FAILURE ANALYSIS
for
PRESS-TO-TEST MEMBRANE SWITCH PN A1-12-0104-001

Where used: Model SRB-406
Next assembly: P3-03-0041 Series

Y3-03-0724

Prepared by:	E. Hiner	Date:	11/20/02
Checked by:	J. Combariza	Date:	11/22/02
Approved by:	E. Hiner	Date:	11/22/02
Approved by:	T. Cohen	Date:	11/22/02

6830 N.W. 16th Terrace, Fort Lauderdale, FL 33309
(954) 975-2100 *Fax (954) 979-3313 * www.dmecorp.com

REVISIONS

Revision	Date	Change Description	Approval
-	11/25/02	ECO #13514	T. Cohen

1.0 PURPOSE

This failure analysis describes the deficiencies discovered, the cause for the deficiencies and the corrective action taken after four each, press-to-test membrane switches, PN A1-12-0104-001, failed after exposure to a variety of environmental conditions.

2.0 ENVIRONMENTAL TESTING INFORMATION

There have been four failures of membrane switches during the course of the Model SRB-406 MHz ELT qualification testing. All the failures occurred on either beacon SN 2006 or 2007. The sequence of testing and when the switch failed are as shown below.

- Beacon SN 2006: Switch failed after exposure to low temperature activation test performed per EUROCAE ED-62, paragraph 4.4.1.1. The membrane switch was replaced (beacon SN 2006 was not subjected to any other Group A test but low temperature activation) and beacon SN 2006 passed Group B humidity test and failed spray proof testing. The membrane switch was replaced with a modified membrane switch and passed the spray proof test. The modified switch was configured as per the corrective action defined herein.

- Beacon SN 2007: The switch passed all Group A tests (low temperature activation, high temperature activation, altitude, decompression, overpressure and vibration) and the Group B humidity test. Switch failed after exposure to the Group B spray proof test performed per RTCA DO-160D, paragraph 10.3.2. The membrane switch was replaced and re-exposed to the spray proof test and the switch failed again. The membrane switch was replaced with a modified membrane switch and passed the spray proof test. The modified switch was configured as per the corrective action defined herein.

3.0 REPORTED PROBLEM

The switches failed after exposure to a temperature change that allowed condensation to form or after exposure to a jet of water, sprayed on each surface of the beacon. The failure mode was that the beacon would be found to be in continuous self-test, when the beacon was removed from the environmental chamber. A continuity test of the membrane switch revealed that the open circuit resistance had changed from infinity to approximately 350K Ohms. At 350K Ohms the switch is effectively closed and the self test routine was launched and continued to cycle until power was removed from the circuit card assembly.

4.0 PROBLEM ANALYSIS

Membrane switches were removed from stock (same lot number as the failed switches), disassembled, examined, and installed on development beacon housings and subjected to immersion tests for period of up to 2 hours.

The visual examinations revealed that there was a split line running the length of the switch and that a recessed area was not well sealed when the switch was manufactured. Immersion tests revealed that water would channel down the split line and through the unsealed areas and flood the membrane compartment.

The membrane switch manufacturer was asked to modify their design and remove the split line and add sealing tape to the recessed area. Further immersion testing revealed that the split line leak path had been eliminated but the addition of the sealing tape did not eliminate the recess leak path.

Experiments were performed using an RTV (PN A2-01-0002-001, Dow Corning RTV 732) and a structural adhesive (PN D8040000010, Weld 10) to seal the recess area. Both adhesives were found to seal the recess after immersion to a depth of three feet for more than 12 hours.

The adhesive material is applied to the recessed area and the area opposite the recess prior to the membrane switch being installed on the housing. After the membrane switch is positioned on the housing and pressed down to seal all edges and surfaces, excess adhesive is removed from the recess location. A bead of adhesive is also applied around the perimeter of the membrane switch edge and the housing, to seal these areas.

5.0 CONCLUSION

The addition of the RTV or structural adhesive creates an effective seal in the recess area and the elimination of the split line solves the water-channeling leak. The RTV adhesive, PN A2-01-0002-001, is the preferred sealing adhesive since it is clear and maintains its elastomeric properties after it is cured.

6.0 CORRECTIVE ACTION

Membrane switches shall be removed from all qualification beacon housings and replaced with a new membrane switch that has no split line and has a bead of RTV applied to the recess area and the area opposite the circuit tail. An additional bead of RTV shall be applied to the perimeter of the membrane switch edge and the housing. This change in the assembly process and the membrane switch shall be documented in the applicable drawings. Beacons that have been modified shall be returned to the formal qualification test.