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January 23, 1976

THE CAPACITOR PEOPLE FOR 40 YEARS

Subject: PHASE-OUT OF PCB IN CAPACITORS

You are probably aware that the most commonly used fluid to impregnate capacitors, Polychlorinated Biphenyl (PCB), has been the subject of environmental concern since 1968.

The sole manufacturer of PCB in the western hemisphere, Monsanto, voluntarily restricted its use in 1971 to capacitors and transformers which are closed systems. Monsanto also introduced a type of PCB that degrades more rapidly than older PCB's, and which - to the best of my knowledge - has not yet been found in the environment.

Because of growing environmental concern, a National Conference was held in Chicago during November of 1975 to discuss the "PCB Problem". No adverse health effects were reported in humans except the Japanese "Yusho" incident involving ingestion of PCB contaminated rice oil. PCB's do seem to be causing problems for certain species of marine and wildlife. The Food and Drug Administration reported that PCB concentration in food has dropped to virtually zero except in fish.

The man who originally identified the "PCB" problem, reported that the harm was probably caused by trichlorinated dibenzofuran (TCDF), and not PCB. TCDF was a contaminant in the Japanese PCB. Further investigations were suggested in Chicago to determine whether or not TCDF can be formed from PCB through a metabolic process. Most speakers at the Chicago conference recommended continued use of PCB in capacitors and transformers.

Unfortunately, only the negative reports seem to have influenced the press and the EPA. Monsanto announced on January 14, 1976, that they feel compelled to cease manufacturing PCB. Monsanto deserves a "well done" for the voluntary restrictions they imposed on themselves, and for their willingness to manufacture PCB for specific uses in the face of poorly informed but loud public criticism.

No timetable for the PCB phase-out has yet been set. A task group of industry and EPA officials has been established, and will probably discuss acceptable timetables. I am a task group member and will keep you informed.

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In my opinion, the biggest issue the PCB phase-out raises is flammability. All known substitutes possess a fire hazard unknown to PCB capacitor users. The flash and fire points of the substitutes are above the normal capacitor operating temperatures, but these fluids are not as safe as PCB if electric arcs are encountered during capacitor failure.

Because of the possibility PCB could eventually be eliminated as a capacitor dielectric, EUC began testing non-PCB fluids in November of 1973 to gain experience.

I have enclosed a Product Development Bulletin announcing EUC's non-PCB dielectric, EUCANON-4, because it is a functional substitute; e.g. similar electrical characteristics and no increase in capacitor size. You may already have seen our bulletin which was first circulated in January of 1975. I encourage you to allow us to provide you with samples. We can even supply fairly large production quantities. I must caution you, however, that these non-PCB capacitors pose a fire hazard which the industry has not yet been able to quantify. Please exercise great care if these samples are released in consumer application tests wherein the fire hazard is not completely understood.

I will write you again when I know more about the details of the PCB phase-out. Contact us if you have any questions.

Very truly yours,

ELECTRICAL UTILITIES COMPANY

Richard L. Hauser

Richard L. Hauser
President

RLH:mw

EUCANON-4
ADDITIONAL PRODUCT INFORMATION

January 21, 1976

EUCANON-4 (NON-PCB Impregnant) consists of a halogen-free aromatic compound (an aromatic hydrocarbon base) with the addition of a diaryl sulfone to increase the dielectric constant, and an epoxide stabilizer. The epoxide has the same end effect as when used in a PCB dielectric (EUC's EUCAREL)..... to reduce the number of early failures plus extending the capacitor's useful life.

Electrical Utilities Company has accumulated over 10,000 unit hours of life tests on EUCANON-4 impregnated capacitors. We believe that eventually 100,000 unit hours may be needed to assure the same reliability as PCB capacitors. EUCANON-4 appears to be a good functional substitute that merits consideration.

The capacitance vs. temperature curve attached shows that EUCANON-4 has a flatter capacitance drift curve than EUCAREL. It shows that EUCANON-4 can be operated to -60° C. without the drastic capacitance drop possessed by EUCAREL. The normal operating temperature range, above 25° C. shows the capacitance drift for EUCANON-4 and EUCAREL to be similar. The dissipation factor vs. temperature curve is also attached, and shows how EUCANON-4 dissipation factor reacts with temperature.

