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Fasteners — Acceptance inspection

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 7, *Reference standards*.

This fourth edition cancels and replaces the third edition (ISO 3269:2000), which has been technically revised.

The main changes compared to the previous edition are as follows:

- introduction of an additional approach for incoming inspection with smaller sample sizes based on $N_A = 0$;
- use of a reference approach in case agreement is not reached;
- sample size specified on the basis of lot size;
- addition of informative [Annexes A](#) and [B](#) explaining the basis for sample size selection.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The manufacturer of fasteners is expected to take due care and apply process control (see ISO 16426) during production in order to minimize the chances of producing parts that do not satisfy requirements of the standard or technical specification to which they are specified. Although every fastener should meet all the specified requirements, this objective is not guaranteed in mass production.

The purchaser of fasteners is expected to decide whether it is reasonable to assume that the delivered fasteners were made to specification. Considering the limitations of inspection by attributes of a fastener inspection lot, it is desirable that both the purchaser and the manufacturer (or supplier) possess a clear understanding of the acceptance inspection procedure to be used by the purchaser. This document describes an inspection procedure for use by the purchaser where no prior agreement exists.

Such acceptance inspection cannot provide complete confidence that non-conforming fasteners do not exist within a production lot. Conversely, the acceptance of a lot based on acceptance quality limit (AQL) values in this document does not imply that the supplier has a right to knowingly supply non-conforming fasteners.

This fourth edition introduces a layered approach for incoming acceptance inspection that begins with small sample sizes associated with a sampling plan based on $Ac = 0$.

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Fasteners — Acceptance inspection

1 Scope

This document specifies an inspection procedure to be used by the purchaser where no prior agreement exists.

It also specifies a reference acceptance procedure for acceptance or rejection of an inspection lot, when no agreement can be reached between the purchaser and the supplier, or where conformance to specification is disputed.

It applies to inspection lots of bolts, screws, studs, nuts, pins, washers, rivets and other related fasteners.

This document applies to fasteners not intended for high volume machine assembly, special-purpose applications or specially engineered applications requiring more advanced in-process control and lot traceability.

For in-process control or final inspection by the manufacture and sorting, see ISO 16426.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1891-4, *Fasteners — Vocabulary — Part 4: Control, inspection, delivery, acceptance and quality*

ISO 2859-1:1999, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1891-4, ISO 2859-1 and ISO 3534-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

inspection lot

quantity of fasteners of the same designation received from the same supplier at the same time and, if available, of the same manufacturing lot number

3.2

characteristic

dimensional element, mechanical, physical or functional property or other recognizable product feature for which limits are specified

EXAMPLE Head height, body diameter, tensile strength or hardness.

3.3 acceptance quality limit AQL

acceptable percentage of non-conforming fasteners in an *inspection lot* (3.1) corresponding to a specific probability of acceptance defined in the AQL index

Note 1 to entry: AQL_{95} is the percentage of non-conforming fasteners where the inspection lot has a 95 % chance of being accepted by the purchaser under the sampling plan; in other words, the supplier's risk of rejection is less than 5 %.

3.4 limiting quality LQ

percentage of non-conforming fasteners in an *inspection lot* (3.1) corresponding to a specific probability of acceptance defined in the LQ index

Note 1 to entry: LQ_{10} is the percentage of non-conforming fasteners where the inspection lot has a 10 % chance of being accepted by the purchaser under the sampling plan; in other words, the consumer's risk of accepting the lot is less than 10 %.

Note 2 to entry: For a given sampling plan, limiting quality (LQ) and acceptance quality limit (AQL) are linked in the corresponding operating characteristic (OC) curve.

4 Symbols

For the purposes of this document, the following symbols apply.

Ac	acceptance number
Re	rejection number
LQ_{10}	limiting quality at 10 % probability of acceptance, in per cent
AQL_{95}	acceptance quality limit at 95 % probability of acceptance, in per cent
N	lot size
P_a	probability of acceptance, in per cent

5 Incoming acceptance inspection procedures for fasteners

5.1 General requirements

The requirements of this document shall apply to fasteners as delivered by the supplier, i.e. without alteration from the as-delivered condition. In case of alteration or further processing performed by the purchaser, the purchaser shall assume responsibility for conformance of all characteristics altered by such processing.

