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MATERIAL - CORROSION PROTECTION COATINGS - FOR USE IN F-111 INTEGRAL FUEL TANKS - SCREENING TESTS OF
TEST DATA MEMORANDUM

F-TDM NO. 3126
MODEL F-111
TEST NO. 30-2657(1), 2691(2),
-2718(3), 2754(4)

TEST: MATERIAL - CORROSION PROTECTION COATINGS - FOR USE IN F-111
INTEGRAL FUEL TANKS - SCREENING TEST OF

OBJECT: To conduct screening tests on corrosion protection coatings for
use in F-111 integral fuel tanks.

TEST SPECIMENS:
Coatings and Primers
PR-1560 A/B Coating (1) (Polyurethane) Products Research Company
P-97-345 A/B Coating (2) (Mod. Epoxy) Burbank, California
Q-9-0089 Coating (1) (Silicone) Dow Corning Corporation
RTV-1200 Primer (used with Q-9-0089 and
Q-94-003) Midland, Michigan
Q-94-000 Coating (3) (Silicone) Dow Corning Corporation
Q-94-003 Coating (4) (Silicone) Midland, Michigan
A-4094 Primer (used with P-9-4000)
(XS-134152) St. Paul, Minnesota
Thermoline 200 Coating (3) (Furane) Thermoline Company
Thermoline R.S. Primer (used with Ther- Dallas, Texas
moline 200)
FMS-1001 A/B Coating (4) (GD/FW for- Desoto Chemical Company
mulation) (Modified silicone) Garland, Texas

PROCEDURES: Procedures for specimen preparation and testing are listed
in Table I.

RESULTS: Test results are listed in Table II.

DISCUSSION: The performance and reliability requirements of the F-111
airplane necessitate the use of corrosion prevention coatings in the
integral fuel tanks. The coatings investigated for this purpose must
first be screened by a few selected tests (Table I), simulating the
F-111 fuel tanks environment, in order to eliminate the inadequate
materials from the more extensive and costly evaluation tests. The
eight coatings and the test data listed in this report represent four
test requests and were grouped together to facilitate reporting.

The coatings tested, environmental conditions, and test results are
listed in Table II. It should be pointed out that one of the desirable
characteristics of the coating selected for this application is trans-
parency before and after exposure to the environments. This would per-
mit visual detection of corrosion if it were to occur beneath the coat-
ing at the metal-coating interface.

CONCLUSION: All coatings tested, with the exception of Thermoline 200
and Desoto FMS-1001, passed all the requirements of the screening tests
conducted. However, of the room temperature curing coatings*, Minnesota
Mining EC-1981 and Dow Corning Q94-003 were the only coatings that are
transparent.

Test Dates: 3-18-63 through 5-28-63
*Q-9-4000 was transparent but required
a 350°F cure.

DATE: 10 June 1963

BY: CHECKED: APPROVED:
### TABLE I

**PROCEDURES FOR SPECIMEN PREPARATION AND TESTING**

**I. Preparation of Test Specimens**

Refer to Paragraphs 4.6.2 and 4.6.3 of Military Specification MIL-C-27725 (USAF) "Coating, Corrosion Preventative, for Integral Fuel Tanks", dated 4 April 1962, for test panel cleaning and coating application. Prior to coating, clean the panels with A3 cleaner per GD/FW specification FMS-0140(A), then treat with Alodine 1200 per GD/FW's FPS-0011.

**II. Adhesion and Resistance to Salt Water and Fuel**

When tested as described below, the cured coating shall show no blistering, softening, leaching, shrinkage, corrosion extending more than 1/8 inch in form the panel edges or loss of adhesion.

Six test panels of 2024-T81 clad aluminum, measuring 0.040 x 2-7/8 x 6 inches, shall be coated with the test coating material and cured in accordance with manufacturer's instructions. After curing, two panels shall be conditioned for seven days at 375°F ±5°F in air and two panels shall be conditioned by being immersed vertically in a covered glass vessel containing a two layer liquid consisting of a three percent aqueous solution of sodium chloride and jet reference fluid in such a manner that two inches of the panels are exposed to the salt solution, two inches to the jet reference fluid and two inches to the air-vapor mixture above the liquid. The test panels shall be subjected to this exposure at 180°F ±2°F for seven days. The panels shall then be removed from the liquid, wiped dry and thoroughly examined. Test panels shall be cooled for a minimum of one hour at standard conditions before being tested for adhesion as follows:

Scribe two parallel marks one inch apart through the coating to the metal. The parallel scribe marks shall be along the six inch dimension. Apply a strip of one inch masking tape perpendicularly across the scribe marks. Apply one strip of tape across each of the test panels which received only a standard cure and across each of the heat conditioned panels. On the immersion conditioned panels, apply a piece of tape in each section of the panels exposed to the different fluid phases including the air-vapor mixture phase. Press the tape firmly onto the coating with a rubber covered roller, using a pressure of approximately 4 psi. The tape shall be removed in one abrupt motion perpendicular to the panel surface. The panel shall be examined for coating adhesion failure.
TABLE I

(continued)

III. Low Temperature Flexibility

When tested as described below, the cured coating shall withstand the low temperature test without cracking, checking or loss of adhesion.

