

FEDERAL SPECIFICATION

CONNECTOR, ELECTRICAL, POWER, GENERAL
SPECIFICATION FOR

The General Services Administration has authorized the use
of this federal specification by all Federal agencies.

1. SCOPE AND CLASSIFICATION.

1.1 Scope. This specification covers electrical plugs, receptacles, and cable outlets for service from 120 to 600 volts with current ratings up to 60 amperes and a frequency rating of 50/60 hertz. It does not cover devices for use in hazardous locations as defined in the National Electrical Code. Special plugs, receptacles, and cable connectors for 400 Hz and dc applications are also included. Connectors are to be used with copper or copperclad aluminum wire only.

1.2 Connector grade. Connectors furnished in accordance with this specification will be either the general grade or the hospital grade as specified for logistics purposes, hospital grade connectors will be stocked in lieu of general grade. (see 3.1 and 6.3).

1.2.1 General grade. A class of connector that meets the requirements of Underwriters Laboratories, Inc. (UL) Standard 498 and the additional requirements as specified herein.

1.2.2 Hospital grade. A class of connector that meets the more stringent requirements of "hospital grade" connectors as specified in UL 498 and the additional requirements as specified herein. This connector is designed to meet the added performance requirements of high abuse areas.

2. APPLICABLE DOCUMENTS.

2.1 Government publications. The following documents of the issues in effect on the date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

Military Standards

MIL-STD-1285 - Marking of Electrical and Electronic Parts.

(Copies of these documents are available online at <http://quicksearch.dla.mil/>)

Beneficial comments, recommendations, additions, deletions, clarifications, etc. and any data which may improve this document should be sent to: DLA Land and Maritime, Attn: VAI, P.O. Box 3990, Columbus, Ohio, 43218-5000 or emailed to: RFConnectors@dlamail. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.



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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal will apply.

UNDERWRITER'S LABORATORIES, INC. (UL)

UL 498 -Standard for Attachment Plugs and Receptacles
UL 943 -Standard for Ground-Fault Circuit-Interruption

(Copies of these documents are available online at <http://www.ul.com>)

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA WD 6 - Wiring Devices – Dimensional Requirements

(Copies of these documents are available online at <http://www.nema.org>)

3. REQUIREMENTS.

3.1 Specification sheets. The individual item requirements will be as specified herein and in accordance with the applicable specification sheets.

3.2 Fire and casualty hazards.

3.2.1 UL or CSA verified connectors. Each contractor shall submit to the contracting agency proof that the connectors supplied under this specification conform to the requirements of UL 498 and applicable bulletins and, where relevant, of UL 943 and applicable bulletins. The U.S. listing mark of Underwriters Laboratories, Inc. (UL) or the U.S. certification mark of Canadian Standards Association (CSA/NRTL), may be accepted as evidence that the connectors conform to UL 498 requirements for general grade connectors and to additional UL 943 requirements for general grade connectors incorporating ground-fault circuit interrupter protection for personnel. The above listing mark and the green dot of UL 498 may be accepted as evidence that the connectors conform to UL 498 requirements for hospital grade connectors.

3.2.2 Non-UL or NON-CSA verified connectors. In lieu of the listing mark or listing mark and hospital grade green dot of UL 498, the contractor shall submit independent proof, satisfactory to the contracting agency, that the connectors conform to the applicable requirements, including methods of tests, of the published standards of UL 498 and, where applicable, UL 943.

3.2.3 Additional requirements. In addition to compliance with 3.2.1 and 3.2.2, the connectors shall comply with the additional requirements specified herein.

3.3 Qualification. The connectors furnished under this specification shall be a product which is qualified for listing on the applicable qualified products list.

3.4 Materials. Materials shall be as specified in UL 498. All current carrying parts of the connectors shall be made of copper or copper alloy. The terminal screws and pressure plates may be of other materials. The grounding contact is considered current carrying, however, the remaining portion of the grounding circuit may be of other metal.

3.5 Design and construction. Connectors shall be of the design, construction, and physical dimensions as specified herein (see 3.1) and in NEMA WD 6. Connectors shall be general grade (see 1.3.1) or

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hospital grade (see 1.2.2 as specified in 3.1 (see section 6). If the specification sheet does not specify the grade, the connector shall be of general grade. Plugs shall be of a solid face, dead front, construction with no insulating discs permitted. Plugs and cable outlets shall be of the non-armored type. Exposed metallic cable clamps are not permitted.

3.5.1 Mounting flanges and plates. Unless otherwise specified (see 3.1), mounting flanges and plates of ferrous material shall be protected against corrosion by galvanizing or by electrodeposition of a suitable metal. Painting alone is not acceptable.

3.5.2 Mounting screws. Unless otherwise specified (see 3.1), each connector receptacle shall be furnished with screws for mounting the device to an outlet box or other enclosure. The screws shall be of the length and type as required in UL 498.

3.5.3 Terminals. All terminals on connectors specified herein are for use with copper or copper clad aluminum wire only.

3.5.3.1 Screw terminals. Terminals shall receive and hold properly the wire required for the current marked on the connector. Receptacles marked 15 amperes or less shall receive and hold No. 12 American Wire Gauge (AWG) wire. Terminals on receptacles shall be positioned for top back side or back and side wiring as specified herein. For hospital grade plugs and cable outlets, the terminals shall be located in individual insulating compartments with no joints or seams through which stray strands of the conductor may pass during wiring of the plugs and cable outlets. The wiring terminals individual wiring compartment insulating walls or barriers are to either:

- a. Extend not less than 1/32 inch (0.79 mm) above metal parts of wired terminals and provide a spacing between metal parts of adjacent wire terminals of not less than 3/32 inch (2.38 mm) through air and over surface.
- b. Extend not less than to be flush with metal parts of wired terminals and provide a spacing between metal parts of adjacent wired terminals of not less than 1/4 inch (6.35 mm) through air and over surface or
- c. Extend over the top of the terminal compartments with a wire clearance hole in the insulating wall or cover sized to (1) accept the individual wire insulation of (2) be spaced not less than 1/4 inch (6.35 mm) apart as measured from the periphery of each hole.

The barriers shall be permanently attached at the time of the manufacture.

3.5.3.1.1 Top-wiring. Top-wired receptacles shall have terminals mounted on the surface facing the plug.

3.5.3.1.2 Back-wiring. Back-wiring receptacles shall have separate access in the back for insertion of gauge stripped connection wiring. The connection shall employ positive screw pressure or metal plate against a bared conductor. Terminals shall meet the strength test indicated in 4.6.4.

3.5.2.1.3 Side-wiring. Side-wired receptacles shall have terminals on the side for connecting wires and with suitable setbacks, grooves, or holes in the receptacle insulating material to allow for unimpeded wiring. A device with wire access holes on the side is considered to be side-wiring regardless of the location of the wire clamping screws.

3.5.3.1.4 Back- and side-wiring. Back- and side-wired receptacles shall conform to 3.5.3.1.2 and 3.5.3.1.3 respectively.

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3.5.3.1.5 Integral leads. Unless otherwise specified (see 3.1), integral leads on receptacles shall be in accordance with UL 498 and associated bulletins.

3.5.4 Finish. Connectors shall have surfaces which are not warped, cracked, chipped or blistered either initially or as a result of the tests specified herein. Connector surfaces which normally come in contact with cable or conductor insulation shall be smooth so as to prevent cutting or abrasion of the insulating material.

3.5.5 Strain relief (plugs and cable outlets only). The strain relief shall clamp any diameter cable within the specified range of cord diameters, so that no strain will be placed on the electrical connectors when the cable is tested in accordance with 4.6.13. Strain relief if exposed shall be nonmetallic. Strain relief shall not be of the hinged type. Current carrying metal parts behind the cord grip shall be covered with an insulating material not less than .06 inch (1.52 mm) in thickness.

3.5.5.1 Angle strain relief. An angle strain relief shall conform to 3.5.4 and shall be designed for the cable to enter the plug at $90^{\circ} \pm 10^{\circ}$ to the plug-in centerline (see 3.1).

3.5.6 Electrical contacts. Positive contact shall be maintained at any point where an electrical connection is made between parts. Receptacle contacts shall contact both sides of the mating blade when inserted. Plugs shall have solid blades.

| 3.6 Performance. Connectors shall meet the performance requirements of UL 498, applicable bulletins of UL 498 and additional requirements as specified herein.

| 3.6.1 Retention of plugs. When connectors are tested as specified in 4.6.2, the connector shall meet the requirements of UL 498 and all applicable bulletins for retention of plugs.

| 3.6.2 Gripping (15 and 20 ampere, 125 and 250 volt straight blade receptacles and cable outlets only). When connectors are tested as specified in 4.6.3, 4.6.3.1, and 4.6.3.2, the test blade or pin shall not be displaced from the face of the connector under test by more than .06 inch (1.52 mm).

| 3.6.3 Terminal strength (15 and 20 ampere, 125 and 250 volt devices only). When connectors are tested as specified in 4.6.4, terminals shall not loosen change in shape or position or be otherwise damaged, and threads shall not strip.

| 3.6.4 Current overload (receptacles and cable outlets only). When tested as specified in 4.6.5, connectors shall meet the requirements of dielectric withstanding voltage and insulation resistance as specified in 3.6.6 and 3.6.7.

| 3.6.5 Temperature rise (receptacles and cable outlets only). When tested as specified in 4.6.6, no connector terminal shall have a temperature rise in excess of 30°C.

| 3.6.6 Dielectric withstanding voltage. When connectors are tested as specified in 4.6.7, there shall be no damage, arcing, or breakdown.

| 3.6.7 Insulation resistance. When connectors are tested as specified in 4.6.8, insulation resistance of mutually insulated parts shall be not less than 100 megohms.

| 3.6.8 Isolated ground (isolated ground receptacles only, see 3.1). When receptacles are tested as specified in 4.6.9, the isolated ground resistance shall be not less than 100 megohms.

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3.6.9 Heat resistance. After connectors are tested as specified in 4.6.10, there shall be no evidence of mechanical or electrical failure, flow or critical softening of sealing compounds or softening or distortion of parts.

3.6.10 Mechanical shock (plugs and cable outlets only). When tested as specified in 4.6.11, connectors shall conform to dielectric withstanding voltage and insulation resistance as specified in 3.6.6 and 3.6.7 respectively and there shall be no evidence of chipping, cracking, breaking or loosening of parts which would interfere with the safe and normal usage of the connector.

3.6.11 Crushing (plugs and cable outlets only). When connectors are tested as specified in 4.6.12, there shall be no evidence of chipping, cracking, breaking or distortion.

3.6.12 Strain relief (plugs or cable outlets only). Plugs and cable outlets shall be tested as specified in 4.6.13 and the strain exerted on the attached cable shall not cause more than .06 inch (1.52 mm) movement of the outer jacket.

3.6.13 Assembly security (15 and 20 ampere duplex 125 volt, 50/60 hertz straight blade receptacles only).

3.6.13.1 Test I. When receptacles are tested as specified in 4.6.14.1, there shall be no mechanical breakage exposing electrical connections or separation of the face and body by more than .06 inch (1.52 mm).

3.6.13.2 Test II. When receptacles are tested as specified in 4.6.14.2, there shall be no cracking of the base or permanent deformation of the yoke exceeding .06 inch (1.52 mm).

3.6.14 UL 498 tests. When tested as specified in 4.6.15, connectors shall meet the following requirements of UL 498 for:

- a. Integrity of assembly.
- b. Potential drop in grounding connections.
- c. Receptacle grounding contact.
- d. Accelerated aging.
- e. Grounding pin retention.
- f. Mold stress relief.
- g. Conditioning.
- h. Abrupt removal.
- i. Line blade retention.
- j. Grounding contact temperature.
- k. Grounding contact resistance.
- l. Fault current.
- m. Connection and separation.
- n. Grounding path resistance.
- o. Strain relief.

3.6.15 Blade strength (plugs and male inlets only). When plugs are tested as specified in 4.6.16, the contacts shall not have moved more than 1/32-inch change in shape or position, or be otherwise damaged.

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3.6.16 Salt spray (corrosion) (when specified, see 3.1). When tested as specified in 4.6.17, there shall not be sufficient corrosion to interfere with the mating of the connectors or accessories. Exposure to salt-laden atmosphere shall not cause corrosion or exposure of the basic metal on any plated metal part such as shells, adapters, coupling rings, or the individual pin and socket contacts submitted which is detrimental to their mechanical or electrical performance.

3.6.17 Impact test (hospital grade). When receptacles, plugs and cable outlets are tested as specified in 4.6.18, the receptacles shall have no breakage that impairs the function of the receptacle. In enclosing and supporting contacting members for the connection of an attachment-plug cap, the plugs and cable outlets shall have no breaking of the body or other damage that may interfere with the "hospital grade" function.

