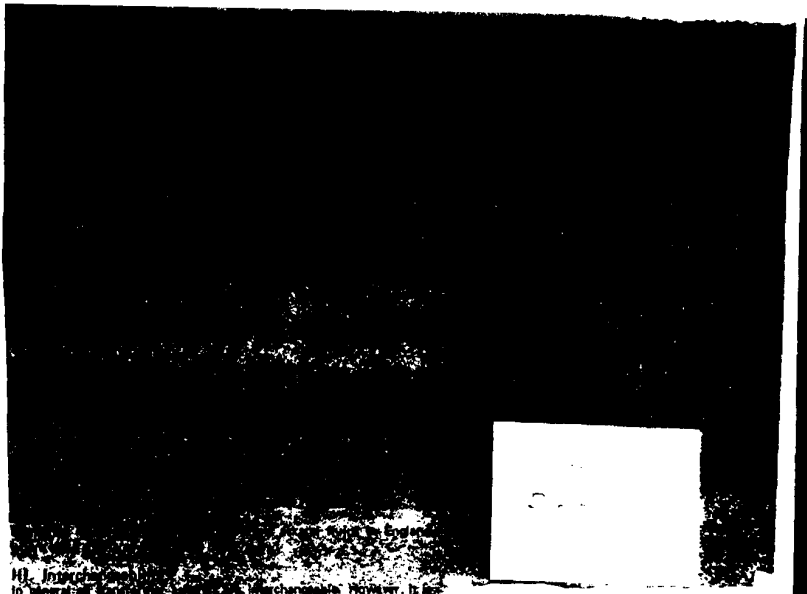

III. Interchangeability

In general, askarel fluids are not interchangeable. However, it is suggested that the transformer manufacturer be consulted prior to mixing in significant proportions or total substitution.

IV. Transformer Askarel Specifications

Specifications for the three askarel fluids are shown in Table I.

V. Ordering Instructions

Monsanto's current policy is to sell askarel transformer fluids only to transformer manufacturers. Others interested in these fluids should contact the manufacturers of askarel transformers and not Monsanto. The transformer name plate indicates the transformer maker and usually gives sufficient data to identify the specific askarel fluids used.

VI. Contamination

Askarel insulation must never be mixed with mineral oil. Over two percent of mineral oil by volume in askarel begins to lower its fire resistance.

In modern transformers, the principal "enemy" of askarel is contamination by water. Keeping askarel water-free will insure long-time service.

Askarel is heavier than water. If water gets into askarel insulation only a tiny amount (approximately 125 ppm) dissolves – the rest floats on top. Askarel is very insoluble in water, only about 200 parts per billion of askarel dissolve in water, at normal temperatures.

VII. Precautions When Handling Drums, Tank Cars, and When Opening Transformers

The following are significant precautions:

A. *Keep Dry During Handling:*
In handling, storing, sampling and inspecting askarel – and in

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Table II

Transformer Askarel Specifications (New Fluid)

