

## DSA324 Quench Heater Test Results

T.S. Jaffery  
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SSC2 heater in DSA324 was fired without changing the value of capacitor bank. To change RC of the heater system, appropriate resistor was added to the circuit. Here are the results from DSA324 heater strip in quadrant 1. The table below shows

Rh = heater resistance (in ohms)  
R\_system = system resistance including one heater strip, (in ohms)  
R\_add = resistance added to the system to achieve required RC (per S.Delchamps E-mail of Aug 19), (in ohms)  
R\_tot = R\_sys + R\_add to achieve the required Tau, (in ohms)  
V\_hfu = heater firing unit voltage (in volts). The voltage is chosen in each case to give the same energy deposition in the heater strip as in the case R\_add = 0.  
T\_fn = total time between heater firing and appearance of coil becoming normal (in milli seconds)  
Iq = magnet current (2 kA, 5 kA)  
Edep = energy (J) deposited in the strip heater

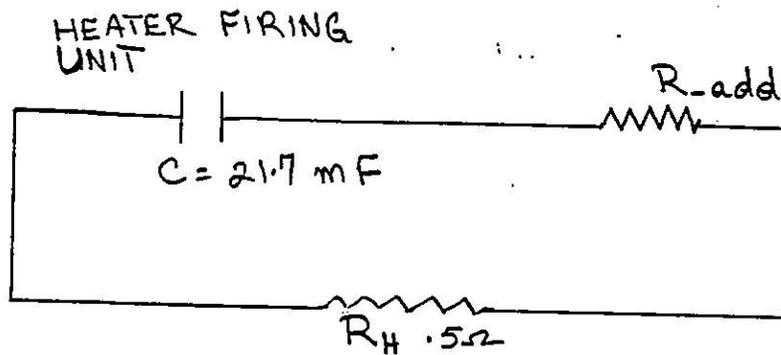
Rh	R_sys	R_add	R_tot	V_hfu	C	T_fn(2kA)	T_fn(5kA)	Rh/Rtot	Tau(RC)	Edep
	(ohms)			(v)	(mF)	(msec)	(msec)		(msec)	(joule)
0.5	3.7	0	3.7	140	21.7	215.00	132.00	.14	80.3	28.7
0.5	3.7	1	4.7	158	21.7	212.50	130.00	.11	102	28.8
0.5	3.7	2	5.7	174	21.7	221.67	142.00	.089	123.7	28.8
0.5	3.7	3	6.7	188	21.7	231.25	150.00	.075	145.4	28.6
0.5	3.7	4	7.7	202	21.7	240.00	160.00	.065	167.1	28.7
0.5	3.7	5	8.7	215	21.7	247.50	166.67	.057	188.8	28.8
0.5	3.7	6	9.7	227	21.7	260.00	180.00	.052	210.5	28.8

MIITS at 2 kA and 5 kA quench currents as given by SSC program are

Rtot	MIITS_2kA	MIITS_5 kA
3.7	1.16	4.01
4.7	1.20	3.96
5.7	1.22	4.05
6.7	1.20	4.02
7.7	1.22	4.09
8.7	1.25	3.97
9.7	1.23	4.0

