

All About APSA Tanks

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Purpose

Provide background information about tanks subject to APSA

Provide examples of shop-fabricated and field erected tanks

Discuss construction standards used in fabricating these tanks

Provide overview of inspection standards used for making sure these tanks are properly inspected consistent with APSA and SPCC

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Disclaimer

This presentation provides information that in many cases will be considered guidance. As such, it does not have statutory or regulatory authority for compliance matters.

Refer to the published statute or regulations for compliance purposes.

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Just APSA Tanks?

While the title of this presentation is “All About APSA Tanks”, there really aren’t “APSA tanks”...

- The Aboveground Petroleum Storage Act (APSA) presented in CA H&S Code Division 20, Chapter 6.67 is the California statute that authorizes the APSA program.
- The APSA statute was designed to align with and largely parallel that of the Federal SPCC program. The authors of APSA wanted to ensure that conformance with the SPCC program was maintained.
- APSA’s scope covers somewhat less than the Federal SPCC program due to the definition of “petroleum”, and by the exclusions derived from the definition of “aboveground storage tank” in the statute

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What's Not an APSA Tank?

Tanks storing liquids not meeting the definition of petroleum liquid at 60 degrees F at 14.7 pounds per square inch absolute (psia) such as:

- Tanks that contain petroleum that is solid at room temperature (e.g., asphalt tanks that require heating to remain liquid, tanks storing paraffin waxes, etc.)
- Tanks holding animal fats and vegetable oils, and similar products
- Other examples exist—see the Petroleum FAQs at the OSFM website at <https://osfm.fire.ca.gov/divisions/pipeline-safety-and-cupa/certified-unified-program-storage-cupa/aboveground-petroleum-storage-act/petroleum/>
- Note that these tanks still remain subject to the SPCC rule



Insulated tank storing asphalt—not in APSA, but included in SPCC

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What's Not an APSA Tank?

Tanks excluded from the definition of AST in 25270.2

- Pressure vessel or boiler subject to Part 6 (commencing with Section 7620) of Division 5 of the California Labor Code
- Tanks storing hazardous waste or extremely hazardous waste if a permit has been authorized by DTSC, or a permit by rule (PBR) authorization from the CUPA
- Aboveground oil production tanks subject to Section 3106 of Public Resources Code
- Oil filled electrical equipment meeting certain conditions--either containing <10,000 gallons of dielectric fluid, or >10,000 gallons with < 50 ppm PCBs with appropriate diversionary structures and visually inspected (see Statute for specifics)

Note that all of the above are still subject to the SPCC rule

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What's Not an APSA Tank?

Tanks excluded from the definition of AST in 25270.2

- USTs regulated under Section 25280 of CA H&S Code and Chapter 16 of Title 23—that does not meet the definition of a tank in an underground area (TIUGA)
- Transportation-related tank facility subject to authority and control of USDOT (as defined in MOU)
- Tank or tank facility located on and operated by a farm exempt from Federal SPCC regulations

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Tanks-Classified by Internal Pressure

Tanks, Containers, and Vessels are fabricated of numerous designs—based on the client needs and creativity of the fabricator

Tanks can be classified based on operating pressure, as defined in Fire Code

- **Pressure Vessels**
- **Low Pressure Tanks**
- **Atmospheric Tanks**

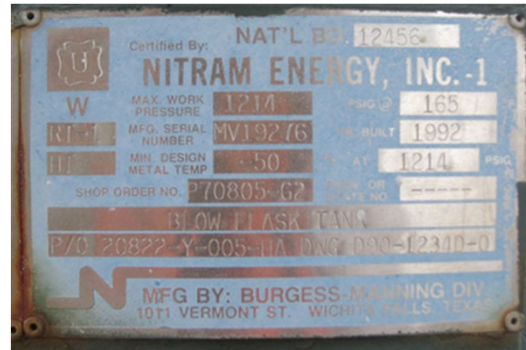
NOTE: In this context, the pressures described are provided in pounds per square inch gauge (psig), not absolute pressure (psia). At sea level, atmospheric pressure is considered by convention to be 0 psig; in absolute terms, this would be 14.7 psia

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Tanks-Pressure Vessels

Designed to store products above 15 psig...and often much higher

Designed to ASME Standards-Boiler and Pressure Vessel Code



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Tanks-Pressure Vessels

Pressure vessels can pose extreme risks due to the amount of energy stored under pressure--All require specialized relief valves and other safety features



- The SPCC rule (and APFA) does not apply to natural gas (including liquid natural gas and liquid petroleum gas), that volatilize on contact with air or water, such as the example shown here.

