

Guide to the selection and usage of acceptance sampling systems for inspection of discrete items in lots —

Part 1: General guide to acceptance sampling

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- Institute of Metal Finishing
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Foreword

This part of BS 6000 has been prepared by Technical Committee SS/5. Together with BS 6000-2 and BS 6000-3 it supersedes BS 6000:1996, which is withdrawn.

BS 6000:2005 *Guide to the selection and usage of acceptance sampling systems for inspection of discrete items in lots* is in three parts:

Part 1: *General guide to acceptance sampling*

Part 2: *Guide to sampling by attributes*

Part 3: *Guide to sampling by variables*

The primary purpose of the BS 6000 series is to give guidance on the selection of an acceptance sampling system, scheme or plan. It does this principally by reviewing the available systems specified by various British Standards and showing ways in which these can be compared in order to assess their suitability for an intended application. The guide also indicates how prior knowledge of the manufacturing or service delivery process and quality performance might influence the choice of sampling system, scheme or plan, and likewise how the particular needs of the customer affect selection. Some specific circumstances encountered in practice are described and the method of choosing a plan is explained. Some checklists or pointers and tables are provided to assist users in selecting an appropriate system, scheme or plan for their purposes. Charts are included to illustrate the procedures to be followed in the selection process.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 33 and a back cover.

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Introduction

This British Standard gives guidance on the selection of an appropriate acceptance sampling scheme for the inspection of discrete items submitted in lots from the schemes described in various national and international standards.

There are many situations where products (materials, parts, components, assemblies and systems) are transferred from one organization to another, where the organizations may be different companies or parts of a single company or even different shops within a plant. In these situations both the supplier and the customer may use acceptance sampling procedures to satisfy themselves that the product is of acceptable quality. The supplier will be seeking to maintain a reputation for good quality and to reduce the likelihood of claims under warranty, but without incurring unnecessary production and supply costs. On the other hand, the customer will require adequate evidence, at minimum cost to himself, that the product he receives conforms to specification. Compared with, say, 100 % inspection, suitable sampling methods will often be beneficial in achieving these aims. Sometimes acceptance sampling methods are the only practical procedure, especially when the tests for conformance are destructive.

Several types of sampling systems, schemes and plans are available for these purposes. They are presented in a number of British and ISO Standards that explain how they are to be used. However, it is often difficult to decide on the most appropriate procedure for use in a particular situation. The purpose of this British Standard is to assist in that decision.

The choice of sampling system, scheme or plan depends on a number of conditions and on the prevailing circumstances. In any supply situation, the first essential is that the supplier and the customer understand, and have agreed, the requirements and the basis for release and acceptance of the product, including any acceptance sampling methods to be used.

Lots that are not acceptable cause difficulties for both supplier and customer. The supplier incurs additional costs in rework, scrap, increased inspection, damage to reputation and possibly loss of sales. Delays in delivery and re-inspection costs are a burden to the customer. For these reasons, it is usually considered essential for the supplier to provide lots that have a very high probability of being accepted, i.e. 95 % or more. The supplier has to ensure that quality control of the production or delivery process provides lots of a quality sufficient to meet this objective. A basic principle of some acceptance sampling inspection schemes is to promote the production of lots of acceptable quality. The primary purpose of these schemes is not to discriminate between acceptable and non-acceptable lots, i.e. to sort, but to keep production under control to yield an acceptable process average quality. Although all acceptance sampling plans are discriminatory to some degree, the process average quality (expressed in terms of percent nonconforming or number of nonconformities) should not be greater than half the acceptance quality limit in order to ensure a very high probability of acceptance.

1 Scope

This part of BS 6000 gives general guidance on the selection of an acceptance sampling system, scheme or plan. It does this principally in the context of British Standards that either already exist or are presently under development. (For more detailed information about specific acceptance sampling systems, see BS 6000-2 for sampling by attributes or BS 6000-3 for sampling by variables.)

The guidance in this British Standard is confined to acceptance sampling of products that are supplied in lots and that can be classified as consisting of discrete items (i.e. discrete articles of product). It is assumed that each item in a lot can be identified and segregated from the other items in the lot and has an equal chance of being included in the sample. Each item of product is countable and has specific characteristics that are measurable or classifiable as being conforming or nonconforming (to a given product specification).

