LIGO-T970246-00-D

HYTEC-TN-LIGO-23
7/25/97

LIGO Damped Coil Spring Test Data
Axial Rotation Position in Shear

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July 25, 1997

Abstract

Experimental results for a LIGO damped coil spring at different axial rotation angles in shear are presented. Test results show a slight preference in the angle pointing toward the test apparatus pivot point in terms of an increase in loss factor compared to other angle positions. The observed minimal bias is not sufficient to suggest a preferable coil spring orientation in the LIGO vibration isolation system.

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LIGO PROJECT

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1. Summary

The purpose of this work is to investigate the shear force angular position effect on the LIGO damped coil spring shear loss factor and stiffness. A spring assembly was positioned in the shear location at four rotation positions in the LIGO pendulum test apparatus. The test results indicate a slight bias in terms of loss factor and stiffness toward one of the four angular positions.

2. Test Configuration and Procedures

Damped LIGO coil designated DC00 on Fluorel seats was installed in the shear test location in the pendulum test apparatus[1]. Loss factor and stiffness data were obtain for four angular rotation positions as shown in Figure 1.

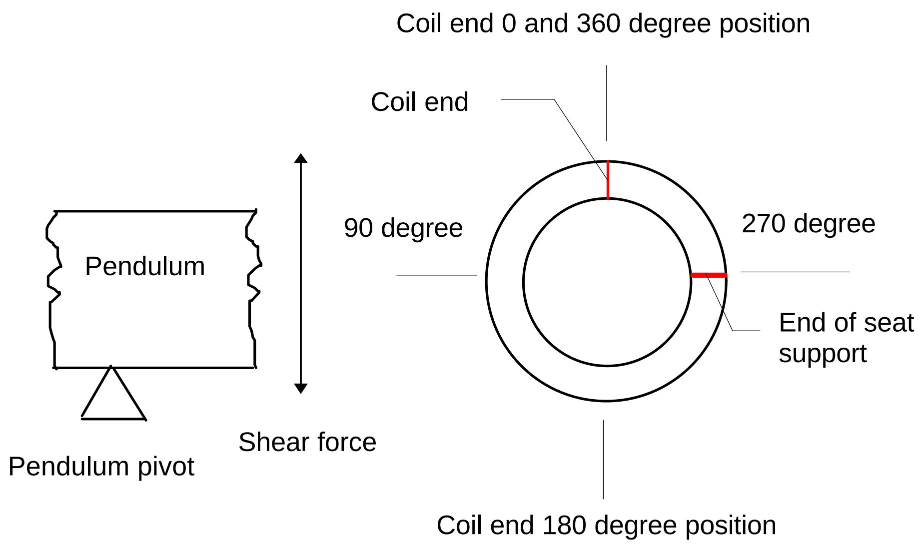

Figure 1: Schematic showing coil docking position in shear (reference zero degree position is coil end in line with shear force)

Angular positions are defined as the coil end location in relation to the shear force direction. Tests were conducted on two successive days to examine repeatability of results. The temperature during the first test was nearly constant at 21^0 C while during the second day the temperature was about 22^0 C.

3. Test Results

First day test loss factor and shear stiffness as a function of angular position is displayed in Figure 2 while second day test results appear on Figure 3. Circles denote discrete test data points. Loss factor (η) is defined as $\eta=2\zeta$ where ζ is the critical damping ratio.

