

FLAMMABLE AND COMBUSTIBLE LIQUIDS

vapor-air mixture will ignite under defined conditions without an external source of ignition

Vapors and gases will spontaneously ignite at a lower temperature in oxygen than in air, and their auto-ignition temperature may be influenced by the presence of catalytic substances.

Flammable limits Flammable liquids have a minimum concentration of vapor in air below which propagation of flame does not occur on contact with a source of ignition. There is also a maximum proportion of vapor or gas in air above which propagation of flame does not occur.

The extremes of vapor or gas concentration with air which, if ignited, will just propagate flame are known as the "lower and upper flammable limits" and are usually expressed in terms of percentage by volume of gas or vapor in air. These limits are also commonly referred to as, respectively, the lower and upper explosive limits.

A mixture with less than approximately 10 per cent of gasoline vapor is too lean, and propagation of flame will not occur on contact with a source of ignition. Similarly, if there is more than approximately 8 per cent of gasoline vapor, the mixture will be too rich. Other gases such as hydrogen, acetylene, and ethylene have a wider range of flammable limits.

Flammable range is the difference between the lower and upper flammable limits, expressed in terms of percentage of vapor or gas in air by volume, and is also often referred to as the "explosive range."

For example, the limits of the flammable range of gasoline are generally taken as 1.4 to 7.6 per cent which is relatively narrow. Thus, a mixture of 1.4 per cent gasoline vapor and 98.6 per cent air is flammable, as are all the intermediate mixtures up to and including 7.6 per cent gasoline vapor and 92.4 per cent air. The range is therefore the difference between the limits, or 6.2 per cent.

Propagation of flame is the spread of flame through the body of the flammable vapor-air mixture independently of the source of ignition. A vapor-air mixture below the lower flammable limit may burn at the point of ignition without propagating (spreading) away from ignition source.

Rate of diffusion indicates the tendency of one gas or vapor to disperse into or mix with another gas or vapor. This rate depends on the density of the vapor or gas as compared with that of air, which is given a value of 1. Whether a vapor or gas is lighter or heavier than air determines to a large extent the method of solving ventilation problems.

Vapor pressure is the pressure measured in pounds per square inch absolute (psia) exerted by a volatile liquid, as determined by the "Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)," ASTM D323-58.

Volatility is the tendency or ability of a liquid to vaporize. Such liquids as alcohol and gasoline, because of their well known tendency to evaporate rapidly, are called volatile liquids.

Oxygen deficiency designates an atmosphere having less than the percentage of oxygen found in normal air. Normal air contains about 21 per cent oxygen at atmospheric pressure.

When the oxygen concentration in air is reduced to approximately 16 per cent, many individuals become dizzy, experience a buzzing in the ears, and have a rapid heart beat.

In addition to tests for toxicity,* the oxygen content of the atmosphere of a tank or similarly confined space should be determined by pre-entry and subsequent tests made with instruments approved for the purpose by the U. S. Bureau of Mines.

No one should enter or remain in a tank or enclosed space that tests show has less than 16 per cent oxygen in its atmosphere at any time unless he wears approved respiratory protective equipment, such as a fresh-air hose mask or self-contained or self-generating breathing apparatus.

Self-contained compressed air breathing apparatus, approved by the U. S. Bureau of Mines, have proved satisfactory in oxygen deficient atmospheres. They are especially useful where it is difficult to run a hose line.

*U. S. Bureau of Mines *Mine Gases and Methods for Their Detection* Circular No. 33