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Low Pressure Tanks

- **Low Pressure Tanks**-designed to store products up to 15 psi. Usually follow API 620 Standards, or ASME Code for Unfired Pressure Vessels



Ammonia Storage Tank built to API 620

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Low Pressure Tanks



- Field fabricated with temperatures up to 250° F
- Vertical design
- Applications include cryogenic tanks, others

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Low Pressure Tanks

API STANDARD 620			
APPENDIX	<input type="text"/>	YEAR COMPLETED	<input type="text"/>
EDITION	<input type="text"/>	ADDENDUM NUMBER	<input type="text"/>
NOMINAL DIAMETER	<input type="text"/>	NOMINAL HEIGHT	<input type="text"/>
NOMINAL CAPACITY	<input type="text"/>	DESIGN LIQUID LEVEL	<input type="text"/>
DESIGN SPECIFIC GRAVITY	<input type="text"/>	MAXIMUM TEST LEVEL	<input type="text"/>
DESIGN PRESSURE	<input type="text"/>	DESIGN METAL TEMP.	<input type="text"/>
PURCHASER'S TANK NO.	<input type="text"/>	MAXIMUM OPERATING TEMP.	<input type="text"/>
MANUFACTURER'S SERIAL NO.	<input type="text"/>	PARTIAL STRESS RELIEF	<input type="text"/>
MANUFACTURER	<input type="text"/>		
SHELL COURSE		MATERIAL	

Example of API Standard 620 placard used on low pressure tanks built to this standard

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Atmospheric Tanks

- Normally operate from atmospheric pressure up to about 0.5 psig; allowed to operate up to 1.0 psig if constructed to listed standards in NFPA 30
- Not designed to be pressurized
- Vertical, Horizontal Cylindrical, and Rectangular Designs
- For flammable and combustible liquids, typically built of steel if used aboveground
- Sized vary from small to very large, include both shop-fabricated and field-fabricated
- Construction standards for ASTs:
 - API 650, 12F, UL 142, UL 2085, UL 80 etc.

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Common Atmospheric Tank Applications

- Large Field Fabricated Tanks
- Motor Vehicle Fueling Tanks
- Vehicle Service Tank Systems
- Emergency Generator Tanks, including sub-base (belly) tanks
- Fire Pump System Diesel Tanks

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Field Constructed Tanks

Marine Terminals, Refineries, and Distribution Terminals use primarily field constructed tanks



Photo Source: Calif. Energy Commission

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Motor Vehicle Fueling Tanks

Range from Simple to Complex

- AST with tank top fill, dispenser on tank
- AST with remote fill, dispenser on tank
- AST with remote fill and remote dispenser

Product Dispensing Style

- Suction Systems
- Pressure Systems

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Motor Vehicle Fueling Tanks



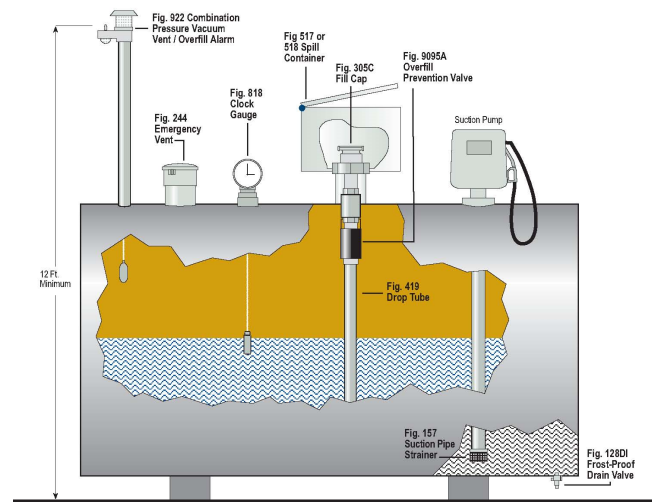
Simple system with pump mounted on tank top. Most systems using this design are fairly small, commonly less than 2000 gallons

