



# Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement<sup>1</sup>

This standard is issued under the fixed designation A 185; 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.

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

## 1. Scope

1.1 This specification covers welded wire fabric to be used for the reinforcement of concrete.

1.2 The values stated in inch-pound or SI units are to be regarded as standard. Within the text the inch-pound units are shown in parenthesis. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values may result in nonconformance with the specification.

## 2. Referenced Documents

### 2.1 ASTM Standards:

A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement<sup>2</sup>

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment<sup>3</sup>

### 2.2 Military Standards:

MIL-STD-129 Marking for Shipment and Storage<sup>4</sup>

MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage<sup>4</sup>

### 2.3 Federal Standard:

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

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *convoluted wire*—when wire for welded fabric is formed into a sinusoidal wave shape, it is commonly referred to as convoluted wire. The wire is used in the manufacture of cages for certain applications of concrete pipe reinforcing.

3.1.2 *welded wire fabric*—as used within the scope and intent of this specification, designates a material composed of cold-drawn steel wire, as-drawn or galvanized, fabricated into sheets or rolls by the process of electric resistance welding. The finished material shall consist essentially of a series of longi-

tudinal and transverse wires arranged substantially at right angles to each other, and welded together at points of intersection.

## 4. Ordering Information

4.1 Orders for material to this specification should include the following information:

4.1.1 Quantity (weight or square area),

4.1.2 Name of material (welded wire fabric for concrete reinforcement),

4.1.3 Wire spacings and sizes,

4.1.4 Minimum yield strength if Supplement S 1 of Specification A 82 applies.

4.1.5 Exclusion of oversteeling, if required (see 8.4.2),

4.1.6 Length and width of sheets or rolls,

4.1.7 Packaging (see Section 16), and

4.1.8 ASTM designation and year of issue.

NOTE 1—A typical ordering description is as follows: 10 000 ft<sup>2</sup> welded wire fabric for concrete reinforcement, 4 × 12-W15 × W 6, in flat sheets 96 in. wide by 240 in. long, in secured lifts, to ASTM A 185—\_\_\_\_\_.

## 5. Materials

5.1 The wire used in the manufacture of welded wire fabrics shall conform to Specification A 82 and its Supplement S1 if so ordered.

5.2 Welded wire fabric shall be furnished either in flat sheets, or in rolls, as specified by the purchaser.

## 6. Manufacture

6.1 The wires shall be assembled by automatic machines or by other suitable mechanical means which will assure accurate spacing and alignment of all members of the finished fabric.

6.2 Longitudinal and transverse members shall be securely connected at every intersection by a process of electrical-resistance welding which employs the principle of fusion combined with pressure.

6.3 Wire of proper grade and quality when fabricated in the manner herein required shall result in a strong, serviceable mesh-type product having substantially square or rectangular openings. It shall be fabricated and finished in a workmanlike manner, shall be free from injurious defects, and shall conform to this specification.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.05 on Steel Reinforcement.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.04.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.05.

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

NOTE 2—A variation of manufacturing includes the application of one or more longitudinal convoluted wires at one edge of fabric for concrete pipe reinforcing cages. This shape allows the cage ends to be expanded to a larger diameter to accommodate the bell-shaped ends of concrete pipe.

**7. Mechanical Property Requirements**

7.1 *Tensile*—Wire for the production of welded wire fabric is described in Specification A 82. Tensile tests may be made on wire cut from the welded wire fabric and tested either across or between the welds; no less than 50 % shall be across welds. Tensile tests across a weld shall have the welded joint located approximately at the center of the wire being tested and the cross wire forming the welded joint shall extend approximately 25 mm (1 in.) beyond each side of the welded joint.

NOTE 3—Tensile, reduction of area, and bend testing are normally done at the time the wire is drawn. The manufacturer’s finished product still must satisfy the mechanical properties when tested after fabrication.

7.2 *Reduction of Area*—The ruptured section of the tensile specimen is measured to determine this property. In the case of a specimen which has been tested across a weld, the measurement shall be made only when rupture has occurred at a sufficient distance from the center of a weld to permit an accurate measurement of the fractured section. The wire shall meet the minimum reduction of area requirements of Specification A 82.

7.3 *Bend Test*—The wire shall withstand the bend test as described in Specification A 82 and shall be performed on a specimen taken from between the welds.

7.4 *Weld Shear Strength*—The weld shear strength between longitudinal and transverse wires shall be tested as described in Section 11. The minimum average shear value in Newtons shall be not less than 241 multiplied by the nominal area of the larger wire in square millimetres (or in pounds-force shall not be less than 35 000 multiplied by the nominal area of the larger wire in square inches). Typical examples of the 40 % or more wire size differential area as follows:

Larger	Smaller
Size No. W 20	Size No. W 8
Size No. W 15	Size No. W 6
Size No. W 10	Size No. W 4

7.4.1 Fabric having a relationship of longitudinal and transverse wires other than those covered in 7.4 shall not be subject to the weld shear requirement.

