Fermilab

May 10, 1990

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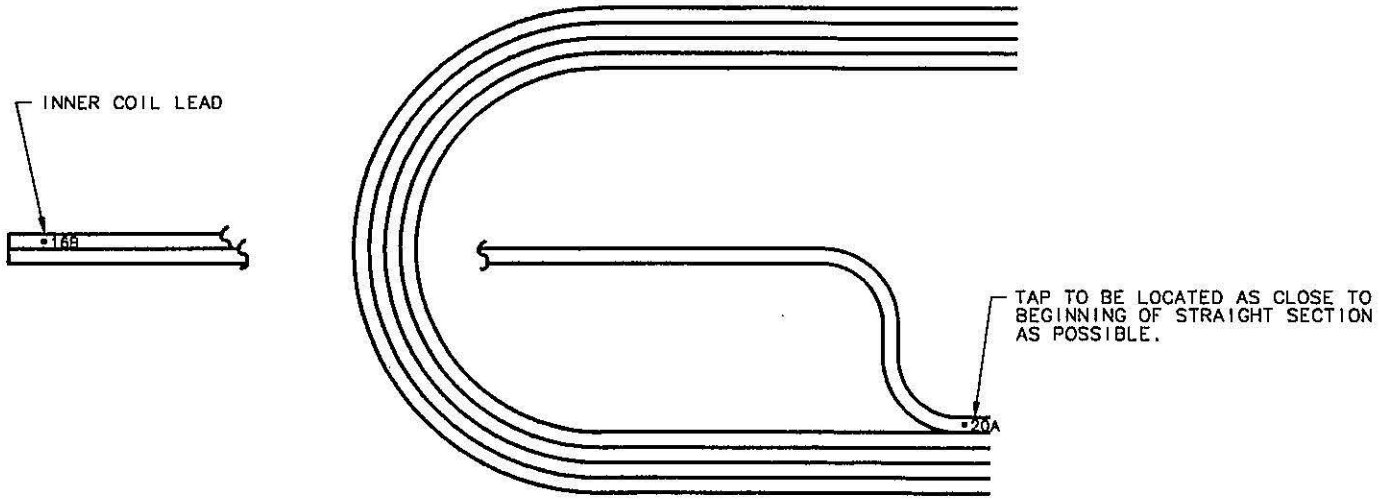
FROM: Jim Strait

SUBJECT: Locations of DS0308 Quenches

DS0308 is equipped with 55 voltage taps, mostly in the inner coil turns near the pole, as shown in Figures 1a and 1b. Table I is a summary of the quench data including quench locations as deduced from the voltage tap data. Initial voltage rises of the earliest three signals from selected quenches are displayed in Figures 2-6.

The one training quench (40 A below plateau) occurred in the lower inner pole turn on the side with the ramp splice. From the relative arrival times of the quench at the two ends, the quench velocity is estimated to be about 50 m/sec and the quench origin is about 25 cm from the lead end tap or about 40 cm from the end of the straight section. (See Figure 2.) All of the low ramp rate ($\leq$ 25 A/sec) plateau quenches are on the other side of the lower inner pole turn. The inferred quench velocity is somewhat higher: 75 m/sec. The quench locations vary from about 0 to 15 cm from the lead end tap or about 15-30 cm from the end of the straight section. (See Figures 3 and 4.) The intermediate ramp rate quenches (50 and 75 A/sec) occur at the very end of the lead end segment between turns 16 and 15. (See Figure 5.) The lower quench velocity at the end is evident; the average quench velocity from the time of arrival at the two side taps is about 25 m/sec. The high ramp rate quenches ($\geq$100 A/sec) all in the upper inner ramp splice. (See Figure 6.) If a quench velocity of 75 m/sec is assumed, then the quench origin is about 15 cm from the tap which is well into the segment of cable which is "pre-formed" and solder filled. It is presumably eddy current heating in the solder filled cable and not any mechanical weakness that causes the quenches in this location. It is not known why the intermediate ramp rate quenches are in a different location from those at high and low ramp rates.



NOTE:

1. WIRE FROM TAP 20A SHOULD FOLLOW COIL LEAD AND THEN BE TWISTED IN A TRIPLET WITH WIRES FROM TAPS 16A AND 16B.
2. COIL AS VIEWED FROM INSIDE.

Figure 1b

REV.	DESCRIPTION	DRAWN / APPD.	DATE

ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.

