PROCESS CONTROL METHODS

WHAT IS RM13006?

Tools & Tips Webinar sponsored by the AESQ Process Control Methods SMIG

December 6, 2022

AESQ – Aerospace Engine Supplier Quality Strategy Group

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PROCESS CONTROL METHODS

Agenda – 60 minutes

Overview
Who is the PCM Subject Matter Interest Group
Why this webinar? Where can we find help?
PCM Community of Practice – Linked In
A Walk Through RM13006
Case Studies
Interaction with other AESQ reference manuals
Red Flags to look out for
Q&A
Summary and Close

Pete Teti – Pratt & Whitney
Pete Teti – Pratt & Whitney
Pete Teti – Pratt & Whitney
Nicklas Godebu – GKN Aerospace
Nicklas Godebu – GKN Aerospace
Nicklas Godebu – GKN Aerospace
Team
Pete Teti – Pratt & Whitney

AESQ – Aerospace Engine Supplier Quality Strategy Group
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PROCESS CONTROL METHODS
OVERVIEW

KEY POINTS
- Who is the AESQ Subject Matter Interest Group
- A walk through RM13006
- What is the PCM Community of Practice
- Summary of the Nine Process Control Methods
WEBINAR OVERVIEW

We are recording today’s webinar and will distribute the video link following the close of the webinar. It will also be posted on the AESQ website for free viewing.

We will take questions during today’s webinar using the Chat feature.

Please remain on Mute during the presentation to prevent background noise. We will also be muting all lines at the start of the session.
Why this webinar?

Communicate the purpose of the RM13006 document and its importance to AS13100

Describe how RM13006 interacts with other AS13100 reference manuals

Promote the available free documents and tools that can be used by any AESQ supplier

Answer questions suppliers may have about process control methods
PROCESS CONTROL METHODS PER RM13006

Purpose of this reference manual

RM13006 provides the user with an array of practical approaches to process control used to ensure consistent product quality.

The purpose of this reference manual is to raise the overall capability of the aerospace engine supply chain, standardize the process control requirements across AESQ suppliers, and build on the requirements for PFMEA and Control Plans (ref. RM13004).

RM13006 supports AS9145 - Requirements for Advanced Product Quality Planning and Production Part Approval Process, and AS9103 - Variation Management of Key Characteristics, supported by detailed guidance and case studies.

This reference manual was developed by a dedicated team from AESQ member companies with expert knowledge and experience in the areas of process control, process improvement, quality systems, and supplier engagement.
The title of RM13004 is "Defect Prevention Quality Tools to Support APQP & PPAP", but that's rather long. Could be shortened to "Defect Prevention Quality Tools"
INTERFACE WITH PFMEA AND CONTROL PLANS

Process Control Methods follows the risk identification and mitigation activities described in RM13004, PFMEA and Control Plans.
The purpose of the PCM Subject Matter Interest Group is to promote the effective deployment of the process control methods across the AESQ Supply Chain.

The Group is made up of Subject Matter Experts from the AESQ Member Companies.

The Group is accountable for the AS13100 related Requirements and associated Reference Manual content, ensuring that it is up to date and reflects current knowledge and best practice.

It shall promote the effective deployment of the Reference Manual using Communities of Practice (CoP). The CoP is open to anyone with an interest in process control from the AESQ Member Companies and the wider AESQ supply chain.

Activities may include webinars, best practice sharing, development of shared training materials, conferences and published papers.

