VORANATE T-80 Toluene Diisocyanates

Tank Car Unloading Procedures

VORANATE® T-80 Toluene Diisocyanates are classified as hazardous materials under the Department of Transportation’s Hazardous Materials Regulations. Thus, the unloading of tank trucks must be done in strict accordance with those regulations.

VORANATE T-80 TDI is shipped in insulated, baked phenolic-lined tank cars, equipped with external heating coils and a safety relief valve set for 75 psi. Tank cars from The Dow Chemical Company can be unloaded only from the top.

CAUTION: Only properly trained and equipped personnel should be permitted to unload tank trucks. Operators should wear an approved respiratory protective device, and impervious clothing, footwear, gloves, and goggles.

For a detailed discussion of health hazards and safe handling procedure, see the handbook for Safe Handling and Storage of VORANATE T-80 Toluene Diisocyanates (Form No. 109-01243) from Dow.

The following is based on use of tank trucks meeting the specifications indicated in the handbook mentioned above.

Figure 1: Typical Tank Car

Note: On some 17,000-gallon DOWX series cars there is a variation in the dome valving configuration. The diagram below shows the normal configuration. However, in some cars the positions of A (the gauging device) and C (the 75# safety valve) are reversed.

Carefully read and understand each of the safety recommendations and precautions listed below:

1. Before attempting to use the following procedure, operators should be thoroughly familiar with the hazards associated with the handling and storage of TDI.

2. Verify that the proper car is being unloaded. Carefully check the car number, product identification and commodity stenciling against the bill of lading or other appropriate document. Also, sample the contents to be sure that the material is indeed TDI. Product identification and information tags are attached to the metal seal.

3. Position the car on the selected siding, then set the brakes and block the wheels.

4. Position caution signs on the track or car to provide adequate warning to persons approaching the car from the open ends of the siding.

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1The authority for approving or certifying respirators is held jointly by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). (In Canada, refer to the Canadian Standards Association [CSA] standard “Selection, Care and Use of Respirators,” Z94.4). For current information on the status of approvals of respirators, e-mail the National Institute for Occupational Safety and Health at pubstaff@cdc.gov, or call 1-800-356-4674.
CAUTION: The signs should not be removed until the car has been unloaded and disconnected from the discharge connection.


- The signs must be of metal or another comparable material, and at least 12 inches high by 15 inches wide.

- This sign must bear the words, STOP — TANK CAR CONNECTED, or STOP — MEN AT WORK, the word “STOP” being in letters at least 4 inches high and the other words in letters at least 2 inches high. The letters must be white on a blue background.

In addition to these mandatory regulations, The Dow Chemical Company recommends that the switches on the open ends of the siding be provided with locks, or that derails be placed on the track at least 50 feet from the ends of the car. This should effectively prevent the entry of other cars into the siding where the TDI is being unloaded.

CAUTION: In the event derails are used, be sure to attach a signal flag to the track to indicate that the derail is in position. Also, attach a signal light to the flag at night.

5. Climb the ladder to the platform area on top of the car. All unloading apparatus on Dow tank cars is located in the manway bonnet in the center of the platform. Remove the seal from the latch pin and open the bonnet dome. When the cover is open, check to see that all valves are in the closed position with plugs in place.

6. Check the temperature of the tank car by removing the 3/4-inch cap from the thermowell and inserting a thermometer approximately 48 inches for 15 to 20 minutes. The temperature of the contents must be above 16°C (60°F) when the car is unloaded.

7. If heating is necessary, remove the cover from the magnetic gauge and raise the gauge rod to where the magnet in the end of the rod engages the magnet on the float. The rod is calibrated in 1/4-inch increments and should read between 4 and 7 inches. Next, attach a steam hose to the steam inlet connection located on the bottom of the car. Attach a steam trap, designed for the steam pressure available, to the heating coil outlet connection. For greater control of the heating process (to avoid hot spots and product deterioration), use a steam pressure of 25 pounds or less. Also, carefully monitor the outage to be sure that expansion does not fill the car “liquid full” and cause it to “pressure relieve” through the safety valve. Finally, be sure to monitor the pressure on the tank car during heating. Do not allow pressure to go beyond 30 psig.

8. Allow the contents to warm until the temperature is at 20°C (68°F). When the temperature reaches 20°C (68°F), turn off the steam, disconnect the lines, and allow the heater coils to drain.

CAUTION: Carefully watch the thermometer during heating. Do not allow the temperature to rise above 40°C (104°F).

9. Connect the vent or vapor lines, and equip the vent or vapor line connection with a pressure gauge. Regulate pad gas to a maximum pressure of 30 psig.

