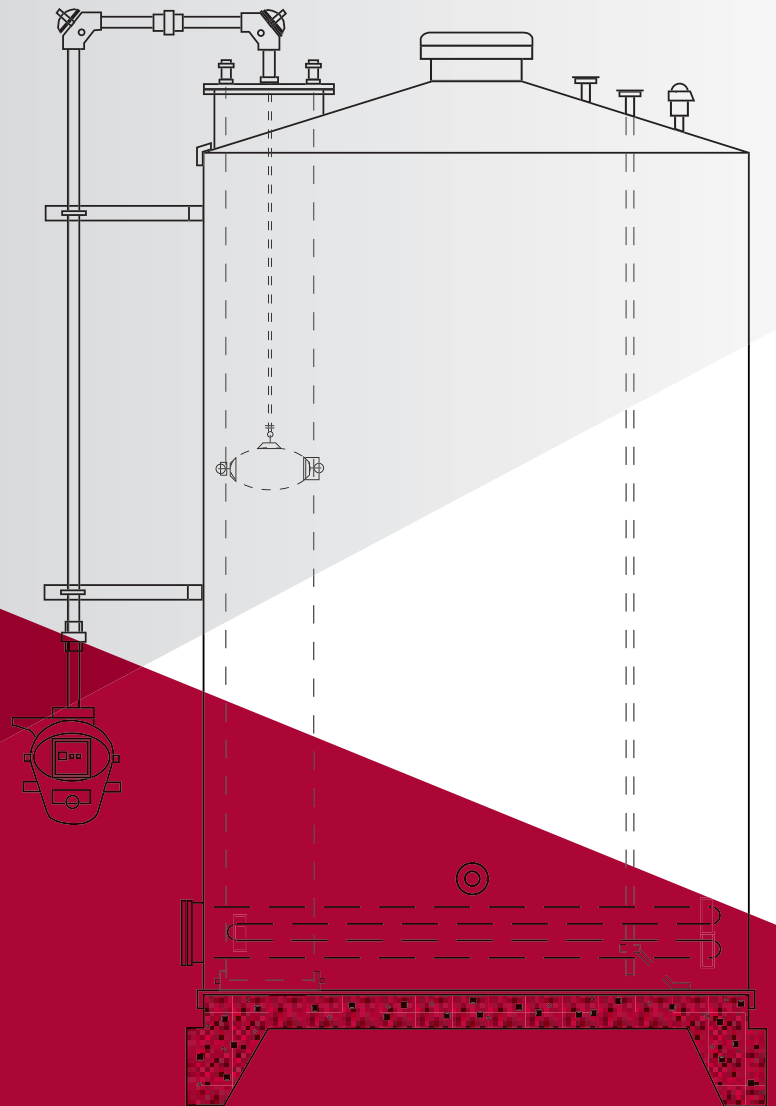


# Bulk storage and handling of acids and anhydrides



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# Bulk storage and handling of acids and anhydrides

## Introduction

This publication provides information on storage and handling of Eastman™ acids and anhydrides. The drawings and discussions are for information only and should be used solely as a guide in developing procedures and facilities for handling Eastman acids and anhydrides listed below. Customers must determine for themselves the appropriate procedures and facilities for their operations.

Acids	Anhydrides
Acetic	Acetic
Propionic	Propionic
<i>n</i> -Butyric	<i>n</i> -Butyric
Isobutyric	Isobutyric
2-Ethylhexanoic	

The information in this publication, along with the data and information contained in Eastman's Material Safety Data Sheets (MSDS), needs to be reviewed and understood to help ensure safe storage and handling of Eastman acids and anhydrides. 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. Title to all chemicals or materials, unless otherwise specified, shall vest in a customer at Eastman's shipping point.

Federal, state, and local regulations regarding 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 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 100-199). Knowledge of these and other appropriate federal and state laws and regulations as well as consultation with the proper authority should provide guidance for developing adequate handling procedures and constructing appropriate storage and drumming facilities.

