

- What is the process change notification procedure and how is it communicated to customers? What validation/qualification data is provided?
 - Whenever a major change affects a product, all current customers using that product are formally notified of the change (usually via e-mail). PNC guidelines include but are not limited to a change in the conductive epoxy manufacturer, a change in the quartz, a change in the electrode dimensions, an IC change, a significant process change, or if the product is moved to another manufacturing line. Most major changes would require a re-qualification of the product and data would be available.
- What are the acceptable out-going quality levels?
 - Under 100DPM. For 2009 the failure rate was 79.68DPM
- What is your AQL sampling and improvement plan?
 - For electrical characteristics – 0.1 AQL
 - For the marking and lead inspection – 0.4 AQL
 - Any rejected lot is again sampled a second time. If that sample is rejected the whole lot is rejected and quarantined. Once the issue is corrected, the AQL is tightened for the next five lots without any rejects.
- What are your methods for identifying maverick lots and how do you disposition them?
 - Maverick lots are typically captured during the pre-seal electrical testing and inspecting. The prime indicator would be a significant yield loss. Once it is determined that a possible issue exists, that production run is quarantined for disposition. If the issue can be corrected the parts are sequestered in rework. If rework is not possible, the lot is scrapped.
- What are your ongoing reliability monitoring programs?
 - Sample sizes, product test conditions, pass/fail criteria and frequency.
 - All product families are subjected to ORT at six month intervals.
- What is your projected failure rate? How is it achieved?
 - Based on the three year trend, the expected failure rate for 2010 is <math><50.0\text{DPM}</math> and falls within the acceptable level of under 100DPM. The failure rate is calculated by dividing the number of customer returns and OQC sample failures by the total number of parts passing final electrical test and inspection. From Q1-07 to Q4-09 the failure rate was 43.73DPM.

- What is the demonstrated failure rates based on field returns? How is it achieved?
 - Based on confirmed field failures over the last three years, the failure rate for field returns is 8.95DPM. The calculations are the same as stated above.
- Can you describe your Failure Analysis and Corrective Action System?
 - Failed product is electrically tested for compliance. Once it is determined that a failing condition exists the device is usually de-lidded. Once de-lidded, a visual microscopic evaluation is conducted. For crystals, the evaluation consists of electrode inspection for particulates, the position of the base plate and final frequency adjust spot, the quartz alignment with the mounting hardware and the conductive mounting epoxy coverage. Should any issues arise that can be attributed to the failing condition, the factory is notified and an investigation is opened. Dependant upon the findings and if possible, attempts are made to correct the problem. The product is again tested to determine if the failing condition still exists. Failures can typically be attributed to physical non-conformities on the quartz blank. Once root cause is determined, factory personnel take appropriate action to correct the problem. For corrective action verification, the subsequent production runs are subjected to tightened AQL screening both at the factory and the company headquarters before being released to the customer. However, should a failure mode be considered to be atypical (first time, one of a kind), no actions are taken but the process is monitored to ensure the condition does not repeat. If, as part of a corrective action a process or step requires changing, the procedure and process flow are updated to reflect the change or improvement. Containment measures include, if a customer reports an unusual number of failures, it is requested that the lot be returned for screening and/or replacement. Also, any current inventory for that part number or similar part numbers at the company headquarters and in factory stores are tested to determine if the problem exists in those products or is limited to the one specific part number and/or lot.