EUCANON-4 is rated, according to OSHA definitions, as a Class III B liquid. Although EUCANON-4 cannot be labeled as non-flammable, its flash point of 163° C. does not differ markedly from that of 170° C. for PCB (MCS 1016).

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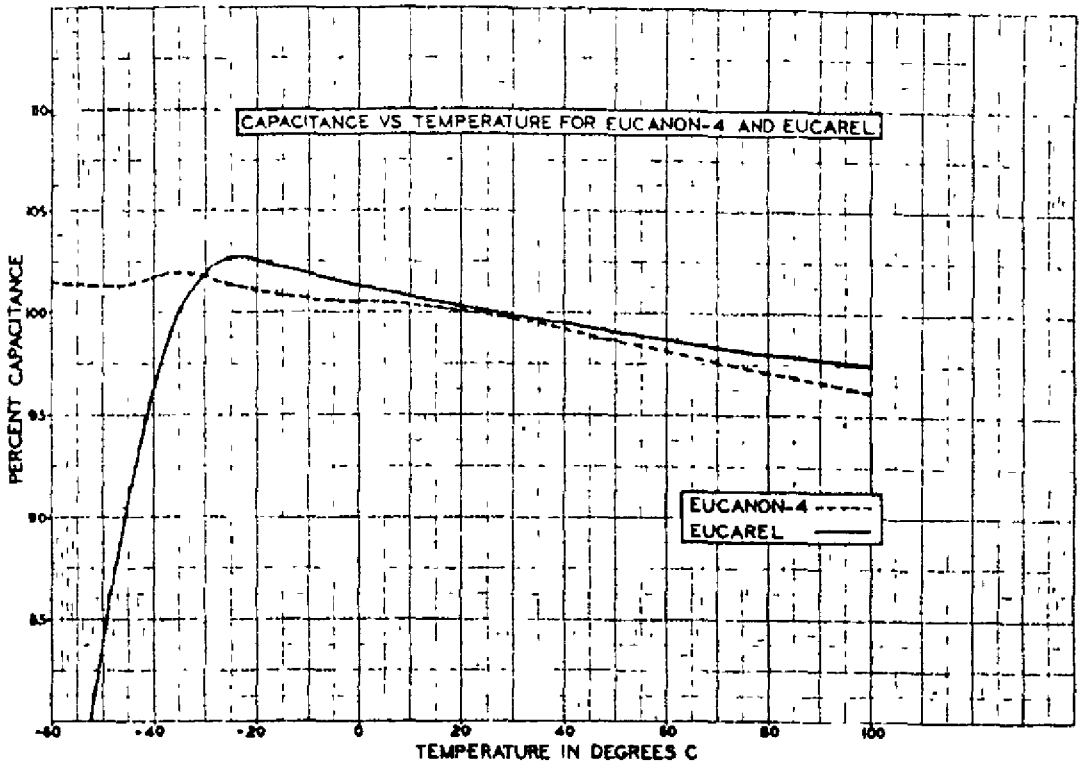
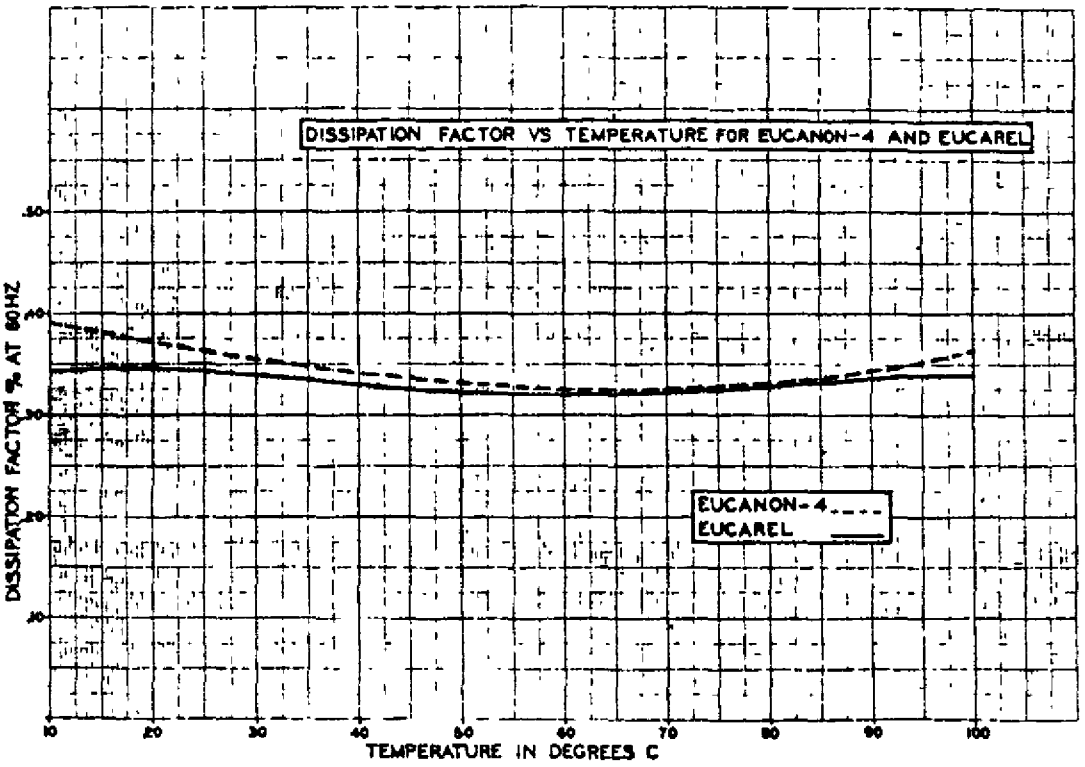

