

White Paper: ISO⁺

Using the Physics of Quality (PoQ) to Improve Supplier Performance

By the Staff of DfR Solutions

The Physics of Quality

Evolving from ISO9001 to ISO⁺

When most of us hear the acronym I-S-O, the one thing comes to mind is the ISO9001 Quality Management System (even though ISO is involved in all worldwide standardization activities; consider the amazing uniformity of credit card dimensions). Standardized in 1987, the release of ISO9001 was critical to the explosion in manufacturing outsourcing worldwide.

Before ISO9001, only a limited number of organizations had the size to develop, implement, and ENFORCE quality requirements throughout the supply chain. Examples included AT&T, Boeing, Ford-GM-Chrysler and Department of Defense. The rest of the electronic community was forced to accept the word of the supplier in regards to quality control. This condition was a significant roadblock in reducing manufacturing costs and increasing production flexibility.

Limitations of ISO9001 and Other Quality Standards

ISO9001 is designed to be applied to all industries that involve design, development, and manufacturing. This allows it to be recognized as a world-wide standard and prompts the development of an entire support infrastructure (consultants, auditors, registrars, training, handbooks, etc.).

This concept is part of a broader mind-think within the quality and reliability community that believes that there is a set of basic tools that can be applied across all fields. The financial motivation is obvious. 'Generic' quality and reliability professionals broaden their potential market / customers and increase their value without having any specific knowledge of a particular industry.

This 'strength' of ISO9001 is also a serious flaw. The result of this march towards uniformity has resulted in a downward spiral in capability, competence, and understanding. The evidence is obvious for anyone involved in the assessment of suppliers within the electronics supply chain. When combined with a perverse reimbursement model, where the company being assessed pays the assessor, the value of ISO9001 becomes limited by the interest and buy-in of the executive teams and employees of the supplier and the customer.

These limitations can be easily demonstrated by a question and a case study

Question: When is the last time you heard of any company losing their ISO9001 certification?

Case Study: We went out to Taiwan to assess a printed circuit board (PCB) manufacturer for an industrial control OEM. At the start of the onsite assessment, our group divided into two teams, with one focusing on a 'quality-type' audit and one focusing on a 'technical-type' audit using its knowledge of the physics of quality (PoQ). At the end of the two days, the comparative findings and the response of the PCB manufacturer was fascinating.

Both teams found some issues. The quality team identified some minor shortcomings in the quality system, which the PCB manufacturer politely acknowledged. However, when the technical team presented its findings, the operations manager fell out of his chair. Not only did these findings correlate exactly with some of the intermittent issues the PCB manufacturer was struggling with, but it was a rare assessment that provided some value to his team. And this is when he revealed a stunning reality within the electronics supply chain.

This PCB manufacturer, who serves a broad range of industries, is audited to the ISO9001 standard over *100 times a year*. On certain days, the PCB manufacturer had up to three customer quality audit teams on the floor at the same time. These activities increasingly had a repetitive and predictable outcome, as PCB manufacturer's staff would escort "ISO9001 experts" with no knowledge of the PCB fabrication process through the plant, the experts read the English signs and calibration stickers, they find one to three minor issues, and then everyone goes to dinner.

The Physics of Quality (PoQ)

The best approach to ensuring quality within the supply chain is to understand the physics (and chemistry and material science and etc.) that drives the introduction of defects and marginal material into the manufacturing process. This physics of quality (PoQ) approach does not lend itself to open-ended quality experts, but requires specific knowledge and expertise of the process being investigated

The PoQ approach looks at the potential failure mechanisms, captures how the manufacturing process can introduce drivers for these failure mechanisms. The value of PoQ over the ISO9001 can be seen in the following example that occurred during a PCB audit

An OEM requested an assessment of two PCB manufacturers, 'Blue Sky, LLC' and 'Red Earth, Inc.' The purpose of this activity was to choose one as an additional provider of PCBs to the existing three providers. The ISO9001 audit identified a number of issues at 'Red Earth', which led the customer's quality team to recommend 'Blue Sky' as the superior supplier. However, further investigation of the ISO issues by DfR identified most of them as bookkeeping concerns and it was a tenuous connection to the risk of defect occurrence. Of greater concern to DfR was the lack of a deionized (DI) wash before solder mask at 'Blue Sky'. This step was not in 'Blue Sky' documented manufacturing process, so in the eyes of the customer's quality team it was not a non-conformance! But DfR was aware that the lack of this process can increase the risk of corrosion and electrochemical migration (ECM), two failure mechanisms that had directly caused failures in the customer's product over the past 24 months.

One of the best practitioners of PoQ is Toyota. The fundamental requirement of the Toyota approach is that it requires an understanding of the science to ensure success of a product or process. As a neutral third-party who conducts numerous root-cause analysis investigations for the automotive industry, we have seen how this focus has led to much more effective changes in materials and manufacturing process, compared to the 'how does it fall under ISO9001?' approach of other industries. The results of this approach can be clearly seen in Toyota's legacy as a leader in quality and reliability in the automotive marketplace and throughout the manufacturing world.

By leverage our team of subject matter experts to offer a PoQ approach in our supplier assessment and benchmarking activities, DfR offers more than ISO9001; **we offer ISO⁺**.

For more information on ISO+ and how it can help you improve the quality of product from your supply chain, please contact Craig Hillman at chillman@dfrsolutions.com.

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