Helical cylindrical compression spring of round wires and bars [in]

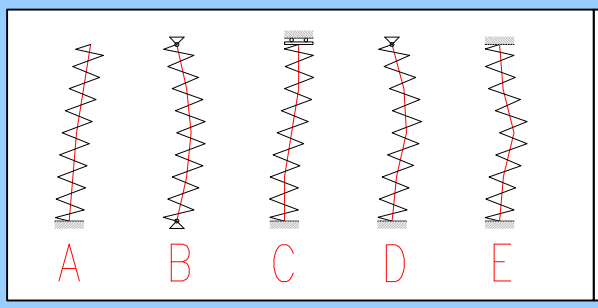
i Calculation without errors.

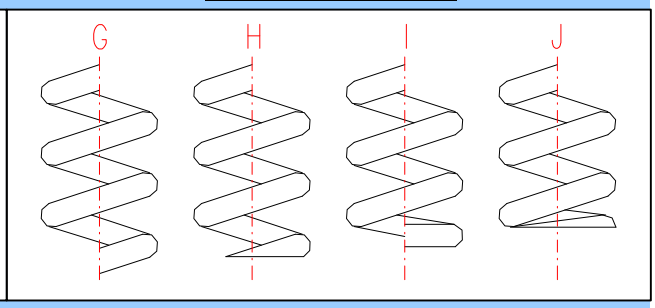
ii ☐ Project information

? **Input parameters section**

1.0 ☑ Selection of load conditions, spring operational and production parameters.

1.1	**Working cycle operational parameters**			
1.2	Method of loading		Fatigue loading	
1.3	Working temperature	T	200,0	[° F]
1.4	Working environment		Non corrosive	
1.5	**Spring design**			
1.6	Seating of the spring		F ... Guided seating	
1.7	Design of spring ends		J ... Closed ends ground	
1.8	Surface treatment		Shot peened springs	
1.9	Direction of coil winding		Right	
1.10	Number of end / ground coils	n_C / n_G	2,0 | 1,0	





1.11	**Spring exposed to static loading**			
1.12	Operational loading mode		Light service	
1.13	Desired level of safety	s_s	1,05	
1.14	Method of stress curvature correction		Without correction	
1.15	**Spring exposed to fatigue loading**			
1.16	Operational loading mode		Continuous loading	
1.17	Desired spring service life in thousands of cycles	N	Infinite life	
1.18	Desired level of safety	s_f	1,05	
1.19	Method of stress curvature correction		Correction by Wahl	

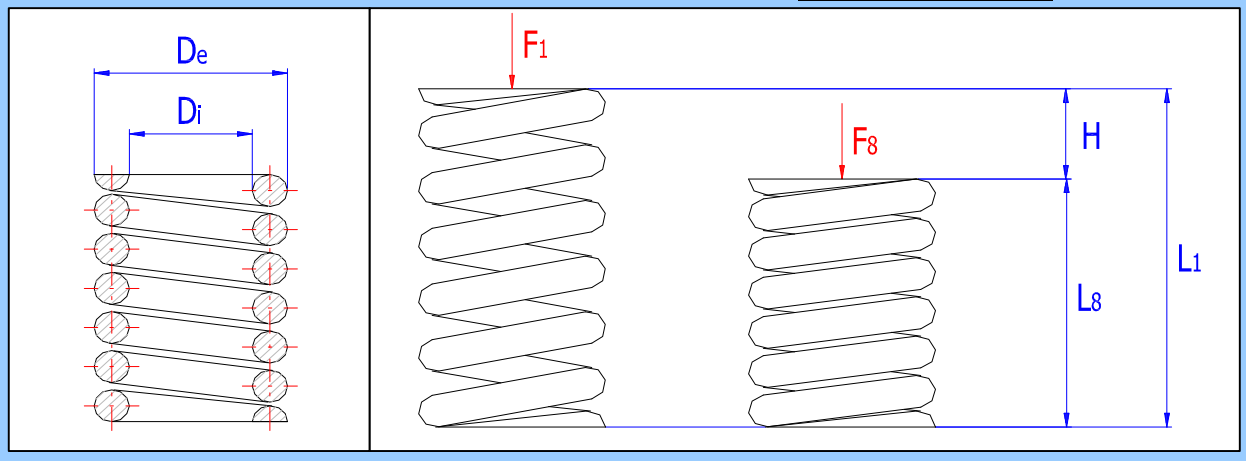
2.0 ☑ Options of spring material.

