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**BS ISO 22514-7:2012**



BSI Standards Publication

# Statistical methods in process management — Capability and performance

Part 7: Capability of measurement processes

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

### **Part 7: Capability of measurement processes**

*Méthodes statistiques dans la gestion de processus — Aptitude et  
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*Partie 7: Aptitude des processus de mesure*



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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.

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 22514-7 was 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 2: Process capability and performance of time-dependent process models*
- *Part 3: Machine performance studies for measured data on discrete parts*
- *Part 4: Process capability estimates and performance measures*
- *Part 6: Process capability statistics for characteristics following a multivariate normal distribution*
- *Part 7: Capability of measurement processes*

A future Part 5 on process capability and performance for attributive characteristics is planned. A future Part 8 on the machine performance of a multi-state production process is under preparation.

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## Introduction

The purpose of a measurement process is to produce measurement results obtained from defined characteristics on parts or processes. The capability of a measurement process is derived from the statistical properties of measurements from a measurement process that is operating in a predictable manner.

Calculations of capability and performance indices are based on measurement results. The uncertainty of the measurement process used to generate capability and performance indices must be estimated before the indices can be meaningful. The actual measurement uncertainty needs to be adequately small.

If the measurement process is used to judge whether a characteristic of a product conforms to a specification or not, the uncertainty of the measurement process must be compared to the specification itself. If the measurement process is used for process control of a characteristic, the uncertainty needs to be compared with the process variation. Limits of acceptability should be stated for both cases.

The quality of measurement results is given by the uncertainty of the measurement process. This is defined by the statistical properties of multiple measurements, or estimates of properties, based on the knowledge of the measurement process.

The methods described in this part of ISO 22514 only address the implementation uncertainty. (For more information on implementation uncertainty, see ISO 17450-2.) Therefore, they are only useful if it is known that the method uncertainty and the specification uncertainty are small compared to the implementation uncertainty. This part of ISO 22514 describes methods to define and calculate capability indices for measurement processes based on estimated uncertainties. The approach given in ISO/IEC Guide 98-3, *Guide to the expression of uncertainty in measurements (GUM)* is the basis of this approach.

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# Statistical methods in process management — Capability and performance —

## Part 7: Capability of measurement processes

### 1 Scope

This part of ISO 22514 defines a procedure to validate measuring systems and a measurement process in order to state whether a given measurement process can satisfy the requirements for a specific measurement task with a recommendation of acceptance criteria. The acceptance criteria are defined as a capability figure ( $C_{MS}$ ) or a capability ratio ( $Q_{MS}$ ).

NOTE 1 This part of ISO 22514 follows the approach taken in ISO/IEC Guide 98-3, *Guide to the expression of the uncertainty in measurement (GUM)*, and establishes a basic, simplified procedure for stating and combining uncertainty components used to estimate a capability index for an actual measurement process.

NOTE 2 This part of ISO 22514 is primarily developed to be used for simple one-dimensional measurement processes, where it is known that the method uncertainty and the specification uncertainty are small compared to the implementation uncertainty. It can also be used in similar cases, where measurements are used to estimate process capability or process performance. It is not suitable for complex geometrical measurement processes, such as surface texture, form, orientation and position measurements that rely on several measurement points or simultaneous measurements in several directions.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3534-1:2006, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 3534-2:2006, *Statistics — Vocabulary and symbols — Part 2: Applied statistics*

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 5725-3, *Accuracy (trueness and precision) of measurement methods and result — Part 3: Intermediate measures of the precision of a standard measurement method*

ISO 5725-4, *Accuracy (trueness and precision) of measurement methods and results — Part 4: Basic methods for the determination of the trueness of a standard measurement method*

ISO 5725-5, *Accuracy (trueness and precision) of measurement methods and results — Part 5: Alternative methods for the determination of the precision of a standard measurement method*

ISO 5725-6, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

ISO 7870-1, *Control charts — Part 1: General guidelines*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*