13-040507-CLN-01

TO: DISTRIBUTION
FROM: C NEUMEYER
SUBJECT: PF4 & 5 ALLOWABLE CURRENTS WITH EXISTING STRUCTURE

References:

[1] 13-040505-CLN-01, "Preliminary Analysis of PF4 Energization", C. Neumeyer

Based on the analysis presented in [1] the magnitude of the axial force on PF4 (directed away from the midplane) can be calculated per the expression below and should be limited to ≤ 45400lbf in order to maintain a safety factor of 1.5 on the mechanical loading of the PF4 support pad studs, assuming that the existing support structure is retained and not improved.

$$Fz_{PF4} = -\left(1789 I_{PF4} + 628 I_{PF4} I_{PF5} + 52 I_{PF4}^2\right)$$

Allowable PF4 and PF5 currents based on the above are listed in the following tabular array. The column headings are IPF5 in kA (positive values), and the row headings are IPF4 in kA (negative values). For those combinations which satisfy F_{zPF4} ≤ 45400lbf the array elements are filled in with the calculated value of the force. For those combinations which would produce excessive force, the elements are blank.

	2	4	6	8	10	12	14	16	18	20
-1	2994	4251	5508	6764	8021	9278	10535	11792	13048	14305
-2	5884	8398	10911	13425	15939	18452	20966	23479	25993	28507
-3	8671	12441	16211	19982	23752	27523	31293	35063	38834	42604
-4	11353	16380	21408	26435	31462	36489	41516			
-5	13932	20216	26500	32784	39068	45352				
-6	16407	23948	31489	39029						
-7	18778	27576	36373	45171						
-8	21046	31100	41154							
-9	23209	34520								
-10	25269	37837								
-11	27225	41050								
-12	29077	44159								
-13	30826									
-14	32470									
-15	34011									
-16	35448									

-17	36781									
-18	38011									
-19	39136									
-20	40158									

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.

Under the above conditions, the safety factor on the other components of the structures of PF4 and PF5 will also be acceptable. Even if the attractive load between PF5U&L is assumed to flow 100% through the turnbuckle strut, with zero through the supports cantilevered off of the VV, the safety factor on the shear on the clevis bolt is still 1.3.

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