

STATE OF MISSOURI  
DEPARTMENT OF AGRICULTURE

SERVICE STATION AND BULK PLANT  
INFORMATIONAL GUIDE

MISSOURI DEPARTMENT OF AGRICULTURE  
DIVISION OF WEIGHTS AND MEASURES  
P. O. BOX 630  
JEFFERSON CITY, MO 65102  
573-751-4278

## FOREWORD

This booklet is intended for use as a guide and **contains only a summary** of the requirements for attended service stations, unattended service stations including card and key operated systems and refined fuels bulk storage plants utilized for the sale of products regulated by Chapter 414 RSMo.

The “notes” sections contained in this booklet are for information and/or definition purposes.

The intent of all information contained in this booklet is to help insure that fuel storage and dispensing systems are installed and maintained properly and safely. The proper and safe installation of fuel storage and dispensing systems will help insure the safety of premises and subsequently the safety of public and property.

**Only trained and experienced personnel shall install any of the systems and system components addressed in this booklet (2 CSR 90-30.050 (35)). It is also important that all persons installing, servicing, or repairing any fuel storage and dispensing system have and utilize all of the codes adopted by Chapter 414 RSMo. (i.e. Handbook 44, NEC 70, NFPA 30, NFPA 30A)**

**Note:** Products regulated by Chapter 414 RSMo:

- Gasoline (Aviation and Auto) - Class IA Flammable
- Gasoline- Alcohol Blends - Class IA Flammable
- Diesel Fuel ID, 2D and 4D- Class II Combustible
- Fuel Oil Nos. 1, 2 , 4 and 5 - Class II Combustible
- Fuel Oil No. 6 - Class IIIA Combustible
- Kerosene 1K and 2K - Class II Combustible
- Aviation Turbine Fuel, Jet A - Class II Combustible
- Aviation Turbine Fuel, Jet B - Class IA Flammable
- Other Motor Fuels

MISSOURI DEPARTMENT OF AGRICULTURE  
DIVISION OF WEIGHTS AND MEASURES  
P.O. BOX 630  
JEFFERSON CITY, MISSOURI 65102  
PHONE: 573-751-4278

## REGULATORY AGENCIES

### **Aboveground Tanks:**

Missouri Department of Agriculture  
Division of Weights & Measures  
P.O. Box 630  
Jefferson City, MO 65102  
(573) 751-4278

United States Environmental Protection Agency  
Region VII Office  
901 North 5<sup>th</sup> Street  
Kansas City, KS  
(913) 551-7003 or (800) 223-0425

### **Underground Tanks:**

Missouri Department of Natural Resources  
Hazardous Waste Program  
P.O. Box 176  
Jefferson City, MO 65102  
(573) 751-6822

United States Environmental Protection Agency  
Region VII Office  
901 North 5<sup>th</sup> Street  
Kansas City, KS  
(913) 551-7003 or (800) 223-0425

## REFERENCES

### **Tank Insurance:**

Missouri Petroleum Storage Tank Insurance Fund (PSTIF)  
Carol Eighmey, Executive Director  
P. O. Box 836  
Jefferson City, MO 65102  
(573) 522-2352

### **Fire Codes & National Electrical Code:**

National Fire Protection Association (NFPA)  
1 Batterymarch Park  
P.O. Box 9101  
Quincy, MA 02269-9101  
Telephone 1-800-344-3555

### **National Institute of Standards and Technology Handbook 44:**

Superintendent of Documents  
U. S. Government Printing Office  
Washington, DC  
Telephone: (202) 512-1800      Fax: (202) 512-2250

## TABLE OF CONTENTS

Full and Self Service Attended Service Stations Dispensing Device/Dispensing Area.....	1
Unattended Self Service Station Dispensing Device/Dispensing Area.....	8
Storage Tank Design Requirements Service Stations and Bulk Storage Plants .....	15
Bulk Plant and Service Station Installation of Aboveground Tanks.....	18
Bulk Plant and Service Station Piping, Valves and Fittings.....	24
Appendix A Emergency venting tables	
Appendix B Secondary containment schematics	
Appendix C Secondary containment volume calculations	
Appendix D Electrical drawings	

<p style="text-align: center;"><b>FULL AND SELF SERVICE ATTENDED SERVICE STATIONS</b></p>
---

**Dispensing (measuring) Devices/Dispensing Area:**

- 1.1 A dispensing device shall be provided for each product dispensed which shall be utilized for the sale of products regulated by Chapter 414 RSMo. (2 CSR 90-30.080 (1))

**Note:** Each dispensing device provided must be National Type Evaluation Program (NTEP) approved and be designed for commercial purposes.

- 1.2 No person shall install, repair or service any dispensing device without first having registered with the Department of Agriculture, Petroleum Inspection Program, submitting documentation of properly designed and calibrated testing equipment and proof of training and experience to perform such work. Registration may be revoked if such person does not obtain and maintain testing equipment calibration at least once every two (2) years and/or installs, repairs or services any dispensing device in violation of Chapter 414, RSMo and/or any rules promulgated thereunder.

- 1.3 Dispensing devices utilized for Class I liquids shall be listed (i.e. UL). Existing listed or labeled dispensing devices shall be permitted to be modified provided that the modifications are "Listed by Report" by an approved testing laboratory or as otherwise approved by the authority having jurisdiction. (NFPA 30A 1996, 4-2.2)

- 1.4 A control shall be provided that will permit the pump to operate only when a dispensing nozzle is removed from its bracket or normal position with respect to the dispensing device and the switch on the dispensing device is manually actuated. This control shall also stop the pump when all dispensing nozzles have been returned to their bracket or the normal non-dispensing position (NFPA 30A 1996, 4-2.3)

- 1.5 Dispensing devices shall be mounted and bolted on a concrete island or protected against collision damage, installed and maintained as recommended by the device manufacturer and accessible for testing, inspection and maintenance purposes. (NFPA 30A 1996, 4-2.5 & 2 CSR 90-30.080 (17))

- 1.6 Dispenser wiring shall be installed in explosion proof conduit and components. (2 CSR 90.30.080 - 1996 NEC, Article 514)

**Note:** NEC article 514 applies to Class I, Group D locations.

- 1.7 Dispensing nozzles shall be automatic closing in operation, free of leaks and with a spout anchor spring in place. (NFPA 30A 1996, 9-1.1 & 2 CSR 90-30.080 (18))

**Note:** Dispensing nozzles and hoses utilized for use with Class I and Class II products must have the ability to ground or bond the components of the fuel dispensing system to the receptacle or fuel tank into which the fuel is being dispensed. Failure to do so may result in a static electrical discharge that could result in a fire.

1.8 Nozzles used for dispensing regular leaded gasoline shall have an outside nozzle spout diameter of .93 inches. (2 CSR 90 - 30.080 (12))

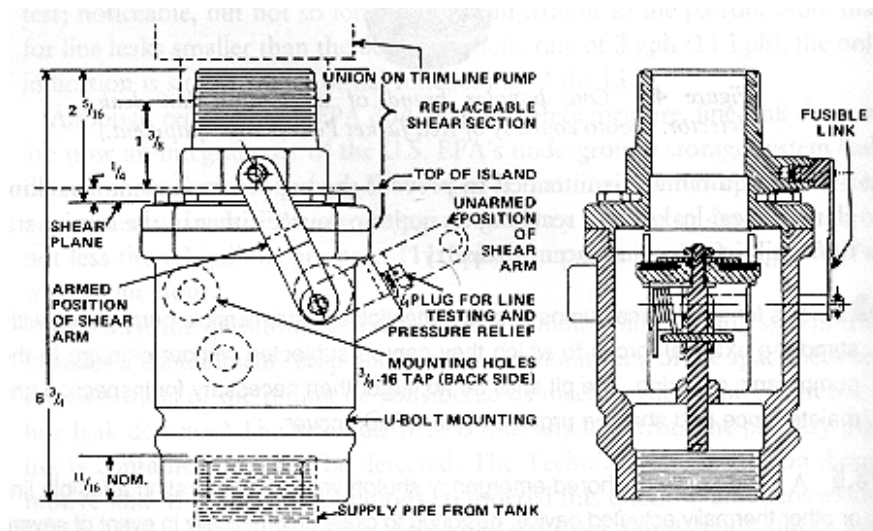
**Note:** This requirement also applies to device dispensing lead substitute additives. It is also highly recommended this size nozzle be installed on diesel fuel and kerosene dispensers.

1.9 Hoses dispensing Class I liquids shall have a breakaway device installed and maintained in accordance with manufacturers instructions. (NFPA 30A 1996, 4-2.7)

**Note:** On dispensers/pumps with hose retrieving devices, the breakaway device must be installed between the hose attachment of the retrieving device and dispensing nozzle.

1.10 Dispensing hose length shall not exceed 18 feet unless approved by the Division of Weights and Measures. (NFPA 30A 1996, 4-2.6)

1.11 All dispensing devices supplied by remote pumping systems and/or aboveground storage tanks shall be equipped with a properly installed fire/impact valve. (NFPA 30A 1996, 4-3.6 & 2 CSR 90-30.080(17))



**Note:** It is extremely important that each fire/impact valve be installed with rigid support and at the proper level under the dispenser (see illustration above). Failure to do so may prevent the valve from activating or to fail in the event of an impact. This requirement also applies to underground storage tank systems located above grade of the dispensers.

**Note:** There may be problems and subsequent hazards produced with the installation of newer style, larger dispensers on existing motor fuel dispenser islands if the piping configuration is not proper. Fuel supply piping should exit the pump sump vertically, enter the fire impact valve vertically and be installed vertically into the dispenser meter inlet without using any elbows. The installation of a

pipng system from fire impact valve to dispenser meter inlet utilizing a “swing joint piping system” may not allow the fire/impact valve to operate properly thus creating a very hazardous situation should the dispenser be impacted. If you have any questions regarding this situation you are urged to call the Division of Weights & Measures at 573-751-4278. **DO NOT INSTALL THIS TYPE OF SYSTEM UNLESS YOU ARE FULLY CLEAR ON THE PROPER METHOD(S) AND AWARE OF THE PRECAUTIONS TO BE TAKEN.**

- 1.12 The dispensing device shall be free of leaks and the dispensing hose shall be kept in such condition as to prevent a hazard of leaking or bursting. (2 CSR 90 - 30.080 (10))
- 1.13 Device must be equipped with a non-resettable totalizer that must work and register accurately. (NIST HB 44 GS.3 & 3.30, S.5)
- 1.14 Each dispensing device meter shall be sealed with an official state security seal. (2 CSR 90 - 30.080 (6))

**Note:** Only registered service personnel may install, repair or service dispensing devices. This includes owners of the device(s) and their employees such as oil marketers and convenient stores owners.

- 1.15 Each dispensing device shall display correct product price and product identity. (NIST HB 44 3.30, S.1.6.4 & 2 CSR 90 - 30.080 (8))

**Note:** This requirement includes the labeling of dispensers/pumps dispensing alcohol blends and lead substitute additives and the posting of the octane rating.

**Note:** “Street side” or marquee pricing must designate whether product price is cash or credit and be reflected as such at the dispenser/pump.

