Overfill Prevention for Aboveground Storage Tanks—A Few Basics

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Objectives

- Why Overfill Prevention is Important
- Regulatory Requirements Review
- Using Tank Charts

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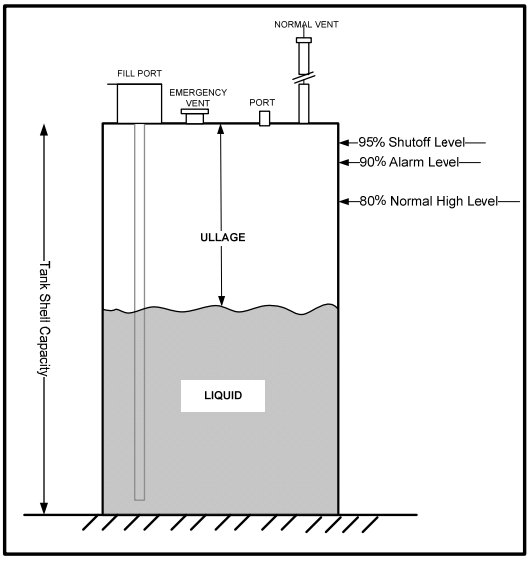
Overfill Prevention

Why is Overfill Prevention Needed

- Overfills are the most common way that releases occur
- Overfills often result in injury, fire, or human exposure to petroleum
- Overfilling stresses the tank beyond its design
- Overfills waste product and money by requiring cleanups



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Overfill Prevention

- Overfilling the tank normally results in petroleum coming out of the vents, usually the primary vent—although it can exit other locations with openings
- Special risks exist for sites where the delivery person can't see the tank or the vents—known as blind fills.

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Characteristics of Flammable & Combustible Liquids

Coefficient of Thermal Expansion

- Fuels and Other Petroleum Compounds expand with temperature—typically around 0.5% with each 10 degree rise in temperature. This varies somewhat by product

Example: 5000 gallons of diesel fuel is delivered to tank at 60 degrees F. Later, the fuel temperature inside the tank increases to 70 degrees F due to the sun's heat. How many gallons are there now at this temperature?

About 5025 gallons, or about another 25 gallons

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Regulatory Requirements Review

- SPCC Regulation: 40 CFR 112.8(c)(8)—for Bulk Storage Containers
- California Fire Code Chapter 57, Flammable and Combustible Liquids
- California Fire Code Chapter 23, Motor Fuel Dispensing and Repair Garages

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SPCC Regulation: 40 CFR 112.8(c)(8)—for Bulk Storage Containers

(8) Engineer or update each container installation in accordance with good engineering practice to avoid discharges. You must provide at least one of the following devices:

(i) High liquid level alarms with an audible or visual signal at a constantly attended operation or surveillance station. In smaller facilities an audible air vent may suffice.

(ii) High liquid level pump cutoff devices set to stop flow at a predetermined container content level.

(iii) Direct audible or code signal communication between the container gauger and the pumping station.

(iv) A fast response system for determining the liquid level of each bulk storage container such as digital computers, telepulse, or direct vision gauges. If you use this alternative, a person must be present to monitor gauges and the overall filling of bulk storage containers.

(v) You must regularly test liquid level sensing devices to ensure proper operation.

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California Fire Code Chapter 57, Flammable and Combustible Liquids

5704.2.7.5.8 Overfill prevention. An approved means or method in accordance with Section 5704.2.9.7.5 shall be provided to prevent the overfill of all Class I, II and IIIA liquid storage tanks. Storage tanks in refineries, bulk plants or terminals regulated by Section 5706.4 or 5706.7 shall have overfill protection in accordance with API 2350.

An approved means or method in accordance with Section 5704.2.9.7.5 shall be provided to prevent the overfilling of Class IIIB liquid storage tanks connected to fuel-burning equipment inside buildings.

Exception: Outside above-ground tanks with a capacity of 1,320 gallons (5000 L) or less.

