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# IPC-9191

## General Guidelines for Implementation of Statistical Process Control (SPC)

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A standard developed by IPC

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## FOREWORD

IPC-9191 is a harmonization of IPC-PC-90 and the International Organization for Standardization (ISO) SPC Guideline 11462-1. ISO 11462-1 has been adopted as the foundation for IPC-9191 and is printed in italicized type. Interpretations and supplemental SPC system requirements, as well as implementation guidelines have been harmonized and printed in normal type. Companies may adopt this document; the IPC retains full control over the content except for ISO 11462-1, of which copyright remains with the ISO.

This document is intended to provide information to support the application of process control and related statistical techniques specified in international and industry standards. The ISO 11462-1 sections were prepared by working group 8 of ISO/TC 69 SC 4.

Appendix A, Appendix B, Appendix C, and Appendix D of this guideline are for information only.

### Introduction

The guideline specified is aimed primarily at increasing production efficiency and reducing cost, by reducing variation in all processes, from design through to servicing.

This Standard extends the definition of process control to integrate the traditional definitions of statistical process control, algorithmic process control, and model-based control methods. They are different approaches with the same purpose of reducing variation in products and in processes.

This Standard also extends the definition and usage of the term parameter to apply to a process parameter or a product parameter; and to recognize that a product parameter can be either an in-process product parameter or a final-product parameter. Under specified conditions of measurement, a product parameter can be equivalent to a product characteristic.

Some considerations given in the formulations of this Standard are noted:

- (a) *Elements of Part 1 of this Standard guide an organization in how to implement an SPC system. Specific tools and techniques that experience has shown useful in applying these elements within processes are catalogued in Part 2 of this standard, in process of establishment.*
- (b) *To clarify for practitioners, in both parts - Elements of SPC (Part 1) and Tools and Techniques for Operation of These Elements (Part 2) - "should" indicates:*
  1. *Among several possibilities, one or more are recommended as being particularly suitable and effective, without mentioning or excluding others;*
  2. *A certain course of action is preferred but not necessarily required for the economic control of production from a process. In both parts, choice of language does not indicate requirements strictly to be followed in order to conform to a standard and from which no deviation is permitted.*

**Note:** See Appendix D for a detailed explanation of the importance of the distinctions between the three types of parameters and their relationship with characteristics.

At the time of publication of IPC-9191, ISO 11462-1 parts 1 and 2 are in their final stages of draft. The IPC SPC Subcommittee will monitor the progress made toward finalization of those documents and incorporate changes as required.

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# General Guidelines for Implementation of Statistical Process Control (SPC)

## 1 SCOPE

This guideline describes the general provisions for implementation of SPC and is intended for use by individuals in electronics and other industries involved in the planning, implementation, and evaluation of an SPC system. This guideline outlines SPC philosophy, implementation strategies, tools, and techniques. These may be applied in different sequences depending on the specific company, operation, or variable under consideration. These tools are also used for relating process control and capability to final product requirements.

This document represents the second revision to the IPC Statistical Process Control (SPC) Standard. This revision reflects the principals of SPC represented by the International Organization for Standardization (ISO) Statistical Methods Technical Committee.

**NOTE:** Text from ISO 11462-1 is included in this document in italics with permission of ISO/TC 69 and has been approved by ANSI.

**1.1 Subject of this Standard** *Statistical process control (SPC) concerns the use of statistical techniques and/or statistical or stochastic control algorithms to achieve one or more objectives:*

1. *To increase knowledge about the process;*
2. *To steer a process to behave in the desired way;*
3. *To reduce variation of final-product parameters, or in other ways improve performance of a process.*

*These guidelines give elements for implementing an SPC system to achieve the above objectives. The common economic objective of statistical process control is to increase good process outputs produced for a given amount of resource inputs.*

**Note 1.** *SPC operates most efficiently by controlling variation of a process parameter or an in-process product parameter that is correlated with a final-product parameter; and/or by increasing the process's robustness against this variation. A supplier's final-product parameter may be a process parameter to the next downstream supplier's process.*

**Note 2.** *Although SPC is concerned with manufactured goods, it is also applicable to processes producing services or transactions (for example, those involving data, communications, software, or movement of material).*

**1.2 Aspects Covered** *This International Standard provides elements to guide an organization in planning, devel-*

*oping, executing, and/or evaluating a Statistical Process Control system. By implementing those elements deemed applicable and appropriate by customer and supplier, an organization may satisfy a requirement to adopt a comprehensive and effective SPC system. By also deploying a quality system for assuring that products and services meet customer requirements (such as the system defined by ISO 9001), an organization can install the infrastructure to help hold the gains from its SPC system.*

## 1.3 Field of Application

**1.3.1 General** *This International Standard specifies SPC system guidelines for use when a supplier's capability to reduce variation in processes associated with design or production needs to be proved, or when a supplier is beginning SPC implementation to achieve such capability.*

*It is intended that elements in this Standard will be selected based on their applicability and appropriateness to a specific process. Elements' selection, the order in which an organization implements the elements, and the depth of elements' adoption and application by an organization all depend on factors including: customer needs, market being served, nature of product or service, technology, and the nature and speed of production and transaction processes.*

*It is emphasized that the SPC system guidelines specified in this standard are complementary (not alternative) to technical (product) specified requirements and to quality system requirements. These guidelines specify what elements SPC systems are recommended to encompass. It is not the purpose of these SPC system guidelines to enforce uniformity of Statistical Process Control systems. These guidelines are generic, independent of any specific process, industry, or economic sector. These guidelines are intended to be adopted in their present form by organizations implementing SPC, but on occasions may need to be tailored by adding or deleting certain SPC system elements for specific circumstances. The phrases, "Where appropriate" and "Where applicable" are used to highlight those elements whose particular application is expected to be more process-dependent or more market-sensitive.*

*These guidelines are not intended for contractual, regulatory, or certification use.*

**1.3.2 Production Characteristics Covered** *This International Standard is applicable in circumstances when:*

- (a) *Variation or deviation from either product requirements or performance to a target value may occur.*