



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: FAA SPECIFICATION FOR L-823, PLUG AND RECEPTACLE, CABLE CONNECTORS
Date: 04/17/00
AC No.: 150/5345-26C
Initiated by: AAS-200
Change:

1. **PURPOSE.** This advisory circular (AC) contains the specification for plug and receptacle (cable connectors) used with underground power cables, isolation transformer leads, and light fixture leads for airport lighting systems.
2. **PRINCIPAL CHANGES.** The changes in this AC include the following:
 - a. Editorial changes to reflect the changes in the procedure for qualifying airport lighting equipment to be furnished under the Federal grant assistance program.
 - b. Deleting reference to ICEA S-19-81, Table 7.7-8 in defining the bonding strength of the completed connector assembly for Class A connectors.
 - c. Deleting requirement for vulcanizing.
 - d. Deleting requirement for the short circuiting cap "S" marking to be RED.
 - e. Changing reference in the Weathering Test from UL74 to UL 1581.
 - f. Updating connector drawings.
 - g. Adding paragraph 5. Production Test Requirement
3. **CANCELLATION.** AC 150/5345-26B, Specification For L-823 Plug and Receptacle, Cable Connectors, dated January 28, 1981, is canceled.
4. **APPLICATION.** The standards contained in this AC are recommended by the Federal Aviation Administration (FAA) in all applications involving airport development of this nature. For airport projects receiving federal funds under the airport grant assistance program, the use of the standards in this AC are mandatory.
5. **METRIC UNITS.** To promote an orderly transition to metric units, this specification includes both English and metric dimensions. The metric conversions may not be exact metric equivalents, and until there is an official changeover to the metric system, the English dimensions will govern.

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FAA SPECIFICATION FOR L-823 PLUG AND RECEPTACLE, CABLE CONNECTORS

1. SCOPE AND CLASSIFICATION.

1.1 Scope. This specification contains requirements for plugs and receptacles (cable connectors) to be used for underground cable connections, for power cables, isolation transformer leads, and light fixture leads for airport systems.

1.2 Classification. Cable connectors are classified by this specification into two types, two classes, and six styles of plugs and two types, two classes, and six styles of receptacles. Formerly, cable connectors were classified only by a figure number. Figures in this specification are now numbered consecutively

1.2.1 Type. Plugs and receptacles with the following electrical characteristics are covered by the specification:

Type I	1 conductor, 25 ampere, 5000 volt
Type II	2 conductor, 20 ampere, 600 volt

1.2.2 Class. Plugs and receptacles with the following attachment methods are covered by this specification:

Class A	Factory molded to conductor(s)
Class B	Field attached to conductor(s)

1.2.3 Style. Plugs and receptacles with following styles of housing are covered by this specification:

Style 1	Plug, figure 1(a)
Style 2	Plug, figure 2(a)
Style 3	Plug, figures 3(a), & 3(c)
Style 4	Plug, figures 4(a), 4(b) & 4(c)
Style 5	Plug, figures 7(a), 7(b), & 7(c)
Style 6	Plug, figure 8
Style 7	Receptacle, figure 1(b)
Style 8	Receptacle, figure 1(c)
Style 9	Receptacle, figure 2(b)
Style 10	Receptacle, figures 3(b), & 3(d)
Style 11	Receptacle, figures 5(a), 5(b), & 5(c)
Style 12	Receptacle, figures 6(a), 6(b), & 6(c)

2. REFERENCED DOCUMENTS.

2.1 General. The following documents, of the issue in effect on the date of application for qualification, are applicable to the extent specified in this AC.

2.2 Federal Aviation Administration (FAA) Standards.

AC 150/5345-53	Airport Lighting Equipment Certification Program
AC-150/5345-7	L-824 Underground Electrical Cable for Airport Lighting Circuits, Specification for

2.3 American Society for Testing and Materials (ASTM) Standards.

B 33	Tinned Soft or Annealed Copper Wire for Electrical Purposes, Specification for
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B 189	Lead-Coated and Lead Alloy Coated Soft Copper Wire for Electrical Purpose, Specification for
D 1149	Rubber Deterioration-Surface Ozone Cracking in a Chamber (Flat Specimens), Test for

2.4 Underwriters Laboratories (UL) Publication.

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
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2.5 American National Standards

ANSI/ASQC Z1.4	Sampling Procedures and Tables for Inspection by Attributes
ANSI/EIA557A	Statistical Process Control Systems

(Copies of FAA standards may be obtained from the Federal Aviation Administration, Program Engineering and Maintenance Service, Washington, DC 20591.)

(Copies of ASTM Standards may be obtained from the American Society for Testing and Materials, 100 Bar Harbor Dr., West Conshohocken, PA 19428-2959 (610) 832-9555.)

(Copies of ANSI Standards may be obtained from the American National Standards Institute, 11 W. 42nd Street, New York, NY 10036; Phone (212) 642-4900.)

(Copies of UL publications may be obtained from Underwriters Laboratories, 207 East Ohio Street, Chicago, Illinois 60611.)

3. EQUIPMENT REQUIREMENTS.

3.1 General. Plugs and receptacles (cable connectors) shall be fabricated in accordance with all specification requirements.

3.2 Environmental Requirements. The plugs and receptacles (cable connectors) shall be designed for continuous use within a temperature range of -55°C (-67°F) to +65°C (+149°F) while exposed to weather, submerged in water, or buried in the earth.

3.3 Performance Requirements.

3.3.1 Electrical Connection. The electrical rating of each connector shall not be less than 5000 V for type I connectors, or 600 V for type II connectors. The voltage drop across the contacts of a connected plug and receptacle shall not exceed 7.5 millivolts for the Type I connectors, nor 6.0 millivolts for the Type II connectors.

