re-circulation System	●	●	●

	Product		
	MMDI	PMDI	TDI
13. Transfer Pump			
Sealless Type	●	●	●
Pressure gauge on discharge side of pump	▲	▲	▲
Drain valves capped or plugged when not in use	▲	▲	▲
Located Inside Containment	●	●	●
14. Piping			
Carbon Steel	N/A	▲	▲
Stainless Steel	▲	■	■
Heat Tracing	▲	■	■
Insulation	▲	■	■
15. Gasket	▲	▲	▲
16. Filters/Strainers	■	■	■
Drain/Vent Valves With Caps or Plugs	▲	▲	▲
Pressure Gauge on Both Sides of Filter	▲	▲	▲
Located Inside Containment	●	●	●
Temperature Control	▲	■	■
17. Safety Considerations	▲	▲	▲
Shower & Eyewash	▲	▲	▲
Fall Protection	▲	▲	▲

(MMDI) Monomeric Methylene Diphenyl Diisocyanate
(PMDI) Polymeric Methylene Diphenyl Diisocyanate
(TDI) Toluene Diisocyanate

▲ - Equipment typically found on storage tanks that service the identified diisocyanate, and helps provide a basic level of protection against spills, leaks, or injuries. The accompanying text provides additional information.

● - Equipment that also helps provide protection against spills, leaks, or injuries of the identified diisocyanate. The accompanying text provides additional information.

■ - Selection of this equipment depends on the specific product application, there may be several alternatives available. Additional information and guidelines are presented in the accompanying text.

Equipment Guidelines: Descriptions

1. **Impervious Spill Containment**

   Capacity and construction details of the containment area for a storage tank vary according to state and local building codes, but, generally, tanks are installed in areas intended to provide an impervious surface and a defined containment. EPA's distance to toxic endpoint for TDI under the Risk Management Program (RMP) regulations is calculated from the size of the spill surface area (40 CFR Part 68). Reducing the containment surface area may assist in keeping vapors from a worst-case release scenario from going off site. Intermediate containment also may be appropriate where polyols and diisocyanates share a common containment area. Certain containment area designs could possibly meet OSHA's definition of a confined space, so keep in mind whether access into these areas should be restricted. See 29 CFR 1910.146 for additional information on confined space requirements.

2. **Equipment Material Used for Construction**

   Tanks, piping, and associated equipment intended for diisocyanate service are constructed of metals such as carbon steel, stainless or others as approved by the product manufacturer. For quality control reasons, typically stainless steel or lined carbon steel are used for MMDI and modified MMDI. Fiberglass, PVC, polyethylene or other plastics are generally not used as materials of construction for diisocyanate service. The specific product or application involved may necessitate a specific material of construction. See suppliers SDS for materials to avoid or contact the supplier with additional questions.

3. **Tanks: General**

   Above ground tanks may be located indoors or outdoors. Access to the top of the tank may be required for installing, inspecting, maintaining and calibrating equipment (i.e., level indication, system alarms, and relief devices).

   Tanks intended for diisocyanate service are typically located above ground. Underground storage tank permitting requirements and temperature controls make it impractical to consider underground storage (40 CFR Parts 280, 281, 282.50-282.105). Talk to your supplier for additional information on tank location and access.

   Tank capacity should be sufficient to handle amount of materials being delivered. It is important to contact your supplier for typical order size and tank capacity for cargo tank trailers or rail tank cars.

4. **Pressure/Vacuum Rating**

   A storage tank's maximum allowable working pressure (MAWP) rating generally should be known to properly size relief devices, such as pressure relief devices, vacuum relief devices and to determine the appropriate set point for tank pad pressure. The American Society of Mechanical Engineers (ASME) and the American Petroleum Institute (API) provide pressure-rating certification for storage tanks (API 650, 620 Code, ASTM Section VIII). Tanks built to these ASME or API code will have a specification plate affixed that will include the pressure ratings.

