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U.S. Department Of Transportation

Federal Aviation Administration
Specification

ISOLATION TRANSFORMER (1500 WATT)
FOR
HIGH INTENSITY APPROACH LIGHTING SYSTEMS

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FAA-E-2690

ISOLATION TRANSFORMER (1500 Watt)

FOR

HIGH INTENSITY APPROACH LIGHTING SYSTEMS

1. SCOPE

1.1 Scope.- This specification covers the requirements for a series/series 1500-Watt isolation transformer to supply a 1500-Watt series lighting load in airport lighting systems.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA specifications, standards, and drawings, of the issues specified in the invitation-for-bids or request-for-proposals, form a part of this specification and are applicable to the extent specified herein.

2.1.1 FAA specifications.

AC 150/5345-26B	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-7D	Specification for L-824 Underground Electrical Cables for Airport Lighting Circuits

2.2 Military and Federal publications.- The following Military and Federal publications, of the issues in effect on the date of the invitation-for-bids or request-for-proposals, form a part of this specification and are applicable to the extent specified herein.

2.2.1 Military specifications.

MIL-I-24391C	Insulation Tape, Electrical, Plastic, Pressure Sensitive Adhesive
MIL-E-17555H	Electronic and Electrical Equipment, Packaging

2.2.2 Military standards.

MIL-STD-810E	Environmental Test Methods

2.3 Other publications.- The following publications, of the issue in effect on the date of the invitation-for-bids or request-for-proposals, form a part of this specification and are applicable to the extent specified herein.

2.3.1 American Society for Testing Materials (ASTM) Standards.

D-2240	Indentation Hardness of Rubber and Plastic by Means

	of a Durometer
D 3951	Standard Practice for Commercial Packaging
D 4169	Standard Practice for Performance Testing of Shipping Containers and Systems

2.3.2 American National Standards.

ANSI/ASQC-Q9003-1994	Quality Systems, Model for Quality Assurance in final Inspection and Test

(Copies of this specification and other applicable FAA documents may be obtained from the Contracting Officer in the Office issuing the invitation for bids or request for proposals. The requests should fully identify material desired; i.e., standard, drawing, specification, amendment numbers, and dates. Request should cite the invitation for bids, request for proposal, or contract involved or other use to be made of the requested material.)

(Request for copies of military specifications and standards should be addressed to Naval Publications and Forms Center, Attn: NAVICP Philadelphia, 700 Robbins Avenue, Philadelphia, Pennsylvania 19111-5098.)

(Information on obtaining copies of federal specifications and standards may be obtained from General Services Administration offices in Washington D.C.; Atlanta; Boston; Chicago; Denver; Kansas City; New York; San Francisco; and Seattle.)

(Information on obtaining NFPA documents may be obtained from the National Fire Protection Association, 1 Batterymarch Park, P.O. 9101, Quincy, MA 02269-9101.)

(Information on obtaining ASTM standards may be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocker, PA 19428-2959.)

(Information on obtaining ANSI/ASQC standards may be obtained from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

3. REQUIREMENTS

3.1 General.- The transformers will be used in series connected, constant current, High Intensity Approach Lighting Systems. The transformers shall provide required isolation between the regulated primary current loop and the secondary lamp circuit. The transformers shall be capable of direct earth burial, and shall be equipped with quick-disconnect connectors.

3.2 Characteristics.- The transformer characteristics are defined as follows:

3.2.1 Electrical characteristics.- The transformers shall exhibit electrical characteristics as shown in Table I. The transformer shall be designed to operate continuously with the following transformer secondary conditions: full load, short-circuit, or open-circuit, with rated current and frequency in the primary.

Table I. Electrical Characteristics

Capacity	1800 Watts (Note 1)
Primary Current	20.0 Amperes
Power Factor	0.90 or Better
Efficiency	95% or Better
Frequency	60 Hz
Secondary Full Load Current	19.8--20.2 Amperes
secondary Short Circuited Current	20-22 Amperes
Secondary Load	4.5 Ohms Max
Maximum Open Circuit Voltage	848.5 Volts Peak to Peak (Note 2)
Voltage Rating	Primary 5,000 Volts rms Secondary 600 Volts rms

Note: 1. While the 1500 Watt transformer will be used to supply power to a 1500 Watt lamp circuit, the unit shall be designed for 1800 Watts to include the additional power consumed by external secondary circuit wiring.

