Fermilab

TS-SSC 90-079
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FROM: Jim Strait

SUBJECT: Keying of DC0303: Strain Gage Data

The keying of DC0303 appears to have been quite successful. DC0303 has two strain gage packs located[1] at the points where the sum of the coil sizes in the four inner coil quadrants are largest ("LE") and the smallest ("RE"). No regard was taken of the outer coil sizes in making the location assignment.

Strain gage data, averaged over the four inner and outer gages at each of the two locations, is displayed in Fig. 1 and Tables Ia and Ib. Several features of the data are worth noting. Despite considerable differences while the coil was in the press, the final prestress is similar if the inner and outer coils at the two locations. The average inner and outer coil prestresses are 8.6 kpsi and 8.5 kpsi respectively. The gage pack at the "high" spot has a lower apparent inner coil prestress than that at the "low" spot. The cause of this is unknown but could result from differences in the outer coil size. It could also be an instrumental effect resulting from, for example, imperfect shimming of the strain gage beams.

The coil stress averaged over the inner and outer coils, is plotted in Fig. 2. The data are quite linear for the "RE" pack, but less so for the "LE" pack. The fit slope $d\sigma/dP_v$ in shown in Tables Ia and IIb. For the "RE" pack the slope does not depend sensitively on the fit region and indicates that about 80% of the coil stress at the mid-plane is transferred to the pole. For the "LE" gages the inferred stress transfer varies from 79% to 93% as the minimum pressure of the fit varies from 1 kpsi to 4 kpsi.

Footnote

[1] W. Koska, TS-SSC note to be published.

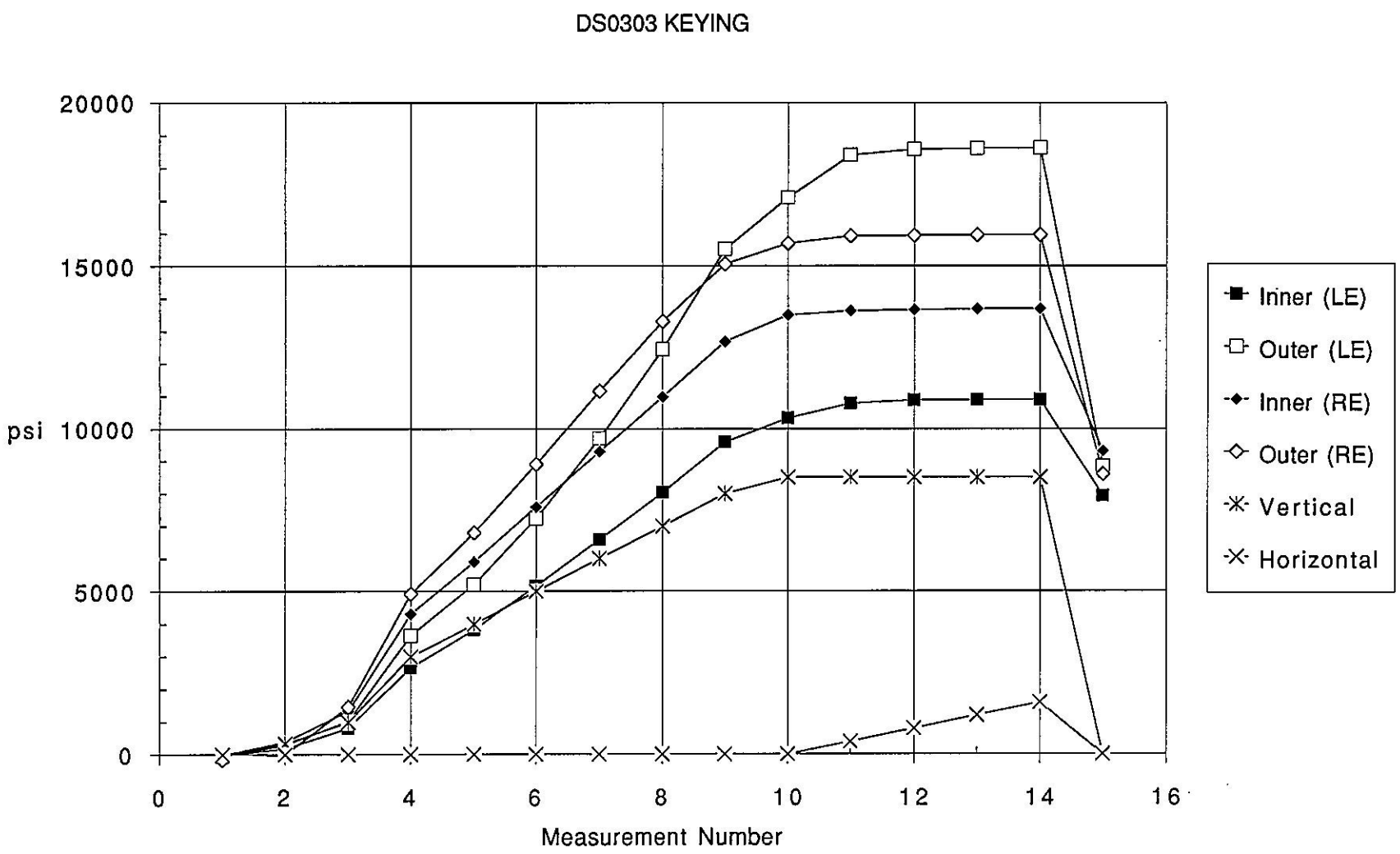
DS0303 KEYING
20000
15000
psi 10000
5000
0
0
2
4
6
8
10
12
14
16
Measurement Number
Inner (LE)
Outer (LE)
Inner (RE)
Outer (RE)
Vertical
Horizontal