Standards on acceptance sampling are typically generic, as a result of which they can be applied to a wide variety of inspection situations. These include, but are not limited to, the following:

- a) end items, such as complete products or sub-assemblies;
- b) components and raw materials;
- c) services;
- d) materials in process;

- e) supplies in storage;
- f) maintenance operations;
- g) data or records; and
- h) administrative procedures.

Although this British Standard is written principally in terms of manufacture and production, this should be interpreted liberally, as it is applicable to the selection of sampling systems, schemes and plans for all types of product and processes as defined in BS EN ISO 9000.

2 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS ISO 3534-1, BS ISO 3534-2 and BS EN ISO 9000 apply.

3 Abuses and uses of acceptance sampling

3.1 Abuses of acceptance sampling

Acceptance sampling has become unpopular since the early 1980s. Some of the reasons for this (although certainly not all) are well founded, so it is important to be able to distinguish those situations where acceptance sampling should not be used from those where it may be appropriate.

The chief arguments used against the use of acceptance sampling are as follows.

- a) When quality is generally very high, the sample sizes needed to detect a slip in quality are uneconomically large.
- b) Quality cannot be inspected into a product.
- c) It is far better to establish a robust design and to implement comprehensive process controls than to try to find and eliminate nonconforming items after manufacture.
- d) Most acceptance sampling standards are indexed in terms of acceptable quality level (AQL). Once an AQL has been established and quality has been brought sufficiently below the AQL to achieve high probabilities of lot acceptance, there is no incentive for the producer to try continuously to improve quality.
- e) Quoting an AQL is tantamount to granting a licence to produce defects.
- f) The only acceptable quality level is zero defects.

These arguments are examined in turn in the following sub-clauses.

3.2 EXAMPLE 1

The following simplified example, supplied by Baillie [1], demonstrates how the optimum sampling plan can vary according to the quality level against which it is desired to guard. A certain item is produced in lots of size 10 000, with a unit production cost of £10.00. The selling price per item is £*a* in accepted lots and at a discounted price of £0.50 in lots non-accepted by the acceptance procedure. Testing is destructive, and the cost of testing each item is £1.00. The downstream cost (e.g. warranty cost plus loss of goodwill) of a nonconforming item in an accepted lot is £10 000, but zero in non-accepted lots sold at a discount. Historical data indicate that the process fraction nonconforming is *p* for 99 % of lots, but that it unaccountably and randomly slips to 100*p* for 1 % of the lots. A single sampling plan by attributes is to be used, i.e. a random sample of size *n* is to be selected from each lot, and the lot is to be considered acceptable if the sample contains no more than *Ac* nonconforming items. What is the optimal sampling plan, i.e. the plan that maximizes the profit per item sold?

Mathematical details are provided in Annex A for information. Table 1 shows the optimal sampling plan for a range of values of the process quality level *p*. The results are instructive.

Table 1 — Optimal sampling plans for Example 1

Usual quality level, in fraction nonconforming p	Quality level after slippage, in fraction nonconforming $100 p$	Optimal plan		Selling price per item, a (£)	Average profit per item sold (£)
		Sample size n	Acceptance number, Ac		
0.00100	0.100	104	2	20.25	0.022
0.00050	0.050	139	1	15.40	0.091
0.00030	0.030	197	1	13.60	0.211
0.00020	0.020	249	1	12.75	0.280
0.00010	0.010	141	0	12.00	0.378
0.00009	0.009	137	0	11.95	0.436
0.00008	0.008	129	0	11.90	0.499
0.00007	0.007	113	0	11.85	0.570
0.00006	0.006	86	0	11.75	0.603
0.00005	0.005	34	0	11.70	0.710
0.00004	0.004	Accept without sampling		11.60	0.804
0.00003	0.003	Accept without sampling		11.50	0.903
0.00002	0.002	Accept without sampling		11.35	0.952
0.00001	0.001	Accept without sampling		11.20	1.001

Not surprisingly, it is found that improvements in the quality level allow the selling price to be decreased while at the same time increasing the profit per item sold. At first, improvements in quality levels necessitate larger sample sizes in order to be able to provide the necessary discrimination between the two quality levels. As quality levels improve, the optimal acceptance number Ac reduces and there comes a point when the sample size that is required also begins to reduce until, eventually, it becomes uneconomical to sample at all. This final state is called “indirect inspection”, as the inspection has effectively been transferred from the producer to the consumer; nonconforming items are so rare that it is more economical not to sample and inspect but to reimburse consumers on the infrequent occasions that they invoke the warranty. Thus 3.1a) is seen to be misleading for, when quality levels reach a sufficiently high level, acceptance sampling simply becomes an unnecessary overhead rather than requiring uneconomically large sample sizes.

