SPRING MATERIALS

SIZES & STRENGTH VALUES

ISSUE VI

April 7, 2005

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Titanium, continued

Tool Steel

The following is provided as a reference guide only, and not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Music Wire ASTM A228 UNS K08500 & G10860	Cold drawn. Constant tensile strength. High-quality and good for high cycle spring applications.	250°F	449/230	(E) 30 (G) 11.5	45%	.012" to .250"

SIZE CHART

Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches
.012	.026	.038	.054	.072	.095	.124	.192
.013	.027	.039	.055	.075	.098	.125	.207
.014	.028	.040	.056	.076	.100	.130	.225
.015	.029	.041	.057	.078	.105	.135	.243
.016	.030	.042	.058	.080	.109	.138	.250*
.017	.031	.044	.059	.082	.110	.148	
.018	.032	.045	.062	.085	.112	.156	
.020	.033	.047	.063	.090	.113	.162	
.022	.035	.048	.065	.091	.114	.170	
.024	.036	.050	.067	.093	.118	.177	
.025	.037	.051	.070	.094	.120	.187	

* Sizes up to .283 dia. are available on request.

TENSILE STRENGTH CHART

Diameter, in [A]	Tensile Strength, ksi		Diameter, in [A]	Tensile Strength, ksi		Diameter, in[A]	Tensile Strength, ksi		Diameter, in[A]	Tensile Strength, ksi	
	min	max		min	max		min	max		min	max
.004	439	485	.022	345	382	.059	396	327	.125	261	288
.005	426	471	.024	341	377	.063	293	324	.130	259	286
.006	415	459	.026	337	373	.067	290	321	.135	258	285
.007	407	449	.028	333	368	.072	287	317	.140	256	283
.008	399	441	.030	330	365	.076	284	314	.145	254	281
.009	393	434	.032	327	361	.080	282	312	.150	253	279
.010	387	428	.034	324	358	.085	279	308	.156	251	277
.011	382	422	.036	321	355	.090	276	305	.162	249	275
.012	377	417	.038	318	352	.095	274	303	.177	245	270
.013	373	412	.040	315	349	.100	271	300	.192	241	267
.014	369	408	.042	313	346	.102	270	299	.207	238	264
.015	365	404	.045	309	342	.107	268	296	.225	235	260
.016	362	400	.048	306	339	.110	267	295	.250	230	255
.018	256	393	.051	303	335	.112	266	294			
.020	350	387	.055	300	331	.121	263	290			

A Tensile strength values for intermediate diameters may be interpolated.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Oil Tempered Wire, Class I ASTM A229 UNS K07001 & G10650	Cold drawn. All purpose spring material. Heat treated before fabrication. Susceptible to hydrogen embrittlement when plated.	250°F	323/125 (class I)	(E) 30 (G) 11.5	45%	.032" to .625"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.032	.067	.099	.135	.180	.250	.306	.468
.035	.072	.100	.148	.187	.262	.312	.500
.040	.080	.105	.156	.192	.263	.331	.531
.041	.086	.113	.162	.207	.281	.343	.562
.047	.087	.120	.170	.225	.283	.362	.625
.051	.091	.125	.172	.235	.295	.406	
.058	.093	.128	.177	.243	.302	.437	

TENSILE STRENGTH CHART

Diameter, in.[A]	Tensile Strength, ksi				Diameter, in.[A]	Tensile Strength, ksi			
	Class I		Class II			Class I		Class II	
	min	max	min	max		min	max	min	max
.020	293	323	324	354	.135	215	240	241	266
.023	289	319	320	350	.148	210	235	236	261
.026	286	316	317	347	.162	205	230	231	256
.029	283	313	314	344	.177	200	225	226	251
.032	280	310	311	335	.192	195	220	221	246
.035	274	304	305	335	.207	190	215	216	241
.041	266	296	297	327	.225	188	213	214	239
.048	259	289	290	320	.244	187	212	213	238
.054	253	283	284	314	.250	185	210	211	236
.062	247	277	278	308	.312	183	208	209	234
.072	241	271	272	302	.375	180	205	206	231
.080	235	265	266	296	.438	175	200	201	226
.092	230	260	261	291	.500	170	195	196	221
.106	225	255	256	286	.562	165	190	191	216
.120	220	250	251	281	.625	165	190	191	216

A Tensile strength values for intermediate diameters may be interpolated.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Chrome Vanadium ASTM A-231 Valve Quality: ASTM A-232 AMS 6450	Cold drawn. Good for shock loads and medium elevated temperature applications. Susceptible to hydrogen embrittlement when plated.	425°F	325/190	(E) 30 (G) 11.5	45%	.043" to .500"

SIZE CHART

Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.
.043	.060	.091	.102	.125	.207	.312	.406
.046	.062	.092	.105	.135	.225	.331	.437
.054	.072	.095	.113	.162	.262	.343	.468
.059	.080	.099	.120	.187	.283	.375	
Valve Quality							
Wire Dia.,In.	**Wire Dia.,In.**	**Wire Dia.,In.**	**Wire Dia.,In.**	**Wire Dia.,In.**	**Wire Dia.,In.**	**Wire Dia.,In.**	**Wire Dia.,In.**
.059	.095	.135	.162	.207	.283	.343	
.085	.109	.142	.177	.243	.306		
.090	.125	.148	.192	.262	.331		

TENSILE STRENGTH CHART

Diameter, inches	Tensile Strength, ksi[A]		Reduction of Area, minimum, %	Diameter, inches	Tensile Strength, ksi[A]		Reduction of Area, minimum, %
	minimum	maximum			minimum	maximum	
.020	300	325	C	.162	225	245	40
.032	290	315	C	.192	220	240	40
.041	280	305	C	.244	210	230	40
.054	270	295	C	.283	205	225	40
.062	265	290	C	.312	203	223	40
.080	255	275	C	.375	200	220	40
.105	245	265	45	.438	195	215	40
.135	235	255	45	.500	190	210	40

A Tensile strength values for intermediate diameters may be interpolated.
C The reduction of area test is not applicable to wire diameters under 0.092in.
Note: Valve quality material has improved surface quality.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Chrome Silicon ASTM A401 UNS G92540	Cold drawn. Good for shock loads and medium elevated temperature applications. Susceptible to hydrogen embrittlement when plated.	475°F	300/226	(E) 30 (G) 11.5	45%	.024" to .625"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.024	.041	.056	.085	.109	.177	.306	.500
.025	.042	.057	.088	.113	.180	.312	.525
.028	.043	.058	.089	.120	.187	.331	.531
.029	.044	.062	.090	.125	.192	.343	.562
.030	.045	.065	.091	.128	.207	.362	.594
.031	.046	.067	.092	.135	.218	.375	.625
.033	.047	.072	.093	.142	.225	.394	
.034	.049	.075	.095	.148	.234	.406	
.036	.050	.076	.098	.156	.243	.421	
.037	.051	.078	.100	.162	.250	.437	
.038	.053	.080	.102	.167	.262	.453	
.039	.054	.083	.105	.170	.281	.468	