PARTS LIST

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	STRAIT/KOSKA	
.XX	.XXX	ANGLES	DRAWN	R. DIXON	1/5/90
±	±	±	CHECKED		
1. BREAK ALL SHARP EDGES .06 MAX.			APPROVED		
2. DO NOT SCALE DRAWING.			USED ON		
3. DIMENSIONS BASED UPON ANSI Y14.5M-1982					
4. MAX. ALL MACH. SURFACES			MATERIAL		

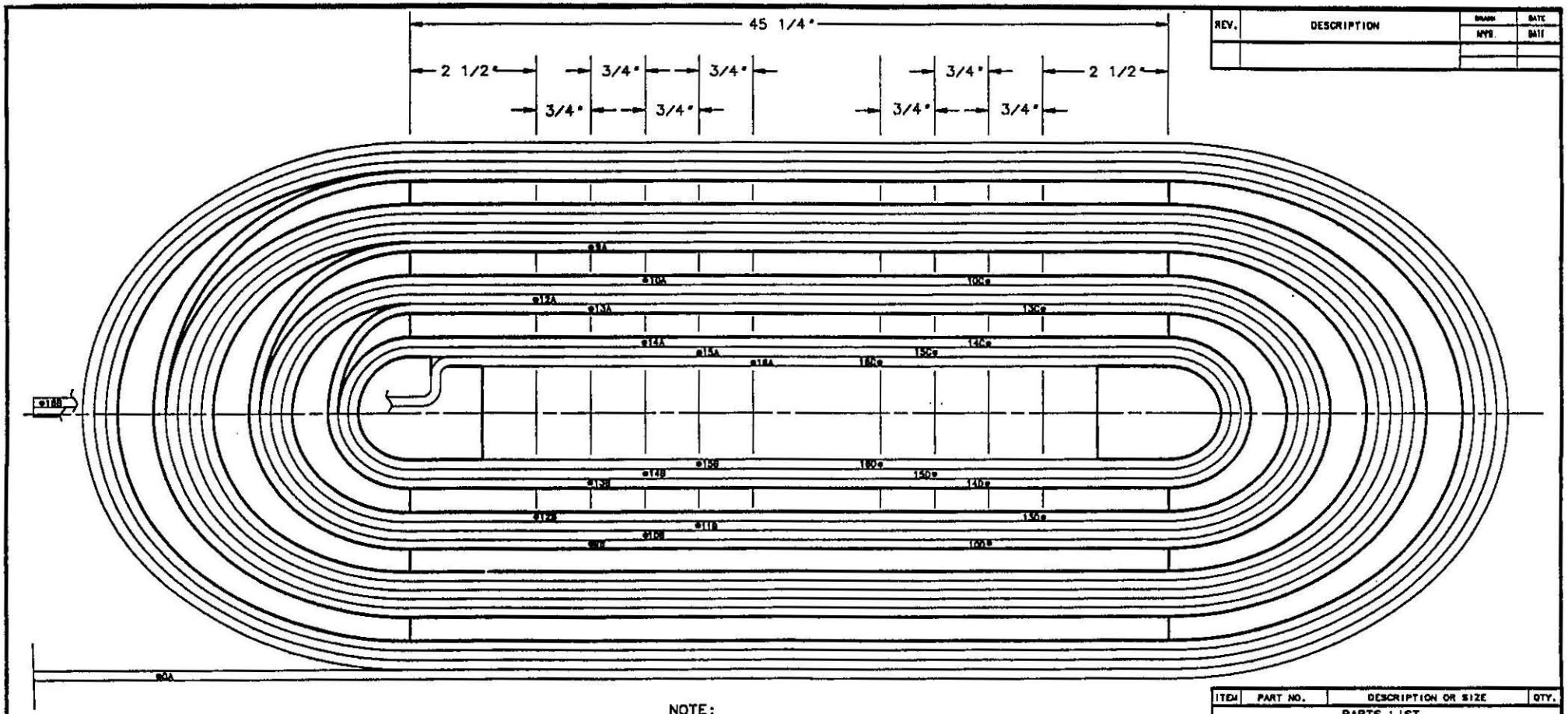
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

DS0308
VOLTAGE TAPS
OUTER COIL

SCALE	FILMED	DRAWING NUMBER	REV.
NONE			

CREATED WITH I-DEAS 4.1 | USER NAME:SPUD

INCHES 0 1 2 3 4 5 6 METRIC 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150



NOTE:

1. VOLTAGE TAP WIRES FOR TAPS 0A, 16B, AND THE HALF COIL TAP ARE #22 AWG TEFLON INSULATED.
2. THE REMAINING VOLTAGE TAP WIRES ARE #32 AWG TEFLON INSULATED.
3. TAP WIRES WITH THE SAME NUMBER AT EACH END SHOULD FORM A TWISTED PAIR (A-B AND C-D).
4. VOLTAGE TAP WIRE SHOULD FOLLOW THE CABLE TO WHICH THEY ARE SOLDERED UNTIL THEY MEET AND ARE TWISTED WITH THEIR "MATE".
5. COIL AS VIEWED FROM INSIDE.