3.3.2 Bonding Strength. The completed Class A connector assembly shall withstand a longitudinal pull of at least 30,000 psi (207 Mpa), 75 percent of an average tensile strength of 40,000 psi, (276 Mpa) for all wire sizes. Separation between the molded on connector and the cable shall not exceed 0.03 inches (0.8 mm). The wires shall be in accordance with ASTM Specification B 33 and B 189.

3.3.3 Mechanical Connection. Each connected plug and receptacle shall withstand a static pull load of 10 pounds (44N) without showing evidence of separation. No damage shall occur to the mating components when the connected plug and receptacle are separated by a greater static pull load.

3.3.4 Seal. A watertight seal shall be provided between the mated plug and receptacle and between the rubber and metal parts of the plug and receptacle.

3.4 Fabrication and Materials.

3.4.1 General. Each plug and receptacle (cable connector), type, class, and style shall conform to the dimensions and construction requirements shown on the applicable figures in Appendix I of this specification.

3.4.2 Housing. The connector housing shall be molded from natural and/or synthetic elastomeric materials serving both as insulation and sheath to fully enclose the pins of the plug and sockets of the receptacle. The housing material shall be suitable for direct earth burial, submergence in water, and capable of withstanding limited attack from chemicals, typically present on the airfield, including but not limited to, oil, de-icing fluids and/or gasoline. Material compounds used in connector housings shall not contain more than 25 pounds (11 kg) of carbon black per 100 pounds (45 kg) of elastomer. Housings for Class A connectors shall be fabricated from materials capable of bonding to cable sheaths or conductor insulation, during the manufacturing process, to provide a watertight bond.

3.4.3 Pins and Sockets. The pins and sockets shall conform to all dimensions and construction requirements indicated on the applicable figures in Appendix I of this specification. Pins and sockets shall be made of materials that contain at least 98 percent copper, or free cutting brass alloy 360 (AMS C36000) and in either case shall be made of material at least "half hard". The contact portion of the pin and socket shall be left "stock hard" and the crimping section, when necessary, fully annealed. The hardness transition shall be limited to the locking section of the pin and socket. The pin and socket shall be electroplated with tin or other suitable material to provide good electrical contact as required by paragraph 3.3.1. The sockets shall be spring loaded or slotted and spring loaded to insure good electrical contact as required by paragraph 3.3.1 and. Class A sockets shall have a means that protects the sockets slots from filling with insulating compound during molding. The pin for the Style 3 connector shall be provided with a visual indication that verifies proper assembly position. Pins and sockets provided for Class B connectors shall have provisions for crimping to the cable conductor(s), and shall not exhibit damage after crimping.

3.4.4 Connector Assemblies.

3.4.4.1 Class A. Pins and sockets shall be held perpendicular to the face of the block. Suitable electrical conductors shall be mechanically and electrically connected to the pin(s) or socket(s). The connector housing shall be molded per paragraph 3.4.2. Primary connectors shall be molded to an electrical conductor having a voltage rating equal to or less than the specified voltage rating of the connector. Secondary connectors shall be molded to an electrical conductor having a voltage rating equal to or less than the specified voltage rating of the connector with the preferred being equal to the connector rating. A connector shall never be molded to an electrical conductor or cable having a higher voltage rating than the specification requirements for the connector. After molding, the space between the pins of Type II plugs shall not be less than 1/8 inch (3 mm) when the pins are pinched together with a force of 6 pounds (27 N) applied 1/2 inch (12.7 mm) out from the face of the plug. Also, the space between the ends of the pin of the Type II plugs shall not be greater than 9/16 inch (14.3 mm) when the pins are pulled apart with a force of 6 pounds (27N) applied 1/2 inch (12.7 mm) out from the face of the plug. The force is applied to the pins only. During testing for the above mentioned requirements the plug is to be held only to keep it from turning.

3.4.4.2 Class B.

3.4.4.2.1 Type I. Each receptacle shall be equipped with a disposable sleeve fitted into the receptacle's water seal to catch surplus silicone compound upon assembly. Each socket shall be equipped with a disposable pin 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 shall be such that proper internal dispersion of silicone compound in the assembly is assured. An adequate amount of silicone insulating compound shall be furnished with each connector to insure filling all internal voids when the connector is assembled. Each housing shall be capped with a disposable shipping cap on the cable entrance end.

3.4.4.2.2 Type II. Connector assemblies shall be composed of two parts, an insert assembly and a housing. Pins or sockets shall be held perpendicular to the face of each end of the molded insert assembly and fastened. After proper assembly, the space between the pins of the plug shall not be less than 1/8 inch (3 mm) when the pins are pinched together with a force of 6 pounds (27 N) applied 1/2 inch (12.7 mm) out from the face of the plug. Also, the space between the ends of the pin shall not be greater than 9/16 inch (14.3 mm) when the pins are pulled apart with a force of 6 pounds applied 1/2 inch (12.7 mm) out from the face of the plug. Inserts and housing shall be molded as specified in paragraph 3.4.2, and shall comply with the dimensions and styles shown on the applicable figures in Appendix I of this AC. When assembled the plug and receptacle assemblies shall provide a watertight seal to prevent moisture from entering the housing.

3.4.5 Marking. Each plug and receptacle shall be marked with manufacturer's identification and L-823 designation with style number, e.g., L-823, Style 3.

