



Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes¹

This standard is issued under the fixed designation A 1023/A 1023M; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification covers the general requirements for the more common types of stranded steel wire ropes. Included in this specification are wire ropes in various grades and constructions from 1/4 in. (6 mm) to 2 3/8 in. (60 mm) manufactured from uncoated or metallic coated wire. Also included are cord products from 1/32 in. (0.8 mm) to 3/8 in. (10 mm) manufactured from metallic coated wire. For specific applications, additional or alternative requirements may apply.

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

2. Referenced Documents

2.1 *ASTM Standards:*²

A 931 Test Method for Tension Testing of Wire Ropes and Strand

A 1007 Specification for Carbon Steel Wire for Wire Rope

2.2 *ISO Standards:*³

ISO 2232 Round Drawn Wire for General-Purpose Non-alloy Steel Wire Ropes

ISO 3108 Steel Wire Ropes for General Purposes—Determination of Actual Breaking

3. Terminology

Description of Terms Specific to this Specification

3.1 *inserts, n*—fiber or solid polymer so positioned as to separate adjacent strands or wires in the same or overlying layers or to fill interstices of the rope.

3.2 Lubrication:

3.2.1 *impregnating compound, n*—material used in the manufacture of natural fiber cores, covers, or inserts for the purpose of providing protection against rotting and decay of the fiber material.

3.2.2 *preservation compound, n*—material, usually containing some form of blocking agent, applied during, after, or both during and after manufacture of the rope to fiber inserts, fillers, and coverings for the purpose of providing protection against corrosion.

3.2.3 *rope lubricant, n*—general term used to signify material applied during the manufacture of a strand, core, or rope for the purpose of reducing internal friction, providing protection against corrosion, or both.

3.3 *rope cores, n*—central element, usually of fiber or steel (but may be a combination of both), of a round rope around which are laid helically the strands of a stranded rope or the unit ropes of a cable-laid rope (Fig. 1).

3.3.1 *fiber core (FC), n*—an element made from either natural or synthetic fibers.

3.3.2 *solid polymer core, n*—a single element of solid polymer material that is either cylindrical or shaped (grooved). It may also include an element or elements of wire or fiber.

3.3.3 *steel core, n*—a stranded rope (IWRC), or a round strand (WSC) construction. The round strand or the stranded rope core or its outer strands, or both, may also be covered or filled with either fiber or solid polymer. Steel cores are normally made as a separate independent element, the exception being rope with a stranded rope core closed parallel with the outer strands.

3.4 *strand, n*—an element of rope normally consisting of an assembly of wires of appropriate shape and dimensions laid helically in one or more layers around a center. The center may consist of one round or shaped wire, of several round wires forming a built-up center, or of fiber or some other material. If multiple wires are used in a strand center, they may be counted as one wire.

3.4.1 Cross-Section Shape:

3.4.1.1 *compacted strand, n*—a strand that has been subjected to a compacting process such as drawing, rolling, or swaging (Fig. 2).

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² 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.

³ Available from International Organization for Standardization (ISO), 1 rue de Varembe, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.ch>.

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

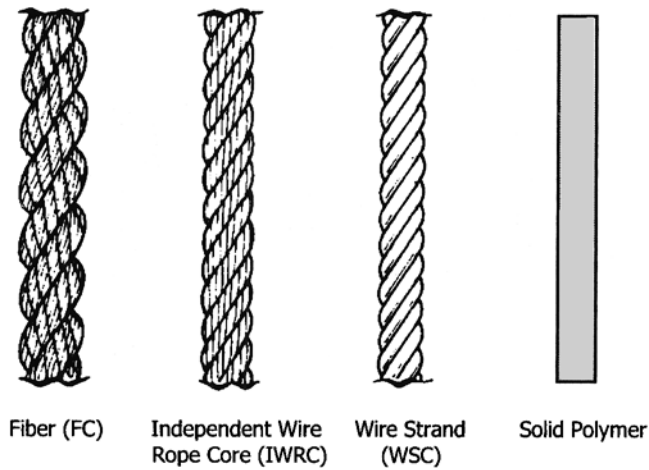


FIG. 1 Examples of Cores

3.4.1.2 *round strand, n*—strand having a perpendicular cross-section that is approximately the shape of a circle (Fig. 3).