3.3 Inspecting quality into a product

Inspection makes little difference to the outgoing quality if the incoming quality is more or less constant, unless the sample size is a large proportion of the lot size, in which case the inspection process is a large overhead. Either way, it is not a particularly sensible approach to improving quality levels.

3.4 Design and control

The advantages of establishing a robust design and a comprehensive process control system are many. The robust design places the least possible demands on the manufacturing process and the process control system tends to prevent process parameters from straying too far from their target values, so process variation and waste is kept low and output quality is kept high. Moreover, the design and the control system of the production process can be reviewed and improved in the light of experience to provide continual quality improvement.

3.5 AQLs

The initials AQL used to stand for Acceptable Quality Level, although in reality the AQL is simply an index to a sampling plan. Standards tried to make this clear by explaining that the level was acceptable for the purposes of acceptance sampling (rather than in an absolute sense). Indeed, lot quality levels typically have to be better than half the AQL to have a very high chance of being accepted.

During the late 20th century, many companies came to realise that the only way to survive in a global marketplace was to strive endlessly for improved levels of quality. The notion that any level of quality other than zero defects (see 3.7) was acceptable began to be derided. Recently, to try to clarify the situation, the

meaning of the initials AQL was changed in International and British standards to Acceptance Quality Limit, which more accurately describes its function. Unfortunately, the damage was already done, for many organizations no longer entertain the use of standards indexed by AQL.

The argument that AQLs provide no incentive for the producer to continuously improve quality once it has been improved to a level that is better than the AQL is not a strong one; in many medium or long-term agreements between supplier and customer, a progressive reduction in the AQL could easily be agreed upon and written into the contract. Moreover, a producer intent on staying in business is already striving for better levels of quality in order to maintain or improve his place in the national or global market.

3.6 A licence to produce defects?

It is untrue that an AQL provides a licence for the producer to provide defects. Most AQL-indexed standards expressly caution that the designation of an AQL does not imply that the supplier has the right knowingly to supply any nonconforming units of product.

3.7 The zero defects philosophy

Crosby [2] introduced the idea that quality can be free, i.e. the extra resources used to improve quality would often be more than compensated for by the reduction in rework or scrap or loss of goodwill. Unfortunately, the corresponding idea that the producer should strive for a perfect process that produces no nonconforming items inevitably often became misconstrued to stipulate that acceptance sampling plans should always have an acceptance number of zero, i.e. that the plans should lead to lot non-acceptance if one or more nonconforming items are found in the sample. Example 1 shows this not to be an inevitable corollary. An acceptance number of zero is seen to be optimal only over a certain range of quality levels; at lower quality levels, acceptance numbers of 1 or more are optimal, while at higher quality levels it is best not to sample at all.

3.8 The use of acceptance sampling

For many mature production processes, quality levels will have become so close to perfection that it is a needless waste of resources to implement acceptance sampling procedures. The design will have been refined such that there are no difficulties in the production process due to any of the target values of the process parameters being difficult to achieve or maintain, and safeguards will have been built into the process control system wherever necessary.

It can be seen from Table 1 that acceptance sampling became redundant at a quality level somewhere in the range 0.0001 to 0.0002 nonconforming. One of the variables in Example 1 (3.2) was the 1 % of lots that slip to the worse quality level. If this percentage could be substantially reduced, then acceptance sampling would become redundant at quality levels in the good lots worse than 0.0002 nonconforming. Thus a two-pronged attack on internal variation and on external, “special causes” of variation in the production process, together with repeated reviews of the product design, ultimately lead to acceptance sampling becoming unnecessary for many products.

However, what about the early stages while the process and its controls are being refined? Example 1 demonstrates that appropriate use of acceptance sampling can play a key part in maximizing profitability during this interim period.

