ELEVATION PRESSURE

- Fresh water weighs 62.4 pounds per cubic foot.

- The pressure at the bottom of container of water is determined by dividing the weight of the water in the container by the area of the bottom of the container.

Pressure = Weight/Area

- If a container with inside dimensions of 1 foot by 1 foot by 1 foot (1 cubic foot) is filled with fresh water, the weight of the water in the container will be 62.4 pounds and the area of the bottom of the container will be 1 square foot. Hence, the pressure at the bottom of the container will be 62.4 pounds per square foot.

- There are 144 square inches in 1 square foot. Hence, the pressure at the bottom of the container will be computed as follows:

  62.4 pounds/144 square inches = 0.433 pounds/square inch (psi)

- If a container with inside dimensions of 1 foot by 6 inches by 1 foot deep (0.5 cubic feet) is filled with fresh water, the weight of the water in the container will be computed as follows:

  62.4 pounds/cubic foot X 0.50 cubic feet = 31.2 pounds

  The pressure at the bottom of the container will be computed as follows:

  31.2 pounds/0.5 square feet = 62.4 pounds/square foot (psf)

  0.5 square feet = 72 square inches

  31.2 pounds/72 square inches = 0.433 pounds/square inch (psi)

- If a container with inside dimensions of 1 foot by 3 inches by 1 foot deep (0.25 cubic feet) is filled with fresh water, the weight of the water in the container will be computed as follows:

  62.4 pounds/cubic foot x 0.25 cubic feet = 15.6 pounds

The pressure at the bottom of the container will be computed as follows:

15.6 pounds/0.25 square feet = 62.4 pounds/square foot (psf)

0.25 square feet = 36 square inches

15.6 pounds/36 square inches = 0.433 pounds/square inch (psi)

Conclusions:

- The size of the container does not affect the pressure in the container.
- The pressure at the bottom of the container is proportional to the depth of the water in a container.
- The factor which can be used to compute changes in pressure in a container of fresh water is 0.433 psi per foot of depth of water.
- A piping system supplying sprinklers or standpipe system outlets is a container. Hence, the elevation pressure factor of 0.433 psi/foot can be used to compute the changes in pressure due to changes in elevation.

EXAMPLE #1

A pressure gauge is provided on a sprinkler riser 4 feet above the floor. The gauge reads 50 psi. **What pressure is available in the riser at a point 20 feet above the floor (assuming no water is flowing in the system)?**

Elevation Difference:	20 feet - 4 feet = 16 feet
Elevation Pressure Difference:	16 feet X 0.433 psi/foot = 6.93 psi
Pressure at Elevation 20 Feet:	50 psi - 6.93 psi = 43.07 psi

EXAMPLE #2

A pressure of 15 psi is required to be provided at the highest sprinkler (assuming no water is flowing in the system). What pressure is required at the base of the sprinkler riser if the highest sprinkler in the system is 36 feet above the base of the sprinkler riser?

Elevation Pressure Difference: 36 feet X 0.433 psi/foot = 15.59 psi

Pressure Required at Base of Riser: 15 psi + 15.59 psi = 30.59 psi
(To Achieve 15 psi at the Highest Sprinkler)

EXAMPLE #3

Hydrants A and B are supplied by a 8 inch water main in a private fire protection water supply system. (Assume that there is no water flowing in the private fire protection system.) A pressure gauge on Hydrant A indicates that the pressure at this hydrant is 80 psi, while a pressure gauge on Hydrant B indicates that the pressure at this hydrant is 73 psi. What is the elevation difference between the outlets used to take the pressure readings at Hydrants A and B? Is the elevation of Hydrant A higher or lower than the elevation of Hydrant B?

Elevation Pressure Difference: 80 psi - 73 psi = 7 psi

Elevation Difference: 7 psi/0.433 psi/foot = 16.2 feet

The elevation of Hydrant A is 16.2 feet lower than the elevation of Hydrant B (because the pressure at Hydrant A is greater than the pressure at Hydrant B).

EXAMPLE #4

The top of an elevated tank is 120 feet above the base of the tank riser, while the bottom of the tank is 80 feet above the base of the tank riser. A pressure gauge is attached to the base of the tank riser. What is the maximum pressure at the base of the tank riser and what is the pressure measured at the base of the tank riser when the tank is empty? (When the tank is empty, assume that the tank riser is still full of water.)

Maximum Pressure: 120 feet X 0.433 psi/foot = 52.0 psi
(At the Base of the Tank Riser)

Minimum Pressure: 80 feet X 0.433 psi/foot = 34.6 psi
(At the Base of the Tank Riser)

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