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Motor Vehicle Fueling Tanks

Aboveground Fuel Storage - Suction System

Horizontal cylindrical tank with top fill and top mounted pump



From Morrison Bros (www.morbros.com)

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Motor Vehicle Fueling Tanks

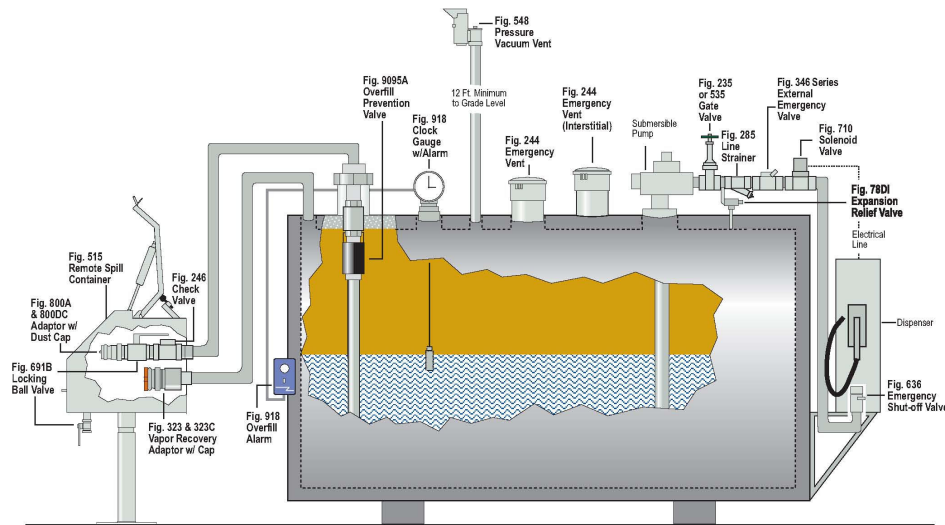
Example of two-compartment double walled AST with dispensers mounted on tank



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Motor Vehicle Fuel Tank

Aboveground Fuel Storage - Pressure System
Rectangular double-wall tank with remote fill and side mounted dispenser



From Morrison Bros (www.morbros.com)

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Vehicle Service Tank Systems

- Typically smaller tanks, ~100-1000 gal
- Commonly use air operated piston pumps to convey products through hose reel systems to work areas
- Fleet services facilities, auto shops, car dealerships use these extensively
- Require compressed air
- Products include lube oil, ATF, greases, other automotive fluids
- Include waste oil systems

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Vehicle Service Tank Systems



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Vehicle Service Tank Systems



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Vehicle Service Tank Systems



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Vehicle Service Tank Systems-Used Oil

- Tank sizes commonly small, ~100-2000 gal
- Some are very simple, manual pour only
- Can also be complex, with remote stations where air operated diaphragm pumps send used oil back to tank
- Secondary containment required (with some exceptions), since these are T22 tank systems; LQG sites normally require PE Certified Tank System Assessments

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Used Oil Systems



Simple, stand alone 2X walled tank, oil poured by hand to fill

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Used Oil Systems



Oil collection station where oil from oil drains and receivers is connected via quick-connect fittings, then pumped by diaphragm pump to tank

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Used Oil Systems



Audible/visual alarms send signals to cut off air to remote pump upon high level

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Emergency Systems

Virtually all sizeable commercial buildings will have some type of emergency generator backup system; fuel is primarily diesel, although propane or natural gas sometimes used

These systems need a ready supply of fuel to power the generator engine, commonly provided by a day tank

In some cases, a larger bulk fuel tank is used to transfer fuel to the day tank



Emergency generator with sub-base tank

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Emergency Systems

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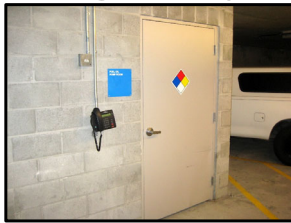


