<table>
<thead>
<tr>
<th>Table of Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TABLE OF CONTENTS</strong> ..............................................................................2</td>
</tr>
<tr>
<td><strong>FOREWORD</strong> ............................................................................................4</td>
</tr>
<tr>
<td>PURPOSE ........................................................................................................5</td>
</tr>
<tr>
<td>WHEN IS PPAP SUBMISSION REQUIRED? ........................................................5</td>
</tr>
<tr>
<td>SUPPLIER CHANGE REQUEST (SCR) INSTRUCTIONS ...........................................6</td>
</tr>
<tr>
<td>ELEMENTS OF A PPAP SUBMISSION ...............................................................7</td>
</tr>
<tr>
<td>SUBMISSION LEVELS .......................................................................................8</td>
</tr>
<tr>
<td>SUPPLIER PPAP CHECKLIST ..........................................................................9</td>
</tr>
<tr>
<td>ELECTRONIC SUBMISSION/SUBMISSION METHOD ..........................................10</td>
</tr>
<tr>
<td>SIGNIFICANT PRODUCTION RUN ....................................................................10</td>
</tr>
<tr>
<td>SUBMISSION STATUS ....................................................................................10</td>
</tr>
<tr>
<td>ONGOING REQUIREMENTS .............................................................................11</td>
</tr>
<tr>
<td>CRITICAL TO QUALITY (CTQ) FEATURES ......................................................11</td>
</tr>
<tr>
<td>PPAP TRAINING ...........................................................................................12</td>
</tr>
<tr>
<td><strong>INSTRUCTIONS FOR COMPLETING A PPAP SUBMISSION</strong> .......................13</td>
</tr>
<tr>
<td>ELEMENT 1 PART SUBMISSION WARRANT (PSW) ..........................................13</td>
</tr>
<tr>
<td>ELEMENT 2 DESIGN RECORDS AND BALLOONED DRAWINGS .......................14</td>
</tr>
<tr>
<td>ELEMENT 3 APPROVED ENGINEERING CHANGE DOCUMENTATION ..............15</td>
</tr>
<tr>
<td>ELEMENT 4 CUSTOMER ENGINEERING APPROVALS .......................................16</td>
</tr>
<tr>
<td>ELEMENT 5 DESIGN FMEA (DFMEA) ...........................................................16</td>
</tr>
<tr>
<td>ELEMENT 6 PROCESS FLOW DIAGRAMS ........................................................18</td>
</tr>
<tr>
<td>ELEMENT 7 PROCESS FMEA (PFMEA) ...........................................................19</td>
</tr>
<tr>
<td>ELEMENT 8 CONTROL PLAN ..........................................................................20</td>
</tr>
<tr>
<td>ELEMENT 9 MEASUREMENT SYSTEM ANALYSIS STUDIES (MSA) .................23</td>
</tr>
<tr>
<td>ELEMENT 10 DIMENSIONAL RESULTS .........................................................25</td>
</tr>
<tr>
<td>ELEMENT 11 MATERIAL AND PERFORMANCE TEST RESULTS .................27</td>
</tr>
<tr>
<td>ELEMENT 12 INITIAL PROCESS STUDY (CPK, PPK) ......................................28</td>
</tr>
<tr>
<td>ELEMENT 13 QUALIFIED LABORATORY DOCUMENTATION ............................33</td>
</tr>
<tr>
<td>ELEMENT 14 APPEARANCE APPROVAL REPORT ..........................................34</td>
</tr>
</tbody>
</table>
Foreword

The Quality Assurance staff at Cooper Industries has prepared this handbook for new and existing suppliers of manufacturing based purchased goods to Cooper Industries. Its purpose is to define the approval process of new or revised parts, or parts resulting from new or significantly revised production methods. As a supplier, it is your responsibility to ensure that you ship only parts that have been approved and meet specifications.

The procedures outlined in this handbook apply to all Cooper Industries facilities. If you have questions regarding the contents or processes described in this handbook, please contact the Quality Assurance representative of the Cooper Industries location to which your documentation is being submitted. Please note that Green Text in this manual will link to the Definitions Appendix.

The requirements in this handbook were drafted to be fully compliant with the Automotive Industry Action Groups (AIAG) Production Part Approval Process (PPAP) standard revision 4 March, 2006. Cooper Industries has specific customer specific requirements and additions to this standard that need to be fully understood before attempting to successfully submit a PPAP to Cooper Industries for review and approval.

Cooper Industries PPAP Kit

- Cooper Industries has created a free “PPAP Kit” for suppliers
  - Contains all of the forms required for submission
  - Includes instruction on the use of the forms through field comments.
  - Fully compliant with the AIAG 4th edition PPAP standard.
  - Includes this training presentation, PPAP manual and the forms kit

- Two forms are mandatory for submission to Cooper
  - Cooper PSW page
  - Cooper Dimensional Data Page

- All other requirements can be met by using either:
  - The additional forms in the kit (Preferred Method)
  - Forms consistent with AIAG guidelines

The Cooper PPAP Kit contains everything required for submission
Production Part Approval Process (PPAP)

Purpose

The purpose of the Production Part Approval Process (PPAP) is:

✓ To provide the evidence that all customer engineering design record and specification requirements are properly understood and fulfilled by the manufacturing organization.
✓ To demonstrate that the now established manufacturing process has the potential to produce product that consistently meets all requirements during an actual production run at the quoted production rate.

When is PPAP Submission Required?

In general a PPAP is required anytime a new part or a change to an existing part or process is being planned. It is at the discretion of each Cooper Industries Division to determine when and if a PPAP submission will be required. As a supplier you should have the type of quality system that develops all of the requirements of a PPAP submission regardless of whether you have been asked to deliver a submission. In the event a PPAP submission is not requested, Cooper quality reserves the right to request any of these documents at any time during the life of the product. Cooper Quality reserves the right to request a PPAP submission for a variety of reasons including all of the following.

New parts, process or suppliers:
1. New part or product
2. New supplier
3. New process or technology

Changes to existing product:
1. Change to construction, material, or component
2. New, additional or modified tools
3. Upgrade or re-arrangement of existing tools
4. Tooling, production, or equipment transferred to a different site
5. Change of supplier or non-equivalent materials/services
6. Product when tooling has been inactive for 12 months
7. Product or process changes on the components of the product
8. Change in test or inspection method
9. Bulk material: New source of raw material
10. Change in product appearance attributes
11. Change in production process or method
12. Change of sub-supplier or material source
If there are any questions concerning the need for a PPAP Submission, please contact a Cooper Industries Quality or Supplier Quality representative.

Supplier Change Request (SCR) Instructions

Whenever you are planning a change that affects the part or the process making the part you must get approval from Cooper prior to initiating any activity. Included in the PPAP Forms kit is the Supplier Change Request (SCR). This document is used for initiating all supplier changes through all Cooper divisions. The SCR must be approved by both Cooper Industries’ purchasing and quality. Failure to have an approved SCR may affect future business opportunities.

Cooper assumes a good faith agreement with you as a supplier with respect to change management. Therefore we rely on the supplier to notify us in good faith of any planned change such as changing the location of manufacture or changing the process that manufactures the part supplied to Cooper. The additional requirements section on the form can be used to document any additional testing, performance data or engineering changes that may be required to make the proposed change a success. Any proposed change to a print requirement from a supplier should be done using the Specification Deviation Form and follow each division’s standard procedure for engineering changes. The SCR should not be used to suggest or initiate print related changes. In addition, the SCR is only for changes that are permanent in nature. Temporary changes or deviations should always follow the Cooper manufacturing site’s process for Temporary Deviations.

The SCR identifies several “Types” of changes that require notification. These types are covered in Table 3.1 in the most recent release of the PPAP standard. All of these changes can have significant affect on overall part quality and are therefore identified for customer approval prior to making the change to avoid any unforeseen issues at Cooper facilities or with end user customers. This methodology around change management is consistent with the Customer Notification section in the AIAG PPAP guidelines revision 4. As a supplier to Cooper Industries you are not under any of these circumstances allowed to make a change without prior notification and approval of the SCR form.
Below is the list of Types of changes that require prior notification and approval by Cooper Industries.

