



SPRING MATERIALS

SIZES & STRENGTH VALUES

ISSUE 10b

English / Metric

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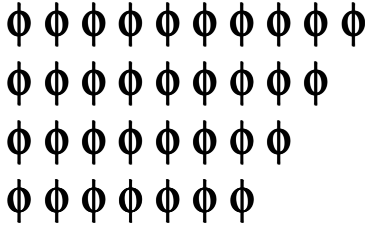
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The following is provided as a reference guide only, and not intended for design purposes. Strength values and sizes are subject to change. Please check with a Suhm Spring representative for confirmation.



Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Music Wire ASTM A228 UNS K08500 & G10860	Cold drawn. Constant tensile strength. High-quality and good for high cycle spring applications.	121 °C	3096/1586	(E) 206,8 (G) 79,3	45%	0,30 to 6,35

SIZE CHART

Wire Diameter, mm							
0,30	0,66	0,97	1,37	1,83	2,41	3,15	4,88
0,33	0,69	0,99	1,40	1,91	2,49	3,18	5,26
0,36	0,71	1,02	1,42	1,93	2,54	3,30	5,72
0,38	0,74	1,04	1,45	1,98	2,67	3,43	6,17
0,41	0,76	1,07	1,47	2,03	2,77	3,51	6,35*
0,43	0,79	1,12	1,50	2,08	2,79	3,76	
0,46	0,81	1,14	1,57	2,16	2,84	3,96	
0,51	0,84	1,19	1,60	2,29	2,87	4,11	
0,56	0,89	1,22	1,65	2,31	2,90	4,32	
0,61	0,91	1,27	1,70	2,36	3,00	4,50	
0,64	0,94	1,30	1,78	2,39	3,05	4,75	

* Sizes up to 7,19 mm diameter are available on request.

TENSILE STRENGTH CHART

Dia., mm	Tensile Strength, MPa		Dia., mm	Tensile Strength, MPa		Dia., mm	Tensile Strength, MPa		Dia., mm	Tensile Strength, MPa	
	min	max		min	max		min	max		min	max
0,10	3027	3344	0,56	2379	2634	1,50	2041	2255	3,18	1800	1986
0,13	2937	3247	0,61	2351	2599	1,60	2020	2234	3,30	1786	1972
0,15	2861	3165	0,66	2324	2572	1,70	1999	2213	3,43	1779	1765
0,18	2806	3096	0,71	2296	2537	1,83	1979	2186	3,56	1765	1951
0,20	2751	3041	0,76	2275	2517	1,93	1958	2165	3,68	1751	1937
0,23	2710	2992	0,81	2255	2489	2,03	1944	2151	3,81	1744	1924
0,25	2668	2951	0,86	2234	2468	2,16	1924	2124	3,96	1731	1910
0,28	2634	2910	0,91	2213	2448	2,29	1903	2103	4,11	1717	1896
0,30	2599	2875	0,97	2193	2427	2,41	1889	2089	4,50	1689	1862
0,33	2572	2841	1,02	2172	2406	2,54	1868	2068	4,88	1662	1841
0,36	2544	2813	1,07	2158	2386	2,59	1862	2062	5,26	1641	1820
0,38	2517	2785	1,14	2130	2358	2,72	1848	2041	5,72	1620	1793
0,41	2496	2758	1,22	2110	2337	2,79	1841	2034	6,35	1586	1758
0,46	2455	2710	1,30	2089	2310	2,84	1834	2027			
0,51	2413	2668	1,40	2068	2282	3,07	1813	1999			

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	121 °C	2227/862 (class I)	(E) 206,8k (G) 79,3k	45%	0,81 to 15,88

SIZE CHART

Wire Diameter, mm							
0,81	1,70	2,51	3,43	4,57	6,35	7,77	11,89
0,81	1,83	2,54	3,76	4,75	6,65	7,92	12,70
1,02	2,03	2,67	3,96	4,88	6,68	8,41	13,49
1,04	2,18	2,87	4,11	5,26	7,14	8,71	14,27
1,19	2,21	3,05	4,32	5,72	7,19	9,19	15,88
1,30	2,31	3,18	4,37	5,97	7,49	10,31	
1,47	2,36	3,25	4,50	6,17	7,67	11,10	

TENSILE STRENGTH CHART

Diameter, mm	Tensile Strength, MPa				Diameter, mm	Tensile Strength, MPa			
	Class I		Class II			Class I		Class II	
	min	max	min	max		min	max	min	max
0,51	2020	2227	2234	2227	3,43	1482	1655	1662	1655
0,58	1993	2199	2206	2199	3,76	1448	1620	1627	1620
0,66	1972	2179	2186	2179	4,11	1413	1586	1593	1586
0,74	1951	2158	2165	2158	4,50	1379	1551	1558	1551
0,81	1931	2137	2144	2137	4,88	1344	1517	1524	1517
0,89	1889	2096	2103	2096	5,26	1310	1482	1489	1482
1,04	1834	2041	2048	2041	5,72	1296	1469	1475	1469
1,22	1786	1993	1999	1993	6,20	1289	1469	1469	1462
1,37	1744	1951	1958	1951	6,35	1276	1448	1455	1448
1,57	1703	1910	1917	1910	7,92	1262	1434	1441	1434
1,83	1662	1868	1875	1868	9,53	1241	1413	1420	1413
2,03	1620	1827	1834	1827	11,13	1207	1379	1386	1379
2,34	1586	1793	1800	1793	12,70	1172	1344	1351	1344
2,69	1551	1758	1765	1758	14,27	1138	1310	1317	1310
3,05	1517	1724	1731	1724	15,88	1138	1310	1317	1310

