



VENTURA COUNTY FIRE PROTECTION DISTRICT
FIRE PREVENTION BUREAU
165 DURLEY AVENUE
CAMARILLO, CALIFORNIA 93010
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FIRE PREVENTION STANDARD 14.5.1

**WATER SUPPLIES
RESIDENTIAL, WITHOUT A PURVEYOR
(Storage Tank and Piping)**

SCOPE: This standard identifies minimum water supply requirements (fire sprinklers and fire fighting) for one and two family dwellings in rural and suburban areas in which an adequate reliable water supply does not exist.

Timing of Installation: Operable Fire Hydrants and required access roads shall be provided prior to and during the time of construction.

Projects located within a water purveyor's service area shall obtain written permission from the water purveyor to use a water storage tank for fire protection under this standard, in lieu of connection and or upgrades to the water purveyor's system.

DEFINITIONS

FIRE FLOW: The flow rate of a water supply, measured at 20 pounds per square inch (PSI) (137.9kPa) residual pressure, that is available for firefighting. When water supply tanks are approved for use, the flow rate of a water supply may be at draft.

WATER PURVEYOR: A public utility, a mutual water company, a governmental body, or other entity, owning and operating a water system and holding a valid permit from the State or County Health Department to purvey water. Reference: Ventura County Water Works Manual.

1. TANK

A. Types of Storage Tanks

- 1) Aboveground metal tanks
- 2) Underground metal tanks that are protected against corrosion
- 1) Fiberglass tanks
- 4) Swimming pools (doughboy style not acceptable)

B. Location

- 1) The location chosen shall be such that the tank shall be a minimum of 20 feet from any structure to avoid being subject to fire exposure. Where this is impractical, fire proofing of not less than two hours may be required.

- 2) Foundations or footings shall furnish adequate support for the tank.
- 3) Water tanks 5,000 gallons and greater require building permits and could require additional agency approvals.
- 4) Elevation of the tank floor shall not be more than 5 feet below the fire hydrant outlet.

C. Venting

- 1) An air vent shall be located above the maximum water level and shall have a cross sectional area at least equal to one half the area of the discharge pipe or fill pipe, whichever is larger.

D. Sight Gage

- 1) A water level gage shall be provided for aboveground tanks.

E. Automatic Fill

- 1) A suitable means shall be provided to *automatically* maintain the water level in the tank.

2. CALCULATING TANK SIZE

CASE	WATER TANK IS TO SUPPLY...	MINIMUM WATER SUPPLY REQUIRED
1.	Sprinklers, Domestic & Hose	Use Table "A"
2.	Hose Stream Only	Use Table "B"
3.	Sprinklers & Domestic	<p>A. For structures up to 10,000 square feet: 2,250 Gallons Auto Fill: 1,500 Gallons</p> <p>B. For structures over 10,000 square feet: 3,750 Gallons Auto Fill: 3,000 Gallons</p>

3. CONNECTIONS TO THE TANK

Refer to *Figure 1* for all the connections to the water tank.

4. PIPING AND HYDRANT OUTLET REQUIREMENTS

A. The hydrant outlet shall be no closer than 50 feet nor farther than 250 feet from the structure. This outlet shall be visible and accessible from the fire equipment access road. A turnout may be required. *See Figure 2*

B. A permanent sign shall be at the outlet which states the following:

“DRAFTING FIRE HYDRANT”

_____ Gallons

See Figure 2 for sign details

C. Hydrant

2) Outlet Size (minimum)

- a) 2 ½ inch outlet with male threads (NST also known as NH & NS), when the required fire flow is 500 gpm or less.
- b) 4 inch outlet with male threads (NST also known as NH & NS) when the required fire flow is greater than 500 gpm.

2) Threads must be protected with a threaded cap.

3) Hydrants shall be painted yellow.

4) Hydrant outlet shall be 18 to 24 inches above the finished grade. *See Figure 2*

5) The hydrant outlet shall be located 6 – 8 feet from the access road edge. This is to allow the use of a 10 – foot long hard suction hose from the engine to the hydrant outlet. A turnout may be required so the access road will be passable when the engine is connected to the hydrant outlet. *See #4A above and Standard 14.6.7.*

6) A blue reflective hydrant location marker shall be provided along the access road. *See Standard 14.5.3.*

D. Piping

1) Size (minimum)

- a) 2 ½ inch when less than 50 feet from the storage tank and less than 500 gpm.
- b) 4 inch when 50 feet or more from the storage tank or greater than 500 gpm.