Figure 1

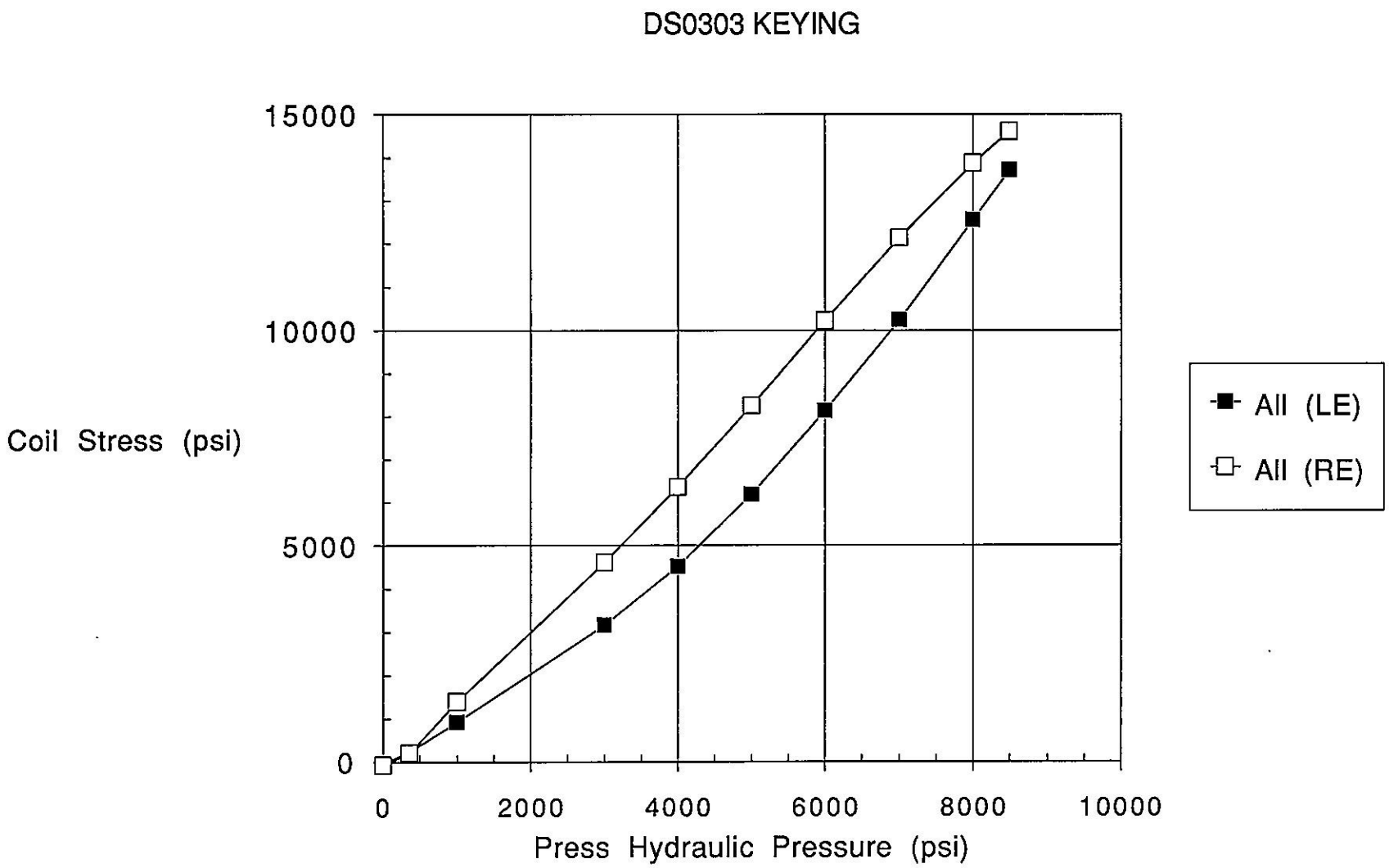
DS0303 KEYING
15000
10000
5000
0
Coil Stress (psi)
0
2000
4000
6000
8000
10000
Press Hydraulic Pressure (psi)
All (LE)
All (RE)

