LIQUID NITROGEN

General

Liquid nitrogen is inert, colorless, odorless, non-corrosive, nonflammable, and extremely cold. Nitrogen makes up the major portion of the atmosphere (78.03% by volume, 75.5% by weight). Nitrogen is inert and will not support combustion; however, it is not life supporting. Nitrogen is inert except when heated to very high temperatures where it combines with some of the more active metals, such as lithium and magnesium, to form nitrides. It will also combine with oxygen to form oxides of nitrogen and, when combined with hydrogen in the presence of catalysts, will form ammonia.

Health Effects

Although nitrogen is nontoxic and inert, it can act as a simple asphyxiant by displacing the oxygen in air to levels below that required to support life. Inhalation of nitrogen in excessive amounts can cause dizziness, nausea, vomiting, loss of consciousness, and death. Death may result from errors in judgment, confusion, or loss of consciousness that prevents self-rescue. At low oxygen concentrations, unconsciousness and death may occur in seconds and without warning. Personnel, including rescue workers, should not enter areas where the oxygen concentration is below 19.5%, unless provided with a self-contained breathing apparatus or air-line respirator.

Personal Protective Equipment (PPE)

Never allow any unprotected part of the body to come in contact with uninsulated pipes or equipment that contains cryogenic product. The extremely cold metal will cause the flesh to stick fast and tear when one attempts to withdraw from it. One must be thoroughly familiar with the properties and safety considerations before handling a cryogenic liquid and its associated equipment. The eyes are the most sensitive body part to the extreme cold of the liquid and vapors of cryogenic liquids. The recommended personal protective equipment for handling cryogens includes a full face shield over safety glasses, loose-fitting thermal insulated or leather gloves, long sleeve shirts, and trousers without cuffs. In addition, safety shoes are recommended for people involved in the handling of containers. Depending on the application, special clothing suitable for that application may be advisable.

A special note on insulated gloves: Gloves should be loose-fitting so they are able to be quickly removed if cryogenic liquid is spilled on them. Insulated gloves are not made to permit the hands to be put into a cryogenic liquid. They will only provide short-term protection from accidental contact with the liquid. In emergency situations, self-contained breathing apparatus (SCBA) may be required.
(D-3) UNLOADING INSTRUCTIONS FOR OXYGEN, NITROGEN AND ARGON

Preparation:
1. Spot your equipment at the customer location in a safe manner and out of the way of customer traffic. Make certain you have enough room to monitor and adjust valves and gauges on the trailer and storage tank.
2. Put on your personal protective equipment.
3. Check your bills to ensure you are at the right location and the right tank, that the tank is properly marked and all unloading equipment is correct for the product you are transporting. If not, do not attempt to unload. Call in for further instructions.
4. Read and record onto the Trip Data Sheet both customer and trailer inch and pressure readings. Pay particular attention to fill marks, pressure instructions and any other instruction on the customer storage tank.

Cool Down & Purge:
5. Open and secure rear doors and open side doors (if equipped) for ventilation.
6. Close the road relief valve.
7. Open the pump inlet valve.
8. Open the re-circulation valve. This will allow liquid to flow through the pump and return to the trailer, cooling down the pump to operating temperature.
9. Open and secure unload engine compartment doors. Slide out the bottom tray (if equipped) for proper ventilation.
10. Make sure clutch is disengaged. Place emergency shut off switch to “on” position. Start engine and allow it to warm up at idle.
11. Remove storage tank fill connection dust cap and trailer discharge connection dust cap. Inspect fitting for damage and worn or damaged gaskets. Replace as necessary.
12. Pull one end of the trailer discharge hose from the hose tube just enough to allow connection to the trailer discharge line. Remove dust plug, connect this end of the transfer hose and tap the coupling lugs lightly with a brass hammer to ensure a tight connection. **WARNING!** Over-tightening can damage valves. Do not use any tool, wrench, persuader or other device to force or over-tighten tank or trailer valves. Report all valve problems immediately.
13. Pull the remaining portion of the transfer hose out of the hose tube, remove the dust plug, connect to tight connection. Do not drop the hose or drag it on the ground.
14. Open trailer discharge valve and customer storage tank purge valve. Purge the hose for a minimum of thirty (30) seconds. Close customer tank purge valve. Open customer storage tank top and bottom fill valves. If the tank is a top fill tank only, it will be noted or possibly the bottom fill valve handle will have been removed. In that case, only open the top fill valve.

