ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

IPC-9191

General Guidelines for Implementation of Statistical Process Control (SPC)

ANSI/IPC-9191

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A standard developed by IPC

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- Show relationship to Design for Manufacturability (DFM) and Design for Engineering (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

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- Increase time-to-market
- Keep people out
- Increase cycle time
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- Contain anything that cannot be defended with data

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General Guidelines for Implementation of Statistical Process Control (SPC)

Developed by the Statistical Process Control Subcommittee (7-22) of the Process Control Management Committee (7-20) of IPC

APPROVED NOVEMBER 11, 1999 BY

AMERICAN NATIONAL STANDARDS INSTITUTE

Users of this standard are encouraged to participate in the development of future revisions.

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INTRODUCTION

Worldwide competition in the electronics industry has prompted many companies to reevaluate business strategies. To increase the profit margin and market share, companies are streamlining their internal operations to minimize the cost of operation, reduce scrap and rework, and in general, improve quality and customer satisfaction. However, these goals cannot be realized if the manufacturing processes and the support service operations are not in control. A process not in control is unpredictable in nature; therefore, process yield, product quality, cost and schedule cannot be determined with any degree of certainty. Such processes cannot be managed effectively. A systematic way to identify the process unpredictability is to use statistical methods throughout the life cycle of the product and process(es). Improvements to processes are only realized when corrective actions are taken to reduce or eliminate causes of process instability.

The objective of statistical process control is to continually identify variation of the end product, through control and reduction of variation upstream in the process. Statistical Process Control (SPC) is a legitimate method to be used by management throughout the company to achieve quality improvement, reduction in costs, and increased customer satisfaction. Experience has shown that implementation planned, directed, and applied in a methodical way on a project-by-project basis has a higher probability of success.

SPC consists of statistical methods and procedures used to document and assure compliance with requirements and to analyze root cause problems and provide approaches to improvement. Quality has traditionally been accepted as ''conformance to requirements.'' Thus SPC is integral to making a process conform to customer requirements.

Depending on the progress made in implementing SPC on a particular product, an individual organization may prove compliance to specification with:

1. Quality conformance evaluations
2. End-product control
3. In-process control
4. Process parameter control

An individual organization may choose to use a combination of the four assurance techniques listed above to prove compliance. For example, a product with 15 characteristics may meet specification by quality conformance evaluations on two characteristics, in-process product evaluations on five characteristics, and process parameter control for five characteristics. The remaining three characteristics meet specification by a combination of in-process control and quality conformance evaluations. Evidence of compliance to the specification at the level of SPC implementation claimed is auditable by the customer or an appointed third party.

Requirements are dynamic in nature and based on what is accepted in the world wide market. Requirements must be agreed upon by organization and customer. Requirements may be stated as a reduction of variation around a target value, as opposed to just meeting the specifications, drawing, etc.

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/ITC 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.

Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Statistical Process Control Subcommittee (7-22) of the Process Control Management Committee (7-20) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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