

# Chapter 296-826 WAC

## ANHYDROUS AMMONIA

### WAC

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**WAC 296-826-100 Scope.** This chapter applies to employers who use, handle, store, distribute, or transport anhydrous ammonia.

• Operations covered by this chapter include, but are not limited to:

– All distributors of anhydrous ammonia, including distributors who store and transport anhydrous ammonia on trucks delivering to a farm.

– Any employer who stores and handles anhydrous ammonia to use in water treatment plants, acid production, metal processing, pollution control, or make products such as:

- Fertilizers
- Synthetic resins
- Plastics and intermediates
- Hexamine for explosives
- Dyes
- Insecticides

• Operations not covered by this chapter include:

– The manufacture of anhydrous ammonia.

– Mechanical refrigeration systems where ammonia is used solely as a refrigerant.

– Pipelines transporting anhydrous ammonia into or out of a storage facility.

– Agricultural operations within the scope of chapter 296-307 WAC. When a distributor delivers anhydrous ammonia to a farmer, the requirements for agricultural operations apply:

■ As soon as the farmer takes possession of the truck or equipment containing ammonia from the distributor, this includes the farmer picking up the farm truck or equipment from the distributor.

■ An ammonia distributor begins performing agricultural operations using their ammonia at the farm.

### References:

- For requirements on agricultural operations using anhydrous ammonia, go to Part U-1 of chapter 296-307 WAC.
- If you use, handle, store, distribute, or transport anhydrous ammonia in quantities of 10,000 pounds or more, follow the requirements found in another chapter, Process safety management of highly hazardous chemicals, chapter 296-67 WAC.
- To protect employees handling ammonia, in addition to this chapter, you will need the following requirements found in other chapters:
  - The following sections from the Safety and health core rules, chapter 296-800 WAC:
    - Accident prevention program, WAC 296-800-140
    - Emergency washing, WAC 296-800-150
    - Personal protective equipment, WAC 296-800-160
  - Emergency response, chapter 296-824 WAC
  - Respiratory hazards, chapter 296-841 WAC
  - Respirators, chapter 296-842 WAC

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-100, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-200 Employee safety.****Your responsibility:**

To protect employees who use, handle, store, distribute, or transport anhydrous ammonia.

Personal protective equipment (PPE)

WAC 296-826-20005

Training

WAC 296-826-20010

Chemical reactions

WAC 296-826-20015

Emergencies

WAC 296-826-20020

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-200, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-20005 Personal protective equipment (PPE).****You must:**

• Provide the following PPE, at no cost to employees, at all stationary storage installations:

– Two respirators in readily accessible locations as required by WAC 296-842, Respirators

– One pair of protective gloves, boots, pants, a protective slicker, and a jacket made of:

■ Rubber;

**OR**

■ Other material that can not be penetrated by ammonia.

– Tight fitting vented goggles and one full face shield.

– An easily accessible shower or fifty gallons of clean water in an open top container.

• Equip tank motor vehicles with all of the following equipment for emergency purposes:

– At least five gallons of water to flush liquid ammonia from skin or eyes.

– Respiratory equipment suitable for anhydrous ammonia as required by chapter 296-842 WAC, Respirators

– A pair of protective gloves made of neoprene rubber or other material that cannot be penetrated by ammonia.

– Tight fitting goggles and a full face shield

**Note:** Additional safety equipment is recommended when more than one employee is present.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 09-05-071, § 296-826-20005, filed 2/17/09, effective 4/1/09; WSR 06-10-067, § 296-826-20005, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-20010 Training.****You must:**

• Train employees who handle ammonia on all of the following:

– Safe operating practices

– Emergency procedures

– Proper use of personal protective equipment (PPE)

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-20010, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-20015 Chemical reactions.****You must:**

• Prohibit the use of ammonia with other chemicals unless the possible reactions have been adequately investigated.

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**Note:**

• Under some circumstances, ammonia and ammonium compounds can form explosive products with other chemicals. For additional information, refer to the following:

– Section 491M "Manual on Hazardous Chemical Reactions" of the NFPA, 1969 Edition;

**AND**

– CG-388, the "Chemical Data Guide for Bulk Shipment by Water," 1969

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-20015, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-20020 Emergencies.****You must:**

• Make sure only trained personnel designated to respond if a leak occurs in an ammonia system do all of the following:

– Evacuate affected personnel to noncontaminated areas

– Shut off appropriate valves

– Put on all of the following PPE in concentrated ammonia atmospheres and in unknown concentrations of ammonia:

■ Self-contained breathing apparatus (SCBA)

■ A plastic or rubber suit

■ Gauntlet-type plastic or rubber gloves

• Make sure a physician treats all employees with eye injuries caused by liquid ammonia. In addition:

– Immediately flush liquid ammonia from skin or eyes continuously for a minimum of fifteen minutes using water or eye wash solutions as required by the safety and health core rules; First aid, WAC 296-800-150.

– Do not use neutralizing solutions or ointments on affected areas.

**Note:**

• Drivers unable to stop a leak during transport should:

– Move the vehicle to an isolated area

– Use the current *Department of Transportation (DOT) Emergency Response Guidebook* to establish safe distances to isolate a leaking tank from the driver and the public.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-20020, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-300 Design, construction and installation.****Your responsibility:**

To make sure containers and tanks used for storing, distributing, or transporting anhydrous ammonia meet design, construction and installation requirements.

Container location and marking

General specifications

WAC 296-826-30005

Specifications for portable DOT containers

WAC 296-826-30010

Nonrefrigerated stationary containers

WAC 296-826-30015

Refrigerated storage

WAC 296-826-30020

Systems mounted on trucks, semi-trailers, and trailers

WAC 296-826-30025

Systems mounted on farm trucks or trailers for transporting ammonia

WAC 296-826-30030

Systems mounted on farm equipment for ammonia application

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WAC 296-826-30035

DOT containers

WAC 296-826-30040

Nonrefrigerated containers

Installation

WAC 296-826-30045

Reinstallation

WAC 296-826-30050

Refrigerated tanks

Installation

WAC 296-826-30055

Reinstallation

WAC 296-826-30060

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060.  
WSR 06-10-067, § 296-826-300, filed 5/2/06, effective 9/1/06.]

## CONTAINER LOCATION AND MARKING

### WAC 296-826-30005 General specifications.

#### You must:

- Locate containers either:
  - In buildings or parts of the building provided for ammonia storage;
- OR**
- Outside, away from densely populated areas.
- Locate containers according to Table 1, Minimum Distances for Container Location.

Table 1  
Minimum Distances for Container Location

Minimum Distances (feet) from Container to:			
Nominal Capacity of Container	Line of Adjoining Property Which may be Built upon, Highways & Main-line of Railroad	Place of Public Assembly	Institution Occupancy
Over 500 to 2,000	25	150	250
Over 2,000 to 30,000	50	300	500
Over 30,000 to 100,000	50	450	750
Over 100,000	50	600	1,000

#### You must:

- Make sure containers are located to meet all of the following:
  - Away from readily ignitable materials such as weeds, long dry grass, and waste.
  - So there is no adverse impact on employee health through unnecessary exposure.
  - At least fifty feet away from dug wells and other sources of potable water.
- If the container is a part of a water treatment installation, then this requirement does not apply.
- Maintain legibility of all container and valve markings.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060.  
WSR 06-10-067, § 296-826-30005, filed 5/2/06, effective 9/1/06.]

(2/17/09)

### WAC 296-826-30010 Specifications for portable DOT containers.

#### IMPORTANT:

This section applies to systems that use cylinders, portable tanks (DOT-51), or "ton containers" (DOT-106A, DOT-110A), constructed according to DOT specifications.