Nothing contained herein constitutes a representation or warranty concerning the products, the attributes of the products, or the manner in which the products are to be safely or properly used, handled, stored, transported, or shipped. You are hereby notified to seek independent advice on all such matters.

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## Storage equipment

Tank construction materials and facilities for tank car and tank trailer handling of these materials are described and illustrated on the following pages. The drawings and discussions are for information only and should be used solely as a guide in storing and handling these Eastman products. Customers/users must determine for themselves the appropriate storage and handling facilities for their operations in the country involved.

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

- ANSI/NB-23—National Board Inspection Code
- ASME Boiler Pressure Code, Section VIII, Division 1
- API Standard 510—Pressure Vessel Inspection Code: Maintenance, Inspection, Rating, Repair, and Alteration
- API Standard 570—Piping Inspection Code: Inspection, Repair, Alteration, and Rerating of In-Service Piping Systems
- API Standard 620—Design and Construction of Large, Welded, Low-Pressure Storage Tanks
- API Standard 650—Welded Steel Tanks for Oil Storage
- API Standard 653—Tank Inspection, Repair, Alteration, and Reconstruction
- API Standard 2000—Venting Atmospheric and Low-Pressure Storage Tanks: Nonrefrigerated and Refrigerated
- 29 CFR 1910.106—Flammable and Combustible Liquids
- NFPA 30—Flammable and Combustible Liquids Code

Bonding and grounding are important to inhibit 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. Regarding bonding and grounding considerations, refer to the following and other appropriate standards:

API RP 2003—Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents

NFPA 77—Recommended Practice on Static Electricity

Potential electrical ignition hazards should be controlled through proper selection and installation of electrical equipment. The storage, handling, and unloading areas should be classified in accordance with the information available in the following standards and any other applicable standards for your area or country.

NFPA 70—National Electrical Code

NFPA 497—Recommended Practice for the Classification of Flammable Liquids, Gases or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

Proper selection and installation of electrical equipment should be based on NFPA 70 in accordance with the area electrical classification. Potential nonelectrical ignition hazards should be controlled through safe work processes and procedures.

