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Fasteners — Acceptance inspection

Éléments de fixation — Contrôle de réception

Reference numbe
ISO 3269 : 1988 (

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 3269 was prepared by Technical Committee ISO/TC 2, *Fasteners.*

This second edition cancels and replaces the first edition (ISO 3269 : 1984), of which it constitutes a technical revision. In particular,

a) the terms "defect" and "defective" have been replaced by "nonconformity" and "nonconforming unit";

b) AQL-values for dimensional and mechanical characteristics for plain washers and pins have been specified.

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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Fasteners — Acceptance inspection

1 Scope and field of application

1.1 This International Standard specifies the procedure to be followed by the purchaser at his acceptance inspection in order to decide whether a lot of fasteners may be accepted or rejected, when no other acceptance procedure has been agreed with the supplier at the time of ordering the fasteners. Additional specific acceptability requirements may be included within a specific product standard (for example, prevailing torque type nuts). The procedure is also to be applied when conformance to specification is disputed.

1.2 It applies to bolts, screws, studs, nuts, pins, washers and other related fasteners not intended for high-volume machine assembly, for special purpose applications or for specially engineered applications requiring greater in-process controls and lot traceability. Procedures for these products shall be agreed between supplier and user prior to confirmation of the order.

1.3 It applies to fully manufactured products only and neither implies nor includes any particular in-process control procedure or inspection during production.

1.4 Accessories, services and partially fabricated parts (for example, washers, nuts, plating, heat treatment, blanks, etc.) may be purchased by the supplier from other suppliers for use in production of fasteners. However, the supplier of the fully manufactured product shall be solely responsible for the quality of the final product.

Any plating or other process carried out by the user after receipt of the fasteners shall invalidate the requirements of this International Standard.

1.5 The annex gives notes for guidance and the rationale behind this International Standard.

2 References

ISO 898-1, *Mechanical properties of fasteners — Part 1: Bolts, screws and studs.*

ISO 898-2, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values.*

ISO 898-6, *Mechanical properties of fasteners — Part 6: Nuts with specified proof load values — Fine pitch thread.*

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

ISO 3506, *Corrosion-resistant stainless steel fasteners — Specifications.*

ISO 3534, *Statistics, vocabulary and symbols.*

ISO 4759-1, *Tolerances for fasteners — Part 1: Bolts, screws and nuts with thread diameters* ⩾ 1,6 *and* ⩽ 150 mm *and product grades A, B and C.*

ISO 4759-3, *Tolerances for fasteners — Part 3: Washers for metric bolts, screws and nuts with thread diameters from* 1 *up to and including 150 mm — Product grades A and C.*

ISO 6157-1, *Fasteners — Surface discontinuities — Part 1: Bolts, screws and studs for general requirements.*

ISO 6157-2, *Fasteners — Surface discontinuities — Part 2: Nuts with thread sizes* M5 *to* M39. [1)]

ISO 6157-3, *Fasteners — Surface discontinuities — Part 3: Bolts, screws and studs for special requirements.*

3 General requirements

3.1 Although every fastener should meet all requirements of its standard specification, in mass production this is not always possible. Depending on the intended function and utilization, it is neither necessary nor economic always to separate fasteners which meet all requirements from those which do not.

3.2 For production quality control, the manufacturer may use any inspection procedure, but due care shall be taken during all production stages that the fasteners will satisfy the respective standards.

The designation of an AQL shall not imply that the supplier has the right to supply knowingly any defective unit of product.

1) In preparation.

3.3 The user may test the fasteners delivered for function and utilization, as he judges necessary or economically justifiable, provided that the supplier's risk is not more than 5 % for dimensional and 12 % for mechanical requirements (see table 2), unless prior agreement has been reached.

3.4 It is important that, during acceptance inspection, stress is laid on the fitness of the product to perform its intended function. Objections shall only be raised if the nonconformities impair the intended function and/or utilization of the fasteners. The user shall give the supplier the opportunity of verifying nonconformities discovered.

