



# Ford Motor Company Customer-Specific Requirements

## For use with PPAP 4.0

### Scope

The US English language version of this document is the official version.  
Any translations of this document shall:

- be for reference only,
- reference the English version as the official language,
- include Ford Motor Company in the copyright statement.

Copies of this document are available from Ford Motor Company at [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html) through the Ford Supplier Portal and International Automotive Oversight Board at [www.iafglobaloversight.org](http://www.iafglobaloversight.org).

PPAP 4.0 is applicable to organizations supplying all regions within Ford Motor Company and Joint Ventures. Wherever the term "Ford" is used throughout this document, it refers to "Ford Motor Company" and its Joint Ventures.

### References

Note: unless otherwise noted, all references listed throughout these Ford Specific Requirements refer to the latest edition.

#### **References available through Automotive Industry Action Group, AIAG**

<http://www.aiag.org/>

- APQP forms disk
- CQI-9 "Special Process: Heat Treat System Assessment",
- CQI-19 AIAG Sub-tier Supplier Management Process Guideline,
- International Automotive Task Force **ISO/TS 16949**, Quality Management Systems - - Particular Requirements for the Application of ISO 9001 for automotive production and relevant service part organizations
- Chrysler, Ford Motor Company, General Motors Corp. **Advanced Product Quality Planning reference manual**
- Chrysler, Ford Motor Company, General Motors Corp. **Measurement Systems Analysis** reference manual
- DaimlerChrysler, Ford Motor Company General Motors Corp. **Production Part Approval Process (PPAP)**.
- Chrysler, Ford Motor Company, General Motors Corp. **Statistical Process Control (SPC)** reference manual.

The latest copies of **ISO/TS 16949, CQI, PPAP, SPC, MSA** and other related manuals are available from AIAG at 01-248-358-3003 and <http://www.aiag.org/>, and may be available through Adare LTD (UK) at +44 1926 818 119 and <http://www.adareinternational.com/qs>.

## References available through Ford

- Ford Engineering CAD and Drafting Standards (FECDS)  
<https://team.extsp.ford.com/sites/C3PNGMethods/C3PNGMethods.html>.
- Ford Specific CQI-9 Requirements  
[https://web.qpr.ford.com/sta/CQI-9\\_Ford\\_Specific\\_requirements.xls](https://web.qpr.ford.com/sta/CQI-9_Ford_Specific_requirements.xls)
- Ford Motor Company **FMEA Handbook**, are available on FSP Library Services (subsection FMEA) through [https://us.library.covisint.com/LibraryServices/secured?cmd=MY\\_DOCUMENTS&action=docdetails&nodeID=2112](https://us.library.covisint.com/LibraryServices/secured?cmd=MY_DOCUMENTS&action=docdetails&nodeID=2112)
- Phased PPAP Handbook, available through [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html)
- Special Process Assessments and Requirements  
[https://web.qpr.ford.com/sta/Ford\\_GTS.html](https://web.qpr.ford.com/sta/Ford_GTS.html)
- Ford Customer Specifics to ISO/TS 16949 available through Ford Supplier Portal  
<https://web.qpr.ford.com/sta/FordspecTS.pdf>

## References available through other groups such as International Standards Organization (ISO)

- ISO/IEC 17025 General Requirements for the Competence of Calibration and Testing Laboratories, available through ISO <http://www.iso.ch/iso/en/ISOOnline.frontpage> (search for "17025" in the standards search).

Some hypertext links within this document may only be accessible on FSP (Ford Supplier Portal) by organizations shipping directly to Ford Motor Company (typically Tier 1). Lower tier organizations pursuing ISO/TS 16949 registration may need to gain access to FSP (Ford Supplier Portal) through a Tier 1.

## **Ford-Specific PPAP 4.0 Requirements**

### **1 Applicability (PPAP section "Introduction")**

For software separate from the hardware – e.g., control module software, not all PPAP clauses apply. PPAP for software guidance is available on [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html) through the Ford Supplier Portal.

The "authorized customer representative" is the Supplier Technical Assistance (STA) site engineer (for both Vehicle and Powertrain) assigned to the organization site. STA engineers are identified in SIM (Supplier Improvement Metrics) on the Ford Supplier Portal for each organization manufacturing site. Internal suppliers to Ford Assembly Plants (e.g., Powertrain and Stamping Business Unit facilities) should contact their responsible approval activity.

In alignment with PPAP 4.0, an "organization" is the manufacturing site of external suppliers manufacturing production or service parts and products for Ford Motor Company. The sub-tier supplier is the manufacturing facility contracted by the organization to ship product to the organization in support of a Ford Motor Company contract. **Special situations may apply where the organization is directed by Ford to contract a particular sub-tier supplier. Please contact the Ford buyer to understand the organization responsibilities where sub-tier suppliers are directed by Ford.**

In this document, the terms "organization" and "tier 1 supplier" are interchangeable, both representing the tier 1 site manufacturing production or service parts for Ford Motor Company.

## 2 **Submission of PPAP (PPAP section 1.1)**

The organization shall submit PPAP per Ford's *Phased PPAP*, available at [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html), through the Ford Supplier Portal.

