



## Production Part Approval Process (PPAP)

### 1. Design Records [DRAWINGS]

Westport design records (Drawings) will be sent to the supplier.

**Suppliers MUST submit a ballooned copy of the Drawing that corresponds to the Dimensional, Material, and Performance Results. The Drawing MUST be the official Westport engineering released design record. The PPAP MUST meet ALL Drawing requirements to be considered for approval.**

- When the design records, e.g. CAD/CAM math data, part Drawings, specifications, are in electronic format, e.g. math data, the supplier shall produce and submit a hard copy (e.g. pictorial, GD&T sheets, Drawing, specification pages, etc.) to identify measurements taken.

### 2. Engineering Change Documents (if any) [CHANGE DOCUMENTS]

**Required only if the change was initiated by the supplier.**

This is the “Supplier Request for Drawing Change” (SRDC) for the change and the Westport approval. This record provides history for the customer on the specific reasons for the changes.

- Westport MUST be informed, via written documentation, of the supplier's plans for changes PRIOR to the actual change. This documentation must include the part numbers affected, the description of the change, the reason(s) for the change, the requested timing for the change, and the supplier representative's contact information, signature and date.
- Sufficient time MUST be given for customer review.
- Failure to follow through with this requirement places Westport at risk and will result in disciplinary action.
- The supplier shall have any authorized engineering change documents for those changes not yet recorded in the design record but incorporated in the product, part or tooling.

### 3. Customer Engineering Approval

Where specified by Westport, the organization have evidence of customer engineering approval including approval for parts, tooling, product or processes.

### 4. Design FMEA [DESIGN-POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS]

**Applicable only when the supplier has design responsibility.**

A tool used when designing a component, system, process, etc. to ensure, to the extent possible, that all potential failure modes (design related) and their associated causes/mechanisms have been considered and addressed.

- Retain at supplier facility. Must be available for Westport review at any time.

### 5. Process Flow Diagrams [PROCESS FLOW CHARTS]



This record is used to verify that the supplier has thoroughly evaluated and analyzed the total manufacturing or assembly process, from start to finish, for all possible causes of variation (i.e. machines, materials, methods, etc.) and has organized the process in such a way as to reduce or eliminate the effect these variations will have on the overall quality system.

- This document shall flow smoothly into the supplier Control Plan and FMEA. Part/Process Numbers and Process Name/Operation Descriptions should carry over and be consistent on all three documents.
- Title blocks must be complete and must reference all unique information.
- Please use one of the standard AIAG Process Flow Diagram Forms.
- In some cases Westport will allow Family Group Process Flow Diagrams (PFD's), FMEA's and Control Plan. When this is agreed upon, the supplier shall have a reference attachment for all part numbers and individual part differences of the parts in the Family Grouping.

#### 6. Process FMEA [PROCESS-POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS]

To ensure that all potential failure modes and the effects they have on a process have been considered, addressed and/or eliminated. Please note the following:

- If there are no recommended actions you must state "none" in the recommended actions column.
- Do not use "Operator Error" as a potential failure. The failure is rooted to a process or system.
- A PFMEA should be created by a team which has representation from every area of the process.
- All Special Characteristics (e.g., critical, key, significant) must be indentified/addressed on the PFMEA.
- Any issue, customer or internal, will require review/adjustment of R.P.N. numbers.
- The PFMEA is a living document that should be used and updated for the life of the product.
- In some cases Westport will allow Family Group PFD's, FMEA's and Control Plans. When this is agreed upon, the supplier shall have a reference attachment for all part numbers and individual part differences of the parts in the Family Grouping.

#### 7. Control Plan [PROCESS/PRODUCT CONTROL PLAN (CP)]

To aid in the manufacture of quality products according to customer requirements, a structured approach must be used for the design, selection, and implementation of value-added control methods for the total system. It provides a written summary description of the systems used in minimizing process and product variation.

- All Special Characteristics (e.g., critical, key, significant, etc.) must be indentified and addressed on the CP.
- The CP is a living document that should be used and updated for the life of the product.
- ANY CHANGES MADE TO THE PRODUCT CONTROL PLAN MUST HAVE "WRITTEN" WESTPORT APPROVAL AND MAY RESULT IN A RESUBMISSION OF THE PPAP.