If at the time of inspection the subsequent function is uncertain (for example, stock parts), any deviation from the specified tolerances shall be regarded as impairing the function and/or utilization.

3.5 A rejected lot of fasteners may not be presented for re-inspection unless the nonconformity has been rectified or the lot sorted (see 5.5).

NOTE — If such rectification could impair the intended function and utilization, it requires the consent of the user.

3.6 Gauges and measuring instruments used for inspection may not determine any fastener to be unacceptable if in fact the fastener dimensions and properties are within specification limits.

If disputes arise, direct measurements should be made for decision.

3.7 Also when the lot satisfies the acceptance conditions of this International Standard, it is possible to reject single fasteners which do not meet the agreed technical requirements.

4 Definitions

The following definitions apply for the purposes of this International Standard; they are based on ISO 3534.

4.1 acceptance inspection: All the procedures such as sampling, gauging, measuring, comparing and testing necessary to decide whether a lot of fasteners should be accepted.

4.2 supplier: Manufacturer of the fasteners, or a dealer or representative who supplies the fasteners.

4.3 purchaser: Receiver or his representative who receives the fasteners; this is not necessarily the final user of the fasteners.

4.4 inspection lot: Definite quantity of fasteners of a single type, tolerance grade, property class and size, manufactured under conditions which are presumed uniform and submitted by a supplier for inspection at one time.

4.5 lot size (N): Number of fasteners contained in a lot.

4.6 sample: One or more fasteners drawn from a lot, taken at random so that all fasteners have an equal chance of selection.

4.7 sample size (n): Number of fasteners in the sample.

4.8 characteristic: Dimensional element, mechanical property or other recognisable feature of a product for which limits are specified, for example, head height, body diameter, tensile strength or hardness.

4.9 major characteristic: Characteristic which, if nonconforming, is likely to result in a failure or to reduce materially the usability of the fastener for its intended purpose.

4.10 minor characteristic: Characteristic that is neither likely to reduce materially the usability of the fastener for its intended purpose, nor a departure from established specifications having little bearing on the effective use or operation of the fastener.

4.11 nonconformity: Departure of a quality characteristic that results in a product not meeting a specified requirement.

4.12 nonconforming unit: Fastener with one or more nonconformities.

4.13 acceptance number (Ac): Maximum number of nonconforming units in any given sample that still allows acceptance of the lot.

4.14 sampling plan: Plan according to which a sample is taken in order to obtain information and to reach a decision on the acceptance of the lot.

4.15 acceptable quality level (AQL): Quality level which in a sampling plan corresponds to a specified relatively high probability of acceptance.

4.16 limiting quality (LQ): Quality level which in a sampling plan corresponds to a specified and relatively low probability of acceptance.

LQ_{10} is the percentage of nonconforming units in the characteristic of the submitted product which has a one-in-ten chance of being accepted by the sampling plan; it is often known as the consumer's risk.

4.17 supplier's risk: Degree of probability that a lot does not satisfy the agreed technical requirements, the quality level of which does correspond to the respective AQL-value, when a sampling plan is used.

4.18 probability of acceptance (P_a): Probability that a lot which contains a certain number of nonconforming units cannot be rejected as a whole on the basis of a sampling plan.

5 Acceptance inspection procedure for dimensional and mechanical property characteristics of fasteners

5.1 Find the description of the fastener to be inspected for dimensional characteristics in tables 1a) to 1c), note the appropriate characteristic to be inspected and the associated AQL value. For mechanical property characteristics, note the characteristic to be inspected and the associated AQL value from tables 3a) to 3c).

5.2 Choose the appropriate ratio LQ_{10}/AQL in accordance with 3.3 (for examples, see table 2).

NOTES

1 Multiplying this ratio by the AQL value gives the LQ_{10}. The LQ_{10} shall correspond to the function and/or utilization of the fastener. For more important functions and/or utilizations of the fasteners, the LQ_{10} value may be smaller, but this requires greater sample sizes and higher inspection costs. It may be possible to reduce the proportion of fasteners inspected from known sources with continuous production controls by choosing a greater ratio LQ_{10}/AQL, if the lots inspected so far have shown good quality. Conversely, it may be necessary to increase the proportion inspected if the lot cannot be presumed to be uniform or is not from one manufacturer. The ratio LQ_{10}/AQL used shall be within the sole judgement of the purchaser.

