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Tolerances for building —

Part 7:

General principles for approval criteria, control of
conformity with dimensional tolerance specifications and
statistical control — Method 2 (Statistical control method)

*Tolérances pour le bâtiment — Partie 7: Principes généraux pour les critères d'acceptation, le
contrôle de conformité aux spécifications de tolérance dimensionnelle et le contrôle statistique
— Méthode 2 (Méthode de contrôle statistique)*

Reference number
ISO 3443-7: 1988 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 3443-7 was prepared by Technical Committee ISO/TC 59, *Building construction*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Tolerances for building —

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General principles for approval criteria, control of conformity with dimensional tolerance specifications and statistical control — Method 2 (Statistical control method)

0 Introduction

The procedure and rules established in this part of ISO 3443 are not compulsory for any parties to an agreement. If the parties agree to follow this part of ISO 3443, they should therefore so indicate in the agreement on inspection.

This part of ISO 3443 forms one of a series of International Standards concerning tolerances for building and building components.

The principles for approval and the statistical methods recommended are, with only minor modifications, based on International Standards for statistical inspection.

Alternative methods of inspection (e.g. based on Bayesian statistics) are permitted when the statistical risks involved in the actual sampling plans are known by the parties.

A shorter and more generalized method, to be used when establishing approval criteria and controlling accuracy, and not applying specific statistical principles, is issued as method 1 in ISO 3443-6.¹⁾

1 Scope

This part of ISO 3443 specifies an operational procedure which can be used to determine acceptance of dimensional accuracy of components, and operations in the building industry to be used when the parties involved agree to refer to this part of ISO 3443. The procedure relates to the recognition of specified requirements, the criteria for acceptance and consequences of rejection, recommendations on the agreements and methods of measurement, and the planning and execution of inspection by statistical methods.

2 Field of application

This part of ISO 3443 applies to all types of forms, dimensions and positions within the building industry.

3 References

ISO 2859, *Sampling procedures and tables for inspection by attributes*.

ISO 2859/Add. 1, *General information on sampling inspection, and guide to the use of ISO 2859 tables*.

ISO 2859-2, *Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*.

ISO 3443-6, *Tolerances for building — Part 6: General principles for approval criteria, control of conformity with dimensional tolerance specifications and statistical control — Method 1*.

ISO 3534, *Statistics — Vocabulary and symbols*.

ISO 3951, *Sampling procedures and charts for inspection by variables for percent defective*.

ISO 4464, *Tolerances for building — Relationship between the different types of deviations and tolerances used for specification*.

ISO 6284, *Tolerances for building — Indication of tolerances on building and civil engineering drawings*.

ISO 7077, *Measuring methods for building — General principles and procedures for the verification of dimensional compliance*.

1) Internationally, users are free to decide if they will use method 1 (the short method) or method 2 (the longer method).

4 Definitions

For the purposes of this part of ISO 3443, the following definitions apply.

4.1 tolerance specification: The set of expressions or their symbols, indicating the domain of acceptance of the characteristic indicated.

4.2 characteristic: A feature for which a tolerance has been specified; it can be a dimension, an angle, the shape of a surface, etc.

4.3 item (unit) of product or operation:

- An actual or conventional object on which a set of observations may be made.
- A defined quantity of material, on which a set of observations may be made.
- An observed value, either qualitative (attributes) or quantitative (values).

NOTES

- The item will normally be a component when checking manufacturing and erection tolerances, or a point when checking setting out tolerances, but it could also be individual dimensions, for instance in the case of checking earth-work or *in situ* cast concrete.
- The item of product or operation is used as a counting item in determining lot size, sample size, number of conforming items, etc.

4.4 conformance with a tolerance specification: The case when the indicated characteristic, as measured according to the specified method under the specified conditions, is within the domain of acceptance.

4.5 Standardized statistical terms

Definitions of statistical terms standardized in other International Standards are shown in annex B.

5 Tolerances and specified requirements

5.1 Tolerance specifications

Tolerance specifications set the limits for such deviations from the ideal or basic specifications which the customer will accept unconditionally.

NOTE — The term tolerance is often used as a synonym for tolerance specification.

The expressions and symbols used in the tolerance specifications shall be clearly understandable, unambiguous and in accordance with International Standards wherever possible.

The expression can have one of the following forms.

- D_{-B}^{+A} where $A + B = T$ (see figure 1).

This means that the indicated dimension X shall fulfil the following inequalities in order to be accepted:

$$D - B \leq X \leq D + A$$

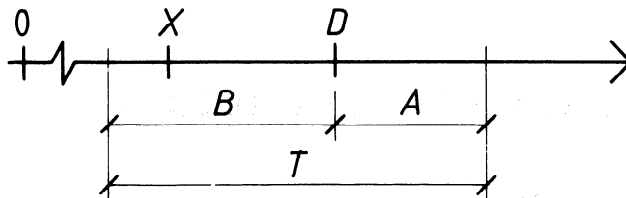


Figure 1

b) One-sided inequalities such as $X \leq T$ (see figure 2).

