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DEPARTMENT OF DEFENSE
HANDBOOK

ELECTRICAL COMPONENTS FOR AUTOMOTIVE VEHICLES; WATERPROOFNESS TESTS

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MIL-STD-1184(AT)

DEPARTMENT OF DEFENSE
Washington, DC 20301

Electrical Components for Automotive Vehicles;
Waterproofness Tests

MIL-STD- (AT)

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C O N T E N T S

MIL-STD-1184(AT)

1. SCOPE

1.1 Purpose. This standard establishes uniform test methods for determining the waterproofness (resistance to the effects of water) of electrical components of automotive vehicles.

1.2 Classification. For the purpose of this standard, components shall be classified as follows (see section 3):

Type I - Rotating (continuous operation)
Type II - Non-rotating
Type III - Rotating (intermittent operation)

Class 1 - Sealed, serviceable
Class 2 - Sealed, non-serviceable
Class 3 - Open, ventilated and not electrically operable during immersion
Class 4 - Open, ventilated, operable while submerged

NOTE: The specification of the electrical component will specify the applicable type and class. The foregoing list is intended to show the usual classification for individual components; however, variance in design characteristics may dictate the placing of a particular component in some other classification. Type III has been added to this document to cover testing of intermittent operation electrical components such as starters, which previously were not adequately covered, but were referenced as type I in some components specifications. Class 4, (see 1.2) has also been added.

1.3 Application of test methods. Test methods contained in this standard apply broadly to automotive electrical components and generally represent the minimum acceptable conditions. When it is known that the component will encounter conditions more severe or less severe than the environmental levels stated herein, the test may be modified by the component specification.

1.4 Method of reference. Test methods referenced herein shall be referenced by specifying:

a. This standard number.
b. Method number.
c. Procedure number and details as specified in the summary paragraph of the test method.

2. REFERENCED DOCUMENTS (Not applicable)

3. DEFINITIONS

3.1 Type I. Components having one or more parts continuously revolving in one direction about an axis.

3.2 Type II. Components which may or may not have moving parts but which do not have revolving parts.

3.3 Type III. Components having one or more parts intermittently revolving in one direction about an axis.

3.4 Class 1. Sealed, waterproof, serviceable, and whose seals are disturbed and resealed during repair operations.

3.5 Class 2. Sealed, waterproof, not serviceable and replaced when failure occurs.

3.6 Class 3. Open and ventilated, not damaged by immersion, and not operable electrically while submerged.

3.7 Class 4. Open and ventilated, not damaged by immersion, electrically operable while submerged.

3.8 Leakage. The term “leakage”, as used in this document, is intended to mean that there shall be no bubbles escaping from the interior of the component when the test chamber is evacuated to a pressure six pounds below atmospheric (see procedures 1, 4 and 5 of Method 100).

4. GENERAL REQUIREMENTS

4.1 Test conditions.

4.1.1 General. Unless otherwise specified in the component specification, tests shall be accomplished on a fully-assembled component. When test conditions require that the component shall be connected in an electrical circuit, only military standard parts such as cables and terminals shall be used in making up the circuit.

4.1.2 Sample. The number of components to be submitted for testing shall be as specified in the applicable component specification. The test component shall be visually examined for cleanliness of its exterior surfaces and all foreign matter shall be removed. When required, for submerged operation, all connections shall be completed and the test circuit operated prior to submersion.

4.2 Test apparatus. Tests shall be conducted in a chamber equipped with a viewing window through which the component may be observed throughout the test. The chamber shall be equipped with the suitable seals, terminal connections, gauges and pumps to permit either evacuation or pressurization of the chamber as required. The minimum size of the chamber shall be 100 percent in excess of the test component and its related hardware.

4.3 Saline solution. The salt used shall be sodium chloride containing on a dry basis not more than 0.1 percent of sodium iodide and not more than 0.2 percent of total impurities. The solution shall be prepared by dissolving 5 parts by weight of salt in 95 parts by weight of distilled water or other water containing not more than 200 parts per million of total solids. The solution shall be kept free of sediment by filtration or decantation.

4.4 Pretest performance record. Prior to submersion, type I and II components shall be installed in a test circuit equivalent to their normal dry environment and operating both mechanically and electrically, as applicable, for a period of 30 minutes at full rated current and voltage. Type III, intermittent operation components, shall be operated three times for 30 seconds each. Operation shall be with no load, at reduced voltage (18-20 volts), and five minute intervals shall be allowed between each operation.

4.5 Failure criteria.

4.5.1 Types I and II, class 1 components. Class 1 components shall evidence no leakage and shall be mechanically and electrically operable during and subsequent to submersion, when subjected to the tests specified in procedure 1, steps 1, 2 and 3.

4.5.2 Types I and II, class 2 components. Class 2 components shall evidence no leakage and shall be mechanically and electrically operable during and subsequent to submersion, when subjected to the tests specified in procedure 1, steps 1 and 2.

4.5.3 Types I and II, class 3 components. The components shall withstand the test specified in procedure 2 without electrical breakdown, or other damage that would affect mechanical or electrical performance.

4.5.4 Types I and II, class 4 components. Components shall be mechanically and electrically operable during and subsequent to submersion, when subjected to the tests specified in procedure 3.

4.5.5 Type III, class 1 components. Components shall evidence no leakage and shall be mechanically and electrically operable during and subsequent to submersion, when subjected to the tests specified in procedure 4.