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	218 °C	2241/1310	(E) 206,8k (G) 72,3k	45%	0,06 to 11,89

SIZE CHART

Wire Diameter, mm							
1,09	1,52	2,31	2,59	3,18	5,26	7,92	10,31
1,17	1,57	2,34	2,67	3,43	5,72	8,41	11,10
1,37	1,83	2,41	2,87	4,11	6,65	8,71	11,89
1,50	2,03	2,51	3,05	4,75	7,19	9,53	
Valve Quality							
Wire Diameter, mm							
1,50	2,41	3,43	4,11	5,26	7,19	8,71	
2,16	2,77	3,61	4,50	6,17	7,77		
2,29	3,18	3,76	4,88	6,65	8,41		

TENSILE STRENGTH CHART

Diameter, mm	Tensile Strength, MPa ^A		Reduction of Area, minimum, %	Diameter, mm	Tensile Strength, MPa ^A		Reduction of Area, minimum, %
	minimum	maximum			minimum	maximum	
0,51	2068	2241	C	4,11	1551	1689	40
.0,81	1999	2172	C	4,88	1517	1655	40
1,04	1931	2103	C	6,20	1448	1586	40
1,37	1862	2034	C	7,19	1413	1551	40
1,57	1827	1999	C	7,92	1400	1538	40
2,03	1758	1896	C	9,53	1379	1517	40
2,67	1689	1827	45	11,13	1344	1482	40
3,43	1620	1758	45	12,70	1310	1448	40

A Tensile strength values for intermediate diameters may be interpolated.

C The reduction of area test is not applicable to wire diameters under 2,34 mm.

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, MPa	Modulus of Elasticity, MPa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Chrome Silicon ASTM A401 UNS G92540	Cold drawn, Good for shock loads and medium elevated temperature applications. Susceptible to hydrogen embrittlement when plated.	246 °C	2068/1558	(E) 206,8k (G) 72,3k	45%	0,61 to 15,88

SIZE CHART

Wire Diameter, mm							
0,61	1,04	1,42	2,16	2,109	4,50	7,77	12,70
0,64	1,07	1,45	2,24	2,113	4,57	7,93	13,49
0,71	1,09	1,47	2,26	3,120	4,75	8,41	14,28
0,74	1,12	1,58	2,29	3,125	4,88	8,71	15,09
0,76	1,14	1,65	2,31	3,128	5,26	9,20	15,88
0,79	1,17	1,70	2,34	3,135	5,54	9,53	
0,84	1,19	1,83	2,36	3,142	5,72	10,01	
0,86	1,25	1,91	2,41	3,148	5,94	10,31	
0,91	1,27	1,93	2,49	3,156	6,17	10,69	
0,94	1,30	1,98	2,54	4,162	6,35	11,10	
0,97	1,35	2,03	2,59	4,167	6,66	11,51	
0,99	1,37	2,11	2,67	4,170	7,14	11,89	

TENSILE STRENGTH CHART

Diameter, mm ^A	Tensile Strength, MPa		Reduction of Area, min, %	Diameter, mm ^A	Tensile Strength, MPa		Reduction of Area, min, %
	minimum	maximum			minimum	maximum	
0,81	2068	2241	C	4,88	1793	1951	40
1,04	2055	2227	C	5,56	1758	1917	40
1,37	2013	2186	C	6,35	1724	1896	40
1,57	1999	2172	C	7,92	1689	1862	40
2,03	1965	2137	C	9,53	1655	1827	40
2,34	1931	2103	45	11,13	1620	1793	35
3,05	1896	2068	45	12,70	1586	1758	35
3,43	1862	2034	40	14,27	1572	1744	30
4,11	1827	1999	40	15,88	1558	1731	30
4,50	1793	1965	40				

A Tensile strength values for intermediate diameters may be interpolated,
 C The reduction of area test is not applicable to wire under 2,50 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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
5160-H ASTM A689, A29 UNS G51600	Hot-rolled special bar quality, fine grained. Good fatigue life.	204 °C	1669/1455	(E) 200k (G) 72.4k	45%	11,89 mm to 31,75 mm

Bar Diameter, mm				
11,89	15,88	19,84	23,80	28,58
12,70	16,66	20,63	24,59	30,15
13,49	17,45	21,41	25,40	31,75
14,28	18,24	22,23	26,21	
15,06	19,05	23,01	26,98	

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
51B60-H ASTM A689, A29 UNS 51601	Hot-rolled special bar quality, fine grained. Good fatigue life.	204 °C	1669/1455	(E) 207k G) 75.8k	45%	31,75 mm to 49,20 mm

Bar Diameter, mm				
31,75	36,50	41,28	46,03	49,20
33,33	38,10	42,85	46,81	
34,93	39,68	44,45	47,63	

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
4161-H ASTM A689, A29 UNS 41610	Hot-rolled special bar quality, fine grained. Good fatigue life.	204 °C	1669/1445	(E) 207k (G) 75.8k	45%	50,80 mm to 73,03 mm

Bar Diameter, mm				
50,80	60,33	65,08	69,85	
53,98	61,90	66,68	71,43	
57,15	63,50	68,25	73,03	

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 HRC 41 & HRC 49. If hardness exceeds HRC 49, brittle properties could be produced, increasing failure possibilities. Bar lengths in general range from 12,2 m 13,7 m.