2. Measurements to be made using 20 amperes, sinusoidal constant current source having no more than 5% distortion and with the transformer constituting no more than 10% of load.

3.2.1.1 Temperature rise.- The internal temperature rise of the transformer shall not exceed 65°C above ambient when the transformer is operated in air under each of the following conditions with rated current and frequency applied to the primary:

A. Rated Load
B. Short Circuit
C. Open Circuit

3.2.1.2 Insulation Resistance.- The transformer when submerged in water shall meet the insulation requirement contained in Table II.

Table II. Minimum Insulation Resistance

Coil	DC Test Voltage	Minimum Insulation Resistance Ambient Temp.		Minimum Insulation Resistance Operating Temp.	
		R	ELC	R	ELC
Secondary	5,000	750	6.7	300	16.7
Primary	15,000	2,000	7.5	750	20.0

ELC = Equivalent Leakage Current in Microamps

R = Minimum Insulation Resistance in Megohms

3.2.2 Physical characteristics.- The physical characteristics of the transformers are given as follows:

3.2.2.1 General characteristics.- The transformers shall be designed and constructed so that no parts will work loose in service. The transformers 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 shall be optional provided all requirements specified herein are met and the maximum dimensions specified hereinafter are not exceeded.

3.2.2.2 Coils.- The transformer shall consist of primary and secondary coils wound upon a core and enclosed in a waterproof case with rubber connectors molded on the primary and secondary leads. The windings shall be insulated from each other and they shall be insulated from the core. The coils on the core assembly shall be tightly wound and secured prior to molding. The coils, core and lead connections shall be constructed so that moisture accidentally getting into the leads or connectors cannot be conducted through the leads into the windings or core of the transformer. Prior to applying the case to the coils and core, the insulated coils, core and lead connections shall be submerged under water and tested to meet the insulation resistance shown in table II. Neoprene shall not be used for electrical insulation.

3.2.2.3 Case.- The transformer shall be enclosed in a permanently sealed case to produce a completely watertight assembly. No portion of the case shall be less than 1/4-inch (0.635 cm) thick, and the case shall be free of cracks, blisters, and holes, which would be detrimental to the transformer service life. Sharp corners and edges of the core and coil assembly shall be eliminated or adequate provisions made so that they will not cut the case if the transformer is dropped from a height of six feet or handled roughly. The case shall be constructed so that moisture accidentally getting into the leads or connectors cannot be conducted through the leads into the windings

of the transformer. The case shall be composed of material formed directly on the core and coil assembly or preformed and compound filled. The case material shall not absorb water or allow water to enter into the case. The minimum strength requirements shall be at least the following:

- Tensile strength - 1200 psi (84.3 kg/cm 2)
- Tensile strength after 96 hours oxygen bomb test 1000 psi (70 kg/cm 2)
- Tensile strength after 168 hours in an oven test at 69°C-71°C (156°F-160°F) - 1000 psi (70.2 kg/cm 2)
- Durometer hardness shall be 65±10 as measured in accordance with ASTM D-2240

3.2.2.3.1 Air pockets.- Insofar as practicable, internal air pockets shall be eliminated and the assembly shall be sufficiently rugged to withstand rough handling. There shall be no improper molding or bonds as evidenced by bubbles, blisters, and cracks. The case of the completed transformer shall be firm to the touch at all points and show no indention (except for compression of case compound) when subjected to pressure which can be exerted directly by the hands (30 pounds, +/- 10 pounds).

3.2.2.3.2 Size.- The case shall be designed so that the transformer may be installed upright or lying on any side. Rectangular shaped designs shall not exceed 8.75 inches (222 mm) by 8 inches (203 mm) by 9 inches (229 mm) in overall dimensions excluding leads. Cylindrical designs shall not exceed 10 inches (254 mm) in diameter by 9 inches (229 mm) high. Attachment of the transformer leads shall allow the case to be installed in a cylindrical container 12 inches (304.8 mm)in diameter.

