First Test sequence for TRC coil

The TRC coil will be tested by pulsing at discrete and increasing current values from 5 kA to a maximum of 31.5 kA. A number of "test shots" will be taken between major current pulses, at intervals dictated by the NSTX testing. The following table illustrates one potential test sequence, with an assumption that NSTX will be pulsing on 5 minute intervals. The coil temperature is calculated to return to the bulk coolant temperature before each major current pulse. The table and accompanying graph illustrate the calculated temperature and resistance vs time. The total time for this sequence, if executed as shown, is 6 hours and 10 minutes.

max total pulse length	2	seconds	test current	200	A	dR/dt=	1.9312E-05	ohms/K
assumed coolant temp	77	K	test flattop	2	second	Rcoil @77K	5.55E-04	ohms
assumed rep rate	5	min	test temp rise	1.64E-03	K			

pulse number	elapsed time since last pulse	cooldown time	cumulative time	max current	rise time	flattop time	temp rise per pulse	I^2*t	estimated max temp at end of pulse	estimated average temp at end of pulse	estimated resistance at end of pulse
	(min.)	(seconds)	(seconds)	(amps)	(seconds)	(seconds)	(K)	(Amp^2-s)	(K)	(K)	(ohm)
1	0		0	200	1.10E-03	2	1.64E-03	9.14E+04	7.70E+01	77.0	5.552E-04
2	5		300	5000	2.75E-02	1.97E+00	1.10E+00	6.05E+07	7.81E+01	78.1	5.763E-04
3	5	300	600	200	1.10E-03	2	1.64E-03	9.14E+04	7.77E+01	77.4	5.630E-04
4	5	600	900	200	1.10E-03	2	1.64E-03	9.14E+04	7.75E+01	77.2	5.598E-04
5	5	900	1200	200	1.10E-03	2	1.64E-03	9.14E+04	7.73E+01	77.2	5.582E-04
6	5	1200	1500	200	1.10E-03	2	1.64E-03	9.14E+04	7.72E+01	77.1	5.572E-04
7	5	1500	1800	200	1.10E-03	2	1.64E-03	9.14E+04	7.71E+01	77.1	5.565E-04
8	5	1800	2100	200	1.10E-03	2	1.64E-03	9.14E+04	7.71E+01	77.0	5.560E-04
9	5		2400	10000	5.69E-02	1.94E+00	4.44E+00	2.39E+08	8.14E+01	81.4	6.410E-04
10	5	300	2700	200	1.10E-03	2	1.64E-03	9.14E+04	7.99E+01	78.6	5.870E-04
11	5	600	3000	200	1.10E-03	2	1.64E-03	9.14E+04	7.89E+01	78.0	5.741E-04
12	5	900	3300	200	1.10E-03	2	1.64E-03	9.14E+04	7.83E+01	77.6	5.675E-04
13	5	1200	3600	200	1.10E-03	2	1.64E-03	9.14E+04	7.78E+01	77.4	5.633E-04
14	5	1500	3900	200	1.10E-03	2	1.64E-03	9.14E+04	7.76E+01	77.3	5.605E-04
15	5	1800	4200	200	1.10E-03	2	1.64E-03	9.14E+04	7.74E+01	77.2	5.587E-04
16	5	2100	4500	200	1.10E-03	2	1.64E-03	9.14E+04	7.72E+01	77.1	5.575E-04
17	5		4800	15000	8.67E-02	1.91E+00	1.00E+01	5.21E+08	8.70E+01	87.0	7.491E-04
18	5	300	5100	200	1.10E-03	2	1.64E-03	9.14E+04	8.36E+01	80.7	6.270E-04
19	5	600	5400	200	1.10E-03	2	1.64E-03	9.14E+04	8.14E+01	79.2	5.980E-04
20	5	900	5700	200	1.10E-03	2	1.64E-03	9.14E+04	7.99E+01	78.4	5.830E-04
21	5	1200	6000	200	1.10E-03	2	1.64E-03	9.14E+04	7.89E+01	77.9	5.735E-04
22	5	1500	6300	200	1.10E-03	2	1.64E-03	9.14E+04	7.83E+01	77.6	5.672E-04
23	5	1800	6600	200	1.10E-03	2	1.64E-03	9.14E+04	7.78E+01	77.4	5.631E-04