Eight test panels of 2024 T-81 clad aluminum, measuring 0.040 x 2-7/8 x 6 inches, shall be coated with the test coating material in accordance with manufacturer's instructions. After standard cure, two panels shall be conditioned for seven days at 375°±5°F in air; two panels shall be conditioned by immersion in jet reference fluid for seven days at 180°±2°F; and two test panels shall be conditioned, first, by immersion in jet reference fluid for seven days at 180°±2°F and, then in air, for seven days at 375°±50°F. Immediately upon completion of the conditioning period, the conditioned panels and the two panels which received only a standard cure shall be placed in a low temperature flexibility jig. The temperature of the test panels shall be reduced to -65°±2°F and stabilized at that temperature for a period not to exceed two hours. After stabilization the panels shall be flexed through 130 consecutive cycles or until the coating fails.

Note: All coatings were allowed to cure 14 days at room temperature except Q-9-4000 which received 24 hours at room temperature plus 8 minutes at 350°F.
### TABLE II

RESULTS OF SCREENING TESTS ON CORROSION PROTECTION COATINGS

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Coating</th>
<th>Primer if Required</th>
<th>Color as Cured</th>
<th>Color After 7 days at 375°F</th>
<th>Flex. Adhesion</th>
<th>Vapor JRF</th>
<th>Salt Water at 180°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-2657 PR-1560</td>
<td>light green</td>
<td>dark brown</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>p</td>
</tr>
<tr>
<td>30-2657 Q-9-0089 RTV-1200</td>
<td>white</td>
<td>white</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>p</td>
</tr>
<tr>
<td>30-2691 EC-1981</td>
<td>clear</td>
<td>clear</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>p</td>
</tr>
<tr>
<td>30-2691 P-97-345</td>
<td>yellow</td>
<td>dark brown</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>p</td>
</tr>
<tr>
<td>30-2718 Q-9-4000 A-4094</td>
<td>clear</td>
<td>clear</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>p</td>
</tr>
<tr>
<td>30-2718 Thermo-line-200 R.S.</td>
<td>transparent amber</td>
<td>black</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>fail</td>
<td>f</td>
</tr>
<tr>
<td>30-2754 FMS-1001</td>
<td>yellow</td>
<td>tan</td>
<td>pass</td>
<td>pass</td>
<td>fail</td>
<td>fail</td>
<td>f</td>
</tr>
<tr>
<td>30-2754 Q94-003 RTV-1200</td>
<td>clear</td>
<td>clear</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>p</td>
</tr>
</tbody>
</table>

(1) Jet Reference Test Fluid
TABLE II
CORROSION PROTECTION COATINGS FOR USE IN F-111 INTEGRAL FUEL TANKS

<table>
<thead>
<tr>
<th>Adhesion</th>
<th>Vapor</th>
<th>JRF</th>
<th>Salt Water</th>
<th>Flex</th>
<th>Salt Water at 180°F</th>
<th>7 Days in JRF (1)</th>
<th>7 Days</th>
<th>7 Days in JRF at 180°F plus 7 days</th>
<th>Sprayability</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>good</td>
<td>pass</td>
<td>good</td>
<td>Coating good but possible health hazard when applying; two component</td>
<td></td>
</tr>
<tr>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>good</td>
<td>pass</td>
<td>good</td>
<td>Very easily marred; one component</td>
<td></td>
</tr>
<tr>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>good</td>
<td>pass</td>
<td>good</td>
<td>Tough after cure; one component</td>
<td></td>
</tr>
<tr>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>fair</td>
<td>pass</td>
<td>fair</td>
<td>Does not wet substrate well; two component</td>
<td></td>
</tr>
<tr>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>poor</td>
<td>pass</td>
<td>poor</td>
<td>Requires 350°F cure; one component</td>
<td></td>
</tr>
<tr>
<td>pass</td>
<td>pass</td>
<td>fail</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>good</td>
<td>pass</td>
<td>good</td>
<td>Lost adhesion in JRF; one component</td>
<td></td>
</tr>
<tr>
<td>pass</td>
<td>fail</td>
<td>fail</td>
<td>fail</td>
<td>pass</td>
<td>fail</td>
<td>good</td>
<td>pass</td>
<td>good</td>
<td>Blistered and lost adhesion; two component</td>
<td></td>
</tr>
<tr>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>pass</td>
<td>good</td>
<td>pass</td>
<td>good</td>
<td>Somewhat tough after cure; one component</td>
<td></td>
</tr>
</tbody>
</table>