Some processes never run for long enough to become mature. This is particularly true for some defence industries. There is not much point in continuing to build an offensive weapon of a given build standard once an effective defence to it has been devised and is widely available. Specifications are therefore frequently modified, which can make it difficult to achieve a robust design or efficient process controls. Sometimes the materials used in the production of armaments are so new that they have properties and limitations that are not completely understood. Sometimes it is in the assembly of individually sound components into complex items where it might be necessary to use acceptance sampling to maintain quality; it will be too late once the items are being used in anger. Sometimes what might seem to be very high levels of nonconformity may be acceptable. For example, an over-the-shoulder anti-tank weapon system would be more than acceptable even if it had only a 50 % chance of destroying a tank costing one thousand times as much, although this translates into 50 % nonconforming. Acceptance sampling may be applied periodically to munitions held in storage over many years, to check that they have not degraded to an unacceptable level. In the computer industry, a process yield as low as 50 % when etching the latest and fastest computer chips may be considered acceptable. Acceptance sampling might even be used as a tool by which to verify statistical process control results.

In summary, acceptance sampling has a legitimate part to play in the quality assurance of many products.

4 Acceptance sampling plans, schemes and systems

An acceptance sampling plan is a set of rules by which a lot is to be inspected and its acceptability determined. The plan stipulates the number of items (units) in the sample to be drawn randomly from a lot for inspection against the product specification. The lot is then sentenced as “acceptable” or “not acceptable” according to how the inspection results compare with the criteria of the acceptance sampling plan.

Sometimes, when a long series of lots is being inspected, a sampling procedure might call for a shift from one sampling plan to another, depending on the current and previous sample results. Sampling procedures that call for switching from one sampling plan to another, and possibly back again, are called sampling schemes. A sampling scheme might also call for discontinuation of inspection if product quality appears to remain poor. The customer may then shift to another supplier, if available, or initiate 100 % screening until the supplier can improve the production process sufficiently to produce acceptable product.

In the case of destructive testing, the customer may cease to accept product until the supplier has demonstrated to his satisfaction that the production problems that were giving rise to the previous low quality have been overcome.

A collection of sampling plans and related sampling schemes constitute a sampling system. The system is generally indexed in some way, e.g. by lot size, inspection level and acceptance quality limit (e.g. BS 6001-1).

The standards reviewed in BS 6000-2 and BS 6000-3 present plans for single, double, multiple or sequential sampling. Procedures for skip-lot sampling for inspection by attributes are given in BS 6001-3. A comparison of the various sampling methods and the principles on which they are based assists in assessing their suitability for a particular application and enables an appropriate selection to be made.

5 Practical and economic advantages of using British Standard sampling plans

To those concerned with the writing of specifications it is of benefit that statistically sound sampling procedures be provided. Because there are economies of scale for larger lots, most sampling schemes presented in the standards reviewed in BS 6000-2 and BS 6000-3 relate sample size to lot size. Apart from providing control over the methods of selection of the sample, these standards should normally be invoked because they specify requirements that control the treatment of nonconformities found during inspection and the treatment of lots resubmitted after initial non-acceptance. Furthermore, most of these sampling systems contain built-in switching rules (e.g. from “normal” to “tightened” or to “reduced” inspection) to adjust the sampling plan in the event of deterioration or improvement in quality. Use of these basic reference standards can save much time often wasted in subjective discussion, and reduce the large areas of discretion often contained in non-standard sampling schemes that have only limited value, particularly for international trade.

Sampling involves risk and, quite naturally, all parties concerned attempt to minimize their share. Theoretically, these risks are functions of the sampling plan and the quality level agreed, without relation to the industry or the product. In practice, these risks are reduced by controlling the production process and improving the level of quality.

These risks cannot be eliminated, but they can be precisely calculated and economically assessed by the use of modern statistical techniques. Consequently, it is of benefit to all parties that statistically sound acceptance criteria be specified in product/process specifications and that, wherever possible, the generally applicable basic reference standards on sampling, such as the BS 6001 and BS 6002 series, be utilized.

In general, when arriving at the optimum performance of an acceptance sampling plan or scheme, the costs of preventing nonconformities should be balanced against the probabilities of failure in service. Subject to various assumptions being made with regard to the ratio of sample size to lot size (n/N) and to the appropriate distribution theory, it is a relatively straightforward matter to formulate sampling plans from statistical theory. Note that, while existing British standards on sampling by variables are only applicable to product characteristics that have normal distributions, standards on sampling by attributes are not dependent on the distributional shape of the product characteristics.

