

Monsanto

FROM (NAME & LOCATION):

P. G. Benignus - B2SH

DATE

June 25, 1971

SUBJECT

Replacements for Capacitor
Aroclor

REFERENCE

TO

H. S. BERGEN - B2SA

CC:

T. L. Gossage - B2SL
W. R. Richard - T3A
R. H. Munch - 1760
P.J.A. Marsh - 5040
C. R. Coleman - 5470
W. B. Papageorge - B2SK
J. R. Fallon - B2SH
J. G. Bryant - 1760

This subject was one of the headings on the agenda of the CIGRE meeting attended by Colin Coleman - who will report. It is my impression that about all that came up was reference to work some years ago by Josh Reynolds, Dir. of Research at BICC on esters, found to lack the full virtues of unpopular castor oil dielectric, which has been resurrected, however, for use in place of Aroclor in a good deal of specialty type high energy storage capacitors. Mr. Coleman will give us a list of these esters so we can compare against the nine sent to GE.

My effort to further probe the subject of replacement with people available at IEC-10, including Coleman, Dr. Knust (Bayer), P. Jay (Prodelec), C. Bozzini (ACEC), D. McClain (Westinghouse) and M. Scoville (GE) leads me to at least outline some thoughts.

However, first it is important to speak in terms of specific type Aroclor capacitors - not generalities and secondly to consider what part of the world is dealt with as both economics and voltage levels are weighty variables.

Power Capacitors

In case of power capacitors, Aroclor is still in process of replacing mineral oil tank type units in such areas as Japan, India, China, Russia and other Iron Curtain countries. In the world areas where Aroclor has already completed replacement of mineral oil in power units no one entertains replacement of Aroclor beyond small units, such as 5 KVAR, and in no instance at the commonly used higher (most economical) voltage levels. In this area, however, PPL film has indeed cut Aroclor use in half - which is near the likely end point.

In this market area Prodelec now sell PPL film made by Ia Cellophane and are introducing Pyralene 2,000. This is mainly dichlorobiphenyl containing a wetting agent for PPL plastic film units.

At this point let me insert that 5 years ago Mr. Crepe, Market Manager of Prodelec told me in Paris that the MCL posture on dielectrics in the European market area is so weak that he does not know why Monsanto should not (best) withdraw. Today not only Prodelec but also Bayer feel our aggressiveness in this

0012690

area and especially Prodelec talk openly of being out to get us elsewhere. Five years ago economic factors were adverse for us in the Benelux countries and Monsanto was not able to sell there. In those days Mr. Bozzini of ACEC told me that he would like to purchase from us but economic factors rule it out. These factors changed and recently Monsanto acquired much of the transformer Askarel business at ACEC - the largest user in Belgium and next week the first shipment of capacitor Aroclor is going to this Westinghouse company. ACEC recently finished duplicating the large Bloomington, Indiana capacitor plant.

I said above that no one foresees replacement of Aroclor for power capacitors and as though needed to cement this view, by Jan. 1972 Sweden will ban Aroclor use for everything except for power capacitors (the only type capacitors produced in Sweden).

Ballast Capacitors

In the USA, General Electric tend to share our smugness that Aroclor is not likely to be replaced for ballast units, because our ballast voltage levels are higher than in many foreign lands and because the GE carousel turns out high quality, relatively long life, fire resistant capacitors at low cost and our NEMA standards are higher than most elsewhere. Also, regarding PCB pollution we have machines capable of digesting spent ballasts provided that they can be collected, economically.

However, GE like ourselves are concerned about what may evolve from other world areas where factors seem less favorable toward Aroclor ballast units.

At this point let me inject that Prodelec's sales of Pyralene 1499 (Aroclor 1242) are now matched by Pyralene 1500, a dichloro-trichloro biphenyl blend which will now contain a Prodelec selected epoxide other than GE's Unox 4-206, recently dropped by Prodelec to get away from "excessive royalty" and application difficulty. Also, the ditrichloro blend is in the right direction regarding PCB pollution. Monsanto's counter product is Aroclor 1016 and MCS 1043 if needed. However, the time is here for Monsanto to have for marketing an epoxide of our selection, other than GE patented epoxides.

