Designation: A 497/A 497M – 07

Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete[1]

This standard is issued under the fixed designation A 497/A 497M; 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.

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

1. Scope*

1.1 This specification covers welded wire reinforcement made from cold-worked drawn or rolled deformed wire, or a combination of deformed and non-deformed wires, to be used for the reinforcement of concrete.

NOTE 1—Welded wire for concrete reinforcement has been described by various terms: welded wire fabric, WWF, fabric, and mesh. The wire reinforcement industry prefers the term "welded wire reinforcement" (WWF) as being more representative of the range of products being manufactured. Therefore, the term "welded wire fabric" has been replaced with the term "welded wire reinforcement" in this specifcation and in other related specifications.

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.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 82/A 82M Specification for Steel Wire, Plain, for Concrete Reinforcement

A 496/A 496M Specification for Steel Wire, Deformed, for Concrete Reinforcement

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment

2.2 *Military Standards:*

MIL-STD-129 Marking for Shipment and Storage[3]

2.3 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)[3]

2.4 *ASTM Adjuncts:*

Testing Jig Drawing[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *convoluted wire*, *n*—when wire for welded wire reinforcement is shaped 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. Only non-deformed wire is normally subject to convolution.

3.1.2 *welded wire reinforcement*, *n—as used within the scope and intent of this specification*, welded wire reinforcement designates a material composed of cold-worked steel wire, fabricated into sheets or rolls by the process of electric resistance welding. The finished material shall consist essentially of a series of longitudinal and transverse wires arranged substantially at right angles to each other, and welded together at points of intersection.

4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for the manufacture and delivery of the welded wire reinforcement under this specification. Such requirements to be considered include, but are not limited to, the following:

4.1.1 Quantity (weight or square area),

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

4.1.3 Wire spacings and sizes,

4.1.4 Minimum yield strength if Supplement S1 of Specification A 496/A 496M applies; and minimum yield strength if wire conforming to Specification A 82/A 82M is to be used and Supplement S1 of Specification A 82/A 82M applies.

4.1.5 Yield strength measurement. The purchaser shall have the options described in Specification A 496/A 496M on Inspection (section 13.3),

4.1.6 Request for outside inspection (if not requested, 15.1 applies),

4.1.7 Exclusion of over-steeling, if required (see 9.4.1),

4.1.8 Length and width of sheets or rolls,

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.05 on Steel Reinforcement.

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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 Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

[4] Available from ASTM International Headquarters. Order Adjunct No. ADJA0185. Original adjunct produced in 1967.

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

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4.1.9 Packaging (see Section 15), and

4.1.10 ASTM designation and year of issue.

NOTE 2—A typical ordering description is as follows: 10 000 ft^2 welded deformed wire reinforcement for concrete, 100 × 300 – MD100 × MD40 2450 mm × 6 m [4 × 12 – D15 × D6 96 in. × 20 ft.] in secured bundles of flat sheets, to ASTM A 497 – ____.

5. Materials

5.1 The wire used in the manufacture of welded wire reinforcement shall conform to Specification A 496/A 496M and its Supplement S1 if so ordered, either solely or in combination with wire conforming to Specification A 82/A 82M and its Supplement S1 if so ordered.

5.2 Welded wire reinforcement 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 that will assure accurate spacing and alignment of all wires of the finished welded wire reinforcement.

6.2 Longitudinal and transverse wires 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 yield strength and quality when fabricated in the manner herein required shall result in a strong, serviceable mat-type product having substantially square or rectangular openings. It shall be fabricated and finished in a workmanlike manner, and shall conform to this specification.

NOTE 3—A variation of manufacturing includes the application of one or more longitudinal convoluted wires at one edge of welded wire reinforcement 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 reinforcement, deformed, is described in Specification A 496/A 496M. Tensile tests shall be made on wire cut from the welded wire reinforcement 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 intersection located approximately at the center of the wire being tested and the cross wire forming the welded intersection shall extend approximately 25 mm [1 in.] beyond each side of the welded intersection.