## 3 **Design Record (PPAP – section 2.2.1)**

For a Design Record to be acceptable, **the following conditions must exist:**

- **Records shall be released and authorized for production and/or service use** in the appropriate Ford design system (i.e., Production Authority level in WERS – Worldwide Engineering Release System, **Teamcenter**).
- **Supporting product data (as mastered) shall comply with the Ford Engineering CAD and Drafting Standards (FECDS) available via the Ford Supplier Portal** <https://team.extsp.ford.com/sites/C3PNGMethods/C3PNGMethods.html>
- **Design records shall be authored within corporate data repositories (i.e. WERS, Teamcenter, FordDoc) as required by Ford Product Development Engineering, and records shall fully align (i.e. WERS/CAD/drawing/Ford Purchase Order)**
- **As part of the design record and where specified by Ford PD, organizations that supply electrical components shall include current Device Transmittal information as defined by the Ford Device Transmittals Engineering Standard (via the Ford Design and Release Engineer).**

**When reviewing Design Record requirements, the drawing notes are also to be reviewed by the organization and evidence of conformance provided.**

## **Service parts requirements**

### **Packaged Service Parts**

**Packaging:** All organizations supplying service parts to North America shall comply with FCSD (Ford Customer Service Division) Packaging and Shipping requirements. The Packaging and Shipping Guidelines can be accessed at: <http://web.pkginfo.ford.com> through the Ford Supplier Portal. All other regions shall comply with local requirements; contact your regional FCSD STA engineer for details.

**Rust:** All organizations supplying service parts to North America shall comply with FCSD (Ford Customer Service Division) rust policy. The Packaging and Shipping Guidelines can be accessed at: <http://web.pkginfo.ford.com> through the Ford Supplier Portal. Organizations supplying FCSD Asia Pacific, FCSD Europe and FCSD South America shall comply with local requirements, contact your regional FCSD STA engineer for details.

**Service Kits with Packaged Chemical Components:** FCSD (Ford Customer Service Division) Package Material Specification L1794 (Labeling Instructions for Kits with Chemical/Regulated Components) will be specified on the individual service kit's packaging specification. The L1794 requires the chemical component tier 1 supplier and/or FCSD Contract Packager to develop the appropriate warning label for these products. The FIR # (FIR #: "Ford Internal Reference Number" also known as Toxicology Number) must be included on the tier 1 supplier developed warning label for the packaged chemical components, e.g. greases, lubricants, adhesives, solvents, butyl tape, etc. The L1794 label Package Material Specification can be found at: <http://web.pkginfo.ford.com/specs/specspdf/specs06/11794.pdf> through the Ford Supplier Portal.

**Dry Friction Materials:** A unique FCSD developed toxicology label or a generic toxicology label will be specified on individual dry friction service part's packaging specifications. The generic label for brake and clutch parts will be L1853. The Package Material Specification for L1853 can be found at <https://web.pkginfo.ford.com/specs/specspdf/specs06/11853.pdf> through the Ford Supplier Portal. Uniquely developed toxicology labels will have their own label number specified on the parts packaging specification.

The generic labels are used whenever a FIR # (FIR #: "Ford Internal Reference Number" also known as Toxicology Number) has not yet been established, otherwise, the unique labels will include the applicable FIR #.

### **Branding Requirements**

Organizations shall comply with the E108 Branding directive as indicated in both <https://web.purinfo.ford.com/> and the "E-3" Ford Engineering CAD and Drafting Standard (FECDS) <https://team.extsp.ford.com/sites/C3PNGMethods/C3PNGMethods.html> :

- Organizations shall utilize the **DVM-0011-19 - Parts Trademark Compliance Check sheet** via the Ford Supplier Portal <https://web.purinfo.ford.com/documents/brandprot/compcheck.xls> to verify compliance with E-108 requirements. Include the completed DVM-0011-19 form with the PPAP submission.
- Where E-108 requirements are not achieved, an approved exemption is required (request form via Ford Supplier Portal <https://web.purinfo.ford.com/>, "E-108"). Include the approved exemption number in the design record. Also include a copy of the approved exemption form with the PPAP submission.
- Where tooling is being added, refurbished or modified, branding compliance is to be included and verified to be correct. In the case where tooling is being added, existing tooling is to be reviewed for branding compliance and to be included in the quote for the incremental tooling.

### **Heat Treat Assessment for Production and Service Parts**

For heat treated parts, all processes (manufacturing, engineering, resources, etc.) associated with heat treating Ford parts at each Tier 1 and sub-tier supplier sites must be assessed using:

1. AIAG CQI-9 HTSA (Heat Treat System Assessment) and
2. Ford customer specifics to CQI-9 available through [https://web.qpr.ford.com/sta/CQI-9\\_Ford\\_Specific\\_requirements.xls](https://web.qpr.ford.com/sta/CQI-9_Ford_Specific_requirements.xls).

See Ford Specific Requirements to ISO/TS 16949 for details.

#### **4 Reporting, Identification and Marking of Materials (PPAP section 2.2.1.1)**

- Ford materials reporting requirement and compliance details are specified in Ford's Restricted Substance Materials Standard (RSMS) WSS-M99P9999-A1 via the Ford Supplier Portal (<https://fsp.portal.covisint.com/web/portal/home>).
- Acceptable evidence of materials reporting and compliance includes a Ford Materials Engineering approved materials declaration or GMIR (Global Materials Integration Reporting) <https://web.emmg.ford.com/gmir/index.cgi> approval. The organization should contact Ford Materials Engineering to determine which method of declaration is appropriate.
- The current Ford RSMS package is released each year in the "FAQ" section of IMDS, via: <http://www.mdssystem.com/> "OEM Specific Info".
- Design record requirements for **material identification and material code parts marking** shall comply with the "E-4" Ford Engineering CAD and Drafting Standard (FECDS) via the Ford Supplier Portal <https://team.extsp.ford.com/sites/C3PNGMethods/C3PNGMethods.html>

#### **5 Customer Engineering Approval (PPAP section 2.2.3)**

The organization shall obtain written Ford Product Development Engineering approval of PV (Production Validation) tests of the initial sample parts. The organization shall conduct the PV testing on parts/products which were produced during Phased PPAP Phase 0, refer to [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html)).