Small day tank used for this emergency generator system

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Emergency Generator Systems

Many high rise buildings will have both a emergency generator system and fire pump system



Fire pump tanks store diesel to power engines that provide supplemental water pressure for sprinklers



Day tank for emergency generator

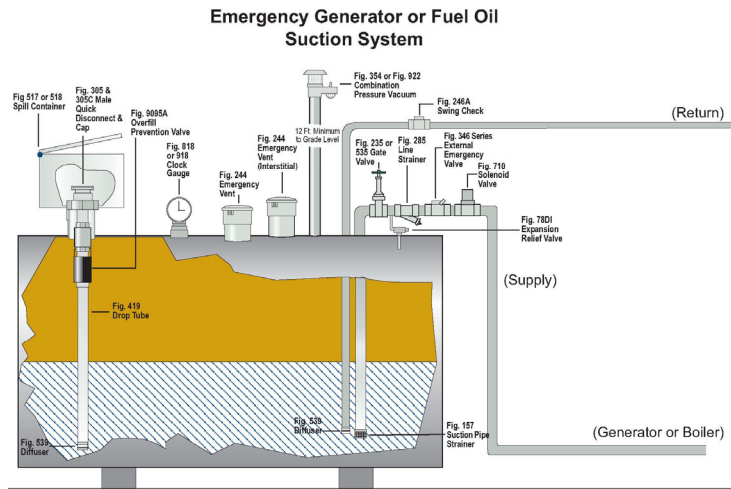


Fire pump tank

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Emergency Generators

- In addition to the fuel supply line, generators use a return line for sending heated unused diesel back to the tank
- Due to the high pressure needed for atomization of fuel for combustion, about 6 gallons of every 7 gallons fuel used by the generator is returned to the tank



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Tank Construction Review

Most tanks are built to some kind of construction standard—commonly UL 142, UL 2085, API 650, API 12F, or others—Most, but not all....

These standards provide minimum design criteria for safe construction and most common applications

However, tanks can be built to buyer specifications that deviate from these standards—in other words, fabricators build what you want.

For compliance with current codes, need to be to a recognized standard

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Tank Construction Standards

Portable Tanks

- DOT
- IBCs/Totes
- IM/UN Portable Tanks

Shop Fabricated Tanks

- UL 142
- UL 2085
- UL 80
- API 12F
- API 650 Appendix J-Shop Assembled Storage Tanks

Field Fabricated Tanks

- API 650

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Tank Construction Standards

Field Fabricated Tanks

- API 650

Shop Fabricated Tanks

- API 650 Appendix J-Shop Assembled Storage Tanks
- API 12F
- UL 142
- UL 2085
- SWRI
- UL 80

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Field Fabricated Tanks

Built onsite-and are much larger than shop fabricated tanks.

API 650 is the construction standard typically used for field fabricated atmospheric tanks; tank designed specifically for site

Various designs, including fixed roof, floating roof, and internal floating roof, all developed specifically for individual tank, application, and site

Vertical Cylindrical only

API 650: Construction Standard

API 653: Inspection Standard

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Fixed, Floating Roof (internal & external)



Photo Source: Google Earth

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Field Fabricated Tanks



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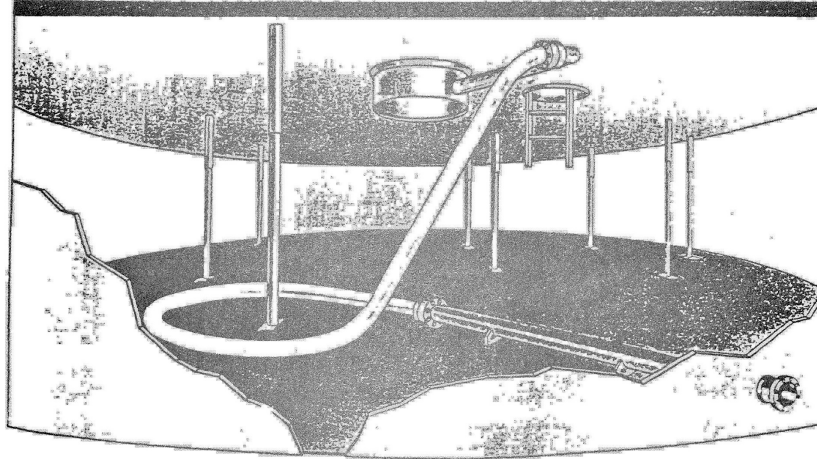
External Floating Roof Tank



