

PPAP – Pre Production Part Approval Process

What Is it and Why Do I Need to Do One?

By Jeff Spira

The pre-production part approval process (PPAP) is a new requirement being flowed down by many industrial customers to their component and process service suppliers. The Automotive Industry Action Group (AIAG) originated this requirement in the automobile industry in their original QS-9000, the automotive version of the ISO-9000 quality system. While the QS-9000 system is now obsolete, replaced by the new ISO/TS 16949, the requirement for doing a PPAP remains. Other industries have grasped these concepts and this requirement is growing ever larger spanning many industries not previously concerned with such formalities. Many suppliers being suddenly required to comply with these new requirements are often baffled by the vast array of paperwork they suddenly have to confront. In truth the PPAP is not as dizzying as it might seem and in many ways offers substantial benefits to the company facing the preparation of one.

A PPAP is simply a series of analyses of various aspects of a production manufacturing process. Prior to beginning production, the supplier needs to prove out his processes and procedures, on actual production tooling. The PPAP is simply a way of reporting the results of this process testing to the customer so they know the supplier has the ability to fulfil the production at the quality level required by the customer. It also demonstrates the recovery techniques to be used in the event non-complying materials are discovered during the production run. This allows the supplier to approach a zero defect quality level in his shipments. The author has created such robust manufacturing systems and procedures to produce assemblies used in critical automotive applications that have maintained a zero defect level at production levels of multi millions of assemblies per year over spans of several years.

The PPAP begins with the quality-planning phase of the production. This starts with a Process Flow Diagram that outlines each step in the process from the time the raw materials arrive, until the completed parts are shipped out to the customer. Any event in the plant from the storage and moving steps, to the processes applied, to the inspections performed are identified and listed in this simple, sequential diagram. Any quality procedures or specific work instructions, if required, are identified in the steps where they may be needed.

From the Process Flow Diagram, a Process Failure Mode and Effects Analysis (PFMEA) is derived. This simply takes each of the production tasks and looks at what can go wrong, how severe the results will be if it goes wrong, and what can be done to minimize those risks.

Using the Process Flow Diagram and PFMEA, a Control Plan can be drawn up that encompasses each phase of the production, how it will be controlled, and probably most importantly, how you will react in the event any out-of-compliance parts are discovered. It also lists the production equipment and tooling, the inspection tools, and other facilities needed to produce a zero defect part.

The control plan is the heart of the PPAP, and should be a document used extensively in your own shop when performing the production processes. Everyone who handles the part and has anything to do with the production should be familiar with this document, able to read it, and to recognize that it is the governing document in how the product is produced. In the event the customer audits your manufacture of processing, they will undoubtedly ask for the control plan and then ask to see each of its steps being performed.

To ensure that the inspection methods as identified on the control plan are repeatable and reproducible, an analysis of the gauges is performed. This is called a Gauge Repeatability and Reproducibility Analysis, or Gauge R&R for short. It requires three inspectors performing inspections of the characteristics that gauge will be used to inspect, on 10 parts three separate times. These results are inserted into a straightforward statistical formula and a numerical evaluation of the capability of that gauge is determined. This is repeated for each of the gauges measuring each of the characteristics identified on the control plan.

The next phase of the PPAP requires the manufacture of a sample number of parts on actual production tooling, using the same procedures, personnel, production facility, and all other aspects of the expected production run. This sampling is of some finite number, usually something like 300 pieces. These are then analyzed in several ways to ensure the production run meets all of the requirements the customer requests.

The first of these analyses is the layout inspection. Generally at least two parts from each different tooling cavity (in the case of a plastic injection molded part) or each assembly machine, each production line, oven or other piece of production machinery, is fully inspected with each characteristic identified and inspected. This is referred to as a layout inspection, and is generally accompanied with an annotated drawing identifying which characteristics were inspected.

Next a process potential study is performed where major characteristics on a certain number of these production parts, usually 30 or 50 are chosen and inspected. These are usually important fit and function characteristics. It may be an interface dimension, for instance in a machined part, or

something like a plating thickness or other characteristic deemed important by the customer. When these results are plugged into a statistical formula, a good reading of the process' capability to produce consistent production is easily determined.

Doing a PPAP is not just a task in paperwork only useful for the customer, but rather a valuable tool usable by the supplier to help identify possible trouble spots in the production ahead. It gives the supplier a chance to formally think through how they can handle future problems that may arise in production. It gives supervisors and managers a simple road map to follow to perform their production tasks. It is also a valuable training tool for employees charged with making the production.

Jeff Spira is a mechanical engineering consultant and runs <http://www.spiraengineering.com> specializing not only in design and engineering, but also in tooling, design, process design and quality system consulting.