2 The sampling plans in table 2 are determined by the choice of AQL and of customer's risk (LQ_{10}). Once these two parameters have been chosen, the sample size, acceptance number, and supplier's risk follow automatically. The lot size/sample size relationship in table 1 of ISO 2859, which is intended to apply only in the case of production of a continuous series of lots, is not appropriate. Table 2 can however be applied to such a case, but is also applicable to isolated lots by suitable choice of LQ_{10}. In case of dispute between purchaser and supplier, a sampling plan shall be chosen according to which the supplier's risk is not higher than that laid down in 3.3.

5.3 Knowing the AQL and the chosen ratio LQ_{10}/AQL, find the sample size and the acceptance number, for example from table 2.

5.4 Select the sample in accordance with 4.6. For each characteristic, carry out the inspection, note the number of nonconforming units and accept the lot if the number of nonconforming units is equal to or lower than the acceptance number.

5.5 In the event of rejection, suitable disposal of the lot shall be agreed upon by purchaser and supplier (see 3.5).

5.6 The samples for the tensile test [see tables 3a) to 3c)] should where possible be those used for the hardness test, with the lowest and/or highest hardness figures. (The tensile test, being destructive, requires fewer samples than the non-destructive hardness test.)

The proof load test is regarded as a destructive test.

Examples:

1 Inspection of threads for hexagon bolts, grade A of a supplier well known for his steady quality; therefore ratio LQ_{10}/AQL of 6,2 is applicable:

AQL 1 — Sample size 80 — Acceptance number Ac 2.

2 Inspection of the driving media for hexagon socket head screws of an unknown supplier; therefore the ratio LQ_{10}/AQL has to be lowered to 3,1:

AQL 1 — Sample size 500 — Acceptance number Ac 10.

3 Inspection of the mechanical property: stress under proof load for nuts:

AQL 1,5 — Sample size 8 — Acceptance number Ac 0.

5.7 Non-destructive (visual) tests for detecting surface discontinuities cannot always give results of the type and dimension of the discontinuity: this can be verified by destructive tests only. Therefore greater sample sizes are necessary for the non-destructive test for surface discontinuities to identify those fasteners which consequently shall be subject to destructive testing.

If during visual inspection, any fastener is found with quench cracks in any location, or folds at or below the bearing surface, except "clover leaf" folds in non-circular fasteners, the lot shall be rejected.

If on the destructive test any fastener is found with seams, bursts, shear bursts, forging cracks, surface discontinuities on the thread, tool marks, voids or damages, which exceed the allowable limits specified for the applicable type of discontinuity, the lot shall be rejected.

Table 1a) — Dimensional characteristics for threaded fasteners

Applicable dimensional characteristics[1]		Product group					
		Socket screws, bolts and screws of grades A and B[2], studs	Bolts and screws of grade C[2]	Nuts ⩾ class 8[3]	Nuts < class 8[3]	Machine screws	Self-tapping screws, thread-forming screws
		AQL[4]					
Major characteristics	width across flats	1	1,5	1	1,5	1,5	1,5
	width across corners	1	1,5	1	1,5		1,5
	width of slot or socket	1				1,5	1,5
	depth of slot or socket	1				1,5	1,5
	recess penetration depth					1,5	1,5
	radius under head	1,5					
	go thread gauge	1	1,5	1,5	1,5	1,5	
	no go thread gauge	1	1,5	2,5	2,5	1,5	
	major diameter						2,5
Minor characteristics	all others	2,5	4	2,5	4	4	4

1) Characteristics shall be individually assessed.

2) The product grades refer to the classification of the product with regard to fit and tolerances. (See ISO 4759-1.)