This document applies after receiving the fasteners, before releasing the lot to any subsequent processing.

Inspections according to this document shall be performed in accordance with [Tables 1](#) and [2](#).

In case of non-conformity found during inspection, [6.2](#) and/or [6.3](#) shall apply.

The purchaser shall give the supplier the opportunity to verify any alleged non-conformity prior to any disposition.

5.2 Inspection procedures

5.2.1 General

The purchaser can choose this document to verify that the fasteners comply with the technical requirements of the product standard or other specified requirements.

5.2.2 Sample size

Sample size shall be based on the size of the inspection lot specified in [Table 1](#). If the sample size is greater than the lot size, 100 % inspection is required for non-destructive tests.

Sample size, acceptance number, A_c , and rejection number, R_e , for each selected characteristic shall be determined individually.

5.2.3 Inspection modalities

Inspection category for the characteristic being inspected shall be in accordance with [Table 2](#), which lists the primary characteristics of various fastener types.

The selection of the characteristics for inspection shall be at the discretion of the purchaser. The purchaser is not required to inspect all characteristics listed in [Table 2](#). The purchaser shall decide which characteristics to inspect based on their impact on the form, fit and function of the fasteners used.

The purchaser can select any other characteristics specified in the relevant product standard or in other technical specifications for inspection.

NOTE The frequency and extent of acceptance inspection are at the discretion of the purchaser and are related to previous experience with the supplier and the purchaser's opinion of the critical nature of the fastener and its application.

Mechanical, physical and functional properties shall be inspected as specified in the relevant basic and reference standards (e.g. ISO 898-1, ISO 3506-2, ISO 16047, ISO 10683, ISO 6157-1).

Dimensional characteristics shall be inspected in accordance with relevant product standards and/or technical specifications.

The inspection of a listed mechanical, physical or functional characteristic can include several tests and/or test results (e.g. tensile strength may be tested using full-size, wedge tensile or specimens).

A listed dimensional characteristic can include several features (e.g. inspecting the drive for a hexagon head includes measuring width across flats, width across corners and minimum wrenching height).

5.3 Acceptance inspection categories

[Table 1](#) specifies sampling plans for acceptance inspection. Categories 1, 2 and 3 are explained in [Annex A](#). Category 3 sampling plans are selected from ISO 2859-1.

For more information on sampling concept, see [Annex B](#).

Table 1 — Sampling plan

Lot size, <i>N</i>	Sample size, acceptance number, <i>Ac</i> , and rejection number, <i>Re</i>			
	Category 1 ^a	Category 2 ^b		Category 3 ^c
		Initial sample	Additional sample	
	<i>Ac</i> = 0 <i>Re</i> = 1	<i>Ac</i> = 0 <i>Re</i> = 2	<i>Ac</i> = 0 <i>Re</i> = 1	
2 to 50	1	4	4	Not applicable
51 to 90	1	5	5	5 <i>Ac</i> = 1 <i>Re</i> = 2
91 to 150	1	6	6	6 <i>Ac</i> = 1 <i>Re</i> = 2
151 to 280	1	7	7	7 <i>Ac</i> = 1 <i>Re</i> = 2
281 to 500	2	9	9	9 <i>Ac</i> = 1 <i>Re</i> = 2
501 to 1 200	2	11	11	11 <i>Ac</i> = 1 <i>Re</i> = 2
1 201 to 3 200	2	13	13	13 <i>Ac</i> = 1 <i>Re</i> = 2
3 201 to 35 000	3	15	15	15 <i>Ac</i> = 2 <i>Re</i> = 3
35 001 to 500 000	5	20	20	20 <i>Ac</i> = 2 <i>Re</i> = 3
Over 500 000	8	20	20	20 <i>Ac</i> = 2 <i>Re</i> = 3

^a **Category 1** – characteristics for which the acceptance number, *Ac*, is zero. Category 1 characteristics include all mechanical and functional properties which are typically inspected by means of destructive tests. If non-conformity is found in the sample, the lot or shipment is rejected. Disposition according to 6.2 and/or 6.3 shall apply.

