Notice to Suppliers

Rolls-Royce

Updated Quality Requirements and Key Product Characteristics

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Business Unit: Engineering

NTS Number: 402
Issue: 1
Date: 10th February 2017

For the attention of the Quality Manager

Dear Sir or Madam,

Scope/Applicability:

All suppliers and partners who supply gas turbine products relating to Rolls-Royce.

Introduction:

Aviation, space, and defence organisations must produce products that are safe, reliable, and that are equal to or exceed the standards set by regulatory authorities and customers' requirements. Each organisation can have their own quality requirements making it challenging for suppliers to manage these differing requirements from multiple customers.

To address this challenge the leading aircraft engine manufacturers have formed a working group under SAE International called the G22 Aero Engine Supplier Quality (AESQ) Committee. The committee consists of aero engine manufacturers Rolls-Royce, Pratt & Whitney, General Electric, and Snecma, and is supported by suppliers including GKN, PCC and Honeywell. The committee's mission is to reduce costs by improving product quality and reducing the waste produced by the shared aerospace supply chain. The committee aims to consolidate current supplier quality management requirements. More information about the AESQ committee can be found here: http://aesq.saeitc.org/. The committee have now developed and published several standards. Rolls-Royce will now be mandating the following published or forthcoming standards:

- AS13000: Problem Solving Requirements for Suppliers
- AS13001: Supplier Self Release
- AS13002: Requirements for Developing and Qualifying Alternate Inspection Frequency Plans
- AS13003: Measurement Systems Analysis Requirements for the Aero Engine Supply Chain
- AS13004: Process Risk Mitigation – (Publication planned in 2017)
- AS13006: Process Control – (Publication planned in 2017)

More Information on each of these standards can be found in Appendix 1 of this NTS. AS13004 and AS13006 are in the final stages of development and will be mandated by Rolls-Royce once published.

Key Product Characteristics

It is important we create a link between our product designs and how we control the quality of our products across our supply chain. One of the ways we maintain this link is with part classifications and Key Product Characteristics (KPCs). Recently we have made improvements to our part classification process as set out in NTS361. We are now making improvements to the way we identify and control KPCs. In many of the AESQ standards KPCs are used to determine the acceptance criteria, dependent upon the importance of the design characteristics. Details about these new KPCs can be found in Appendix 2.

Action Required:

AESQ Standards

- Obtain copies of the AS13000, AS13002 and AS13003 standards and build the requirements into your own quality system.
- Brief your staff on these new requirements.
- Review the capability of your employees and ensure they are operating at the standard effectively. Improve their capability if required, seeking training where necessary.
- Review your manufacturing quality management submissions to us and check that you are satisfied the standard of work being undertaken meets the requirements of the AESQ standards.
- Fully transition to the new standards by July 2017.

KPCs

- The new KPC classifications shall be used if they are defined on the engineering definition to support sample or reduced inspection (SABRe sub-clause B4.2 & B4.3 / AS13002) and Measurement Systems Analysis (SABRe sub-clause B3.7 / AS13003 / NTS 377). The table in Appendix 3 gives a summary of how the new KPCs align to the AESQ standards and SABRe requirements
- Design/Make suppliers shall review and, if necessary, update their procedures for Key Product Characteristic classifications to ensure they are equivalent to the Rolls-Royce system.

NTS Category:

Engineering / Technical

Authorised by:

Dr Ian Riggs

Head of Quality Assurance, Audit & Zero Defects Program

Appendix 1 – AESQ Standards

AS13000: Problem Solving Requirements for Suppliers

As previously briefed in NTS368 & NTS389, AS13000 adopts the eight disciplines (8D) approach that is widely recognised across industry. It is supported globally through existing external training and consultancy organisations. SABRe already allows the use of 8D and a number of suppliers currently use this tool.

AS13001: Supplier Self Release

AS13001 was written to standardise the Delegated Product Release (Self-Release) training requirements that each Original Equipment Manufacturer requires in order to ship product to the delegating organisation, without additional oversight by a representative of that organisation. Prior to AS13001, a supplier would have to attend training from each delegating organisation in order to be approved to ship products on behalf of that organisation. With AS13001 a supplier can attend a single training class conducted by SAE international at an independent location.

AS13002: Requirements for Developing and Qualifying Alternate Inspection Frequency Plans

AS13002 defines requirements for moving from 100% inspection to a reduced or sample method. AS13002 recognises a number of possible control methods which are suited to a broad range of manufactured product:

- Statistical process control
- Software numerical Control
- Die/Mold and form tool control (including methods for complex structural castings)
- Process parameter control

AS13003: Measurement Systems Analysis Requirements for the Aero Engine Supply Chain

As previously briefed in NTS377, AS13003 adopts best-practice from other industries, including the Automotive Industry Action Group's (AIAG) Measurement Systems Analysis Manual, and describes the acceptance criteria that suppliers are expected to demonstrate.

AS13004: Process Risk Mitigation

This standard is currently in the final stages of drafting and has been created to establish a common practice for effective process risk identification, assessment, mitigation and prevention. It defines a methodology to mitigate risk using process flow diagrams, Process Failure Mode and Effects Analysis (PFMEA) and control plans. It is to be used by customers and producers throughout the life cycle of a product.

