EASTMAN

Bulk storage and handling of Eastman acetaldehyde

Contents

Overview

This publication is intended to provide general information on the storage and handling of Eastman acetaldehyde. Eastman and its affiliates assume no liability or responsibility for any use or misuse, or the results of such use or misuse, of any information, procedure, conclusion, opinion, product, or process provided in this publication. Users of this information must be guided by the specific requirements of their company, personnel, technology, and manufacturing operations. All persons involved in using, storing, transporting, disposing, or otherwise handling Eastman products have an independent obligation to ensure that their actions are in compliance with current federal, state, and local laws and regulations and should consult with their technical and regulatory experts concerning such matters.

The information provided in this publication and the Safety Data Sheet (SDS) for Eastman acetaldehyde should be carefully reviewed to help ensure the safe storage and handling of acetaldehyde. Some special concerns with acetaldehyde include health hazards from exposure to vapors, ease of ignition, wide flammability range (4%–57% by volume in air), and the tendency to form shock-sensitive peroxides with air. Every effort must be made to avoid the formation of these peroxides. This product may also polymerize, resulting in hazardous conditions. It is the customer's responsibility to direct and control the unloading of any chemical or material into or from bulk storage and handling facilities.

From a quality perspective, this product forms paraldehyde upon storage, which may present a quality concern for some customers. Factors such as storage temperature, oxygen concentration in the vapor space, and storage container materials of construction will influence the rate of paraldehyde formation as well as have an effect on the useful life of a product. Maximum shelf life may be achieved by storing acetaldehyde in a stainless steel or phenolic resin lined storage tank under a nitrogen-pressurized vapor space.

Federal, state, and local regulations regarding the handling and storage of chemicals may vary widely. The Federal Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), National Fire Protection Association (NFPA), and a user's insurance company also impose specific safety standards. In addition, the U.S. Department of Transportation (DOT) prescribes rules and regulations for unloading hazardous materials from tank cars and tank trailers (see 49 CFR Parts 100–199). Knowledge of these and other appropriate federal and state laws and regulations, as well as consultation with the proper authority, is recommended to provide guidance for developing adequate handling procedures and constructing appropriate storage facilities.

Storage equipment

The following pages describe and illustrate tank construction materials and facilities for tank car and tank trailer handling of Eastman acetaldehyde. The drawings and discussions are only intended to provide general information and should be used solely as a guide for storing and handling this Eastman product. Users of this product must determine for themselves the appropriate procedures, equipment, and design for their storage and handling operations.

Acetaldehyde can be stored in a refrigerated tank at atmospheric pressure. A generally more acceptable arrangement, however, is the use of a pressure tank without refrigeration. In either case, provisions must be made for blanketing the tank with nitrogen. Appropriate precautions must be taken to avoid venting acetaldehyde into the atmosphere.

For the location, fabrication, installation, inspection, and testing of acetaldehyde storage tanks, the designer should refer to appropriate standards, including:

ANSI/NB-23—National board inspection code
API RP 520—Sizing, selection, and installation of pressure-relieving devices in refineries
API RP 521—Guide for pressure-relieving and depressuring systems
API Standard 510—American Petroleum Institute inspection codes
API Standard 570—Inspection, repair, alteration, and rerating of in-service piping
ASME boiler pressure code, Section VIII, Division 1
29 CFR 1910.106—Flammable and combustible liquids
NFPA 30—Flammable and combustible liquids code

Bonding and grounding are important to prevent the accumulation of static electricity and provide for its safe discharge. Bonding and grounding are required for all equipment, piping, tank cars, tank trailers, and interconnections. Designers should refer to the appropriate standards, including:

API RP 2003—Protection against ignitions arising out of static, lightning, and stray currents
NFPA 77—Recommended practice on static electricity

For maintenance of storage tanks and relief devices, it is recommended that the customer establish a regular inspection schedule for the tanks, relief devices, and piping.