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

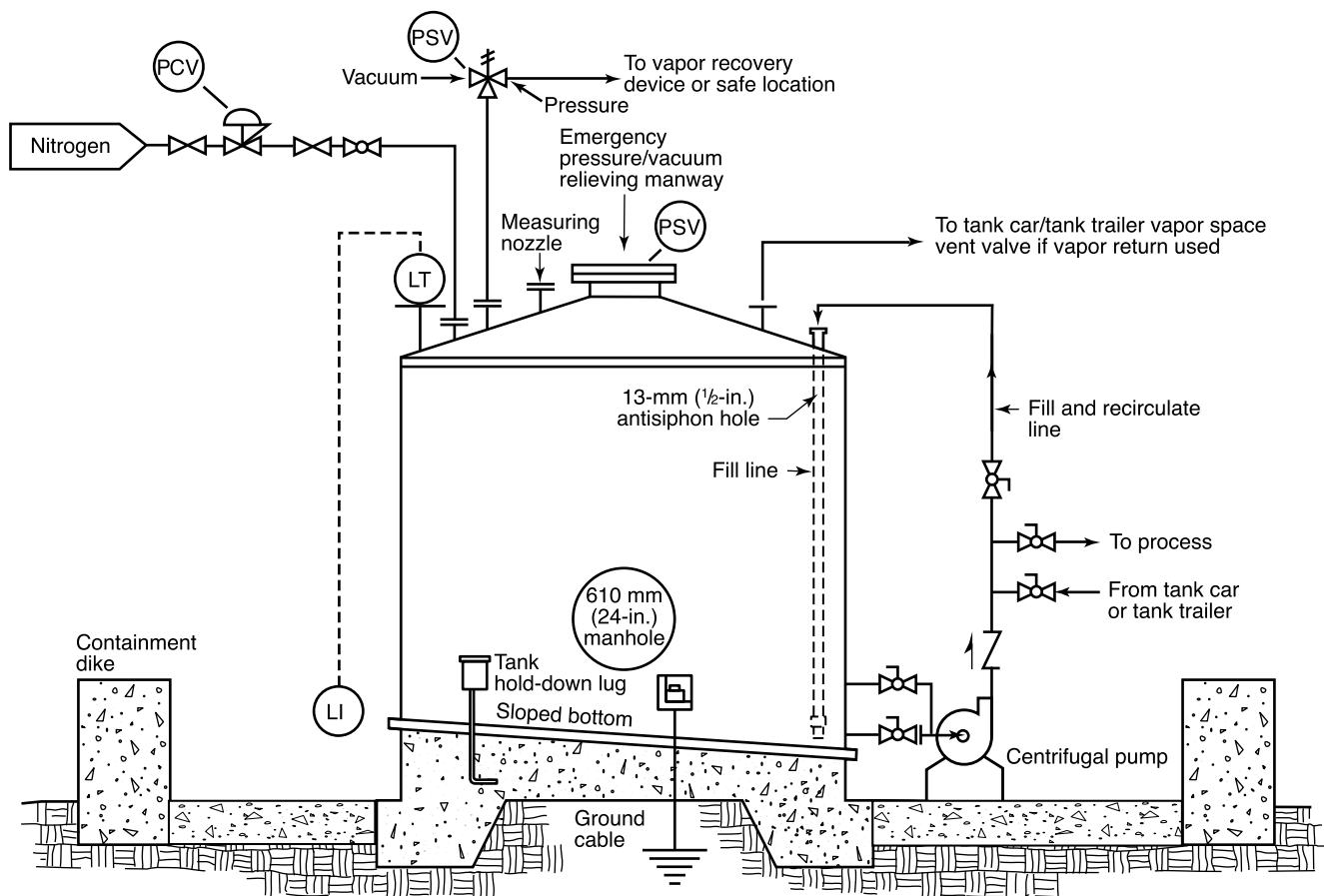
## Tank construction materials

Storage tanks should be constructed of 316L stainless steel. To reduce corrosion of the tank bottom exterior, a coating should be applied between the tank and foundation.

A vertical atmospheric storage tank is shown in Figure 1. The storage tank area should be enclosed by containment facilities capable of containing the contents of the tank and the maximum expected rainfall for an appropriate design storm event. The enclosed area should be drained through a trap to a safe location that is protective of human health and the environment and is in compliance with applicable laws and regulations. A vertical tank provides a more economical use of land than does a horizontal tank.

For outdoor storage of glacial (anhydrous) acetic acid (freezing point 16.6°C [61.9°F]), a heating system and tank insulation should be provided. The recommended heating system consists of low-temperature electric heating pads installed between the tank exterior and the insulation that will maintain the temperature at a desirable level. Heating a point of the tank or pipe wall to a high temperature may result in accelerated corrosion at the point of heating. For example, if the tank or pipe wall was contacted with a steam tracer (tubing) at 100 psig (about 168°C), accelerated corrosion could result. Using sandwich tracing, 100-psig steam could be utilized for heat tracing without substantially elevating the wall temperature. If storage tanks for other Eastman™ acids or anhydrides are subject to extreme cold (near or below the freezing point of the contents), they should be equipped with heating systems to facilitate transfer.

**Figure 1**  
**Storage tank**



*Note: A leak detection system with provisions for secondary containment is recommended.*

Normal handling temperatures are below the flash points of these acids and anhydrides. However, if these solvents will be handled at or above their flash points, it is recommended they be treated as if they were flammable solvents. To inhibit the accumulation of static charges, the storage tank, pumps, transfer lines, and offloading vehicle should be adequately grounded.

**Storage facilities should be constructed so that water cannot be accidentally introduced into anhydride storage tanks. Anhydrides react with water and generate heat. In a confined space, considerable pressure caused by this reaction can result in an explosion that can rupture a storage tank.**

## Piping

Stainless steel pipe, type 316L, should be used for transfer lines.