<table>
<thead>
<tr>
<th>Type of Change</th>
<th>Note</th>
<th>Designations in [ ] are the recommended PPAP level submissions for this type of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Change to construction, material or component (L3)</td>
<td>7. Product/process changes on components of the product (L4)</td>
<td></td>
</tr>
<tr>
<td>2. New, additional or modified tools (L3)</td>
<td>8. Change in test or inspection method (L4)</td>
<td></td>
</tr>
<tr>
<td>3. Upgrade or rearrangement of existing tools (L2)</td>
<td>9. Bulk Material New source of raw material (L2)</td>
<td></td>
</tr>
<tr>
<td>4. Tooling, production or equipment transferred to different site (L3)</td>
<td>10. Change in product appearance attributes (L2)</td>
<td></td>
</tr>
<tr>
<td>5. Change of supplier or non-equivalent materials/services (L3)</td>
<td>11. Change in production process or method (L4)</td>
<td></td>
</tr>
<tr>
<td>6. Product when tooling has been inactive for 12 months (L2)</td>
<td>12. Change of Sub Supplier or material source (L3)</td>
<td></td>
</tr>
</tbody>
</table>

Reference: Section 3 Table 3.1 on Page 13 of AIAG PPAP 4th edition (May 2006)

Elements of a PPAP Submission

The Cooper Industries PPAP submission requirements are compliant with the existing AIAG standard. One or more of the following elements may be required as part of your formal submission depending upon your assigned submission level:

1. **Part Submission Warrant** (Cooper Specific Format Required)
2. **Design Records & Ballooned Drawings**
3. **Approved Engineering Change Documents**
4. **Customer Engineering Approval**
5. **DFMEA**
6. **Process Flow Diagram**
7. **PFMEA**
8. **Control Plan**
9. **Measurement Systems Analysis (MSA)**
10. **Dimensional Results** (Cooper Specific Format Required)
11. **Material, Performance Test Results**
12. **Initial Process Study (Cpk) Capability Studies**
13. **Qualified Laboratory Documentation**
14. **Appearance Approval Report (AAR)**
15. **Sample Product Parts**
16. **Master Sample(s)**
17. **Checking Aids**
18. **Cooper-Specific Requirements**
   A. Tooling information Form
   B. Packaging Form
   C. Inspection Plan (Asian Sourcing Center Only)
   D. Specification Deviation
   E. Supplier PPAP Worksheet

Cooper industries have many of these forms available to suppliers at no charge as part of our “PPAP kit” which is available on CD. You can use the Cooper supplied forms or
any AIAG compliant forms with the exception of Element 1 (PSW) and Element 10 (Dimensional Report). Both of these elements must be submitted on the Cooper Industries format.

Submission Levels

Submission levels define which elements are required to be submitted. The levels are used for different reasons and applications. The level to be submitted is determined by Cooper Industries, and unless otherwise noted, always defaults to Level 3 which is a full PPAP submission. There are five submission levels listed below, and each is typically applied to the specific areas listed.

**Level 1.** Warrant only and Appearance Approval Report as requested submitted to the customer. Applied to: ‘Non-critical’ parts, ‘non critical’ raw/bulk material or catalog/commodity parts for electrical applications and re-certification of existing parts previously approved by Cooper at levels 3, 4 or 5. Also used for self-certification.

**Level 2.** Warrant with product samples and limited supporting data submitted to the customer. Applied to: Critical Bulk products such as Plastic/Paint/Chemicals, critical fasteners, simple material changes, simple revision level only changes or simple print updates not affecting form-fit-function. This level can also be applied to low and medium risk parts within a product family.

**Level 3.** Warrant with product samples and complete supporting data submitted to customer. Default Cooper Industries Submission Level. Applied to: New parts on Cooper programs, changes affecting form-fit-function, reliability, or performance. All products resourced to new suppliers, serial production parts, and existing high risk parts undergoing a part number change.

**Level 4.** Warrant and other requirements as defined by the customer. This level is reserved for special applications only. Applied to: This level can only be applied with prior approval from the designated divisional Cooper Quality PPAP representative.

**Level 5.** Warrant with product samples and complete supporting data reviewed at the supplier’s manufacturing location. Applied to: On site review as requested by each Cooper Division.

Note: A level 4 submission cannot be utilized without the consent of your Cooper Industries Quality or Supplier Quality Representative. Parts sourced in other countries that are delivered to North America must be translated into English and must be Level 3
submissions. Changes to existing parts will be handled on a case-by-case basis and submissions other than level 3 must have prior approval from your Division level North American Quality or Supplier Quality representative.

Supplier PPAP Checklist

Cooper Industries has a customer specific requirement that can be used for referencing and organizing a PPAP submission. The Supplier PPAP Checklist lists all of the required elements for each LEVEL option 1 through 5.

The level for your PPAP submission is determined by Cooper Industries. If you are not sure what level you are submitting to you should check with your Divisional Cooper Industries Quality or Supplier Quality representative. The Supplier Checklist provides an opportunity to assign responsibilities internally and documents concerns to Cooper about specific areas within the submission. If you have issues or problems with any of the specific elements of a PPAP submission then they should be documented here or on the PSW cover page. For example, if at the time of submission you have not received approval of your packaging material, then this would be the place to document that concern. All concerns must be documented at the time of submission to avoid rejection of the issue at a later time.

Below is the top portion of Supplier PPAP Checklist and the full form is in the addendum section of this manual and the PPAP Forms Kit.
**Electronic Submission/Submission Method**

Cooper Industries requires that all PPAPs be submitted electronically. There are two preferred methods of submission:
1. Upload to the Cooper Division designated FTP site. *(preferred)*
2. Email to your quality/supplier quality representative.

Each Cooper division handles delivery of the submission differently so you should check to make sure you are sending your documentation to the correct location. It is preferred that the PPAP be 1 PDF file of the entire submission. If this is not possible then we would request that each element would be in PDF format and not Native format such as MS Excel or Word. **Important: The use of a paper or email submission must have prior approval by the authorized Supplier Quality or Quality representative. All submissions must be received prior to the PPAP due date.**

**Significant Production Run**

PPAP data must be submitted from a “significant production run”, which is identified by AIAG in the PPAP standard as 300 consecutive pieces sampled randomly. Unless otherwise agreed upon by the Cooper Industries and the supplier, sampling should be taken from no less than 300 pieces from a production run, utilizing production equipment, tooling and production employees operating at production rate.

The intent is that all data reflects the *actual production process* to be used during production. You are required to document the date, time and the actual rate of this run on the Part Submission Warrant.

**Submission Status**

The review and approval process will be managed by each Cooper division. Subsequently the PPAP submission will be reviewed and dispositioned with one of the following submission statuses:

**Approved:** A formal acceptance of the submission within the guidelines of any and all criteria set forth by the Cooper division managing the submission.

**Rejected:** The provision is not acceptable and needs to be resubmitted for approval. *(Note: Submission to the wrong revision level or part number will constitute an automatic rejection.)*

**Interim:** An interim approval can occur through an agreement with quality management. The product must be deemed “sellable” by Cooper and the interim
may only be issued for 90 days. The submission must have an approved Specification Deviation that clearly identifies the corrective action plan to achieve full approval within the 90 day period. The Specification Deviation is in the Cooper Industries’ PPAP Forms kit.

Ongoing Requirements

Cooper Industries reserves the right to request any information you have provided in any data or documented in any element of approval, at any time, including after the approval has been granted. Cooper Industries reserves the right to require recertification at any time.

As a supplier to Cooper Industries, the expectation is that you will build your product and processes to be robust not only for the launch of the product but for the life of the product. The expectation is that your system will include verification of the parts and the part requirements on an “on-going basis”. This includes building periodic conformance testing into your overall process such as routine dimensional analysis, functional analysis and process verification.

Our recommendation is that you have designated intervals for verifying Critical To Quality (CTQ) characteristics and key process related methods. All of these must be identified on the control plan as part of your ongoing process to verify that your product meets Cooper’s requirements. Cooper reserves the right at any time throughout the life of the product to request evidence of this ongoing conformance.

Critical to Quality (CTQ) Features

- **CTQ Characteristic Definition:**
  - A critical PART requirement specified on a controlling document (typically an engineering drawing, specification or performance requirements)
  - A critical PROCESS requirement identified by Customer or Supplier.
  - Directly represents the safety, regulatory, or primary functional performance requirements by the end customer or business
  - Requires verification of part conformance during first production.
  - Requires documented evidence of process control to maintain part conformance through the life of the product
Critical to Quality (CTQ) characteristics are those features that most affect the outcome of a product or process. CTQ controls must be designed and implemented as part of your company's advanced quality planning. Special attention is required during this phase to identify and control variables that affect the conformance of the product.

Cooper’s expectation is that you will address all CTQs in the control plan and ensure that you have a robust process for consistently achieving all CTQ requirements as they are defined in the Cooper part print. Each division will have its own CTQ designation methodology. Specific definition per division will be found in Addendum D. Please refer to your division Quality or Supplier Quality Representative with any question concerning.

CTQ are typically mandatory for Element 12, the “initial process study” which is sometimes referred to as the capability element. Cooper requires capability studies for all CTQ and any process related characteristics that either you or Cooper identify as critical. This section is mandatory even if there are no CTQs on your part print because there are always critical elements and characteristics of the process that manufactures the part.

As a supplier developing product for Cooper, your team may discover process and sometimes additional product characteristics that are critical to part performance. Even if the print does not clearly define any CTQs, Cooper expects that suppliers will identify CTQs for their processes and methods. **NOTE: SEE APPENDIX B**

**PPAP Training**

Cooper Industries offers Supplier PPAP training at several levels. You can contact either a member of Cooper Plant Quality or Supplier Quality for more information. The training for suppliers is typically around 4-6 hours and is offered at various times throughout the year both in an on-site format and via Webinar. For these offerings contact your Division Supplier Quality Representative.

