TECHNICAL BULLETIN

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THE AROCLOR® POLYCHLORINATED POLYPHENYLS

Dielectrics for Capacitors & Transformers

TECHNICAL BULLETIN O-FF/1R

Monsanto

0408362

TOWOLDMON0005133
WATER_PCB-00001643

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Ask your Man from Monsanto for additional Aroclor literature:

Askarel Inspection and Maintenance Guide
Aroclor® Plasticizers Technical Bulletin
Thermal® FR Fluid Heat Systems
Engineering Heat Transfer Data

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What are the Aroclor® Polychlorinated Polyphenyls

These compounds are a series of chlorinated biphenyls and chlorinated polyphenyls. They range in form and appearance from mobile oily liquids to fine white crystals and hard transparent resins. Aroclor is non-oxidizing, permanently thermoplastic, of low volatility, and non-corrosive to metals. Aroclor is not hydrolyzed by water, alkalis, or acids. The viscous liquids and resins will not support combustion when heated alone, and they impart fire-resistance to other materials.

Crystalline Aroclor is relatively insoluble, but the liquid and resinous compounds are soluble in most of the common organic solvents, thinners and oils. All Aroclor chlorinated compounds are insoluble in water, glycerine or the glycols. Aroclor 5460 is insoluble in the lower molecular weight alcohols; 4465 is only partly soluble in the lower alcohols.

The following table describes the properties of twelve Aroclor chlorinated compounds, each of which is representative of a series.

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General Physical Properties of the Aroclor® Chlorinated Compounds

Form	Aroclor 1221 Colorless mobile oil	Aroclor 1232 Practically colorless mobile oil	Aroclor 1242 Practically colorless mobile oil	Aroclor 1248 Colorless to light yellow-green, clear, mobile oil	Aroclor 1254 Light yellow viscous oil
Color	50 Max. (APHA)	50 Max. (APHA)	50 Max. (APHA)	50 Max. (APHA)	50 Max. (APHA)
Acidity — Maximum (Mgm. KOH per Gm.)	0.014	0.014	0.010	0.010	0.010
Average Coefficient of Expansion....cc/cc/°C	0.00071 (15°-40°C)	0.00073 (25°-100°C)	0.00068 (25°-65°C)	0.00070 (25°-65°C)	0.00066 (25°-65°C)
Typical Density					
Specific Gravity	1.182-1.192 (25°/15.5°C)	1.270-1.280 (25°/15.5°C)	1.381-1.392 (25°/15.5°C)	1.405-1.415 (65°/15.5°C)	1.495-1.505 (65°/15.5°C)
Pounds per gallon — 25°C(77°F)	9.85	10.55	11.50	12.04	12.82
Distillation Range — ASTM D-20 (Mod.)					
Corr. °C	275°-320°	290°-325°	325°-366°	340°-375°	365°-390°
Evaporation Loss — % — ASTM D-6 Mod.					
163°C....5 hrs.	—	—	3.0 to 3.6	3.0 to 4.0	1.1 to 1.3
100°C....6 hrs.	1.0 to 1.5	1.0 to 1.5	0.0 to 0.4	0.0 to 0.3	0.0 to 0.2
Flash Point — Cleveland Open Cup....°C	141°-150°	152°-154°	176°-180°	193°-196°	None
°F	286°-302°	305°-310°	348°-356°	379°-384°	
Fire Point — Cleveland Open Cup....°C	176°	238°	None*	None	None
°F	349°	460°			
Pour Point — ASTM D-97....°C	Crystals at 1°C	−35.5°	−19°	−7°	10°
°F	Crystals at 34°F	−32°	2°	19.4°	50°
Softening Point — ASTM E-28....°C	—	—	—	—	—
°F	—	—	—	—	—
Refractive Index — D-line — 20°C	1.617-1.618	1.620-1.622	1.627-1.629	1.630-1.631	1.639-1.641
Viscosity — Saybolt Universal Sec. (ASTM — D-88) 210°F (98.9°C)	30-31	31-32	34-35	36-37	44-48
130°F (54.4°C)	35-37	39-41	49-56	73-80	260-340
100°F (37.8°C)	38-41	44-51	82-92	185-240	1800-2500

*NONE indicates — "No fire point up to boiling temperature"