2.1	Production method :		Cold formed springs	
2.2	Spring material :		Music wire ASTM A228	
2.3	**Field of use of the selected material**			
2.4	Suitability for fatigue load		Excellent	
2.5	Relative strength		High	
2.6	Corrosion resistance		Insufficient	
2.7	Max. operational temperature		250	[° F]
2.8	Delivered wire diameters		0,005 - 0,25	[in]
2.9	**Mechanical and physical properties of the material**			
2.10	Modulus of elasticity in shear	G_{20}	11750	[ksi]
2.11	Modulus of elasticity at operational temperature	G	11481	[ksi]
2.12	Density	ρ	490	[lb/ft^3]
2.13	**Strength characteristics of the material**			
2.14	Ultimate tensile strength	S_u	244	[ksi]
2.15	Permissible torsional stress	τ_A	122	[ksi]

2.16	Endurance limit in shear	τ_e	87,8		[ksi]
2.17	Endurance limit by finite life	τ_f	87,8		[ksi]

3.0 ☑ Spring design.

				Deviat. [%]	
3.1	**Desired parameters of working cycle**				
3.2	Maximum working loading	F_8	100,0	10,0	[lb]
3.3	Minimum working loading	F_1	20,0	30,0	[lb]
3.4	Fully loaded spring length	L_8	2,500	10,0	[in]
3.5	Required spring working stroke	H	1,000	0,0	[in]
3.6	Preloaded spring length	L_1	3,5	7,14	[in]



3.7	**Filters of the designed solution**			
3.8	☐ Maximum permissible spring outer diameter	D_{emax}	1,500	[in]
3.9	☐ Minimum permissible spring inner diameter	D_{imin}	1,000	[in]
3.10	Permissible division of the number of active coils		1/4	
3.11	Permissible exceeding of spring limit dimensions		0,0	[%]
3.12	Perform check of buckling		No	
3.13	Perform check of the limit working length		Yes	
3.14	Keep to the required level of safety with the strength check		Yes	
3.15	Quality criterion		Combined	
3.16	Number of design iteration		Medium	
3.17	**Options of solutions**			
3.18	Sort design result by		Qualities of solutions	
3.19	Run design calculation			