SOURCE: GOOGLE EARTH

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External Floating Roof Tank Drain



SOURCE: COFLEXIP LITERATURE, INCLUDED IN CA RWQCB-SF BAY REGION "RESPONSE TO THE OIL SPILL AT SHELL OIL COMPANY MARINEZ MANUFACTURING COMPLEX", MAY 6, 1998

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Field Fabricated Tanks

- Shell course thicknesses are based on calculations

$$t_d = \frac{2.6D(H-1)G}{S_d} + CA$$

- t_d = design thickness (in.)
- D = nominal tank diameter (ft.)
- H = height of liquid (ft.)
- G = specific gravity
- CA = corrosion allowance (in.)
- S_d = allowable stress (psi)

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Inspection Standards for Field Fabricated Tanks

API 653 “Tank Inspection, Repair, Alternation, and Reconstruction” is the Inspection Standard used for Field Fabricated tanks

Scope limited to tank up to first flanged, threaded or welded joint

Annex C contains the in-service and out of service inspection checklists

Inspection Frequency-Periodic by owner, every 5 years External, every 10 years Internal (typical)

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API 653

- First published in 1991--Covers a wide variety of tank types
- Monthly external visual inspection required by the owner/operator
 - Evidence of leaks
 - Shell distortions
 - Corrosion
 - Condition of foundation, coatings, insulation systems and appurtenances

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API 653 Authorized Inspections

- Include both external in-service and internal out of service inspections conducted by authorized inspectors
- Formal external inspections are typically required every five years.
- Internal inspection intervals are typically every 10 years, although certain designs and analyses can extend this interval, but typically not to exceed 20 years. Check API 653 for allowable intervals

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Resources-Field Erected Tanks

API 650: Welded Tanks for Oil Storage

API 651: Cathodic Protection of Aboveground Storage Tanks

API 653: Tank Inspection, Repair, Alteration and Reconstruction

API 2000: Venting Atmospheric and Low Pressure Storage Tanks: Nonrefrigerated and Refrigerated

API 2015 Requirements for Safe Entry and Cleaning Petroleum Storage Tanks

API 2610 Design, Construction, Operation, Maintenance and Inspection of Terminal and Tank Facilities

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Shop Fabricated Tanks



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Shop Fabricated vs Field Fabricated

Transportation limits shop fabricated tanks size-Max OTR is typically 14 feet; most around 8.5'

Cheaper to build tanks in a fabrication shop, where equipment needed to construct tank is readily available

Tighter control over variables that affect welding quality and fabrication



Photo: Transliquid Technologies, Inc

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Shop Fabricated vs Field Fabricated

Tank tested at fabrication plant prior to delivery to site

Standardized and listed/verified designs speed fabrication



Photo: Transliquid Technologies, Inc

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Shop Fabricated Tank Standards

Construction Standards

- API 650 Appendix J
- API 12F
- UL 142
- UL 2085
- SWRI
- UL 80

Inspection Standard: Steel Tank Institute (STI) SP001

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API 650 Appendix J-"Shop Assembled Storage Tanks"

Vertical Cylindrical only

Bottom min thickness 1/4" steel

Shell thickness uses API 650 formula, with min:

- 3/16" steel for tanks \leq 10.5 ft diameter
- 1/4" steel for tanks $>$ 10.5 ft. diameter

Bottom can be flat or flat flanged

Internal air pressure test 2-3 psi; for tanks \leq 12' diameter, up to 5 psi; Hydrostatic testing can be used as alternative

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API 12F-"Specification for Shop Welded Tanks for Storage of Production Liquids"