TENSILE STRENGTH CHART

Diameter, in.[A]	Tensile Strength, ksi		Reduction of Area, min, %	Diameter, in.[A]	Tensile Strength, ksi		Reduction of Area, min, %
	minimum	maximum			minimum	maximum	
.032	300	325	C	.192	260	283	40
.041	298	323	C	.219	255	278	40
.054	292	317	C	.250	250	275	40
.062	290	315	C	.312	245	270	40
.080	385	310	C	.375	240	265	40
.092	280	305	45	.438	235	260	35
.120	275	300	45	.500	230	255	35
.135	270	295	40	.562	228	253	30
.162	265	290	40	.625	226	251	30
.177	260	285	40				

A Tensile strength values for intermediate diameters may be interpolated.

C The reduction of area test is not applicable to wire under 0.105 in. (2.500 mm) in diameter Preferred sizes. For a complete list, refer to ANSI B32.4.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
5160-H .468" to 1.25" ASTM A689, A29 UNS G51600	Hot-rolled special bar quality, fine grained. Good fatigue life.	400°F	242/211	(E) 29 (G) 10.5	45%	.468" to 1.25"

Bar Diameter	Bar Diameter	Bar Diameter	Bar Diameter	Bar Diameter
.468	.625	.781	.937	1.125
.500	.656	.812	.968	1.187
.531	.687	.843	1.000	1.250
.562	.718	.875	1.032	
.593	.750	.906	1.062	

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
51B60-H 1.25" to 1.937" ASTM A689, A29 UNS 51601	Hot-rolled special bar quality, fine grained. Good fatigue life.	400°F	242/211	(E) 30 G) 11.0	45%	1.25" to 1.937"

Bar Diameter	Bar Diameter	Bar Diameter	Bar Diameter	Bar Diameter
1.250	1.437	1.625	1.812	1.937
1.312	1.500	1.687	1.843	
1.375	1.562	1.750	1.875	

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
4161-H 2.00" to 2.875" ASTM A689, A29 UNS 41610	Hot-rolled special bar quality, fine grained. Good fatigue life.	400°F	242/211	(E) 30 (G) 11.0	45%	2.00" to 2.875"

Bar Diameter	Bar Diameter	Bar Diameter	Bar Diameter
2.000	2.375	2.562	2.750
2.125	2.437	2.625	2.812
2.250	2.500	2.687	2.875

COMMENTS FOR ALL ALLOYS:
Material is produced in the “As Rolled" condition. Springs are manufactured via the Hot Wound
procedure, quenched and tempered. Each spring is checked for Rockwell Hardness to insure
the proper temper is achieved. Temper Hardness should range between 41 R_C & 49 R_C.
exceeds 49 R_C this could produce brittle properties, increasing failure possibilities.
Bar lengths in general range from 40’ to 45’.
41R_C / = 187,000 psi tensile 49R_C / = 253,000 psi tensile
Note: Virtually all Hot Rolled Alloy Bar stocked by Suhm is turned and polished.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
AISI 302/304 Stainless Steel Wire ASTM A313 AMS 5688 UNS S30200	Cold drawn. Low cost. Good for general purpose corrosion and elevated temperature applications. Has some magnetism in a spring temper.	500°F	325/130	(E) 28 (G) 9.8	40%	.015" to .500"

SIZE CHART

Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches	Wire Dia., inches
.015	.033	.052	.072	.094	.138	.244
.016	.034	.053	.074	.095	.140	.250
.017	.035	.054	.075	.097	.142	.262
.018	.036	.055	.076	.098	.148	.282
.019	.037	.056	.077	.099	.156	.297
.020	.038	.057	.078	.100	.162	.306
.021	.039	.058	.080	.102	.170	.312
.022	.040	.059	.082	.105	.172	.331
.023	.041	.060	.083	.109	.177	.343
.024	.042	.061	.084	.112	.179	.362
.025	.043	.062	.085	.113	.180	.375
.026	.044	.064	.086	.115	.182	.393
.027	.045	.065	.088	.118	.187	.406
.028	.046	.067	.089	.120	.192	.437
.029	.047	.068	.090	.125	.207	.468
.030	.049	.069	.091	.128	.218	.500
.031	.050	.070	.092	.129	.225	.562
.032	.051	.071	.093	.135	.234	

TENSILE REQUIREMENTS

Diameter, in.(mm)[A]	Tensile Strength, PSI (Mpa)	
	minimum	maximum
Up to 0.009 (0.23), incl.	325,000 (2240)	355,000 (2450)
Over 0.009 (0.23) to 0.010 (0.25), incl.	320,000 (2205)	350,000 (2415)
Over 0.010 (0.25) to 0.011 (0.28), incl.	318,000 (2190)	348,000 (2400)
Over 0.011 (0.28) to 0.012 (0.30), incl.	316,000 (2180)	346,000 (2385)
Over 0.012 (0.30) to 0.013 (0.33), incl.	314,000 (2165)	344,000 (2370)
Over 0.013 (0.33) to 0.014 (0.36), incl.	312,000 (2150)	342,000 (2360)
Over 0.014 (0.36) to 0.015 (0.38), incl.	310,000 (2135)	340,000 (2345)
Over 0.015 (0.38) to 0.016 (0.41), incl.	308,000 (2125)	338,000 (2330)
Over 0.016 (0.41) to 0.017 (0.43), incl.	306,000 (2110)	336,000 (2315)
Over 0.017 (0.43) to 0.018 (0.46), incl.	304,000 (2095)	334,000 (2300)
Over 0.018 (0.46) to 0.020 (0.51), incl.	300,000 (2070)	330,000 (2275)
Over 0.020 (0.51) to 0.022 (0.56), incl.	296,000 (2040)	326,000 (2250)
Over 0.022 (0.56) to 0.024 (0.61), incl.	292,000 (2015)	322,000 (2220)
Over 0.024 (0.61) to 0.026 (0.66), incl.	291,000 (2005)	320,000 (2205)
Over 0.026 (0.66) to 0.028 (0.71), incl.	289,000 (1995)	318,000 (2190)