CAPACITANCE VS TEMPERATURE FOR EUCANON-4 AND EUCAREL
PERCENT CAPACITANCE
EUCANON-4
EUCAREL
-60
-40
-20
0
20
40
60
80
100
TEMPERATURE IN DEGREES C


DISSIPATION FACTOR VS TEMPERATURE FOR EUCANON-4 AND EUCAREL
DISSIPATION FACTOR % AT 60 HZ
EUCANON-4
EUCAREL
10
20
30
40
50
60
70
80
90
100
TEMPERATURE IN DEGREES C

MONS 201714

PRODUCT DEVELOPMENT BULLETIN

January 21, 1975

EUC ANNOUNCES EUCANON-4

The Impregnant For Quality NON-PCB Capacitors

Eucanon-4 is the culmination of extensive R&D to find a NON-PCB impregnant and facilitate manufacture of NON-PCB capacitors for those applications, especially in the export market, where PCB usage is restricted or prohibited.

To you, the capacitor user, Eucanon-4 means:

No change in planning for capacitor space - unlike Ester impregnated capacitors, the Eucanon-4 capacitor is the same size as a comparably rated PCB capacitor. Eucanon-4 allows you to maintain or improve your capacitor-space design thereby eliminating expensive re-design of your product.

An anticipated service life span equivalent to PCB capacitors. Obviously, the years of field experience and in-plant testing on PCB capacitors have not been duplicated with Eucanon-4. However, our extensive test data allows us to offer you a quality NON-PCB capacitor with an operational life comparable to PCB capacitors.

Greatly reduced cause for enviromental concern. Eucanon-4 degrades naturally, is not absorbed in fatty animal tissue, and is believed not to be potentially harmful to the ecology.

No problems in low temperature application. Eucanon-4 capacitors can be operated to -60°C.

Eucanon-4 is rated, according to OSHA definitions, as a Class III B liquid. Although Eucanon-4 cannot be labeled as non-flammable, its flash point of 163°C does not differ markedly from that of 170°C for PCB's.

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MONS 201715

Eucanon-4

Dielectric Composition:

Halogen-free aromatic organic compounds with sulfones and other added stabilizers. Unlike the Esters, Eucanon-4 is not hygroscopic, which eliminates acid formation harmful to capacitor life.

Characteristics:

High dielectric constant
Low power factor losses
Improved low temperature properties compared to PCB capacitors.
Biodegradability
Low toxicity
Compatibility with all currently used dielectric materials.
Paper, polymeric film, paper/film combination, metallized paper and metallized film.
Flash point at 163°C.

Eucanon-4 is introduced as a supplementary impregnant for use in PCB restricted applications. Due to Eucanon-4's flash point of 163°C and a higher cost, Eucanon-4 should not be nor can it be considered a replacement for Eucarel PCB Impregnant.