#### **6 Failure Mode and Effects Analysis (PPAP sections 2.2.4 and 2.2.6)**

Organizations shall meet the requirements of the Ford FMEA handbook when developing DFMEAs, and PFMEAs (available through Ford Supplier Portal Library Services, [https://us.library.covisint.com/LibraryServices/secured?cmd=MY\\_DOCUMENTS&action=docdetails&nodeID=2112](https://us.library.covisint.com/LibraryServices/secured?cmd=MY_DOCUMENTS&action=docdetails&nodeID=2112)).

### **Design FMEA**

#### **Ford PD Engineering approval of DFMEAs**

Ford Product Development Engineering authorization is required to create a single DFMEA for a family of similar parts or materials used in similar applications, environments, etc.  
Where the organization is design responsible, Design FMEA(s) require Ford Product Development Engineering approval.

### **Potential Special Characteristics**

For non-design responsible (build-to-print) tier 1 suppliers, the tier 1 supplier confirms that they have reviewed the failure modes with the responsible Ford PD engineer (or FCSD engineer where applicable) and have completed and agreed to the Potential Critical/Significant Characteristics (YCs and YSs) regardless of the location of the special controls in the supply chain (tier 1 through tier N). This is accomplished by use of the Ford Special Characteristics Communication and Agreement Form (FAF03-111-2) available through the APQP/PPAP Evidence Workbook,  
Special Characteristics are defined in the Ford FMEA Handbook.

## **Process FMEA**

### **Ford approval of PFMEAs**

For all PPAP submission levels (1, 3 and 5), Process FMEA(s) for safety and regulatory (inverted delta) component(s) require Ford Product Development Engineering (or FCSD engineering where applicable) & STA approval.

Ford reserves the right to review and approve all organization-developed PFMEAs.

### **Special Characteristic traceability for build to print organizations**

For build to print organizations, the organization shall obtain from Ford DFMEA information (including potential Critical Characteristics - YCs and potential Significant Characteristics – YSs) to develop the PFMEA and special characteristics (CC, SC, HI and OS, as appropriate). The organization shall document special characteristics on the Special Characteristics Communication and Agreement Form - SCCAF (FAF03-111-2) including where special characteristics are controlled at sub-tier suppliers, and obtain Ford approval. The SCCAF template is available through APQP/PPAP Evidence Workbook (through <https://web.qpr.ford.com/sta/APQP.html>).

This also applies to Ford-directed sub-tier suppliers without a Multi-Party Agreement.

### **Documentation of Controls for Critical Characteristics**

Both build-to-print and design responsible organizations identify in the APQP/PPAP Evidence Workbook the special controls which prevent shipment of any nonconformance to Ford specified Critical Characteristics, regardless of the location of the special controls in the supply chain (tier 1 through tier N).

This also applies to Ford-directed sub-tier suppliers without a Multi-Party Agreement.

Characteristic traceability is required from the DFMEA through the PFMEA to the Control Plan and to the process instructions. Such traceability is to be documented on the APQP/PPAP Evidence Workbook available through [https://web.qpr.ford.com/sta/APQP\\_PPAP\\_Evidence\\_Workbook.xls](https://web.qpr.ford.com/sta/APQP_PPAP_Evidence_Workbook.xls).

## **7 Control Plan (PPAP section 2.2.7)**

### **Ford approval of Control Plans**

For all PPAP submission levels (1, 3 and 5), Control plan(s) for safety and regulatory (inverted delta) component(s) require the organization cross functional team approval, and approvals by Ford Product Development Engineering & STA.

The Control Plan shall include provisions for on-going monitoring of process capability, stability and control; refer to Ford customer specifics for ISO/TS 16949, Table A.

Ford reserves the right to review and approve all organization-developed Control Plans.

**Note: Controls for all part/product (dimensional and performance) and process characteristics are to be documented in the organization's quality management system.**

## **8 Measurement Systems Analysis Studies (PPAP 2.2.8)**

Where measurement analysis studies are performed using software, the software is to be validated using standard input data sets and checked using corresponding expected output results. Example validation data sets are available on <https://web.qpr.ford.com/sta/Statistics.html> through the Ford Supplier Portal

The preferred method for calculating Gauge R&R is by using the Analysis of Variance (ANOVA) method, since the ANOVA method allows identification of the operator to part interaction, whereas the Average and

Range or Range methods do not. Refer to the AIAG published SPC manual, and the ANOVA method is available through commercial statistical software packages and the AIAG APQP forms disk. The organization shall report the number of distinct categories. All variable gauge R&R studies should have a minimum of 5 distinct categories (See Measurement Systems Analysis Reference Manual published by AIAG, refer to "ndc" in the index). **The organization shall report gauge R&R as both a percent of study variation and a percent of tolerance.**

Guidance on selection of the appropriate (rational) samples (including sample sizes) for Gauge R&R is available through [https://web.lean.ford.com/cqdc/doc/Course\\_Mats/Book\\_7.pdf](https://web.lean.ford.com/cqdc/doc/Course_Mats/Book_7.pdf) (search for "rational").