https://aesq.sae-itc.com/interest-groups

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**FUTURE WEBINAR TOPICS**

<table>
<thead>
<tr>
<th>NO.</th>
<th>FUTURE WEBINAR TOPICS</th>
<th>TARGET DATE/TIME</th>
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<tbody>
<tr>
<td>1</td>
<td>Process Control Methods - What is RM13006? Interaction with other AESQ Reference Manuals</td>
<td>12/6/2022 (11 AM US Eastern)</td>
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<td>2</td>
<td>What makes a good Process Capability Study?</td>
<td>1/26/2023 (11 AM U.S. Eastern)</td>
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<td>3</td>
<td>Process Capability Study for True Position (handling MMC)</td>
<td>2/8/2023 (11 AM U.S. Eastern)</td>
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<td>4</td>
<td>The use of non-statistically based process control methods</td>
<td>2/15/2023 (11 AM U.S. Eastern)</td>
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<td>5</td>
<td>The Power of Precontrol</td>
<td>3/8/2023 (11 AM U.S. Eastern)</td>
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<td>6</td>
<td>The One-Hour Process Control Assessment</td>
<td>4/11/2023 (11 AM U.S. Eastern)</td>
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<td>7</td>
<td>Why is statistical control a prerequisite for process capability?</td>
<td>Target 2nd Qtr (May)</td>
</tr>
<tr>
<td>8</td>
<td>Dealing with Non-Normal Data</td>
<td>Target 2nd Qtr (June)</td>
</tr>
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<td>9</td>
<td>Conducting capability studies for one-sided geometric tolerances</td>
<td>Target 3rd Qtr (July)</td>
</tr>
</tbody>
</table>
Is it mandatory to be a SME to attend?

This was original wording from the AESQ SMIG website but I changed it.
SUBJECT MATTER INTEREST GROUPS

Who is the Process Control Methods SMIG Team?

Pete Teti
PWA
(Leader)

Andrew Stout
PWC
(Co-Lead)

Nicklas Godebu
GKN

Paul Gorg
PCC

Rudi Braunieder
MTU

Karen Scavotto
PWA

Steve Hampton
PCC

Douglas Dush
Honeywell

Grant Braun
PCC

Geoffrey Carpentier
Safran

Marnie Ham
GE

Shailesh Shinde
RR

Curator for RM13006

Experts who you may address process control related question to

Provider of process control related webinars. See Slide 23 for webinar schedule which is subject to change based on your feedback

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SAP0  It's on the previous page.  
Also wording could be improved.  
Stout, Andrew             PWC, 2022-12-01T14:44:29.606

TPEP0 0  Yikes!! That was supposed to be deleted!! Thanks! I deleted the paragraph.  
Teti, Peter E                  , 2022-12-01T17:40:30.356

TPEP0 1  I actually reworded it and referenced Slide 23 that contains the schedule.  
Teti, Peter E                  , 2022-12-01T17:42:12.781
**PROCESS CONTROL METHODS COP**

*Where to get help*

AESQ Supplementary Materials webpage for a copy of RM13000 and supporting templates

[https://aesq.sae-itic.com/supplemental-material](https://aesq.sae-itic.com/supplemental-material)

Subject Matter Interest Group – meets monthly – supports continuous improvement of RM13006 and supporting templates & tools

AESQ Process Control Methods Community of Practice (COP) on LinkedIn

Current membership is 200 – let’s get some more!!

[https://www.linkedin.com/groups/12647920/](https://www.linkedin.com/groups/12647920/)
A WALK THROUGH RM13006

KEY POINTS
- Table of Contents
- Case studies
- Training syllabus
- Red Flags

NICKLAS GODEBU
INDUSTRIAL ENGINEER
GKN AEROSPACE ENGINE SYSTEMS
TABLE OF CONTENTS

Highlights

The importance of process control
Key principles of process control
Applying process control
The Nine Recognized Process Control Methods
Process Capability Indexes
Guidance for Non-Normal Data
Common Sources of Variation
Case Studies
Appendixes
- Training Syllabus
RECOGNIZED PROCESS CONTROL METHODS

Purpose of this reference manual

Process Control has three main facets that are: Product Capability, Process Control Methods and Foundational Activities. High performance is not achievable without all three elements being in good order.
EXAMPLES AND CASE STUDIES
Real-life examples are used to facilitate understanding and provide guidance in areas that are typically found in a textbook.

## Case Study Example - PreControl

An aerospace manufacturer produces a Fuel Air Bracket (see Figure 2.4-3) with a key feature having an engineering tolerance of 0.386 ± 0.005 inches. The central 50% of the total tolerance (+/- 0.0025 inches) defines the green zone.