- 1.16 All device indicators must be working, legible, unobstructed and with primary and secondary indicators in agreement. (NIST HB 44 1.10 - 3.30)
- 1.17 Each device must be capable of clearing to zero after each delivery with a working interlock to prevent deliveries without returning to an initial zero condition. (NIST HB 44 3.30)
- 1.18 No means shall be provided which any measured liquid can be diverted from the measuring chamber of the meter or its discharge line. Two or more delivery outlets may be installed only if means are provided to insure that: (HB 44 3.30, S.3.1)
  - (a) liquid can flow from only one outlet at a time, and
  - (b) the direction of flow for which the mechanism may be set at any time is clearly and conspicuously indicated.
- 1.19 The provisions of 1.18 (HB 44 3.30, S3.1), “diversion prohibited” shall not apply to:

Truck refueling when diversion of flow to other than the receiving vehicle cannot be readily accomplished and is readily apparent. Allowable deterrents include, but are not limited to, physical barriers to adjacent driveways, visible valves or lighting systems that indicate which outlets are in operation, and explanatory signs;

(a) Other devices, when all discharge outlets designed to operated simultaneously are 3.8 cm in diameter or larger.

1.20 Devices dispensing home heating oils, kerosene and LP Gas shall be located at least 20 feet from any device dispensing Class I liquids. (NFPA 30A 1996, 4-2.8)

**Note:** It is not uncommon for Class I products (gasoline) to be inadvertently dispensed into Class II (kerosene) containers and then introduced into heating appliances thus creating a tremendous hazard to public and property. Because of this fact, it is of great importance that proper labeling and separation of Class I and Class II devices be done.

1.21 Warning signs shall be posted in a conspicuous location in the dispensing area incorporating the following or equivalent wording: (NFPA 30A, 9-9)

- (A) Warning - It is unlawful and dangerous to dispense gasoline into unapproved containers.
- (B) No Smoking
- (C) Stop Engine

1.22 Self service pumps shall have operating instructions posted in a conspicuous location in the dispensing area. (NFPA 30A 1996, 9-4.6)

1.23 Dispensing area shall have at least one listed fire extinguisher with a minimum rating of 40 B:C located within 100 feet of each pump, tank fill opening and lubrication or service room. (NFPA 30A 1996, 9-8)

**Note:** **Class A Fires:** Fires in ordinary combustibile materials, such as wood, cloth, paper, rubber, and many plastics.

**Class B Fires:** Fires in flammable liquids, oils, greases, tars, oil-base paints, lacquers, and flammable gases.

**Class C Fires:** Fires that involve energized electrical equipment where the electrical non-conductivity of the extinguishing media is of importance. (When electrical equipment is de-energized, fire extinguishers for Class A or B fires may be used safely.)

**Class D Fires:** Fires in combustibile metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.



**Note:** Many fires are small at origin and may be extinguished by the use of proper portable fire extinguishers. It is strongly recommended that the fire department be notified as soon as a fire is discovered. This alarm should not be delayed awaiting results of the application of portable fire extinguishers. Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon the following conditions having been met:

1. The fire extinguisher is properly located and in working order.
2. The fire extinguisher is of proper type for a fire that may occur.
3. The fire is discovered while still small enough for the fire extinguisher to be effective.
4. The fire is discovered by a person ready, willing, and able to use the fire extinguisher.

1.24 A container or storage shall be provided by the owner or operator of the device for storage of the fuel dispensed during the device test. The container or storage must comply with the requirements of NFPA 30 1996 Edition. (2 CSR 90 - 30.080(9))

**Note:** Failure by the owner or operator of the device to provide a container or storage for the fuel dispensed during the device test, may be reason to place all dispensing devices out of service until such time that a container or storage is provided for the device test.

1.25 On remote pumping systems, each pump shall have installed on the discharge side, a listed leak detection device that will provide indication if the piping and dispenser are not essentially liquid tight. (NFPA 30A 1996, 4-3.3)

1.26 Any portion of a tank or its piping system that is in contact with the soil shall be protected from corrosion in accordance with sound engineering practice. Tanks and their piping shall be protected by either: (NFPA 30 1996, 2-4.3 & NFPA 30A 1996, 2-4.8)

(a) A properly engineered, installed, and maintained cathodic protection system in accordance with recognized standards of design, such as:

1. American Petroleum Institute Publication 1632, Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems; Underwriters Laboratories of Canada ULC-S603.1 M, Standard for Galvanic Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids;
2. Steel Tank Institute Standard No. Sti-P3®, Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks;

3. National Association of Corrosion Engineers Standard RP-01-69 (1983 rev.), Recommended Practice, Control of External Corrosion of Underground or Submerged Metallic Piping Systems;
4. National Association of Corrosion Engineers Standard RP-02-85, Recommended Practice, Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems; and
5. Underwriters Laboratories Inc., Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks, UL 1746, Part 1.

(b) Approved or listed corrosion-resistant materials or systems, which can include special alloys, fiberglass reinforced plastic, or fiberglass reinforced plastic coatings.

1.27 When maintenance to Class I dispensing devices becomes necessary and such maintenance might allow the accidental release or ignition of liquid, the following precautions shall be taken before such maintenance is begun: (NFPA 30A 1996, 4-2.9)

(a) Only persons knowledgeable in performing the required maintenance shall perform the work.

(b) All electrical power to the dispensing devices, to the pump serving the dispensing devices, and to all associated control circuits shall be shut off at the main electrical control panel.

(c) The emergency shut-off valve at the dispenser, if installed, shall be closed.

(c) All vehicle traffic and unauthorized persons shall be prevented from coming within 20 feet of the dispensing device.

1.28 A vapor return pipe inside the dispenser housing shall have a shear section or flexible connector so that the liquid emergency shut-off valve will function properly.

**Note:** This requirement applies to Stage II vapor recovery systems such as required in the St. Louis metropolitan area.

1.29 No delivery of any Class I or Class II liquid shall be made into portable containers unless the container is constructed of metal or is approved by the authority having jurisdiction, has a tight closure, and is fitted with a spout or so designed that the contents can be poured without spilling. (NFPA 30A 1996, 9-2)

1.30 No sale or purchase of any Class I, Class II or Class III liquids shall be made in containers unless such containers are clearly marked with the name of the product contained therein. (NFPA 30A 1996, 9-2.1)

**Note:** It is highly recommended that warning labels or signs utilizing the following language be placed either on the face of each dispenser or in a conspicuous location in the dispensing area.

## **WARNING: PORTABLE CONTAINER FIRE HAZARD**

**Improper filling of portable kerosene containers creates a danger of fire.**

### **To Fill a container:**

-Placed approved container on the ground away from vehicle or trailer. DO NOT fill any container that is inside a vehicle or on a truck/trailer bed liner.

-Keep nozzle in contact with the container while filling. DO NOT use a nozzle latch open device.

-Never use a container that once contained gasoline or other flammable liquid.

It is unlawful and dangerous to dispense kerosene into an unapproved or improperly labeled container.

- 1.31 All attended self-service station shall have at least one attendant on duty while the station is open for business. The attendant's primary function shall be to supervise, observe and control the dispensing of Class I liquids while said liquids are actually being dispensed. (NFPA 30A 1996, 9-4.3)
- 1.32 It shall be the responsibility of the attendant to (1) prevent the dispensing of Class I liquids into portable containers not in compliance with the regulations, (2) prevent the use of hose nozzle valve latch-open devices that do not comply with the regulations, (3) control sources of ignition, and (4) immediately activate emergency controls and handle accidental spill and fire extinguishers if needed. The attendant or supervisor on duty shall be mentally and physically capable of performing the functions and assuming the responsibility prescribed in this section. (NFPA 30A 1996, 9-4.4)
- 1.33 Installation of equipment and devices, such as vending machines and ATMs, that may produce safety hazards by distracting the customer from the dispensing operation, limit ingress and egress to the dispensing area or from electrical components of the equipment or device, or limit visibility to vehicle refueling on islands utilized for the dispensing of petroleum products regulated by Chapter 414, RSMo is prohibited. (2 CSR 90-30.050 (37))
- 1.34 The dispensing area shall at all times be in clear view of the attendant, and the placing or allowing of any obstacle to come between the dispensing area and the attendant control area shall be prohibited. The attendant shall at all times be able to communicate with persons in the dispensing area.

**SELF SERVICE UNATTENDED  
KEY OR CARD OPERATED SERVICE STATION**

**Dispensing Devices/Dispensing Area:**

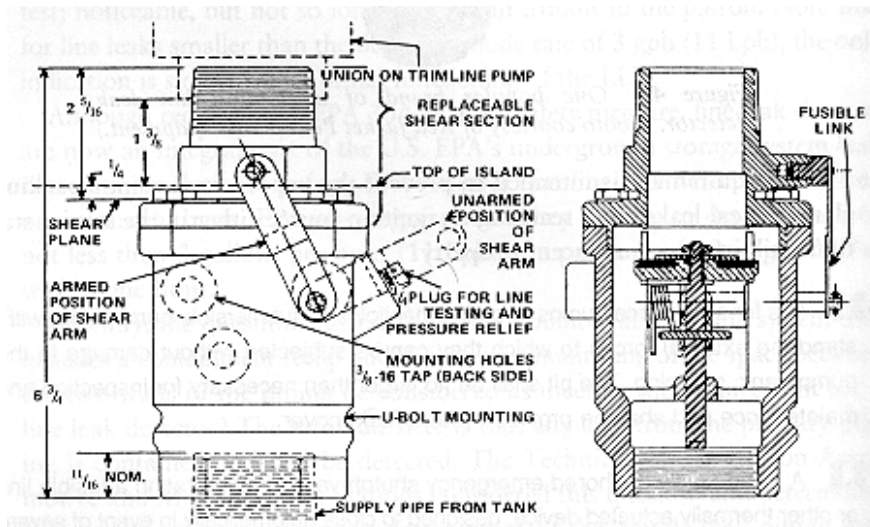
2.1 A dispensing device shall be provided for each product dispensed. (2 CSR 90 - 30.080)

**Note:** Each dispensing device provided must be National Type Evaluation Program (NTEP) approved and be designed for commercial purposes. Devices that are marked **NOT FOR RESALE USE** are prohibited from use.

2.2 No person shall install, repair or service any dispensing device without first having registered with the Department of Agriculture, Petroleum Inspection Program, submitting documentation of properly designed and calibrated testing equipment and proof of training and experience to perform such work. Registration may be revoked if such person does not obtain and maintain testing equipment calibration at least once every two (2) years and/or installs, repairs or services any dispensing device in violation of Chapter 414, RSMo and/or any rules promulgated thereunder.

2.3 All dispensing devices shall be mounted and bolted on a concrete island or protected against collision damage, installed and maintained as recommended by the device manufacturer and accessible for testing, inspection and maintenance purposes. (NFPA 30A 1996, 4-2.5 & 2 CSR 90-30.070(14B))

2.4 All dispensing devices supplied by remote pumping systems and/or aboveground storage tanks shall be equipped with a properly installed fire/impact valve. (NFPA 30A 1996, 4-3.6 & 2 CSR 90-30.080 (17))



**Note:** It is extremely important that each fire/impact valve be installed with rigid support and at the proper level under the dispenser (see illustration above). Failure to do so may prevent the valve from activating or to fail in the event of an impact. This requirement also applies to underground storage tank systems located above grade of the dispensers.

**Note:** There may be problems and subsequent hazards produced with the installation of newer style, larger dispensers on existing motor fuel dispenser islands if the piping configuration is not proper. Fuel supply piping should exit the pump sump vertically, enter the fire impact valve vertically and be installed vertically into the dispenser meter inlet without using any elbows. The installation of a piping system from fire impact valve to dispenser meter inlet utilizing a “swing joint piping system” may not allow the fire/impact valve to operate properly thus creating a very hazardous situation should the dispenser be impacted. If you have any questions regarding this situation, you are urged to call the Division of Weights & Measures at 573-751-4278. **DO NOT INSTALL THIS TYPE OF SYSTEM UNLESS YOU ARE FULLY CLEAR ON THE PROPER METHOD(S) AND AWARE OF THE PRECAUTIONS TO BE TAKEN.**

- 2.5 Dispenser wiring shall meet the requirements of the National Electrical Code. (2 CSR 90-30.080 (10) - NEC Article 514)
- 2.6 Dispensing nozzles shall be automatic closing in operation, free of leaks and with a spout anchor spring in place. (NFPA 30A 1996, 9.1.1. & 2 CSR 30.070, 2 CSR 90-30.080 (18))
- 2.7 All dispensing nozzles must be equipped with a latch open device installed as an integral part of the nozzle assembly. (2 CSR 90-30.070(12))

**Note:** Dispensing nozzles and hoses utilized for use with Class I and Class II products must have the ability to ground or bond the components of the fuel dispensing system to the receptacle or fuel tank into which the fuel is being dispensed. Failure to do so may result in a static electrical discharge that could result in a fire.