### **Guidance for acceptable Gauge R&R analysis**

For additional guidance, see the Measurement Systems Analysis and Statistical Process Control manuals from AIAG:

- a) At least one half of the averages should be outside the control limits on the average chart
- b) On the range charts, all values should be within the control limits

Note: in the special case where the manufacturing process is very capable, stable and in control (e.g. Ppk > 2.5), percent tolerance is used, the number of distinct categories is not applicable, and the values on the range chart are not always within the control limits.

For any special situations, please contact your STA site engineer.

### **Acceptability criteria for Gauge R&R**

Gauge R&R as a percent of study variation < 10% is acceptable (the parts used for the Gauge R&R study must be representative of a production run with all known sources of variation). If Gauge R&R as a percent of study variation is greater than or equal to 10%, but less than or equal to 30%, contact the STA site engineer to determine if the Gauge R&R is acceptable. If Gauge R&R as a percent of study variation > 30%, it is unacceptable and the organization shall implement a containment actions and a corrective action plan to improve measurement capability until the Gauge R&R requirements are met.

### **Number of Operators, parts and trials for Gauge R&R studies:**

As stated in Ford's ISO/TS 16949 Customer Specific Requirements

Variable gauge studies should utilize, at a minimum 10 parts, 2 operators and 3 trials.

Attribute gauge studies should utilize, at a minimum, 50 parts, 3 operators, 3 trials.

In general, the gauge R&R should use the full range of part to part variation from the process – representing all expected sources of manufacturing variation, while providing enough resolution around the upper and lower specification limits.

Where attribute gauging is used, the following section applies:

#### **Criteria for Attribute Gauge R&R Study (Measurable Characteristic)**

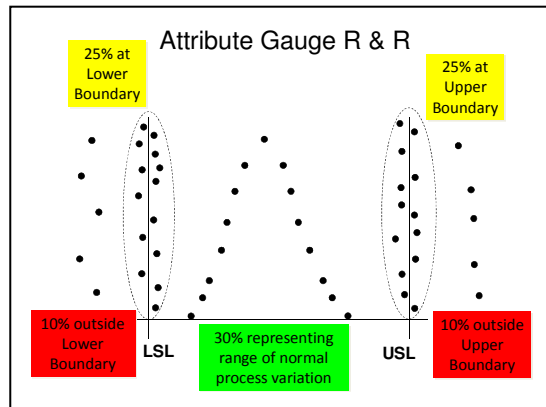
- Gauge must reject all parts that are outside the specification limits
- Rejecting good parts may be acceptable if any throughput or efficiency losses are acceptable to the team.
- All Kappa values should be greater than 0.75. Please note that if the gauge limits are less than the specification limits (Guard Banding) it may be acceptable for the Kappa values to be less than 0.75 if the reduced Kappa values are due to operators rejecting good parts. If the gauge limits are the same as the specification limits then all Kappa values (between appraiser, within appraiser, appraiser to standard) should be greater than 0.75.
- Training on Gauge R&R is available through [https://web.lean.ford.com/cqdc/doc/Course\\_Mats/Book\\_7.pdf](https://web.lean.ford.com/cqdc/doc/Course_Mats/Book_7.pdf)

#### **Parts for Attribute Gauge R&R Study**

- 25% of the parts should be near the lower specification limit (on both sides of the specification).
- 25% of the parts should be near the upper specification limit (on both sides of the specification).
- 30% of the parts should represent the expected process variation.
- 10% of the parts should be outside the upper gauge specification limit and beyond the 25% of the parts near the specification as described above.

- 10% of the parts should be outside the lower gauge specification limit and beyond the 25% of the parts near the specification as described above.

Graphic representing the data distribution for Attribute Gauge R&R



Depending on the characteristic, the above parts should be independently measured with a variable gauge (such as a CMM or other known standard) so that the physical measurement of each part is known.

Note: When measuring a true attribute that cannot be measured with a variable gauge, use other means such as experts to pre-determine which samples are good or non-conforming.

### Gauge R&R for tires

All tire tier 1 suppliers must follow the 10x10 Gauge R&R methodology for tire uniformity defined by Corporate Engineering Test Procedure CETP 04.04-E-414, Gauge R&R for Tire Uniformity at Low Speed. The results are to be reported for both the clockwise and counter clockwise directions separately. The CETP is available from the Ford tire Product Development Engineer.

Gauging must use production intent holding fixtures such that the part is held the same way as installed in the vehicle or Powertrain.

See the AIAG published Measurement Systems (MSA) Analysis manual for guidance on other MSA approaches.

### 9 Dimensional Results (PPAP section 2.2.9)

Dimensional results are to be documented on the "Prototype or Production Measurement Results" section of the APQP/PPAP Evidence Workbook, GD&T sheets, checked (ballooned) print or other method of recording the results acceptable to the STA engineer.

At least 5 parts are to be measured and individual results from all Ford specified dimensions are to be recorded. The Annual Dimensional Layout requirement (see ISO/TS 16949 customer specifics) shall be included in the Control Plan.

