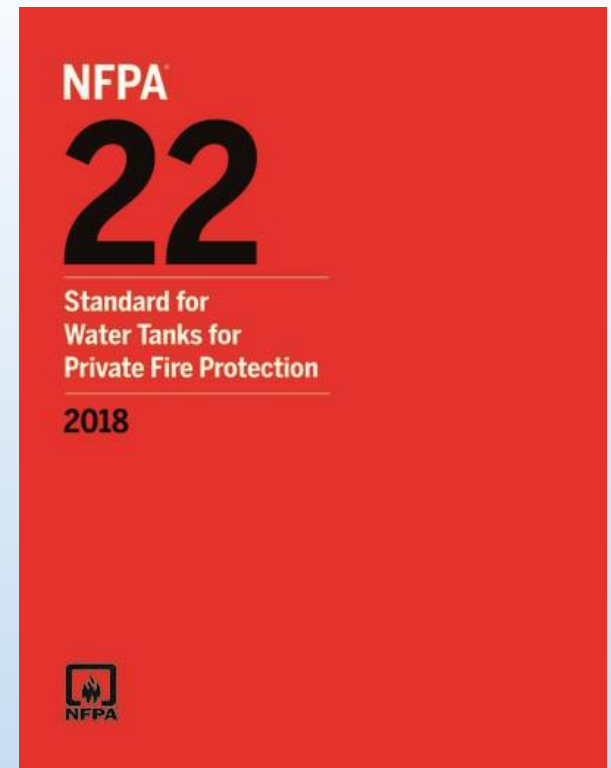




# NFPA 22

## STANDARD FOR Water Tank for Private Fire Protection

**NFPA 22 Training- Mehboob Shaikh(M Tech. | B.Eng. | AMIE |  
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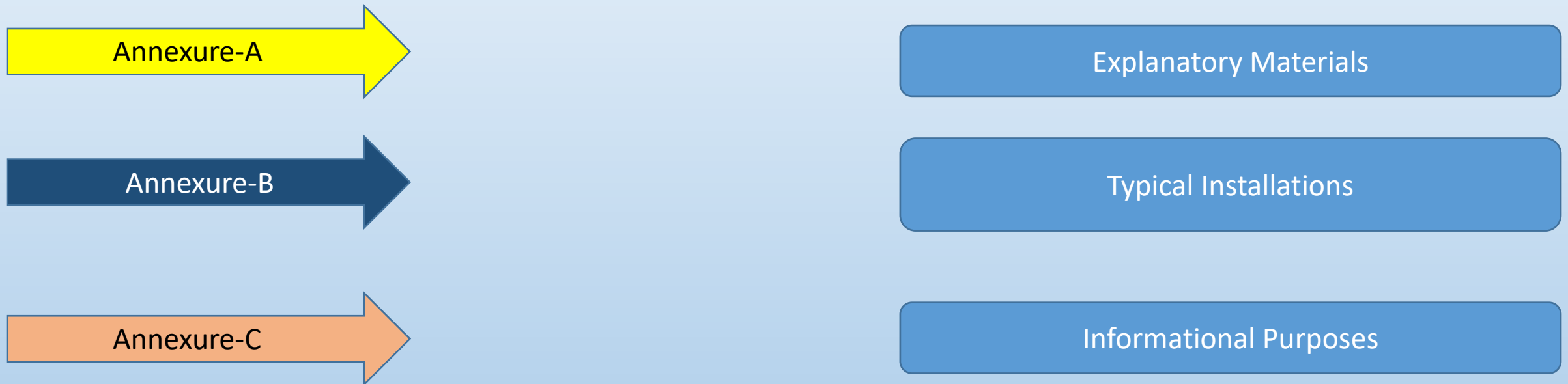
# CHAPTERS & STRUCTURE

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# CHAPTERS & STRUCTURE



# TYPES OF TANKS USED IN FIREFIGHTING

## **GRAVITY TANK**

- A storage tank that uses elevation as a source of pressure, which might be capable of providing the necessary head pressure to operate a fire suppression system or used to provide water to a fire pump.

## **SUCTION TANK**

- A tank that provides water to a fire pump for which a minimal amount of head pressure is provided.

