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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.

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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

TEST PHASE	Chamber Temp (°F)	Chamber Humidity (%RH)	(ph)	Total Duration (Hours)
1 st Wet Cycle	94	100%	6.6	24
1 st Dry Cycle	77	40%	NA	48
2 nd Wet Cycle	95	100%	6.9	72
2 nd Dry Cycle	77	40%	NA	96

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

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Figure 1: Post 1st Wet Cycle (In Test Chamber)

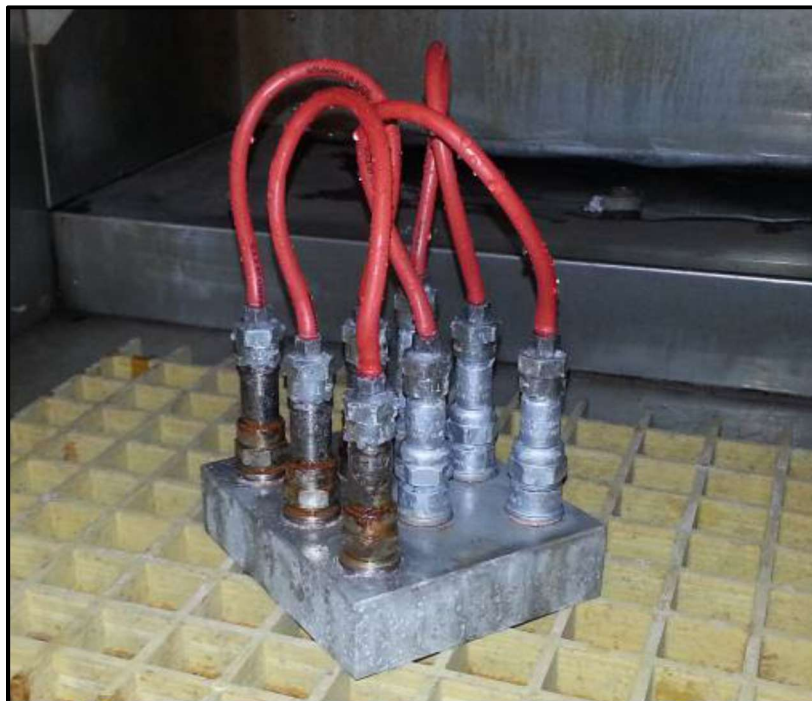


Figure 2: Post 2nd Wet Cycle (In Test Chamber)

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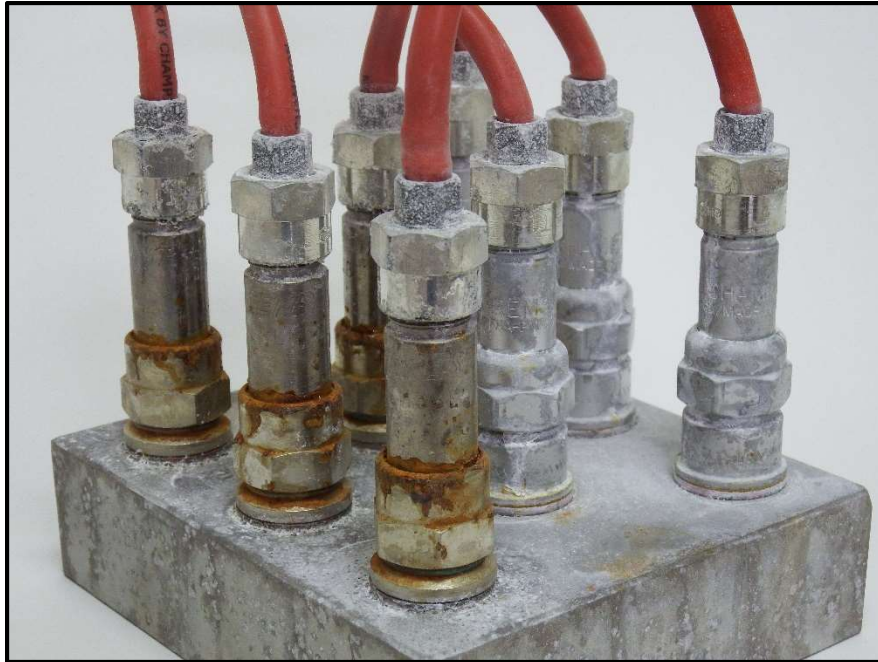


Figure 3: Post Test Completion

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)

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Figure 4: Pushout Test Setup

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_f difference between samples)

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- The competitive product had greater variability amongst the tested samples (8.3 lb_f or 3.3 times the variation of the Champion samples)

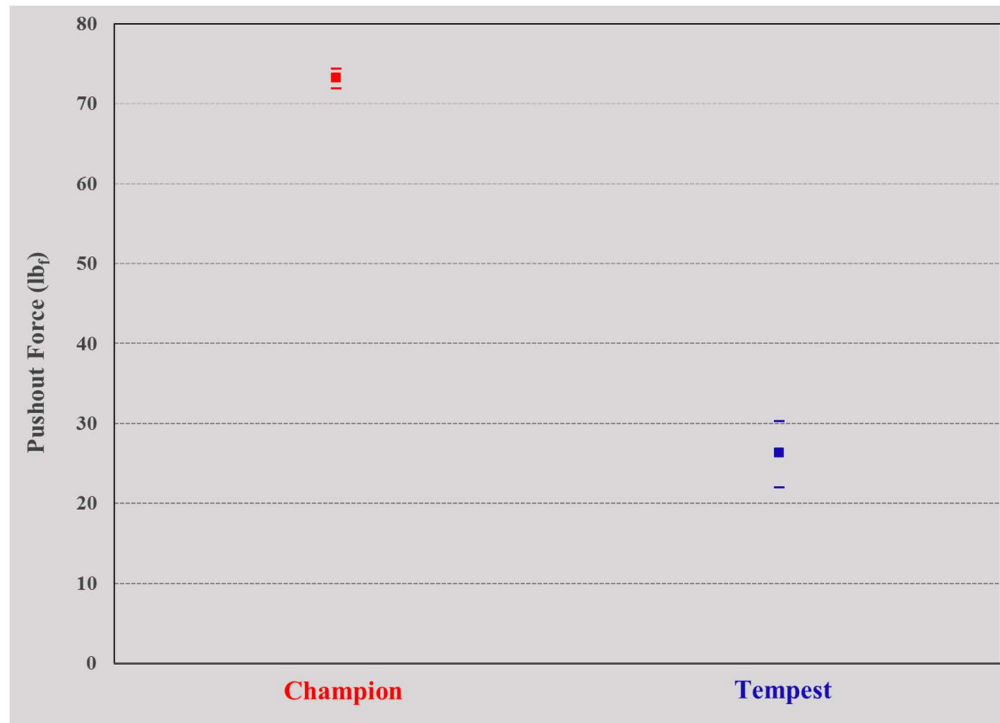


Figure 5: Pushout Force Comparison Data

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

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