Specification Properties[1]	General Electric Co. Transformer (Pyranol A13[illegible]) ASTM D22[illegible] Type	Westinghouse Transformer Inertene 70-30* ASTM D22[illegible] Type
Color, APHA	160 max.	[illegible]
Condition	Clear	[illegible]
Water content, ppm (ASTM D1533 60)	30 max.	[illegible]
Acidity, mg KOH/g (ASTM D974 55)	0.014 max.	[illegible] max.
Dielectric strength, 25°C, 0.1 in. gap (ASTM D877 49)	35 KV, min.	35 KV, min.
Dielectric Constant, 100°C, 60 Hz (ASTM D924 49)	4.2 to 4.6	4.2 to 4.6
Volume Resistivity, 100°C, 500 volts DC 0.1 inch gap, 10^8 ohm-cm (ASTM D1169)	100	[illegible]
Inorganic chlorides, ppm (ASTM D1821 and G.E. Method E4C4B)	0.10 max.	[illegible] max.
Refractive index, 25°C (ASTM D1807)	1.6110 to 1.6120	1.61[illegible] to 1.617[illegible]
Viscosity at 37.8°C (ASTM D88 56) Saybolt Universal Seconds	44 to 48	[illegible] to 51
Pour Point °C (ASTM D97 57)	38 or lower	[illegible] lower
Specific gravity 25/15.5°C (ASTM D1810)	1.495 to 1.510	[illegible] to 1.52[illegible]
Burn point (ASTM D92)	None to boiling	[illegible] boiling
Distillation range (ASTM D20 56) corrected for stem and barometric pressure	1st drop 200°C min. 40% max. below 270°C 90% 379 to 394	[illegible]
Fixed chlorine	56.4 ± 0.5%	[illegible]
Corrosion test	After heating with [illegible] on either visual or [illegible]	[illegible]
Color, APHA	200 max.	[illegible]
Acidity, mg KOH/g	0.014 max.	[illegible]
Inorganic chlorides ppm	0.15 max.	[illegible]
Condition	Clear	[illegible]
Scavenger content	0.115 to 0.13[illegible]% Diepoxide	[illegible]
Typical Properties[2]		
Coefficient of Thermal Expansion (ASTM D1903), $cm^2/cm^2/C$	0.0007	[illegible]
Arc formed gases	Askarels of various [illegible] predominantly of non-[illegible] upon the askarel type. [illegible] when arced, produce gaseous [illegible] removed from the askarel by [illegible] before any work is performed [illegible]	[illegible]

*Westinghouse uses their private number Inertene 54201KA for Inertene 70-30 and their private number Inertene 54201CM for Inertene 100-42.

[1] These quantities are final sales specifications only to [illegible] coincide [illegible]

[2] This data is based upon samples tested in [illegible]

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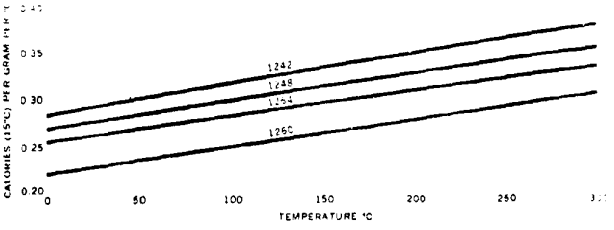
HEAT CAPACITY OF AROCLORS
AT VARIOUS TEMPERATURES



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 x 10^{-4}
60	140	0.0687	284 x 10^{-4}
100	212	0.0697	288 x 10^{-4}



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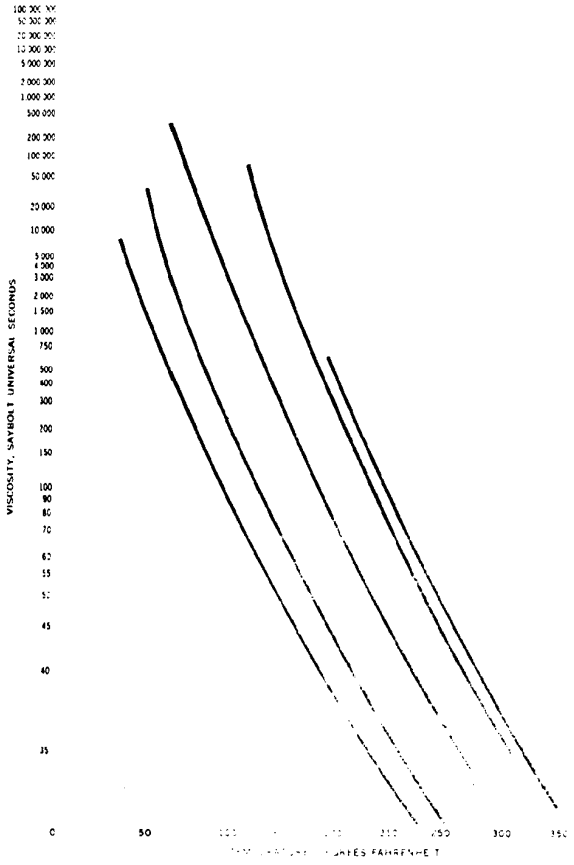
VISCOSITY RANGES OF SOME OF THE AROCLORS



