NSTX

TO: DISTRIBUTION
FROM: C NEUMEYER
SUBJECT: PF1a & PF1b ALLOWABLE CURRENTS

References:

[1] NSTX-CALC-13-020-1, "PF Coil Axial and Radial Force Calculation", C. Neumeyer
[2] 13-040225-CLN-01, "PF1A and PF1b Forces and Operating Limits", C. Neumeyer

Based on the influence matrix calculated in [1] the magnitude of the axial forces on PF1aL and PF1b away from the midplane (in the direction which challenges their support straps) can be calculated per the expression below.

$$Fz_x = aI_x + bI_xI_y + cI_x^2$$

… where x and y are PF1a and PF1b.

Values of the coefficients are as follows…

		PF1a Toward MP			PF1b Toward MP	
		FzPF1aL			FzPF1b	
a	798	lbf/ka	a	-1702	lbf/ka	
b	-98	lbf/ka^2	b	99	lbf/ka^2	
c	0	lbf/ka^2	c	0	lbf/ka^2	

The analysis presented in [2] described the structural support limits for PF1a and PF1b which are based on the welds on the support straps.

Allowable PF1a and PF1b currents based on the above are listed in the following tabular array. The column headings are IPF1b in kA, and the row headings are IPF1a in kA. For those combinations which satisfy $F_{zPF1aL} \leq 9900$ lbf and $F_{zPF1b} \leq 13200$ lbf the array elements are filled in "OK". For those combinations which would produce excessive force, the elements are blank.

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
-15	OK	OK	OK	OK						
-14	OK	OK	OK	OK						
-13	OK	OK	OK	OK						
-12	OK	OK	OK	OK						
-11	OK	OK	OK	OK						
-10	OK	OK	OK	OK						
-9	OK	OK	OK	OK	OK					
-8	OK	OK	OK	OK	OK					
-7	OK	OK	OK	OK	OK					
-6	OK	OK	OK	OK	OK					
-5	OK	OK	OK	OK	OK	OK				
-4	OK	OK	OK	OK	OK	OK				
-3	OK	OK	OK	OK	OK	OK				
-2	OK	OK	OK	OK	OK	OK				
-1	OK	OK	OK	OK	OK	OK	OK			
0	OK	OK	OK	OK	OK	OK	OK			
1	OK	OK	OK	OK	OK	OK	OK	OK		
2	OK	OK	OK	OK	OK	OK	OK	OK		
3	OK	OK	OK	OK	OK	OK	OK	OK	OK	
5	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

Please note that the current polarities correspond to the engineering convention (clockwise viewed from above), and that the above is consistent with the present operating limits set on the other NSTX PF coils.

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