You can also refer to the AIAG website (www.aiag.org) for additional information, training and materials on the PPAP standard 4th edition as well many of the various elements within the standard.

AIAG has developed industry standard publications available for many of the elements that go into specific detail on the concepts and how to plan your approach. In addition you can register for additional AIAG training on these and many other important industry standards.
Instructions for completing a PPAP Submission

All submissions must be received prior to the PPAP due date. The review and approval process will be managed by each Cooper division.

Element 1 Part Submission Warrant (PSW)

The purpose of the **Part Submission Warrant (PSW)** is to document the submission and the approval or rejection of purchased parts prior to production. Cooper Industries has developed its own Submission Warrant document and this form is a required element of PPAP. It must be submitted as part of the PPAP at every submission level. Cooper Industries will not accept the AIAG form or any internal PSW format.

Completing the Part Submission Warrant

The Part Submission Warrant is included in the forms file in the Cooper Industries’ PPAP Kit. It must be filled out and signed by the supplier. The part number must match the Purchase Order or material agreement that is provided by Cooper Purchasing.

The form must be submitted in this format, with the correct part number, revision and submission level. This is 1 of 2 forms that are mandatory for all Cooper submissions. Any fields that do not apply to your submission should be filled in with “N/A” (Not Applicable). It is critical to make sure the PSW is filled out correctly, and contains accurate and legible information. A sample of the Part Submission Warrant described above can be found below. Each field in the Cooper PSW in the forms kit has comments that provide additional clarity on each field.

---

**Part Submission Warrant**

<table>
<thead>
<tr>
<th>Field</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supplier Company Name</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Supplier Vendor Number</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Customer Name</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Additional Manufacturing Sites</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Street Address</strong></td>
<td></td>
</tr>
<tr>
<td><strong>City</strong></td>
<td></td>
</tr>
<tr>
<td><strong>State</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Zip</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Does this part utilize Cooper owned tooling? Is it properly identified?</strong></td>
<td></td>
</tr>
</tbody>
</table>

---
Element 2 Design Records and Ballooned Drawings

The purpose of designed records and ballooned drawings is to document and provide a copy of the formal part print and to provide any additional engineering records for reference.

Example of a Ballooned Drawing

A ballooned drawing shows the parts or assemblies in a part print with numbered “balloons” that point to individual dimensions and requirements of the part. The numbers on the ballooned drawing correlate with the numbers found on the Dimensional Data Sheet. A ballooned drawing must be submitted as part of PPAP for every submission level when there are dimensional results.
Completing the balloon drawing
All part requirements on the Cooper print must be ballooned and numbered for reference and measurement. These may include:

1. Dimensions and tolerances of parts
2. Electrical requirements (performance data, functional tests, etc.)
3. Visual features (color, texture, etc.)
4. Chemical characteristics (cure time, etc.)
5. Physical and mechanical properties (tensile strength, plating thickness, heat-treat hardness, etc.)
6. Any other specified requirement that you have the capability to measure or that is described in print notes or referenced specifications.

When dimensions are specified at multiple locations on the drawing, the data for each location should be numbered separately.

**Dimensional data** for Element 10 such as dimensions and tolerances must be addressed on the Cooper Industries *Dimensional Data Sheet*.

**Material or Performance data** should be included in Element 11 on a format that allows for clear interpretation of the results. For example, material results can be addressed using a material composition report or a certificate of analysis. Either an in-house format or the AIAG formats for material and performance are acceptable.

**Element 3 Approved Engineering Change Documentation**

This section is used to cover anything that is not addressed in a part print such as emails, *Supplier Change Requests (SCR)*, and Feasibility Studies.

- **Cooper ECNs** must be approved, not pending.
- Print change submissions must have current prints.
- Emails can only clarify requirements, not define them.
- Emails cannot re-define a requirement in lieu of a print change.
- All supplier initiated changes must have a copy approved Supplier Change Request (SCR) form.

The Supplier Change Request must be approved by both Cooper Purchasing and Quality prior to making any proposed changes. You should not proceed with your change until you have an approved SCR from Cooper.
Element 4 Customer Engineering Approvals

Customer Engineering Approvals are used to demonstrate pre-approval by Cooper’s customers of a design. Customer Engineering Approvals are not required for supplier submissions. In the event that this would be required in the future we have maintained a placeholder within the Cooper requirements.

Element 5 Design FMEA (DFMEA)

Design FMEA stands for Design Failure Mode and Effects Analysis (DFMEA) and shows evidence that potential failure modes and their associated risks have been addressed in order to eliminate or minimize their effects through product design changes and improvements. DFMEA is only required when the part is designed by the supplier and must address all Critical to Quality characteristics (CTQs) and any potential voice of the customer inputs identified in the Cooper Project Scope.

The date on the DFMEA should show release prior to print release. Severity, Occurrence and Detection ratings are used when performing FMEA activities. These rating scales must be compliant with the AIAG guidelines for FMEA (4th edition) and definitions are included in the DFMEA worksheet as well as this handbook.

Cooper has included a worksheet format in the forms kit. Above is the form and to the right is an example of how the ratings scale for Severity is available in the comments for easy reference. Any potential failure mode not mitigated in the DFMEA should be included in the PFMEA also included on the PPAP worksheet. Any potential failure mode with a severity ranking of 9 or 10 must be addressed with
a corrective action plan. Furthermore, potential failure items in the top 25 percent high RPN ranking should have corrective action items addressing the potential failure mode.

Organizations that have already developed a DFMEA or PFMEA can submit that as part of their PPAP submission. For organizations without a DFMEA or PFMEA, sample forms have been included in the PPAP kit. The chart below describes the fields in the DFMEA.

**Completing the DFMEA**

The DFMEA supports the design process by reducing the risk of failures. The DFMEA should be initiated before the design concept is finalized. Each item/function needs to be addressed. Any potential failure mode of the item/function should be defined as completely as possible. Recommended actions should be recorded. All severities of 9 or 10 must have an associated action plan. **Prevention is the preferred method to address the design failure mode.** If prevention is not possible, then highlight detection controls. The DFMEA is not meant to be a stand alone document and the results of the DFMEA can be used in the PFMEA.

The FMEA Revision 4 tables for Severity, Occurrence and Detection are embedded in the cell comments on Cooper’s FMEA template. The three of these ratings multiplied together produce the initial *Risk Priority Number* or RPN.

\[
\text{Severity} \times \text{Occurrence} \times \text{Detection} = \text{RPN}
\]

The use of an **RPN Threshold** is not recommended practice for determining the need for actions. Applying thresholds assumes that RPNs are a measure of relative risk (which they often are not) and that continuous improvement is not required (which it is). Cooper Industries recommends that you treat all FMEA activity on a separate case by case basis and that you address the top 25% of your highest RPN values within the FMEA activity you are doing.
Example of Guidance Comments within each cell of the DFMEA Form.

Example of Severity, Occurrence and Detection Tables within the cell comments of the DFMEA Form. (per FMEA revision 4).

Element 6 Process Flow Diagrams

The purpose of Process Flow Diagrams is to document and clarify all the steps required in the manufacturing of a part. The Primary process steps must match both the Control plan and the PFMEA. Process flows must include the entire manufacturing process (receiving through shipping).
The Process Flow Diagram must also include all key steps in the process and all offline activities (such as measurement, inspection and handling). The flow of nonconforming material such as scrap parts, non-conforming parts and rework parts should also be included. The Process Flow can be provided in any format used within an organization. (Examples are available in the training material that is part of the PPAP tool kit.)

**Element 7 Process FMEA (PFMEA)**

The **Process FMEA (PFMEA- Process Failure Mode and Effects Analysis)** is used to show evidence that any potential failure modes and risks have been assessed at the manufacturing process level. Process FMEA’s can be submitted in the Cooper format or any AIAG compliant format. Cooper Industries has provided a PFMEA Worksheet in excel format in the PPAP Forms kit. Like the DFMEA it also contains that latest rating definitions for FMEA Revision 4.

A PFMEA should be performed for every part, piece of equipment or process involved in manufacturing. PFMEA is a cross-functional activity that is performed internally, updated routinely and reviewed periodically. Severity, occurrence and detection ranking values are included in this handbook, as well as in the PPAP toolkit.

Cooper Industries requires that any severity ranking of 9 or 10 be addressed with a corrective action plan. Furthermore, potential failure items in the top 25 percent of the high RPN ranking items must have action items addressing the potential failure mode. This in turn will lower the re-calculated RPN value for that failure mode. Any high RPN process concerns should be carried over and addressed in the **control plan**. All critical failure modes must be addressed.

**Completing the PFMEA**

The PFMEA worksheet is a tool used to identify and show potential process risks associated with the manufacture of each part. It also highlights the controls associated with each process. Each process step/function should be identified with an action plan to address the process failure mode. All high RPN process concerns should be carried over to the control plan.

