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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5678E

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Superseding AMS 5678D

Steel, Corrosion Resistant, Wire
17Cr - 7.1Ni - 1.1Al
Cold Drawn, Precipitation-Hardenable

(Composition similar to UNS S17700)

1. SCOPE:

1.1 Form::

This specification covers a corrosion-resistant steel in the form of wire, cold drawn to Condition C and capable of being precipitation heat treated to Condition CH900.

1.2 Application:

This wire has been used typically for springs requiring corrosion resistance and resistance to permanent set up to 600 °F (316 °C), but usage is not limited to such applications. Where parts require welding during fabrication, strength of this cold-drawn wire will be impaired.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2241	Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
MAM 2241	Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
AMS 2248	Chemical Check Analysis Limits, Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 (Continued):

AMS 2371 Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS 2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys

2.2 ASTM Publications::

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 370 Mechanical Testing of Steel Products

ASTM E 3 Preparation of Metallographic Specimens

ASTM E 353 Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	--	0.09
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	16.0	18.00
Nickel	6.50	7.75
Aluminum	0.75	1.50
Molybdenum	--	0.75
Copper	--	0.50

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2248.

3.2 Condition:

Solution annealed and cold reduced 60% minimum to the required size (Condition C).

3.2.1 Wire ordered for coiling on automatic spring-winding machines shall be coated with a suitable lubricant.

3.3 Properties:

Wire shall conform to the following requirements; tensile and wrapping testing shall be performed in accordance with ASTM A 370:

3.3.1 As Received (Condition C):

3.3.1.1 Tensile Properties: Shall be as shown in Table 2.

TABLE 2A - Tensile Strength, Condition C, Inch/Pound Units

Nominal Diameter Inch	Tensile Strength ksi, min	Tensile Strength ksi, max
0.007 to 0.010, incl	284	313
Over 0.010 to 0.015, incl	281	310
Over 0.015 to 0.020, incl	275	305
Over 0.020 to 0.025, incl	270	300
Over 0.025 to 0.029, incl	265	295
Over 0.029 to 0.041, incl	260	290
Over 0.041 to 0.051, incl	255	285
Over 0.051 to 0.061, incl	250	280
Over 0.061 to 0.071, incl	242	272
Over 0.071 to 0.086, incl	240	270
Over 0.086 to 0.090, incl	230	260
Over 0.090 to 0.100, incl	227	257
Over 0.100 to 0.106, incl	223	253
Over 0.106 to 0.130, incl	221	251
Over 0.130 to 0.138, incl	215	245
Over 0.138 to 0.146, incl	213	243
Over 0.146 to 0.162, incl	211	241
Over 0.162 to 0.180, incl	209	239
Over 0.180 to 0.207, incl	207	237
Over 0.207 to 0.225, incl	203	233
Over 0.225 to 0.306, incl	198	228
Over 0.306 to 0.440, incl	192	222
Over 0.440 to 0.625, incl	187	217

TABLE 2B - Tensile Strength, Condition C, SI Units

Nominal Diameter Millimeters			Tensile Strength MPa, min	Tensile Strength MPa, max
	0.18 to	0.25, incl	1958	2158
Over	0.25 to	0.38, incl	1937	2137
Over	0.38 to	0.51, incl	1896	2103
Over	0.51 to	0.64, incl	1862	2068
Over	0.64 to	0.74, incl	1827	2034
Over	0.74 to	1.04, incl	1793	2000
Over	1.04 to	1.30, incl	1758	1965
Over	1.30 to	1.55, incl	1724	1931
Over	1.55 to	1.80, incl	1669	1875
Over	1.80 to	2.18, incl	1655	1862
Over	2.18 to	2.29, incl	1586	1793
Over	2.29 to	2.54, incl	1565	1772
Over	2.54 to	2.69, incl	1538	1744
Over	2.69 to	3.30, incl	1524	1731
Over	3.30 to	3.50, incl	1482	1689
Over	3.50 to	3.71, incl	1469	1675
Over	3.71 to	4.11, incl	1455	1662
Over	4.11 to	4.57, incl	1441	1648
Over	4.57 to	5.26, incl	1427	1634
Over	5.26 to	5.72, incl	1400	1607
Over	5.72 to	7.77, incl	1365	1572
Over	7.77 to	11.18, incl	1324	1531
Over	11.18 to	15.88, incl	1289	1496

3.3.1.2 Wrapping: Wire shall withstand, without cracking, wrapping at 77 °F ± 9 (25 °C ± 5) one full turn around a diameter equal to the nominal diameter of the wire.

3.3.1.3 Coiling: Wire shall show a uniform pitch with no splits or fractures when wound in a tightly closed coil on an arbor of size shown in Table 3 and the resultant coil stretched to a permanent set of 4 times its as-wound length. This requirement shall apply only to wire having a nominal diameter of 0.125 inch (3.18 mm) and under.