3.7 Marking.

3.7.1 Connectors supplied under the Federal Specification verification program.

3.7.1.1 General grade. Each connector shall be marked in accordance with UL 498 with the manufacturer's trade mark and electrical rating (see 3.1). In addition, a Federal Specification verification mark shall appear on connectors that have met all the requirements of this specification. The Federal Specification verification mark shall be "FS-UL" or "FS-CSA" as applicable or the initials "FS" adjacent to the registered trade mark of UL or CSA.

NOTE: Under the Federal Specification verification program manufacturers may mark a connector with the Federal Specification verification mark even though there is no W-C-596 specification sheet for that connector. However, the connector must comply with all the performance requirements of W-C-596. (This allows for broader use in manufacturing of common parts on which the manufacturer may choose to place the Federal Specification verification mark.

3.7.1.2 Hospital grade. In addition to the marking required in 3.7.1.1 connectors which have met all of the requirements of this specification shall have the green dot and hospital grade marking.

3.7.2 Connectors not supplied under the Federal Specification verification program. Each connector shall be marked with the manufacturer's trade mark and electrical rating (see 3.1). Connectors meeting the performance and test requirements of this specification shall be marked with the W-C-596 Part Identification Number (PIN) in accordance with MIL-STD-1285. The Federal Specification verification mark shall not appear on this category of connectors (see 1.2). The registered trade mark of UL or CSA shall not appear on the connector unless the device separately has UL or CSA listing for the specific grade.

3.7.3 Package marking. The smallest unit carton or package shall be marked as specified in the contract or order (see 5.1). NOTE: Inclusion of the W-C-596 PIN and a packaging date code is optional, though suggested.

3.7.4 Part substitution. A connector qualified to hospital grade specifications and carrying the hospital grade marking (including the hospital grade PIN), may be supplied under a general grade PIN but not vice versa (see 3.1).

3.8 Workmanship. Connectors shall be manufactured in such a manner as to be uniform in quality and shall be free from pits, corrosion, cracks, rough edge, chips, and other defects that will affect life, serviceability or appearance.

3.9 Termination instructions. Each device shall be accompanied by guidelines for termination. These instructions may be supplied on an instruction sheet on the smallest unit container, or on the device itself.

4. QUALITY ASSURANCE PROVISIONS.

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor.

4.1.3 Test connector. A test connector of the type specified as the mating connector (see 3.1) shall be used in testing sample connectors. Approval of the test connector for use in the tests shall not constitute acceptance of the connector PIN represented by the test connector. In the event of failure of the test connector, a new one shall be substituted and the test continued. Rejection of a test connector will not constitute a failure of the connector under test.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified herein all inspections, examinations, and tests shall be performed in accordance with the applicable conditions specified in UL 498.

4.3.1 Conditioning during inspection. Neither pin, blade, nor socket contacts of connectors submitted for examinations or test shall be adjusted, lubricated or otherwise conditioned before, during or after any examination or test.

4.4 Qualification inspection. Qualification shall be obtained by either of the following:

- a. By testing the connector in accordance with 4.4.1. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.4) on sample units produced with equipment and procedures normally used in production. Qualification approval may be granted upon successful completion of the inspections and tests conducted upon test samples, such approval to include classes, finishes, configuration and insert arrangements other than those actually tested providing that the capability to manufacture these parts is demonstrated by providing exhibit samples.

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- b. By having Underwriters Laboratories or Canadian Standards Association listing and Federal Specification verification. Manufacturers electing this option shall submit a letter of certification to the qualifying activity listing the Underwriters Laboratories or the Canadian Standards Association file number, report date, the Government PIN and the manufacturer's PIN for each connector for which qualification is desired. Qualification approval may be granted upon successful completion of the inspections and tests conducted by UL or CSA upon test samples, such approval to include classes, finishes, configuration, and insert arrangements other than those actually tested providing that the capability to manufacture these parts is demonstrated by providing exhibit samples.

4.4.1 Initial qualification routine. Connectors shall be subjected to the inspections specified in UL 498 and also to the inspections specified in table I or II (as applicable) in the order shown. Sample size shall be as specified in UL 498 and in table I or II (as applicable). Representative connectors shall be selected from each family grouping as described in 4.7.

4.4.1.1 Failures. One or more failures shall be cause for refusal to grant qualification approval.

4.4.2 Retention of qualification. To retain qualification, the contractor shall use the following applicable procedure.

4.4.2.1 Connectors qualified in accordance with 4.4a. The contractor shall forward a report at 12- or 36-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. Initial retention of qualification shall be at 12-month interval; subsequent retention of qualification at 36-month intervals. The report shall consist of:

- a. A summary of the results of tests performed for inspection of product for delivery group I of table I or table II (as applicable) (see 4.5.1) indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for. This shall be submitted every 12 months.
- b. A summary of the results of tests performed for periodic inspection (see 4.4.3.1) including the number and modes of failures. The summary shall include results of all qualification verification inspection tests performed and completed during the 12- or 36-month period. If the summary of the test results indicates nonconformance with specification requirements and corrective action acceptable to the qualifying activity has not been taken action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 60 days after the end of each 12- or 36-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 12-or 36-month period that the inspection data indicates failure of the qualified products to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the items. If during 3 consecutive reporting periods, there has been no production, the manufacturer may be required at the discretion of the qualifying activity to submit a representative product of each style, voltage rating, and current rating to testing in accordance with the qualification inspection requirements.

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TABLE I. Qualification testing for general grade connectors.

Inspection	Plug	Receptacle	Cable outlet	Male inlet	Requirement paragraph	Test paragraph
<u>Group I (6 samples)</u>						
Retention of plugs (UL 498) <u>1/</u>		X	X		3.6.1	4.6.2
Gripping		X	X		3.6.2	4.6.3
Terminal strength	X	X	X	X	3.6.3	4.6.4
Current overload		X	X		3.6.4	4.6.5
Temperature rise		X	X		3.6.5	4.6.6
Retention of plugs (UL 498) <u>1/</u>		X	X		3.6.1	4.6.2
Dielectric withstanding voltage	X	X	X	X	3.6.6	4.6.7
Insulation resistance	X	X	X	X	3.6.7	4.6.8
Isolated ground <u>2/</u>		X			3.6.8	4.6.9
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group II (6 samples)</u>						
Heat resistance (85°C, 2 hours)	X	X	X	X	3.6.9	4.6.10
Mechanical shock	X		X		3.6.10	4.6.11
Dielectric withstanding voltage	X	X	X	X	3.6.6	4.6.7
Insulation resistance	X	X	X	X	3.6.7	4.6.8
Crushing (75 pounds)	X		X		3.6.11	4.6.12
Strain relief (general grade)	X		X		3.6.12	4.6.13
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group III (6 samples)</u>						
Assembly security <u>3/</u>		X			3.6.13	4.6.14
Integrity of assembly (UL 498) <u>1/</u>	X		X		3.6.14a	4.6.15a
Potential drop in grounding connections (UL 498) <u>1/</u>			X	X	3.6.14b	4.6.15b
Receptacle grounding contact (UL 498) <u>1/</u>		X			3.6.14c	4.6.15c
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group IV (6 samples)</u>						
Blade strength	X				3.6.15	4.6.16
Accelerated aging (UL 498) <u>1/ 4/</u>	X	X	X	X	3.6.14d	4.6.15d
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1

1/ Not required if UL or CSA listed.

2/ Isolated ground receptacle only.

3/ For 15 and 20 ampere, 125 volt duplex, nonlocking receptacles only.

4/ Rubber and PVC materials only.

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TABLE II. Qualification testing for hospital grade connectors.

Inspection	Plug	Receptacle	Cable outlet	Male inlet	Requirement paragraph	Test paragraph
<u>Group I (6 samples)</u>						
Retention of plugs (UL 498) <u>1/</u>		X	X		3.6.1	4.6.2
Gripping		X	X		3.6.2	4.6.3
Terminal strength	X	X	X		3.6.3	4.6.4
Current overload		X	X		3.6.4	4.6.5
Temperature rise		X	X		3.6.5	4.6.6
Retention of plugs (UL 498) <u>1/</u>		X	X		3.6.1	4.6.2
Dielectric withstanding voltage	X	X	X		3.6.6	4.6.7
Insulation resistance	X	X	X		3.6.7	4.6.8
Isolated ground <u>2/</u>		X			3.6.8	4.6.9
Visual and mechanical	X	X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group II (6 samples)</u>						
Heat resistance (85°C, 2 hours)	X	X	X		3.6.9	4.6.10
Mechanical shock	X		X		3.6.10	4.6.11
Dielectric withstanding voltage	X	X	X		3.6.6	4.6.7
Insulation resistance	X	X	X		3.6.7	4.6.8
Crushing <u>1/</u>	X		X		3.6.11	4.6.12
Strain relief <u>1/</u>	X		X		3.6.12	4.6.13
Visual and mechanical	X	X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group III (6 samples)</u>						
Assembly security <u>3/</u>		X			3.6.13	4.6.14
Receptacle grounding contact (UL 498) <u>1/ 4/</u>	X	X	X		3.6.14c	4.6.15c
Mold stress relief (UL 498) <u>1/</u>		X			3.6.14f	4.6.15f
Salt spray (corrosion) (when specified)		X			3.6.16	4.6.17
Visual and mechanical	X	X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group IV (6 samples)</u>						
Temperature rise	X	X	X		3.6.5	4.6.6
Blade strength	X				3.6.15	4.6.16
Impact test (UL 498) <u>1/</u>	X	X	X		3.6.17	4.6.18
Accelerated aging (UL 498) <u>1/ 5/</u>	X	X	X		3.6.14d	4.6.15d
Visual and mechanical		X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group V (6 samples)</u>						
Crushing (UL 498, hospital grade) (500 pounds)	X		X		3.6.11	4.6.12
Visual and mechanical	X		X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group VI (8 samples) <u>1/</u></u>						
Conditioning (UL 498) (with plug)		X			3.6.14g	4.6.15g
Grounding pin retention (method I) (UL 498)		X			3.6.14e	4.6.15e
Abrupt removal (UL 498)		X			3.6.14h	4.6.15h
Grounding pin retention (method I) (UL 498)		X			3.6.14e	4.6.15e
Line blade retention (UL 498)		X			3.6.14i	4.6.15i
Grounding contact temperature (UL 498)		X			3.6.14j	4.6.15j
Ground contact resistance (UL 498)		X			3.6.14k	4.6.15k
Fault current test (UL 498)		X			3.6.14l	4.6.15l
Visual and mechanical		X			3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1

See footnotes at end of table.

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TABLE II. Qualification testing for hospital grade connectors. – Continued.

Inspection	Plug	Receptacle	Cable outlet	Male inlet	Requirement paragraph	Test paragraph
<u>Group VII (12 samples)</u>						
<u>Subgroup A (6 samples) 1/</u>						
Conditioning (UL 498) (.204 pin)			X		3.6.14g	4.6.15g
Grounding pin retention (method 3) (UL 498)			X		3.6.14e	4.6.15e
Plug connection and separation test (UL 498)			X		3.6.14m	4.6.15m
Visual and mechanical			X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Subgroup B (6 samples)</u>						
Conditioning (UL 498) (with plug)			X		3.6.14g	4.6.15g
Grounding contact temperature (UL 498)			X		3.6.14j	4.6.15j
Grounding path resistance (UL 498)			X		3.6.14n	4.6.15n
Visual and mechanical			X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group VIII (17 samples) 1/ 6/</u>						
Strain relief (static and rotary) (UL 498) (9 samples total)	X		X		3.6.14o	4.6.15o
Strain relief (abrupt removal) (UL 498)	X				3.6.14o	4.6.15o
Strain relief (abrupt removal) (UL 498)			X		3.6.14o	4.6.15o
Visual and mechanical	X		X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1

1/ Not required if UL or CSA listed as hospital grade.

2/ Isolated ground receptacle only.

3/ For 15 and 20 ampere, 125 volt duplex, nonlocking receptacles only.

4/ Only for receptacles with a U shape ground pin opening intended to receive .190 by .843-inch (4.8260 by 21.412-mm) (max) plug grounding pin.

5/ Rubber and PVC materials only.

6/ Angle plugs require an additional 8 samples.

4.4.2.2 Connectors qualified in accordance with 4.4b. The contractor shall forward a report at 12-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall include certification that the qualified connectors retain the Federal Specification verification mark. Any test data generated by UL, CSA or the contractor shall be made available for review by the qualifying activity upon request.