---

<table>
<thead>
<tr>
<th>Process/Step Function/ Requirements</th>
<th>Potential Failure Mode</th>
<th>Potential Causes/ Failure Mechanisms</th>
<th>Current Process Controls</th>
<th>Recommended Action(s)</th>
<th>Responsibility and Completion Date</th>
<th>Action Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Please indicate EITHER:

1.) A designated RPN threshold for this process
2.) A target percentage of steps to be addressed

Check One
The recommended actions in any FMEA should address the initial high RPN numbers to minimize risk in the manufacturing process. The goal is to drive the final RPN number as low as possible.

FMEA is a cross-functional activity that can lead to inconsistency particularly when specific team members are not trained. A number of organizations provide good training on both DFMEA ad PFMEA. In addition the AIAG manual (shown to the left) is the industry reference for comprehensive details on FMEA and can be purchased through their website. In addition, AIAG also offers additional training that you or your team can attend. Your Cooper Industries Quality or Supplier Quality representative can also assist with any questions concerning FMEA. Below is a list of some of the more common mistakes made when performing FMEAs and should be avoided when performing the activity. It is recommended that you review this list with your team prior to performing FMEA.

Examples of common mistakes made on PFMEA

- Misapplication of Severity, Occurrence and Detection
- Redefining Severity, Occurrence and Detection
- Over estimating the effectiveness of a “Recommended Action”
- Applying RPN thresholds arbitrarily
- Not recognizing all potential failures.
- Failure to properly identify the customer.
- Misapplication of ranking scales.
- Confusing Failure Modes with Effects or Failure Modes with Causes.
- Allowing the PFMEA to turn into a design review.

Element 8 Control Plan

A Control Plan defines the operations, processes, materials, equipment, methodologies, and CTQs (as determined by Cooper and suppliers) for controlling variations in key product or process characteristics integral to the manufacturing process. Its purpose is to communicate the supplier’s decisions during the entire manufacturing process from materials purchase through final shipping. Specifically, the control plan should address the following:

- Methods of production
- Identification of CTQ characteristics’ controls
- Secondary or outsourced operations
All processes must have a control plan that defines all methods used for process control and complies with the customer-specified requirements. The control plan must clearly state each step in the process; the specification & all Critical to Quality (CTQs) must be addressed for product and process.

**Completing the Control Plan**

Completing the Control Plan is a fairly straightforward process whereby the supplier simply documents all materials and processes involved in the manufacturing process from start to finish. The process flow diagram and ballooned drawing provide inputs to the Control Plan. All CTQs identified as Process, First-Piece, or Safety Related by the supplier must be listed on the control plan form. Additionally, the supplier will list decisions that are foreseen to affect the outcome of production.

**Example of Reaction Plan**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specification</th>
<th>Class</th>
<th>Measurement system (evaluation method)</th>
<th>Sample</th>
<th>Present control method</th>
<th>Reaction plan &amp; Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>i Boss ID min.</td>
<td>24.21 ± 0.12</td>
<td>CTQ</td>
<td>Vernier</td>
<td>5 nos.</td>
<td>Each die approval</td>
<td>FPI</td>
</tr>
<tr>
<td>ii Boss ID max.</td>
<td>24.46 ± 0.12</td>
<td>CAQ</td>
<td>Vernier</td>
<td>5 nos.</td>
<td>Each die approval</td>
<td>FPI</td>
</tr>
</tbody>
</table>

A control plan should address all testing requirements, inspection and measurement that are required to make a quality product. Suppliers should also include other details they know to be vital in the process. The control plan cannot be excessively dependent on visual inspection and should target prevention techniques wherever possible. The control plan can be submitted on the Cooper Industries supplied format or any AIAG compliant format.

The control plan should be developed in stages from proto-type through production. Early planning on the control plan will usually result in a more robust process. Suppliers should develop a pre-launch control plan early in the development of a new product and submit it to their Cooper Industries representative for feedback. This will allow both the supplier and Cooper to troubleshoot and finalize the production level control plan early and avoid unexpected costs or delays. Cooper may also request that you provide specific documents required at PPAP early in the development phase and the most common ones are the PFMEA and a pre-launch Control Plan.
It is vital the control plan describes the actions required within the manufacturing process flow to ensure that all process outputs are in a state of control and that every step in the process requiring disposition has a defined “Control Method” and “Reaction Plan” outlined on the control plan. This includes all forms of testing, inspection, measurement and process setup. The “Reaction Plan” should clearly define any contingency planning that may need to be addressed during the manufacturing of the product.

Finally, the Control Plan should be a living active part of your overall quality system. Cooper Industries prefers that all suppliers develop the Control Plan methodology as part of their everyday practice and Quality system. Control plans should not be developed just for a PPAP submission and in the event of an issue will typically be requested by Cooper.

Therefore it is in the best interest of all suppliers to embrace the overall concepts that develop from implementing a robust Control Plan. Cooper Industries may also request that a specific pre-launch Control Plan be developed that minimizes the overall risk of specific product concerns during the launch phase. Unless otherwise requested the control plan for all PPAP submissions is the “production” control plan.

The control plan methodology is formally defined in the AIAG APQP guidelines. You must utilize an AIAG compliant format and Cooper has provided one in the PPAP Forms Kit.

Below is the control plan template provided in the Cooper Industries PPAP Kit.

Cooper Industries Control Plan Form
Element 9 Measurement System Analysis Studies (MSA)

Measurement system analysis (MSA) is a mathematical method of determining how much the variation within the measurement process contributes to overall process variability. MSA is used to ensure the use of the right measurement system for running production. Detail on MSA is found in the AIAG manual which defines guidelines for stability, bias, linearity, repeatability and reproducibility.

Cooper Industries requires an analysis of the capability of all measurement tools identified in the Control Plan (in process and offline gages). The requirement for Cooper Suppliers is to perform a Gage R&R study using Total Tolerance on each measurement tool. The percentage R&R should be at 10% or less.

A Gage Repeatability and Reproducibility (GR&R) Study is used to ensure that measurements used in the manufacturing process are reasonably consistent regardless of how many times they are performed, or by who they are performed. GR&R studies can be useful to suppliers in that they can identify equipment that is in need of service, or operators who may need additional training on the equipment. Below is the Cooper Industries format provided in the PPAP Tool Kit.

A GR&R must be submitted for devices measuring data on CTQs and for each measurement device on all Level 3 submissions. Guidelines for Cooper Suppliers performing GR&R are:

- Cooper requires an analysis of the capability of ALL measurement tools identified in the Control Plan. (In process and offline gages). The minimum requirement for Cooper Suppliers are:
  - A Gage R&R study using Total Tolerance on each measurement tool
    - % R&R should be at 10% or less for CTQs
    - Marginal gages (between 10% and 30%)*
    - Gages with R&R at 30% or more cannot be used

Important: Marginal Gages with 10 - 30% error need an action plan to address and improve the method of measurement.

Below is a table showing the percentage breakdown for acceptance from the study.

<table>
<thead>
<tr>
<th>GR&amp;R_{TOL}%</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10</td>
<td>Pass - Gage System is Useable</td>
</tr>
<tr>
<td>10 ≤ GR&amp;R_{TOL}% ≤ 30</td>
<td>Gage System is useable but marginal</td>
</tr>
<tr>
<td>&gt; 30</td>
<td>Fail - Gage System is Unstable</td>
</tr>
</tbody>
</table>
Completing the GR&R Multiple Worksheet

The individual completing the GR&R Multiple worksheet should fill out the data at the top of the sheet as appropriate. The Gage Type, Gage ID, Calibration Date, and Unit of Measure should be entered. “USL” and “LSL” values should be entered based on the specifications and tolerances for the feature as listed on the ballooned drawing.

This worksheet is appropriate for 2-3 operators. You must enter an operator name or id for the results to be counted.

The worksheet is also designed for two to three trials. (Two is the minimum to establish repeatability. Three is preferred.) Ten sample parts should be selected and tested to act as a reference standard.

All operators will use these same ten parts. Also, all operators will use the same gage, and the gage will be reset before each measurement is taken. If the reference standard parts have unique identifiers you can enter them into the “Part #” column. Once all the data is entered, the Disposition will reflect either “Pass”, “Marginal”, or “Fail”.

Two graphs are provided showing the performance of operator measurements. Even when a GR&R shows that your gage system is passing or useable, an examination of the graphs can aid in refining your gage system.

For instance, if one operator’s results aren’t consistent with the other two, then one or more of the operators may need retraining on the use of the gage. If all three operators show consistent deviations from mean, the reference standard part itself may be the problem.
**Element 10 Dimensional Results**

The **Dimensional Results** are documented in the “Dimensional Data Sheet” provided in the PPAP Tool Kit. The measurements on this form should correlate with your balloon drawing from Element 2.

The purpose is to show conformance to the Cooper Industries part print on dimensions and all other print requirements. Non-dimensional requirements should be addressed in the Material and Performance section of the PPAP submission. **Cooper requires a full dimensional layout of the part on all PPAP submissions except level 1 for all drawings related to the part.**

The parts used for dimensional data must be from production tooling and randomly sampled from a run at production rate. The dimensional report must address all of the following:
- All dimensions.
- All applicable notes that have variable dimensions (example: tensile test)
- Any dimensions contained on reference prints.
- Tolerances that include bonus points for Geometric Dimensioning & Tolerancing (GDT) callouts.

