LOADING STRESSES

CRITICAL STRESS POINTS

When a Disc Spring is loaded, compressive stresses are generated at Points I and IV. Compressive stresses typically act on the upper surface of the Disc.

At the theoretical Point (0) between Points I and IV, the stress must not exceed the yield strength of the Disc material (1,400 – 1,600 MPa for the specified materials) to ensure that there will be no permanent deformation (set).

Tensile stresses at Points II and III are the basis for fatigue life calculations. Tensile stresses typically act on the lower surface of the Disc.

STATIC LOADING

Static loading is defined as carrying a constant load or an occasionally changing load at relatively long time intervals not exceeding ten thousand cycles per design life. In these cases the highest calculated stress at Point 0 is most critical and should not exceed 1400 - 1600 MPa. The standard range of Disc Springs may be used in static loading conditions without the need to perform theoretical stress calculations. Under these conditions, spring set is not a factor with stresses up to \( S = 0.75 \, h_o \).

DYNAMIC LOADING

One of the key benefits of using DIN Disc Springs is the fact that they can be used in high frequency cyclic applications where fatigue life is a primary concern. In order to realize the maximum benefit of Disc Springs in these applications, there are a few considerations that must be taken into account. In simplified terms, the following techniques will help to ensure that the proper Disc Spring is selected to meet the application requirements.

Understand the Application:
Knowing the loading of the Disc Spring is crucial and requires specifics on such information as preload, working forces, displacement, motion profile, and frequency. Other factors such as the required life, the working temperature, and environmental conditions that may require corrosion protection or cleanliness requirements all will contribute to actual fatigue life and need to be taken into account.

Design to Minimize Stresses:
The fatigue life of a Disc Spring is directly related to the magnitude of stresses developed in the part as it cycles. This applies to both the maximum stress developed during the highest loading part of the cycle as well as the differential stress between the full load and the unloaded or preloaded condition.

Select the Proper Configuration:
In order to minimize the stresses in the part, it is often recommended to utilize the ability of Disc Springs to be oriented into preassembled stacks consisting of Discs in series or parallel. Parallel Discs allow for increased forces for a given size Disc, while Discs in series allow for extended stroke lengths for the application. Both of these will enable the design to minimize the stresses generated in each Disc, thus extending its life.
SPIROL Application Engineers will review your application needs and work with you to recommend the optimum solution. One way to start the process is to visit our Optimal Application Engineering portal at SPIROL.com.

Please refer to www.SPIROL.com for current specifications and standard product offerings.