Transfer lines should be welded and have no screwed fittings. Pipe connections should be flanged with 150-lb forged steel lap-jointed flanges. Lines should have as few flanged connections as possible.

For outdoor storage of glacial acetic acid, a heat tracing system should be provided for the piping and pumps. As described in the Tank construction materials section on page 5, the tracing system should not heat the wall to elevated temperatures. Other Eastman™ acids or anhydrides subjected to extreme cold may also require heat tracing.

## Pumps

Centrifugal pumps should be considered for acid and anhydride transfer. A self-priming centrifugal or a positive-displacement pump should be used when unloading tank cars from the top. Centrifugal pumps should have mechanical seals. For Eastman installation, all parts of the pumps wetted by the liquid should be made of type 316 stainless steel.

## Valves

Stainless steel, type 316L, flanged ball or sleeve type plug valves with seats, sleeves, seals, gaskets, and packing made of Teflon®<sup>1</sup> plastic (or equivalent PTFE<sup>2</sup>) should be considered for use in acid and anhydride transfer lines.

## Gaskets

Gaskets made of filled, restructured Teflon® (or equivalent PTFE), or corrugated metal (316 stainless steel) faced with expanded PTFE should be considered for use with Eastman acids and anhydrides. For sheet gaskets made of filled, restructured Teflon (or equivalent PTFE), a gasket thickness of 1.59 mm (<sup>1</sup>/<sub>16</sub> in.) is recommended for typical valve and piping applications.

## Vents

If environmental laws and regulations of federal, state, and local agencies permit, tank vents may be open to the atmosphere. The vents should be angled at 45° from vertical and cut off vertically to prevent rain from entering. The vents should be at least 1 inch larger in diameter than the tank fill line and in accordance with the appropriate sections of 29 CFR 1910.106, API Standard 2000, and NFPA 30. A coarse-mesh stainless steel wire screen should be placed over vent openings to prevent entry of foreign objects. Per 29 CFR 1910.106, if the storage tank is located inside a building, the vents should extend outside the building. It is recommended that storage tanks be provided with a blanket of inert gas or nitrogen and equipped with a pressure/vacuum conservation vent piped away to a safe location that is protective of human health and the environment and is in compliance with applicable laws and regulations.

## Tank fill line

The fill line should enter the tank through the roof and extend downward to within 2 to 3 inches of the bottom of the tank to inhibit the accumulation of static charges. The tank should also be blanketed with nitrogen.

<sup>1</sup>Product of DuPont

<sup>2</sup>Polytetrafluoroethylene

## Bulk unloading

The following pages outline procedures for unloading tank cars and tank trailers. These procedures are for information only. In addition, consult and observe the comprehensive Department of Transportation (DOT) regulations or other applicable regulations. It is the customer's responsibility to be aware of and comply with all applicable laws and regulations governing the unloading of tank cars and tank trailers. The unloading procedures should address the appropriate protective clothing that should be used and when the operator should wear it.

Eastman™ acids and anhydrides are shipped in aluminum or stainless steel tank cars and stainless steel tank trailers. The usual tank car sizes are 10,000 and 20,000 gallons. Tank trailer sizes vary upward from 4,000 gallons. The unloading area should be provided with an emergency containment and drainage system to direct at minimum, the contents of the off-loading vehicle, in the case of a spill, to a safe location that is protective of human health and the environment and is in compliance with applicable laws and regulations. Also, a vapor return line can be used to comply with EPA venting requirements. A properly designed system utilizing vapor return can be used to reduce vapor generation and increase recovery of product