- 2.8 Hose nozzles shall be of the type which will close automatically, independent of the latch open device upon loss of pressure or if the nozzle falls from the fill pipe of the vehicle being fueled. (2 CSR 90-30.070)
- 2.9 Nozzles used for dispensing regular leaded gasoline shall have an outside nozzle spout diameter of .93 inches. (2 CSR 90-30.080)

**Note:** This requirement also applies to devices dispensing lead substitute additives. It is recommended that a nozzle of this size be utilized on diesel and kerosene dispensers.

- 2.10 All hoses dispensing Class I, II or III liquids shall have a breakaway device installed and maintained in accordance with manufacturers instructions. (2 CSR 90-30.070(14E))

**Note:** This requirement also includes diesel dispensers/pumps.

**Note:** On dispensers/pumps with hose retrieving devices, the breakaway device must be installed between the hose attachment of the retrieving device and nozzle.

- 2.11 Dispensing hose length shall not exceed 18 feet unless approved by the Division of Weights and Measures. (NFPA 30A 1996, 4-2.6)
- 2.12 The dispensing device and hose shall be free of leaks. (2 CSR 90-30.080(10))
- 2.13 The device must be equipped with a non-resettable totalizer, it must work and register accurately. (NIST HB 44 3.30, S.5)
- 2.14 Each dispensing meter shall be sealed with an official state security seal. (2 CSR 90-30.080(6))

**Note:** Only registered service personnel may install, repair or service dispensing devices.

- 2.15 Each dispensing device shall display correct product price, octane rating and product identity. (2 CSR 90-30.080(8))

**Note:** This requirement includes the labeling of dispensers/pumps dispensing alcohol blends and lead substitute additives.

- 2.16 All device indicators must be legible, working, unobstructed and with primary and secondary indicators in agreement. (NIST HB 44 G.S.5.1 - 3.30, S.1.6.6)
- 2.17 Each device must be capable of clearing to zero after delivery with a working interlock to prevent deliveries without returning to an initial zero condition. (NIST HB 44 3.30, S.1.6.3 & 3.30, S.2.5)
- 2.18 Dispensing devices may use keys or cards to activate dispenser and pumps. Coin or currency activated devices may be utilized if approved by the director of agriculture. (2 CSR 90-30.070 (9))
- 2.19 Money operated devices shall have clearly and conspicuously displayed thereon, or immediately adjacent thereto, adequate information detailing the method for the return of monies paid when the product or service cannot be obtained. This information shall include the name, address and telephone number of the local responsible party of the device. This requirement does not apply to locations where employees are present and responsible for resolving any monetary discrepancies for the customer.
- 2.20 Motors of pumps to dispensing devices shall not have electrical current supplied to them unless and until the dispensing device is activated by the insertion of the card /key. The electric current to the pump motors shall automatically terminate not more than three minutes after the flow of product has ceased. (2 CSR 90-30.070 (9)(4))
- 2.21 The owner or operator of each unattended self-service station upon reasonable request shall make available person(s) and keys or cards necessary to inspect and test all dispensing devices. (2 CSR 90-30.070 (11))
- 2.22 A container or storage shall be provided by the owner or operator of the device for storage of the fuel dispensed during the device test. (2 CSR 90-30.080(9))

**Note:** Failure by the owner or operator of the device to provide a container or storage for the fuel dispensed during the device test, may be reason to place all dispensing devices out of service until such time that a container or storage is provided for the device test.

2.23 Devices used to fill portable containers with home heating fuels, LP Gas and compressed natural gas shall be located at least 20 feet away from any device dispensing Class I liquids. (NFPA 30A 1996, 4-2.8)

**Note:** It is not uncommon for Class I products (gasoline) to be inadvertently dispensed into Class II (kerosene) containers and then introduced into heating appliances thus creating a tremendous hazard to public and property. Because of this fact, it is of great importance that proper labeling and separation of Class I and Class II devices be done.

**Note:** It is highly recommended that warning labels or signs utilizing the following language be placed either on the face of each dispenser or in a conspicuous location in the dispensing area.

<b>WARNING: PORTABLE CONTAINER FIRE HAZARD</b>
<b>Improper filling of portable kerosene containers creates a danger of fire.</b>
<b>To Fill a container:</b>
-Placed approved container on the ground away from vehicle or trailer. DO NOT fill any container that is inside a vehicle or on a truck/trailer bed liner.
-Keep nozzle in contact with the container while filling. DO NOT use a nozzle latch open device.
-Never use a container that once contained gasoline or other flammable liquid.
It is unlawful and dangerous to dispense kerosene into an unapproved or improperly labeled container.

2.24 Operating instructions shall be conspicuously posted in the dispensing area and shall include location of emergency controls. (2 CSR 90-30.070(4))

2.25 Warning signs shall be posted in a conspicuous location in the dispensing area stating: (2 CSR 90-30.070(5))

Warning:

(A) User must stay outside of vehicle in view of fueling nozzle during dispensing operation.

- (B) It is unlawful and dangerous to dispense gasoline into unapproved containers.
- (C) No Smoking
- (D) Stop Engine

- 2.26 Emergency instructions and telephone numbers shall be posted in a conspicuous location in the dispensing area. (NFPA 30A 1996, 9-5.5 2 & CSR 90-30.070)
- 2.27 A telephone or other clearly identified means shall be provided on the site in a conspicuous, easily accessible location to be used to notify proper authorities. (NFPA 30A 1996, 9-5.7 & 2 CSR 90-30.070)
- 2.28 A master electrical shut-off switch shall be provided at a location not less than twenty (20) feet from the nearest, nor more than one hundred (100) feet from the farthest dispensing device and be visible from all dispensing device locations. The electrical shut-off switch shall be of a type, or installed in such a way, that it may only be reset manually with a key which shall be kept in the custody of the owner or employee of the owner or, alternatively, the resetting device shall be kept in a secured area accessible only by key or other device which is kept solely in the custody of the owner or employee of the owner. (NFPA 30A 1996, 9-5.3 & 2 CSR 90-30.070)
- 2.29 In addition to the master shut-off switch required, additional emergency electrical controls shall be provided for each group of pumps or dispensers served by a single control device. (2 CSR 90-30.070(15))
- 2.30 Dispensing area shall have at least one listed fire extinguisher with a minimum rating of 40 B:C located within 100 feet of each pump, tank and fill opening. (NFPA 30A 1996, 9-8)

**Note: Classification of fires:**

**Class A Fires:** Fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.

**Class B Fires:** Fires in flammable liquids, oils, greases, tars, oil-base paints, lacquers, and flammable gases.

**Class C Fires:** Fires that involve energized electrical equipment where the electrical nonconductivity of the extinguishing media is of importance. (When electrical equipment is de-energized, fire extinguishers for Class A or B fires may be used safely.)

**Class D Fires:** Fires in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

**Note:** Many fires are small at origin and may be extinguished by the use of proper portable fire extinguishers. It is strongly recommended that the fire department be



notified as soon as a fire is discovered. This alarm should not be delayed awaiting results of the application of portable fire extinguishers. Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon the following conditions having been met:

1. The fire extinguisher is properly located and in working order.
2. The fire extinguisher is of proper type for a fire that may occur.
3. The fire is discovered while still small enough for the fire extinguisher to be effective.
4. The fire is discovered by a person ready, willing, and able to use the fire extinguisher.

2.31 On remote pumping systems, each pump shall have installed on the discharge side, a listed leak detection device that will provide an indication if the piping and dispensers are not essentially liquid tight. (NFPA 30A 1996, 4-3.3)

2.32 Any portion of a tank or its piping system that is in contact with the soil shall be protected from corrosion in accordance with sound engineering practice. Tanks and their piping shall be protected by either: (NFPA 30 1996, 2-4.3 & NFPA 30A 1996, 2-4.8)

(a) A properly engineered, installed, and maintained cathodic protection system in accordance with recognized standards of design, such as:

1. American Petroleum Institute Publication 1632, Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems;
2. Underwriters Laboratories of Canada ULC-S603.1 M, Standard for Galvanic Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids;
3. Steel Tank Institute Standard No. Sti-P3®, Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks; (NFPA 30 1996 2-4.3)
4. National Association of Corrosion Engineers Standard RP-01-69 (1983 rev.), Recommended Practice, Control of External Corrosion of Underground or Submerged Metallic Piping Systems;
5. National Association of Corrosion Engineers Standard RP-02-85, Recommended Practice, Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems; and
6. Underwriters Laboratories Inc., Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks, UL 1746, Part 1.

(b) Approved or listed corrosion-resistant materials or systems, which can include special alloys, fiberglass reinforced plastic, or fiberglass reinforced plastic coatings.

- 2.33 Installation of equipment and devices, such as vending machines and ATMs, that may produce safety hazards by distracting the customer from the dispensing operation, limit ingress and egress to the dispensing area or from electrical components of the equipment or device, or limit visibility to vehicle refueling on islands utilized for the dispensing of petroleum products regulated by Chapter 414, RSMo is prohibited.  
(2 CSR 90-30.050 (37))

<p style="text-align: center;"><b>STORAGE TANK DESIGN REQUIREMENTS FOR SERVICE STATIONS AND BULK PLANTS</b></p>
---

**Storage Tanks:**

- 3.1 Underground storage tanks cannot be used for aboveground storage. Only aboveground storage tanks shall be used. (NFPA 30A 1996, 2-4.1.1)
- 3.2 Aboveground storage tanks shall be designed and built in accordance with recognized good engineering standards for the materials of construction being used and shall be of steel or approved noncombustible material with the following limitations and exceptions:
- (a) The material of tank construction shall be compatible with the liquid to be stored. In case of doubt about the properties of the liquid to be stored, the supplier, producer of the liquid, or other competent authority shall be consulted.
- (b) Tanks constructed of combustible materials shall be subject to the approval of the authority having jurisdiction and limited to:
1. Installation underground, or
  2. Use where required by the properties of the liquid stored, or
  3. Storage of Class IIIB liquids aboveground in areas not exposed to a spill or leak of Class I or Class II liquid, or
  4. Storage of Class IIIB liquids inside a building protected by an approved automatic fire extinguishing system.
- (c) Unlined concrete tanks shall be permitted to be used for storing liquids having a gravity of 40° API or heavier. Concrete tanks with special linings shall be permitted to be used for other services provided the design is in accordance with sound engineering practice.
- (d) Tanks shall be permitted to have combustible or noncombustible linings. The choice of a suitable protective lining shall depend upon the properties of the liquid stored.
- (e) Special engineering consideration shall be required if the specific gravity of the liquid to be stored exceeds that of water or if the tank is designed to contain liquids at a liquid temperature below 0°F (-17.8°C). (NFPA 30 1996, 2-2.1)
- 3.3 Aboveground storage tanks taken out of service or abandoned shall be emptied of liquid, rendered vapor free, and safeguarded against trespassing. Only those tanks that comply with the applicable code(s) and are approved by the authority having jurisdiction shall be installed for flammable or combustible liquids service.