3.4.6 Caps. Caps shall be supplied with Class A connectors (unless requested otherwise by the buyer) to protect plugs and receptacles prior to final connection. Caps shall be made of a plastic material compatible with the housing materials specified in paragraph 3.4.2. When a series short circuiting plug type cap with internal jumpers is required for Type II receptacles, jumpers shall be connected to the proper pins. The mating dimensions shall be the same as the corresponding plug. The short circuiting cap shall be permanently marked with an "S".

3.4.7 Instructions. Installation instructions shall be furnished by the manufacturer with each Class B connector.

4. EQUIPMENT QUALIFICATION REQUIREMENTS.

4.1 Qualification Procedures. Procedures for qualifying equipment to be furnished under the Federal grant assistance program for airports are contained in Advisory Circular 150/5345-53, Airport Lighting Equipment Certification Program.

4.2 Qualification Tests. The following tests shall be performed on each unit submitted for qualification to demonstrate compliance with all specifications in this AC. Should a conflict exist between this AC and referenced documents, the specification in this AC shall apply.

4.2.1 General. Assembled connectors, with conductors attached, shall be subjected to electrical and physical tests. Class B connectors shall be assembled in accordance with manufacturer's instructions to lengths of wire or cable, as appropriate, of at least 24 inches (0.6 m) for all tests. Six pairs of mated connectors shall be selected at random from a production run for each type of connector to be tested for approval. Each tested connector shall pass all qualification tests. Failure of any one of the connectors in any one of the qualification tests shall indicate failure of this product to comply with this specification unless otherwise noted in a particular test.

4.2.2 Dielectric Tests.

4.2.2.1 Plugs and Receptacles. Six test insert plugs made of nylon or equal material of suitable dielectric strength shall be provided for the test. These test plugs shall meet the mating dimensions of the corresponding standard plug intended for use with the receptacle being tested. Each plug shall be checked with "go" and "no go" ring gauges to insure compliance with specified dimensions. Each connector receptacle under test shall be mated with one of the test plugs and allowed to soak for 24 hours in a tap water bath at room temperature, 20-25 °C. At the end of the soaking period, with the receptacle still immersed, apply a test voltage of 4.7 kV dc for 5 minutes to Type II connectors and 15 kV dc to Type I connectors. One minute after the test voltage has been applied the minimum insulation resistance between the conductors and water, and between conductors measured with a 500-volt source shall be 25,000 megohms. The receptacles having passed this test are now used for testing the corresponding plugs in a like test.

4.2.2.2 Connector Assembly. After the conclusion of the test in paragraph 4.2.2.1, each plug and receptacle being tested shall be mated and immersed in a tap water bath at room temperature, 20-25 °C. Immerse not more than 2 feet (0.6 m) of cable, 1 foot (0.3 m) of the plug, and 1 foot (0.3 m) of the receptacle. While immersed, each connector assembly shall be manually flexed for 2 minutes and then left immersed for a minimum of 24 hours with its cable leads flexed and maintained 180° from its longitudinal axis. Measure insulation resistance between conductors of each connected assembly after the 24 hour soaking period. The resistance measurements shall be taken 1 minute after a test voltage of 4.7 kV dc has been applied for 5 minutes to Type II connectors and 15 kV dc to Type I connectors. The minimum resistance between conductors shall be 25,000 megohms. Heat the tap water to 65 °C without removing the assemblies and maintain this temperature for at least 1 hour. Again measure the resistance between the conductor(s) and water, and between conductors with a 500-volt source. The minimum acceptable resistance after the heated soaking period shall be 10,000 megohms.

4.2.3 Bond Test. The molded bond between cable and Class A connector shall be subjected to a static longitudinal pull load of the magnitude specified in paragraph 3.3.2. When testing Class A, Type II, connectors of any Style the two conductors shall be pulled as a single cable, not as individual conductors. The connector shall be held in a manner that does not impart a crimping or clamping action to the connector that would affect the pull test. The connector molding cavity, or a similarly shaped fixture, is acceptable for holding the connector. Separation between the molded on connector and the cable jacket or conductor insulation exceeding .03 inches shall be cause for rejection.

4.2.4 Mechanical Connection Test. Each plug and receptacle intended to be mated shall be connected together and subjected to the static pull load specified in paragraph 3.3.3. Any evidence of separation of the connection shall be cause for rejection. Increasing load shall be applied to the connector assembly until separation occurs. No damage shall occur to the mating components when the connected plug and receptacle are separated by the greater static pull load. Any evidence of damage to plugs, receptacles, conductors, and/or the connector bond shall be cause for rejection.

4.2.5 Electrical Connection Test. Voltage drop measurements shall be made across mated connectors while conducting rated current. Voltage drops in excess of those specified in 3.3.1 shall be cause for rejection. This test may be performed using unmolded contacts conducting rated current. This would permit the measurement to be made without damaging the molded connectors. This test shall be performed on the equivalent of six connectors (six contact pairs for Type I connectors and twelve contact pairs for Type II connectors).

4.2.6 Weathering Test. A slab of connector housing material and sample pairs of connectors shall be subjected to simulated sunlight by conditioning with carbon-arc or xenon-arc radiation for 720 hours as described in Section 1200 of UL-1581. The conditioned and unconditioned slabs of connector housing material shall then be evaluated to Section 1200.9 of UL-1581. Failure of the test slab samples and/or the connectors to meet the ratio requirements of Section 1200.9 of UL-1581 shall be cause for rejection.

Additionally, a slab of connector housing material and sample pairs of connectors shall be exposed to ozone according to ASTM D1149, with 50 pphm ozone, 38° C, 20 percent sample extension, and 100 hours exposure. Cracking of the connectors, or test slab, as a result of weathering test shall be cause for rejection.

4.2.7 Metal Bond Test. Class A assemblies shall have their connector plug and receptacle placed in water, with 20 psi air pressure applied from the free end of the cable, for a period of 10 minutes. No air bubbles shall be observed in the water.