## **BREAK TANK**

- A tank providing suction to a fire pump whose capacity is less than the fire protection demand (flow rate times flow duration).

## **PRESSURE TANK**

- A tank that uses air or some other gas under pressure to expel its contents.

**BLADDER TANK** ( not the one Bladder tanks used as foam concentrate tanks installed in In accordance with NFPA 16 or NFPA 11)

- A pressure tank containing air and water separated by a flexible membrane (bladder).

# TYPES OF TANKS USED IN FIREFIGHTING



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## PRESSURE TANK

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## SUCTION TANK

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## BREAK TANK

A tank providing suction to a fire pump whose capacity is less than the fire protection demand (flow rate times flow duration).



# FIREFIGHTING WATER TANK MATERIAL

A firefighting tank can be fabricated using one of the following materials:

- Steel
- Wood
- Concrete
- Coated fabrics
- Fiberglass-reinforced plastic tanks.

4.4.1 Materials shall be limited to steel, wood, concrete, coated fabrics, and fiberglass-reinforced plastic tanks.

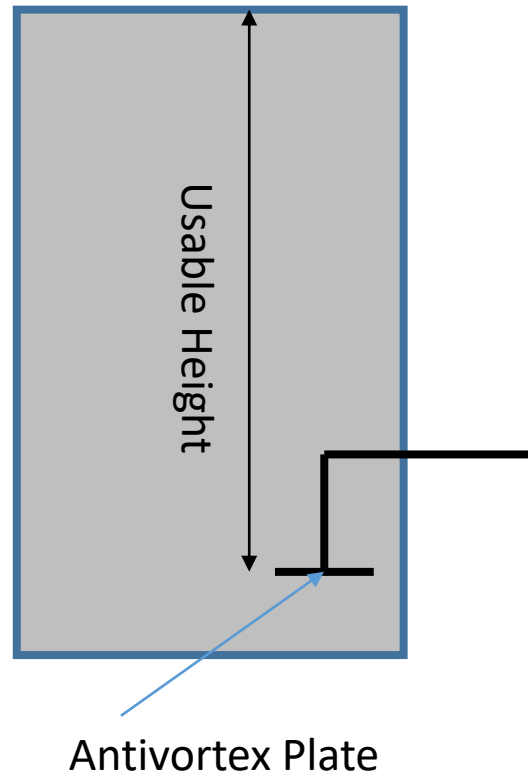
Polyethylene is not a material recognized by NFPA 22. Polyethylene tanks are often used in NFPA 13D systems where neither the tank nor fire pump is required to be listed.

# SIZING OF FIREFIGHTING WATER TANK

- A tank shall be sized so that the stored supply plus reliable automatic refill shall meet the system demand for the design duration.
- A break tank shall be sized for a minimum duration of **15 minutes with the fire pump operating at 150 percent of rated capacity**

# SIZING OF FIREFIGHTING WATER TANK

**4.1.3** For suction tanks, the net capacity shall be the number of U.S. gallons (cubic meters) between the inlet of the overflow and the level of the vortex plate.



The amount of water between the overflow and the anti-vortex plate constitutes the amount of usable water in the storage tank. The Tank size may be slightly larger than the quantity needed by the fire protection system.

## Example :

A standpipe system that requires 1000 GPM (3785 L/min) for the required 30-minute duration needs 30,000 gal (113.55 m<sup>3</sup>) of fire protection water. In this case, the next size tank may be needed [40,000 gal (151.40 m<sup>3</sup>)] to provide the required 30,000 gal (113.55 m<sup>3</sup>). This requirement applies to all types of tanks except break tanks

# PURPOSE OF BREAKTANK



NFPA 20 allows the use of break tanks for the following reasons:

- As a backflow prevention device between the water supply (water supply from the city water grid, process water supply system...) and the fire pump suction pipe
- To eliminate fluctuations in the water supply pressure and provide a steady suction pressure to the fire pump (water supply from the city water grid, process water supply system)
- To provide a quantity of stored water on site where the normal water supply will not provide the required quantity of water required by the fire protection system (existing water tank, too small for the required needs).

# SIZING OF FIREFIGHTING WATER TANK

**4.1.5** A break tank shall be sized for a minimum duration of 15 minutes with the fire pump operating at 150 percent of rated capacity.

