

MIL-T-27535A(ASG)

15 MAY 1964

Superseding data  
(see 6.4)

MILITARY SPECIFICATION

TRANSFORMER, POWER, ISOLATION: SERIES CIRCUIT, AIRPORT LIGHTING, GENERAL SPECIFICATION FOR

This specification has been approved by the Department of the Air Force and by the Bureau of Naval Weapons.

1. SCOPE

1.1 This specification covers the general requirements for isolation, series circuit, power transformers for airport lighting.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Military

MIL-C-4921	Cable, Power, Electrical, Airport Lighting, General Requirements for
MIL-C-5136	Cable, Power, Electrical, Polychloroprene Sheathed, Buna Compound Insulated
MIL-I-7798	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic
MIL-E-17555	Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of

STANDARDS

Military

MIL-STD-130	Identification Marking of US Military Property Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-143	
MIL-STD-810	Environmental Test Methods for Aerospace and Ground Equipment
MIL-STD-831	Test Reports, Preparation of
MS24526	
MS33586	
	Metals, Definition of Dissimilar

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See Supplement 1 for list of applicable MS Standards.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications.- The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply:

Federal Aviation Agency

L-823	Plug and Receptacle, Cable Connectors
L-824	Underground Electric Cable for Airport Lighting Circuits

(Copies of FAA documents may be obtained from the Federal Aviation Agency, Washington, D. C. 20553.)

3. REQUIREMENTS

3.1 Qualification.- The transformer furnished under this specification shall be a product which has been subjected to and which has passed the qualification tests specified herein, and which has been listed on or approved for listing on the applicable Qualified Products List.

3.2 Data.- Unless otherwise specified in the contract or order, no data (other than reports and drawings accompanying qualification samples) are required by this specification or any of the documents referenced in section 2 (see 6.2).

3.3 Components.- The transformer shall consist of primary and secondary coils wound upon a core and included in a waterproof case with rubber connectors molded on the primary and secondary leads.

3.4 Selection of specifications and standards.- Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.5 Materials.-

3.5.1 Fungus-proof materials.- Materials that are nutrients for fungi shall not be used when it is practical to avoid them; when used they shall be treated with a fungicidal agent.

3.5.2 Metals.- Metals shall be corrosion resistant or suitably treated to resist corrosion due to fuels, salt spray, or atmospheric conditions as may be encountered in storage or service.

3.5.2.1 Dissimilar metals.- Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MS33586.

3.5.3 Solder.- Lead-tin solder shall not be used.

3.6 Design and construction.- The design of the transformer shall be in accordance with the applicable MS standard (see 6.2).

3.6.1 The transformer shall be designed to perform under environmental, mechanical, and electrical conditions specified herein for continuous service at ambient temperatures from  $-54^{\circ}$  C to  $+65^{\circ}$  C, either on the surface, buried directly in the ground, or submerged in water.

3.6.1.1 The transformer shall be designed and constructed so that parts will not work loose in service. It shall be built to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation and service. The exact shape and design of the transformer may be optional, provided all requirements specified herein and on the applicable MS standard are met, and the design is approved by the qualifying activity.

3.6.1.2 Rating.- The transformer shall be designed to operate in accordance with the requirements of the applicable MS standard, within a frequency range of 50 to 60 cycles per second.

3.6.1.3 Windings.- The windings shall be completely insulated from each other and the core. The transformer shall be designed to operate indefinitely on load, short-circuit, or open-circuit conditions in the secondary with rated current and frequency in the primary. The transformer shall have sufficient capacity to allow for lamp aging and secondary contact losses.

3.6.2 Case.- The transformer shall be enclosed in a permanently sealed case so as to produce a completely watertight assembly. No portion of the case shall be less than 1/4 inch thick. Sharp corners and edges of the core and coil assembly shall be eliminated or adequate provisions made so they will not cut the case if the transformer is dropped or handled roughly. The case shall be constructed so moisture accidentally getting into the leads or connectors cannot be conducted through the leads into the transformer. The case shall be molded from rubber or rubber-like compounds and may be molded directly on the transformer or premolded and compound filled. Insofar as is practicable, internal air pockets shall be eliminated and the assembly shall be sufficiently rugged to withstand rough handling. The case shall be capable of withstanding exposure to sun, oil, gasoline, moisture, and acid and alkaline soils. The case shall form a permanent watertight junction with the leads. The case and the transformer shall be designed so that it can be installed in a MS24526 light base. It shall be possible to install the transformer in this base so that the leads are horizontal without excessive bending of the leads. No part of the transformer and leads shall extend more than 8 inches above the bottom of the base.