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Aroclor 1260 Light yellow soft sticky resin	Aroclor 1262 Light yellow sticky clear resin	Aroclor 1268 White to off-white powder	Aroclor 4465 Light-yellow, clear, brittle resin	Aroclor 5442 Yellow transparent sticky resin	Aroclor 5460 Clear, yellow-to-amber, brittle resin	Aroclor 2565 Black, opaque, brittle resin
50 max. (APHA)	50 Max. (APHA)	1.5 Max. NPA (molten)	2 Max. NPA (molten)	2 Max. NPA (molten)	2 Max. NPA (molten)	—
0.014	0.014	0.05	0.05	0.05	0.05	1.4
0.00067 (20°-100°C)	0.00064 (25°-65°C)	0.00067 (20°-100°C)	0.00061 (25°-65°C)	0.00123 (25°-99°C)	0.00179 (25°-124°C)	0.00066 (25°-65°C)
1.555-1.566 (90°/15.5°C) 13.50	1.572-1.583 (90°/15.5°C) 13.72	1.804-1.811 (25°/25°C) 15.09	1.670 (25°/25°C) 13.91	1.470 (25°/25°C) 12.24	1.670 (25°/25°C) 13.91	1.734 (25°/25°C) 14.44
385°-420°	395°-425°	435°-450°	230°-320° at 4 mm. Hg.	215°-300° at 4 mm. Hg.	280°-335° at 5 mm. Hg.	—
0.5 to 0.8 0.0 to 0.1	0.5 to 0.6 0.0 to 0.1	0.1 to 0.2 0.0 to 0.06	0.2 to 0.3 0.0 to 0.02	0.2 0.01	0.03 1.5 to 1.7 (at 260°—5 hrs.)	0.2 to 0.3 —
None	None	None	None	247° 477°	None	None
None	None	None	None	>350° >662°	None	None
31° 88°	35°-38° 99°	— —	— —	46° 115°	— —	— —
— —	— —	150° to 170° (hold pt.) 302° to 338° (hold pt.)	60° to 66° 140° to 151°	46° to 52° 115° to 126°	98° to 105.5° 208° to 222°	66° to 72° 149° to 162°
1.647-1.649	1.6501-1.6517	—	1.664-1.667	—	1.660-1.665	—
72-78	86-100	—	90-150 (266°F or 130°C)	300-400	—	—
3200-4500	600-850 (160°F or 71°C)	—	—	—	—	—
—	—	—	—	—	—	—

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Stability

Toward Alkalies — Aroclor is remarkably resistant to the action of either hydrolyzing agents or high temperature. It is not affected by boiling with sodium hydroxide solution.

Toward Acids — Experiments were made to determine whether hydrogen chloride is evolved during the treatment of Aroclor with sulfuric acid. Aroclor 1254 (selected as typical) was stirred with an equal volume of ten per cent sulfuric acid for a period of 150 hours. Any gases escaping from the reaction flask had to pass through a trap filled with silver nitrate solution, which would give a precipitate of silver chloride if any HCl came in contact with it. After 150 hours of treatment, neither the trap solution nor the acid layer in the treating flask showed any hydrogen chloride present.

Even prolonged treatment (255 hours) with concentrated sulfuric acid indicated negligible effect.

Toward Oxidation — When Aroclor is subjected to a bomb test at 140°C with 250 pounds oxygen per square inch, there is no evidence of oxidation as judged by development of acidity or formation of sludge.

Electrical Resistivity

Aroclor has extremely interesting electrical characteristics: high resistivity and dielectric strength and low power factor. The dielectric constant ranges from 3.4 to 5.0 at 100°C and 1000 cycles, depending upon the particular Aroclor.

Solubility

All Aroclor chlorinated compounds are insoluble in water. They are soluble, however, in most of the common solvents, plasticizers, and resins.

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Electrical Applications of Aroclor

Aroclor is one of the purest commercial chemical compounds, virtually free of even traces of conducting impurities. For this reason, dielectric properties of Aroclor closely approximate the theoretical maximum for these particular organic compounds. With its stability, heat-resistance and fire-resistance – Aroclor can be used for a variety of heavy-duty dielectric applications, in hermetically sealed systems.

Dielectrics for Askarel Type Capacitors and Transformers

Aroclor is used per se in capacitors and is formulated for the liquid coolant-insulation fluids in transformers. Such dielectrics must be highly pure with dependably minimal traces of electrolytes. They must be chemically stable and non-corrosive to a wide variety of structural materials. Most important, the dielectric fluid must be fire-resistant.

Aroclor is the only liquid in low cost commercial supply that meets these exacting requirements.

Aroclor liquids 1242, 1248, 1254, and 1260 are used directly, or are carefully formulated with chlorinated benzene and other additives to make askarel fluid for particular needs. Typical formulated askarel fluids are shown on the following pages.

Aroclor liquids 1242 and 1254, themselves or in special formulations, are used as the dielectric in fixed paper capacitors, for the power factor correction in utility transmission lines; for home appliances such as air conditioners, furnaces, washers and driers; for electric motors; and for ballast in fluorescent fixtures. There are also a number of applications in DC systems, in condensers, and the new energy storage capacitors.

ELECTRICAL PROPERTIES

Aroclor	Dielectric Constant at 1,000 Cycles (1) 25°C	100°C	Volume Resistivity (2) Ohm-cm at 100°C, 500 Volts D.C.	Dielectric Strength (3)	Power Factor (4) 100°C, 1,000 Cycles
1232	5.7	4.6			
1242	5.8	4.9	Above 500×10^9	Greater than 35KV	<0.1%
1248	5.6	4.6	Above 500×10^9	Greater than 35KV	<0.1%
1254	5.0	4.3	Above 500×10^9	Greater than 35KV	<0.1%
1260	4.3	3.7	Above 500×10^9	Greater than 35KV	<0.1%
1268	2.5	—			
5442	3.0	4.9	Above 500×10^9		
5454	2.7	4.2			
5460	2.5	3.7			
4465	2.7	3.3			

(1) ASTM D-150-47T (2) ASTM D-257-46 (3) ASTM D-149-44 (4) ASTM D-150-47T

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Typical Transformer Askarel

(MIXTURE OF AROCLOR AND CHLOROBENZENES)