Figure 1a

Table I
DS0308 Quench File Summary

Q#	File	I-m	Idot	I-t	Idot	QDC	MIITs	t-Q	V-max	Coil	t(H)	V(H)	T(t)	T(m)	T(b)	P	LL	Location
	0	179.	-50.	0.0	0.0	U-L	0.0	0.000	-1.	LI	0.000	0.	4.19	4.16	4.15	741.	79.	
	1	991.	0.	0.0	0.0	U-L	0.1	0.000	9.	LI	0.000	0.	4.19	4.16	4.15	741.	82.	
	2	991.	0.	0.0	0.0	Vtot	0.1	0.000	9.	LI	0.000	0.	4.19	4.15	4.15	740.	81.	
	3	76.	0.	0.0	0.0	U-L	0.0	0.000	1.	LI	0.000	0.	4.19	4.15	4.14	740.	78.	
	4	100.	0.	0.0	0.0	U-L	0.0	0.000	-1.	LI	0.000	0.	4.18	4.15	4.14	738.	81.	
	5	91.	0.	0.0	0.0	U-L	0.0	0.000	-1.	LI	0.000	0.	4.20	4.17	4.16	744.	84.	
	6	979.	0.	0.0	0.0	U-L	0.1	0.000	-6.	LI	0.000	0.	4.19	4.16	4.15	743.	83.	
	7	979.	0.	0.0	0.0	U-L	0.1	0.000	-6.	LI	0.000	0.	4.19	4.16	4.15	744.	81.	
	8	983.	0.	0.0	0.0	U-L	0.1	0.000	-6.	LI	0.000	0.	4.20	4.17	4.16	745.	79.	
	9	983.	0.	0.0	0.0	U-L	0.1	0.000	-6.	LI	0.000	0.	4.20	4.17	4.16	744.	84.	
	10	974.	0.	0.0	0.0	U-L	0.1	0.000	-6.	LI	0.000	0.	4.20	4.17	4.16	749.	80.	
	11	2873.	16.	0.0	0.0	Cu L	4.2	0.000	0.	UO	0.000	0.	4.20	4.17	4.16	749.	80.	
1	12	6937.	0.	0.0	0.0	U-L	4.8	-.010	-26.	LI	0.000	0.	4.21	4.18	4.16	797.	87.	IL16SL 5ms from tap 16A
2	13	6981.	16.	0.0	0.0	U-L	4.7	-.008	-23.	LI	0.000	0.	4.21	4.18	4.16	797.	87.	IL16SR 2ms from tap 15B
3	14	6981.	16.	0.0	0.0	U-L	4.8	-.009	-23.	LI	0.000	0.	4.20	4.16	4.15	747.	82.	IL16SR <1ms from tap 15B
4	15	6981.	16.	0.0	0.0	U-L	4.8	-.008	-23.	LI	0.000	0.	4.20	4.17	4.17	748.	84.	IL16SR <1ms from tap 15B
5	16	6981.	16.	0.0	0.0	U-L	4.8	-.009	-23.	LI	0.000	0.	4.20	4.17	4.16	747.	84.	IL16SR 2ms from tap 15B
6	17	6976.	16.	0.0	0.0	U-L	4.8	-.008	-23.	LI	0.000	0.	4.20	4.17	4.16	750.	81.	IL16SR <1ms from tap 15B
7	18	6976.	16.	0.0	0.0	U-L	4.8	-.009	-23.	LI	0.000	0.	4.20	4.17	4.16	750.	78.	IL16SR 1ms from tap 15B
8	19	6976.	16.	0.0	0.0	U-L	4.7	-.008	-23.	LI	0.000	0.	4.20	4.17	4.16	750.	80.	IL16SR 1ms from tap 15B
9	20	6981.	25.	0.0	0.0	U-L	4.8	-.008	-22.	LI	0.000	0.	4.21	4.18	4.17	753.	81.	IL16SR 2ms from tap 15B
10	21	6976.	50.	0.0	0.0	U-L	4.7	-.008	-20.	LI	0.000	0.	4.21	4.18	4.17	753.	81.	IL16EF 4ms frm taps 15A,15B
11	22	6976.	75.	0.0	0.0	U-L	4.7	-.007	-20.	LI	0.000	0.	4.21	4.18	4.17	753.	81.	IL16EF 4ms frm taps 15A,15B
12	23	6957.	100.	0.0	0.0	U-L	5.0	-.016	-28.	UI	0.000	0.	4.21	4.18	4.17	752.	82.	IU Rmp Spl 2ms from tap 16A
13	24	6976.	16.	0.0	0.0	U-L	4.8	-.010	-23.	LI	0.000	0.	4.21	4.18	4.17	752.	82.	IL16SR 2ms from tap 15B
14	25	6741.	150.	0.0	0.0	U-L	4.9	-.018	-28.	UI	0.000	0.	4.21	4.18	4.17	752.	82.	IU Rmp Spl 2ms from tap 16A
15	26	6624.	200.	0.0	0.0	U-L	4.8	-.019	-28.	UI	0.000	0.	4.21	4.18	4.17	752.	82.	IU Rmp Spl 2ms from tap 16A
16	27	6859.	0.	0.0	0.0	U-L	4.9	-.017	-28.	UI	0.000	0.	4.21	4.18	4.17	752.	82.	IU Rmp Spl 2ms from tap 16A