pulse number	elapsed time since last pulse	cooldown time	cumulative time	max current	rise time	flattop time	temp rise per pulse	I^2*t	estimated max temp at end of pulse	estimated average temp at end of pulse	estimated resistance at end of pulse
	(min.)	(seconds)	(seconds)	(amps)	(seconds)	(seconds)	(K)	(Amp^2-s)	(K)	(K)	(ohm)
24	5	2100	6900	200	1.10E-03	2	1.64E-03	9.14E+04	7.75E+01	77.3	5.604E-04
25	5	2400	7200	200	1.00E+00	2	1.64E-03	9.14E+04	7.74E+01	77.2	5.586E-04
26	5	2700	7500	200	0.00E+00	2	1.64E-03	9.14E+04	7.72E+01	77.1	5.574E-04
27	5		7800	20000	1.18E-01	1.88E+00	1.81E+01	8.94E+08	9.51E+01	95.1	9.040E-04
28	5	300	8100	200	1.80E+00	2	1.64E-03	9.14E+04	8.89E+01	83.7	6.845E-04
29	5	600	8400	200	1.80E+00	2	1.64E-03	9.14E+04	8.49E+01	81.0	6.321E-04
30	5	900	8700	200	1.80E+00	2	1.64E-03	9.14E+04	8.22E+01	79.6	6.052E-04
31	5	1200	9000	200	1.80E+00	2	1.64E-03	9.14E+04	8.04E+01	78.7	5.881E-04
32	5	1500	9300	200	1.80E+00	2	1.64E-03	9.14E+04	7.92E+01	78.1	5.769E-04
33	5	1800	9600	200	7.70E+01	2	1.64E-03	9.14E+04	7.85E+01	77.7	5.695E-04
34	5	2100	9900	200	7.70E+01	2	1.64E-03	9.14E+04	7.80E+01	77.5	5.646E-04
35	5	2400	10200	200	7.70E+01	2	1.64E-03	9.14E+04	7.76E+01	77.3	5.614E-04
36	5	2700	10500	200	7.70E+01	2	1.64E-03	9.14E+04	7.74E+01	77.2	5.593E-04
37	5	3000	10800	200	7.70E+01	2	1.64E-03	9.14E+04	7.73E+01	77.1	5.579E-04
38	5		11100	25000	1.50E-01	1.85E+00	2.88E+01	1.35E+09	1.06E+02	105.8	1.111E-03
39	5	300	11400	200	7.70E+01	2	1.64E-03	9.14E+04	9.60E+01	87.7	7.613E-04
40	5	600	11700	200	7.70E+01	2	1.64E-03	9.14E+04	8.95E+01	83.4	6.779E-04
41	5	900	12000	200	7.70E+01	2	1.64E-03	9.14E+04	8.53E+01	81.1	6.350E-04
42	5	1200	12300	200	7.70E+01	2	1.64E-03	9.14E+04	8.24E+01	79.7	6.077E-04
43	5	1500	12600	200	7.70E+01	2	1.64E-03	9.14E+04	8.06E+01	78.8	5.898E-04
44	5	1800	12900	100	7.70E+01	2	1.64E-03	9.14E+04	7.94E+01	78.2	5.780E-04
45	5	2100	13200	100	7.70E+01	2	1.64E-03	9.14E+04	7.86E+01	77.8	5.702E-04
46	5	2400	13500	100	7.70E+01	2	1.64E-03	9.14E+04	7.80E+01	77.5	5.651E-04
47	5	2700	13800	100	7.70E+01	2	1.64E-03	9.14E+04	7.77E+01	77.3	5.617E-04
48	5	3000	14100	100	7.70E+01	2	1.64E-03	9.14E+04	7.74E+01	77.2	5.595E-04
49	5		14400	30000	1.83E-01	1.82E+00	4.27E+01	1.88E+09	1.20E+02	119.7	1.380E-03
50	5	300	14700	200	7.70E+01	2	1.64E-03	9.14E+04	1.05E+02	92.8	8.608E-04
51	5	600	15000	200	7.70E+01	2	1.64E-03	9.14E+04	9.56E+01	86.4	7.371E-04
52	5	900	15300	200	7.70E+01	2	1.64E-03	9.14E+04	8.92E+01	83.1	6.735E-04
53	5	1200	15600	200	7.70E+01	2	1.64E-03	9.14E+04	8.51E+01	81.0	6.330E-04
54	5	1500	15900	200	7.70E+01	2	1.64E-03	9.14E+04	8.23E+01	79.7	6.065E-04
55	5	1800	16200	100	7.70E+01	2	1.64E-03	9.14E+04	8.05E+01	78.8	5.890E-04
56	5	2100	16500	100	7.70E+01	2	1.64E-03	9.14E+04	7.93E+01	78.2	5.775E-04
57	5	2400	16800	100	7.70E+01	2	1.64E-03	9.14E+04	7.85E+01	77.8	5.699E-04
58	5	2700	17100	100	7.70E+01	2	1.64E-03	9.14E+04	7.80E+01	77.5	5.649E-04
59	5	3000	17400	100	7.70E+01	2	1.64E-03	9.14E+04	7.77E+01	77.3	5.615E-04
60	5	3300	17700	100	7.70E+01	2	1.64E-03	9.14E+04	7.74E+01	77.2	5.594E-04