TABLE 3A - Coiling Parameters, Inch/Pound Units

Nominal Diameter Inch	Arbor Diameter Inch
0.016 to 0.024, incl	0.067
Over 0.024 to 0.034, incl	0.102
Over 0.034 to 0.045, incl	0.145
Over 0.045 to 0.055, incl	0.212
Over 0.055 to 0.078, incl	0.250
Over 0.078 to 0.125, incl	0.328

TABLE 3B - Coiling Parameters, SI Units

Nominal Diameter Millimeters	Arbor Diameter Millimeters
0.41 to 0.61, incl	1.70
Over 0.61 to 0.86, incl	2.59
Over 0.86 to 1.14, incl	3.68
Over 1.14 to 1.40, incl	5.38
Over 1.40 to 1.98, incl	6.35
Over 1.98 to 3.18, incl	8.33

3.3.2 After Precipitation Heat Treatment: Shall be as follows, determined on wire precipitation heat treated to Condition CH900 by heating to 900 °F ± 10 (482 °C ± 6), holding at heat for 60 minutes ± 5, and cooling in air.

3.3.2.1 Tensile Properties: Shall be as shown in Table 4.

TABLE 4A - Tensile Strength, Condition CH900, Inch/Pound Units

Nominal Diameter Inch	Tensile Strength ksi, min	Tensile Strength ksi, max
0.007 to 0.010, incl	343	373
Over 0.010 to 0.015, incl	340	370
Over 0.015 to 0.020, incl	335	365
Over 0.020 to 0.025, incl	330	360
Over 0.025 to 0.029, incl	325	355
Over 0.029 to 0.041, incl	320	350
Over 0.041 to 0.051, incl	310	340
Over 0.051 to 0.061, incl	305	335
Over 0.061 to 0.071, incl	297	327
Over 0.071 to 0.086, incl	292	322
Over 0.086 to 0.090, incl	282	312
Over 0.090 to 0.100, incl	279	309
Over 0.100 to 0.106, incl	274	304
Over 0.106 to 0.130, incl	272	302
Over 0.130 to 0.138, incl	260	290
Over 0.138 to 0.146, incl	258	288
Over 0.146 to 0.162, incl	256	286
Over 0.162 to 0.180, incl	254	284
Over 0.180 to 0.207, incl	252	282
Over 0.207 to 0.225, incl	248	278
Over 0.225 to 0.306, incl	242	272
Over 0.306 to 0.440, incl	235	265
Over 0.440 to 0.625, incl	230	260

TABLE 4B - Tensile Strength, Condition CH900, SI Units

Nominal Diameter Millimeters			Tensile Strength MPa, min	Tensile Strength MPa, max
	0.18 to	0.25, incl	2365	2572
Over	0.25 to	0.38, incl	2344	2551
Over	0.38 to	0.51, incl	2310	2517
Over	0.51 to	0.64, incl	2275	2482
Over	0.64 to	0.74, incl	2241	2448
Over	0.74 to	1.04, incl	2206	2413
Over	1.04 to	1.30, incl	2137	2344
Over	1.30 to	1.55, incl	2103	2310
Over	1.55 to	1.80, incl	2048	2255
Over	1.80 to	2.18, incl	2013	2220
Over	2.18 to	2.29, incl	1944	2151
Over	2.29 to	2.54, incl	1924	2131
Over	2.54 to	2.69, incl	1889	2096
Over	2.69 to	3.30, incl	1875	2082
Over	3.30 to	3.50, incl	1793	2000
Over	3.50 to	3.71, incl	1779	1986
Over	3.71 to	4.11, incl	1765	1972
Over	4.11 to	4.57, incl	1751	1958
Over	4.57 to	5.26, incl	1738	1944
Over	5.26 to	5.72, incl	1710	1917
Over	5.72 to	7.77, incl	1669	1875
Over	7.77 to	11.18, incl	1620	1827
Over	11.18 to	15.88, incl	1586	1793

3.3.2.2 Microstructure: Wire shall exhibit a martensitic microstructure having no circumferential surface layer of retained austenite of depth equal to or greater than 0.002 inch (0.05 mm) or 5% of the wire diameter, whichever is smaller, and extending more than 45 degrees in any continuous arc, determined on a cross-section which is metallographically prepared in accordance with ASTM E 3, etched with Fry's Reagent (See 8.2), and examined at 100X magnification. Random patches of internal retained austenite, especially near the center of large diameter wire, are acceptable.

3.4 Quality:

3.4.1 Wire, as received by purchaser, shall be uniform in quality and condition, cylindrical, clean unless lubricated as in 3.2.1, and free from twists, splits, seams, and other imperfections detrimental to usage of the wire.