Q# Quench number or Spot heater number (e.g. s4 is spot heater 4)
File Quench file number
I-m Main coil current at quench
Idot Main coil dI/dt at quench
I-t Trim coil current at quench
Idot Trim coil dI/dt at quench
QDC Name of quench detection circuit which tripped:
1) U-L Upper - Lower Coil
2) V-dI Magnet - Idot
3) SC L SC Pwr Leads - Idot
4) Vtot Magnet
5) Trim Trim Coil
6) Cu L Cu Pwr Leads - IR
7) GndI Ground Fault Monitor
8) Thru Through Bus - Idot
MIITs Integral of (I**2)dt from t-Q to "infinity"
t-Q Time first voltage appears in V(Upper) - V(Lower) (relative to quench detection time)
V-max Maximum voltage across any quarter coil
Coil Coil corresponding to V-max
t(H) Protection heater firing time (relative to quench detection time); -.999 if heater did not fire
V(H) Protection heater firing voltage; -999. if heater did not fire
T(t) Temperature at top of magnet
T(m) Temperature at middle of magnet
T(b) Temperature at bottom of magnet
P Dewar pressure (Torr)
LL Liquid level (%)
Location Quench or spot heater location

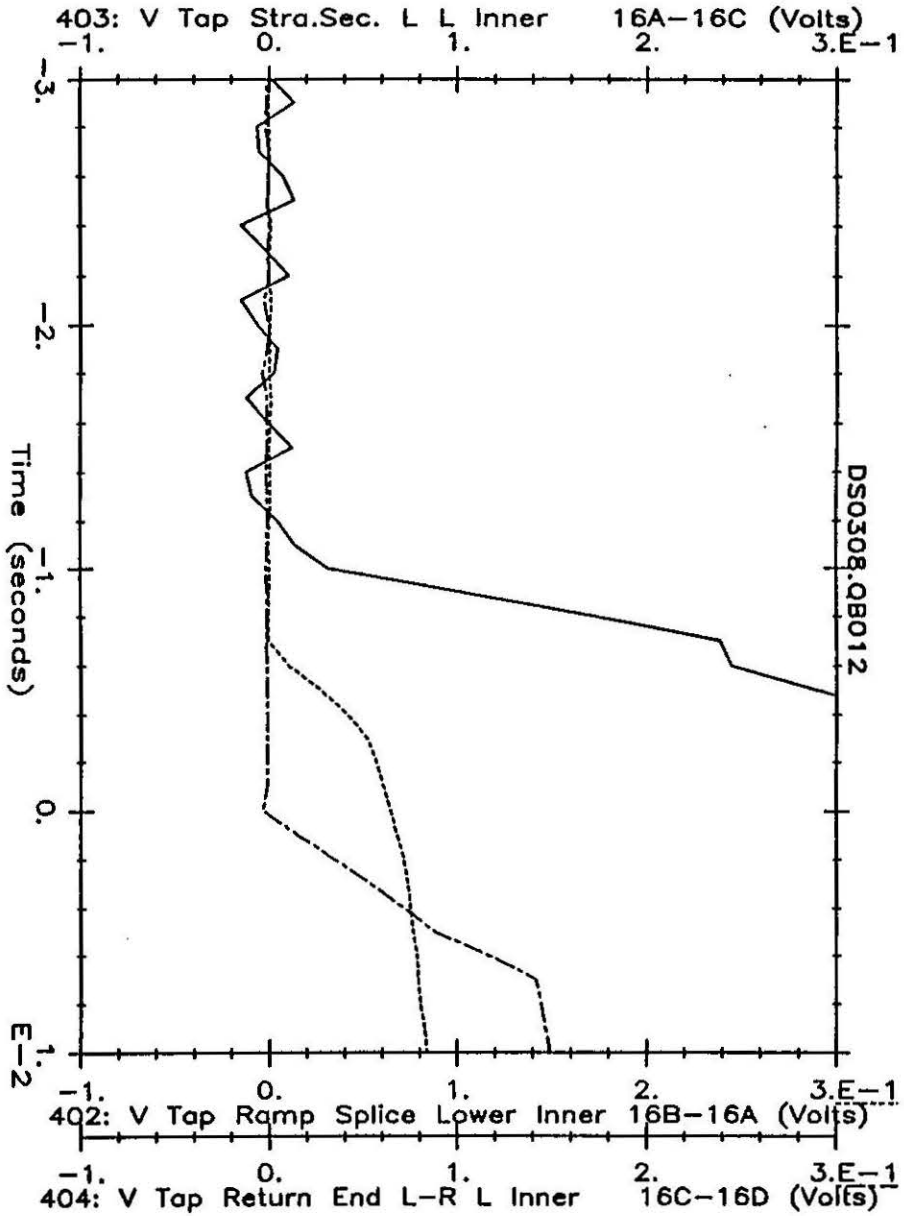

403: V Tap Stra.Sec. L L Inner 16A−16C (Volts)
−1.
0.
1.
2.
3.E−1
−3.
−2.
−1.
0.
1.
E−2
Time (seconds)
DS0308.QB012
−1.
0.
1.
2.
3.E−1
402: V Tap Ramp Splice Lower Inner 16B−16A (Volts)
−1.
0.
1.
2.
3.E−1
404: V Tap Return End L−R L Inner 16C−16D (Volts)