#### 8. Measurement System Analysis Studies [GAGE R&R, BIAS, LINEARITY, & STABILITY]

The purpose of this record is to verify that the gauge (U.S. gage) or measurement system is capable of accurately assessing the quality of the parts.

- Measurement System Analysis Studies must be submitted with ALL Initial Process Studies.
- Gage R&R, Bias, Linearity, & Stability must be submitted when applicable



## Definitions:

Please reference the Measurement Systems Analysis manual. Please contact Westport to receive this as part of the Supplier Evaluation Process.

## Acceptance Criteria:

### Gage R&R:

- <10% is acceptable
- 10 to 20% may be acceptable based on importance, and
- >20% is rejectable

**Corrective action is necessary for all rejectable items.**

### SUBMIT FOR LEVEL 2 PPAP IF:

- Measurement System Analysis Studies must be included with all Initial Process Studies for ALL engineering changes that could have an effect on the Special Characteristics (e.g., critical, key, significant, etc.) that are called out on the Drawing or Control Plan. They must also be submitted if the gauge is modified for any reason. If it is unclear please contact Westport Purchasing.
- **Attribute Studies** (if applicable) will be performed on 20 parts, with two operators and two trials. To meet acceptance criteria all results from the study must "PASS".

## 9. Dimensional Results Report [DIMENSIONAL LAYOUT]

This record is used to verify that the parts meet all of the dimensional requirements called out on the Drawing and Control Plan.

- If production parts will be produced from more than one cavity, mould (U.S. mold), tool, die, pattern, or production process, the supplier shall complete a dimensional evaluation on a minimum of one part from each variation (including colour, if applicable, for certain processes) The specific cavities, moulds, line, etc. shall then be identified in the on the Part Submission Warrant (PSW) & on the Dimensional Results Report.
- All dimensions, characteristics, and specifications noted on the Drawing and Control Plan should be listed in a convenient and organized format with the **actual results** recorded.
- All records shall be submitted on the AIAG Dimensional Results Form.

## 10. Material, Performance Test Results [LAB & FUNCTIONAL RESULTS]

This record is used to verify that the parts meet all of the Material and/or Performance requirements/specifications called out on the Drawing and Control Plan.

- All dimensions, characteristics, and specifications noted on the Drawing and Control Plan should be listed in a convenient and organized format with the actual results recorded.
- Material Testing Results, Performance Testing Results, and other engineering requirements on the design record shall be less than one year old at the time of the initial submission. This data shall be updated for engineering changes that affect the original data. The supplier shall also maintain and update all testing data for each lot of material. When PPAP is requested for an



engineering change, the supplier shall submit the testing data that corresponds to the material used to for the change.

#### 11. Initial Process Study [CAPABILITY (CPK/PPK) STUDIES]

The purpose of this record is to determine if the production process will produce product that meets the Customer's requirements. This includes both the raw data (data points) and the results (e.g. CPK, PPK, CP).

- When the customer specifies special characteristics and the estimated annual usage is less than 500 pieces, the organization shall document in their Control Plan that they will either:
  1. perform 100% inspection and record the results, or
  2. conduct an initial process capability study with a minimum of 30 production pieces and maintain Statistical Process Control (SPC) control charts of the characteristics during production.
- For special characteristics that can be studied using variables data, the organization shall use one of the following techniques to study the capability of the process:
  - X-Bar and R Charts, n=5, plot minimum 6 subgroups, or
  - Individual X - Moving Range, plot minimum 30 data points
- When performing the initial process study, data shall be plotted from consecutive parts taken from the production trial run. These studies could be augmented or replaced by long term results from the same or similar process run on the same equipment with prior customer concurrence. Study data shall be submitted in a format agreed to by the customer.
- ALL Initial Process Studies must be accompanied by Measurement System Analysis Studies. Supplier MUST submit Initial Process Study for all Special Characteristics (e.g., critical, key, significant, etc.) that are called out on the Drawing or Control Plan. Studies must be submitted that are representative of each unique production process, e.g. duplicate assembly line and/or work cell, each position of a multiple cavity die, mould, tool, or pattern, etc. Westport has certain acceptance criteria for these studies:
  - SHORT TERM STUDY: MUST meet  $\geq$  to 1.67 CPK **AND**  $\geq$  to 2.00 CP
  - LONG TERM STUDY: MUST meet  $\geq$  to 1.33 CPK **AND**  $\geq$  to 2.00 CP
- If CPK falls between 1.33 and 1.67 (Short Term Study), a corrective action plan and interim revised Control Plan (normally providing for 100% inspection) must be developed by the supplier and approved by the customer prior to approval. New studies MUST be performed after corrective action is implemented and must be included in a revised PPAP submission.