2) PVC may be allowed for horizontal runs when not subject to damage, i.e. vehicle traffic, etc.

- a) Up to 1½ inch pipe - Schedule 40
- b) 2 inch to 4 inch pipe - Schedule 80 or Standard Design Ratio (SDR) of 13.5
- c) 6 inch and above - SDR of 13.5

E. All exposed pipes, elbows and risers shall be steel.

F. All ferrous metal pipe and fittings shall be lined.

G. The following applies to the underground installation.

- 1) Steel pipe shall be coated and wrapped.
- 2) Steel pipe joints shall be field coated and wrapped after assembly.
- 3) After assembly, all metallic parts such as rods, nuts, bolts, washers, clamps, and other restraining devices, except thrust blocks, shall be cleaned and thoroughly coated with bituminous or other acceptable corrosion-retarding material.

H. Where above ground piping passes through an area subject to freezing, it shall be protected by a reliable means to maintain the temperature of the water in the piping between 40° F and 120° F.

I. Depth of cover shall be not less than 2 feet to prevent mechanical damage. Pipe under driveways shall be buried a minimum of 3 feet and under railroad tracks a minimum of 4 feet.

5. PLANS

A. The size and location of the hydrant outlet, piping and storage tank shall be approved by the Fire District prior to installation. Submit plans to the Fire Prevention Bureau for review.

- B. A minimum of 2 scaled site plans shall be submitted to the Fire Prevention Bureau for review. The plans shall include:
- All structures; indicate square footage of each.
 - Access roads; indicate width and percentage of grade.
 - Proposed tank size and location.
 - Elevation view of tank indicating point of connections to the tank.
 - Proposed outlet size and location.
 - Type, size and location of piping.
 - If the hydrant is remote from the tank, show the elevations and number of (feet) from the tank and the location of the hydrant outlet. Tanks located 100 feet or more above the hydrant outlet will require thrust blocks for the piping.
 - If plastic tanks are used, they must be UV rated and the manufacturers listed specifications must be provided.
 - Engineering scale of 10 to 60 shall be used.

6. INSPECTIONS

- A. The following inspections shall be conducted by the Fire Prevention Bureau:
- 1) Any below ground piping shall have a visual inspection prior to being covered.
 - 2) Final inspection, including testing the auto fill.