7.4.2 Weld-shear tests for determination of conformance to the requirements of 7.4 shall be conducted using a fixture as described in Section 11.

7.4.3 Four welds selected at random from the specimen described in 11.2 shall be tested for weld shear strength. The transverse wire of each test specimen shall extend approximately 25 mm (1 in.) on each side of the longitudinal wire. The longitudinal wire of each test specimen shall be of such length below the transverse wire so as to be adequately engaged by the grips of the testing machine. It shall be of such length above the transverse wire that its end shall be above the center line of the upper bearing of the testing device.

7.4.4 The material shall be deemed to conform to the requirements for weld shear strength if the average of the four samples complies with the value stipulated in 7.4. If the average fails to meet the prescribed value, all the welds across

the specimen shall then be tested. The fabric will be acceptable if the average of all weld shear test values across the specimen meets the prescribed minimum value.

**8. Dimensions, Mass, and Permissible Variations**

8.1 *Width*—The width of fabric shall be considered to be the center-to-center distance between outside longitudinal wires. The permissible variation shall not exceed 13 mm (½ in.) greater or less than the specified width. In case the width of flat sheets or rolls is specified as the overall width (tip-to-tip length of cross wires), the width shall not vary more than ±25 mm (±1 in.) from the specified width.

8.2 *Length*—The overall length of flat sheets, measured on any wire, may vary ±25 mm (±1 in.), or 1 %, whichever is greater.

8.3 Overhang of the transverse wires shall not project beyond the centerline of each longitudinal edge wire more than a distance of 25 mm (1 in.), unless otherwise specified. When transverse wires are specified to project a specific length beyond the center line of a longitudinal edge wire, the permissible variation shall not exceed 13 mm (½ in. ) greater or less than the specified length.

8.4 The permissible variation in diameter of any wire in the finished fabric shall conform to the tolerances prescribed for the wire before fabrication, in Specification A 82, with the following exceptions:

8.4.1 Because of the mechanical characteristics of fabricating welded wire fabric, the out-of-round requirements shall not apply.

8.4.2 Unless otherwise precluded by the purchaser, the manufacturer will be permitted to apply over-sized wire (not under-sized). The size differential shall not exceed one “W” size increment on sizes W 8 and smaller, and two “W” size increments on sizes larger than W 8. A “W” size increment is a whole number increment, for example, W 5 to W 6, or W 5.4 to W 6.4, etc. In all cases where such over-steeling is practiced, the producer shall identify the fabric with the style originally ordered.

8.5 The average spacing of wires shall be such that the total number of wires contained in a sheet or roll is equal to or greater than that determined by the specific spacing, but the center-to-center distance between individual members may vary not more than 6.35 mm (¼ in.) from the specified spacing. It is understood that sheets of fabric of the specified length may not always contain an identical number of transverse wires and, therefore, may have various lengths of longitudinal overhang.

**9. Workmanship, Finish, and Appearance**

9.1 Wire of proper grade and quality, when fabricated in the manner herein required, shall result in a strong, serviceable mesh-type product having substantially square or rectangular openings. It shall be fabricated and finished in a workmanlike manner, as determined by visual inspection, and shall conform to this specification.

**10. Number of Tests**

10.1 One test for conformance to tensile strength and bend requirements shall be made for each 6 968 m<sup>2</sup>(75 000 ft<sup>2</sup>) of fabric or remaining fraction thereof.

10.2 One test for conformance to weld shear strength requirement shall be made for each 27 870 m<sup>2</sup>(300 000 ft<sup>2</sup>) or remaining fraction thereof.

**11. Weld Shear Test Apparatus and Methods**

11.1 As the welds in welded wire fabric contribute to the bonding and anchorage value of the wires in concrete, it is imperative that the weld acceptance tests be made in a jig that will stress the weld in a manner similar to which it is stressed in concrete. In order to accomplish this the vertical wire in the jig must be stressed in an axis close to its center line. Also the horizontal wire must be held closely to the vertical wire, and in the same relative position, so as to prevent rotation of the horizontal wire. When the fabric is designed with different wire sizes, the larger diameter wire is the “vertical wire” when tested (see Fig. 1<sup>5</sup>).

11.2 Fig. 1 shows the details of a typical testing jig together with two anvils which make it possible to test welds for wire

<sup>5</sup> A detailed drawing showing complete dimensions of the testing jig may be obtained from ASTM Headquarters. Order Adjunct No. 12-101850-00.

up to 15.88 mm (5/8 in.) in diameter. This testing jig can be used in most tension testing machines and should be hung in a ball and socket arrangement at the center of the machine. This, or a similarly effective fixture designed on the same principle, is acceptable.