continued

AISI 302/304 Stainless Steel ASTM A313, continued

Diameter, in.(mm)[A]	Tensile Strength, PSI (Mpa)	
	minimum	maximum
Over 0.028 (0.71) to 0.031 (0.79), incl.	285,000 (1965)	315,000 (2170)
Over 0.031 (0.79) to 0.034 (0.86), incl.	282,000 (1945)	310,000 (2135)
Over 0.034 (0.86) to 0.037 (0.94), incl.	280,000 (1930)	308,000 (2125)
Over 0.037 (0.94) to 0.041 (1.04), incl.	275,000 (1895)	304,000 (2095)
Over 0.041 (1.04) to 0.045 (1.14), incl.	272,000 (1875)	300,000 (2070)
Over 0.045 (1.14) to 0.050 (1.27), incl.	267,000 (1840)	295,000 (2035)
Over 0.050 (1.27) to 0.054 (1.37), incl.	265,000 (1825)	293,000 (2020)
Over 0.054 (1.37) to 0.058 (1.47), incl.	261,000 (1800)	289,000 (1990)
Over 0.058 (1.47) to 0.063 (1.60), incl.	258,000 (1780)	285,000 (1965)
Over 0.063 (1.60) to 0.070 (1.78), incl.	252,000 (1735)	281,000 (1935)
Over 0.070 (1.78) to 0.075 (1.90), incl.	250,000 (1725)	278,000 (1915)
Over 0.075 (1.90) to 0.080 (2.03), incl.	246,000 (1695)	275,000 (1895)
Over 0.080 (2.03) to 0.087 (2.21), incl.	242,000 (1670)	271,000 (1870)
Over 0.087 (2.21) to 0.095 (2.41), incl.	238,000 (1640)	268,000 (1850)
Over 0.095 (2.41) to 0.105 (2.67), incl.	232,000 (1600)	262,000 (1805)
Over 0.105 (2.67) to 0.115 (2.92), incl.	227,000 (1565)	257,000 (1770)
Over 0.115 (2.92) to 0.125 (3.17), incl.	222,000 (1530)	253,000 (1745)
Over 0.125 (3.17) to 0.135 (3.43), incl.	217,000 (1495)	248,000 (1710)
Over 0.135 (3.43) to 0.148 (3.76), incl.	210,000 (1450)	241,000 (1660)
Over 0.148 (3.76) to 0.162 (4.11), incl.	205,000 (1415)	235,000 (1620)
Over 0.162 (4.11) to 0.177 (4.50), incl.	198,000 (1365)	228,000 (1570)
Over 0.177 (4.50) to 0.192 (4.88), incl.	194,000 (1335)	225,000 (1550)
Over 0.192 (4.88) to 0.207 (5.26), incl.	188,000 (1295)	220,000 (1515)
Over 0.207 (5.26) to 0.225 (5.72), incl.	182,000 (1255)	214,000 (1475)
Over 0.225 (5.72) to 0.250 (6.35), incl.	175,000 (1205)	205,000 (1415)
Over 0.250 (6.35) to 0.278 (7.06), incl.	168,000 (1160)	198,000 (1365)
Over 0.278 (7.06) to 0.306 (7.77), incl.	161,000 (1110)	192,000 (1325)
Over 0.306 (7.77) to 0.331 (8.41), incl.	155,000 (1070)	186,000 (1280)
Over 0.331 (8.41) to 0.362 (9.19), incl.	150,000 (1035)	180,000 (1240)
Over 0.362 (9.19) to 0.394 (10.00), incl	145,000 (1000)	175,000 (1205)
Over 0.394 (10.00) to 0.438 (11.12), incl.	140,000 (965)	170,000 (1170)
Over 0.436 (11.12) to 0.500 (12.70), incl.	135,000 (930)	165,000 (1150)
Over 0.500 (12.70)	130,000 (895)	160,000 (1105)

A Tensile strength values for intermediate diameters may be interpolated.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
AISI 316 Stainless Steel Wire ASTM A313 UNS S31600	Cold drawn. Better corrosion resistance than 302/304. Good for elevated temperatures. No magnetism.	550°F	245/110	(E) 28 (G) 9.8	40%	.017" to .500"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.017	.029	.039	.051	.067	.085	.105	.142	.218	.312
.018	.030	.040	.054	.068	.086	.106	.148	.225	.331
.020	.031	.041	.055	.070	.088	.109	.156	.234	.343
.022	.032	.042	.056	.072	.090	.112	.162	.250	.362
.023	.033	.043	.057	.076	.091	.115	.172	.262	.375
.024	.034	.044	.058	.078	.094	.118	.177	.282	.406
.025	.035	.045	.059	.080	.095	.120	.187	.283	.437
.026	.036	.047	.060	.082	.098	.125	.192	.292	.468
.027	.037	.049	.062	.083	.100	.135	.203	.300	.500
.028	.038	.050	.065	.084	.101	.138	.207	.306	.562

TENSILE STRENGTH CHART

Diameter, in.(mm)	Tensile Strength, PSI (Mpa)[A]	
	minimum	maximum
Up to 0.010 (0.25), incl.	245,000 (1690)	275,000 (1895)
Over 0.010 (0.25) to 0.015 (0.38), incl.	240,000 (1655)	270,000 (1860)
Over 0.015 (0.38) to 0.024 (0.61), incl.	235,000 (1620)	265,000 (1825)
Over 0.024 (0.61) to 0.041 (1.04), incl.	235,000 (1620)	265,000 (1825)
Over 0.041 (1.04) to 0.047 (1.19), incl.	230,000 (1585)	260,000 (1790)
Over 0.047 (1.19) to 0.054 (1.37), incl.	225,000 (1550)	255,000 (1760)
Over 0.054 (1.37) to 0.062 (1.57), incl.	220,000 (1515)	250,000 (1725)
Over 0.062 (1.57) to 0.072 (1.83), incl.	215,000 (1480)	245,000 (1690)
Over 0.072 (1.82) to 0.080 (2.03), incl.	210,000 (1450)	240,000 (1655)
Over 0.080 (2.03) to 0.092 (2.34), incl.	205,000 (1415)	235,000 (1620)
Over 0.092 (2.34) to 0.105 (2.67), incl.	200,000 (1380)	230,000 (1585)
Over 0.105 (2.67) to 0.120 (3.05), incl.	195,000 (1345)	225,000 (1550)
Over 0.120 (3.05) to 0.148 (3.76), incl.	185,000 (1275)	215,000 (1480)
Over 0.148 (3.76) to 0.166 (4.22), incl.	180,000 (1240)	210,000 (1450)
Over 0.166 (4.22) to 0.177 (4.50), incl.	170,000 (1170)	200,000 (1380)
Over 0.177 (4.50) to 0.207 (5.26), incl.	160,000 (1105)	190,000 (1310)
Over 0.207 (5.26) to 0.225 (5.72), incl.	155,000 (1070)	185,000 (1275)
Over 0.225 (5.72) to 0.250 (6.35), incl.	150,000 (1035)	180,000 (1240)
Over 0.250 (6.35) to 0.312 (7.92), incl.	140,000 (965)	170,000 (1170)
Over 0.312 (7.92) to 0.375 (9.53), incl.	135,000 (930)	165,000 (1140)
Over 0.375 (9.53) to 0.500 (12.70), incl.	130,000 (895)	160,000 (1105)
Over 0.500 (12.70)	125,000 (850)	155,000 (1970)