- Vertical Cylindrical only
- Bottom min thickness 1/4" steel
- Shell thickness 3/16" or 1/4" steel
- Bottom can be flat or flat flanged
- Pressure test 1.5x design pressure
- Designed primarily for oil field use



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API 12F Tanks

Design standardized for capacities from 90 -750 bbl (~3780-31,500 gal)

Wide variety of styles, including skid mounts, insulated, and many others

The rectangular cleanout is a common characteristic of this type of tank



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UL 142 Construction Standard

- UL142 used for **stationary** tanks >60 up to 75,000 gallons
- Vertical, horizontal, or rectangular design; both single & 2X walled
- Include open top, closed top diked tanks
- Up to 13' diameter
- UL 142 also used for Emergency Gen Base Tanks (UL 142A, Special Purpose)
- Each tank is tested prior to shipment
- UL Standard has specific requirements for minimum steel thickness, allowable welding design, bracing, venting, and many other criteria

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UL 142 Vertical Tanks



Vertical UL 142 tanks common at oil distribution locations; these reduce the footprint of the tank, but tank top access often limited. Fixed roof.

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UL 142 Placards



UL listing label sometimes found on tank...but these are commonly corroded away or missing

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UL 142 Horizontal Single Walled Horizontal Tank

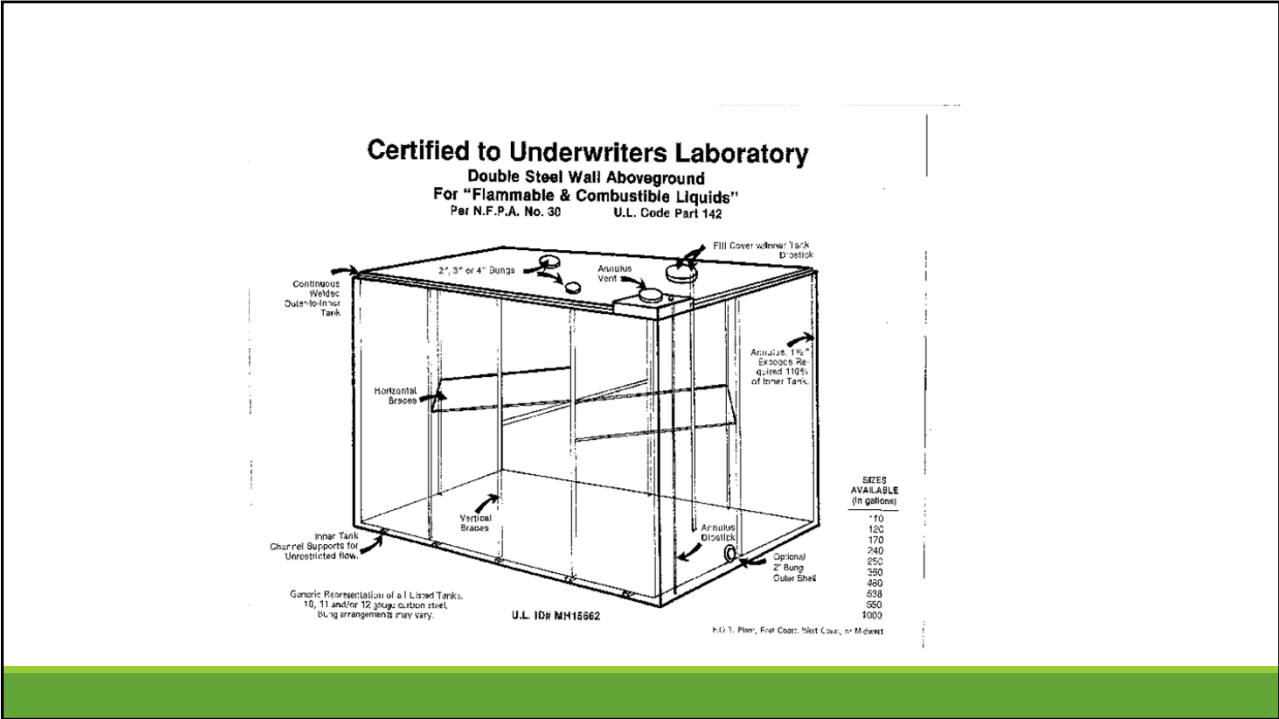


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UL 142 Rectangular Double Walled Tank, with common (single wall) Top