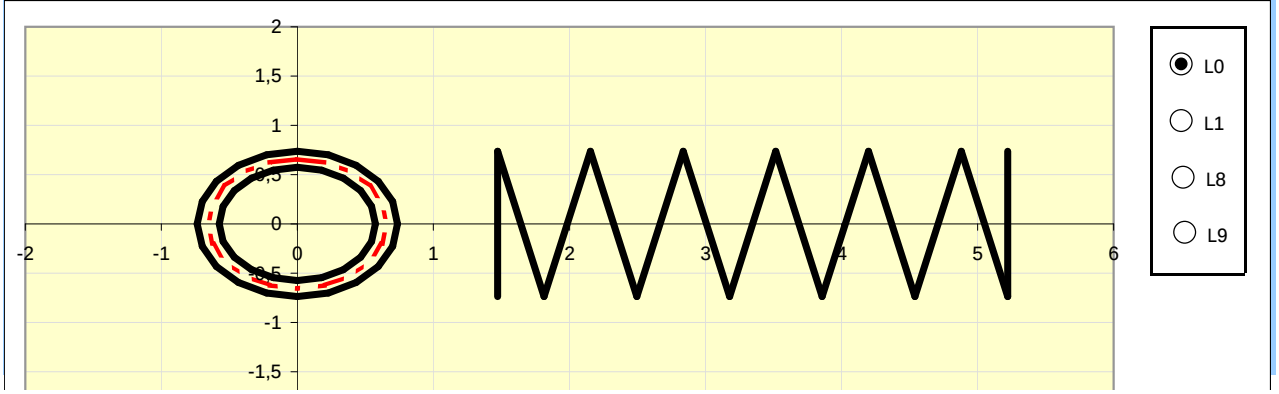
3.20

ID	D	D_e	D_i	d	n	L_0	L_1	L_8	F_1	F_8	τ_8	s_s	s_f	m	quality
1.	1.310	1.472	1.148	0.1620	5.50	3.750	3.500	2.500	20.0	100.0	78	1.56	1.06	0.184	0.37

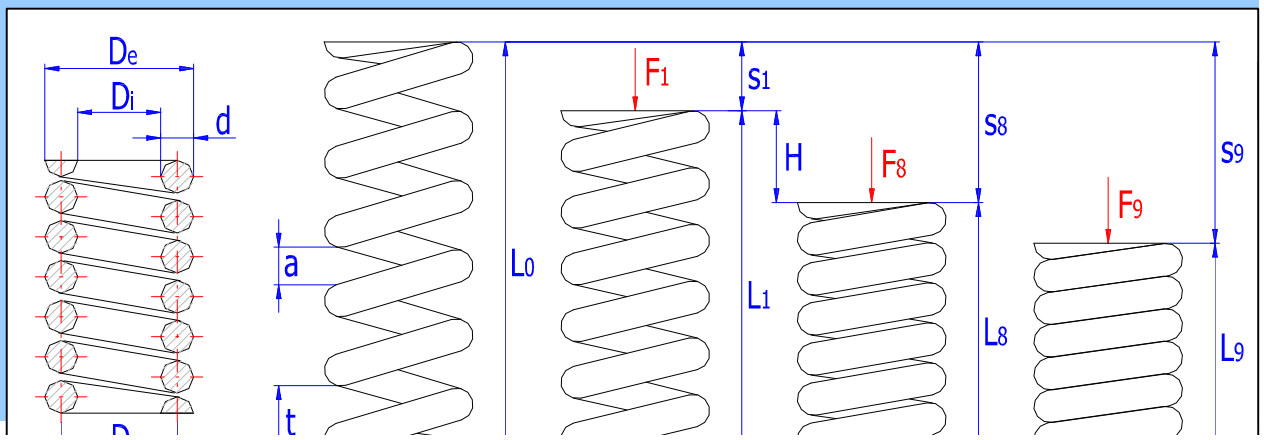
Results section

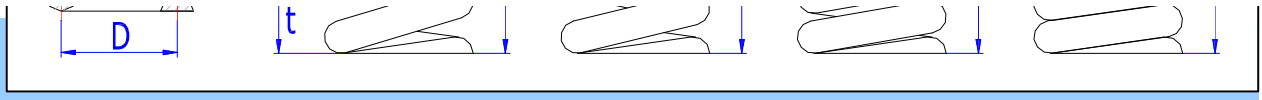
4.0 ☑ Summarized list of designed spring parameters.