A When wire is specified in straightened and cut lengths, the minimum tensile strength shall be 90% of the values listed in the table.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
T-316 Stainless Steel Bar ASTM A276 Cond B UNS S31600	Cold drawn. Better corrosion resistance than 302/304. Good for elevated temperatures. No magnetism.	550°F	245/11	(E) 28 (G) 9.8	40%	.562" to 1.750"

SIZE CHART

Bar Dia., in.	Bar Dia., in.	Bar Dia., in.	Bar Dia., in.	Bar Dia., in.	Bar Dia., in.	Bar Dia., in.	Bar Dia., in.
.562	.656	.812	.938	1.063	1.250	1.438	1.625
.593	.687	.875	.968	1.125	1.313	1.500	1.750
.625	.750	.906	1.000	1.188	1.375	1.562	

TENSILE STRENGTH CHART

Diameter, in.	Tensile Strength, ksi minimum	Elongation in 2 in. or 4D, minimum %	Reduction of Area, minimum, %
up to .750	125	12	35
over .750 to 1.000	115	15	35
over 1.000 to 1.250	105	20	35
over 1.25 to 1.500	100	24	45
over 1.500 to 1.750	95	28	45

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
17-7PH Stainless Steel Wire ASTM A313 AMS 5678 UNS S17700	Age hardened. High tensile strength. Good for general corrosion resistance. No magnetism.	550°F	365/230	(E) 29 (G) 11.0	45%	.017" to .562"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in..	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in..	Wire Dia., in.	Wire Dia., in.
.017	.029	.039	.051	.067	.085	.105	.142	.218	.312
.018	.030	.040	.054	.068	.086	.106	.148	.225	.331
.020	.031	.041	.055	.070	.088	.109	.156	.234	.343
.022	.032	.042	.056	.072	.090	.112	.162	.250	.362
.023	.033	.043	.057	.076	.091	.115	.172	.262	.375
.024	.034	.044	.058	.078	.094	.118	.177	.282	.406
.025	.035	.045	.059	.080	.095	.120	.187	.283	.437
.026	.036	.047	.060	.082	.098	.125	.192	.292	.468
.027	.037	.049	.062	.083	.100	.135	.203	.300	.500
.028	.038	.050	.065	.084	.101	.138	.207	.306	.562

TENSILE STRENGTH CHART

Diameter, in.(mm)	Tensile Strength		
	Cold Drawn Condition C, psi (Mpa) nominal	Condition CH-900[B], psi (Mpa), minimum	Condition CH-900[B], psi (Mpa), maximum
0.010 (0.25) to 0.015 (0.38), incl.	295,000 (2035)	335,000 (2310)	365,000 (2515)
Over 0.015 (0.38) to 0.020 (0.51), incl.	290,000 (2000)	330,000 (2275)	360,000 (2480)
Over 0.020 (0.51) to 0.029 (0.74), incl.	285,000 (1965)	325,000 (2240)	355,000 (2450)
Over 0.029 (0.74) to 0.041 (1.04), incl.	270,000 (1860)	310,000 (2135)	340,000 (2345)
Over 0.051 (1.30) to 0.061 (1.55), incl	265,000 (1825)	305,000 (2100)	335,000 (2310)
Over 0.061 (1.55) to 0.071 (1.80), incl.	257,000 (1770)	297,000 (2050)	327,000 (2255)
Over 0.071 (1.80) to 0.086 (2.15), incl.	255,000 (1760)	292,000 (2015)	322,000 (2220)
Over 0.086 (2.15) to 0.090 (2.18), incl.	245,000 (1690)	292,000 (1945)	312,000 (2150)
Over 0.090 (2.18) to 0.100 (2.54), incl.	242,000 (1670)	279,000 (1925)	309,000 (2130)
Over 0.100 (2.54) to 0.106 (2.69), incl	238,000 (1640)	274,000 (1890)	304,000 (2095)
Over 0.106 (2.69) to 0.130 (3.30), incl.	236,000 (1625)	272,000 (1875)	302,000 (2080)
Over 0.130 (3.30) to 0.138 (3.50), incl.	230,000 (1585)	260,000 (1795)	290,000 (2000)
Over 0.138 (3.50) to 0.146 (3.71), incl.	228,000 (1570)	258,000 (1780)	288,000 (1985)
Over 0.146 (3.71) to 0.162 (4.11), incl.	226,000 (1560)	256,000 (1765)	286,000 (1970)
Over 0.162 (4.11) to 0.180 (4.57), incl.	224,000 (1545)	254,000 (1750)	284,000 (1960)
Over 0.180 (4.57) to 0.207 (5.26), incl.	222,000 (1530)	252,000 (1740)	282,000 (1945)
Over 0.207 (5.26) to 0.225 (5.72), incl.	218,000 (1505)	248,000 (1710)	278,000 (1915)
Over 0.225 (5.72) to 0.306 (7.77), incl.	213,000 (1470)	242,000 (1670)	272,000 (1875)
Over 0.306 (7.77) to 0.440 (11.2), incl.	207,000 (1425)	235,000 (1620)	265,000 (1825)
Over 0.440 (11.2) to 0.625 (15.88), incl.	203,000 (1400)	230,000 (1585)	260,000 (1795)

B Aged at 900º F (482º C) for one hour and air cooled.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
17-4PH Bar ASTM A564 UNS S17400	Age hardened. High tensile strength. Good for general corrosion resistance. No magnetism.	550°F	365/230	(E) 29 (G) 11.2	45%	.562" to 2.875"

