SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-W-21425B

Issued JAN 1999
Noncurrent OCT 2003
Cancelled FEB 2005

Superseded by MIL-W-21425

Wire, Steel, High Carbon, Square, Uncoated, For Mechanical Springs (General Purpose)

CANCELLATION NOTICE

This specification has been declared “CANCELLED” by the Aerospace Materials Division, SAE, as of February, 2005, and has been superseded by MIL-W-21425. The requirements of the latest issue of MIL-W-21425 shall be fulfilled whenever reference is made to the cancelled AMS-W-21425. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it has been superseded by MIL-W-21425.

Cancelled specifications are available from SAE.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE 100 Leading Our World In Motion

NONCURRENCY NOTICE

This specification has been declared “NONCURRENT” by the Aerospace Materials Division, SAE, as of October, 2003. It is recommended, therefore, that this specification not be specified for new designs.

“NONCURRENT” refers to those specifications which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these specifications for future use in new designs. “NONCURRENT” specifications are available from SAE upon request.

NOTICE

This document has been taken directly from U.S. Military Specification MIL-W-21425B and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-W-21425B. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE:

1.1 Scope:

This specification covers three types of uncoated, square (0.050 to 0.500 inches in width), high-carbon steel wire (see 6.1).

1.2 Classification:

Wire shall be of the following types, as specified (see 6.2):

Type I Oil tempered spring wire for the manufacture of springs which require no subsequent hardening.

Type II Hard drawn wire for the manufacture of springs which require no subsequent hardening.

Type III[1] Soft (0.55 to 0.75 carbon) wire for the manufacture of springs which are to be hardened after cold forming, furnished in two conditions as follows (see 6.1.3):

Condition A - Annealed at finished size

Condition B - Annealed and lightly drawn.

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

FED-STD-66 Steel; Chemical Composition and Hardenability
FED-STD-151 Metals; Test Methods

MIL-STD-129 Marking for Shipment and Storage
MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage

2.2 ASTM Publications:

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

ASTM A 318 Tension Testing of Steel Spring Wire

1. If a condition letter is not specified for type III wire, either condition A or condition B may be selected at the option of the spring manufacturer.

3. REQUIREMENTS:

3.1 Process:

The steel for the manufacture of the wire shall be made by the open-hearth, basic oxygen, or electric-furnace method.

3.2 Chemical composition:

The composition of the steel shall be as shown in table I, subject to the variations for check analysis given in table 4 of FED-STD-66.

TABLE I
CHEMICAL COMPOSITION (LADLE ANALYSIS)

Type	Carbon (%)	Manganese (%)	Silicon (%)	Phosphorus (max.) (%)	Sulfur (max.) (%)
I and III	0.55-0.75	0.60-1.20[1]	0.10-0.30	0.040	0.050
II	0.45-0.75[2]	0.60-1.20[3]	0.10-0.30	0.040	0.050

[1]For type III wire, manganese shall be between 0.80 and 1.20 percent for widths 3/16 inch and larger.

[2]Not varying more than 0.20 percent in any one lot.

[3]Not varying more than 0.30 percent in any one lot.

3.3 Defects:

The wire shall be free from cracks, pipes, and other detrimental imperfections (see 6.1).

3.4 Surface:

All wire shall be smooth and free from rust. Type I and type III, condition A, wire shall be free from excessive surface oxidation and shall be oiled or given an equivalent protective coating. Type II and type III, condition B, wire shall be free from scale or surface oxidation and shall be oiled.

3.5 Uniformity of form:

All wire shall be sufficiently uniform in quality and temper to permit manufacture of springs. The wire shall not be wavy or kinked.

3.6 Dimensions:

The wire shall be of the size specified, subject to the tolerances given in tables II and III.

3.7 Wrapping properties:

The wire shall be free from cracks after wrapping around a mandrel of the size shown in table IV. Unless otherwise specified (see 6.4), the wrapping test shall not be required for wire of widths over 0.312 inch or for type III material.