Failure to submit the report within 60 days after the end of each 12 month period may result in loss of qualification for the product. Contractors shall notify the qualifying activity immediately of inspection data that indicates failure of the product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the items. If during 3 consecutive reporting periods, there has been no production the manufacturer may be required, at the discretion of the qualifying activity to submit a representative product of each style, voltage rating, and current rating to resting in accordance with the qualification inspection requirements.

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4.4.3 Qualification retention inspection routine. Connectors shall be subjected to inspections as specified in the applicable method below. Representative connectors shall be selected from each family grouping as described in 4.7.

4.4.3.1 Connectors qualified in accordance with 4.4a. Representative samples of each family grouping of connectors shall be subjected to the inspections specified in table III or table IV (as applicable) in the order shown. Sample size shall be as specified in table III or table IV (as applicable). These inspections shall be performed within one year of the date of the initial qualification and once every three years thereafter.

4.4.3.2 Connectors qualified in accordance with 4.4b. Connectors shall be subjected to quarterly re-examination by a representative of Underwriters Laboratories Inc. or Canadian Standards Association. The examination shall include verification of materials, dimensions, configurations, and all other construction and testing requirements specified in UL 498 and any applicable bulletins, and in the Follow-Up Service Procedures issued by UL or by CSA. Once every three years representative samples of each family grouping of connectors shall be subjected to the inspections specified in table III or table IV (as applicable) in the order shown. Sample size shall be as specified in table III or table IV (as applicable).

4.4.4 Duplicate tests/altered sequences. When the inspections of UL 498 and W-C-596 are essentially the same they need not be duplicated. Test sequences may be altered at the discretion of a testing agency if it has adequate rationale for doing so and the results of the tests would be the same as if the stated sequences in W-C-596 were adhered to. This applies to both initial qualification and qualification retention testing.

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the following inspections and procedures as applicable.

4.5.1 Inspection of product for delivery for connectors qualified in accordance with 4.4a. Inspection of product for delivery shall consist of group I of table I or table II (as applicable) inspections. Samples shall be selected in accordance with table V. If one or more defects are found, the lot shall be screened for that particular defect(s) and defects removed. A new sample of parts shall be selected in accordance with table V and all group I tests again performed. If one or more defects are found in the second sample the lot shall be rejected and shall not be supplied to this specification.

4.5.1.1 Inspection lot. An inspection lot shall consist of all connectors of the same style produced under essentially the same conditions and offered for inspection at one time.

4.5.2 Inspection of product for delivery for connectors qualified in accordance with 4.4b. The Federal Specification verification mark shall be evidence of compliance.

4.5.3 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be as specified in the contract or order (see 5.1).

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TABLE III. Qualification retention for general grade connectors.

Inspection	Plug	Receptacle	Cable outlet	Male inlet	Requirement paragraph	Test paragraph
<u>Group I (6 samples)</u>						
Retention of plugs (UL 498) <u>1/</u>		X	X		3.6.1	4.6.2
Gripping		X	X		3.6.2	4.6.3
Terminal strength	X	X	X	X	3.6.3	4.6.4
Current overload		X	X		3.6.4	4.6.5
Temperature rise		X	X		3.6.5	4.6.6
Retention of plugs (UL 498) <u>1/</u>		X	X		3.6.1	4.6.2
Dielectric withstanding voltage	X	X	X	X	3.6.6	4.6.7
Insulation resistance	X	X	X	X	3.6.7	4.6.8
Isolated ground <u>2/</u>		X			3.6.8	4.6.9
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group II (6 samples)</u>						
Heat resistance (85°C, 2 hours)	X	X	X	X	3.6.9	4.6.10
Mechanical shock	X		X		3.6.10	4.6.11
Dielectric withstanding voltage	X	X	X	X	3.6.6	4.6.7
Insulation resistance	X	X	X	X	3.6.7	4.6.8
Crushing (75 pounds)	X		X		3.6.11	4.6.12
Strain relief (general grade)	X		X		3.6.12	4.6.13
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group III (6 samples)</u>						
Assembly security <u>3/</u>		X			3.6.13	4.6.14
Integrity of assembly (UL 498) <u>1/</u>	X		X		3.6.14a	4.6.15a
Potential drop in grounding connections (UL 498) <u>1/</u>			X	X	3.6.14b	4.6.15b
Receptacle grounding contact (UL 498) <u>1/ 4/</u>		X			3.6.14c	4.6.15c
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group IV (6 samples)</u>						
Blade strength	X			X	3.6.15	4.6.16
Accelerated aging (UL 498) <u>1/ 5/</u>	X	X	X	X	3.6.14d	4.6.15d
Visual and mechanical	X	X	X	X	3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1

1/ Not required if UL or CSA listed.

2/ Isolated ground receptacle only.

3/ For 15 and 20 ampere, 125 volt duplex, nonlocking receptacles only.

4/ Only for receptacles with a U shape ground pin opening intended to receive .190 by .843 inch (4.8260 by 21.412-mm) (max) plug grounding pin.

5/ Rubber and PVC materials only.

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TABLE IV. Qualification retention for hospital grade connectors.

Inspection	Plug	Receptacle	Cable outlet	Male inlet	Requirement paragraph	Test paragraph
<u>Group I (3 samples) 1/</u>						
Retention of plugs (UL 498) 2/		X	X		3.6.1	4.6.2
Gripping		X	X		3.6.2	4.6.3
Terminal strength	X	X	X		3.6.3	4.6.4
Current overload		X	X		3.6.4	4.6.5
Temperature rise		X	X		3.6.5	4.6.6
Retention of plugs (UL 498) 2/		X	X		3.6.1	4.6.2
Dielectric withstanding voltage	X	X	X		3.6.6	4.6.7
Insulation resistance	X	X	X		3.6.7	4.6.8
Isolated ground 3/		X			3.6.8	4.6.9
Visual and mechanical	X	X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group II (3 samples) 1/</u>						
Heat resistance (85°C, 2 hours)	X	X	X		3.6.9	4.6.10
Mechanical shock	X		X		3.6.10	4.6.11
Dielectric withstanding voltage	X	X	X		3.6.6	4.6.7
Insulation resistance	X	X	X		3.6.7	4.6.8
Visual and mechanical	X	X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group III (3 samples) 1/</u>						
Assembly security 4/		X			3.6.13	4.6.14
Receptacle grounding contact (UL 498) 2/ 5/		X			3.6.14c	4.6.15c
Mold stress relief (UL 498) 2/	X	X	X		3.6.14f	4.6.15f
Salt spray (corrosion) (when specified)		X			3.6.16	4.6.17
Visual and mechanical	X	X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group IV (3 samples) 1/</u>						
Temperature rise		X	X		3.6.5	4.6.6
Blade strength	X				3.6.15	4.6.16
Impact test (UL 498)	X	X	X		3.6.17	4.6.18
Accelerated aging (UL 498) 2/ 6/	X	X	X		3.6.14d	4.6.15d
Visual and mechanical	X	X	X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group V (3 samples) 1/</u>						
Crushing (UL 498 hospital grade) (500 pounds) 7/	X		X		3.6.11	4.6.12
Visual and mechanical	X		X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group VI (8 samples) 1/ 7/</u>						
Conditioning (UL 498) (with plug)		X			3.6.14g	4.6.15g
Grounding pin retention (UL 498)		X			3.6.14e	4.6.15e
Abrupt removal (UL 498)		X			3.6.14h	4.6.15h
Grounding pin retention (UL 498)		X			3.6.14e	4.6.15e
Line blade retention (UL 498)		X			3.6.14i	4.6.15i
Grounding contact temperature (UL 498)		X			3.6.14j	4.6.15j
Ground contact resistance (UL 498)		X			3.6.14k	4.6.15k
Fault current test (UL 498)		X			3.6.14l	4.6.15l

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Visual and mechanical		X			3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
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See footnotes at end of table.

TABLE IV. Qualification retention for hospital grade connectors – Continued.

Inspection	Plug	Receptacle	Cable outlet	Male inlet	Requirement paragraph	Test paragraph
<u>Group VII (6 samples) 1/</u>						
<u>Subgroup A (3 samples) 1/</u>						
Conditioning (UL 498) (.204 pin)			X		3.6.14g	4.6.15g
Grounding pin retention (UL 498)			X		3.6.14e	4.6.15e
Plug connection and separation test (UL 498)			X		3.6.14m	4.6.15m
Visual and mechanical			X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Subgroup B (3 samples) 1/</u>						
Conditioning (UL 498) (with plug)			X		3.6.14g	4.6.15g
Grounding contact temperature (UL 498)			X		3.6.14j	4.6.15j
Grounding path resistance (UL 498)			X		3.6.14n	4.6.15n
Visual and mechanical			X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1
<u>Group VIII (7 samples) 8/</u>						
Strain relief (static only) (UL 498) (3 samples) 9/	X		X		3.6.14o	4.6.15o
Strain relief (abrupt removal) (UL 498) (4 samples) 8/	X				3.6.14o	4.6.15o
Strain relief (abrupt removal) (UL 498) (4 samples) 9/			X		3.6.14o	4.6.15o
Visual and mechanical	X		X		3.1, 3.4, 3.5, 3.7 and 3.8	4.6.1

- 1/ If single failure in group occurs, sample size of group to be doubled and entire test sequence repeated. Any additional failures disqualify product.
- 2/ Not required if UL or CSA listed.
- 3/ Isolated ground receptacle only.
- 4/ For 15 and 20 ampere, 125 volt duplex, nonlocking receptacles only.
- 5/ Only for receptacles with a U shape ground pin opening intended to receive 0.190 by 0.843-inch (4.8260 by 21.412-mm) (max) plug grounding pin.
- 6/ Rubber and PVC materials only.
- 7/ Not required if UL or CSA listed as Hospital Grade.
- 8/ Angle plugs require an additional 8 samples.
- 9/ Not required for cable outlets if plugs in this group employ identical cord grip construction.

TABLE V. Inspection level.

Lot size		Group I of table I or II Inspections	
		Major	Minor
1 to	8	All	5
9 to	15	All	5
16 to	25	20	5
26 to	50	20	5
51 to	90	20	7
91 to	150	20	11
151 to	280	20	13
281 to	500	47	16
501 to	1,200	47	19
1,201 to	3,200	53	23
3,201 to	10,000	68	29
10,001 to	35,000	77	35
35,001 to	150,000	96	40
150,001 to	500,000	119	40
500,001 and over		143	40

1/ Samples may be pulled from either the production lot itself or from samples pulled from the lot for major defect testing.

NOTES:

1. Major defect. A major defect is a defect that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose.
2. Minor defect. A minor defect is a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose or is a departure from established standards having little bearing on the effective use or operation of the unit.

4.6 Methods of inspection. Connectors shall be tested as specified in UL 498 with additional tests as specified herein.

4.6.1 Visual and mechanical examination. Devices shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.4, 3.5, 3.7, and 3.8).

4.6.2 Retention of plugs (see 3.6.1). The connectors shall be tested in accordance with UL 498 and applicable bulletins. Following the test, connectors shall meet the requirements of 3.6.1.

4.6.3 Gripping (15 and 20 ampere, 125 and 250 volt straight blade receptacles and cable outlets only (see 3.6.2). The tests required in 4.6.3.1 and 4.6.3.2 shall be performed using conditioning tools and pull out tools conforming to figures 1, 2, 3, and 4. The conditioning and pull out tools shall be free of grease.

4.6.3.1 Power blade. Using a plug with a single 0.074 to 0.075 inch (1.88 to 1.91 mm) thick steel blade without holes (see figure 1) the blade shall be inserted into each current-carrying opening of the receptacle for 20 conditioning cycles. After the 20 conditioning cycles, the contact shall be capable of

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supporting for one minute 1 1/2 pounds secured to a single 0.055 inch (1.40 mm) thick solid blade without holes (see figure 2). The force shall be in a direction normal to the plane of the face of the receptacle and tending to withdraw the plug.

4.6.3.2 Grounding blade. Using a hardened polished steel pin with a spherical end (see figure 3), the grounding contact shall be conditioned by 20 insertions. After conditioning a 0.184 inch (4.67 mm) diameter pin shall be inserted in the grounding contact and shall be capable of supporting at least 4 ounces for one minute (see figure 4). The forces shall be applied in a direction normal to the face of the receptacle and tending to withdraw the pin.