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UL 142 Double Walled Tank



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UL 142 Double Walled Tank



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UL 142 Double Walled Tank



Channel steel used to maintain annular space on 2X walled tank

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UL 142 Closed Top Dike Tank



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UL 142 Rectangular Day Tank with Open Dike Containment



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Protected Tanks

- Protected tanks use fire resistant materials, typically lightweight concrete, to provide a two hour fire resistance rating
- Use UL 142 for welding, wall thickness, supports, and venting design
- Required to have means to check annular space
- Required for new installations for gasoline ASTs in CA ≥ 250 gal for most air districts
- Protected tanks can be used to decrease setback distances under Fire Code; can also be used to increase allowable storage at a location if approved by AHJ
- Some provide ballistics and impact resistance
- Common Designs
 - Fireguard (steel interior, steel exterior, lightweight concrete between) UL 2085 Standard
 - Supervault (steel interior, steel exterior, lightweight concrete between) UL 2085 & SWRI Standards 95-03
 - Convault (steel interior, HDPE Secondary liner, Concrete Exterior) UL 2085 Standard

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UL 2085 Tanks



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UL 2085 Tanks



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UL 2085 Tanks



Double walled steel protected tanks have ports where the lightweight insulating material is poured during tank fabrication

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UL 2085 Protected Tank



Supervault Tanks Fire Resistant tanks (UL 2085 & SWRI 95-03)

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UL 2085 Concrete Exterior Tank



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Concrete Exterior Tanks



This style of tank features an inner steel tank, with a HDPE liner that forms the secondary space. Reinforced concrete surrounds the tank.



Source: Oldcastle Convault Brochure

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The technical drawing shows a concrete exterior tank with the following components labeled:

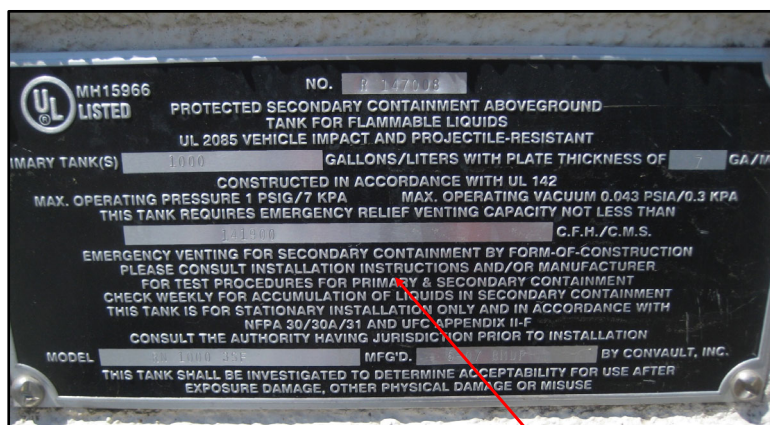
- UL 2500 2-10 GALLON SPILL CONTAINMENT RELIEF VENT AS SHOWN WITH POP-UP PORT AND OPEN VENT
- 1/2" OR 3/4" PRIMARY STEEL TANK
- 1/2" POLYURETHANE INSULATION
- CONCRETE OF STRENGTH ACCORDING TO STRUCTURE
- TOP TO WALLS
- DETAIL A
- BOTTOM TO WALLS

- Concrete Exterior Tanks have specific inspection requirements under SP001
- Older versions may not have secondary emergency vent; they claim “form of construction” as means to meet emergency venting requirements under Fire Code
- Concrete Exterior Tanks cannot have secondary liner pressurized

Source: Convault Owner's Manual

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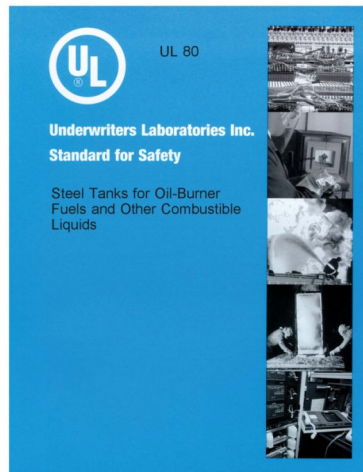
UL 2085 Concrete Exterior Tank



