

Packaging Materials and Protection Against Corrosion at NOOK INDUSTRIES

In Conjunction with the:

American Competitiveness Institute



American Competitiveness Institute

The EMPF under a cooperative agreement with the Navy's Office of Naval Research (ONR) MANTECH program.

Salt Spray/Humidity Testing

American Competitiveness Institute was selected because it has a Harshaw salt spray/humidity cabinet, with a capacity of one cubic meter. The types of materials commonly tested in these cabinets include metals, plated metals, plastics, coated panels, electronic, automotive and aircraft components as well as adhesives. This capability allows for operational testing of components (either electrical or materials) in aggressive environments.

Cabinet of this type are routinely used for salt spray and humidity testing at temperatures of 95 degrees F. The salt spray testing is conducted with certified solution conforming to ASTM B117.

Besides meeting the requirements of ASTM B117, they have installed flow meters on the air supply to provide extra assurance as to the quality of the environment in the cabinets.

Problem:

- Current packaging methods provide incomplete protection against atmospheric corrosion
- Evidenced by visible Corrosion (rust) after shipping and prolonged storage
- Rejects in surface finishes

Scope of Testing

- Simulate advanced corrosion atmosphere
- Expose packaged samples to aging
- Evaluate effectiveness of various packaging materials to keep shaft samples free from rust, tarnish and corrosion

Corrosion Test Chamber



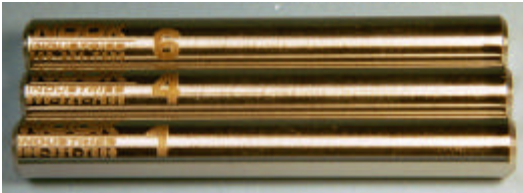
Packaging Materials

- Aluminized Polyester
- VCI (volatile corrosion inhibitors) Suffused polyethylene sleeving
- Anti-Static Polyethylene (Pink Poly)
- Static Intercept (reactive polymer)

Test Details

- Salt spray testing was conducted by independent test lab with certified protocol conforming to ASTM B117.
- Packaging was exposed in test chamber for a duration of 672 hours (4 weeks)
- Designed to simulate international shipping by ocean liner (containerized freight)

Samples



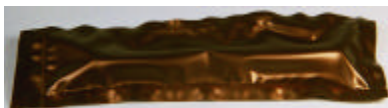
- All bars were received machined to equal lengths and part marked by NOOK
- Pristine samples were then washed and dried in IPA
- Proper lab method was implemented for handling

Packaging and sealing (typical)



- Bags were constructed of sleeved packaging materials by cutting and heat sealing
- Airtight packaging was the objective
- Actual seal was manually inspected to ensure that no leaky packages were tested

Packaged Samples



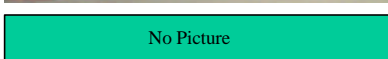
Static Intercept



VCI



Pink-Poly



No Picture

Aluminized Polyester

Results After Testing (VCI's)



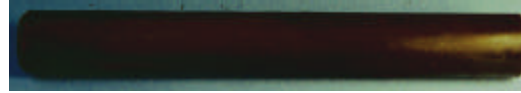
- Part badly rusted and corroded on all surfaces
- Etched part marking is illegible
- Due to transparency of package tester noticed visible corrosion through the packaging at regular intervals
- Corrosion was evident after day one of test
- Initial corrosion had occurred in first shift (between 8 and 12 hours)

Results After Testing Anti-static (Pink-Poly)



- Uniform discoloration (oxide and tarnish)
- Packaging was permeated by moisture
- Etched marking is now illegible

Results After Testing Aluminized Polyester



- Sample blackened due to aluminum oxide
- Discoloration is uniform and complete
- Part Mark is obscured

Results after testing (Static Intercept)



- No Visible Rust or corrosion
- Pristine condition maintained