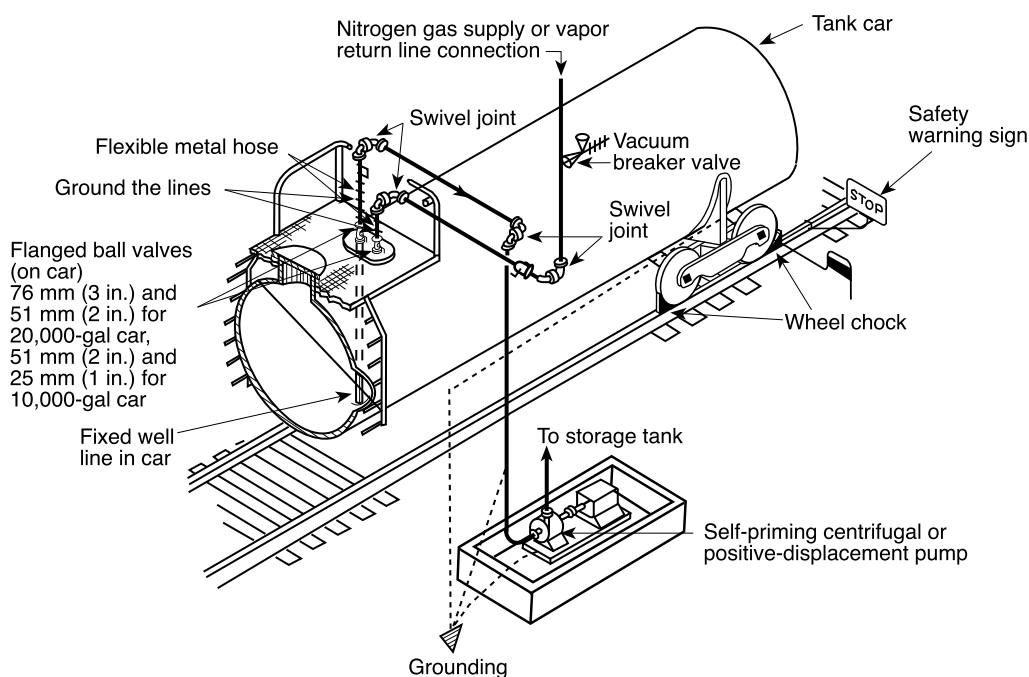
vapor. It is also recommended that a nitrogen or inert gas blanket be used during loading or unloading of materials at or above their flash point.

On shipments of acids with high freezing points, heating coils are provided in tank cars [51 mm (2 in.)] and tank trailers (25 mm [1 in.]) for use with low-pressure steam or hot water to thaw acid that may have frozen in transit. During heating, the car should be monitored to prevent overflowing from expansion. Before the acid is unloaded, the tank car or trailer should be carefully checked to ensure material is completely thawed.