SIZE CHART

Bar Diameter, inches	Bar Diameter, inches	Bar Diameter, inches	Bar Diameter, inches
.562	1.125	1.688	2.313
.625	1.188	1.750	2.375
.688	1.250	1.813	2.438
.750	1.313	1.938	2.500
.812	1.375	2.000	2.563
.875	1.438	2.063	2.625
.938	1.500	2.125	2.688
1.000	1.563	2.188	2.750
1.063	1.625	2.250	2.875

COMMENTS:
Material is produced in the “Cold Rolled” / Annealed condition. After coiling springs should be aged
to the H 900 condition. Rockwell C should average 44 R^C with an estimated tensile of 200 KSI.
As a general rule, bar lengths are 12 feet long. Some sizes are available up to 20 feet in length.
Check with a Suhm representative to verify lengths.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Alloy 20 Spring Tempered Wire ASTM B473 UNS N08020	Excellent mechanical properties and easily fabricated. Moderate to good corrosion resistance. Used extensively in petrochemical and refining applications.	-	200/125	(E) 29 (G) 10.9	45%	.025" to .362"

SIZE CHART

Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.
.025	.037	.050	.062	.077	.092	.113	.156
.026	.038	.051	.064	.078	.093	.115	.162
.027	.039	.052	.065	.080	.094	.118	.187
.028	.040	.053	.067	.082	.095	.120	.207
.029	.041	.054	.068	.083	.097	.125	.234
.030	.042	.055	.069	.084	.098	.128	.235
.031	.043	.056	.070	.085	.099	.129	.262
.032	.044	.057	.071	.086	.100	.135	.362
.033	.045	.058	.072	.088	.102	.138	
.034	.046	.059	.074	.089	.105	.140	
.035	.047	.060	.075	.090	.109	.142	
.036	.049	.061	.076	.091	.112	.148	

TENSILE STRENGTH CHART

Diameter, in.	Diameter, mm	Tensile Strength, ksi	
		minimum	maximum
Over 0.010 to 0.030	Over 0.254 to 0.762	200	230
Over 0.030 to 0.060	Over 0.762 to 1.52	195	225
Over 0.060 to 0.075	Over 1.52 to 1.90	190	220
Over 0.075 to 0.100	Over 1.90 to 2.54	185	215
Over 0.100 to 0.125	Over 2.54 to 3.18	180	210
Over 0.125 to 0.140	Over 3.18 to 3.56	170	200
Over 0.140 to 0.187	Over 3.56 to 4.75	160	190
Over 0.187 to 0.250	Over 4.75 to 6.35	150	180
Over 0.250 to 0.312	Over 6.35 to 7.92	135	165
Over 0.312 to 0.375	Over 7.92 to 9.52	125	155

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
A-286 Spring Tempered Wire AMS 5734 and others UNS S66286	Cold drawn. Good corrosion resistance. Good for use in elevated temperature applications.	900°F	200/160	(E) 29.1 (G) 10.4	45%	.040" to .295"

SIZE CHART

Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.
0.040		0.148		0.250
0.093		0.150		0.295
0.125		0.207		

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Phosphor Bronze Wire Grade A ASTM B159 H08 UNS C51000	Cold drawn. Good electrical conductivity. Good corrosion resistance.	200°F	145/105	(E) 15 (G) 6.25	40%	.010" to .468"

SIZE CHART

Wire Dia., in.		Wire Dia., in.		Wire Dia., in.		Wire Dia., in.		Wire Dia., in.		Wire Dia., in.		Wire Dia., in.		Wire Dia., in.
.010		.025		.045		.072		.109		.144		.204		.468
.012		.028		.051		.080		.114		.156		.244		
.015		.032		.057		.091		.120		.162		.250		
.018		.036		.062		.095		.125		.182		.312		
.020		.040		.064		.101		.128		.187		.406		

TENSILE STRENGTH CHART

Diameter, in.(mm)	Tensile Strength, PSI (Mpa), minimum	Elongation in 2 inches (50 mm) minimum, %
.025 and under	145.0 (1000)	....
over .025 to .0625 (.060 to 1.6)	135.0 (930)	....
over .0625 to .125 (1.6 to 3.0)	130.0 (890)	....
over .125 to .250 (3.0 to 6.0)	125.0 (850)	....
over .250 to .375 (6.0 to 10)	120.0 (830)	5.0
over .375 to .500 (10 to 16)	105.0 (720)	9.0

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Beryllium Copper Wire ASTM B197	Cold drawn. Good electrical conductivity. Good corrosion resistance.	400°F	230/150	(E) 18.5 (G) 7.2	45%	.010" to .468"

SIZE CHART

Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.
.010	.028	.052	.085	.187
.0113	.032	.055	.093	.468
.0126	.035	.057	.095	
.014	.040	.060	.099	
.016	.045	.064	.125	
.020	.050	.072	.156	
.025	.051	.080	.1645	

Comment
Beryllium Copper has several temper designations. The application
determines which temper to use. Call your Suhm representative for
details.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Inconel X-750 Spring Tempered Wire AMS 5698, AMS 5699 UNS N07750	Cold drawn, age hardened. Good corrosion resistance. Good for use in elevated temperature applications. Good for use in Sour-Gas applications.	700°F	230/180	(E) 29 (G) 11.2	45%	.005" to .750"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.005	.022	.044	.059	.114	.182	.281	.500
.007	.023	.045	.062	.115	.187	.295	.531
.008	.025	.047	.072	.125	.192	.312	.562
.010	.028	.050	.080	.135	.207	.331	.625
.012	.030	.051	.093	.144	.218	.343	.750
.014	.032	.052	.099	.148	.225	.362	
.015	.035	.054	.100	.156	.234	.375	
.016	.038	.055	.101	.162	.243	.406	
.018	.040	.057	.105	.172	.250	.437	
.020	.041	.058	.109	.177	.262	.468	

SS-X750
Suhm Coil Spring Works Wire Specification for Inconel X-750

Suhm Spring Specification	Heat Treat	Notes
SS-X750	1200F Min. / 4 Hrs. Min	Must meet and be certified to AMS-5699E Chemicals Only, Physical Properties are to meet SS-X750. Solution Heat Treat and Original Mill Required NACE MR-01-75

Physical Properties for SS-X750

Sizes	Min. Tensile	Min. Yield	Min. Elong. %	Min. R of A %	HRC Max.
0.0 - .125	220	200	4	20	50
.126 - .250	220	200	4	20	50
.251 - .437	210	190	6	20	50
.438 - .500	200	175	8	20	50
.501 - All	180	160	8	20	50