### 10 Material Test Results (PPAP section 2.2.10.1)

Where Ford specifies that materials are to be purchased from an approved sub-tier supplier, the organization should contact the Ford buyer to determine appropriate materials suppliers.

### 11 Initial Process Studies (General) (PPAP section 2.2.11.1)

#### Designation of characteristics for demonstration of process capability

Where the part does not have any Ford-designated special characteristics (CC, SC, or HI – see the Ford FMEA Handbook), the organization shall select part characteristics for which process capability is to be demonstrated, and include the selected characteristics in the Control Plan. The selection of these tier 1 supplier designated part characteristics is to be included in the special characteristics approval process, recorded on the SCCAF and may be identified as Characteristic classification "Other".

Where Critical Characteristics are identified in the Special Characteristics Communication and Approval form (SCCAF), the physical characteristics (e.g. dimensional or material) leading to the compliance of the Critical Characteristic are identified on the SCCAF with the control method, regardless of the point of manufacture of the Critical Characteristics in the supply chain (tier 1 through tier N). The SCCAF is available through APQP/PPAP Evidence Workbook (through <https://web.qpr.ford.com/sta/APQP.html>)

This also applies to Ford-directed sub-tier suppliers without a Multi-Party Agreement.

## Demonstration of process capability (Capability Index)

The organization shall demonstrate process capability per 2.2.11.3 of PPAP 4<sup>th</sup> Edition using the  $P_{pk}$  process capability index.

Where process capability index calculation software is used, it is to be validated using standard input data sets and checked using corresponding expected output results. Example validation data sets are available on <https://web.qpr.ford.com/sta/Statistics.html> through the Ford Supplier Portal.

Critical Characteristics require controls which prevent the shipment of non-conforming product, regardless of the location in the supply chain (tier 1 through tier N) of the manufacture of the physical characteristic(s) associated with the Critical Characteristic and are recorded in the APQP/PPAP Evidence Workbook. This also applies to Ford-directed sub-tier suppliers without a Multi-Party Agreement. Statistical process control on product characteristics without continuous manufacturing process controls is not appropriate or sufficient for Critical Characteristics.

Note: Process capability demonstration is not required for Operator Safety (OS) Special Characteristics.

## Demonstration of initial process capability (Calculation of $P_{pk}$ ) (for all Special Characteristics except Critical Characteristics)

The  $P_{pk}$  index of the initial process study must be calculated using a data set that is statistically stable, in control and normally distributed or of the expected distribution (see note 1 below). Stability, control and normality are determined using a data set of at least 25 subgroups and a subgroup size of at least 5 for a minimum of 125 measurements using rational sampling methods (see the AIAG SPC manual). Subgroups are to contain measurements from consecutive parts evenly spaced throughout the population being evaluated (minimum 300 parts).

The process capability for each special characteristic is determined using the data from the 125 piece sample. . Exceptions to the minimum number of parts are to be approved by the STA Manager.

The initial process study data set of 25 subgroups is to be developed to include the full range of expected variation of the manufacturing process (e.g., the actual manufacturing environment, including all tools, all cavities, all streams, all shifts, expected operating patterns and variation in environmental conditions.)

Note 1: If the data collected are not statistically stable, in control and normally distributed, special causes are to be eliminated and if still not normally distributed, the data should be matched to the expected distribution, such as Weibull, as appropriate, before calculation of  $P_{pk}$ . See [https://web.qpr.ford.com/sta/Expected\\_Process\\_Distributions.pdf](https://web.qpr.ford.com/sta/Expected_Process_Distributions.pdf) for a sample list of manufacturing processes and corresponding distribution types for guidance. Calculation of  $P_{pk}$  for non-normal distributions typically requires a statistical software package. Please contact your STA site engineer for guidance.

For guidance on stability and control, see the Statistical Process Control (SPC) reference manual.

Note 2: Critical Characteristics require controls which prevent shipment of any nonconforming product, regardless of the location in the supply chain (tier 1 through tier N) of the manufacture of the physical characteristic(s) associated with the Critical Characteristic.

Note 3: The subgroup size of 5 should be considered a minimum for most situations. Where a process is highly automated and part to part (within subgroup) variation is small, larger subgroups may be necessary. Please contact your STA site engineer for guidance.

Note 4: For homogeneous processes, such as extrusion, it is recommended to measure 125 parts or samples which are evenly spaced throughout the population being evaluated

Note 5: For bulk materials, process capability is typically not demonstrated, contact your STA site engineer for advice.

Note 6: The process capability requirement for both “initial process capability” (Phase 1 and Phase 2) and “final process capability” demonstration with PPAP Phase 3 is  $P_{pk} > 1.67$ .

## Demonstration of process capability for both “Initial” and “Final” Process Capability (Acceptance Criteria)

Acceptable levels:

$P_{pk}$

$\geq 1.67$



### **Demonstration of process capability (When the $P_{pk}$ data set requirements are not met)**

If part size or other factors prevent the collection of 25 subgroups covering the expected variation of the manufacturing process, the process capability is not defined and 100% inspection or mistake proofing integrated into the process is required (see section 12 below). Later demonstration of process stability and acceptable capability will remove the need for 100% inspection.

### **Inverted Delta parts**

For parts designated as inverted delta (parts with Critical Characteristics), the organization shall prevent the shipment of non-conforming product to Ford.

Note: this is typically accomplished by using error and/or mistake proofing techniques integrated into the organization's manufacturing and material handling processes.