Property	Typical
Visc. @ 37.8°C. (ASTM D88) Spec. Gravity @ 15.5/15.5°C., (ASTM D287)	41-45 Sec. Saybolt Univ.
Color, APHA	1.563-1.571
Condition	150 max.
Acidity, mg. KOH/g.	Clear
Pour Pt., °C., (ASTM D97)	0.01 max.
Inorganic Chlorides, ppm	−44°C., or lower
Refractive Index @ 25°C.	0.10 max.
Distillation Range (ASTM D20) Corrected for stem and barometric pressure	1.6075-1.6085
First drop	210°C., min.
35%	240-256°C.
55%	290-330°C.
65%	385-400°C.
95%	395-415°C.
Corrosion	After heating with aluminum for 6 hrs. @ 200-220°C., the aluminum must not be corroded either on visual or weight inspection.
	The askarel fluid meets the following specifications: Color, APHA — 200 max. Acidity, mg. KOH/g. — 0.01 max. Inorg. Chlorides, ppm — 5 max. Condition — Clear
Water Content, ppm.	30 max.
Resistivity, 100°C., 500v., 0.1″ gap	100 x 10^9 ohm-cm., min.
Dielectric Strength, 25°C.	35 KV., min.
Dielectric Constant, 100°C., 1000 cycles*	3.8-4.2
Tin Tetraphenyl*	0.125% ± 0.01% by weight
Burn Point, (ASTM D92)*	None up to Boiling Point
Fixed Chlorine*	60.5 ± 0.5
Arc Formed Gases* (Oxygen Free Liquid @ 25°C.)	Total combustible gases including carbon monoxide, hydrogen and volatile hydrocarbons.
Electrical Stability*	After heating for 96 hours @ 100°C in a closed container, the resistivity should not decrease more than 10%.

*Determined by special request.

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TOWOLDMON0005141
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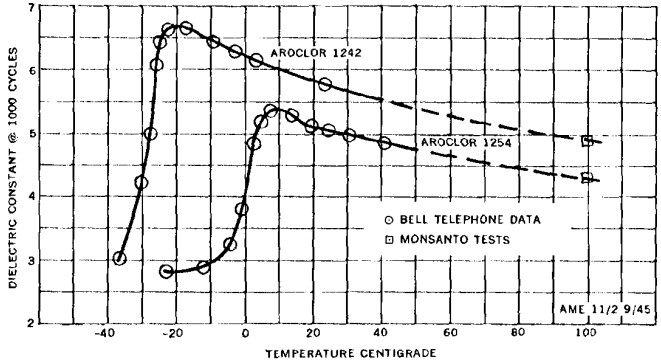
Typical Capacitor Aroclor

Property	Typical
Visc. @ 37.8°C. (ASTM D88)	82-92 seconds Saybolt Univ.
Specific Gravity @ 25/15.5°C (ASTM D287)	1.381-1.392
Color, APHA	50 max.
Condition	Clear
Acidity, mg. KOH/g.	0.01 max.
Pour Pt., °C. (ASTM D97)	−14 or lower
Inorganic Chlorides, ppm	0.10 max.
Refractive Index @ 25°C.	1.6240-1.6260
Distillation Range (ASTM D20) Corrected for stem and barometric pressure	10% 325°C. min. 90% 360°C. max.
Corrosion	After heating with aluminum for six hours at 210°C ± 10°C the aluminum must not be corroded either on visual or weight inspection and the Aroclor 1242 should meet the following specs.: Color, APHA 60 max. Acidity, mg. KOH/g. 0.01 max. Inorg. Chlorides, ppm 0.10 max. Condition Clear
Water Content, ppm	35 max.
Resistivity 100°C. 500 volts DC @ 0.1" gap	500 x 10^9 ohm-cm., min.
Dielectric Constant 100°C. @ 1000 cycles (ASTM D924)	4.7-4.9
Flash Point Cleve. Open Cup*	170°C., min.
Fire Point °C.*	None to boiling point
Sulfates (ASTM-D117-31)*	None
Fixed chlorine content (Carius)*	41.5-42.5%
Specific Heat @ 25°C.*	0.29
Evaporation @ 100°C for 6 hrs.*	0.4% max.
Dielectric Strength (KV) (ASTM D877)*	35 Min.

*Determined by special request.

DIELECTRIC CONSTANT VS. TEMPERATURE
Aroclor® 1242 & Aroclor® 1254



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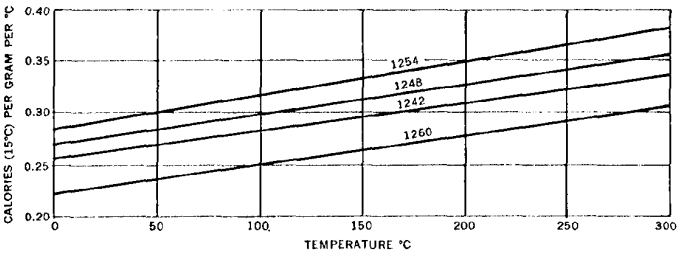
HEAT CAPACITY OF AROCLOR® LIQUIDS
at Various Temperatures



THERMAL CONDUCTIVITY OF AROCLOR 1248

Temperature °C.	Temperature °F.	BTU./Hr./Sq. Ft./°F./Ft.	Calories, gram/Sec./Sq.Cm./°C./Cm.
30	90	0.0680	281×10^{-6}
60	140	0.0687	284×10^{-6}
100	212	0.0697	288×10^{-6}