![Fuel Air Bracket Example](image)

### Guidance Table Example

<table>
<thead>
<tr>
<th>Scenario</th>
<th>When to use</th>
<th>Control type (which chart)</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>A process that observes discrete values, such as pass/fail, go/no-go, present/absent, or conforming/non-conforming.</td>
<td>Appropriate when it is important to control the number or % of defects over a given time period, lot to lot, or unit to unit such as measuring improvement over time, when go/no-go gauges are employed or when visual inspections are used.</td>
<td>P-chart</td>
<td>Plot the percent defective of a critical supplier; plot On Time Delivery performance of a critical supplier.</td>
</tr>
</tbody>
</table>

### Specific Control Method Example

- **Preliminary Control Example**
  - **UPPER SPECIFICATION LIMIT**
  - **LOWER SPECIFICATION LIMIT**
  - **UPPER PC LIMIT**
  - **LOWER PC LIMIT**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>USL</th>
<th>LSL</th>
<th>Nominal</th>
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<td>.245</td>
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<td>.980</td>
<td>.970</td>
<td>.975</td>
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</tbody>
</table>

### Case Study Example - Target-to-Nominal Chart

Control of multiple part numbers on one chart.

Similar configuration, machine, and tolerances.

Process Control vs Part Control.
<table>
<thead>
<tr>
<th>SAP0</th>
<th>“from” should be removed.</th>
</tr>
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<tbody>
<tr>
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<th>Great catch! Revised as suggested.</th>
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<td>Teti, Peter E</td>
<td>, 2022-12-01T17:43:31.725</td>
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</table>
**RM13006 TRAINING SYLLABUS**

Details the minimum content that a Process Control Methods training syllabus needs to contain to support continued competence in the application of this standard.

<table>
<thead>
<tr>
<th>THEME</th>
<th>OUTCOMES</th>
<th>MINIMUM CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>The importance of Process Control</td>
<td>Appreciation of customers’ needs and the benefits to the organization, industry and society</td>
<td>• Examples and discussion on process control failures</td>
</tr>
<tr>
<td></td>
<td>Learning Objective: Learner will be able to describe the importance of process control including how it benefits company, industry, and society.</td>
<td>• Reputational impact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Effect on the Aerospace industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Benefits of achieving design nominal (Taguchi’s Loss Function)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Understanding and importance of a closed loop control system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Effectiveness of in process control over end-of-line inspection</td>
</tr>
<tr>
<td>Process Control in Context of Quality Planning</td>
<td>Understanding of the linkages between the quality planning activities</td>
<td>• Linkage between PFMEA, Control Plans, and work instructions</td>
</tr>
<tr>
<td></td>
<td>Learning Objective: Learner will be able to explain the purpose of Control Plans, what they contain, and their use in developing work instructions.</td>
<td>• Purpose and content of a Control Plan</td>
</tr>
<tr>
<td></td>
<td>Learning Objective: Learner will be able to describe how Control Plans link to Process FMEA.</td>
<td></td>
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**RM13006 APPENDIX C FOCUS AREAS**

- The importance of Process Control
- Process Control in context of quality planning
- Selection of Process Control Methods
- Data Collection
- Process Capability Analysis
- Basic Root Cause Analysis and Process Improvement
- Application of Control Charts
- Error-Proofing

Partial syllabus shown

Refer to Appendix C for the full training syllabus
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<tr>
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<tr>
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<td>, 2022-12-01T17:44:07.347</td>
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The Reference Manual Interactions

Process Control Methods (RM13006) will interact with failure mode and cause identification (RM13004), which includes sources of human error (RM13010), and root cause investigations (RM13000)

- **RM13004** PFMEA & Control Plans
- **RM13006** Process Control Methods
- **RM13010** Human Factors
- **RM13000** Problem Solving Methods

**Identify failure modes and causes (risk identification & mitigation)**

**Identify and implement preventive and detection based controls**

**Look for sources of human error as part of root cause investigation**

Failure modes, causes and controls that were not initially anticipated are feedback to the PFMEA and Control Plan.

