Repl. by 26A

Federal Aviation Agency

ADVISORY CIRCULAR

AC NO:	AC 150/5345-26
	AIRPORTS
EFFECTIVE:	10/5/64

SUBJECT: SPECIFICATION FOR L-823 PLUG AND RECEPTACLE, CABLE CONNECTORS

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1. PURPOSE. This circular describes the subject specification requirements for plug and receptacle, cable connectors. The specification is for the guidance of the public, and its use is required for project activity under the Federal-aid Airport Program.

2. CANCELLATION. This advisory circular cancels and replaces Federal Aviation Agency Specification L-823, "Plug and Receptacle, Cable Connectors", dated January 1, 1961. The substantive changes made in this circular consist of deleting four figures and text reference for special plugs and receptacles, deletion of certain American Society for Testing and Materials specifications, the addition of changed requirements occasioned by the deletion of ASTM specifications, and the addition of a new drawing, Figure 15, and text material for this new equipment.

   NOTE: The deletion of the four figures from the last issue of the referenced specification together with the deletion of six figures from prior issues now makes only Figures 1, 6, 11, 14, and 15 currently effective. The retention of the figure numbers, not in sequence, is to preserve the continuity of prior approval actions for currently used plugs and receptacles.

3. SCOPE OF SPECIFICATION. The specification requirements presented are for a plug and receptacle to be used with underground supply cable and transformer primary leads, and with transformer secondary and fixture leads, as applicable. Where shapes other than those described (such as a "T" or other cable terminals) are used, the shape may be altered but the dimensions relating to mating and interchangeability shall be as described in the applicable figure.

4. APPLICABLE SPECIFICATIONS AND STANDARD. The following specifications and standard, of the issue in effect on the date of application for qualification (see paragraph 9), apply to this circular. This circular shall govern in case of conflict.

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a. ASTM Specifications.

(1) B33 - Tinned Soft or Annealed Copper Wire for Electrical Purposes.

(2) B189 - Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes.

(3) D676 - Method of Test for Indentation of Rubber by Means of a Durometer (Tentative).

b. IPCEA Standard. S-19-81 - General Specifications for Wire and Cable with Rubber, Rubber-Like and Thermoplastic Insulations.

5. SOURCE OF APPLICABLE SPECIFICATIONS AND STANDARD.

a. Obtain copies of ASTM specifications from the American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pennsylvania, at published prices.

b. Obtain copies of IPCEA standard publication from the Insulated Power Cable Engineers Association, 283 Valley Road, Montclair, New Jersey.

6. PERFORMANCE REQUIREMENTS.

a. The voltage rating and current carrying capacity of each connector shall not be less than the values shown on the figures describing the connector.

b. The voltage drop across the contacts of a connected plug and receptacle shall not exceed the values tabulated below for the indicated ampere rating:

Ampere Rating	Maximum Voltage Drop Across Contact
20	6.0 Millivolts
25	7.5 Millivolts

c. Bonding Strength.

(1) The bond between the cable and the molded on plug or receptacle shown on Figure 1 shall withstand a pull of at least 75 percent of the test force required in determining the mechanical strength of completed cord as set forth in IPCEA Standard Publication S-19-81, under the table entitled "Strength of Completed Cord". Cord conductors not covered by this table shall be tested in accordance with requirements set forth in paragraph 6c(2).

(2) The bond between the cable and the molded on plug or receptacle shown on Figures 6 and 11 of this specification shall withstand a pull of at least 30,000 psi. This is based on 75 percent of an average tensile strength of 40,000 psi for all wire sizes. The wires are in accordance with ASTM Specifications B33 and B189.

d. A connected plug and receptacle shall not show any evidence of separation when subjected to a static pull load of ten pounds.

e. The connector shall be designed for static service within a temperature range from a minimum of -45°F to a maximum of +120°F at sea level.

f. There shall be a watertight seal between rubber and metal parts of the plug and receptacles.

7. DETAIL REQUIREMENTS.

a. Each connector shall conform to the requirements shown on the applicable figure.

b. Housing.