Figure 2.

DS0302 LE

Table Ia

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2													
3											C3	C2	C1
4				GAGE NO.	TYPE	COIL	Quadrant	Gage Facto	R0 (Ohms)	A0	A1	A2	A3
5				1038	Active	Inner	1	2.02	350.170	-32.7	2.6E+00	2.72E-03	0.00000
6				1034	Active	Inner	2	2.02	350.044	-88.6	1.3E+00	3.76E-03	0.00000
7				267	Comp.	Inner	1&2	2.02	350.330				
8				1043	Active	Inner	3	2.02	350.389	135.7	1.3E+00	3.43E-03	0.00000
9				1044	Active	Inner	4	2.02	350.436	-64.7	6.5E-01	3.76E-03	0.00000
10				264	Comp.	Inner	3&4	2.02	350.328				
11				66	Active	Outer	1	2.02	350.441	-70.7	3.8E-01	5.16E-03	0.00000
12				67	Active	Outer	2	2.02	350.151	-38.3	9.3E-01	5.17E-03	0.00000
13				254	Comp.	Outer	1	2.02	350.290				
14				307	Comp.	Outer	2	2.02	350.235				
15				86	Active	Outer	3	2.02	350.426	-157.3	9.6E-01	4.24E-03	0.00000
16				85	Active	Outer	4	2.02	350.618	24.1	1.9E+00	3.11E-03	0.00000
17				300	Comp.	Outer	3	2.02	349.895				
18				301	Comp.	Outer	4	2.02	349.764				
19													
20													
21						Hydraulic Pressure		Average Coil Stress			d(Stress)/dPv		
22			Seq #	Date	Press	Vertical	Horizontal	Inner (LE)	Outer (LE)	All (LE)	Inner	Outer	All
23			1	11/1/90	0	0	0	-11	-51	-31			
24			2	11/1/90	0	350	0	182	298	240			
25			3	11/1/90	0	1000	0	813	1028	920	0.97	1.12	1.05
26			4	11/1/90	0	3000	0	2662	3650	3156	0.92	1.31	1.12
27			5	11/1/90	0	4000	0	3831	5205	4518	1.17	1.55	1.36
28			6	11/1/90	0	5000	0	5158	7236	6197	1.33	2.03	1.68
29			7	11/1/90	0	6000	0	6586	9706	8146	1.43	2.47	1.95
30			8	11/1/90	0	7000	0	8029	12450	10239	1.44	2.74	2.09
31			9	11/1/90	0	8000	0	9587	15520	12553	1.56	3.07	2.31
32			10	11/1/90	0	8500	0	10331	17094	13713	1.49	3.15	2.32
33			11	11/1/90	0	8500	400	10782	18410	14596			
34			12	11/1/90	0	8500	800	10879	18589	14734			
35			13	11/1/90	0	8500	1200	10905	18622	14764			
36			14	11/1/90	0	8500	1600	10905	18631	14768			
37			15	11/1/90	0	0	0	7931	8848	8389			
38													
39						fit	d(stress)/dPv	1.30	2.19	1.75	1≤Pv≤8.5 kpsi		
40								1.45	2.67	2.06	4≤Pv≤8.5 kpsi		
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DS0302 RE