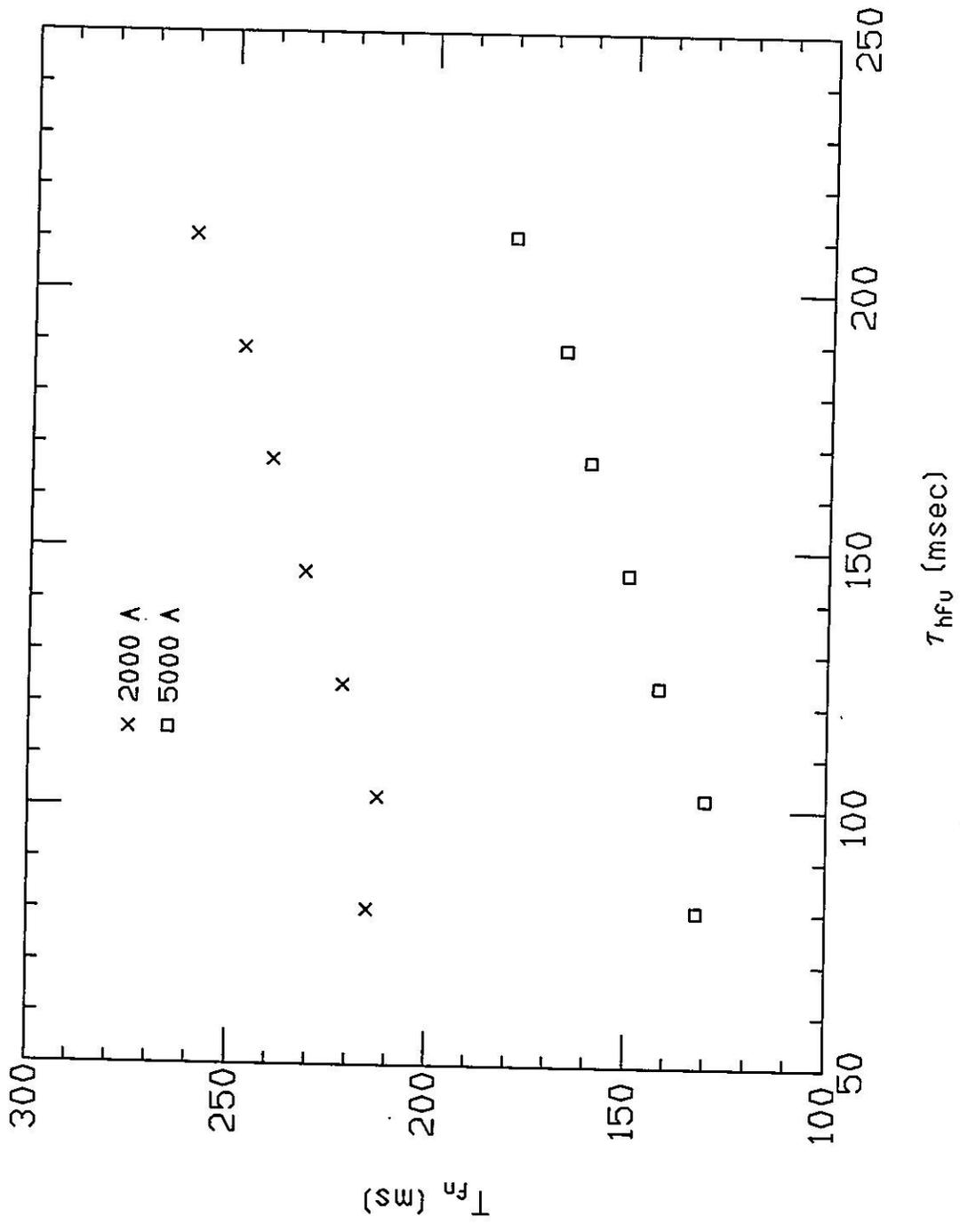
The heater system resistance is 3.7 ohms including one 0.5 ohm heater strip. A system schematic is attached. For each Tau (RC) the heater in Q1 was fired at two different magnet currents: 2000 A and 5000 A. A plot of T\_fn against Tau is attached. For a given V\_hfu and RC the T\_fn for 2 kA is ~36 percent higher than T\_fn at 5 kA. When Tau is doubled from 80 to 160 msec, T\_fn increases by about 25 msec at both currents, implying an increase in MIITs of at most 0.63 kA\*\*2-sec at 5 kA.

I have compared my results for  $V_{hf} = 140$  V ( $R_{tot} = 3.7$  ohms) with Mike Lamm's results on the same heater during third thermal cycle, and my  $T_{fn}$  is ~12-15 ms higher than what he gets at same magnet current. I think this is expected, since there is ~5 percent variation in heater voltages and roughly 10 msec uncertainty in finding quench start. The differences in  $T_{fn}$  are consistent with measurement uncertainties.



Heater circuit for DSA324

# DSA324 QUAD 1 Heater



S. Delchamps

P. Mazur

J. Strait

M. Lamm

D. Orris

J. DiMarco

C. Haddock (at SSC Dallas)