HRC 41 = 1289 MPa tensile

HRC 49 = 1744 MPa 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 MPa	Modulus of Elasticity, MPa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes mm
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.	260 °C	2241/896	(E) 193k (G) 67,6k	40%	0,38 to 12,70

SIZE CHART

Wire Diameter, mm						
0,38	0,84	1,32	1,83	2,39	3,51	6,20
0,41	0,86	1,35	1,88	2,41	3,56	6,35
0,43	0,89	1,37	1,91	2,46	3,61	6,66
0,46	0,91	1,40	1,93	2,49	3,76	7,16
0,48	0,94	1,42	1,96	2,52	3,96	7,54
0,51	0,97	1,45	1,98	2,54	4,12	7,77
0,53	0,99	1,47	2,03	2,59	4,32	7,93
0,56	1,02	1,50	2,08	2,67	4,37	8,41
0,58	1,04	1,52	2,11	2,77	4,50	8,71
0,61	1,07	1,55	2,13	2,85	4,55	9,20
0,64	1,09	1,58	2,16	2,87	4,57	9,53
0,66	1,12	1,63	2,18	2,92	4,62	9,98
0,69	1,14	1,65	2,24	3,00	4,75	10,31
0,71	1,17	1,70	2,26	3,05	4,88	11,10
0,74	1,19	1,73	2,29	3,18	5,26	11,88
0,76	1,25	1,75	2,31	3,25	5,54	12,70
0,79	1,27	1,78	2,34	3,28	5,72	14,28
0,81	1,30	1,80	2,36	3,43	5,94	

TENSILE STRENGTH CHART

Diameter, mm ^A	Tensile Strength, MPa	
	minimum	maximum
Up to 0,23 incl.	2240	2450
Over 0,23 to 0,25 incl.	2205	2415
Over 0,25 to 0,28 incl.	2190	2400
Over 0,28 to 0,30 incl.	2180	2385
Over 0,30 to 0,33 incl.	2165	2370
Over 0,33 to 0,36 incl.	2150	2360
Over 0,36 to 0,38 incl.	2135	2345
Over 0,38 to 0,41 incl.	2125	2330
Over 0,41 to 0,43 incl.	2110	2315
Over 0,43 to 0,46 incl.	2095	2300
Over 0,46 to 0,51 incl.	2070	2275
Over 0,51 to 0,56 incl.	2040	2250
Over 0,56 to 0,61 incl.	2015	2220
Over 0,61 to 0,66 incl.	2005	2205
Over 0,66 to 0,71 incl.	1995	2190
Over 0,71 to 0,79 incl.	1965	2170
Over 0,79 to 0,86 incl.	1945	2135
Over 0,86 to 0,94 incl.	1930	2125
Over 0,94 to 1,04 incl.	1895	2095
Over 1,04 to 1,14 incl.	1875	2070
Over 1,14 to 1,27 incl.	1840	2035
Over 1,27 to 1,37 incl.	1825	2020
Over 1,37 to 1,47 incl.	1800	1990

Over 1,47 to 1,60 incl.	1780	1965
Over 1,60 to 1,78 incl.	1735	1935
Over 1,78 to 1,90 incl.	1725	1915
Over 1,90 to 2,03 incl.	1695	1895
Over 2,03 to 2,21 incl.	1670	1870
Over 2,21 to 2,41 incl.	1640	1850
Over 2,41 to 2,67 incl.	1600	1805
Over 2,67 to 2,92 incl.	1565	1770
Over 2,92 to 3,17 incl.	1530	1745
Over 3,17 to 3,43 incl.	1495	1710
Over 3,43 to 3,76 incl.	1450	1660
Over 3,76 to 4,11 incl.	1415	1620
Over 4,11 to 4,50 incl.	1365	1570
Over 4,50 to 4,88 incl.	1335	1550
Over 4,88 to 5,26 incl.	1295	1515
Over 5,26 to 5,72 incl.	1255	1475
Over 5,72 to 6,35 incl.	1205	1415
Over 6,35 to 7,06 incl.	1160	1365
Over 7,06 to 7,77 incl.	1110	1325
Over 7,77 to 8,41 incl.	1070	1280
Over 8,41 to 9,19 incl.	1035	1240
Over 9,19 to 10,0 incl.	1000	1205
Over 10,00 to 11,12 incl.	965	1170
Over 11,12 to 12,70 incl.	930	1150
Over 12,70	895	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 MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
AISI 316 Stainless Steel Wire ASTM A313 UNS S31600	Cold drawn. Better corrosion resistance than 302/304. Good for elevated temperatures. No magnetism.	285 °C	1689/758	(E) 193k (G) 67.6k	40%	0,43 to 14,3