^b **Category 2** – characteristics for which the acceptance number, *Ac*, is zero, but in case of a non-conformity, a second sample may be taken. Category 2 characteristics are major dimensional properties that can affect the fit or function of the fastener. If, however, a single non-conformity is found in the first sample, an additional sample equal to the first sample size shall additionally be inspected for that characteristic. If zero non-conformity is found in the additional sample for that characteristic, the lot is accepted. If the lot or shipment is rejected, disposition in accordance with 6.2 and/or 6.3 shall apply.

^c **Category 3** – characteristics for which the acceptance number, *Ac*, is one non-conformity or more, as specified in Table 2. Category 3 characteristics are minor dimensional properties and certain functional properties where some degree of non-conformity is tolerated. If more than the specified acceptable non-conformities are found in the sample, the lot or shipment is rejected. Disposition in accordance with 6.2 and/or 6.3 shall apply.

Table 2 — Designated inspection categories

Fastener characteristics		Externally threaded fasteners	Internally threaded fasteners	Washers	Pins	Rivets
Mechanical and physical properties	Hardness	1	1	1	1	1
	Tensile strength	1	—	—	—	—
	Proof load	—	1	—	—	—
	Breaking torque	1	—	—	—	—
	Shear strength	—	—	—	1	1
	Others (including material and surface discontinuities)	1	1	1	1	1
Dimensional characteristics	Drive, recess and slot	2	2	—	—	—
	Height	2	2	2	2	2
	Shank diameter	2	—	—	2	2
	Length, thread length	2	—	—	2	2
	Thread diameter d, D (external diameter for externally threaded parts, internal diameter for internally threaded parts)	2	2	—	—	—
	Internal diameter	—	—	2	—	—
	External diameter	—	—	2	—	—
	Thickness	—	—	2	—	—
	Others	3	3	3	3	3
Functional properties	Prevailing torques	3	3	—	—	—
	Torque/clamp force relationship	3	3	—	—	—
	Thread GO gauging	3	3	—	—	—
	Others (destructive tests)	1	1	1	1	1
	Others (non-destructive tests)	3	3	3	3	3

6 Result of inspection and disposition

6.1 General

If no non-conformity is found with the samples inspected and/or tested, the inspection lot shall be accepted.

For categories 2 and 3, if non-conformities are found but satisfy the acceptance number (Ac) criteria specified in [Table 1](#), the inspection lot shall be accepted.

NOTE Lot acceptance in accordance with this document does not presume that the accepted lot is free of non-conforming parts (see Introduction).

If non-conformities are found that exceed the acceptance number (Ac) criteria specified in [Table 1](#), the purchaser shall reach a disposition agreement with the supplier in accordance with [6.2](#).

If the purchaser and supplier cannot agree on the acceptance or rejection of an inspection lot in accordance with [6.2](#), they shall apply disposition in accordance with [6.3](#).

Non-conformities shall be declared on the basis of appropriate test, measurement and/or gauging methods and related appropriate equipment.

6.2 Purchaser's options for lot disposition

In case of non-conformity found by performing inspection in accordance with 5.2, the purchaser shall choose from the following options:

If the purchaser assumes that the non-conformity will have no significant effect on the performance in the intended service application:

a) the purchaser accepts the inspection lot.

Otherwise, the following options can be chosen:

b) return the lot to the supplier;

c) sort and/or inspect the lot to remove the non-conforming parts;

d) rework or reprocess the parts to correct the non-conformity;

e) scrap the lot.

The purchaser shall have approval from the supplier before any activity, such as sorting, reworking, reprocessing, scrapping, or returning the lot, when such action impacts the supplier.

