MIL -F-13927A(Ord)
22 August 1957
SUPERSEDING
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23 December 1954

MILITARY SPECIFICATION

FUNGUS RESISTANCE TEST; AUTOMOTIVE COMPONENTS

1. SCOPE

1.1 Scope. - This specification covers methods of testing automotive components for resistance to fungus attack to determine conformance to requirements specified in the item specification.

1.2 Classification. - For the purposes of this specification, specimens, to be tested shall be classified in one of the three following classes (see 6.2) and tested by one of the two following methods (as specified):

Class 1 - Permanently sealed component assemblies
Class 2 - Unsealed assemblies and sealed assemblies normally disassembled for servicing
Class 3 - Separate components not used in assemblies, or separate components used as replacement parts in assemblies
Method A - Tropical room
Method B - Incubation cabinet.

2. APPLICABLE DOCUMENTS

There are no applicable documents.

3. MATERIALS, EQUIPMENT, AND TEST SPECIMENS

3.1 Materials.

3.1.1 Test organisms. - Except as otherwise specified, following species of fungi, propagated in conformance to pertinent preparatory procedures specified in Section 4 shall be used for fungus-resistance tests:

Test Organisms	ATCC No.	QMC No.
Aspergillus flavus	9643	380
Aspergillus niger	6275	458
Penicillium citrinum	9849	1226
Trichoderma sp.	9645	365
Spicarea violacea (Penicillium lilacinum)		1034

(ATCC cultures may be secured on application to American Type Culture Collection, 2029 M. Street, N.W., Washington, D.C.)

(QMC cultures may be secured on application to Quartermaster Corps General Laboratories, Natick, Massachusetts.)

3.1.2 Test reagents. - Sterile mineral salts solution for use when specified, for diluting prepared spore suspensions, shall be of the following composition:

KH_2PO_4	0.7 g
K_2HPO_4	0.7 g
$MgSO_4 \cdot 7H_2O$	0.7 g
NH_4NO_3	1.0 g
NaCl	0.005 g
$FeSO_4 \cdot 7H_2O$	0.002 g
$ZnSO_4 \cdot 7H_2O$	0.002 g
$MnSO_4 \cdot 7H_2O$	0.001 g
Distilled water	1.0 liter

3.2 Test equipment. - Unless otherwise specified, method A, tropical room incubation (see 1.2 and 3.2.1), shall be used. Method B shall be used only when specifically approved in the detail (product or material) specification.

3.2.1 Tropical room (Method A). - Tropical room shall be provided with means for controlling and for cycling humidity and temperature conditions between limits specified in 4.2.5.2.

3.2.2 Incubation cabinet (Method B). - Incubation cabinet shall be provided with means for maintaining relative humidity between 96 and 100 percent and temperature between 80° and 84° F.

3.3 Test specimens. - Unless otherwise specified, not less than 1 specimen each of classes 1 and 2 items, and not less than 4 specimens of class 3 items, shall be subjected to this test. However, if any of the performance tests required by the detail (product or material) specification to ascertain the effect of this test are destructive in nature, a sample of sufficient size shall be furnished to complete all specified tests.

3.3.1 Preparation. - Prior to specified tests, test specimens shall not be leached, or otherwise conditioned, and there shall be no prior fungi inoculation. Specimens containing rubber, synthetic rubber, or similar materials shall not be subjected to heat-aging tests prior to fungi-resistance tests. Prior to any fungi-resistance tests, specimens shall be subjected to such other tests as are specified in the detail (item or material) specification.

4. PROCEDURES

4.1 Inspection. - Each specimen shall be visually inspected, in accordance with detail specification before testing. After completion of the test specified herein, each specimen shall again be inspected for conformance to detail specification requirements when applicable.

4.2.1 Culture stock maintenance. - Cultures of specified fungi shall be maintained separately on media, such as potato dextrose agar. Stock cultures shall be kept not more than 4 months in a refrigerator at a temperature between 37.4° and 50° F. Subcultures incubated at a temperature between 82.4° and 86° F. for 7 to 20 days shall be used to prepare spore suspensions.