SIZE CHART

Wire Diameter, mm									
0,43	0,74	0,99	1,30	1,70	2,16	2,67	3,61	5,54	7,93
0,46	0,76	1,02	1,37	1,73	2,18	2,62	3,76	5,72	8,41
0,51	0,79	1,04	1,40	1,78	2,24	2,77	3,96	5,94	8,71
0,56	0,81	1,07	1,42	1,83	2,29	2,85	4,12	6,35	9,20
0,58	0,84	1,09	1,45	1,93	2,31	2,92	4,37	6,66	9,53
0,61	0,86	1,12	1,47	1,98	2,39	3,00	4,50	7,16	10,31
0,64	0,89	1,14	1,50	2,03	2,41	3,05	4,75	7,19	11,10
0,66	0,91	1,19	1,52	2,08	2,49	3,18	4,88	7,42	11,89
0,69	0,94	1,25	1,58	2,11	2,54	3,43	5,16	7,62	12,70
0,71	0,97	1,27	1,65	2,13	2,57	3,51	5,26	7,77	14,28

TENSILE STRENGTH CHART

Diameter, mm	Tensile Strength, MPa ^A	
	minimum	maximum
Up to 0,25 incl.	1690	1895
Over 0,25 to 0,38 incl.	1655	1860
Over 0,38 to 0,61 incl.	1620	1825
Over 0,61 to 1,04 incl.	1620	1825
Over 1,04 to 1,19 incl.	1585	1790
Over 1,19 to 1,37 incl.	1550	1760
Over 1,37 to 1,57 incl.	1515	1725
Over 1,57 to 1,83 incl.	1480	1690
Over 1,82 to 2,03 incl.	1450	1655
Over 2,03 to 2,34 incl.	1415	1620
Over 2,34 to 2,67 incl.	1380	1585
Over 2,67 to 3,05 incl.	1345	1550
Over 3,05 to 3,76 incl.	1275	1480
Over 3,76 to 4,22 incl.	1240	1450
Over 4,22 to 4,50 incl.	1170	1380
Over 4,50 to 5,26 incl.	1105	1310
Over 5,26 to 5,72 incl.	1070	1275
Over 5,72 to 6,35 incl.	1035	1240
Over 6,35 to 7,92 incl.	965	1170
Over 7,92 to 9,53 incl.	930	1140
Over 9,53 to 12,70 incl.	895	1105
Over 12,70	850	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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	288 °C	1689/759	(E) 193,1k (G) 67,6k	40%	14,27 to 44,45

SIZE CHART

Bar Diameter, mm							
14,27	16,66	20,62	23,83	27,00	31,75	36,53	41,28
15,06	17,45	22,23	24,59	28,58	33,35	38,10	44,45
15,88	19,05	23,01	25,40	30,18	34,93	39,67	

TENSILE STRENGTH CHART

Diameter, mm	Tensile Strength, MPa minimum	Elongation in 50,80 mm or 4D, minimum %	Reduction of Area, minimum, %
up to 19,05	125	12	35
over 19,05 to 25,40	115	15	35
over 25,40 to 31,75	105	20	35
over 31,75 to 38,10	100	24	45
over 38,10 to 44,45	95	28	45

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	288 °C	1689/759	(E) 193,1k (G) 67,6k	40%	14,27 to 44,45

SIZE CHART

Bar Diameter, mm							
14,27	16,66	20,62	23,83	27,00	31,75	36,53	41,28
15,06	17,45	22,23	24,59	28,58	33,35	38,10	44,45
15,88	19,05	23,01	25,40	30,18	34,93	39,67	

TENSILE STRENGTH CHART

Diameter, mm	Tensile Strength, MPa minimum	Elongation in 50,80 mm or 4D, minimum %	Reduction of Area, minimum, %
up to 19,05	125	12	35
over 19,05 to 25,40	115	15	35
over 25,40 to 31,75	105	20	35
over 31,75 to 38,10	100	24	45
over 38,10 to 44,45	95	28	45

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 (Mpa min)	Modulus of Elasticity, Mpa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes mm
17-4PH Bar ASTM A564 UNS S17400 H900	Age hardened. High tensile strength. Good for general corrosion resistance. No magnetism.	288°C	1310	(E) 200k (G) 77,2k	45%	14,28 to 73,03

SIZE CHART

Bar Diameter, mm			
14,28	28,58	42,88	58,75
15,88	30,18	44,45	60,33
17,48	31,75	46,05	61,93
19,05	33,35	49,23	63,50
20,63	34,93	50,80	65,10
22,23	36,53	52,40	66,68
23,83	38,10	53,98	68,28
25,40	39,70	55,58	69,85
27,00	41,28	57,15	73,03

COMMENTS:

Material is produced in the "Cold Rolled" / Annealed condition. After coiling springs should be aged to the H 900 condition. Bars with hardness value of HRC 44 will have estimated tensile of 1379 Mpa.
As a general rule, bar lengths are 3,6m long. Some sizes are available up to 6,1m in length. Check with a Suhm representative to verify 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 MPa	Modulus of Elasticity, MPa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	-	1379/862	(E) 200k (G) 75,1k	45%	0,64 mm to 9,20 mm

SIZE CHART

Wire Diameter, mm							
0,64	0,94	1,27	1,58	1,96	2,34	2,87	3,96
0,66	0,97	1,30	1,63	1,98	2,36	2,92	4,12
0,69	0,99	1,32	1,65	2,03	2,39	3,00	4,75
0,71	1,02	1,35	1,70	2,08	2,41	3,05	5,26
0,74	1,04	1,37	1,73	2,11	2,46	3,18	5,94
0,76	1,07	1,40	1,75	2,13	2,49	3,25	5,97
0,79	1,09	1,42	1,78	2,16	2,52	3,28	6,66
0,81	1,12	1,45	1,80	2,18	2,54	3,43	9,20
0,84	1,14	1,47	1,83	2,24	2,59	3,51	
0,86	1,17	1,50	1,88	2,26	2,67	3,56	
0,89	1,19	1,52	1,91	2,29	2,77	3,61	
0,91	1,25	1,55	1,93	2,31	2,85	3,76	