A non-conforming lot of fasteners shall not be presented for re-inspection until one of the options above has been completed.

6.3 Reference acceptance procedure

If the purchaser and supplier cannot agree on the acceptance or rejection of an inspection lot in accordance with 6.2, for example if the validity of the testing is questioned, the parties shall select a mutually agreed upon competent third party laboratory to test the non-conforming characteristic as specified above. The additional third-party inspection results shall serve as the basis for the purchaser and supplier to agree upon one of the options in 6.2.

Annex A (informative)

Sampling plans basics

Acceptance inspection is generally performed by the purchaser to confirm by inspection whether it is reasonable to assume that the delivered fasteners were made to specification. [Table 1](#) provides acceptance inspection sampling plans for three categories of characteristics based on different statistical approaches having different customer and supplier risk consequences. The selection of a sampling plan and suitable tests are the responsibility of the party conducting the acceptance inspection.

Category 1 characteristics are for mechanical properties that are critical to the function of the fastener. It is assumed that a process parameter deviation in mass production will lead to non-conformity in a substantial proportion of the lot and is expected to be detected in a small sample. Based on this assumption, acceptance inspection sampling plans for category 1 properties require acceptance number $A_c = 0$ and do not provide statistical information. When non-conformity is found, in-depth investigation is required to reach agreement about disposition of the lot (see [Clause 6](#)).

Category 2 characteristics are for dimensional properties that can influence the usability of the fastener. It is assumed there is a statistical distribution of the characteristic resulting from normal variation in production processes. Category 2 sampling plans are based on acceptance number $A_c = 0$; however, a single non-conformity does not automatically require rejection of the lot. An additional sampling with the same acceptance number $A_c = 0$ increases confidence in conformance of the lot while avoiding rejections based on a single detected non-conformity.

Sample sizes for category 2 characteristics are selected to provide "consumer risk" similar to a 6,5 AQL plan and are selected from OC curves for single sampling plans shown by Reference [\[7\]](#). The term "consumer risk" is described by values for the quality level expressed in percentage of non-conforming parts, with a 10 % probability of being accepted. See [Table A.1](#) (LQ_{10}). The term "supplier risk" is described by values for the quality level expressed in percentage of non-conforming parts, with a 95 % probability of being accepted. See [Table A.1](#) (AQL_{95}). These values apply only for single inspection. Taking an additional sample after finding a non-conforming part in first sample is not considered.

Category 3 characteristics are for dimensional properties and certain functional properties where some degree of non-conformity is tolerated. It is assumed that there is a statistical distribution of the characteristic resulting from normal variation in production processes. Category 3 sampling plans are based on an acceptance number, A_c , greater than zero. Sample sizes for Category 3 characteristics are chosen from ISO 2859-1:1999, Table 1, level S3. A_c values connected with AQL_{95} are taken from ISO 2859-1:1999, Table 2-A.

Table A.1 — Sampling plans – Consumer risk LQ_{10} – Supplier risk AQL_{95}

Lot size, N	Category 2 (1 st inspection run)			Category 3		
	Ac = 0	LQ ₁₀	AQL ₉₅	Sample size	Acceptance number	AQL ₉₅
	Sample size	$P_a = 10\%$	$P_a = 95\%$			$P_a = 95\%$
2 to 50	4	42,44	1,25	NA		—
51 to 90	5	36,10	1,00	5	Ac = 1	7,6
91 to 150	6	31,33	0,83	6	Ac = 1	6,2
151 to 280	7	27,73	0,72	7	Ac = 1	5,3
281 to 500	9	22,39	0,56	9	Ac = 1	4,1
501 to 1 200	11	18,80	0,46	13	Ac = 1	3,3
1 201 to 3 200	13	16,10	0,39	13	Ac = 1	2,8
3 201 to 35 000	15	15,40	0,33	15	Ac = 2	5,7
35 001 to 500 000	20	10,9	0,26	20	Ac = 2	4,2
Over 500 000	20	10,9	0,26	20	Ac = 2	4,2