Tank construction materials

To maintain the high quality of Eastman acetaldehyde, a stainless steel tank is preferred over steel. To minimize heat absorption, the exterior of the tank should be painted white. Figure 1 is a schematic diagram of a storage tank with a 40 psig (276 kPa) minimum pressure rating. The normal working pressure in the tank is 12–30 psig (82.7–207 kPa). The mixture of nitrogen and acetaldehyde vapors in the storage tank is vented to the vapor space of the tank car or truck during unloading, thus providing a closed transfer system. The entire system must remain under positive pressure so that air and moisture cannot leak into the system. The nitrogen supply should be sized to provide sufficient flow to compensate for the combination of maximum pump-out rate and pressure drop from sudden cooling of the vapor space. Full-vacuum design is necessary to prevent collapse of the tank in the event nitrogen is lost during tank pump-out or the tank cools suddenly due to a rainstorm or similar occurrence. To prevent contamination of the nitrogen system, the nitrogen supply pressure must be in excess of maximum tank pressure and reduced by means of a pressure-reducing station.

The storage tank should be protected by a remotely operated and/or heat-actuated water-spray fire protection system. No matches, smoking, open flame, or other ignition source should be allowed in the storage area. Only nonsparking tools should be permitted in the area. All electrical equipment should be explosion-proof (Class I, Group C).

Piping

Flanged, welded steel, or 304L stainless steel transfer lines can be used. To minimize possible leakage points, flanged joints should be used only where necessary. Screwed fittings should not be used. For steel transfer lines, flanges may be A105 carbon steel, class 150-lb weld neck with raised face and 125 AARH finish per ANSI B16.5. Spiral-wound gaskets (0.175-in. [4.45-mm] thickness type 316 stainless steel with graphite filler and internal and external gauge rings) are recommended for the flanged joint. If a stainless steel storage tank is used, type 304L stainless steel pipe should be used for transfer lines. In instances where lines can be valved off at both ends, a pressure relief valve should be provided to prevent excess pressure buildup in the line.

Pumps

Positive-displacement pumps are often used for unloading the tank car. Centrifugal pumps or positive-displacement pumps can be used to transfer from storage to process. Centrifugal pumps should be equipped with mechanical seals. If the pump requires an elastomeric seal under the end plate, an O-ring seal made of butyl rubber is suggested. Preferably, pumps should be constructed of type 316 stainless steel.

Valves

Stainless steel plug valves with Teflon™ plastic sleeves or ball valves with Teflon[1] plastic (or equivalent PTFE[2]) seats, seals, and packing should be considered.