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3.6.3 Cables.- The transformer shall be provided with a two-conductor secondary cable and two single-conductor primary cables. The cables shall be securely fastened to the transformer in such a manner that carrying by the cables will not loosen the electrical connections or damage the water seal. A connector shall be molded on the outer end of each lead. Cable lengths shall be as specified on the applicable MS standard.

3.6.3.1 Primary cables.- Primary cables shall be single conductor, 5,000V, No. 8 AWG stranded cable conforming to MIL-C-4921 or FAA-L-824, type B. The cables shall be marked H1 and H2. The H1 cable shall connect to the plug shown on figure 6a of FAA-L-823 and the H2 cable shall connect to the receptacle shown on figure 6b of FAA-L-823.

3.6.3.2 Secondary cable.- The secondary cable shall be 600V, two-conductor, No. 12 AWG flexible cord conforming to MIL-C-5136 or FAA-L-824, type A and shall terminate in a 600V, two-pole receptacle in accordance with FAA-L-823, as specified on the applicable MS standard. Each conductor shall have not less than 37 strands. The receptacle shall be so wired that the large contact will connect to the X1 lead of the transformer secondary and the smaller contact will connect to the X2 lead.

3.6.4 Caps.- A watertight cap shall be placed on each connector for protection during shipment and installation. The cap shall consist of a rubber or rubber-like compound plug (or receptacle) designed to protect the mating surfaces of the connector from moisture and dirt. Insulation tape at least 7 mils thick and 3/4 inch wide conforming to MIL-I-7798 shall be wrapped over the joining seam to hold the cap in place and to protect against dirt and moisture. The dimensions of the mating surface of the caps shall be in accordance with FAA-L-823.

### 3.7 Performance.-

3.7.1 Electrical characteristics.- When tested as specified in 4.7.1, the transformer shall conform to the values specified on the MS standard.

3.7.1.1 Current ratio.- When tested as specified in 4.7.1.1, the transformers shall meet the requirements of the MS standard.

3.7.2 Impact.- When tested as specified in 4.7.2, there shall be no damage to the transformer or a change of more than 1 percent in the results obtained in the test specified in 4.7.1.

3.7.3 Insulation resistance.- When transformers are tested as specified in 4.7.3 and 4.7.4, the insulation shall equal or exceed the values specified in table I. There shall be no softening of the case, evidence of leakage, or damage.

3.7.4 Temperature rise.- When transformers are tested as specified in 4.7.5, the temperature rise shall not exceed 55° C when operating under rated load, short-circuit, or open-circuit conditions.

3.7.5 Destructive examination.- When transformers are examined as specified in 4.7.6, there shall be no evidence of mechanical or electrical damage and all internal and external components shall conform to this specification and the applicable MS standard.

3.7.6 High temperature.- When transformers are tested as specified in 4.7.7.1, there shall be no mechanical or electrical damage to the transformer, and it shall be operative at the conclusion of the test.

3.7.7 Low temperature.- When transformers are tested as specified in 4.7.7.2, there shall be no mechanical or electrical damage to the transformer, and it shall be operative at the conclusion of the test.

3.8 Dimensions and tolerances.- Dimensions and tolerances not specified shall be as close as is consistent with the best shop practices. Where dimensions and tolerances may affect the interchangeability, operation, or performance of the transformer, they shall be held or limited accordingly.

3.9 Weight.- The weight of the transformer shall be held to the minimum consistent with good design and shall not exceed the weight specified on the applicable MS standard.