In the European market area and elsewhere these are the Aroclor products that must stand up against the already known new ballast capacitors.

Item I. Siemen's Unit

These interestingly designed units are a sandwich of plain PPL film, with paper metallized on both sides and impregnated with

0012691

mineral oil. They are produced in Germany, but Dr. Knust is of the impression that they tend to be uneconomical and the self-healing does not hold up as well as it should at higher temperatures.

Item II. Bosch

Bosch are producing some poly carbonate ballast units, and have long offered metallized paper impregnated with mineral oil.

Unless PCB pollution dictates otherwise Dr. Knust feels that Clophen will hold at least 75% of the market in the German area.

Item III. Prodelec

For metallized film capacitors Prodelec recently patented monochloro-alkyl biphenyl, used also with terphenyl and alkyl benzene and in all cases Prodelec's epoxide is suggested.

We would feel that MCS 1043 with epoxide may be better or at least equivalent.

Item IV. Chlorinated Napthalene

While not acceptable in the USA, however in the UK and some other countries chlorinated naphthalene is used in place of Aroclor for some low voltage ballast capacitors.

Item V. Dry Ballast Capacitors

Dry ballast (no impregnant) capacitors are used widely in Italy and are also made and used to some extent in the UK. This is not a new development. The capacitors employ PPL film, zinc metallized on one side. Obviously, these units are used in place of Aroclor.

Item VI. Dry Motor-Run Capacitors

Dry, motor-run capacitors are mentioned by Coleman as a very new development on which little information is available. These consist of a sandwich of PPL film, zinc metallized on only one side and a layer of PPL film metallized on both sides. This latter is inserted as a "floating layer" as it is not connected to any terminal.

Item VII.

We could restate other possible developments, even to the extent of asking, "Why not use mineral oil to replace Aroclor in PPL film power capacitors?"

0012692

Our purpose is to point out that these developments to replace Aroclor arise in Europe, Japan, etc. - not in the USA. Certainly, GE, Westinghouse and the rest in the USA seem far more interested in retaining Aroclor than in replacing it. Possible replacements for Aroclor appear far more likely to be used in Europe and Japan, etc. This emphasizes our need to have aggressive input from the ME marketing area.

ME lament that they have only Colin Coleman and very restricted funds to do this.

It is apparent that Prodelec are more committed than Monsanto to a significant research effort (manpower and funds) towards developing different Aroclor and Aroclor related products. To meet this challenge and introduce in the European market area the developments under way in Monsanto USA research, ME feels need for more than the \$4,000 used last year, by Coleman.

While Prodelec's modifications of Aroclor 1242 all use lower chlorination levels, Prodelec are weak by not having made biodegradation studies. ME feel that their strength is not in the modified product, per se, but in our ability to present test data on biodegradation. See Dr. Vodden's report on the Swedish Government's requirement for evidence of biodegradability. In the mean time Sweden are prepared to license use of Aroclor 1242 for power capacitors, which is the only type capacitor made in Sweden. The story is expected to be the same in Finland. However, Aroclor for ballast and motor-run capacitors (mostly all these types are imported) is banned.

ME's policy is switch the UK to Aroclor 1016, when the Newport plant is on stream - a year from now. By then the USA will have already been converted.

ME's policy for Scandinavia primarily but also elsewhere will be to obtain and present sufficient biodegradability of Aroclor 1016 to allow withdrawal of licenses allowing use of Aroclor 1242. If Aroclor 1016 does not fulfill this then the ME policy is to look ahead for something that will do so.

Most European capacitor makers are not subjected to the political pressure prevalent in the USA and are reluctant to undertake expensive testing programs on 1016 unless forced to do so.

In Scandinavia, ME at this stage feel it best to not alert their competitors, namely Bayer and Prodelec to what Monsanto is doing for the long-run - lest their competitors undertake the same.

P. G. Benignus .

CS

0012693