Development of generic acceptance sampling standards is a more difficult matter. There are undeniable advantages in having relatively few standard schemes, as this leads to greater uniformity of action and simplifies the administrative procedures across organizational and national boundaries. However, for these to be adopted for general use by industry worldwide, sampling standards have to be practical and flexible enough to take account of the many and varied situations met in practice. The established

AQL-indexed procedures given in the BS 6001 and BS 6002 series, and in corresponding international standards, have served industry well in the past, and are continuing to be developed to fulfil current and future needs.

The motivation for acceptance sampling is primarily economic: inspection of a sample from a lot is the (usually small) price paid to achieve desirable quality in the accepted lots. This quality is achieved by two pressures:

- a) the purely statistical pressure of different probabilities of acceptance of good and bad quality lots; and
- b) when sequences of lots are purchased, the commercial pressure of frequent non-acceptance of lots and the switch to tightened inspection or discontinuation of inspection when quality is poor.

The problem associated with acceptance sampling inspection relates to defining unambiguously the criteria used to judge discrete individual items supplied in quantity, the criterion for acceptance of the lot, the quality level expected from the manufacturing process, the discrimination afforded by the sampling plans and the rules to be followed when a lot is not accepted. Above all, however, it is necessary to design the sampling scheme so that it can be invoked easily in a purchasing contract. The sampling plans in the sets of related British Standards discussed in BS 6000-2 and BS 6000-3 enable this to be done efficiently.

The parties should agree on the following:

- a) the specification to which the discrete items of product are to conform; this is necessary because, in all dealings between the parties, there has to be agreement on what constitutes a conforming item and what constitutes a nonconforming item;
- b) whether the acceptance of the product is to be determined by the acceptance of individual items or collectively by the acceptance of inspection lots of items (acceptance of individual items precludes sampling).

When the acceptance is to be on a lot basis, the agreement between supplier and recipient needs to include

- the criteria for item conformance;
- the criteria for lot acceptance;
- the criteria for non-acceptance of the lot; and
- the acceptance sampling system, scheme or plan to be used.

The latter should be based on risk factors that are mutually acceptable to both producer and customer.

Having agreed on the acceptance sampling system, scheme or plan to use, the supplier knows, for various quality levels, the probability that his supply lots will be accepted. Likewise, the customer understands the protection provided by the sampling system, scheme or plan against acceptance of poor quality product.

Current British Standards present plans for single, double, multiple, sequential and skip-lot sampling. A comparison of the various sampling methods and the principles on which they are based will assist in assessing their suitability for a particular application and enable an appropriate selection to be made.

6 Attributes versus variables

Acceptance sampling standards generally describe procedures for inspection by attributes or for inspection by variables, so a key decision to make is which of these to use.

If certain assumptions are true, the variables method has the advantage of generally requiring a smaller sample size than the attributes method to attain a given degree of protection against incorrect decisions. In addition, it provides more information as to whether quality is being adversely affected by process mean, process variability or both.

The attributes method has the advantage that it is more robust, in the sense that it is not subject to assumptions of distributional shape, and that it is simpler to use. The larger sample sizes and consequential increased costs associated with using attribute sampling methods might be justifiable for these reasons. Furthermore, an attribute scheme might be understood and accepted more readily by inspection personnel. To avoid the assumption of normality and the attendant inability or difficulty in checking for this with “short runs”, sampling by attributes is recommended even to the extent of converting measurements to attributes. Sampling by variables is always inappropriate for isolated lots.

When the quality characteristics are known to be normally distributed, at least to a good approximation, sampling by variables has a substantial advantage when inspection is expensive, e.g. when testing is

destructive. Often, a simple mathematical transformation, such as taking the logarithm or square root, will convert a set of measurements from a non-normal to a normal, or near-normal, distribution.

Table 2 gives a comparison of the sample sizes for inspection by attributes and by variables for certain lot size ranges when using normal single sampling plans at inspection level II (see 7.6.1). Similar advantages exist when comparing inspection by variables and by attributes in double and sequential sampling.

Table 2 — Comparison of sample sizes in inspection by attributes and by variables

Lot sizes	Single sample sizes under normal inspection		
	Inspection by attributes (BS 6001-1)	Inspection by variables (BS 6002-1)	
		Unknown process Standard deviation	Known process standard Deviation
16 to 25	5	4	3
91 to 150	20	13	8
281 to 500	50	25	12
1 201 to 3 200	125	50	18
35 001 to 150 000	500	125	32

7 Further considerations influencing a selection

7.1 Long and short production runs

Most acceptance sampling standards are intended for use primarily on a continuing series of lots of sufficient duration to allow the switching rules to be applied. This implies a “long” production run.

