

PPPL Calculation Form

Calculation # NSTX-CALC-132-06 Revision # 01 ____ WP #, if any _____
(ENG-032)

Purpose of Calculation: (Define why the calculation is being performed.)

To determine if the upgrade TF flex joint and bundle stub design is adequate to meet the requirements of the NSTX Structural Design Criteria, specifically, the fatigue requirements of Section I-4.2 for 60,000 full power cycles without failure.

References (List any source of design information including computer program titles and revision levels.)

- [1] NSTX Structural Design Criteria Document, I. Zatz
- [2] NSTX Design point, June 2010
- [3] ANSYS v13.0
- [4] Maxwell v14.0

Assumptions (Identify all assumptions made as part of this calculation.)

- 1.) Because it results in the largest background field at the radial center of the flex strap, Current Scenario #81 was assumed worst-case for this analysis.
- 2.) A one-way coupled electromagnetic-structural analysis was used, based on the assumption that the bolted joints do not separate. This assumption was proven valid by checking the contact status of the joints after the analysis was completed.

Calculation (Calculation is either documented here or attached)

See attached.

Conclusions (Specify whether or not the purpose of the calculation was accomplished.)

1. The maximum stress in the lamellae is 19 ksi, below the NSTX Design Criteria allowable to meet the fatigue requirements for 60,000 full-power cycles;
- 2.) The HeliCoil and SuperBolt stresses are below the maximum allowable to meet the fatigue requirement ;
- 3.) The bolted joints were shown not to separate, and the minimum contact pressure is well above the design goal of 1500 psi.
- 4.) The dynamic load factor was calculated for the flex strap alone. A full transient electromagnetic disruption analysis using the worst-case combination of current and plasma disruption scenarios should be performed to fully qualify the joint and flex strap designs.

Cognizant Engineer's printed name, signature, and date

I have reviewed this calculation and, to my professional satisfaction, it is properly performed and correct.

Checker's printed name, signature, and date
