



Fastener Engineering News You Can Use

# FASTENER FORUM

ISSUE 3 | MAY 2021



# PPAP

PRODUCTION    PART    APPROVAL    PROCESS

Customer Quality Assurance Requirements  
& Getting the Most Out of Your  
Manufacturing/Distribution Partner

## Engineering & Testing Center

### Product Development Support from Concept through Production

Find out why our experienced  
Application Engineers are relied on for  
cost-effective design support and data analysis.  
We are here to assist you!

## "Our company needs a Level 3 PPAP with that order"

Any fastener supplier will tell you that PPAP (Production Part Approval Process) submissions are a common request in the automotive fastener supply world and have become increasingly common in many other industries. However, do end users really understand what a PPAP request entails and how to weigh the value of the request against the expense, time, and resources of providing the submission? Let's take a moment to discuss that here.



A PPAP is an automotive industry standard developed to ensure engineering design and product specification requirements are met and a change control process is in place. PPAP requirements are defined in the Automotive Industry Action Group (AIAG) PPAP manual. The PPAP manual defines the 18 required elements of a PPAP submission package (customers/suppliers may agree to waive the requirements for a particular element).

Elements include:

- 1) Design Documentation – such as component drawings, purchase orders, specifications
- 2) Engineering Change Documentation
- 3) Customer Engineering Approval – if required by the customer in advance of the PPAP
- 4) Design Failure Mode Effects Analysis (DFMEA) – many fastener manufacturers will maintain DFMEA documents for fastener commodity families of parts
- 5) Process Flow Diagram
- 6) Process Failure Mode Effects Analysis (PFMEA)
- 7) Control Plan
- 8) Measurement Systems Analysis
- 9) Dimensional Results
- 10) Records of Material/Performance Tests –



Includes Design Verification Plan Report (DVP&R)

- 11) Initial Process Studies – if required for any critical characteristics
- 12) Qualified Laboratory Documentation
- 13) Appearance Approval Report- Not usually applicable to fasteners
- 14) Sample Production Parts
- 15) Master Sample
- 16) Checking Aids – List of all tools used to inspect and test products
- 17) Customer Specific Requirements
- 18) Part Submission Warrant (PSW) –Summary of submission and supplier/customer authorizations

The PPAP Level describes the documentation expectations of the customer, **but the supplier's responsibility is to satisfy the required PPAP elements regardless of the level of documentation requested.**

- Level 1 – Part Submission Warrant (PSW) only submitted to the customer
- Level 2 – PSW with product samples and limited supporting data
- Level 3 – PSW with product samples and complete supporting data
- Level 4 – PSW and other requirements as defined by the customer
- Level 5 – PSW with product samples and complete supporting data available for review at the supplier's manufacturing location

It is important to maintain a consistent process when producing a product and this can be achieved without all the required documentation of a PPAP. In today's supply environment, third party certification to IATF 16949 and/or ISO 9001 Quality Management System is a must for most reputable suppliers. These certifications ensure that processes and procedures are well documented to ensure customer requirements are defined and the company is able to meet the requirements. These systems are also audited internally and by third parties on a regular basis.



## Are there more cost effective options that meet the intent of a PPAP?

In some cases, collecting/reviewing/refining the documentation for a PPAP can add thousands of dollars in burden for suppliers, which ultimately affects the price of the part. For standard items in non-critical applications, end-users can make a substantial impact on supplier efficiency if a basic sample submission is performed vs. a full AIAG PPAP. "Basic" means the submission includes only the PPAP elements directly tied to the product: dimensional results, material certifications, finish, and performance test results (as applicable). This type of submission has been referred to as an Initial Sample Inspection Report or First Article Report. Little value is lost as the PPAP elements verifying supplier processes should already be in place based on the supplier's quality management system.

## Is a PPAP really necessary for all parts?

This is the key question. Surely there are parts and applications that require more scrutiny than others. It would make sense that quality documentation requirements reflect this and supplier time and energies are freed up. This way, suppliers spend less time verifying the requirements of a blind rivet securing a metal label, for example, and more time scrutinizing critical fasteners such as wheel bolts and connecting rod bolts.

During design reviews, give consideration to limiting PPAP requests to fastened assemblies with high priority. Your suppliers will thank you for it!

**We are available to assist in creating fastener quality verification requirements for your applications.**



## Spotlight on Case Hardened Thread Rolling Screws and changes coming to ASME B18.6.3 & SAE J1237

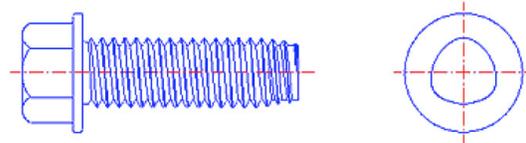
Just make mention of the term, “Hydrogen Embrittlement (HE)” to folks in the fastener industry and you will see eyebrows raise and then furrow. It is a phrase that evokes images of catastrophic failure and costly lawsuits. Fear of HE can lead to escalating costs due to extreme caution in processing product to avoid risk. Rest assured, the Fastener Committees at organizations such as ASME, SAE, ASTM, and ISO do seek out ways to improve fastener standards to minimize risks while keeping an eye out for excessive cost based on fear instead of fact.



Fastener Committees at SAE and ASME have recently drawn attention to the processing requirements for case hardened tapping and thread rolling screws covered in ASME B18.6.3 and SAE J1237. Product requirement revisions that are being considered include the following:

- 1) A reduction in the maximum core hardness allowed from HRC 28-38 to HRC 28 – 36.
- 2) Addition of language to consider the heat treat and HE test requirements for tapping and thread rolling screws that are part of a screw and washer assembly.

Item 1 revisions are based on industry research\* that identified that case hardened screws were not inherently susceptible to HE as long as the core hardness was kept below the level at which the screw is prone to HE fracture. The studies confirmed that while embrittlement cracks may form in the hardened case, the cracks did not propagate through the core if the core hardness is properly controlled.



Item 2 revisions, requested by engineers at General Fasteners, addresses the special heat treat and test considerations when a washer is assembled to the case hardened screw. Preferably, the washer is rolled on the screw after it is heat treated or the washer is masked from the carburizing atmosphere prior to heat treat. This is to keep thinner washer sections from becoming prone to brittle fracture due to a lack of a ductile core.

These HE mitigation efforts via consensus standards illustrate this fact: threaded fasteners, first conceived in 400 B.C., are still vital to humankind and continue to evolve through continuous improvement and attention!

\*Mecalf, J.S., Thomas, B.G., and Brahimi, S.V., “Hydrogen Embrittlement Susceptibility of Case Hardened Steel Fasteners,” SAE Technical Paper 2018-01-1240, 2018, doi:10.4271/2018-01-1240

**Contact our Engineering & Testing Center for support on any fastened assembly**

Contact your Applications Engineer,

Click on this email link: [gfengineer@genfast.com](mailto:gfengineer@genfast.com) or Call: 248-307-0565