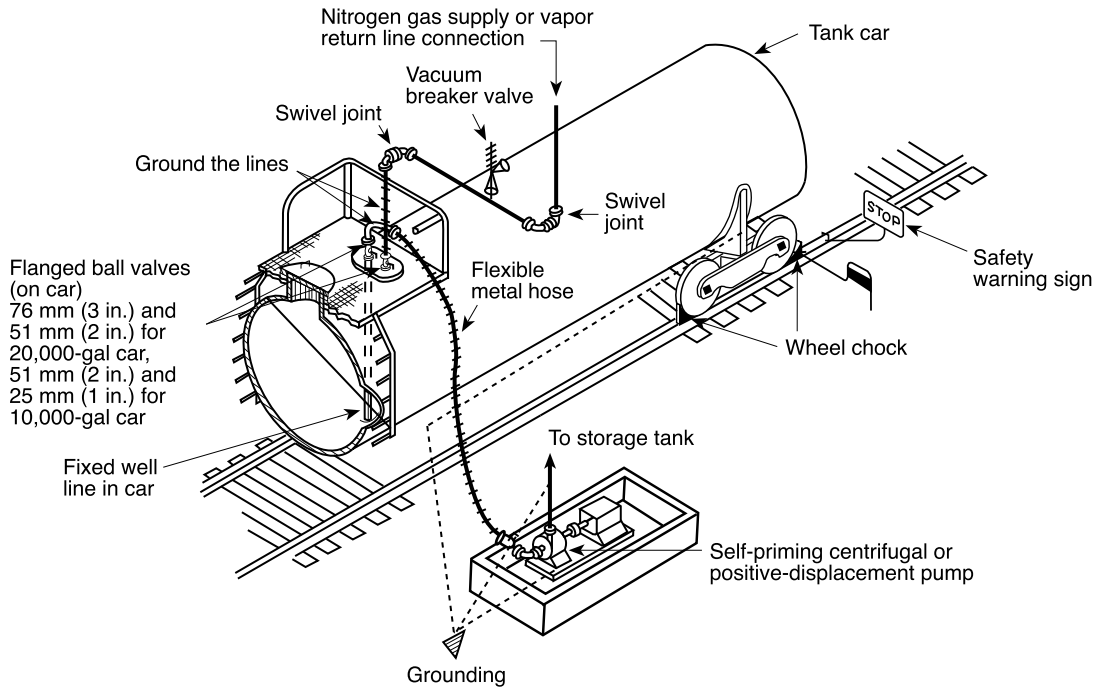
### Tank car unloading

Unloading operations must be performed only by reliable persons properly instructed in unloading hazardous materials as per 49 CFR 174.67. **The recommended method of unloading tank cars is from the top.** It is easier to shut off the flow in case of a transfer line leak or rupture. Figures 2–4 show several unloading arrangements for tank cars that minimize the chance of an accidental discharge. In Figures 2 and 3, the unloading lines are connected to the fixed well line in the tank car. For top unloading, an approach platform is suggested.

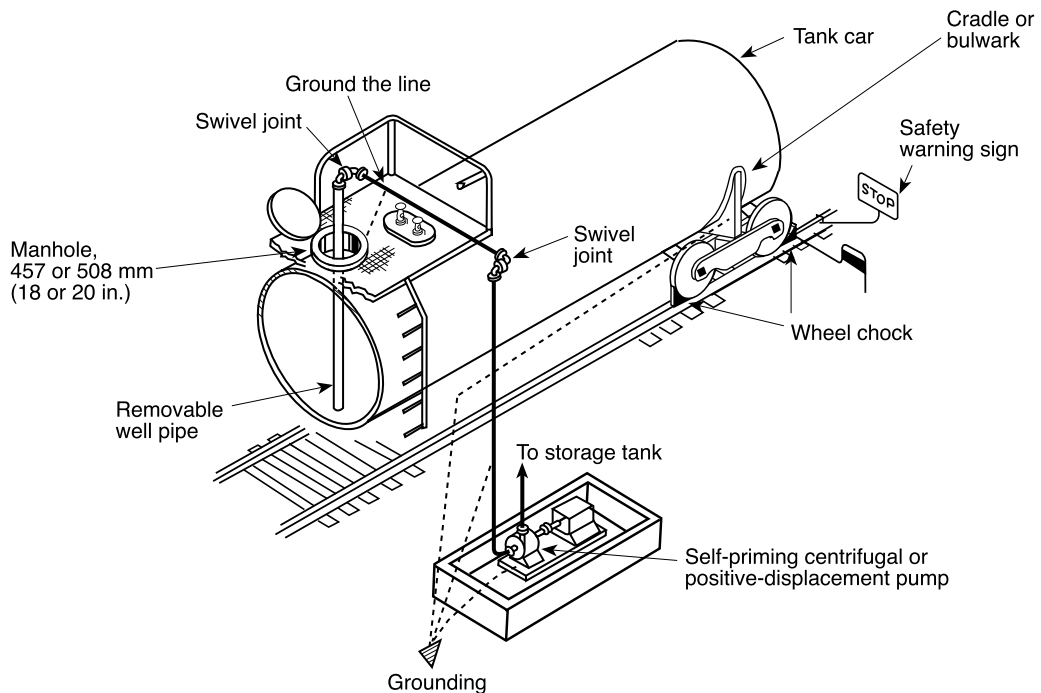
**Figure 2**  
Tank car top unloading—fixed piping with swivel joints



