Monsanto

Fill capacitor fluid

FROM (NAME—LOCATION—PHONE) : J. K. Sears - Galt 1730

DATE : January 11, 1982

SUBJECT : Plasticizers as Capacitor Fluids
Aerovox Call Report DMC/8-6-81

REFERENCE : JKS/JHO 6/9/81

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cc.

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John, your phone call 1/5/82 reminded me of Arovox's suggestion through Diane Clay 8/6/81 that we talk to Paul Benignus about plasticizers as liquid dielectrics. I had not called him because I assumed I knew his answer. However, I have now talked with him. He is still a consultant for Aerovox and other capacitor and transformer manufacturers. He concurred in our earlier judgment, but came back with some suggestions of possible value.

On this subject he said:

1) DOP is used a great deal. It is on the ragged edge of acceptability, so no compromise in dielectric constant DK, and especially in stability (thermal and hydrolytic) can be tolerated. (The DK of DOP is 5.18).

2) He thinks very little DINP is used. The DK is too low.

3) Dihexyl phthalate is better than DOP in DK and its pour point should be about the same. "Why don't you make it?" (DK = 5.69).

4) Santicizer® 160 (DK = 6.4) is "no good." Its stability is bad. He knows of nothing out in the capacitor industry that could clean it up better or stabilize it better than we did years ago when it failed.

5) Santicizer® 711 might work if Monsanto lowered the price enough. At this point he was suggesting a compromise on DK but not on stability. (DK = 4.76).

Paul did spark the old question again of taking a hydrocarbon and adding a high DK liquid to it. He specifically mentioned the sulfone Ralph Munch was working on in a Santosol® hydrocarbon. That was too expensive. But just for a 15 minute probe, I drew the attached graph, Figure 1, Dielectric constants of blends.

If we were to blend S-8 (DK$\sim$36.5) with a hydrocarbon (HB-40 is a suitable example) with DK $\sim$2.4 it would take about a 91/9 blend of HB-40/S-8 to give a DK equal to DOP. The price would be exorbitant today compared to DOP and we might not be able to get it electrically clean and stable. I guess Munch tried something like that, but I do not recall. But, if we used S-711 or S-900/S-8 (98/2) we could get the same DK as DOP. That would still cost too much. Could

we clean it up? But once more, if we used a 95/5 blend of S-900/S-8 we would have a DK of 6. A 92/8 blend would have a DK of 7, much higher than any dialkyl phthalate. If we could clean a blend up and if it should be stable enough the price should be right.

This also poses the following questions:

1) Would Dale Emge's new sulfonamide be good in this use? It might be more easily cleaned up because of the more buried H-Bonding group.

2) (Assume sulfonamides survive) Would an N,N-diethyl, o,p-toluene sulfonamide be out of range? It should be easier to clean up, I think.

3) Would a blend of S-160 with S-711 or S-900 be as unstable as S-160 alone or would it be stable enough? A 50/50 blend should have a DK of 5.5.

4) Would HB-40 in 1 to 3% conc. in S-711 or S-900 have a stabilizing effect in this environment as it does in straight autoxidation? If so the lower DK of S-900 might be accepted to obtain better stability. Might HB-40 even help S-160? Its influence in autoxidation is to eliminate an inductor period and no speed oxidation, yet a ternary blend of DOP/S-160/HB-40 is autoinhibiting. I suggest a blend of S-900/S-160/HB-40 (45/45/10) with a DK of about 5.2 as worth a try. MXP-2020 could be used in place of HB-40 if the price is better. See "Odor Development and Inhibitions in Plasticized PVC" by Sears and Darby.

5) Is there something else that is relatively inexpensive, high in DK, cleanable, stable that could blend with S-900 to get us up above the dialkyl phthalate range and get back the business? Diethylene glycol dibenzoate (DK = 7.1), ethylene carbonate (DK = 89.6) come to mind, but are totally untried so far as I know.

Any interest, anyone?

Kern Sears

P.S. Paul G. Benignus retired from Monsanto in 1974. His address is 47 Metcalf Drive, Belleville, Illinois 62223; Phone: 618/397-9011.

