

Does Aging Degrade Performance of the Pull Out Switch Contact Assembly?

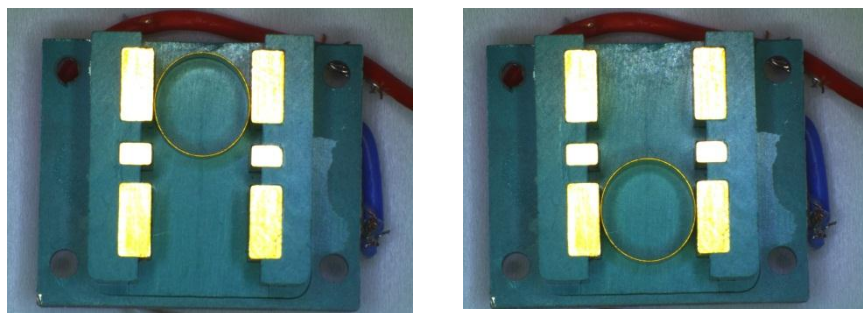
Using Contact Resistance Measurements to Determine Aging Effects on Pull Out Switch Assembly Contacts

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Abstract

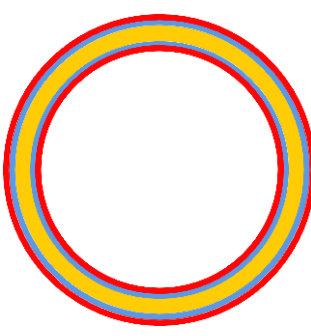
The pull out switch assembly is responsible for firing all the electronics in a bomb as it is released for deployment. The movement of the “wedding band” contact from position 1 to position 2, as seen in the diagram below, initiates all the electronics. As these switches age corrosion at plating defects results in increased contact resistance (see background section). To assess the degradation in contact resistance, measurements were taken across the contact surface. Some of the measurements exhibit extremely high resistance. To verify that the high values are the result of atmospheric corrosion, samples were abraded slightly with 4000 grit silicon carbide paper, resulting in a significant decrease in contact resistance. Additional experiments are needed to determine the fraction of the population affected by this process, and to assess the extent of degradation. These measurements must then be analyzed to determine the likely effect on performance.



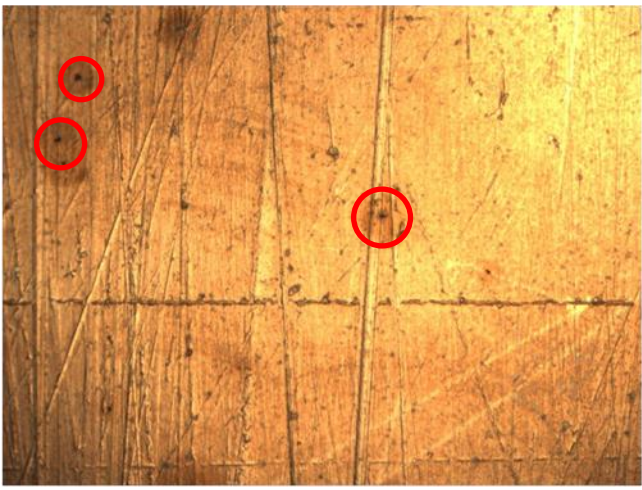
Reset

Actuated

Background

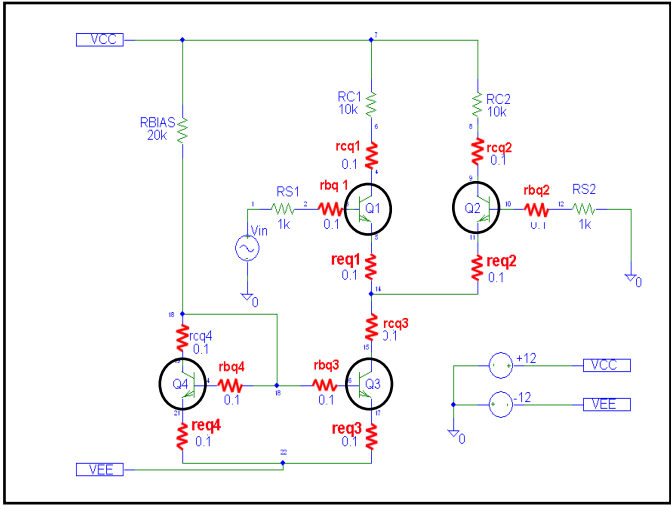


Copper rings, “wedding bands”, are plated with 50 micro in. of Ni, then 50-150 micro in. Au