(1) The connector housing shall be molded from synthetic elastomeric materials serving both as insulation and sheath to fully enclose the pins and sockets of the connectors. The synthetic elastomeric material shall be suitable for direct burial in the earth, submergence in water, direct sunlight exposure, and capable of withstanding limited chemical, oil, or gasoline attack. Where applicable, the material shall be capable of bonding during vulcanizing to cable sheaths made of polychloroprene or other synthetic elastomers to provide a watertight bond. All connectors shall be vulcanized to the cable sheath to provide a watertight bond, except those shown on Figures 14 and 15.

(2) The compound used shall contain not more than 25 pounds of carbon black per 100 pounds of elastomer, and the total weight of the compound with ingredients (elastomers excluded) shall not exceed one and one-half times the weights of the elastomer used.

(3) The hardness of the housing shall be between 50 and 75 durometer as measured in accordance with ASTM Specification D676.

c. Pins and Sockets.

(1) The design of the plug shall be such that the pins shall be held perpendicular to the face of the block. The pins shall be fastened so that:

(a) The space between the ends of the pins will be not less than 1/8 inch when the pins are pinched together with a force of 6 pounds applied 1/2 inch out from the face of the plug.

(b) The space between the ends of the pins will be not greater than 9/16 inch when the pins are pulled apart with a force of 6 pounds applied 1/2 inch out from the face of the plug.

(c) The above requirements apply to plugs equipped with two pins. The force is applied to the pins only, plug not being held, except to prevent it from turning.

(2) The sockets shall conform to the dimensional and construction requirements as indicated on the applicable figure of this specification. The sockets for connectors shown in Figures 1b, 1c, 6b, 11, 14b, and 14d shall be slotted and spring-loaded to insure positive electrical contact, as required under paragraph 6b.

(3) Figures 14 and 15 connectors shall have provisions for pins or sockets to be crimped to the cable conductor at the job site. The metal of the pins and sockets for connectors shall exhibit no damage after crimping. Figures 14 and 15 pins or sockets shall be made of materials that contain at least 98 percent copper and have a minimum electrical conductivity of 85 percent at 68°F (International Annealed Copper Standard, IACS). Sockets shall be fully annealed and supplied with a copper beryllium sleeve type spring which shall assure adequate contact pressure and protect the socket slots from filling with insulating compound during assembly and subsequent use. The pin shall be made from material at least "half hard"; the crimping section shall be fully annealed, but the contact portion of the pin shall be left "stock hard". The hardness transition should be confined to the locking section of the pin. Both the pin and socket shall be plated with any suitable electrical treatment such as electro tinplating. The pin for Figure 14 shall be provided with a visual indication that verifies proper assembly position.

d. Insulating Compound. Each part of the Figure 14 connector shall be furnished with an amount of silicone insulating compound, adequate to insure the filling of all internal voids when the connector is assembled.

e. Figure 15 Assembly. The Figure 15 plug connector shall be composed of two parts, an insert assembly and a housing. The insert assembly shall consist of two pins molded into material as specified in paragraph 7b(1) and as shown on Figure 15b. One end shall have an opening to receive and lock the insert assembly, and the other end shall

have two openings for cable entrance. When assembled, the Figure 15 plug assembly shall provide a watertight seal to prevent moisture entrance into the housing.

f. Wire Connection. Except for Figures 14 and 15 connectors, a suitable conductor shall be mechanically and electrically bonded to a pin or socket which shall be molded into the connector housing. Each socket shall be sealed at the end connected to the conductor in order to provide a barrier against entrance of moisture to conductor.

g. Marking.

(1) Each plug and each receptacle shall be marked with the manufacturer's name. Each plug and each receptacle shall also be marked with the specification number and the appropriate identification number in accordance with the specification figures, i.e., L-823, Figure 1a.

(2) A connector shall not be molded on to a cable having a higher voltage rating than the specification requirements for the connector.

h. Caps.

(1) Caps, other than the series short circuiting type, where required, shall be designed to protect plugs and receptacles prior to final connection. Size and shape are optional.

(2) When a series short circuiting plug type cap is required for a receptacle, it shall have jumpers internally connected to the proper pins. The mating dimensions shall be the same as the corresponding plug. The series short circuiting cap shall be marked with an "S" and shall be molded of a red material.

i. Instructions. Installation instructions shall be furnished with each Figures 14 and 15 connector.

j. Figure 14 Disposable Accessories.

