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Control charts —

Part 2: Shewhart control charts

Cartes de contrôle —

Partie 2: Cartes de contrôle de Shewhart



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7870-2 was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 4, *Applications of statistical methods in process management*.

This first edition cancels and replaces ISO 8258:1991, which has been technically revised.

ISO 7870 consists of the following parts, under the general title Control charts:

- *Part 1: General guidelines*
- *Part 2: Shewhart control charts*
- *Part 3: Acceptance control charts*
- *Part 4: Cumulative sum charts*
- *Part 5: Specialized control charts*

EWMA control charts will form the subject of a future Part 6.

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Introduction

A traditional approach to manufacturing has been to depend on production to make the product and on quality control to inspect the final product and screen out items not meeting specifications. This strategy of detection is often wasteful and uneconomical because it involves after-the-event inspection when the wasteful production has already occurred. Instead, it is much more effective to institute a strategy of prevention to avoid waste by not producing unusable output in the first place. This can be accomplished by gathering process information and analysing it so that timely action can be taken on the process itself.

Dr. Walter Shewhart in 1924 proposed the control chart as a graphical means of applying the statistical principles of significance to the control of a process. Control chart theory recognizes two kinds of variability. The first kind is random variability due to "chance causes" (also known as "common/*natural/random/inherent/uncontrollable* causes"). This is due to the wide variety of causes that are consistently present and not readily identifiable, each of which constitutes a very small component of the total variability but none of which contributes any significant amount. Nevertheless, the sum of the contributions of all of these unidentifiable random causes is measurable and is assumed to be inherent to the process. The elimination or correction of common causes may well require a decision to allocate resources to fundamentally change the process and system.

The second kind of variability represents a real change in the process. Such a change can be attributed to some identifiable causes that are not an inherent part of the process and which can, at least theoretically, be eliminated. These identifiable causes are referred to as "assignable causes" (*also known as special/unnatural/systematic/controllable causes*) of variation. They may be attributable to such matters as the lack of uniformity in material, a broken tool, workmanship or procedures, the irregular performance of equipment, or environmental changes.

A process is said to be in statistical control, or simply "in control", when the process variability results only from random causes. Once this level of variation is determined, any deviation from this level is assumed to be the result of assignable causes that should be identified and eliminated.

Statistical process control is a methodology for establishing and maintaining a process at an acceptable and stable level so as to ensure conformity of products and services to specified requirements. The major statistical tool used to do this is the control chart, which is a graphical method of presenting and comparing information based on a sequence of observations representing the current state of a process against limits established after consideration of inherent process variability called process capability. The control chart method helps first to evaluate whether or not a process has attained, or continues in, a state of statistical control. When in such a state the process is deemed to be stable and predictable and further analysis as to the ability of the process to satisfy the requirements of the customer can then be conducted. The control chart also can be used to provide a continuous record of a quality characteristic of the process output while process activity is ongoing. Control charts aid in the detection of unnatural patterns of variation in data resulting from repetitive processes and provide criteria for detecting a lack of statistical control. The use of a control chart and its careful analysis leads to a better understanding of the process and will often result in the identification of ways to make valuable improvements.