10. If desired, a sample of the contents may be drawn off through the sample valve, which is a 1/4-inch needle valve equipped with standard pipe threads.

Note: If a sample is desired from an unpressured car, use 3 to 4 pounds of purge gas pressure.

11. Attach the unloading line. The line should be a clean, dry hose preferably made of flexible metal or made using Teflon® fluorocarbon or Viton® fluoroelastomer, that can safely withstand unloading pressures to the unloading valves. After proper attachment of the unloading lines, slowly open the unloading valves until discharge lines are liquid full.

12. Pressure on the car may now be increased to discharge the product. Make certain, however, that the amount of pressure is appropriate to the unloading method used (e.g., purge gas pressure or pump). If the contents are to be unloaded by purge gas pressure alone, the storage tank should be fitted with a vent scrubber. Also, storage tank pressure should be carefully controlled and monitored during the unloading operation.

13. When the tank car is empty, the unloading lines should be blown clear of liquid and blocked in before being disconnected. There are a number of ways to determine when the tank car is empty. For example, a rapid drop in pressure on the car would indicate that the liquid is gone and that the gas is blowing out through the unloading line. The amount of product received into the storage tank should also indicate whether or not the tank car is empty.

CAUTION: Do not use the magnetic gauging device to determine if the car is empty. This device extends only 60 inches into the car, and the car itself is typically at least 102 inches in diameter. These devices are used only during filling.

14. Once the tank car is empty, return all valves, connections and unloading lines to their original condition:
   a. Remove the thermometer from the thermowell and replace the dust cap.
   b. Completely lower the magnetic gauging device and replace the dust cap.
   c. Close the sample valve and replace the 1/4-inch plug.
   d. Blow dry the liquid unloading lines and disconnect in the following sequence:
      1. Blow the line to the storage tank and close off the valve to the storage tank.
      2. Open the unloading valve on the tank car and blow any material left in the line back into the car.
      3. Determine the amount of pressure remaining in the car. If it is below 10 psig, continue flow of purge gas until pressure in the car reaches a minimum of 10 psig.
      Note: Do not allow pressure to exceed 40 psig.
      4. Close the tank car valve, bleed off any pressure left in the unloading line and disconnect.
      5. Finally, replace the plug in the unloading valve.

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Viton is a registered trademark of DuPont Dow Elastomers.
e. Remove the purge gas line and replace the plug.
f. Close dome cover and replace latch pin. It is recommended that the pin be sealed to preclude its removal during transportation.
g. If any car defects are found, note them on the standard “Bad Order” tag and attach the tag to the dome cover latch pin.
h. If steam is used, do not replace inlet and outlet plugs on the heater coils. This will allow drainage.


- When lading requiring placards or car certificates are removed from a rail car other than a tank car, each placard and car certificate must be removed by the person unloading the car.
- For a tank car that contained a hazardous material, the person responsible for removing the lading must assure, in accordance with the provisions of Section 172.510(c) of this subchapter, that the tank car is properly placarded for any residue that remains in the tank car.

Section 172.510(c), “Special Placarding Provisions: Rail,” states, in part:

- Each tank car containing the residue of a hazardous material must be placarded with the appropriate RESIDUE placards, as required in Section 172.525 and paragraph (a) of this section.
- The RESIDUE placard must correspond to the placard that was required for the material the tank car contained when loaded, unless the tank car is reloaded with a material requiring no placards or different placards, or is sufficiently cleaned of residue and purged of vapor to remove any potential hazard.

Section 172.525, “Standard Requirements for the RESIDUE Placard,” states, in part that each RESIDUE placard must be as follows:

- The triangle at the bottom of the placard must be black. The word “RESIDUE” must be white.
- The midsection and upper triangle on the RESIDUE placard must be as specified in Section 172.519 and ... as appropriate for the residue of the commodity being transported and required by this subchapter to be placarded.
- The top part of each RESIDUE placard must be specified as follows and illustrated on the POISON — RESIDUE placard, which, except for size and color, must be as follows:

16. Remove warning, open derails, unlock switches, etc. Release hand brakes and remove chocks from wheels. If an unloading rack was used for entrance to the dome platform, be sure that all parts of the rack are removed and relocated far enough away from the car to conform to American Association Railroad (AAR) specified clearance for entry of the rail crew for switching operations.

17. Complete all final paperwork (e.g., “Empty Return Instructions”). After all forms have been completed and the proper carrier endorsements obtained, send the various copies to the locations designated in the instructions.

Note: If gas flow is allowed to continue after unloading, the gas flowing into the storage tank could rapidly increase internal pressure. This could cause serious structural damage to the storage vessel.

Figure 2: RESIDUE Placard
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