3) Product property class for nuts: see ISO 898-2.

4) For features left in the hot-forged condition use an AQL of 2,5. Hot-forged products shall be presented for inspection separately.

Table 1b) — Dimensional characteristics for plain washers

Applicable dimensional characteristics[1]		Product classification[2]	
		Grade A	Grade C
		AQL	
Major characteristics	Hole diameter	1	1,5
	Outside diameter	1,5	2,5
Minor characteristics	All others	2,5	4

1) Characteristics shall be individually assessed.

2) The product grades refer to the classification of the product with regard to fit and tolerances. (See ISO 4759-3.)

Table 1c) — Dimensional characteristics for pins

Applicable dimensional characteristics[1]		Product group		
		Parallel pins	Taper pins	Clevis pins
		AQL		
Major characteristics	Major diameter	1	1	
	Major diameter d_1			1
	Surface roughness	1	1	1
	Taper		1	
Minor characteristics	All others	2,5	2,5	2,5

1) Characteristics shall be individually assessed.

Table 2 — Examples of sampling plans[1]

Acceptance number Ac	AQL %					Ratio $\frac{LQ_{10}}{AQL}$	Supplier's risk %
	0,65	1	1,5	2,5	4		
	Sample size[2]						
0	20	13	8	5	3	16,5	12
1	80	50	32	20	13	7,5	9
2	125	80	50	32	20	6,2	5
3	200	125	80	50	32	5,2	4
5	315	200	125	80	50	4,4	2
7	500	315	200	125	80	3,7	2
10		500	315	200	125	3,1	2
14			500	315	200	2,6	2
21				500	315	2,2	1

1) All figures in this table have been taken from ISO 2859. LQ_{10}/AQL ratios are mean values.

2) If the lot size is less than the required sample size, 100 % inspection shall be carried out.

Table 3a) — Mechanical characteristics for threaded fasteners

Applicable mechanical characteristics[1] See ISO 898, ISO 3506 and ISO 6157	Carbon or alloy steel				Stainless steel		
	Socket screws, bolts, screws and studs	Nuts	Machine screws	Self tapping screws, thread forming screws	Bolts, screws and studs		Nuts
					⩽ M5	> M5	
	AQL						
Tensile strength[2]	1,5		1,5		1,5	1,5	
Hardness	0,65	0,65	0,65	0,65		0,65[3]	0,65[3]
Stress at 2 % permanent strain[2]						1,5	
Extension value at fracture[3]						1,5	
Stress under proof load[3]		1,5					1,5
Stress under wedge loading	1,5						
Surface discontinuities							
Non-destructive (visual)	0,65	0,65	0,65	0,65			
Destructive	1,5	1,5	1,5	1,5			
Decarburization (class ⩾8.8)	1,5						
Application test				1,5			
Torque test				1,5	1,5		
Widening or cone proof load test		1,5					
Marking[4]	0,65	0,65				0,65	0,65

1) Other characteristics may be required according to the specification applicable, for example, performance of prevaling torque type nuts.

2) Tensile strength and stress at 0,2 % permanent strain may be checked in the same test.

3) Where applicable according to the steel grades concerned.

4) In accordance with International Standards.

Table 3b) — Mechanical characteristics for plain washers

Applicable mechanical characteristics[1]	Carbon or alloy steel	Stainless steel
	AQL	
Hardness	0,65	[2]

1) Other characteristics may be required according to the specification applicable.

2) Use material identification test: a future International Standard will cover this subject.

Table 3c) — Mechanical characteristics for pins

Applicable mechanical characteristics[1]	Product group
	Parallel, taper and clevis pins
	AQL
Shear strength	1,5
Hardness	0,65

1) In accordance with product standards. Other characteristics may be required according to the specification applicable.

Annex

Notes for guidance and rationale

(This annex does not form part of the Standard.)

A.1 General

It is not possible to prevent nonconforming units occurring in mass production. In particular, therefore, larger lots may occasionally contain some nonconforming units . Technical requirements do not generally demand that these nonconforming units be sorted out, a procedure which is in any case difficult and uneconomic.