(1) Each Figure 14 receptacle shall be equipped with a disposable sleeve made of high density (linear) polyethylene fitted into the receptacle's water seal to catch surplus silicone compound upon assembly. Each Figure 14 socket shall be equipped with a disposable pin, made of high density (linear) polyethylene, fitted tightly into the pin end of the socket to prevent entry of silicone compound on assembly and to provide a visual indication of proper socket position after assembly. The pin design should be such that proper internal dispersion of silicone compound in the assembly is assured.

(2) Each housing shall be capped with a disposable shipping cap on the cable entrance end. Each cap shall have a small pinhole in it so as to allow air venting to the pothead chamber. This pinhole shall be small enough to prevent the escape of the silicone compound.

8. TESTING.

a. Approval Testing.

(1) All completed plugs and connectors molded of materials compounded in accordance with paragraph 7b(2) shall be subjected to the electrical and physical tests described below and the requirements specified under paragraph 6 and paragraphs 7a, 7b(3), 7c, and 7g. For all tests, Figures 14 and 15 connectors shall be assembled when appropriate, in accordance with the manufacturer's instructions to individual lengths of cable, each at least 24 inches long.

(2) Six pair of mated connectors, for each type of connector to be approved, selected at random from a production quantity shall be furnished for a direct current insulation test for voltage to ground. Where the assemblies to be tested are rated at 600, 3000, or 5000 volts, the test voltages shall be 4700 volt DC for rated 600 volt assemblies, and 15,000 volt DC for rated 3000 and 5000 volts, respectively.

(3) The tests shall be made as follows:

(a) The manufacturer shall provide 6 test insert plugs manufactured of nylon or equal material with suitable dielectric strength. The test plugs shall be made to the minimum dimensions of the corresponding standard plug, intended for use with the receptacle being tested.

(b) Each receptacle under test shall be mated with one of these test plugs and allowed to soak for 24 hours in a tap water bath.

(c) At the end of the soaking period and with measurements made at room temperature (provided the latter does not exceed 80°F), the minimum megohm resistance shall be 3000 with the receptacles still immersed.

(d) The receptacles having passed this test will be used for testing not only the corresponding male plugs but also the assembled connectors to determine the characteristics of both.

(e) Each of the male plugs supplied shall be checked with "go" and "no go" ring gauges to determine that the plugs are in accordance with the dimensions specified for the plugs being tested.

(f) The dielectric strength of an assembly of a plug and a receptacle shall be measured in megohms, and the minimum megohm resistance shall be 3000 to ground at 60°F and 1000 megohms to ground at 135°F. The assembly shall be immersed in a tap water bath for at least 24 hours prior to test. Not more than two feet of cable (one foot on receptacle and one foot on plug) shall be immersed during the soaking and testing period along with the connector. A test shall be made with the water at 60°F. The water shall then be heated to 135°F without removing the assembly and this temperature held for a minimum of one hour before further testing.

(g) When the assembly has two or more conductors, dielectric tests shall also be made between contacts. For these tests 3000 volts shall be applied and a minimum of 1000 megohms resistance shall be observed at 60°F while assemblies are mated.

(h) If an assembly fails in any of the foregoing dielectric tests, a sample of its cable may be tested separately to determine whether the cable insulation resistance is satisfactory. If cable is found to cause failure, a new assembly shall be retested.

(i) Figure 14 connectors shall be additionally tested by connecting one Figure 14 plug and one mating Figure 14 receptacle together and then immersing in tap water at room temperature. While immersed, the two connectors shall be manually flexed for two minutes and then remain immersed for a minimum of 24 hours with their cable leads flexed 180° from their longitudinal axis and tied in that position. After 24 hours immersion, the connected assembly shall have a minimum resistance of 7500 megohms to ground. The measurement shall be made one minute after a test voltage of 15KV, DC, has been applied, with the assembly immersed in water which has been maintained at a temperature of 90°F for the last hour. A guard connection shall be used to eliminate the effect of leakage current.