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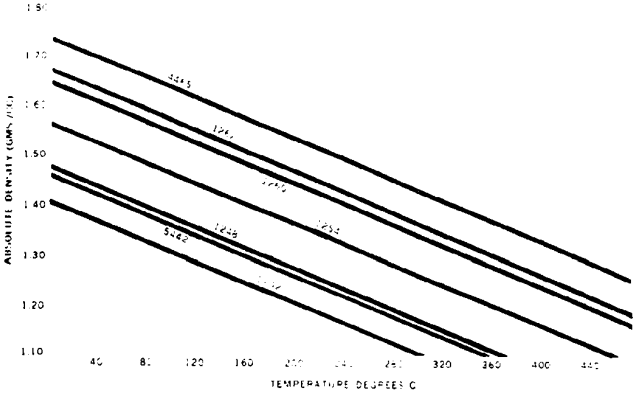
DENSITIES OF AROCLORS AT VARIOUS TEMPERATURES





OIL

AROCLOR

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[illegible]

(MIXTURE OF AROCLOR AND CHLOROBENZENES)

Property	Typical
Viscosity, 37.8 C., ASTM D88	[illegible] Saybolt Univ.
Specific Gravity, 15.5-15.5 C., ASTM D287	[illegible]
Color, APHA	[illegible] max.
Condition	Clear
Acidity, mg. KOH/g.	[illegible] max.
Pour Pt., C., ASTM D97	[illegible] or lower
Inorganic Chlorides, ppm	0.10 max.
Refractive Index, 25 C.	[illegible]
Distillation Range, ASTM D20 Corrected for stem and barometric pressure	
First drop	210 C., min.
35	2[illegible]-256 C.
55	275-345 C.
65	80-400 C.
95	390-415 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[illegible] ohm-cm., min.
Dielectric Strength, 25 C.	35 KV., min.
Dielectric Constant, 100 C., 1000 cycles*	3.8-4.3
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%

TYPICAL [illegible] AROCLOR

Property	Typical
Viscosity @ 37.8 C., ASTM D88	82-92 seconds Saybolt Univ.
Specific Gravity, 25-15.5 C., ASTM D287	1.381-1.392
Color, APHA	300 max.
Condition	Clear
Acidity, mg. KOH/g.	0.01 max.

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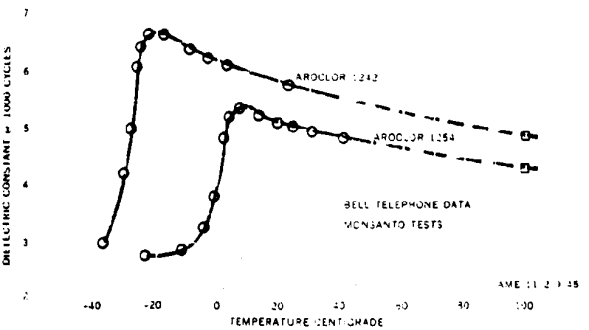
Typical Capacitor Aroclor *(continued)*

Property	[illegible]
Pour Pt. C. ASTM D97	[illegible]
Inorganic Chlorides, ppm	[illegible]
Refractive Index 25 C	[illegible]
Distillation Range ASTM D20 Corrected for stem and barometric pressure	[illegible] C min. [illegible] C max.
Corrosion	After heating with aluminum for six hours at 250 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 150 max.
	Acidity, mg KOH/g. 0.01 max.
	Inorg. Chlorides, ppm 0.10 max.
	Condition Clear
Water Content, ppm	[illegible] max.
Resistivity 100 C 500 volts DC ± 0.1% gap	500 x 10[illegible] ohm-cm. min.
Dielectric Constant 100 C ± 1000 cycles ASTM D924	4.7-4.9
Flash Point Cleve. Open Cup*	100 C. min.
Fire Point C.*	None to boiling point
Sulfates ASTM-D117-51	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	[illegible] Min.

