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## **Statistical methods in process management — Capability and performance —**

### **Part 4: Process capability estimates and performance measures**

*Méthodes statistiques dans la gestion de processus — Aptitude et  
performance —*

*Partie 4: Estimations de l'aptitude de processus et mesures de  
performance*



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Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
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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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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/TR 22514-4 has been prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 4, *Applications of statistical methods in process management*.

ISO 22514 consists of the following parts, under the general title *Statistical methods in process management — Capability and performance*:

- *Part 1: General principles and concepts*
- *Part 3: Machine performance studies for measured data on discrete parts*
- *Part 4: Process capability estimates and performance measures [Technical Report]*

In the future, it is planned to revise ISO 21747:2006 (*Statistical methods — Process performance and capability statistics for measured quality characteristics*) as Part 2.

NOTE ISO/TR 22514-4 was initially prepared as ISO/DTR 12783. It was renumbered before publication to include it in the ISO 22514 series.

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## Introduction

Many organizations have embarked upon a continuous improvement strategy. To comply with such a strategy, any organization will need to evaluate the capability and performance of its key processes. The methods described in this part of ISO 22514 are intended to assist any management in this respect. These evaluations need to be constantly reviewed by management so that actions compatible with continuous improvement can be taken when required.

The content of this part of ISO 22514 has been subject to large shifts of opinion during recent times and this report attempts to reflect the current position. The most fundamental shift has been to philosophically separate what is named in this document as capability conditions from performance conditions, the primary difference being whether statistical stability has been obtained (capability) or not (performance). This naturally leads onto the two sets of indices that are to be found in their relevant clauses. It has become necessary to draw a firm distinction between these since it has been observed in industry that companies have been deceived about their true capability position due to inappropriate indices being calculated and published.

The progression of this part of ISO 22514 is from the general condition to the specific and this approach leads to general formulae being presented before their more usual but specific manifestations.

There exist numerous references that describe the importance of understanding the processes at work within any organization, be it a manufacturing process or an information handling process. As organizations compete for sales with each other, it has become increasingly apparent that it is not only the price paid for a product or service that matters so much, but also what costs will be incurred by the purchaser from using such a product or service. The objective for any supplier is to continually reduce variability and not to just satisfy specification.

Continual improvement leads to reductions in the costs of failure and assists in the drive for survival in an increasingly more competitive world. There will also be savings in appraisal costs for as variation is reduced the need to inspect product might disappear or the frequency of sampling might be reduced.

Process capability and performance evaluations are necessary to enable organizations to assess the capability and performance of their suppliers. Those organizations will find the indices contained within this part of ISO 22514 useful in this endeavour.

Quantifying the variation present within a process enables judgement of its suitability and ability to meet some given requirement. The following paragraphs and clauses provide an outline of the philosophy required to be understood to determine the capability or performance of any process.

All processes will be subject to certain inherent variability. This part of ISO 22514 does not attempt to explain what is meant by inherent variation, why it exists, where it comes from nor how it affects a process. This part of ISO 22514 starts from the premise that it exists and is stable.

Process owners should endeavour to understand the sources of variation in their processes. Methods such as flowcharting the process and identifying the inputs and outputs from a process assist in identification of these variations together with the appropriate use of cause and effect (fishbone) diagrams.

It is important for the user of this part of ISO 22514 to appreciate that variations exist that will be of a short-term nature as well as those that will be of a long-term nature and that capability determinations using only the short-term variation might be greatly different to those which have used the long-term variability.

When considering short-term variation, a study that uses only the shortest-term variation, sometimes known as a machine study, might be carried out. The method required to carry out such a study will be outside the scope of this part of ISO 22514; however, it should be noted that such studies are important and useful.

It should be noted that where the capability indices given in this part of ISO 22514 are computed, they only form point estimates of their true values. It is therefore recommended that, wherever possible, the indices' confidence intervals are computed and reported. This part of ISO 22514 describes methods by which these can be computed.