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

+Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Inconel X-750 Bar ASTM B637 UNS N07500	Cold drawn. Good corrosion resistance. Good for use in elevated temperature applications. Good for use in Sour-Gas applications.	700°F	170	(E) 29 (G) 11.2	45%	.750" to 2.500"

SIZE CHART

Bar Dia., in.		Bar Dia., in.		Bar Dia., in.		Bar Dia., in.
.750		1.125		1.375		2.250
.812		1.150		1.500		2.500
.956		1.187		1.625		
.968		1.312		1.750		
1.000		1.325		2.125		

Tensile and Hardness Requirements

Alloy	Heat Treatment	Tensile Strength, min, psi (Mpa)	Yield Strength (0.2% offset), min, psi (Mpa)	Elongation in 2 in. (50 mm) or 4D, min, %	Reduction of Area, min, %	Brinell Hardness
N07750 Type 2[c]	solution at 1800°F (982°C) + precipitation harden	170,000 (1170)	115,000 (790)	18	18	302 to 363

COMMENTS:
Material is produced in either the solution annealed or solution annealed/aged condition. This
specification only requires that minimum strength values be met. If necessary check with a Suhm
representative to attain actual capabilities for tensile and yield. Aging time and temperatures are
extensive (20 Hrs. @ 1300ºF) to produce the required strengths.
Bar lengths in general will average 12’ to 14’; however, Suhm maintains a stocking arrangement to
have available 10’ - 20’ lengths on some sizes. Some sizes are available in lengths up to 35'.
Check with a Suhm representative to verify sizes and lengths.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Inconel 600 QQ-W-390 UNS N06600	Cold drawn. Good corrosion resistance. Good for use in elevated temperature applications.	700°F	205/120	(E) 29 G) 11.0	45%	.005" to .750"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.005	.014	.025	.072	.135	.192	.343	.625
.007	.015	.032	.080	.148	.207	.375	.750
.008	.017	.045	.093	.156	.225	.406	
.009	.018	.050	.105	.162	.243	.437	
.010	.021	.054	.114	.177	.250	.500	
.012	.022	.062	.125	.187	.312	.562	

TENSILE STRENGTH CHART[A]

Diameter, in.(mm)	Tensile Strength, psi (Mpa)	
	minimum	maximum
Annealed		
Under 0.032 (0.81)	80,000 (552)	115,000 (793)
0.032 (0.81) and over	80,000 (552)	105,000 (724)
Cold-worked, regular temper, all sizes	120,000 (827)	
Cold-worked, spring temper	.....	165,000 (1138)
Up to 0.057 (1.45), incl.	185,000 (1276)	.....
Over 0.057 (1.45 to 0.114 (2.90), incl.	175,000 (1207)	.....
Over 0.114 (2.90) to 0.229 (5.82), incl.	170,000 (1172)	.....
Over 0.229 (5.82) to 0.329 (8.36), incl.	165,000 (1138)	.....
Over 0.329 (8.36) to 0.375 (9.53), incl.	160,000 (1103)	.....
Over 0.375 (9.53) to 0.500 (12.7), incl.	155,000 (1069)	.....
Over 0.500 (12.7) to 0.563 (14.3), incl.	140,000 (965)	.....

A Tensile strengths not available for sizes larger than .563".

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Inconel 625 Spring Tempered Wire ASTM B446 UNS N06625	Cold drawn. Good corrosion resistance. Good for use in elevated temperature applications.	-	120	(E) 29 (G) 11.0	45%	.012" to .175"

SIZE CHART

Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.
.012		.033		.092		.112		.148		.207
.023		.054		.104		.120		.160		.562
.029		.091		.105		.135		.177		

COMMENTS:
There is currently not a standard/specification which covers tensile/yield strength values for
spring tempered wire. Tensile strengths should be comparable to Inconel X750; however,
please check with a Suhm representative for actual strength values.
Larger sizes can be attained in the spring tempered condition. Check with a Suhm
representative for further information.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Inconel 718 Spring Tempered Wire ASTM B637 UNS N07718	Age hardened. Good corrosion resistance. Good for use in elevated temperature applications. No magnetism	1200°F	250/210	(E) 29 (G) 11.2	45%	.012" to .275"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.012	.029	.045	.062	.080	.098	.128	.179
.014	.030	.046	.063	.082	.099	.129	.180
.015	.031	.047	.064	.083	.100	.135	.182
.016	.032	.049	.065	.084	.102	.138	.187
.017	.033	.050	.066	.085	.105	.140	.192
.018	.034	.051	.067	.086	.107	.141	.200
.019	.035	.052	.068	.087	.109	.142	.202
.020	.036	.053	.069	.088	.110	.144	.207
.021	.037	.054	.070	.089	.112	.148	.218
.022	.038	.055	.071	.090	.113	.156	.225
.023	.039	.056	.072	.091	.115	.157	.234
.024	.040	.057	.074	.092	.118	.162	.244
.025	.041	.058	.075	.093	.120	.165	.250
.026	.042	.059	.076	.094	.122	.170	.262
.027	.043	.060	.077	.095	.125	.172	.275
.028	.044	.061	.078	.097	.127	.177	

COMMENTS:
There is currently not a standard/specification which covers tensile/yield strength values for spring tempered
wire. Tensile strength should be comparable to Inconel X750, however please check with a Suhm
representative for actual strength values.
Larger sizes can be attained in the spring tempered conditions. Also bar stock is available in the solution
annealed/aged condition. Check with a Suhm representative for further information.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Inconel 718 Bar ASTM B637 UNS N07718	Age hardened. Good corrosion resistance. Good for use in elevated temperature applications. No magnetism.	1200°F	250/210	(E) 29 (G) 11.2	45%	.234" to 1.500"

SIZE CHART

Bar Diameter, in.	Bar Diameter, in.	Bar Diameter, in.	Bar Diameter, in.
.234	.406	.687	.885
.250	.562	.734	1.420
.281	.573	.750	1.500
.359	.625	.875	

COMMENTS:
There is currently not a standard/specification which covers tensile/yield strength values for spring tempered wire. Tensile strength should be comparable to Inconel X750, however please check with a Suhm representative for actual strength values.
Larger sizes can be attained in the spring tempered conditions. Also bar stock is available in the solution annealed/aged condition. Check with a Suhm representative for further information.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
MP35N Spring Tempered Wire AMS 5844 UNS R30035	Cold drawn, age hardened. High strength. High modulus value and corrosion resistance. Great choice for severe spring applications. Good for applications involving the presence of Hydrogen Sulfide.	600°F	330/230	(E) 34 (G) 11.74	45%	.005" to .750"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.005	.017	.035	.058	.120	.177	.283	.562
.007	.018	.041	.062	.125	.187	.312	.625
.008	.021	.042	.072	.135	.192	.343	.750*
.009	.022	.044	.080	.142	.207	.375	
.010	.024	.045	.093	.148	.218	.406	
.012	.025	.048	.100	.156	.225	.437	
.014	.031	.050	.105	.162	.243	.468	
.015	.032	.054	.114	.172	.250	.500	

* Larger sizes available.