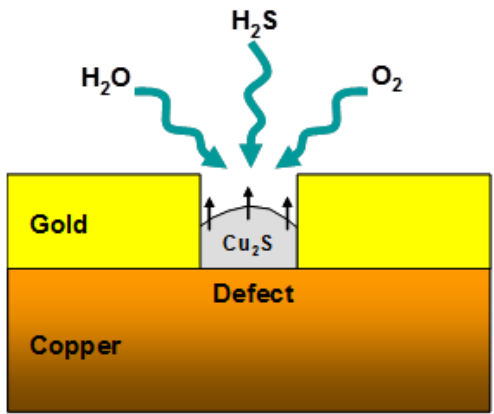


Visible corrosion spots on a Cu coupon showing presence of corrosion products (copper sulfides).

Corrosion products can be represented as parasitic resistances to assess reliability.

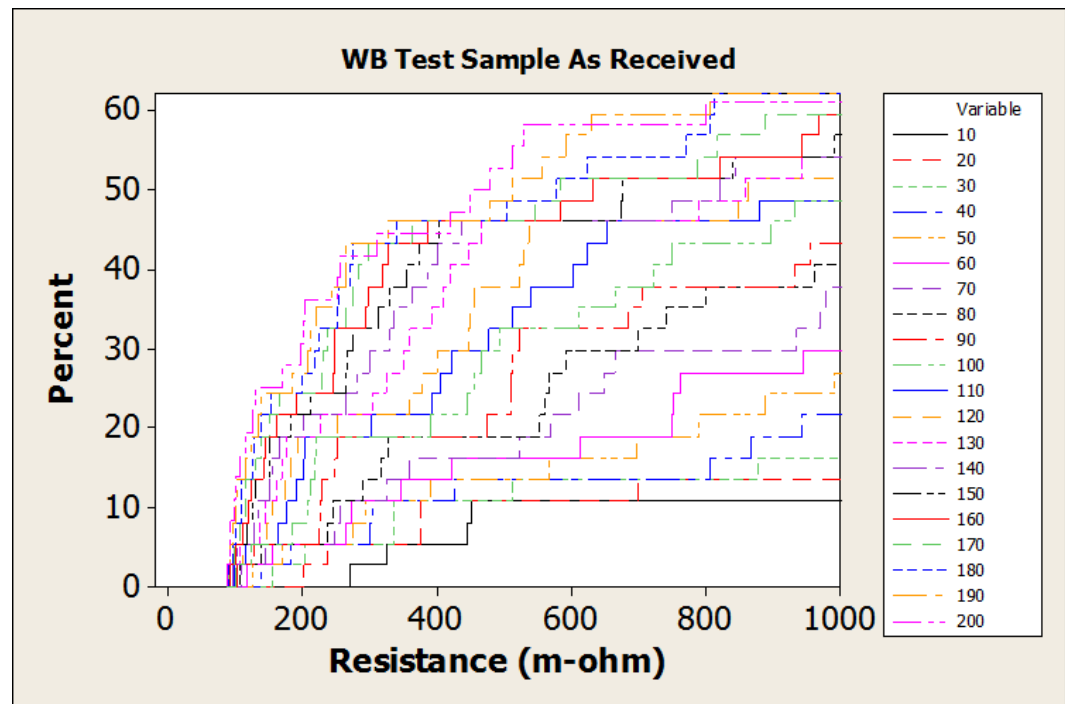
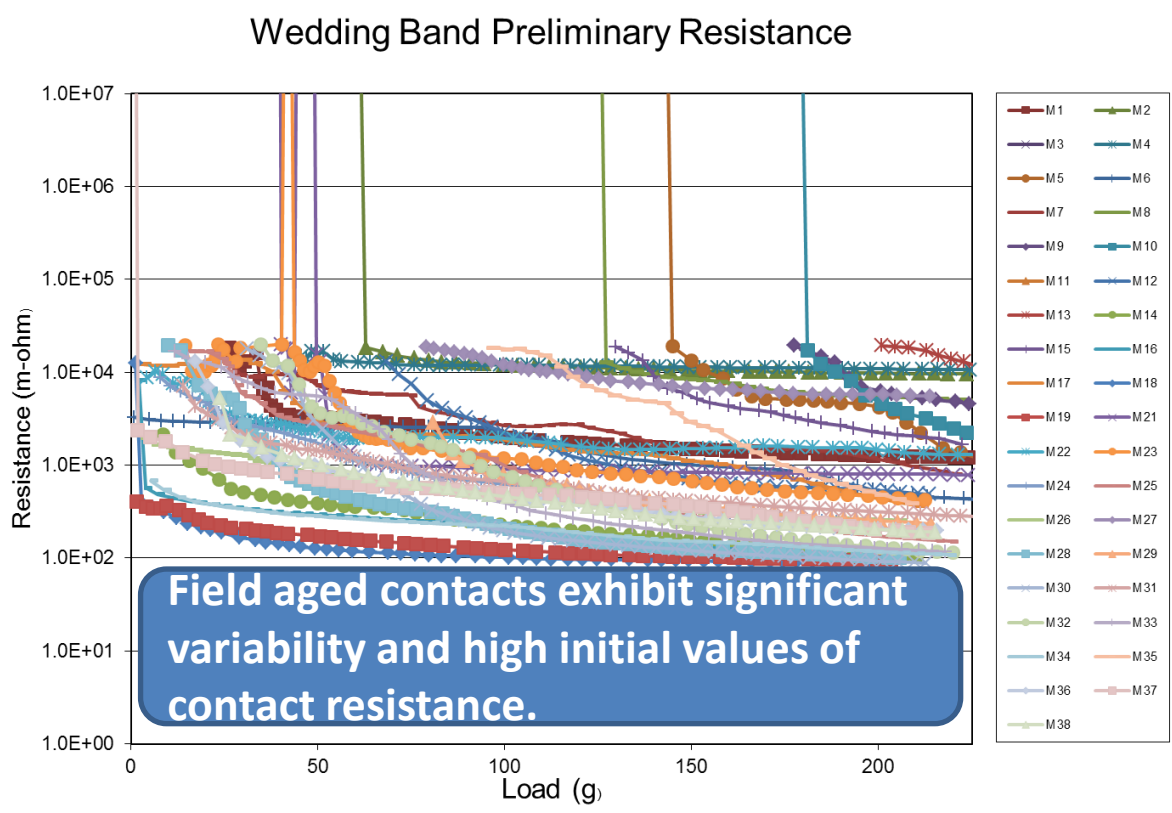


Defects in the plating layer are susceptible to atmospheric corrosion resulting in corrosion product build-up on the surface.