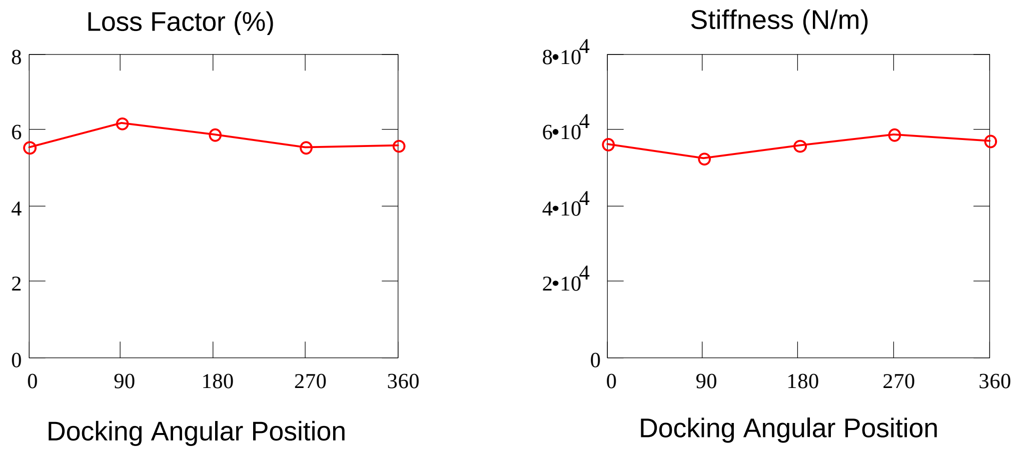

Figure 2: First day test shear loss factor and stiffness as a function of coil docking position (tests at 21^0 C)

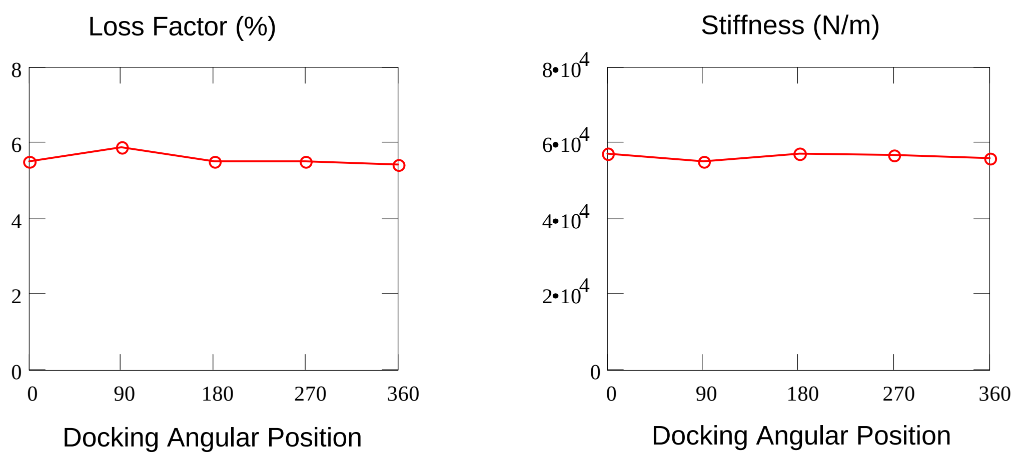

Figure 3: Second day test shear loss factor and stiffness as a function of coil docking position (tests at 22^0 C)

Inspection of Figures 2 and 3 shows that the test results are very similar for the two days. Both show an increase in loss factor and decrease in stiffness at the 90 degree position. The data in Figure 1 indicates a slight increase in stiffness at the 270 degree position that is not apparent in Figure 2. Temperature effects[2] are minimal within the temperatures measured during the test sequence.

4. Conclusions

Test results presented in this document support the conclusion that there appears to be little effect of docking position on shear loss factor and stiffness for the LIGO damped coils. Thus that there is little incentive toward a particular orientation in a stack spring assembly.

5. References

1. E. Ponslet, *Low Frequency Damping Measurement Setup and First Results*, HYTEC Inc., Los Alamos, NM, document HYTEC-TN-LIGO-17, June 1997.
2. F. Biehl, *Temperature Effects on LIGO Damped Coil Springs,* HYTEC Inc., Los Alamos,NM document HYTEC-TN-LIGO-18, June 24, 1997.

Note 1, Linda Turner, 09/03/99 02:15:53 PM
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