- 3.4 All tanks must be tested before they are placed into service. (NFPA 30 1996, 2-8.1)
- 3.5 All aboveground storage tanks shall be equipped with adequate normal venting to prevent the development of vacuum or pressure sufficient to distort or damage the tank structure. The vent must be as large as the fill or withdrawal connection, whichever is larger but in no case smaller than 1 1/4 inches inside diameter. (NFPA 30 1996, 2-3.5)
- Note:** Storage tanks containing different classes of petroleum products must never be connected to a common fill, withdrawal or venting system. Serious and hazardous fuel contamination can result from this practice.
- 3.6 If any tank or pressure vessel has more than one fill or withdrawal connection and simultaneous filling or withdrawal can be made, the vent size shall be based on the maximum anticipated simultaneous flow. (NFPA 30 1996, 2-3.5.4)
- 3.7 Tanks storing Class IA products shall be equipped with venting devices that will be normally closed, except when venting to pressure or vacuum conditions. (NFPA 30 1996, 2-3.5.6)
- Note:** Care should be exercised when selecting a pressure/vacuum vent to meet this requirement. Some vents are more prone to “freeze ups” during the winter. This condition can cause the tank to implode when product is dispensed from the tank. Care should also be exercised when using “right angle” type or “directional vents”. If the vent is installed pointing toward an ignition source, such as a transformer, air conditioner compressor, transport unloading area, etc., ignition of the vapors can occur. This is especially true in the event of a tank overflow.
- 3.8 Every aboveground storage tank shall have some form of construction or device, such as emergency venting or weak roof to shell seams, that will relieve excessive pressure caused by exposure to fire. (NFPA 30 1996, 2-3.6)
- Note:** Lack of weak roof to shell seam or emergency venting may cause rupture of the tank shell during exposure to fire or overfilling by transport vehicle.
- Note:** Use of “long bolt” manholes is discouraged because of improper sealing, unknown capacity and many are not installed in a horizontal plane which causes them not to open or close properly.
- 3.9 Where the entire dependence for emergency relief is placed upon pressure-relieving devices, the total venting capacity of both normal and emergency venting shall be enough to prevent the rupture of the shell or bottom of a vertical tank or the shell or heads if horizontal. (NFPA 30 1996, 2-3.6.4) Refer to the table in appendix A
- 3.10 Where vent pipe outlets for tanks storing Class I liquids are adjacent to buildings or public ways, they shall be located so that the vapors are released at a safe point outside of buildings and not less than 12 ft (3.6 m) above the adjacent ground level. In order to aid their dispersion, vapors shall be discharged upward or horizontally away from closely

adjacent walls. Vent outlets shall be located so that flammable vapors will not be trapped by eaves or other obstructions and shall be at least 5 ft (1.5 m) from building openings (NFPA 30 1996, 2-3.7.2)

- 3.11 Accurate daily inventory records shall be maintained and reconciled on all Class I liquid and diesel fuel storage tanks for indication of possible leakage from tanks or piping. The records shall be kept at the premises or made available for inspection by the enforcing authority within 24 hours of a written or verbal request. The records shall include, as a minimum, records showing, by product, daily reconciliation between sales, use, receipts, and inventory on hand. If there is more than one system consisting of a tank(s) serving a separate pump(s) or dispenser(s) for any product, the reconciliation shall be maintained separately for each tank system. (NFPA 30A 1996, 2-1.5)
- 3.12 All storage tanks, valves, piping and pumps shall be kept free of leaks. (2CSR 90-30.050 (7))
- 3.13 Each storage tank shall have the product it contains identified clearly and conspicuously on the container. (2 CSR 90-30.50 (8))
- 3.14 All aboveground storage tanks, except those of 2,000 gallons capacity or less that are filled by nozzle, shall be equipped with a 90% overfill alarm. (NFPA 30A 1996, 2-4.6.1 & 2 CSR 90-30.050 (27))
- 3.15 Effective July 1, 2000, plastic sight tube gauges are prohibited. (2 CSR 90-30.050 (15))  
  
**Note:** Plastic sight tube gauges have been a source of, and have supported fires that have occurred with aboveground storage tanks systems.
- 3.16 Tanks of double wall construction cannot be utilized in lieu of secondary containment. (2 CSR 90-30.050 (18))
- 3.17 Aboveground storage tanks shall not be installed under electric lines or transformers. All aboveground storage tanks shall maintain a minimum horizontal distance of 10 feet from any overhead power line or transformer.
- 3.18 Aboveground storage tanks utilizing compartments shall be constructed with a double wall center bulkhead. (2 CSR 90-30.050 (20))

## INSTALLATION OF ABOVEGROUND STORAGE TANKS AT BULK PLANTS AND SERVICE STATIONS

- 4.1 Apparatus dispensing Class I liquids into the fuel tanks of motor vehicles of the public shall not be located at a bulk plant unless separated by a fence or similar barrier from the area in which bulk operations are conducted. Aboveground tanks located at a bulk plant shall not be connected by piping to service station tanks. (NFPA 30A 1996, 2-1.3)

**Note:** This restriction is deemed necessary to reduce the likelihood of overfilling underground storage tanks. The intent is that bulk storage tanks are not to be used as a source of supply to dispensers via underground tanks.

- 4.2 Tanks shall rest on the ground or on foundations made of concrete, masonry or steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation. (NFPA 30 1996, 2-6.1)

**Note:** All tanks installed on the “ground” must be installed in such a manner that moisture will not be trapped under the tank bottom creating a corrosion and potential leak problem. It is wise to install each tank on a surface, such as “pea gravel”, that will promote drainage and allow the tank to remain stable.

- 4.3 Steel supports or exposed piling for tanks storing Class I, Class II, or Class IIIA liquids shall be protected by materials having a fire resistance rating of not less than 2 hour, except that steel saddles need not be protected if less than 12 in. (0.3 m) high at their lowest point. At the discretion of the authority having jurisdiction, water spray protection in accordance with NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, or NFPA 13, Standard for the Installation of Sprinkler Systems, or equivalent shall be permitted to be used. (NFPA 30 1996, 2-6.3)

**Note:** Unprotected steel supports are prohibited. Experience has shown that they soften and fail after only a brief exposure to fire resulting in damage to piping and a possible spill of tank contents.

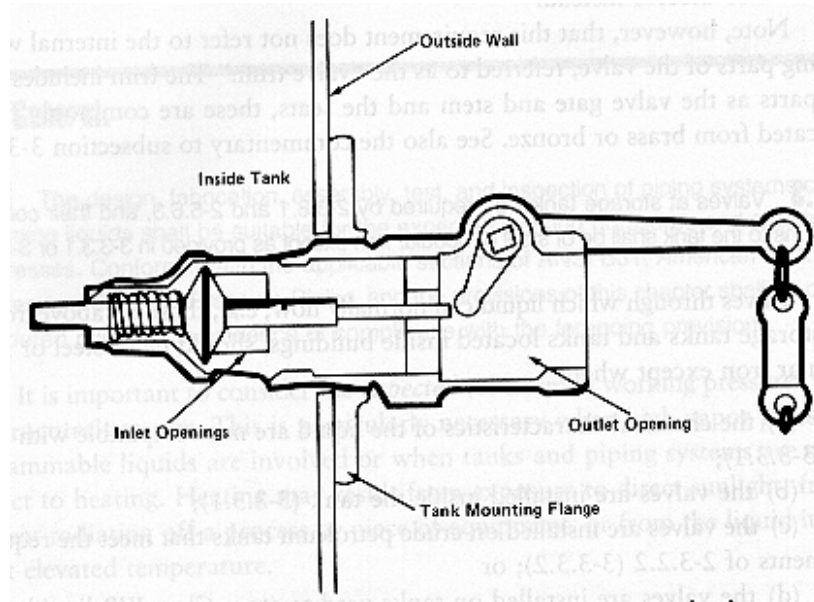
- 4.4 At service stations where tanks are at an elevation, which produces a gravity head on the dispensing device, the tank outlet shall be equipped with a device, such as a solenoid valve, positioned adjacent to and downstream from the valve specified in the following section (4.5), so installed and adjusted that liquid cannot flow by gravity from the tank in case of piping or hose failure when the dispenser is not in use. (NFPA 30A 1996, 2-1.7)

**Note:** Underground storage tanks installed above grade of dispensers/pumps produce a gravity head on dispensing devices and require such a device.

**Note:** It is important that a seal-off be installed within eighteen (18) inches of any solenoid valve. Solenoid valves are considered a heat generating device. All seal-offs must be filled with the appropriate type and volume of sealing compound. Silicone, putty or other such material is not consider appropriate type of sealing compound for “explosion proof” systems and will not be accepted.

- 4.5 Each connection to an aboveground tank through which liquid can normally flow shall be provided with an internal or an external valve located as close as practical to the shell of the tank. (NFPA 30 1996, 2-3.8.1)

**Note:** It is recommended that in systems utilizing submersible pumps that are installed in “day tanks”, that an internal fire valve be installed in the tank outlet to shut off the flow of liquid in the event of a fire involving both the storage and day tanks. (See illustration below)

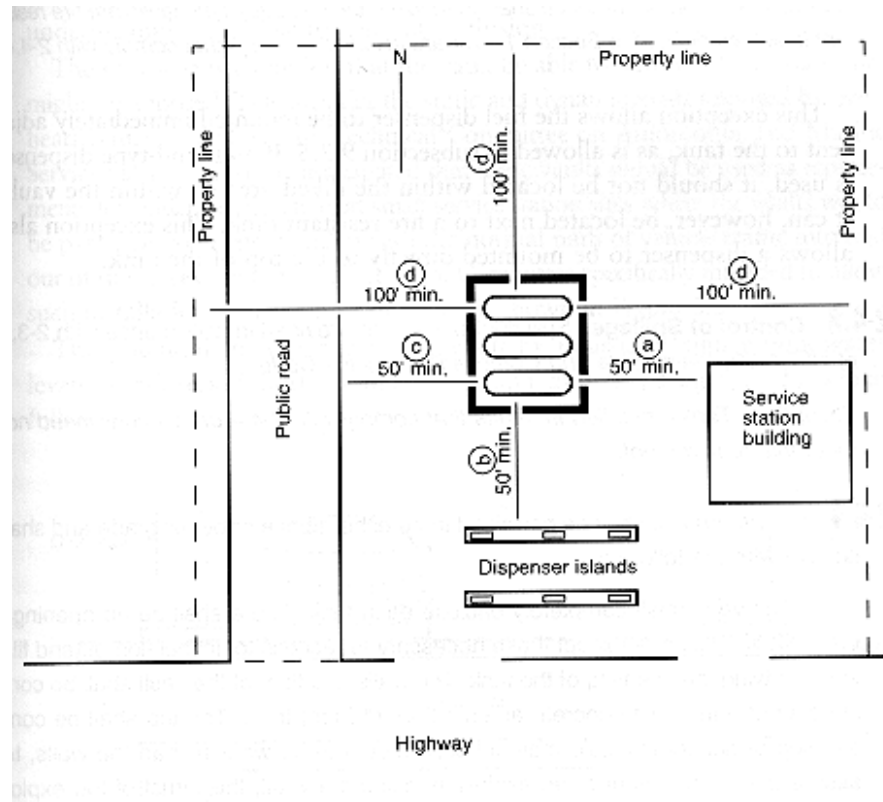


**Note:** Low melting point materials such as aluminum may soften and fail upon exposure to fire.

- 4.6 Only aboveground storage tanks shall be utilized for aboveground use. Tanks designed and built for underground use shall not be used for aboveground use. (NFPA 30A 1996, 2-4.1.1)
- 4.7 Tanks storing Class I and Class II liquids at an individual site shall be limited to a maximum individual capacity of 12,000 gallons and an aggregate capacity of 40,000 gallons unless amended by the director of agriculture if justification for the need for additional is provided in writing and the level of safety to public and property will not be diminished. (NFPA 30A 1996, 2-4.2.1 & 2 CSR 90-30.050 (13))

4.8 Aboveground tanks shall be located:

- (a) 50 feet from the nearest important building on the same property;
- (b) 50 feet from any fuel dispenser;
- (c) 50 feet from the nearest side of a public way; and
- (d) 100 feet from any property line that is or might be built upon, including the opposite side of a public way. (NFPA 30A 1996, 2-4.2.2)



**\*Exception:** all distances shall be permitted to be reduced by 50 percent if the tanks are fire-resistant tanks, which is a listed tank that provides fire-resistive protection from exposures to a high intensity liquid pool. (i.e. UL 2085)

4.9 Fire-resistant tanks shall be listed for the use intended and shall comply with the following:

- (a) The construction that provides the required fire-resistive protection shall prevent the release of liquid, failure of the primary tank, failure of the supporting structure, and impairment of venting for a period of not less than two hours when tested using fire exposure that simulates a high intensity pool fire, such as described in UL 2085, Standard for Insulated Aboveground Tanks for Flammable and Combustible Liquids, or the equivalent test procedure.
- (b) There shall be no openings except those necessary for access to, inspection of, filling, emptying, and venting of the tank. All openings shall be located in the top of the tank.