The average coefficient of expansion of Aroclor 1248 per degree F within the various temperature ranges indicated in the table below was determined by using the simple formula $Vt = Vt^{1} [1 + a (t - t_1)]$. The coefficient a, has been calculated at 100°F increments as follows:

Temp. Range °F	Average Coefficient of Expansion cc/cc/F
0 to 100	0.00037
100 to 200	0.00039
200 to 300	0.00040
300 to 400	0.00046
400 to 500	0.00048
500 to 600	0.00051

The specific volume of aroclor 1248 at different temperatures is as follows:

Temp. °F	Specific Volume ml/gm
0	0.674
100	0.699
200	0.726
300	0.755
400	0.790
500	0.828
600	0.870

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SOLUBILITY OF AROCLOR® CHLORINATED COMPOUNDS IN 100 MILLILITERS OF VARIOUS SOLVENTS

Type of Solvent	Aroclor 1242 25°C	1242 Hot	1248 25°C	1248 Hot	1254 25°C	1254 Hot	1270 Cold	1270 Hot	4465 Cold	4465 Hot	5460 25°C
Acid											
Acetic Acid	S	S	—	—	S	S	—	—	SS	S	—
Oleic Acid	S	S	—	—	S	S	—	—	S	VS	—
Benzoic Acid	10.0 31°C	—	10.0 32°C	—	—	—	—	—	—	—	—
Aldehyde											
40% Formaldehyde	I	I	I	I	I	I	I	I	I	I	—
Furfural	VS	VS	VS	VS	VS	VS	SS	SS	VS	VS	—
Amine											
Aniline	S	S	—	—	S	S	—	—	VS	VS	—
Pyridine	132.5 30°C	440 99°C	—	—	114 31°C	425 100°C	—	—	VS	VS	—
Chloro – derivatives											
Amyl chlorides – mixed	S	S	S	S	S	S	—	—	VS	VS	—
Carbon Tetrachloride	S	S	S	S	S	S	3.7	—	VS	VS	156
Chloroform	S	S	S	S	S	S	—	—	VS	VS	—
Dichlorethylene	—	—	—	—	—	—	3.0	—	VS	VS	—
Ethylene Dichloride	S	S	S	S	S	S	—	—	VS	VS	—
Monochlorobenzene	S	S	S	S	S	S	2.9	—	VS	VS	—
Orthodichlorobenzene	—	—	—	—	—	—	—	—	VS	VS	—
Tetrachlorethane	S	S	S	S	S	S	—	—	VS	VS	—
Trichlorethane	S	S	S	S	S	S	3.3	—	VS	VS	—
Trichlorethylene	S	S	S	S	S	S	—	—	VS	VS	—
Drying Oil											
Tung Oil	S	S	S	S	S	S	—	—	VS	VS	—
Linseed Oil	S	S	S	S	S	S	—	—	VS	VS	—
Ester											
Amyl Acetate	S	S	S	S	S	S	—	—	VS	VS	—
Butyl Acetate	S	S	S	S	S	S	—	—	VS	VS	—
Cellosolve Acetate	S	S	S	S	S	S	—	—	VS	VS	—
Cottonseed Oil	S	S	S	S	S	S	—	—	S	VS	—
Dibutyl Phthalate	S	S	S	S	S	S	—	—	S	VS	—
Diethyl Phthalate	S	S	S	S	S	S	—	—	S	VS	—
Ethyl Acetate	S	S	S	S	S	S	—	—	S	VS	—
Ethyl Lactate	S	S	S	S	S	S	—	—	VS	VS	—
Ethylene Glycol Diacetate	S	S	S	S	S	S	—	—	VS	VS	—
Methyl Acetate	S	S	S	S	S	S	—	—	S	S	—
Tricresyl Phosphate	S	S	S	S	S	S	—	—	SS	S	—
Ether; Ethyl Ether	S	S	S	S	S	S	S	S	S	—	—
Ether Alcohol											
*Carbitol**	224 31°C	307 99°C	VS	VS	173 26°C	259 98°C	—	—	SS	—	—
Cellosolve	S	S	S	S	S	S	—	—	S	—	—
Diethylene Glycol	—	—	—	—	—	—	—	—	S	—	—
p-p' Dihydroxy Ethyl Ether	16.9 23°C	19 99°C	SS	SS	8 30°C	10 100°C	—	—	SS	—	—
Hydrocarbon											
Benzene	VS	VS	VS	VS	VS	VS	3.5	—	VS	VS	143
Gasoline	VS	VS	VS	VS	VS	VS	—	—	VS	VS	—
Kerosene	VS	VS	VS	VS	VS	VS	—	—	VS	VS	—
Mineral Spirits	VS	VS	VS	VS	VS	VS	—	—	VS	VS	—
Paraffin	2.0 27.5°C	S	2.0 28°C	S	—	S	—	—	<5.0	S	—
Pine Oil	S	S	VS	VS	S	S	—	—	S	S	—
Toluene	VS	VS	VS	VS	VS	VS	—	—	VS	VS	142
Turpentine	VS	VS	VS	VS	VS	VS	—	—	VS	VS	—
Xylene	VS	VS	VS	VS	VS	VS	—	—	VS	VS	178
***Hydroxy* derivatives**											
Amyl Alcohol	S	S	—	—	S	S	—	—	S	S	—
n-Butyl Alcohol	S	S	—	—	S	S	—	—	SS	S	—
Ethyl Alcohol (3-A)	23.3 29°C	80.0 70°C	—	—	10 27°C	28 75°C	—	—	SS	—	—
Glycerine	I	I	I	I	I	I	I	I	I	I	—
Methyl Alcohol	42.5 29°C	88.5 60°C	—	—	15 26°C	22.2 65°C	—	—	SS	—	—
Phenol–90%	194 30°C	S	—	—	SS	S	—	—	S	S	—
Ketone											
Acetone	S	S	—	—	S	S	—	—	S	S	260
Miscellaneous											
Carbon Disulfide	S	S	—	—	S	S	—	—	VS	VS	—
Nitrobenzene	S	S	—	—	S	S	—	—	VS	—	—
Water	I	I	I	I	I	I	I	I	I	I	—

