TABLE 6. APPROXIMATE LIMITS OF FLAMMABILITY OF SINGLE GASES AND VAPORS IN AIR AT ORDINARY TEMPERATURES AND PRESSURES[a]

| GAS OR VAPOR | LOWER LIMIT PERCENT BY VOLUME | UPPER LIMIT PERCENT BY VOLUME | *Closed Cup*[b] FLASH POINT FAHRENHEIT | NBFU CLASSIFICATION[c] |
|---|---|---|---|---|
| Acetyldehyde | 4.0 | 57 | −17 | I |
| Acetone | 2.5 | 12.8 | 0 | I |
| Acetylene | 2.5 | 80 | .... | |
| Allyl alcohol | 2.5 | .... | 70 | II |
| Ammonia | 15.5 | 26.6 | .... | |
| Amyl alcohol | 1.2 | .... | 100 | III |
| Amyl chloride | 1.6 | .... | .... | |
| Amylene | 1.6 | 7.7 | .... | |
| Benzene (benzol) | 1.3 | 6.8 | 12 | I |
| Benzyl chloride | 1.1 | .... | 140 | III |
| Butane | 1.8 | 8.4 | .... | |
| Butyl acetate | 1.4 | 15.0 | 84 | III |
| Butyl alcohol | 1.7 | .... | .... | |
| Butylene | 2.0 | 9.7 | .... | |
| Carbon disulfide | 1.2 | 50 | −22 | I |
| Carbon monoxide | 12.5 | 74.2 | .... | |
| Crotonaldehyde | 2.1 | 15.5 | 55 | II |
| Cyclohexane | 1.3 | 8.4 | 1 | I |
| Cyclopropane | 2.4 | 10.5 | .... | |
| Decane | 0.67 | 2.6 | 115 | III |
| Dichloroethylene (1, 2) | 9.7 | 12.8 | 57 | II |
| Diethyl selenide | 2.5 | .... | .... | |
| Dioxane | 2.0 | 22.2 | 54 | II |
| Ethane | 3.1 | 12.5 | .... | |
| Ether (diethyl) | 1.8 | 36.5 | −49 | I |
| Ethyl acetate | 2.2 | 11.5 | 28 | II |
| Ethyl alcohol | 3.3 | 19.0 | 54 | II |
| Ethyl bromide | 6.7 | 11.3 | .... | |
| Ethyl cellosolve | 2.6 | 15.7 | 104 | III |
| Ethyl chloride | 4.0 | 14.8 | −58 | I |
| Ethylene | 2.7 | 28.6 | .... | |
| Ethylene dichloride | 6.2 | 15.9 | 56 | II |
| Ethyl formate | 2.7 | 16.5 | −4 | I |
| Ethyl nitrite | 3.0 | 50 | −31 | I |
| Ethylene oxide | 3.0 | 80 | .... | |
| Furfural (125 C) | 2.1 | .... | 140 | III |
| Gasoline (variable) | 1.4–1.5 | 7.4–7.6 | −50 | I |
| Heptane | 1.0 | 6.0 | 25 | II |
| Hexane | 1.2 | 6.9 | −15 | I |
| Hydrogen cyanide | 5.6 | 40.0 | .... | |
| Hydrogen | 4.0 | 74.2 | .... | |
| Hydrogen sulfide | 4.3 | 45.5 | .... | |
| Illuminating gas (coal gas) | 5.3 | 33.0 | .... | |
| Isobutyl alcohol | 1.7 | .... | 82 | III |
| Isopentane | 1.3 | .... | .... | |
| Isopropyl acetate | 1.8 | 7.8 | 43 | II |
| Isopropyl alcohol | 2.0 | .... | 53 | II |
| Methane | 5.0 | 15.0 | .... | |
| Methyl acetate | 3.1 | 15.5 | 14 | I |
| Methyl alcohol | 6.7 | 36.5 | 52 | II |
| Methyl bromide | 13.5 | 14.5 | .... | |
| Methyl butyl ketone | 1.2 | 8.0 | .... | |
| Methyl chloride | 8.2 | 18.7 | .... | |
| Methyl cyclohexane | 1.1 | .... | 25 | II |
| Methyl ethyl ether | 2.0 | 10.1 | −35 | I |
| Methyl ethyl ketone | 1.8 | 9.5 | 30 | II |
| Methyl formate | 5.0 | 22.7 | −2 | I |
| Methyl propyl ketone | 1.5 | 8.2 | .... | |
| Natural gas (variable) | 4.3 | 13.5 | .... | |
| Naphtha (benzene) | 1.1 | 6.0 | 20–110 | III |
| Naphthalene | 0.9 | .... | 176 | III |
| Nonane | 0.83 | 2.9 | 88 | III |
| Octane | 0.95 | 3.2 | 56 | II |
| Paraldehyde | 1.3 | .... | .... | |
| Pentane | 1.4 | 7.8 | .... | |