Vents

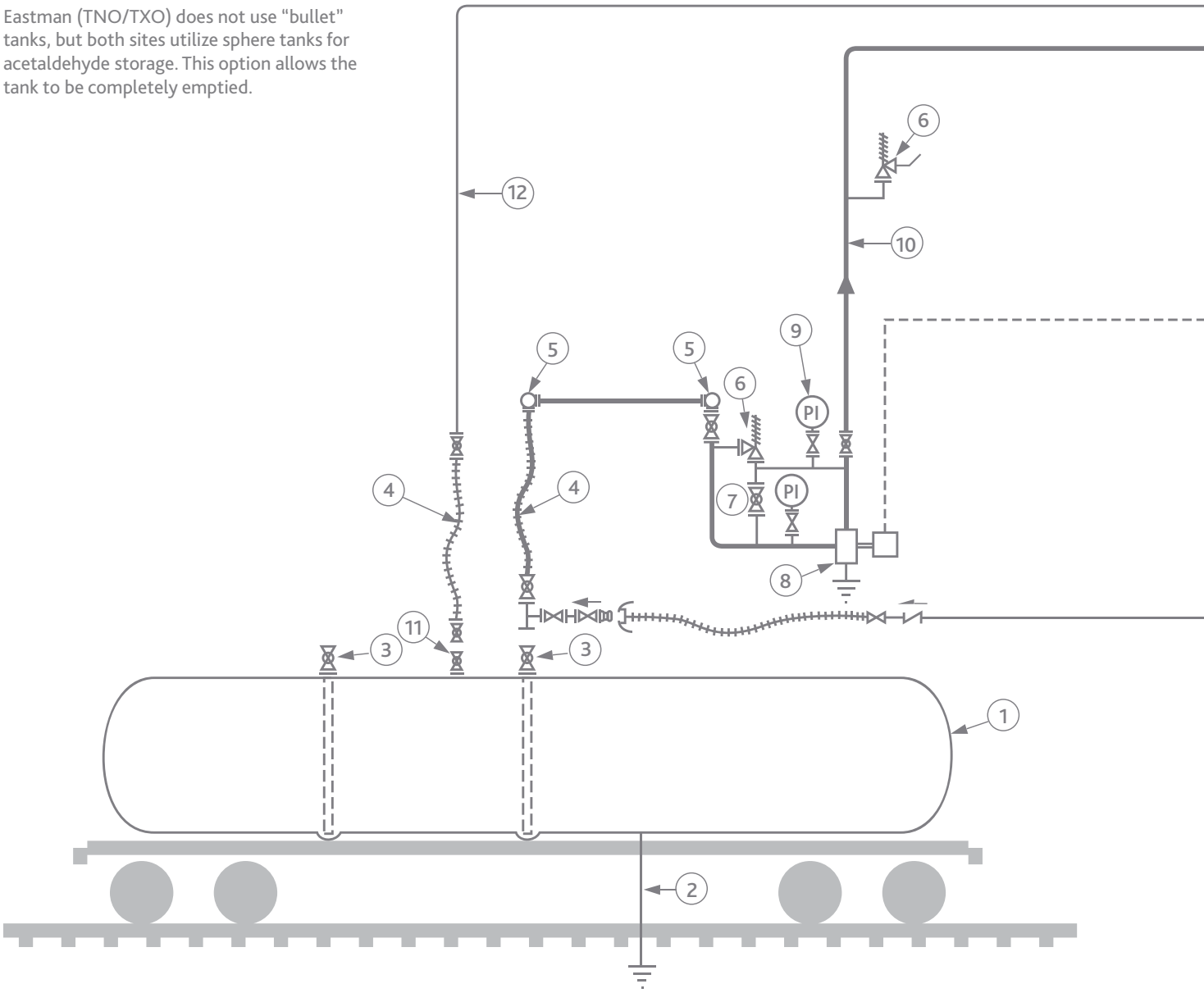
The emergency relief to the tank is provided by a pressure relief valve set at the maximum working pressure of the tank. The 3-way valve in the emergency relief device arrangement, shown in Figure 1, allows easy maintenance when the relief valve is periodically removed for testing. Either of the relief valves must be capable of providing full emergency relief to the tank. The use of rupture discs on the pressure side of the relief valves eliminates fugitive emissions. An alarm should be used to indicate pressure buildup in the space between the rupture disc and the valve; this indicates a leak or rupture in the disc. Use of an excess flow valve, appropriately vented, between the rupture disc and relief valve will prevent pressure buildup in the event of a small leak in the rupture disc. Alternatively, a high-pressure alarm could be placed between the rupture disc and relief valve to indicate the disc has been compromised.

Tank vents must meet federal, state, and local environmental laws and regulations. Relief valves should be sized and installed in accordance with the appropriate sections of 29 CFR 1910.106, API RP 520, and API RP 521. Vents should be piped to a safe location. Vents open to the atmosphere should be angled at 45° from vertical and cut off vertically to prevent rain from entering.