(c) Each fire-resistant tank shall be suitably anchored to withstand uplifting by groundwater or flooding, including when the tank is empty.

(d) Each fire-resistant tank shall be resistant to damage from impact of a motor vehicle or shall be protected by suitable collision barriers.

(e) Vent pipes that are provided for normal tank venting shall terminate at least 12 feet above ground level.

(f) Section 2-3.6.7 contained in the 1996 edition of NFPA 30 shall not be used to reduce the size of the emergency vent. (NFPA 30A 1996, 2-4.5)

4.10 Spill control facilities shall be provided so that any accidental discharge of any Class I, II or IIIA liquids will be prevented from endangering important facilities, adjoining property or waterways. (NFPA 30 1996, 2-3.4.1) (refer to appendix b for schematic)

**Note:** Spill control is required by both the State of Missouri (NFPA 30, 1987 Section 2-3.4.1) and the United States Environmental Protection Agency (USEPA) 40 CFR 112. The requirements contained within this section pertains only to the State of Missouri requirements. Many state requirements may duplicate those mandated by the USEPA. To insure compliance with both USEPA and Missouri requirements, information should be obtained from USEPA prior to the design and construction of any spill control facility.

**Note:** USEPA requires that any spill plan be certified by a professional engineer. It is recommended that a professional engineer be consulted regarding the location and design of any spill control facility.

**Note:** All spill control facilities must be substantially liquid tight. Any facility that is found not to have contained a product release, is in violation of state regulations and subject to legal action.

**Note:** Open cell block, gravel or rock containment facilities are not considered to be liquid tight and cannot be used (2 CSR 90-30.050 (29))

**Note:** Containment facilities shall not contain cracks or defects which would allow the loss of product from the containment facility in the event of a release.

4.11 The walls and floor of secondary containment structures shall be constructed of earth, steel, concrete or solid masonry that is compatible with the specifications of the product being stored, that is liquid tight and have the ability to contain any released product until corrective action, such as the removal of released product and subsequent cleanup including soil and groundwater, can occur. Cleanup of any released product and contaminated soil, groundwater, etc., shall be in conformance with the Department of Natural Resources environmental regulations. The walls and floor of the containment structure shall be designed to support the gravity load of the storage containers and the hydrostatic loads resulting from a release within the secondary containment structure.

Gravel, rock or open cell block structures are not considered to be liquid tight and cannot be used. (2 CSR 90-3-.050 (29))

4.12 Remote Impounding - where protection of adjoining property or waterways is by means of drainage to a remote impounding area. Such systems shall comply with the following:

(a) A slope of not less than 1 percent away from the tank shall be provided for at least fifty feet toward the impounding area.

(b) The impounding area shall have a capacity not less than that of the largest tank that can drain into it.

(c) The route of the drainage system shall be so located that, if the liquids in the drainage system are ignited, the fire will not seriously expose tank or adjoining property.

(d) The confines of the impounding area shall be located so that, when filled to capacity, the liquid will not be any closer than 50 feet from any property line that is or can be built upon or from any tank. (NFPA 30 1996, 2-3.4.2)

4.13 Impounding by diking - When protection of adjoining property or waterways is by means of impounding by diking around the tanks, such system shall comply with the following:

(a) A slope of not less than 1 percent away from the tank shall be provided for at least 50 feet or to the dike base, whichever is less. (NFPA 30 1996, 2-3.4.3)

(b) The capacity of the diked area shall not be less than the greatest amount of liquid that can be released from the largest tank within the diked area, including the volume displacement of other tanks within the diked area. (NFPA 30 1996, 2-3.4.3)

(c) To permit access, the outside base of the dike at ground level shall be no closer than 10 feet to any property line that is or can be built upon. (NFPA 30 1996, 2-3.4.3)

(d) Walls of the diked area shall be of earth, steel, concrete, or solid masonry designed to be liquid tight and to withstand a full hydrostatic head. Earthen walls 3 ft (0.9 m) or more in height shall have a flat section at the top not less than 2 ft (0.6 m) wide. The slope of an earthen wall shall be consistent with the angle of repose of the material of which the wall is constructed. Diked areas for tanks containing Class I liquids located in extremely porous soils might require special treatment to prevent seepage of hazardous quantities of liquids to low-lying areas or waterways in case of spills. (NFPA 30 1996, 2-3.4.3)

**Note:** The porous soil conditions in many areas of Missouri make earthen dikes unacceptable unless liner systems are used to insure liquid tightness of the containment system. Because of fire exposure, liners must be protected adequately when installed.

(e) Where provision is made for draining water from diked areas, such drains shall be controlled in a manner so as to prevent flammable or combustible liquids from entering natural water courses, public sewers, or public drains, if their presence would constitute a hazard. Control of drainage shall be accessible under fire conditions from outside of dike (NFPA 30 1996, 2-3.4.3)

**Note:** Drain piping and drain valves must be of metal construction.

(f) Storage of combustible materials, empty or full drums, or barrels, shall not be permitted within the diked area. (NFPA 30 1996, 2-3.4.3)

- 4.14 Where a tank is located in an area subject to flooding, provisions shall be taken to prevent tanks, either full or empty, from floating during a rise in water level up to the established maximum flood stage. ((NFPA 30 1996, 2-6.6)

## **PIPING, VALVE & FITTING REQUIREMENTS FOR BULK PLANTS AND SERVICE STATIONS**

- 5.1 The design, fabrication, assembly, test and inspection of piping systems containing liquids shall be suitable for the expected working pressure and structural stresses. (NFPA 30 1996, 3-2.1)
- 5.2 Piping systems shall be maintained liquid tight. A piping system that has leaks that constitutes a hazard shall be emptied of liquid or repaired in a manner acceptable to the authority having jurisdiction. (NFPA 30 1996, 3-2.2)
- 5.3 Valves at storage tanks shall be permitted to be other than steel or nodular iron where the chemical characteristics of the liquid stored are not compatible with steel or where installed internally to the tank. Where installed externally to the tank, the material shall have a ductility and melting point comparable to steel or nodular iron so as to withstand reasonable stresses and temperatures involved in fire exposure or otherwise be protected, such as by materials having a fire resistance rating of not less than 2 hours. (NFPA 30 1996, 3-3.31)
- 5.4 Low melting point materials such as aluminum, copper, and brass, materials that soften on fire exposure such as plastics, or nonductile material such as cast iron shall be permitted to be used underground for all liquids within the pressure and temperature limits of ANSI B31, American National Standard Code for Pressure Piping. If such materials are used outdoors in aboveground piping systems handling Class I, Class II, or Class IIIA liquids or within buildings handling any liquid they shall be either: (a) resistant to damage by fire, (b) so located that any leakage resulting from the failure will not unduly expose persons, important buildings, or structures, or (c) located where leakage can readily be controlled by operation of an accessible remotely located valve(s). (NFPA 30 1996, 3-3.4)
- 5.5 Nonmetallic piping, including piping systems incorporating secondary containment, shall be built in accordance with recognized standards of design or approved equivalents and shall be installed in accordance with the previous section, 5.4. Nonmetallic piping shall be built, installed, and used within the scope of their approvals or within the scope of Underwriters Laboratories Inc.'s Standard for Nonmetallic Underground Piping for Flammable Liquids, UL 971. (NFPA 30 1996, 3-3.6)
- 5.6 All piping, including fiberglass and other non-metallic piping, constructed of low melting point materials shall be installed in conformance with manufacturers instructions. All piping, including fiberglass and other non-metallic piping, constructed of low melting point materials cannot be installed in dispensing devices or open pits beneath the dispensing device, unless the piping is protected from fire exposure by a method having a two (2)-hour fire rating and that is approved by the director of the Department of Agriculture.

**Note:** There may be methods and or equipment available whereby the dispensing system can be retro-fitted to provide required protection at a reasonable and easily attainable cost. If you have questions regarding this matter please contact the Division of Weights and Measures at 573-751-4278.

5.7 Piping systems shall be substantially supported and protected against physical damage and excessive stresses arising from settlement, vibration, expansion or contraction. (NFPA 30 1996, 3-5)

5.8 All piping systems for liquids, both aboveground and underground, that are subject to external corrosion shall be protected. Underground piping systems shall be protected in accordance with the following: (NFPA 30 1996, 2-4.3)

(a) A properly engineered, installed, and maintained cathodic protection system in accordance with recognized standards of design, such as:

1. American Petroleum Institute Publication 1632, Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems;

2. Underwriters Laboratories of Canada ULC-S603.1 M, Standard for Galvanic Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids;

3. Steel Tank Institute Standard No. Sti-P3®, Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks;

4. National Association of Corrosion Engineers Standard RP-01-69 (1983 rev.), Recommended Practice, Control of External Corrosion of Underground or Submerged Metallic Piping Systems;

5. National Association of Corrosion Engineers Standard RP-02-85, Recommended Practice, Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems; and

6. Underwriters Laboratories Inc., Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks, UL 1746, Part 1.

(b) Approved or listed corrosion-resistant materials or systems, which can include special alloys, fiberglass reinforced plastic, or fiberglass reinforced plastic coatings.