TABLE A

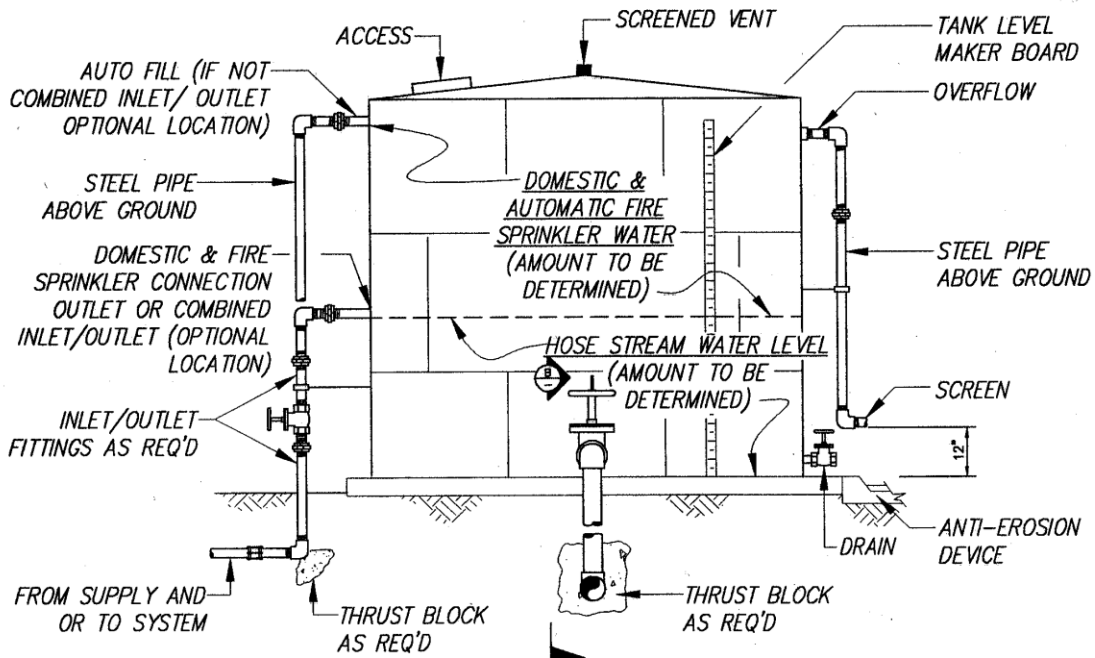
BUILDING SQUARE FOOTAGE	MINIMUM WATER SUPPLY REQUIRED (HOSE STREAM+SPRINKLERS +DOMESTIC) (GALLONS)	RESERVED FOR HOSE (GALLONS)	AUTO FILL LEVEL (GALLONS)
Up to 2,800	4,250	2,000	3,500
2,800 – 3,500	4,750	2,500	4,000
3,501 – 4,200	5,250	3,000	4,500
4,201 – 4,900	5,750	3,500	5,000
4,901 – 5,600	6,250	4,000	5,500
5,601 – 6,300	6,750	4,500	6,000
6,301 – 7,000	7,250	5,000	6,500
7,001 – 7,700	7,750	5,500	7,000
7,701 – 8,400	8,250	6,000	7,500
8,401 – 9,100	8,750	6,500	8,000
9,101 – 10,000	9,250	7,000	8,500
10,001 – 10,500	11,250	7,500	10,500
10,501 – 11,200	11,750	8,000	11,000
11,201 – 11,900	12,250	8,500	11,500
11,901 – 12,100	12,750	9,000	12,000
12,101 – 12,800	12,250	9,500	12,500
12,801 – 13,500	13,250	10,000	13,000
13,501 – 14,200	13,750	10,500	13,500
14,201 – 14,900	14,250	11,000	14,000
14,901 – 15,600	14,750	11,500	14,500
15,601 – 16,300	15,250	12,000	15,000
16,301 – 17,000	15,750	12,500	15,500
17,001 – 17,700	16,250	13,000	16,000
17,701 – 18,400	17,250	13,500	16,500
18,401 – 19,100	17,750	14,000	17,000
19,101 – 19,800	18,250	14,500	17,500

TABLE B**MINIMUM WATER SUPPLY REQUIRED**

BUILDING SQUARE FOOTAGE	HOSE STREAM ONLY STRUCTURES WITHOUT SPRINKLERS (gallons)*	HOSE STREAM ONLY STRUCTURES WITH SPRINKLERS (gallons)*
Up to 2,800	4,000	2,000
2,801 – 3,500	5,000	2,500
3,501 – 4,200	6,000	3,000
4,201 – 4,900	7,000	3,500
4,901 – 5,600	8,000	4,000
5,601 – 6,300	9,000	4,500
6,301 – 7,000	10,000	5,000
7,001 – 7,700	11,000	5,500
7,701 – 8,400	12,000	6,000
8,401 – 9,100	13,000	6,500
9,101 – 10,000	14,000	7,000
10,001 – 10,500	15,000	7,500
10,501 – 11,200	16,000	8,000
11,201 – 11,900	17,000	8,500
11,901 – 12,100	18,000	9,000
12,101 – 12,800	19,000	9,500
12,801 – 13,500	20,000	10,000
13,501 – 14,200	21,000	10,500
14,201 – 14,900	22,000	11,000
14,901 – 15,600	23,000	11,500
15,601 – 16,300	24,000	12,000
16,301 – 17,000	25,000	12,500
17,001 – 17,700	26,000	13,000
17,701 – 18,400	27,000	13,500
18,401 – 19,100	28,000	14,000
19,101 – 19,800	29,000	14,500