#### You must:

- Locate containers aboveground, never buried below the ground.
- Put containers on firm ground or secure them.
- Guard against settling on the outlet piping by using a flexible connection or a special fitting.
- Protect containers from all of the following:
  - Ignitable debris
  - External damage including corrosion
  - Heat sources, like radiant flames and steam pipes
  - Moving vehicles.
- Prohibit the use of heat to raise the container pressure.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060.  
WSR 06-10-067, § 296-826-30010, filed 5/2/06, effective 9/1/06.]

### WAC 296-826-30015 Nonrefrigerated stationary containers.

#### You must:

- Construct and test containers according to the Unfired Pressure Vessel Code.
- Make sure the minimum design pressure of the container is 250 psig
- Make sure all containers with a capacity exceeding two hundred fifty gallons are constructed to meet one or more of the following:
  - Stress relieved after fabrication according to the Unfired Pressure Vessel Code
  - Have stress relieved cold-formed heads
  - Hot-formed heads

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060.  
WSR 06-10-067, § 296-826-30015, filed 5/2/06, effective 9/1/06.]

### WAC 296-826-30020 Refrigerated storage.

#### You must:

- Make sure the minimum design temperature is the same as the refrigerated temperature of the tank.
- Construct and test containers, with a design pressure exceeding 15 psig, according to the Unfired Pressure Vessel Code.
- Select construction materials from those listed from *API Standard 620, 4th Edition 2002, Recommended Rules for Design and Construction of Large, Welded Low Pressure Storage Tanks*.
- Construct tanks with a design pressure with 15 psig or less according to API Standard 620, 4th Edition, 2002.
- Use ASME Code as a guide in the selection of austenitic steels or nonferrous materials, if used at the design temperature.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060.  
WSR 06-10-067, § 296-826-30020, filed 5/2/06, effective 9/1/06.]

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**WAC 296-826-30025 Systems mounted on trucks, semi-trailers, and trailers.****You must:**

- Construct and test containers, when transported within the state of Washington, according to both of the following:
  - A minimum design pressure of 250 psig
  - The Unfired Pressure Vessel Code.
- Construct containers used for interstate transport according to DOT regulations.
  - Make sure the shell or head thickness of any container is at least 3/16 of an inch.
  - Make sure electrical lighting circuits meet all of the following:
    - Have suitable over-current protection, such as fuses or automatic circuit breakers.
    - Are suitably secured, insulated, and protected against physical damage.
    - Have wiring with sufficient carrying capacity and mechanical strength.
  - Use only electric light.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30025, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-30030 Systems mounted on farm trucks or trailers for transporting ammonia.****You must:**

- Construct and test containers, with a design pressure exceeding 15 psig, according to the Unfired Pressure Vessel Code.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30030, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-30035 Systems mounted on farm equipment for ammonia application.****You must:**

- Construct and test containers according to the Unfired Pressure Vessel Code.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30035, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-30040 DOT containers.****You must:**

- Make sure containers meet DOT specifications.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30040, filed 5/2/06, effective 9/1/06.]

**NONREFRIGERATED CONTAINERS****WAC 296-826-30045 Installation.****You must:**

- Provide a minimum distance of five feet between aboveground and underground containers that have more than a twelve hundred gallon capacity each.
- Protect containers from floating away, in areas with a potential for high flood waters, by providing either:
  - Secure anchorage;
  - OR**
  - Adequate pier height.
- Follow Table 2 for aboveground, nonrefrigerated containers.

Table 2  
Aboveground Nonrefrigerated Container Requirements

If you have:	Then:
Aboveground containers	Provide one of the following: <ul style="list-style-type: none"> <li>– Substantial reinforced concrete footings and foundations</li> <li><b>OR</b></li> <li>– Structural steel supports mounted on reinforced concrete foundations.</li> </ul>
	Make sure the reinforced concrete foundation meets all of the following: <ul style="list-style-type: none"> <li>– Extends below the established frost line</li> <li>– Is of sufficient width and thickness to support the total weight of the containers and contents</li> <li>– Has the lowest point of the tank at least eighteen inches above the ground.</li> </ul>
	Make sure the footings meet all of the following: <ul style="list-style-type: none"> <li>– Extend below the established frost line</li> <li>– Are of sufficient width and thickness to support the total weight of the containers and contents.</li> </ul>
Floating type foundations on containers installed aboveground	Make sure they are designed to adequately support the tank, contents, and pumping equipment.
A horizontal, aboveground container	Mount the container on a foundation that permits expansion and contraction.
	Prevent the weight of excessive loads from resting on the supporting portion of the shell.
	Provide saddle bearing that extends over at least one-third the circumference of the shell.
	Prevent corrosion on the portions of the container in contact with the foundations or saddles.

**You must:**

- Follow Table 3 for underground, nonrefrigerated containers.

Table 3

## Underground Nonrefrigerated Container Requirements

If you have:	Then:
Underground containers	Set the containers on firm foundations or earth <ul style="list-style-type: none"> <li>– Surround containers with soft earth or sand well tamped into place.</li> </ul>
	Make sure the top of the container is at least one foot below the surface of the ground. <ul style="list-style-type: none"> <li>– If ground conditions make this impractical, use precautions to prevent physical damage to the container.</li> </ul> <p>Exemption: It is not necessary to cover the portion of the container where a manhole and other connections are attached.</p>
	Securely anchor or weight containers when necessary to prevent floating.
	Have a protective corrosion resistant coating applied before it is placed underground that is both of the following: <ul style="list-style-type: none"> <li>– Satisfactory to the authority having jurisdiction;</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>– Equal to either hot dip galvanizing or two preliminary coatings of red lead followed by a heavy coating of coal tar or asphalt.</li> </ul>
	Lower containers onto firm foundations without damaging the protective corrosion resistant coating.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30045, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-30050 Reinstallation.****You must:**

- Prohibit the reinstallation of nonrefrigerated, previously installed underground, containers unless they meet both of the following:
  - Pass a hydrostatic pressure retest using the original pressure specified by the Unfired Pressure Vessel Code under which the tank was constructed;

**AND**

  - Show no evidence of serious corrosion.- Maintain a corrosion resistant coating on reinstalled underground containers.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30050, filed 5/2/06, effective 9/1/06.]

(2/17/09)

**REFRIGERATED STORAGE TANKS****WAC 296-826-30055 Installation.****You must:**

- Support tanks on noncombustible foundations designed for the type of tank.
- Provide protection against flotation or other water damage, where high floodwater might occur.
- Prevent the effects of freezing and consequent frost heaving, in tanks used for product storage at less than 32°F, by providing either support or heat supply.
- Prevent accidental discharge of liquids from spreading into uncontrolled areas by providing, to the area surrounding a refrigerated tank or group of tanks, one of the following:
  - A drainage system provided with at least a one percent slope that terminates in an impounding basin with a capacity as large as the largest tank served;

**OR**

  - A diked enclosure with a capacity as large as the largest tank served.- Meet, when using a diked enclosure or an impounding basin in a drainage system, the following requirements:
  - The wall is made of earth, steel, or concrete. If made of earth, meet both of the following:
    - The top is flat and at least two feet wide;

**AND**

    - There is a stable slope consistent with the angle of the earth used
  - Design the wall to be both:
    - Liquid tight;

**AND**

    - Able to withstand the hydrostatic pressure and the temperature.
- Provide for drainage of rain water, that does not permit the release of ammonia, from diked or impounding areas.

- Note:**
- It is recommended that the ground in an impounding basin or within a diked enclosure be graded so that small spills or the early part of a large spill will accumulate at one side or corner contacting both:
    - A relatively small area of ground;

**AND**

    - Exposing a relatively small surface area for heat gain.  - Shallow channels in the ground surface or low curbs of earth can help guide the liquid to these low areas without contacting a large ground area.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30055, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-30060 Reinstallation.****You must:**

- Make sure moved and reinstalled containers of a size to require field fabrication are reconstructed and reinspected to:
  - Meet the original Unfired Pressure Vessel Code under which the tank was manufactured and do the following according to the same code:
    - A pressure retest
    - Any necessary rerating.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-30060, filed 5/2/06, effective 9/1/06.]