** Identify root causes and corrective actions when conducting an investigation for customer, supplier or internal escapes & defects**
Current RM title is "Defect Prevention Quality Tools to Support APQP & PPAP" - rather long, perhaps just the first part "Defect Prevention Quality Tools"

I was aware of the title but am trying to show the relationship of PCM following the use of PFMEA and Control Plans. I'll point out in the presentation what the actual title is.

I believe it's much broader than just "Identify failure modes and causes". How about "Identify high risk areas and mitigate" or something like that.

Want to link process control methods to failure modes and their causes as it follows in an actual PFMEA spreadsheet. Will keep as written.

Only to escapes?

Rewritten to be broader. Great catch!
WHAT QUESTIONS TO ASK WHEN ASSESSING A PROCESS CONTROL SYSTEM

Some things to look out for

- Process Flow Diagram with KC’s identified (where produced/inspected)
- PFMEA with KC’s accounted for
- Control Plan accounting for all KC’s and other high-risk areas
- Gage Capability Studies for gages used to measure KC’s
- Use of non-statistical methods such as error proofing devices for high-risk areas
- Use of Control Charts KC’s at point of manufacturing
- Is a process control subject matter expert (e.g., Six Sigma GB/BB or CQE)
- How an operator responds to an out-of-control condition
- Evidence of process control training
- Use of process control data by company’s engineering department

ASK THE KEY QUESTIONS

1. Have product risks and mitigation plans been identified?
2. Have KCs been identified to help address design risks?
3. Has a detailed process flow map been created?
4. Has a PFMEA been conducted by a cross-functional team and have high-risk items been addressed?
5. Has a control plan been initiated?
6. Have MSA studies been completed and shown to be acceptable?
7. Has an initial assessment of statistical control & capability been performed?
8. Have process improvements been identified, implemented and verified so KCs are in statistical control with capability ≥ 1.00?
9. Has process map, PFMEA and control plan been updated to reflect process improvements?
10. Have KCs demonstrated a sustained capability ≥ 1.33?
11. Has a self-audit plan been implemented to include process control (refer to checklist in Appendix A)?
Would be good to indicate where this comes from in the RM - is it Appendix A - PCM Assessment Checklist? Doesn't seem to be.

It is something I came up with. The questions are from our ProCert Interactive Tool. The audit checklist does reflect many of these items I believe.

Control should be removed as it's in SPC

I removed "SPC" instead as I want to emphasize the use of Control Charts.

i.e. should be e.g. as it's not limited to just those.

Changed it to e.g

"process control engineer" is not used in the RM. The term "engineer", at least in Canada, is controlled by professional engineering associations. How about "expert" as in subject matter expert.

Changed to "process control SME"

The term "discipline health" is not used in the RM.

Removed "as part of DH"

"Use of process control data by company’s engineering department" is not mentioned in the RM. Many build to print supplier won’t have an Engineering department.

In that case it would not be applicable to a BTP supplier. But for DRA suppliers it is an important item to ask about.

"product risks and mitigation plans" is under RM13004.

That's OK. There is an interaction between these two RM's.
“Have KCs been identified to help address design risks?” Is this covered in RM13006? No mentioned of "design risk"
Stout, Andrew  PWC, 2022-12-01T15:43:20.109

Process control is a subject wider than RM13006. We are showing interconnectivity.
Teti, Peter E 2022-12-01T17:56:43.465

Aren't points 3, 4 and 5 are more applicable to RM13004? Although there certainly is some overlap.
Stout, Andrew  PWC, 2022-12-01T15:46:16.854

Process control is a subject wider than RM13006. We are showing interconnectivity.
Teti, Peter E 2022-12-01T17:56:52.725

“Self audit” is not mentioned in the RM. Perhaps "PCM Assessment Checklist, per appendix A.
Stout, Andrew  PWC, 2022-12-01T15:51:11.389

Revised to include PCM Checklist.
Teti, Peter E 2022-12-01T17:58:02.926
THE NINE PROCESS CONTROL METHODS AND THEIR REACTION PLANS

PETER E. TETI
FELLOW, QUALITY ENGINEERING
PRATT AND WHITNEY

Figure 5 - Process Control Overview
PURPOSE

- To provide Suppliers guidance on the selection of Process Control Methods
- What each control method's reaction plan should look like