SS-MP35N
Suhm Coil Spring Works Wire Specification for MP35N

Suhm Spring Specification	Heat Treat	Notes
SS-MP35N	1200F Min. / 4 Hrs. Min.	Must meet and be certified to AMS-5844A Chemicals Only. Physical Properties are to meet SS-MP35N. Solution Heat Treat and Original Mill Required NACE MR-01-75-94. (55.0 HRC Max)

Physical Properties for SS-MP35N after Drawn and Aged

Sizes	Minimum Tensile Strength, ksi	Minimum Yield, ksi	Minimum Elongation, %	Minimum Reduction of Area, %	HRC
.001 - .005	300	280	1.0	Report	40 - 55
.006 - .100	290	280	4	20	40 - 55
.101 - .170	280	270	4	20	40 - 55
.171 - .250	260	240	5	20	40 - 55
.251 - .437	240	230	6	20	40 - 55
.438 - Over	230	220	8	20	40 - 55

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range, ksi min	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Elgiloy Spring Tempered Wire AMS 5834 UNS R30003	Cold drawn. Very high fatigue strength and long life.	600°F	350/220	(E) 29.5 (G) 11.5	45%	.005" to .750"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.005	.021	.041	.062	.105	.155	.243	.468
.007	.022	.044	.065	.107	.156	.250	.500
.008	.023	.045	.067	.109	.162	.263	.531
.009	.024	.047	.072	.110	.172	.275	.562
.010	.025	.048	.073	.113	.177	.306	.625
.012	.028	.049	.080	.114	.187	.307	.750
.013	.030	.050	.085	.120	.192	.312	
.014	.031	.051	.089	.125	.200	.331	
.015	.032	.054	.091	.135	.207	.343	
.016	.035	.055	.093	.141	.218	.375	
.017	.037	.058	.098	.142	.225	.406	
.018	.040	.060	.100	.148	.242	.437	

SS-ELGILOY
Suhm Coil Spring Works Wire Specification for Elgiloy

Suhm Spring Specification	Heat Treat	Notes
SS-ELGILOY	980F Min. / 5 Hrs. Min.	Must meet and be certified to AMS-5834A Chemicals Only. Physical Properties are to meet SS-Elgiloy. Solution Heat Treat and Original Mill Required NACE MR-01-75 (55.0 HRC Max.)

Physical Properties for SS-ELGILOY after Drawn and Aged

Sizes	Minimum Tensile Strength, ksi *	Minimum Yield Strength, ksi	Minimum Elongation, %	Reduction of Area, minimum, %	HRC
.001 - .005	330	290	1.5	Report	46 - 55
.006 - .100	300	290	1.5	Report	46 - 55
.101 - .125	290	280	4	20	46 - 55
.126 - .170	290	280	4	20	46 - 55
.171 - .250	260	240	4	20	46 - 55
.251 - .437	240	230	6	20	46 - 55
.438 - Over	230	220	8	20	46 - 55

* Tensile strengths are not specified for sizes greater than .562

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Monel 400 Spring Tempered Wire AMS 7233 or 4544, ASTM B164 UNS N04400	Cold drawn. Good corrosion resistance. Good for elevated temperature applications.	450°F	165/120	(E) 26 (G) 9.5	40%	.014" to .562"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.014	.052	.068	.085	.102	.140	.200	.331
.024	.053	.069	.086	.105	.142	.207	.343
.026	.054	.070	.088	.109	.148	.218	.362
.028	.055	.071	.089	.112	.156	.225	.375
.031	.056	.072	.090	.113	.162	.234	.393
.032	.057	.074	.091	.115	.168	.244	.406
.034	.058	.075	.092	.118	.170	.250	.437
.035	.059	.076	.093	.120	.172	.262	.468
.038	.060	.077	.094	.121	.177	.282	.500
.040	.061	.078	.095	.125	.179	.295	.562
.041	.062	.080	.097	.128	.180	.297	
.045	.064	.082	.098	.129	.182	.306	
.050	.065	.083	.099	.135	.187	.312	
.051	.067	.084	.100	.138	.192	.325	

MECHANICAL PROPERTIES OF COLD-WORKED WIRE IN COIL[A]

SPRING TEMPER

Diameter, in.(mm)	Tensile Strength, psi (Mpa)	
	minimum	maximum
0.028 (0.71) and less	165,000 (1138)	.....
Over 0.028 (0.71) to 0.057 (1.45), incl.	160,000 (1103)	.....
Over 0.057 (1.45) to 0.114 (2.90), incl.	150,000 (1034)	.....
Over 0.114 (2.90) to 0.312 (7.92), incl.	140,000 (965)	.....
Over 0.312 (7.92) to 0.375 (9.53), incl.	135,000 (931)	.....
Over 0.375 (9.53) to 0.500 (12.7), incl.	130,000 (896)	.....
Over 0.500 (12.7) to 0.563 (14.3), incl.	120,000 (827)	.....

A Properties are not applicable to wire after straightening and cutting

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Monel K-500 Spring Tempered Wire/Bar QQ-N-286 AMS 4676C UNS N05500	Cold drawn. Very high corrosion resistance. Good for use in elevated temperature applications.	500°F	195/140	(E) 26 (G) 9.5	40%	..018" to 2.00"

SIZE CHART

Wire Dia. in.	Wire Dia. in.	Wire Dia. in.	Wire Dia. in.	Wire Dia. in.	Wire Dia. in.	Wire Dia. in.
.018	.038	.105	.177	.268	.393	.531
.027	.041	.125	.184	.281	.406	.562
.031	.062	.135	.236	.312	.437	.625
.033	.072	.148	.250	.362	.468	
.034	.080	.162	.262	.437	.500	
Bar Dia. in.	**Bar Dia. in.**	**Bar Dia. in.**	**Bar Dia. in.**	**Bar Dia. in.**	**Bar Dia. in.**	**Bar Dia. in.**
.687	.750	.875	1.000	1.250	1.625	1.875
.718	.812	.937	1.125	1.500	1.750	2.000

