Competitive Analysis
Spark Plugs For Reciprocating Aircraft Engines

Champion Aerospace manufactures a comprehensive line of spark plugs for reciprocating aircraft engines. Customer feedback has indicated that competitive alternatives lack adequate corrosion resistance and exhibit poor fine-wire ground electrode retention. Champion sought to benchmark product performance, relative to the competition, in these areas. The following spark plug part numbers were used for this evaluation.

**Champion**
REM38E
REM38S

**Tempest**
UREM38E
UREM38S

This evaluation included 96 hours of Salt Fog testing and mechanical pushout testing of the Iridium fine-wire ground electrodes.
Salt Fog Testing

- Testing was conducted per RTCA/DO-160G, 12/08/2010, Environmental Conditions and Test Procedures for Airborne Equipment, Section 14
- Testing was performed concurrently on both sets of samples by an independent third party lab – Element Materials Technology
- (4) REM38E and (4) UREM38E spark plugs were threaded into an aluminum block (simulated aircraft engine cylinder head installation) and torqued to 35 ft-lb
- A representative ignition harness termination was installed onto the terminal end of each spark plug

Test Sequence

<table>
<thead>
<tr>
<th>TEST PHASE</th>
<th>Chamber Temp (°F)</th>
<th>Chamber Humidity (%RH)</th>
<th>(ph)</th>
<th>Total Duration (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Wet Cycle</td>
<td>94</td>
<td>100%</td>
<td>6.6</td>
<td>24</td>
</tr>
<tr>
<td>1st Dry Cycle</td>
<td>77</td>
<td>40%</td>
<td>NA</td>
<td>48</td>
</tr>
<tr>
<td>2nd Wet Cycle</td>
<td>95</td>
<td>100%</td>
<td>6.9</td>
<td>72</td>
</tr>
<tr>
<td>2nd Dry Cycle</td>
<td>77</td>
<td>40%</td>
<td>NA</td>
<td>96</td>
</tr>
</tbody>
</table>

Performance Summary

- Following the 1st 24 hour Wet Cycle, the competitive product exhibited considerable corrosion (See Figure 1)
- The competitive product continued to deteriorate, exhibiting excessive corrosion during the 2nd Wet Cycle (See Figure 2)
- At the end of the 96 hours of testing, Champion samples experienced only minor corrosion (See Figures 2 and 3)

Product Claim

Champion’s combination of plating and high-temperature paint provides superior corrosion protection compared to plating alone
Figure 1: Post 1st Wet Cycle (In Test Chamber)

Figure 2: Post 2nd Wet Cycle (In Test Chamber)
Fine-Wire Ground Electrode Pushout Testing

- Testing was conducted by Champion Aerospace
- Testing was performed sequentially, alternating between sample types (Champion vs. Tempest)
- (3) REM38E and (3) UREM38E spark plug shells were used for this testing
- The firing end shell was removed from each spark plug such that it could be inserted into the test fixture

Test Sequence

- (3) REM38E and (3) UREM38E spark plug shells were used for this testing
- The firing end shell was removed from each spark plug such that it could be inserted into the test fixture (See Figure 4)
- An axial load was applied until the Iridium fine-wire ground electrode separated from the spark plug shell
- Testing was performed sequentially, alternating between sample types (Champion vs. Tempest)
Performance Summary

- The minimum pushout reading of the Champion samples was 2.37 times greater than the maximum pushout of the competitive samples.
- The Champion weld process for attaching the Iridium fine-wire ground electrode to the shell provides very consistent pushout readings (only 2.5 lb difference between samples).
• The competitive product had greater variability amongst the tested samples (8.3 lb or 3.3 times the variation of the Champion samples)

![Figure 5: Pushout Force Comparison Data](image)

**Product Claim**

The Champion weld joint is vastly superior in axial pushout strength – Champion fine-wire spark plugs can be re-gapped without risk of the ground electrode detaching