



Standard Practice for Machine/Process Potential Study Procedure¹

This standard is issued under the fixed designation F 1503; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the proper method for establishing process potentials for new or existing processes.

2. Referenced Documents

2.1 ASTM Standards:

F 1469 Guide for Conducting a Repeatability and Reproducibility Study on Test Equipment for Nondestructive Testing²

2.2 ASME Standard:

ASME-FAP-1 Quality Assurance Program Requirements for Fastener Manufacturers and Distributors³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *bilateral specifications*—specifications that have both upper and lower values.

3.1.2 *Pp*—an index that indicates the variability of the process with respect to tolerance.

3.1.3 *Ppk*—an index of process variability and centering. This is a widely-used index which considers the process mean, range, and its relation to the specification nominal.

3.1.4 *process parameters*—combination of people, equipment, materials, methods, and environment that produce output.

3.1.5 *unilateral specifications*—specifications that have only upper or lower values.

3.1.6 σ —an estimate of the standard deviation of a process characteristic.

4. Summary of Practices

4.1 A process potential study is conducted to provide a level of confidence in the ability of a machine/process to meet engineering specification requirements. This is accomplished through statistical process control techniques as defined in this practice.

4.2 For new equipment purchases, the purchaser's manufacturing engineering department, or equivalent discipline, shall

have primary responsibility for ensuring that the requirements of this practice are met. The purchaser's quality assurance department shall be available to assist on an as-requested basis.

4.3 New manufacturing processes will not be accepted for use in production with *Pp* values less than 1.67. If a manufacturing process must be conditionally accepted, a process improvement/product control plan must be developed.

4.3.1 The process improvement/product control plan shall identify specific process improvement activities, which will be implemented to make the process fully capable as well as an interim inspection plan to ensure that nonconforming product is not shipped to a customer.

4.4 Product Specifications:

4.4.1 Prior to any process potential study, the product specifications (nominal dimension and tolerances) must be identified, and an appropriate method of variables type inspection selected.

4.4.2 This practice is limited to bilateral specifications whose distributions can be expected to approximate a normal curve. This practice should not be applied to unilateral specifications (flatness, concentricity, minimum tensile, maximum hardness, etc.).

4.5 Gage Capability Analysis:

4.5.1 All gaging systems used to evaluate product must have documentation for a gage repeatability and reproducibility study in accordance with Guide F 1469 before the process study is conducted.

4.5.1.1 Gaging systems which consume $\leq 10\%$ of the applicable product tolerance are considered acceptable.

4.5.1.2 Gaging systems which consume over 10 to 30 % of the applicable product tolerance are generally considered to be unacceptable. However, users of this guide may authorize their use depending on factors such as the criticality of the specification in question, the cost of alternative gaging systems, and so forth.

4.5.1.3 Gaging systems which consume more than 30 % of the product tolerance are unacceptable and must be replaced.

4.5.2 All gaging systems must be certified as accurate using standards traceable to NIST.

4.6 Process Parameter Selection:

4.6.1 For studies conducted at the equipment vendor's facility, all process parameters (for example, infeed rates, coolant, dies, pressures, fixtures, etc.) must be established and documented prior to the process qualification test so the requirements of 9.5 can be met.

¹ This practice is under the jurisdiction of ASTM Committee F-16 on Fasteners and is the direct responsibility of Subcommittee F16.93 on Quality Assurance Provisions for Fasteners.

Current edition approved Aug. 15, 1995. Published October 1995. Originally published as F 1503 – 94. Last previous edition F 1503 – 94.

² *Annual Book of ASTM Standards*, Vol 15.08.

³ Available from American Society of Mechanical Engineers, 345 E. 47th Street, New York, NY 10017.