BACKGROUND

- The Reaction Plan, the last column on a Process Control Plan is commonly misunderstood
- Often, the assumption is a nonconforming part is generated driving the user to create an operator Reaction Plan that requires the operator to utilize the local MRB procedure
- PCP reaction plans should align to the identified control method
- If the process control signals the operator they’ve entered an error state, the reaction plan needs to instruct the Operator on what to do

The best process control methods avoid the error state of making mistakes and subsequent defective parts; Reaction plans are the response to the control method signal
## TABLE 1 - RM13006 PROCESS CONTROL METHODS

<table>
<thead>
<tr>
<th>NO.</th>
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<th>APPLICATION</th>
<th>EXAMPLE</th>
<th>PCP REACTION PLAN</th>
</tr>
</thead>
</table>
| 1   | Error / Mistake Proofing | To avoid defects caused by inadvertent errors. The most robust and preferred method. | ● One-way fit of a die insert to prevent mis-orientation during loading.  
● Use of a physical device to prevent installation of an oil-fill tube into the wrong port. | ● Level I & P device prevents the possibility of entering an error state so no reaction plan is required.  
● Level II devices such as alarms and buzzers require the operator to stop and investigate the error cause. This reaction may lead to following a prescribed recovery plan that eliminates the error condition or at least to contact their M.E. and/or supervisor for the next steps to take. |
| 2   | Variable Control Charts | To monitor a process input or process output that is continuous in nature for the purpose of establishing and maintaining a state of statistical control (statistical stability). | ● Dimensional product features are plotted on control charts at the point of process and monitored by the operator. The operator takes action to investigate and remedy issues when special causes are detected.  
● The pressure drop in a vacuum furnace is monitored on a control chart to warn of developing issues. The operator responds to special causes by performing equipment diagnostic checks. | Variable Control Charts will send signals to the operator in the way of unusual/non-random patterns displayed by the data. These are known as the Western Electric Rules. Operators using control charts should have a laminated copy of these rules at their workstation, stop the job if any of these patterns are displayed on the control chart, take the appropriate action to bring the process back into statistical control. The operator may also decide to seek help from their M.E. and/or supervisor. |
| 3   | Run Charts with Non-Statistical Limits | To monitor process inputs that require adjustment within acceptable operating limits in response to natural drift. Likely to be used when statistical limits offer little practical benefit or lead to false signals of special cause. | ● The viscosity of the slurry used in an investment casting process is monitored. When a limit is reached, the operator adds water to the mixture to correct for evaporation over time.  
● A highly capable general tolerated characteristic on a machined part where tool wear is expected and can be tolerated to a point to maximise its effective use. The operator changes the tool at a predetermined dimension before the dimension becomes nonconforming.  
● Furnace run charts tracking thermocouple temperature levels throughout a cycle for heat treat and brazing processes. Each point in the cycle will have a normal ‘operating window’ beyond which investigation occurs. Most likely to use an IT system linked to the equipment. | Run Charts may have “warning limits” applied that may have been determined by taking 50% or 75% of the engineering tolerance. While these limits may not be statistically determined, the reaction plan is similar to the ones used for Variable & Attribute Control Charts. The signal isn’t so much an unusual pattern but approaching the warning limits that trigger the operator to stop and investigate what action to take. The operator may also decide to seek help from their M.E. and/or supervisor. |
### TABLE 1 - RM13006 PROCESS CONTROL METHODS