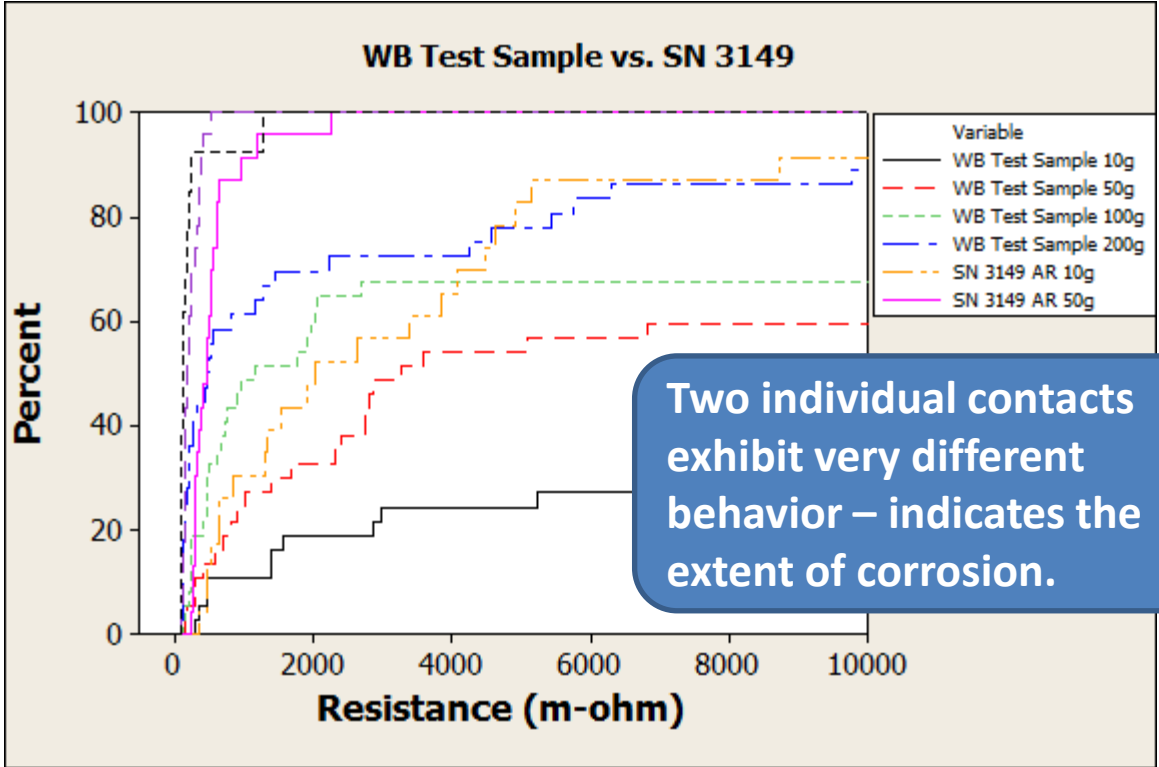