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**WAC 296-826-400 Equipment and systems.****Your responsibility:**

To make sure all equipment and systems are operated and maintained safely.

Electrical

WAC 296-826-40005

Hose specifications

WAC 296-826-40010

Piping, tubing, and fittings

General requirements for all systems

WAC 296-826-40015

Nonrefrigerated systems

WAC 296-826-40020

Systems mounted on trucks, semi-trailers, and trailers

WAC 296-826-40025

Refrigeration storage

Refrigerated storage compressors

WAC 296-826-40030

Refrigeration load

WAC 296-826-40035

Separators for refrigerated storage

WAC 296-826-40040

Automatic control equipment for refrigerated storage

WAC 296-826-40045

Other refrigerated storage equipment

WAC 296-826-40050

Compressors for refrigerated systems

WAC 296-826-40055

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-400, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-40005 Electrical.****You must:**

• Use electrical equipment and wiring on ammonia installations that is either of the following:

– General purpose;

**OR**

– Weather resistant.

• Follow the electrical requirements found in another chapter, chapter 296-24 WAC, Part L for Class 1, Group D locations when the concentrations of ammonia in air are in excess of 16% by volume.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40005, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-40010 Hose specifications.****You must:**

• Make sure hose used in ammonia service and subject to container pressure meets both of the following:

– The *Joint Rubber Manufacturers Association, RMA-IP-14, Specifications for Anhydrous Ammonia Hose* 7th Edition 2003;

**AND**

– The *Fertilizer Institute "Hose Specifications for Anhydrous Ammonia."*

• Make sure hose assemblies are able to withstand a 500 psig pressure test.

• Follow Table 4 for hose specifications.

[Ch. 296-826 WAC p. 6]

Table 4  
Hose Specifications

If you have:	Then:
Hose subject to container pressure	Design it with a minimum <ul style="list-style-type: none"> <li>– Working pressure of 350 psig</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>– Burst pressure of 1750 psig</li> </ul>
Hose and their connections	Design them for the maximum low side working pressure when located on either: <ul style="list-style-type: none"> <li>– The pressure reducing valves on devices discharging to atmospheric pressure;</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>– The low pressure side of flow control.</li> </ul>
	Design, construct, and install so there is no leakage when connected.
Liquid transfer hose that is not drained of liquid upon completion of transfer operations	Equip with an approved shut off valve at the discharge end.
	Prevent excessive hydrostatic pressure in the hose.
Hose with an outside diameter one-half inch and larger	Make sure the hose is marked and legible at five foot intervals.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40010, filed 5/2/06, effective 9/1/06.]

**PIPING, TUBING, AND FITTINGS****WAC 296-826-40015 General requirements for all systems.****You must:**

• Prohibit the use of cast iron fittings.

– The use of malleable or nodular iron such as Specification ASTM A47 or ASTM A395 is permitted.

• Make sure all metal flexible connections for permanent installations have a minimum working pressure of 250 psig

• Make sure all pipes, tubes, and fittings used for ammonia service meet all of the following:

– Made of material with a design pressure at least equal to the maximum service pressure.

– Well supported and have provisions for all of the following:

■ Expansion

■ Contraction

■ Vibration

■ Jarring

■ Settling.

• Protect all exposed pipes from damage resulting from undue strain including:

– Moving machinery

– The presence of vehicles.

(2/17/09)

- Use ammonia resistant joint compounds.
- Make sure, after assembly, that all piping and tubing are leak free at a pressure not less than the normal operating pressure of the system.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40015, filed 5/2/06, effective 9/1/06.]

#### **WAC 296-826-40020 Nonrefrigerated systems.**

##### **You must:**

- Make sure piping on nonrefrigerated systems is:
  - ASTM A-53-2004 Electrical Resistance Welded and Electric Flash Welded Pipe or equal. In addition piping needs to be:
    - At least schedule 80 when joints are threaded.
    - At least schedule 40 when joints are either welded or welded and flanged.
  - Prohibit the use of piping or tubing made of any of the following:
    - Brass
    - Copper
    - Galvanized steel.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40020, filed 5/2/06, effective 9/1/06.]

#### **WAC 296-826-40025 Systems mounted on trucks, semi-trailers, and trailers.**

##### **You must:**

- Make sure all piping, tubing, and fittings are:
  - Securely mounted
  - Protected against physical damage.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40025, filed 5/2/06, effective 9/1/06.]

### **REFRIGERATED STORAGE**

#### **WAC 296-826-40030 Refrigerated storage compressors.**

##### **You must:**

- Make sure compressors have all of the following:
  - Their own driving unit
  - Discharge pressure that is governed by the condensing conditions
    - Suitable compressor operation controls based on the load pressure in the container
    - At least two compressors either of which is of sufficient size to handle the intended loads
    - Standby equipment equal to the largest normally operating piece of equipment installed when more than two compressors are provided
    - Automatic controls installed to prohibit the operation of alternate compressors unless the controls will function with alternate compressors.
  - Make sure compressors are sized to operate with a suction pressure that is both of the following:
    - At least ten percent below the minimum setting of the safety relief valves on the storage tank
    - Able to withstand one hundred twenty percent of the design pressure of the tank.
  - Install an oil separator of suitable size in the compressor discharge line that is both:
    - Designed for at least 250 psig;

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##### **AND**

- Equipped with a drain valve and gauging device.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40030, filed 5/2/06, effective 9/1/06.]

#### **WAC 296-826-40035 Refrigeration load.**

##### **You must:**

- Make sure the total refrigeration load includes the loads imposed by all of the following:
    - Heat flow into the container caused by the temperature difference between both:
      - The ambient temperature;
- AND**
- The design storage temperature
    - Heat flow into the tank caused by maximum sun radiation
    - Filling the tank with ammonia warmer than the design storage temperature.
  - Provide emergency power capable of handling loads imposed by both of the following:
    - The temperature difference between the ambient temperature and the design storage temperature;

##### **AND**

- Sun radiation.

**Note:** Emergency power is not necessary for facilities able to effectively vent vapors when the refrigeration system is not operating.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40035, filed 5/2/06, effective 9/1/06.]

#### **WAC 296-826-40040 Separators for refrigerated storage.**

##### **You must:**

- Install an entrainment separator, of suitable size and design pressure, in the compressor suction line that is equipped with both of the following:
    - A drain valve;
- AND**
- A gauging device.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40040, filed 5/2/06, effective 9/1/06.]

#### **WAC 296-826-40045 Automatic control equipment for refrigerated storage.**

##### **You must:**

- Install an emergency alarm to detect minimum and maximum allowable operating pressure changes.
- Install an emergency alarm and shut off in the condenser system to detect excess discharge pressure caused by the failure of the cooling medium.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40045, filed 5/2/06, effective 9/1/06.]

#### **WAC 296-826-40050 Other refrigerated storage equipment.**

##### **You must:**

- Discharge ammonia to storage by using either:
  - A receiver with an automatic float valve;
- OR**
- A high pressure liquid drain trap of suitable capacity.
- Make sure receivers are:

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- Designed for at least 250 psig;

**AND**

- Equipped with all of the following:

- Necessary connections
- Safety relief valves
- Gauging devices.

• Cover insulated containers and pipelines with material that meets all of the following:

- Thick enough for the temperatures it will be exposed to
- Supported
- Weather and fire resistant.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40050, filed 5/2/06, effective 9/1/06.]

### **WAC 296-826-40055 Compressors for refrigerated systems.**

#### **You must:**

- Make sure condensers are designed:
  - For at least 250 psig;

**AND**

- To manually or automatically purge noncondensibles.