Each nonconforming unit, the nonconformity in which may adversely affect its intended use to a greater than negligible extent, may be cause for complaint.

If the customer tests each unit, and therefore the total delivery, he will, himself, sort out the nonconforming units and can make a complaint, if necessary. The procedures and AQL values specified in ISO 3269 are not used, in these cases.

Larger lots are usually only subjected to random sampling by the customer. The results of random inspection permit the deduction, with a higher or lower degree of probability only, of the actual number of nonconforming units present in the inspection lot; probability here depends on the sample size (extent of testing).

A.2 Purpose

The purpose of this International Standard is the specification of objective criteria for deciding under what circumstances a complaint may be raised about a whole lot, without knowledge of the precise proportion of nonconforming units in the lot. This is intended to protect the supplier, as far as possible, against complaints about those inspection lots in which the proportion of nonconforming units is small (smaller than the AQL value), but where it has wrongly been indicated to be too great as a result of unsuitable sampling inspection (for example, because sample sizes were too small).

A.3 Background to clause 1

This International Standard therefore specifies quality limits (AQL values) and sampling plans, where the supplier's risk of 5 % for dimensions and 12 % for mechanical properties of lots with a percent nonconforming equal to the AQL value is not exceeded.

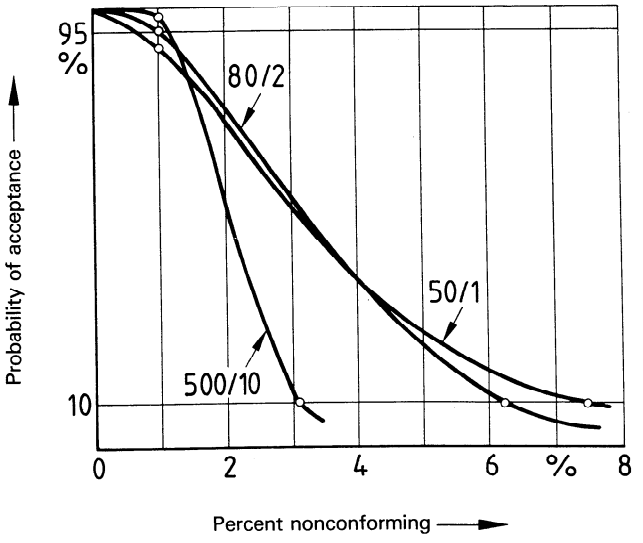
On the one hand, this specification protects the supplier, but on the other hand it leaves the customer the necessary freedom to choose the sampling plan that is required for technical reasons.

The customer can therefore match the extent of inspection with functional requirements and with the experience gained from previous lots received from the same supplier (quality history). The greater the sample size, i.e. the nearer the LQ value of the sampling plan is to the AQL, the greater is the probability of recognizing lots where the percent nonconforming appreciably exceeds the AQL value, but the greater, too, the effort and expense involved. Using this system the customer can select the technical and economic optimum suitable for himself.

A.4 Background to clause 3

The following relationship exists between the sampling plan (sample size, acceptance number) and the AQL and LQ values.

Each sampling plan is described by its operating characteristic curve OC (see the figure). It shows the probabilities of acceptance in a sampling inspection as a function of the actual percent nonconforming in the inspection lot. The points on the operating characteristic curve indicating a 95 % and a 10 % probability of acceptance have been selected for the determination of suitable sampling. The 95 % point of the operating characteristic curve is required to be equal to or greater than the AQL value specified. The 10 % point on the operation characteristic curve (LQ_{10} value) is to be selected by the customer at his own discretion. The LQ_{10} value corresponds to the percent nonconforming in inspection lots which is highly likely (90 % probability) to give rise to complaints.



NOTE — For AQL = 1, sampling plans 80/2 and 500/10 are permitted whereas 50/1 is not permitted (supplier's risk higher than 5 %).

Figure — Operating characteristic curves for sampling plans