4.1 Refresh results from the selected spring design



4.2	**Spring loading**				
4.3	Minimum working loading	F_1	20,00		[lb]
4.4	Maximum working loading	F_8	100,00		[lb]
4.5	**Spring dimensions**				
4.6	Mean spring diameter	D	1,3097		[in]
4.7	Recommended limits of wire diameter	d_{min} / d_{max}	0,0819	0,2500	[in]
4.8	Wire diameter	d	0,162		[in]
4.9	Outer / inner spring diameter	D_e / D_i	1,4717	1,1477	[in]
4.10	Spring index	c	8,08		
4.11	Number of active coils	n	5,5		
4.12	Recommended limits of free spring length	L_{0min} / L_{0max}	2,4850	4,6460	[in]
4.13	Free spring length	L_0	3,75		[in]
4.14	Recommended pitch limits	t_{min} / t_{max}	0,3929	0,7858	[in]
4.15	Space / pitch between coils of free spring	a / t	0,4609	0,6229	[in]
4.16	**Parameters of preloaded spring**				
4.17	Spring deflection	s_1	0,2500		[in]
4.18	Spring length	L_1	3,5000		[in]
4.19	Spring stress	τ_1	15,69		[ksi]
4.20	**Parameters of fully loaded spring**				
4.21	Spring deflection	s_8	1,2501		[in]
4.22	Spring length	L_8	2,4999		[in]
4.23	Spring working stroke	H	1,0000		[in]
4.24	Spring stress	τ_8	78,45		[ksi]
4.25	**Parameters of spring limit state**				
4.26	Theoretic spring limit loading	F_9	202,79		[lb]
4.27	Theoretic spring deflection / length	s_9 / L_9	2,5350	1,2150	[in]
4.28	Teoretic stress	τ_9	159,08		[ksi]
4.29	Sum of min. permissible spaces between active coils	s_{amin}	0,2647		[in]
4.30	Minimum spring limit length	L_{minF}	1,4797		[in]
4.31	**Spring mechanical and physical properties**				
4.32	Spring constant	k	80,00		[lb/in]
4.33	Spring deformation energy	W_8	5,21		[ft lb]
4.34	Critical spring speed	v_k	51,74		[ft/s]
4.35	Natural spring frequency	f	241,59		[Hz]
4.36	Developed wire length	l	31,43		[in]
4.37	Spring weight	m	0,184		[lb]

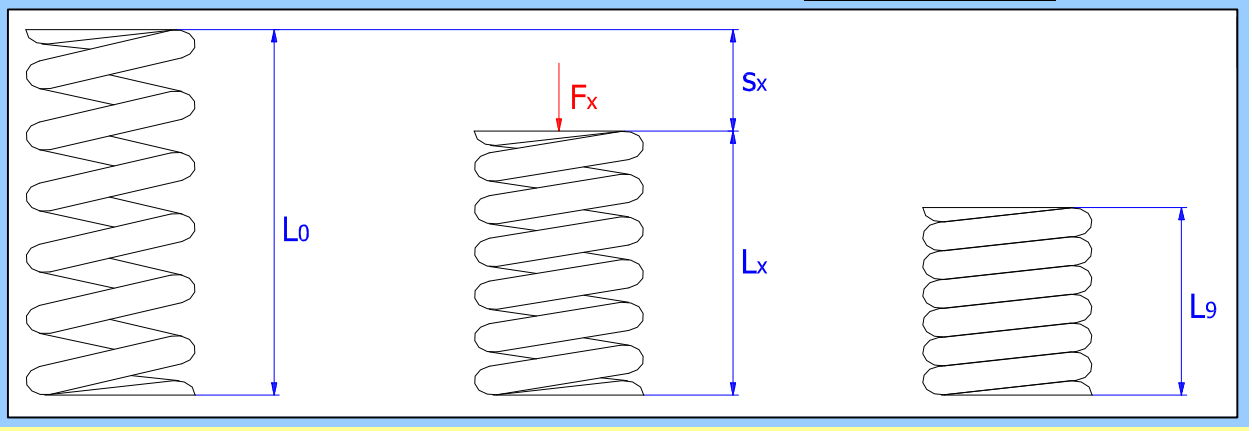




4.38	**Spring strength check**				
4.39	Curvature correction factor	K_s	1,0000		
4.40	Corrected stress of fully loaded spring	τ_{8C}	78,45		[ksi]
4.41	Permissible torsional stress	τ_A	122		[ksi]
4.42	Level of safety		1,555		
4.43	**Check of buckling**				
4.44	Permissible / actual max. working compression of spring		100	33,33	[%]
4.45	**Strength check of a spring exposed to fatigue loading**				
4.46	Curvature correction factor	K_f	1,1819		
4.47	Corrected stress of fully loaded spring	τ_{8C}	92,72		[ksi]
4.48	Max. fatigue strength for the given loading	τ_{max}	98,6		[ksi]
4.49	Level of safety		1,063		

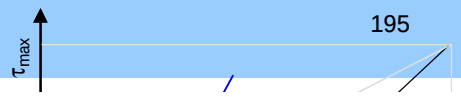
5.0 ☑ Parameters of designed spring for specific working load or spring length.