Where a tank is only sized for 15 minutes, a redundant automatic refill line is required to ensure that the tank does not run out of water before the fire department can respond and verify the operation of the tank fill valve. It is anticipated that the fire department will respond and review the tank and tank fill within 30 minutes.

## **Example :**

A 1000 gpm (3783 L/min) fire pump flows 1500 gpm (5678 L/min) at 150 percent of rated demand.  
A 15-minute supply, therefore, equals  $15 \text{ min} \times 1500 \text{ gpm (5678 L/min)}$  or 22,500 gal (85,163 L).

# CALCULATION OF THE NET CAPACITY OF FIREFIGHTING TANK

## **FOR SUCTION TANKS:**

- the net capacity shall be the number of gallons between the inlet of the overflow and the level of the vortex plate.

## **FOR ALL TANKS OTHER THAN SUCTION TANKS:**

- the net capacity shall be the number of gallons between the inlet of the overflow and the discharge outlet

# FILLING OF FIREFIGHTING WATER TANK

- The water supply shall be capable of filling the minimum required fire protection volume within the tank in a maximum of 8 hours.
- The tank shall be kept filled, and the water level shall never be more than 4 in. (102 mm) below the designated fire service level.

# DISCHARGE PIPE SIZING OF FIREFIGHTING WATER TANK

The minimum discharge pipe sizing shall be based on the hydraulic demand of the systems attached to the tank but **shall not be less than 6 in.**

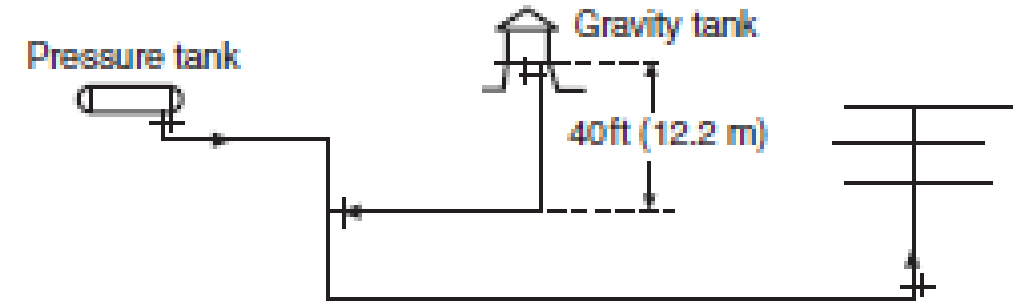
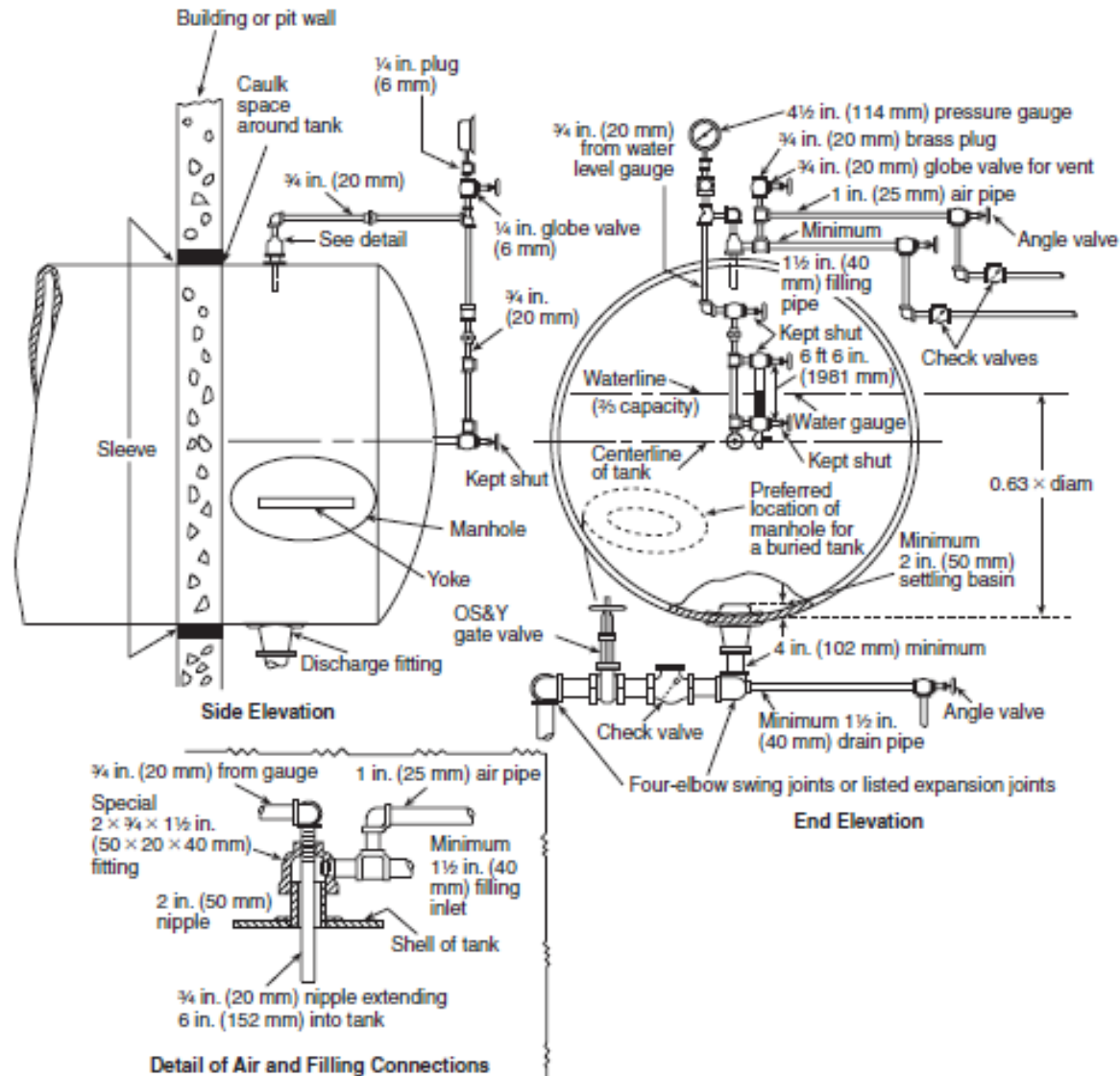
# FIREFIGHTING WATER TANK OVERFLOW