**Note:** • Condensers may be cooled by any of the following:

- Air
- Water
- Air and water.

#### **You must:**

• Make sure compressors used for refrigerating ammonia meet all of the following:

- Are connected to plant piping with shut off valves located as close as practical to compressor connections
- Have a safety relief valve that is both:
  - Large enough to discharge the full capacity of the compressor;

**AND**

■ Connected to the discharge and placed before any shut off valve

– Have an oil separator on the discharge side, where necessary to prevent contamination.

– Have a drainable liquid trap or other adequate method on the compressor suction to minimize the entry of liquids into the compressor.

– Pressure gauges on the suction and discharge ends graduated to at least one and one-half times the maximum pressure that can develop.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-40055, filed 5/2/06, effective 9/1/06.]

### **WAC 296-826-500 Appurtenances.**

#### **Your responsibility:**

To follow the requirements in this section when using appurtenances.

Appurtenance requirements for all systems

WAC 296-826-50005

Nonrefrigerated stationary containers

WAC 296-826-50010

Refrigerated tanks

WAC 296-826-50015

Systems mounted on trucks, semi-trailers and trailers

WAC 296-826-50020

Systems mounted on farm trucks or trailers for transportation of ammonia

WAC 296-826-50025

Systems mounted on farm equipment for ammonia application

WAC 296-826-50030

Portable DOT containers

WAC 296-826-50035

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-500, filed 5/2/06, effective 9/1/06.]

### **WAC 296-826-50005 Appurtenance requirements for all systems.**

#### **Definition:**

Appurtenance means all devices such as pumps, compressor, safety relief devices, liquid-level gauging devices, valves and pressure gauges.

#### **You must:**

• Make sure each appurtenance installed before February 8, 1973, is determined to be safe by meeting one of the following:

– Approved, tested, and installed by either:

■ The American National Standard for the Storage and Handling of Anhydrous Ammonia (in effect at the time of installation)

■ The Fertilizer Institute Standards for the Storage and Handling of Agricultural Anhydrous Ammonia (in effect at the time of installation)

– Accepted, certified, listed, or labeled, by a nationally recognized testing laboratory

– Inspected or tested by a federal, state, municipal, or local authority responsible for enforcing occupational safety provisions, when no nationally recognized laboratory will provide approval

– Tested and approved by a registered professional engineer or other qualified person if the system is a custom-designed or custom-built unit and no other recognized entity will provide approval

– Keep a document on file signed by the qualified person that indicates the unit is safe. Include the test bases, test data and results and the qualifications of the qualified person.

#### **You must:**

• Make sure container appurtenances are both of the following:

– Designed for at least the working pressure for the portion of the system where installed;

**AND**

– Fabricated from materials suitable for anhydrous ammonia service.

• Make sure fixed liquid level gauges, except on refrigerated storage:

– Are designed so the maximum volume of the container filled by liquid does not exceed eighty-five percent of its water capacity;

**AND**

– Have a coupling into which it is threaded that is placed at the eighty-five percent level of the container

■ If located elsewhere, install the dip tube of this gauge so it can not be easily removed.



- Equip each container, except those filled by weight, with an approved liquid level gauging device that does all of the following:
  - Has a design pressure equal to or greater than the design pressure of the container
  - Are arranged so the maximum liquid fill level of containers can be readily determined.
- Follow additional requirements found in Table 5, Appurtenance Requirements for all Systems

Table 5  
Appurtenance Requirements for all Systems

If you have:	Then make sure they:
Safety relief devices	Do not have discharge termination in or beneath any building.
Safety relief valves	Have a flow capacity that is not restricted by any connection to it on either the upstream or downstream side.
Connections to containers	Have shut off valves located as close to the container as possible.  Exemption: Safety relief devices, gauging devices or devices fitted with a No. 54 drill size hole are not required to have shut off valves located as close to the container as possible.
Connections and the line, including valves and fittings	Have a greater rated flow than the excess flow valves that protects them
Excess flow valves, where required	Meet all of the following: <ul style="list-style-type: none"> <li>• Are designed with a bypass no larger than a No. 60 drill size opening to allow equalization of pressures.</li> <li>• Close automatically at the rated flow of vapor or liquid specified by the manufacturer.</li> <li>• Maintain legible markings.</li> </ul>
Excess flow valves provided with shut off valves	Are designed to close if the shut off valve breaks during installation
Excess flow and back pressure check valves, where required	Are located either: <ul style="list-style-type: none"> <li>• Inside the container;</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• Outside the container as long as the excess flow valve is:</li> </ul>

If you have:	Then make sure they:
	<ul style="list-style-type: none"> <li>– As close as possible to the entrance of the line;</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>– Installed without excessive stress that could result in breakage between the container and the valve.</li> </ul>
Liquid level gauging devices that: <ul style="list-style-type: none"> <li>– Require bleeding of the product into the atmosphere such as the rotary tube, fixed tube, and slip tube devices</li> </ul>	Are either: <ul style="list-style-type: none"> <li>• Designed so that the maximum opening of the bleed valve is not larger than No. 54 drill size;</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• Provided with an excess flow valve.</li> </ul> <p>Exemption:</p> <ul style="list-style-type: none"> <li>– If openings from the containers or through fittings are attached directly onto the container where pressure gauge connections are made, then there is no need for excess flow valves as long as the openings are not larger than a No. 54 drill size</li> <li>– This requirement does not apply to farm vehicles used for the application of ammonia as covered by WAC 296-826-50030.</li> </ul>

**You must:**

- Follow Table 6, Safety Valve Start to Discharge Rate, and Table 7, Safety Relief Valve Rate of Discharge, for the following systems:
  - Nonrefrigerated stationary containers
  - Mounted on trucks, semi-trailers, and trailers used for the transportation of ammonia
  - Mounted on farm wagons for the transportation of ammonia
  - Mounted on farm equipment for the application of ammonia

**Exemption:**

The rate of discharge of spring-loaded safety relief valves installed on underground containers may be reduced to thirty percent of the rate of discharge specified in Table 6, Safety Relief Valve Rate of Discharge so long as the container is not uncovered after installation until the liquid ammonia has been removed.

Table 6  
Safety Valve Start to Discharge Rate

Containers	Minimum	Maximum*
ASME U-68, U-69	110%	125%
ASME U-200, U-201	95%	100%
ASME 1952, 1956, 1959, 1962, 1965, 1968, or 1971	95%	100%
API-ASME	95%	100%
U.S. Coast Guard	(As required by U.S.C.G. regulations)	
DOT	(As required by DOT regulations)	

**Note:** A relief valve manufacturer's tolerance of plus ten percent is permitted.

Instructions are found below the table

Table 7  
Safety Relief Valve Rate of Discharge

Surface Area sq. ft.	Flow Rate CFM Air	Surface Area sq. ft.	Flow Rate CFM Air	Surface Area sq. ft.	Flow Rate CFM Air	Surface Area sq. ft.	Flow Rate CFM Air
20	258	145	1,310	340	2,640	1,350	8,160
25	310	150	1,350	350	2,700	1,400	8,410
30	360	155	1,390	360	2,760	1,450	8,650
35	408	160	1,420	370	2,830	1,500	8,900
40	455	165	1,460	380	2,890	1,550	9,140
45	501	170	1,500	390	2,950	1,600	9,380
50	547	175	1,530	400	3,010	1,650	9,620
55	594	180	1,570	450	3,320	1,700	9,860
60	640	185	1,600	500	3,620	1,750	10,090
65	686	190	1,640	550	3,910	1,800	10,330
70	732	195	1,670	600	4,200	1,850	10,560
75	778	200	1,710	650	4,480	1,900	10,800
80	824	210	1,780	700	4,760	1,950	11,030
85	870	220	1,850	750	5,040	2,000	11,260
90	916	230	1,920	800	5,300	2,050	11,490
95	962	240	1,980	850	5,590	2,100	11,720
100	1,008	250	2,050	900	5,850	2,150	11,950
105	1,054	260	2,120	950	6,120	2,200	12,180
110	1,100	270	2,180	1,000	6,380	2,250	12,400
115	1,146	280	2,250	1,050	6,640	2,300	12,630
120	1,192	290	2,320	1,100	6,900	2,350	12,850
125	1,238	300	2,380	1,150	7,160	2,400	13,080
130	1,284	310	2,450	1,200	7,410	2,450	13,300
135	1,330	320	2,510	1,250	7,660	2,500	13,520
140	1,376	330	2,570	1,300	7,910		