**Sample Requirements**

**Important: The parts measured for Element 10 should be the same parts submitted as formal samples in Element 15.**

**Single Cavity Mold**
The minimum number of parts to measure for the dimensional element is 3 parts. These must be the same 3 parts that are submitted as **Sample Parts** in Element 15. All 3 parts should be identified with the corresponding number on the part or the tag.

**Multiple Cavity Molds**
The minimum number of parts to measure for the dimensional element is 1 part from each cavity. A minimum of 1 part from each cavity should be submitted as **Sample Parts** in Element 15 and these must be the same parts measured for dimensional data. All parts should be identified with the corresponding number on the part or the tag.

**Completing the Dimensional Data Sheet**

All dimensional requirements on the ballooned drawing must be listed on the Dimensional Data Sheet. The Dimensional element **must be submitted** on the Cooper Industries Dimensional Data Sheet. If multiple pages are required to complete a full inspection, all copies of the Dimensional Data Sheet must include completed headers. When requirements are referenced at multiple locations on the
print the data must be recorded for each individual location. All callouts and notes must be included.

All sections of the Dimensional Data Sheet must be filled out completely. The **Method of Measurement** must be documented for every line item set of data. In addition, on GD&T tolerances the specification and any bonus tolerance must be added to the minimum and maximum tolerances.

**Example:** This call out would require 3 lines of separate data on the dimensional report.

1. Hole diameter (.25 ± 0.2)
2. True Hole Position (0.05 MMC on Datum A,B,C)
3. Cylindricity (0.1)

The following conditions will result in this requirement being deemed unacceptable:
1. Any requirement that is non-conforming
2. Any requirement with excessive range or variation
3. Any requirement that is too close to the proposed tolerance limits

Any of these conditions will require corrective action to be addressed and identified on the Dimensional Data Sheet. The proposed corrective action should address the cause and what will be done in response. This same issue should be addressed on the "specification deviation" sheet provided in the forms kit.
Any concerns identified in the Dimensional Data should be brought to the attention of Cooper Engineering or Quality before submitting your PPAP submission. We expect all suppliers to place the formal dispositions on each line item.

**Element 11 Material and Performance Test Results**

**Material/Performance Test Results** is a broad category for the majority of all other test results other than the dimensional results reported in the previous element. Either your own in house documents or AIAG forms may be used for test results. Cooper Industries is primarily concerned that the **material is confirmed** and the acceptable performance is demonstrated. If there is a performance requirement make sure the results of the testing are acceptable, credible and performed to the specification. Together with the Dimensional Data Sheet, this section of the submission should address a complete review of all product specifications and/or part print requirements.

**Material Test Results** should be provided in the form of a material composition report typically called a **Certificate of Analysis (COA)** from an accredited lab that confirms the material content meets a known standard. It is your responsibility as a supplier to Cooper to confirm the composition of your material for both the PPAP submission and ongoing conformance. It is also your responsibility to plan for ongoing material conformance testing and identify this as a separate requirement (line item) in your control plan. This ensures that you have a plan for continuing conformance to the material standard.

Cooper’s expectation is that you have a designated lab (internally or externally) that is capable of confirming your raw material on a periodic basis. The interval of inspection is recommended by the supplier however Cooper reserves the right to request a change in the frequency of inspection at any time throughout the life of the part to ensure quality. In addition Cooper may require submission of composition test results or other forms of material certification as part of the supplier’s standard process.

**Certificate of Compliance (COC)** is acceptable but not preferred. Cooper Industries prefers to have results in the format of Certificate of Analysis (COA). COA will show

<table>
<thead>
<tr>
<th>Chemical Analysis Results (Weight Percent)</th>
<th>Element</th>
<th>Sample PO #490082058</th>
<th>Sample PO #490095154</th>
<th>Sample Lot Not Verified</th>
<th>ASTM B85 - 03 AA 389.0 Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon</td>
<td>9.20</td>
<td>9.35</td>
<td>9.38</td>
<td>7.50 - 9.50</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>0.92</td>
<td>0.75</td>
<td>0.77</td>
<td>2.00 max.</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>3.66</td>
<td>3.75</td>
<td>3.64</td>
<td>3.00 - 4.00</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>0.16</td>
<td>0.16</td>
<td>0.16</td>
<td>0.50 max.</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.20</td>
<td>0.24</td>
<td>0.23</td>
<td>0.10 max.</td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>0.03</td>
<td>0.02</td>
<td>0.02</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td>0.50 max.</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>1.83</td>
<td>1.82</td>
<td>1.81</td>
<td>3.00 max.</td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Tin</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.35 max.</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>Remainder</td>
<td>Remainder</td>
<td>Remainder</td>
<td>Remainder</td>
<td></td>
</tr>
</tbody>
</table>

Certificate of Compliance (COC) is acceptable but not preferred. Cooper Industries prefers to have results in the format of Certificate of Analysis (COA). COA will show
actual test results to a known standard rather than simply certifying that a material meets the standard.

**Performance Test Results** should be acceptable, credible and meet the agreed upon specifications to be measured. Performance results may include data confirming any referenced specifications in the part print or specific testing required by Cooper Industries.

Cooper Industries, engineering or quality will communicate specific material, performance, and testing requirements either the in part print, reference specifications or by specific request prior to PPAP approval. **It is the responsibility of the supplier to confirm the data and format for this requirement with their Cooper Quality or Supplier Quality representative.**

**Element 12 Initial Process Study (Cpk, Ppk)**

The purpose of **initial process studies** (Cp, Cpk, Pp, Ppk) is to determine if the production process is likely to manufacture product that will meet our requirements. Initial process studies (capability) are mandatory for all CTQs.

Subgroups are the preferred method of determining Cpk in most cases. There are two primary indexes used in determining process capability. **Cpk** predicts future capability and should be used when developing new parts or revising specifications on a part. Cpk should also be used when materials, processes, manufacturing location, or equipment have significantly changed or material suppliers have changed (including Certificates of Analysis). **Ppk** indicates past performance. Use Ppk when you are a new supplier to Cooper, but have already been manufacturing a part.

Minimum requirement for capability studies is 25 subgroups containing at least 100 readings and sampled consecutively from a “significant production run.” If testing involves destructive tests of expensive parts, Cpk by Moving Range can also be allowed. **Minimum acceptable capability for all CTQs is 1.33 and 1.67 for all safety related CTQs.**

**Reporting Ppk vs. Cpk**

When asked to report a CTQ for initial process study, what must be reported is the Ppk or Cpk number derived from a study of actual production parts from a production run that are sampled randomly.

Whether Ppk or Cpk is used will depend on the reason for the PPAP submission.
(Cpk) If a supplier is submitting a PPAP for (a) a new part, (b) a part with revised specifications, (c) a part in which the materials, processes, manufacturing location, or production equipment have significantly changed, or (d) a part in which the material suppliers have changed, then the supplier will be asked to report the Cpk.

(Ppk) If the supplier (a) has already been manufacturing the specified part, but is a new supplier to Cooper Industries, or (b) is an existing supplier to Cooper Industries that has been found to have supplied a large number of nonconforming parts, then the supplier will report Ppk numbers.

Whether using Cpk or Ppk, it must be noted that where processes exist involving multi-cavity/multi-spindle tooling, the Cpk or Ppk numbers reported must reflect a survey of parts from each individual cavity or spindle, not the total output of parts from a given machine. This will help isolate non-conformances resulting from problems with individual cavities or spindles.

**Cooper Capability Forms**

Cooper Industries has provided 3 separate forms in the PPAP kit to use for capability studies. Above are the forms for Cpk, Ppk Cpk moving range.
Completing the Ppk Worksheet

Fill out the relevant information at the top of the Ppk worksheet. Remember that for safety-related features, a Cpk/Ppk greater than 1.67 is required. For functional features a Cpk/Ppk greater than 1.33 is required.

Enter the Upper Specification Limit (USL) and Lower Specification Limit (LSL) from the ballooned drawing. If you need to calculate the USL/LSL, then use the following formulas:

\[
USL = \text{Specification} + \text{Tolerance}
\]
\[
LSL = \text{Specification} - \text{Tolerance}
\]

For each item, enter the value recorded during your testing procedure. If the part being tested has a unique identifier associated with it, you can enter that identifier in the left column under “Item Number” and overwrite the default value. Once the data has been entered, the disposition will reflect whether the Ppk is “Acceptable”, or is “Rejected”. If it becomes necessary to clear the values, the user can single left-click the “Clear Test Values” button. This will clear the “USL” and “LSL” fields, the data in the “Test Data” column, and will return the “Test No.” column to its default enumeration.

After completing the Ppk worksheet, the supplier should examine the results. Even if the worksheet “Accepts” a process as in-control, the distribution of data on the histogram may indicate a process that could be improved. Ideally, the histogram should resemble a bell shaped curve, be somewhat symmetrical, and all the data points should be within the limits of the graph.