SPECIFICATIONS FOR MONEL K-500

Element	Minimum	Maximum
Nickel + Cobalt	63.00	70.00
Aluminum	2.00	4.00
Titanium	1.025	1.00
Iron	….	2.00
Manganese	….	1.50
Silicon	….	1.00
Cobalt (3.1.1)	….	1.00
Carbon	….	0.25
Zinc (3.1.1)	….	0.02
Phosphorus (3.1.1)	….	0.02
Sulfur	….	0.010
Tin (3.1.1)	….	0.006
Lead (3.1.1)	….	0.006
Copper	Remainder	Remainder

TENSILE PROPERTIES

(after Precipitation Heat Treatment)

Tensile Strength, min	140,000 psi (965 Mpa)
Yield Strength at 0.2% Offset, min.	100,000 psi (690 Mpa)
Elongation in 2 in. (50.8 mm) or 4D, min	20% (3.3.1.2.1.1)

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Hastelloy C-276 Wire AMS B574 (Chem. only), AMS J470 UNS N10276	Good corrosion resistance to many acids and salts.	see comment	see comment	(E) 29.8 (G) 10.9	-	.012" to .437"

SIZE CHART

Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.	Wire Dia.,In.
.012	.029	.045	.062	.083	.102	.156	.250
.014	.030	.046	.064	.084	.105	.162	.262
.015	.031	.047	.065	.085	.109	.170	.282
.016	.032	.049	.067	.086	.112	.172	.297
.017	.033	.050	.068	.088	.113	.177	.306
.018	.034	.051	.069	.089	.115	.179	.312
.019	.035	.052	.070	.090	.118	.180	.331
.020	.036	.053	.071	.091	.120	.182	.343
.021	.037	.054	.072	.092	.125	.187	.362
.022	.038	.055	.074	.093	.128	.192	.375
.023	.039	.056	.075	.094	.129	.200	.393
.024	.040	.057	.076	.095	.135	.207	.406
.025	.041	.058	.077	.097	.138	.218	.437
.026	.042	.059	.078	.098	.140	.225	
.027	.043	.060	.080	.099	.142	.234	
.028	.044	.061	.082	.100	.148	.244	

COMMENTS:
Note: There is not a specification which covers tensile/yield values for spring
tempered wire. Check with a Suhm representative for actual strength values.
Larger size can be attained in spring tempered condition. Check with a
Suhm representative for further information.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Hastelloy B-2 ASTM B335 AMS J470 UNS N10665	Good corrosion resistance to many acids and salts.	see comment	see comment	(E) 28 (G) 8.0	-	.018" to .207

SIZE CHART

Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.		Wire Dia.,In.
.018		.030		.041		.109		.130		.177
.023		.032		.062		.120		.148		.193
.025		.038		.102		.128		.162		.207

COMMENTS:
Note: There is not a specification which covers tensile/yield values for spring
tempered wire. Check with a Suhm representative for actual strength values.
Larger size can be obtained in spring tempered condition. Check with a Suhm
representative for further information.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Titanium Beta-C AMS 4957 UNS R58640	Age hardened. Good ductility and toughness. Good fabricability, and good resistance to general corrosion. Good for environments containing Ferric Chloride, Sodium Chloride, Carbon Dioxide, and Hydrogen Sulfide.	600°F	190/180	(E) 15.4 (G) 5.9	45%	.005" to .625"

* Larger sizes are available.

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.005	.014	.025	.062	.125	.187	.312	.562
.007	.015	.032	.072	.135	.192	.343	.625
.008	.017	.045	.080	.148	.207	.375	
.009	.018	.048	.093	.156	.225	.406	
.010	.021	.050	.105	.162	.243	.437	
.012	.022	.054	.114	.177	.250	.500	

TENSILE STRENGTH CHART
VALUES INDICATE COLD DRAWN AND AGED MATERIAL

Nominal Diameter, inches	Tensile Strength, psi	Elongation in 4D %, minimum	Reduction of Area %, min.
Up to 0.187, incl.	190,000 - 210,000	10	20
Over 0.187 to 0.375, incl.	185,000 - 205,000	10	20
Over 0.375 to 0.625, incl.	180,000 - 200,000	8	20

COMMENTS:
Material has been cold drawn 20 - 35% final reduction. Additional cold reduction may be
possible to produce higher tensile/yield strength. Larger sizes can be obtained in spring
tempered and annealed condition. Check with a Suhm representative for size and tensile
strengths.

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
Titanium 6Al-4V AMS 4965 UNS 56400	Age hardened. Good ductility and toughness. Good fabricability, and good resistance to general corrosion.	-	165	(E) 15.0 (G) 5.0	40%	.020" to .250"

SIZE CHART

Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.	Wire Dia., in.
.020	.026	.037	.062	.105	.162	.193
.022	.028	.038	.069	.127	.163	.225
.024	.033	.040	.080	.135	.170	.250
.025	.036	.045	.090	.142	.177	

TENSILE PROPERTIES:
VALUES INDICATE COLD DRAWN AND AGED MATERIAL

Nominal Diameter, inches	Tensile Strength, minimum, psi	Elongation in 4D %, min.	Reduction of Area %, min.
Up to 0.500, incl.	165,000	10	20

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.

Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range (ksi min)	Modulus of Elasticity, psi 10^6	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes (inches)
H-12 Tungsten Bar ASTM A681 (Chem. only) UNS T20812	Good for high temperature applications.	700°F	187	(E) 30 (G) 11.0	45%	.500" to 2.250"

SIZE CHART

Bar Diameter, inches	Bar Diameter, inches	Bar Diameter, inches	Bar Diameter, inches
.500	.750	1.00	1.500
.531	.781	1.062	1.562
.562	.812	1.125	1.625
.593	.843	1.187	1.687
.625	.875	1.250	1.750
.656	.906	1.312	1.812
.687	.937	1.375	2.000
.718	.968	1.437	2.250

COMMENTS:
Material is produced in the “As Rolled” condition. Springs produced from wire size diameters
are "Cold Wound" and Tempered. Springs produced from bar size diameters are "Hot Wound",
quenched, and tempered. Each Hot Wound spring is hardness checked to insure proper
hardness. Tempered hardness should range between $41R^{\underline{C}}$ and $49R^{\underline{C}}$. Bar lengths
range from 15’ to 19’.
$41R^{\underline{C}}$ / = 187,000 psi tensile
$49R^{\underline{C}}$ / = 253,000 psi tensile

These data are provided as a reference guide only and are not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.