

Variation Management of Key Characteristics (AS9103) Evaluation



Variation Management of Key Characteristics (AS9103) Evaluation Tool

This matrix tool is designed to facilitate the evaluation of supplier systems relative to the expectations of SAE AS9103, "Variation Management of Key Characteristics." AS9103 is imposed contractually through Boeing Quality Management System Addendum 1. Addendum 1 is typically called out whenever the supplier has key characteristics defined by Boeing specification document, drawing or dataset, or by SCD. Key characteristics may also be identified through supplier implementation of AS/EN/SJAC 9100 paragraph 7.3.3.e: "[Design and development outputs shall] **identify key characteristics, when applicable, in accordance with design or contract requirements.**" Capability is indicated for those supplier systems that meet minimum expectations as defined by the "shaded boxes" of the matrix. Each shaded box contains a reference to a requirement contained in AS9103. A score for the assessment is calculated only when it is part of a PSC evaluation (see below).

Boeing suppliers are expected to use this matrix periodically for self-assessment purposes. Companies desiring to develop an advanced AS9103 system may find this matrix to be a valuable guide, particularly when combined with Boeing documents *AQS Guidelines* and D1-9000-1, *AQS Tools*, available on the Boeing "Doing Business" website:

<http://www.boeing.com/companyoffices/doingbiz/supplier/index.html>

Preferred Supplier Certification

This same matrix is used for evaluations when the supplier is participating in the Boeing Preferred Supplier Certification program. Boeing personnel will review the supplier's system relative to the expectations of this tool, and score the matrix appropriately. The supplier's system must meet the minimum expectations (shaded boxes) for Bronze level qualification in the Preferred Supplier Certification program. Silver and Gold level expectations are substantially higher, with correspondingly higher minimum scores. Please note: PSC evaluations are the only instance in which scores are assigned to this matrix.

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Expectation	Column 1 (1 point)	Column 2 (2 points)	Column 3 (3 points)	Column 4 (4 points)	Column 5 (5 points)
1. Variation Management (General requirements) ---- The analysis of products and processes, implementation of improvement projects, or the existence of customer defined Key Characteristics may indicate that variation management activities are required. Variation control methods other than SPC may be used, but measurable evidence must demonstrate that the controls are effective. For Boeing defined Key Characteristics, the requirement to control and reduce variation may be waived in situations where it is impossible or prohibitively expensive to meet the control and capability requirements of AS9103 Section 5. These exceptions must be documented by the organization and approved by Boeing.					
<i>1 Documentation of KC or process information</i>	Little or no documentation on identified Key Characteristics.	Documentation exists for all identified Key Characteristics, including mfg. process elements that influence variation in KCs as well as their control techniques and measurement methods. Ref. AS9103, 5.2	Variation management documentation exists for core manufacturing processes in addition to KCs.	Variation management documentation contains lessons learned.	Documentation and understanding of processes leads to further improvement.
<i>2 Need for variation reduction and KCs</i>	Organization has not considered the need for variation reduction.	When analysis indicates, KCs have been identified. Ref. AS9103,5.2c	Organization examines for part-family or process Key Characteristics.	Advanced analytical methods are used to identify Key Process Parameters.	Variation is managed through process control.
<i>3 KC management</i>	Little or no variation control/reduction activities.	Plan in place to manage identified key characteristics. Ref. AS9103 5.5	Key characteristic activities are given a high priority.	Key characteristics are periodically reviewed for suitability.	Advanced variability reduction tools are used to avoid variation in product and/or process development.
<i>4 Variation management activities</i>	Little or no variation management activity observed on Key Characteristics.	Variation management activities performed on identified KCs until control and capability established, unless agreed to by the customer. Ref. AS9103, 5.1, 5.3e & 5.6	Demonstrable improvement exists from part level variation management activities.	Part families and/or process variation management activities implemented.	Demonstrable improvement in part family and/or process variation management activities.
<i>5 Verification of control method and process monitoring</i>	Little or no measurable evidence of control.	Measurable evidence demonstrates that the selected variation control method is effective. Appropriate monitoring methodology implemented to ensure continued performance. Ref. AS9103, 5.1 & 5.4	Organization performs regular validation of control method effectiveness. Monitoring methodology drives improvement activities.	Monitoring methodology implemented that ensures process performance through control of process settings.	Comprehensive database of control techniques and methods is consistently used to establish effective and efficient process controls.
<i>6 Variation control methods</i>	Little or no standardized processes exist.	Variation control methods such as tooling, control of process settings, standard processes and mistake proofing may be used to ensure process stability and capability. Ref. AS9103, 5.4	Key Processes are standardized through the use of variation control methods.	Demonstrated improvement is evident from use of variation control methods. (e.g. Mistake proofing is used to ensure non-conforming product is not passed on.)	Process settings are well controlled to ensure consistent processes.

