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Dielectric Constants of Liquids

Some fluids and their dielectric constants or permittivities

The Dielectric Constant, or permittivity - ϵ - is a dimensionless constant that indicates how easy a material can be polarized by imposition of an electric field on an insulating material. The constant is

- *the ratio between the actual material ability to carry an alternating current to the ability of vacuum to carry the current*

The dielectric constant can be expressed as

$$\epsilon = \epsilon_s / \epsilon_0 \quad (1)$$

where

ϵ = the dielectric constant

ϵ_s = the static permittivity of the material

ϵ_0 = vacuum permittivity

The Dielectric Constant of common fluids are indicated in the table below. The Dielectric Constant is in general influenced by

- temperature
- moisture levels
- electrical frequency
- part thickness

Fluid	Temperature (°C) (°F)	Dielectric Constant - ϵ -
Acetal	25	3.8
Acetaldehyde	18	21.8
Acetamide	91	67.6
Acetic acid	20	6.2
Acetone	25	20.7
Acetonitrile	20	36.6
Acetophenone		18
Acetyl bromid		16.2
Acetyl chloride	22	15.8
Acetylacetone		23
Acetylene	-78	2.48
Acetylene dibromide		7.2

Fluid	Temperature (°C) (°F)	Dielectric Constant - ϵ -
Acetylene tetrabromide		5.6
Acrylonitrile	20	33
Aconite acid ester		6.3
Adipic Acid		1.8
Aerosile		1.0
Air (at STP , for 0.9 MHz))		1.00058986 ± 0.00000050
Alcohol, allyl	20	19.7
Alcohol, benzyl	30	11.9
Alcohol, cetyl	60	3.6
Alcohol, diacetone		18.2
Alcohol, ethyl (ethanol)	20	25.3
Alcohol, methyl (methanol)	20	33.0
Alcohol, propyl	20	21.8
Allene	-4	2.03
Allylbenzene	20	2.63
Allyl chloride		8.2
Allyl iodide		6.1
Allyl isocyanate	15	15.2
Aluminum bromide	100	3.38
Ammonia	20	16.61
Ammonia solution 25%		31.6
Amyl amine		4.5
Aniline	20	7.06
Anisole	21	4.3
Antimony hydride		1.8
Anthracene	229	2.65
Argon	-133	1.32
Arsine		2.1
Arsole		2.3
Azoxybenzene	36	5.2
Benzaldehyde	20	17.9
Benzene	20	2.28
Benzil	95	13.04
Benzonitrile	20	25.9
Benzyl acetat	30	5.34
Benzyl formate	30	6.34
Benylamine	20	5.18
Biphenyl	75	2.35
Bromine	25	3.15
Bromine trifluoride	25	107
Bromoethane	25	9.01
Butane	22	1.77
Butanoic acid		3.0
1-Butanol	20	17.8
Butyl acetate	20	5.07
Butyl acrylate	28	5.25
Butylamine	20	4.71
Butylbenzene	20	2.36
Butyl nitrate	20	13.1

Fluid	Temperature	Dielectric Constant - ϵ -
	(°C) (°F)	
Caproic acid	71	2.6
Caprylic acid		2.5
Carbon dioxide	22	1.45
Carbon disulfide	20	2.63
Carbon tetrachloride	20	2.23
Castor Oil	15	4.7
Chlorine, chlor fluid	-65	2.15
Chlorine pentafluoride	-80	4.28
Chlorine trifluoride	20	4.39
Chlor benzene		5.7
Chloroacetic acid	65	12.4
Chlorocyclohexane	30	7.95
Chloroethane	20	9.45
Chloroform	20	4.8
Chlorodifluoromethane refrigerant R-22	25	2.0
Coconut oil, refined		2.9
Cotton seed oil		3.1
Cresol	17	10.6
Cumene	20	2.4
Cyanoacetic acid	4	33.4
Cyanoacetylene	19	72.3
Cycloheptane	20	2.08
Cycloheptene	22	2.27
Cyclohexane	20	2.02
Cyclohexene	20	2.22
Decane	20	2.0
Diacetone alcohol	25	18.2
Dichlorodifluoromethane refrigerant R-12	25	2.0
Diesel oil, fuel		2.1
Diethyl ether	20	4.27
Diethyl sulfide	25	5.7
Difluoromethane	-121	53.7
Dimethyl ether	-15	6.18
Docosane	20	2.08
Dodecane	20	2.01
Ethane	-178	1.94
Ether	20	4.3
Ethylamine	21	6.3
Ethylene glycol	20	37.0
Ethoxybenzene	20	4.22
Ethylamine	0	8.7
Ethyl acrylate	30	6.05
Ethylbenzene	20	2.44
Ethylene	-3	1.48
Ethyl isocyanate	20	19.7
Ethyl lactate	30	15.4
Ethyl salicylate	35	8.48
Ethyl silicate	20	2.5
Eucalyptol	25	4.57
Fish oil		2.6