4.2.2 Spore suspensions. - A composite spore suspension shall be prepared from 5 species of fungi specified in 3.1.1. Ten milliliters of sterile distilled water shall be poured into tubes of each of the cultures specified. A sterile needle or other means shall be used to harvest the spore growths on the surface of each culture. The spores and distilled water from the tubes of each species shall be poured into a 125 ml. flask containing 50 ml. of sterile distilled water and 15 - 20 sterile solid glass beads approximately 5 mm in diameter. The flask shall be shaken vigorously to break up the spore clumps and the suspension filtered through a thin layer of sterile glass wool to

remove mycelial filaments. The residue minus the filaments shall be added to 30 ml. of sterile mineral salts solution specified in 3.1.2 and the resultant suspension refrigerated at 40° F. until used. The suspension shall not be kept more than 24 hours.

4.2.3 Specimen inoculation. - The entire surface of each specimen shall be inoculated by spraying with the mixed spore suspension (see 4.2.2) by means of a spray apparatus (see 6.3). A culture dish with potato agar or similar media, shall be inoculated with the same spore suspension that is sprayed on the specimen. The dish shall serve as a control and shall be subjected to the same test conditions as the inoculated test specimens. Failure of the test fungi to produce copious growth on the control dish after 7 days will require the preparation of another spore suspension and a re-inoculation of the test specimens.

4.2.4 Specimen placement.

4.2.4.1 Classes 1 and 3. - Classes 1 and 3 units, assemblies, components, parts, etc., (see 6.2.1), immediately after inoculation (see 4.2.3), shall be placed for method A incubation (see 3.2.1) on open lattice shelves and so arranged as to permit free air circulation around specimens.

4.2.4.2 Class 2. - Class 2 specimens, unless otherwise specified, shall be placed in disassembled condition for incubation as specified in 4.2.4.1. When method B is used specimens shall be placed in the incubation cabinet (see 3.2.2)

4.2.5 Incubation.

4.2.5.1 Period. - Except as otherwise specified, after incubation (see 4.2.3 and 4.2.4), specimens shall be incubated for 90 days.

4.2.5.2 Cycling. - The tropical room shall be operated under the following conditions: Twenty hours with relative humidity between 93 and 97 percent and an ambient air temperature of 80° to 85° F. followed by 4 hours of a nominal 100 percent relative humidity, with condensation and an ambient air temperature of 75° to 80° F.

4.2.6 Performance ratings. - Failure of any specimen to pass any of the periodic performance tests specified below shall be considered as failure of the fungus test and shall end the test.

4.2.6.1 Class 1. - Class 1 items shall be subjected to performance tests in accordance with the detail (product or material) specification after 30, 60, and 90 days exposure.

4.2.6.2 Class 2. - Class 2 items, after initial incubation period of 15 days, shall be assembled and subjected to performance tests specified in the detail (product or material) specification. After performance tests, the incubation shall be continued with the specimen disassembled. At the end of 30, 60, and 90 days incubation respectively, the specimen shall be assembled, performance rated and then disassembled for placement back into incubation provided that it does not fail the performance test. Ninety days shall be considered as the termination of the test.

4.2.6.3 Class 3. - Specimens shall be removed from the chamber after 30, 60 and 90 days of incubation and subjected to the tests specified in the item specification. After performance tests the specimen shall not be replaced in the incubation chamber.

5. PREPARATION FOR DELIVERY

There are no applicable requirements.

6. NOTES

6.1 Intended use. - This specification is intended to be used as a test procedure for determining the effects of exposure to fungi and moisture on the physical, electrical, and material characteristics of automotive items, components, and materials

of components, used in or with military vehicles. The detail (product or material) specification when making reference to this specification would specify the applicable class and the permissible tolerances from specified requirements, if any, after exposure specified herein.

6.2 Classes.

6.2.1 Class 1. - Class 1 items include such sealed items as instruments, circuit breakers, solenoids, switches, etc., which are not normally serviced but are discarded and replaced when defects occur.

6.2.2 Class 2. - Class 2 items include starting motors, generators, unsealed magnetos, open or ventilated distributors, and sealed distributors, and other assemblies that are opened or disassembled for servicing.

6.2.3 Class 3. - Class 3 items include materials or separate components which may be procured as replacement parts of electrical or other assemblies or are not used in assemblies. Typical items in this class are gaskets, cable, hose, insulating material, etc., which require destructive tests such as tensile strength tests, ultimate elongation tests, etc. to determine the effect of fungi.

6.3 Spray apparatus. - Satisfactory spore suspension distribution (see 4.2.3) can be secured with DeVilbiss No. 2 hand-operated spray apparatus, or equal.

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