The principal exception is BS 6001-2, which comprises limiting quality (LQ) plans that can be used when the switching rules of BS 6001-1 are not applicable. These are primarily intended for use with single lots or lots of an “isolated nature”. By implication, this embraces a “short” series of inspection lots — or a “short” production run.

BS 6001-4 and BS 6002-4.1 provide sequential plans that match other standards in their respective series, and in many cases are thus similarly applicable to long or short runs.

In order for a production run to qualify as “long”, one criterion is clearly that the switching rules have a reasonable chance of coming into effect if “the quality is unsatisfactory”. It is equally clear that this alone raises a number of supplementary issues (as indicated by the quotation marks) depending on the requirements and circumstances prevailing in each case considered. It is impossible to stipulate simply and precisely what constitutes a short run (number of lots) in the context of sampling inspection.

In the absence of any other guide or evidence on which to base a judgement, anything up to 10 consecutive inspection lots should be considered as a “short run”, and the plans in BS 6001-2 should be used. However, lots should not be subdivided arbitrarily in order to create a “long run”. It is generally preferable to have large homogeneous lots because they allow a smaller sample size to lot size ratio, and provide better representation by the sample, sharper discrimination and more economical inspection.

In a long production run there is continuity and stability, so production settles down to a long-term stable process average. Nevertheless, the quality of individual lots varies about this process average. On the other hand, at the start of production, after a significant break or change in production, or for a short production run, the lot quality might well be somewhat different and more variable, even markedly so. The practical factor to consider is whether there is evidence that a stable process average has been established and still exists.

7.2 Nonconformity and nonconforming item

7.2.1 Failure to conform

Any failure to conform to a specified product characteristic, dimension, attribute or performance requirement represents nonconformity. A nonconforming item might have one or more nonconformities.

The failure of a ballpoint pen to write, for example, is a nonconformity; the pen is nonconforming. However, the same pen might have failed to conform in a number of other ways, e.g. colour, dimensions, etc. A pen that exhibited several nonconformities would still be counted as one nonconforming item.

The qualification “nonconformity” does not necessarily imply that the unit of product cannot be used for the purpose intended. For example, a brick with one of its dimensions outside the prescribed tolerance interval, though nonconforming, can still be used for building.

The distinction between nonconformity and nonconforming item is of no importance if the items have no more than one nonconformity, but becomes essential when multiple nonconformities can occur.

The quality of a given quantity of product may be expressed either as percent nonconforming or as the number of nonconformities per hundred items, but these are only interchangeable when items can have no more than one nonconformity.

Under sampling by attributes, sampling plans are available for either percent nonconforming or the number of nonconformities per hundred items.

EXAMPLE 2: In counting pinholes in metal foil, the number of pinholes per square metre might be of interest. Here we would count all the pinholes in each square metre (item) examined and then express the quality in pinholes per 100 m².

EXAMPLE 3: Suppose that a lot consists of 500 articles. Of these, 480 conform and are acceptable, 15 have one nonconformity each, four have two nonconformities each, and one has three nonconformities.

The lot percent nonconforming is given by the formula:

$$\begin{aligned}\text{Percent nonconforming} &= \frac{\text{number of nonconforming items}}{\text{total number of items}} \times 100, \\ &= \frac{20}{500} \times 100 \\ &= 4,\end{aligned}$$

that is, the lot is 4 % nonconforming.

The number of nonconformities per hundred items in the lot is given by the formula:

$$\begin{aligned}\text{Nonconformities per 100 items} &= \frac{\text{number of nonconformities}}{\text{total number of items}} \times 100, \\ &= \frac{26}{500} \times 100 \\ &= 5.2,\end{aligned}$$

that is, the lot has 5.2 nonconformities per hundred items.

Hence, under sampling by attributes, whether percent nonconforming or nonconformities per hundred items is to be used is a matter for individual consideration in each particular case. The important thing is that it has to be considered, specified, and agreed beforehand, not left until a sample has been inspected and then considered.

Under sampling by variables, sampling plans are only available for percent nonconforming, so there is no choice to be made. However, different quality characteristics might belong to different classes (see 7.2.3), in which case they are treated separately.