Note that some CA fire jurisdictions do not allow the exception above

Fire Code Flammable and Combustible Liquids Classifications

Class I: Flammable Flash Point <100°F (e.g., gasoline)
Class II: Combustible Flash Point ≥100°F but < 140°F (e.g., diesel, kerosine)
Class III: Combustible Flash Point ≥140°F
Class IIIB: ≥200°F Motor Oil, Lube Oil, Waste Oil

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California Fire Code Chapter 57, Flammable and Combustible Liquids

5704.2.9.7.5 Overfill prevention. Protected aboveground tanks shall not be filled in excess of 95 percent of their capacity. An overfill prevention system shall be provided for each tank . During tank-filling operations, the system shall comply with one of the following:

1. The overfill prevention system shall include the following:
   1.1 An independent means of notifying the person filling the tank that the fluid level has reached 90 percent of tank capacity by providing an audible or visual alarm signal, providing a tank level gauge marked at 90 percent of tank capacity, or other approved means.

   1.2. Automatic shut off of the flow of fuel to the tank when the quantity of liquid in the tank reaches 95 percent of tank capacity. For rigid hose fuel-delivery systems, an approved means shall be provided to empty the fill hose into the tank after the automatic shutoff device is activated.

2. The system shall reduce the flow rate to not more than 15 gallons per minute (0.95 L/s) so that at the reduced flow rate, the tank will not overfill for 30 minutes, and automatically shut off flow into the tank so that none of the fittings on the top of the tank are exposed to product because of overfilling.

*Note that 5704.2.9.7.5 is in a section of Chapter 57 that cites "additional requirements for protected tanks"…but as referenced, it applies to all tanks containing Class I, II, or IIIA liquids.

There are additional requirements for tanks storing Class I, II or IIIA liquids inside buildings under **5704.2.9.5 Aboveground tanks inside of buildings**

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CFC Chapter 23, Motor Fuel Dispensing Facilities and Repair Garages

2306.6.2.3 Overfill protection. Overfill protection shall be provided for above-ground flammable and combustible liquid storage tanks in accordance with Sections 5704.2.7.5.8 and 5704.2.9.7.5.

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Recommended Practices

API Recommended Practice 2350 "Overfill Protection for Storage Tanks in Petroleum Facilities"

Applies primarily to Bulk Plants, Terminals, and tanks at refineries; would not cover fueling facilities

It does not cover the following:

- ASTs < 1320 gal;
- Tanks integral to a process;
- Tanks containing Class IIIB liquids
- Loading or delivery from wheeled vehicles, like tank trucks or rail cars

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Recommended Practices

PEI RP 600 "Recommended Practices for Overfill Protection for Shop-Fabricated Aboveground Tanks"

Applies to stationary and atmospheric aboveground tanks intended for the storage or supply of liquid petroleum products and alternative fuels.

Typical ASTs construction types: UL 142, UL 80, UL 2085, API 650 Appendix J, API 12F or other nationally recognized standards.

Covers motor fuels dispensing, emergency generator systems, bulk storage or supply, residential and commercial heating oil supply, and used oil storage and supply

Does not cover tanks where fuel is delivered by pipelines or marine vessels, or for filling tank vehicles or rail car tankers.

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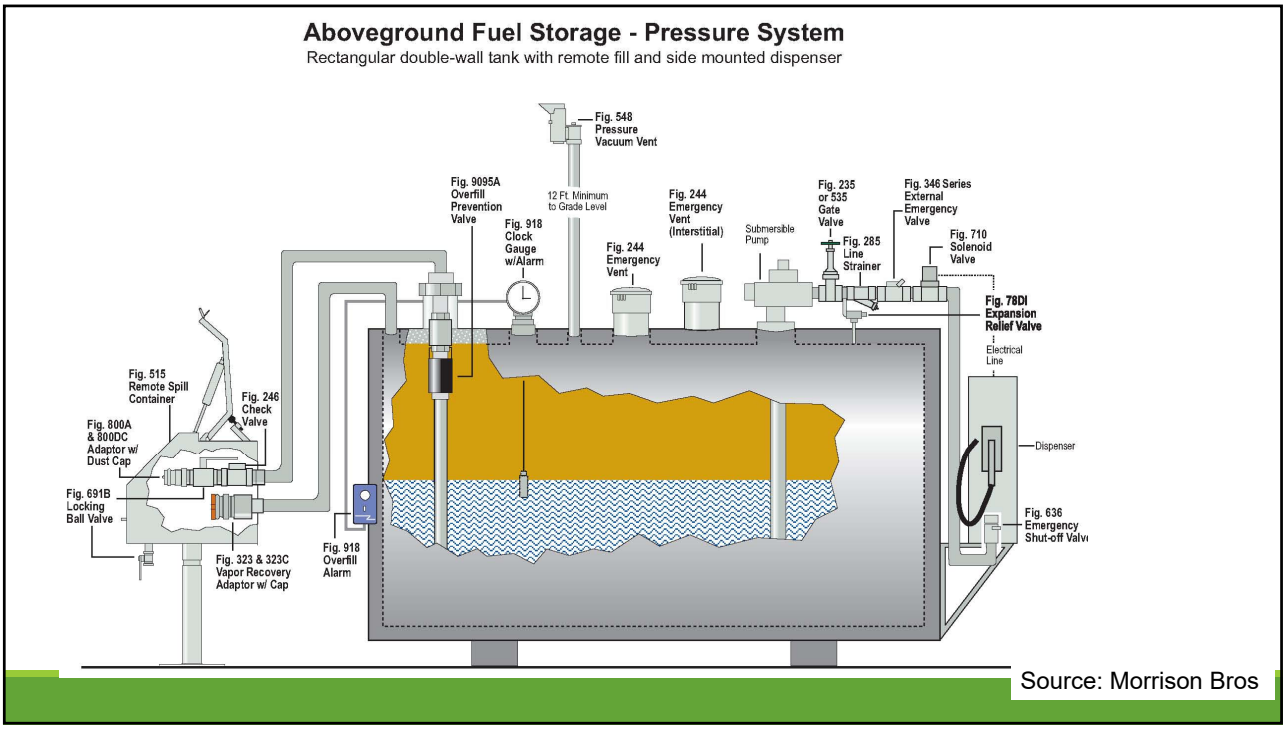