Fluid	Temperature	Dielectric Constant - ϵ -
	(°C) (°F)	
Fluorbenzene	20	6.4
Fluorine	-220	1.49
Fluoromethane	-142	51.0
Formamide	20	111
Formic acid	25	51.1
Furan	25	2.94
Furfural	20	42.1
Furfuryl alcohol	25	16.9
Gasoline, gas	21	2.0
Glycerine		47-68
Glycerol	20	46.5
Glycerol water		37
Glycol		37
Helium	-271	1.056
Heptadecane	20	2.06
Heptanal	22	9.07
Heptane	20	1.92
Heptanoic acid	15	3.04
1-Heptanol	20	11.75
Heptyl acetat	20	4.2
Heptylamine	20	3.81
Heptylbenzene	20	2.26
Hexadecane	20	2.05
Hexane	20	1.89
Hexanoic acid	25	2.6
1-Hexanol	20	13.03
1-Hexene	21	2.1
Hexyl acetate	20	4.42
Hexylamine	20	4.1
Hexylbenzene	20	2.3
Hydrazine	25	51.7
Hydrogen	-260	1.279
Hydrogen bromide	-86	8.23
Hydrogen chloride	-114	14.3
Hydrogen cyanide	20	114.9
Hydrogen fluoride	0	83.6
Hydrogen peroxide	17	74.6
Hydrogen sulfide	10	5.93
Iodine	118	11.08
Iodine heptafluoride	25	1.75
Isobutane	22	1.75
Isobutyl acetat	20	5.1
Isobutylbenzene	20	2.3
Isopentane	20	1.85
Isopentyl acetat	20	4.72
Isopentyl lactate	0	11.2
Isopentyl salicylate	20	7.26
Isopropanol (2-Propanol, Isopropyl alcohol, propan-2-ol, (CH ₃) ₂ CHOH)		18.2
Isopropylamine	20	5.6

Fluid	Temperature	Dielectric Constant - ϵ -
	(°C) (°F)	
Isopropylbenzene	20	2.38
Jet fuel	21	1.7
Kerosene	21	1.8
Krypton	-153	1.66
Lead chloride	20	2.78
Linoleic Acid	0	2.6-2.9
Linseed Oil		3.2-3.5
Menthol	36	3.9
Mercury (vapor)	148	1.00074
Methane	-182	1.68
Methyl acetate	15	7.07
Methyl acrylate	30	7.03
Methylamine	-58	16.7
Methyl benzoate	30	6.64
Methylcyclohexane	20	2.02
Methyl nitrate	20	23.9
Methyl nitrite	27	27.8
Napthalene	20	2.5
Neon	-247	1.19
Neopentane	23	1.77
L-Nicotine	20	8.9
Nitric oxide	-149	2.0
Nitrobenzene	20	35.6
Nitroethane	15	29.1
Nitrogen	-210	1.47
Nitrogen tetroxide	20	2.44
Nitromethane	20	37.3
Nonane	20	1.97
Nonanoic acid	22	2.48
1-Nonanol	20	8.83
Nonyl acetat	20	3.87
Octane	20	1.95
Octanoic acid	15	2.85
Octyl acetat	15	4.18
Oil		2
Olive Oil	20	3.1
Oxygen	-219	1.57
Ozone	-183	4.75
Palmitic Acid	71	2.3
Palm seed oil		1.8
Paraffin		1.6
Pentaborane	25	21.1
Pentadecane	20	2.04
Pentanal	20	10
Pentane	20	1.84
Pentanoic acid	21	2.66
Pentamethylbenzene	61	2.36
1-Pentanol	25	15.3
Pentyl acetat	20	4.79
Pentylamine	20	4.27