4.6.4 Terminal strength 15 and 20 ampere, 125 and 250 volt devices only (see 3.6.3).

4.6.4.1 Connector plugs, cable outlets and male inlets. The samples shall be tested with stranded conductors as used in jacketed cords. One half of the samples shall be tested with the maximum size and type wire for which the device is rated and one half of the samples with the minimum size wire for a total of 6 terminals. The wires shall be connected to all of the terminals of each device as in normal use. If binding head screws or any other system which depends upon screws to achieve connections to the wire is used, they shall be tightened with a torque screwdriver until a torque of 14 inch-pounds is reached. The screws shall be loosened and retorqued 5 times. A pull force of 20 pounds in a straight line shall then be applied once on each wire for 1 minute unless an integral built-in strain relief is part of the device under test, in which case the pull force shall be 10 pounds. The built-in strain relief must require the device to be fully assembled before the device can be used in its normal manner. The device shall then be examined for conformance to 3.6.3.

4.6.4.2 Receptacles. Devices shall be tested with solid copper branch circuit conductors, using a minimum of one terminal on each sample for a total of 8 terminals tested. Each tested terminal screw shall be used only once. The minimum (#14 AWG) and maximum (#10 AWG) conductor size shall each be tested with 4 terminals. Side wired devices with back wiring for only one wire per terminal screw shall be tested with 1/2 of the terminals side wired and 1/2 back wired. Side wire devices with back wiring for one or two wires clamped under the same pressure plate and secured by the action of a single terminal screw shall be tested with 1/4 of the terminals side wired and 3/4 back wired. These back wired terminals shall be tested with 1 wire in one retaining means, 1 wire in the other means, and one wire in each retaining means at the same time using each terminal for only one method. Each terminal screw shall be tightened with a torque screwdriver until a torque of 14 inch-pounds is reached. Each screw shall be loosened and retorqued 5 times using a new stripped conductor each time. A pull force of 20 pounds in a straight line shall then be applied once for 1 minute on each wire connected to a back wiring terminal. The devices shall then be examined to determine conformance with 3.6.3.

4.6.5 Current overload (receptacles and cable outlets only) (see 3.6.4). Mating connectors (see 3.1) shall be coupled and wired as for actual service with suitable conductors. Devices shall be tested in accordance with UL 498 and its applicable bulletins, except that the number of cycles shall be 250 and the current 200 ± 5 percent of the rated current. At the completion of the last cycle, the connectors shall be examined in accordance with 3.6.4. Test current shall be ac with a .70 to .80 power factor except for devices specifically rated for dc.

4.6.6 Temperature rise (receptacles and cable outlets only) (see 3.6.5). Receptacles and cable outlets shall be tested in accordance with UL 498 and its applicable bulletins, except that the test current shall be 20 amperes for all 15 and 20 ampere devices and the test plug shall have solid brass blades.

4.6.7 Dielectric withstanding voltage (see 3.6.6). An alternating current root mean square voltage of commercial-line-frequency equal to 1,000 volts plus twice the rated voltage, shall be applied between mutually insulated terminals. The test voltage shall be increased from zero at a rate not to exceed 500

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volts per second until the specified potential is reached and shall be maintained at the value for one minute. The test voltage may be applied instantaneously for production test at the option of the manufacturer. The connector shall be examined to determine conformance to 3.6.6.

4.6.8 Insulation resistance (see 3.6.7). The insulation resistance shall be measured between mutually insulated terminals and if applicable between each terminal and the metal shell of the connector except where the terminal is electrically continuous with armor or shell. Measurements shall be made by means of a megohm bridge or other approved method at a direct current potential of at least 500 volts to determine conformance to 3.6.7.

4.6.9 Isolated ground (isolated ground receptacles only) (see 3.1 and 3.6.8). Connectors shall be mounted to a metal outlet box and a metal box cover or metal wall plate attached. The resistance between the grounding contact and the outlet box cover shall be measured as specified in 4.6.8.

4.6.10 Heat resistance (see 3.6.9). Connectors shall be placed in an oven maintained at $85^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($185^{\circ}\text{F} \pm 4^{\circ}\text{F}$) for a period of at least two hours. After removal from the oven the connectors shall be examined for conformance to 3.6.9.

4.6.11 Mechanical shock (plugs and cable outlets only) (see 3.6.10).

4.6.11.1 Devices rated 15 and 20 amperes. Samples of the connectors shall be assembled to .25 inch (6.35 mm) braided nylon line of a length suitable for mounting as illustrated on figure 5. The line and connector shall be supported at point A so that when hanging freely, the plug takes the position (1). A moving member shall lift the line and connector assembly to the position B and then released so that it falls freely and strikes the impact board C. This constitutes one cycle of the test. Each sample shall be subjected to the above test for 1,300 cycles then tested for dielectric withstanding voltage and insulation resistance as specified in 4.6.7 and 4.6.8 respectively. The samples shall be considered acceptable if each sample completes not less than 500 cycles and the average number of cycles completed for all plugs tested is not less than 1,000. Samples shall be inspected every 50 cycles after completion of the first 450 cycles.

4.6.11.2 Devices rated 30 amperes and above. The unwired connector shall be dropped 50 times with random orientation through a vertical distance of three feet (914.40mm) (upon a steel plate at least .25 inch (6.35 mm) thick. At the completion of this test, the connector shall be examined for conformance to 3.6.10 and then tested for dielectric withstanding voltage and insulation resistance as specified in 4.6.7 and 4.6.8 respectively. Bent blades shall not be cause for rejection if they can be straightened without breaking at the end of the test.

4.6.12 Crushing (plugs and cable outlets only) (see 3.6.11). The connector shall be wired in accordance with 4.6.4 and placed between two parallel hardwood slabs, each at least .50 inch (12.7 mm) thick, with the major axis of the device parallel with the flat surfaces of the slabs. A compressive force shall be applied to the connector at right angles to the major axis and shall be increased to 75 pounds and maintained at that value for one minute. The connector shall be observed during the test and examined after the test for conformance to 3.6.11. For hospital grade, the compressive force shall be 500 pounds.

4.6.13 Strain relief (plugs and cable outlets only) (see 3.5.4 and 3.6.12). The cable employed in the strain relief test shall have a smooth surface of the minimum diameter the plug is designed to utilize, and it shall be secured to the plug by means of the strain relief only. The conductor leads shall not be connected to terminals. When strain relief screws are provided, they shall be tightened to a maximum torque acceptable without stripping, but not to exceed 14 inch-pounds. With the plug held securely in place a mechanical force shall be applied to the cable in a direction tending to withdraw the cable from

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the plug. The force shall be increased to 30 ± 1 pounds and held at the value for one minute. Movement of the outer jacket shall not exceed the value specified in 3.6.12.

4.6.14 Assembly security (15 and 20 ampere duplex 125 volt, 50/60 hertz straight blade receptacles only) (see 3.6.13).

4.6.14.1 Test I. With the sample mounted in the fixture shown on figure 6, the test of the security of the assembly shall consist of a force of 100 pounds minimum applied as shown on figure 7, by means of the push out tool described by figure 8, inserted into the slots of the receptacles. The receptacle shall be visually examined for damage as specified in 3.6.13.1. Other test fixtures may be used for receptacles not compatible with the fixture on figure 6, provided they allow for equivalent testing and meet all test requirements specified herein.

4.6.14.2 Test II. With the sample mounted in the fixture shown on figure 6, the test of the security of the assembly shall consist of a force of 50 pounds minimum applied to the bridge shown on figure 10, applied as shown on figure 9. When the force is removed, there shall be no evidence of damage as specified in 3.6.13.2 or yoke deformation exceeding .06 inch (1.52 mm) when measured as shown on figure 9. Other test fixtures may be used for receptacles not compatible with the fixture on figure 6, provided they allow for equivalent testing and meet all test requirements specified herein.

4.6.15 UL 498 tests (see 3.6.14). Connectors shall be tested in accordance with UL 498 for the following requirements:

- a. Integrity of assembly.
- b. Potential drop in grounding connection.
- c. Receptacle grounding contact.
- d. Accelerated aging.
- e. Grounding pin retention.
- f. Mold stress relief.
- g. Conditioning.
- h. Abrupt removal.
- i. Line blade retention.
- j. Grounding contact temperature.
- k. Grounding contact resistance.
- l. Fault current.
- m. Connection and separation.
- n. Grounding path resistance.
- o. Strain relief.

Nonconformance to 3.6.14 shall constitute failure of this test.

4.6.16 Blade strength (plugs and male inlets only) (see 3.6.15). Devices shall be tested in accordance with 4.6.16.1, 4.6.16.2, and 4.6.16.3. The device shall be rigidly held in place in such manner as to withstand, without damage, the specified force, which shall be applied to each contact and shall be increased to the specified magnitude. The axial application of the force shall pass through the center of the hole in the contact. If the contact does not have a hole a force shall be applied at a point 3/16 inch from its free end.

4.6.16.1 Bending stress.

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4.6.16.1.1 Perpendicular stress (plugs only). Unless otherwise specified (see 3.1) a force of 20 pounds minimum shall be applied in each of two directions parallel with the plug face and perpendicular to the axis of the contact hole.

4.6.16.1.2 Axial stress (plugs only). Unless otherwise specified (see 3.1) a force of nine pounds minimum shall be applied in each of two directions parallel with the plug face and along the axis of the contact hole.

4.6.16.2 Tensile strength. Unless otherwise specified (see 3.1) a force of 20 pounds minimum shall be applied to each contact in a longitudinal direction away from the contact and shall be held for at least one minute.

4.6.16.3 Blade retention. Unless otherwise specified (see 3.1) a force of 40 pounds minimum for general grade connectors and 150 pounds minimum for hospital grade connectors shall be applied to each contact in a longitudinal direction toward the contact and shall be held for one minute minimum.

4.6.17 Impact test (hospital grade) (see 3.6.17). Receptacles shall be mounted to a cast metal (malleable iron) box and a metal face plate installed as intended to provide peripheral support against the frame. The receptacle, plate and box shall be placed on a substantial steel plate with the outlet facing upward. A 5-pound cylindrical weight (1 1/4-inch (31.75 mm) diameter) having a flat end shall be dropped from a height of 18 inches (457.20 mm) to impact the center of each receptacle outlet. Plugs and cable outlets shall be tested by dropping a cylindrical 10 pound weight having a flat face two inches (50.80 mm) in diameter from a height of 18 inches (457.20 mm). Each sample shall be placed on a hard wood natural surface in any natural position (a cylindrical body shall have its major axis parallel to the surface). The hard wood shall be a maple block approximately 1 5/8 inches (41.275 mm) thick by 4 1/2 inches (114.30 mm) square and shall rest on a fixed surface such as a concrete floor. The device shall be examined for conformance to 3.6.17.

4.7 Sample selection. When a group of similar connectors employing common construction features is submitted for qualification, the devices shall be grouped into families to minimize redundant testing. Testing shall be conducted on samples of one representative device at the highest current and voltage rating within the family.

4.7.1 Criteria for general grade family grouping. General grade connectors shall be grouped into families using the criteria outlined in table VI for each test group.

4.7.2 Criteria for hospital grade family grouping. Hospital grade connectors shall be grouped into families using the criteria outlined in table VII for each test group.

4.7.3 Representative testing between families. The strain relief test for cable outlets (see 4.6.13 and 4.6.15o) need not be conducted if plugs with the same strain relief or cord clamp construction have already been subjected to the test on the required cord type and diameter.

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TABLE VI. Guidelines for waiving tests – general grade.

Construction similarity	Needed to waive tests			
	Group			
	I	II	III	IV
<u>Plug</u>				
Terminal	Y	Y	Y	Y
Separation between live parts and grounding or dead metal parts	Y	Y	N	N
Blade	N	N	N	Y
Insulating material	N	Y	N	Y
Housing	Y	Y	Y	Y
Face	Y	Y	N	Y
Terminal cover	Y	Y	Y	Y
Strain relief/cord clamp	N	Y	Y	N
<u>Receptacle</u>				
Terminal	Y	Y	N	N
Separation between live parts and grounding or dead metal parts	Y	Y	Y	Y
Line, neutral contacts	Y	Y	N	N
Grounding contact	Y	Y	Y	N
Insulating material	Y	Y	Y	Y
Housing	Y	Y	Y	Y
Face	Y	Y	Y	Y
Yoke	N	N	Y	N
Mounting flange	N	N	Y	Y
Distance from contact to face	Y	Y	Y	N
<u>Cable outlet</u>				
Terminal	Y	Y	Y	N
Separation between live parts and grounding or dead metal parts	Y	Y	N	N
Line, neutral contacts	Y	Y	N	N
Grounding contact	Y	Y	Y	N
Insulating material	Y	Y	N	Y
Housing	Y	Y	Y	Y
Face	Y	Y	N	Y
Terminal cover	Y	Y	Y	Y
Strain relief/cord clamp	N	Y	Y	Y
<u>Male inlet</u>				
Terminal	Y	Y	Y	N
Separation between live parts and grounding or dead metal parts	Y	Y	N	N
Blade	N	N	Y	N
Insulating material	N	Y	N	Y
Housing	Y	Y	N	Y
Face	Y	Y	N	Y
Mounting flange	N	Y	N	Y

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TABLE VII. Guidelines for waiving tests – hospital grade.