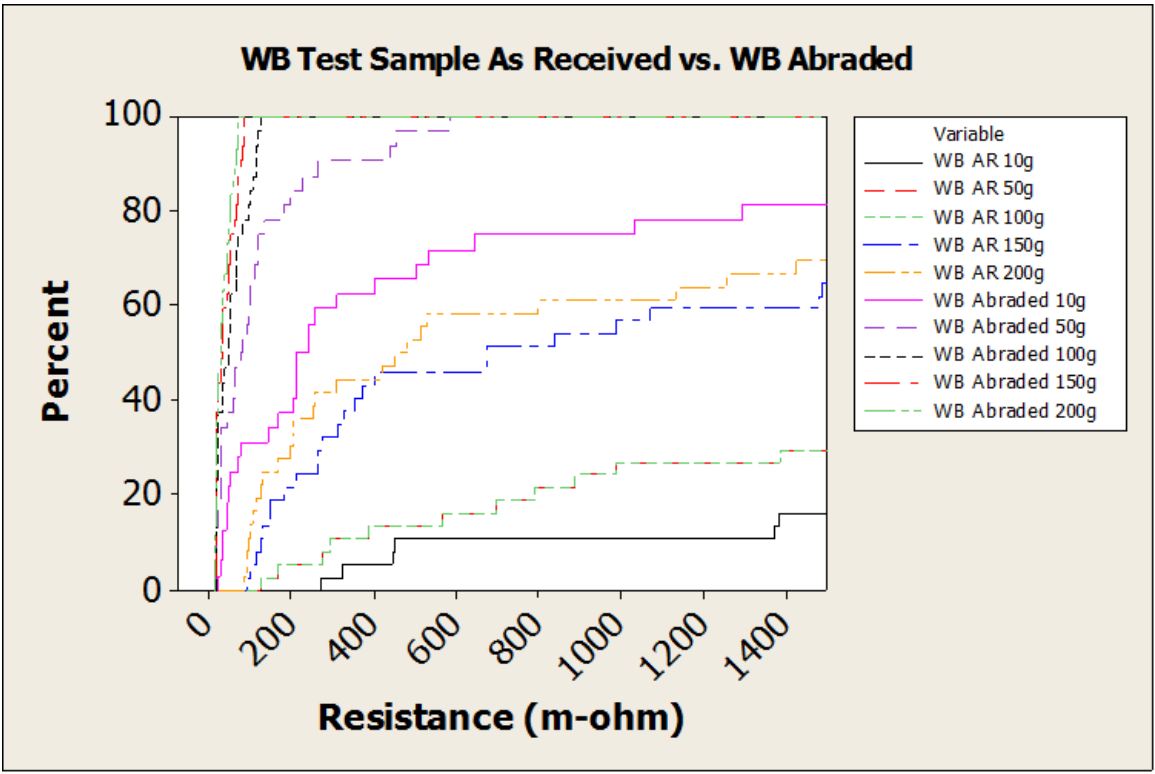
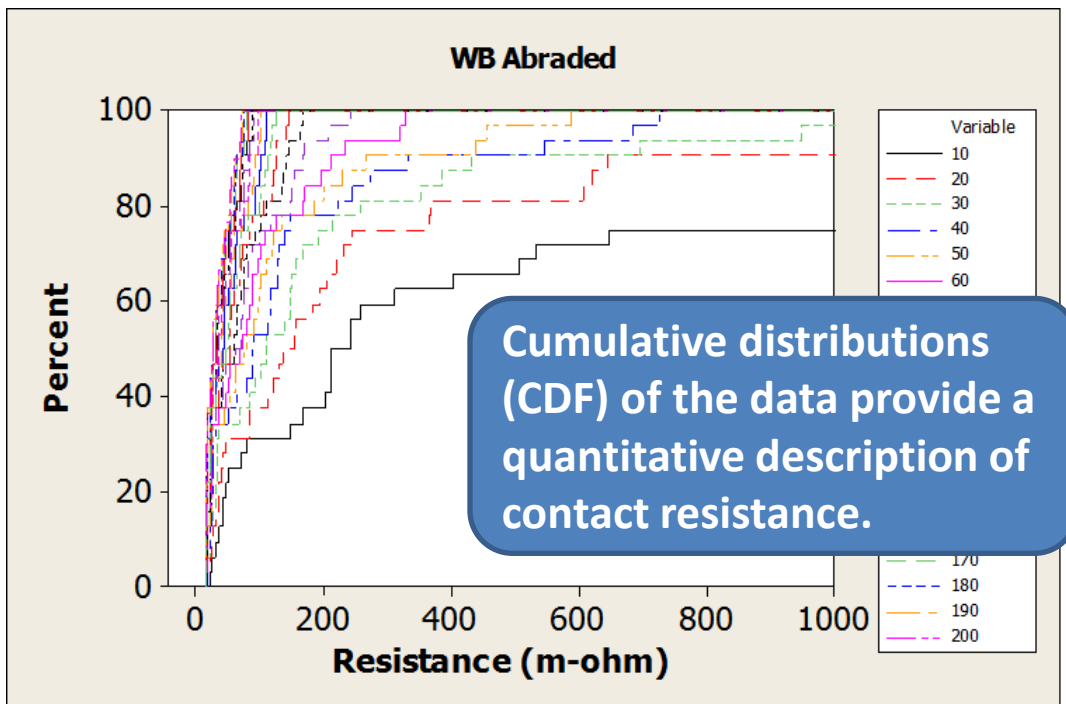