NOTE 4—Tensile and bend testing are normally done at the time wire is drawn. The manufacturer's finished product shall meet the requirements of this specification and Specifications A 496/A 496M and A 82/A 82M if applicable.

7.2 *Bend Test*—The wire shall withstand the bend test as described in Specification A 496/A 496M and shall be performed on a specimen taken from between the welds.

7.3 *Weld Shear Strength*—The weld shear strength between longitudinal and transverse wires shall be tested as described in Section 8. The minimum average shear value in Newtons shall not be less than 241 multiplied by the nominal area of the larger wire in square millimeters [in pounds-force shall not be less than 35 000 multiplied by the nominal area of the larger wire in square inches], where the smaller wire is not less than MD25 [D4] and has an area of 40 % or more of the area of the larger wire.

7.3.1 Welded wire reinforcement having a relationship of larger and smaller wires other than that covered in 7.3 shall meet an average weld shear strength requirement of not less than 3.6 kN [800 lbf] provided that the smaller wire is not smaller than MD26 [D4].

7.3.2 Weld-shear tests for determination of conformance to the requirements of 7.3 shall be conducted using a weld tester as described in Section 8.

7.3.3 Four welds selected at random from the specimen described in 10.2 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 weld tester.

7.3.4 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 7.3. If the average fails to meet the prescribed value, all the welds across the specimen shall then be tested. The welded wire reinforcement shall be deemed acceptable if the average of all weld shear test values across the specimen meets the prescribed minimum value.

8. Weld Shear Test Apparatus and Methods

8.1 As the welds in welded wire reinforcement contribute to the bond and anchorage value of the wires in concrete, the weld acceptance tests shall be made in a weld tester that stresses the weld in a manner similar to which it is stressed in concrete. In order to accomplish this, the vertical wire in the weld tester shall be stressed in an axis close to its center line. Also the horizontal wire shall be held closely to the vertical wire, and in the same relative position, so as to prevent rotation of the horizontal wire. When the welded wire reinforcement is manufactured with different wire sizes, the larger diameter wire shall be the "vertical wire'' when tested (see Fig. 1[4]).

8.2 The weld tester shown in Fig. 1 shall be hung in a ball and socket, or similar self aligning arrangement, at the center of the machine and used with an anvil sized such that it fully supports the horizontal wire and allows the vertical wire of the test specimen to move freely in the vertical direction. This, or a similarly effective fixture designed on the same principle, shall be acceptable.

8.3 Test specimens shall be inserted through the notch in the anvil using the smallest notch available in which the vertical wire fits 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 ksi/min].