<table>
<thead>
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</tr>
</thead>
</table>
| 4   | PreControl Charts       | To keep a capable process on target when the process either have a tendency to move from the nominal value. The process is not sensitive to small changes and statistical stability offers little benefit. | ● Qualification that set-up of a fuel control valve grinding process is done by running the process and making adjustment until process is centred. Once centred the process is monitored and only adjusted when pre-control rules are broken.  
   ● Monitoring of the outside diameter of an air cycle machine shaft where the operator controls adjustments by use of a machine offset in response to signals on the pre-control chart. | Pre-Control Charts have "warning limits" based on establishing an Upper PreControl and Lower PreControl Limit that represent 50% of the engineering tolerance. While these limits may not be statistically determined, the reaction plan is similar to the ones used for Run Charts with Non-Statistical Limits. The signal isn't so much an unusual pattern but approaching the PreControl limits that trigger the operator to stop and investigate what action to take. The operator may also decide to seek help from their M.E. and/or supervisor. |
| 5   | Life / Usage Control    | Processes that degrade over time where the useful life/usage is known. Limits to operation (Time or number of cycles) will be set conservatively to avoid non-conformance. | ● A forging die is running for a predetermined number of cycles (or number of predetermined pieces monitored by a counter) before being removed for refurbishment/disposal. The life and die change is managed to coincide with batch changes.  
   ● Cutting tools with known wear characteristics are run for a specific cutting time. The life is monitored by recording operation to a Baluff chip and the life control is set up in the CNC program to prevent overuse. | The operator will be provided a signal by a part and/or machine cycle counter. The reaction is to inform 1st line supervision that the die will need to be inspected and/or replaced per the line procedure.  
   ● Cutting tool wear may be accounted by tracking a predetermined number of pieces using a counter, Run Chart w/o statistical limits, control chart or PreControl Chart. Once achieved, the reaction plan will be to replace the subject tool. |
| 6   | Attribute Control Charts| For the monitoring of quality levels of product/process attributes where the output is based on counts (typically defects) or classification (typically defectives). | ● Inspectors counting solder defects on a printed circuit board (PCB) use a system that monitors the average number of defects per PCB. If a special cause is detected the soldering process owner is informed and investigates the cause of the issue.  
   The charts are reviewed by the operations management to identify opportunities for improvement and results of improvement initiatives. | Attribute control charts will send signals to the operator in the way of unusual/non-random patterns displayed by the data. These are known as the Western Electric Rules. Operators using control charts should have a laminated copy of these rules at their workstation, stop the job if any of these patterns are displayed on the control chart, take the appropriate action to bring the process back into statistical control. The operator may also decide to seek help from their M.E. and/or supervisor. |

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### TABLE 1 - RM13006 PROCESS CONTROL METHODS

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</tr>
</thead>
</table>
| 7   | Visual Process Check and Checklist | Checking a process attribute against a known standard and recording it as conforming (before allowing a process to run, or during a process run). | • A forging die is periodically examined by an operator for evidence of damage, wear or scoring. The operator uses a checklist to record that the check has been conducted, and the result of the check.  
• An operator of a process with a lengthy setup operation uses a checklist to confirm each step of an operation is completed before running the machine. The checklist may also include safety items. | Reaction Plan for the operator when a visual process check and/or set-up checklist illustrates a nonconformance to a known standard, and/or checklist requirement, will be to correct, if possible, the nonconformance prior to running the job. Otherwise, the operator shall inform 1st line supervision and/or M.E. to aid in a corrective action. |
| 8   | First Piece Check               | To validate the set-up and quality of a process prior to the full production run.                                                                                                                   | • A CMM check of the first part in a batch of parts off a press is performed following change of press tooling. If the part meets the requirements the process is controlled using other control methods in the process. | If the first piece check inspection reveals a nonconformance, the inspector shall inform the first line supervisor, M.E., and producing operator. Following will be an investigation of the set-up and set-up procedure used to identify the cause of the first piece rejection. |
| 9   | Test Piece evaluation           | Commonly used along with process parameter control to provide validation of product quality.                                           | • A piece of test material processed along with a batch of material is more inspection than control; so needs to be used along with effective process input control.  
• A piece of test material processed along with a batch of carburized gears in a heat treatment cycle is tested in a laboratory.  
• Tensile strength destructive examination of a test specimen used in a heat exchanger vacuum brazing process. | For a test specimen that does not meet specifications upon the test conducted, the reaction plan will instruct the test operator to contact the appropriate engineer (e.g., Materials, Quality or Manufacturing Engineer) who will investigate the process parameter inputs, furnace run schedule, etc. as for clues to why the test specimen failed to meet the test. |
RED FLAGS TO LOOK OUT FOR