TENSILE STRENGTH CHART

Diameter, mm	Tensile Strength, MPa	
	minimum	maximum
Over 0,254 to 0,762	1379	1586
Over 0,762 to 1,52	1345	1551
Over 1,52 to 1,90	1310	1517
Over 1,90 to 2,54	1276	1482
Over 2,54 to 3,18	1241	1448
Over 3,18 to 3,56	1172	1379
Over 3,56 to 4,75	1103	1310
Over 4,75 to 6,35	1034	1241
Over 6,35 to 7,92	931	1138
Over 7,92 to 9,52	862	1069

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
A-286 Spring Tempered Wire AMS 5734 and others UNS S66286	Cold drawn. Good corrosion resistance. Good for use in elevated temperature applications.	482°C	1379/1103	(E) 200k (G) 71.7k	45%	1,02 to 7,49

SIZE CHART

Wire Diameter, mm		
1,02	3,76	6,35
2,36	3,81	7,49
3,18	5,26	

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Phosphor Bronze Wire Grade A ASTM B159 H08 UNS C51000	Cold drawn. Good electrical conductivity. Good corrosion resistance.	93°C	1000/724	(E) 103,4k (G) 43,1k	40%	0,25 to 11,89

SIZE CHART

Wire Diameter, mm							
0,25	0,64	1,14	1,83	2,77	3,66	5,18	11,89
0,30	0,71	1,30	2,03	2,90	3,96	6,20	
0,38	0,81	1,45	2,31	3,05	4,11	6,35	
0,46	0,91	1,57	2,41	3,18	4,62	7,92	
0,51	1,02	1,63	2,57	3,25	4,75	10,31	

TENSILE STRENGTH CHART

Diameter, mm	Tensile Strength, Mpa, minimum	Elongation in 50,8 mm, %
0,64 and under	1000	....
over 0,64 to 1,57	930	....
over 1,57 to 3,18	890	....
over 3,18 to 6,35	850	....
over 6,35 to 9,53	830	5.0
over 9,53 to 12,70	720	9.0

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Beryllium Copper Wire ASTM B197	Cold drawn. Good electrical conductivity. Good corrosion resistance.	204 °C	1586/1034	(E) 127.5k (G) 49.6k	45%	0,25 to 11,89

SIZE CHART

Wire Diameter, mm				
0,25	0,71	1,32	2,16	4,75
0,29	0,81	1,40	2,36	11,89
0,32	0,89	1,45	2,41	
0,36	1,02	1,52	2,52	
0,41	1,14	1,63	3,18	
0,51	1,27	1,83	3,96	
0,64	1,30	2,03	4,18	

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Inconel X-750 Spring Tempered Wire 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.	371 °C	1586/1241	(E) 200k (G) 77.2k	45%	0,13 to 19,05

SIZE CHART

Wire Diameter, mm							
0,13	0,56	1,12	1,50	2,77	4,62	7,14	12,70
0,18	0,58	1,14	1,57	2,77	4,75	7,49	13,49
0,20	0,64	1,19	1,83	3,18	4,88	7,92	14,27
0,25	0,71	1,27	2,03	3,43	5,26	8,41	15,88
0,30	0,76	1,30	2,36	3,66	5,54	8,71	19,05
0,36	0,81	1,32	2,51	3,76	5,72	9,19	
0,38	0,89	1,37	2,54	3,96	5,94	9,53	
0,41	0,97	1,40	2,57	4,11	6,17	10,31	
0,46	1,02	1,45	2,67	4,37	6,35	11,10	
0,51	1,04	1,47	2,77	4,50	6,65	11,89	

SS-X750

Suhm Spring Works Wire Specification for Inconel X-750

Suhm Spring Specification	Heat Treat	Notes
SS-X750	649°C 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, mm	Min. Tensile, MPa	Min. Yield, MPa	Min. Elong. %	Min. R of A %	HRC Max.
0,13 - 3,18	1517	1379	4	20	50
3,20 - 6,35	1517	1379	4	20	50
6,38 - 11,10	1448	1310	6	20	50
11,13 - 12,70	1379	1207	8	20	50
12,73 - 19,05	1241	1103	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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	371 °C	1172	(E) 200k (G) 77,2k	45%	19,05 to 63,50

SIZE CHART

Bar Diameter, mm			
19,05	28,58	34,93	57,15
20,62	29,21	38,10	63,50
24,28	30,15	41,28	
24,59	33,32	44,45	
25,40	33,66	53,98	

Tensile and Hardness Requirements

Alloy	Heat Treatment	Tensile Strength, min, Mpa	Yield Strength (0.2% offset), min, Mpa	Elongation in 50 mm or 4D, min, %	Reduction of Area, min, %	Brinell Hardness
N07750 Type 2 ^c	solution at 982 °C + precipitation harden	1170	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 obtain actual capabilities for tensile and yield. Aging time and temperatures are extensive (20 Hrs. @ 704°C) to produce the required strengths.