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2. Variation Control Methods ---- Statistical process control charts can be an effective means of controlling variation and obtaining process knowledge. This process knowledge will help establish mistake proof processes, develop up stream process controls, contribute to process and product redesign, and eventually alleviate the reliance on control charts. The requirements in this section are conditional on the selection of SPC as the variation control method.					
<i>1 Data collection and usage</i>	Control charts do not represent normal production output.	Measurements used for control charts represent the normal production output. Ref. AS9103, 5.3a	Summaries of control chart data are readily available to all employees.	Lessons learned from data being used on similar products/processes.	Control chart data is analyzed at a more detailed level (i.e. by shift, machine, etc).
<i>2 Control chart selection and usage</i>	Control Chart chosen is inappropriate for application.	Control Chart chosen is appropriate for application. Ref. AS9103, 5.3a	Control charts periodically reviewed for appropriateness.	Process shifts and trends are investigated (e.g. Western Electric rules)	Advanced methods of control are used (e.g. Target charts, Multivariate charts, EWMA).
<i>3 Calculation of control limits</i>	Errors in control limit calculation.	Control limits computed appropriately and reflect the current process. Ref. AS9103, 5.3a	Control limits 'frozen' with appropriate data and the data used in control limits is readily identifiable.	Control limits are reviewed periodically for needed changes.	Control Limits are recalculated for processes that exhibit statistically significant change.
<i>4 Control charting processes</i>	Little or no Control Chart usage.	When similar KCs from different products are combined on the same control chart, the characteristics shall have similar variability and be traceable to the specific part or product. Ref. AS9103, 5.3.c	Reduction of control chart frequency is evident as a result of Process Improvement.	Process control is used extensively in lieu of charts for each Key Characteristic.	Process control yields improvements in other, non-Key Characteristics.
<i>5 Process control and correction</i>	Out-of-control conditions are identified, but no action taken.	Out-of-control conditions identified, and investigated. Action is taken to remove or minimize the effect of these causes. Ref. AS9103, 5.1	Corrective action consistently addresses the root cause of the out of control condition.	Processes are stable and predictable.	Processes are designed to minimize or eliminate out-of-control conditions.
<i>6 Identification of variation sources</i>	Potential sources of variation are not consistently identified for incapable Key Characteristics.	Sources of variation are identified and controlled for incapable Key Characteristics. Ref. AS9103, 5.1 & 5.2	Sources of variation are identified and controlled for all (including capable) Key Characteristics.	Advanced Statistical Techniques are sometimes used to identify and correlate sources of variation with Key Characteristics.	Advanced Statistical Techniques are routinely used to identify and correlate sources of variation with Key Characteristics.

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3. Variation Management Activities ---- The identification, control, and optimization of key processes impacts the performance measures. When a process is not in control, the out-of-control condition must be investigated and corrective action shall be taken. A process is considered capable if its Cpk exceeds 1.33. If the process is not capable, the organization will identify and control sources of variation and take corrective action. (D1-9000-1 contains information that is useful in diagnosing sources of variation as well as providing guidance in techniques to reduce measurement error and process variation.)					
<i>1 Establishing capability measures</i>	Data collected but capability measure not established.	Process capability shall be established for Key Characteristics Ref. AS9103, 5.1 & 5.3.a	Reporting of process capability to management on a regular basis.	Capability measures calculated for Process Key Characteristics.	Management uses process capability database for process improvement efforts.
<i>2 Process capability and improvement</i>	Little or no action plans for incapable processes.	For Cpk (or equivalent measures) that are less than 1.33, corrective action plans are in place for improvement. Ref. AS9103, 5.1 & 5.3b	Action plans for capability improvement show progress over time.	Majority of processes have Cpk (or equivalent measures) of >1.33.	Capability values show stability over time.
<i>3 Reduced frequency of inspection</i>	Reduced frequency of inspection is not related to process capability.	Process capability or equivalent fallout rate are calculated whenever capability is used to reduce inspection frequency. Ref. AS9103 5.3d	Process capability and inspection frequencies are reported to management on a regular basis.	Opportunities to reduce inspection frequency based on capability are occasionally reviewed.	Opportunities to reduce inspection frequency based on capability are reviewed on a frequent, scheduled basis.
<i>4 Ensure customer KC requirements are met</i>	Little or no activity related to ensuring customer KC requirements are met	KC requirements are flowed to subcontractors, and all KCs are managed to conform to customer requirements. Ref. AS9103 4.0	Log of KCs flowed to subcontractors exists; status of all KCs in house and at subcontractors is recorded.	KC status, both in-house and at subcontractors, is reported to management on a regular basis.	There is an active program to work with subcontractors to improve the control and capability of their KCs.
<i>5 Use of capability data</i>	Inconsistent records of capability trends.	Capability trends are consistently recorded.	Lesson learned database is shared so as to improve similar parts / processes.	Process capability information is used in choosing the appropriate manufacturing process/equipment (i.e. shop loading, capacity loading, etc.).	Savings from improvements are calculated and reviewed. Plans link capability improvement to cost-benefit ratio.
<i>6 Gage variation studies</i>	Little or no gage variation studies are performed.	Gage variation studies are performed for incapable Key Characteristics when analysis indicates, and corrective action is taken as needed.	Gage variation studies are routinely performed for all (including capable) Key Characteristics, and corrective action is taken as needed.	Gage variation studies are routinely performed prior to any data collection.	Gage variation studies are performed as a regular part of the calibration/certification process.