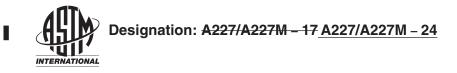
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# Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs<sup>1</sup>

This standard is issued under the fixed designation A227/A227M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\varepsilon$ ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

### 1. Scope\*

1.1 This specification covers two classes of round cold-drawn steel spring wire having properties and quality for the manufacture of mechanical springs, rings, and wire forms that are not subject to high stress or requiring high fatigue properties.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

### 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A510/A510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment

A751 Test Methods and Practices for Chemical Analysis of Steel Products

A764 Specification for Metallic Coated Carbon Steel Wire, Coated at Size and Drawn to Size for Mechanical Springs

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 American National Standard:

B32.100 Preferred Metric Sizes for Round, Square, Rectangle, and Hexagon Metal Products<sup>3</sup>

2.3 Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>4</sup>

### 3. Terminology

3.1 Definitions of Terms Specific to This Standard:

#### \*A Summary of Changes section appears at the end of this standard

<sup>&</sup>lt;sup>1</sup> This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.03 on Steel Rod and Wire.

Current edition approved Sept. 1, 2017 March 1, 2024. Published September 2017 April 2024. Originally approved in 1939. Last previous edition approved in 2017 as A227/A227M – 06 (2017). A227/A227M – 17. DOI: 10.1520/A0227\_A0227M-17.10.1520/A0227\_A0227M-24.

<sup>&</sup>lt;sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>&</sup>lt;sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

<sup>&</sup>lt;sup>4</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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3.1.1 For definition of terms used in this specification, refer to Terminology A941.

# 4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for material under this specification. Such requirement may include, but are not limited to, the following:

- 4.1.1 Quantity (mass),
- 4.1.2 Name of material (cold-drawn steel mechanical spring wire) and class (Table 1),
- 4.1.3 Wire diameter (Section 9),
- 4.1.4 Packaging (Section 15), and
  - 4.1.5 ASTM designation and date of issue.
  - 4.2 The purchaser shall have the option to specify additional requirements, including but not limited to:
  - 4.2.1 Requirements for certifications, heat analysis or test reports (see Section 14),
  - 4.2.2 Special packing, marking, and loading requirements (see Section 15), and
  - 4.2.3 Other special requirements, if any.

NOTE 1—A typical ordering description is as follows: 15 000 kg Cold-Drawn Mechanical Spring Wire, Class I, Size 5.00 mm in 700-kg coils to ASTM A227M dated\_\_\_\_\_\_, or for non-SI units, 30 000 lb Cold-Drawn Mechanical Spring Wire, Class I, Size 0.207 in. diameter in 500-lb1500-lb coils to ASTM A227 dated\_\_\_\_\_.

### 5. Manufacture

5.1 The steel may be made by any commercially accepted steel-making process. The rod to be used in the manufacture of wire furnished to this specification shall be in accordance with Specification A510/A510M.

- 5.2 The finished wire shall be free of detrimental pipe and undue segregation.
- 5.3 The wire shall be cold drawn to produce the desired mechanical properties.

### 6. Chemical Composition

- 6.1 The steel shall conform to the requirements for chemical composition prescribed in Table 2.
- 6.2 *Cast or Heat Analysis*—Each east or heat of steel shall be analyzed by the manufacturer to determine the percentage of elements prescribed in Table 2. This analysis shall be made from a test specimen preferably taken during the pouring of the cast or heat. When requested, this shall be reported to the purchaser and shall conform to the requirements of Table 2.

6.3 *Product Analysis*—An analysis may be made by the purchaser from finished wire representing each cast or heat of steel. The chemical composition thus determined, as to elements required or restricted, shall conform to the product analysis requirements specified in Table 3 of Specification A510/A510M.