### **Parts without inverted delta designation**

An error proof approach is recommended for all parts, not just parts designated as inverted delta.

### **Process Capability and Special Characteristic Evidence**

Process capability demonstration data and special characteristic linkage evidence are recorded on the APQP/PPAP Evidence Workbook [https://web.qpr.ford.com/sta/APQP\\_PPAP\\_Evidence\\_Workbook.xls](https://web.qpr.ford.com/sta/APQP_PPAP_Evidence_Workbook.xls) and included in the PPAP submission. **The special characteristics identified in the SCCAF (in the APQP/PPAP Evidence Workbook) must be traceable to the special characteristics controls in the Control Plan.**

**Special Characteristics and associated process control methods for Ford parts are to be approved and recorded in the SCCAF in the APQP/PPAP Evidence Workbook, regardless of the tier where the physical characteristics are being controlled (tier 1 through tier N).**

**This also applies to Ford-directed sub-tier suppliers without a Multi-Party Agreement.**

### **12 Actions to be taken when acceptance criteria are not satisfied (PPAP 2.2.11.6)**

The modified control method shall include techniques to incorporate mistake proofing methods or 100% product inspection integrated into the manufacturing process to prevent the shipment of non-compliant product to Ford facilities. Visual or statistical control methods are not permitted in this situation.

Note: examples of mistake proofing methods include the modification of manufacturing processes to detect and prevent the errors which lead to non-conforming product (e.g., poka-yoke), or a gauge to ensure product compliance to specification where the process does not meet the capability requirements. This is not the addition of a temporary manual inspection process at the end of the line.

The organization shall continue to determine sources of variation, improve the process with permanent corrective actions, and improve the process to meet the capability requirements.

#### **100% Inspection required / selected**

**Wherever a 100% inspection is used, the organization shall use the gauge error (independent of whether the Gauge R&R met the acceptance criteria) to identify modified product acceptance criteria (typically tighter tolerances and often referred to as “guard banding”) to prevent the shipment of non-conforming product to Ford Motor Company.**

### **The following are examples of measurement equipment mistake proofing methods**

#### **For Variable Gauges**

**Two sided tolerances:** Tolerances used for 100% inspection gauges can be reduced by the extent of the gauge R&R as a percent of tolerance of the gauge(s) being used in the 100% inspection methodology. The typical practice is to remove half the gauge R&R as a percent of tolerance from the upper specification limit and the other half from the lower specification limit.

Example: A variable gauge is used to check a product characteristic of 600 microns +/- 40 microns (this equates to 80 microns specification tolerance spread). Additionally, this variable gauge has a gauge R&R as a percentage of tolerance of 20%. The upper limit compensated for gauge capability would be 632 microns  $(600+40- 80 \times 0.2/2)$  (Upper Specification – (Specification tolerance spread  $\times$  (% tolerance Gauge R&R)/2)) and the lower limit compensated for gauge capability would be 568 microns  $(600-40 + 80 \times 0.2/2)$  (Lower Specification + (Specification tolerance spread  $\times$  (% tolerance Gauge R&R)/2)). This example assumes the gauge error is equally distributed. Continue process variation reduction efforts until a  $P_{pk}$  greater than 1.67 is

achieved.

**One-sided tolerances:** For a "less than" tolerance specification (e.g. length less than 20 mm) subtract three gauge R&R standard deviations from the tolerance specification. For a greater than tolerance specification (e.g. plating thickness greater than 10 microns) add three gauge R&R standard deviations to the tolerance specification.

"Greater than" example: A variable gauge is used to check the length of a product characteristic. The product specification is greater than 150 microns. The gauge R&R standard deviation is 2 microns. The specification compensated for gauge error would be greater than 156 microns ( $150 + 3 \times 2$ ) (Specification + 3 x gauge R&R standard deviation).

"Less than" example: A variable gauge is used to check the length of product characteristic. The product specification is less than 150 microns. The gauge R&R standard deviation is 2 microns. The specification compensated for gauge error would be less than 144 microns ( $150 - 3 \times 2$ ).

If business reasons exist to deviate from the recommendations listed above, contact STA to obtain concurrence.

Continue process variation reduction efforts until an acceptable process capability is achieved.

### 13 **Qualified Laboratory Documentation (PPAP 2.2.12)**

The internal or external laboratory shall be in compliance with the latest ISO/IEC 17025 (or national equivalent), however, accreditation to ISO/IEC 17025 or national equivalent is not required.

### 14 **Appearance Approval Report (AAR) (PPAP 2.2.13)**

All parts/products having appearance criteria shall be reviewed and approved by Ford Design Quality and approval recorded on the Appearance Approval Report (AAR) as specified in the Global Decorative Component Approval Process (GDCAP). The completed Appearance Approval Report (form CFG-1002) shall accompany all PSW submissions.

NOTE 1: Appearance items are: all interior, exterior, luggage compartment, and select under-hood components which are visible to the customer. AAR sign-off ensures compliance with Ford Color Harmony Requirements, including the Global Decorative Component Approval Process (GDCAP).

NOTE 2: Visual "match-to-master" is the specified requirement for AAR sign-off. Numeric evaluations should only be used for on-going statistical process control after visually acceptable parts/products are attained.

