



Designation: ~~A1007–15~~ A1007 – 22

## Standard Specification for Carbon Steel Wire for Wire Rope<sup>1</sup>

This standard is issued under the fixed designation A1007; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. ~~Scope~~ Scope\*

1.1 This specification covers uncoated and ~~four metallic coated~~ classes of round, ~~metallic coated~~, cold-drawn, carbon steel wire for wire rope in five strength levels. This specification specifies:

1.1.1 Dimensional tolerances,

1.1.2 Mechanical characteristics,

1.1.3 Chemical composition requirements,

1.1.4 Coating requirements (if applicable), and

1.1.5 Packaging requirements.

1.2 The values stated for ~~metric equivalents are provided for informational purposes only~~ in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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 This specification ~~incorporates, by dated or undated reference, incorporates~~ provisions from other publications. These normative references are cited at their appropriate place in the text and the publications are listed. ~~For dated references, subsequent amendments to or revisions of any of these publications apply to this specification only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to would apply.~~

2.2 *ASTM Standards:*<sup>2</sup>

~~A90/A90M~~ A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

~~A510/A510M~~ A510/A510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel (Metric)

~~A0510–A0510M~~ A0510–A0510M Steel, and Alloy Steel

<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.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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

[A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment](#)

[A902 Terminology Relating to Metallic Coated Steel Products](#)

[A938 Test Method for Torsion Testing of Wire](#)

[A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys](#)

[B6 Specification for Zinc](#)

[B750 Specification for GALFAN \(Zinc-5 % Aluminum-Mischmetal\) Alloy in Ingot Form for Hot-Dip Coatings](#)

[B899 Terminology Relating to Non-ferrous Metals and Alloys](#)

[B997 Specification for Zinc-Aluminum Alloys in Ingot Form for Hot-Dip Coatings](#)

[E8E8/E8M Test Methods for Tension Testing of Metallic Materials—Metric—E0008\\_E0008M](#)

[IEEE/ASTM-SI-10 Standard for Use of the International System of Units \(SI\): The Modern Metric System—American National Standard for Metric Practice](#)

~~2.3 ISO/EN Standards:<sup>3</sup>~~

~~EN 10264-1.2 Steel Wire and Wire Products—Steel Wire for Wire Rope~~

~~2.3 Industry Standard:~~

~~API 9A Specification for Wire Rope<sup>3</sup>~~

~~2.5 Industry References:<sup>5</sup>~~

~~AIIME/ISS Carbon Steel, Wire and Rods~~

~~AIAG 02.00 Primary Metals Identification Tag Application<sup>5</sup>~~

~~2.6 Non-Referenced Industry Applicable Standard:~~

~~ISO Std. 2232 Drawn Wire for General Purpose Non-Alloy Steel Wire Ropes<sup>3</sup>~~

### 3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, refer to Terminologies [B899](#), [A902](#), and [A941](#).

3.2 *Definitions: Definitions of Terms Specific to This Standard:*

3.2.1 *actual diameter, n*—the arithmetic mean of the minimum and maximum diameter measurements in one location on the wire.

3.2.2 *breaking forestrength level (Levels 1,2,3,4 or 5), n*—a wire strength based on the minimum load carrying capability of a designated wire.

3.2.3 *drawn-galvanized, drawn-metallic coated, n*—a zinc-pure zinc, Zn-5Al-MM (Type 5), Type 10, or Type 15 coating that is applied to the wire prior to the final cold drawing operation by either an electro-deposition or hot-galvanizinghot-dipping process.

3.2.4 *drawn-Zn5 Al-MM, final-metallic coated, n*—a zinc-aluminum alloy (misch-metal)-pure zinc, Zn-5Al-MM (Type 5), Type 10, or Type 15 coating that is applied to the wire prior to after the final cold drawing operation by a molten coating either an electro-deposition or hot-dipping process.

3.1.5 *final-coated Zn5 Al-MM, n*—a zinc-aluminum alloy (misch-metal) coating that is applied to the wire after the final cold drawing operation by a molten coating process.

3.1.6 *final-galvanized, n*—a zinc coating that is applied to the wire after the final cold drawing operation by either an electro-deposition or hot-galvanizing process.

3.2.5 *nominal diameter, n*—the diameter of the wire expressed in inches (millimetres)(millimeters) and specified by the user to designate the wire size. It is the basis for the determination of the values of all characteristics of the wire for acceptance purposes.