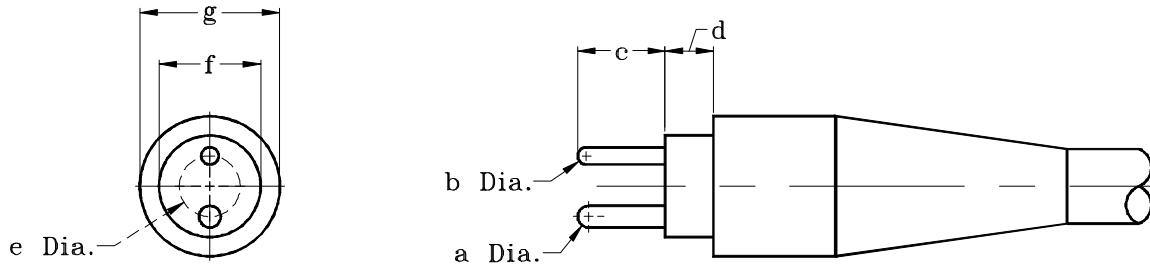
5. PRODUCTION TEST REQUIREMENTS.

5.1 Production Tests. Each connector shall be visually inspected and interface dimensions checked in accordance with process control below. Each plug and receptacle, cable connector (Class A) shall be subjected to a dielectric and continuity test during validation of a production run. The test voltage shall be 4.7 kV dc for Type II connectors and 15 kV dc for Type I connectors. The minimum insulation resistance between the conductors shall be 23,500 megohms for Type II connectors and 750 megohms for Type I connectors (0.2 microamps leakage current). The time of application of

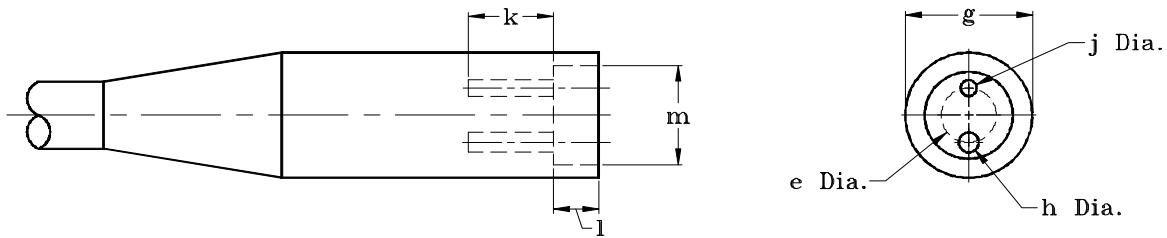
the test voltage may be reduced to 1 second.. For conventional testing, sampling is defined by ANSI/ASQC Z1.4-1993, Inspection Level II, AQL 2.5. For SPC systems, sampling shall be per ANSI/EIA557 A 1995 and shall show statistical capability with a $C_{pk} \geq 1.0$ and $\sigma \geq 3.0$.

APPENDIX I

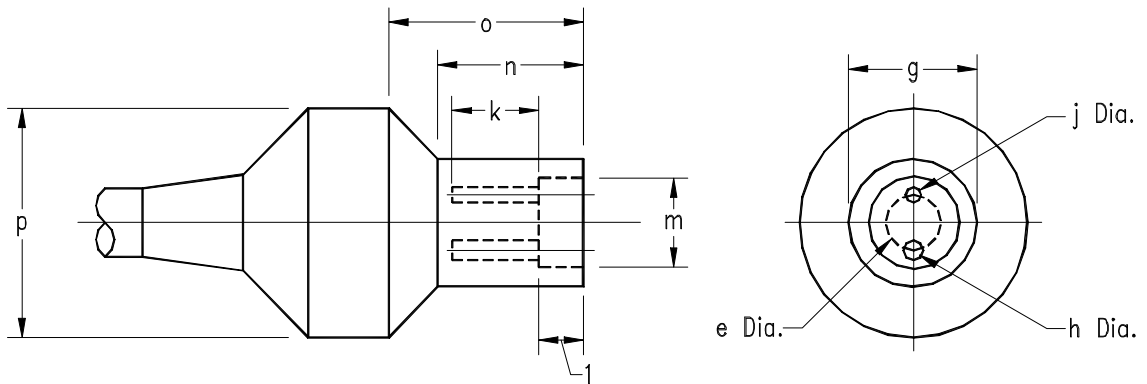
Cable Connector Figures



(a) PLUG - Class A, Type II, Style 1



(b) RECEPTACLE - Class A, Type II, Style 7



(c) RECEPTACLE - Class A, Type II, Style 8

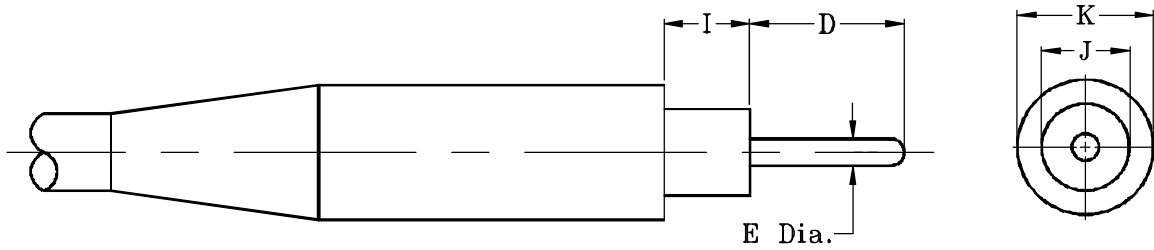
Note:

Dimensions are defined on figure 1A.

