INVESTIGATION OF PRODUCTION PART APPROVAL PROCESS AND INNOVATION OF DIFFERENT COMPOSITION IN CAST IRON MOUNTING FLANGE AND COMPARE

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Abstract

Effective June 1,2006, PPAP Fourth Edition replaces PPAP Third Edition, unless otherwise specified by your customer.

Production Part Approval Process (PPAP) is updated to the 4th edition to incorporate the customer focused process approach associated with ISO/TS 16949:2002 and other changes listed below to update requirements.

PPAP purpose continues to be to provide the evidence that all customer engineering design record and specification requirements are properly understood by the organization and that the manufacturing process has the potential to produce product consistently meeting these requirements during an actual production run at the quoted production rate.
PPAP 4th Edition includes the following changes:

. Aligning the order of the PPAP requirements with the automotive product developme

. Relocation of Customer Specific Instructions to appropriate websites, (e.g. OEM and IAOB,www.iaob.org) to provide current requirements

. Update of Truck OEM requirements and moved to Appendix H

. Revised PSW (part Submission Warrant) to:
. Provide a more logical flow for the part / design description fields
. Make the suppliers address field applicable to international location
. Include imds material reporting to indicate reporting status
. Update specific ppap requriment
Materials reporting and polymeric identification requirement in the design record.
. Process capability index (cp.cpk)

PPAP refers to the following reference manuals: Advanced Product Quality Planning & Control Plan, Potential Failure Modes and Effects Analysis, Measurement System Analysis, and Statistical Process Control. These manuals are authored by DaimlerChrysler Corporation, Ford Motor Company, and General Motors Corporation and are available through the Automotive Industry . Action Group (AIAG) at www.aiag.org.

The Supplier Quality Requirements Task Force gratefully acknowledges the contributions of the many individuals and their respective companies that participated in the revision process

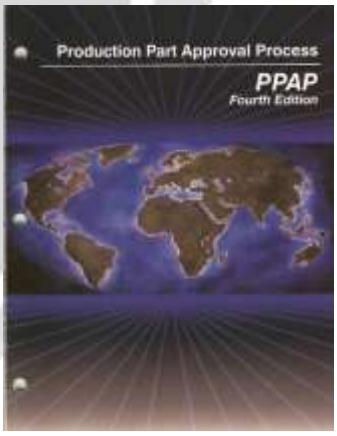
Introduction

Modern companies have been focused on producing own final products and have been decided to buy all components from suppliers. There are often many different supplier firms, from big, well-known listed companies to small family firms with a couple of employees. To ensure the high quality of the final product the buyer companies have to be sure that all components are following the quality requirements and expectations. The purpose of this paper is to test and analyze Production Part Approval Process (PPAP) as a tool to build quality into the new product and processes and ensure that the product meets the customer expectations. The purpose is to test the usability of PPAP to ensure that the supplier has understood what is expected from component, reduce quality defects inproductionlinesbypreventingthemanddoingthingsrightatthefirsttime.

This article includes four parts. The first part is introducing part including the description of the study, targets and backgrounds and research question. The second part includes a theoretical framework of PPAP, quality management and new product development processes in the form of literature review. The third part includes an empirical part of this study in which a case study related to PPAP and its effects to new product development (NPD) is described. In the case study we have tested PPAP with three suppliers from three different kinds of component fields, and the results are summazied anddiscussed.
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.



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 PPAP 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. 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 12months
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.

3. Experimental procedure and PPAP methodology

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
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
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

Method Levels

Method 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

Method 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

3 DISCUSSION AND CONCLUSIONS

The process of successful NPD requires much skill and disciplines. There are lots of different reasons why NPD is so challenging for an NPD team. New product development and innovations are one of the most profitable ways for a company to get a stronger place at the market, create better possibilities for further product development, growth, compete in markets and find new market areas and make an impact to the customers. There are many factors that make product development challenging and more complicated. A changing environment, changing customers' preferences, multiple choices, time winning product the company has to create something new which differs from the competitive products and brings special and unique benefits to the users. Finding new ideas and solutions has its effects to the quality level and that extends also to the suppliers' processes. New product development and quality management go hand in hand representing a commitment to better order. Product development is born from innovation creating new products and services. New product or service generates instability of the process and variation of the quality during ramp up- and learning phase.