Bar lengths in general will average 3,66 m to 4,27 m; however, Suhm maintains a stocking arrangement to have available 3,05 m - 6,10 m lengths on some sizes. Some sizes are available in lengths up to 10,67 m. 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, MPa	Modulus of Elasticity, MPa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Inconel 600 QQ-W-390 UNS N06600	Cold drawn, Good corrosion resistance. Good for use in elevated temperature applications.	371 °C	1413/827	(E) 200k G) 75,8k	45%	0,13 to 19,05

SIZE CHART

Wire Diameter, mm							
0,13	0,36	0,64	1,83	3,43	4,88	8,71	15,88
0,18	0,38	0,81	2,03	3,76	5,26	9,53	19,05
0,20	0,43	1,14	2,36	3,96	5,72	10,31	
0,23	0,46	1,27	2,67	4,11	6,17	11,10	
0,25	0,53	1,37	2,90	4,50	6,35	12,70	
0,30	0,56	1,57	3,18	4,75	7,92	14,27	

TENSILE STRENGTH CHART^A

Diameter, mm	Tensile Strength, Mpa	
	minimum	maximum
Annealed		
Under 0,81	552	793
0,81 and over	552	724
Cold-worked, regular temper, all sizes	827	
Cold-worked, spring temper	,,,,,,	1138
Up to 1,45 incl.	1276	,,,,,,
Over 1,45 to 2,90 incl.	1207	,,,,,,
Over 2,90)to 5,82 incl.	1172	,,,,,,
Over 5,82 to 8,36 incl.	1138	,,,,,,
Over 8,36 to 9,53 incl.	1103	,,,,,,
Over 9,53 to 12,7 incl.	1069	,,,,,,
Over 12,7 to 14,3 incl.	965	,,,,,,

^A Tensile strengths not available for sizes larger than 14,27 mm,

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Inconel 625 Spring Tempered Wire ASTM B446 UNS N06625	Cold drawn. Good corrosion resistance. Good for use in elevated temperature applications.	-	827	(E) 200k (G) 75,8k	45%	0,30 to 19,05

SIZE CHART

Wire Diameter, mm					
0,58	0,91	1,37	2,67	3,76	5,26
0,74	1,02	1,50	2,84	4,37	5,72
0,84	1,07	2,34	3,43	4,50	8,41

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 obtained 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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Inconel 718 Spring Tempered Wire ASTM B637 UNS N07718	Age hardened. Good corrosion resistance. Good for use in elevated temperature applications. No magnetism	649°C	1724/1448	(E) 200k (G) 77,2k	45%	0,30 to 6,99

SIZE CHART

Wire Diameter, mm							
0,30	0,74	1,14	1,57	2,03	2,49	3,25	4,55
0,36	0,76	1,17	1,60	2,08	2,51	3,28	4,57
0,38	0,79	1,19	1,63	2,11	2,54	3,43	4,62
0,41	0,81	1,24	1,65	2,13	2,59	3,51	4,75
0,43	0,84	1,27	1,68	2,16	2,67	3,56	4,88
0,46	0,86	1,30	1,70	2,18	2,72	3,58	5,08
0,48	0,89	1,32	1,73	2,21	2,77	3,61	5,13
0,51	0,91	1,35	1,75	2,24	2,79	3,66	5,26
0,53	0,94	1,37	1,78	2,26	2,84	3,76	5,54
0,56	0,97	1,40	1,80	2,29	2,87	3,96	5,72
0,58	0,99	1,42	1,83	2,31	2,92	3,99	5,94
0,61	1,02	1,45	1,88	2,34	3,00	4,11	6,20
0,64	1,04	1,47	1,91	2,36	3,05	4,19	6,35
0,66	1,07	1,50	1,93	2,39	3,10	4,32	6,65
0,69	1,09	1,52	1,96	2,41	3,18	4,37	6,99
0,71	1,12	1,55	1,98	2,46	3,23	4,50	

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes mm
Inconel 718 Bar ASTM B637 UNS N07718	Age hardened. Good corrosion resistance. Good for use in elevated temperature applications. No magnetism.	649 °C	1724/1448	(E) 200k (G) 77,2k	45%	5,94 to 38,10

SIZE CHART

Bar Diameter, mm			
5,94	10,31	17,45	22,48
6,35	14,27	18,64	36,07
7,14	14,55	19,05	38,10
9,12	15,88	22,23	

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, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	260 °C	1345/965	(E) 179,3k (G) 63,5k	45%	0,46 to 50,80

SIZE CHART

Wire Diameter, mm							
0,13	0,43	0,81	1,47	3,05	4,50	7,19	14,27
0,18	0,46	1,04	1,57	3,18	4,75	7,92	15,88
0,20	0,53	1,07	1,83	3,43	4,88	8,71	19,05*
0,23	0,56	1,12	2,03	3,61	5,26	9,53	
0,25	0,61	1,14	2,36	3,76	5,54	10,31	
0,30	0,64	1,22	2,54	3,96	5,72	11,10	
0,36	0,79	1,27	2,67	4,11	6,17	11,89	
0,38	0,81	1,37	2,90	4,37	6,35	12,70	

* Larger sizes available.

