Management: The AS9100 Approach

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Learn how to use quality management systems to comply with AS9100 traceability requirements.

Manufacturers supplying the aerospace industry face the decision of whether to become certified to AS9100, the international quality management system standard that builds on ISO 9001:2000 and adds requirements specific to the aircraft, space and defense industry. For those new to this standard, it basically combines and harmonizes AS9000, ISO 9001 and Europe's prEN9000-1 standards. In addition to providing a single standard for all suppliers, its stated benefits are greater focus on key customer requirements, improved product and process quality, reduced quality variation, increased efficiency, potential reduction of second-party audits, and precise traceability throughout the supply chain.

A cleanroom production line works on power conversion solutions for aircraft and spacecraft. *Source: VPT Inc.*

AS9100's core concept is the Plan-Do-Check-Act cycle that focuses the organization on its key processes, planning, reviewing, and continual improvement. From its inception, one of the tenets of AS9100 has been to mandate what a quality management system must achieve, but not how to achieve it, leaving this to the supplier. As a result, the way the requirements of the standard are met varies dramatically from supplier to supplier.

For example, some manufacturers who are ISO 9001 certified create their own

systems that meet AS9100 requirements. The AS9100 standard's flexibility allows these companies to fine-tune existing quality management systems and avoid investing the considerable time and money required to purchase and implement new enterprise-level software. Many companies have electronic files, and demonstrating compliance still requires the production of paper documents. Therefore, organizations must ensure that their quality manual is extremely comprehensive and well-written, and that their documentation is exceptionally thorough.

Companies may be able to modify their existing quality system, even if it was not originally designed for lot tracking from parts procurement through final build and shipping, by scrupulously maintaining the process. For example, when a part arrives, it would be entered into the system, which then issues a transaction number that begins the process of recording all subsequent information and becomes a new lot number. When the part gets kitted, a tracking number is assigned. Tracking continues as the component becomes part of larger and larger assemblies. The end result is a build package that includes every routing document created throughout the process. This package is used to generate the "as-built" list. Even though this process is only minimally automated, it provides the ability to find what lot tracking number was given to every part and thus trace it back to its supplier. It also offers the ability to produce any associated certificates, test reports and other supporting documentation at a moment's notice.

Going Above and Beyond the Standard

For manufacturers supplying hardware that will be used in space, the requirements for "hi-rel" (high-reliability) and space-qualification vastly exceed those of AS9100. Considering that repairs are generally impossible to equipment orbiting the Earth, component failure is not an option. For these companies, meeting the AS9100 standard is considerably less difficult – more like dotting i's and crossing
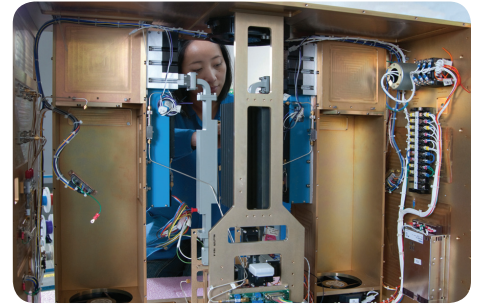
A highly trained assembler works on a Traveling Wave Tube (TWT) Amplifier, of which every component meets stringent traceability requirements. *Source: dB Control*

t's. Companies must maintain extraordinary levels of traceability, including the serial and lot numbers for every component in an assembly. Traceability must also be maintained from the materials level through plating and a broad array of other functions that are well beyond what is required in AS9100 as it applies to the aerospace community as a whole.

For example, a manufacturer required to meet the MIL-PRF-38534 QML for hybrid microcircuits must meet specifications that demand extraordinary traceability, require extensive accountability for manufacturing control, worst-case analysis, shock, vibration, thermal cycling, and many other factors. Serial numbers, part numbers and date codes must be present on every product. Traceability must be provided all the way back to original materials and components, such as the wafer number in the case of a semiconductor or the lot number for a packaged part. This requires strict controls on materials procurement, kitting and record retention during manufacturing – an expensive, labor-intensive process. The benefit to the customer is that if a problem develops even five years after the product was delivered, the manufacturer can trace the individual failed component, in which products it was used, as well as the customers who received them. Many terrestrial platforms also require this high level of detail and testing,

especially in military and mission-critical applications, but this is usually flowed down contractually regardless of what certifications a subcontractor may hold.

AS9100C Compliance Beckons

After being revised in 2008 (AS9100 Rev. B) all AS9100-certified companies must now be certified to a new revision (AS9100 Rev. C) by July 1, 2012. Although the new standard contains many clarifications to its predecessor, its most significant and broad-based enhancements are to risk mitigation. In fact, language specifically dedicated to risk management is present throughout.

Unmanned military aircraft like this MQ-9 Reaper require precise traceability throughout the supply chain. *Source: General Atomics Aeronautical Systems*

In general, AS9100C increases requirements for demonstrating compliance in more detail, from internal auditing to corrective action, while also mandating the ability to provide objective evidence of compliance, whether a document, chart or diagram, thus eliminating some gaps in the previous version. It is generally acknowledged among quality assurance managers that the changes within AS9100C were driven by the aerospace industry rather than the aircraft industry. Thus risk analysis, assessment and mitigation, processes that were only minimally covered in the previous revision, are now essential. In addition to taking a major step forward in risk mitigation, AS9100C expands sections of its predecessor to better define compliance requirements. In short, it calls for more detailed documentation and thus potentially greater traceability.

As the AS9100C standard requires significantly higher levels of effort to remain compliant, enterprise software and the automated accountability it provides can be a significant benefit. For example, rather than simple tooling documentation,

a procedure must be in place and records kept as to when a tool will be replaced and whether it in fact was replaced. Enterprise software can automate this and many other functions. In larger companies, this could become a necessity. Another benefit of enterprise software is that it can make companies more productive without adding hordes of new employees who can actually complicate, rather than streamline, the process.

Customers Influence Certification Decision

The Department of Defense, Federal Aviation Administration (FAA) and NASA endorse AS9100 certification, but do not demand it. As suppliers serving the defense and aerospace markets are not required to be certified, in practical terms, the decision is often determined by whether or not a major customer requires it. For example, if a manufacturer's customers are prime contractors such as Boeing, Rolls Royce, United Technologies or Raytheon, certification becomes a necessity. In addition, if a manufacturer is supplying a component to a contractor further up the food chain and the ultimate recipient of the end product requires certification to AS9100, the manufacturer may find itself in a situation that much resembles a full-blown certification audit, with the need to prove it is compliant with key aspects of the standard.

Regardless of AS9100 certification, manufacturers must aim for continual improvement of the quality management system. *Source: dB Control*

For many manufacturers, the customer with the most strenuous requirements dictates whether ISO 9000 alone or AS9100 (which incorporates ISO 9000) is necessary. At the very least, AS9100 is beneficial because it forces manufacturers to pay strict attention to quality. At its best, the standard provides a very high level of accountability, especially in the case of first article inspection – the standard's furthest reach into the domain of military specifications. **Q**

Tech Tips

As AS9100 certification is not a mandatory requirement of many prime contractors, every manufacturer should evaluate whether or not ISO 9001 certification alone will suffice.

The decision is often determined by whether or not a major customer requires it.

Subcontractors facing compliance challenges stand to benefit from a solid relationship with their customer's quality representatives.

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