TABLE II
TOLERANCES FOR WIDTH AND OUT-OF-SQUARE
(All dimensions are in inches)

Width	Tolerance plus and minus	Out-of square maximum
0.050 to 0.071, incl	0.0015	0.0020
0.072 to 0.375, incl	0.0030	0.0040
0.376 to 0.500, incl	0.0045	0.0060

TABLE III
CORNER RADII
(All dimensions are in inches)

Width	Corner radius	
	Minimum	Maximum
0.050 to 0.125, incl	0.012	0.017
0.126 to 0.188, incl	0.020	0.025
0.189 to 0.250, incl	0.025	0.035
0.251 to 0.312, incl	0.030	0.040
0.313 to 0.500, incl	0.035	0.045

TABLE IV
MANDREL SIZE FOR WRAPPING TEST
(All dimensions are in inches)

Wire width	Diameter of mandrel
0.050 to 0.162, incl	Diagonal of wire
0.163 to 0.312, incl	Twice the diagonal of wire

3.8 Mechanical properties:

3.8.1 Type I wire: Type I wire shall be quenched and tempered to obtain the tensile strength specified in table V.

Table V
TENSILE STRENGTH, TYPE I WIRE

Width[1] (in.)	Tensile strength (psi)	
	Minimum	Maximum
0.050	253,000	283,000
0.054	247,000	277,000
0.062	241,000	271,000
0.072	235,000	265,000
0.080	230,000	260,000
0.091	225,000	255,000
0.105	220,000	250,000
0.120	215,000	240,000
0.135	210,000	235,000
0.148	205,000	230,000
0.162	200,000	225,000
0.177	195,000	220,000
0.192	190,000	215,000
0.207	188,000	213,000
0.225	185,000	210,000
0.250	183,000	208,000
0.312	180,000	205,000
0.375	175,000	200,000
0.437	170,000	195,000
0.500	165,000	190,000

[1]For widths other than those shown in table V, tensile strength shall be determined by interpolation.

3.8.2 Type II wire: Type II wire shall be cold drawn to obtain the tensile strength specified in table VI.

3.8.3 Type III wire:

3.8.3.1 Condition A: Type III, condition A, wire shall be annealed at finished size and shall have no cold work in the finished condition. The maximum tensile strength shall be 95,000 psi.

TABLE VI
TENSILE STRENGTH, TYPE II WIRE

Width[1] (in.)	Tensile strength (psi)	
	Minimum	Maximum
0.050	243,000	279,000
0.054	237,000	272,000
0.062	232,000	266,000
0.072	227,000	261,000
0.080	221,000	254,000
0.091	216,000	248,000
0.105	210,000	241,000
0.120	206,000	237,000
0.135	203,000	234,000
0.148	200,000	230,000
0.162	195,000	225,000
0.177	192,000	221,000
0.192	190,000	218,000
0.207	186,000	214,000
0.225	182,000	210,000
0.250	174,000	200,000
0.312	167,000	193,000
0.375	162,000	187,000
0.437	156,000	180,000
0.500	152,000	176,000

[1] For widths other than those shown in table VI, tensile strength shall be determined by interpolation.

3.8.3.2 Condition B: Type III, Condition B, wire shall be annealed and shall be given at least one pass through dies or rolls after the last annealing treatment. The minimum tensile strength shall be 100,000 psi and the maximum, 130,000 psi.

3.8.3.3 When heattreated: Type III, wire, when heattreated, shall develop the properties of table V.

3.9 Cast:

Type II wire shall be properly cast. When tested as specified in 4.5.4, wire shall lie substantially flat on itself and shall not spring up and show a wavy condition.

3.10 Coil sizes and weights:

Unless otherwise specified, wire shall be furnished in the coil diameters and weights specified in table VII for the appropriate wire size.

TABLE VII
APPROXIMATE COIL DIAMETERS AND WEIGHTS

Wire type	Wire size (in.)	Approx. mean coil diameter (in.)	Approx. coil weights (lb)
I	0.050-0.080	24, 22,16	75-300
	0.081-0.160	54, 48, 42, 36, 30	125-600
	0.161-0.375	60, 54, 48, 42, 36	150-600
	0.376-0.500	72, 60, 54	150-600
II and III	0.050-0.0625	22, 16	75-300
	0.063-0.1875	30, 28, 26, 24, 22	125-600
	0.188-0.375	36, 30, 28, 26, 24, 22	150-600
	0.376-0.500	36, 30, 28, 26	150-600

3.11 Identification marking:

Each coil shall have two substantial tags, printed with the name or trademark of the manufacturer, the specification number, the size, the type, and the condition.

3.12 Workmanship:

The wire shall be substantially uniform in quality and temper and shall not have imperfections of a nature or degree, for the grade and quality ordered, that will be detrimental to the forming or fabrication of finished parts.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.