6.4 For referee purposes, Test Methods, Practices, and Terminology A751 shall be used.

### 7. Mechanical Properties

7.1 Tension Test:

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# TABLE 1 Tensile Requirements<sup>A</sup>

		SI Units			
	Cla	ss I	Clas	Class II	
Diameter, <sup><i>B</i></sup> mm	Tensile Stre	ength, MPa	Tensile Str	ength MPa	
	min	max	min	max	
0.50	1960	2240	2240	2520	
0.55	1940	2220	2220	2500	
0.60	1920	2200	2200	2480	
0.65	1900	2180	2180	2460	
0.70	1870	2140	2140	2410	
0.80	1830	2100	2100	2370	
0.90	1800	2070	2070	2340	
1.00 1.10	1770 1740	2040 2000	2040 2000	2310 2260	
1.20	1720	1980	1980	2240	
1.40	1670	1930	1930	2180	
1.60	1640	1880	1880	2120	
1.80	1600	1840	1840	2080	
2.00	1580	1810	1810	2040	
2.20	1550	1780	1780	2010	
2.50	1510	1730	1730	1960	
2.80	1480	1700	1700	1920	
3.00	1460	1680	1680	1900	
3.50	1420	1630	1630	1840	
4.00	1380	1590	1590	1800	
4.50	1350	1550	1550	1750	
5.00	1320	1510	1510	1700	
5.50	1300	1490	1490	1670	
6.00	1280	1470	1470	1650	
6.50	1250	1440	1440	1630	
7.00	1220	1410	1410	1600	
7.50	1200	1390	1390	1580	
8.00	1190	1370	1370	1550	
9.00	1160	1340	1340	1520	
10.00	1130	1310	1310	1490	
11.00	1110	1280	1280	1450	
12.00 14.00	1090 1050	1260 1210	1260 1210	1430 1380	
16.00	1010	1170 D	1170	1330	
10.00		h-pound Units	Fevie	1000	
	Cla	Class I		Class II	
Diameter, in.		rength, ksi		rength, ksi	
0.020	min	max	7 <u>M min</u> 324	max	
0.020 sta0.023 rds/a	283 279 9 9	323 319 4 7 4	-4/320-81	364 25-360 62	
0.026	275	315	316	356	
0.029	271				
			312	352	
0.032		311 306	312 307	352 347	
0.032 0.035	266	306	307	347	
0.032 0.035 0.041	266 261	306 301	307 302	347 342	
0.035	266 261 255	306 301 293	307 302 294	347 342 332	
0.035 0.041 0.048	266 261	306 301 293 286	307 302 294 287	347 342 332 325	
0.035 0.041 0.048 0.054	266 261 255 248 243	306 301 293 286 279	307 302 294 287 280	347 342 332	
0.035 0.041 0.048	266 261 255 248	306 301 293 286	307 302 294 287	347 342 332 325 316	
0.035 0.041 0.048 0.054 0.062	266 261 255 248 243 237	306 301 293 286 279 272	307 302 294 287 280 273	347 342 332 325 316 308	
0.035 0.041 0.048 0.054 0.062 0.072	266 261 255 248 243 237 232	306 301 293 286 279 272 266	307 302 294 287 280 273 267	347 342 332 325 316 308 301	
0.035 0.041 0.048 0.054 0.062 0.072 0.080	266 261 255 248 243 237 232 227	306 301 293 286 279 272 266 261	307 302 294 287 280 273 267 262	347 342 325 316 308 301 296	
0.035 0.041 0.048 0.054 0.062 0.072 0.080 0.092	266 261 255 248 243 237 232 227 220	306 301 293 286 279 272 266 261 253	307 302 294 287 280 273 267 262 254	347 342 332 325 316 308 301 296 287	
0.035 0.041 0.048 0.054 0.062 0.072 0.080 0.092 0.106	266 261 255 248 243 237 232 227 220 216	306 301 293 286 279 272 266 261 253 248	307 302 294 287 280 273 267 262 254 254 249	347 342 332 316 308 301 296 287 281	
0.035 0.041 0.048 0.054 0.062 0.072 0.080 0.092 0.106 0.120	266 261 255 248 243 237 232 227 220 216 210	306 301 293 286 279 272 266 261 253 248 248 241	307 302 294 287 280 273 267 262 254 254 249 242	347 342 325 316 308 301 296 287 281 273	
0.035 0.041 0.048 0.054 0.062 0.072 0.080 0.092 0.106 0.120 0.135	266 261 255 248 243 237 232 227 220 216 210 206	306 301 293 286 279 272 266 261 253 248 241 237	307 302 294 287 280 273 267 262 254 249 249 242 238	347 342 325 316 308 301 296 287 281 273 269	
0.035 0.041 0.048 0.054 0.062 0.072 0.080 0.092 0.106 0.120 0.135 0.148	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195	306 301 293 286 279 272 266 261 253 248 241 237 234 237 234 230 225	307 302 294 287 280 273 267 262 254 249 242 238 238 235 231 226	347 342 332 325 316 308 301 296 287 281 273 269 266 261 256	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162	266 261 255 248 243 237 232 227 220 216 210 210 206 203 200	306 301 293 286 279 272 266 261 253 248 241 237 234 230	307 302 294 287 280 273 267 262 254 249 242 238 235 231	347 342 332 316 308 301 296 287 281 273 269 269 266 261	