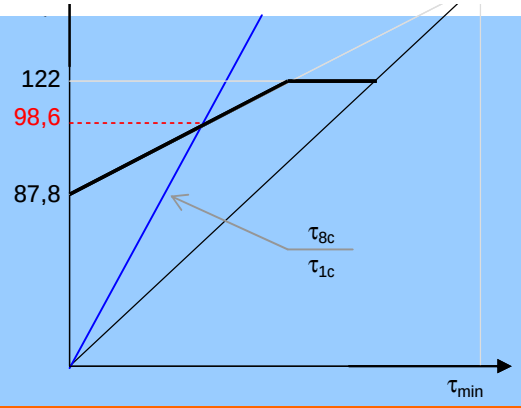
5.1	**Spring parameters for the given working loading**			
5.2	Spring loading	F_x	50,0	[lb]
5.3	Spring deflection	s_x	0,6250	[in]
5.4	Spring length	L_x	3,1250	[in]
5.5	Spring stress	τ_x	39,22	[ksi]
5.6	**Spring parameters for the given working length**			
5.7	Spring length	L_x	3,000	[in]
5.8	Spring deflection	s_x	0,7500	[in]
5.9	Spring produced force	F_x	60,00	[lb]
5.10	Spring stress	τ_x	47,07	[ksi]



6.0 ☑ Check of loading capacity of a spring exposed to fatigue loading.

6.1	Curvature correction factor	K_f	1,1819	
6.2	Corrected stress of preloaded spring	τ_{1c}	18,54	[ksi]
6.3	Corrected stress of fully loaded spring	τ_{8c}	92,72	[ksi]
6.4	Ultimate shear strength	S_{us}	195	[ksi]
6.5	Permissible torsional stress	τ_A	122	[ksi]
6.6	Endurance limit in shear	τ_e	87,8	[ksi]
6.7	Endurance limit by finite life	τ_f	87,8	[ksi]
6.8	Max. fatigue strength for the given loading	τ_{max}	98,6	[ksi]
6.9	Level of safety		1,063	





Supplements section

7.0 ☑ Spring check calculation.

7.1	Uploading of input data from main calculation				
7.2	**Parameters of working cycle**				
7.3	Maximum working loading	F_8	100,00		[lb]
7.4	Minimum working loading	F_1	20,00		[lb]
7.5	Spring working stroke	H	1,0000		[in]
7.6	**Spring strength check**				
7.7	Mean spring diameter	D	1,3097		[in]
7.8	Recommended limits of wire diameter	d_{min} / d_{max}	0,1483	0,3274	[in]
7.9	Wire diameter / from table	d	0,1620	0,1483 ▼	[in]
7.10	Outer / inner spring diameter	D_e / D_i	1,4717	1,1477	[in]
7.11	Spring index	c	8,08		
7.12	Permissible torsional stress	τ_A	122		[ksi]
7.13	Corrected stress of fully loaded spring	τ_{8c}	78,4		[ksi]
7.14	Level of safety		1,555		
7.15	**Spring design stability**				
7.16	Recommended minimum number of active coils	n_{min}	4,40		
7.17	Number of active coils	n	5,50		
7.18	Theoretic spring limit length	L_9	1,2150		[in]
7.19	Recommended limits of free spring length	L_{0min} / L_{0max}	2,7297	4,6690	[in]
7.20	Free spring length	L_0	3,7500		[in]
7.21	Recommended pitch limits	t_{min} / t_{max}	0,3929	0,79	[in]
7.22	Pitch of coils of free spring	t	0,6229		[in]
7.23	Minimum spring limit length	L_{minF}	1,4797		[in]
7.24	Length of min. / max. loaded spring	L_1 / L_8	3,4999	2,4999	[in]
7.25	Compression of min. / max. loaded spring	s_1 / s_8	0,2501	1,2501	[in]
7.26	Permissible / actual max. working compression of spring		100	33,33	[%]
7.27	Transfer of solution into main calculation				