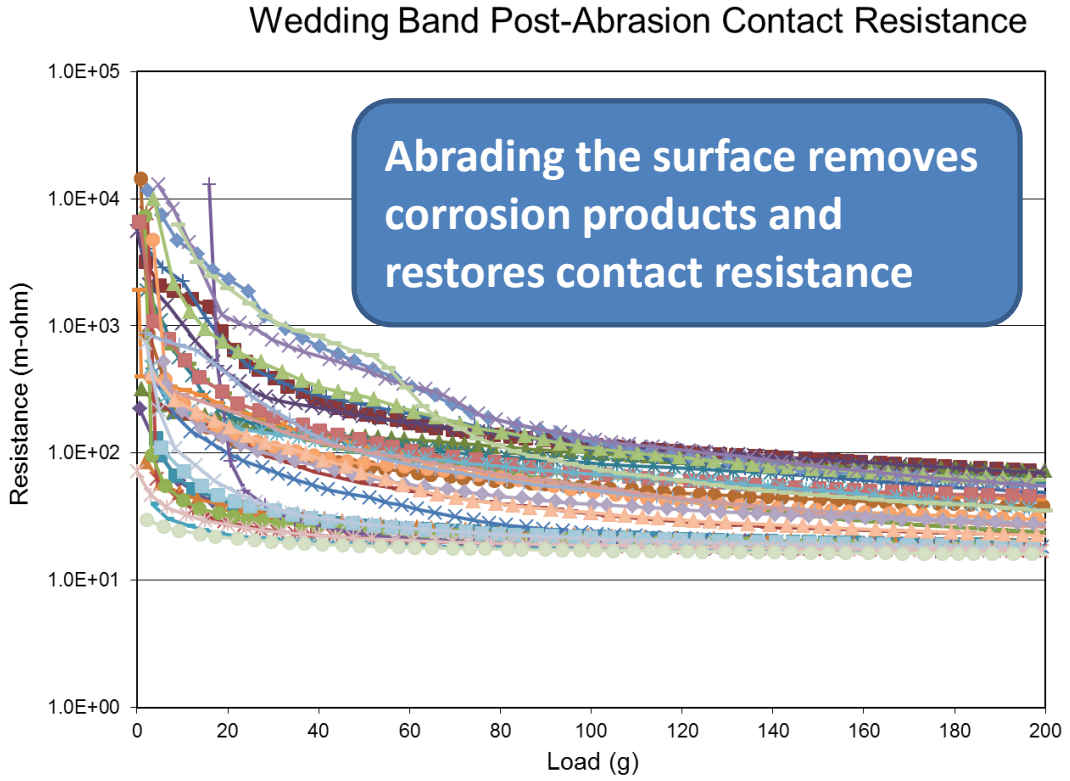


