



QA Technology Company, Inc.

# A p p l i c a t i o n s N o t e

## Common Failure Modes

### for Test Probes

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**I. High electrical resistance between the probe tip and the contact surface** is the most common failure mode for probes. This is caused by one or more of the following:

1. **Contamination buildup on the probe points** (in the valleys and on the tips) which forms an insulating layer and prevents reliable contact. This contamination is commonly composed of:
  - a) Flux residue from the contact surface.
  - b) Solder oxides and solder particulate from the contact surface.
  - c) Fibrous contamination from clothing, gloves or the recently sheared PCB material.
2. **Impenetrable oxides, flux residue or other coatings (i.e. conformal coatings) on the Unit Under Test itself.** In some cases, component leads have also picked up bits of plastic as they are slid into and removed from storage totes and plastic queuing racks.
3. **Damage to the probe tip plating** which allows formation of oxides on the plunger base material. This effect is compounded in fixtures that sit idle for long periods between uses, and further compounded in humid environments.
4. **Damaged probe points** which can no longer create contact pressure high enough to make reliable contact. Points are commonly damaged by improper installation, bottoming during use, or lateral motion between the tip and the Unit Under Test.

**II. Internal wear** is the next most common failure mode for probes. Internal wear is caused by:

1. **Wear of plating on internal contact surfaces**, which in turn is caused by:
  - a) Sideloaded of the plunger (contacting angled component leads with crowns, contacting misaligned open vias with chisels, etc.).
  - b) Lack of lubricant, caused by rinsing with solvent, or using unlubricated probes.
  - c) Normal wear of contact surfaces caused by extended cycling.
2. **Introduction of contamination into the internal contact surfaces.** For example, rinsing dirty plungers with solvent is an ideal (and unfortunately, common) method of bringing contamination onto the critical internal contact areas.
3. **Deflecting probes beyond their rated working stroke** (particularly in cases of extremely high force springs) will cause fatigue failure of the spring, which in turn creates a loss of contact force (both at the tip and internally). The probe will often continue to function after fatigue failure, but the broken coils will quickly damage the internal contact surfaces.

**III. Spring failure** is the least-common failure mode, and it falls into two categories:

1. **Fatigue failure**, probes are rated for a particular cycle life and working stroke. When these values are exceeded fatigue failure of the spring can occur. Generally, overstroking causes fatigue failure. Fatigue failure of the spring affects contact reliability in the following ways:
  - a) The plunger may no longer extend enough to make contact.
  - b) The spring force is reduced, which decreases contact pressure and contact reliability
  - c) The broken coils of the spring will damage the critical inside contact surfaces of the probe tube as the plunger is exercised.

**Temperature relaxation**, which occurs when music wire springs are exposed to temperatures greater than 250° F (120° C) for extended periods. (Request *Working Temperature Ranges* for more info). Temperature relaxation reduces spring force and therefore contact reliability.