

PPPL Calculation Form

Calculation # **NSTX-CALC-133-04** Revision # **00** WP #, if any **1672**
(ENG-032)

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

NSTX update requires the center column OH coil assembly to remain steady in its proper position during the applications of the TF and OH coils currents. The OH should remain steady since the cooling mechanisms could experience the unnecessary stresses. To accomplish this, a compressive force (pre load) on the upper surface of the OH coil is necessary. For these analyses a force of about 20,000. lbs total, was estimated to accomplish this task.

It was also calculated that during the maximum currents applications, the involved coils grow due to the following thermal expansions: TF coil expands 8.4 mm, while the OH coil 6.0 mm, and, may not occur at the same time. Therefore, a mechanical OH coil pre load system is required to regulate these variations?

This is best accomplished by creating a disk springs stacks regulating system as is shown in the enclosed analyses.

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

Basic disk spring equations according to the SCHNORR catalogue were programmed in XL. This file is included in this package as a reference, and also, as a tool that can be used by anyone.

A commercial code WFED4 from HEXAGON software was also purchased and is available now at PPPL (see P. Rogoff)

All calculations were performed with both packages and the results closely agree!

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

The disk spring must be made from the Stainless Steel grade 301. (low permeability). Used modulus of elasticity was 206,000. MPa and $\mu = 0.3$.

Calculation (Calculation is either documented here or attached)

See the enclosed Executive Summary and the Power Point data (4 files – Summary, TfcoldOHhot, TphotOHcold, & TphotOHhot)

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

A designed system of disk springs stack will accomplish the original goal of maintaining a minimum compressive force of 20,000. Lbs. on the OH coil upper surface.

Cognizant Engineer's printed name, signature, and date

Prepared by P.Rogoff 10/15/2010 _____

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

Verified by testing (see presentation summary) – from 3/23/2011 Power Point presentation [Bellville_Test.pptx]

Checker's printed name, signature, and date: Tom Kokub _____