Table instructions:

- The surface area = the total outside surface area of the container in square feet.
- When the surface area is not stamped on the name plate or the marking is not legible, calculate the area by using the Table 8, Surface Area

Table 8  
Surface Area

If you have:	Then calculate as follows:
Cylindrical container with hemispherical heads	Area = overall length in feet times the outside diameter in feet times 3.1416
Cylindrical container with other than hemispherical heads	Area = (overall length in feet plus 0.3 outside diameter in feet) times outside diameter in feet times 3.1416
Spherical container	Area = outside diameter in feet squared times 3.1416

• Flow rate—CFM air = cubic feet per minute of air required at standard conditions, 60°F and atmospheric pressure (14.7 psia).

– The rate of discharge may be altered for intermediate values of surface area.

– For containers with total outside surface area greater than 2,500 sq. ft., the required flow rate can be calculated using the formula, flow rate CFM air = 22.11 A<sup>0.82</sup> where A = outside surface area of the container in square feet

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-50005, filed 5/2/06, effective 9/1/06.]

### **WAC 296-826-50010 Nonrefrigerated stationary containers.**

#### **IMPORTANT:**

In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

#### **You must:**

• Make sure all containers are equipped with all of the following:

- An approved vapor return valve
- A fixed maximum liquid level gauge
- A pressure gauge that is both:

■ Graduated from zero to 400 psig;

**AND**

■ Designed for use in ammonia service

• Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers.

• Make sure safety relief valves do all of the following:

– Discharge in the following ways:

■ Away from the container in an upward, unobstructed manner into the atmosphere

■ Not in or beneath a building

– Have raincaps that allow free discharge of the vapor and prevent the entrance of water

– Have a method for draining accumulated condensation

– Have a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate

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- Are arranged to minimize the possibility of tampering
- Are provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
- Have direct communication with the vapor space of the container

#### **Note:**

• Vent pipes from 2 or more safety relief devices located on the same unit, or similar lines from 2 or more different units, may be run into a common header if:

– The cross-sectional area of the header is at least equal to the sum of the cross sectional areas of the individual vent pipes.

#### **You must:**

• Protect container appurtenances against physical damage and during transit of containers intended for underground installation.

• Make sure shut off valves are not installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

#### **Exemption:**

• You are exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:

– A three-way valve installed under two safety relief valves, each with

■ The required rate of discharge;

**AND**

■ Installed to allow either of the safety relief valves to be closed off but not at the same time.

– Two separate relief valves are installed with individual shut off valves.

■ The two shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.

– When a safety relief valve manifold that allows:

■ One valve of two or more to be closed off;

**AND**

■ The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

#### **You must:**

• Make sure vapor and liquid connections have either of the following:

– An approved excess flow valve;

**OR**

– An approved quick-closing internal valve that remains closed except during operation.

#### **Exemption:**

• The following do not need to be fitted with excess flow valves:

– Safety relief valves

– Liquid level gauging devices that require both of the following:

■ Bleeding of the product into the atmosphere

■ Construction so that outward flow will not exceed that passed by a No. 54 drill size opening

– Those with openings from the containers or through fittings that are attached directly onto the container where pressure gauge connections are made as long as:

■ The openings are not larger than a No. 54 drill size.

#### **You must:**

• Follow additional requirements found in Table 9, Appurtenances for Nonrefrigerated Stationary Containers

Table 9

## Appurtenances for Nonrefrigerated Stationary Containers

If you have:	Then make sure they:
Columnar-type gauges	Are restricted to stationary storage installations
	Are shielded against the direct rays of the sun
	Are equipped with all of the following: <ul style="list-style-type: none"> <li>• Shut off valves having metallic hand-wheels</li> <li>• Excess flow valves</li> <li>• Extra heavy glass that is adequately protected with a metal housing applied by the gauge manufacturer</li> </ul>
Main shut off valves	Are kept closed and locked when the installation is unattended Exemption: Valve locks are not required if the facility is protected against tampering by fencing or other suitable means.
Filling connections	Are provided with one of the following: <ul style="list-style-type: none"> <li>• Combination back-pressure check valve and excess flow valve</li> <li>• One double or two single back-pressure check valves</li> <li>• A positive shut off valve in conjunction with either an internal back-pressure check valve or an internal excess flow valve</li> </ul>
Underground installations with a probability of the manhole or housing becoming flooded	Have vent lines located above the high water level
	Have manholes or housings with ventilated louvers or their equivalent with the area of their openings equal or exceeding: <ul style="list-style-type: none"> <li>• The combined discharge areas of the safety relief valves and vent lines which discharge their content into the manhole housing</li> </ul>
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-50010, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-50015 Refrigerated tanks.****IMPORTANT:**

In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

**You must:**

[Ch. 296-826 WAC p. 12]

- Protect container appurtenances against the following:
    - Physical damage during transit of containers intended for underground installation
    - Damage from vehicles.
  - Make sure safety relief devices have a total relieving capacity larger than either of the following:
    - A possible refrigeration system upset such as a cooling water failure, power failure, instrument air or instrument failure, mechanical failure of any equipment, excessive pumping rates or changing atmospheric pressure;
- OR**
- The amount based on using either one of the following fire exposure formulas (see note below for codes):
    - Valve manufacturers who use weight of vapors to be relieved as the classifying basis, use this formula:

$$W = \frac{34,500 F A (0.82)}{L}$$

**OR**

- Valve manufacturers that classify valves based on air flows, use this formula:

$$Q_{(a)} = \frac{633,000 F A O.32}{LC}$$

- Make sure safety relief devices meet the following additional requirements:
  - Are set to start-to-discharge at a pressure not in excess of the design pressure of the tank
  - Have a total relieving capacity sufficient to prevent a maximum pressure in a tank of more than one hundred twenty percent of the design pressure.
- Provide shut off valves for all connections including plugs, safety valves, and thermometer wells:
  - Locate them as close to the tank as is practical.

**Exemption:** Shut off valves do not need to be provided on connections with a No. 54 drill size restriction

- Note:**
- Install, when operating conditions make it advisable, both of the following:
    - A check valve on the fill connection
    - A remotely operated shut off valve on other connections located below the maximum liquid level.