- The overflow pipe shall have a capacity greater than the fill connection but shall not be less than 3 in. throughout.
- The inlet of the overflow pipe shall be located at the top capacity line or high water.

# FIREFIGHTING WATER TANK DRAIN.

A drain pipe of at least 2 in. that is fitted with a controlling valve and a 1/2 in. drip valve shall be connected to the tank discharge pipe near its base and on the tank side of all valves.

# Pressure Tanks



# Pressure Tank Sizing Example

A Pressure tank is to be used to provide a 30 min water supply to a system with a hydraulically calculated demand of 140 gpm (530 L/min) at a pressure of 118 psi (8.14 bar). Due to nearby component pressure ratings, it is important that air pressure in the tank not exceed 175 psi (12.0 bar). To determine the minimum size tank.

# Solution

$$P_i = \frac{P_f + 15}{A} - 15$$

where

$P_i$  = Tank air pressure to be used

$P_f$  = System pressure required per hydraulic calculations

$A$  = Proportion of air in the tank

# Solution

Solve for A,

$$A = 0.7$$

It means proportion of air in the tank is 70%

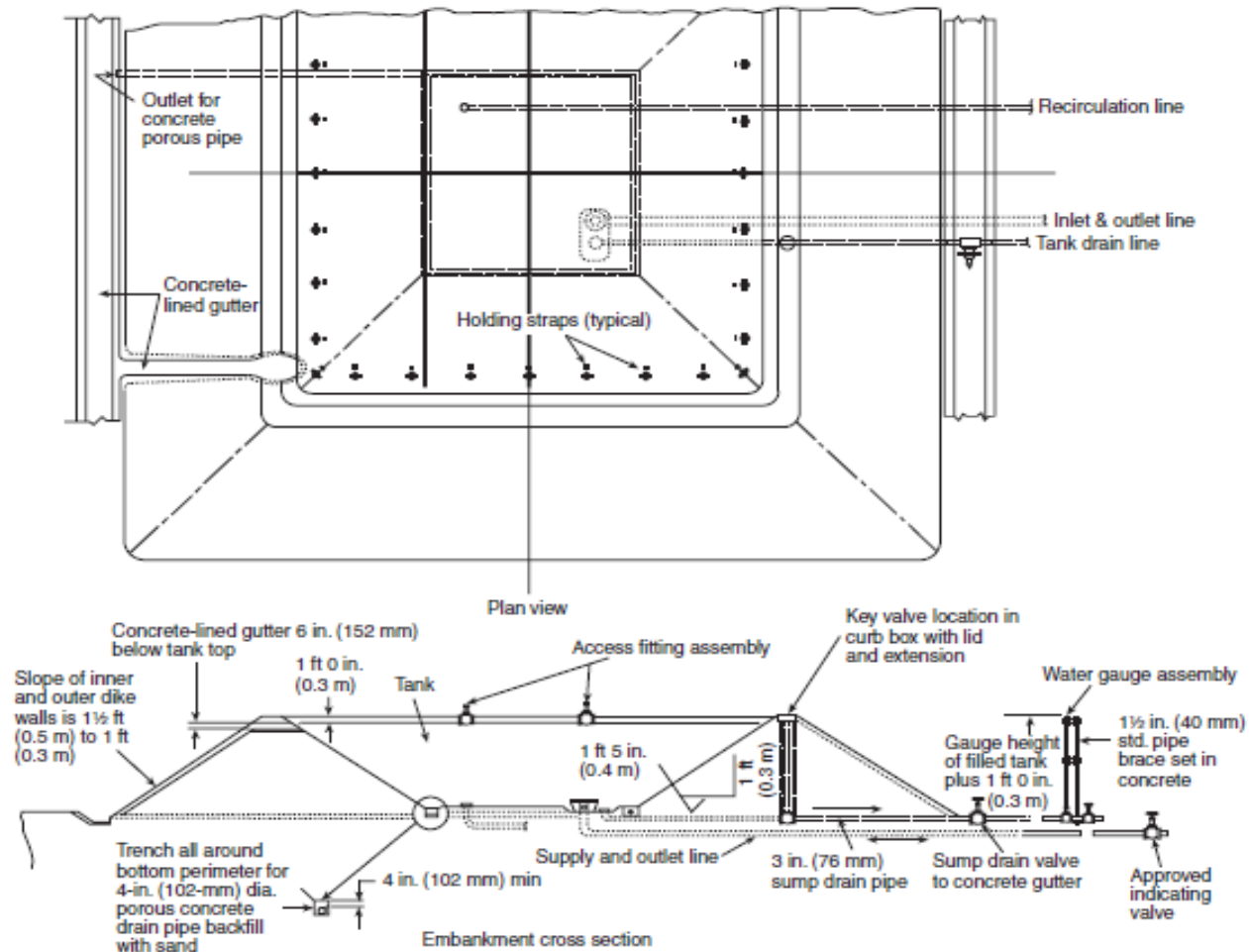
We have been given sprinkler demand as 140 GPM for 30 minutes, yielding a water requirement of 4200 gallons(which is going to be in 30% of the tank)