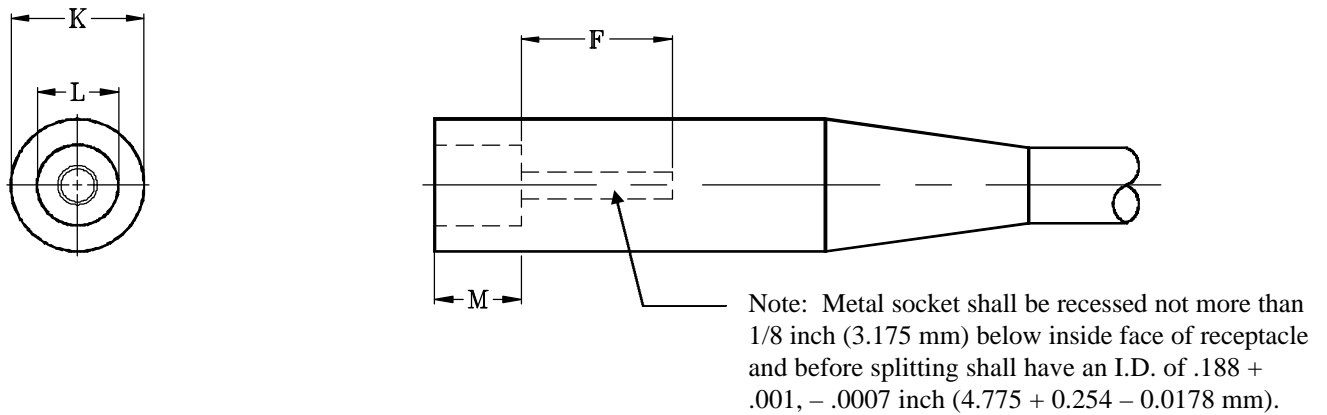
Figure 1 Class A, Type II, Plugs and Receptacles – Two Conductor, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to ground

DIMENSION	INCHES	MILLIMETERS	REFERENCES
a	0.155 ± .001	3.937 ± 0.025	Connector
b	0.124 ± .001	3.150 ± 0.025	Connector
c	0.625 ± .015	15.875 ± 0.381	Plug pin
d	0.343 + .031, –.000	8.712 + 0.787, – .000	Plug
e	0.435 ± .010	11.049 ± 0.254	Plug, Receptacle
f	0.725 + .020, – .000	18.415 + 0.508, – .000	Plug
g	1.000 + .000, –.031	25.40 + .000, – .787	Plug, Receptacle
h	0.1570 + .0010, –.0007	3.988 + 0.0254 – .018	Socket Diameter Before Splitting
j	0.1260 + .0010, –.0007	3.2004 + 0.0254 – .018	Receptacle.
k	0.641 Min.	16.28 Min	Depth Of Socket Includes .125” (.318 cm) Recess Below Inside Face Of Receptacle
l	0.358 + .000, –.015	9.093 + .000, – .381	Receptacle
m	0.694 ± .010	17.628 ± .254	Receptacle
n	1.125 ± .031	28.575 ± .787	Receptacle
o	1.500 ± .031	38.10 ± .787	Receptacle
p	1.750 ± .031	44.45 ± .787	Receptacle