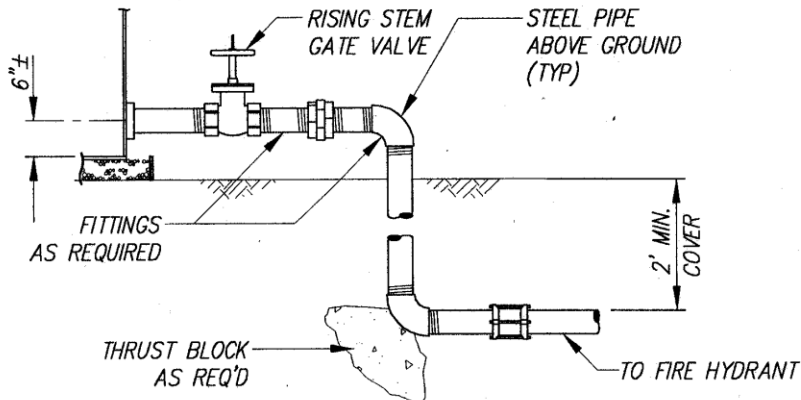
* Auto fill shall be set so the amount of water indicated in this table is always available.

FIGURE 1
TANK INSTALLATION GUIDELINE FOR RESIDENTIAL
AND MINOR ACCESSORY USE BUILDINGS



A FIRE HYDRANT TANK OUTLET

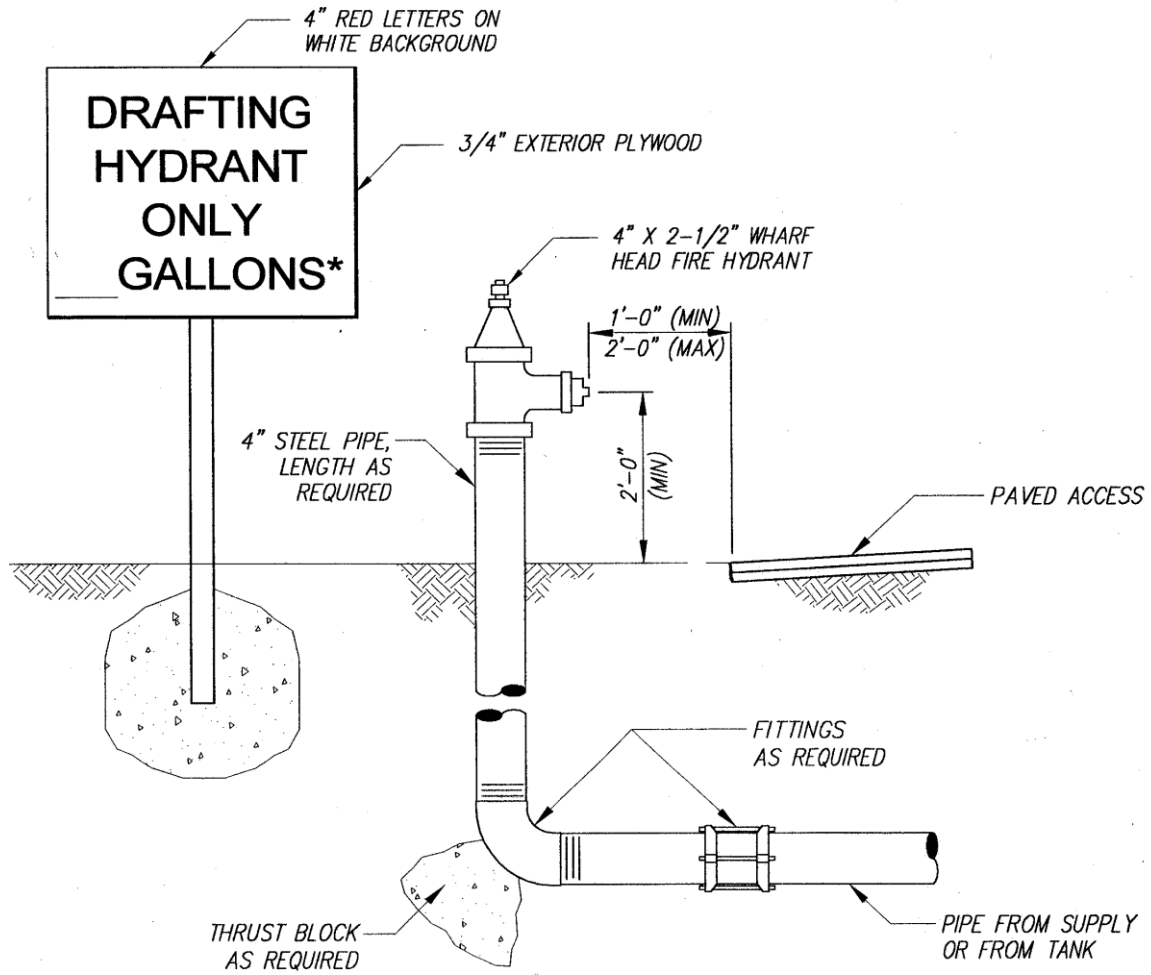
- NOTES: 1. CERTAIN ITEMS MAY BE ROTATED FOR CLARITY. NOT TO SCALE
 2. WATER TANKS 5000 GALLONS AND GREATER REQUIRE BUILDING PERMITS AND COULD REQUIRE ADDITIONAL AGENCY APPROVALS.