Table Ib

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	PSI AVERAGING FORMULAS CORRECTED 10-23-90												
2													
3											C3	C2	C1
4				GAGE NO.	TYPE	COIL	Quadrant	Gage Facto	R0 (Ohms)	A0	A1	A2	A3
5				1032	Active	Inner	1	2.02	349.833	37.1	1.9E+00	3.77E-03	0.00000
6				1017	Active	Inner	2	2.02	349.839	-0.2	2.2E+00	3.24E-03	0.00000
7				286	Comp.	Inner	1&2	2.02	349.526				
8				1047	Active	Inner	3	2.02	350.554	-40.2	3.5E+00	3.33E-03	0.00000
9				1048	Active	Inner	4	2.02	350.583	-123.8	4.7E+00	3.54E-03	0.00000
10				310	Comp.	Inner	3&4	2.02	350.290				
11				1040	Active	Outer	1	2.02	349.799	-307.3	4.1E+00	4.40E-03	0.00000
12				1035	Active	Outer	2	2.02	349.914	12.9	3.8E+00	3.84E-03	0.00000
13				302	Comp.	Outer	1	2.02	350.147				
14				284	Comp.	Outer	2	2.02	349.799				
15				1034	Active	Outer	3	2.02	350.044	-88.6	1.3E+00	3.76E-03	0.00000
16				1033	Active	Outer	4	2.02	349.701				
17				311	Comp.	Outer	3	2.02	350.444				
18				253	Comp.	Outer	4	2.02	350.055				
19													
20													
21						Hydraulic Pressure		Average Coil Stress			d(Stress)/dPv		
22			Seq #	Date	Press	Vertical	Horizontal	Inner (RE)	Outer (RE)	All (RE)	Inner	Outer	All
23			1	11/1/90	0	0	0	-10	-167	-88			
24			2	11/1/90	0	350	0	400	8	204			
25			3	11/1/90	0	1000	0	1336	1461	1399			
26			4	11/1/90	0	3000	0	4301	4918	4609	1.48	1.73	1.61
27			5	11/1/90	0	4000	0	5913	6804	6359	1.61	1.89	1.75
28			6	11/1/90	0	5000	0	7596	8914	8255	1.68	2.11	1.90
29			7	11/1/90	0	6000	0	9293	11163	10228	1.70	2.25	1.97
30			8	1/1/04	0	7000	0	10977	13305	12141	1.68	2.14	1.91
31			9	11/1/90	0	8000	0	12693	15074	13883	1.72	1.77	1.74
32			10	11/1/90	0	8500	0	13501	15703	14602	1.62	1.26	1.44
33			11	11/1/90	0	8500	400	13628	15929	14778			
34			12	11/1/90	0	8500	800	13661	15949	14805			
35			13	11/1/90	0	8500	1200	13685	15956	14821			
36			14	11/1/90	0	8500	1600	13697	15957	14827			
37			15	11/1/90	0	0	0	9307	8607	8957			
38													
39						fit	d(stress)/dPv	1.64	1.96	1.80	1≤Pv≤8.5 kpsi		
40								1.69	2.01	1.85	4≤Pv≤8.5 kpsi		
41													
42													
43													
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