[1]*Product of DuPont* [2]*Polytetrafluoroethylene*

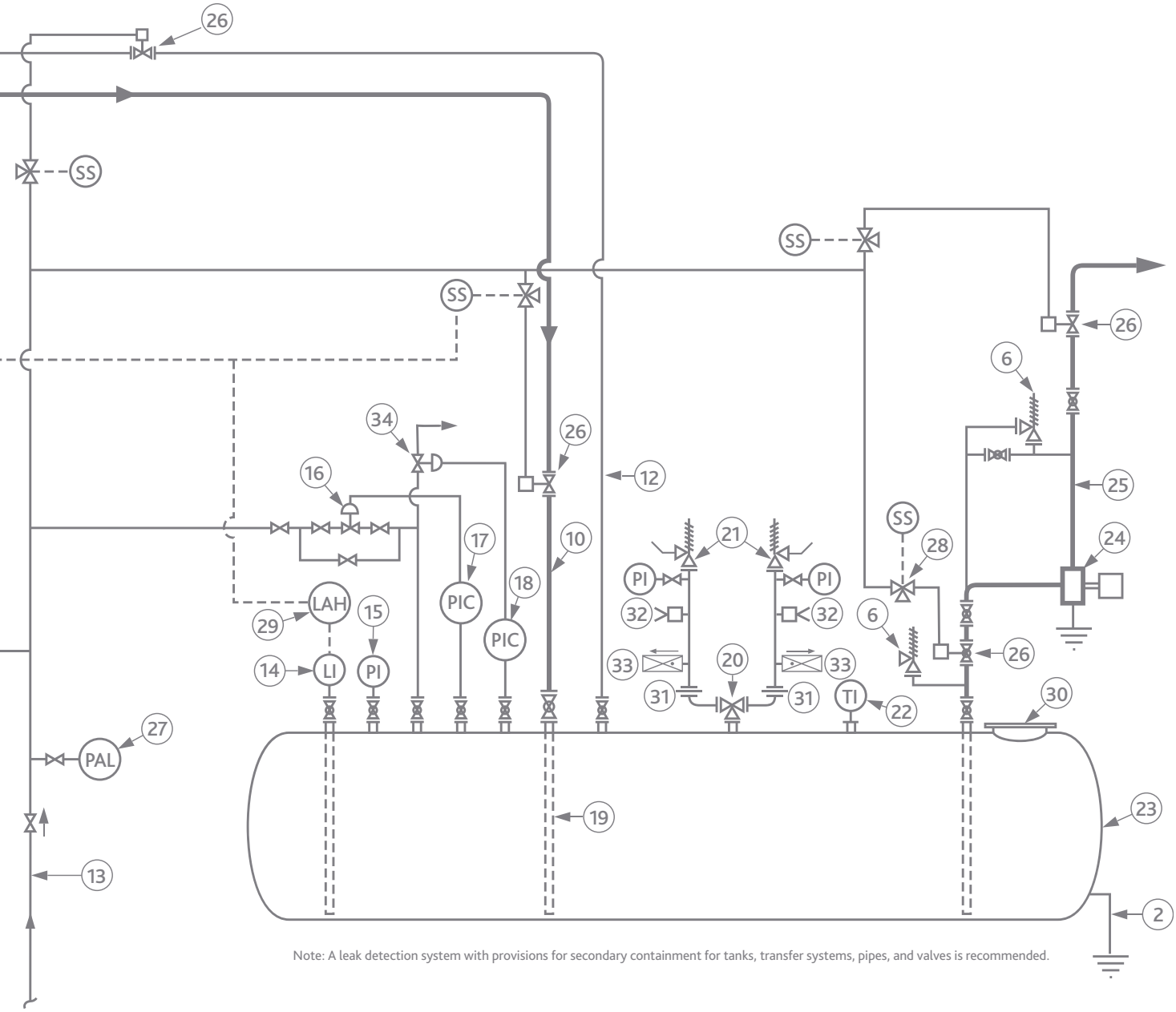
Figure 1.

Eastman (TNO/TXO) does not use "bullet" tanks, but both sites utilize sphere tanks for acetaldehyde storage. This option allows the tank to be completely emptied.



Equipment list

1. Tank car, steel, lined DOT Specification 105J pressure
2. Grounding wire
3. 3-in. angle valve on tank car liquid line (22,000-, 29,000-, or 30,000-gal carbon steel pressure cars)
4. Flexible hose, stainless steel, helical corrugated
5. Swivel joint, stainless steel
6. Relief valve for liquid service, stainless steel
7. Ball valve in pump bypass line, stainless steel
8. Pump, stainless steel
9. Pressure gauge
10. Acetaldehyde transfer line between tank car and storage tank
11. 2-in. angle valve on tank car vapor space (22,000-, 29,000-, or 30,000-gal carbon steel pressure cars)
12. Vapor line between tank car and storage tanks
13. Nitrogen supply line, 50-psig minimum
14. Storage-tank liquid level indicator
15. Pressure indicator with alarm
16. Low-pressure control valve, stainless steel, positive shutoff
17. Low-pressure controller
18. High-pressure controller
19. Storage tank fill line



Note: A leak detection system with provisions for secondary containment for tanks, transfer systems, pipes, and valves is recommended.