5. **Dry Air or Nitrogen Pad**

   Tanks in diisocyanate service are generally padded with a source of dry, inert gas having a dew point of -40°C/F. Both dry air and nitrogen have been used successfully as inert gas pads. In applications sensitive to

the presence of oxygen, nitrogen may be more appropriate than dry air. Pressure regulators, relief devices and a pressure indicator are typical components of a tank padding system. Use of air or inert gas with a higher dew point (above -40°C/F) could cause formation of solids (polyurea) in the storage tank. Consider a device, with an alarm, for measuring the dew point of the inert gas supply.

6. Venting

Tank overpressure may be prevented during unloading or filling operations by properly designing and installing the tank venting system. For example, if a pump unloading system is employed, it may be possible to return vapor build-up in the receiving tank to the container being unloaded. If a pressure unloading system is used, vapors can be discharged into a suitable treatment system. Further, activated carbon has proven effective in removing diisocyanate vapors from a vent gas stream. These options, by providing alternatives to venting tanks directly into the working environment, help limit workplace exposures and keep levels below legally permissible limits.

7. Pressure/Vacuum Protection

Relief valves are intended to provide protection from high pressure in diisocyanate storage tanks. Typically, diisocyanate tanks are equipped with two, and sometimes more, means of pressure relief to protect the tank. In most tanks, the primary pressure relief device is a pressure vent or the pressure side of a pressure-vacuum conservation vent. A pressure vent or rupture disk may be used as secondary pressure protection. In order to protect against over-pressurization, the set points for these relief devices are often set higher than the set point for the tank's blanketing and padding system, but lower than the tank's maximum allowable working pressure rating.

To prevent potential implosions, it may be appropriate to equip diisocyanate storage tanks with a means of vacuum protection. Vacuum protection may be accomplished with a vacuum vent, the vacuum side of a pressure-vacuum conservation vent, a rupture disk, a vacuum breaker or any combination of the above.

A scheduled inspection and preventive maintenance program can be effective in helping to prevent failure or malfunction of pressure and vacuum relief devices.

8. Level Indicator

A level indicator provides a means to identify the volume of liquid in a diisocyanate storage tank. Level indication systems that have been used successfully include weigh scales, pressure transmitters, by-pass visual level indicators made of steel, radar, sonar, and ultrasonic devices. Glass and plastic sight tubes may not be suitable because they can become opaque or plugged, leading to an inaccurate level reading or detoriate and break. The result could be a significant spill from a tank overflow or a leak in the tube. A scheduled inspection and preventive maintenance program can be effective in helping to prevent failure or malfunction of tank level indication systems.

9. Level Alarms

Low-level alarms help protect transfer pumps from being run dry, which can damage the pump. High-level alarms can help alert operating personnel before the tank is overfilled. These alarms may function from the tank's level indication system or can be separate devices installed in the tank sidewalls. A scheduled preventive maintenance and calibration program can be effective in helping to prevent failure or malfunction of tank level alarm systems.

10. High-Level Switch

High-level shut-off switches aid in preventing tank overflow. For pressure unloading systems, this switch would be interlocked to an automatic valve in the unloading piping. For pump unloading systems, the switch would be interlocked to the unloading pump. It is designed so that a critical high-level would activate the switch, closing the automatic valve and/or shut off the unloading pump depending on system design. Depending on the unloading method, simply shutting off a centrifugal pump may not completely stop the flow of product into the tank.

Keeping the switch independent from the tank level indication system can provide a backup system in the event the primary level indication system fails. A scheduled preventive maintenance and calibration program can be effective in helping to prevent failure or malfunction of a high-level shutoff switch.

11. Temperature Control

The freezing point of the specific product involved and the desired processing temperature helps determine the appropriate degree of temperature control for diisocyanate products.

Temperature control measures may include, but are not limited to, temperature controlled rooms, electric tracing systems, external heating panels, external heating coils, insulation, and external heat exchangers on re-circulation loops, or combinations of these items. The most widely used heating mediums include tempered low-pressure steam, water, glycol and oil. System design considerations also include potential for cross contamination of heating medium and product and avoiding localized heating which could result in the creation of a dimer within the material. Use of internal coils (versus external coils) in diisocyanate vessels can present a potential hazard because an adverse chemical reaction could occur if the coils fail.