Figure 2

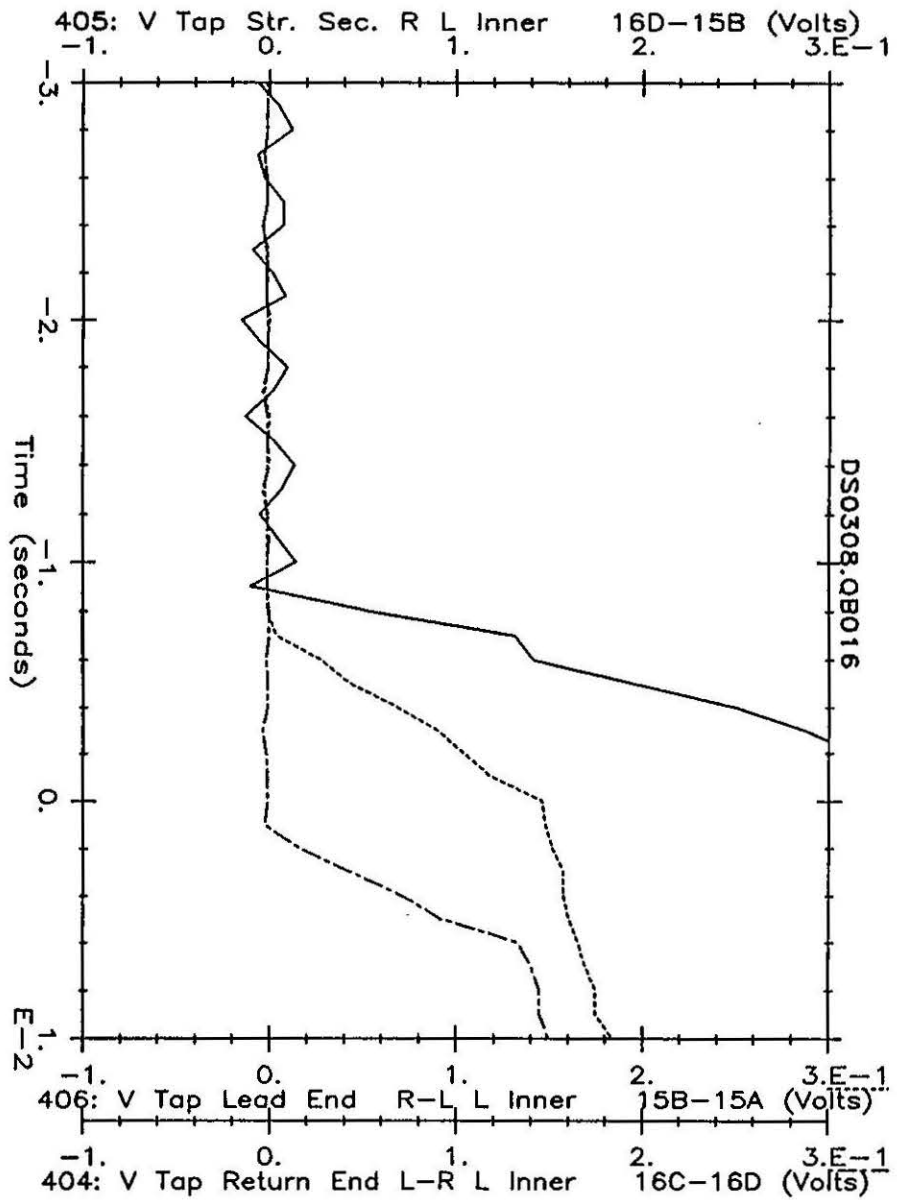

405: V Tap Str. Sec. R L Inner 16D−15B (Volts)
−1.
0.
1.
2.
3.E−1
−3.
−2.
−1.
0.
1.E−2
Time (seconds)
DS0308.QB016
−1.
0.
1.
2.
3.E−1
406: V Tap Lead End R−L L Inner 15B−15A (Volts)
−1.
0.
1.
2.
3.E−1
404: V Tap Return End L−R L Inner 16C−16D (Volts)