**Figure 3**  
**Tank car top unloading—flexible hose with flanged elbow**



**Figure 4**  
**Tank car top unloading—removable well pipe with swivel joints<sup>a</sup>**



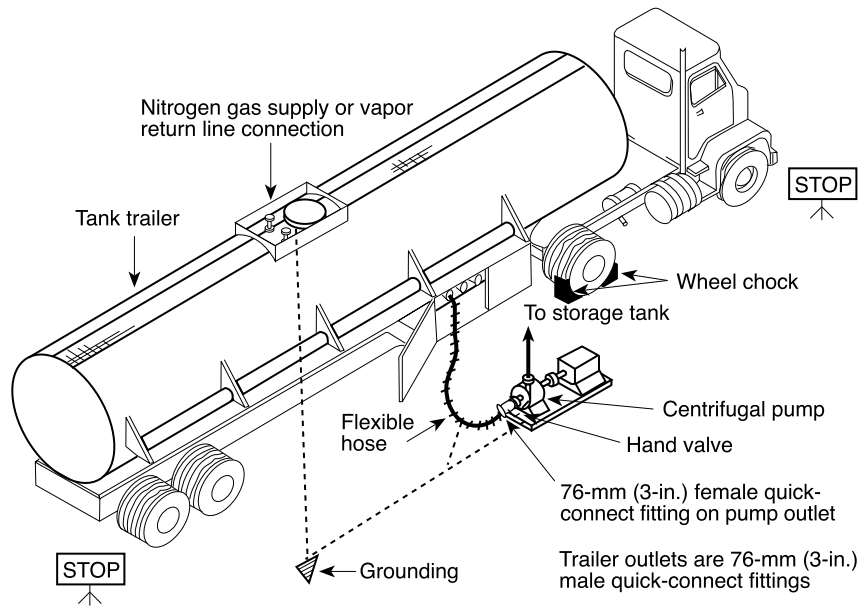
<sup>a</sup>The unloading method shown involves lowering a well pipe through the open manhole of the car.



## Suggested unloading guidelines for tank cars

1. Read storage tank liquid level gauge and record reading. Convert inventory to gallons and make certain that tank will accept the contents of tank car.
2. Spot tank car at unloading station and set hand brake. Apply chocks to wheels to help prevent travel of car in either direction. Position a stop sign on each side of car along rails and, if necessary, attach derailing device to rails or lock switch to the spur track involved. Each end of car that can be accessed by a locomotive must have a stop sign.
3. Attach a ground wire to bulwark or cradle of tank car and to mailbox or manway (not the manway lid).
4. Read and record tank car number, numbers on the metal tape seals located at various openings on car, and product identification tags on manhole and bottom outlet. If these do not agree with information in shipping papers, check with shipper before unloading. Mixing an acid or anhydride with an incompatible material can be hazardous and costly.
5. If tank car contents must be sampled, open manway and dip sample.
6. Depending on the type of unloading facilities, connect flexible stainless steel hose to outlet valve on car or open manway and lower well pipe through manhole.
7. If pressure unloading or using nitrogen purge, connect nitrogen supply to tank car vent valve; otherwise make certain car is vented. Open smaller ball vent valve next to top unloading line. If applicable, start nitrogen purge/flow.
8. Open all valves in transfer line between tank car and storage tank.
9. Start pump and immediately check transfer line for leaks. If pressure unloading, begin pressuring tank car with nitrogen. Be sure relief valves on tank car and storage tank are properly rated for nitrogen supply pressure.
10. Check liquid level gauge on storage tank to ensure liquid is being transferred.
11. When tank car is empty, stop pump. If applicable, stop nitrogen purge. Close unloading and vent valves on tank car. If applicable, bleed pressure off nitrogen purge line and disconnect nitrogen purge.
12. Connect nitrogen to unloading line and blow product from unloading line into storage tank. (Residue in unloading line should not be released onto the ground.)
13. Before disconnecting flexible hose from tank car well line, blow disconnect clear of product with nitrogen and bleed off pressure. Then disconnect flexible hose or raise well pipe. Close up car and secure tank car for transportation per 49 CFR 173.31.d. Remove chocks, warning signs, derails, and switch locks.
14. Read storage tank liquid level gauge and record reading.