Outdoor storage tanks that are insulated also can include measures such as cladding to help protect the insulation from weather. However, outdoor carbon steel tanks can be at risk of corrosion due to wet insulation.

Diisocyanate storage tanks connected to an auxiliary heat source are typically equipped with a temperature indicator and a temperature alarm system. For products where tight temperature controls are appropriate, both low and high temperature alarms can be used.

12. Agitation/Re-circulation

The decision of whether or not to use a tank agitator is usually based on the particular product application. When used, consider whether the agitator's material of construction is consistent with that used for the tank. In addition, consider whether any gasketing materials are compatible with the diisocyanate involved.

Piping that permits the contents of a diisocyanate tank to be re-circulated can aid with temperature control and provide a location for the installation of a heat exchanger and filter. During system design, consider accounting for the amount of heat certain types of pumps may input into a product.

13. Transfer Pump

Both canned motor and magnetic drive, sealless pumps have a long history of leak free service with a variety of diisocyanate products. Either a centrifugal or positive displacement pump may be appropriate, depending on the product involved. Product transfer pumps are typically installed on an impervious surface inside a defined containment area. Pump installations can include a pressure gauge in the pump discharge piping. An isolation valve, installed between the gauge and the piping, can facilitate gauge replacement. Isolation valves and drain or bleed valves, installed on both sides of the pump, can aid in future maintenance activities. Drain or bleed valves are typically placed at a low point in the piping system, but high enough to permit a catch container to be placed under the valves. The materials of construction for all wetted pump surfaces and for the pressure gauge and drain or bleed valves are consistent with that used for the transfer piping.

14. Piping

Material of construction for unloading, re-circulation and transfer piping for diisocyanate service is typically consistent with that required for the bulk tank. Fiberglass, PVC, polyethylene or other plastics typically are not considered appropriate options for construction of diisocyanate piping. Depending on the product involved and the specific geographic location, temperature control, including heat tracing and insulation, may be appropriate for unloading and transfer piping. Outdoor piping that requires insulation can include cladding to protect the insulation from weather. Unprotected outdoor carbon steel piping is at risk from the potentially corrosive effect of wet insulation and should be appropriately protected. The type of heat tracing used could include electric, hot water, or a mixture of glycol and water. The type of tracing used will also be a product specific and application-dependent decision.

15. Gasket

Typical gaskets, including non-graphited gaskets impregnated with Polytetrafluoroethylene (PTFE) fluorocarbon or braided PTFE fluorocarbon fiber, may be used. Spiral-wound gaskets made of PTFE fluorocarbon are also suitable. Depending on the application, other materials of construction may be considered. Contact your supplier for additional information.

16. Filters/Strainers

Filters or strainers may be appropriate for many diisocyanate bulk systems, and can be installed in the product unloading piping, in the tank re-circulation piping, or in both places. Bag and cartridge filters or basket strainers have been used successfully in diisocyanate service. Micron or mesh rating for the filter or strainer will vary, depending on the product involved and the specific application. Filter or strainer installations may include isolation valves, drain valves and pressure gauges on both sides of the unit. Isolation and drain valves allow the filter or strainer to be blocked in and bled down for changing, while pressure gauges allow operations personnel to view a pressure drop across the filter or strainer

to determine when the elements need to be replaced. The filter or strainer system is typically installed on an impervious surface inside a defined containment area. The drain valves are placed at a low point in the system, but still high enough to permit a catch container to be placed under the valves. The materials of construction for the filter or strainer housing, drain valves and other wetted parts are consistent with that used for the transfer piping. Isolation valves, installed between the pressure gauges and the piping, can facilitate gauge replacement.

17. Safety Considerations

Safety considerations include but are not limited to, providing a safety shower and eyewash installation in handling areas (including unloading and bulk storage areas) can help in situations where there is a potential for diisocyanate exposures. If a shower and eyewash are installed, then they should be installed and maintained in accordance with ANSI Z358.1.

Fall protection must be considered when discussing access to the top of the storage tank. Fall protection must be constructed and used in accordance with current OSHA standards, and all elevated work must comply with OSHA's fall protection standards (29 CFR Part 1910).

LEGAL NOTICE