SS-MP35N

Suhm Spring Works Wire Specification for MP35N

Suhm Spring Specification	Heat Treat	Notes
SS-MP35N	649 °C 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. (HRC 55.0 Max)

Physical Properties for SS-MP35N after Drawn and Aged

Sizes	Minimum Tensile Strength, MPa	Minimum Yield, MPa	Minimum Elongation, %	Minimum Reduction of Area, %	HRC
0,03 - 0,13	2068	1931	1.0	Report	40 - 55
0,15 - 2,54	1999	1931	4	20	40 - 55
2,57 - 4,32	1931	1862	4	20	40 - 55
4,34 - 6,35	1793	1655	5	20	40 - 55
6,38 - 11,10	1655	1586	6	20	40 - 55
11,13 - 19,05	1586	1517	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, MPa	Modulus of Elasticity, MPa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Elgiloy Spring Tempered Wire AMS 5834 UNS R30003	Cold drawn, Very high fatigue strength and long life,	316°C	2413/1517	(E) 203,4k (G) 79,3k	45%	0,13 to 19,05

SIZE CHART

Wire Diameter, mm							
0,13	0,53	1,04	1,57	2,67	3,94	6,17	11,89
0,18	0,56	1,12	1,65	2,72	3,96	6,35	12,70
0,20	0,58	1,14	1,70	2,77	4,11	6,68	13,49
0,23	0,61	1,19	1,83	2,79	4,37	6,99	14,27
0,25	0,64	1,22	1,85	2,87	4,50	7,77	15,88
0,30	0,71	1,24	2,03	2,90	4,75	7,80	19,05
0,33	0,76	1,27	2,16	3,05	4,88	7,92	
0,36	0,79	1,30	2,26	3,18	5,08	8,41	
0,38	0,81	1,37	2,31	3,43	5,26	8,71	
0,41	0,89	1,40	2,36	3,58	5,54	9,53	
0,43	0,94	1,47	2,49	3,61	5,72	10,31	
0,46	1,02	1,52	2,54	3,76	6,15	11,10	

SS-ELGILOY

Suhm Coil Spring Works Wire Specification for Elgiloy

Suhm Spring Specification	Heat Treat	Notes
SS-ELGILOY	527°C 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-01-97 (HRC 60 Max.)

Physical Properties for SS-ELGILOY after Drawn and Aged

Sizes, mm	Minimum Tensile Strength, MPa *	Minimum Yield Strength, MPa	Minimum Elongation, %	Reduction of Area, minimum, %	HRC
0,03 - 0,00	2275	1999	1,5	Report	46 - 55
0,15 - 2,54	2068	1999	1,5	Report	46 - 55
2,57 - 3,18	1999	1931	4	20	46 - 55
3,20 - 4,32	1999	1931	4	20	46 - 55
4,34 - 6,35	1793	1655	4	20	46 - 55
6,38 - 11,10	1655	1586	6	20	46 - 55
11,13 - Over	1586	1517	8	20	46 - 55

* Tensile strengths are not specified for sizes greater than 14,27 mm

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Monel 400 Spring Tempered Wire AMS 7233 or 4544, ASTM B164 UNS N04400	Cold drawn. Good corrosion resistance. Good for elevated temperature applications.	232°C	1138/827	(E) 179.3k (G) 65.5k	40%	0,36 to 14,27

SIZE CHART

Wire Diameter, mm							
0,36	1,32	1,73	2,16	2,59	3,56	5,08	8,41
0,61	1,35	1,75	2,18	2,67	3,61	5,26	8,71
0,66	1,37	1,78	2,24	2,77	3,76	5,54	9,19
0,71	1,40	1,80	2,26	2,84	3,96	5,72	9,53
0,79	1,42	1,83	2,29	2,87	4,11	5,94	9,98
0,81	1,45	1,88	2,31	2,92	4,27	6,20	10,31
0,86	1,47	1,91	2,34	3,00	4,32	6,35	11,10
0,89	1,50	1,93	2,36	3,05	4,37	6,65	11,89
0,97	1,52	1,96	2,39	3,07	4,50	7,16	12,70
.1,02	1,55	1,98	2,41	3,18	4,55	7,49	14,27
1,04	1,57	2,03	2,46	3,25	4,57	7,54	
1,14	1,63	2,08	2,49	3,28	4,62	7,77	
1,27	1,65	2,11	2,51	3,43	4,75	7,92	
1,30	1,70	2,13	2,54	3,51	4,88	8,26	

MECHANICAL PROPERTIES OF COLD-WORKED WIRE IN COIL^A SPRING TEMPER

Diameter, mm	Tensile Strength, MPa	
	minimum	maximum
0,71 and less	1138	.....
Over 0,71 to 1,45 incl.	1103	.....
Over 1,45 to 2,90 incl.	1034	.....
Over 2,90 to 7,92 incl.	965	.....
Over 7,92 to 9,53 incl.	931	.....
Over 9,53 to 12,7 incl.	896	.....
Over 12,7 to 14,3 incl.	827	.....