11.3 Test specimens should be inserted through the notch in the anvil using the smallest notch available in which the vertical wire will fit loosely. The vertical wire shall be in contact with the surface of the free rotating rollers while the horizontal wire shall be supported by the anvil on each side of the slot. The bottom jaws of the testing machine shall grip the lower end of the vertical wire and the load shall be applied at a rate of stressing not to exceed 689 MPa/min (100 000 psi/min).

**12. Sampling**

12.1 Test specimens for testing mechanical properties shall be obtained by cutting from the finished fabric a full width section, of sufficient length to perform testing described in 7.1 and 7.2.

12.2 Test specimens for determining weld-shear properties

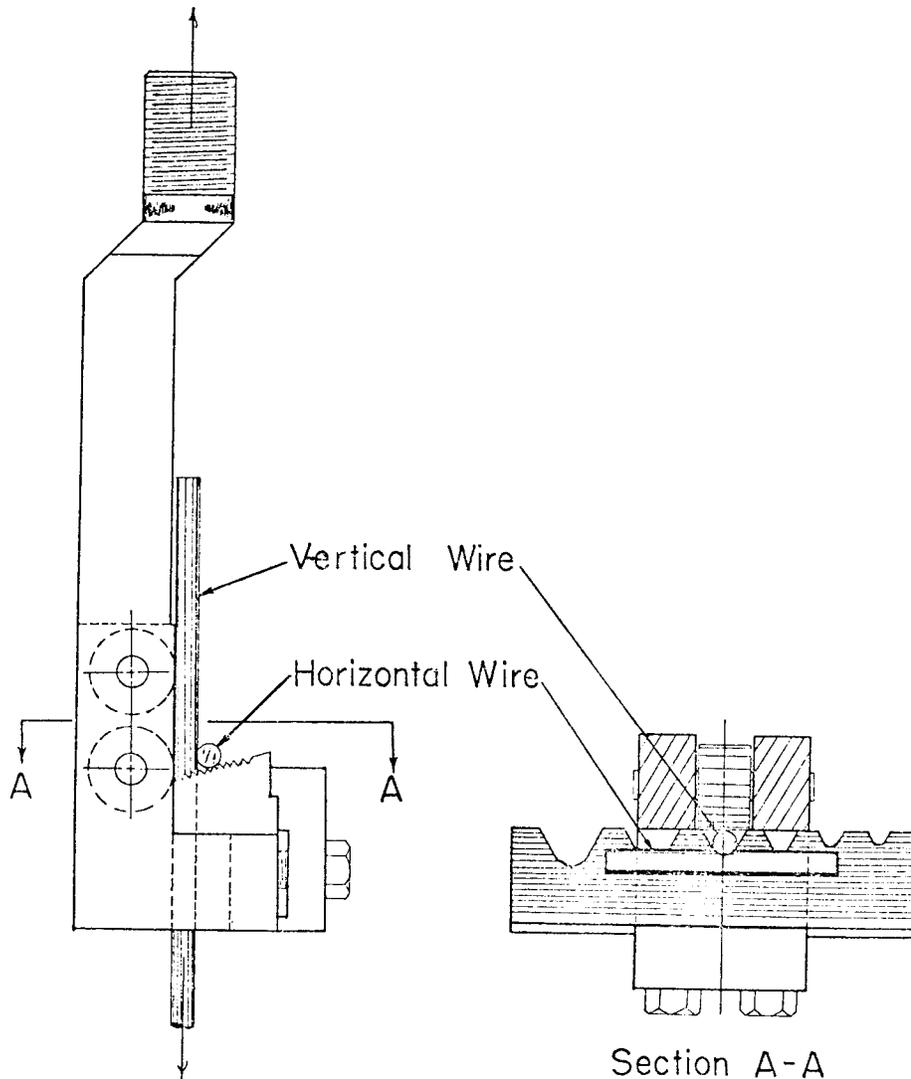


FIG. 1 Welded Wire Fabric Weld Tester

shall be obtained by cutting from the finished fabric, a full width section of sufficient length to perform testing described in 7.4.

12.3 Measurements for conformance to dimensional characteristics shall be made on full sheets or rolls.

12.4 If any test specimen exhibits obvious imperfections, it may be discarded and another specimen substituted.

### **13. Inspection**

13.1 The inspector representing the purchaser shall have free entry at all times while work on the contract of the purchaser is being performed to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to assure that the material is being furnished in accordance with this specification.