Figure 3

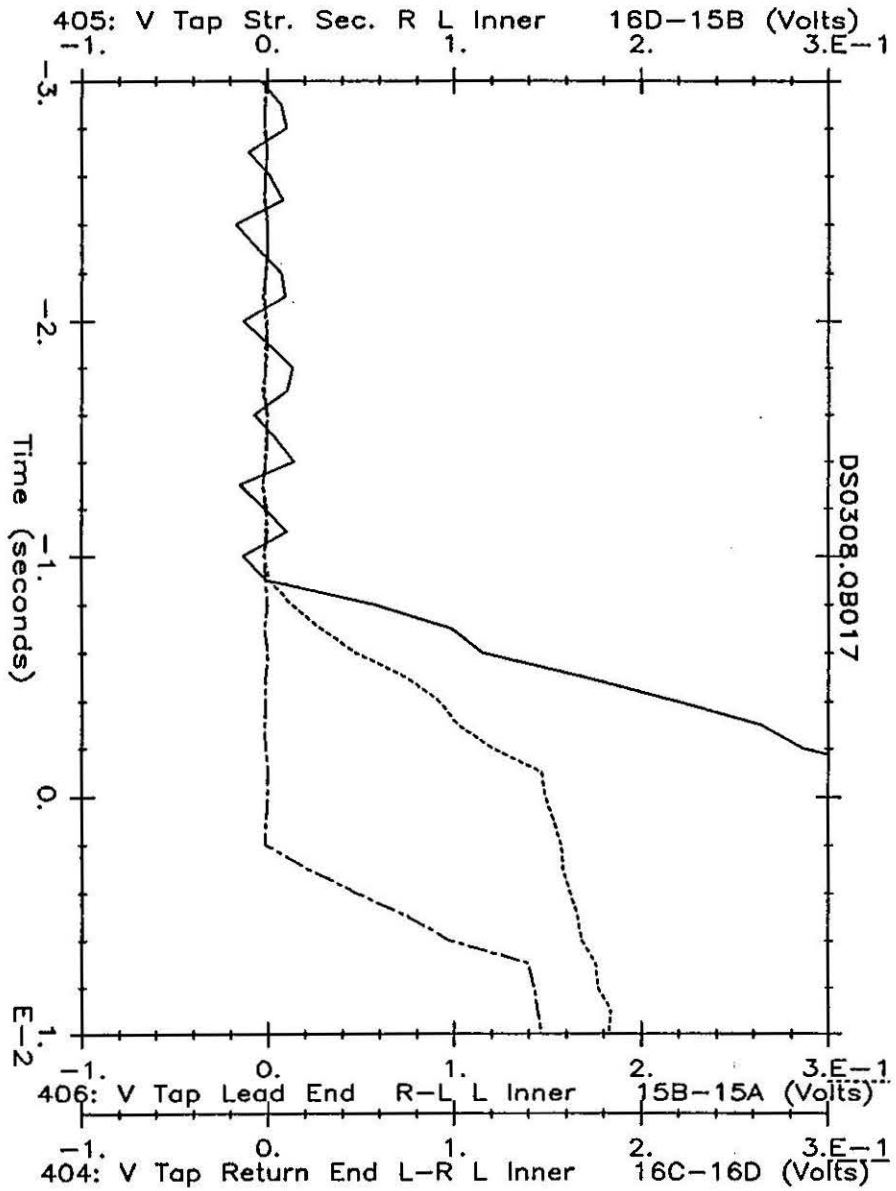

405: V Tap Str. Sec. R L Inner 16D−15B (Volts)
−1.
0.
1.
2.
3.E−1
−3.
−2.
−1.
0.
1.
E−2
Time (seconds)
DS0308.QB017
406: V Tap Lead End R−L L Inner 15B−15A (Volts)
404: V Tap Return End L−R L Inner 16C−16D (Volts)

Figure 4

