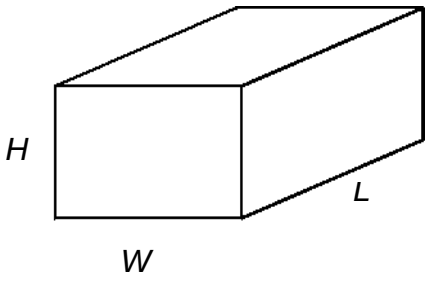
Flammable and Combustible Liquids 155: Storage Rooms

An OSHA-approved storage room is required if the company stores more than twenty-five gallons of flammable and combustible liquids. The approved storage room must have a ventilation system that can completely exchange the air within the room at least six times per hour. To be sure that the ventilation system is the proper size, the volume of air in the room that must be exchanged must be known. With most storage rooms being rectangular, the volume that needs to be calculated is the volume of a rectangular box or prism.



This image of a rectangular prism shows the three dimensions of the prism as length (*L*), width (*W*), and height (*H*). The formula for finding the volume is $V = LWH$.

Image illustrated by author

Remember that the volume is the amount of space inside the rectangular prism. Therefore, the proper units for volume are cubic units, indicating it is three-dimensional.

Once the volume is known, the exchange rate can be determined by dividing the volume of air that must be exchanged by the time frame for the exchange.

$$\text{Exchange rate} = \frac{\text{Volume of air to be exchanged}}{\text{Time for exchange}}$$

This exchange rate is also called the air flow capacity of a ventilation system and is usually given in cubic feet per minute (cfm).

EXAMPLE:

A storage room is 14 feet wide and 20 feet long, and has 8 foot ceilings.

a. What volume of air is in an empty storage room of this size?

b. What is the air exchange rate for this room if the air is exchanged six times per hour?

SOLUTION:

a. length (L) = 20 ft

   width (W) = 14 ft

   height (H) = 8 ft

   $V = LWH = (20\text{ ft})(14\text{ ft})(8\text{ ft}) = 2240$ cubic feet $= 2240\text{ ft}^3$

b. Since the air in the room must be exchanged at least six times per hour, first determine the volume of air exchanged after six times.

   $2240\text{ ft}^3 \times 6 = 13{,}440\text{ ft}^3$

   Now find the exchange rate.

$$\text{Exchange rate} = \frac{\text{Volume of air to be exchanged}}{\text{Time for exchange}}$$

$$\text{Exchange rate} = \frac{13{,}440\text{ ft}^3}{1\text{ hour}} = 13{,}440\text{ ft}^3/\text{hr}$$

or

$$\text{Exchange rate} = \frac{13{,}440\text{ ft}^3}{60\text{ min}} = 224\text{ ft}^3/\text{min} = 224\text{ cfm}$$

EXERCISES:

1. A storage room with 10 ft ceilings is 15 feet wide and 18 feet long. What volume of air is in a room of this size?

2. To be OSHA approved, the storage room in exercise 1 must have a complete air exchange at least 6 times per hour. Determine the exchange rate in ft^3/hr, if the air is exchanged 6 times per hour.

3. Change the exchange rate in exercise 2 to ft^3/min (cfm) so as to know the required airflow capacity of the ventilation system.

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