Fermilab

TS-SSC 92-041
3/20/92

To: R.Bossert, J.Carson, R.Jensen, F.Markley, P.Schmidt

From: Jim Strait

Subject: Plan for cable-pair insulation breakdown tests

I give here a plan for the tests of Kapton-epoxy and Apical-Cryorad cable insulation breakdown under pressure. I apologize for not writing this down sooner. (Pam is already well along in doing the tests.)

We are using a variety of insulation types in the last 5 short and last 4 long SSC magnets and would like to make insulation breakdown tests on many of these. The tests are being carried out using pairs of 40 mm outer cables molded narrow edge to narrow edge. Ten pairs can be molded at one time in a fixture in Finley's lab which has the geometry of a 40 mm outer coil. A piece of 1 mil Kapton with mold release sprayed on both sides is placed between every other turn to define the pairs for test. The 40 mm outer coil has 20 turns with a wedge between turns 11 and 12. The geometry can be maintained adequately if the wedge is moved to be between turns 10 and 11, thereby defining 5 pairs on either side of it. Shims are place at the top of the coil package so that the pressure required to "close" the short mold to the design size is 7-9 kpsi.

Listed in Table I are the combinations of insulations that have been or will be used in DCA320-322 and DSA330-334. The first set are those that are being used on the inner coil, the second on the outer coil. So far the only tests done and the ones for which Pam has the materials are all outer coil insulations, and one combination she has corresponds to no planned magnet. I have listed in the left-most column of the table above the priorities that I think should be applied to this work. We should concentrate on the inner coil type insulations for 2 reasons: 1) previous tests and experience with magnets show that the inner coil is more vulnerable to insulation failure due to the higher design prestress and the nature of collar and coil deflections, especially during collar keying, and 2) the insulation is thinner and therefore more vulnerable. (Tests at the SSCL done with one of our test coils indicated that inner system [a] fails at about 22 kpsi, while Pam has demonstrated that outer system [a] exceeds twice that in most cases.)

Bob should have cable samples insulated with the types used on the inner coils of the long magnets (types [a] and [b]) made and sent to Pam ASAP. If possible, she could mold one stack with 5 pairs of each type and test them. The tests of [b] are important to see if that system is any better (or worse, perish the thought) than [a] before we get too committed to using it in long magnets. The tests of [a] are important to get a cross-calibration between these tests and those done with actual molded coil segments at the SSCL. Tests of outer coil type insulations should be done after the inner insulations are

finished (except that Pam should continue with what she has until Bob can get the inne-type insulated cables to her).

I believe that getting data on inner coil type insulations [a] and [b] is sufficiently important that it should not be delayed for the visit of Dick Sims and Amanda Spindel, currently scheduled for the week of 3/30. My guess is that such a visit will interefere maximally with getting the most important insulation tests done, so it should probably be postponed. We can know better when they should come after Bob has told us when he can get the next batch of cable to Pam.

Table I
Cable insulation types

	Inner Wrap			Outer Wrap				
	film	over-lap	adhes.	film	over-lap	adhes	magnets	Status/Results
1	H	50%	-	LT	butt	2290	[a]	
2	NP	50%	-	NP	butt	2xCR	[b]	
4	H	50%	-	LT	butt	2x2290	[c]	
3	NP	66%	CR	-	-	-	[d]	
5	H	50%	-	LT	50%	2290	[a]	40-50 kpsi breakdown
6	NP	50%	-	NP	50%	2xCR	[b]	Stack being molded
8	H	50%	-	LT	50%	2x2290	[c]	
7	NP	50%	CR	NP	50%	CR	[d]	
-	NP	50%	-	NP	50%	CR	none	Pam has insulated cable

H = DuPont H-film Kapton
LT = DuPont LT-film Kapton
NP = Allied Signal NP-film Apical

2290 = 3M 2290 epoxy on one side
2x2290 = 3M 2290 epoxy on both sides
CR = cryorad on one side
2xCR = cryorad on both sides

Magnets
[a] DSA330,332, DCA320,321
[b] DSA334 DCA322,323
[c] DSA333
[d] DSA331

cc: R.Crockett, S.Delchamps, W.Koska, E.G.Pewitt, M.Wake