3.10 Identification of product.- The transformer shall be marked for identification in accordance with MIL-STD-130, except the serial number shall not be included. The markings shall be molded on the surface of the transformer. The following special marking shall be added according to the transformer rating:

MS Part No. _____	Primary amperes _____
Manufacturer's Part No. _____	Secondary amperes _____
Rating: Watts _____	Federal Stock No. _____

3.11 Workmanship.- The transformer, including all parts and accessories, shall be constructed and finished in a thoroughly workmanlike manner. Particular attention shall be given to neatness and thoroughness of soldering, wiring, impregnation of coils, marking of parts and assemblies, and freedom of exposed parts from burrs and sharp edges.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspection are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests.- The inspection and testing of the transformer shall be classified as follows:

- (a) Qualification tests (4.4)
- (b) Quality conformance tests (4.5)

4.3 Test conditions.- Unless otherwise specified, tests shall be conducted at room temperature (approximately 25° C). The electrical tests shall be conducted with a suitable 60-cycle sine wave power source with primary current maintained at the specified values.

4.4 Qualification testing.-

4.4.1 Test samples.- The test samples shall consist of three transformers. Samples shall be identified with the manufacturer's own part number and any additional information required by the letter of authorization.

4.4.2 Test report.- A test report shall be prepared in accordance with MIL-STD-831 and three complete copies of the report furnished to the procuring activity.

4.4.3 Qualification tests.- Qualification tests shall consist of all the examinations and tests specified under 4.6 and 4.7.

4.5 Quality conformance tests.- The quality conformance tests shall consist of the following:

- (a) Individual tests (4.5.1)
- (b) Periodic sampling tests (4.5.2)

4.5.1 Individual tests.- Each transformer shall be subjected to the following tests:

- (a) Examination of product (4.6.1)
- (b) Insulation resistance (4.7.4)
- (c) Current ratio (4.7.1.1)

4.5.2 Periodic sampling tests.-

4.5.2.1 Sampling plan.- Once each week during production, a group of five transformers shall be selected at random from transformers which are representative of current production and have passed the specified individual tests. The five transformers shall be subjected to the test specified in 4.7.3, except that the test procedures may be modified as specified in 4.7.4.

4.5.3 Rejection and retest.- Instructions for rejection and retest shall be as specified by the qualifying activity.

#### 4.6 Examinations.-

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4.6.1 Examination of product.- The transformer shall be examined to determine compliance with the requirements specified herein with respect to materials, workmanship, and marking.

4.6.1.1 Each connector and cap shall be inspected to determine that mating surfaces are free from blemishes, holes, cracks, and rough spots.

4.6.1.2 Each connector and cap shall be checked to determine if the diameters of the mating surfaces are in accordance with specified dimensions. This test shall be performed immediately after molding, prior to insertion of the caps, and need not be repeated during the final tests of the completed transformer.

4.6.1.3 The junction of the case and the cables shall be examined to determine that they have not been damaged and are otherwise satisfactory.

#### 4.7 Test methods.-

4.7.1 Electrical characteristics.- The transformer shall be energized at room temperature. After the transformer windings have stabilized at the operating temperature, the electrical characteristics shall be determined. At each specified primary current, the secondary current at the rated load shall be within the limits specified on the applicable MS standard.

4.7.1.1 Current ratio.- With maximum rated current flowing in the primary, the secondary current at maximum rated load shall be within the limits specified on the MS standard.

4.7.2 Impact.- Two of the transformers subjected to the test specified in 4.7.1, shall be dropped twice from a height of 4 feet upon a hard, rigid surface, once in such a manner that they hit on a bottom corner or location where the most damage is likely to occur because of the core cutting into the case, and once in such a manner that they hit on a side or location where the most damage is likely to occur to the windings. After being dropped, the two transformers shall again be subjected to the test specified in 4.7.1. Any evidence of damage to the case or a change of more than 1 percent in the results obtained in the test specified in 4.7.1 shall be cause for rejection.

4.7.3 Insulation resistance (sampling tests).- The two transformers subjected to the test specified in 4.7.2 shall be subjected to a continuous 20-cycle test as follows.

4.7.3.1 Mating connectors shall be installed in the three connectors of each transformer. The mating connectors shall not be removed before completion of the 20 cycles. If they are removed for any reason, tests shall be repeated so that each transformer and its connector satisfactorily pass 20 continuous cycles. One cycle shall consist of the sequence of operations specified in 4.7.3.2, 4.7.3.3, and 4.7.3.4.

4.7.3.2 The transformers shall be operated, with mating connectors installed, for a minimum of 5 hours in air, at room temperature, with the rated current flowing in the primary and the secondary open circuited.