3.2.2.4 Transformer leads.- The transformer shall be provided with one two-conductor secondary lead and two single-conductor primary leads. Lead connections may be of the solder or of the solderless type. When solderless connectors are used in joining leads to the transformer windings, they shall be of a type designed for that application and properly applied. Care shall be exercised during molding to insure that proper clearance exists between these connections after the molding operation has been completed. All three leads shall emerge from one end of the transformer. Spacing and arrangement are optional, provided all other requirements are complied with. Each lead shall be securely fastened to the transformer in such a manner that a 5-minute, 50-pound pull test on a lead shall not loosen the electrical connections or affect the water seal. The junction of the case with the sheath of the leads shall not crack or show evidence of damage when subjected to the 5-minute, 50-pound pull or when the leads are bent or twisted as they normally would be during testing and installation. The case shall form a permanent watertight junction with the leads. At the junction, the case compound shall provide a reinforcing area for the leads. At the case surface, the reinforcing shall be at least 25 percent greater than the outside diameter of the connecting leads. The reinforcing may be of a cone shape around individual leads or a continuous ridge enclosing all three leads, and shall form an integral bond with the entire cable sheath within this reinforcing cone or ridge.

3.2.2.4.1 Primary leads.- One primary lead (H1) shall have a plug-type connector conforming to figure 6(a) of AC 150/5345-26B (Specification for L-823). The other primary lead (H2) shall have a receptacle-type connector conforming to figure 6(b) of AC 150/5345-26B (Specification for L-823). The primary leads shall be equipped with No. 8 AWG, 19-strand, single conductor cable insulated for not less than 5,000 volts and conforming to AC 150/5345-7D Type B (Specification for L-824). Extend each primary lead 24 inches ±3 inches (61 cm. ±7.6 cm.) beyond the housing, including the connector.

3.2.2.4.2 Secondary leads.- The secondary lead shall have a receptacle conforming to figure 1(c) of AC 150/5345-26B (Specification for L-823). 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. The secondary lead shall be equipped with a No. 10 AWG, two-conductor, 600 volts, cable. Extend the secondary lead cable 24 inches ±3 inches (61 cm ±7.6 cm.) beyond the housing including the cable connector. Where the secondary leads connect to the core leads the secondary cable shall be sealed to prevent moisture migration from the secondary leads into the core.

3.2.2.4.2.1 Secondary connector temperature rise.- The temperature rise of the transformer secondary connector shall not be more than 6 degrees Celsius (10.8 degrees Fahrenheit) above the ambient temperature when continuously conducting 20 amperes current through the connection.

3.2.2.4.3 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 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-24391C 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 AC 150/5345-26B (Specification for L-823).

3.2.2.5 Weight.- The weight of the transformer shall be held to the minimum consistent with good design, and shall not be greater than 75 pounds (34.0 Kg).

3.2.2.6 Handle.- A lifting handle shall be provided on the transformer case on the same side as the leads. It shall be permanently attached and insulated from the core assembly and shall be made of non-conducting material. The handle shall support the weight of the complete 1500-watt transformer when supported by a four inch diameter mandrill.

3.2.3 Environmental conditions.- The transformer shall be capable of continuous, unimpaired operation when exposed to the environment specified herein. Materials used in the construction of the transformers shall not exhibit any signs of degradation when exposed to the extremes of sunshine, petroleum solvents, or hostile soils as specified herein.

3.2.3.1 Temperature.- The transformer shall be constructed for continuous outdoor service at any ambient temperature from a minimum of -55°C (-67°F)

to a maximum of +70°C (158°F). It shall operate properly when buried in the ground with up to 20 amperes and 5,000 volts on the primary winding.

3.2.3.2 Solar radiation.- The material used to encapsulate the transformer and the insulation on the leads and connectors shall not be degraded by exposure to sunlight. The exposure shall be 1120 ±47 Watts/square meter of solar energy, having a spectral distribution as defined in MIL-STD-810E, Method 505.3, Procedure II for a duration of 56 twenty four hour cycles (20 hours of light and 4 hours of no light per cycle).

3.2.3.3 Petroleum solvents.- The transformer case or the input/output lead insulation (including connectors) shall not be degraded, or soluble in petroleum based solvents including oil, gasoline, or jet fuel.

3.2.3.4 Hostile soils.- The transformer case or the input/output lead insulation (including connectors) shall not be degraded when buried in acid or alkaline soils having PH factors ranging from 4 to 9.

3.2.3.5. Sea Water.- The transformer case or the input/ output lead insulation (including connectors) shall not degrade in sea water or water of the same salinity.

3.3 Materials.- Materials shall be as specified herein. When materials are not specifically designated, they shall be of the best commercial quality and entirely suitable for the purpose.

