Cautionary Tale: Prestressing

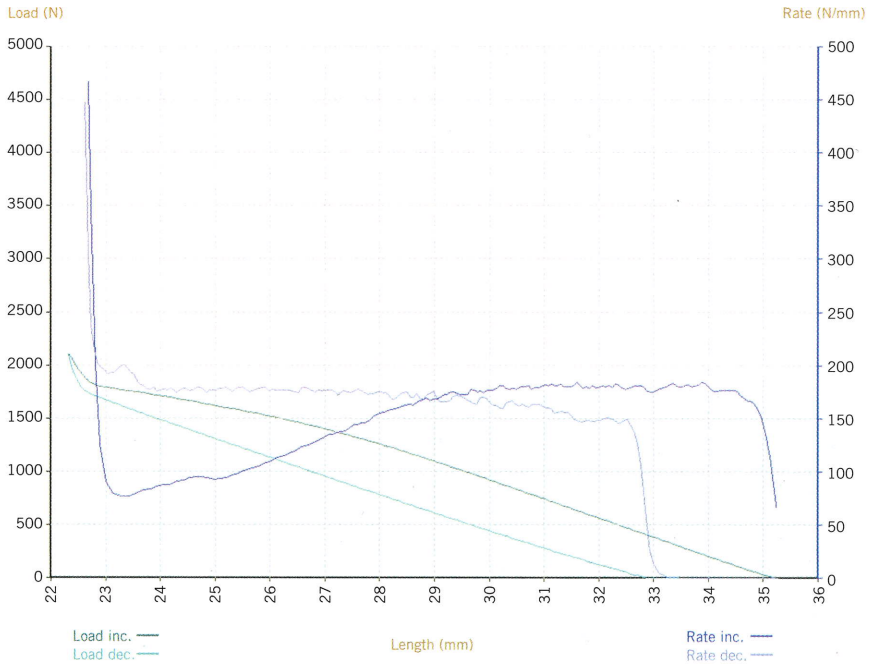
by Mark Hayes

The purpose of this cautionary tale is to illustrate the process of prestressing compression springs. During a recent training course in Scandinavia, it became clear that the process had not been fully understood. So a new approach to explaining prestressing is presented.

To illustrate prestressing, a compression spring that was made overlong from SiCr wire was stress relieved and ground. The corrected stress of this index 3.5 spring prior to prestressing was 87 percent of the wire tensile strength. This spring was then prestressed to its theoretical solid or block load of 2100N, and the graph produced in the load increasing and decreasing direction is shown as figure 1.

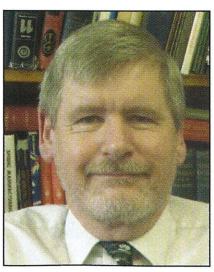
This graph shows that the free length of the spring was reduced from 35.2mm to 32.8mm by the prestressing process. The rate prior to prestressing was linear between 34.6mm and 30.0mm and the average value of the rate was 178N/mm. After prestressing the load-length graph of the spring is shown in figure 2 (see next page).

Figure 1: Capture of data during the prestressing process



The average rate of the spring was 178N/mm after prestressing, and the rate was approximately linear between lengths of 32.3 and 23.5mm. That is to say the elastic deflection range was 8.8mm, up from only 4.6mm prior to prestressing. This was a very highly stressed spring and, consequently, the increase in the elastic range is not usually as great as this. Figure 2 also shows more hysteresis in this spring than usual and the reason for this was not immediately apparent, but this is a cautionary tale – beware that the load in the increasing load direction may be higher than that in the decreasing direction.

The moral of this cautionary tale is that the prestressing of springs is beneficial, but the process is not easy to understand for people new to the spring industry or to spring



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manufacturers' customers (those who specify springs). The important message is that prestressing will not change the rate, but will increase the available elastic deflection. It does this by putting a permanent (plastic) twist into the surface of a compression spring. ◆

Figure 2: Capture of data after the spring had been prestressed to 2100N twice