Hence, the Total size of the pressure tank would be 14,000 gallons

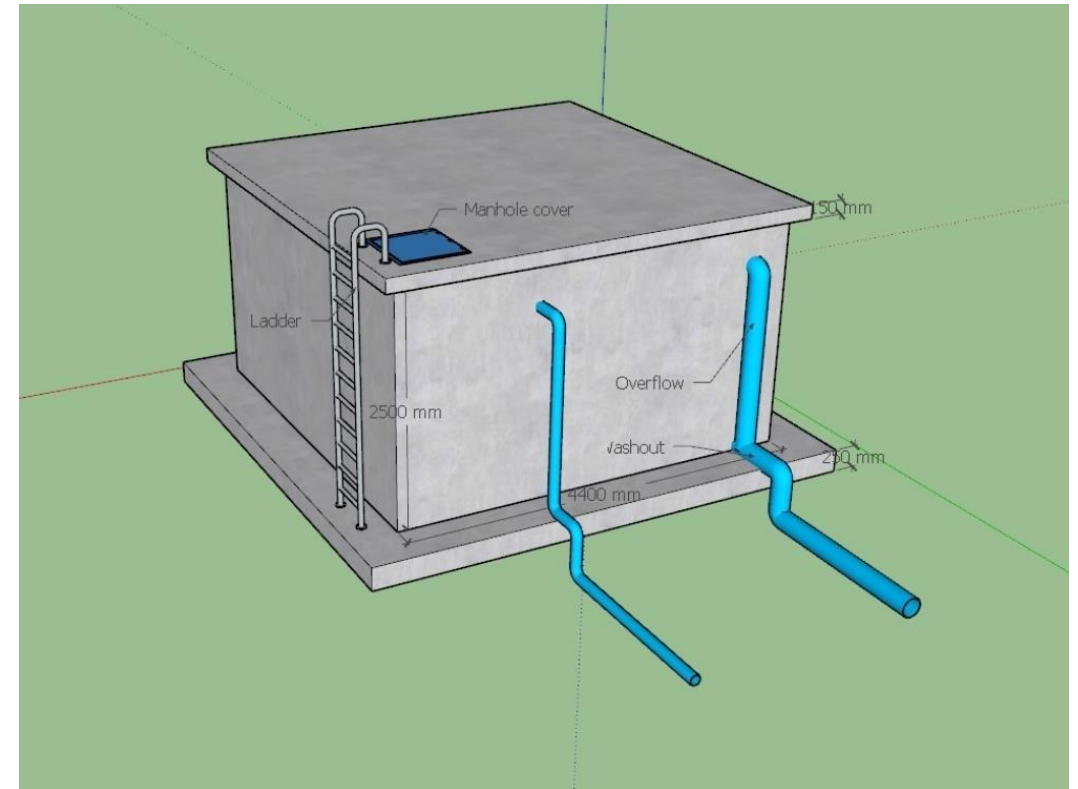
# Wood Gravity Tanks and Suction Tanks



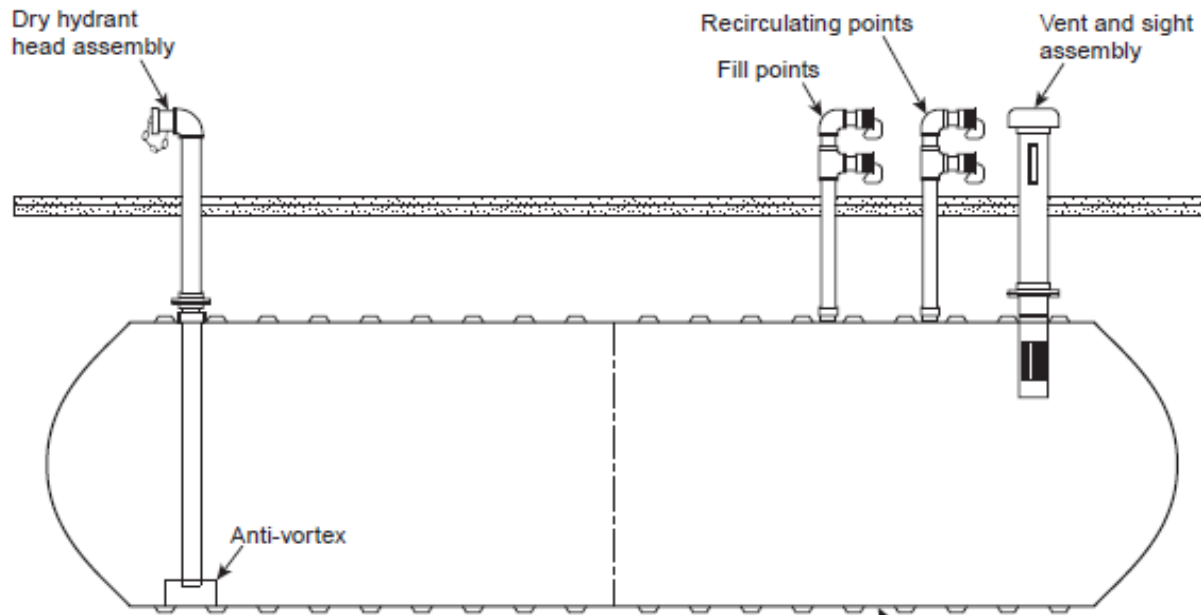
# Embankment-Supported Coated Fabric Suction Tanks