3.4 Nameplate.- The transformer shall have a nameplate. The nameplate data listed below shall be molded on the case surface of the transformer.

Transformer Rating: 1500 Watts
Frequency: 60 Hz
Primary Current: 20 A
Secondary Current: 20 A
Voltage Rating: 5000 V
FAA Specification Number:
Manufacturer's Part Number:
Manufacturer's Name or Trademark:
Made in U.S.A.
Order/Contract Number:

3.5 Workmanship.- Particular attention shall be given to neatness and thoroughness of soldering, wiring, impregnation of coils, freedom of case and leads from burrs and sharp edges, open pores in the case molding material, and firmness of case molding material, and firmness of case molding to transformer lead sheath. The transformer, including all parts and accessories , shall be constructed and finished in a thoroughly workmanlike manner.

4. QUALITY ASSURANCE PROVISIONS

4.1 General.- The contractor shall provide and maintain a quality control program that fulfills the requirements of American National Standards

ANSI/ASQC-Q9003-1994. ISO certification is not required. Unless otherwise specified in this specification or in the contract, all tests and inspections to determine compliance with the requirements of the contract specifications shall be made by the contractor and shall be subject to Government inspection. The term "Government inspection" as used in this specification, means that a FAA representative will witness the contractor's testing and inspection, and will carry out such visual and other inspection as deemed necessary to assure compliance with contract requirements. The Government reserves the right to waive Government inspection at the contractor's plant. When Government inspection is waived, the contractor shall furnish to the Contracting Officer two copies of test data, certified by an independent testing agency describing the results obtained during the inspection and tests required by the contract specification. The test data must demonstrate that the equipment meets contract requirements, and shall include the statement: "This certifies that this unit fully meets all technical requirements of the contract". The statement shall be dated, and signed by a responsible official of the contractor or the testing agency. Certified test data shall be furnished to the Contracting Officer. Shipment shall not be made until the contractor receives written Government approval of the test data.

4.2 Tests.- The tests 4.2.1 through 4.2.4.5 shall be conducted on two preproduction units to prove compliance with this specification. Unless otherwise specified, all tests shall be made at room temperature (approximately 25°C ±5 °C/77°F ±9°F), using a controlled-voltage sinusoidal electrical source (variable transformer or equal). If it is necessary for water bath temperature to be substantially different from limits set herein, the proper temperature coefficient for the compound being used shall be applied when computing insulation resistance values. It shall be the manufacturer's responsibility to furnish proof that the coefficient used is correct. Proof shall be in the form of a certified test report furnished by the manufacturer. Joints between transformer leads, and between transformer leads and test leads, shall not be taped during any of the dielectric or insulation resistance tests. All test lead connectors shall be checked with a "go", "no-go" gauge prior to use to assure proper watertight seal. The "go", "no-go" gauge shall be prepared in accordance with AC 150/5345-26B.

4.2.1 Electrical characteristics tests.-The units shall be tested to show that their electrical characteristics (3.2.1) are as specified in Table I. All corrections to compensate for meter-power consumption shall be applied. The transformer shall operate in air at room temperature with rated load connected to the secondary until the transformer windings have reached normal operating temperature, at which time the measurements will be taken. Open circuit voltage measurements shall be made using a sinusoidal, 20-ampere, current source having no more than 5 percent distortion of the 60 Hz waveform and with the transformer under test consisting no more than 10 percent of the load.

4.2.1.1 Temperature rise.- The transformer internal temperature rise (3.2.1.1) shall be tested using the resistance method as defined by American Standard Test Code for transformers. Temperature rise shall be measured with 20 amperes of primary current for three configurations. The temperature rise

shall be measured with a rated load (1800 Watts), a shorted secondary, and an open secondary and it shall not exceed 65°C (149°F) above ambient in any configuration. The temperature rise shall be computed using the following formula:

Temperature Rise (°C) = (234.5 + T0)x(R1 - R0)/R0

Where T0 = Temperature (°C) corresponding to Cold Resistance

R0 = Cold Resistance

R1 = Hot Resistance

4.2.1.2 Ratio test.- All transformer units shall be tested for current ratio (3.2.1) at rated frequency with 20 amps current in the primary and an 1800 Watt load on the secondary. The secondary current of each transformer shall be between 19.8 and 20.2 amperes.

4.2.2 Physical characteristics tests.- The units shall be tested to show that their physical characteristics meet the requirements of 3.2.2.

