PCB IMPREGNATED CAPACITORS - PRESENT STATUS

Because of the pressure to phase out the use of PCBs in capacitors, for environmental reasons, and because the prospective introduction of a substitute raises many questions which a number of organizations and agencies are going to have to face and to resolve collectively, we believe it is useful to take time for a brief overview of our present product--some of its principal features, and why it is made as it is. We are going to need to weigh carefully the feasibility of, and the effect of deviating from the present product, whether the deviation be in size, reliability, fire resistance or whatever; in order to do that, we need to know what we are "deviating from".

Almost all capacitors made for alternating current application in the United States are impregnated with a particular variety of polychlorinated biphenyl (PCB) made only by Monsanto, and identified by the trade name Aroclor 1016. Capacitor manufacturers adapt this material to their particular processing procedures, with or without additives, and identify their dielectric liquids by such trade names as Pyranol, Dykanol, Hyvol, Eucarel, Clorphen, Chlorinol and the like. The generic term for this type of dielectric liquid is askarel. This particular variety of PCB has been used by the capacitor industry since about the first of 1972. The principal difference from its predecessor (Aroclor 1242) is that most of the higher

boiling homologues have been removed, leaving the lower chlorinated and therefore more biodegradable fractions.

The family of polychlorinated biphenyls have characteristics which make them suitable for a wide variety of uses, which in the past have resulted in widespread entry into the environment. At present, usage is limited almost entirely to transformers and capacitors where Aroclors have been used since the early 1930s. Aroclor 1016 has a unique combination of several different characteristics which make it especially suited for use in AC capacitors. The most important of these, which are shared by no other known potential alternative, are:

1. High (approximately 5) dielectric constant, which results in small size, and efficient utilization of other capacitor materials such as electrical grade kraft paper and aluminum foil.
2. High stability to electrical, thermal and chemical stresses, which results in long life and reliability.
3. Fire resistance. It has a flash point of 358°F, no fire point to its boiling point of 620°F, and has a UL classification of "non-flammable".

Thus, capacitors impregnated with this material are characterized by small size, long life in service, exceptional reliability, and safety. All of these factors are important from the economic standpoint, but the last one mentioned: safety, has a special

importance in many of the applications for the type of capacitors we call "small industrial". As you no doubt know, these capacitors are used in the home in devices such as TV receivers, air conditioners, microwave ovens and the larger dehumidifiers, and in whole host of commercial and industrial applications such as ballasts for fluorescent and high intensity discharge (e.g. mercury and sodium vapor) lamps.

Because of the compelling economic and safety considerations, the capacitor industry has spent untold millions of unit hours in testing the product which has evolved into present-day small industrial capacitor designs. The resulting product has an overall survival rate of more than 95% in the 12 to 15 year design life demanded by the capacitor users, with yearly failure rates of very substantially less than one percent. Even so, unforeseen circumstances have in the past resulted in abnormally high failure rates in particular instances. Capacitor manufacturers are therefore careful, even using the familiar existing materials and processes, to make extensive evaluations before introducing into production capacitor designs which represent seemingly modest departures from past practice.

One approach to product safety has been to incorporate circuit interrupting devices, either in the capacitors themselves, or in the circuit in which they are used. Examples are the pressure or thermally sensitive circuit interrupters sometimes used in fluorescent lamp ballast capacitors, and electrical fuses either built-in or used in the external cir-

cuit of capacitors used in air conditioners. Aside from considerations of providing protection against damage to associated devices, the intent of such protective means is to prevent rupture of the can in the event of capacitor failure. Because with the present PCB impregnant the fire hazard from can rupture has been regarded as minimal, such protection has not been used very extensively in the past few years.

In summary, small industrial capacitors are a tried and proven product which is made from readily available materials, are relatively small, inexpensive, reliable and fire resistant, and we have literally hundreds of millions of them operating successfully as components in a wide variety of domestic, commercial and industrial equipment. In the subsequent discussion, we will be reviewing a variety of points, including why it appears to be necessary to make a significant change.

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