AS13006: Process Control

This standard is likely to be published in 2017. The use of statistical techniques and other proven methods will result in improved quality and manufacturing maturity.

Appendix 2 Key Product Characteristics

Previously Rolls-Royce's KPCs were: Conformance Control Features (CCF) and Key Characteristic Features (KCF). Additionally some parts of Rolls-Royce have used the A, B & C characteristics associated with the Feature Verification Risk Analysis (FVRA) process. We have now simplified our approach to KPCs by:

- Standardising KPCs across Rolls-Royce.
- Enhancing the link between the key safety and performance aspects of our products and the controls we expect to see in our supply chain.
- Replacing the A, B & C characteristics which have historically been defined by the Feature Verification Risk Analysis (FVRA) process.
- Standardising our approach with the wider industry to enable simple adoption of AESQ standards.

Our new classifications which apply for gas turbine products are as follows:

Classification	Drawing Symbol	What this means
Critical		Critical characteristics are the most important on the component and failure could directly lead to a hazardous failure.
Significant		Significant characteristics are important characteristics which through a chain of events could lead to a hazardous failure but the product is designed to prevent this occurring. Failure however could be very disruptive to our customers.
KCF (Briefed in NTS 361)	KCF or Flag Note	These directly affect the performance of our product (e.g., fuel efficiency), typically these require special controls such as variation management.
Unclassified	Not Applicable	Unclassified characteristics are those that do not meet the criteria for Critical, Significant, KCF or CCF.

Table 1 - Key Product Characteristic Classifications

- KCFs could appear on any part, even Unclassified parts. A characteristic designated as Critical or Significant which is important for safety, could also be important for performance and so additionally carry the KCF designation.
- KPCs to the new standard will be marked on the drawing at final issue.
- The new KPC classifications will be applied to new products. Application to existing products will be by exception only.
- A note will be present on engineering definitions assessed for Critical and Significant characteristics which gives a count of the characteristics present e.g.,:

  THIS DRAWING CONTAINS 2 CRITICAL CHARACTERISTICS, 5 SIGNIFICANT CHARACTERISTICS. THE REMAINDER ARE UNCLASSIFIED.

- If the engineering definition has been assessed for Critical and Significant characteristics but none are present then the note will indicate this e.g.,:

  THIS DRAWING CONTAINS 0 CRITICAL CHARACTERISTICS, 0 SIGNIFICANT CHARACTERISTICS. THE REMAINDER ARE UNCLASSIFIED.

- If the drawing note and KPC symbols are not present on the engineering definition then it may be a legacy definition created prior to the new KPC classifications. In this case the general requirements of SABRe apply and Rolls-Royce should be contacted in the usual manner before undertaking activity such as sample or reduced inspection.

Appendix 3 – Summary of Requirements for each KPC

<table>
<tr><th>Characteristic Classification</th><th>Mitigation & Process Control Strategy:

How should the characteristic be controlled?

(SABRe B3.4)</th><th>Measurement & Inspection

What are the test and inspection criteria requirements?

(SABRe B3.7)</th><th>Production Proving:
How the production process is confirmed as capable of producing the characteristic for ongoing production?</th><th>Ongoing Monitoring:
How should the characteristic be monitored during ongoing production?</th><th>Provision of data:
How should the results be provided to Rolls-Royce?</th></tr>
<tr><td>Critical ⊕</td><td rowspan="3">In accordance with AS13004 the PFMEA corrective action for high RPNs [1] is required to reduce or eliminate the chance of the potential failure occurring and the Control Plan is developed to account for these.</td><td>Sample inspection is not permitted.

MSA as required by AS13003, Critical Characteristics</td><td rowspan="2">Process capability calculations or other industry recognised statistical methods and suitable control charts are recommended.</td><td rowspan="2">In accordance with the specifications of the Control Plan (SABRe section B3.5).</td><td rowspan="2">Supply of data (SABRe B4.5) is not required unless specified by Rolls-Royce Technical Authority (e.g., in the event of a quality failure)</td></tr>
<tr><td>Significant ⊖</td><td>Inspection in accordance with AS13002, Major Characteristics

MSA as required by AS13003, Major Characteristics</td></tr>
<tr><td>KCF & CCF
(Note: CCFs will appear on legacy drawings only)</td><td colspan="3">As per the requirements of SABRe sections B4.5 & B3.5</td></tr>
<tr><td>Unclassified</td><td>Inspection in accordance with AS13002, Minor Characteristics

MSA as required by AS13003, Minor Characteristics</td><td colspan="2">Standard requirements of SABRe for characteristics not designated as Key Product Characteristics apply.</td><td>Supply of data (SABRe B4.5) is not required unless specified by Rolls-Royce Technical Authority (e.g., in the event of a quality failure)</td></tr>
</table>

[1] The term high RPNs refers to the result of the calculation (RPN number) and the individual components of the calculation (S, O and D) values arising from a Process FMEA (PFMEA). A high RPN number or high individual Severity, Occurrence or Detection value needs attention. The action(s) taken shall be appropriate to the effects of the potential failure mode.