DIELECTRIC CONSTANT VS. TEMPERATURE
AROCLOR 1242 & AROCLOR 1254



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TOWOLDMON0040552
WATER_PCB-00025021

some of the aroclor compounds

Aroclor 1260 Light yellow soft sticky resin	Aroclor 1262 Light yellow sticky clear resin	Aroclor 1268 White opaque resin	Aroclor 4465 Yellow transparent brittle resin	Aroclor 5442 Yellow transparent sticky resin	Aroclor 5460 Yellow transparent resin	Aroclor 2565 Brown-black opaque resin
150 Max. (APHA)	150 Max. (APHA)	1.5 Max. NPA	2.0 Max. NPA	1.5 Max. NPA	2.0 Max. NPA	—
0.015	0.02	0.05	0.05	0.05	0.07	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)
1.620 13.50	1.646 13.72	1.810 15.09	1.670 13.91	1.470 12.24	1.670 13.91	1.734 14.44
385° 420°	400°-430°	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	0.2 to 0.3 —
None	None	None	None	247° 477°	None	None
None	None	None	None	>350° >662°	None	None
31°	37°	—	—	46°	—	—
88°	99°	—	—	115°	—	—
—	—	135° to 160° (hold pt.)	60° to 66°	50° to 61°	100° to 105.5°	66° to 72°
—	—	275° to 320° (hold pt.)	140° to 151°	113° to 122°	212° to 222°	149° to 162°
1.647-1.649	1.6501-1.6517	—	1.664-1.667	—	1.660-1.665	—
72-78	90-103	—	90-150	300-400	—	—
3200-4500	600-850	—	—	—	—	—
—	—	—	—	—	—	—

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TOWOLDMON0040553
WATER_PCB-00025022

general physical properties of

	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254
Form	Colorless mobile oil	Practically colorless mobile oil	Practically colorless mobile oil	Yellow tinted mobile oil	Light yellow viscous oil
Color	50 Max. (APHA)	60 Max. (APHA)	100 Max. (APHA)	100 Max. (APHA)	150 Max. (APHA)
Acidity—Maximum (Mgm. KOH per Gm.)	0.015	0.015	0.015	0.015	0.015
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 25° 25°C (77° 77°F) Pounds per Gallon—25°C (77°F)	1.182 9.85	1.266 10.55	1.380 11.50	1.445 12.04	1.538 12.82
Distillation Range—ASTM D-20 (Mod.) Corr. °C	275° 320°	290° 325°	325° 360°	340°-375°	365° 390°
Evaporation Loss—%—ASTM D-6 Mod. 163°C.....5 hrs. 100°C.....6 hrs.	— 1.0 to 1.5	— 1.0 to 1.5	3.0 to 3.6 0.0 to 0.4	3.0 to 4.0 0.0 to 0.3	1.1 to 1.3 0.0 to 0.2
Flash Point—Cleveland Open Cup.....°C °F	141°-150° 286°-302°	152°-154° 305° 310°	176° 180° 348° 356°	193°-196° 379° 384°	None
Fire Point—Cleveland Open Cup.....°C °F	176° 349°	238° 460°	None*	None	None
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 210°F (98.9°C) Sec. (ASTM—D-88)	30 31	31 32	34 35	36-37	44-48
130°F (54.4°C)	35 37	39 41	49 56	69-78	240-300
100°F (37.8°C)	40 42	47 50	80 93	185-240	1500-2000

*Some flashes—None at boiling point of water

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