I — Insoluble S — Soluble SS — Slightly Soluble VS — Very Soluble
Figures show grams of Aroclor per 100 milliliters of solvent at 25°C unless otherwise indicated.

*Carbitol is a registered trademark of Union Carbide and Carbon Co.

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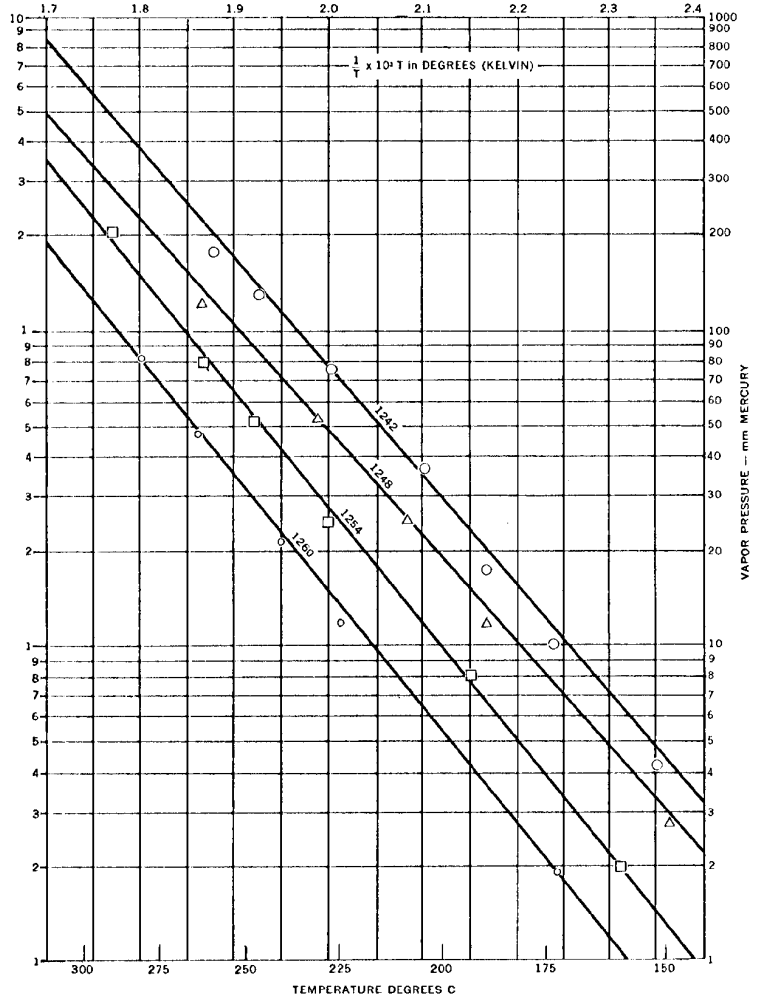
VAPOR PRESSURE OF AROCLOR® CHLORINATED COMPOUNDS



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VAPORIZATION RATES

Sample	Wt. Loss Gms.	Hours Exposure	Surface Area $Cm.^2$	Vaporization Rate $gms./cm.^2hr./100°C$
Aroclor® 1221	0.5125	24	12.28	0.00174
Aroclor 1232	0.2572	24	12.28	0.000874
Aroclor 1242	0.0995	24	12.28	0.000338
Aroclor 1248	0.0448	24	12.28	0.000152
42% chlorinated paraffin	0.0745	48	12.28	0.000126
dioctyl phthalate	0.0686	48	12.28	0.000117
Dutrex* 25	0.0256	24	12.28	0.000087
Aroclor 1254	0.0156	24	12.28	0.000053
Dutrex 20	0.0047	24	12.28	0.000016
Aroclor 1262	0.0039	24	12.28	0.000013
Aroclor 1260	0.0026	24	12.28	0.000009
Aroclor 4465	0.0064	72	12.28	0.000007
Aroclor 1270	0.0045	72	12.28	0.000005
Aroclor 5442	0.0039	72	12.28	0.000004
Aroclor 5460	0.0032	72	12.28	0.000004
Tricresyl phosphate	0.0010	24	12.28	0.000003

*Dutrex is a registered trademark of the Shell Oil Co.

APPROXIMATE VAPOR PRESSURES CALCULATED AT 100° F (37.8° C)

Aroclor® 1232	0.005 mm. Hg.
Aroclor 1242	0.001 mm. Hg.
Aroclor 1248	0.00037 mm. Hg.
Aroclor 1254	0.00006 mm. Hg.