FIGURE 1A. Class A and B, Plugs and Receptacles – Dimensions



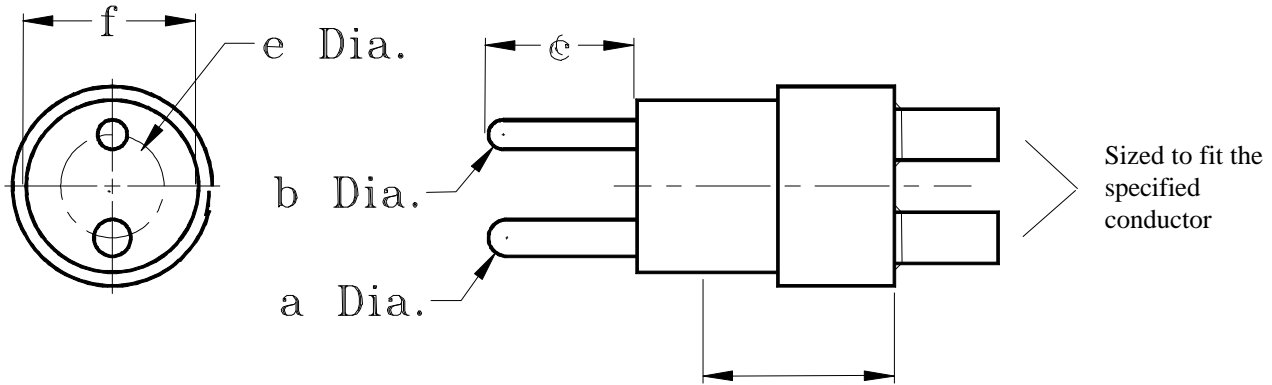
(a) Plug – Class A, Type I, Style 2



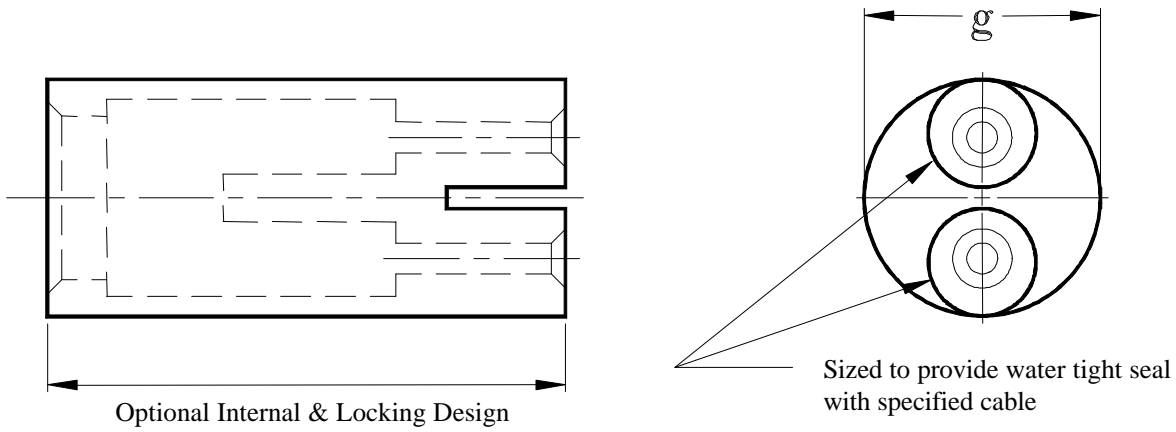
(b) RECEPTACLE – Class A, Type I, Style 9

DIMENSION	INCHES	MILLIMETERS
D	1.062 ± .015	26.975 ± .381
E	0.186 ± .001	4.7244 ± .0254
F	1.080 Min.	27.432 Min.
I	0.593 + .015, - .000	15.062 + .381, - .000
J	0.604 + .010, - .000	15.342 + .254, - .000
K	0.937 + .000, - .031	23.800 + .000, - .787
L	0.573 ± .010	14.554 ± .254
M	0.608 + .000, - .015	15.443 + .000, - .381

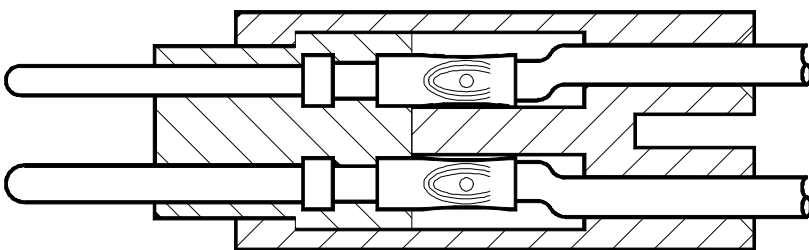
FIGURE 2. Class A, Type I, Plugs and Receptacles – Single Conductor, 25 Ampere, 5000 Volts to Ground



(a) INSERT ASSEMBLY



(b) HOUSING

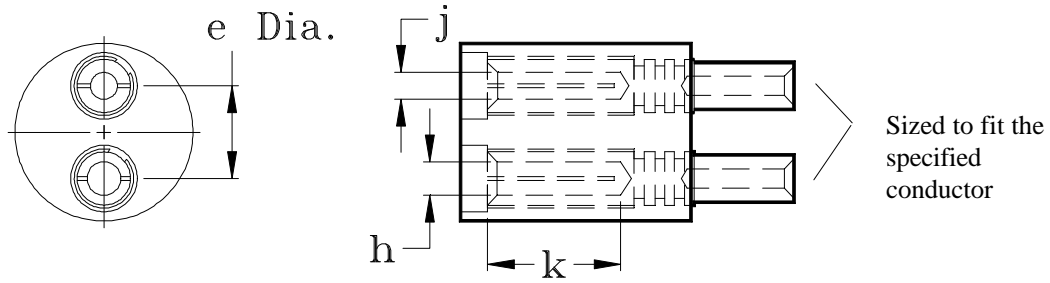


(c) PLUG, a & b Assembled, Style 4

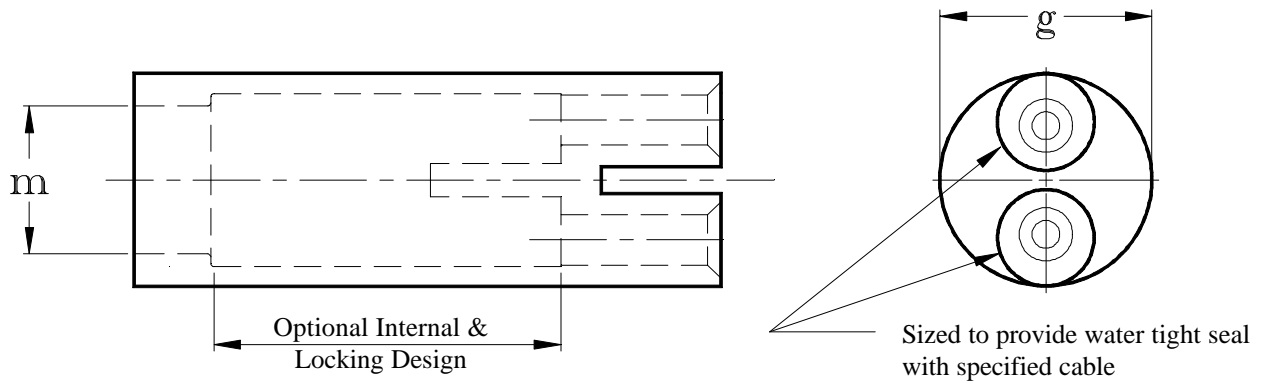
Note:

Dimensions are defined on Figure 1A.

