

Procedure for Fatigue Testing of Hot Coiled Helical Springs

1. Background

The purpose of fatigue test of the coil spring is to prove that springs meet the expected endurance life. The fatigue test shall be carried out on springs as per the procedure given below.

2. Test Machine

The springs can be tested as single spring or in a fixture together with other springs. The fixture shall be designed in such a way that both ends of the spring remain parallel and perpendicular to the loading direction. The end plates of the fixture shall not allow spring ends move sideways. Spring pilot on the spring Inner diameter (ID) or guide on the outer diameter (OD) shall not be used. The test setup shall allow measuring height and load simultaneously. The test shall be properly calibrated. The machine shall have facility to seal the Fatigue Cycle Counters.

3. Test Preparation

All spring samples shall be marked before commencing testing. In addition, the following key parameters shall be verified in the test machine for each spring individually:

- a) Free height
- b) Actual height at the static load specified in approved drawing.
- c) Actual load for the static height specified in approved drawing.
- d) Load v/s. Height curve from free height to stop height and solid height.

4. Fatigue Testing

The test shall be displacement controlled with the following values:

1. Static height of the spring: As per the relevant approved drawing.
2. Alternating displacement: $\pm 30\%$ of the static deflection unless the maximum deflection exceed 85% of the nominal travel. In this case the amplitude shall be limited to $\pm 85\%$ of nominal travel minus nominal static deflection.
3. The test shall not include any lateral displacement loading.
4. Frequency for Testing

The springs shall be tested at the highest frequency safely obtainable by the fatigue-testing machine based on the actual displacement values (Note less than 1.5Hz). The frequency at which the spring has been tested shall be recorded.

5. Monitoring of testing

The test machine shall be monitored at least once a day to ensure that the test setup is performing well. The actual height for the static load shall be recorded for each spring individually for every 2 lakh cycles.

6. Criteria for Acceptance

After completion of fatigue test, all springs shall be checked by magna flux testing for any indications of cracks. All spring samples shall satisfactorily complete at least 10 million cycles of fatigue test without any cracks of new design springs.

The firm shall declare the mean life of the springs.

7. Inspection and Test Report

After completion of fatigue test, the following parameters shall be verified in the test machine for each spring individually:

- i. Free height
- ii. Actual height at the static load specified in the approved drawing.
- iii. Actual load for the static height specified in the approved drawing.
- iv. Load vs. Height curve from free height to stop-height & solid height

A test report shall be furnished that includes a description of the test, all measured spring data prior to the test, during the test and after the test and a failure analysis for the failed springs.

NOTE: Vendor shall carry out type testing only after the test specification is duly approved by BEML/DMRC. Type test shall be carried out at worst conditions. Vendor has the liberty to specify the worst conditions for type test in the test specification, if not specified in the PTS.