Fluid	Temperature (°C) (°F)	Dielectric Constant - ϵ -
Pentyl nitrite	25	7.21
Pentyl salicylate	28	6.25
Phenol	30	12.4
Phenyl acetat	25	5.40
Phenylacetylene	25	2.98
Phosgene	0	4.7
Phosphorus liquid		3.9
Pinane	25	2.15
Pinene	20	2.7
Propane	20	1.67
Propanenitrile	20	29.7
Propanol (propyl alcohol, 1-Propanol, n-propanol, or propan-1-ol, CH ₃ CH ₂ CH ₂ OH)		20.1
Propene	-53	2.14
Propyl acetate	20	5.62
Propylamine	23	5.08
Propylbenzene	20	2.37
Propylene		11.9
Propylether		3.3
Pyrazine	50	2.80
Pyridine	20	1.12
Resorcinol		3.2
Stearic Acid	71	2.3
Styrene	20	2.47
Sulfur	134	3.5
Sulfur dioxide	20	14.3
Terpinene	17	2.7
Thymol	60	4.3
Toluene	23	2.38
Transformer oil		2.1
Trichlorofluoromethane refrigerant R-11	20	2.0
Turpentine (wood), white spirit	20	2.2
Vacuum (by definition)		1
Vinegar		24
Water	20	80.1
Water	360	10
Water, demineralised		29.3
Water, heavy		78.3
Water - oil emulsion		24
Wine		25
Xenon	-112	1.88
o-Xylene	20	2.56
m-Xylene	20	2.36
p-Xylene	20	2.27
Xylitol	20	40.0

Typical dielectric values for some common plastic materials are indicated below:

Plastic Material	Dielectric Constant - ϵ -
Acetal	3.7 - 3.9

Plastic Material	Dielectric Constant - ϵ -
Acrylic	2.1 - 3.9
ABS	2.9 - 3.4
Nylon 6/6	3.1 - 8.3
Polycarbonate	2.9 - 3.8
Polyester, TP	3.0 - 4.5
Polypropylene	2.3 - 2.9
Polysulfone	2.7 - 3.8
PPO, Modified	2.4 - 3.1
Polyphenylene sulfide	2.9 - 4.5
Polyacrylate	2.6 - 3.1
Liquid Crystal	3.7 - 10

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- **Material Properties** - Material properties for gases, fluids and solids - densities, specific heats, viscosities and more

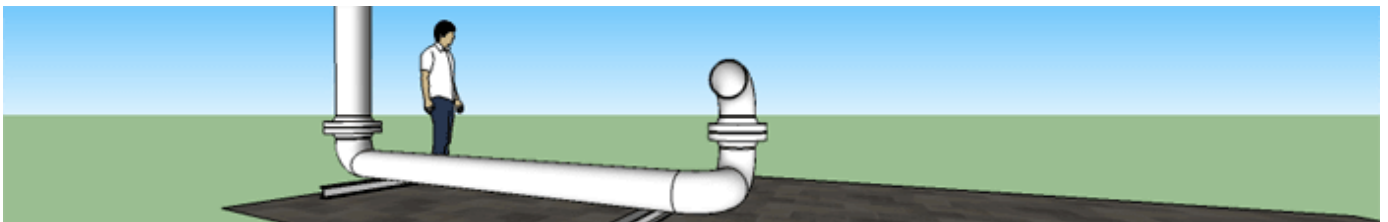
Related Documents

- **Acetone - Thermophysical Properties** - Chemical, physical and thermal properties of acetone, also called 2-propanone, dimethyl ketone and pyroacetic acid. Phase diagram included.
- **Benzene - Dynamic and Kinematic Viscosity** - Online calculator, figures and table showing dynamic and kinematic viscosity of benzene, C_6H_6 , at varying temperature and pressure - Imperial and SI Units
- **Dielectric Strength of Insulating Materials** - Ability to act as an electrical insulator
- **Toluene - Density and Specific Weight** - Linear temperature expansion coefficients for aluminum, copper, glass, iron and other common materials

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