Construction similarity	Needed to waive tests							
	Group							
	I	II	III	IV	V	VI	VII	VIII
<u>Plug</u>								
Terminal	Y	Y	Y	Y	N	-	-	N
Separation between live parts and grounding or dead metal parts	Y	Y	N	N	N	-	-	N
Blade	N	N	N	Y	N	-	-	N
Insulating material	N	Y	N	Y	Y	-	-	Y
Housing	Y	Y	Y	Y	Y	-	-	Y
Face	Y	Y	N	Y	Y	-	-	Y
Terminal cover	Y	Y	Y	Y	Y	-	-	Y
Strain relief/cord clamp	N	Y	Y	N	Y	-	-	Y
<u>Receptacle</u>								
Terminal	Y	Y	N	N	-	Y	-	-
Separation between live parts and grounding or dead metal parts	Y	Y	Y	Y	-	Y	-	-
Line, neutral contacts	Y	Y	N	N	-	Y	-	-
Grounding contact	Y	Y	Y	N	-	Y	-	-
Insulating material	Y	Y	Y	Y	-	Y	-	-
Housing	Y	Y	Y	Y	-	Y	-	-
Face	Y	Y	Y	Y	-	Y	-	-
Yoke	N	N	Y	N	-	Y	-	-
Mounting flange	N	N	Y	Y	-	Y	-	-
Distance from contact to face	Y	Y	Y	N	-	Y	-	-
<u>Cable outlet</u>								
Terminal	Y	Y	Y	N	N	-	Y	N
Separation between live parts and grounding or dead metal parts	Y	Y	N	N	N	-	Y	N
Line, neutral contacts	Y	Y	N	N	N	-	Y	N
Grounding contact	Y	Y	Y	N	N	-	Y	N
Insulating material	Y	Y	N	Y	Y	-	N	Y
Housing	Y	Y	Y	Y	Y	-	Y	Y
Face	Y	Y	N	Y	Y	-	Y	Y
Terminal cover	Y	Y	Y	Y	Y	-	Y	Y
Strain relief/cord clamp	N	Y	Y	Y	Y	-	N	Y
<u>Male inlet</u>								
Terminal	Y	Y	Y	N	-	-	-	-
Separation between live parts and grounding or dead metal parts	Y	Y	N	N	-	-	-	-
Blade	N	N	Y	N	-	-	-	-
Insulating material	N	Y	N	Y	-	-	-	-
Housing	Y	Y	N	Y	-	-	-	-
Face	Y	Y	N	Y	-	-	-	-
Mounting flange	N	Y	N	Y	-	-	-	-

5. PACKAGING.

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department of Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES.

(This section contains information of a general or explanatory nature which is helpful but is not mandatory).

6.1 Intended use. Connectors covered by this specification are intended for use in any electrical circuit within their voltage, current, frequency, and physical limitations. These connectors are designed with mating polarization for specific current rating, voltage, frequency (Hz), phase, and grounding requirements. This prevents mating with a connector of incompatible power characteristics.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents.

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable specification sheet and complete PIN (see 3.1).
- c. Marking if other than Federal specification verification program is used (see 3.7).
- d. Specify color of part if desired unless color is restricted by PIN on the specification sheet or by industry standard.

6.3 Definitions.

6.3.1 Connector plug. A device with male blades which, by insertion into a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected to the receptacle.

6.3.2 Connector receptacle. A device with female contacts primarily installed at an outlet box or on equipment to establish electrical connections with an inserted plug.

6.3.3 Connector cable outlet. A portable receptacle provided with means for attachment to a flexible cord which is not intended for permanent mounting.

6.3.4 Connector male inlet. A device with male blades which by insertion of a cable outlet establishes connection between the conductors of the cable outlet and the conductors connected to the male inlet. This device is intended for permanent mounting on equipment.

6.3.5 Dead-front construction. The method of construction of a plug which has its wire terminals usually on the rear of the plug and these terminals are covered by a mating section of the plug.

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6.3.6 General grade. A class of connector that meets the requirements of Underwriters Laboratories, Inc. UL 498 and the additional requirements as specified herein.

6.3.7 Hospital grade. A class of connector that meets the more stringent requirements of "hospital grade" connectors as specified in UL 498 and the additional requirements as specified herein. This connector is designed to meet the added performance requirements of high abuse areas.

6.3.8 Isolated ground. A device in which the grounding terminals are isolated from the mounting strap to prevent transmission of transient currents often associated with the building ground.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Product List QPL No. 596 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, DLA-VQ, 3990 East Broad Street, Columbus, Ohio 43218-3990 or via email: vqp@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

6.5 Date coding. Date coding of the part is not a requirement, however, it is suggested that each connector be permanently marked with a code which is traceable to the date of manufacture. For products not bearing a date code the manufacturer may bear the full risk responsibility and expense of a total purge of all material in stock should that manufacturer's products fail to meet the requirements of W-C-596 and there is no means of readily differentiating good parts from those that are bad or suspect.

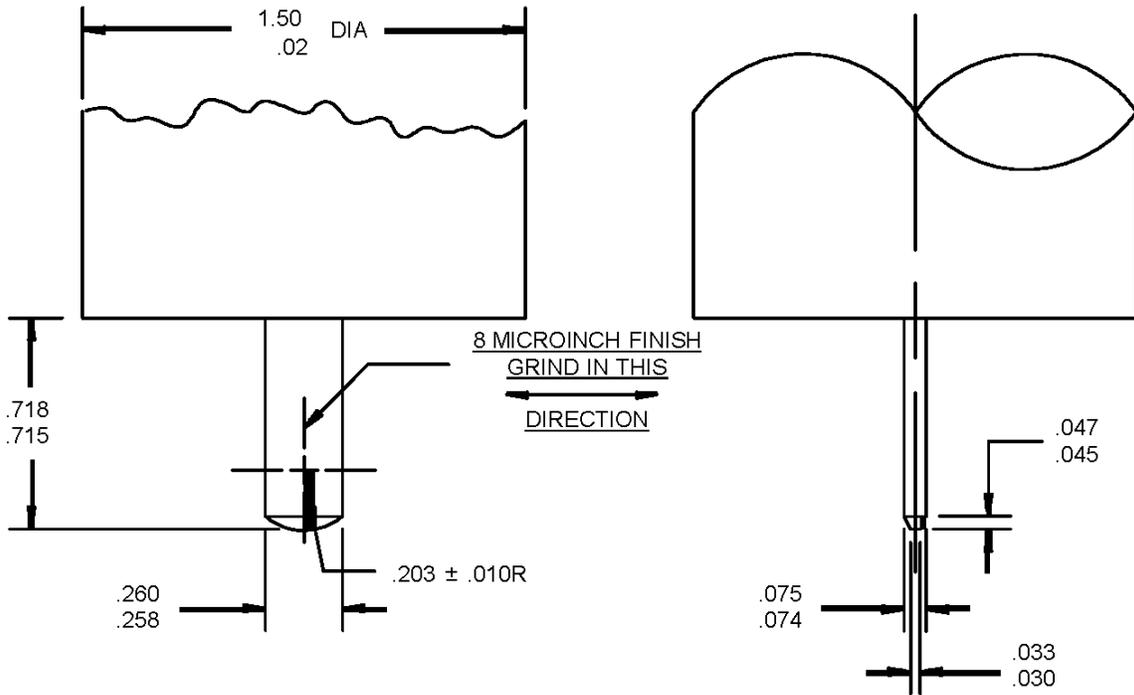
6.6 Part Identification Number (PIN). The Part Identification Number (PIN) is specified in the applicable specification sheet (see 3.1).

6.7 Subject term (key word listing).

| Connector, general grade.
Connector, hospital grade.
Cable outlets.
Electrical plugs.
Receptacles.

| 6.8 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

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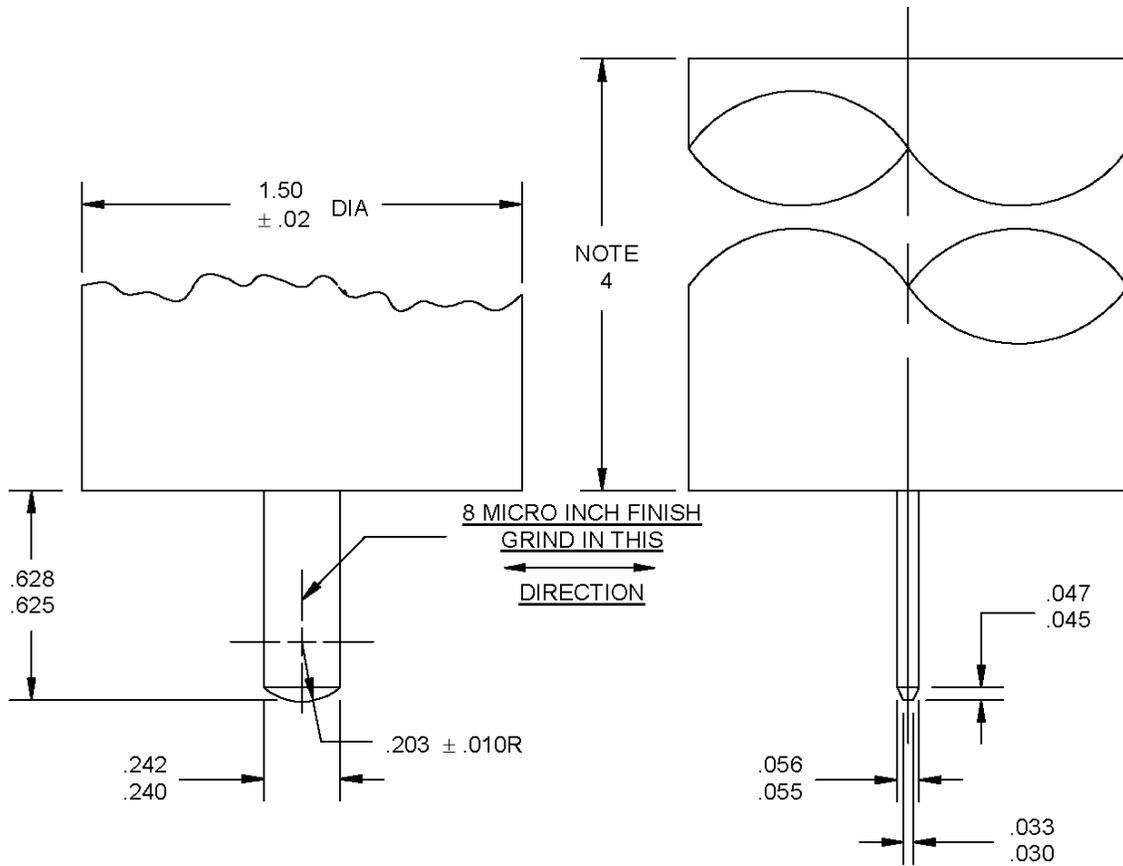
Inches	mm	Inches	mm
.010	0.25	.075	1.91
.02	0.5	.203	5.16
.030	0.76	.258	6.55
.033	0.84	.260	6.60
.045	1.14	.715	18.16
.047	1.19	.718	18.24
.074	1.88	1.500	38.10

NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. The blade is to be fastened to the handle in a rigid manner.
4. The blade shall be of steel having a Rockwell hardness of C-58 to 60. The handle shall be of cold rolled steel.
5. Sharp edges shall be removed to a maximum radius of .015 inch (0.38 mm).

FIGURE 1. Condition tool No. 1.