5.9 Piping systems shall contain a sufficient number of valves to operate the system properly and to protect the plant. Piping systems in connection with pumps shall contain a sufficient number of valves to control properly the flow of liquid in normal operation and in the event of physical damage. Each connection to piping by which equipment such as tank cars, tank vehicles, or marine vessels discharge liquids into storage tanks shall be provided with a check valve for automatic protection against back-flow if the piping arrangement is such that back-flow from the system is possible. (NFPA 30 1996, 3-8)

- 5.10 Each connection to piping by which equipment such as tank cars, tank vehicles or marine vessels discharge liquids into storage tanks shall be provided with a check valve for automatic protection against back-flow if the piping arrangement is such that back-flow from the system is possible. (NFPA 30 1996, 3-8)
- 5.11 All piping, before being covered, enclosed or placed in use, shall be tested. (NFPA 30 1996, 3-9)
- 5.12 Each loading and unloading riser for liquid storage shall be identified by color code or marking to identify the product for which the tank is used. (NFPA 30 1996, 3-10)
- 5.13 All electrical equipment shall comply with the National Electrical Code. (NEC 1996)

# Appendix A





Table 2 A  
 Approximate Wetted Areas for Vertical Tanks  
 (Area of Shell to Elevation Not More than 30 Ft. Above Bottom)

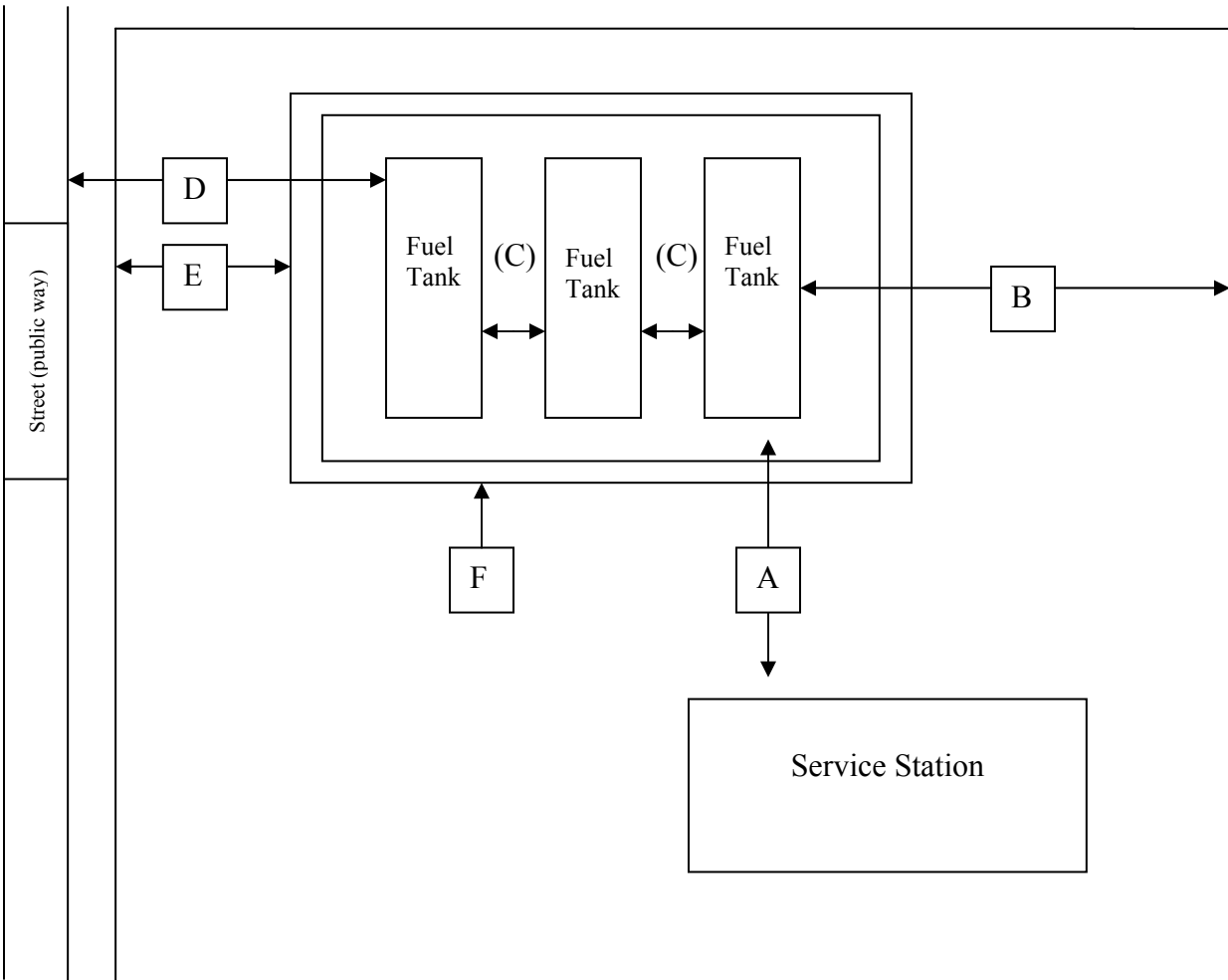
Tank diameter	3 feet	4 feet	5 feet	6 feet	7 feet	8 feet	9 feet	10 feet	11 feet	12 feet
Tank length										
3 feet	28									
4 feet	38	50								
5 feet	47	63	79							
6 feet	56	76	94	113						
7 feet	66	88	110	132	154					
8 feet	75	101	127	151	176	201				
9 feet	85	113	141	170	198	226	255			
10 feet	94	126	157	189	220	251	283	314		
11 feet	103	139	173	208	242	276	311	345	381	
12 feet	113	151	188	227	264	301	340	377	415	452
13 feet		164	204	246	286	326	368	408	450	490
14 feet		176	220	265	308	351	396	440	484	528
15 feet		189	236	284	330	377	424	471	519	566
16 feet		202	251	302	352	402	453	502	554	603
17 feet			267	321	374	427	481	534	588	641
18 feet			283	340	396	452	510	565	623	679
19 feet			298	359	418	477	538	597	657	716
20 feet			314	378	440	502	566	628	692	754
21 feet				397	462	527	594	659	727	792
22 feet				416	484	552	623	691	761	829
23 feet				435	506	577	651	722	796	867
24 feet				454	528	602	679	757	830	905
25 feet					550	628	708	785	865	943
26 feet					572	653	736	816	900	980
27 feet					594	678	764	848	934	1018
28 feet					616	703	792	879	969	1056
29 feet						728	821	911	1003	1093
30 feet						753	849	942	1038	1131

Table 3 A

**Emergency Venting Capacity**

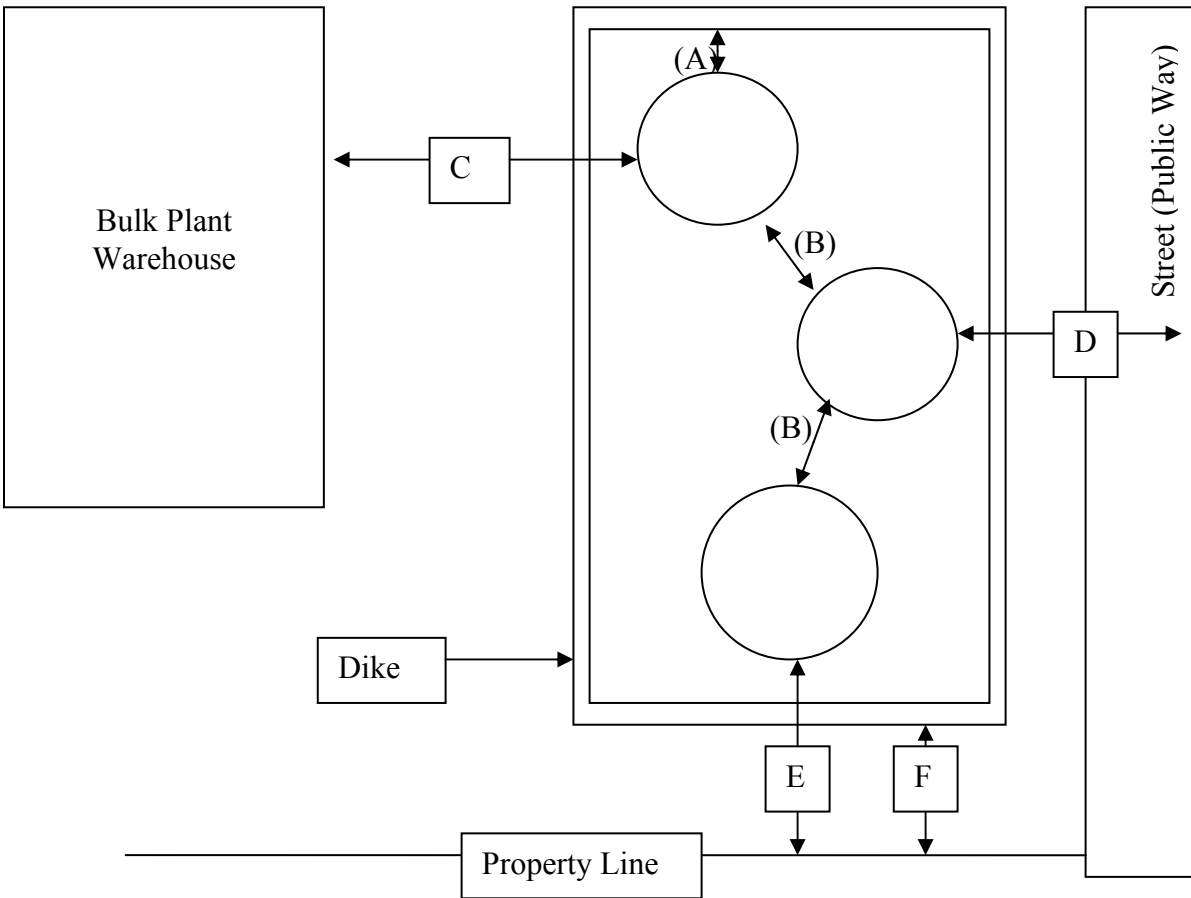
Wetted Surface Area in Square feet	Venting capacity in cubic feet per hour (CFH)	Minimal opening, nominal pipe size in inches
20	21,000	2
30	31,600	2
40	42,100	3
50	52,700	3
60	63,200	3
70	73,700	4
80	84,200	4
90	94,800	4
100	105,000	4
120	126,600	5
140	147,000	5
160	168,000	5
180	190,000	5
200	211,000	6
250	239,000	6
300	265,000	6
350	288,000	8
400	312,000	8
500	354,000	8
600	392,000	8
700	428,000	8
800	462,000	8
900	493,000	8
1000	524,000	10
1200	557,000	10
14000	587,000	10
1600	614,000	10
1800	639,000	10
2000	662,000	10
2400	704,000	10
2800 & over	742,000	10
>At 14.7 psi and 60 degrees F >Interpolate for intermediate values		>These pipe sizes apply only to open vent pipes to the specified diameter not more than 12 inches long

# Appendix B



### Distance Requirements

- A. Distance from storage to nearest important building.
- B. Distance from storage tank to property line that can be built upon.
- C. Tank spacing
- D. Distance from storage tank to public way.
- E. Dike distance to property line. Minimum of ten feet required.
- F. If dike wall is above six feet in height, the minimum spacing between the dike wall and storage tank must be at least five feet.