3.4.1.3 *triangular strand, n*—strand having a perpendicular cross-section that is approximately the shape of a triangle (formerly referred to as flattened strand) (Fig. 4).

- (a) Style B—Solid center wire
- (b) Style G—3×2 or 3×2+3F center
- (c) Style H—3 or 3+3F center
- (d) Style V—1×7 center

3.4.2 *strand lay direction, n*—the direction right (z) or left (s) corresponding to the direction of lay of the outer wires in relation to the longitudinal axis of the strand (Fig. 5).

3.4.3 *Type and Constructions:*

3.4.3.1 *multiple operation lay, n*—construction containing at least two layers of wires in which successive layers are laid in more than one operation, with different lay lengths. There are two basic types of multiple operation strand:

(a) *compound lay, n*—strand that contains a minimum of three layers of wires where a minimum of one layer is laid in a separate operation, but in the same direction, over a parallel lay center.

(b) *cross-lay, n*—strand in which the wires are laid in the same direction. The wires of superimposed wire layers cross one another and make point contact.

3.4.3.2 *parallel lay, n*—strand that contains at least two layers of wires, all of which are laid in one operation (in the same direction). The lay length of all the wire layers is equal, and the wires of any two superimposed layers are parallel to each other, resulting in linear contact. There are four types of parallel lay constructions:

(a) *combined, adj*—describes a parallel lay construction having three or more layers laid in one operation and formed from a combination of the above, for example, Warrington-Seale construction (Fig. 6a).

(b) *filler (F), adj*—describes a construction having outer layer containing twice the number of wires than the inner layer, with filler wires laid in the interstices between the layers. Filler wires are designated with the letter “F” (Fig. 6b).

(c) *Seale (S), adj*—describes a construction having same number of wires in each layer, for example, 9-9-1 (Fig. 6c).

(d) *Warrington (W), adj*—describes a construction having outer (Warrington) layer containing alternately large and small wires and twice the number of wires as the inner layer. Warrington layers are designated by listing the number of large and small wires with a + sign in between and bracketing () the layer, for example, (6+6) (Fig. 6d).

NOTE 1—Strand construction is designated by listing the number of wires, beginning with the outer wires, with each layer separated by a hyphen.

3.4.3.3 *single lay, n*—strand that contains only one layer of wires.

3.5 *stranded wire rope, n*—an assembly of strands laid helically in one or more layers around a core. Exceptions are stranded wire ropes consisting of three or four outer strands that may or may not be laid around a core. Elements of stranded wire rope are shown in Fig. 7.

3.6 *Wires:*

3.6.1 *finish and quality of coating, n*—the condition of the surface finish of the wire, that is, uncoated or metallic coated (zinc or zinc alloy).

3.6.1.1 *metallic coated wire, n*—carbon steel wire that has a metallic coating.

(a) *drawn-galvanized wire, n*—coated carbon steel wire with a zinc coating applied prior to the final wire drawing operation, that is, galvanized in process.

(b) *drawn-Zn5/Al-MM wire, n*—coated carbon steel wire with a zinc-aluminum alloy (mischmetal) coating applied prior to the final wire drawing operation.

(c) *final-coated Zn5/Al-MM wire, n*—coated carbon steel wire with a zinc-aluminum alloy (mischmetal) coating applied after the final wire drawing operation.

(d) *final-galvanized wire, n*—coated carbon steel wire with a zinc coating applied after the final wire drawing operation, that is, galvanized at finished size.

3.6.1.2 *uncoated wire, n*—carbon steel wire that does not have a metallic coating. Commonly referred to as bright wire.

3.6.2 *Function:*

3.6.2.1 *filler wires, n*—comparatively small wires used in certain constructions of parallel lay ropes to create the necessary number of interstices for supporting the next layer of covering wires.