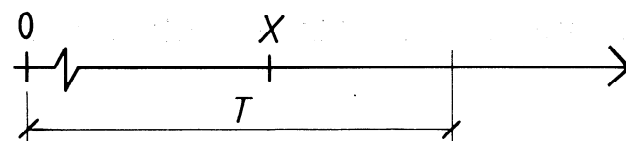


Figure 2

c) Specification, by mathematical or linguistic expressions, of the envelope for the permitted positions of the points of a line or a surface (see figure 3). See for instance the explanation of the box principle for a 3-dimensional component in ISO 4464.

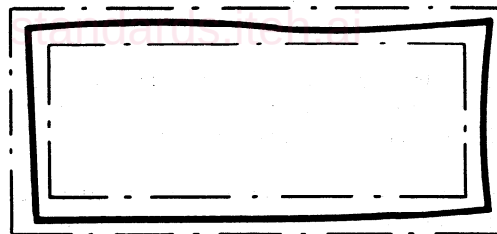


Figure 3

Tolerance specifications may include, directly or indirectly, the conditions under which the parameters are to be measured. For methods and instruments to be used, see ISO 7077.

5.2. Indication and recognition of tolerance specifications

5.2.1 Particular indication

The case when the tolerance specification is indicated directly on the building drawing or in the specification of work.

The rules and principles given in ISO 4464 and ISO 6284 should be followed, and a reference to these International Standards should appear on all drawings and specifications of work.

5.2.2 General indication

In cases where the tolerance specification is not indicated as in 5.2.1, general tolerance specifications, if any, shall be applied.

Such specifications shall appear, in order to be recognized, either in an agreement between the parties or as legal demands.

NOTE — Normally an agreement between the parties will have the form of an order or a sales contract. The general tolerance specifications may be stated therein, or they may be indicated by reference to other documents, for instance project descriptions, general product specifications, trade recommendations and national or International Standards.

5.2.3 No indication

If there are no tolerance specifications indicated, directly or indirectly, requirements in accordance with normal practices are assumed.

These requirements can only be controlled according to the rules in 7.5.

5.3 Recommendations on the use of tolerance specifications

It is generally recommended that only such tolerance specifications which will be controlled according to the agreement on inspection be indicated on the drawings and specifications of work, in order to maintain the respect for tolerance specifications.

However, in cases where requirements "in accordance with normal practice" are not evident, for instance in connection with new production or building techniques, it is recommended that tolerance specifications for all significant characteristics be indicated, even for those not intended for economic reasons to be controlled systematically.

6 Inspector responsible

An inspector responsible for undertaking the control of conformity with the tolerance specifications shall be designated in the inspection agreement.

The inspector responsible is normally a private person who is recognized by both parties as having the necessary knowledge and reliability to perform the important operations stated below and being impartial to a high degree in judgement, regardless of his employment.

The inspector responsible shall supervise or carry out the following:

- a) authorization of sampling plans (confirming the proper sampling plan for the personnel who carry out the inspection);
- b) formation of lots and drawing of samples;
- c) checking the proper conditions and methods of measurement;
- d) checking the calibration of the instruments and carrying out the measurements;
- e) recording the measurements, physical conditions and other control data in an inspection journal. The inspection journal shall be presented to the parties on demand;

- f) approval or rejection of items or lots according to the measurements.

The inspector responsible will further make necessary judgements during the inspection; for instance rejection of certain control measurements, the applicability, conditions of repair and resubmission of defective items, and the determination whether normal, tightened or reduced inspection shall be used. A record of these judgements shall be presented to the parties.

The competence of the inspector responsible shall be stated in the agreement on inspection. It is important in practice that his power to make judgements according to the procedures described in clause 8 be not too limited, as many negotiations between the parties will otherwise be necessary.

NOTE — The inspector responsible need not in principle be independent of both parties. It may be practical that he be employed by one of the parties, often the supplier, in order to have necessary facilities at easy disposal.

7 Approval criteria for items (units)

7.1 Definition of item

The term "item" shall be further specified in the agreement on inspection if it is not unambiguous, possibly by reference to other International Standards covering inspection in particular fields.

7.2 Conditions for remeasuring defective items

It is not permitted, except in the two cases indicated below, to make new measurements on defective items, even with more accurate instruments, in order to recheck the conformity with the tolerance specification. This procedure will otherwise introduce a systematic error in the control method in the form of higher acceptability than planned, since the number of measurements is guided according to the benefit of the supplier.

The two exceptions are as follows:

- a) If it can be shown with high certainty that the outlying result of the measurement is due to severe errors in measuring, the responsible inspector may permit a new measurement on the same item.
- b) In case of planned multiple stage control procedures, where it is shown that the resulting acceptability is equal to that of a single direct measurement of the characteristic.

Example: The characteristic in question is first measured with a simple or cheap method, which accordingly must have a systematic offset in the form of lower acceptability. In case of non-conformity a more comprehensive method of measurement is applied.

NOTE — An item which has been repaired and is submitted for re-inspection according to the procedure described in 8.3 is not in this connection regarded as defective prior to the re-inspection.