**You must:**

- Follow requirements found in Table 10, Refrigerated Tank Appurtenances

Table 10  
Refrigerated Tank Appurtenances

If you have:	Then make sure they:
Shut off valves used as a means of lock out for inspection or repair	Are of adequate flow capacity
	Are arranged to be locked or sealed open and not closed except by an authorized person who does both of the following: <ul style="list-style-type: none"> <li>• Remains there while the valve is closed</li> </ul>

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If you have:	Then make sure they:
	<ul style="list-style-type: none"> <li>Locks or seals the valve open when leaving the station.</li> </ul>
Discharge line and header	<p>Are designed to accommodate the maximum flow.</p> <p>Have a back pressure not greater than ten percent of the design pressure of the storage container</p> <p>Include the back pressure in the one hundred twenty percent of the maximum pressure of the design pressure.</p> <p>Do not have other containers or systems that exhaust into the discharge line or header.</p> <p>Have vent lines installed to prevent the accumulation of liquid in the lines</p> <p><b>Note:</b> Multiple safety relief valves on the same storage unit may be run through a common discharge header.</p>
Vacuum breakers	Are provided with atmospheric storage
Stacks	<p>Do both of the following:</p> <ul style="list-style-type: none"> <li>Prevent any obstructions by rain, snow, ice, or condensation;</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>Have an outlet size not smaller than the size of the safety relief valve outlet connection</li> </ul>

**You must:**

• Make sure appurtenances meet all of the requirements found in the following:

- ANSI CGA C-7 2004
- ANSI CGA G2.1 1999
- API Standard 620 4th Edition, 2002
- ASHRAE 15 2004
- ASME 2001, Section VIII, Division 1
- ANSI B95.1 1977

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-50015, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-50020 Systems mounted on trucks, semi-trailers and trailers.**

**IMPORTANT:**

In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

**You must:**

- Make sure each container has all of the following
  - Fixed maximum liquid level gauging devices
  - Pressure-indicator gauges with a dial graduated from zero to 400 psig
  - Either of the following:
    - Equipped for spray-loading, which fills in vapor space;

**OR**

  - Has an approved vapor return valve of adequate capacity.

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• Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers, that do all of the following:

- Discharges in the following ways:
  - Away from the container in an upward, unobstructed manner into the atmosphere
  - Not in or beneath a building.
- Has raincaps that allow free discharge of the vapor and prevent the entrance of water
- Has a method for draining accumulated condensation
- Has a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate
- Are arranged to minimize the possibility of tampering
- Provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
- Has direct communication with the vapor space of the container
- Make sure shut off valves are not installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

**Exemption:**

• You are exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:

- A three-way valve installed under two safety relief valves, each with

■ The required rate of discharge;

**AND**

■ Installed to allow either of the safety relief valves to be closed off but not at the same time.

- Two separate relief valves are installed with individual shut off valves.

■ The two shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.

- When a safety relief valve manifold that allows:

■ One valve of two or more to be closed off

**AND**

■ The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

• Follow additional requirements found in Table 11, Appurtenances for Systems Mounted on Trucks, Semi-Trailers and Trailers

Table 11

Appurtenances for Systems Mounted on Trucks, Semi-Trailers and Trailers

If you have:	Then make sure they:
All container connections	<p>Are provided with either of the following:</p> <p>Automatic excess flow valves;</p> <p><b>OR</b></p> <p>Quick-closing internal valves that remain closed except during delivery operations</p>

[Ch. 296-826 WAC p. 13]

If you have:	Then make sure they:
	<p><b>Note:</b> If the control mechanism is provided with a secondary control remote from the delivery connection, then a fusible section (melting point 208°F to 220°F) is required to permit the internal valve to close automatically in case of fire.</p> <p><b>Exemption:</b> Filling connections, safety relief devices, and liquid level and pressure gauge connections are exempt from automatic excess flow valves and quick-closing internal valves.</p>
Filling connections <sup>2</sup>	<p>Prevent back-flow in the event the filling connection breaks with at least one of the following:</p> <ul style="list-style-type: none"> <li>• Automatic back pressure check valves</li> <li>• Excess flow check valves</li> <li>• Quick closing internal valves</li> </ul> <p><b>Exemption:</b></p> <ul style="list-style-type: none"> <li>• An automatic valve is not required if: <ul style="list-style-type: none"> <li>– The filling and discharge connect to a common opening in the container shell;</li> </ul> </li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>– The opening is fitted with a quick-closing internal valve</li> </ul>
Nonrecessed container fittings and appurtenances	<p>Are protected against physical damage by one of the following methods:</p> <ul style="list-style-type: none"> <li>• A protected location</li> <li>• The vehicle frame or bumper</li> <li>• A protective housing that meets the following: <ul style="list-style-type: none"> <li>– Is fabricated from material that is compatible with the containers design and construction requirements</li> <li>– Designed to withstand static loadings in any direction equal to twice the weight of the container and attachments when filled using a safety factor of not less than 4, based on the ultimate strength of the material used</li> </ul> </li> </ul> <p><b>Note:</b> Protect nonrecessed container fittings and appurtenances with a weather cover as needed for proper operation of valves and safety relief devices</p>

If you have:	Then make sure they:
Columnar-type gauges	Are restricted to stationary storage installations
	Are shielded against the direct rays of the sun
	<p>Are equipped with all of the following:</p> <ul style="list-style-type: none"> <li>– Shut off valves having metallic hand-wheels</li> <li>– Excess flow valves</li> <li>– Extra heavy glass that is adequately protected with a metal housing applied by the gauge manufacturer</li> </ul>
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-50020, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-50025 Systems mounted on farm trucks or trailers for transportation of ammonia.**

**IMPORTANT:**

- This section applies to containers of three thousand gallons capacity or less and pertinent equipment mounted on farm trucks or trailers used for the transportation of ammonia.

- In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

**You must:**

- Make sure all containers are equipped with a fixed maximum liquid level gauge.

- Make sure vapor and liquid connections have either of the following:

- An approved excess flow valve;

**OR**

- An approved quick-closing internal valve that remains closed except during operation.

**Exemption:** • The following do not need to be fitted with excess flow valves:

- Safety relief valves

- Those with openings from the containers or through fittings that are attached directly onto the container where pressure gauge connections are made as long as the openings are not larger than a No. 54 drill size.

- Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers, that do all of the following:

- Discharges in the following ways:

- ■ Away from the container in an upward, unobstructed manner into the atmosphere

- Has raincaps that allow free discharge of the vapor and prevent the entrance of water

- Has a method for draining accumulated condensation

- Has a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate

- Are arranged to minimize the possibility of tampering

- Provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
- Has direct communication with the vapor space of the container
- Make sure shut off valves are not installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

**Exemption:**

- You are exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:
  - A three-way valve installed under two safety relief valves, each with
    - The required rate of discharge;

**AND**

- Installed to allow either of the safety relief valves to be closed off but not at the same time.
- Two separate relief valves are installed with individual shut off valves.
  - The two shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.
- When a safety relief valve manifold that allows:
  - One valve of two or more to be closed off

**AND**

- The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

- Secure both ends of the hose while in transit
- Make sure all containers with a capacity exceeding two hundred fifty gallons are equipped with both of the following:
  - A pressure gauge with a dial graduated from 0-400 psig;

**AND**

- A method for spray loading or with an approved vapor return valve
- Follow additional requirements found in Table 12, Appurtenances for Systems Mounted on Farm Trucks or Trailers

Table 12  
Appurtenances for Systems Mounted  
on Farm Trucks or Trailers

If you have:	Then make sure they:
Filling connections	Are fitted with one of the following: <ul style="list-style-type: none"> <li>– A combination back-pressure check valve and excess flow valve</li> <li>– One double or two single back-pressure check valves</li> <li>– A positive shut off valve used with either an:               <ul style="list-style-type: none"> <li>■ Internal back-pressure check valve;</li> </ul> </li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>■ Internal excess flow valve</li> </ul>
A fully enclosed guard	Have properly vented safety relief valves.

(2/17/09)

If you have:	Then make sure they:
Fittings	Are protected from physical damage by a rigid guard designed: <ul style="list-style-type: none"> <li>– To withstand static loading in any direction equal to twice the weight of the container and loading</li> <li>– With a safety factor of four based on the maximum strength of the material used</li> </ul>
Liquid withdrawal lines installed in the bottom of the container	Have connections, including the hose, that are not lower than the lowest horizontal edge of the truck axle
Columnar-type gauges	Are shielded against the direct rays of the sun  Are equipped with all of the following: <ul style="list-style-type: none"> <li>– Shut off valves having metallic hand-wheels</li> <li>– Excess flow valves</li> <li>– Extra heavy glass that is adequately protected with a metal housing applied by the gauge manufacturer</li> </ul>
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-50025, filed 5/2/06, effective 9/1/06.]