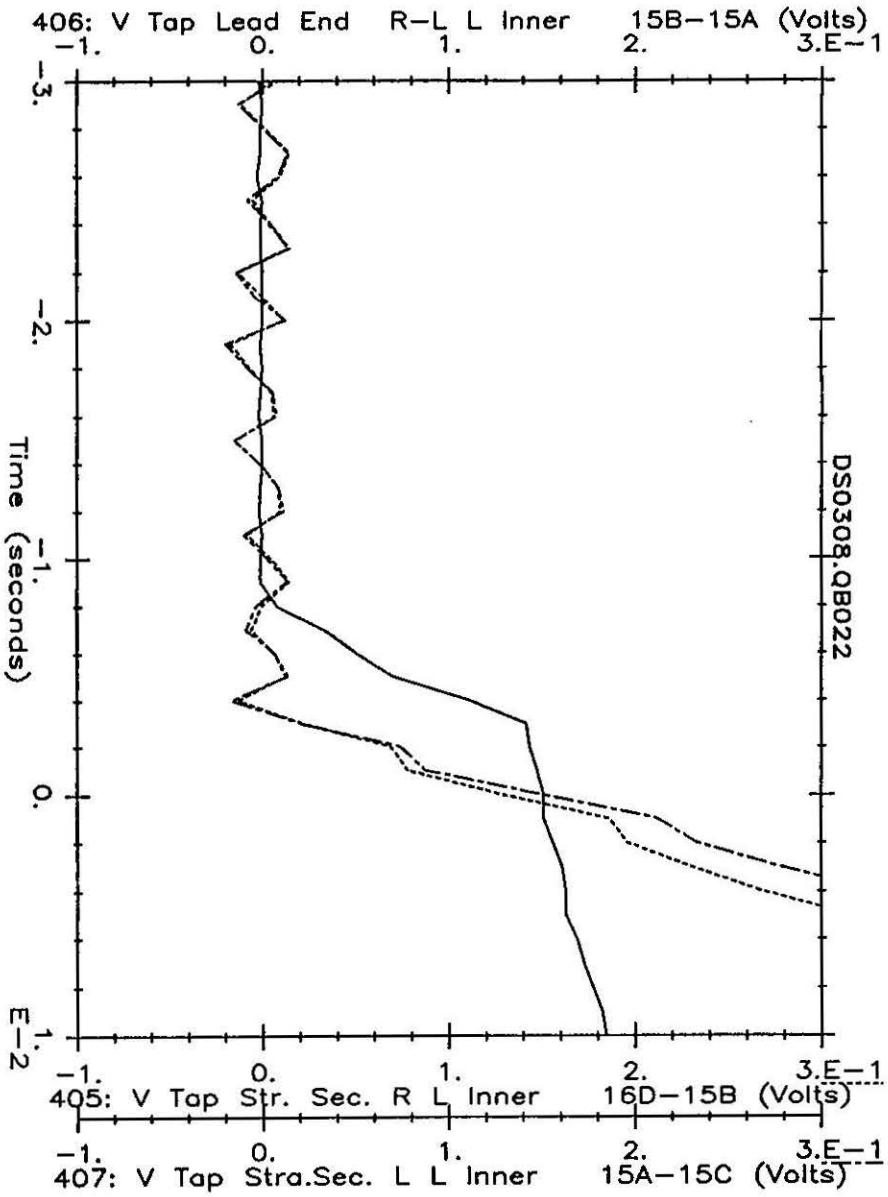

406: V Tap Lead End R-L L Inner 15B-15A (Volts)
-1.
0.
1.
2.
3.E-1
-3.
-2.
-1.
0.
1.
E-2
Time (seconds)
DS0308.QB022
-1.
0.
1.
2.
3.E-1
405: V Tap Str. Sec. R L Inner 16D-15B (Volts)
-1.
0.
1.
2.
3.E-1
407: V Tap Stra.Sec. L L Inner 15A-15C (Volts)