A Properties are not applicable to wire after straightening and cutting

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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	1345/965	(E) 179,3k (G) 63,5k	40%	0,46 to 50,80

SIZE CHART

Wire Diameter, mm						
0,46	0,97	2,67	4,50	6,81	9,98	13,49
0,69	1,04	3,18	4,67	7,14	10,31	14,27
0,79	1,57	3,43	5,99	7,92	11,10	15,88
0,84	1,83	3,76	6,35	8,41	11,89	
0,86	2,03	4,11	6,65	9,19	12,70	
Bar Diameter, mm						
17,45	19,05	22,23	25,40	31,75	41,28	47,63
18,24	20,62	23,80	58,58	38,10	44,45	50,80

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	965 Mpa
Yield Strength at 0.2% Offset, min.	690 Mpa
Elongation in 50,8 mm or 4D, min	20% (3.3.1.2.1.1)

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp,	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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) 205,5k (G) 75,2k	-	0,30 to 11,10

SIZE CHART

Wire Diameter, mm							
0,30	0,74	1,14	1,57	2,11	2,59	3,96	6,35
0,36	0,76	1,17	1,63	2,13	2,67	4,11	6,65
0,38	0,79	1,19	1,65	2,16	2,77	4,32	7,16
0,41	0,81	1,24	1,70	2,18	2,84	4,37	7,54
0,43	0,84	1,27	1,73	2,24	2,87	4,50	7,77
0,46	0,86	1,30	1,75	2,26	2,92	4,55	7,92
0,48	0,89	1,32	1,78	2,29	3,00	4,57	8,41
0,51	0,91	1,35	1,80	2,31	3,05	4,62	8,71
0,53	0,94	1,37	1,83	2,34	3,18	4,75	9,19
0,56	0,97	1,40	1,88	2,36	3,25	4,88	9,53
0,58	0,99	1,42	1,91	2,39	3,28	5,08	9,98
0,61	1,02	1,45	1,93	2,41	3,43	5,26	10,31
0,64	1,04	1,47	1,96	2,46	3,51	5,54	11,10
0,66	1,07	1,50	1,98	2,49	3,56	5,72	
0,69	1,09	1,52	2,03	2,51	3,61	5,94	
0,71	1,12	1,55	2,08	2,54	3,76	6,20	

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 sizes can be attained in spring tempered condition. Check with a Suhm representative for further information.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Hastelloy B-2 ASTM B335 AMS J470 UNS N10665	Good corrosion resistance to many acids and salts.	see comment	see comment	(E) 193,1k (G) 55,2k	-	0,46 to 5,26

SIZE CHART

Wire Diameter, mm					
0,46	0,76	1,04	2,77	3,30	4,50
0,58	0,81	1,57	3,05	3,76	4,90
0,64	0,97	2,59	3,25	4,11	5,26

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.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
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.	316°C	1310/1241	(E) 106,2k (G) 40,7k	45%	0,13 to 15,88

* Larger sizes are available.

SIZE CHART

Wire Diameter, mm							
0,13	0,36	0,64	1,57	3,18	4,75	7,92	14,27
0,18	0,38	0,81	1,83	3,43	4,88	7,71	15,88
0,20	0,43	1,14	2,03	3,76	5,26	9,53	
0,23	0,46	1,22	2,36	3,96	5,72	10,31	
0,25	0,53	1,27	2,67	4,11	6,17	11,10	
0,30	0,56	1,37	2,90	4,50	6,35	12,70	

TENSILE STRENGTH CHART

VALUES INDICATE COLD DRAWN AND AGED MATERIAL

Nominal Diameter, mm	Tensile Strength, MPa	Elongation in 4D %, minimum	Reduction of Area %, min.
Up to 4,75 incl.	1310 - 1448	10	20
Over 4,75 to 9,53 incl.	1276 - 1413	10	20
Over 9,53 to 15,88 incl.	1241 - 1379	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.

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp.	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx. Design % of Ultimate Tensile (torsional)	Common Sizes, mm
Titanium 6Al-4V AMS 4965 UNS 56400	Age hardened. Good ductility and toughness. Good fabricability, and good resistance to general corrosion.	-	1138	(E) 103,4k (G) 34,5k	40%	0,51 to 6,35

SIZE CHART

Wire Diameter, mm						
0,51	0,66	0,94	1,57	2,67	4,11	4,90
0,56	0,71	0,97	1,75	3,23	4,14	5,72
0,61	0,84	1,02	2,03	3,43	4,32	6,35
0,64	0,91	1,14	2,29	3,61	4,50	

TENSILE PROPERTIES: VALUES INDICATE COLD DRAWN AND AGED MATERIAL

Nominal Diameter, mm	Tensile Strength, minimum, MPa	Elongation in 4D %, min.	Reduction of Area %, min.
Up to 6,35, incl.	1138	10	20

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Suhm Spring Works - Materials Properties

Material	Material Properties	Maximum Working Temp,	Ultimate Tensile Range, MPa	Modulus of Elasticity, MPa	Approx, Design % of Ultimate Tensile (torsional)	Common Sizes, mm
H-12 Tungsten Bar ASTM A681 (Chem, only) UNS T20812	Good for high temperature applications.	371 °C	1289	(E) 206,8k (G) 75,8k	45%	12,70 to 57,15

SIZE CHART

Bar Diameter, mm			
12,70	19,05	25,40	38,10
13,49	19,84	26,97	39,67
14,27	20,62	28,58	41,28
15,06	21,41	30,15	42,85
15,88	22,23	31,75	44,45
16,66	23,01	33,32	46,02
17,45	23,80	34,93	50,80
18,24	24,59	36,50	57,15

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 HRC 41 and HRC 49. Bar lengths range from 4,57 m to 5,79 m.

HRC 41 = 1289 MPa tensile
HRC 49 = 1744 MPa tensile

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