### **WAC 296-826-50030 Systems mounted on farm equipment for ammonia application.**

#### **IMPORTANT:**

- This section applies to systems mounted on farm equipment and used for the filed application of ammonia.
- In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

#### **You must:**

- Make sure each container has a fixed maximum liquid-level gauge.
- Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers, that do all of the following:
  - Discharges in the following ways:
    - Away from the container in an upward, unobstructed manner into the atmosphere
    - Not in or beneath a building.
  - Has raincaps that allow free discharge of the vapor and prevent the entrance of water
  - Has a method for draining accumulated condensation
  - Has a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate
- Are arranged to minimize the possibility of tampering

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- Provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
- Has direct communication with the vapor space of the container

**You must:**

- Make sure shut off valves are not installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

**Exemption:**

- You are exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:

- A three-way valve installed under two safety relief valves, each with

- The required rate of discharge;

**AND**

- Installed to allow either of the safety relief valves to be closed off but not at the same time.

- Two separate relief valves are installed with individual shut off valves.

- The two shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.

- When a safety relief valve manifold that allows:

- One valve of two or more to be closed off;

**AND**

- The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

- Follow additional requirements found in Table 13, Appurtenances for Systems Mounted on Farm Equipment for Ammonia Application

Table 13

## Appurtenances for Systems Mounted on Farm Equipment for Ammonia Application

If you have:	Then make sure they:
Filling connections	<p>Are fitted with one of the following:</p> <ul style="list-style-type: none"> <li>– A combination back-pressure check valve and excess flow valve</li> <li>– One double or two single back-pressure check valves</li> <li>– A positive shut off valve used with either an: <ul style="list-style-type: none"> <li>■ Internal back-pressure check valve;</li> </ul> </li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>■ Internal excess flow valve</li> </ul> <p><b>Exemption:</b></p> <ul style="list-style-type: none"> <li>• An excess-flow valve is not required in either of the following: <ul style="list-style-type: none"> <li>– Vapor connection providing you meet both of the following: <ul style="list-style-type: none"> <li>■ The controlling orifice is not in excess of seven-sixteenths of an inch in diameter;</li> </ul> </li> </ul> </li> </ul>

If you have:	Then make sure they:
	<p><b>AND</b></p> <ul style="list-style-type: none"> <li>■ The valve is hand-operated (attached hand-wheel or equivalent) shut off valve;</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>– In the liquid withdrawal line if the controlling opening between the contents of the container and the outlet of the shut off valve do not exceed 7/16 inch in diameter.</li> </ul> <p>Note: To assist in filling applicator tanks, you are allowed to bleed vapors into the open air if you meet the above requirements.</p>
Columnar-type gauges	<p>Are shielded against the direct rays of the sun</p> <p>Are equipped with all of the following:</p> <ul style="list-style-type: none"> <li>– Shut off valves having metallic hand-wheels</li> <li>– Excess flow valves</li> <li>– Extra heavy glass that is adequately protected with a metal housing applied by the gauge manufacturer</li> </ul>
An applicator tank that is both of the following: Trailed; <b>AND</b> The metering device is remotely mounted (for example on a tractor tool bar)	Use an automatic break-away type, self-closing, coupling
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

- Note:**
- Metering devices may be connected directly to the tank withdrawal valve.
  - A union type connection is acceptable between the tank valve and metering device

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-50030, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-50035 Portable DOT containers.****IMPORTANT:**

- This section applies to systems that use cylinders, portable tanks (DOT-51), or ton containers (DOT-106A, DOT-110A).
- In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.



**You must:**

- Make sure safety relief devices meet DOT specifications.
- Provide the following protection:
  - To valves and pressure regulating equipment from tampering once installed for use
  - To containers:
    - From heat sources such as radiant flame and steam pipes. Do not apply heat directly to containers to raise the pressure
    - From moving vehicles or external damage while being stored
    - From ignitable debris and to prevent external corrosion while being stored. Storage can be indoors or outdoors.
- Protect container valves while in transit, in storage, and while being moved into final use by doing either of the following:
  - Setting them into the recess of the container;

**OR**

- By fastening a ventilated cap or collar to the container that can withstand a blow from any direction equivalent to a thirty-pound weight being dropped four feet
  - Construction should be such that a blow will not be transmitted to the valves or other connections.
- Keep outlet valves tightly closed when containers are not connected for service on all empty or loaded containers
  - Secure the valve protection cap, if the container is designed for one, when the container is not in service.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-50035, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-600 Operations.****Your responsibility:**

To protect employees while transporting, transferring, loading and unloading anhydrous ammonia.

Mounting containers on trucks, semi-trailers and trailers  
WAC 296-826-60005

Mounting containers on farm trucks or trailers for transporting ammonia

WAC 296-826-60010

Tank car loading or unloading

WAC 296-826-60015

Transferring liquids

General specifications

WAC 296-826-60020

Additional requirements for systems mounted on trucks, semi-trailers, and trailers for transporting ammonia

WAC 296-826-60025

Filling densities

Nonrefrigerated containers

WAC 296-826-60030

Refrigerated tanks

WAC 296-826-60035

Welding

WAC 296-826-60040

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-600, filed 5/2/06, effective 9/1/06.]

(2/17/09)

**WAC 296-826-60005 Mounting containers on trucks, semi-trailers and trailers.****You must:**

• Make sure the method for attaching any container to the cradle, frame, or chassis of a vehicle is based on both of the following:

- Two "g" loading in either direction
- Using a safety factor of at least four based on the maximum strength of the material used.

**Note:**

- Two "g" is either of the following:
  - For load support it is equivalent to three times the static weight of the supported articles
  - For loading and bending, acceleration, and torsion it is equivalent to twice the static weight support applied horizontally at the road surface.

**You must:**

- Secure both ends of the hose during transit.
- Follow the requirements in Table 14, Additional Container Mounting Requirements.

Table 14  
Additional Container Mounting Requirements

If you have:	Then:
"Hold-down" devices	Anchor the container to the cradle, frame, or chassis so there is no area of unnecessary stress
	Lock the container down tightly
	Provide stops or anchors to minimize movement between the container and the framing Note: Movement could be the result of stopping, starting or changing direction.
Vehicles with cargo tanks designed with stress members instead of a frame	Support the tank with external cradles suspended at least one hundred twenty degrees of the shell circumference
	The design calculation needs to include all of the following stressors: <ul style="list-style-type: none"> <li>– Beam</li> <li>– Shear</li> <li>– Torsion</li> <li>– Bending moment</li> <li>– Acceleration</li> <li>– Any other stresses covered by the code of the cargo tank design.</li> </ul>
A liquid withdrawal line installed in the bottom of a container	Then make sure the connections to the container, including the hose, are not lower than the lowest horizontal edge of the trailer axle.
A cradle and container that are not welded together	Use suitable material between them to eliminate metal-to-metal friction.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60005, filed 5/2/06, effective 9/1/06.]

### **WAC 296-826-60010 Mounting containers on farm trucks or trailers for transporting ammonia.**

#### **You must:**

- Make sure tanks mounted on farm trucks and trailers meet all of the following:
  - Are securely attached using drawbars and safety chains
  - Follow behind the towing vehicle without swerving
  - Have at least five gallons of readily available clean water.
- Do all of the following when mounting containers on farm trucks:
  - Use suitable material between the cradle and the container to eliminate metal-to-metal friction
    - This is not necessary if the cradle and container are welded together
  - Use stops and hold down devices to prevent displacement.
  - Distribute the container's weight, when mounted on four-wheel farm trucks or trailers, evenly over both axles.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60010, filed 5/2/06, effective 9/1/06.]