#### SUBMIT FOR LEVEL 2 PPAP IF:

- Initial Process Studies must be performed for ALL engineering changes that could have an effect on the Special Characteristics (e.g., critical, key, significant, etc.) that are called out on the Drawing or Control Plan. If it is unclear please contact Westport Purchasing to liaise with Westport Engineering.

#### 12. Laboratory Scope and Accreditation or ISO 17025 CERTIFICATION

The purpose of this record is to verify that the supplier has used an Accredited Laboratory or Testing Facility to perform all Material, Functional, and Performance testing called out on the Drawing and Control Plan.

- This Record must be submitted with ALL testing data.
- This includes ALL standards and specifications called out on the Drawing and CP.



- Records must be submitted by the Laboratory that actually performed the testing.
- ISO 17025 certification must be current.

### 13. AAR [APPEARANCE APPROVAL REPORT]

#### **For Appearance Items ONLY**

Submitted with PPAP and sample parts for the customer to sign, verifying the parts meet all aesthetic criteria.

- Suppliers shall submit the Westport Appearance Approval Report for appearance items when Visual Quality Audit (VQA) required along with all checking aids (see # 16) for acceptance criteria.

### 14. Sample Parts [PPAP SAMPLES]

Sample parts are submitted for appearance and functional evaluation.

- A few of the parts used for dimensional verification shall be submitted. These shall be labelled with part number, cavity, revision, tool number, etc. and include a sample number that corresponds to the Dimensional Report. Suppliers shall submit samples that represent **each** unique cavity, mould, line, etc.
- Sample parts sent in shall be from a significant "production" run as outlined in the PPAP Manual.

### 15. Master Sample

The supplier shall retain a master sample for the same period as the production part approval records or

- until a new master sample is produced for the same customer part number for customer approval, or
- where a master sample is required by the design record, Control Plan or inspection criteria, as a reference or standard.

The master sample shall be identified as such, and shall show the Westport approval date on the sample. The supplier shall retain a master sample for each position of a multiple cavity die, mould, tool or pattern, or production process unless otherwise specified by Westport.

### 16. Checking Aids

If requested by Westport, the supplier must submit with the PPAP submission any part-specific assembly or component checking aid.

The supplier shall certify that all aspects of the checking aid agree with part dimensional requirements. The supplier shall document all released engineering design changes that have been incorporated in the checking aid at the time of submission. The supplier shall provide for preventive maintenance of any checking aids for the life of the part.

Measurement System Analysis Studies (e.g. Gage R&R, accuracy, bias, linearity, stability) shall be conducted in compliance with Westport requirements (see # 8).



## 17. Record of Compliance

The supplier shall have records of compliance to all applicable Westport specific requirements. For bulk materials, applicable Westport requirements shall be documented on the Bulk Materials Requirements Checklist.

## 18. PSW [PART SUBMISSION WARRANT]

This record is to clearly state to the Customer the reason for your submission.

Take special note of the following:

- Record part revision level to the right of the part number (Drawing revision and part revisions may be different)
- Place Process Change Notice (PCN) number on the line identified as "Additional Engineering Changes"
- Supplier must mark "yes" or "no" to meeting all Drawing Requirements and sign the PSW.
- Part weight to be expressed in kilograms to **four** digits.  
*Reminder:* Part weight is determined by an average of ten randomly selected parts.
- Identify whether the part does or does not contain Reportable or Restricted Substances
- Suppliers are encouraged to mark plastic parts with the appropriate ISO symbols to designate type of polymer & filler used in the part. Identify on the PSW ("Yes" or "No")
- The specific moulds, cavities, production processes pertaining to the PPAP shall be identified on the PSW.
- Record on the PSW the production rate at which the PPAP samples were produced.
- All checking aids used in the everyday processing of a part shall be identified on the PSW.