4.2.2.1 Coil and core insulation resistance.- Prior to applying the case to the coils and core, the insulated coils, core and lead connections shall be submerged under water as shown in figure 1 and tested (3.2.2.2) to meet the insulation resistance shown in table II.

4.2.2.2 Shock test.- The transformer shall be dropped twice (3.2.2.3) from a height of 6 feet on a smooth hardwood floor; once so it hits on a bottom corner or location where the most damage is likely to occur due to the core cutting into the case, and once so it hits on a side or location where the most damage is likely to occur to the windings. The rigidity of each lead shall be tested (3.2.2.4), one at a time, by securing each lead just below the connector, in a clamp and applying a 50-pound pull for 5 minutes. The lead clamp used shall not cause damage to the lead at the point of attachment. After the completion of these tests, the transformer shall be tested to insure that it meets the secondary current requirements at rated load. A change of more than one percent from the results obtained in the test specified in 4.2.1 or evidence of damage to the case or attaching leads shall be cause for rejection.

4.2.2.3. Secondary connector temperature rise test.- All transformer units shall be connected to a 20 amperes current source and operated for 15 minutes. The transformer secondary should be connected to a matching L-823 plug connector. Prior to conducting the test, the terminals of the matching L-823 plug connector shall be short-circuited with a # 10 AWG wire, thus short circuiting the transformer secondary. The temperature rise of the transformer secondary connector (3.2.2.4.2.1) shall not be more than 6 degrees Celsius (10.8 degrees Fahrenheit) above the ambient temperature during the conduct of the test, or at the conclusion of the test.

4.2.2.4 Weight test.- The transformer weight shall be measured and shall not exceed the requirement of 3.2.2.5.

4.2.2.5 Handle test.- The transformer lifting handle shall be tested for compliance with 3.2.2.6. The test shall be conducted by inserting a mandrill through the transformer lifting handle and raising the complete transformer one foot above the ground. The portion of the mandrill in contact with the handle shall have a radius of two inches. The handle shall support the transformer in this position for one hour and show now signs of yielding to the weight.

4.2.2.6 Test for voids.- For each transformer, the maximum pressure that can be exerted directly with the hands (30 pounds +/- 10 pounds) shall be applied to all parts of the transformer case. Any evidence of voids beneath the surface of the case shall be cause for rejection.

4.2.3 Transformer insulation resistance.- The transformers shall be subjected to a continuous 20-cycle test. One cycle shall consist of the sequence of operation specified in 4.2.3.2, 4.2.3.3, and 4.2.3.4. The test in 4.2.3.5 shall be conducted at the end of each of the 20 cycles.

4.2.3.1 Mating connectors.- Mating connectors that were measured with "go" and "no-go" gauges in accordance with FAA AC 150-5345/26B shall be installed in three connectors of the transformers. The mating connectors shall not be removed before completion of the 20-cycle testing. If they are removed for any reason, tests shall be repeated so that the transformers and their connectors satisfactorily pass 20 continuous cycles.

4 2.3.2 Transformer heating cycle test.- The transformers shall be operated, with mating connectors installed, for a minimum of 6 hours in air at room temperature with rated current flowing in primary coils. The secondary of the transformers shall be open-circuited. This procedure shall hereinafter be referred to as "the heating cycle".

4.2.3.3 Water immersion test.- Immediately following the heating cycle, the transformers, with leads and connectors, shall be completely submerged in water, which is grounded, at room temperature, see figure 1. Care should be taken to insure that all molded connections, on transformer leads and test harness, are completely immersed in water during this test. Immediately after immersion, the insulation resistance of each coil and lead assembly shall be measured. The time period between interruption of the heating cycle and start of the measurement shall not exceed 3 minutes. The PH of this water shall be controlled as specified in 4.2.4.4.

4.2.3.4 Soaking test.- The transformers and their connectors shall be soaked in water, at room temperature, for not less than 12 hours, and the insulation resistance measurements repeated, see figure 1. This test shall be accomplished without current flowing in the transformer.