B FIRE HYDRANT TANK OUTLET

NOT TO SCALE

FIGURE 2



NOTES:

1. SIGN FOR DRAFTING HYDRANT REQUIRED IF RESIDUAL PRESSURE AT DESIGN FLOW IS LESS THAN 20 PSI
2. AMOUNT OF WATER RESERVED FOR HOSE STREAM. EXAMPLE: 5,000 GALLONS

B TYPICAL "WHARF" FIRE HYDRANT INSTALLATION

NOT TO SCALE

FIGURE 3

CALCULATING TANK LEVELS

EXAMPLE: - 3000 square foot dwelling, using a 10 foot diameter tank

Requirements from Fire Prevention Standard 14.5.1, Table A:

Minimum Tank Size	Reserved for Hose	Automatic Fill Level
4750 gallons	2500 gallons	4000 gallons

DETERMINING HEIGHTS WHEN DESIGNING PRIVATE WATER SYSTEMS:

Formula: $A = \pi R^2$

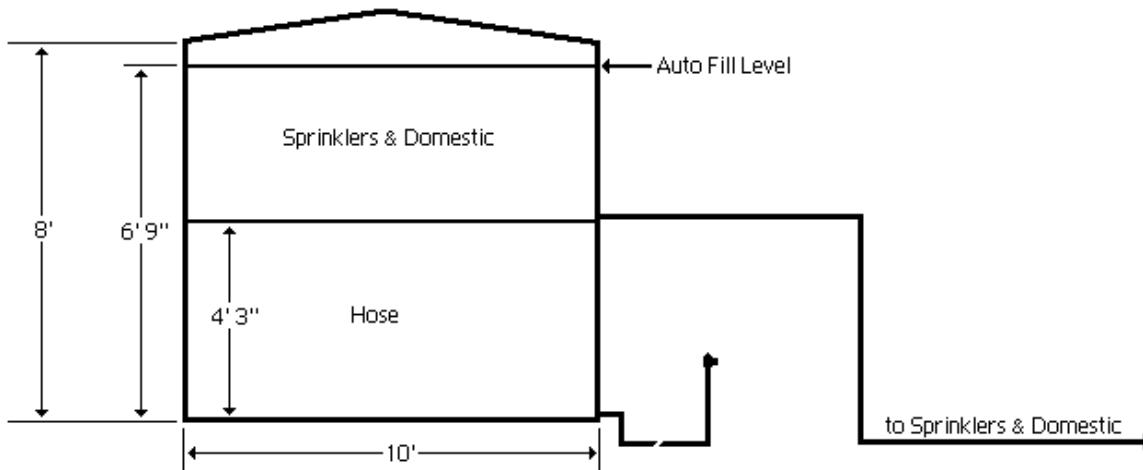
$$3.1416 \times 25 = 78.54 \text{ cu. ft. (per ft. of height)}$$

There are 7.48 gallons per cubic ft.:

$$7.48 \times 78.54 = 587.47 \text{ gallons per ft. of height}$$

Minimum water heights:

Tank	Sprinkler/Domestic Connection	Auto Fill Height
$4750 \div 587 = 8$	$2500 \div 587 = 4.25$	$4000 \div 587 = 6.8$
8'	4' 3"	6' 9"



DETERMINING GALLONS WHEN INSPECTING:

Formula: $A = \pi R^2$

$$3.1416 \times 25 = 78.54 \text{ cu. ft. (per ft. of height)}$$

There are 7.48 gallons per cubic ft.:

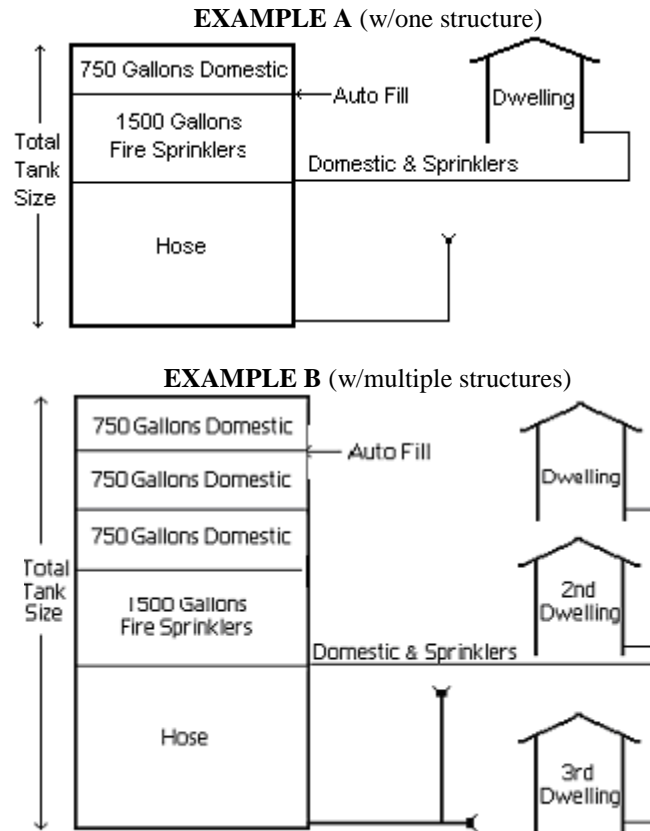
$$7.48 \times 78.54 = 587.47 \text{ gallons per ft. of height}$$

$$8' \times 587 = 4696 \text{ gallons} \quad 4.25' \times 587 = 2494 \text{ gallons} \quad 6.8' \times 587 = 3991 \text{ gallons}$$

FIGURE 4

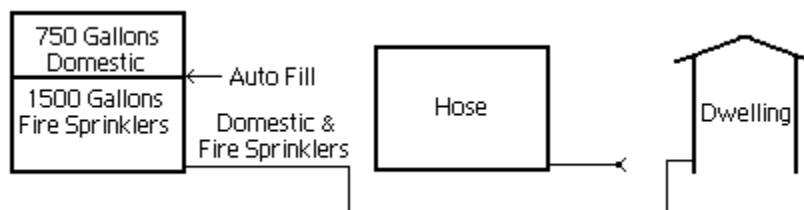
DETERMINING TANK SIZE WHEN SERVING 2 – 4 CONNECTIONS

(Requirements assume only one structure will be on fire at a time)



PRIVATE WATER SYSTEMS SERVING MORE THAN (4) FOUR CONNECTIONS (EACH STRUCTURE SERVED IS A CONNECTION) ARE OUTSIDE THE SCOPE OF STANDARD 14.5.1 AND ARE REQUIRED TO COMPLY WITH THE VENTURA COUNTY WATERWORKS MANUAL AND THE ENVIRONMENTAL HEALTH DEPARTMENT (EHD).

EXAMPLE C (w/multiple tanks)