Prime & Unload:
15. Open trailer pressure build valve a couple of turns. You want the trailer pressure to be at least 10-15 pounds above the pressure it was when you arrived at the unloading site, but no higher than 30 pounds. When the pump, lines, valves and discharge hoses are frosted over, the cool down process is complete. **NOTE:** if unloading oxygen, any leaks detected during the cool down process must be repaired before unloading.
16. Engage clutch on pump engine and pull the throttle open to increase the engine rpm’s.
17. When pump catches prime (pump discharge pressure will rise and pump will change pitch),
quickly close re-circulation valve and turn on meter.

**Monitoring:**

18. Maintain the trailer pump discharge pressure 50-100 pounds more than the customer storage tank pressure by adjusting the engine throttle.
19. Unless otherwise instructed, maintain the customer storage tank pressure at the same pressure it was when you arrived. To increase the storage tank pressure, start closing the top fill valve and stop when you reach the desire pressure. To reduce the storage tank pressure, start closing the bottom fill valve and stop when you reach the desired pressure. Storage tank pressure should never fluctuate more than 10 pounds above or below the required pressure during the unloading process.
20. Maintain trailer pressure between 20-30 pounds to help maintain prime. To increase pressure, start opening pressure building valve and stop when you reach the desired pressure. To reduce the pressure, start closing the pressure building valve and stop when you reach the desire pressure (NOTE: Some trailers are equipped with a “force feed valve.” This valve can be used in lieu of the pressure build valve to maintain pump prime and trailer pressure after you have made several deliveries and towards the end of your run, the product is warm and/or the amount of product left for a delivery is low. Do not use both valves together. Only one can be used at a time.
21. If the storage tank full level is marked and the liquid level gauge is working properly, when you get within 10 inches of the full mark, open the customer storage tank full tri-cock valve a couple of turns. IF the full level is not marked or the liquid level gauge is not working properly, open the full tri-cock valve immediately after you close the re-circulation valve. When the storage tank is full, liquid will come out of the full tri-cock valve and the storage tank pressure will begin to rise, signaling the tank is full and to begin the shut down process.

**Shut Down Procedure:**

22. When storage tank is full, your trailer is empty or you have delivered the ordered amount, release the engine throttle, open the re-circulation valve and close the pressure build valve.
23. Disengage the engine clutch.
24. Close the pump inlet valve.
25. Close the discharge valve.
26. Close the storage tank top and bottom fill valves and full tri-cock valve.
27. Open storage tank purge valve to blow down transfer hose.
28. Once all pressure is released from transfer hose, disconnect hose from storage tank connection. Place the transfer hose on the ground and away from your body and allow any remaining liquid in the hose to drain out and close the storage tank purge valve. Replace dust cap.
29. Once completely drained, replace the dust plug and place that end of the hose in the hose tube. Disconnect the other end of the hose from the trailer discharge connection, replace the dust plug and finish putting the hose in the hose tube.
30. If the trailer is empty or this was your last delivery, open the trailer manual vent valve and blow the trailer pressure down to 10 pounds.
31. Close the trailer manual vent valve and open road relief valve.
32. Shut down unload engine, place emergency shut off switch to “off” position, slide tray back under engine, close and secure doors.
33. Record meter reading, turn meter off, close re-circulation valve.
34. Replace all dust caps, close and secure doors.
35. Record storage tank inch and pressure readings.
36. Complete paperwork, obtain delivery signature and leave all required paperwork at designated spot.
37. Before leaving, make sure all storage tank valves are closed, dust caps/pugs replaced and return anything you moved, unlocked, etc. to its original position when you first arrived. Walk around your units to ensure everything is disconnected and secure.

Note: Contractors must remain at the rear of the trailer during the unload process to monitor gauges and valves. Do not leave the area or sit in the cab of the tractor until the unload process is complete.

Reminders:
A. There are only four (4) valves on the customer storage tank that you work with – top fill valve, bottom fill valve, full tri-cock, and purge valve.
B. Unless otherwise instructed, maintain storage tank pressure at no more than 10 pounds above or below the beginning pressure.
C. You raise the storage tank pressure with the bottom fill valve and lower the storage tank pressure with the top fill valve.
D. Before leaving the customer, make sure all storage tank valves are closed and the pressure is correct.
E. The only valve on the trailer that should be open when leaving is the road relief valve.