



Tech-Spring Report 7
EFFECT OF STRESS RELIEF HEAT TREATMENT ON FATIGUE PERFORMANCE

Introduction

Customers of the spring industry regularly ask whether the time a spring is stress relieved will affect performance. The standard answer to this reasonable question is that time has very little effect. The purpose of this project is to provide the proof that the standard answer is correct.

Springs

Compression springs made from two materials were supplied. For each batch, the springs were stress relieved for 0, 5, 15 and 30 minutes. The effect of this stress relief on spring dimensions and fatigue life was evaluated.

Drawn Carbon Steel

The stress relief heat treatment causes this grade to wind up, and so the outside diameter should become smaller and the total coils should increase. The results were as follows.

Six springs in each condition were supplied.

D_o/mm	n	100-700	100-750	100-850
Not Stress Relieved				
18.00	5.92	1 @ 2.9m 1 x 10 ⁷	1 @ 3.7m 1 @ 10 ⁷	1 @ 1.9m 1 @ 2.2m
Stress relieved at 270° for 5 minutes				
17.88	5.97	2 @ 10 ⁷	1 @ 8.1m 1 @ 10 ⁷	2 @ 2.2m
Stress relieved at 270° for 15 minutes				
17.86	5.97	2 @ 10 ⁷	1 @ 3.8m 1 @ 4.0m	1 @ 1.6m 1 @ 3.8m
Stress relieved at 270° for 30 minutes				
17.82	5.96	2 @ 10 ⁷	2 @ 10 ⁷	1 @ 3m 1 @ 1.8m

Conclusion

The time of stress relief has no effect upon fatigue life.

SiCr

Again, this spring should wind up during stress relief, but not so much as the drawn carbon steel. The results were as follows.

D_o/mm	n	100-700	100-750	100- 800	100-850
Not Stress Relieved					
21.18	5.89	1 @ 10 ⁷	1 @ 1.6m	1 @ 2.3m	1 @ 328k



D_o /mm	n	100-700	100-750	100- 800	100-850
				1 @ 1.6m	1 @ 224k
Stress relieved at 400° for 5 minutes					
21.07	5.92	1 @ 10^7	1 @ 9.9m	1 @ 10^7	1 @ 836k 1 @ 5.5m
Stress relieved at 400° for 15 minutes					
21.04	5.92	1 @ 10^7	1 @ 10^7	1 @ 10^7	1 @ 3.7m 1 @ 3.8m
Stress relieved at 400° for 30 minutes					
21.03	5.94	1 @ 10^7	1 @ 10^7	2 @ 10^7	1 @ 4.2m 1 @ 4.9m

Conclusion

Five minutes stress relief may not be quite so good as 15 or 30 minutes. There is a case for further investigation of 5 minute heat treatment Times (or less) at 380°, 400° and 420°C.