# Concrete Gravity Tanks and Suction Tanks



# FRP Tanks



*Fiberglass Tank as an Underground Cistern*

Typical illustration drawing  
Fiberglass underground cistern tank

Fiberglass water tank



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# FRP Tanks

**11.6.3** Fiberglass-reinforced plastic (FRP) tanks located inside a building shall be protected by automatic sprinklers in accordance with ordinary hazard Group 2 occupancies.

**11.6.5** Fiberglass tanks installed outdoors shall be protected from freezing and mechanical and UV damage.

Electronic supervision of the tank water temperature should be provided and can be accomplished by the installation of a temperature supervisory switch. This switch must be installed in accordance with *NFPA 72®*, *National Fire Alarm and Signaling Code*, and should produce two separate and distinct signals.

One signal should indicate a decrease in water temperature to 40°F (4.4°C), and the other signal should indicate a return to water temperature above 40°F (4.4°C). A single switch can be used to accomplish this task.



# Antivortex Plate

The discharge outlet for every suction tank shall be equipped with an anti-vortex plate assembly



# WHEN TO INSTALL "ANTI-VORTEX PLATE"?:

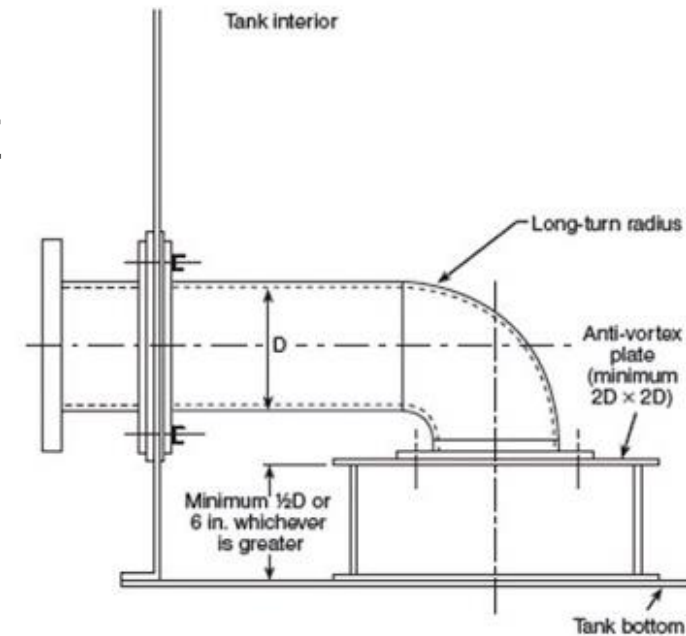
Where a **tank** is used as the suction source for a fire pump, the discharge outlet of the tank shall be equipped with an assembly that controls vortex flow.

# PURPOSE OF USING "ANTI-VORTEX PLATE"?

ANTI-VORTEX PLATE IS INSTALLED IN THE SUCTION LINE OF FIRE PUMPS TO CONTROL THE **TURBULENCE** IN FLOWING WATER, THEY ARE SIMPLE IN DESIGN AND VERY EFFECTIVE IN CONTROLLING THE **VELOCITY** OF THE FLUID THUS PREVENTING **CAVITATION** TO FIRE PUMPS AND DAMAGE TO IMPELLERS.