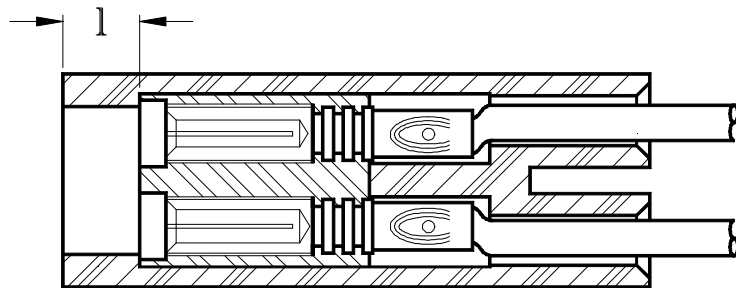
FIGURE 4. Class B, Type II, Style 4, Plug - Two Conductor, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to Ground



(a) INSERT ASSEMBLY



(b) HOUSING

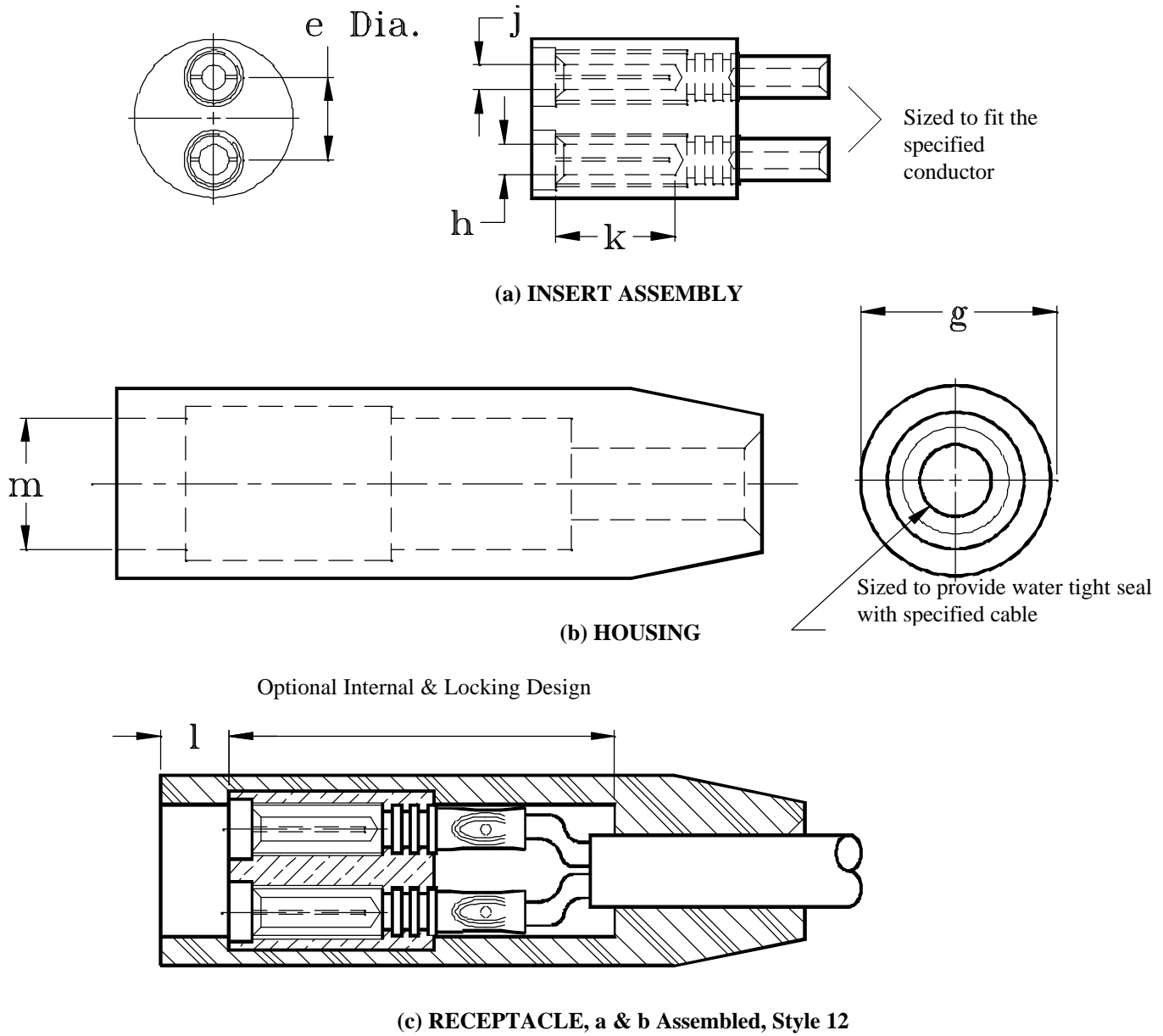


(c) RECEPTACLE, a & b Assembled, Style 11

Note:

Dimensions are defined on Figure 1A.