3.2.6 *ovality, n*—the arithmetic difference between the maximum diameter and the minimum diameter in one location on the wire; it shall not be greater than half the tolerance specified in the respective tables referred to in the following parts of this specification.wire.

3.2.7 *uncoated wire, n*—the surface of a carbon steel wire furnished with a residual lube film as a result of cold-drawing said wire.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>3</sup> Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, <http://api-ee.api.org><http://api.org>.

#### 4. Ordering Information

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

- 4.1.1 Quantity (mass),
- 4.1.2 Name of material (drawn steel wire for wire rope),
- 4.1.3 Wire type (uncoated, ~~drawn or final-galvanized~~/Zn5 Al-MM drawn-metallic coated, or final-metallic coated),
- 4.1.4 Wire diameter,
- 4.1.5 Wire strength grade (Level 1 through 5),
- 4.1.6 Packaging (Section 15),
- 4.1.7 Cast or heat analysis; if requested,
- 4.1.8 Certification or test report; if requested, and
- 4.1.9 ASTM designation and date of issue.

#### 5. Materials and Manufacture

5.1 The base metal rod used in the manufacture of rope wire shall be ~~rolled from good commercial quality steel. The steel may be either ingot cast made by any commercially accepted steel making process as specified by A510/A510M or strand cast.~~

5.2 A sufficient discard shall be made to ensure freedom from detrimental piping and undue segregation.

5.3 The wire shall be cold-drawn to produce the desired properties.

5.4 The wire shall be furnished in one of ~~five types, as specified;~~ the specified types:

- 5.4.1 Uncoated,
- 5.4.2 ~~Drawn-galvanized;~~
- 5.4.3 ~~Final-galvanized;~~
- 5.4.2 ~~Drawn Zn5/Al-MM;~~Drawn-metallic coated, and
- 5.4.3 ~~Final-coated Zn5/Al-MM;~~Final-metallic coated.

5.5 ~~Uncoated, drawn-galvanized and drawn-Zn5 Al-MM wire can be furnished in Levels 1 through 5. Final-galvanized and final-coated Zn5 Al-MM wire is usually furnished in Levels 1 through 4.~~

5.5 The method utilized in the production of either drawn- or final-galvanized wire types may be by an electro-deposition or hot-dip galvanizing process at the option of the producer.

5.5.1 The slab zinc used in galvanized zinc coatings shall be as specified in Specification B6.

5.6 The method utilized in the production of ~~Zn5 Al-MM~~ Zn-5Al-MM (Type 5), Type 10, or Type 15 wire types may be either a continuous hot-dip ~~alloy-metallic coating or two step coating where the first coating is zinc followed by a final bath having an aluminum content up to 7.2% up to the allowable aluminum content, as specified in B750 or B997, to prevent the depletion of the aluminum content of the bath.~~ aluminum within the bath during the coating process.

5.6.1 The bath metal used in continuous hot-dip ~~Zn-5 Al-MM alloy~~ Zn-5Al-MM (Type 5) metallic coating shall meet the chemical composition limits specified in Specification B750 or B997.

5.6.2 The bath metal used in continuous hot-dip Type 10 or Type 15 metallic coating shall meet the chemical composition limits specified in Specification B997.

## 6. Chemical Composition

6.1 Upon agreement with the purchaser, the wire manufacturer shall ~~apply~~ supply a steel of suitable chemical composition that will satisfy the properties of the material ordered.

6.2 A quantitative analysis of each cast or heat shall be made by the steel producer or ~~his~~ their representative to determine the percentage of the elements specified. The analysis shall be made from a test sample preferably taken during the pouring of the cast or heat. The chemical composition thus determined shall be reported, if required, to the purchaser or ~~his~~ their representative.

6.3 An analysis may be made by the purchaser from the finished wire. The chemical composition thus determined as to the elements required shall conform to the product analysis requirements specified in Table 3 of Specification ~~A510/A510M~~ A510/A510M or as agreed upon between the purchaser and the manufacturer.

## 7. Wire Diameter

7.1 The wire shall be measured using a micrometer with an minimum accuracy of 0.0001 in. (0.002 mm) for all diameters.

7.2 All diameter values measured in one location along the wire shall be within the tolerance limits given in Table 1 for uncoated and ~~drawn-galvanized or drawn~~ Zn5 Al-MM drawn-metallic coated rope wire or Table 2 for ~~final-galvanized or final-coated~~ Zn5 Al-MM final-metallic coated rope wire.