pulse number	elapsed time since last pulse	cooldown time	cumulative time	max current	rise time	flattop time	temp rise per pulse	I^2*t	estimated max temp at end of pulse	estimated average temp at end of pulse	estimated resistance at end of pulse
	(min.)	(seconds)	(seconds)	(amps)	(seconds)	(seconds)	(K)	(Amp^2-s)	(K)	(K)	(ohm)
61	5	3600	18000	100	7.70E+01	2	1.64E-03	9.14E+04	7.73E+01	77.1	5.579E-04
62	5		18300	31500	1.93E-01	1.81E+00	4.76E+01	2.06E+09	1.25E+02	124.6	1.474E-03
63	5	300	18600	200	7.70E+01	2	1.64E-03	9.14E+04	1.08E+02	94.6	8.959E-04
64	5	600	18900	200	7.70E+01	2	1.64E-03	9.14E+04	9.77E+01	87.5	7.580E-04
65	5	900	19200	200	7.70E+01	2	1.64E-03	9.14E+04	9.06E+01	83.8	6.871E-04
66	5	1200	19500	200	7.70E+01	2	1.64E-03	9.14E+04	8.60E+01	81.5	6.420E-04
67	5	1500	19800	200	7.70E+01	2	1.64E-03	9.14E+04	8.29E+01	80.0	6.124E-04
68	5	1800	20100	100	7.70E+01	2	1.64E-03	9.14E+04	8.09E+01	79.0	5.929E-04
69	5	2100	20400	100	7.70E+01	2	1.64E-03	9.14E+04	7.96E+01	78.3	5.800E-04
70	5	2400	20700	100	7.70E+01	2	1.64E-03	9.14E+04	7.87E+01	77.8	5.716E-04
71	5	2700	21000	100	7.70E+01	2	1.64E-03	9.14E+04	7.81E+01	77.6	5.660E-04
72	5	3000	21300	100	7.70E+01	2	1.64E-03	9.14E+04	7.77E+01	77.4	5.623E-04
73	5	3300	21600	100	7.70E+01	2	1.64E-03	9.14E+04	7.75E+01	77.2	5.599E-04
74	5	3600	21900	100	7.70E+01	2	1.64E-03	9.14E+04	7.73E+01	77.2	5.583E-04
75	5	3900	22200	100	7.70E+01	2	1.64E-03	9.14E+04	7.72E+01	77.1	5.572E-04