For additional information:

Visit: [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html)

"Ford Color Harmony Requirements (includes GDCAP – Global Decorative Component Approval Process and the Regional Design Quality Contact list)"

or

Write: Ford Motor Company  
Corporate Design  
Design Technical Operations-Design Quality  
Product Development Center, Mail Drop 533  
PO Box 2110  
Dearborn, MI 48124

### 15 **Part Submission Warrant (PPAP section 2.2.18 and section 5)**

See Phased PPAP [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html) available through the Ford Supplier Portal for PPAP level and PSW submission requirements.

See Table 1A below for PSW submission practices.

The organization shall include in the PPAP submission package to Ford evidence of organization approval of sub-tier part approval submissions. Ford also reserves the right to review the detailed sub-tier supplier part approval submission data for the sub-tier supplier components included in the Ford specified end item. Where Critical Characteristic controls are implemented at the sub-tier supplier, the PPAP submission package must

show evidence that the sub-tier Critical Characteristic controls are effective in preventing the shipment of non-conforming product.

### Sub-tier Supplier Advanced Product Quality Planning

- Tier 1 Suppliers to Ford must require their sub-tier suppliers to use Advanced Product Quality Planning (APQP) to plan for production part approval
- Tier 1 Suppliers to Ford must use a production part approval process for their sub-tier suppliers. The Tier 1 Suppliers shall include the approved sub-tier supplier part approval submissions with each phase of PSW submission to Ford.
- For each New Tooled End Item (NTEI), where sub-tier suppliers are used to support the manufacture of the NTEI, the organization shall:
  - Manage the sub-tier supplier readiness using the principles defined in the AIAG published Advanced Product Quality Planning (APQP) manual
  - Prioritize its sub-tier suppliers by impact on Ford and assess the sub-tier suppliers with greater impact on Ford. For sub-tier suppliers with lower impact on Ford, self-assessment may be adequate.
  - Track sub-tier supplier component readiness using APQP, in support of each applicable deliverable and expectation in Ford's APQP/PPAP Readiness Assessment (Schedule A)
  - Report sub-tier supplier component readiness to Ford in support of each deliverable in Ford's APQP/PPAP Readiness Assessment (Schedule A) throughout the Vehicle or Powertrain program
  - Include the final Schedule A with the PSW submission to Ford for each NTEI, including sub-tier supplier readiness, and retain in the PPAP record

These requirements also apply to Ford-directed sub-tier suppliers without a Multi-Party Agreement.

### Post Job 1 PPAP submissions, including Functional Trials

The organization is not to ship production quantities to the Ford facilities until after PPAP and functional trial approval or functional trial waiver are obtained from all affected Ford plants. The functional trial approval or functional trial waiver is obtained after PPAP approval, and is managed by Plant Vehicle Team (PVT at VO plants) or Local Vehicle Team (LVT) or the locally defined approver at Powertrain plants. Contact the PVT or LVT or the Powertrain plant for instructions.

For PPAP submissions during a vehicle launch, the launch builds constitute the "functional trials" and therefore provide approval to ship parts subject to plant releases.

### Family of parts on a single PSW

Organizations are permitted to submit multiple part numbers (same family of parts) on a single PSW, with prior concurrence by the STA site engineer, with all part specifics (e.g., prefix, base, suffix) clearly noted on the PSW or on an attachment to the PSW.

Tables 1A and 1B below summarize submission practices and methods for notifying the appropriate Ford system of completion of the PSW:

The organization must allow for STA approval timing (at least 1 week) ahead of the sample promise date.

### PSW submissions with service and production parts

Where the same part is being submitted for PPAP approval for production and service application (Ford Customer Service Division – FCSD) the organization enters the service part number (if different from the production part number) above the production part number in parentheses. The organization should contact FCSD STA to determine if this situation applies.

<b>PPAP Submission Warrant</b>	
	(6F2Z-14630-BAA)
Cust. Part Number	6F2T-14632-BM

## 16 Change Notification (PPAP – section 3)

Organizations contracted by Ford are required to obtain Ford approval per the Ford SREA Process (Supplier Request for Engineering Approval) prior to implementation of any organization-initiated or sub-tier supplier-

initiated change. The notification requirements of section 3 in PPAP 4.0 are met by following the SREA process; (the SREA requirements and process are available on <https://web.qpr.ford.com/sta/SREA.html>, Ford Supplier Portal).

Where the same part has a production and service application, any associated tier 1 supplier-initiated change is submitted via the production SREA process.

### **Service Part Deviation (SREA) Process**

A web based SREA tool is available via <https://web.srea.ford.com/> for parts that are not used in production and are covered by warranty.

Service-Unique parts released by FCSD Engineering (Ford Customer Service Division) and not common with production parts (e.g. components, service chemicals, etc.) or past model parts no longer used for Ford production, but still produced for service, should be processed via the FCSD Service Part Deviation SREA process found via <https://web.srea.ford.com/> or <https://web.purinfo.ford.com/> through the Ford Supplier Portal. Contact your local FCSD STA engineer for further details.

### **17 Appendix A – Completion of the Part Submission Warrant (PPAP sections 2.18 and 3)**

See Ford's Phased PPAP for instructions on PPAP and PSW submission requirements, available through [https://web.qpr.ford.com/sta/Phased\\_PPAP.html](https://web.qpr.ford.com/sta/Phased_PPAP.html), Ford Supplier Portal

### **Tool Tagging**

Customer tool tagging/numbering is not applicable to Ford internal suppliers such as Powertrain and Stamping Business Unit.

