PCBs In Japan
July, 1972

When the Japanese Government recently banned all non-electrical use of PCBs, this resulted also in termination of PCB production in Japan. Alone, the electrical use of PCBs in Japan was not large enough to adequately support manufacture of PCB compounds.

While possible to import PCBs for transformers and capacitors, need for accountability to Government agencies has made it difficult to manufacture PCB containing electrical apparatus in Japan and markedly thwarted desire to use such apparatus.

Although Japanese capacitor manufacturers have been searching for non-PCB high DK dielectric fluids none seem to have been found nor developed suitable for use in typical PCB capacitor designs.

Accordingly, there has been speculation on what Japanese capacitor manufacturers would substitute for standard Aroclor (PCB) impregnated capacitors formerly produced in Japan.

The first concrete evidence, although confined to a ballast type unit, is at hand. The unit made by Matsushita is a 3.95/ 0.05 μ F 300 V ballast capacitor.

We have measured the electrical characteristics of the one given to us and have dissected it to determine what type of construction and what materials are used.

The low dissipation factor indicates that the dielectric is polypropylene film and this was substantiated when the capacitor was dissected.

Internal inspection revealed that the two sections of the capacitor are mechanically separate using different dielectric and electrode construction.

The 3.95 μ F section uses one thickness of 0.3 mil polypropylene film as the dielectric. The electrodes are 0.4 mil paper metallized on both sides. One electrode extends to one end of the roll, the other electrode to the other end so that contact can be made with them by spraying with zinc to which the leads are soldered. The roll has an outer winding of paper. This is basically the Siemens construction.

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The 0.05 μ F section uses two layers of 0.5 mil film for dielectric and 0.25 mil aluminum foil electrodes. The leads are inserted wire loops, both at the top end. It is compressed into a thin flat shape which is placed beside the oval 3.95 μ F section with a kraft board separator between.

The leads to both sections have plastic tubing threaded over them for insulation.

The two sections are wrapped together in a kraft paper covering with the end carefully folded to insulate the ends as well as the sides from the can. Leads are soldered to the terminals of the can.

The cans are epoxy sealed extruded aluminum.

The impregnant is a mono alkyl benzene probably having about 12 carbon atoms in a straight chain. Flash and Fire points are said to be 150° and 200°C respectively.

The question is: how does this construction compare with the standard Aroclor impregnated paper type capacitor? In that construction two layers of 0.3 mil paper form the dielectric, the electrodes are 0.25 mil aluminum foil. The two sections are wound in one roll with three inserted tabs for leads on an automatic machine. Leads are spotwelded to the header terminals. There is no need for plastic tubing to insulate the leads since all three leads are at the top of the roll. Likewise, there is no need for an extra wrapping. These items plus zinc spraying and soldering leads add greatly to the labor cost of the new Japanese units.

It appears that the new Japanese ballast capacitor design would be expensive even in a low cost labor area; in a country where labor costs are as high as they are here it would be used only as a last resort. Present U.S. design permits almost completely automated construction and gives fire resistance as an added bonus. The only way in which the new Japanese design is better is that it has a lower dissipation factor; this seems to be of no interest in ballast capacitors. The most important advantage of a capacitor constructed with paper impregnated with a high D.K. fluid as the dielectric appears to be lower cost because of automated manufacture permitted by this design. If polypropylene film ~ 0.15 mil thick could be produced and if the cost was low enough, similar manufacturing techniques might be used with it using a hydrocarbon as impregnant. Such film cannot be manufactured at present and would be very costly if it could be.

Therefore, we can expect that ballast capacitors will continue to use paper impregnated with a high D.K. fluid - Aroclor 1016.