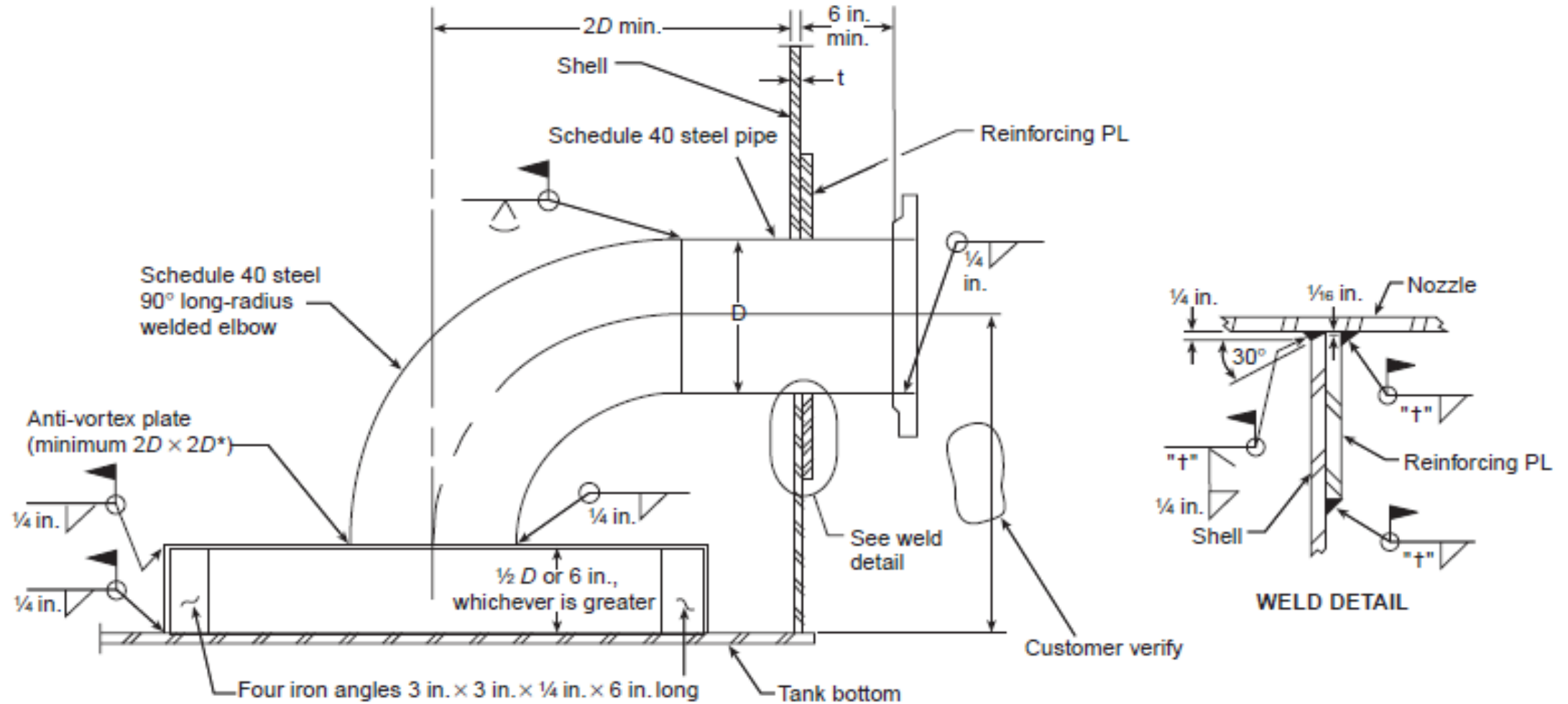
# DIMENSIONS OF "ANTI-VORTEX PLATE"?

- The assembly shall consist of a horizontal steel plate that is at least **twice the diameter of the outlet on an elbow fitting**.
- Large, standard size anti-vortex plates [48 in. X 48 in. (1219 mm × 1219 mm)] are **most common** and are adequate for all sizes of fire protection normally used



For SI units, 1 in. = 25.4 mm.

# DIMENSIONS OF "ANTI-VORTEX PLATE"?



For SI units, 1 in. = 25.4 mm.

\*Frequently, a 48 in.  $\times$  48 in. size is used as a standard size that will work for any situation.

# INSTALLATION DIMENSIONS

Mounted at the outlet a distance above the bottom of the tank equal to one-half the diameter of the discharge pipe or 152mm whichever is greater.

# ANTI-VORTEX PLATE INSPECTION

- Inspection of anti-vortex plate shall be **after** completion of the tank construction, and **before** filling the tank with water.
- The inspection shall verify that the horizontal steel plate and long radius elbow are installed properly and meet the requirements of dimensions and installation height mentioned above.

# Thank You