

PROCESS CAPABILITY (SPC) — Section 4

Process Capability studies and SPC control is only required on Special Characteristics as identified in the approved Control Plan for each part number (or part family). The cross-functional team that develops the Control Plan (which includes the P&S Engineer) will determine SPC and Process Capability requirements. (See Section 1 of this manual—“Special Characteristics”—for details on Special Characteristics, their identification, the cross-functional team, and additional control options.)

SPC is to be implemented and maintained by the supplier per the AIAG *Statistical Process Control (SPC) Manual* (current edition).

Control charts must be keyed to lot traceability (i.e., cavity number, heat codes, die code, Mfg./ship dates.)

Capability reports or charts may be requested for review by Powers and Sons. All records must be retained for the last **2 years** or as per prior agreement from Powers and Sons.

The SPC and Capability Requirement may be reduced or deleted if sustained capability is demonstrated by the supplier, after mutual agreement between Powers and Sons and the supplier. This will be documented by Control Plan revision as necessary.

Process Capability Requirements

Short-term capability submissions must be **1.67Ppk** or greater for new processes or for those processes that use new tooling. Following are action items for those processes.

Short-term capability $\geq 1.67\text{Ppk}$ The supplier will maintain an on-going database as indicated above.

Short-term capability $< 1.67\text{Ppk}$ The supplier will be required to submit an action plan to achieve a short-term capability $\geq 1.67\text{Ppk}$

The next page details the interpretation and reaction to on-going process monitoring by SPC.

**Table-A - Ongoing Process and Product Monitoring
Control Chart Interpretation and Reaction**

The Control Chart indicates that the process:	ACTIONS ON THE PROCESS OUTPUT Based on Process Capability (Ppk)	
	Less than 1.33	Equal to or Greater than 1.33
Is in control	100% inspect*	Accept product Continue to reduce product variation
Has gone out of control	<div style="border: 1px solid black; padding: 5px; display: inline-block; margin-bottom: 10px;">IDENTIFY SPECIAL CAUSE</div> 100% inspect* all product since the last in-control sample	

*The organization ensures that the 100% inspection methodology prevents shipment of any non-conforming product to Ford. The 100% inspection methodology would typically include error proofing, such as a poka-yoke.

The organization ensures that Critical Characteristics (CC) have 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. The organization records the CC controls in the APQP/PPAP Evidence Workbook.

Statistical process control on product characteristics without continuous manufacturing process controls is not appropriate or sufficient for Critical Characteristics.

** Unless superseded by a P&S-approved Control Plan.

This table applies only when stability and capability have been demonstrated and special causes are rigorously identified and eliminated. Otherwise, the supplier shall implement 100% inspection. The table applies only to those product characteristics that are normally distributed.

Capability Studies

1. Studies shall be completed from a significant production run of approx 250 pieces.
2. For variable data, use 250pcs. Number the parts 1 through 250. Measure 5pcs, skip the next 5, measure the next 5 and repeat this process for capability.
For attribute data, use 125pcs. Number the parts 1 through 125. Record as pass/fail, conforms/rejected, etc. The capability study will be acceptable if all 125pcs pass inspection.
3. The Capability run must be made without changes to the process (no setups, no lot changes, no operator changes, lunch breaks, etc.)
4. Capability must be calculated by data that represents a Normal (Bell-shaped) Distribution, that is demonstrated to be stable (usually as indicated on an R-chart) and in control (usually as indicated on the X-bar chart).
5. If you find you have Non-Normal Data, determine if the process has a reason to be non-normal (for example, flatness which approaches an absolute and thus is likely to become skewed), then use a matching curve (Pearson, Log-normal, etc.). If the process does not have a reason to be non-normal, you may transform the data to a normal distribution using one of the accepted transform algorithms, but show both sets of data and remember to also transform the specification limits.
6. When you are calculating short-term capability you must have a number of 1.67 or higher. Long-term capability is expected to have a number of 1.33 or higher.
7. Capability has to be calculated on all SC's, CC's, M's K's and any other High Impact Characteristic the team determines.
8. The raw data is to be presented as part of the capability study information, so the customer can duplicate the calculations.