Results

As-Received



Abraded 2400 grit



Conclusions

- Contacts exhibit high resistance
 - Variable between contacts
 - Variable across surface for single contact
- Abrasion of the surface lowered the contact resistance
- Variability likely due to:
 - Storage environment
 - Defect density

Future Work

- The tests above are not sufficient to assess component reliability.
 - Determine inherent susceptibility of the contact to atmospheric corrosion
 - Determine current extent of degradation.
 - Assess potential for additional degradation in the future.
- Metallurgical analysis of contacts (Au, Ni thickness)
- Establish link to performance – at what value of resistance do we care?

To assure that the process would work, we made measurements on the “wedding band” contact of a test pull out switch assemble. After initial measurements, the ring was abraded with p1400 sand paper in an attempt to remove any corrosion buildup on the surface. As evidenced by the data, the resistance was quite a bit higher on the “wedding band” before abrasion. A similar comparison was completed with a “wedding band” that was in a weapon, SN 3149, and the WB test sample pre-abrasion. Nothing had been done to SN 3194 and the data after from tested as received was more comparable to the contact resistance of the abraded test sample, not the un-abraded test sample.

Methods

- Prepare sample by soldering lead to sample
- Place sample on measuring table and connect wires to correct location on volt meter
- Collect data, taking measurement with the probe every .25”
- Analyze data using Excel macros and Minitab