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CORROSION RESISTANCE OF STRUCTURAL MATERIALS

Metals	Aroclor Number 1248 25°C	1248 125°C	1254 25°C	1254 125°C	4465 125°C	5460 125°C
Aluminum	R	R	R	R	*RR	RR
Copper	R	D	R	D	D	D
Magnesium	RR	R	R	R	RR	*RR
Nickel	RR	R	R	RR	RR	R
Silver	R	R	R	R	R	R
Tin	R	R	R	R	R	R
Zinc	R	R	R	R	R	RR
Mild Steel	RR	R	RR	RR	R	RR
Phosphor Bronze	R	D	R	R	R	R
Red Brass	D	D	R	D	R	De
Stainless Steel (Type 316)	RR	RR	RR	RR	RR	RR
Yellow Brass	R	Re	R	De	Re	Re
Plastics						
Alkyd Resin No. 46594-12	*P	P	*P	P	P	P
Alkyd Resin No. 46594-13A	*D	P	*D	P	P	P
Cellulose Acetate (Fibestos)	D	P	D	P	P	P
Durite(1) Phenol Furfural Resin	*D	P	*R	P	D	P
Formvar® Highly Plasticized polyvinyl formal resins	De	T	Pe	T	T	T
Formvar® Low Plasticized polyvinyl formal resins	PS	T	PS	T	T	T
Glyptal 1276	R	P	D	P	P	P
Glyptal 7136	*D	T	*R	T	T	T
Maleic Resin No. 46594-13B	P	P	*P	P	P	P
Maleic Resin No. 46594-13C	P	P	*R	P	P	P
Methyl Methacrylate	*D	P	*D	P	P	P
Lustron® B Polystyrene	P	T	P	T	T	T
Resinox® Mineral Filled Melamine Resin	*D	*P	*R	R	*P	*D
Resinox Wood Flour Filled Melamine Resin	*D	P	*R	D	R	P
Resinox Mineral Filled Phenol Formaldehyde	*D	D	*D	D	R	P
Resinox Wood Flour Filled Phenol Formaldehyde	*D	P	*D	*R	D	P
Resinox Rag Filled Phenol Formaldehyde	*D	D	*D	*D	*D	P
Urea Formaldehyde Resin (Plaskon Co.)	*D	P	*D	*P	P	P

Meaning of Abbreviations:
*— Based on weight gain calculated as penetration value shown.
RR Excellent resistance — less than 1.0×10^{-6} cm/day penetration or .00014 in/yr.
R Good resistance — has penetration between 1.0×10^{-4} and 10×10^{-4} cm/day or between 0.00014 and 0.0014 in/yr.
D Doubtful resistance, penetration between 10×10^{-4} cm/day and 100×10^{-4} cm/day or between 0.0014 and 0.014 in/yr.
P Poor resistance — penetration greater than 100×10^{-4} cm/day or 0.014 in/yr.
PS Poor resistance due to visible local action although weight change indicates greater resistance.
e Following the letter indicating resistance signifies material may be better than indicated if totally immersed since weight loss is believed to come from oxidation of the part of test strip exposed to air.
T Material alone will not stand temperature.
(1) Durite is a registered Trademark of Borden Chemical Co.

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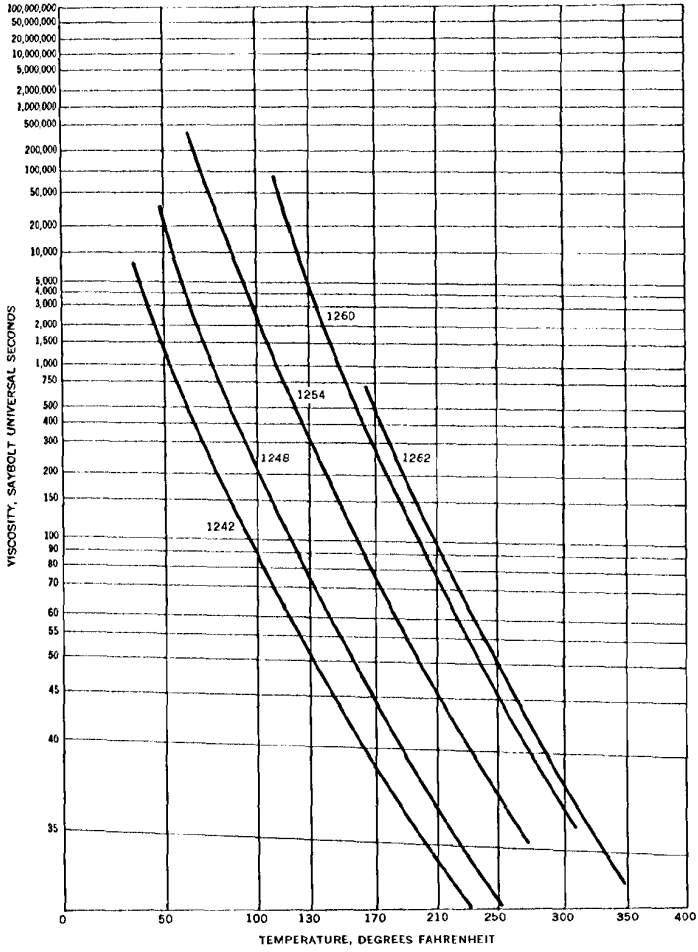
VISCOSITY RANGES OF SOME OF THE AROCLOR® CHLORINATED COMPOUNDS