7.3 The measured ovality shall not be greater than half the tolerance limits specified in Table 1 for uncoated and drawn-metallic coated rope wire or Table 2 for final-metallic coated rope wire.

## 8. Tensile Properties

8.1 *Tensile Test Procedure:*

8.1.1 *Standard Testing Method*—The tensile test shall be carried out in accordance with Test Methods E8E8/E8M. The distance between the grips of the testing machine shall not be less than 8 in. (203 mm). The speed of the movable head of the testing

**TABLE 1 Wire Diameter Tolerances Uncoated and ~~Drawn-Galvanized or~~ Zn5 Al-MM Rope Wire**

Diameter Range, in.	Diameter Range, mm	Tolerance, in.		Tolerance, mm	
		Minus	Plus	Minus	Plus
0.010 to 0.025 incl.	0.25 to 0.64 incl.	0.0003	0.0007	0.01	0.02
Over 0.025 to 0.060 incl.	Over 0.64 to 1.50 incl.	0.0005	0.001	0.01	0.03
Over 0.060 to 0.093 incl.	Over 1.50 to 2.36 incl.	0.001	0.001	0.03	0.03
Over 0.093 to 0.142 incl.	Over 2.36 to 3.61 incl.	0.001	0.0015	0.03	0.04
Over 0.142 to 0.200 incl.	Over 3.61 to 5.08 incl.	0.0015	0.002	0.04	0.05
Over 0.200 to .250 incl.	Over 5.08 to 6.35 incl.	0.002	0.002	0.05	0.05

**TABLE 1 Wire Diameter Tolerances Uncoated and Drawn-Metallic Coated Rope Wire**

Diameter Range, in.	Diameter Range, mm	Tolerance, in.		Tolerance, mm	
		Minus	Plus	Minus	Plus
Up to 0.010 incl.	Up to 0.25 incl.	0.0003	0.0005	0.008	0.013
Over 0.010 to 0.025 incl.	Over 0.25 to 0.64 incl.	0.0003	0.0007	0.008	0.018
Over 0.025 to 0.060 incl.	Over 0.64 to 1.52 incl.	0.0005	0.001	0.013	0.025
Over 0.060 to 0.093 incl.	Over 1.52 to 2.36 incl.	0.001	0.001	0.025	0.025
Over 0.093 to 0.142 incl.	Over 2.36 to 3.61 incl.	0.001	0.0015	0.025	0.038
Over 0.142 to 0.200 incl.	Over 3.61 to 5.08 incl.	0.0015	0.002	0.038	0.051
Over 0.200 to 0.250 incl.	Over 5.08 to 6.35 incl.	0.002	0.002	0.051	0.051

**TABLE 2 Wire Diameter Tolerances Final-Galvanized or Final-Coated Zn5 Al-MM Rope Wire**

Diameter Range, in.	Diameter Range, mm	Tolerance, in.		Tolerance, mm	
		Minus	Plus	Minus	Plus
0.025 to 0.061 incl.	0.64 to 1.55 incl.	0.001	0.001	0.03	0.03
Over 0.061 to 0.079 incl.	Over 1.55 to 2.01 incl.	0.002	0.002	0.05	0.05
Over 0.079 to 0.092 incl.	Over 2.01 to 2.34 incl.	0.003	0.003	0.08	0.08
Over 0.092 to 0.103 incl.	Over 2.34 to 2.62 incl.	0.003	0.003	0.08	0.08
Over 0.103 to 0.119 incl.	Over 2.62 to 3.02 incl.	0.003	0.003	0.08	0.08
Over 0.119 to 0.142 incl.	Over 3.02 to 3.61 incl.	0.003	0.003	0.08	0.08
Over 0.142 to 0.187 incl.	Over 3.61 to 4.75 incl.	0.004	0.004	0.10	0.10
Over 0.187	Over 4.75	0.004	0.004	0.10	0.10

**TABLE 2 Wire Diameter Tolerances Final-Metallic Coated Rope Wire**

Diameter Range, in.	Diameter Range, mm	Tolerance, in.		Tolerance, mm	
		Minus	Plus	Minus	Plus
Up to 0.025 incl.	Up to 0.64 incl.	0.0007	0.0007	0.018	0.018
Over 0.025 to 0.061 incl.	Over 0.64 to 1.55 incl.	0.001	0.001	0.025	0.025
Over 0.061 to 0.079 incl.	Over 1.55 to 2.01 incl.	0.002	0.002	0.051	0.051
Over 0.079 to 0.142 incl.	Over 2.01 to 3.61 incl.	0.003	0.003	0.076	0.076
Over 0.142 to 0.250 incl.	Over 3.61 to 6.35 incl.	0.004	0.004	0.102	0.102

machine, under no load, shall not exceed  $\pm 1 \text{ in. in./min}$  ( $0.4 \text{ mm} (0.4 \text{ mm/s})$ ). Any specimen breaking within  $\pm 1 \text{ in.} (25.4 \text{ mm})$  of the jaws may be disregarded and a retest performed.

