VOLTAGE BREAKDOWN OF VARIOUS TYPES OF SEALED ALUMINUM HARDCOAT ANODIZING

Richard E. Sims October 26, 1990

Purpose: To determine if aluminum which has been "Hardcoat Anodized" to a thickness of approximately .002" has sufficient dielectric voltage stand-off while under pressure to be useful in fabricating coil end parts in the SSC magnet.

Method of Test: A bare superconductor cable was pressed against 1.5" diameter aluminum discs which had been Hardcoat anodized and then sealed with Teflon (NITUFF Tradmark), nickel acetate , dichromate, or no sealer. A 1" wide strip of aluminum foil was placed under the disc to act as an electrode and pieces of .005" thick Kapton film were placed above the cable and below the aluminum foil to electrically isolate the stack from the hydraulic press. A DC hipot tester was connected between the cable and the aluminum foil. The voltage control was turned up slowly until the leakage current meter started to "pop". The voltage just below the point where the pooping breakdown occurred was recorded. This was done twice for each sample and recorded as "breakdown #1" and "breakdown #2". Three samples of each type of disc were run and the readings averaged. This series of tests was performed first at 5000 psi (under the cable-aluminum foil crossectional area) and then again at 20,000 psi, as two separate runs.

The nickel acetate seal test runs required that the leakage meter range be set to 2000 microamperes and had before breakdown leakages of approximately 1000 microamps. All the other test runs were run on the 200 microamp range and read approximately 50 to 100 microamps before breakdown.

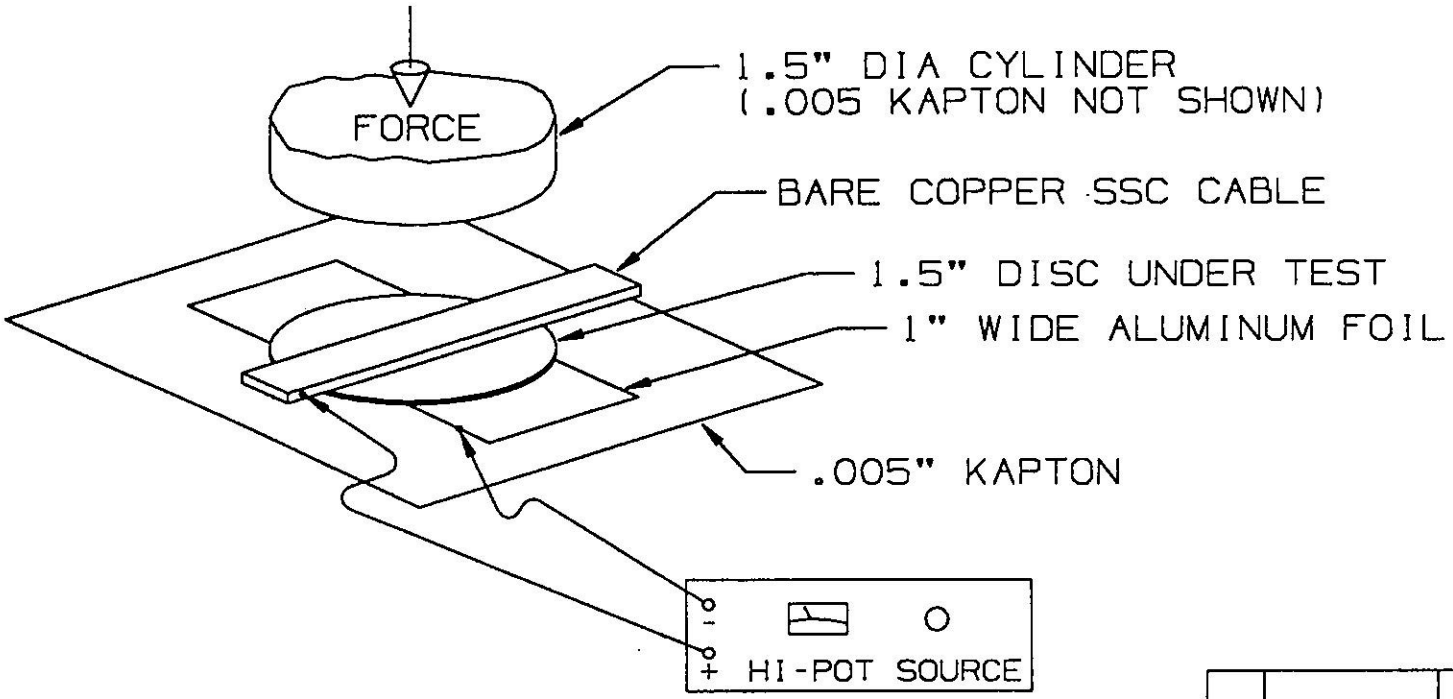
The summary of the averages are:

	5000 psi breakdown #1	5000 psi breakdown #2	20,000 psi breakdown #1	20,000 psi breakdown #2
Teflon	1,066	1,133	867	850
No sealer	717	667	317	317
Dichromate	567	550	483	483
Ni. Acetate	833	833	400	400

Comments: Running these tests with "bare" cable was an effort to simulate the worst case conditions that might be found where the insulated cable wraps in a tight radius around one of the end pieces and insulation cut through has occurred. The normal condition cable has .002" of Kapton insulation which should provide over 14,000 volts of dielectric standoff strength. To illustrate a more normal situation we substituted a cable wrapped with two layers of .001" Kapton and pressed it against a teflon sealed disc in the above test set to 5000 psi. with 5000 volts DC applied there was no breakdown and the leakage current was only about 30 microamps.

This test allowed the Hardcoat and sealer on both sides of the disc under test because that is how the possible end parts would be made. The final version of end parts would be made from cast aluminum rather than the rolled sheet form used here. The anodizing company estimates that when using cast aluminum these dielectric withstanding values will be cut in half. However, there is a possibility that "electropolishing" the castings before anodizing them would reduce the surface finish and allow the build up of a thicker anodized coating.

REV.	DESCRIPTION	DRAWN / APPD.	DATE / DATE



ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.

PARTS LIST

UNLESS OTHERWISE SPECIFIED:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. TOLERANCES: ± 1 mm.
3. DIMENSIONS BASED UPON ANSI Y14.5M-1982.
4. INCH DIMENSIONS ARE FOR REFERENCE ONLY.
5. BREAK ALL SHARP EDGES.
6. DO NOT SCALE DRAWING.
7. MAX. ALL MACH. SURFACES √
8. DIMENSION IDENTIFICATION: MILLIMETER/INCH

ORIGINATOR	R.E. SIMS	
DRAWN	VINCENT T. LEE	10/30/90
CHECKED		
APPROVED		
USED ON		
MATERIAL		

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY
SSC

HARDCOTE ALUMINUM COATING

TEST SET-UP

SCALE	FILMED	DRAWING NUMBER	REV.
NONE			

CREATED WITH UNIGRAPHICS /MSD/USERS/LEE/HACT.SET-UP