Figure 5

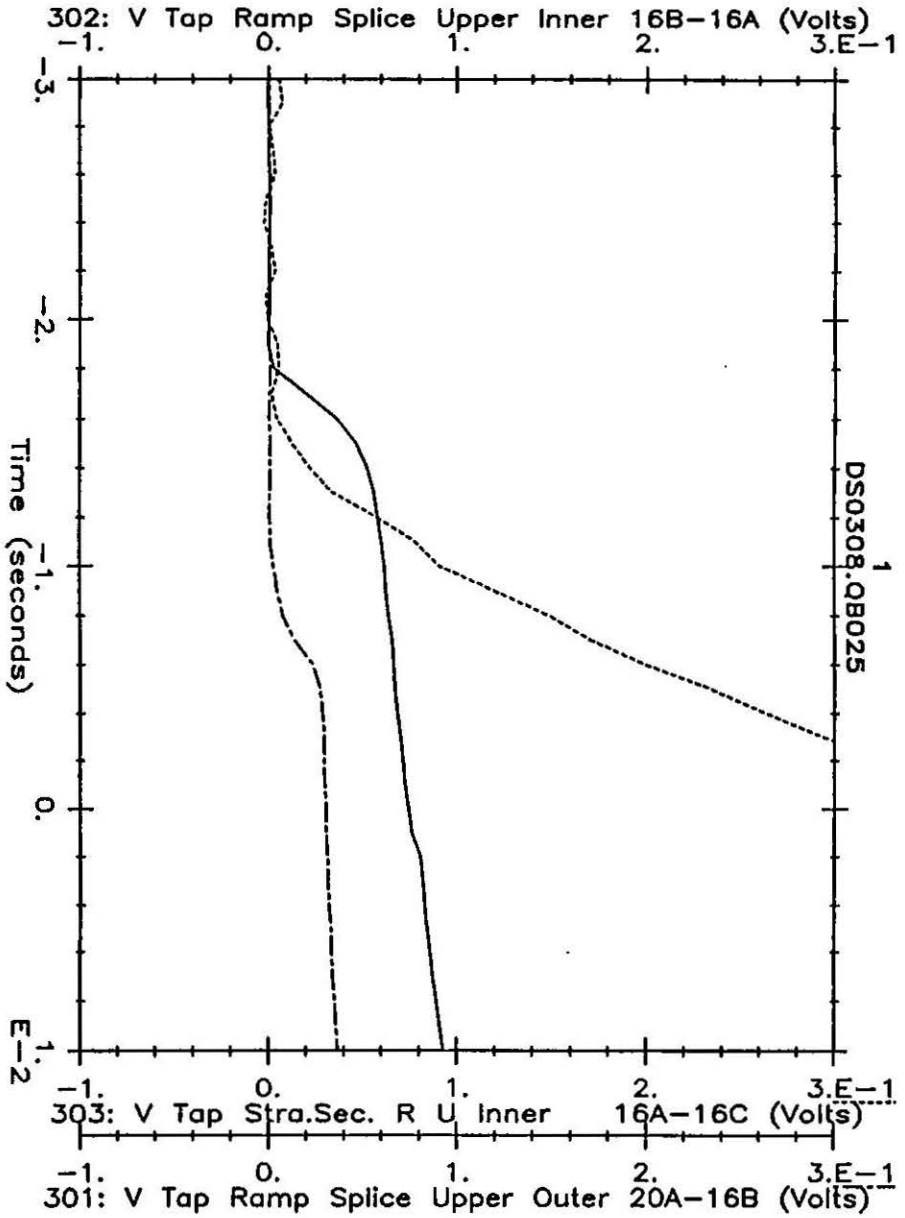

302: V Tap Ramp Splice Upper Inner 16B−16A (Volts)
−1.
0.
1.
2.
3.E−1
−3.
−2.
−1.
0.
1.E−2
Time (seconds)
DS0308.QB025
1
303: V Tap Stra.Sec. R U Inner 16A−16C (Volts)
301: V Tap Ramp Splice Upper Outer 20A−16B (Volts)

Figure 6