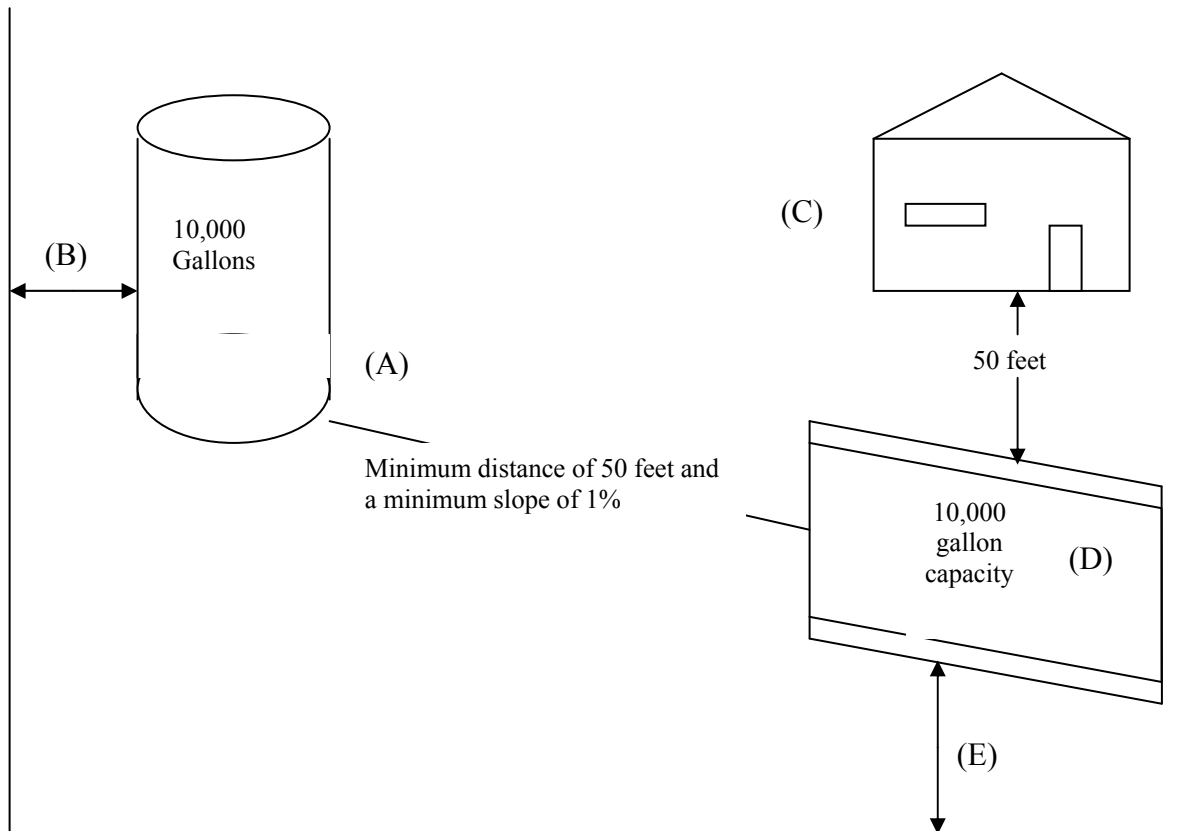


### Diking

- A. If dike wall is six feet or more in height, the minimum spacing between the dike wall and tank must be at least five feet.
- B. Tank spacing
- C. Tank distance from important buildings on same property
- D. Distance from tank to public ways
- E. Distance from tank to property lines
- F. Distance from dike to property line. Must be a minimum of ten feet.

**\*Note:** Other provisions may apply to installations requiring dike walls in excess of six feet.

**\*Note:** Dike capacity must hold contents of the largest tank plus the displacement of other tanks within the dike.

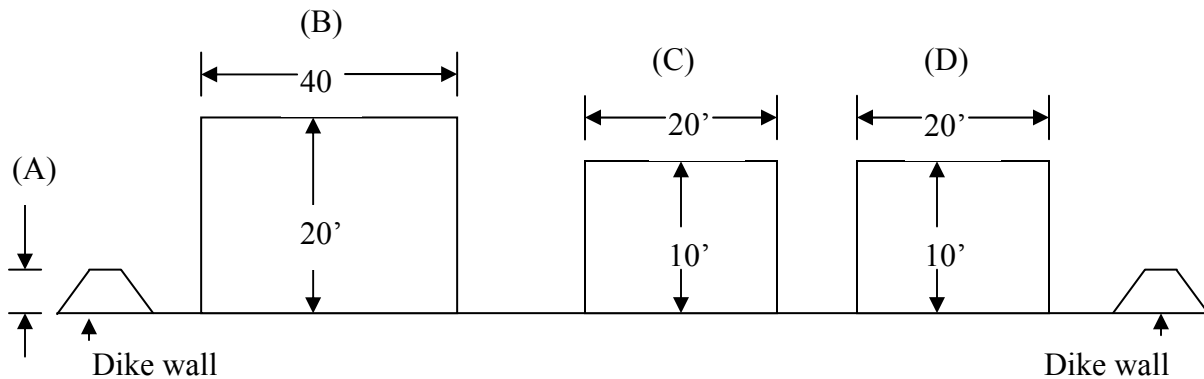


### Remote Impounding

- A. Tank must be a minimum of 50 feet from impounding area
- B. Distance of tank from property lines
- C. Important building on same property must be a minimum of 50 feet from impoundment
- D. Impoundment must be able to hold the contents of the largest tank
- E. Impoundment area must be a minimum of 50 feet from property lines

# Appendix C

## Dike Volume Multi-Tank Installation



1. Dike volume must be adequate to contain the volume of the largest tank (B), plus the area displaced by the other tanks within the diked area (C) (D).
2. Tanks (C) and (D) will displace volume only below the top of the dike area.
3. To calculate volume of tank (B):

$$\frac{\pi \times d^2 \times h}{4} = V \quad \text{Example: } 3.14 \times 40' \times 40' \times 20' \div 4 = 25,120 \text{ cubic feet}$$

4. To calculate volume displacement of tank (C) and (D):

$$\frac{\pi \times d^2 \times \text{dike height}}{4} = V \quad \text{Example: } 3.14 \times 20' \times 20' \times 5' \div 4 = 1,570 \text{ cubic feet}$$

5. Total dike volume required:

Contents of tank (B) 25,120 cubic feet x 7.481 gal/cu.ft.= 187,923 gallons

Contents of tank (C) 1,570 cubic feet x 7.481 gal/cu.ft.= 11,745 gallons

Contents of tank (D) 1,570 cubic feet x 7.481 gal/cu.ft.= 11,745 gallons

Total 28,620 cubic feet x 7.481 gal/cu.ft.=211,413 gallons

Note:  $\pi = 3.14$

h = height

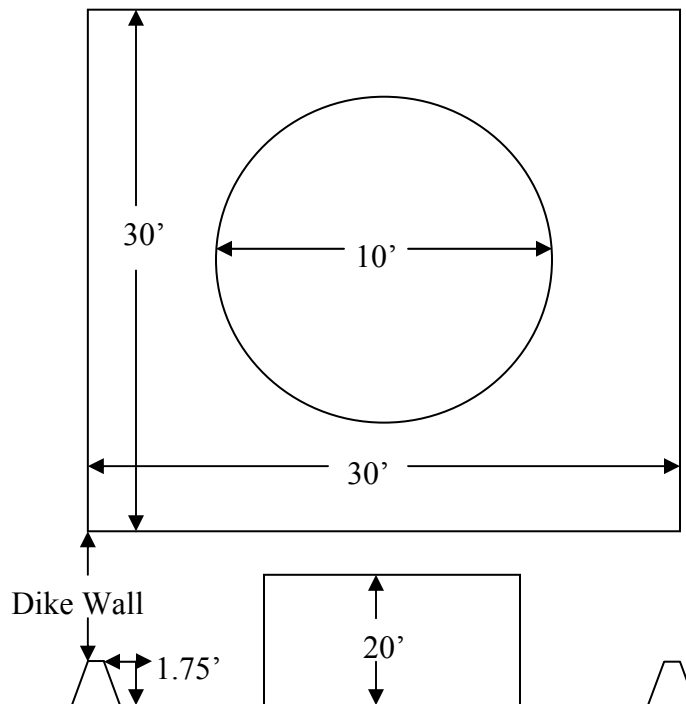
d<sup>2</sup>= diameter squared

V= volume

7.481 gallons per cubic foot



# Dike Volume Single Tank Installation



1. Dike volume must be able to hold 100% of the tank contents
2. Formula for calculating tank volume:  
$$V = \frac{\pi \times d^2 \times h}{4}$$
 Example:  $3.14 \times 10' \times 10' \times 20' \div 4 = 1,570$  cubic feet

3. Dike volume must be a minimum of 1,570 cubic feet (11,745 gallons) to contain 100% of the tank capacity.

4. Formula to calculate dike capacity:  
Length x Width x Height = Volume in cubic feet

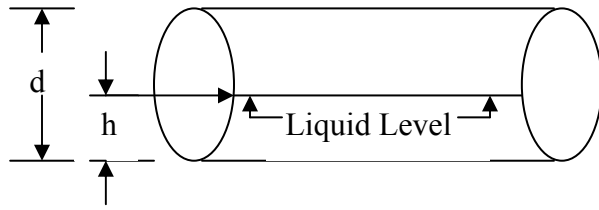
Example: Length 30'  
Width 30'  
Height 1.75'

$$30' \times 30' \times 1.75' = 1,570 \text{ cubic feet}$$

$$1,570 \text{ cubic feet} \times 7.481 \text{ gal/cu. Ft.} = 11,745 \text{ gallons}$$

Note: an allowance should also be made for the accumulation of Precipitation (rain, snow, etc.).

## Volume of a partially filled horizontal cylindrical tank with flat ends



$$\text{Factor} = \frac{h}{d}$$

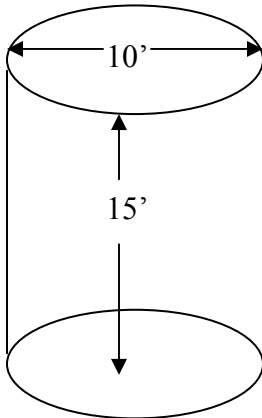
Factor	Percent of tank capacity	Factor	Percent of tank capacity
0.15	1.9	0.55	56.4
0.10	5.2	0.60	62.6
0.15	9.4	0.65	68.8
0.20	14.2	0.70	74.8
0.25	19.5	0.75	80.4
0.30	25.2	0.80	85.8
0.35	31.2	0.85	90.6
0.40	37.4	0.90	94.8
0.45	43.6	0.95	98.1
0.50	50.0	1.00	100.0

Example: Tank capacity = 10,000 gallons  
 Liquid level (h) = 19 inches  
 Diameter of tank (d) = 96 inches

$$\text{Factor} = \frac{h}{d} = \frac{19}{96} = .20$$

$$10,000 \times 14.2 \div 100 = 1,420 \text{ gallons}$$

### Vertical Tank Volume



1. Formula

$$\frac{\pi \times d^2 \times h}{4} = \text{Volume in cubic feet}$$

Example:  $3.14 \times 10' \times 10' \times 15 \div 4 = 1,177.5 \text{ cu. ft.}$

2. To calculate gallons:

$$1,177.5 \text{ cubic feet} \times 7.481 = 8,808.87 \text{ gallons}$$

3. Tank volume is:

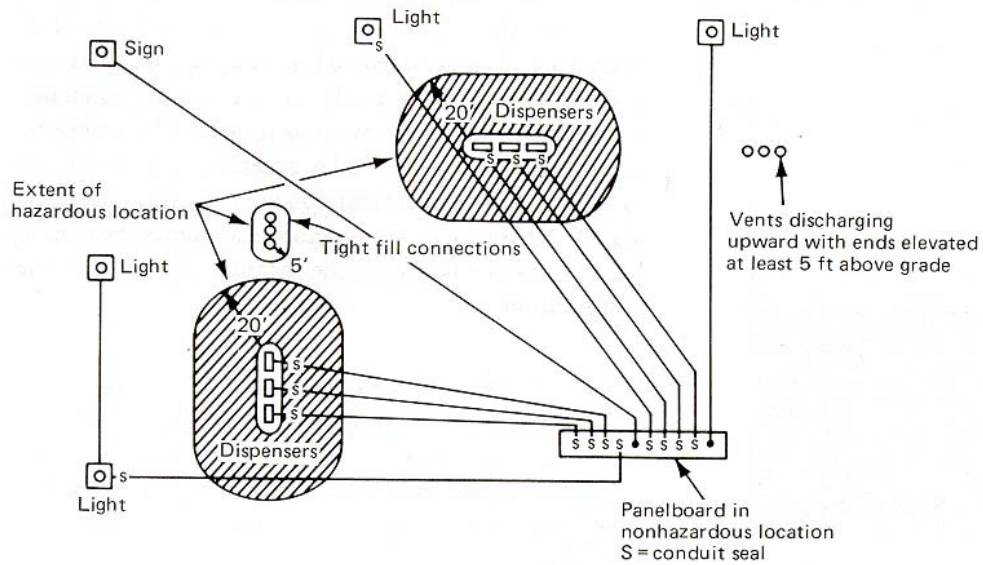
$$1,177.5 \text{ cubic feet or } 8,808.87 \text{ gallons}$$