NICKLAS GODEBU
INDUSTRIAL ENGINEER
GKN AEROSPACE ENGINE SYSTEMS
**RED FLAGS**

**PROCESS FLOW DIAGRAM – RM13004**

Process Flow does not link or correlate with job router/traveler/shop order

Not accounting for multiple stations where process step may be performed; control system may be different depending where the process step is run

**PFMEA – RM13004**

PFMEA documents are dated even when changes to process plan have occurred

Failure modes and causes are combined making it hard to determine the control strategy

Misalignment between requirements, failure modes, causes and controls

No Supplier self-identified KC’s
Job router / traveler / shop order etc.

I don't see the term "red flags" in the RM. Is there a plan to add them?

We probably should. Not everything being presented has to be out of the RM.

Shouldn't we focus this webinar on RM13006?

Again, the interconnectivity with RM13004 is critical. We get to RM13006 in the next slides.
MEASUREMENT SYSTEMS ANALYSIS – RM13003
Gage Capability Study has unacceptable percent-to-tolerance ratio (> 20%) with no containment plan or corrective action plan in place (i.e., guard banding, new gage on order, calibrating operator methods)
Attribute AbA study conducted with only good parts when nonconforming parts are required in the sample used

CONTROL PLAN – RM13004
Reaction Plans geared to the generation of non-conforming/out of tolerance features only

Reaction Plans do no align to the established control method or reflect RM13006

Control Plan only addresses KCs but does not account for all high risks and/or process variation

Control Plan does not address Customer KC’s nor Supplier self-selected KC’s

Operator work instructions lack alignment with Control Plan

WHAT MAKES A “GOOD” GAUGE?

<table>
<thead>
<tr>
<th>% Tol and % SV</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10%</td>
<td>Excellent gauge performance</td>
</tr>
<tr>
<td>10% to 20%</td>
<td>Adequate gauge performance</td>
</tr>
<tr>
<td>20% to 30%</td>
<td>Marginal gauge performance, may be unacceptable</td>
</tr>
<tr>
<td>&gt; 30%</td>
<td>Poor gauge performance, generally unacceptable</td>
</tr>
</tbody>
</table>

LSL
USL
Process variability (6σ)
Engineering Tolerance

Reaction Plan correlates to the Control Method
Again not RM13006
Stout, Andrew             PWC, 2022-12-01T15:58:31.064

Again, interconnectivity with other RM's. Part of the objective here.
Teti, Peter              , 2022-12-01T18:00:37.343
AESQ – Aerospace Engine Supplier Quality Strategy Group

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**RED FLAGS**

**SPC CONTROL CHART AND CAPABILITY STUDIES – RM13006**

Control Charts are not in place at transformation operation

No evidence operators are trained in use of control charts or the Western Electric Rules

Data collected at transformation operation but analysis done separately for the purpose of satisfying Customer reporting or PPAP submission

General SPC resistance as described in RM13006, Section 12.3.

**CONTROL CHART INTERPRETATION**

Below summarizes the patterns on a control chart that might indicate a Special Cause of variation may be present in the process.

- Below outlines the patterns on a control chart that might indicate a Special Cause of variation may be present in the process.
- Investigate for a special cause if one of these patterns should develop on a control chart you are using to monitor a process.

**POSSIBLE CAUSES**

- Sticky Gauge
- Worn Die
- Drift in Controls
- Etc.

**POSSIBLE CAUSES**

- Gradual deterioration of equipment
- Operator Fatigue
- Tool Wear
- Etc.