If the worksheet “Fails” the process, or the histogram shows a process that is barely in-control, the supplier should investigate factors that might be causing this to happen and run the analysis again after the issues have been resolved.

Remember that this worksheet should only be used when you are interested in “estimating” past performance.
Completing the Cpk Worksheet

The individual completing the Cpk Subgroup worksheet should fill out the data at the top of the sheet as appropriate. Then they should determine which Subgroup configuration is most appropriate for data collected and click the button next to that subgroup. Upon doing so, the table will change such that only columns and rows where data is expected to be entered will be active.

Data entered outside these columns will not be included in overall Cpk calculations. Finally, the “USL” and “LSL” should be entered. After all data is entered, be sure to save the workbook. If the subgroup being tested has a unique identifier associated with it, you can enter that identifier in the left column under “Subgroup” and overwrite the default value.

If at any time the user wishes to clear the values, they can single left-click the “Clear Data” button. This will clear the “USL” and “LSL” fields, the data in the “Test Data” column, and will return the “Subgroup” column to its default enumeration.

As with Ppk, the supplier will want to examine the results of the Cpk histogram. The Cpk histogram should resemble a bell shaped curve that is centered on the graph. Further, the Control Chart should show data randomly distributed on or about the mean or “R-Bar” line. If data shows extreme fluctuations, or cyclical patterns, it can indicate either a process that is out-of-control, or merely an incorrect sub grouping. Below is the Cpk worksheet. This worksheet should be used for the majority of capability studies unless you are estimating past performance.
Completing the Cpk Moving Range Worksheet

When using the Cpk Moving Range worksheet fill out the data at the top of the sheet as appropriate. Fill in the USL and LSL fields as appropriate. Lastly, data collected during testing is entered under the “Test Value” column. If the Subgroup being tested has a unique identifier associated with it, you can enter that identifier in the left column under “Subgroup” and overwrite the default value.

If at any time the user wishes to clear the values, they can single left-click the “Clear Data” button. This will clear the “USL” and “LSL” fields, the data in the “Test Data” column, and will return the “Subgroup” column to its default enumeration.

Interpretation of results for the Cpk Moving Range worksheet is similar to that for the Subgroups worksheet. Remember that even if the Cpk meets or exceed Cooper Industries standards, repeating patterns or extreme peaks and valleys in the Control Chart may indicate a process that is only barely in control, and may need further examination.

Below is the Cpk moving range worksheet. Remember to utilize this worksheet when you need Cpk data but the parts you are studying have high expense or involve destructive testing in order to perform the study.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Test Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

Reporting Cpk Subgroup vs. Cpk Moving Range

In most cases, Cpk numbers will be reported based on the results of the Cpk Subgroup worksheet. This worksheet gives a choice between subgroups measuring 30x2 (30 subgroups of size 2), 25x5 (25 subgroups of size 5), or 50x5 (fifty...
subgroups of size 5). Unless the supplier receives instructions otherwise, they should choose the subgroup configuration most appropriate to analyzing the data. That decision will be a balance between maximizing data points, and minimizing overall cost of testing.

For instance, if reporting Cpk involves nondestructive testing of safety related features, then the 50x5 subgroup will yield 250 data points and is therefore preferred. On the other hand, destructive testing of slightly more expensive items with only functional characteristics can be satisfactorily completed with a 30x2 subgroup (60 data points). If expense is really a concern, then the Cpk Moving Range worksheet will be more appropriate for calculating Cpk numbers.

Element 13 Qualified Laboratory Documentation

The purpose of Qualified Laboratory Documentation is to ensure that the testing for PPAP has been done by a qualified lab. If your organization is performs testing or measurement internally or externally at an outside facility then proof of Scope and accreditation is required.

Internal Labs located at the Supplier

All suppliers that have testing or measurement performed on site must provide the following in this section of the PPAP submission.

1. Record/Scope that identifies the testing to be done and it must include:
2. List of your personnel’s competency and training to perform the testing
3. List of all test equipment used in process and offline.
4. List of methods and standards used to calibrate the equipment.

External Labs located offsite from the Supplier

If you are sending out for measurement and testing you must ensure that you have an accredited lab and can provide proof of the accreditation. Cooper prefers that external labs be accredited to known lab accreditation standards such as A2LA and ISO 17025.

1. Provide a copy of the lab company’s THIRD PARTY accreditation.
2. Results must be on company letterhead and includes:
   - The name of the Lab
   - Date of testing
   - Standards used for testing have to be identified.

   Note: See below for more info on Lab accreditation standards
Hyperlink - More Information on A2LA:
A2LA The American Association for Laboratory Accreditation

Hyperlink - More information on ISO 17025:
ISO/IEC 17025:2005 - General requirements for the competence of testing and calibration laboratories

Element 14 Appearance Approval Report

This requirement is used for more ‘print’ definition when a specification or print reference does not exist. Appearance approvals can be used when a specific testing to a known standard or in defining limit samples. This requirement should always be in reference to a specific specification such as color, texture, contrast or paint.

It is not uncommon for projects that have no defined appearance requirements to develop them throughout the course of development. This could be as simple as a paint or color application that has developed into an appearance issue based on Cooper feedback or Cooper’s customer feedback. Whenever appearance related issues arise that have no defined specification it is in the best interest of both the supplier and Cooper to utilize this element and clearly define what is acceptable and what is not acceptable. When non-conformances arise appearance issues can be readily resolved when there is clear definition of acceptance.

Element 15 Sample Parts

Sample Parts are to be included and are to be the actual samples measured in the dimensional element-element 10. Sample parts should be delivered with or before the submission. Each Cooper division has a different requirement for delivering sample parts for PPAP approval.

Contact either your Supplier Quality representative or the Quality Manager at the site you are delivering parts to for clarification on who should receive the sample parts. The default quantity for all submissions is 3 parts unless requested otherwise. Sample parts must reflect the print revision, the submission data and be sampled from an actual production run.

Multicavity Parts: If the product you are providing comes from a multi-cavity tool then Cooper’s requirement is that you provide 1 part from each cavity.
Instructions for Sample Parts Identification.

A minimum of 3 samples should be included with the PPAP submission. Contact your Quality Manager or Supplier Quality Representative to determine the proper department(s) to which to address the parts. Each sample part MUST be properly tagged and identified as a PPAP sample part with information listed below. The box that ships the parts should also be clearly labeled as containing Unapproved PPAP Sample Parts in order to avoid being misplaced or inadvertently mixed with approved production parts.

Your sample parts must contain the following information listed below at a minimum or could possibly be rejected back for re-submission:

1. Identifying the part as a PPAP Sample Part
2. Include key information on the part label
3. Date of Manufacture
4. Cooper Part Number
5. Revision Level
6. Supplier Name
7. Name of Product (Optional)
8. Product Serial and Batch Number (Required if applicable)
9. Supplier Part and Type (Optional)
10. Approval markings (CL, UL, etc) where applicable
11. Quantity of Sample (Indicate Partial Shipments)
12. Procurement Contact, Purchasing Representative, etc

Element 16 Master Samples

Master Part Samples are required only when Level 5 PPAP is requested on a case by case basis. Cooper Industries requires Master Part maintenance as 1 Master part for every part number at the most recent revision level or part number. The Master Part must be Must be maintained for the life of the product.

Element 17 Checking Aids

Purpose: To provide evidence that the checking aids used to verify product exist and have been properly validated.

There are many different types of checking aids. Examples of checking aids include but are not limited to certified check fixtures, un-certified check fixtures, templates and custom gauges.
Cooper requires the following for all checking aids:

- Copy of a controlled print that documents the design of the checking aid
- If the aid confirms form or fit, there should be a third party certification
- Evidence that the checking aid has been verified as repeatable.

If a fixture is used to check physical print dimensions either in process or off line then it is a checking aid. Checking aids must be documented through a formal print and all additional verification data submitted with PPAP. You should review the design of your checking aid with Cooper prior to building the check fixture to avoid additional costs.

Checking aids must have evidence of the following submitted with the PPAP:

- Conformance to the design print
- Evidence of Repeatability in measuring the part
- GRR studies for all CTQ related features

**Element 18 Cooper Specific Requirements**

**Purpose:** To address Cooper specific requirements during PPAP submission.

Element 18 of the PPAP process is reserved for Customer Specific requirements and Cooper Industries has five designated Customer Specific requirements. Each PPAP level requires a different combination of these specific requirements. The customer specific requirements for Cooper Industries are:

- Tooling Information Form
- Packaging Form
- IQC Inspection Plan (CES sourced product only)
- Specification Deviation Form
- Supplier PPAP Checklist

*Additional documents are available on a case by case basis.*

Cooper reserves the right to request any of these at the time of PPAP submission or to request updates to these documents anytime during the life of the part. It is important for suppliers to understand each of these requirements and why they are important. We strongly recommend that you actively communicate with your Cooper Industries representative to facilitate the completion of these specific requirements prior to submitting your PPAP for approval.
Element 18a Tooling Form

**Purpose:** Document important information on all Cooper owned tools at the time of production start-up.

This requirement is mandatory for all Cooper owned tools and must be completed by the supplier prior to PPAP approval. Each division has different methods for identifying tools and tracking them over time so each supplier should verify with their purchasing representative what the Division process is for tool identification.