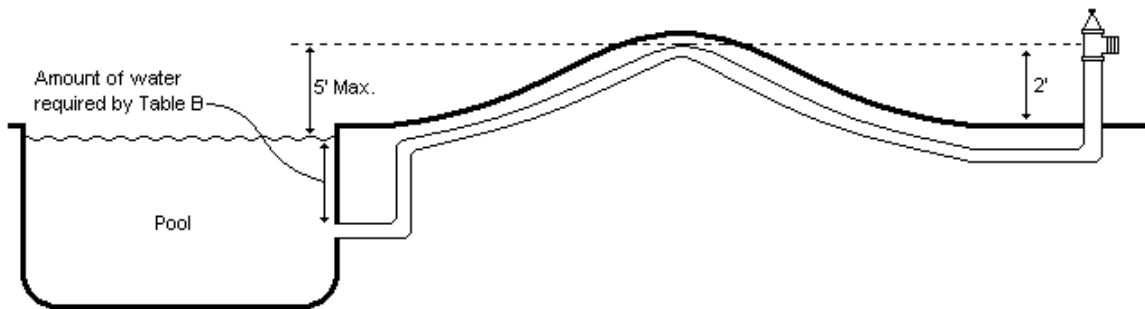


Domestic and sprinkler may come from a purveyor or a tank which includes both the domestic and sprinkler water.

Hose supply must come from a tank. (A swimming pool may be used for this tank)

FIGURE 5

SWIMMING POOL/TANK INFORMATION



- A pool may be used for hose reserve. (Domestic & sprinkler cannot come from a pool)
- Hydrant piping must be a permanent connection to the bottom or side of the pool, such that the required amount of water is available above the connection at the pool.
- The connection and pipe size must be as required in Fire Prevention Standard 14.5.1.
- The hydrant outlet shall be 2 feet above the finished grade at the hydrant location.
- The level of the required amount of water shall not be more than 5 feet below the hydrant outlet.
- The piping from the pool to the hydrant shall not rise above the hydrant outlet.
- The connection may tee off the bottom drain (with the correct pipe size), but must do so before the equipment and must meet the above elevation issues.
- A check valve is not permitted in the piping.
- If water quality is a concern, the line can be flushed as needed.
- If the pool is not completed prior to construction, a temporary water tank must be provided before combustible materials are on site. (This may be the permanent tank to be used ultimately for sprinklers and domestic)
- The temporary tank must be sized to the amount of water required for a structure with sprinklers. Auto-fill is not required for the temporary tank. The pool must be completed at the time of final inspection, or the temporary tank must be retrofitted to comply with all requirements for a permanent tank.

Frequently asked questions regarding private water systems (PWS)

What is standard design ratio (SDR) 13.5?

It is the thickness of the pipe wall. If not indicated as schedule 40 or 80, ask for the manufacturers specification sheet.

Can C-900 / Class 150 pipe be used for PWS?

Yes. It does not matter if the system is pressure or drafting.

What type of sight gauge can be used?

The concern is water leaking from the tank due to the sight gauge melting or being damaged due to fire / heat exposure. The preferred sight gauge is a marker board type as shown on the tank exhibit in the standard. Other types may be used if not subject to fire exposure / heat. Hard plastic tubing is not allowed, as it will deteriorate in the sun and is easily damaged. Same issue with aboveground piping.

How does the piping have to be connected when a swimming pool is used?

Pools may only be used for hose reserve. Domestic and fire sprinkler water must come from a purveyor or separate tank. The hydrant piping needs to be a permanent connection to the bottom or the side of the pool. The connection must be the same size as the hydrant outlet. The connection at the pool cannot be more that 5 feet below the hydrant outlet or the highest portion of the piping from the pool to the hydrant outlet. A check valve is not permitted on the piping. **Note:** If the pool is not completed prior to the start of combustible construction, a temporary water tank must be provided. The temporary tank must be of a size equal to the amount of water required for a non-sprinklered building per Table B. Auto fill is not required for temporary tanks. The pool must be completed at time of building final or the temporary tank must be retrofitted to comply with all requirements for a permanent tank.

Can additional uses be allowed form the tank?

Yes. Uses other than domestic, fire sprinklers and hose reserve are allowed from the same tank. The point of connection for these other uses shall be above the level required for domestic, sprinklers and hose reserve.

Can a tank serve more than one dwelling / building?

Yes. The tank shall be sized based upon the largest structure and add 750 gallons for each additional building served, up to 4 buildings maximum. If serving both R-3 and U occupancies, use the largest hose demand + 2250 gallons for the first sprinklered dwelling + 750 gallons for each additional building using domestic water, including barns, shops, cabanas, etc. **Note:** Private water systems serving more than four (4) connections (each building served is a connection) are outside the scope of Standard 14.5.1 and are required to comply with the Ventura County Water Works Manual and the Environmental Heath Department (EHD).