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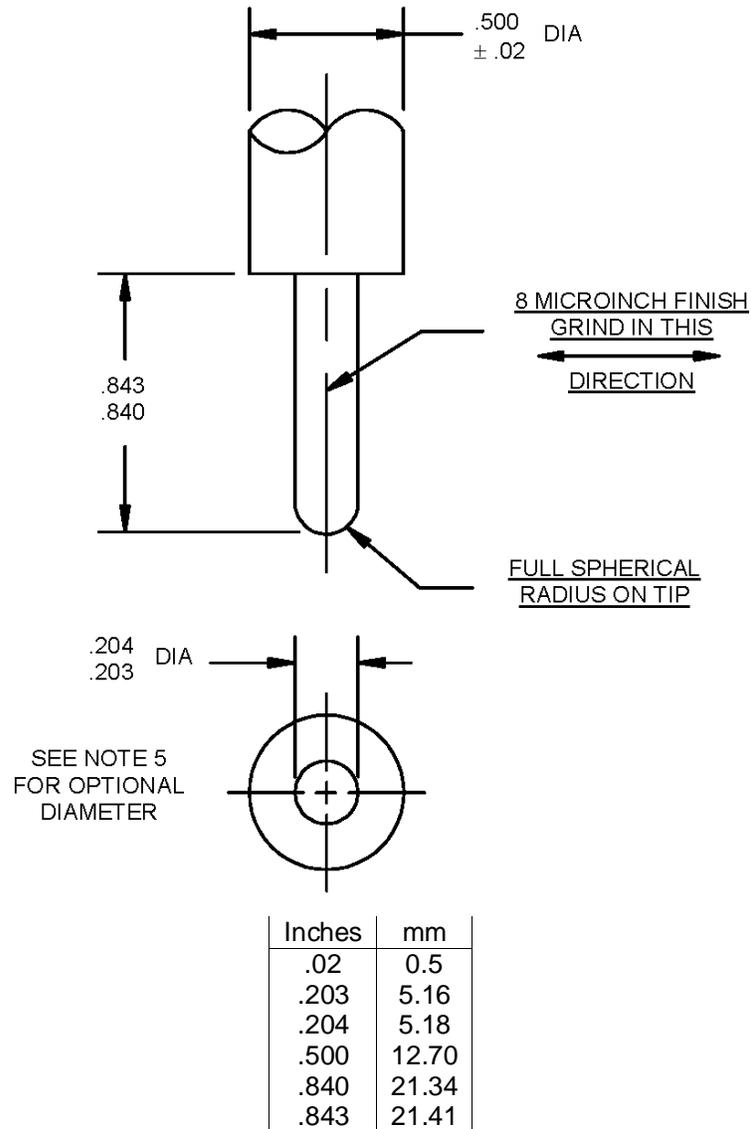
Inches	mm	Inches	mm
.010	0.25	.056	1.42
.02	0.5	.203	5.16
.030	0.76	.240	6.10
.033	0.84	.242	6.15
.045	1.14	.625	15.88
.047	1.19	.628	15.95
.055	1.40	1.500	38.10

NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Axis of blade and axis on holder must have a combined concentricity and axial alignment tolerance of .006 (0.15 mm) maximum TIR.
4. Length to suit total tool weight of 1.50 pounds.
5. The blade is to be fastened to the handle in a rigid manner.
6. Sharp edges shall be removed to a maximum radius of .015 inch (0.38 mm).
7. The blade shall be of steel having a Rockwell hardness of C-58 to 60. The handle shall be of cold rolled steel.

FIGURE 2. Pull-out tool No. 1.

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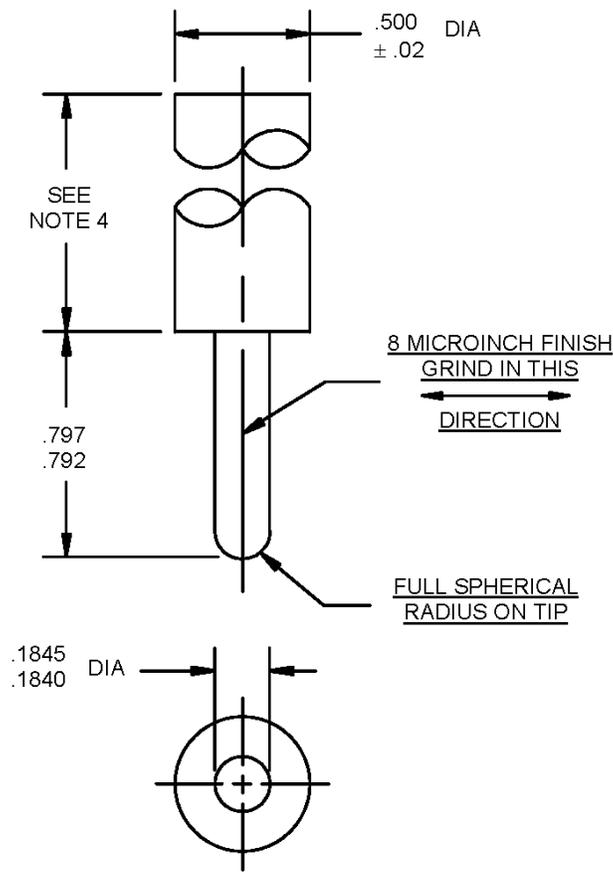


NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. The ground pin is to be fastened to the handle in a rigid manner.
4. The pin shall be of steel having a Rockwell hardness of C-58 to 60. The handle shall be of cold rolled steel.
5. For a receptacle with a restricted ground socket throughway, the diameter shall be the minimum design diameter of the restriction +.000, -.002 (0.05 mm).

FIGURE 3. Conditioning tool No. 2.

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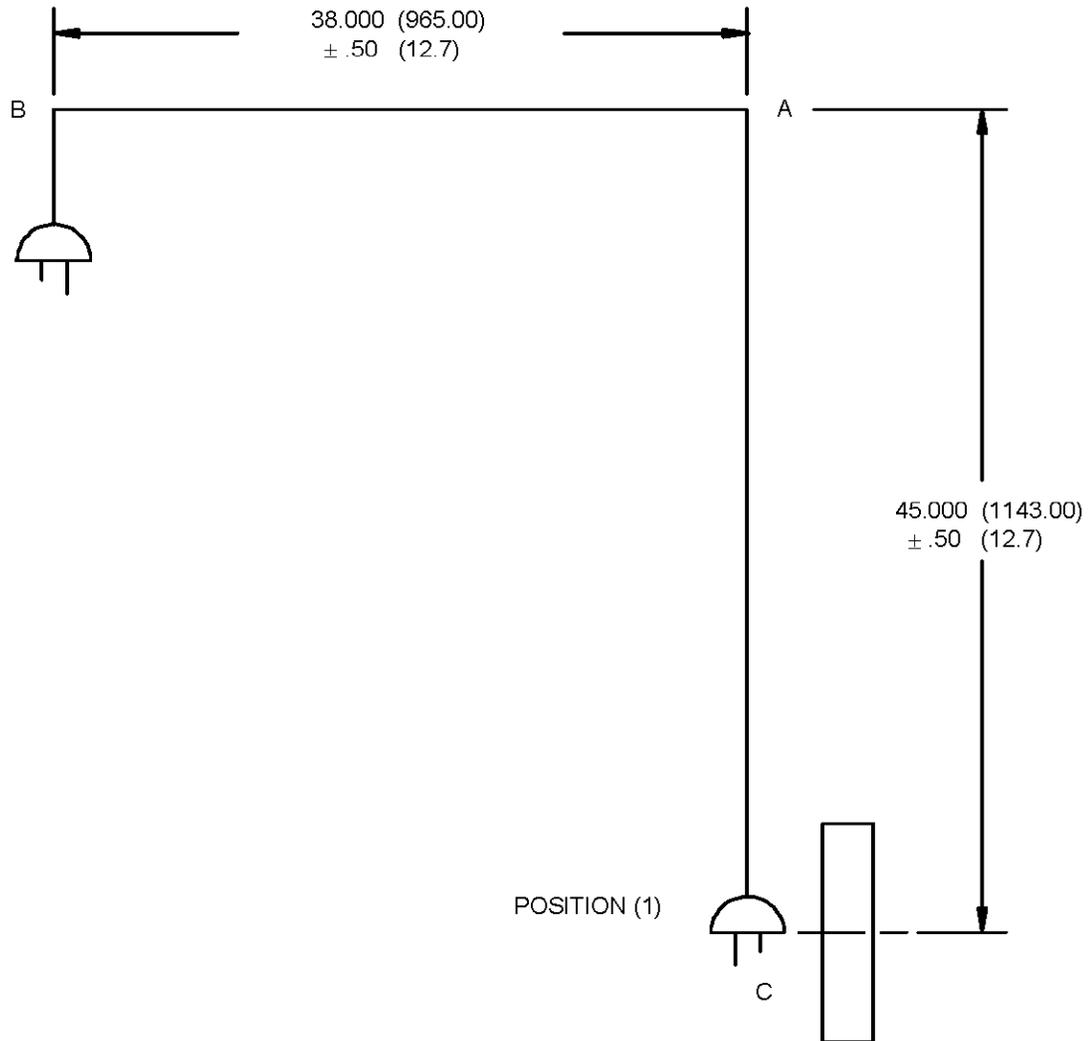
Inches	mm
.02	0.5
.1840	4.674
.1845	4.686
.500	12.70
.792	20.12
.797	20.24

NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. The ground pin is to be fastened to the handle in a rigid manner.
4. Length to suit total tool weight of 4 ounces.
5. Axis of blade and axis on holder must have a combined concentricity and axial alignment tolerance of .006 (0.15 mm) maximum TIR.
6. The pin shall be of steel having a Rockwell hardness of C-58 to 60. The handle shall be of cold rolled steel.
7. For a receptacle with a restricted ground socket throughway, the diameter shall be the minimum design diameter of the restriction +.000, -.002 (0.05 mm).

FIGURE 4. Pull-out tool No. 2.

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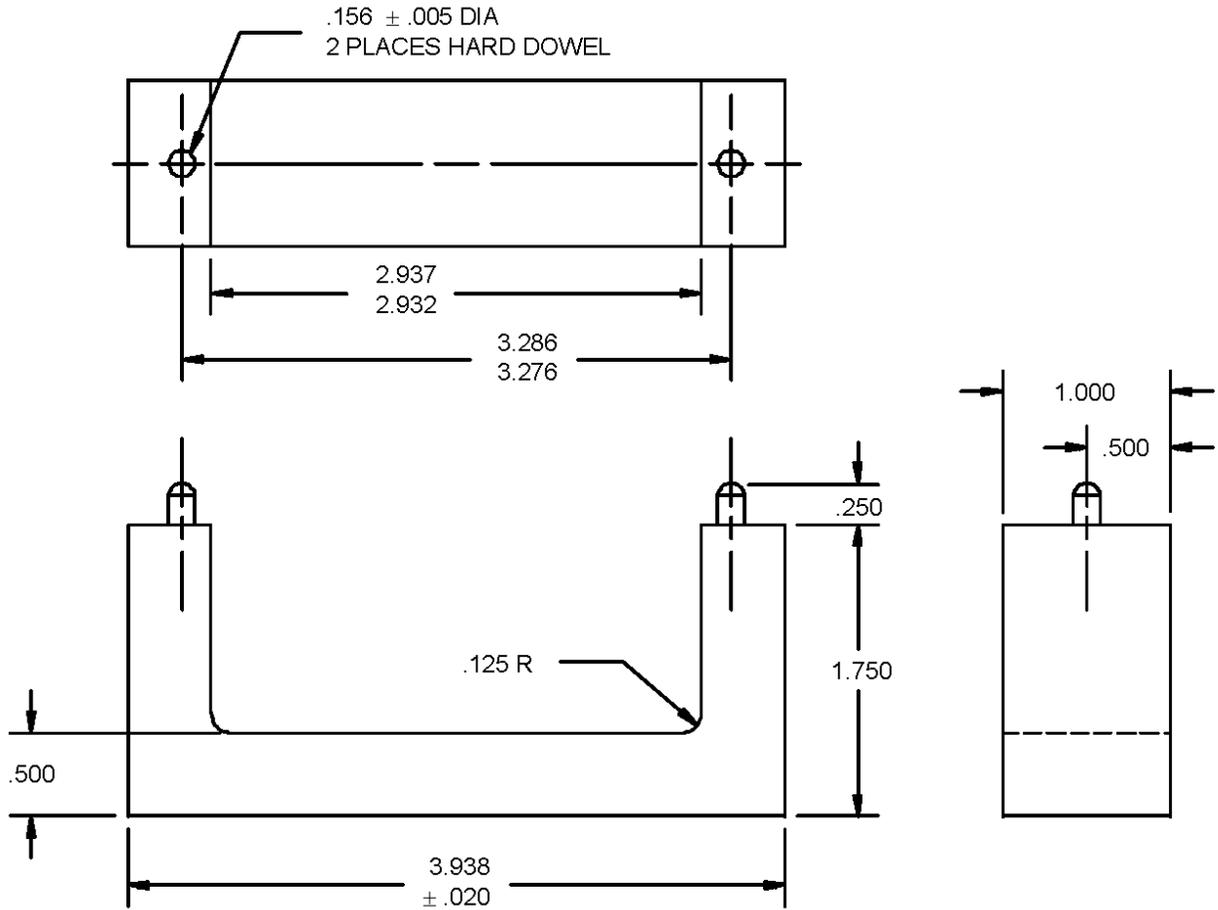


NOTES

1. C is a board of hard maple, mounted rigidly and with the grain of the wood running vertically. The board shall be from 1.50 to 2.00 inches (38.1 to 50.8 mm) thick and of sufficient width and length and so located that when the plug is allowed to fall, it will not strike near any edge of the board. The screws may be tightened after each 200 cycles.
2. Dimensions are in inches.
3. Metric equivalents are given for information only.
4. Metric equivalents are in parentheses.