0.035 0.041 0.048 0.054 0.062 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192 0.207	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192 190	306 301 293 286 279 266 261 253 248 241 237 234 234 230 225 221 218	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 222 219	347 342 332 316 308 301 296 287 281 273 269 266 261 256 251 247	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192	306 301 293 286 279 272 266 261 253 248 241 237 234 230 225 221 218 214	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 221 222 219 215	347 342 332 316 308 301 296 287 281 273 269 266 261 256 251	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192 0.207 0.225 0.250	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192 190 186 182	306 301 293 286 279 272 266 261 253 248 241 237 234 230 225 221 218 214 210	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 222 219 215 211	347 342 332 316 308 301 296 287 281 273 269 266 261 256 251 256 251 247 243 239	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192 0.207 0.225 0.250 0.312	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192 190 186 182 174	306 301 293 286 279 272 266 261 253 248 241 237 234 230 225 221 218 218 214 210 200	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 222 219 219 215 211 201	347 342 325 316 308 301 296 287 281 273 269 266 261 256 251 247 243 239 227	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192 0.207 0.225 0.250 0.312 0.375	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192 190 186 182 174	306 301 293 286 279 272 266 261 253 248 241 237 234 230 225 221 218 214 218 214 210 200 193	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 222 219 215 211 201 194	347 342 325 316 308 301 296 287 281 273 269 266 261 256 251 247 243 243 239 227 220	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192 0.207 0.225 0.250 0.312 0.375 0.438	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192 190 186 182 174 167 161	306 301 293 286 279 272 266 261 253 248 241 237 234 237 234 230 225 221 218 214 210 200 193 186	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 222 219 215 211 201 194 187	347 342 332 325 316 308 301 296 287 281 273 269 266 261 256 251 247 243 239 227 220 212	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192 0.207 0.225 0.250 0.312 0.375 0.438 0.500	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192 190 186 182 174 167 161	306 301 293 279 272 266 261 253 248 241 237 234 230 225 221 218 214 210 200 193 186 180	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 222 219 215 211 201 194 187 181	347 342 325 316 308 301 296 287 287 269 266 261 256 251 247 243 239 227 220 212 205	
0.035 0.041 0.048 0.054 0.072 0.080 0.092 0.106 0.120 0.135 0.148 0.162 0.177 0.192 0.207 0.225 0.250 0.312 0.375 0.438	266 261 255 248 243 237 232 227 220 216 210 206 203 200 195 192 190 186 182 174 167 161	306 301 293 286 279 272 266 261 253 248 241 237 234 237 234 230 225 221 218 214 210 200 193 186	307 302 294 287 280 273 267 262 254 249 242 238 235 231 226 222 219 215 211 201 194 187	347 342 332 325 316 308 301 296 287 281 273 269 266 261 256 251 247 243 239 227 220 212	

<sup>A</sup> Tensile strength values for intermediate diameters shall be interpolated.
<sup>B</sup> Preferred sizes. For a complete list, refer to ANSI/ASME B32.100, Preferred Metric Sizes for Round, Square, Rectangle, and Hexagon Metal Products.