(j) Figure 15 plug shall be additionally tested by connecting one Figure 15 plug, attached to a 2-foot length of proper size cable leads to one mating receptacle, Figure 1b or Figure 1c, attached to a 2-foot length of the proper size cable leads and then immersing the assembly in tap water at room temperature. While immersed, the two connectors shall be manually flexed for two minutes and then remain immersed for a minimum of 24 hours with their cable leads bent 180° from their longitudinal axis and tied in that position. During the last hour of the 24-hour period, the bath water shall be maintained at 90°F. After the above cycle and while still immersed, the connected assembly shall have a minimum resistance of 3000 megohms to ground and 1000 megohms between conductors. The measurements shall be made one minute after a test voltage of 4700 volts DC has been applied. A guard connection shall be used to eliminate the effect of leakage currents.

9. QUALIFICATION. To obtain approval of equipment covered by this specification, the manufacturer shall furnish sample connectors to a disinterested testing laboratory, acceptable to the Federal Aviation Agency, Airports Service, Washington, D. C. 20553, to be tested as described in paragraph 8 to obtain certification regarding the ability to manufacture connectors meeting the requirements of this specification. The manufacturer shall furnish two copies of the testing laboratory's report to the Airports Service for review and approval consideration. The cost of testing shall be borne by the manufacturer offering the material for qualification.

a. In addition to the test performed by the above disinterested testing laboratory, the manufacturer shall:

(1) Furnish samples of connectors to the Airports Service for physical inspection. Cost of submitting these samples shall be borne by the manufacturer.

(2) Furnish installation instructions for connectors shown in Figures 14 and 15 to the Airports Service for review and approval.

(3) Furnish certification that the housing compound is in accordance with paragraph 7b(2).

b. Upon approval of the disinterested testing laboratory's test reports and the additional data required in paragraph 9a, which have shown satisfactory conformance to specification requirements, the Airports Service will list the name of the qualified manufacturer and a description of their connector in Advisory Circular No. 150/5345-1, "Approved Airport Lighting Equipment".

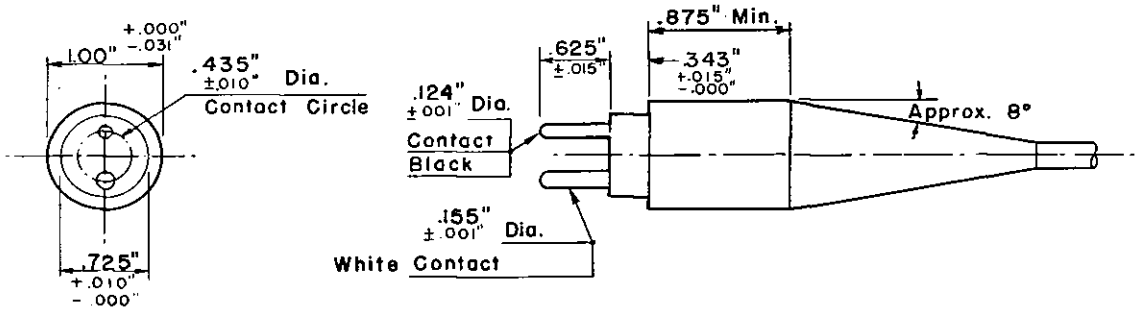
c. Additional inspection and tests, including tests for watertightness, mechanical strength, and interchangeability, will be made as deemed necessary by the Federal Aviation Agency, Airports Service, Washington, D. C. 20553, to determine compliance with this specification.

d. The furnishing of products which prove to be unequal to the approved sample(s) may be sufficient cause for removal of the product and the manufacturer's name from the list of approved equipment.