**POSSIBLE CAUSES**

- Overadjustment of the process
- Control of two or more processes on the same chart
- Fixtures or holders not holding work in position
- Etc.
Consider adding something from section 12.3 Resistance to SPC

Stout, Andrew PWC, 2022-12-01T16:00:40.813

Added
Teti, Peter E, 2022-12-01T18:01:38.479
SUMMARY AND CLOSE

PETER E. TETI
FELLOW, QUALITY ENGINEERING
PRATT AND WHITNEY
### FUTURE WEBINARS

**From the Process Control Methods SMIG Group**

Look for these future topics in the “Upcoming Events” page on the AESQ website:

https://aesq.sae-itc.com/interest-groups

<table>
<thead>
<tr>
<th>NO.</th>
<th>FUTURE WEBINAR TOPICS</th>
<th>TARGET DATE/TIME</th>
<th>WEBINAR LEAD</th>
<th>SUPPORTING SUB‐TEAM</th>
<th>BRIEF DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>What makes a good Process Capability Study?</td>
<td>1/26/2023 (11 AM U.S. Eastern)</td>
<td>Steve Hampton</td>
<td>Marnie Ham/Karen Scavotto/Geoffrey Carpenter</td>
<td>Cpk values are only as good as what goes into the data used to calculate Cpk, such as the adequacy of the measurement system and achieving statistical control.</td>
</tr>
<tr>
<td>3</td>
<td>Process Capability Study for True Position (handling MMC)</td>
<td>2/8/2023 (11 AM U.S. Eastern)</td>
<td>Grant Braun</td>
<td>Karen Scavotto/Marnie Ham/Shailesh Shinde/Andrew Stout</td>
<td>How do we handle process capability for one-sided or unilateral tolerances such as true position where Maximum Material Condition modifiers may play a role?</td>
</tr>
<tr>
<td>4</td>
<td>The use of non‐statistically based process control methods</td>
<td>2/15/2023 (11 AM U.S. Eastern)</td>
<td>Paul Gorg</td>
<td>Pete Teti/Earl Capozzi/Rudi Braunieder/Nicklas Godebu</td>
<td>Process controls need not only be statistically based. Here we explore non‐statistical methods such as error‐proofing devices, the PreControl method, and the use of run charts with non‐statistical limits.</td>
</tr>
<tr>
<td>5</td>
<td>The Power of Precontrol</td>
<td>3/8/2023 (11 AM U.S. Eastern)</td>
<td>Pete Teti</td>
<td>Andrew Stout/Steve Hampton</td>
<td>PreControl is a powerful non‐statistical tool that is easy to get up and running with that can be used to qualify the set‐up of a lot as well as a control for the production run.</td>
</tr>
<tr>
<td>6</td>
<td>The One‐Hour Process Control Assessment</td>
<td>4/11/2023 (11 AM U.S. Eastern)</td>
<td>Pete Teti</td>
<td>TBD</td>
<td>If you were visiting a supplier and only had time to carve out one hour for a process control assessment, what questions would you ask and where whom would you ask those questions to?</td>
</tr>
<tr>
<td>7</td>
<td>Why is statistical control a prerequisite for process capability?</td>
<td>Target 2nd Qtr (May)</td>
<td>Marnie Ham</td>
<td>Andrew Stout/Geoffrey Carpenter/Dougus Dush</td>
<td>Process Capability indexes without the use of SPC Control Charts are invalid. Control Charts are the method to monitor and control a process and are a key prerequisite prior to calculating Cp &amp; Cpk.</td>
</tr>
<tr>
<td>8</td>
<td>Dealing with Non‐Normal Data</td>
<td>Target 2nd Qtr (June)</td>
<td>Karen Scavotto</td>
<td>Marnie Ham/Shailesh Shinde/Andrew Stout</td>
<td>What happens when the data coming from a process is non‐normal? What can be done to accurately assess process capability? We will show you!</td>
</tr>
<tr>
<td>9</td>
<td>Conducting capability studies for one‐sided geometric tolerances</td>
<td>Target 3rd Qtr (July)</td>
<td>Karen Scavotto</td>
<td>Marnie Ham/Shailesh Shinde/Andrew Stout</td>
<td>Aerospace component manufacturers the world over deal with geometric/one‐sided features such as runout, flatness, etc. What rules have to change when assessing process capability?</td>
</tr>
</tbody>
</table>
Q & A SESSION

USE THE “CHAT” FUNCTION TO ASK A QUESTION...
SUMMARY

All resources will be available on the AESQ website within a few days.

An email will be sent to all registrants with a link.
THANK YOU FOR PARTICIPATING