8.0 ☑ Calculation of working forces of the spring.

8.1	Uploading of input data from main calculation				
8.2	**Parameters of working cycle**				
8.3	Fully loaded spring length	L_8	2,4999		[in]
8.4	Preloaded spring length	L_1	3,5000		[in]
8.5	Spring working stroke	H	1,0001		[in]
8.6	**Spring dimensions**				
8.7	Mean spring diameter	D	1,3097		[in]
8.8	Wire diameter / from table	d	0,1620	0,1483 ▼	[in]
8.9	Outer / inner spring diameter	D_e / D_i	1,4717	1,1477	[in]

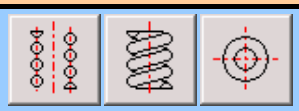
8.10	Spring index	c	8,08		
8.11	Number of active coils	n	5,50		
8.12	Free spring length	L_0	3,7500		[in]
8.13	Compression of min. / max. loaded spring	s_1 / s_8	0,2500	1,2501	[in]
8.14	Theoretic spring limit length	L_9	1,2150		[in]
8.15	**Spring loading**				
8.16	Maximum working loading	F_8	100,0		[lb]
8.17	Minimum working loading	F_1	20,0		[lb]
8.18	**Spring strength check**				
8.19	Permissible torsional stress	τ_A	122		[ksi]
8.20	Corrected stress of fully loaded spring	τ_{8c}	78,4		[ksi]
8.21	Level of safety		1,555		
8.22	Transfer of solution into main calculation				

9.0 ☑ Calculation of working lengths of the spring.

9.1	Uploading of input data from main calculation				
9.2	**Spring loading**				
9.3	Maximum working loading	F_8	100,00		[lb]
9.4	Minimum working loading	F_1	20,00		[lb]
9.5	**Spring dimensions**				
9.6	Mean spring diameter	D	1,3097		[in]
9.7	Wire diameter / from table	d	0,1620	0,1483	[in]
9.8	Outer / inner spring diameter	D_e / D_i	1,4717	1,1477	[in]
9.9	Spring index	c	8,08		
9.10	Number of active coils	n	5,50		
9.11	Free spring length	L_0	3,7500		[in]
9.12	Theoretic spring limit length	L_9	1,2150		[in]
9.13	**Parameters of working cycle**				
9.14	Compression of min. / max. loaded spring	s_1 / s_8	0,2500	1,2501	[in]
9.15	Fully loaded spring length	L_8	2,4999		[in]
9.16	Preloaded spring length	L_1	3,5000		[in]
9.17	Spring working stroke	H	1,0000		[in]
9.18	**Spring strength check**				
9.19	Permissible torsional stress	τ_A	122		[ksi]
9.20	Corrected stress of fully loaded spring	τ_{8c}	78,4		[ksi]
9.21	Level of safety		1,555		
9.22	Transfer of solution into main calculation				

10.0 ☑ Graphical output, CAD systems

10.1	2D drawing output to:	DXF File	
10.2	2D Drawing scale	Automatic	



10.3	Spring length in the drawing and the model	2,500
10.4	**Text description (Information for BOM)**	
	Row 1 (BOM attribute 1)	Compression spring ☑
	Row 2 (BOM attribute 2)	D=1,3097; d=0,162; n=5,5; L0=3,7
	Row 3 (BOM attribute 3)	Music wire ASTM A228
10.5	Table of parameters	