The **Tooling** Information form documents critical information including:

- New or Modified Tooling
- Cost Information
- Dimensional Information
- Capacity Information
- Life Expectancy
- Location of the Tool

It is critical that all information on the tooling form be filled out completely and for the supplier to take the time to photograph the requested pictures and place them into the tooling form. The tool used for production is owned by Cooper and documentation of the tool is critical for future reference and comparison. The form consists of 2 sections. The first seen below is for documenting technical information related to the tool. It is set up in a worksheet format to assist with acquiring all of the information Cooper requires to complete this document.

<table>
<thead>
<tr>
<th>Tooling Information Form</th>
<th>Cooper Tooling reference number, (if applicable) XXXXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier Name</td>
<td>PPAP Submission Level</td>
</tr>
<tr>
<td>Date</td>
<td>PPAP Due Date</td>
</tr>
<tr>
<td>Date of Tooling Change</td>
<td>Part Name</td>
</tr>
<tr>
<td>New Tooling</td>
<td>Modified Tooling</td>
</tr>
</tbody>
</table>

Complete Supplier Tooling Action Item List to ensure all items are completed.

<table>
<thead>
<tr>
<th>Tooling Action Items</th>
<th>Who</th>
<th>What</th>
<th>When</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tooling Images</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagram or Shop Layout</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool Drawings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool Cost Breakdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tooling Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool Dimensions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daylight Opening</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Press Size |     |      |      |        |
| Tool Material |     |      |      |        |
| Tool Capacity |     |      |      |        |
| Hourly      |     |      |      |        |
| Daily       |     |      |      |        |
| Annual      |     |      |      |        |
| Life Expectancy |     |      |      |        |
| Comments    |     |      |      |        |
The second portion of the tooling form requests specific pictures of the front, back and tool label required by each division.

**Element 18b Packaging Form**

**Purpose:** Approve the packaging method and material for supplied product.

Suppliers are required to provide packaging to Cooper facilities that:
- Meet all facility related requirements
- Ensures the prevention of shipping and handling defects
- Addresses any Hazmat related concern

Below is the first page of the Packaging form. The top portion is basic technical information. It is important that Cooper have a designated supplier contact identified in this section for any packaging questions. The most important part of the form is the pictures.

This portion of the form is very important and addresses the following issues:
1. Approval of the intended packaging material
2. Documentation of the intended packaging material
3. Weight and Dimensions of the finished part packaging
4. Pictures of the part, part container, dunnage and packing material
5. The final packaged product load delivered to Cooper
6. Package labeling.

The packaging form must be filled out in detail and all questions answered. It is important that there be clear pictures of the packaging in all four areas specified:
1. A picture of the part in the packaging position
2. A picture of the outside container with label
3. A picture of any dunnage for the container
4. A picture of the final unit load in the shipping configuration

**Element 18c IQC Inspection Form**

**Purpose:** To plan and record all lot inspection requirements.

This requirement is only for suppliers sourced through Cooper Industries **Asian Sourcing Center (ASC)**. The inspection plan covers all planned inspection(s) for a specific part for lot sampling and is included with all ASC submissions.
This document is only mandatory for ASC PPAP Submissions. Below is an example of an IQC document.

### Element 18d Specification Deviation Form

The **Specification Deviation Form (SD)** documents variations in products from the initial specification, and the actions of the supplier regarding those variations. There are three instances in which a Specification Deviation Form can be submitted:

1. **Existing Production Deviation:** When temporary out-of-tolerance parts or out-of-control processes are encountered during manufacturing. The SD Form will document the actions of the supplier in correcting the nonconformances.

   **Important:** Many Cooper facilities require a *temporary deviation* approval to utilize product with temporary issues or nonconformances. The SD form is used only to notify Cooper of the issue and your plan to resolve the issue. You may still be required to receive approval via a temporary deviation at the Cooper site that you supply. Contact the Quality Manager at the Cooper Site you are supplying for additional clarification on the sites requirement for temporary deviation. **Submitting an SD form to Cooper does not allow for shipment of nonconforming product.**
2. **PPAP Submission:** When documenting issues with the PPAP requirements that are either viewed as not attainable or may require a print change in order to approve the submission.  
   **Important:** It is the responsibility of the supplier to notify Cooper as early as possible in the development process of issues with part conformance to requirements. Issues that are documented only on an SD form and that have not been communicated to Cooper prior to PPAP submission will be treated as non-conformance. **Do not wait until PPAP submission to document and notify Cooper of product issues.**

3. **Request Print Changes:** When seeking a change to a part specification to accommodate manufacturing variances or any long term manufacturability issues via capability or test results.

A Specification Deviation form should be included any time a PPAP submittal is made seeking **approval of engineering changes** to a part or product. Alternatively, a Specification Deviation form should be included in a PPAP submittal as requested by Cooper Industries in response to production of nonconforming parts, or identification of out-of-control processes by a supplier. An SD must be included to get interim approval on a PPAP submission.

If the supplier wishes a review of engineering specifications to accommodate manufacturing processes or manufacturability concerns, they should fill out the top part of form (parts 1-9). Suppliers should note that if parts are greatly out of specification or tolerance, Cooper Industries will most likely not accept the nonconforming parts. If the supplier is reporting an out-of-control process or out-of-tolerance part that is to be corrected, then the supplier should list whatever corrective action they have taken or will take with Cooper’s consent.

### Specification Deviation Form

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Part No.</th>
<th>Expiration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing or Spec No.</td>
<td>Revision</td>
<td>Revision Date</td>
</tr>
<tr>
<td>Purchase order number</td>
<td>Initiated by</td>
<td>Maximum Units to be Deviated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirement Stated on Drawing or Specification</th>
<th>Actual Observed Results or Condition</th>
<th>Deviation from Specification to be Allowed</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Interim Action Status</th>
<th>Effect on Cost, Quality and/or Delivery</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Occurrence (Action Item)</th>
<th>Responsible Party</th>
<th>Due Date</th>
<th>Index</th>
</tr>
</thead>
</table>

### Element 18e Supplier Checklist

**Purpose:** To provide an organizational and communication tool for suppliers to use when completing the PPAP Submission.
The Supplier PPAP Checklist is a useful tool. It provides a reference for what elements are required by each level. It allows for assigning and delegating responsibilities for each of the elements which often originate from different areas within a supplier’s organization. And it allows for communication of issues.

Cooper Industries recommends that you utilize these documents to assist you and to show that you have done the due diligence required by the PPAP process. We recommend that as soon as your company is requested to supply a new part to Cooper Industries, that you hold a cross functional meeting to discuss, assign and target goals for completion of all the elements required. In this way you can track and delegate the requirements across your company during the development of the part. At the time of submission, the Supplier PPAP checklist allows for two additional things.

1. Confirmation that the element is included (Check the “included” box)

2. Additional comments or concerns that would not be identified on a Specification Deviation form as a non conformance but still need to be brought to the attention of Cooper. This includes areas such as packaging concerns, needed feedback from Cooper on specific issues and additional information related to areas such as testing, measurement and appearance etc..

Cooper Industries strongly encourages all suppliers to utilize this document in preparing and submitting your PPAP.
Appendix A – Definitions

A – C

Actual Production Run
The production run that PPAP data is sampled from must be conducted using production tooling, equipment, environment (including production operators), facility, cycle time, etc. It should be performed once the supplier’s process is considered ready for production.

Advanced Product Quality Planning (APQP)
APQP is a framework of procedures and techniques used to develop products in various industries. It was developed by AIAG for the automotive industry.

Automotive Industry Action Group (AIAG)
AIAG (The Automotive Industry Action Group www.aiag.org) is a group based in Southfield Michigan originally created to develop recommendations and a framework for the improvement of quality in the American Automotive Industry.

Approved Status
Approved indicates that the part or material PPAP submission has been deemed acceptable and will meet customer requirements.

Ballooned Drawings
A ballooned drawing shows the parts or assemblies in a part print with numbered “balloons” that identifies individual dimensions and requirements of the part.

Capability Index
Process capability index is a statistical measure of product or process capability. The ability of a process to produce output within specification limits. The concept of process capability only holds meaning for processes that are in a state of statistical control.

Certificate of Analysis (COA)
Certificate of Analysis (COA) normally is from an accredited lab that confirms the material content meets a known standard. Material Test Results should be provided in the form of a material composition report.

Certificate of Conformance (COC)
A certification of material/part that states the material/part meets the agreed upon specification per customer requirements.

Checking Aids
Any tool, gage or assembly equipment that verifies the physical or performance requirements of a part for the customer.
Control Plan
The Control Plan follows the PFMEA and Process Flow steps, and provides step by step details on how the process is controlled to product specification and how to respond to potential issues in the event of non-conformances.

C - E

Cp
This is the capability index which is defined as the tolerance width divided by the process capability, irrespective of process centering.