20. 3-way, 2-position ball or plug valve, stainless steel, transflow parts
21. Storage tank vapor relief valve
22. Temperature gauge
23. Storage tank, minimum MAWP = 40 psig
24. Positive-displacement or centrifugal pump
25. Acetaldehyde transfer line between storage tank and process
26. Pneumatically operated stainless steel plug or ball valve
27. Low-pressure alarm
28. 3-way solenoid valve and selector switch for remote operation of pipe valves
29. Tank high-level alarm electrically interlocked with unloading pump and valve
30. 24-in. tank manhole
31. Rupture disc, stainless steel
32. High-pressure alarm, 35 psig
33. Excess flow valve, stainless steel
34. Pressure control valve, stainless steel with positive shutoff, vented to vapor recovery device or atmosphere as appropriate

The nitrogen/vent system is designed to allow the pressure of the vapor space to range from 12–30 psig without creating emissions to the air. Below 12 psig, nitrogen will enter the tank, and above 30 psig, the nitrogen-acetaldehyde vapor mixture will vent.

The system, operating, and alarm pressures described here are designed for a storage tank (item 23) that has a MAWP of 40 psig and full vacuum. If a vessel with a different MAWP is used, the system should be designed accordingly by an appropriately certified engineer.

Tank fill line

In addition to the fire protection by the nitrogen blanket in the tank, the tank fill line should enter the tank through the roof and extend downward to within 2–3 in. (51–76 mm) of the bottom of the tank to inhibit static electricity. For the same reason, any removable well pipe or isolated conductor should be bonded to the tank and the tank should be grounded.

Bulk unloading

The following pages are only intended to provide general information about procedures for unloading Eastman acetaldehyde from tank cars and tank trailers. In addition, consult and observe the comprehensive Department of Transportation (DOT) regulations. Customers of this product must determine for themselves the appropriate procedures, equipment, and design for their unloading operations.

It is the customer's responsibility to be aware of and comply with all laws and regulations governing the unloading of tank cars and tank trailers. Eastman acetaldehyde is shipped in 22,000-, 29,000-, or 30,000-gal lined carbon steel pressure tank cars. Tank trailer capacity is approximately 7,000 gal.

It is recommended that unloading areas be protected by a remotely operated or heat-actuated, water-spray fire protection system. The unloading area should be provided with an emergency containment and drainage system to direct the contents of the delivering vehicle to a safe location other than the sanitary sewer or surface waters in the event a spill occurs. A slope is necessary to direct any spilled acetaldehyde away from the unloading area in the event of fire.

No matches, smoking, open flame, or other ignition source should be allowed in the unloading area. Only nonsparking tools should be allowed in the area. All electrical equipment should be explosion-proof (Class I, Group C).

Tank car and trailer unloading

Tank cars are normally unloaded from the top of the car through the fixed well line in the tank car. The vapor space of the tank car should be connected to the vapor space of the storage tank during unloading, as shown in Figure 1.

Typical unloading procedure for tank cars

1. Read the storage tank liquid level indicator (14), record the reading, and make certain that the storage tank (23) will accept the contents of the tank car (1).
2. Spot the tank car at the unloading station and set hand brake. Apply chocks to wheels to help prevent travel in either direction. Place warning signs at applicable ends along rails and attach derailing device to rails or lock the switch to the spur track involved.
3. Attach ground wires to the tank car.