4.2.3.5 Insulation resistance measurements.- Measurements of dielectric and insulation resistance shall be made with direct current, see figure 1. On the primary the test voltage shall be applied for 1 minute at the one lead of the primary coil with the other lead of the primary coil open and the secondary lead grounded with the entire unit submerged in water. On the

primary the insulation resistance at the test voltage indicated shall equal or exceed the minimum values specified in Table III. On the secondary the test voltage indicated in Table III shall be applied for 1 minute at one lead of the secondary coil with the other lead of the secondary coil open and one primary lead grounded with the entire unit submerged in water. The secondary minimum insulation resistance shall comply with Table II. Zero and maximum readings of the test instrument shall be periodically checked by touching the high voltage test lead to the water surface and then suspending it in air. After the instrument needle settles down following current inrush, it shall remain steady without fluctuations.

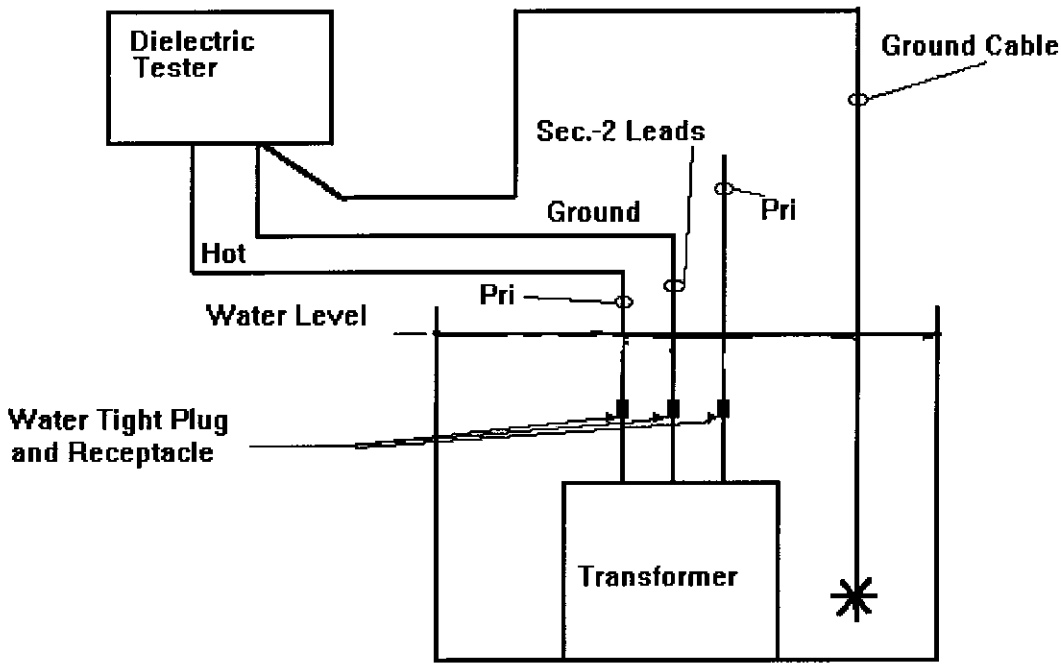

Figure 1: Transformer/Coil and Core Immersion Connection Diagram

4.2.4. Environmental tests.- The transformer shall be subjected to environmental testing as specified herein.

4.2.4.1 Temperature test.- The transformer shall be subjected to the temperature extremes required in 3.2.3.1 in accordance with MIL-STD-810E, Method 501.3, Procedure II, and Method 502.3-Procedure II. The transformer shall be operated with 20 amperes of primary current and an 1800 Watt load. The unit shall continue to operate without degradation of performance and the case shall not exhibit signs of blistering, cracking, discoloration, or softening.

4.2.4.2 Sunshine test.- The transformer shall be exposed to radiant energy (3.2.3.2) at a rate of 1120 Watts per square meter in accordance with MIL-STD-810E, Method 505.3, Procedure II. A test duration of 56 cycles (20 hours of light and 4 hours of no light per cycle) shall be conducted. Examination of the unit after exposure shall not disclose any signs of degradation of the case, connecting leads or connectors.