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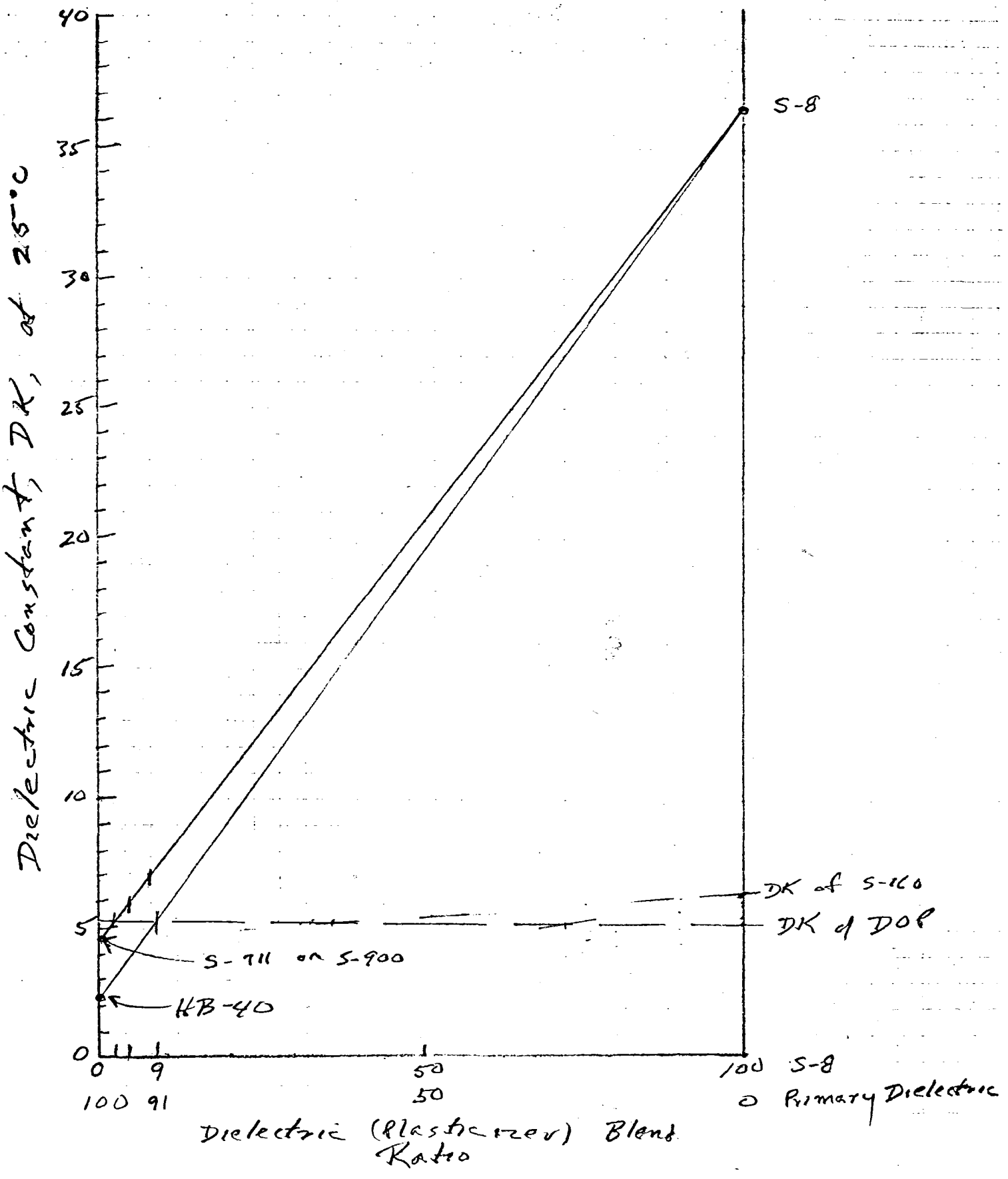

Fig 1. Dielectric constants of Blends.

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