**Figure 5**  
**Tank trailer unloading—stationary pump**



### Tank trailer unloading

A cargo tank carrying a DOT regulated material must be attended by a qualified person at all times during unloading as per 49 CFR 177.834(2) or applicable regulations in your country.

Tank trailer unloading connections are shown in Figure 5. (Note: Many tank trailers unload from the rear.) It is the customer's responsibility to specify the configuration of the tank container to meet their needs. Consider the total unloading environment because the engine of the truck adds an additional ignition source. In a flammable environment, the pump on the tractor should not be used to transfer liquid from the trailer to the storage tank. Tractor pumps also cannot be guaranteed to be contaminant free.

### Suggested unloading guidelines for tank trailers

Read storage tank liquid level gauge and record reading. Convert inventory to gallons and make certain that tank will accept contents of tank trailer.

1. Position tank trailer at unloading station and set hand brake. Apply chocks to wheels to help inhibit travel in either direction. Position a stop sign at the end of the truck and the trailer.
2. Attach ground wire to tank trailer rear axle or structure of landing gear and manway (not the crash box or manway lid).
3. Read and record tank trailer number, numbers on seals located on various openings on trailer, and product identification tags on manhole and bottom outlet. If these do not agree with information in the shipping papers, check with shipper before unloading. Mixing an acid or anhydride with an incompatible material can be hazardous and costly.

4. If tank trailer contents must be sampled, open manway and dip sample.
5. Connect flexible chemical stainless steel hose to tank trailer outlet and to quick-connect fitting on inlet of customer's pump (Figure 5).
6. Make certain flexible hose connections are connected and secured properly. If pressure unloading or using nitrogen purge, connect nitrogen to tank trailer vent valve and start purge, otherwise open vent valve or manway to atmosphere. Open valves in the line between trailer and storage tank.
7. Open trailer manual outlet valve and trailer hydraulic (internal) outlet valve.
8. Start pump and immediately check transfer line for leaks. If pressure unloading, begin pressurizing tank trailer with nitrogen. Be sure relief valves on tank car and storage tank are properly rated for nitrogen supply pressure.
9. Check storage tank liquid level gauge to ensure liquid is being transferred.
10. When tank trailer is empty, close pump suction outlet valve and stop pump. If applicable, stop nitrogen purge. Close vent valves. If applicable, bleed pressure off trailer nitrogen supply line and disconnect nitrogen purge.
11. Connect nitrogen to unloading line and clear flex hose quick disconnect of product by blowing product from unloading line back into trailer. Immediately close trailer hydraulic (internal) outlet valve and then close trailer manual outlet valve.
12. With valves in transfer line closed, bleed off pressure and disconnect flexible hose. (Residue in transfer line should not be released onto the ground.)
13. Close and verify all container valves are closed and caps properly secured per 49 CFR 174.67.
14. Remove chocks and stop signs from trailer wheels.
15. Read storage tank liquid level gauge and record reading.

## Safety precautions

### Information

Material safety data sheets (MSDS) providing toxicity information, physical and chemical data, and spill and emergency response information have been provided for the individual Eastman™ acids and anhydrides. The user should review these publications before undertaking to handle, store, or use any of these materials. For copies, write or call your Eastman representative.

### Protective clothing

Protective clothing such as gloves, goggles, face shields, boots, and aprons—appropriate for the chemical being handled—should be readily available and should be worn by persons involved in the handling operation. Consult the MSDS for recommended practices.

## Technical assistance

If you have questions concerning bulk storage or handling of acids and anhydrides, contact your Eastman representative.



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Material Safety Data Sheets providing safety precautions that should be observed when handling and storing Eastman products are available online or by request. You should obtain and review the available material safety information before handling any of these products. If any materials mentioned are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

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