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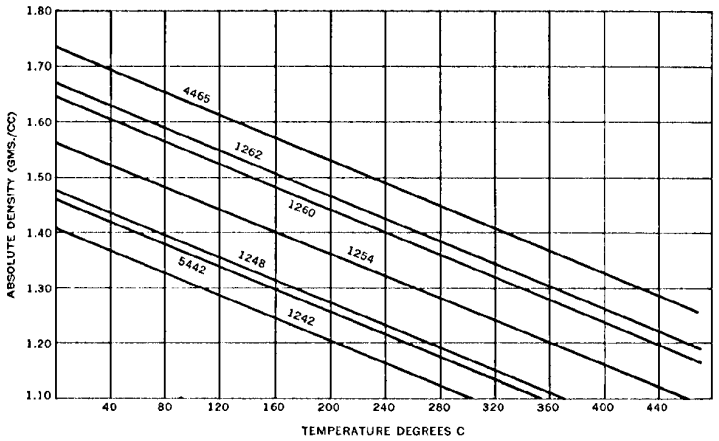
TOWOLDMON0005148
WATER_PCB-00001658

DENSITIES OF AROCLOR® CHLORINATED COMPOUNDS AT VARIOUS TEMPERATURES



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Dermatology and Toxicology

At ordinary temperatures the Aroclor polychlorinated polyphenyls have not presented industrial toxicological problems. The hazard of potential toxic exposure varies with their volatility: the lower-chlorinated ones, being more volatile, present more of a potential problem from the standpoint of both inhalation and skin contact. When Aroclor is used at elevated temperatures, engineering controls must be applied, either by the use of closed systems or by effective local-exhaust ventilation together with general workroom exhaust.

Inhalation tests on animals indicate that the maximum safe concentration of vapor is in the range of 0.5 to 1.0 milligram of the lower-chlorinated Aroclor compounds per cubic meter of air. The threshold limits (maximum allowable concentration for an 8-hour working day) set by the American Conference of Government Hygienists are 1.0 milligram of the lower-chlorinated Aroclor compounds per cubic meter of air and 0.5 milligram of the more-highly-chlorinated compounds, such as Aroclor 1254, per cubic meter of air.

Schwartz patch tests on 200 volunteers showed that neither Aroclor 1254 alone when applied to gauze nor a polyvinyl chloride film containing 11.5-weight-per cent Aroclor 1254 was a primary irritant or a sensitizer. Canvas coated with an oil-modified alkyd resin (17-weight-per cent of the paint-film solids and 7-weight-per cent of the painted fabric was Aroclor 5460) did not produce primary skin irritancy or sensitization according to the same Schwartz technique. Continuous or repeated skin contact with Aroclor must be avoided because of the possible occurence of a condition called chlorance. Although reports of this condition caused by Aroclor are rare, it can be produced by excessive skin contact.

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The Proper Handling of PCB'S by the Electrical Industry to Avoid Environmental Contamination

Polychlorinated biphenyls (PCB's), better known by various trade names including Aroclor (Monsanto), Pyranol (General Electric Co.), and Inerteen (Westinghouse Electric) are the most commonly used askarel class fire-resistant dielectric fluids for hermetically sealed capacitors and transformers. They have served these essential purposes in a satisfactory and irreplaceable manner for over 40 years.

PCB's are noted for their high order of stability, inertness, low volatility and very low water solubility. For these reasons PCB's will persist, if introduced into the environment. This holds true especially for the more highly chlorinated PCB's, as these members of the family have been found quite refractory to soil organisms and are considered to be essentially non-biodegradable.

Recent studies indicate that typical small amounts of PCB's found in the environment can be harmful to certain species of birds and young marine life.

Therefore it is essential to do all that is possible to avoid environmental contamination with PCB's. To establish guide lines, the FDA indicates as maximums 5 parts per million of PCB in fish and 0.2 parts per million in milk.

PCB's must not be introduced into water or marine areas. Spills or leakage must be contained.

Monsanto, and several others, provide facilities for the proper incineration and destruction of scrap PCB fluids. Such materials can be sent freight prepaid to Monsanto's attention, Supervisor Department A-246, Sauget, Illinois for incineration at 3 cents per pound.

Also, PCB fluids should be removed from solid scrap. For example, discarded transformer coils and cores, should be drained free from PCB's followed by flushing or solvent extraction, using such solvents as perchloroethylene, or trichloroethylene employed in vapor degreasing equipment. The scrap fluid mixtures should then be incinerated under the conditions, as provided by Monsanto to destroy the PCB's.

If additional assistance is required about handling PCB's, please contact Monsanto's PCB environmental coordinator, Mr. W. B. Papageorge, Monsanto Company, 800 N. Lindberg, St. Louis, Missouri 63166; phone (314) 694-4051.

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Safe Handling

Vapors of the Aroclor liquids at room temperature should not be breathed in a confined space. Vapors evolved at elevated temperatures should not be allowed to be dispersed into the general workroom. Instead, engineering control must be applied to reduce vapor concentrations below the allowable concentrations mentioned above.

Continuous or repeated skin contact with Aroclor must be avoided by the use of gloves and protective garments. If any Aroclor is spilled on the skin, the skin should be washed in the usual manner with a soap solution.