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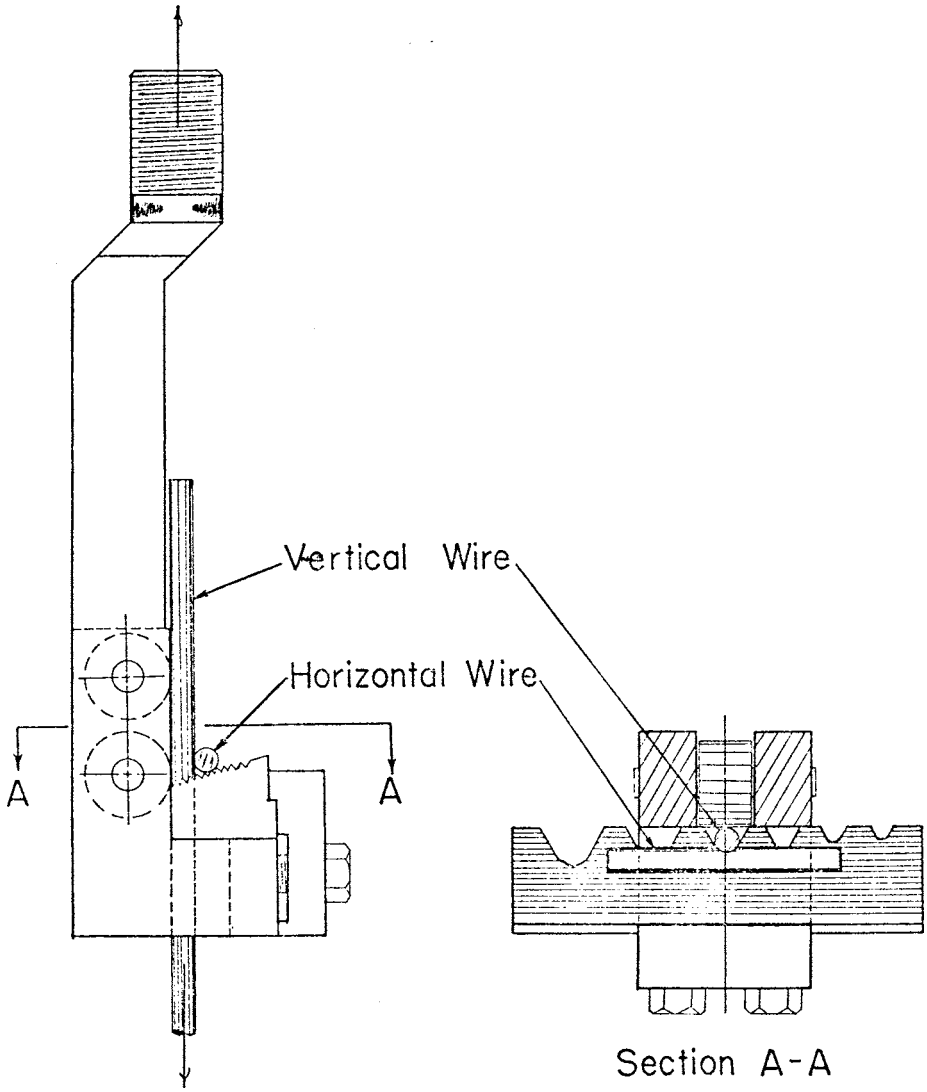

NOTE—A detailed drawing showing complete dimensions of the testing jig may be obtained from ASTM International.

FIG. 1 Welded Wire Reinforcement Weld Tester

9. Dimensions

9.1 *Width*—The width of welded wire reinforcement shall be considered to be the center-to-center distance between outside longitudinal wires. The permissible variation shall not exceed 13 mm [0.5 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. When measurements involve a convoluted wire, the measurement shall be made to the approximate center of the sinusoidal wave shape.

9.2 *Length*—The overall length of flat sheets, measured on any wire, shall not vary more than ±25 mm [±1 in.], or 1 %, whichever is greater.

9.3 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 [0.5 in.] greater or less than the specified length.

9.4 The permissible variation in weight of any wire in the finished welded wire reinforcement shall conform to the tolerances prescribed for the wire before fabrication, in Specification A 496/A 496M, with the following exceptions:

9.4.1 Unless otherwise precluded by the purchaser in 4.1, the manufacturer shall be permitted to apply over-sized wire. The size differential shall not exceed two “D” size increments on sizes MD52 [D8] and smaller, and four “D” size increments on sizes larger than MD52 [D8]. A “D” size increment is a whole number increment, for example, D5 to D6, or D5.4 to D6.4, and so forth. In all cases where such over-steeling is practiced, the manufacturer shall identify the welded wire reinforcement with the style originally ordered. With the permission of the purchaser, the manufacturer shall be permitted to exceed the limits of this section.

9.5 The average spacing of wires shall be such that the total number of wires contained in a sheet or roll is equal to or

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greater than that determined by the specific spacing, but the center-to-center distance between individual members shall not vary more than 6.35 mm [0.25 in.] from the specified spacing. Sheets of welded wire reinforcement having the specified length shall not be required to contain an identical number of transverse wires, and therefore, shall be permitted to have various lengths of longitudinal overhang.

10. Sampling

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

10.2 Test specimens for determining weld-shear properties shall be obtained by cutting from the finished welded wire reinforcement, a full width section of sufficient length to perform testing described in 7.3.3.

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

10.4 Any test specimen exhibiting obvious imperfections shall be discarded and another specimen substituted.

11. Number of Tests

11.1 One test for conformance to tensile strength and bend requirements, and one check for conformance to dimensional characteristics shall be made for each 7 000 m^2[75 000 ft^2] of welded wire reinforcement or remaining fraction thereof. For testing prior to fabrication, one test for each 18 Mg [20 tons] of wire shall be made.