TABLE 6. APPROXIMATE LIMITS OF FLAMMABILITY OF SINGLE GASES AND VAPORS IN AIR AT ORDINARY TEMPERATURES AND PRESSURES[a] (Concluded)

| GAS OR VAPOR | LOWER LIMIT PERCENT BY VOLUME | UPPER LIMIT PERCENT BY VOLUME | *Closed Cup*[b] FLASH POINT FAHRENHEIT | NBFU CLASSIFICATION[c] |
|---|---|---|---|---|
| Propane | 2.1 | 10.1 | .... | |
| Propyl acetate | 1.8 | 8.0 | 58 | II |
| Propyl alcohol | 2.1 | 13.5 | 59 | II |
| Propylene | 2.0 | 11.1 | .... | |
| Propylene dichloride | 3.4 | 14.5 | 60 | II |
| Propylene oxide | 2.0 | 22.0 | .... | |
| Pyridine | 1.8 | 12.4 | 74 | III |
| Toluene (toluol) | 1.3 | 7.0 | 40 | II |
| Turpentine | 0.8 | .... | 95 | III |
| Vinyl ether | 1.7 | 27.0 | .... | |
| Vinyl chloride | 4.0 | 21.7 | .... | |
| Water gas (variable) | 6.0 | 70 | .... | |
| Xylene (xylol) | 1.0 | 6.0 | 63 | II |

[a] Adapted from: Fire and Explosion Hazards of Combustible Gases and Vapors, by G. W. Jones; Chapter 13, Industrial Hygiene and Toxicology, edited by F. A. Patty (Interscience Publishers, 1948); Properties of Flammable Liquids, Gases and Solids (Associated) Factory Mutual Fire Ins. Cos., January (1940); and National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives—1945 (*National Fire Protection Association*).

[b] *Closed cup* refers to the equipment used in flash point determinations.

[c] From Standards for Storage, Handling and Use of Flammable Liquids (*National Board of Fire Underwriters*, No. 30, July 1954).

vestigators frequently experience difficulty in obtaining dust suspensions of uniform dispersion, and this should be kept in mind when comparing results from several sources.[14]

Minimum explosive concentrations of airborne dusts already tested range from 0.01 to 0.5 oz per cubic foot, or 10 to 500 grams per cubic meter of air. Maximum pressures generated have been reported as high as 500 psi, although they are more likely to be of the order of 50 psi. Investigations on the flammable characteristics of dusts are currently made at 0.1 and 0.5 oz. per cubic foot.[15-21]

## ATMOSPHERIC POLLEN

Properties of pollen grains discharged by weeds, grasses and trees and responsible for hay fever, are of special interest to designers of air cleaning equipment (see Allergic Disorders in Chapter 7, and Air Cleaning, Chapter 34). Whole grains and fragments transported by the air range chiefly between 10 and 50 microns in size, but some have been measured as small as 5 microns, and others over 100 microns in diameter. Ragweed pollen grains are fairly uniform in size within the range of 15 to 25 microns. Pollen grains can be removed from the air more readily than the particles of dust prevalent in outdoor air or produced by dusty processes, since the latter predominate in the range of 0.1 to 10 microns in size.

Most grains are quite hygroscopic and therefore vary in weight with the humidity. Illustrations and data on individual pollen grains are available in the botanical literature.[22, 23, 24] Geographical distribution of plants known to produce hay fever is also recorded.[25, 26]

The quantity of pollen grains in the air is generally estimated by exposing an adhesive-coated glass plate outdoors for 24 hr, and then counting calibrated areas under the microscope. Methods are available for determining the number of grains in a measured volume of air,[25, 27, 28] but their greater accuracy has not caused them to replace the more simple *gravity slide method* used for most pollen counts. Counting technics vary somewhat, but the daily pollen counts reported in local newspapers during the