4.5.6 Acceptance or control test. When specified in the component specification, components shall withstand the submersion test specified in procedure 5 without evidence of leakage as indicated by bubbles from the interior of the component (see 3.8).

5. TEST METHODS

5.1 Procedure. Procedures for waterproof testing of automotive electrical components for the various types and classes in this standard are incorporated in a single method.

Custodian:
Army - AT

Preparing Activity:
Army - AT

Review Activity:
DLA - CS

(Project No. 2590-0172)

User Activities:
Army - ME
Navy - YD

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METHOD 100

WATERPROOFNESS

1. SCOPE

1.1 Procedure. Waterproofness testing is conducted to determine the effects of total water submersion on automotive electrical components. The tests are considered to be as severe as most conditions encountered in field operation and are intended to prevent early failure when component is installed in a vehicle. This standard divides electrical components into different types and classes according to their design and construction and this test method is divided into different procedures to cover the various designs. The paragraph references in this test method apply to the body of this standard.

1.2 Procedure 1. This procedure is applicable to components covered by types I and II, classes 1 and 2 (see 1.2).

1.3 Procedure 2. This procedure is applicable to components covered by types I and II, class 3 (see 1.2).

1.4 Procedure 3. This procedure is applicable to components covered by types I and II, class 4 (see 1.2).

1.5 Procedure 4. This procedure is applicable to components covered by type III, class I (see 1.2).

1.6 Procedure 5. (see 4.5.6).

2. TEST APPARATUS (see 4.2).

3. SALINE SOLUTION (see 4.3).

4. PROCEDURES

4.1 Procedure 1.

Step 1 - The component with its electrical connections, shall be submerged in a container with the uppermost surface a minimum of one inch below the surface of the saline solution (see 4.3) and installed in the chamber. The component shall be carefully observed during its entire period of submersion and shall be operated while submerged for 30 minutes at full rated current

and voltage. The chamber shall be evacuated to a pressure six pounds below atmospheric so as to apply a minimum of six pounds per square inch (psi) in internal pressure to all voids within the component. Test results obtained shall be compared with the data obtained from the test of 4.4. During this period the component shall be carefully observed for poor seals, as evidenced by bubbles escaping from the interior of the component (see 3.8). Leakage thus indicated shall be considered as noncompliance with the waterproofness requirement and the component shall be rejected. Bubbles which are the result of entrapped air on the exterior surfaces of the component shall not be considered a leak.

Step 2 - The chamber shall then be pressurized to six pounds above atmospheric and the component again operated for 30 minutes. Test results obtained shall be compared with the data from the test of 4.4.

Step 3 - Class 1 components only shall be disassembled as normally required in servicing and inspection made for the presence of water. If water is present, the component shall be rejected. If the component is dry, it shall be reassembled and subjected to 15 hours of dry operation (three 5-hour periods) at full rated current and voltage. The results shall be compared with the test data obtained under 4.4 (prior to initial submersion). Insulation breakdown or other damage that would impair mechanical or electrical operation of the component shall be considered as evidence of failure.

4.2 Procedure 2. The components shall be submerged in a container of saline solution (see 4.3), a minimum of one inch below the surface, at room ambient temperature (77° ± 15°F) for a period of one hour. The component shall then be removed from the solution and allowed to drain for a period of five minutes in its normal operating position. It shall then be subjected to 15 hours of dry operation (three 5-hour periods) at full rated current and voltage and results obtained compared with pre-submergence data obtained under 4.4.

4.3 Procedure 3. The component shall be submerged in a container of saline solution (see 4.3) a minimum of one inch below the surface, at room ambient temperature (77° ± 15°F), for a period of one hour and then operated for 30 minutes while submerged. The component shall then be removed from the solution and allowed to drain for a period of five minutes in its normal operating position. It shall then be subjected to 15 hours of dry operation (three 5-hour periods) at full rated current and voltage and results obtained compared with pre-submergence data obtained under 4.4.

4.4 Procedure 4. The component, with its electrical connections and with the drive end sealed, shall be submerged in a container with the uppermost surface a minimum of one inch below the surface of the saline solution (see 4.3) and installed in the chamber. The motor shall be subjected to 6 psi internal pressure for 30 minutes and then 6 psi internal vacuum for 30 minutes. The pressure and vacuum shall be applied to the chamber as specified in procedure 1. While

submerged, the motor shall be operated three times for 30 seconds each at 5 minute intervals and reduced voltage (18-20 V). Test results obtained shall be compared with the data obtained from the test of 4.4. There shall be no air leakage from the interior of the motor or water accumulation inside the motor (see 3.8). Air bubbles which are the result of air trapped in pockets on the exterior of the motor shall not be considered a leak. After removal from the chamber, the motor shall again be operated three times for 30 seconds each at 5 minute intervals and reduced voltage (18-20 V).

4.5 Procedure 5. The component shall be submerged in tapwater, with the component uppermost surface a minimum of one inch below the surface of the water. The component shall be checked for leaks (see 3.8) by applying 6 psi internal pressure for one minute while submerged. The internal pressure shall be obtained by applying vacuum over the water. When the component is a starting motor, the pinion opening shall be sealed or covered to achieve the internal pressure. Bubbles which are the result of entrapped air on the exterior surfaces of the component shall not be considered a leak.

5. Summary. The following details shall be specified in the component specification:

a. Procedure number, or type and class of item per this standard.
b. Pretest data required.