### **WAC 296-826-60015 Tank car loading or unloading.**

#### **You must:**

- Establish a location for tank car loading and unloading operations.
- Assign employees and instruct them in the unloading of tank cars.
- Make sure, when unloading cars, to set the brake and block the wheels.
- Make sure the track of tank siding is level.
- Place caution signs on the track or car to warn approaching persons of loading and unloading operations that are:
  - Kept in place until the car is unloaded and disconnected from discharge connections.
- Make sure these caution signs meet all of the following:
  - Are made of metal or other suitable material
  - Are at least twelve to fifteen inches in size
  - Read either "STOP-Tank Car Connected" or "STOP-Men at Work" meeting the following criteria:
    - "STOP" at least four inches high
    - All other words at least two inches high
    - All with white letters on a blue background.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60015, filed 5/2/06, effective 9/1/06.]

## **TRANSFERRING LIQUIDS**

### **WAC 296-826-60020 General specifications.**

#### **You must:**

- Get owner authorization to use transfer containers.
- Make sure transfer containers are gauged and filled in either:
  - Open atmospheres;
- OR**
- Buildings approved for that purpose.

[Ch. 296-826 WAC p. 18]

- Make sure pumps used to transfer ammonia meet all of the following:

- Have a manufacturer's label for ammonia service
- Are designed for at least 250 psig working pressure
- Have a constant differential relief valve discharging into the suction port that:

- Is installed on positive displacement pumps;

#### **AND**

- Meets the pump manufacturer's recommendation for the settings and installation

- Have a pressure gauge graduated zero to 400 psig installed on the discharge side before the relief valve line.

- Make sure plant pipes with shut off valves are located as close as possible to the pump connections.

- Make sure meters used for measuring liquid anhydrous ammonia:

- Are recommended and labeled for ammonia service by the manufacturer

- Are designed for a minimum working pressure of 250 psig

- Incorporate devices that prevent unintended measurement of vapor.

- Do the following when transferring ammonia:

- Maintain ammonia at a temperature suitable for the receiving container

- Have at least one attendant supervise the transfer from the time connections are made to when disconnection occurs

- Do NOT use flammable gases or gases that will react with ammonia, such as air to unload tank cars or transport trucks.

- Make sure compressors used for transferring ammonia meet all of the following:

- Have a working pressure of at least 250 psig when transferring ammonia.

- If crank cases of compressors are not designed to withstand system pressure, then provide protection with a suitable safety relief valve

- Are connected to plant piping with shut off valves located as close as practical to compressor connections

- Have a safety relief valve that is both:

- Large enough to discharge the full capacity of the compressor;

#### **AND**

- Connected to the discharge before any shut off valve
- Have an oil separator on the discharge side, where necessary to prevent contamination

- Have a drainable liquid trap or other adequate method on the compressor suction to minimize the entry of liquids into the compressor

- Pressure gauges on the suction and discharge ends graduated to at least one and one-half times the maximum pressure that can develop.

- Protect loading and unloading systems in the event of hose severance by suitable devices where necessary, such as:

- Backflow check valves;

#### **OR**

- Properly sized excess flow valves.

**Note:** If such valves are not practical, remotely operated shut off valves may be installed.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60020, filed 5/2/06, effective 9/1/06.]

(2/17/09)

**WAC 296-826-60025 Additional requirements for systems mounted on trucks, semi-trailers, and trailers for transporting ammonia.**

**You must:**

• Make sure the content of vehicle containers is determined by one of the following:

- Weight
- Liquid-level gauging devices
- Meters

**OR**

- Other approved methods.

• Use a thermometer well when the content of a container is determined by liquid-level measurement. Make sure of the following:

- The volume, when converted to weight, does not exceed the DOT filling density requirement.
- Protect pumps and compressors against physical damage when mounted on trucks or trailers.
- Unload tank motor vehicles with a water capacity greater than 3500 gallons at approved locations.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60025, filed 5/2/06, effective 9/1/06.]

**FILLING DENSITIES**

**WAC 296-826-60030 Nonrefrigerated containers.**

**You must:**

• Make sure filling densities for nonrefrigerated containers are below or equal to the requirements in Table 15, Filling Densities.

Table 15  
Filling Densities

Containers	Aboveground Containers	Underground Containers
Uninsulated	56%	58%
Insulated	57%	—

**Note:**

- For uninsulated, aboveground containers, the 56% corresponds to:
  - 82% by volume at -28°F.
  - 85% by volume at 5°F
  - 87.5% by volume at 30°F
  - 90.6% by volume at 60°F.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60030, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-60035 Refrigerated tanks.**

**You must:**

Make sure refrigerated tanks are not liquid full at a liquid temperature so that the vapor pressure is below the "start-to-discharge" pressure setting of the safety relief valve.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60035, filed 5/2/06, effective 9/1/06.]

**WAC 296-826-60040 Welding.**

**You must:**

Permit welding only on the saddle plates, lugs, or brackets attached to the container by the manufacturer.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-60040, filed 5/2/06, effective 9/1/06.]

(2/17/09)

**WAC 296-826-900 Definitions.**

**Appurtenance**

All devices that are added onto the system such as pumps, compressors, safety relief devices, liquid-level gauging devices, valves, and pressure gauges.

**Capacity**

The total volume of the container measured in U.S. gallons, unless otherwise specified.

**Container**

All vessels, tanks, cylinders or spheres used for transportation, storage or application of anhydrous ammonia.

**Cylinder**

A container constructed according to the United States Department of Transportation Specifications with a water capacity of one thousand pounds or less.

**Design pressure**

The same as the "maximum allowable working pressure" as used in the Unfired Pressure Vessel Code.

**DOT regulations**

The department of transportation (DOT) hazardous materials regulations and Specifications for Shipping Containers found in:

- Title 49—Transportation, Code of Federal Regulations, Parts 171 to 190, inclusive.

**Filling density**

The ratio of the weight of the gas in a container to the weight of water at 60°F that the container will hold. One lb. H<sub>2</sub>O = 27.737 cu. in. at 60°F

- For determining the weight capacity of the tank in pounds, the weight of a gallon (231 cubic inches) of water at 60°F in air is 8.32828 pounds.

**Gas**

Anhydrous ammonia in either the gaseous or liquefied state.

**Hydrostatic relief valve**

An automatic pressure activated valve for liquid service

- It is characterized by a throttle or slow weep opening, a nonpop action.

- Refer to American National Standards Institute, Terminology for Pressure Relief Devices, B95.1 for more information.

**"psig" and "psia"**

Abbreviations that mean the following:

- "psig" refers to pounds per square inch gauge
- "psia" refers to absolute pounds per square inch.

**Safety relief valve**

An automatic spring loaded or equivalent type pressure activated device for gas or vapor service

- It is characterized by a pop action upon opening, and is sometimes referred to as a pop valve.

- Refer to American National Standards Institute, Terminology for Pressure Relief Devices, B95.1 for more information.

**Semi-trailer**

Every vehicle that meets both of the following:

- Designed for carrying property and for being drawn by a motor vehicle
- Constructed so that some part of its weight and the weight of its load rests upon or is carried by another vehicle.

**Systems**

An assembly of equipment consisting of the container or containers, appurtenances, pumps, compressors, and inter-connecting piping.

**Tank motor vehicle**

Any motor vehicle designed or used for the transportation of anhydrous ammonia that has either:

- A tank designed to be permanently attached to any motor vehicle;

**OR**

- A container that is not permanently attached but needs to be loaded and unloaded without being removed from the motor vehicle due to its size, construction, or means of attachment.

**Trailer**

Every vehicle meeting all of the following:

- Designed for carrying property and for being drawn by a motor vehicle

- Constructed so that no part of its weight except the towing device rests on the towing vehicle.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 06-10-067, § 296-826-900, filed 5/2/06, effective 9/1/06.]