Table III. 20 Cycle Insulation Resistance Test

TEST CYCLE	PRIMARY VOLTAGE	HOT LEAKAGE CURRENT (μA)	COLD LEAKAGE CURRENT (μA)	SECONDARY VOLTAGE
1	15,000	20.00	7.50	5,000
2	14,500	19.33	7.25	5,000
3	14,000	18.67	7.00	5,000
4	13,500	18.00	6.75	5,000
5	13,000	17.33	6.50	5,000
6	12,500	16.67	6.25	5,000
7	12,000	16.00	6.00	5,000
8	11,500	15.33	5.75	5,000
9	11,000	14.67	5.50	5,000
10	10,500	14.00	5.25	5,000
11	10,000	13.33	5.00	5,000
12	9,500	12.67	4.75	5,000
13	9,000	12.00	4.50	5,000
14	8,500	11.33	4.25	5,000
15	8,000	10.67	4.00	5,000
16	7,500	10.00	3.75	5,000
17	7,000	9.33	3.50	5,000
18	6,500	8.67	3.25	5,000
19	6,000	8.00	3.00	5,000
20	15,000	20.00	7.50	5,000

4.2.4.3 Petroleum solvent test.- The transformer shall be soaked (3.2.3.3) for 48 hours in a petroleum solvent solution consisting of equal parts of SAE 30 motor oil, gasoline, and JP-4 jet fuel. The case and leads of units shall not exhibit any signs of degradation upon removal from this solution.

4.2.4.4 Hostile soil test.- The hostile soil test (3.2.3.4) shall be conducted during the conduction of the water immersion test (4.2.3.3.), the PH of the test water shall be adjusted by the addition of appropriate chemicals (acid or alkali) from 4 to 9. Ten immersion cycles shall be conducted at PH 4 and 10 cycles at PH 9.

4.2.4.5. Sea Water Test.-The first two transformer units (production models) shall be energized and soaked in salt water (3.2.3.5) for 20 days with no change in insulation resistance as shown in table II specification.

4.3 Production testing.- All transformers offered for delivery shall be subjected to the tests specified in 4.2.1.2, 4.2.2.3, 4.2.2.6 and 4.3.1.

4.3.1 Dielectric testing.- Each transformer shall be subjected to one complete cycle of the test specified in 4.2.3. The transformers may be oven-heated, as a substitute for the Transformer heating cycle test, to a coil temperature known to equal or exceed that obtained in the 6-hour open circuit conditions.

4.4. Test instrument.- The manufacturer or the testing laboratory performing preproduction and production tests shall provide adequate instrumentation for these tests. All instruments shall have calibration labels indicating that the instruments have been calibrated by a reliable laboratory in accordance with American National Standards ANSI/ASQC-Q9003-1994. Indicating instruments, voltmeters, and ammeters shall be of the one-half of 1-percent classification or better. Alternating current instruments shall be true RMS types.

4.5 Test performance.- All tests described above shall be performed at the contractor's expense at the contractor's facility or at an FAA approved independent testing laboratory. All tests shall be witnessed by a FAA representative. A minimum of 10-days notice of inspection readiness should be given. Tests shall be conducted on preproduction model and on production units as outlined above to prove compliance with this specification.

5. PREPARATION FOR DELIVERY

5.1 General.- Unless otherwise specified in the contract, lamps shall be packaged for extended warehouse storage and reshipment. Packaging shall be in accordance with ASTM D 3951 and testing or validation shall be in accordance with ASTM D 4169, Assurance level II, Distribution cycles 18.

5.2 Packaging.- Each lamp, with one inch cushioning, shall be packaged in an individual unit package fiberboard container. Unit packages shall be over packed in intermediate containers with 12 unit packages per container. Intermediate packaging and shipping containers shall be capable of multiple handling and storage under favorable conditions, such as enclosed facilities, for a minimum of one year.

5.3 Palletized shipments.- All palletized shipments shall be made on disposable pallets with maximum outside dimensions of forty seven and one-half

inches (47 ½ inches) by forty inches (40 inches). Overall height of the pallet and contents shall not exceed forty seven inches (47 inches). Fork entry of the pallet shall be on the long sides of the pallet. No portion of the load shall overhang or extend beyond any pallet edge. Shrink wrapping to secure intermediate containers is encouraged.

5.4 Marking.- Unit and intermediate packages and exterior shipping containers shall be marked in accordance with MIL-STD-129, M, 4.2.1. Bar code is not required. Each intermediate package and each shipping container shall be durably marked with the following information: (example in parentheses)

National Stock Number:
Cage Code or Manufacturer's Part Number:
Item Description: (Isolation Transformer, 1500 W, 20A/20A)
Specification:
Quantity and Unit of Issue:
Contract/Order Number:
Level of Protection and Date Packed:
Manufacturer's Name and Trade Mark:

6. NOTES

6.1 Notes.- None.

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