Fermilab

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MEMO TO: R. Bossert, J. Carson, S. Delchamps, W. Koska, M.J. Lamm, E.G. Pewitt, R.E. Sims, A. Spindel, M. Wake, J. Zbasnik

FROM: Jim Strait

SUBJECT: Proposed Insulation Systems for Remaining Short and Long SSC Dipoles

I present here a proposal for the conductor insulation systems to be used in the remaining short and long SSC dipoles that we will build and test this year. This proposal in some sense comes from the conductor workshop held at the SSCL yesterday. In fact it represents a consensus worked out by Dick Sims, Amanda Spindel and me after the workshop had formally ended and is "approved" by no one but the three of us. The proposal is summarized in Table I.

DSA330, DSA332 and DCA320-322 use the Kapton-epoxy system we selected in December. Dick's work with 10-stacks[1] suggested enough interesting options and left enough questions unanswered that we thought it would be worth while to try 3 other configurations in short magnets.

The specific suggestions follow from 2 of Dick's recent results: 1) Apical NP-film containing systems tend to creep less than comparable Kapton systems (a weak effect) and 2) the more layers of polyimide film that are expoxied together the lower the creep (a strong effect). Several samples with adhesive on the inner wrap are the only "all-Kapton" systems to show less creep than the standard Kapton and Glass system. The concern, however, is that epoxy can flow during curing and wet the conductor, posing a risk of epoxy-cracking induced quenching. Dick has pealed apart one such 10-stack and found that a very small amount of epoxy does, in fact, end up on the wire. The amount is small and is all in low stress regions, so it is not obvious whether or not this will cause quenching. The relatively poor training characteristics of the Low Beta Quads does not allow us to conclude that this is not a problem. DSA331 is proposed to have an LBQ-like insulation system to test this issue. It is proposed to build this as the 2nd magnet of the series to get results as soon as possible.

Amanda pointed out that putting epoxy on both sides of the outer wrap would bond more layers of the insulating film than our original choice. With uncoated film as the inner wrap there is no risk from epoxy contacting the wire. DSA333 and 334 are tests of this type of system. DSA333 is an "all-Apical" version, while DSA334 is a hybrid which takes advantage of the purported lower thermal contraction of the filled Kapton. Of course the existence and order of those two magnets depends on the time required to obtain the double coated NP and LT films. Also, we need to consider the thickness of the epoxy layers - do we want to use 0.2 mils on each side (the thickness on the single coated film) or reduce the thickness to more closely preserve the same amount of material in the coil package?

DSA332 uses the same system as DSA330 and the first long magnets. We felt that this system is still the surest bet and there is advantage to having at least one pair of nominally identical magnets. It is put third in the sequence to allow more time for procuring the double coated Apical and Kapton films.

Because of the usual high visibility and consequent political risks associated with long magnets we felt we could not propose a system with epoxy on the inner layer. We therefore opted for one with a double coated outer layer. The particular choice - H-film on the inside and LT-film on the outside - was somewhat arbitrary and was based on the perception that continued use of Kapton was lower risk. I would propose, however, that we procure enough NP-film with both sides coated with Cryorad to allow us the option of making a long magnet with this material instead. We propose only one long magnet with this alternative system because the first 3 must be started too early for there to be any hope at all of obtaining double coated film in time for them. The current schedule for the long magnets shows winding of DCA323 beginning around March 25 and tests being complete in mid-August. If this could slip by 2-4 weeks, then we would have 8-10 weeks to procure the double coated films.

Dick has volunteered to contact Allied Signal about obtaining NP-film with both sides coated with Cryorad. I propose that John Zweibohmer contact DuPont and whoever put on the 2290 epoxy coating about double coated LT-film.

Although we are pushing to start procurement of the double coated films ASAP, let me emphasize that this is only a proposal for now and is open for discussion. However, we need to decide relatively soon (next week?) at least about the next short magnet. Please give me any comments or suggestions you may have.

Reference [1] R.E Sims, Kapton-Epoxy Insulation and Apical-Cryorad System Tests, presented at The Cable Insulation Workshop at SSCL, 2/5/92, TS-SSC 92-018.

Table I

	Inner Coil				Outer Coil			
	Inner Wrap	Inner Adhes.	Outer Wrap	Outer Adhes.	Inner Wrap	Inner Adhes.	Outer Wrap	Outer Adhes.
DSA330	50% H	-	Butt LT	2290	50% H	-	50% LT	2290
DSA331	66% NP	CR	-	-	50% NP	CR	50% NP	CR
DSA332	50% H	-	Butt LT	2290	50% H	-	50% LT	2290
DSA333	50% NP	-	Butt NP	2xCR	50% NP	-	50% NP	2xCR
DSA334	50% NP	-	Butt LT	2x2290	50% NP	-	50% LT	2x2290
DCA320-322	50% H	-	Butt LT	2290	50% H	-	50% LT	2290
DCA323	50% H	-	Butt LT	2x2290	50% H	-	50% LT	2x2290