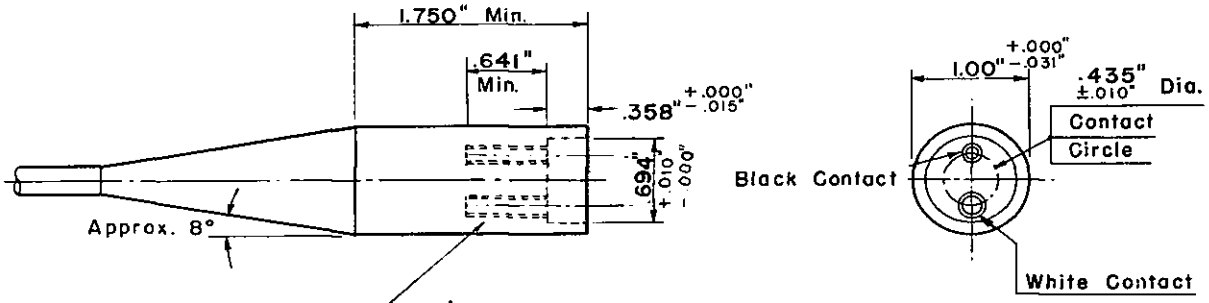
e. Due to the inherent characteristics of the material involved and the critical demand placed on this equipment, the Federal Aviation Agency, Airports Service, Washington, D. C. 20553, may, whenever in its judgement it appears desirable, require the requalification of plugs and receptacles manufactured in accordance with this specification.

10. HOW TO GET THIS CIRCULAR. Obtain additional copies of this circular, AC 150/5345-26, "Specification for L-823 Plug and Receptacle, Cable Connectors", from the Federal Aviation Agency, Distribution Section, HQ-438, Washington, D. C. 20553.

Cole Morrow, Director
Airports Service



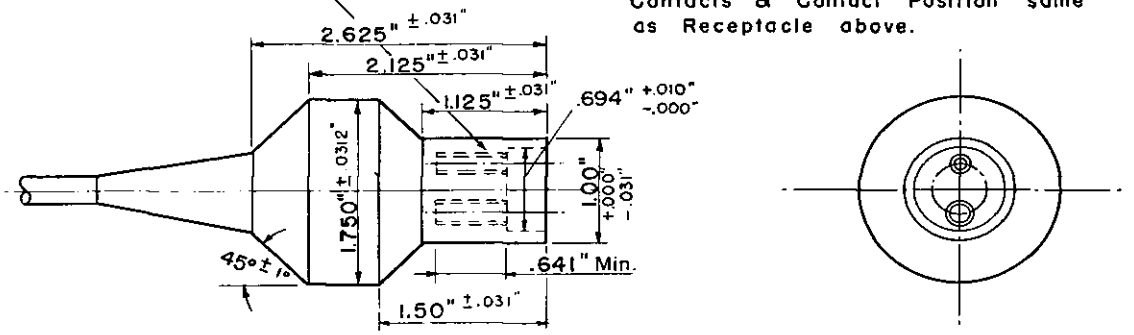
(a.) PLUG.



(b.) RECEPTACLE

Note: Metal sockets shall be recessed not more than $\frac{1}{8}$" below inside face of receptacle and before splitting the large socket shall have an I. D. of .157"±.001" and the small socket shall have an I. D. of .126" ± .001".

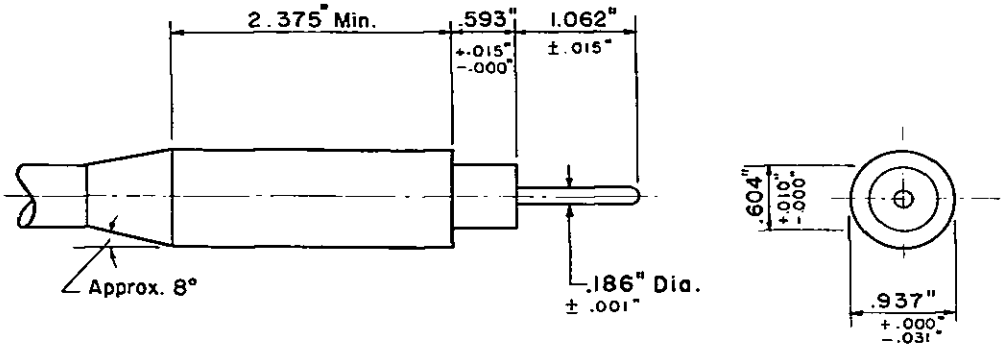
Contacts & Contact Position same as Receptacle above.