Cpk
Cpk is an index that measures “process capability” and also accounts for process centering. It “estimates” the capability that could be achieved over time assuming a stable process. It looks at how close a process is running to its specification limits, relative to the natural variability of the process. The larger the index, the less likely it is that any item will be outside the specs. It uses a population estimator to calculate the standard deviation and therefore “estimates” what the process is capable of producing in the future. Cp measures straightforward process capability and Cpk measures process capability as well as how close you are to your target and how consistent you are around your average performance. Cpk should at a minimum be 1.33 or higher, 1.67 on CTQ requirements. It should be used in the short term for estimating whether a process is capable of meeting customer requirements in the future.

Critical To Quality (CTQ)
CTQ is the key measurable characteristic(s) of a product or process whose performance standards or specification limits must be met in order to satisfy the customer. These are typically the most important characteristics of the part design. Each Cooper division defines CTQ differently. (See Appendix B)

Design Failure Mode Effects Analysis (DFMEA)
DFMEA is the application of the Failure Mode and Effects Analysis method specifically to product design. It is an analytical method performed cross-functionally and used in engineering to document and explore the ways that a product design might fail in real-world use.

Design Record
A copy of the drawing or related specifications. If the customer is design responsible this is a copy of customer drawing that is sent together with the Purchase Order (PO). If supplier is design responsible this is a released drawing in supplier's release system. Electronic parts often have several components of the “design record” including part prints, gerber files and other related specifications.
Detection Rating
The rating scale utilized in FMEA to evaluate the ability of the current design or process control to actually “detect” a failure mode based on the assessed testing method and the quality of evidence.

Dimensional Results
A list of all dimensions or requirements identified on the ballooned drawing and control plan. This list shows the product characteristics, specifications, measurement results, measurement method or final disposition.

Electronic Submission
Electronic submission is the sending of files and the final PPAP submission electronically to Cooper. Each division has a preferred method.

Elements
The 18 sections listed in the PPAP submission requirements. The elements of PPAP submission depends on the required submission level.

Engineering Change Notice (ECN)
A customer approved document that shows the detailed description of the change.

Existing Part
A part currently made from a supplier used at a Cooper facility in production.

G - O

Gage R&R
Gauge R&R measures the amount of variability induced in measurements that comes from the measurement system itself and compares it to the total variability observed to determine the viability of the measurement system. A Gage R&R study is used to determine the repeatability and reproducibility of a specific gage or measurement device.

Geometric Dimensioning and Tolerancing (GD&T)
Geometric dimensioning and tolerancing is used to define the nominal geometry of parts and assemblies, to define the allowable variation in form and possibly size of individual features, and to define the allowable variation between features.

Initial Process Studies
The purpose of initial process studies (CpK, Ppk) is to determine if the production process is likely to manufacture product that will meet our requirements.

Interim Status
Interim approval permits shipment of material for production requirements on a limited time or piece quantity basis.
Levels
Determine which of the 18 elements are required at the time of submission. Level 3 is the default submission unless you have prior agreement with Cooper.

Master Samples
A sample signed off by customer and supplier that are used to train operators on subjective inspections such as visual or for noise. It documents the current revision level of the product being manufactured.

Material Test Results
Specific requirements defined by Cooper that validates the design verification plan and report and summarizes appropriate performance and functional test results.

Measurement System Analysis (MSA)
MSA usually contains the Gage R&R for the critical or high impact characteristics, and a confirmation that gauges used to measure these characteristics are calibrated.

New Part
A part made from an approved, new or changed drawing that the current part number or revision level has not been used in mass production.

Occurrence Rating
The rating scale utilized in FMEA that estimates how many times a potential failure may occur.

Ongoing Requirements
Cooper’s supplier requirement to continually monitor product quality and the right to request any information or data that confirms conformance of product. It is the responsibility of the supplier to ensure that adequate proof of ongoing conformance is performed and is available.

P – S

Part Submission Warrant (PSW)
This is the form that summarizes the whole PPAP package. This form shows the reason for submission (design change, annual revalidation, etc) and the level of documents submitted to the customer. If there are any deviations the supplier should note on the warrant or inform the customer that PPAP cannot be submitted.

Performance Test Results
Performance Test Results covers all tests for a product, part or product materials when performance or functional requirements are specified by the design record, control plan or customer request.
Production Part Approval Process (PPAP)
PPAP is used to establish confidence in component suppliers and their production processes, by demonstrating that all customer engineering design records and specification requirements are properly understood by the supplier. It validates that the process has the potential to produce product consistently meeting these requirements during an actual production run at the quoted production rate.

Pp
This is the *performance* index which is defined as the process width divided by the process performance, irrespective of process centering.

Ppk
Ppk is an index (a simple number) that measures actual “process performance” or whether the sample that you have generated from the process is capable of meeting customer requirements. Ppk estimates total standard deviation by using individual values and it tells you how the process has performed in the past. Pp measures straightforward process performance and Ppk measures both process performance and how close you are to the target value. It differs from process capability (Cp Cpk) in that process performance only applies to a specific batch of material. It should be used only for measuring the capability of past performance over the long term when identifying issues and determining future improvement.

Process Failure Mode Effects Analysis (PFMEA)
The PFMEA follows the Process Flow steps and identifies potential modes of failure during the fabrication and assembly of each component. The PFMEA is a living document that serves to continuously address and reduce the potential of failure and non-conforming product.

Process Flow Diagram
Process Flow Diagram is a process map in the form of a flow chart that outlines all steps in the production process, including incoming components. In PPAP, it should focus on the manufacturing process, including rework and repair.

Rejected Status
Used when a PPAP is determined to be unacceptable at the current part number or revision level and typically requires re-submission for approval.

Risk Priority Number (RPN)
During an FMEA activity and after ranking the severity (S), occurrence (O) and detection (D) an *RPN number* can be easily calculated by multiplying these 3 numbers together: RPN = Severity (S) x Occurrence (O) x Detection (D)

RPN Threshold
An RPN threshold is a specific number chosen as the point when action on a failure mode is required. For example, if you have an RPN threshold of 50, then any failure mode with an RPN value higher then 50 would require action on the right hand side
of the FMEA form. Cooper discourages against using arbitrary RPN thresholds and encourages suppliers to improve the top 20%-30% of the highest RPN values generated during the FMEA exercise.

S - T

Sample Parts
Sample parts are the parts delivered with the PPAP submission and should be the same parts measured in the dimensional report. The default quantity is 3 parts for all submissions unless there is a multi-cavity mold. For multi-cavity molded parts suppliers need to provide 1 part per cavity.

Severity Rating
The rating scale utilized in FMEA to determine and estimate the “severity” of the failure modes based on the functional requirements and their effects.

Specification Deviation
Document used to advise Cooper of nonconformance(s) on a PPAP submission, and supplier requested corrective actions or suggestions.

Supplier Change Request (SCR)
This document is used for initiating all supplier changes through all Cooper divisions. The SCR should not be used to suggest or initiate print related or temporary changes.

Tooling
It is defined as the portion of process machinery which is specific to component or sub-assembly. Tooling is used in process machinery to transform raw material into a finished part or assembly. All Cooper owned tooling must have a tooling form submitted with the PPAP submission.

Total Tolerance
In GR&R, the total tolerance calculation for overall Gage R&R % is the preferred method instead of Total Variation.
Appendix B – Critical to Quality Characteristics (CTQ)

**Critical Dimensions and Gage Checkpoints**

- **C** Identifies features as CTQ on specifications or ballooned drawing. Supplier then determines if CTQ belongs to one of the three following categories:

  **Process**
  - Features that may vary during production are marked as Process CTQs. A GR&R Study and Process Capability Analysis will likely be required on all Process CTQs.

  **First-Piece**
  - Features that if verified at job start and job end will assure production to specification are considered First Piece CTQs.

  **Safety Related**
  - Features that affect the safe handling or operation of the part are considered Safety CTQs. All safety CTQs will require a Process Capability Analysis, and Cpk/Ppk indices must all be 1.67 or greater.

---

**COOPER Lightning**

- A critical **PART** requirement specified on a controlling document (typically an engineering drawing or specification)

- A critical **PROCESS** requirement identified by Customer or Supplier.

- Directly represents the safety, regulatory, or primary functional performance requirements by the end customer or business

- Requires verification of part conformance during first production.

- Requires documented evidence of *process control* to maintain part conformance through the life of the product

- **Each CTQ shall be indicated by a stop sign (octagon) symbol**
  - The “n” inside the octagon refers to sequential number that will be inserted based on how many CTQs are placed on the print
For the remaining Cooper Industries Divisions you should contact either your immediate Cooper Quality or Supplier Quality representative for information or questions regarding Critical to Quality Characteristics (CTQ).
Appendix C – Revision History

- Rev 1.0 – DRAFT- Initial Draft August 2008
- Rev 2.0 – DRAFT September 3, 2008
- Rev 3.0 – DRAFT November 14, 2008
- Rev 5.0 - Draft – peer feedback and definitions January 20, 2009
- Rev 6.0 – Final Draft and release February 1, 2009