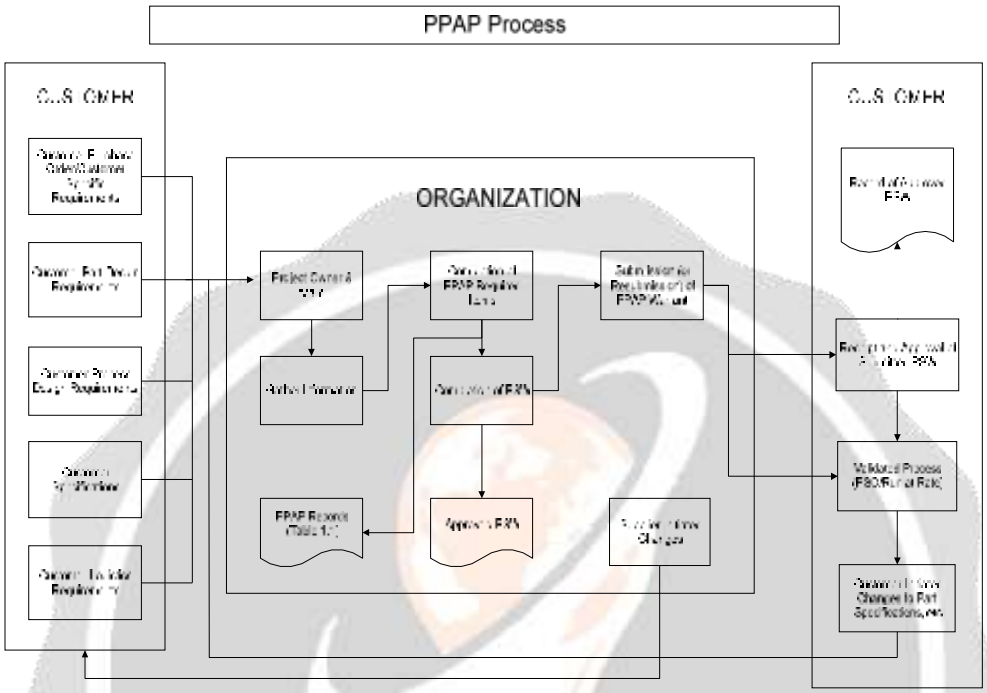
Quality activities in production ensure the faultlessness of the products or services and the expected functions of the processes. Quality management has changed from the characteristic of the product or service to one of the biggest success factors of the organization. It is important to build the quality into the processes and product and create meters metrics to measure it. In addition to its theoretical contribution to new product development and quality management literature, this paper offers several implications for those responsible for managing quality in new product development method.

PFMEA, Control plan and MSA are the most important steps in the PPAP. A Process Failure Mode and Effects Analysis (PFMEA) follow the process flow steps and indicate possible implications during the manufacture and assembly of each component. The control plan provides more details on how the "potential issues" are checked during the whole manufacturing process. The measurement system analysis study (MSA) is a specially designed experiment and its purpose is to identify the variation of the components in the measurement. The common tools and techniques of MSA are usually selected and determined by the characteristics of the measurement system itself. Production can be started and ramped up to the required production level after an approved verification. When starting production, it must be ensured, that all documents (such as working instructions) are up-to-date, all personnel have the required training and all the needed capacity is available (human and machine capacity).

The deployment of the PPAP in case company requires the checking of new product development processes. The most important things are to follow decided process steps and include suppliers in the process if possible. Also documentations and drawing needs to be on better level and include critical metrics and parameters. New product development would be more effective and PPAP possible to get through. This supports the elimination of defects in the beginning of the production rate. The PPAP ensures also that the process produces sufficient quality. The content of the PPAP is defined during the component's proto state. The target is that the product requirements are understood and the process is effective enough.

PPAP will be started when there exists a prototype of the product. Product development responsible and quality engineer will define the level of the PPAP and what kinds of documents are required. It is depending on supplier what kind of elements are required. There may be a big listed company which processes and quality assurance is on a good level and only a few stages of PPAP are necessary. There can also be a small family company and in that case a heavy and broad PPAP is impossible to carry through because of lack of resources. When PPAP is carried through the product is ready for mass production. The purpose of PPAP is to continuously develop quality level, actions and processes and to ensure the capability of new products and processes.

Figure 2 – PPAP (AIAG, 2006)



RESULTS

The purpose of this paper was to test and analyze Production Part Approval Process as a tool to build quality into the new product and processes and ensure that it meets the customer expectations. The purpose was to find out if PPAP is capable tool to ensure that the New product development engineers and managers found that PPAP enabled them to better understand the customers. In turn, PPAP enabled the new product development department to demonstrate commitment and support to their new product development process. Product development departments work often separately from others and there are many peoples in other departments who don't know what he new product design doing.

What was valued about this study was the manner in which the stakeholders could use to facilitate a sense of partnerships or co-workers aiming the same goals rather than have a traditional customer-seller relationship. While this study offers new insights into the quality management of new product development processestherearеanumberoflimitations.Thestudyonlycoversthreemedium

sized companies making generalization a little bit difficult.

Future scope: further study may wish to consider other tools for developing quality in new product development processes and compare those to PPAP as a tool.

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