4. Read and record the tank car number, numbers on the high-security seals located at various openings on the tank car, and product identification tag on the top unloading assembly. If these do not agree with the information on the shipping papers, check with the Eastman CSR prior to unloading.
5. Check that angle valve (11) is fully closed and remove the plug from the end of valve (11) on the tank car vapor space. DO NOT OPEN THIS VALVE AT THIS TIME.
6. Connect ball valve at end of vapor return line (12) to the tank car vapor valve (11). Open valves in the vapor return line and allow pressure in tank car and storage tank to equalize.
7. Check that valve (3) is closed and remove the plug from the end of valve (3) on the tank car unloading line. DO NOT OPEN THIS VALVE AT THIS TIME.
8. Connect a ground wire between unloading line and the tank car.
9. Connect acetaldehyde unloading line to valve (3) on car unloading line. Open valves in unloading line.
10. Close valve (7) in bypass line around pump (8). Start the pump. Check the transfer line for leaks. Check the storage-tank liquid level indicator (14) to ensure liquid is being transferred.
11. Proceed with the transfer until the tank car is empty. The transfer is completed when there is a sharp decrease in the pressure difference between pump (8) inlet and outlet.
12. Stop the pump. Close valves (3 and 11) on the tank car.
13. Open valve (7) in bypass line around the pump.
14. Connect flexible hose from nitrogen supply line (13) to the tee in the acetaldehyde unloading line (4). Open the valves in this line to remove acetaldehyde from the unloading line (10).
15. Close valve in nitrogen supply line (13).
16. Close valves in flexible hoses connected to the tank car. Bleed pressure from load, vent and nitrogen lines before disconnecting. Disconnect nitrogen supply line from unloading line. Disconnect acetaldehyde unloading line and vapor return line from angle valves (3 and 11) on tank car. Replace plug in the end of tank car valves (3 and 11).
17. Remove ground wires, chocks, warning signs, derails, and unlock spur track switch. DOT PLACARDS MUST REMAIN ON RESIDUE TANK CAR.
18. Read the storage-tank liquid level indicator (14) and record the reading.

Typical unloading procedure for tank trailers

A cargo tank must be attended as specified in 49 CFR 177.834.

1. Read the storage tank liquid level indicator (14), record the reading, and make certain that the storage tank (23) will accept the contents of the trailer.
2. Position trailer at the unloading station. Apply chocks to wheels to help prevent movement in either direction.
3. Attach a ground wire to the tank trailer.
4. Read and record tank trailer number, numbers on the high-security seals located at the various openings on the tank trailer, and product identification tag on the manhole and bottom outlet. If these do not agree with the information on the shipping papers, check with the Eastman CSR prior to unloading.

5. Check that bottom outlet valve is closed and remove the cap from the bottom outlet valve on the trailer. DO NOT OPEN THE VALVE AT THIS TIME.
6. Connect acetaldehyde unloading line (on inlet of customer's pump) to bottom outlet valve on bottom of trailer. Open valves in unloading line and on trailer. TRAILER PUMPS MUST NOT BE USED.
7. Connect a ground wire between unloading line and the trailer.
8. Check that vent valves on trailer are fully closed before removing cap from end of trailer vent line. DO NOT OPEN THESE VALVES AT THIS TIME.
9. Connect ball valve at end of nitrogen line to the trailer vent valve. Open valve on the vapor line and allow nitrogen to flow. BE SURE NOT TO OVERPRESSURE TRAILER.
10. Close valve (7) in bypass line around pump (8).
11. Start the pump. Check the transfer line immediately for leaks. Check the storage-tank liquid level indicator (14) to ensure the liquid is being transferred.
12. Proceed with the transfer until the trailer is empty. Completion of the transfer occurs when there is a sharp decrease in the pressure difference between pump (8) inlet and outlet.
13. Stop the pump. Close valves (both bottom outlet and vent) on the trailer.
14. Open valve (7) in bypass line around the pump.
15. Connect flexible hose from nitrogen supply line (13) to the tee in the acetaldehyde unloading line (4). Open the valves in this line to remove acetaldehyde from the unloading line (10).
16. Close valves in nitrogen supply line and bleed excess pressure from hose before removing flexible hose.
17. Close valves in flexible hoses connected to the trailer and bleed excess pressure from hoses before disconnecting. Disconnect acetaldehyde unloading line and nitrogen line from valves on trailer. Replace caps on trailer valves.
18. Remove ground wires and chocks. DOT placards must remain on the trailer.
19. Read the storage-tank liquid level indicator (14) and record the reading.

Safety precautions

Information

An SDS with hazard and safety information, physical and chemical data, and spill and emergency response information has been provided for Eastman acetaldehyde. All users should carefully review the SDS before undertaking any handling, storage, or use of acetaldehyde. For copies, visit www.eastman.com or call your Eastman representative.

Protective clothing

Personal protective equipment (PPE)—such as gloves, goggles, face shields, boots, and flame-retardant clothing—appropriate for handling Eastman acetaldehyde should be readily available and worn by personnel involved in all handling and storage operations. Further information regarding PPE and handling practices is available in the SDS.

EASTMAN

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