Requirements for tagging/marketing of Ford owned tooling at tier 1 supplier or sub-tier supplier locations are available through <https://web.fsp.ford.com/gtc/docs/suptooltagging.pdf>

### **18 Appendix G – Tires – Specific Requirements**

Appendix G is not applicable to organizations supplying tires to Ford Motor Company. The tire tier 1 suppliers to Ford shall meet the "Ford Motor Company - Phased PPAP Requirements for Tires" defined by Ford, available through Ford Supplier Portal [https://web.qpr.ford.com/sta/Ford\\_GTS.html](https://web.qpr.ford.com/sta/Ford_GTS.html) or the tire STA site engineer.

The Ford Tire PPAP requirements are also referenced in the current version of the "Ford Functional Specification - Tire Casing" (Ford Tire FS) that is released by Ford Product Development. All engineering requirements defined in the Ford Tire Functional Specifications must be met to comply with Tire PPAP requirements. The Ford Tire Functional Specifications are available from the Ford tire Product Development engineer.

### **19 Labeling Requirement**

Organizations supplying Ford of Europe facilities are required to affix orange labels (Form EU 3441, minimum A5 size) on all four sides of the packaging for all shipments of new or changed product to each using Ford of Europe facility.

Organizations supplying North America and Asia Pacific are required to follow local practices – contact the local MP&L (Material Planning and Logistics).

Organizations supplying FCSD North America are required to provide a sample label to FCSD North American STA's for service products. Organizations supplying FCSD Asia Pacific, FCSD Europe and FCSD South America are required to follow local practices – contact your regional FCSD STA engineer for details.

Organizations supplying FCSD North America are required to provide a copy of the part screen information from Direct Data Link (DDL) to FCSD North American STA's for service products, e.g. "GPMA" from DDL. Organizations supplying FCSD Asia Pacific, FCSD Europe and FCSD South America are required to follow local practices – contact your regional FCSD STA engineer for details.

## **Commodity Specific**

### **Internal Ford Stamping Facilities**

Internal Stamping suppliers shall meet the requirements of Ford Motor Company, Vehicle Operations' Operating Procedure VOPQUN-050, "Production Part Approval Process (PPAP) / Part Submission Warrant (PSW) Process"

Table 1A

Summary of submission practices and methods for notifying the appropriate Ford system of completion of the PSW:

PPAP Submission Level	ORGANIZATION	STA ENGINEER APPROVAL OF PPAP DATA PACKAGE	DATA ENTRY OF APPROVAL
<b>Level 1</b> DDL (Direct Data Link)	<ul style="list-style-type: none"> <li>– Prepare PPAP data package/self-approve.</li> <li>– Enter approval in Ford system.</li> <li>– Maintain the completed PPAP data package on file.</li> </ul>	Ford Signature not required. Organization self certifies.	Organization enters in Ford system.
Non-DDL	<ul style="list-style-type: none"> <li>– Prepare PPAP data package/self-approve.</li> <li>– Contact Ford STA and report PPAP data package approval status to Purchasing.</li> </ul> Maintain the completed PPAP data package on file.	Ford Signature not required. Organization self certifies.	Purchasing support function records approval, per local practice.
<b>Level 3 or 5</b> DDL (levels 2 and 4 not used)	<ul style="list-style-type: none"> <li>– Prepare PPAP data package.</li> <li>– Get STA approval on paper PSW (for priority supplier PD approval also required).</li> <li>– Enter approval in Ford system after STA (and PD for priority parts) approval of PSW and PPAP data package.</li> <li>– Maintain the completed PPAP data package on file.</li> </ul>	<ul style="list-style-type: none"> <li>– Approve PPAP data package/sign warrant</li> <li>– Return PPAP data package to organization.</li> </ul>	Organization enters approval in Ford system after STA (and PD for priority parts) approval of PPAP data package.
Non-DDL	<ul style="list-style-type: none"> <li>– Prepare PPAP data package.</li> <li>– Get STA approval on paper PSW (for priority supplier PD approval also required).</li> <li>– Maintain the completed PPAP data package on file.</li> <li>– Contact the Purchasing support function and report PPAP data package approval status.</li> </ul>	<ul style="list-style-type: none"> <li>– Approve PPAP data package/sign warrant</li> </ul> Return PPAP data package to organization	Local Practice (Purchasing support function) records approval per local practice.

Note: for DDL enabled organizations, PPAP status is submitted to Ford via the VPP (Vehicle) and MPP (Powertrain) systems.

Table 1B

Summary of submission practices and methods for notifying the appropriate Ford system of completion of the PSW:  
**See section 16 above of this document.**

**PSW SUBMISSION LOCAL PRACTICES**

Organization or STA Site Engineer will handle approved warrant per local practices below:

<b>Purchase Orders Issued in all regions (Americas, Europe and APA)</b>	
<b>Powertrain</b>	<b>Vehicle Operations</b>
<b>BOTH NON-DDL AND DDL ORGANIZATIONS:</b> <ul style="list-style-type: none"> <li>– Electronically transmit, fax or equivalent (or hand deliver to onsite PTO plant drop box) copy of the STA (and PD for priority parts) approved warrant and PPAP data packet as required to plant MP&amp;L Timing Analyst</li> <li>– Analyst records approval.</li> </ul>	<b>NON-DDL ORGANIZATIONS:</b> <ul style="list-style-type: none"> <li>– Notify Material Follow-up Analyst when PPAP data package is approved.</li> </ul> Analyst will record approval per local practice