4.7.3.3 The transformers and connectors shall be immediately immersed in a grounded tap-water bath, at room temperature, to a depth of approximately 1 foot and the insulation of each coil measured. The measurements shall be made with the connectors submerged in water, with the bare ends of the mating connectors out of the water. The period of time between interruption of the heating cycle and start of the measurements shall not exceed 3 minutes.

4.7.3.4 The transformer and its connector shall be soaked in water, at room temperature, for not less than 12 hours and the insulation resistance measurements repeated.

4.7.3.5 Measurements of insulation resistance shall be made with direct current after the transformer has been soaked in a water bath for 12 hours. The voltages specified in table I shall be applied for 1 minute between each coil and ground, with the other coil grounded and connectors submerged in water. The insulation resistance shall equal or exceed the values specified in table I. Zero and maximum readings of the test instrument shall be periodically checked by immersing the high voltage lead in water alongside a transformer and by suspending it in air.

TABLE I. Insulation resistance

Coil	Dc test voltage	Minimum insulation resistance in megohms	
		Cold	Hot
Secondary	5,000	750	300
Primary	15,000	2,000	750

4.7.4 Insulation resistance (individual tests).- Each transformer shall be subjected to one complete cycle of the test specified in 4.7.3. When approved by the qualifying activity, the following modifications may be made in the test specified in 4.7.3.

4.7.4.1 The heating cycle specified in 4.7.3.2 may be conducted by heating the transformers in an oven, or by short circuiting either the primary or secondary coil and circulating slightly more than rated current through the other coil. The heating cycle, however, shall produce equivalent or greater temperatures in the coils, case, and leads of a transformer than the 5-hour open-circuit conditions, and the transformers shall be heated for not less than 2 hours.

4.7.4.2 Primary connectors of several transformers may be plugged directly together and the transformers heated, soaked, and tested as a group, as for one transformer. The minimum acceptance insulation resistance for the combined primary coils of the group shall be not less than that specified for a single transformer. No connector in the group shall be unplugged until after the tests are completed.

4.7.5 Temperature rise.- The temperature rise of the transformer windings not subjected to the impact test shall be determined by the resistance method and shall not exceed 55° C when the transformer is operated under any of the following conditions with the rated current in the primary:

- (a) Rated load
- (b) Short circuit
- (c) Open circuit

4.7.6 Destructive examination.- One transformer shall be cut open and examined internally and externally to determine compliance with all requirements of this specification.

4.7.7 Environmental.- The transformer shall be subjected to the following tests conducted in accordance with the specified procedures of MIL-STD-810.

4.7.7.1 High temperature.- The transformer shall be subjected to high temperature in accordance with Method 501, Procedure I, except the temperature shall be 65° C.

4.7.7.2 Low temperature.- The transformer shall be subjected to low temperature in accordance with Method 502, Procedure I.

4.7.8 Inspection for delivery.- The transformers shall be inspected to determine that preservation, packaging, packing and marking are in accordance with section 5. (See 5.1.)

## 5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing, and marking.- Transformers shall be preserved and packaged in accordance with level A or C of MIL-E-17555, as specified (see 6.2). They shall be packed in accordance with level A, B, or C, as specified (see 6.2), and marked in accordance with MIL-E-17555.

## 6. NOTES

6.1 Intended use.- The transformers are intended for use in both permanent and advance airport lighting series circuit installation.

6.2 Ordering data.- Procurement documents should specify:

- (a) Title, number, and date of this specification.
- (b) MS part number (see 3.6).
- (c) Levels of preservation, packaging, and packing required (see 5.1).
- (d) Reports or drawings, if other than 4.4.2 (see 3.2).

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6.3 Qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of suppliers is called to this requirement 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. The activity responsible for the qualified products list is the Systems Engineering Group, Wright-Patterson Air Force Base, Ohio 45433, ATTN: SEHCC, and information pertaining to qualification of products may be obtained from that activity.

6.4 Superseding data.- This specification supersedes MIL-T-27535(USAF) dated 23 May 1963, MIL-T-4949A(ASG) dated 28 May 1958, MIL-T-4950A(ASG) dated 7 July 1958, and MIL-T-7641B(ASG) dated 28 September 1955.

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Review/user information is current as of the date of this document. For future coordination of changes to this document, draft circulation should be based on the information in the current Federal Supply Classification Listing of DoD standardization documents.