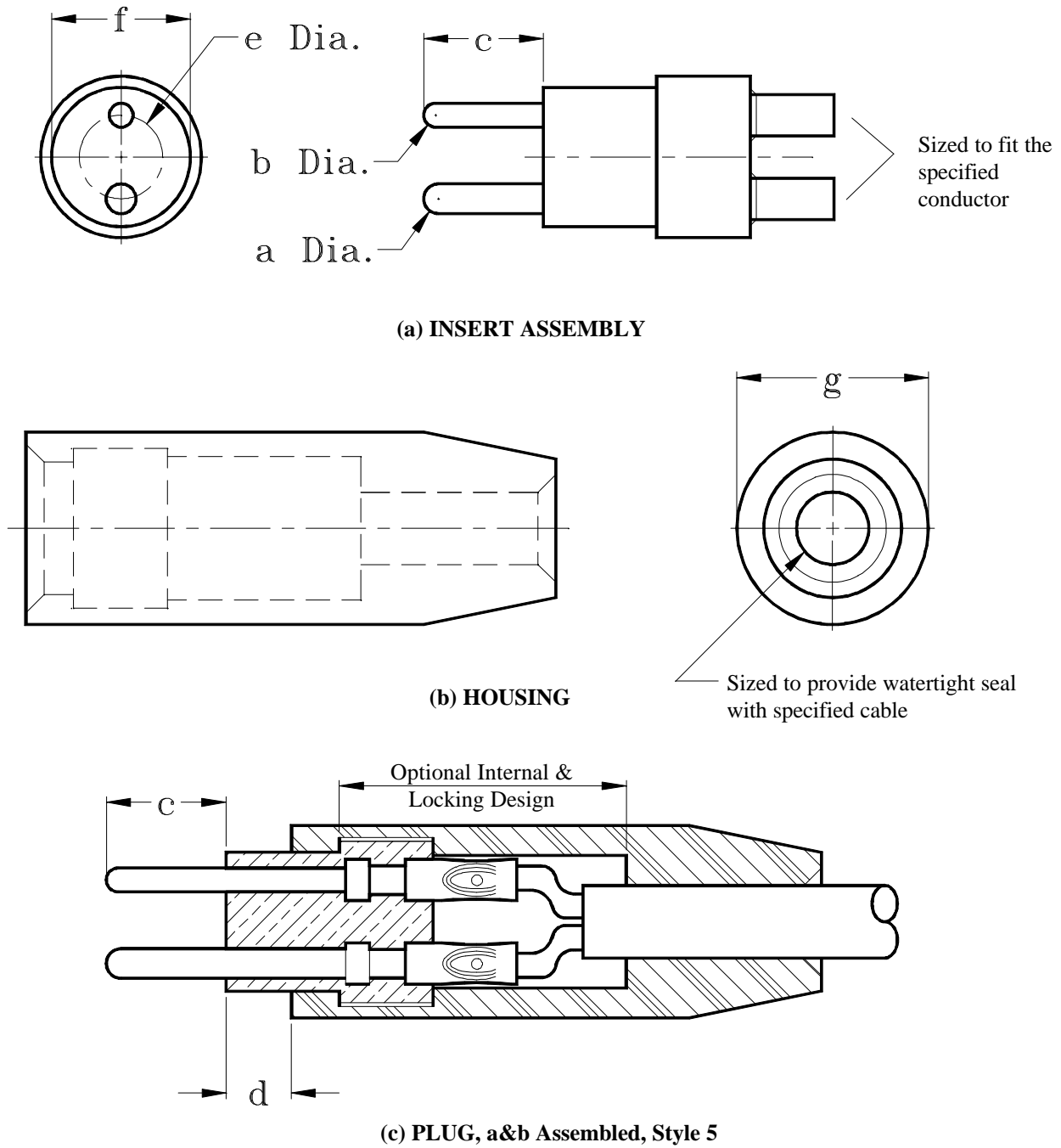
FIGURE 5. Class B, Type II, Style 11, Receptacle - Two Conductor, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to Ground



Note:

Dimensions are defined on Figure 1A.

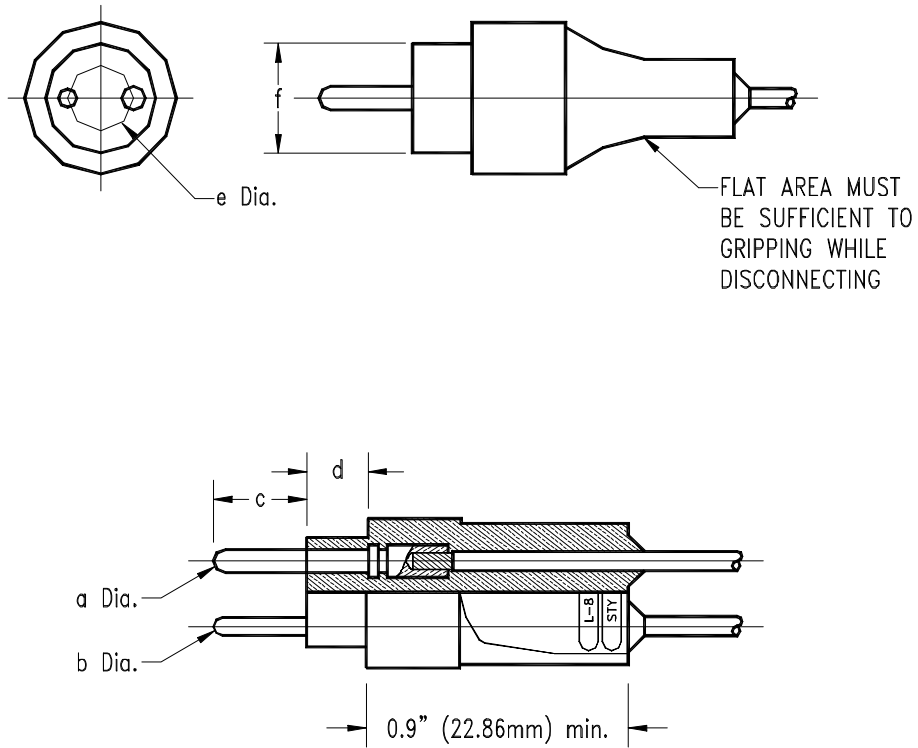
FIGURE 6. Class B, Type II, Style 12, Receptacle - Single Conductor, 20 Ampere, 600 Volts Between Contacts 1500 Volts to Ground



Note:

Dimensions are defined on Figure 1A.

FIGURE 7. Class B, Type II, Style 5, Plug - Single Conductor, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to Ground



Note:
Dimensions are defined on Figure 1A.

FIGURE 8. Class A, Type II, Style 6, Plug - Two Conductor, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to Ground