A burn caused by contact with a hot Aroclor should be treated like any ordinary burn. Aroclor adhering to the burned area need not be removed immediately, unless treatment of the burn demands it, in which case either soap and water or repeated washings with a vegetable oil are recommended.

Shipping Information

Freight Classification	
AROCLOR 1221, 1243, 1242, 1248, 1254, 1260, 1262	Synthetic Resin, Liquid, NOIBN
Rail Classification	
AROCLOR 1268, 2565, 4465, 5442, 5460	Synthetic Resin, Other Than Liquid, NOIBN
Truck Classification	
AROCLOR 1268, 2565	Synthetic Resin, Powder, NOI
AROCLOR 4465, 5442, 5460	Synthetic Resin, Lumps or Solid Mass, NOI
Shipping Regulations	None
Standard Containers	
AROCLOR 1221	Tank car, 520-lb. steel drum, 50-lb. can
AROCLOR 1232	Tank car, 550-lb. steel drum, 50-lb. can
AROCLOR 1242, 1248, 1254, 1260, 1262	Tank car, 600-lb. steel drum, 50-lb. can
AROCLOR 1268	200-lb. fiber drum, 50-lb. can
AROCLOR 2565, 4465	500-lb. steel drum, 50-lb. can
AROCLOR 5442	450-lb. steel drum, 50-lb. can
AROCLOR 5460 (flaked)	100-lb. bag

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DISTRICT SALES OFFICES ALL DIVISIONS

AKRON, OHIO 44313
260 Springside Drive
Montrose Development Park
Tel. (216) 666-4111

ATLANTA, GEORGIA 30339
320 Interstate North Parkway
Suite 500
Tel. (404) 432-7111

BOSTON, MASSACHUSETTS 02149
Everett Station
Tel. (617) 387-5010

CHICAGO, ILLINOIS
3158 Des Plaines Ave.
Des Plaines, Illinois 60018
Tel. (312) 296-6588

CINCINNATI, OHIO 45206
1501 Madison Road
Tel. (513) 751-6707

DETROIT, MICHIGAN
500 Northland Towers West
Southfield, Mich. 48075
Tel. (313) 357-0910

HONOLULU, HAWAII 96812
205 Pacific International Bldg.
677 Ala Moana Blvd., P. O. Box 3824
Tel. (808) 531-2744

HOUSTON, TEXAS 77027
1301 Post Oak Tower
5051 Westheimer Road
Tel. (713) 621-9550

LOS ANGELES, CALIFORNIA 90022
6670 E. Flotilla St.
Tel. (213) 723-2492

NEW YORK, NEW YORK 10017
277 Park Avenue
Tel. (212) 922-4111

ST. LOUIS, MISSOURI 63166
800 N. Lindbergh Blvd.
Tel. (314) 694-1000

SAN FRANCISCO BAY AREA
2710 Lafayette, Santa Clara, Calif. 95052
Tel. (408) 243-0414

SEATTLE, WASHINGTON 98121
2112 Third Avenue
Tel. (206) 622-4203

WILMINGTON, DELAWARE 19810
Suite 204, Bancroft Bldg.
3411 Silverside Road
Tel. (302) 478-4600

Additional District Offices are maintained by:

Agricultural Division

DECATUR, ILLINOIS 62523
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363 South Main Street
Tel. (217) 423-6031

DES MOINES, IOWA 50310
312 Merle Hay Tower
Tel. (515) 276-8503

INDIANAPOLIS, INDIANA 46205
Suite 215, 4002 Meadows Drive Building
Tel. (317) 547-9149

KANSAS CITY, MISSOURI 64133
701 Blue Ridge Tower
4240 Blue Ridge Boulevard
Tel. (816) 363-8060

LULING, LOUISIANA 70070
P. O. Box 174
Tel. (504) 784-6263

MANKATO, MINNESOTA 56001
111 Madison East
Tel. (507) 387-3406

MEMPHIS, TENNESSEE 38104
303 Union Plaze Building
1835 Union Avenue
Tel. (901) 278-7811

MUSCATINE, IOWA 52761
P. O. Box 473
Tel. (319) 263-1331

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Indian Orchard, Mass. 01051
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Lion Oil Building
Tel. (501) 863-3111

JACKSON, MISSISSIPPI 39209
P. O. Box 10937, Westland Station
Tel. (601) 352-3648

N. LITTLE ROCK, ARKANSAS 72119
410 West 8th Street, P. O. Box 5821
Tel. (501) 376-2137

MEMPHIS, TENNESSEE 38113
1023 Riverside Drive, P. O. Box 13248
Tel. (901) 948-4451

Plastic Products & Resins Division

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855 Seneca Road
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KENILWORTH, NEW JERSEY 07033
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Tel. (201) 276-2800

NEW ENGLAND AREA
190 Grochmal Avenue
Indian Orchard, Mass. 01051
Tel. (413) 788-6911

Textiles Division

CHARLOTTE, NORTH CAROLINA 28210
6230 Fairview Road, Suite 400
Tel. (704) 364-0110

GREENVILLE, SOUTH CAROLINA 29606
McAlister Plaza
P. O. Box 5564, Station B
Tel. (803) 242-8700

NEW YORK, NEW YORK 10001
350 Fifth Ave.
Tel. (212) 556-5100

MONSANTO, 800 N. LINDBERGH BLVD., ST. LOUIS, MISSOURI 63166

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