11.2 One test for conformance to weld shear strength requirement shall be made for each 28 000 m^2[300 000 ft^2] of welded wire reinforcement or remaining fraction thereof.

12. Inspection

12.1 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 facilities 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.

12.2 Except for yield strength, all tests and inspections shall be made at the manufacturer's facilities prior to shipment, unless otherwise specified. Such tests shall be so conducted as not to interfere unnecessarily with the operation of the manufacturer's facilities.

12.3 The purchaser shall have the option to require a yield strength measurement to determine compliance with yield strength requirements of Specification A 496/A 496M and A 82/A 82M if applicable, and shall specify that the measurement be performed by the manufacturer at the manufacturer's facilities, a recognized laboratory, or the purchaser's representative at the manufacturer's facilities. Such measurements shall be conducted without unnecessarily interfering with the manufacturing operations.

12.4 *For Government Procurement Only*—The purchaser shall be furnished a manufacturer's certification of conformance to A 497/A 497M for each production date or production lot shipped. A production lot shall not exceed 28 000 m^2 [300 000 ft^2], and certifications shall be traceable to specific date(s) of production marked on the product bundle prior to shipment. 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 shall have the option to 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.

13. Rejection and Retests

13.1 Unless otherwise specified, any rejection shall be reported to the manufacturer within five working days from the time of selection of test specimens.

13.2 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 with 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 with respect to bend test requirements, provided both additional specimens satisfactorily pass the prescribed bend test.

13.3 Any material that is found not to meet the requirements of this specification subsequent to its acceptance at the manufacturer's facilities shall be subject to rejection and the manufacturer shall be promptly notified.

13.4 Welded intersections 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 intersections in a sheet. For material furnished in rolls, not more than 1 % of the total number of intersections in 14 m^2 [150 ft^2] of welded wire reinforcement shall be broken. Not more than one half the permissible maximum number of broken welds shall be located on any one wire.

13.5 In the event of rejection because 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 8. If the average of all the weld shear tests performed does not meet the requirement, the material shall be rejected.

13.6 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.

13.7 Rust, surface seams, or surface irregularities shall not be cause for rejection provided the minimum welded wire

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reinforcement dimensions, cross-sectional area, tensile properties, and weld shear strength of a hand wire-brushed test specimen meet the requirements of this specification. The height of deformations above the minimum height requirements (see Specification A 496/A 496M) shall not be cause for rejection.

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

14. Certification

14.1 If outside inspection is waived, a manufacturer's certification that the material has been manufactured 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.

14.2 This conformance is predicated upon testing and acceptance of wire prior to fabrication, coupled with random shear testing during production. The purchaser shall be furnished a manufacturer's certification of conformance to A 497/A 497M for each production date or production lot shipped. A production lot shall not exceed 28 000 m^2 [300 000 ft^2]. Any purchaser shall have the right to invoke any of the provisions of 12.4.

14.3 When Supplement S1 of Specifications A 82/A 82M or A 496/A 496M is specified for the material, test results for yield strength, tensile strength, and bend tests shall be reported (S1.3.1 of Specification A 82/A 82M, S1.3.1 of Specification A 496/A 496M).

14.4 A material test report, certificate of inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of the invoked ASTM standard(s) and conform to any existing EDI agreement between the purchaser and the supplier. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

NOTE 5—The industry definition as invoked here is: EDI is the computer-to-computer exchange of business information in a standard format such as ANSI ASC X12.

15. Packaging and Marking

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

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

15.3 When welded wire reinforcement is furnished in rolls, each roll shall be secured so as to prevent unwinding during shipping and handling.

15.4 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 497/A 497M, and such other information as may be specified by the purchaser.

15.5 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.

16. Keywords

16.1 concrete reinforcement; deformed steel wire; reinforced concrete; reinforcing steels; welded wire reinforcement

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 497/A 497M–06$^{\epsilon 1}$) that may impact the use of this standard.

(*1*) Remove reference to MIL-STD-163.

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