8.1.2 *Alternate Testing Method*—The tensile test shall be carried out in accordance with Test Methods **E8E8/E8M**. The loading rate may be greater than that specified, depending on the number of tests to be carried out for the batch inspection. However, it shall not exceed the rate corresponding to a 25 % elongation between anchorages in 1 min. The minimum distance between the clamping jaws of the test machine is 4 in. ( $100(102 \text{ mm})$ ). In the event of a dispute, the tensile test shall be carried out strictly in accordance with Test Methods **E8E8/E8M**, in particular with regard to the loading rate.

8.1.3 The minimum breaking forces are specified in **Table 3** of this specification for uncoated and metallic coated wire grade Levels 1 through 5. The range in breaking force for a given grade level is based on the calculated minimum tensile strength requirement (psi). While no maximum values are shown for breaking force, rope wire is generally produced to a tensile strength range of 30 000 psi unless an alternative is agreed upon between the purchaser and producer. The resultant minimum breaking force of either uncoated, drawn-galvanized, and drawn-Zn5 Al-MM strength of uncoated and drawn-metallic coated wires of various levels shall meet or exceed the values shown in **Table 3**. The resultant minimum breaking force for final-galvanized or final-coated Zn5 Al-MM strength for final-metallic coated wire is obtained by reducing the value stated for its level in **Table 3** for uncoated wire by 10 %. Minimum breaking strength and torsional values for wire diameters not specified within **Table 3** shall be agreed upon between the purchaser and producer.

**TABLE 3 Minimum Breaking Forces Rope Wire Breaking Strengths and Torsional Values**

Wire Diameter		Minimum Torsional Values (Number of Twists in 8 in.)					Minimum Breaking Force <sup>A</sup>									
in.	mm	Level 1	Level 2	Level 3	Level 4	Level 5	Level 1		Level 2		Level 3		Level 4		Level 5	
							lbf	N	lbf	N	lbf	N	lbf	N	lbf	N
0.010	0.254	274	254	234	218	190	16	70	17	80	20	90	22	100	24	110
0.011	0.279	249	231	213	196	173	18	90	21	100	24	110	27	120	29	130
0.012	0.305	228	212	195	182	158	22	100	25	120	29	130	32	150	31	160
0.013	0.330	211	196	180	168	146	26	120	29	140	34	150	37	170	41	180
0.014	0.356	196	181	167	156	136	31	140	34	160	39	180	43	200	45	210
0.015	0.381	182	169	156	145	126	36	180	39	180	45	200	49	220	53	240
0.016	0.408	174	156	146	136	118	40	180	41	200	51	230	56	250	60	270
0.016	0.406	171	156	146	136	118	40	180	41	200	51	230	56	250	60	270
0.017	0.432	161	149	137	126	111	48	200	50	230	57	260	63	290	68	300
0.018	0.467	152	144	130	121	105	50	230	53	250	64	290	71	320	76	340
0.018	0.457	152	141	130	121	105	50	230	53	250	64	290	71	320	76	340
0.019	0.483	144	133	123	114	100	56	250	62	260	72	320	79	360	85	380
0.020	0.508	136	126	116	108	94	60	280	69	310	79	360	87	390	94	420
0.021	0.533	130	120	111	103	90	68	310	73	340	87	390	96	430	100	450
0.022	0.559	124	115	106	96	86	75	340	83	360	96	430	110	490	110	490
0.023	0.584	118	110	101	94	82	80	370	91	410	100	450	120	540	120	540
0.024	0.610	113	105	97	90	78	85	400	100	450	110	490	130	580	130	580
0.025	0.635	109	101	93	86	75	90	430	110	490	120	540	140	630	150	670
0.026	0.660	105	97	89	83	72	100	450	130	540	130	560	150	670	160	720
0.026	0.660	105	97	89	83	72	100	450	115	540	130	560	150	670	160	720