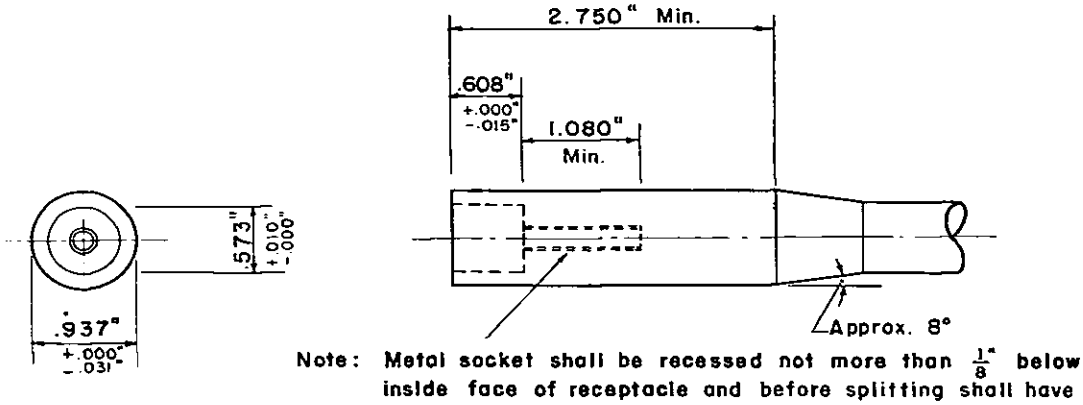
(C.) RECEPTACLE

Figure 1

Type I. PLUG and RECEPTACLES. (Two conductor, 20 ampere, 600 volts between contacts, 1500 volts to ground.)



(a) PLUG



Note: Metal socket shall be recessed not more than $\frac{1}{8}$" below inside face of receptacle and before splitting shall have an I. D. of .188" ± .001.

(b) RECEPTACLE

Figure 6

Type 6. PLUG and RECEPTACLE (Single conductor, 25 ampere, 5000 volts to ground.)