Source: Morrison Bros

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Overfill Prevention

Procedural Methods-Written

- Procedure explains the steps needed during a product transfer
- Requires means to know tank level-manual sticking or accurate gauge
- Requires means to identify maximum allowable limit-This requires a tank calibration chart (tank chart); this limit should be clear and preferably posted at tank fill location
- Requires calculation as to how much product is to be added to tank to avoid exceeding fill limit

Tank charts can be obtained from the manufacturer or online calculators exist.

(all dimensions are inches)	Length	Width	Height
External Dimensions	277	96	105
Internal Dimensions	263.25	82.25	86
Nominal Capacity	8,000	Gallons	
100% Tank Capacity	8,060	Gallons	**93.73** Gallons-per-Inch

Inches	Gallons	Inches	Gallons	Inches	Gallons	Inches	Gallons
1/8	12	16	1500	40	3749	64	5998
1/4	23	17	1593	41	3843	65	6092
3/8	35	18	1687	42	3937	66	6186
1/2	47	19	1781	43	4030	67	6280
5/8	59	20	1875	44	4124	68	6373
3/4	70	21	1968	45	4218	69	6467
7/8	82	22	2062	46	4311	70	6561
1	94	23	2156	47	4405	71	6655
		24	2249	48	4499	72	6748
1	94	25	2343	49	4593	73	6842
2	187	26	2437	50	4686	74	6936
3	281	27	2531	51	4780	75	7029
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6	562	30	2812	54	5061	78	7311
7	656	31	2906	55	5155	79	7404
8	750	32	2999	56	5249	80	7498
9	844	33	3093	57	5342	81	7592
10	937	34	3187	58	5436	82	7686
11	1031	35	3280	59	5530	83	7779
12	1125	36	3374	60	5624	84	7873
13	1218	37	3468	61	5717	85	7967
14	1312	38	3562	62	5811	86	8060
15	1406	39	3655	63	5905		

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Using a Tank Chart

How much fuel can I put in before reaching the 90% limit in my tank?

Let's do the math:
Tank has nominal 8000 gallon capacity

8000 x .90 = 7,200 gallons= 90% limit

(here I selected 76 inches = 7123 gallons to round to nearest inch; this also adds conservatism)

(all dimensions are inches)			Length	Width	Height		
External Dimensions			277	96	105	90% LIMIT	
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Overfill Prevention

What is the level in this tank?
How much fuel can I put in before reaching the 90% limit?

(all dimensions are inches)			Length	Width	Height		
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Using a Tank Chart

What is the level in this tank?
3 feet 11 inches, or 47 inches; tank has 4405 gallons of product

How much fuel can I put in before reaching the 90% limit?

90% = 7123-4405 = 2,718 gallons

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90% LIMIT

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Tank Gauges and Charts

What is the level in this tank?

How many gallons are in this tank?

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Questions?

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