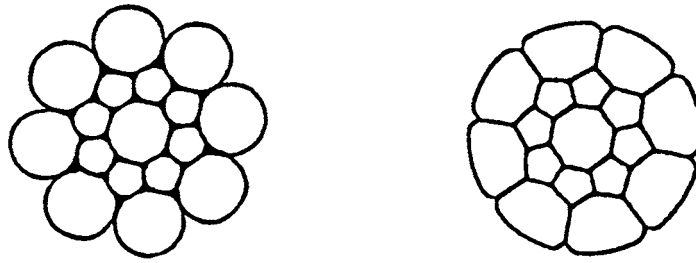
3.6.2.2 *load-bearing wires (main wires), n*—those wires in a rope that are considered as contributing toward the breaking force of the rope.

3.6.2.3 *non-load-bearing wires, n*—those wires in a rope that are considered as not contributing toward the breaking force of the rope.

3.6.2.4 *seizing (serving) wires or strands, n*—single wires or strands used for making a close-wound helical serving to retain the elements of a rope in their assembled position.

3.6.3 *layer of wires, n*—an assembly of wires having one pitch diameter. The exception is a Warrington layer comprising large and small wires where the smaller wires are positioned on a larger pitch circle than the larger wires. The first layer of wires is that which is laid over the strand center. Filler wires do not constitute a separate layer.

3.6.4 *Position:*



Strand Before Compacting

Strand After Compacting

FIG. 2 Compacted Round Strand—Before and After

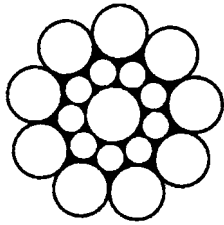


FIG. 3 Round Strand

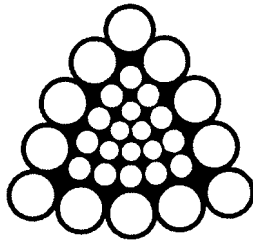


FIG. 4 Triangular Strand



Right Lay (z)



Left Lay (s)

FIG. 5 Lay Direction of Strands for Stranded Ropes

3.6.4.1 *center wires, n*—wires positioned at the center of a strand of a stranded rope.

3.6.4.2 *core wires, n*—all wires comprising the core of a stranded rope.

3.6.4.3 *inner wires, n*—all wires except center, filler, core, and outer wires in a stranded rope.

3.6.4.4 *outer wires, n*—all wires in the outer layer of the outer strands of a stranded rope.

Dimensional Characteristics

3.7 Diameter of Rope:

3.7.1 *diameter of plastic-coated rope, n*—the diameter that circumscribes the overall rope cross-section including the cover followed by the diameter, which circumscribes the underlying rope (for example, $\frac{3}{4} \times \frac{5}{8}$ in.).

3.7.2 *diameter of round rope, n*—the diameter (d) that circumscribes the rope cross-section. Diameter is expressed in inches or millimeters (Fig. 8).

3.8 Lay Length:

3.8.1 *rope lay length, n*—that distance measured parallel to the longitudinal rope axis in which the outer strands of a stranded rope or the component ropes of a cable-laid rope make one complete turn (or helix) about the axis of the rope (Fig. 9).

3.8.2 *strand lay length, n*—that distance measured parallel to the longitudinal strand axis, in which the wire in the strand makes one complete turn (or helix) about the axis of the strand. The lay length of a strand is that corresponding to the outer layers of wires (Fig. 9).

Manufacture (Rope)

3.9 Preformation:

3.9.1 *non-preformed rope, n*—rope in which the wires and strands in the rope will, after removal of any seizing (serving), spring out of the rope formation.

3.9.2 *preformed rope, n*—rope in which the wires and strands in the rope will not, after removal of any seizing (serving), spring out of the rope formation.

3.10 *prestretching, n*—the name given to a process that results in the removal of a limited amount of constructional stretch.

Mechanical Properties

3.11 Rope:

3.11.1 *actual (measured) breaking force, n*—breaking force obtained using the prescribed test method in Test Method A 931 or ISO 3108.

3.11.2 *calculated breaking force, n*—value of breaking force obtained from the sum of the measured breaking forces of the wires in the rope, before rope making, multiplied by the measured spinning loss factor as determined by the rope manufacturer's design.

3.11.3 *measured spinning loss factor, n*—ratio between the measured breaking force of the rope and the sum of the measured breaking forces of the wires, before rope making.