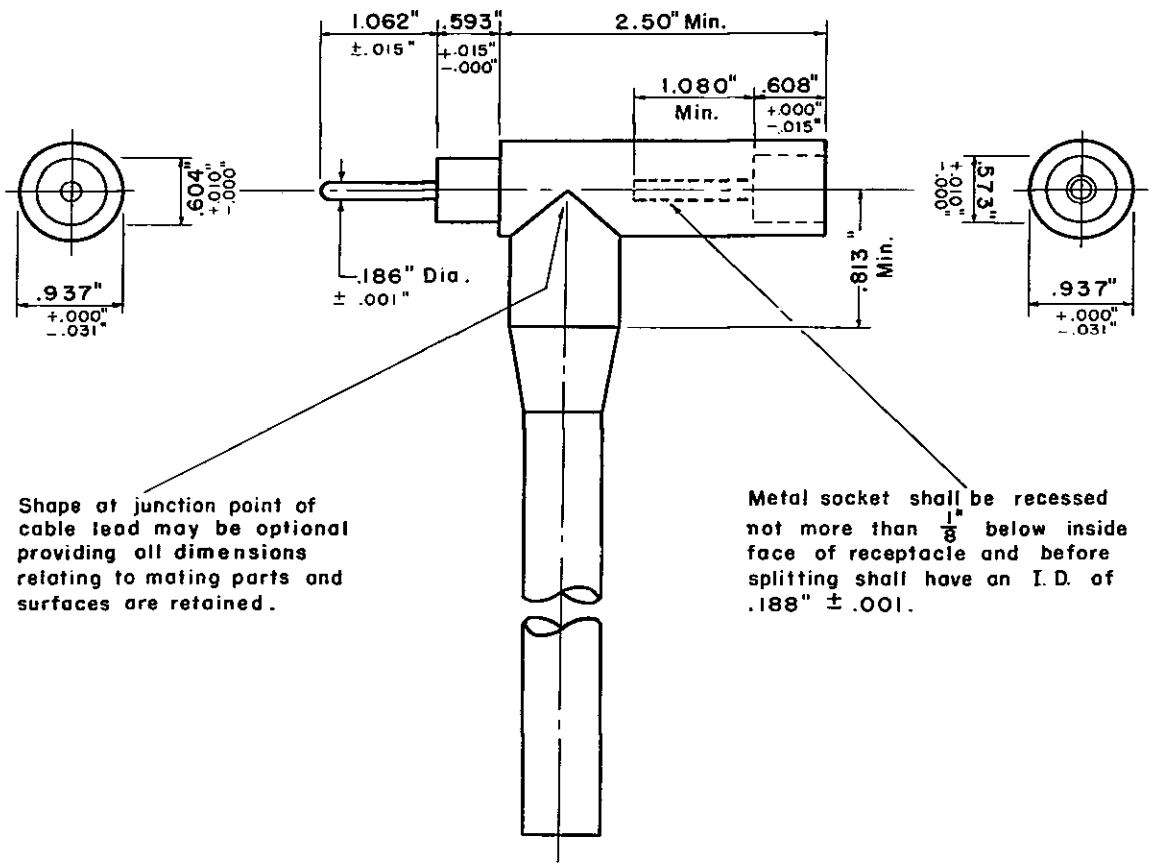
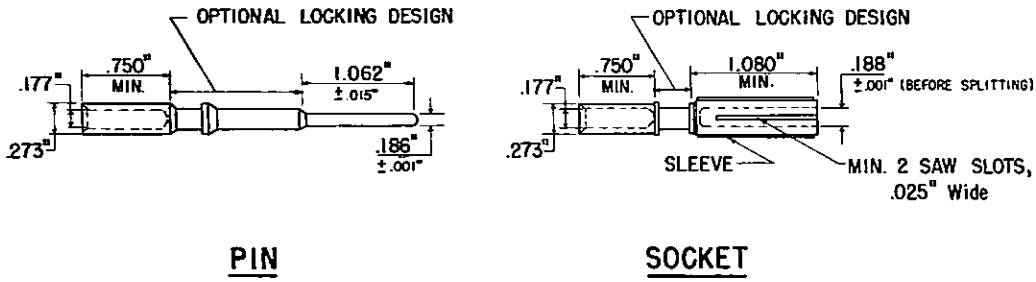
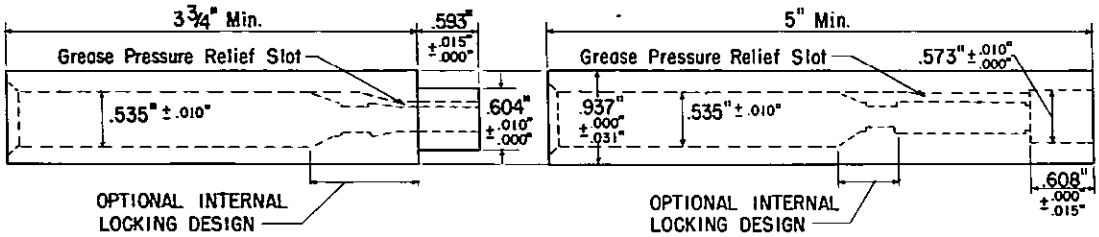


Figure II

Type II. PLUG and RECEPTACLE (Single conductor, 25 ampere, 5000 volts to ground.)