Note:  $\pi = 3.14$

$d^2$  = Diameter squared

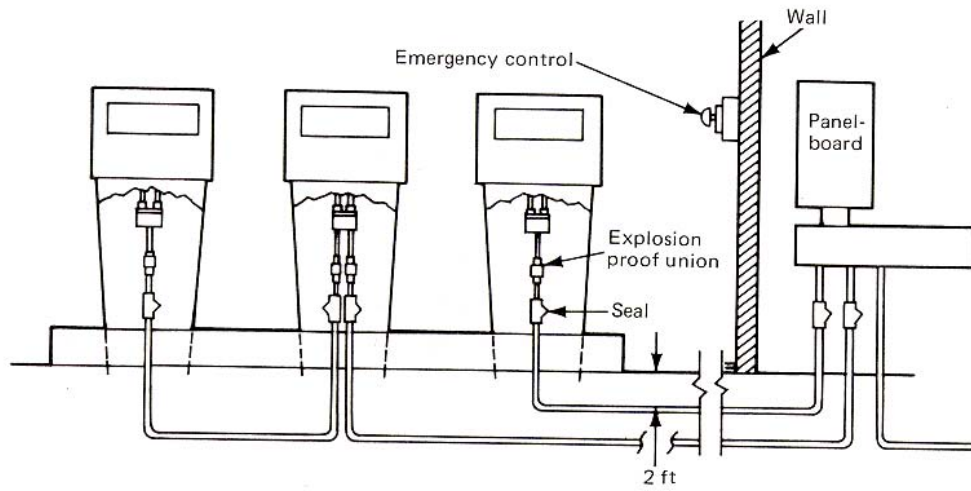
one cubic foot = 7.481 gallons

h = Height

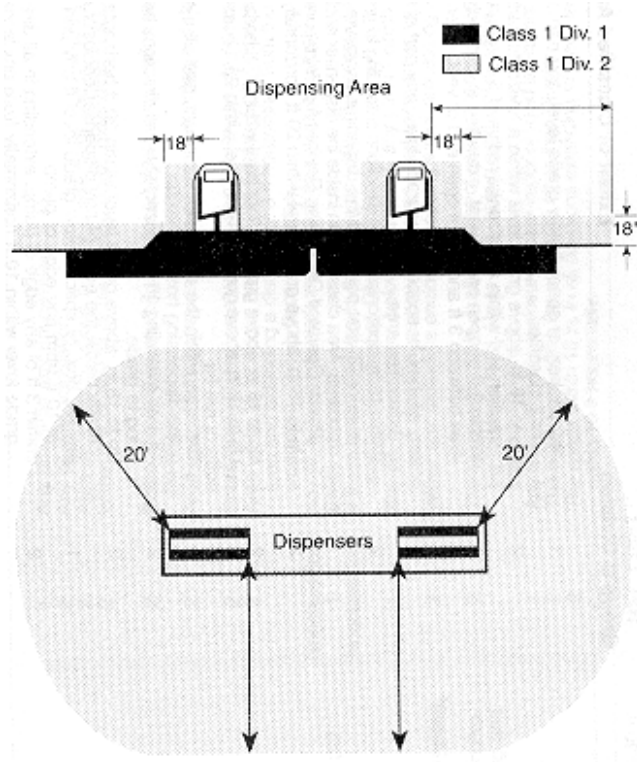


Seals are required at points marked “S”. Seals are not required at the sign and two of the lights because conduit runs do not pass through a hazardous location.

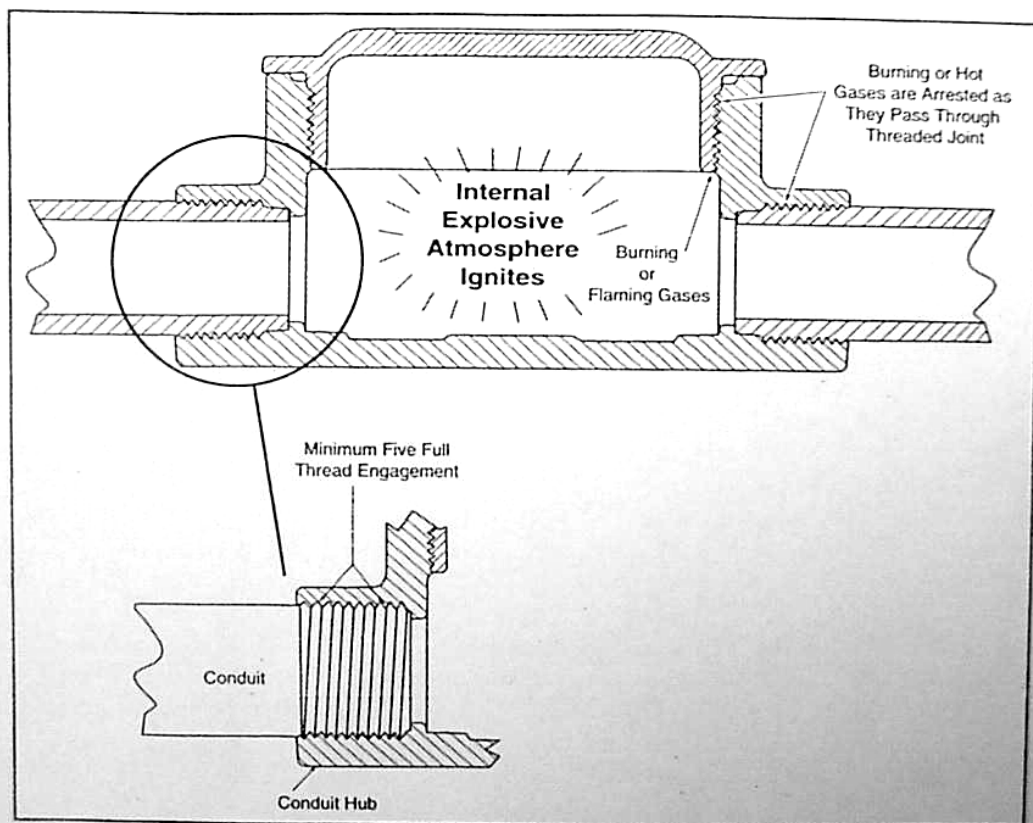
Tanks vents must discharge at least twelve (12) feet above grade so that vapors can dissipate away from sources of ignition such as lighting, meter bases, breaker boxes, air conditioner compressors, etc.



A gasoline dispensing installation indicating locations for sealing fittings. Emergency controls are required for service stations.

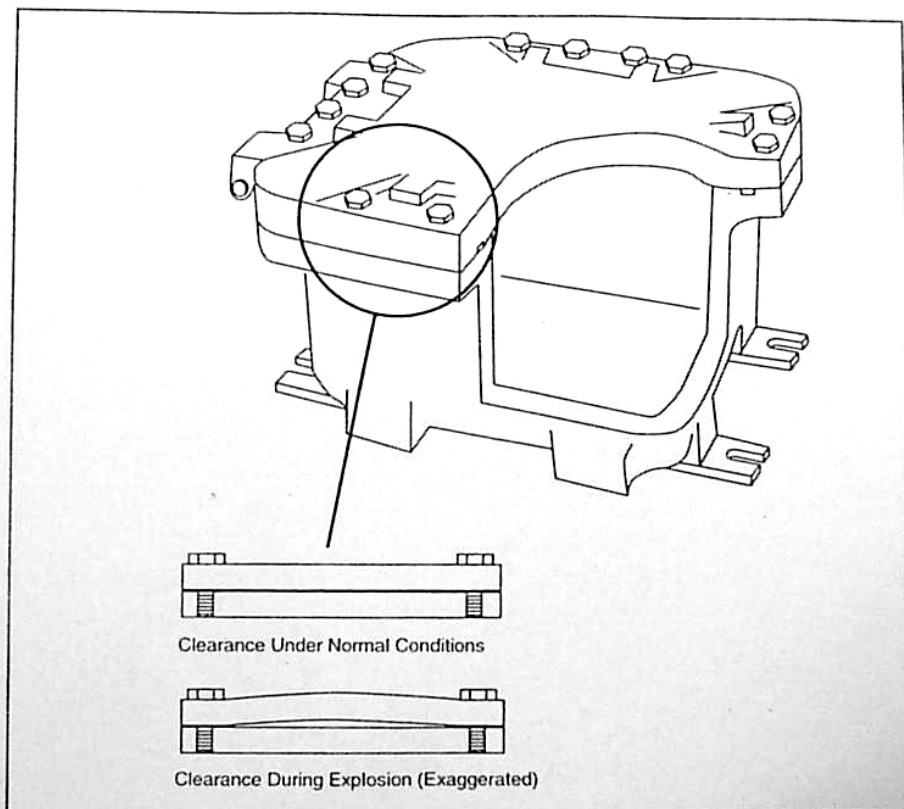


Classified areas adjacent to fuel dispensers

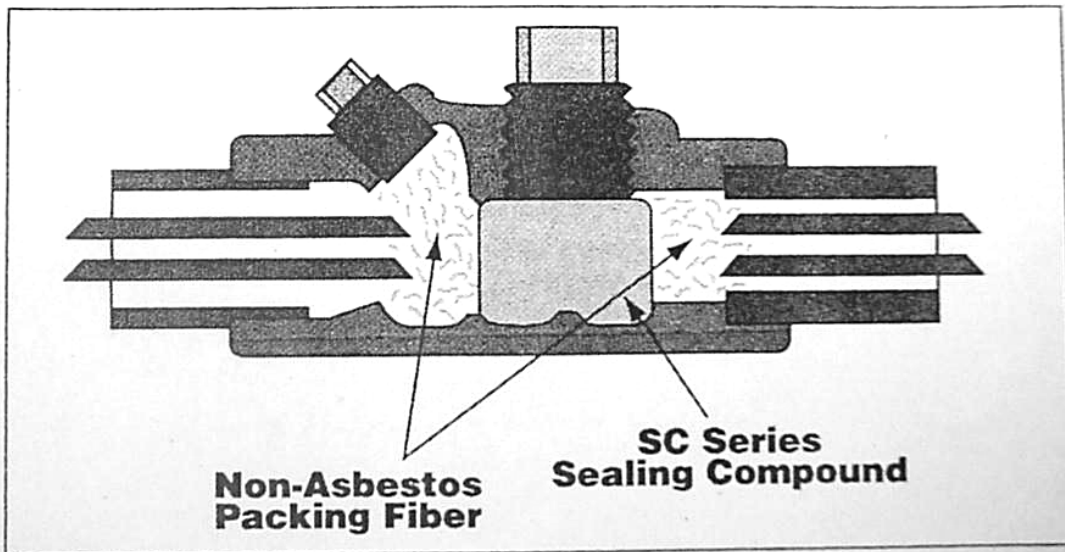


***Threaded Joint***

Threaded joints must be engaged a minimum of five full threads.



All explosion proof electrical boxes must have all bolts installed and tightened to a proper torque as required by the manufacturer. Those boxes with machined mating surfaces must remain clean and without damage to work appropriately.



All seal-offs must be installed at the proper location and be sealed with an appropriate compound. Silicone, putty or other similar material is not acceptable.



# Appendix D