FIGURE 5. Mechanical shock test.

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Inches	mm	Inches	mm
.005	0.13	1.750	44.45
.020	0.51	2.932	74.47
.125	3.18	2.937	74.60
.156	3.96	3.276	83.21
.250	6.35	3.286	83.46
.500	12.70	3.938	100.03
1.000	25.40		

NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Unless otherwise specified tolerance is ± .010 (0.25 mm).
4. The handle shall be of cold rolled steel.

FIGURE 6. Fixture for assembly security tests.

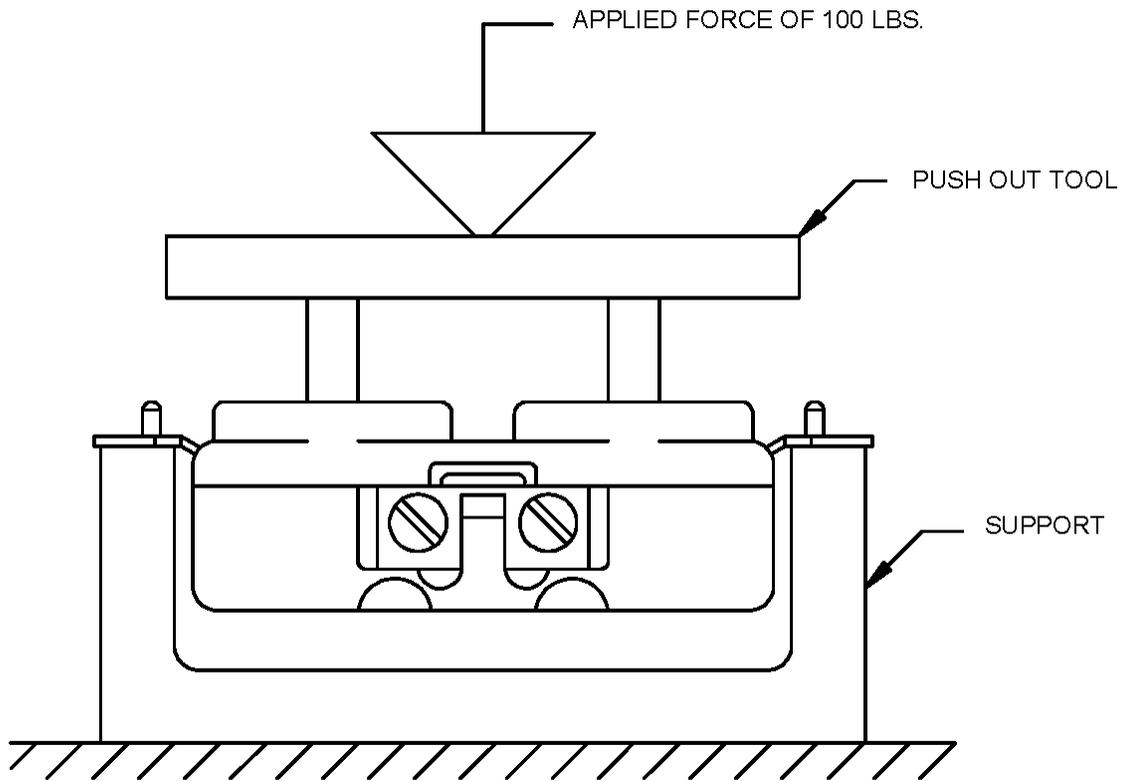
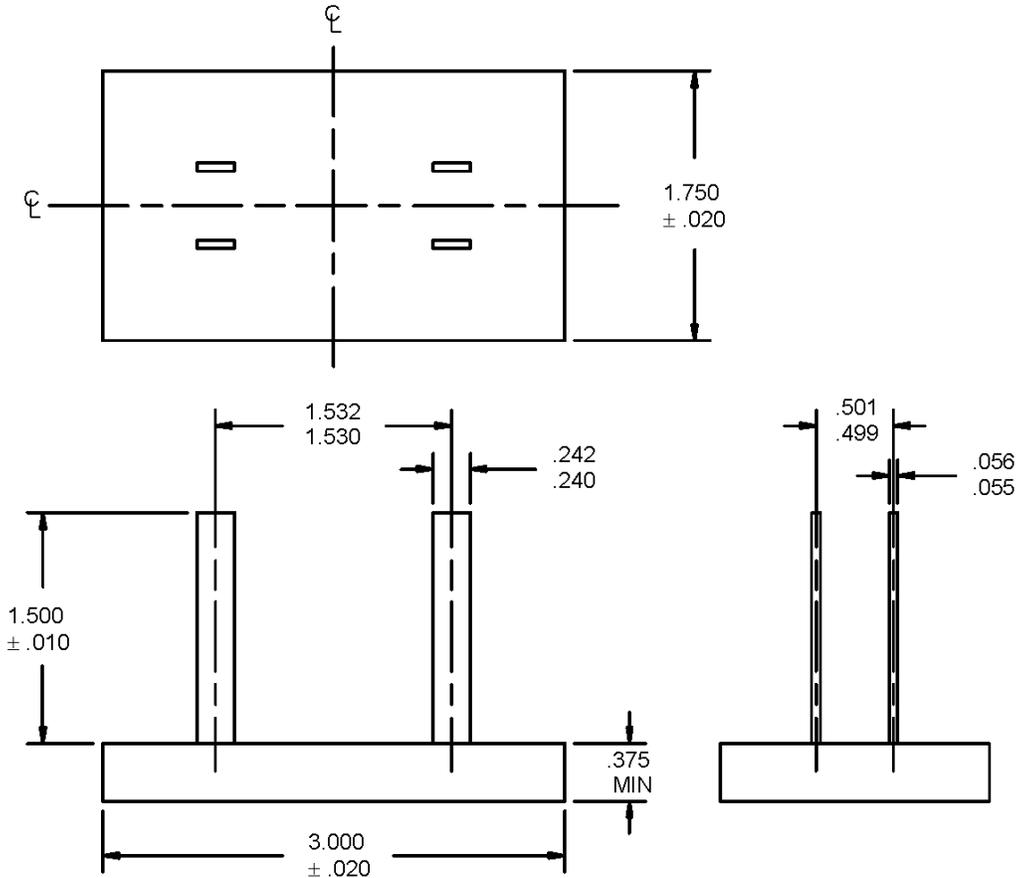


FIGURE 7. One hundred pound assembly security pressure test.

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Inches	mm	Inches	mm
.010	0.25	.499	12.67
.020	0.51	.501	12.73
.055	1.40	1.500	38.10
.056	1.42	1.530	38.86
.240	6.10	1.532	38.91
.242	6.15	1.750	44.45
.375	9.52	3.000	76.20

NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Blades to be parallel to each other and perpendicular to the base within .006 (0.15 mm) TIR.
4. Length to suit total tool weight of 1.50 pounds.
5. Blades are to be fastened to the handle in a rigid manner.
6. Sharp edges shall be removed to a maximum radius of .015 inch (0.38 mm).
7. The blade shall be of steel having a Rockwell hardness of C-58 to 60. The handle shall be of cold rolled steel.
8. The fixture shall be of cold rolled steel.

FIGURE 8. Push out tool.

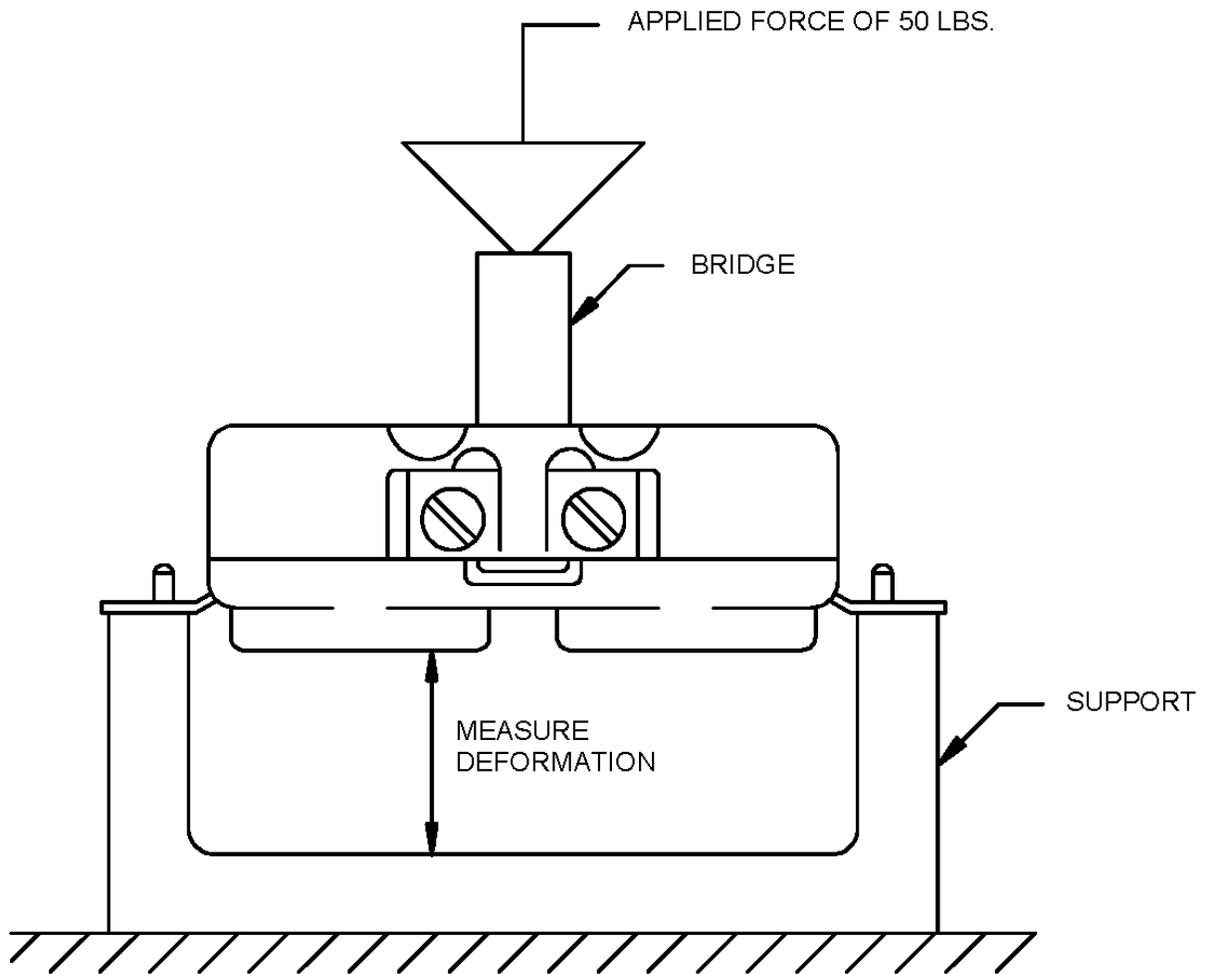
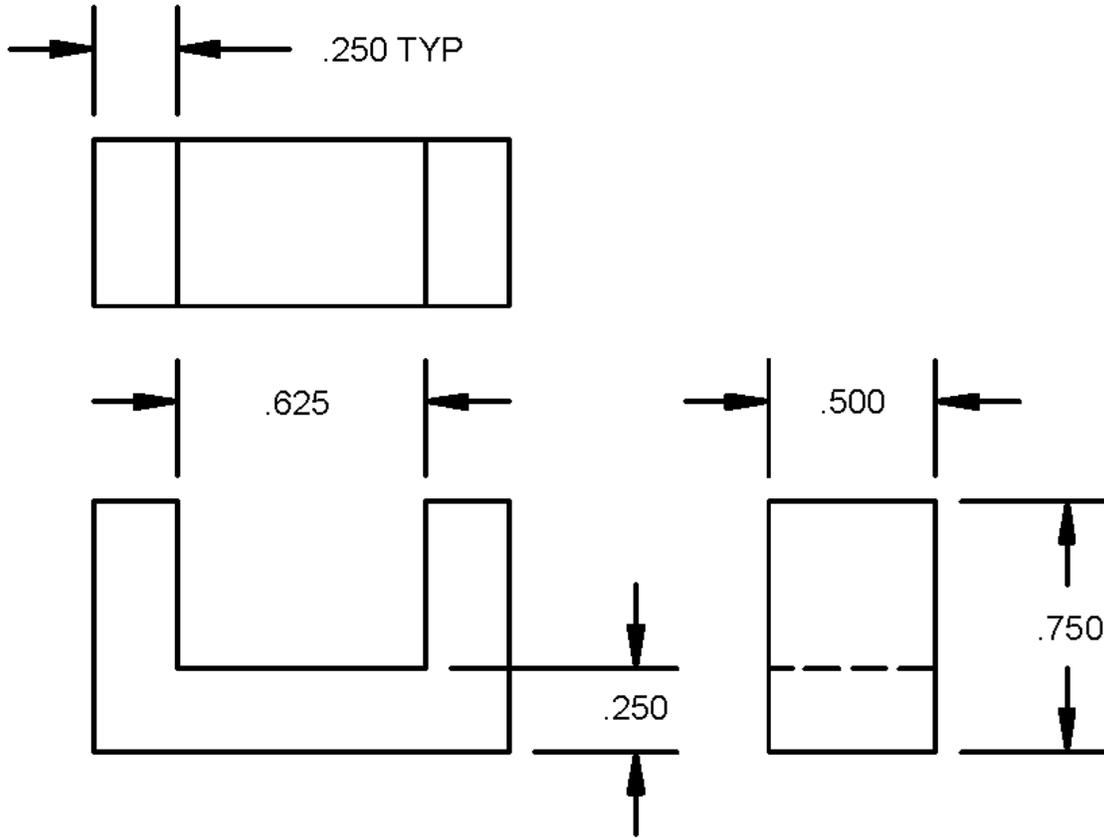


FIGURE 9. Fifty pound assembly security pressure and deformation test.



