M. Gordon 3-12-91
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50mm SSC G-10 End Keys Used During Curing

This note examines the dimensional changes which may occur in the G-10 outer coil end keys when they are used in coil curing. A statistical analysis is done on eight outer short model coils, lead and return ends.

Steel end keys have been used on the coils during winding and curing for fear that the G-10 keys would crush from the heat and pressure of the curing process. Using steel keys has draw backs, the insulation can become damaged during the removal of the steel key and the steel keys have rough surfaces which can damage the cable insulation during winding. The outer keys may have sufficient cross section to resist crushing during the cure cycle.

Eight outer coil were wound and cured with G-10 end keys. The G-10 keys were measured before winding and after curing, Fig. 1. The measurements were done by clamping the key to the mandrel. A 3/8 rod was placed on either side of the key to contact the coil surfaces. A micrometer was used to measure the distance between the two rods. The lead end keys were measured in two locations, the return end in three.

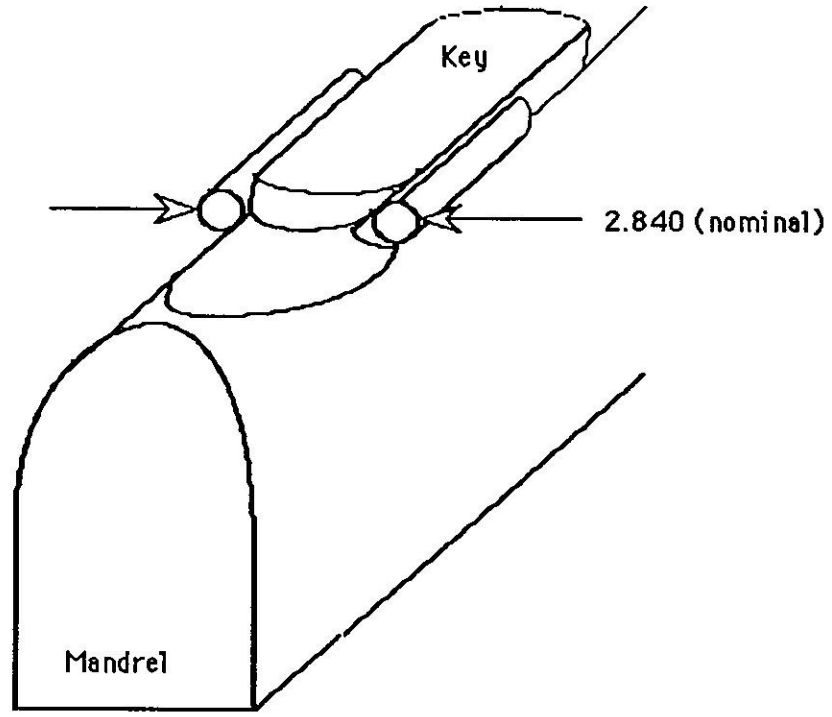

Fig. 1

The difference between the before and after curing measurements were computed for each position. The average change in size was 0.0147 and -0.0012 (the negative indicates that the after cure was larger than before) for the lead and return ends respectively. Both the high and low change in size fall within two standard deviations for each case. The deviation in the before cure sizes and after cure sizes were also computed. In each case the after cure deviation was smaller than the before cure deviation. A close examination of the data reveals that smaller than average before cure measurements were increased as a result of the curing process. The floating tooling keys were also measured, this measurement is considered to be the proper size for the key, and was found to be 2.840. The data indicates that the use of G-10 keys in the curing cycle brings the G-10 key closer to the corresponding nominal tooling key size.

The lead end measurements are greater than the return end because the lead end keys have the slot for the preform splice. The slot allows relaxation of the G-10 fibers resulting in an increased size. The larger deviation of the lead end keys after cure can also be explained. The amount and type of insulation applied to the preform splice is not standardized, therefor the amount of material filling the slot during curing may change from coil to coil. If coils are cured with G-10 keys the holes and slots should be minimized or constantly filled.

It is recommended that outer coils continue to be wound and cured with the G-10 end keys for the following reasons:

1) The curing process seems to bring the G-10 key closer to its proper nominal size.

2) Using G-10 keys throughout the process eliminates the need to removing the steel keys and replacing them with the G-10. Eliminating an assembly step and reducing the threat of damaging the insulation during this step.

3) The G-10 keys did not see any damage as a result of the curing.

4) The G-10 keys have smoother machined surfaces than the steel keys, reducing the possibility of damaging the cable insulation during winding.

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LEAD

POS.	BEFORE	AFTER	B-A
217			
1	2.8760	2.8370	0.0390
2	2.8770	2.8550	0.0220
218			
1	2.8820	2.8470	0.0350
2	2.8820	2.8480	0.0340
214			
1	2.8700	2.8490	0.0210
2	2.8680	2.8550	0.0130
211			
1	2.8600	2.8570	0.0030
2	2.8470	2.8540	-0.0070
210			
1	2.8740	2.8710	0.0030
2	2.8700	2.8550	0.0150
216			
1	2.8710	2.8470	0.0240
2	2.8740	2.8520	0.0220
219			
1	2.8750	2.8570	0.0180
2	2.8735	2.8510	0.0225
220			
1	2.8470	2.8610	-0.0140
2	2.8460	2.8610	-0.0150
AVG.	2.8683	2.85356	0.0147
STD.	0.0119	0.0076	0.0166

0.0645
0.0479
0.0313
0.0147
-0.0019
-0.0185
-0.0351

RETURN

POS.	BEFORE	AFTER	B-A
1	2.8420	2.8400	0.0020
2	2.8420	2.8420	0.0000
3	2.8460	2.8410	0.0050
1	2.8390	2.8390	0.0000
2	2.8380	2.8400	-0.0020
3	2.8390	2.8400	-0.0010
1	2.8380	2.8400	-0.0020
2	2.8370	2.8420	-0.0050
3	2.8380	2.8430	-0.0050
1	2.8380	2.8430	-0.0050
2	2.8370	2.8430	-0.0060
3	2.8370	2.8390	-0.0020
1	2.8390	2.8410	-0.0020
2	2.8390	2.8420	-0.0030
3	2.8380	2.8390	-0.0010
1	2.8440	2.8420	0.0020
2	2.8430	2.8410	0.0020
3	2.8380	2.8410	-0.0030
1	2.8450	2.8400	0.0050
2	2.8450	2.8420	0.0030
3	2.8425	2.8390	0.0035
1	2.8380	2.8410	-0.0030
2	2.8360	2.8410	-0.0050
3	2.8350	2.8420	-0.0070
AVG.	2.8397	2.84096	-0.0012
STD.	0.0031	0.0013	0.0031

0.0106
0.0075
0.0044
0.0012
-0.0019
-0.0050
-0.0082