13.2 Except for yield strength, all tests and inspections shall be made at the place of manufacture prior to shipment, unless otherwise specified. Such tests shall be so conducted as not to interfere unnecessarily with the operation of the works.

13.3 If the purchaser considers it desirable to determine compliance with the yield strength requirements of Specification A 82, yield strength tests may be made in a recognized laboratory, or their representative may make the test at the mill, if such tests do not interfere unnecessarily with the mill operations.

13.4 *For U.S. Government Procurement Only*—Except as otherwise specified in the contract, the contractor is responsible for the performance of all inspection and test requirements specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser at the time of purchase. The purchaser shall have the right to perform any of the inspections and tests at the same frequency as set forth in this specification where such inspections are deemed necessary to assure that material conforms to prescribed requirements.

### **14. Rejection and Rehearing**

14.1 Material that does not meet the requirements of this specification may be rejected. Unless otherwise specified, any rejection shall be reported to the manufacturer within five days from the time of selection of test specimens.

14.2 In case a specimen fails to meet the tension or bend test, the material shall not be rejected until two additional specimens taken from other wires in the same sheet or roll have been tested. The material shall be considered as meeting the specification in respect to any prescribed tensile property, provided the tested average for the three specimens, including the specimen originally tested, is equal to or exceeds the required minimum for the particular property in question, and provided further that none of the three specimens develops less than 80 % of the required minimum for the tensile property in question. The material shall be considered as meeting this specification in respect to bend test requirements, provided both additional specimens satisfactorily pass the prescribed bend test.

14.3 Any material that shows injurious imperfections sub-

sequent to its acceptance at the manufacturer's works may be rejected and the manufacturer shall be promptly notified.

14.4 Welded joints shall withstand normal shipping and handling without becoming broken, but the presence of broken welds, regardless of cause, shall not constitute cause for rejection unless the number of broken welds per sheet exceeds 1 % of the total number of joints in a sheet, or if the material is furnished in rolls, 1 % of the total number of joints in 14 m<sup>2</sup>(150 ft<sup>2</sup>) of fabric and, furthermore, provided not more than one half the permissible maximum number of broken welds are located on any one wire.

14.5 In the event of rejection because reason of failure to meet the weld shear requirements, four additional specimens shall be taken from four different sheets or rolls and tested in accordance with Section 11. If the average of all the weld shear tests performed does not meet the requirement, the material shall be rejected.

14.6 In the event of rejection because of failure to meet the requirements for dimensions, the amount of material rejected shall be limited to those individual sheets or rolls which fail to meet this specification.

14.7 Rust, surface seams, or surface irregularities will not be cause for rejection provided the minimum dimensions, cross-sectional area and tensile properties of a hand wire brushed test specimen are not less than the requirements of this specification.

14.8 *Rehearing*—Rejected materials shall be preserved for a period of at least two weeks from the date of inspection, during which time the manufacturer may make claim for a rehearing and retesting.

### **15. Certification**

15.1 If outside inspection is waived, a manufacturer's certification that the material has been tested in accordance with and meets the requirements of this specification shall be the basis of acceptance of the material. The certification shall include the specification number, year-date of issue and revision letter, if any.

15.2 This conformance is predicated upon testing and acceptance of wire prior to fabrication, coupled with random shear testing during production. Because of warehousing and stocking problems, no efforts are normally taken to supply actual test data on material shipped. If this is deemed essential, outside inspection should be utilized.

15.3 When Supplement S1 of Specification A 82 is specified for the material, test results for yield strength, tensile strength, reduction of area, and bend tests shall be reported (S1.3.1 of Specification A 82).

### **16. Packaging and Marking**

16.1 Unless otherwise specified, packaging, marking, and loading for shipment shall be in accordance with Practices A 700.

16.2 When fabric is furnished in flat sheets, it shall be assembled in bundles of convenient size containing not more than 150 sheets and securely fastened together.

16.3 When fabric is furnished in rolls, each roll shall be secured so as to prevent unwinding during shipping and handling.

16.4 Each bundle of flat sheets and each roll shall have attached thereto a suitable tag bearing the name of the manufacturer, description of the material, ASTM A 185, and such other information as may be specified by the purchaser.

16.5 When specified in the contract or order, and for direct procurement by or direct shipment to the U.S. government, when Level A is specified, preservation, packaging, and packing shall be in accordance with the Level A requirement of MIL-STD-163.

16.6 When specified in the contract or order, and for the

direct procurement by or direct shipment to the U. S. government, marking for shipment, in addition to requirements specified in the contract or order, shall be in accordance with MIL-STD-129 for U. S. military agencies and in accordance with Fed. Std. No. 123 for U. S. government civil agencies.

## **17. Keywords**

17.1 concrete reinforcement; reinforced concrete; reinforcing steels; steel wire; welded wire fabric

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