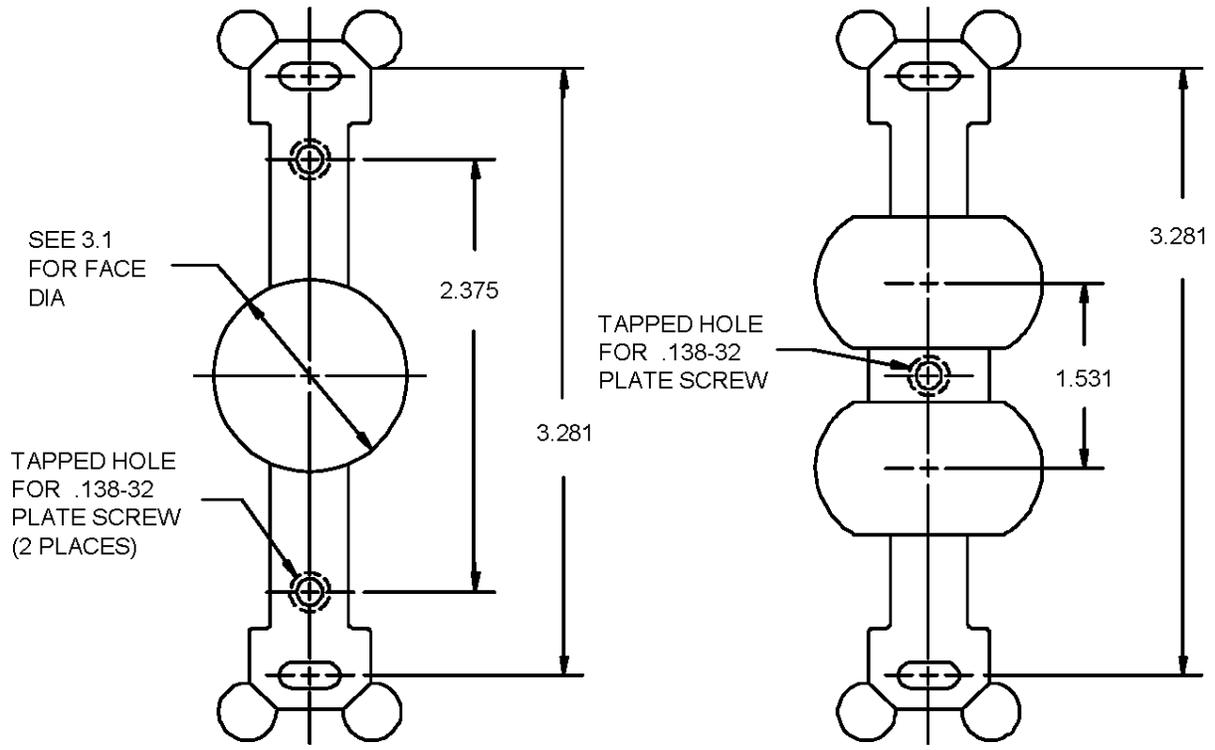
Inches	mm
.250	6.35
.500	12.70
.625	15.88
.750	19.05

NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Unless otherwise specified, tolerance is $\pm .005$ (.013 mm).
4. The .625 (15.88 mm) may be varied so that the tool clears the strap of the receptacle.
5. The shape of the bridge may be varied to suit the back of the device being tested.

FIGURE 10. Bridge.

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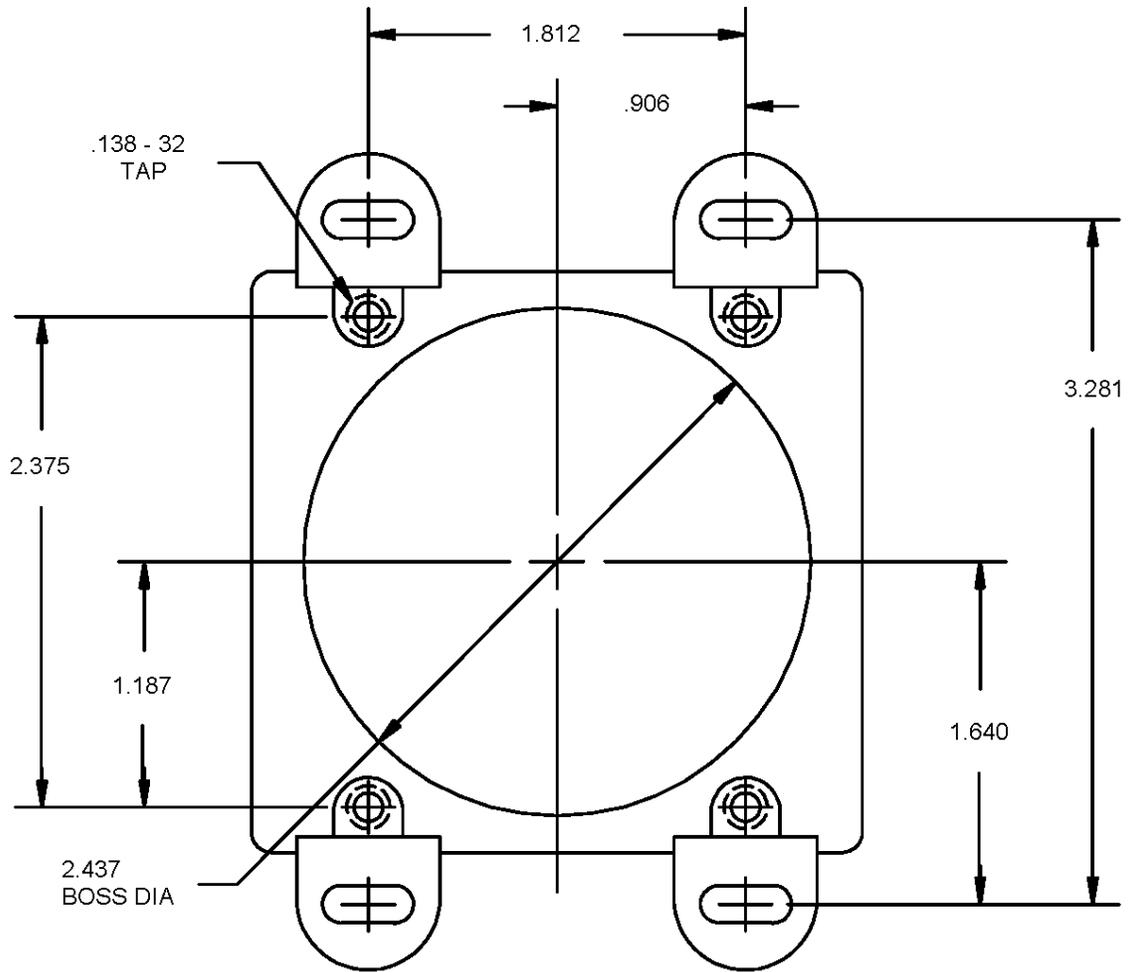


CONFIGURATION A - SINGLE RECEPTACLES
WITH BREAK-OFF EARS

CONFIGURATION B - DUPLEX RECEPTACLES
WITH BREAK-OFF EARS

FIGURE 11. Mounting dimensions.

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CONFIGURATION C - CENTER BOSS RECEPTACLES

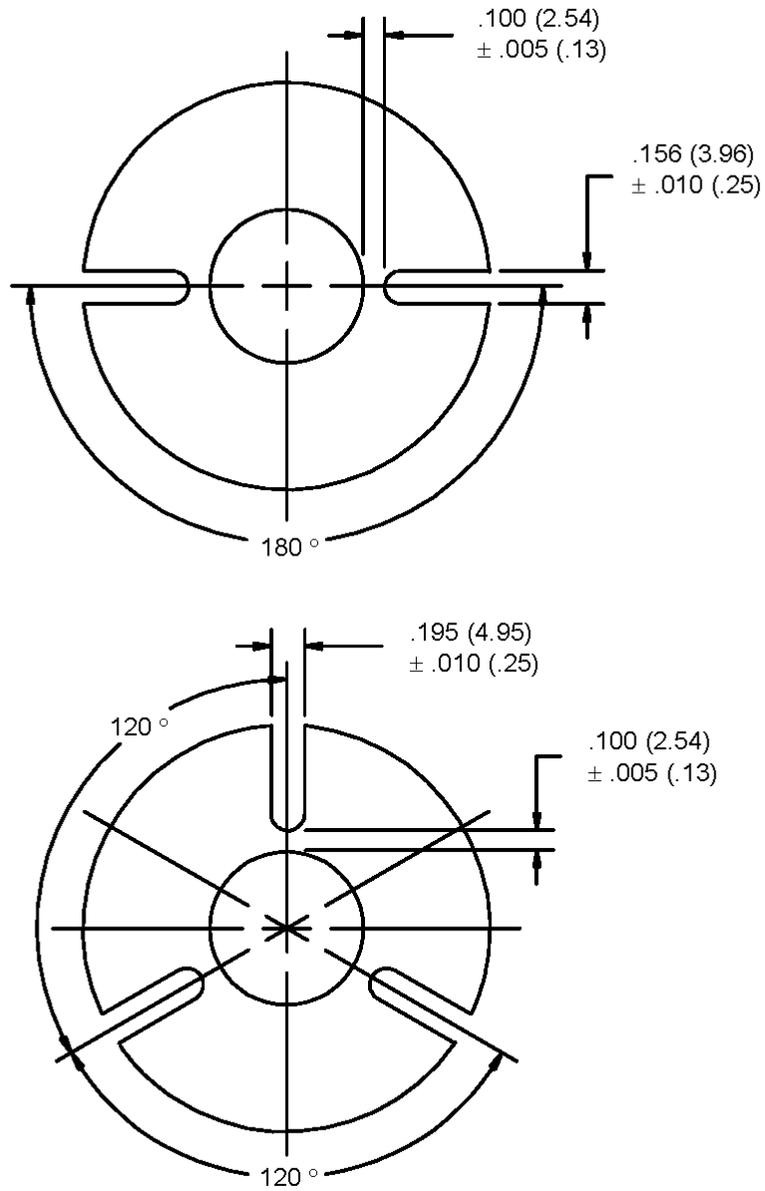
Inches	mm	Inches	mm
.138	3.51	1.812	46.02
.906	23.01	2.375	60.32
1.187	30.15	2.437	61.90
1.531	38.89	3.281	83.34
1.640	41.66		

NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Unless otherwise specified, tolerance is $\pm .005$ (0.13 mm).
4. Configuration C is for four wire 30, 50 and 60 ampere receptacles.
5. Outline configuration is optional.

FIGURE 11. Mounting dimensions – Continued.

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NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Metric equivalents are in parentheses.

FIGURE 12. Optional mounting slots for male inlet.

CONCLUDING MATERIAL

MILITARY INTERESTS

Custodians

Army – CR
Navy – YD
Air Force – 85

Review activities

Army – AR, AV, CR4, MI
Navy – AS, EC, MC, SH
Air Force – 19, 99

CIVIL AGENCY COORDINATING ACTIVITIES

DCGOVT DCG
DOT – ACO
GSA – 7FXE
HHS – FEC
USDA – AFS
VA – OSS

PREPARING ACTIVITY
DLA – CC

Project 5935-2016-178

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