Convault Placard indicating emergency venting provided by form-of-construction

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UL 80 Tanks



- UL 80-Steel Tanks for Oil-Burner Fuels and other Combustible Liquids
- Small Obround Tanks, typically 275 & 330 gallon capacity
- More common in NE US for heating oil
- Not a good choice for CA due to high center of gravity and anchorage design

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UL 80 Tanks



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UL SU2258 Tanks



These tanks are relatively rare (currently) in CA. Similar to UL 80, designed for NE US home heating oil—although sometimes seen for Class IIIB liquids. May not be acceptable in some fire jurisdictions, as these are constructed with an inner HDPE tank, with an outer galvanized steel outer tank.

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Inspection Standards for Shop Fabricated Tanks

- STI's SP001 "Standard for the Inspection of Aboveground Storage Tanks" is the Inspection Standard used for Shop Fabricated tanks
- Scope covers containers (such as 55-gallon drums and IBC totes), shop-fabricated stationary tanks, and small field erected tanks
- Includes monthly and annual inspection checklists, which are not copyrighted and can be obtained from various sites on the internet
- SP001 includes requirements for periodic inspections to be conducted by STI-certified inspectors.

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Inspection Standards for Shop Fabricated Tanks

- SP001 uses a tank categorization scheme based on the installed AST features and risks to the environment.
- Two important concepts in SP001 that comprise the elements of the categorization include
 - **Spill Control:** A means of preventing a release of liquid from the tank including adjoining property and waterways: Common types include
 - Secondary Containment Systems
 - Open top steel diked ASTs
 - Double wall ASTs
 - Others
 - **Continuous Release Detection Method (CRDM):** A means of detecting a release of liquid through the inherent design of the tank system. Examples include:
 - Double wall ASTs, or double bottom ASTs
 - Elevated ASTs
 - Release Prevention Barriers (e.g., liners, concrete pads, etc.)
 - Others

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Inspection Standards for Shop Fabricated Tanks

- Category 1: ASTs with both spill control and CRDM

Spill control provided by engineered concrete berm

CRDM provided by elevated tank



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Inspection Standards for Shop Fabricated Tanks

- Category 2: ASTs with spill control, but not CRDM

This site has spill control provided by the earthen dike/berm

The large tank in the photo center rests directly on the earthen bermed area, and a release could occur through the tank bottom and go undetected



Photo Credit: STI/SPFA

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Inspection Standards for Shop Fabricated Tanks

- Category 3: ASTs without spill control

Note that Category 3 tanks would normally not meet SPCC bulk storage container sized secondary containment requirements in 40CFR112.8(c)



Spelling: -5 points

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Inspection Standards for Shop Fabricated Tanks

- In addition to the routine monthly and annual inspections performed by the owner, formal inspections (conducted by STI-Certified inspectors) is based on the tank category and tank size
- The categorization scheme penalizes tanks with more risks to the environment by requiring more frequent certified inspections, including both external and internal inspections
- The certified inspection frequency ranges from a short as 5 years up to 20 years, depending upon the tank category and size. Leak testing (commonly pneumatic testing) is also required in some circumstances
- See Table 5.5 of the SP001 Standard for specifics

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Resources-Shop Fabricated Tanks

Construction Standards

- API 650 Appendix J Shop Assembled Storage Tanks
- API 12F Specification for Shop Welded Tanks for Storage of Production Liquids
- UL 142 Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids
- UL 2085 Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids

Inspection Standards

- STI SP001 "Standard for the Inspection of Aboveground Storage Tanks" available at www.steeltank.com

Recommended Practices

- PEI/RP200 Recommended Practices for Installation of Aboveground Storage Systems for Motor Vehicle Fueling
- PEI/RP1400-14 Recommended Practices for the Design and Installation of Fueling Systems for Emergency Generators, Stationary Diesel Engines and Oil Burner Systems

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Questions



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