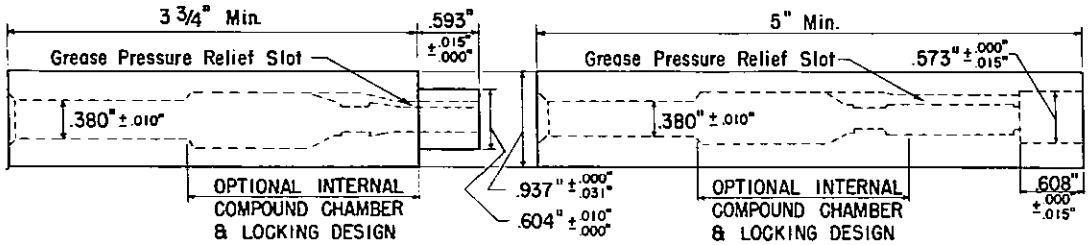


PIN **SOCKET**



A) 5000 VOLT PLUG

B) 5000 VOLT RECEPTACLE

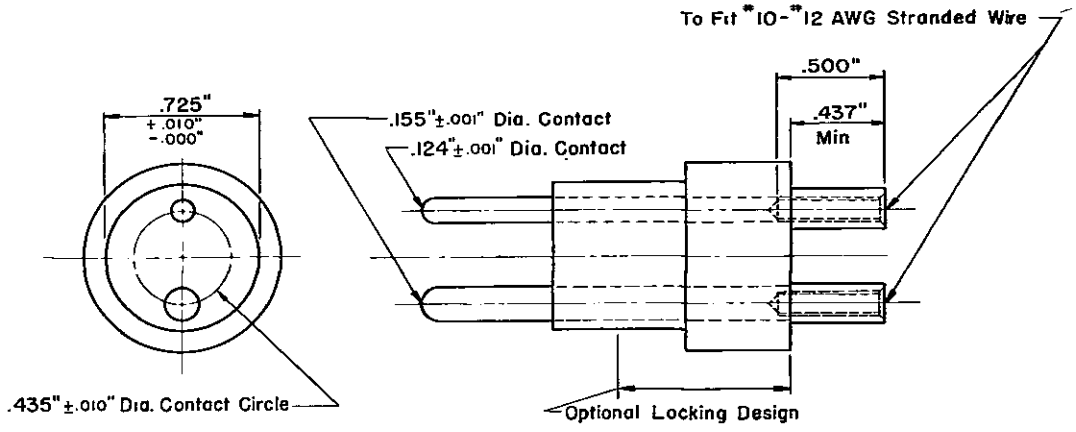


C) 3000 VOLT PLUG

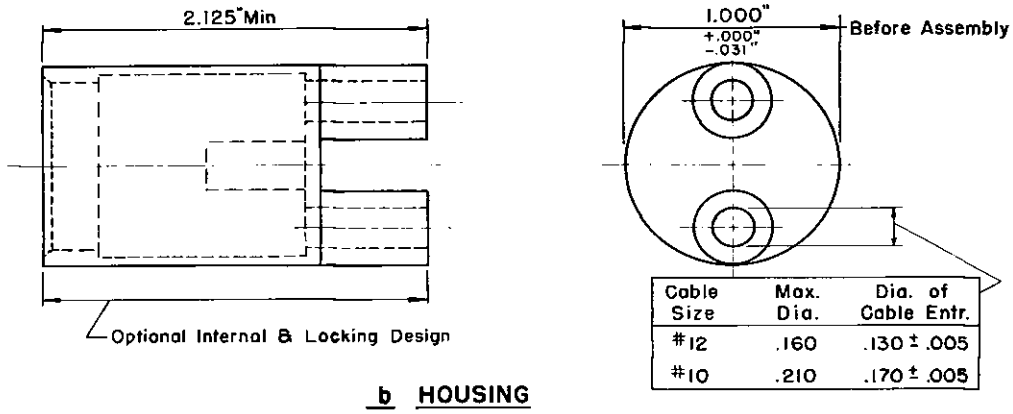
D) 3000 VOLT RECEPTACLE

Figure 14

PLUG and RECEPTACLE KIT (Single Conductor, 25 ampere)

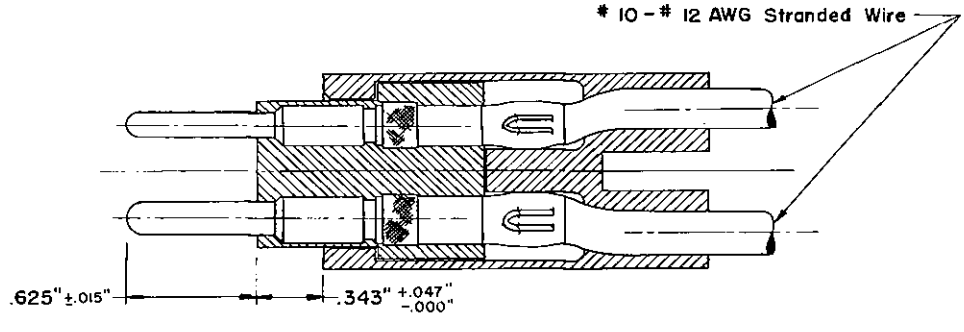


a INSERT ASSEMBLY



Cable Size	Max. Dia.	Dia. of Cable Entr.
#12	.160	.130 ± .005
#10	.210	.170 ± .005

b HOUSING



a + b ASSEMBLED

Figure 15

PLUG KIT (Two conductor, 20 ampere 600 volts between contacts, 1500 volts to ground.)